Taxonomy and distributional pattern of Pimplinae (Hymenoptera: Ichneumonidae) from Vietnam

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TABLE OF CONTENTS

INTRODUCTION

BACKGROUND AND OBJECTIVES

Vietnam is situated in the Indo-Burma region, which is known as one of the biodiversity hotspots of the world (Conservation International, 2010). The total area of Vietnam is about 330,000 square kilometers with mountains and hills covering three quarters of the country. Vietnam holds within its boundaries a great variety of the world's richest and grandest natural places, including vast deltas, fantastically eroded limestone towers, high-elevation cloud forests, red sand-dune coastal forests, and savanna-like grassland and forest mosaics. The country remains relatively unstudied when compared with other regions of high biodiversity (Sterling *et al.*, 2006).

The wide range of latitude and elevation, as well as a wide variety of landforms has given the country a great diversity of natural environments and a high level of biodiversity (The Government of Vietnam, 1995). Therefore, Vietnam's biodiversity draws scientists for several reasons: the country harbors a globally significant diversity of species, scientists have described an unexpectedly large number of new species since 1992, and a high proportion of its species are endemic (Sterling *et al.*, 2006).

The Pimplinae is a moderately large group of Hymenoptera with more than 1,500 species belonging to 77 genera (Yu *et al.*, 2005; Gauld & Dubois, 2006; Palacio *et al*., 2007). Because this subfamily includes several particularly common species, it is often numerically the best represented subfamily in general collections of Ichneumonidae (Gauld, 1991). The ecological specialization coupled with the great ranges of hosts and biology makes the Pimplinae one of the most attractive of all ichneumonid groups for biological study (Gauld, 1991).

Despite of its diversity and abundance as well as its interesting biology, the Ichneumonidae fauna in general and the Pimplinae fauna of Vietnam is poorly studied. Up to 2009, only 39 pimpline species belonging to nine genera have been documented (Gupta, 1962; Townes & Chiu, 1970; Gupta & Tikar, 1976; Plant Protection Research Institute, 1976; Gupta & Saxena, 1987; Bui, 1990; Pham, 1997; Pham & Le, 2007; Vu, 2007; Pham & Khuat, 2008). Moreover, most of aforementioned species were recorded from agricultural habitat, only occasionally from natural ecosystems. There exists a lack of information regarding the diversity of Pimplinae from the remaining regions of Vietnam to assess with sufficient confidence the diversity of this group for the whole country.

Taking these situations, this study is urgently required to fill the taxonomic gaps and to improve the knowledge on the diversity and geographical distribution of pimpline wasps in Vietnam.

The specific objectives of this research are: (1) to investigate the species richness of pimpline

wasps in Vietnam; (2) to discover new records and describe the new taxa of Pimplinae from this country; (3) to discuss the distributional patterns, including the species composition in different habitat types, altitudinal gradients and geographic regions.

A major part of this dissertation is taxonomic revision of Pimplinae from Vietnam, which is combined to a monograph using the taxonomic system of Gauld *et al*. (2002) to order them. Resulted from this study, a total of 12 articles were published and other two are in press or under review with numerous discoveries of new country records and even new species. Taxonomic work has been done by the author in collaboration with colleagues from England, Japan and Netherlands. Gavin Broad from the Natural History Museum (UK) kindly assisted in identification to genus of the ichneumonid collection, which is deposited in the Netherlands Centre for Biodiversity Naturalis. Some specimens of *Acrodactyla*, *Brachyzapus* and *Xanthopimpla*, which were collected in Vietnam by Rikio Matsumoto from the Osaka Museum of Natural History (Japan) from 1997 to 2006, were also loaned to Germany for morphological examination. Together with Kees Zwakhals from Netherlands, we published a paper on the genus *Dolichomitus* from Vietnam. Two Vietnamese colleagues, Long Dang Khuat and Hoa Thi Dang from the Institute of Ecology and Biological Resources, were partially involved in this study by providing newly collected material and obtaining the data of comparative specimens in the collection of the Plant Protection Research Institute in Hanoi, Vietnam. In this part, species descriptions are provided in detail only for the newly described species.

Another key part of my dissertation is the distributional patterns of pimpline species in Vietnam. The species composition of Pimplinae was compared among geographical regions, habitat types and elevation gradients using cluster analyses.

NATURAL CONDITIONS OF VIETNAM

Topography

Topography plays an important role in the distribution of Vietnam's wildlife and vegetation and in the interaction between humans and their environment. Vietnam's northern border abuts China's Yunnan and Guangxi provinces just below the Tropic of Cancer (23°30'N), and its southernmost coast meets the Gulf of Thailand. Laos and Cambodia bound the country to the west, and the East Sea (or South China Sea) lies to the east (Figure 1) (Sterling *et al.*, 2006).

Descriptions of Vietnam often emphasize the hilly and mountainous nature of three quarters of the country, though much of the land lies at moderate elevations. One fourth of the country sits below an elevation of 20 m a.s.l., primarily the two delta regions in the north and the south and the narrow coastal plains along the East Sea in Vietnam's central region, while another fourth lies above 625 m a.s.l. The remaining half of Vietnam's land thus lies in hills and lower slopes (Sterling *et al.*, 2006).

Hilly and montane areas form a rough semicircle around the northern boundary of Vietnam. Within this semicircle lies the extensive Red River Delta. According to Sterling *et al.* (2006), northern Vietnam is geologically and environmentally complex, a mixture of granite and limestone, upland and delta, jagged peaks and humid lowlands, and tropical and subtropical species. This diversity reflects northern Vietnam's position near the intersection of the tropical and subtropical zones and the biotic influence of three biogeographic units: Indochina, south China and coastal Indochina.

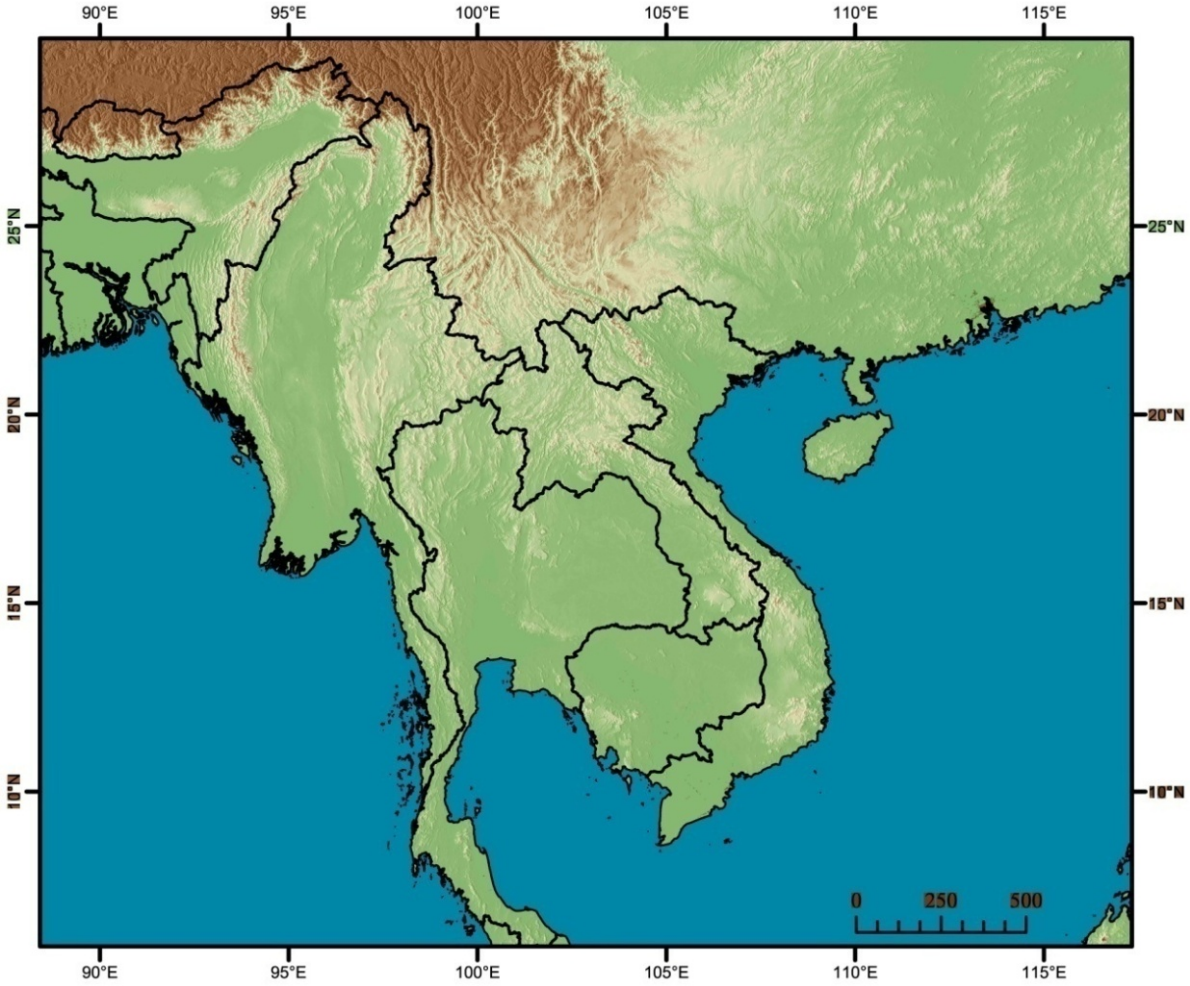

Figure 1. Physical map of Vietnam in the Indochinese subregion (© K. Koy)

Averyanov *et al.* (2003) considered the Red River as the boundary between the western and eastern regions of northern Vietnam. West of the Red River, the Hoang Lien Son Range represents the southearsternmost extension of the Himalayas. This granite formation runs northwest to southwest, paralleling the river's west bank. Vietnam's highest peak, Fan Si Pan, is found here, rising to 3,143 m a.s.l. (Sterling *et al.*, 2006).

The northeastern region's geology is of largely south Chinese origin with hilly and montane areas in the north and the Red River Delta in the south. The landscape here is formed by a

combination of exposed ancient metamorphic basement rock and eroded marine sediments deposited in the late mid-Devonian (370–360 million years ago) and early Triassic (245–224 million years ago) (Averyanov *et al.*, 2003). Several smaller ranges lie in northeastern Vietnam, Cao Bang and Bac Son are two large karst formations at 1,000 m a.s.l., their hilltops rising between 100–600 m over the intervening lowland valleys and flat depressions; Viet Bac, Tam Dao, and Yen Tu massifs are the largest granite formations, which lie on the edge of the delta (Figure 2). The karst formations are normally at an elevation of 300–700 m, however nearer to the border with China they often reach 1,400–1,600 m. A number of isolated granite mountain systems are Tay Con Linh (2,419 m), Pu Tha Ca (2,274 m), Pia Da (1,980 m), and Pia Oac (1,930 m) (Averyanov *et al.*, 2003).

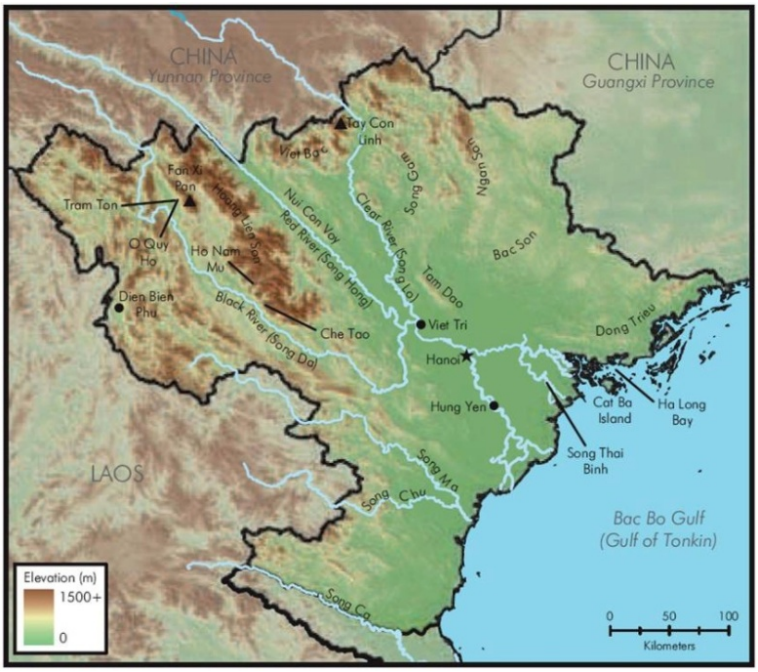

Figure 2. Physical map of northern Vietnam (© K. Koy)

The Red River Delta covers 17,321 km^2, with a coastline of nearly 300 km. The northeastern coastline is dotted by more than 2,000 offshore islands in the Gulf of Tonkin (Sterling *et al.*, 2006).

Central Vietnam's highland areas are parts of the Truong Son Range, which stretches for 1,200 km from around 20°, along Vietnam's western border with Laos, ending south of the Da Lat Plateau in South Central Vietnam. Vietnam's Truong Son Range can be divided into three subregions. Starting in Nghe An Province, the range's northern stretch terminates at a break in the ridge at Khe Sanh (Quang Tri Province). The mountains here are quite low, few exceed 1,300 m a.s.l. Contiguous with extensive areas in Laos, this area is among the largest tracts of limestone habitat in Indochina (Sterling *et al.*, 2006).

Below Khe Sanh, near the Hai Van Pass, a spur ridge of the Truong Son Range runs east to the sea while the rest of the range continues south along the Laos-Vietnam border to the Song Ba-Da

Rang River. The dominant feature of this part is the Kon Tum Massif, an enormous, largely granite formation stretching about 250 km north to south and 200 km in land, composed of now-exposed crystalline basement rocks formed over 560 million years ago in the Precambrian. It is among the oldest uncovered rocks in the Southeast Asia. Mount Ngoc Linh on the northwestern border of the massif is the highest peak in Central Vietnam at 2,598 m a.s.l. Extending to its south is the lower 800–1,400 m a.s.l., Play Ku Plateau made of basalts deposited by volcanic activity beginning some 20 million years ago (Sterling *et al.*, 2006).

Figure 3. Physical map of Central Vietnam (© K. Koy)

The south part of Truong Son Range includes the remaining uplands of Vietnam, a series of eroded granite and basalt plateaus dotted with isolated peaks: Dak Lak Plateau (400–800 m a.s.l.), Da Lat Plateau (1,200–2,200 m a.s.l.) with the peaks of Bi Dup (2,163 m a.s.l.), Chu Yang Sin (2,410 m a.s.l.) and Di Linh Plateau (1,000–1,500 m a.s.l.) (Sterling *et al.*, 2006).

The lowland areas in Central Vietnam are far smaller than the large, fertile delta regions of the north and the south. Along the northern Truong Son, they are particularly limited, squeezed between the mountains and the coast. The narrow coastal plains of Central Vietnam widen in its southern half, extending inland for 20–30 km around Nha Trang and south (Sterling *et al.*, 2006).

In southern Vietnam, the flat Mekong Delta has an average elevation of only a few meters above sea level, with a small number of isolated hills rising out of the flatlands. Most are granite, with occasional limestone outcroppings; the tallest hill is Cam Mountain with 710 m a.s.l. Along the border between Cambodia and Vietnam, ancient terraces of sediment deposited by the Mekong River cover about 150,000 ha of the delta. Three major landforms comprise the delta: the floodplain, the coastal complex, and the broad depression. The floodplain is the most widely distributed landform type in the delta, located in the northern and central regions. In the southern and eastern regions, marine and river environments combine to influence the coastal complex of flats, sand ridges, and mangrove forests. A broad depression occupies much of the inland areas of the southern delta. This region is the most isolated from the effect of the Mekong River and saltwater floods (Sterling *et al.*, 2006).

Figure 4. Physical map of southern Vietnam (© K. Koy)

Climate

Because of Vietnam's shape, topography and location along mainland Asia's southeastern edge, the country experiences many climatic regimes.

According to Sterling *et al*. (2006), most of northern Vietnam is characterized by the monsoon tropical climate with cold winter and summer rains. The temperatures are strongly seasonal, more so than in the rest of the country, and subtropical, especially in the interior. This coldness and seasonality is caused by the northeast monsoon winds that bring cold air from the edge of the Tibetan Plateau into northern Vietnam in the winter (from November to March). The winter monsoon winds are also quite arid, and most of northern Vietnam experiences a dry season during

these months. The hot weather and rain during summer result from the arrival of warm southwestern monsoon winds blowing in from southerly oceans. Typhoons arrive during the rainy season, from April to October, and can cause severe flooding in the Red River Delta.

Within this basic pattern, northern Vietnam's rainfall and temperature regimes vary considerably. Above 2,000 m a.s.l., the Hoang Lien Son Range experiences no dry season, and temperatures regularly drop below freezing during December and January, with snowfall on one to three days of the year. These conditions are closer to temperate Chinese climates than to subtropical ones (Sterling *et al*., 2006).

Average annual temperature in the region ranges from 18°C to 23.5°C; average annual rainfall varies considerably from 1,343.5 mm (in Cho Ra, Bac Can Province) to 2,749.0 mm (in Huu Lung, Lang Son Province); and the average annual humidity ranges between 81–84% (Nguyen *et al*., 2000, Table 1; Sterling *et al.*, 2006).

Compared with the North, Central Vietnam experiences a generally wetter monsoon climate, though the seasonality of both temperature and rainfall vary widely throughout the region. Lowland and foothills of the north and central Truong Son experience temperatures resembling northern Vietnam's, with warm summer highs around 30°C, and winter lows of 16°C. Rainfall is higher, however at 2,000–2,500 mm, and the wet season is later, with rains most frequent between August and November. The coastal lowlands at Nha Trang and south experience a far drier, semi-arid climate. Mean rainfall is below 1,350 mm and annual average below 750 mm have been recorded. Temperatures are less seasonal with 24°C–29°C throughout the year, and wet seasons are shorter and later (October to December). The interior lowlands and foothills south of Kon Tum Plateau are also drier than farther north (rainfall: 1,500–2,000 mm) with distinct wet and dry periods (Sterling *et al.*, 2006).

The Truong Son's uplands are cooler and wetter than the lowlands, and its eastern and windward slopes usually receive more rain than western and leeward ones. Rainfall is more than 2,000 mm, increasing with altitude. Temperatures in these upland mountain areas are less seasonal and quite cool (Sterling *et al.*, 2006).

Southern Vietnam exhibits a tropical, strongly monsoonal climate, and the typical annual rainfall range is 1,500–2,000 mm. The northern regions receive barely half the annual rainfall (1,250 mm) of the southwestern regions (2,350 mm). Inland regions south to the Mekong Delta experience smaller seasonal fluctuations in temperature than areas to the north, with summer rains and a dry season of zero to five months. On the high plateaus of the central region, temperatures are lower and conditions wetter, with dry seasons lasting for only three months. Coastal areas experience a rainy season in autumn and winter (September to January) followed by

a dry period of up to seven months. Futher south in the Mekong Delta, temperatures are quite warm and stable during the year: from 20°C–23°C during the coldest times and from 32°C–35°C during the hottest times. Rain falls in the summer occurs from May to October. The dry season varies from two to six months. The hottest period is from March to May, with high humidity in the latter month. Winter season (December to March) is extremely dry, with four to six months of rainfall below 100 mm (Sterling *et al.*, 2006).

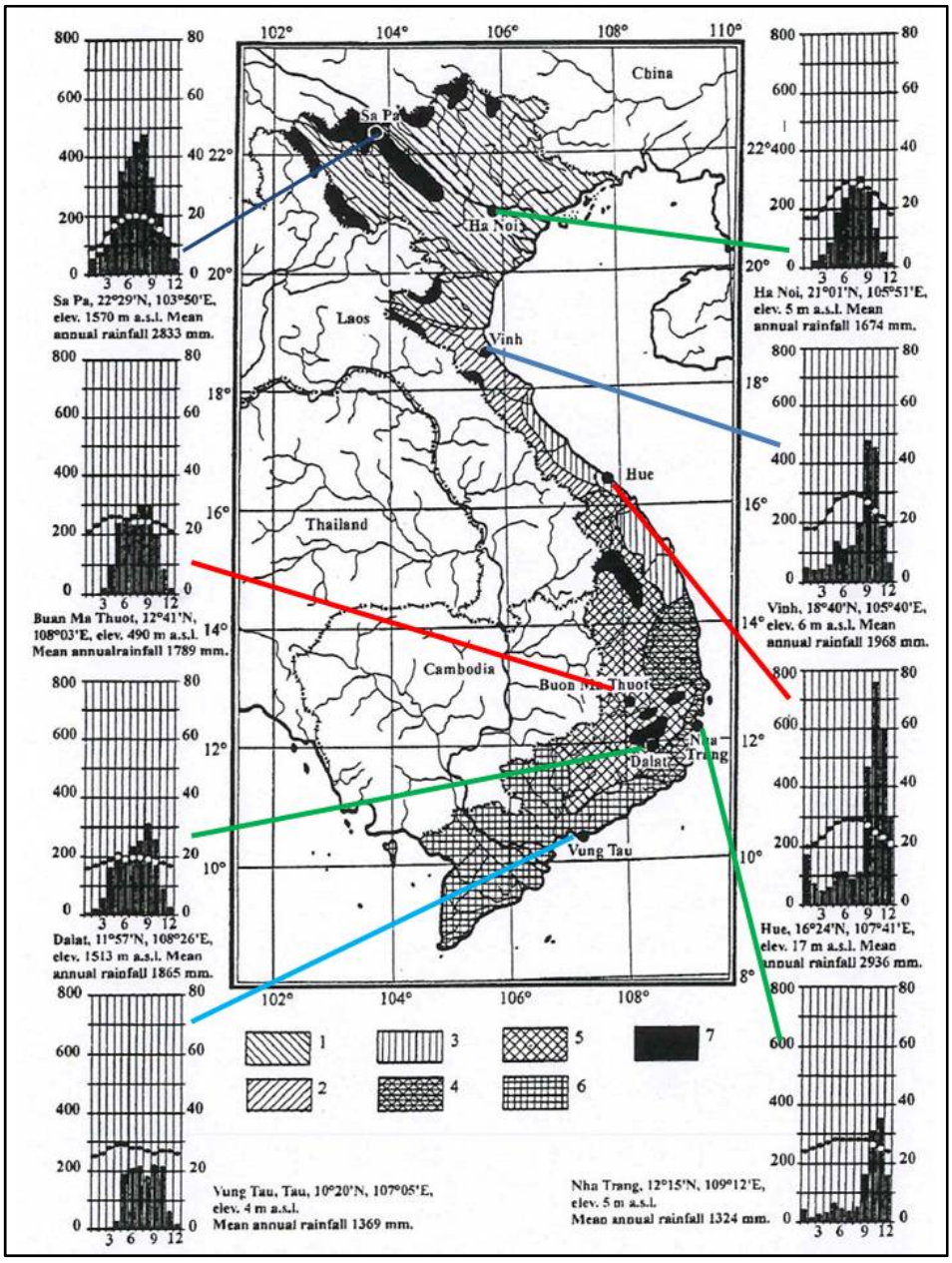

Figure 5. Climatological regions of Vietnam (© Averyanov *et al.*, 2003):

Monsoon tropical climate: (1) with cold winter and summer rains, (2) with cold winter and summer-autumn rains, (3) with warm winter and summer-autumn-winter rains, (4) with warm winter and autumn-winter rains, (5) with warm winter and summer rains, (6) Monsoon sub-equatorial climate with summer rains and (7) Monsoon tropical climate associated with mountains

Table 1. Principal climatic data from climate stations in Vietnam.

Name	Elevation (m a.s.l.)	Temperature (°C)		Rainfall (mm)		Average annual humidity (%)
		Annual average	Range monthly average	Annual average	Range monthly average	
Ha Giang	118	22.7	15.4–27.8	2430.1	31.5–515.6	84
Nguyen Binh	208	20.3	12.3–26.1	1763.0	34.7–312.1	82
Cao Bang	258	21.6	14.0–27.3	1442.7	16.1–267.1	81
Cho Ra	210	22.0	14.1–27.5	1343.5	18.2–249.4	83
Dinh Hoa	220	22.6	15.3–28.1	1666.9	14.8–315.1	83
Hoang Lien Son	2,170	12.8	7.1–16.4	3552.0	64.0–680	82
Huu Lung	40	22.8	15.3–28.4	2749.0	37.6–598.6	83
Tam Dao	897	18.0	10.8–28.3	1850.0	24.9–382.5	84
Son Dong	59	22.6	15.3–28.1	1529.1	17.4–297.1	81
Ba Vi	30	23.2	15.9–28.7	2033.6	13.6–340.9	83
Hanoi	5	23.5	16.5–28.9	1674.4	17.7–313.6	84
Minh Dai	100	22.6	15.7–27.9	1786.3	22.4–308.2	86
Mai Chau	160	23.0	16.3–27.5	1833.4	6.3–344.4	82
Lac Son	40	23.0	15.9–28.3	1986.8	23.3–348.5	85
Nho Quan	12	23.3	16.2–28.9	1908.6	21.4–358.8	84
Con Cuong	27	23.5	17.0–28.7	1791.1	33.5–386.0	86
Dong Hoi	7	24.6	19.0–29.8	2160.2	43.1–601.9	83
A Luoi	550	21.6	17.3–25.1	3404.6	39.7–910.9	86
Kon Tum	536	23.4	20.4–25.7	1783.0	1.8– 327.6	78
Buon Ma Thuot	490	23.7	21.1–25.8	1788.9	2.1–302.1	81
Dong Phu	89	26.2	24.1–28.4	2469.2	6.9–433.2	79

Source: Nguyen *et al.* (2000)

Vegetation types

Northern Vietnam's forests lie at the northern distributional limit of tropical plants and the southern distributional limit of subtropical and temperate ones. Transitions between plant communities move from south to north, east to west, and from lowlands to uplands. The dominant forest type in northern Vietnam is evergreen forest (Figures 6, 7). Coastal mangrove formations

and forest growing on limestone are also important elements of the natural landscape diversity of this area (Figures 8, 9) (Sterling *et al.*, 2006).


Figures 6 and 7. Evergreen forests of Hoang Lien NP (left) and Tam Dao NP (right)
(© T. Q. Nguyen)


Figures 8 and 9. Limestone forests of Ba Be NP (left) and Cuc Phuong NP (right)
(© T. Q. Nguyen and T. T. Nguyen)

Lowland broad-leaved evergreen forests once covered much of northern Vietnam up to elevation 600–800 m a.s.l. These are now rare and greatly threatened. Most areas have been cleared for crops and pasture, and many are replaced now by scrub and secondary forest (Sterling *et al*., 2006).

At 600–800 m a.s.l. in northern Vietnam the vegetation transitions from wet lowland to montane evergreen forests. The montane forest is distributed roughly between 600–2,000 m a.s.l. and is mixed of broad-leaved trees and conifers. Subtropical and temperate plants replace previously dominant tropical ones, largely due to lower temperatures. Dominant families at this elevation include beeches (Fagaceae), magnolias (Magnoliaceae), and laurels (Lauraceae) alongside a diversity of conifers. At higher altitudes are mostly conifers and heaths (Ericaceae), which includes the rhododendrons. On the upper slopes and ravines of the Hoang Lien Son Range are forests whose taxa are indicative of the

strong affinity between Vietnam's highlands and the forest communities of southern China. Growing between 2,000–2,800 m a.s.l. are conifer forests dominated by tall Himalayan Hemlock (*Tsuga dumosa*) and Delavay's Fir (*Abies delavayi fansipanensis*). These forests are the sole Southeast Asian occurrence of a temperate hemlock-fir community more typical of southwestern China, and they include species found nowhere else in Vietnam. Also present are a wide variety of temperate species, including birches (Betulaceae), walnuts (Juglandaceae), willows (Salicaceae), and blueberries (Ericaceae: *Vaccinium*) (Sterling *et al.*, 2006).

The vegetation of northern Vietnam with the extensive and quite distinctive plant communities roots on limestone. These forests are found at altitudes up to 1,700 m a.s.l., most commonly from 300–900 m a.s.l. With increasing altitude, they pass from closed-canopy evergreen forests to shorter, more open semi-evergreen formations featuring twisted and bend vegetative forms. Northern Vietnam's limestome communities are often dominated by a rich mix of conifers, including the rare pine *Pinus kwangtungensis*, which is restricted to a few locations in southern China and northern Vietnam. Increased light reaching the forest floor favours a thick and diverse community of smaller trees and shrubs. Above 1,200 m a.s.l., limestone forest canopies become even more open and dominated by conifers (Sterling *et al.*, 2006).

Figures 10 and 11. Evergreen forest of Pu Mat NP (left) and limestone forest of Phong Nha-Ke Bang NP (right) (© T. T. Nguyen and T. Q. Nguyen)

The vegetation on the northern Truong Son's limestone areas is similar to that in the North: largely semi-evergreen forests rich in endemic species (Figures 10, 11). Evergreen forests grow on the Truong Son at elevations from its northern tip to around 14°N. At elevations up to about 800 m a.s.l., Central Vietnam's evergreen forests are largely broad-leaved, with canopies dominated by tropical families such as the dipterocarps, and with many palms and lianas in the understory. As elevation increases and the climate becomes cooler and wetter, more temperate families such as the beeches (Fagaceae) and magnolias (Magnoliaceae) begin to dominate. The transition is often

abrupt, occurring over a gradient 200–300 m a.s.l. Wet, submotane and montane forests are found at elevation of 1,000 m a.s.l. or more throughout the Truong Son. Rhododendrons are an important component of these communities, which can be found as far south as Bi Dup-Nui Ba National Park on the Da Lat Plateau (Sterling *et al.*, 2006).

Evergreen trees bearing cones are an important component of Central Vietnam's forests, and the number of conifer species here is second only to karst regions in the northeast. Two fairly common pines usually dominate drier coniferous forest below 1,500 m a.s.l.: the Benguet (*Pinus kesiya*) at 1,000–1,500 m a.s.l. and the Tenasserim Pine (*P. latteri*) at lower elevations and on drier soils. The highest diversity and most interesting species are concentrated in the Truong Son's wetter, montane areas, usually above 1,200 m a.s.l., where they grow in highly diverse, mixed broad-leaved and coniferous forest. Some endemic plants can be found in these habitats, including Da Lat Pine (*Pinus dalatensis*), Krempf's Pine (*P. krempfii*) and the yew *Amentotaxus poilanei* (Sterling *et al.*, 2006).

Figures 12 and 13. Evergreen forests of Chu Mom Ray NP (left) and Chu Yang Sin NP (right) (© T. N. Vu and C. v. Achterberg)

In the southern part of the Truong Son, areas below 1,000 m a.s.l. are covered with a variety of forest types depending on local conditions (Figures 12, 13). At these elevations the lowland evergreen forests of the northern Truong Son give way to drier semi-evergreen and decidous dipterocarp formations. Soil moisture and climate can vary over small areas, so these three forest types are often present in a patchwork without clear boundaries. Semi-evergreen forests form a transition between wet evergreen forests and the drier, dipterocarp-dominated deciduous forests of the plains south of Kon Tum Plateau and wet of Dak Lak's uplands. These forests are widespread and link Central Vietnam ecologically with similar regions from Cambodia through Myanmar (Sterling *et al.*, 2006).

In the northern spur of southern Vietnam, forests range from lowland evergreen to semi-evergreen, as well as widespread secondary grassland and bamboo habitat (Figure 14). Deciduous trees in the genus *Lagerstroemia* (Lythraceae), a loosestrife, dominate the 35–45 m a.s.l. canopy of the region's semi-evergreen forest, while a mix of evergreen and deciduous trees grows in the understory. Interspersed in the forested regions are small areas of freshwater wetlands, including lakes, seasonally inundated grasslands, and flooded forest (Sterling *et al.*, 2006).

Figures 14 and 15. Lowland evergreen forest of Cat Tien NP and wetland area in U Minh Thuong NP (© C. v. Achterberg and K. V. Nguyen)

Three main forms of natural vegetation now characterize the Mekong Delta: freshwater swamp forests, mangroves and grasslands. Which form dominates in an area depends on the amount of rainfall, salinity levels, depth and duration of standing water and soil characteristics. The remaining semi-natural wetland areas in the Mekong Delta are the Plain of Reeds, the Ha Tien Plain and the U Minh wetlands. Freshwater vegetation includeds swamp forests and nonwoody, riverbank and aquatic vegetation in waterways and other bodies of water. Although they are low in plant diversity, these forests are an essential part of the greater ecosystem. They temper water flow in the wet season, store fresh water in the dry season, reduce soil acidification and serve as habitat for aquatic organisms and a variety of wild animals (Sterling *et al.*, 2006).

The U Minh wetlands are among the Mekong Delta's most important wetlands for biodiversity conservation because, in addition to containing the most extensive paperbark formations, they harbour the only peat swamp forests (Figure 15) (Sterling *et al.*, 2006).

Mangrove forests grow in flooded areas that experience higher salinity than swamp forests occurring along coastlines and estuaries of southern Vietnam. Mangroves form an ecological link between marine and terrestrial systems. One species, *Avicennia alba*, dominates mangrove communities that are closest to the sea and almost permanently inundated by salt water (Sterling *et al.*, 2006).

Several types of grassland – communities dominated by sedge (Family Cyperaceae) and greases (Family Poaceae) – grow in the delta, in both acid sulfate and alluvial soils. Although grasslands are often overlooked in conservation consideration and deemed wasteland in development planning, they support diverse plant and animal species that are important components in the region's biodiversity (Sterling *et al.*, 2006).

The coastal and marine areas of southern Vietnam harbour many types of habitat, from low diversity sea grass beds in the shallow regions on the Sunda Shelf that sustain Dugong (*Dugong dugon*) populations to coral reefs, particularly in the Con Dao Archipelago (Sterling *et al.*, 2006).

PIMPLINAE WESMAEL, 1845: AN OVERVIEW

Pimplinae is a moderately large group of Ichneumonidae comprising more than 1500 species classified in 77 genera (Gauld *et al.*, 2002; Yu *et al.*, 2005; Gauld & Dubois, 2006; Palacio *et al.*, 2007). This subfamily includes some of the most common species of ichneumonids found anywhere. It is often numerically the best represented subfamily in general collections of Ichneumonidae (Gauld, 1991; Gauld *et al.*, 2002). As a consequence, it is one of the most extensively studied ichneumonid taxa, both from a taxonomic perspective (e.g., Narayanan & Lal, 153; Townes & Townes, 1960; Baltazar, 1961; Gupta, 1961, 1962; Momoi, 1966, 1970; Aubert, 1969; Gupta & Tikar, 1969, 1976; Townes & Chiu, 1970; Constantineanu & Pisica, 1970; Porter, 1979; Gauld, 1984, 1991; Kusigemati, 1984; Kasparyan, 1987; Fitton *et al.*, 1988; Kolarov, 1997; Gauld *et al.*, 2002; Sääksjärvi *et al.*, 2003, 2004; Gauld & Dubois, 2006; Kasparyan & Khalaim, 2007; Palacio *et al.*, 2007; Matsumoto & Takasuka, 2010; Zwakhals, 2010) and from a biological one (e.g., Arthur, 1966; Kishi, 1970; Jussila & Käpylä, 1975; Carton, 1979; Bruzzese, 1982; Führer & Willers, 1986; Brooks & Wahl, 1987; Ueno, 1999; Bin *et al.*, 1999; Eberhard, 2000; Sato & Takasu, 2000; Matsumoto & Konishi, 2007). According to Gauld *et al.* (2002), pimplines are also increasingly being used as indicator organisms in biodiversity studies (Gaston & Gauld, 1993; Bartlett *et al.*, 1999) and are being used as model laboratory organism in studies of sex allocation strategies (Ueno, 1997; 1998), host location (Henaut & Guerdoux, 1982; Wäckers *et al.*, 1999; Broad & Quicke, 2000) and host acceptance (Iizuka & Takasu, 1998).

Diagnosis

They are small to large wasps with a dorsoventrally depressed metasoma, ample wings and usually with a conspicuously exerted ovipositor; the clypeus is usually clearly separated from the face by an impressed clypeofacial suture, apically bilobate, concave, convex or truncate; the antenna is generally short, not exceeding the fore wing in length, those of males are almost never specialized, usually without tyloids; propodeum often without distinct areas, occasionally with area

basalis, area superomedia and/or area petiolaris defined by sharp carinae; the fore wing often has a more or less rhombic areolet, sometimes with this areolet either petiolate or slightly truncated above, occasionally with vein 3*rs-m* absent, very occasionally with 2*rs-m* obliterated because *Rs* is touching *M*; base of 1*m-cu* generally separated from *Cu*1*a* by a distance about equal to, or greater than length *Cu*1*b*; 2*m-cu* generally bowed, less commonly sinuous or straight, with two bullae; first abscissa of vein *Rs* of the hind wing is generally longer than *rs-m*; diatal abscissa of *Cu*1 present or in smaller species absent; tarsal claws are generally quite large, those of the female frequently with an apically pointed basal lobe, never pectinate; the metasoma varies from rather short and stout to very long and slender; the spiracle on tergite 1 is closed to or in front of the centre of the segment, first tergite often with lateromedian longitudinal carina present, sometimes with a discernible lateral carina; sternite 1 is usually short and not reaching beyond the centre level of the tergite, generally not fused to tergite; tergite 2 onwards are generally rigid and quite strongly sclerotized, convex, and often with lateromedian rounded swellings or other surface irregularities; the sternal region is more or less membranous, in dried specimens often collapsing against the tergite so that the underside of the metasoma is concave; the ovipositor is most commonly long and projecting well beyond the hind end of the metasoma, straight or apically decurved or up-curved, without a subapical dorsal notch, sometimes with a weak nodus; teeth of the lower valve are usually strong, occasionally weak or absent; the ovipositor sheath is flexible; male often with aedegus dorsoventrally flattened and distally decurved, almost ribbon-like (Townes, 1969; Gauld, 1984, 1991; Gauld *et al*., 2002).

The monophyly of Pimplinae is supported by five characters, of which the posterior 0.2 of tergites 2–4 of the female sculpturally differentiated from the anterior part of the tergite and the presence of thyridium on tergite 2 sunken in a deep transverse impression are very characteristic pimpline features (Gauld *et al*., 2002).

A synopsis of the classificatory history of the Pimplinae

The taxonomic concept of Pimplinae differs from that of most previous authors (e.g. Townes, 1969; Carlson, 1979; Gauld, 1984, Fitton *et al.*, 1988). Townes (1969) divided the Pimplinae (which he called Ephialtinae) into seven tribes (Table 2). This classification was broadly followed by most hymenopterists for the next 20 years, although there has been considerable dispute about the correct application of certain generic and family group names (Gauld *et al.*, 2002). The principal aspect of taxonomic disagreement with Townes's classification concerned the limits of the Polysphinctini and the Theroniini. The composition of the Polysphinctini is equivocal. Townes (1969) placed the *Tromatobia* genus-group in Pimplini, whilst Gupta & Tikar (1976) excluded this group from Pimplini. These authors included all pimplines associated with spiders in Polysphinctini (Gauld *et al.*, 2002).

Table 2. Changes in the classification of Pimplinae

Townes (1969)	Gupta & Tikar (1976)	Gauld (1991)	Wahl & Gauld (1998)	Gauld *et al.* (2002)
EPHIALTINAE	PIMPLINAE	PIMPLINAE	PIMPLINAE	PIMPLINAE
Pimplini	**Pimplini**	**Ephialtini**	**Ephialtini**	**Ephialtini**
Pimpla	*Pimpla*	*Ephialtes*	*Ephialtes*	*Ephialtes*
Tromatobia		*Tromatobia*	*Tromatobia*	*Tromatobia*
		Delomerista		
		Perithous		
			Acrodactyla	*Acrodactyla*
			Zatypota	*Zatypota*
Polysphinctini	**Polysphinctini**	**Polysphinctini**		
Acrodactyla	*Acrodactyla*	*Acrodactyla*		
Zatypota	*Zatypota*	*Zatypota*		
	Tromatobia			
Ephialtini	**Ephialtini**	**Pimplini**	**Pimplini**	**Pimplini**
Coccygomimus	*Coccygomimus*	*Pimpla*	*Pimpla*	*Pimpla*
Ephialtes	*Ephialtes*	*Apecthis*	*Apecthis*	*Apecthis*
Theroniini	**Theroniini**	*Theronia*	*Theronia*	*Theronia*
Theronia	*Theronia*			
Delomerista	*Delomerista*		**Delomeristini**	**Delomeristini**
Perithous	*Perithous*		*Delomerista*	*Delomerista*
Pseudorhyssa	*Pseudorhyssa*	POEMENIINAE		*Perithous*
Poemeniini	**Neoxoridini**	*Pseudorhyssa*	**Perithoini**	
Poemenia	*Poemenia*	*Poemenia*	*Perithous*	
Rhyssini	**Rhyssini**	RHYSSINAE		
Rhyssa	*Rhyssa*	*Rhyssa*	POEMENIINAE	POEMENIINAE
Diacritini	**Diacritini**	DIACRITINAE	*Pseudorhyssa*	*Pseudorhyssa*
Diacritus	*Diacritus*	*Diacritus*	*Poemenia*	*Poemenia*
			RHYSSINAE	RHYSSINAE
			Rhyssa	*Rhyssa*
			DIACRITINAE	DIACRITINAE
			Diacritus	*Diacritus*

The generic composition of the Theroniini is even more problematic. Originally it comprised five genera: *Theronia*, *Perithous*, *Delomerista*, *Atractogaster* and *Pseudorhyssa* (Townes, 1969). They were only united on the basis of a symplesiomorphy, the retention of a vestigial area superomedia on the propodeum. *Theronia* has often been divided into a number of subgenera or genera (Gupta, 1962, 1987). Theroniini has always been considered a very heterogenous group (Gauld *et al.*, 2002).

The major subsequent change to Townes's system was the division of the Pimplinae into four separate subfamilies (Eggleton, 1989; Gauld, 1991). Eggleton (1989) suggested that, as previously defined, the Pimplinae was a paraphyletic group of relatively primitive ichneumonids, and he attempted to split the group into monophyletic units by separating off several tribes and elevating them to the status of subfamilies. Gauld (1991) placed *Pseudohyssa* in Poemeniinae rather than with *Delomerista* in Pimplinae and transferred *Theronia* to the Pimplini.

Wahl & Gauld (1998) recognized four monophyletic tribes within Pimplinae based on a cladistic analysis: the Delomeristini (*Delomerista* + *Atractogaster*), the Perithoini (for *Perithous* including *Hybomischos*), the Pimplini (including the *Theronia* genus-group) and the Ephialtini (including the *Polysphincta* genus-group).

Gauld *et al.* (2002) merged Perithoini into Delomeristini and recognized three tribes of Pimplinae (Delomeristini, Ephialtini and Pimplini) and this division has been broadly used by many authors, especially it is used in the Taxapad, the biggest database concerning scientific names for information management (Yu *et al.*, 2005). In this study I followed Gauld *et al*. (2002) for taxonomic classification of Pimplinae in Vietnam.

Biology

The Pimplinae is of particular biological interest because its species show a greater variety of host interactions than almost any other subfamily of Ichneumonidae. Some species are idiobionts, other koinobionts. They may develop ectoparasitically or endoparasitically, solitarily or gregariously (Gauld *et al.*, 2002).

A majortity of species belonging to the tribe Ephialtini are idiobiont ectoparasitoids of the immature stages of other endopterygote insects (Salt, 1931; Stuart, 1957; Fitton *et al.*, 1988). Typically, the host is a mature larva, prepupa or pupa concealed in plant tissue, under bark, in boring timber, in thick cocoons or even in aculeate nests. The host is permanently immobilized prior to actual oviposition by the female parasitoid stinging it and injecting a venomous secretion which is produced by the accessory glands associated with the reproductive system (Togashi, 1963). The venom may actually kill the host (the case with some species of *Scambus*) or induce

permanent paralysis (the case with some species of *Sericopimpla*). After the host has been immobilized, a fully yolked large egg is laid externally to it. The parasitoid egg encloses rapidly and the larva commences to feed on the host via an integumentary lesion. When fully fed, normally when it has consumed all but harder parts of the host, the parasitoid larva generally spins a cocoon in which it eventually pupates (Gauld, 1991). Members of the *Polysphincta* genus-group (= Polysphinctini sensu Townes, 1969) allow the host to develop further after they have oviposited on it (Nielsen, 1923, 1928, 1929, 1935, 1937), a strategy recently termed koinobiont. The females are known to sting their spider hosts, but in this case the venom induces only temporary paralysis during the time the ichneumonids attaches its egg to the host. Subsequently, the spider recovers and continues to develop and even moult, but it supports an ectoparasitic larva which eventually destroys it (Nielson, 1923; Cushman, 1926).

The idiobiont ectoparasitoid way of life is also practiced by some relatively primitive members of the Pimplini (e.g. many members of the *Theronia* genus-group). However, some *Neotheronia* species are at least facultatively endoparasitic, though their larvae lack the more specialized features associated with higher Pimplini (the *Xanthopimpla* and *Pimpla* genus-groups) (Short, 1978). Members of these groups are obligate endoparasitoids, and their final instar larvae are highly modified for such existence – with a reduced hypostoma, strong hypostimal spur, large mandibles and a complete epistomal arch (Short, 1978). The higher Pimplini lay their egg inside a host which is normally inactivated during or soon after parasitization. This may be accomplished by the newly hatched parasitoid larva, which migrates to and destroys the host's brain (Führer & Kilincer, 1972). Selective egg placement (Carton, 1979) and injected venoms (Führer, 1975; Osman, 1978; Osman & Führer, 1979) are also important in helping overcome the host's defences.

Pimpline species are not only parasitoids of a wide range of phytophagous hosts but also facultative hyperparasitoids via the primary parasitoids of their usual hosts (Gauld, 1991). Many endoparasitic species are facultative pseudohyperparasitoids that regularly attack the cocoon pupae and prepupae of other parasitoids, such as some species of *Nomotheronia* and *Itoplectis* (Townes & Townes, 1960; Gauld, 1984; Fitton *et al.*, 1988)

The adults of many Pimlinae feed on honeydew, nectar (Leius, 1960; Cole, 1967) and sometimes other plant secretions (Juillet, 1959). This sustenance provides the carbohydrates necessary to sustain the ichneumonid's activity. Female pimplines lay comparatively large eggs (Iwata, 1960; Gauld, 1984), and they have only a small number of mature eggs in their lateral oviducts at any one time (Itawa, 1960). They are synovigenic (Gauld & Bolton, 1988), a form of reproduction in which the female continues to produce mature eggs throughout its life cycle (Gauld, 1991). In order to sustain egg production, female pimplines require a protein-rich food

source in addition to their normal carbonhydrate food supply. To obtain this they often feed on individuals of their hosts (Gauld, 1991).

Adult pimplines locate hosts by a variety of successive environmental cues: odours from the host's substrate or from frass and contact chemicals from the host itself (Gauld, 1991). In many species of *Pimpla* and *Itoplectis*, vibrational sounding is known to be used to locate concealed hosts. The wasp taps the substrate (wood, stem or soil) with their antennae and detects the position of a potential host through the returning "echoes" (Broad & Quicke, 2000).

Mated female pimplines are known to be able to select the sex of their progeny by controlling the access of stored sperm to the egg as it passes down the oviduct. This enables them to preferentially allocate female eggs to larger host individuals, and male eggs to smaller ones (Gauld, 1991).

Although most pimplines are solitary, the members of some genera such as *Iseropus*, *Sericopimpla, Tromatibia* are gregarious parasioids. They lay multiple eggs, and then many parasitoid larvae develop on a single host (Gauld, 1984, 1991).

Pimpline eggs hatch quite rapidly, often only one or two days after oviposition, and early larval development proceeds very quickly with generally only one or two days between ecdyses. The final larval instar is of longest duration, frequently exceeding the length of the sum of all others. The cocoon of pimplines is generally only rudimentary though some polysphinctines spin thick and very characteristic ones (Gauld, 1984, 1991).

MATERIAL AND METHODS

STUDY AREA AND SAMPLING METHOD

Material for this study was collected mainly by sweeping, Malaise traps, and, to a lesser degree, light traps, pitfall traps and rearing during a period of more than ten years (1997–2012) in 31 provinces of Vietnam, including 26 national parks and nature reserves (Figure 16). The main part of pimpline collection was collected by the author and colleagues from the Institute of Ecology and Biological Resources (IEBR), Hanoi, Vietnam. In addition, voucher specimens were loaned from the Netherlands Centre for Biodiversity Naturalis (RMNH), Leiden, Netherlands and the Osaka Museum of Natural History (OMNH), Osaka, Japan. The specimens are now deposited in the collections of above institutes and museums and the Natural History Museum (BMNH), London, UK; the Zoological Research Museum Alexander Koenig (ZFMK), Bonn, Germany. Some specimens in the collection of the Plant Protection Research Institute (PPRI), Hanoi, Vietnam were also examined.

Abbreviations of the some other museums referred to in this dissertation are as below:

AEIC	USA, Florida, Gainesville, American Entomological Institute
BPBM	USA, Hawaii, Honolulu, Bernice P. Bishop Museum
CNC	Canada, Ontario, Ottawa, Canadian National Collection of Insects
DEI	Germany, Müncheberg, Senckenberg Deutsches Entomologisches Institut
EIHU	Japan, Sapporo, the Hokkaido University
GPTA	India, Delhi, Delhi University, Department of Zoology, Gupta Collection
HMUG	United Kingdom, Glasgow, Glasgow University, Hunterian Museum
HNHM	Hungary, Budapest, Hungarian Natural History Museum
IFRI	India, Uttar Pradesh, Dehra Dun, Indian Forest Research Institute
IZCAS	China, Beijing, Chinese Academy of Sciences, Institute of Zoology
MZPW	Poland, Warsaw, Polish Academy of Science, Museum of the Institute of Zoology
MSNG	Italy, Genova, Museo di Storia Naturale “Giacomo Doria”
NHRS	Sweden, Stockholm, Naturhistoriska riksmuseet
MVMA	Australia, Victoria, Museum of Victoria
OUMNH	United Kingdom, Oxford, University Museum of Natural History
TARI	Taiwan, Taichung, Taiwan Agricultural Research Institute
USNM	USA, Washington D.C., National Museum of Natural History
UUZM	Sweden, Uppsala, Uppsala University
ZJUH	China, Zhejiang University, Collection of Institute of Insect Sciences
ZMAN	Netherlands, Amsterdam, Universiteit van Amsterdam, Instituut voor Taxonomische

Zoologie, Zoologisch Museum

ZMHB Germany, Berlin, Museum für Naturkunde der Humboldt-Universität

ZMUC Denmark, Copenhagen, University of Copenhagen, Zoological Museum

Other abbreviations: NP: national park, NR: nature reserve, a.s.l.: above sea level.

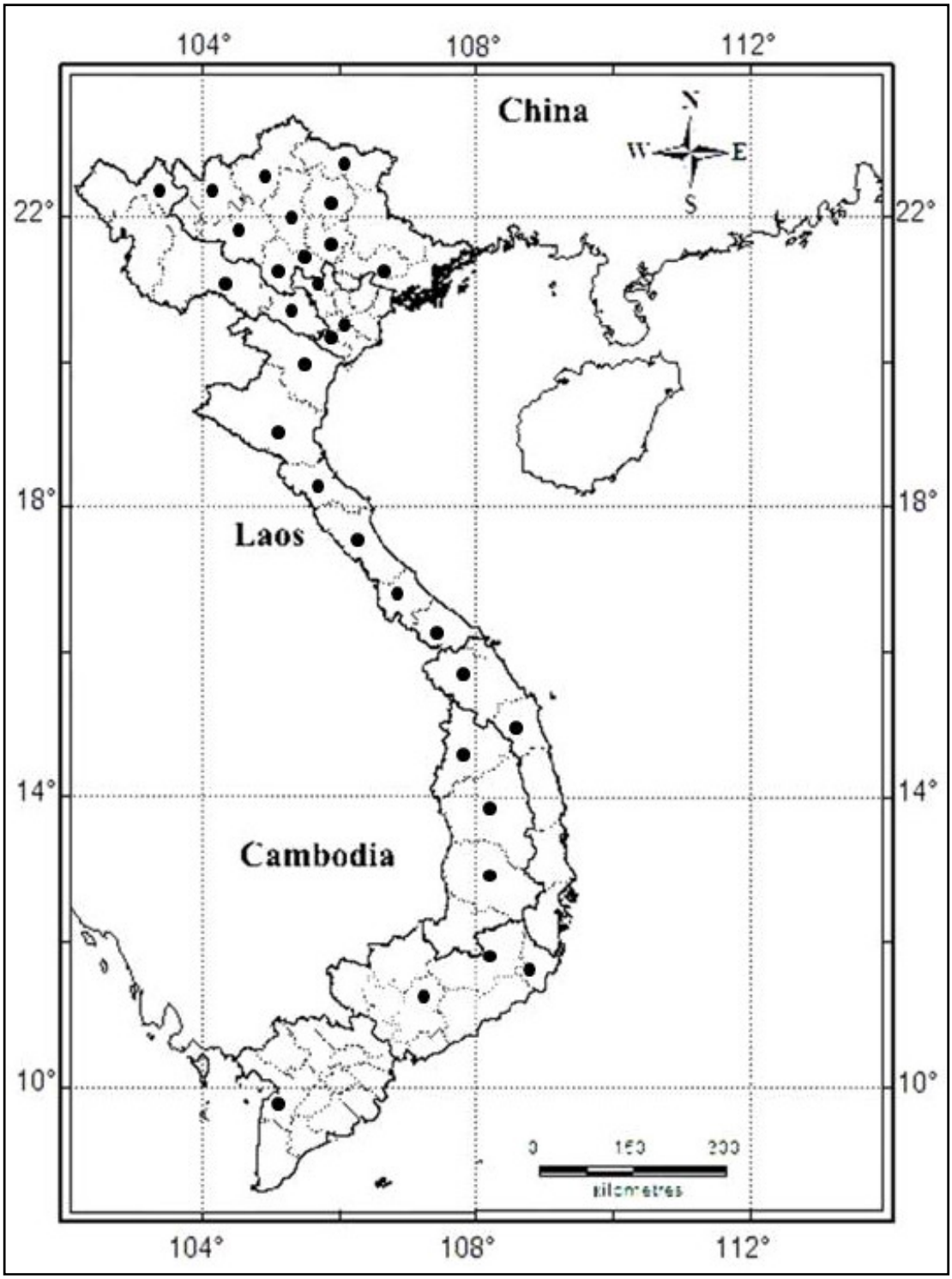

Figure 16: Map of collecting sites of Pimplinae in Vietnam

(localities are not shown in detail)

SPECIMEN EXAMINATION

Taxonomic study is based on morphological examination of more than 900 specimens. Datasheets were developed for all genera. For each specimen, morphological features comprise measurements, proportions, and coloration. Datasheets were used for morphological analyses and for the development of identification keys to the species of each genus. Closely related species have similar morphologies, therefore identification often relies on qualitative rather than quantitative differences.

Photographs were taken with a Nikon Digital Camera DXM 1200 via a stereomicroscope with light-box and a Keyence VHX-500F camera. Drawings were made with an Olympus SZX 12 microscope via an Olympus-DA 4E 07567 drawing attachment. Scanning electron micrographs were taken with a Hitachi S-2460N.

TERMINOLOGY

The morphological terminology in this work follows Gauld (1991). Most of the terms used for morphological features are explained in figures 17–23.

MEASUREMENTS

Specimens were measured with a Wild Heerbrugg Plan 1x microscope equipped with a Nikon CW 10X/22 dual-axis optical micrometer.

Body length is estimated from the anterior edge of the eye to the tip of metasoma (excluding the antennae and ovipositor).

The fore wing length is measured from the apex of the tegula to the apex of the wing.

The ovipositor length is measured from the tip of the hypopygium. In this work, the length of the ovipositor is always compared with the length of the hind tibia, and it is used as an important index.

DATA ANALYSIS

The data is represented as binary matrix (1: present; 0: absent) then analysed and clustered using the software PAST (Hammer *et al*., 2001). Clusters are joined based on the smallest distance between the two groups. The Sorensen coefficient is used to compare the similarity of the species compositions between two regions. This index is measured by the following fomular:

$$djk = 2M / (2M+N)$$

in which M is the number of species occurring in both regions and N is the total number of species with presence in just one region.

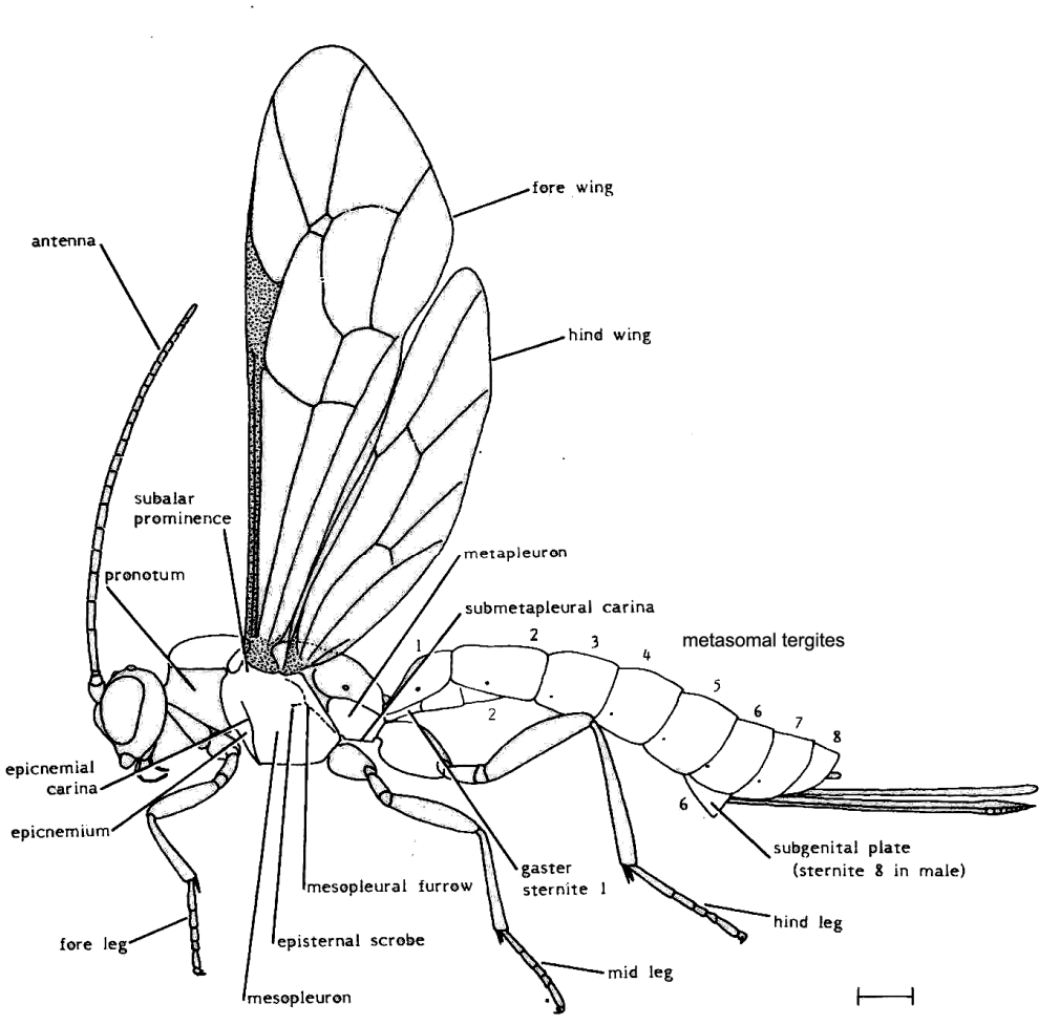

Figure 17. Pimplinae lateral view (From Fitton *et al.*, 1988; scale: 0.5 mm)

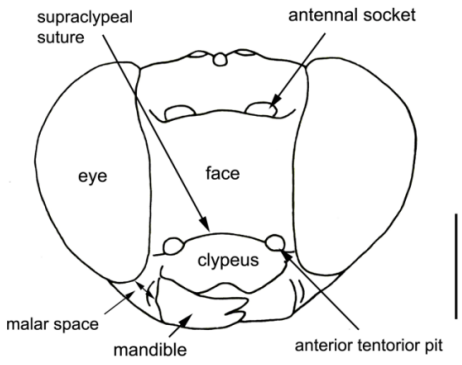

Figure 18. Face of *Acropimpla leucostoma* (scale: 0.5 mm)

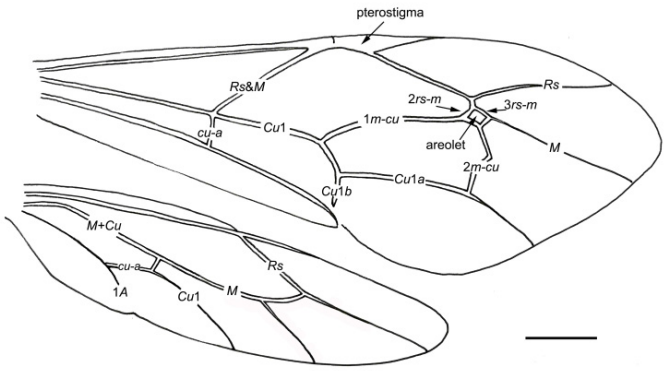

Figure 19. Wings of *Xanthopimpla pseudosternata* (scale: 1 mm)

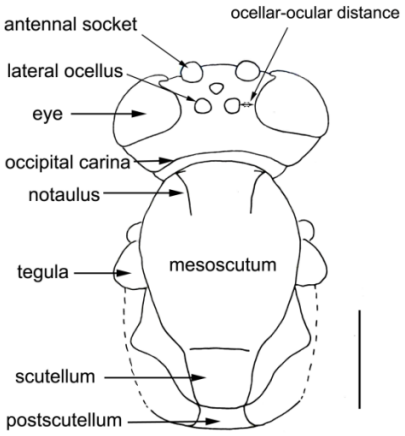

Figure 20. Dorsal face of head and mesonotum of *Xanthopimpla stemmator* (scale: 1 mm)

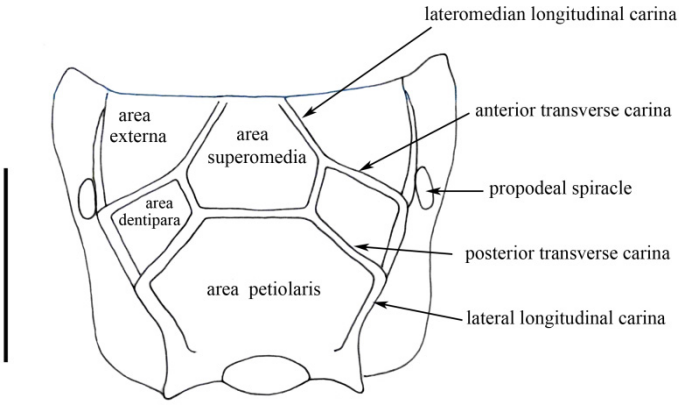

Figure 21. Dorsal view of propodeum of *Xanthopimpla pedator* (scale: 1 mm)

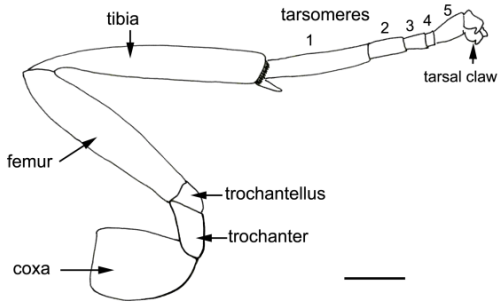

Figure 22. Hind leg of *Camptotypus trui* (scale: 1 mm)

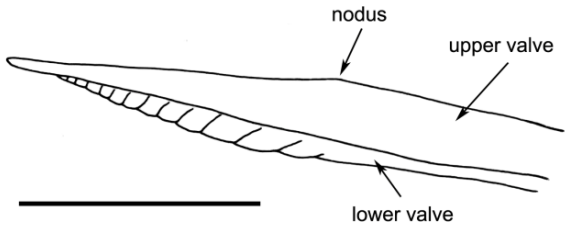

Figure 23. Ovipositor tip of *Acropimpla hapaliae* (scale: 0.5 mm)

RESULTS

According to Gauld *et al.* (2002), Vietnamese pimpline wasps, with 122 species in 21 genera, are classified into two tribes: Ephialtini and Pimplini. The tribe Delomeristini has not been recorded in the country.

The monophyly of Pimplini is strongly supported by 14 characters, of which several features such as the short and deep pronotum, the elliptical propodeal spiracle, the obliquely truncate hind tarsomere 4, the low rounded swelling on sternite 1 and the broad laterotergite 4 are very convincing apomorphies. Pimplini includes the *Pimpla* and *Theronia* genus-groups (Gauld *et al.*, 2002). Members of both two genus-groups are represented in Vietnam.

The monophyly of Ephialtini is supported by five characters. Only one of these, the female tarsal claws with a large basal lobe, is particularly robust as it is characteristic of all recognized taxa, and very rarely found in a few species elsewhere in the subfamily, such as in *Apecthis*. This tribe is divided into five genus-groups: *Pseudopimpla*, *Alophosternum*, *Camptotypus*, *Ephialtes* and *Sericopimpla* (Wahl & Gauld, 1998; Gauld *et al.*, 2002). Members of the last three genus-groups are recorded from Vietnam.

KEY TO GENERA OF PIMPLINAE IN VIETNAM

(This key is made based mostly on the Vietnamese material with the general ideas of Gauld *et al*. (2002) and Gauld & Dubois (2006))

1. Pronotum short and deep (Figures 32, 46a, 46b); mesopleural sulcus straight to weakly curved at episternal scrobe, except in *Theronia* genus-group sulcus more distinct; propodeal spiracle elliptical; hind leg with basitarsus often shorter, about 0.32–0.35 times as long as tarsus (except 0.37–0.4 times in *Pimpla*); mid and hind tarsal claws of female simple, without basal lobe (Figure 76c)……..2. Pimplini

-. Pronotum moderately long to long (Figures 110, 124); mesopleural sulcus distinctly curved at episternal scrobe; propodeal spiracle round or oval; hind leg with basitarsus often longer, about 0.45–0.5 times as long as tarsus (except 0.3–0.4 times in *Acrodactyla*, *Chablisea* and *Zatypota*); mid and hind tarsal claws of female with basal lobe (Figure 22)……11. Ephialtini

2. Clypeus divided into basal and apical parts by a transverse suture (Figures 24b, 27b); mandible twisted, tapered to apex, lower tooth shorter than upper tooth [inner margin of eye with a deep, more or less V-shaped invagination opposite antennal sockets]……3

-. Clypeus not divided into basal and apical parts by a transverse suture; mandible not twisted, length of mandibular teeth variable……5

3. Mandible twisted about 90°, therefore that the lower tooth invisible in anterior view; mesopleuron with epicnemial carina present on lower half; mesopleural suture smooth; mesepisternum with postpectal carina present centrally, usually forming a large flange; propodeum usually with carinae (sometimes absent); tarsal claws of female usually with spatulate bristles; hind wing with first abscissa of vein *Cu*1 about 0.2–0.6 times length of vein *cu-a*; body lemon yellow, often with black marks……..*Xanthopimpla*

-. Mandibles twisted but not more than 80°, the lower tooth visible in anterior view; mesopleuron with epicnemial carina longer, extending at least to groove below subalar prominence; mesopleural suture partly or entirely foveolate; mesepisternum with postpectal carina present as short stubs laterally; propodeum punctate, striate, or mat, without carinae; hind wing with first abscissa of vein *Cu*1 very short or obliterated; body colour various……..4

4. Transverse suture divides clypeus into longer basal half and shorter apical half; face without vertical impressions (Figure 24b); notauli short or absent, without transverse crest at anterior part of mesoscutum; fore wing with vein *Rs*+*M* distinct basad of vein *cu-a*; hind femur without a ventral tooth; propodeum without swellings posteriorly; metasomal tergites punctate or mat; ovipositor tip depressed.....*Echthromorpha*

-. Transverse suture divides clypeus into shorter basal half and slightly longer apical half; face with a vertical impression on each side of the midline (Figure 27b); notauli sharp, convergent at posterior 0.30 of mesoscutum, front end crossed by a short, strong, transverse crest (Figure 27c); fore wing with vein *Rs*&*M* opposite or distad of vein *cu-a*; hind femur with a small, acute tooth ventrally, near its apex; propodeum with one median and two lateral swellings posteriorly (Figure 27a); metasomal tergites polished, impunctate; ovipositor tip cylindrical.....*Lissopimpla*

5. Mesopleuron with mesopleural sulcus straight (Figure 32); propodeum without carinae, except posterior part of lateral and basal stub of lateromedian longitudinal carina present, or in *Pimpla cameronii* with lateromedian longitudinal carina extending to middle; tarsal claws without enlarged hair with flattened tip.....6

-. Mesopleuron with mesopleural sulcus moderately curved (Figures 84b, 90g, 90h, 90i); propodeum always with carinae, lateral longitudinal and basal part of lateromedian longitudinal carinae always present; tarsal claws with enlarged hair with flattened tip; metasomal tergites smooth.....7

6. Propodeum angled at level of lateral longitudinal carina (Figure 33); inner margin of eye weakly to moderately concave opposite antennal socket (Figure 29); apical flagellomeres not thickened; in female, front tarsal claws of female simple, second tarsomere of hind tarsus as long as or slightly longer than fifth.....*Pimpla*

-. Propodeum normally not angled at level of lateral longitudinal carina; inner margin of eye strongly concave opposite antennal socket; apical flagellomeres slightly to distinctly thickened; in female, front tarsal claws of female with a low, acute tooth, second tarsomere of hind tarsus shorter than fifth.....*Itoplectis*

7. Teeth of mandible equal in length.....8

-. Teeth of mandible unequal in length.....10

8. Epicnemial carina complete, extending to anterior margin of mesopleuron (Figure 88a); scutellum gradually curved, with lateral carinae extending to posterior impunctate area (Figure 88d); ovipositor lower valve partly enclosing upper valve (Figure 88c)…….....*Parema*

-. Epicnemial carina present on lower half of mesopleuron (Figures 90g, 90h, 90i), rarely complete; scutellum strongly convex, posteriorly sloping vertically from summit, with lateral carinae shorter, usually not extending to posterior impunctate area; ovipositor with upper and lower valves meeting in straight line, lower valve not enclosing upper valve 9

9. Clypeus flat, without swellings (Figures 79b, 80b), sometimes strongly concave apically (Figure 78b); ovipositor short, about 0.7–1.0 times as long as hind tibia, tip compressed, upper valve bulb-like apically (Figure 79d) or with ridges near apex (Figures 78d, 80f).....*Augerella*

-. Clypeus flat or with swellings apically; ovipositor longer, at least 1.2 times as long as hind tibia, tip cylindrical, upper valve without or with very small ridges (Figures 91d, 92c, 93d).....*Theronia*

10. Mandible with lower tooth shorter than upper tooth (Figure 82b); propodeum with strongly raised carinae, posterior transverse carina complete, area superomedia longer than wide (Figure 82f); ovipositor lower valve slightly widened but not enclosing upper valve (Figure 82g).....*Epitheronia*

-. Mandible with lower tooth longer than upper tooth (Figures 84e, 85b, 86b); propodeum with weakly to moderately strong carinae, posterior transverse carina often absent medially, sometimes nearly complete but weak, area superomedia wider than long (Figures 84h, 85d, 86d); ovipositor lower valve enclosing upper valve (Figures 84d, 85c, 86c).....*Nomosphecia*

11. Fore wing with areolet closed, vein 3*rs-m* present (Figure 118); clypeus usually with median apical notch (Figures 117, 135b); notauli weak to moderately deep, never convergent posteriorly in a shallow hollow.....12

-. Fore wing with areolet open on outer side, vein 3*rs-m* completely absent (Figures 112, 126); clypeus with apical margin thin, truncate or emarginated (Figures 109, 122), without or in *Zaglyptus* with weakly, broadly median apical notch; notauli deep, usually convergent posteriorly in a shallow hollow (Figure 111).....18

12. Occipital carina absent or indistinct mediodorsally; mesoscutum polished, almost impunctate

(Figure 96); pleural carina of propodeum entirely absent; wings pale reddish brown with infuscate margin……*Camptotypus*

-. Occipital carina complete; mesoscutum dense punctate, pubescent; pleural carina of propodeum present; wings hyaline……13

13. Hind wing with first abscissa of vein *Cu*1 longer than vein *cu-a*……14

-. Hind wing with first abscissa of vein *Cu*1 shorter than or nearly as long as vein *cu-a*……15

14. Eye very large, inner margin strongly concave opposite antennal socket (Figure 135b); occipital carina not dipped mediodorsally; propodeum without any stub of lateromedian longitudinal carinae.....*Sericopimpla*

-. Eye normal, inner margin weakly concave opposite antennal socket (Figure 117); occipital carina dipped mediodorsally; propodeum with lateromedian longitudinal carina short to long (Figure 119)……*Acropimpla*

15. Mesopleural suture foveolate; propodeum with mediodorsally hollow (Figures 101f, 102d); tergite 2 usually with impressed oblique groove cutting off anterior corner (Figure 101b); ovipositor with lower valve party enclosing upper valve (Figures 101c, 102c)…… ……*Dolichomitus*

-. Mesopleural suture smooth; propodeum without mediodosally hollow; tergite 2 without or with weakly impressed oblique groove; ovipositor with lower valve never enclosing upper valve……..16

16. Epicnemial carina present on lower half of mesopleuron; propodeum with lateromedian longitudinal present on basal 0.5 (Figure 134b); tibiae without bristles at apex; ovipositor shorter than fore wing, with distinct nodus (Figure 134c)……*Gregopimpla*

-. Epicnemial carina extending nearly to dorsal margin of mesopleuron; propodeum without carinae, except posterior stub of lateral longitudinal carina; tibiae with bristles at apex; ovipositor longer than fore wing, without or with weak nodus……17

17. Occipital carina dipped mediodorsally; notaulus weak and short, present anteriorly; metasoma exceptionally long, without tubercles (Figure 108); first sternite about 0.8 times as long as its tergite……*Leptopimpla*

-. Occipital carina evenly curved; notaulus moderately long and impressed; metasoma not exceptionally long, with tubercles (Figures 104b, 105b, 106e); first sternite about 0.4–0.5 times as long as its tergite (Figures 104d, 106d)……*Flavopimpla*

18. Mandible stout, swollen next to apex (Figures 137c, 138e, 139d); mesoscutum with lateral flange postero-centrally narrow, not or only barely broader than it is anteriorly; mesopleuron with epicnemial carina long, extending at least to groove below subalar prominence; posterior part of propodeum with a median and two lateral swellings (Figure 138g); ovipositor tip subcylindric, the

most proximal tooth of ovipositor lower valve with an elongate free tip (Figure 137e)……*Zaglyptus*

-. Mandible narrow, pointed; mesoscutum with lateral flange postero-centrally distinctly broadened (Figures 111, 123); mesopleuron with epicnemial carina present on lower half; posterior part of propodeum without median and lateral swellings (Figures 125, 130g, 132f); ovipositor tip strongly pointed; ovipositor lower valve without teeth……..19

19. Mesoscutum polished, sparsely pubescent (Figure 111), with sharp vertical carina on each side of median lobe anteriorly; epomia strong, extending from ventral nearly to dorsal margin of pronotum (Figure 110); proximal end of lower valve of ovipositor expanded forming a lobe (Figure 114) ……*Acrodactyla*

-. Mesoscutum moderately to densely, evenly pubescent, without vertical crest anteriorly (Figures 123, 130f, 132e); lower end of epomia remote from lower margin of pronotum; proximal end of lower valve of ovipositor not expanded (Figures 128, 130d, 132g)……..20

20. Metasoma insertion separated from hind coxal cavities by strong sclerotized bridge; first tergite elongate, about more than 2.0 times, as long as apical width; second tergite shorter than first; ovipositor lower valve without small ridges basally; fifth tarsomere of hind tarsus about 1.7–2.0x times longer than third.....*Brachyzapus*

-. Metasoma insertion confluent with hind coxal cavities; first tergite broader, not more than 1.7 times as long as apical width; second tergite slightly longer than first; ovipositor lower valve with small ridges basally (Figure 131); fifth tarsomere of hind tarsus slightly shorter than third.....*Chablisea*

CHAPTER 1. THE *PIMPLA* GENUS-GROUP

Diagnosis. Mandibular upper tooth slightly to distinctly broader and longer than lower tooth; mesopleural sulcus straight; fore wing with areolet closed (except in some species of *Xanthopimpla*); hind wing with first abscissa of vein *Cu*1 always shorter than length of vein *cu-a*; female flagellum with columnar projections apically, second tergite with a long, oblique, impression; male with 8th sternite elongate (Gauld *et al*., 2002).

The *Pimpla* genus-group includes eight genera: *Alophopimpla*, *Apecthis*, *Echthromorpha*, *Itoplectis*, *Lissopimpla*, *Pimpla*, *Strongylopsis* and *Xanthopimpla*. This monophyletic group is supported by 16 apomorphies (Gauld *et al.,* 2002). Inside this genus-group, the *Xanthopimpla* genus-group (*Lissopimpla* + *Xanthopimpla*) is a strongly monophyletic subgroup and the remaining six genera, the *Pimpla* genus-group, also form a robust monophyletic clade (Gauld *et al.*, 2002).

In Vietnam, members of five genera: *Echthromorpha*, *Itoplectis*, *Lissopimpla*, *Pimpla* and *Xanthopimpla* have been documented (Plant Protection Research Institute, 1976; Vu, 1986; Townes & Chiu, 1970; Pham *et al.*, 2011c, e*,* 2013a).

Echthromorpha Holmgren, 1868

Echthromorpha Holmgren, 1868: 406. Type-species: *Echthromorpha maculipennis* Holmgren, 1868.
Syene Snellen van Vollenhoven, 1878: LXXVI. Type-species: *Cryptus notulatorius* Fabricius (= Synonyms:
Ichneumon agrestorius Swederus) by subsequence designation, Ashmead, 1900: 57.
Stagmopimpla Saussure, 1892. In Grandidier: Histoire physique, naturelle et politique de Madagascar 20 (Hyménoptères), part 1, pl. 16, Figure 1, pl. 20, Figure 2. Type-species: (*Stagmopimpla hyalina* Saussure) = *agrestoria hyalina* Saussure, designated by Viereck, 1914.
Polyamma Kriechbaumer, 1894. Berlin. Ent. Ztschr. 39: 304. Type-species: (*Pimpla continua* Brullé) = *agrestoria variegata* Brullé, by monotypy.
Rhynchopimpla Kriechbaumer, 1894. Berlin. Ent. Ztschr. 39: 51. Type-species: (*Pimpla interrupta* Brullé) = *agrestoria interrupta* Brullé, by monotypy.
Chrysopimpla Cameron, 1899. Mem. & Proc. Manchester Lit. Phil. Soc. 43 (3): 185. Type-species: (*Chrysopimpla ornatipes* Cameron) = *agrestoria notulatoria* Fabricius, designated by Viereck, 1914.
Allotheronia Ashmead, 1900. Proc. U.S. Natl. Mus. 23: 55. Type-species: (*Allotheronia 12-guttata* Ashmead) = *intricatoria* Fabricius, by monotypy.
Glyptogastra Ashmead, 1900. Proc. U.S. Natl. Mus. 23: 57. Type-species: *Glyptogastra hawaiiensis* Ashmead, by original designation.

Diagnosis. Inner margin of eye broadly and deeply concave above level of antennal socket; clypeus

moderately to very long, subdivided by transverse suture; malar space 0.5–2.0x basal width of mandible; mandible short, taped to apex, lower tooth much shorter than upper tooth; notaulus short or absent; mesopleural suture straight, not angled centrally; propodeum with coarse punctures or sometimes with transverse winkles; tarsal claws of female large and sharp, without basal lobe, largest bristles on mid and hind tibiae enlarged with strong flattened tips; fore wing with *cu-a* far distad of *Rs*&*M*; hind wing with first abscissa of vein *Cu*1 very short, sometimes arising from *M+Cu*; metasomal tergites subpolished and with coarse punctures or mat; ovipositor weakly decurved, depressed at tip (Townes, 1969; Gauld, 1984).

This genus comprises 14 currently recognized species, centred in the Papuan subregion (Yu *et al.,* 2005). It has been known as the most successful ichneumonid genus to colonize small oceanic islands (Townes, 1969). The species, *E. agrestoria*, is extremely widespread. It appears to migrate (Common, 1954) and has spread across the south Pacific, colonizing many remote islands (Perkins, 1952; Mason, 1974).

Echthromorpha species are known to parasitize a variety of lepidopterous pupae and prepupae including those of Noctuidae, Hesperiidae, Agaristidae, Anathelidae, Bombycidae, Lycaenidae, Lymamtriidae, Psychidae, Xyloryctidae, Papilionidae, Tortricidae and Saturniidae (Gauld, 1984).

In Vietnam, a single species, *E. agrestoria*, has been known (Plant Protection Institute, 1976).

***Echthromorpha agrestoria* (SWEDERUS, 1787)**

(Figures 24, 25)

Ichneumon agrestorius Swederus, 1787. Kongliga Svenska Vetenskapsakademiens Handlingar. 8: 279. Holotype: ♀, Tahiti (BMNH).

Material examined. Ninh Binh, Cuc Phuong NP, 225 m a.s.l.: 1♂ (RMNH), 01–15.v.2000; 4♂, 15–27.v.2000, Malaise trap, Q. P. Mai leg.; Vinh Phuc, Ngoc Thanh, Phuc Yen: 1♂ (IEBR), 24.v.2000, hand net, L. T. P. Nguyen leg.; Son La, To Hieu: 1♀ (IEBR), 20.ix.2000, L. X. Truong leg.; Ha Noi, Yen Bai, Khoang Xanh: 1♂ (IEBR), 100 m a.s.l., 01.vi.2001, N. T. Pham leg.; Ha Noi, Gia Lam, Da Ton: 1♂ (IEBR), 22.vi–02.vii.2001, Malaise trap, L. D. Khuat leg.; Hoa Binh, Yen Thuy, Lac Thinh: 1♂ (IEBR), 01–10.iv.2002; 1♀ (IEBR), 10–20.vi.2002; 1♂ (IEBR), 01–10.vii.2002, Malaise trap, L. D. Khuat leg.; Lam Dong, Bao Loc, Dambri: 1♀ (IEBR), 04.v.2003, T. V. Hoang leg.; Phu Tho, Xuan Son NP: 1♂ (IEBR), 08.v.2005, N. T. Pham leg.; Dong Nai, Cat Tien NP, 100 m a.s.l.: 1♀4♂ (RMNH), 01–09.x.2005, Malaise trap, C. v. Achterberg & R. de Vries leg.; 3♀2♂ (RMNH), 09–30.iv.2007; 2♀ (RMNH), 10–30.iv.2007, Malaise trap, Q. P. Mai & M. T. Nguyen leg.; 1♂ (RMNH), 09.iv–13.v.2007; 1♂ (RMNH), 09.iv–19.v.2007, Malaise trap, Q. P. Mai, M. T. Nguyen & C. v. Achterberg leg.; Thai

Nguyen, Dinh Hoa Phu Dinh: 1♂ (IEBR), 03.iv.2005, hand net, T. V. Hoang leg.; Thai Nguyen, Dai Tu, Cat Ne: 1♂ (IEBR), 15–20.v.2008, Malaise trap, L. D. Khuat leg.; Ha Tinh, Huong Son, Son Hong: 1♂ (IEBR), 25.iv.2005, hand net, L. X. Truong leg.; Nghe An, Pu Mat NP: 2♂ (IEBR), 350 m a.s.l., 26.iv.2006, hand net, H. X. Le leg.; 1♀ (IEBR), 150–200 m a.s.l., 14.iv.2006, at light, T. V. Hoang leg; 5♂ (IEBR), 14.iv.2006, hand net, N. T. Pham leg.; Nghe An, Anh Son, Phuc Son: 1♂ (IEBR), 250–400 m, 22.iv.2006, H. X. Le leg.; Hoa Binh, Mai Chau, Pa Co: 2♂ (IEBR), 1000 m a.s.l., 23.viii.2005, hand net, L. T. P. Nguyen leg.; Thua Thien-Hue, Hong Van, A Luoi: 1♀ (IEBR), 600–650 m a.s.l., 30.v.2006, hand net, N. T. Pham leg.; Thua Thien Hue, Bach Ma NP: 1♀2♂ (RMNH), 105 m a.s.l., 16°14.46'N 107°52.06'E, 27.iii–12.iv.2011, Malaise trap, C. v. Achterberg leg.; Quang Binh, Phong Nha-Ke Bang NP: 1♀ (IEBR), 600 m a.s.l., 04.xi.2006, hand net, H. X. Le leg.; Ha Giang, Vi Xuyen, Cao Bo: 1♂ (IEBR), 400 m a.s.l., 10.iv.2007, hand net, L. D. Khuat leg.; Thanh Hoa, Nhu Xuan, Xuan Hoa: 1♀ (IEBR), 30.v.2008, hand net, T. V. Hoang leg.; Kon Tum, Sa Thay, Sac Li: 1♀ (IEBR), 22.vi.2008, hand net, T. V. Hoang leg.; Da Nang, Hai Van pass: 3♂ (IEBR), 03.iv.2011, hand net, L. D. Khuat leg.; Da Nang, opposite Da Nang Bay: 7♂ (RMNH), 55 m a.s.l., 16°08.32'N 107°08.02'E, 03.iv.2011, hand net, C. v. Achterberg leg.

Diagnosis. Face slightly wider than long; clypeus as long as wide, transverse suture divided clypeus into long basal half and short apical half; malar space 1.1–1.2x mandible basal width; occipital carina complete, meeting hypostomal carina at about more than 2.0x basal mandible width from base of mandible; metapleuron with submetapleural carina absence; fore wing with fuscous spot at apical of marginal and third cubital cells; ovipositor about 1.4x hind tibia length, depressed at tip, both upper and lower valves with apical ridges.

Distribution. The Plant Protection Research Institute (1976) recorded this species for the first time from Vietnam on material collected in Hanoi. Our records extended the distribution of this species in Vietnam. Outside Vietnam, this species has a wide range from the Indo-Australian, Afrotropic and Nearctic regions (Yu *et al*., 2005).

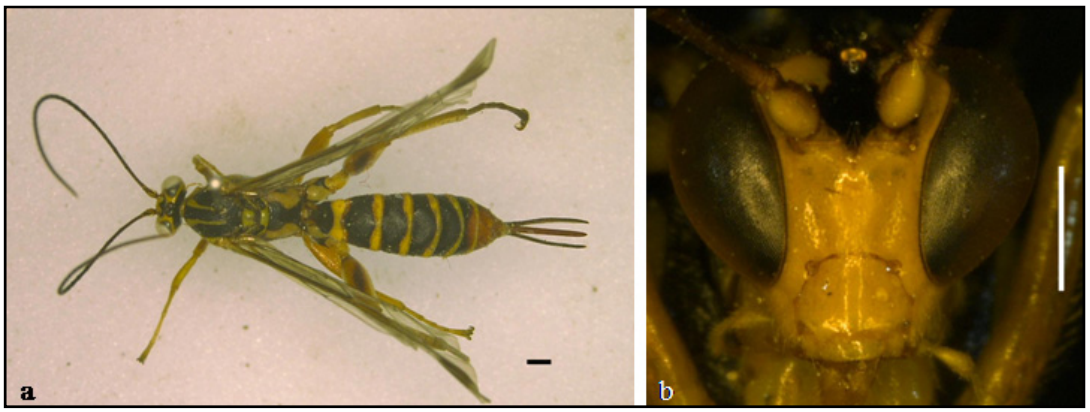

Figure 24. *E. agrestoria* (scales 1 mm): a. dorsal view; b. face

Remarks. Male specimens collected from Cat Tien NP have a strongly developed epomia, the diameter of the lateral ocellus is much larger than the ocellar-ocular distance (more than 2.0x), and epicnemial carina does not extending to the groove below the subalar prominence. Currently 24 subspecies are known, of which *E. agrestoria notulatoria* (Fabricius, 1804) is the only one recorded from Vietnam.

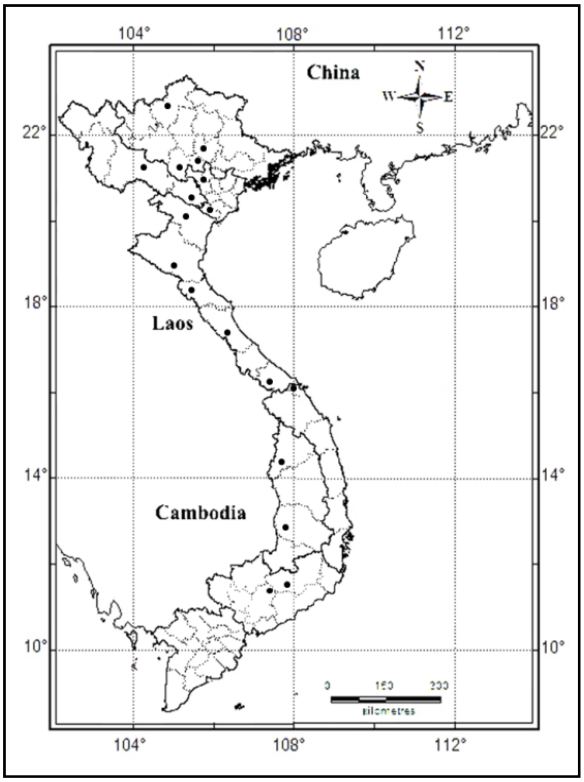

Figure 25. Distribution map of *Echthromorpha agrestoria*

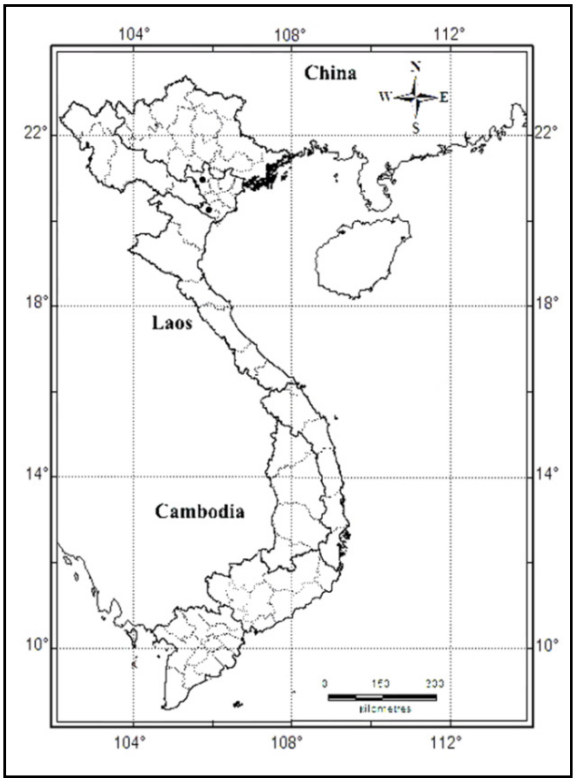

Figure 26. Distribution map of *Itoplectis naranyae*

Itoplectis **Foerster, 1869**

Itoplectis Foerster, 1869. Vehr. Naturh. Ver. Rheinlande 25: 164. Type-species: (*Ichneumon scanicus* Villers, 1789) = *Ichneumon maculator* Fabricius, 1775, by subsequent designation, Viereck, 1914: 79.

Nesopimpla Ashmead 1906. Proc. U. S. Natl. Mus. 30: 180. Type-species: *Nesopimpla naranyae* Ashmead, by monotypy.

Exeristesoides Uchida 1928. Jour. Faculty Agr. Hokkaido Imp. Univ. 25: 51. Type-species: (*Pimpla spectabilis* Matsumura, 1926) = *alternans spectabilis* Matsumura, by original designation.

Diagnosis. Small sized insects (fore wing length 5.0–9.0 mm) which are predominantly reddish to blackish in colour with the metasoma usually pale banded; clypeus simple, not divided into basal and apical parts by transverse suture; clypeal margin thin, apically truncate; mandible evenly narrowed, bidentate, not twisted; occipital carina complete; pronotum moderately long, with anteriorly margin simple, lower corner acutely pointed; epomia present as a weak ridge more or

less parallel to anterior margin of pronotum; mesoscutum smooth, with notaulus absent; epicnemial carina complete; mesopleural suture straight; metapleuron with submetapleural carina complete or only represented by an anterior vestige; fore tarsal claws of female usually with a tooth; fore wing with vein 3*rs-m* complete, enclosing a rhombic areolet; hind wing with distal abscissa of *Cu*1 present, joining *cu-a* much closer to *M* than to 1*A*; metasoma quite short and stout; ovipositor sheath about 0.9 times as long as hind tibia; apex of ovipositor more or less straight; male with subgenital plate elongate (Townes, 1969; Gauld, 1991).

Itoplectis is a moderately large genus with species recorded from most regions of the world except for Australia (Gauld, 1991). Among 61 recognized species, *Itoplectis* is represented in the Oriental region by eight species (Yu *et al.*, 2005; Kasparyan, 2007). In Vietnam, only one species has been documented so far (Vu, 1986; Bui, 1990).

Itoplectis species are primary endoparasitoids of weakly concealed or cocooned lepidopterous pupae. Many hosts are species which pupate on or in vegetation rather than in the leaf litter. Some *Itoplectis* species also regularly behave as facultative pseudohyperparasitoids, developing in ichneumonid pupae within their cocoons (Gauld, 1991).

***Itoplectis naranyae* (ASHMEAD, 1906)**

(Figure 26)

Nesopimpla naranyae Ashmead, 1906. Proc. U. S. Natl. Mus. 30: 180. Holotype: ♀, Japan: Hokkaido, Sapporo (USNM).
Itoplectis naranyae: Townes (1940).

Material examined. None.

Diagnosis. Face nearly quadrate; inner margin of eye strongly concave opposite antennal socket; frons deeply excavated; mesosoma black; legs ferruginous except hind leg marked with black; propodeum with lateromedian longitudinal carina present; metasomal tergites 1–5 ferruginous; female with hind second tarsomere shorter than fifth (Ashmead, 1906; Bui, 1990).

Distribution. This species was recorded from Hanoi and Ninh Binh provinces as parasitoid of lepidopteran pests: *Cnaphalocrocis medinalis* (Guenée) (Pyralidae), *Parnara guttata* (Bremer and Grey), *Pelopidas mathias* Fabricius (Hesperiidae), *Naranga aenescens* Moore (Noctuidae), *Brachmia sp*. (Gelechiidae) (Vu, 1986; Bui, 1990). Outside Vietnam, it has been known from China, Japan, Korea, Russia, Taiwan and the Philippines (Yu *et al*., 2005).

***Lissopimpla* Kriechbaumer, 1889**

Lissopimpla Kriechbaumer, 1889: 309. Type-species: *Lissopimpla octoguttata* Kriechbaumer, 1899 (= *Pimpla excelsa* Costa), by subsequent designation, Ashmead, 1900: 55.

Synonyms:

Xenopimpla Cameron, 1898: 28. Type-species: *Rhyssa semipunctata* Kirby (= *Pimpla excelsa* Costa), by monotypy.

Trichrus Tosquinet, 1903: 373. Type-species: *Trichrus stupenda* Tosquinet (= *Pimpla basalis* Snellen van Vollenhoven), by mototypy.

Notiopimpla Vachal, 1907: 118. Type-species: *Notiopimpla priocnemidea* Vachal (= *Pimpla excelsa* Costa), by subsequent designation, Viereck, 1914: 101.

Diagnosis. Inner margin of eye broadly concave above antennal socket; clypeus moderately long, transverse suture divided clypeus into shorter basal and slightly longer apical half; face with a vertical impression on each side of the midline; mandible about 1.4x basal width of mandible; mandible twisted about 20–40°, rather short, strongly tapered toward apex, its lower tooth much smaller than upper tooth; notaulus sharp, reaching centre of mesoscutum, its front end crossed by a short, strong, transverse crest; mesopleuron with strong horizontal impression reaching from mesopleural sulcus forward to near upper end of epicnemial carina, mesopleural suture angled slightly centrally; propodeum with subconical apophyses present at position of junction of posterior transverse carina and lateral longitudinal carina and a strong median tubercle; hind wing with first abscissa of vein *Cu*1 very short or obliterated; hind femur with a tooth beneath near apex; metasomal tergites polished, impunctate or with very small punctures; first sternite of female with a strong sharp transverse crest (Townes, 1969; Gauld, 1984).

This genus comprises 10 described species from the Indo-Australian region with most species in Australia and nearby south Pacific Islands. Their hosts are the pupae and prepupae of various Lepidoptera, especially Noctuidae (Gauld, 1984; Yu *et al.,* 2005). In Vietnam, *Lissopimpla* is represented by a single species, *L. basalis* (Pham *et al.,* 2011e).

***Lissopimpla basalis* (VOLLENHOVEN, 1879)**

(Figures 27, 28)

Pimpla basalis Vollenhoven, 1879. Stettin Ent. Ztg. 40 (4-6): 148. Holotype: ♂, Indonesia: Sumatra (RMNH).

Lissopimpla basalis: Townes, Townes & Gupta (1961).

Material examined. Thua Thien-Hue, Phong Dien NR: 1♀5♂ (RMNH), 100–150 m a.s.l., 22.iii–06.iv.2001, Malaise trap, C. v. Achterberg & R. de Vries leg.; Thua Thien-Hue, Bach Ma NP: 1♂ (IEBR), 700 m a.s.l., 19.v.2007, hand net, L. D. Khuat leg.; 1♀1♂ (RMNH), 105 m a.s.l., 16°14.46'N 107°52.06'E, 27.iii–12.iv.2011; 1♀ (RMNH), 480 m a.s.l., 16°13.43'N 107°51.15'E, 28.iii–12.iv.2011, Malaise trap, C. v. Achterberg leg.; Ninh Binh, Cuc Phuong NP: 1♂ (IEBR), 20–30.viii.2002; 1♀ (IEBR), 10–20.xi.2002, Malaise trap, L. D. Khuat leg.; Hoa Binh, Yen Thuy, Lac Thinh: 1♂ (IEBR), 01–

10.iii.2003; 1♂ (IEBR), 10–20.iii.2003; 1♂ (IEBR), 30.iii–10.iv.2003, Malaise trap, L. D. Khuat leg.; Dong Nai, Cat Tien NP: 2♀3♂ (RMNH), 100 m a.s.l., 01–09.x.2005, Malaise trap, C. v. Achterberg & R. de Vries leg.; 1♂ (RMNH), same locality, 09.iv–13.v.2007, Malaise trap, Q. P. Mai, M. T. Nguyen & C. v. Achterberg leg.; 2♀3♂ (RMNH), same locality, 09–30.iv.2007, Malaise trap, Q. P. Mai & M. T. Nguyen leg.; Nghe An, Pu Mat NP: 2♂ (IEBR), 150–200 m a.s.l., 08.v.2005, hand net, N. T. Pham leg.; Nghe An, Tuong Duong, Tam Quang: 1♀1♂ (ZFMK) 1♂ (IEBR), 200–300 m a.s.l., 19.iv.2006, hand net, N. T. Pham leg.; Quang Nam, Phuoc Son, Phuoc Xuan: 1♂ (IEBR), 300–400 m a.s.l., 26.v.2006, hand net, N. T. Pham leg.; Dak Lak, Chu Yang Sin NP: 2♀3♂ (RMNH), 740–900 m a.s.l., 02–10.vi.2007; 1♀ (RMNH), 500 m a.s.l., 03–09.vi.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.; Dak Lak, Ea So NR: 1♂ (IEBR), 310 m a.s.l., 12°55.93'N–108°37.96'E, 27.vii.2008, Malaise trap, H. T. Ngo leg.; Ha Tinh, Vu Quang NP: 1♂ (RMNH), 66 m a.s.l., 18°19.47'N 105°26.28'E, 04.iii–15.iv.2011, Malaise trap, C. v. Achterberg leg.

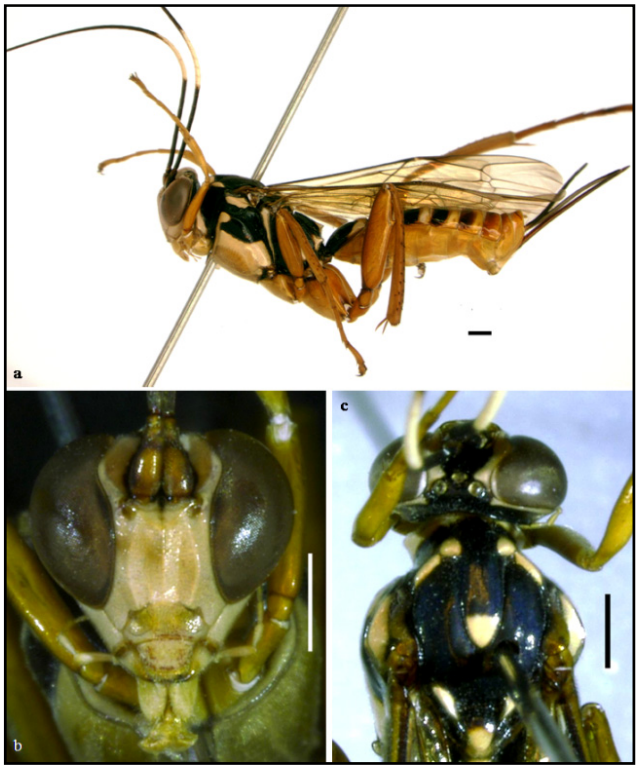

Figure 27. *L. basalis* (scales 1 mm): a. lateral view; b. face; c. dorsal view of head and mesonotum

Diagnosis. Antenna of female with flagellomeres 8–13 whitish, antenna of male with less flagellomeres than in female; diameter of lateral ocellus about 2.0x ocellar-ocular distance, face with anterior tentorial pit usually present below level of lower margin of eye; clypeus nearly as long as wide; notauli sharp, convergent at posterior 0.3 of mesoscutum; dorsomedian part of propodeum with strongly transverse wrinkles; fore wing with *cu-a* basad of *Rs*&*M*; hind tibia with many sharp bristles; ovipositor straight, cylindrical, about 1.25x hind tibia length, lower valve with apical ridges.

Distribution. Pham *et al.* (2011e) recorded this species from Vietnam for the first time. Outside Vietnam, this species has been known from Indonesia and the Philippines (Yu *et al.,* 2005).

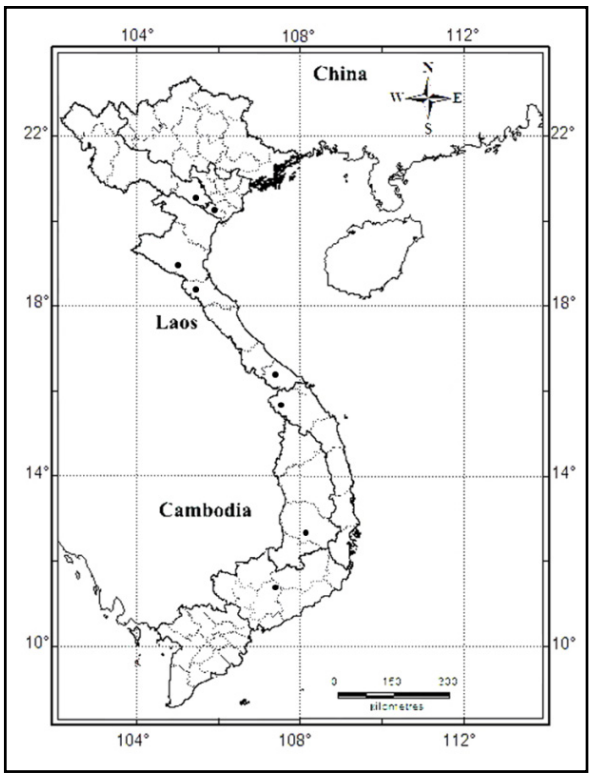

Figure 28. Distribution map of *L. basalis*

***Pimpla* Fabricius, 1804**

Pimpla Fabricius, 1804: 112. Type-species: *Ichneumon instigator* Fabricius *(= Ichneumon hypochondriaca* Retzius), by subsequent designation (Opinion 159, International Commission on Zoological Nomenclature, 1954: 282).

Synonyms:

Coccygomimus Saussure, 1892: plate 14, Figure 12. Type-species: *Coccygomimus madecassus* Saussure, by monotypy.

Habropimpla Cameron, 1900: 96. Type-species: *Habropimpla bilineata* Cameron, by monotypy.

Lissotheronia Cameron, 1905: 139. Type-species: *Lissotheronia flavipes* Cameron, by monotypy.

Phytodiaetoides Morley, 1913: 221. Type-spcies: *Phytodiaetoides megaera* Morley = *Pimpla flavipalpis*, by original designation.

Pimplidea Viereck, 1914: 117. Type-species: *Pimpla pedalis* Cresson, by original designation.

Coelopimpla Brèthes, 1916: 402. Type-species: *Coelopimpla amadei* Brèthes, by original designation.

Liotheronia Enderlein, 1919: 147. Type-species: *Liotheronia kriegeri* Enderlein, by original designation.

Dihyboplax Enderlein, 1919: 148. Type-species: *Dihyboplax flavipennis* Enderlein, by original designation.

Neogabunia Brèthes, 1927: 322. Type-species: *Neogabunia paulistana* Brèthes = *Pimpla tomyris* Schrottky, by monotypy.

Opodactyla Seyrig, 1932: 60. Type-species: *Pimpla* (*Opodactyla*) *waterloti* Seyrig, by original designation.

Oxypimpla Noskiewicz & Chudoba, 1951: 42, 56. Type-species: *Pimpla turionellae* Linnaeus, by monotypy.

Jamaicapimpla Mason, 1975: 225. Type-species: *Ephialtes nigroaeneus* Cushman, by original designation.

Diagnosis. Face moderately convex, wider than long; inner margin of eye weakly to moderately concave above antennal socket; clypeus a little convex basally, concave apically, not divided into basal and apical parts by transverse suture; malar space usually long; mandible moderately stout, tapered, not twisted, upper tooth usually slightly broader and longer than lower tooth; mesoscutum without distinct crest anteriorly; notaulus weak or absent; mesopleuron with epicnemial carina complete, mesopleural suture straight; propodeum angled at level of lateral longitudinal carina, without carinae except posterior part of lateral carina and basal stub of median longitudinal carina present (sometimes extending to middle); propodeal spiracle elongate, not touching pleural carina; fore wing with areolet closed; first abscissa of hind wing vein *Cu*1 much shorter than vein *cu-a*; tarsal claws of both sexes large, simple, without basal lobe, without spatulate bristle; metasomal tergites usually densely punctate, but sometimes coriaceous, sparsely punctate or impunctate (Townes, 1969; Gupta & Saxena, 1987; Gauld, 1984, 1991).

Pimpla is a large, cosmopolitan genus of the tribe Pimplini (Hymenoptera: Ichneumonidae) with 205 currently recognised species. Species richness is higher in the Neotropics and the Palearctics (61 and 57 species respectively) compared to the Oriental region (42 species), whilst only 10 species occur in the Australian region (Momoi, 1973; Gupta & Saxena, 1987; Diaz, 2000; Yu *et al*., 2005; Khalaim, 2008; Pham *et al*., 2013a). For a long time, this genus was referred to by its junior synonym *Coccygomimus* by many workers (e.g. Townes & Townes, 1960; Townes, 1969; Gupta & Saxena, 1987). Morphologically *Pimpla* is most closed to *Apechthis* and *Itoplectis* but is distinguished by the inner margins of the eyes weakly to moderately concave at the antennal sockets (as opposed to strongly concave); antenna of male often with tyloids; female tarsal claws without a basal tooth; and ovipositor not apically down-curved (Fitton *et al*., 1988, Gauld *et al*., 2002). Gauld *et al*. (2002) found one unambiguous apomorphy for *Pimpla*, the presence of a longitudinal band of fine hair on the ventral surface of the fourth mid-tarsomere. This character is

perhaps better expressed as a narrow zone lacking the stronger, bristle-like setae covering much of the ventral surface of the tarsomeres, this character can be hard to see in small specimens.

In Vietnam, a total of ten species have been documented (Plant Protection Research Institute, 1976; Gupta & Saxena, 1987; Bui, 1990; Pham *et al*., 2013a).

Biologically, *Pimpla* species are endoparasitoids of Lepidoptera pupae or prepupae, usually weakly concealed (e.g. in leaf litter, moss, leaf rolls, in the soil), but sometimes also exposed pupae are used as host (Townes & Townes, 1960; Townes *et al*., 1965; Gupta & Saxena, 1987; Fitton *et al*., 1988; Gauld, 1991). In Vietnam, the lepidopteran hosts of some *Pimpla* species have been recorded (Bui, 1990; Pham, 1997).

Key to Vietnamese species of Pimpla (male of *P. lexuanhuei* and female of *P. chuyangsinensis* are unknown)

1. Male……2

-. Female……10

2. Hind leg black (except a narrow, basal red mark on femur of *P. ereba*)……3

-. Hind leg always marked with red or yellow……4

3. Flagellomeres 5–7 with tyloids, tyloid on flagellomere 5 present apically, on flagellomeres 6–7 tyloids as long as length of flagellomeres (Figure 30b); propodeum with short section of lateromedian longitudinal carina; metasomal tergites weakly corinaceous (Figure 34e)……*P. ereba* Cameron

-. Flagellomeres 6–9, 10 or 11 with tyloids, all extending over length of flagellomeres; propodeum with lateromedian longitudinal carina absent; whole body dull and densely punctate……*P. aethiops* Curtis

4. All femora reddish; metapleuron entirely rugose (Figure 32b); tergites 1–4 densely, coarsely punctate (Figure 34d)……5

-. Femora patterned differently, not at all reddish; metapleuron polished, impunctate ventrally, punctate or rugose dorsally (Figures 32a, 32c); tergites 1–4 with dense, fine to moderate sized punctures (Figures 34a, 34b, 34c)……7

5. Flagellomeres 6–9, 10 or 11 with tyloids (Figure 30e); scutellum with yellow or brown spot apically; fourth laterotergite more elongate, 2.5–2.9 times as long as wide (Figure 34j)……*P. laothoe* (Cameron)

-. Antenna without tyloids; scutellum entirely black; fourth laterotergite broader, usually less than 2.0 times longer than wide (Figure 34i)……6

6. Mesopleuron densely punctate (Figure 32b); trochanters partly to entirely black……*P. cameroni* Dalla Torre

-. Mesopleuron finely, sparsely punctate; trochanters entirely red……*P. nipponica* Uchida

7. Ground colour yellow, with black marks (Figures 35a, 35b); scutellum strongly convex, lateral carina extending to summit (Figure 33d); metapleuron with small punctures dorsally (Figure 32c); [flagellomere 8–10 with tyloids (Figure 30c); fore wing with vein *Rs*&*M* opposite *cu-a*.....*P. chuyangsinensis* Pham, Broad, Dang & Böhme

-. Ground colour black, with yellow or brown marks; scutellum weakly to moderately convex with lateral carina usually not extending to summit; metapleuron with rugose punctures dorsally.....8

8. Pronotum finely punctate near ventral margin, usually with distinct wrinkles along posterior margin (Figure 32a); pronotum and propodeum entirely black; metasomal tergites with narrow yellow apical transverse bands, without apicolateral yellow spots on tergites 1–5 (Figure 34b), [flagellomeres 6–7 with tyloids (Figure 30d)].....*P. carinifrons* Cameron

-. Pronotum polished and impunctate near ventral margin, without or with short wrinkles along posterior margin; pronotum and propodeum marked with yellow; metasomal tergites 1–5 with apicolateral yellow spots (Figure 34a).....9

9. Flagellomeres 6–10 or 7–9 with tyloids (Figure 30a); face with coarse punctures, usually with two lateral yellow spots (Figure 29a); propodeum with two lateral yellow stripes, area petiolaris largely polished, impunctate (Figure 33a); fore wing with vein *Rs*&*M* basad of *cu-a*....*P. bilineata* (Cameron)

-. Antenna usually without tyloids, or sometimes with tyloid on flagellomere 6; face with moderate sized punctures, entirely black (Figure 29b); propodeum with two apicolateral yellow spots, area petiolaris finely punctate (Figure 33c); fore wing with vein *Rs*&*M* opposite to distad of *cu-a*.....*P. flavipalpis* Cameron

10. Scutellum strongly convex with lateral carina long, extending nearly to apex (Figure 33e); metapleuron with shallowly rugose punctures dorsally (Figure 32f); fore wing with infuscate margin; tip of ovipositor depressed, ovipositor straight (Figure 31a); pale reddish with restricted black marks (Figures 35c, 35d); [vein *Rs*&*M* opposite *cu-a*)].....*P. lexuanhuei* Pham, Broad, Dang & Böhme

-. Scutellum moderately to strongly convex with lateral carina present basally or extending to middle, except *P. cameronii*, with lateral carina extending nearly to apex; metapleuron strongly punctate or striate over entire height (Figures 32d, 32e); fore wing entirely brownish yellow; tip of ovipositor cylindrical or depressed in *P. bilineata*, in which ovipositor down-curved; black marked with yellow or reddish.....11

11. Legs black, although fore leg may have yellowish marks.....12

-. Legs largely reddish or yellowish.....13

12. Propodeum densely, strongly striate (Figure 33g); first tergite with lateromedian carinae strongly humped dorsally; metasomal tergites distinctly coriaceous (Figure 34f)....*P. ereba* Cameron

-. Propodeum densely, coarsely punctate; first tergite without humps; metasomal tergites densely, coarsely punctate……*P. aethiops* Curtis

13. Metasomal tergites entirely black or with reddish or brownish apical transverse smooth bands; pronotum usually densely, coarsely punctate or striate; all femora reddish ……14

-. Metasomal tergites black marked with yellow; pronotum largely smooth and shiny, with shallow punctures, striations, when present, only at hind edge ……16

14. Fourth laterotergite more elongate, 2.4–3.0 times as long as wide; scutellum with yellow or brown spot apically (Figure 33h).....*P. laothoe* Cameron

-. Fourth laterotergite broader, 1.7–1.8 times as long as wide; scutellum entirely black.....15

15. Propodeum with lateromedian longitudinal carinae long, posterior transverse carina present medially (Figure 33f); mesopleuron densely punctate; trochanters largely black...*P. cameronii* Dalla Torre

-. Propodeum without or with short stub of lateromedian longitudinal carina, posterior transverse carina entirely absent; trochanters entirely red……*P. nipponica* Uchida

16. Scutellum flat; ovipositor depressed and down-curved, with distinct transverse ridges on upper and lower valves apically; propodeum with yellow, elongate lateral stripes.....*P. bilineata* (Cameron)

-. Scutellum moderately convex; ovipositor straight, subcylindric, upper valve without or with weak ridges apically; propodeum entirely black or with yellow apicolateral spots 17

17. Mesopleuron with dense, small, rugose punctures; fore wing with vein *Rs*&*M* distad of *cu-a*; propodeum with yellow apicolateral spots; metasomal tergites with apical transverse bands and apicolateral spot yellow……*P. flavipalpis* Cameron

-. Mesopleuron shiny, with well separated, large punctures; fore wing with vein Rs&M basad of *cu-a*; propodeum entirely black; tergites with apical transverse bands yellow.....*P. carinifrons* Cameron

***Pimpla aethiops* CURTIS, 1828**

(Figure 36)

Pimpla aethiops Curtis, 1828. British Ent. 5: 214. Lectotype: ♀, Great Britain: reared from *Laelia coenosa* (Lepidoptera: Lymantriidae) (MVMA).

Material examined. None.

Diagnosis. Black, including legs; flagellomeres 6–10 (or 7–9) of male with tyloids; first tergite without humps; tergites densely, coarsely punctate, without smooth apical bands (Curtis, 1828; Bui, 1990).

Distribution. Bui (1990) recorded this species from Hanoi as parasitoid of lepidopteran pests in

rice fields: *Parnara guttata* (Bremer and Grey), *Pelopidas mathias* Fabricius (Hesperiidae), *Cnaphalocrocis medialis* (Guenée) (Pyralidae), *Brachmia* sp. (Gelechiidae) and *Naranga aenescens* Moore (Noctuidae). I have not seen any Vietnamese material. Outside Vietnam, this species has been recorded widely in Europe (although now extinct in the United Kingdom) and in Asia (China, Japan, Korea and Taiwan) (Yu *et al*., 2005).

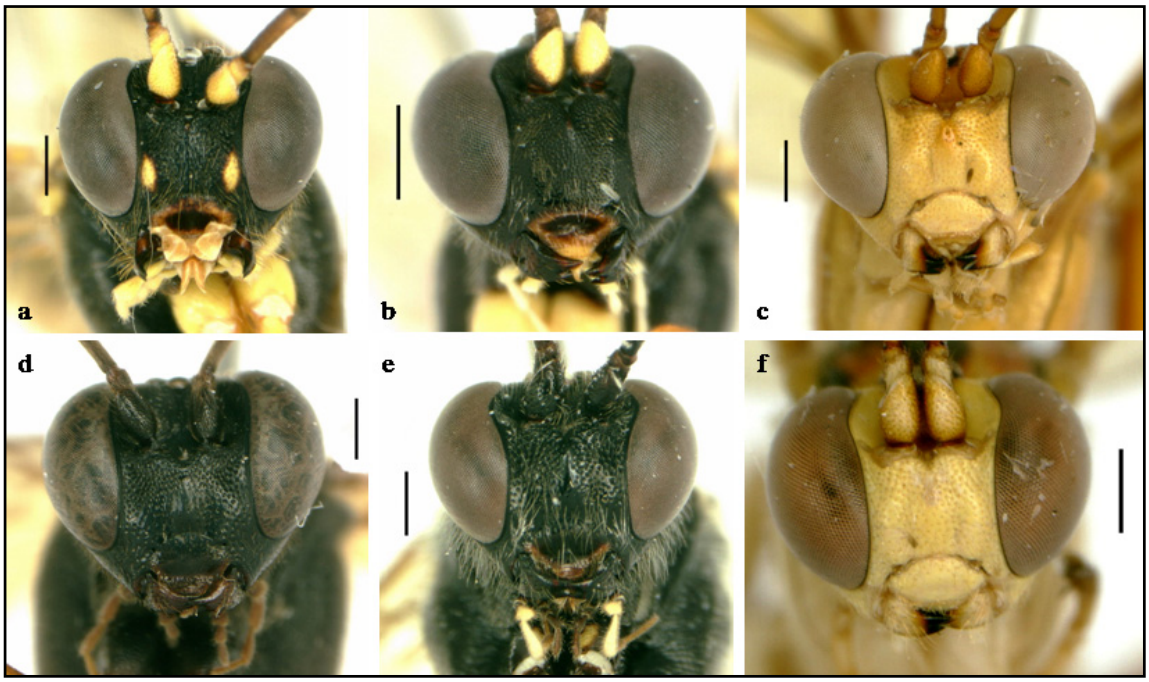

Figure 29. Faces of *Pimpla* species (scales 0.5 mm): a. *P. bilineata* (male); b. *P. flavipalpis* (male); c. *P. lexuanhuei* (female); d. *P. laothoe* (female); e. *P. ereba* (male); f. *P. chuyangsinensis* (male)

***Pimpla bilineata* (CAMERON, 1900)**

(Figures 29a, 30a, 33a, 34a, 36)

Habropimpla bilineata Cameron, 1900. Mem. & Proc. Manchester Lit. Phil. Soc., 44 (15): 97. Holotype: ♂, India: Meghalaya: Khasi Hill (BMNH).

Pimpla bilineata: Gauld (1991).

Material examined. Lao Cai, Hoang Lien NP: 4♂ (RMNH) 2♂ (IEBR), 1550 m a.s.l., 22–29.x.1999, Malaise trap, C. v. Achterberg leg.

Diagnosis. Body black with yellow marks on face, mesosoma and metasomal tergites; flagellomeres 6–10 (or 7–9) of male with tyloids; scutellum weakly convex, nearly flat dorsally; propodeum black with two latero-dorsal yellow stripes; fourth laterotergite elongate, 3.0–4.0x as long as wide; ovipositor depressed and down-curved, with distinct transverse ridges on upper and lower valves.

Distribution. Pham *et al*. (2013a) recorded this species for the first time from Vietnam. Outside

Vietnam, it is known from China, India, Myanmar and Nepal (Yu *et al*., 2005).

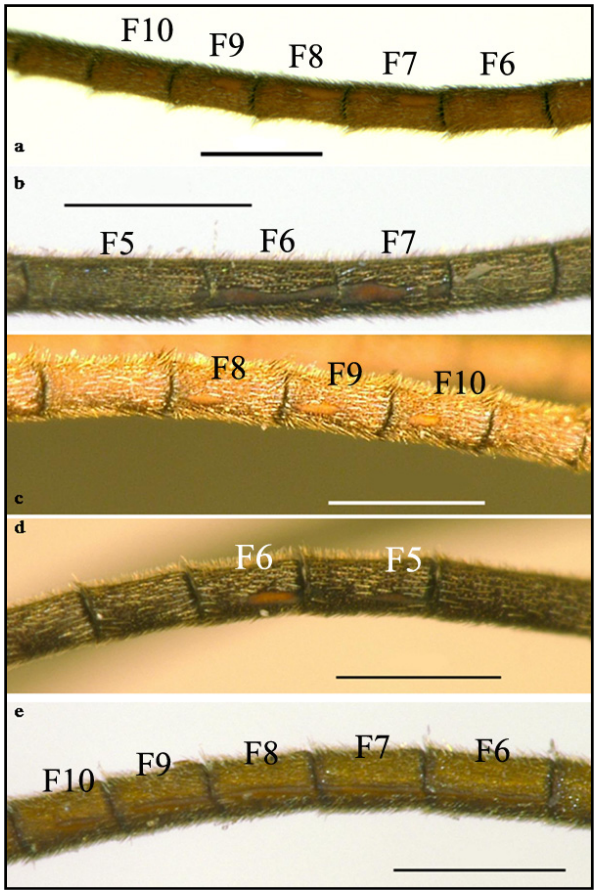

Figure 30: Tyloids on male flagellomeres of *Pimpla* species (scales: 0.5 mm): a. *P. bilineata*; b. *P. ereba*; c. *P. chuyangsinensis*; d. *P. carinifrons*; e. *P. laothoe*

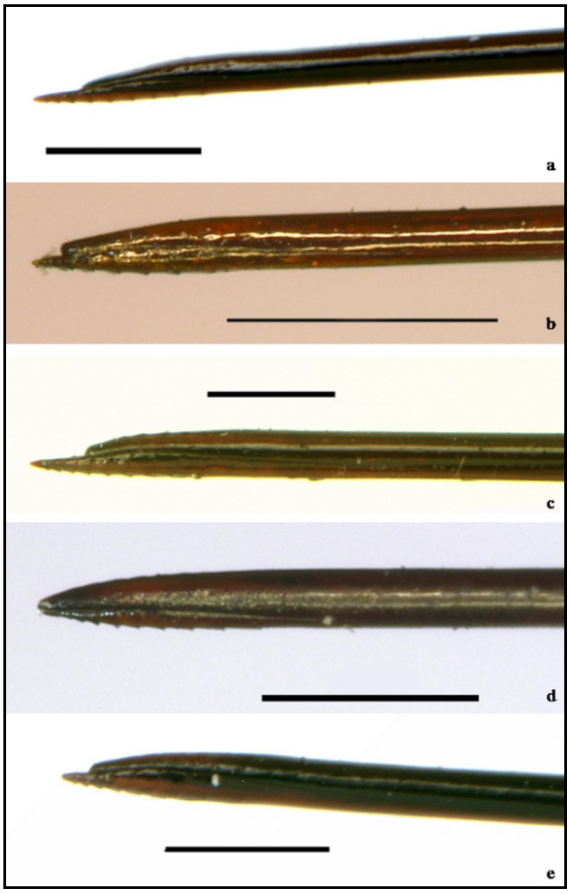

Figure 31. Ovipositor tips of *Pimpla* species (scales 0.5 mm): a. *P. lexuanhuei*; b. *P. cameronii*; c. *P. ereba*; d. *P. flavipalpis*; e. *P. laothoe*

***Pimpla cameronii* DALLA TORRE, 1901**

(Figures 31b, 32b, 33f, 34d, 34i, 36)

Pimpla vidua Cameron, 1899. Mem. & Proc. Manchester Lit. Phil. Soc. 43 (3): 180. Name preoccupied by *Pimpla vidua* Walsh, 1873 (= *Tromatobia ovivora* (Boheman, 1821)). Holotype: ♂, India: Meghalaya: Khasi Hills (OUMNH).

Pimpla cameronii Dalla Torre, 1901. Catalogus Hymenopterorum, 3.

Material examined. Lao Cai, Hoang Lien NP: 1♂ (RMNH), 1550 m a.s.l., 22–29.x.1999, Malaise trap, C. v. Achterberg leg.; Hoa Binh, Mai Chau, Pa Co: 2♀ (IEBR), 1100 m a.s.l., 22.iv.2002, hand net, H. D. Nguyen leg.; Son La, Thuan Chau, Co Ma: 1♀ (IEBR), 1400 m a.s.l., 08.vi.2008, hand net, H. X. Le leg.

Diagnosis. Black; flagellomeres of male without tyloids; scutellum moderately convex,

propodeum of female with median longitudinal and median part of posterior transverse carinae present; mesoscutum subrounded, nearly as long as wide at level of front of tegulae; metapleuron rugosely punctate, tergites with dense, coarse punctures; fourth laterotergite broad, about 1.7–1.9x as long as wide; ovipositor straight, as long as hind tibia.

Distribution. Pham *et al*. (2013a) recorded this species for the first time from Vietnam. Outside Vietnam, it is known from India, Indonesia, Myanmar, Nepal and Taiwan (Yu *et al*., 2005).

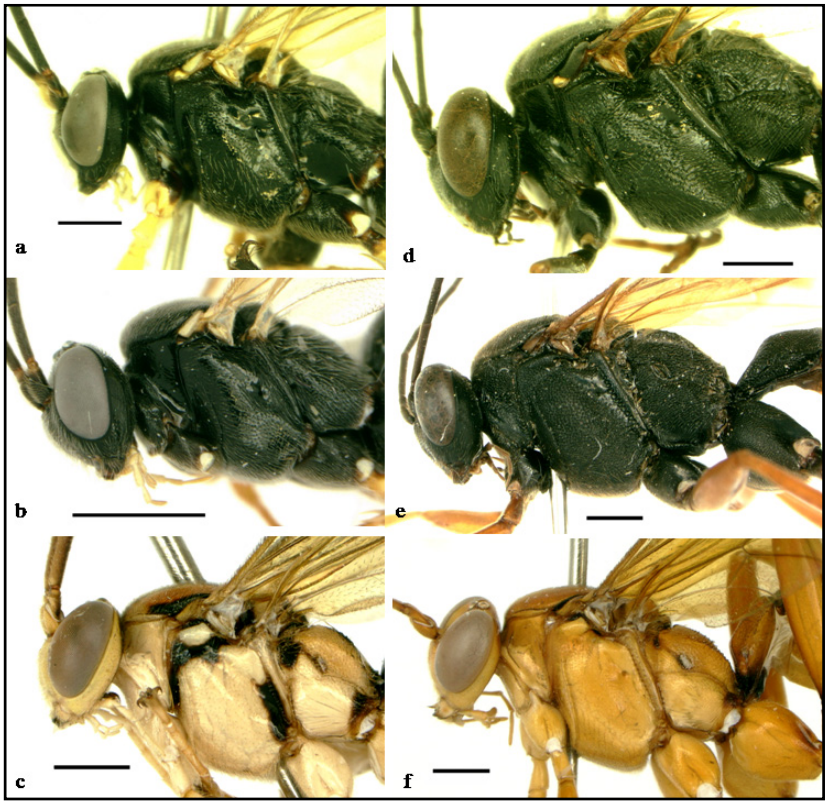

Figure 32. Lateral views of head and mesosoma of *Pimpla* species (scales 1 mm): from a to c – males: a. *P. carinifrons*; b. *P. cameronii*; c. *P. Chuyangsinensis*; from d to f – females: d. *P. ereba*; e. *P. laothoe*; f. *P. lexuanhuei*

***Pimpla carinifrons* CAMERON, 1899**

(Figures 30d, 32a, 33b, 34b, 36)

Pimpla carinifrons Cameron, 1899. Mem. Proc. Manchester Lit. Phil. Soc. 43 (3): 172. Lectotype: ♀, India: Meghalaya, Khasi Hills (BMNH).

Material examined. Lao Cai, Hoang Lien NP: 22♂ (RMNH) 2♂ (IEBR), 1500 m a.s.l., 22–29.x.1999, Malaise trap, C. v. Achterberg leg.

Diagnosis. Body black, with narrow, apical yellow bands on tergites 1–5; flagellomeres 6–7 of male with tyloids; inner margins of eyes moderately concave above antennal sockets, parallel ventrally; scutellum moderately convex, yellow dorsally; hind femur black, sometimes with reddish

band basally; fourth laterotergite elongate, about 2.7–3.2x as long as wide .

Distribution. Gupta & Saxena (1987) have previously recorded *P. carinifrons* from South Vietnam (imprecise locality). Our records extended the distribution of this species to the North. Outside Vietnam, this species is known from China, India, Laos, Myanmar, Nepal and Taiwan (Yu *et al*., 2005).

***Pimpla chuyangsinensis* PHAM, BROAD, DANG & BÖHME, 2013**

(Figures 29f, 30c, 32c, 33d, 34c, 35a, 35b, 36)

Pimpla chuyangsinensis Pham, Broad, Dang & Böhme, 2013. Org. Divers. Evol. DOI: 10.1007/s13127-013-0125-7

Material examined. Dak Lak, Chu Yang Sin NP, Krong K'Mar: 1♂ (RMNH, holotype), 840–940 m a.s.l., 02–10.vi.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Pale yellowish, with black markings on mesosoma and metasoma; flagellomeres 8–10 with tyloids; scutellum strongly convex, lateral carina extending to summit; propodeum with transverse ridges dorsally; wings yellowish.

Description. (Male). *Head*. Antenna with 30 flagellomeres, first flagellomere 1.35x length of second, second flagellomere 4.0x as long as wide, flagellomeres 8–10 with tyloids; diameter of lateral ocellus 1.1x ocellar-ocular distance; frons subpolished, with fine punctures; inner margins of eyes moderately concave above antennal sockets, parallel ventrally; face 0.85x as high as wide, with rugose punctures, pubescent, upper margin concave between antennal sockets; clypeus about 0.5x as high as wide, basally punctate, pubescent, apical margin thin, emarginate; malar space 0.5x basal width of mandible; occipital carina meeting hypostomal carina about 0.6x basal mandible width from base of mandible.

Mesosoma. Epomia 0.6x mandible basal width; pronotum subpolished with fine punctures dorsally; mesoscutum with dense, fine punctures, pubescent, 1.2x as long as wide at anterior level of tegulae, notaulus absent; scutellum strongly convex, pubescent, lateral carina extending to summit; mesopleuron with small punctures, pubescent; metapleuron polished, impunctate ventrally, dorsally with small punctures, pubescent, submetapleural carina complete, forming large, anterior lobe; propodeum moderately convex, without carinae except posterior stub of lateral longitudinal carina, laterally with fine punctures, pubescent, dorsally with transverse ridges, area petiolaris polished, impunctate. Fore femur 4.0x as long as wide; hind femur 3.3x as long as wide, length 0.8 tibia, basitarsus length 0.45x tibia, 0.37x tarsus, 1.7x second tarsomere, fifth tarsomere longer than third. Fore wing length 10.0 mm, vein *Rs*&*M* opposite *cu-a*, vein 2*rs-m* about 0.65x length of 3*rs-m*, hind wing with vein *M*+*Cu* straight posteriorly, first abscissa of vein *Cu*1 0.35x as

long as vein *cu-a*.

Metasoma. Tergites with fine to moderate-sized punctures, pubescent; first tergite 1.35x as long as apical width, median longitudinal carina indistinct; second tergite 0.75x as long as apical width, 1.2x as long as third tergite, tergites 2–4 with basal oblique grooves moderately deep; first sternite roundly convex subapically; fourth laterotergite 3.1x as long as wide.

Colour. Pale yellow. Antenna brown ventrally, blackish dorsally; hind slope of vertex black; mesoscutum reddish brown with broad median, black stripe joined posteriorly to black spot in front of scutellum, two lateral narrow stripes touching lateral ridges of mesoscutum; scutellum apically and postscutellum black; mesopleuron with black stripe along anterior margin extending from level of fore coxa to groove below subalar prominence and black stripe along posterior margin ventrally; metapleuron black posteriorly; propodeum dorsally with black, glass-shaped stripe extending from submedian part to apex; hind coxa with apical black marks on lateral and dorsal faces, hind trochantellus, dorsal and ventral stripes of hind femur and apical half of tibia reddish brown, tarsus black; metasomal tergites each with basal half black; wings brownish yellow.

Female. Unknown.

Distribution. Currently known only from Chu Yang Sin NP, Dak Lak Province; Central Highland of Vietnam (Pham *et al*., 2013a).

Ecological notes. The single specimen was collected in evergreen forest at an elevation of 840–940 m a.s.l. (Pham *et al*., 2013a).

***Pimpla ereba* CAMERON, 1899**

(Figures 29e, 30b, 31c, 32d, 33g, 34e, 34f, 36)

Pimpla ereba Cameron, 1899. Mem. Proc. Manchester Lit. Phil. Soc. 43 (3): 172. Holotype: ♀, India: Meghalaya, Khasi Hills (OUMNH).

Material examined. Lao Cai, Sa Pa: 1♀ (IEBR), 1800 m a.s.l., 18.v.2003, hand net, L. D. Khuat leg.; Lao Cai, Hoang Lien NP: 8♂ (RMNH) 2♂ (IEBR), 1900 m a.s.l., 15–21.x.1999, Malaise trap, C. v. Achterberg leg.

Diagnosis. Black; flagellomeres 5–7 of male with tyloids; mesosoma coarsely punctate, strongly winkled in female, propodeum with short stub of lateromedian longitudinal carina; legs black except fore leg (mid leg in male also) with anterior face of femur, tibia and tarsus yellow; metasomal tergites coriaceous; fourth laterotergite about 2.4x as long as wide; ovipositor straight, ovipositor sheath slightly longer than hind tibia.

Distribution. Pham *et al*. (2013a) recorded this species for the first time from Vietnam. Outside Vietnam, it is known from China, India and Myanmar (Yu *et al*., 2005).

Remarks. In comparison with the description of Gupta & Saxena (1987), Vietnamese specimens have a narrower malar space (0.65x basal mandible width versus 0.9–1.0x); metasoma leathery from apex of first tergite; and a slightly longer ovipositor sheath (1.05x hind tibia versus 0.84x).

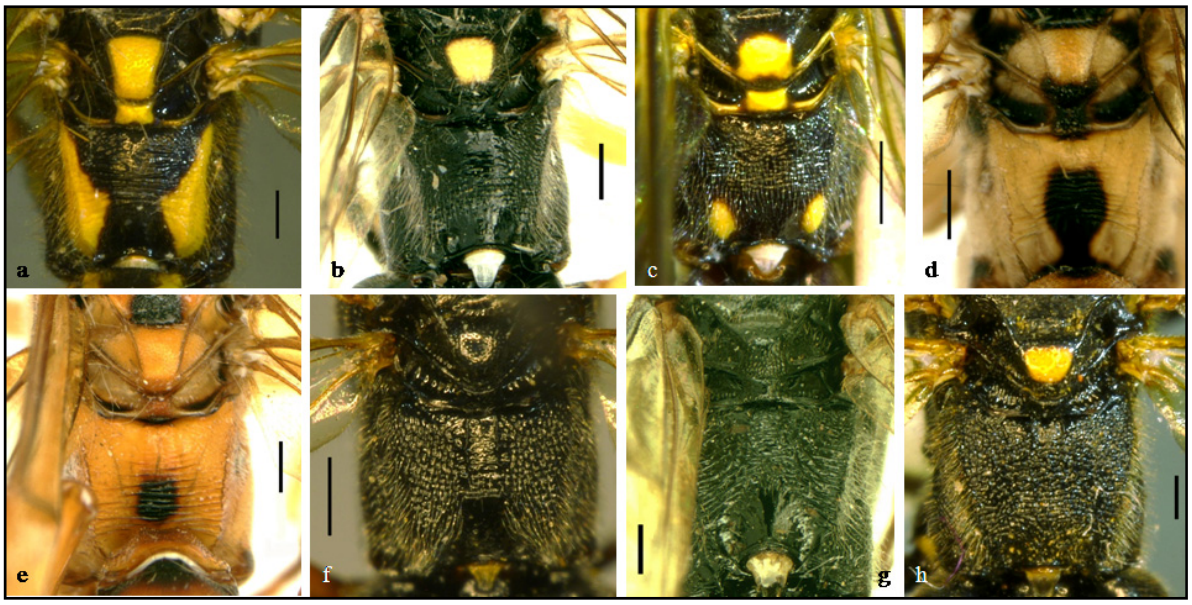

Figure 33. Dorsal views of scutellum and propodeum of *Pimpla* species (scales 0.5 mm): from a to d – male: a. *P. bilineata*; b. *P. carinifrons*; c. *P. flavipalpis*; d. *P. chuyangsinensis*; from e to h – females: e. *P. lexuanhuei*; f. *P. cameronii*; g. *P. ereba*; h. *P. laothoe*

***Pimpla flavipalpis* CAMERON, 1899**

(Figures 29b, 31d, 33c, 34g, 36)

Pimpla flavipalpis Cameron, 1899. Mem. & Proc. Manchester Lit. Phil. Soc., 43 (3): 174. Lectotype: ♀, India: Meghalaya: Khasi Hill (BMNH).

Material examined. Lao Cai, Hoang Lien NP: 6♂ (RMNH) 1♂ (IEBR), 1900 m a.s.l., 15–21.x.1999; 1♂ (RMNH) 1♂ (IEBR), 1550 m a.s.l., 22–29.x.1999, Malaise trap, C. v. Achterberg leg.; Kon Tum, Ngoc Linh: 2♀ (IEBR), 1900 m a.s.l., 29.iii–03.iv.2006, pitfall-trap, A. D. Nguyen leg.

Diagnosis. Black with yellow apicolateral spots on propodeum and metasomal tergites 1–5; flagellomeres of male with or without tyloid on flagellomere 7; propodeum wrinkled, without or with very short stub of lateromedian longitudinal carnina, area petiolaris punctate; fore wing with vein *Rs*&*M* opposite to distad of *cu-a*; metasomal tergites with fine to moderate-sized punctures; fourth laterotergite of female broad, about 1.8x as long as wide; ovipositor straight, sheath slightly shorter than hind tibia.

Distribution. Pham *et al*. (2013a) recorded this species for the first time from Vietnam. Outside Vietnam, it is known from China, India, Myanmar, Nepal and Taiwan (Yu *et al*., 2005).

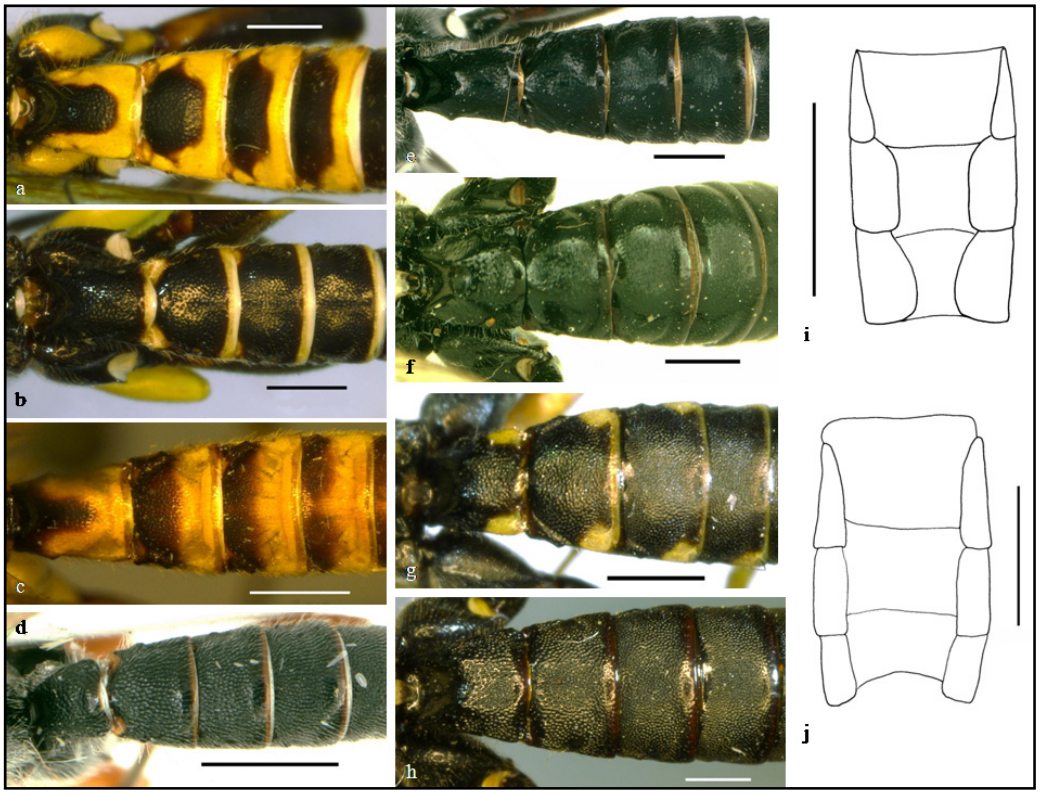

Figure 34. *Pimpla* species (scales 1 mm): from a to e – dorsal views of metasomal tergites 1– 4 of males: a. *P. bilineata*; b. *P. carinifrons*; c. *P. chuyangsinensis*; d. *P. cameronii*; e. *P. ereba*; from d to f – dorsal views of metasomal tergites 1–4 of females: f. *P. ereba*; g. *P. flavipalpis*; h. *P. laothoe*; from i & j – metasomal sternites 3–5 of males: i. *P. cameronii*; j. *P. laothoe*

***Pimpla laothoe* CAMERON, 1897**

(Figures 29d, 30e, 31e, 32e, 33h, 34h, 34j, 36)

Pimpla laothoe Cameron, 1897. Mem. & Proc. Manchester Lit. Phil. Soc., 41 (4): 22. Holotype: ♀, India: Uttar Predesh: Mussoorie (OUMNH).

Material examined. Lao Cai, Lao Chai: 1♀ (PPRI), 01.x.1967 (on peach-tree), unknown collector; Lao Cai, Nam Cuong: 1♀ (PPRI), 20.x.1967, (in rice field), unknown collector; Lao Cai, Hoang Lien NP: 1♂ (RMNH), 1550 m a.s.l., 22–29.x.1999, Malaise trap, C. v. Achterberg leg.; Vinh Phuc, Vinh Yen, Ngoc Thanh: 2♀1♂ (IEBR), 200 m a.s.l., 07–26.vii.2001, Malaise trap, L. D. Khuat leg.; Ha Noi, Ba Vi NP: 1♀ (IEBR), 400–600 m a.s.l., 02.vi.2001, hand net, N. T. Pham leg.; Ha Noi, Tu Liem, Co Nhue: 1♀ (IEBR), 16.v.2006, hand net, H. T. Dang leg.; Ha Noi, Tu Liem, Phu Dien: 2♀ (IEBR) 1♂ (ZFMK), 17.iv.2008, hand net, N. T. Pham leg.; Hoa Binh, Mai Chau, Pa Co: 1♂ (IEBR), 1200 m a.s.l., 21.iv.2002, T. V. Hoang leg.; Hoa Binh, Mai Chau, Tan Son: 1♂ (IEBR), 01–05.v.2010; 1♂ (IEBR), 10–15.vii.2010; 1♂ (IEBR), 10–15.viii.2010, 850–900 m, a.s.l., Malaise trap, L. D. Khuat leg.

Diagnosis. Black, with dense striations and coarse punctures; flagellomeres 6–11 or 6–10

(rarely 6–9) of male with tyloids; coarse punctures on mesopleuron almost confluent; propodeum strongly rugose; first tergite without or with low humps.

Distribution. Pham *et al*. (2013a) recorded this species for the first time from Vietnam. Outside Vietnam, it is known from from China, India, Indonesia, Myanmar, Nepal, Pakistan, Sri Lanka and Taiwan (Yu *et al*., 2005).

Remarks. The Plant Protection Research Institute (1976) recorded this species from Lao Cai, Son La and Yen Bai provinces (northwestern Vietnam) as *P. instigator* (Fabricius, 1793), a junior synonym of *P. rufipes* (Miller, 1759). However, based on the examination of these specimens, Pham *et al*. (2013a) reclassified them as *P. laothoe*.

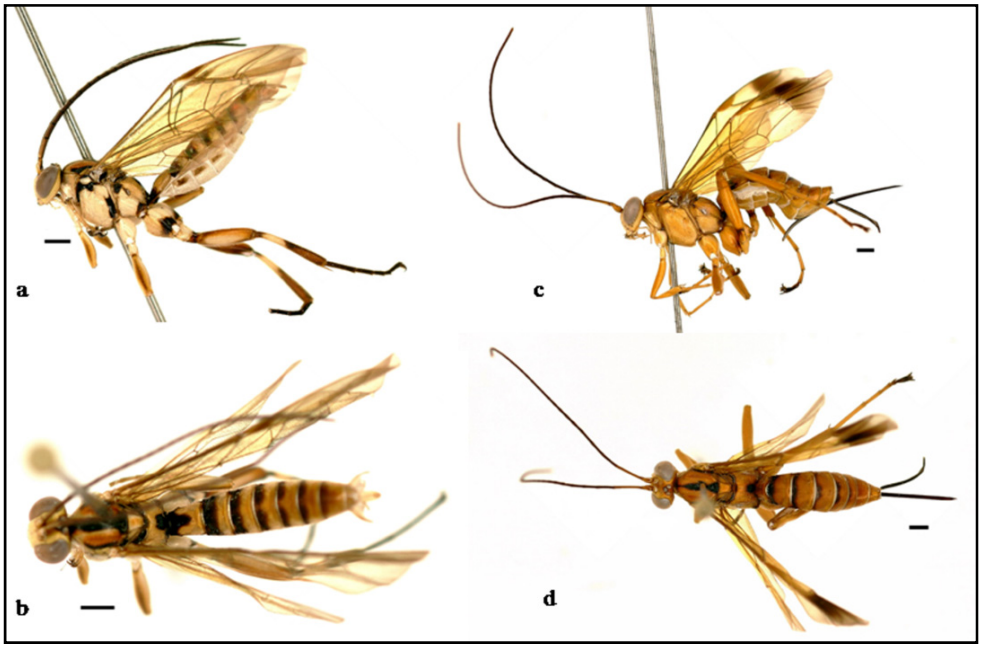

Figure 35. Lateral and dorsal views of *Pimpla* species (scales 1 mm): a & b. *P. chuyangsinensis*; c & d. *P. lexuanhuei*

***Pimpla lexuanhuei* PHAM, BROAD, DANG & BÖHME, 2013**

(Figures 29c, 31a, 32f, 33e, 35c, 35d, 36)

Pimpla lexuanhuei Pham, Broad, Dang & Böhme, 2013. Org. Divers. Evol. DOI: 10.1007/s13127-013-0125-7

Material examined. Phu Tho, Thanh Son, Thuong Cuu: 1♀ (RMNH, holotype), 350–400 m a.s.l., 20°59'N–105°08'E, 11–16.x.1999, Malaise trap, R. de Vries leg.

Diagnosis. Body ferruginous with black markings; scutellum strongly convex, lateral carina extending nearly to apex; propodeum with transverse ridges dorsally; ovipositor depressed at tip, with ridges on lower valve; ovipositor sheath as long as hind tibia; wings pale reddish brown with infuscate margin.

Description. (Female). *Head*. Antenna with 31 flagellomeres, first flagellomere 1.6x length of second, second flagellomere 6.0x as long as wide, apical flagellomeres short; diameter of lateral ocellus equal to ocellar-ocular distance; frons concave, subpolished, with fine punctures; inner margins of eyes moderately concave above antennal sockets, divergent ventrally; face 0.75x as high as wide, moderately convex, with moderate-sized punctures, pubescent, upper margin concave between antennal sockets; clypeus about 0.5x as high as wide, finely punctate, pubescent, apical margin thin, emarginate; malar space 0.6x basal width of mandible; occipital carina meeting hypostomal carina about 0.6x basal mandible width from base of mandible.

Mesosoma. Epomia 0.7x mandible basal width; pronotum subpolished with fine punctures dorsally and short striations at hind margin; mesoscutum with dense, small punctures, pubescent, 1.3x as long as wide at anterior level of tegulae, notaulus weakly impressed anteriorly; scutellum strongly convex, pubescent, lateral carina extending nearly to apex; mesopleuron with shallow punctures, pubescent; metapleuron polished and impunctate ventrally, with shallow wrinkles and pubescent dorsally, submetapleural carina complete, forming elevated lobe anteriorly; propodeum moderately convex, with transverse ridges dorsally, without carinae except short basal stub of lateromedian and posterior part of lateral longitudinal carinae, petiolar area polished, impunctate. Fore femur 5.3x as long as wide; hind femur 4.5x as long as wide, length 0.8x tibia, basitarsus length 0.5x tibia, 0.45x tarsus, 2.0x second tarsomere, fifth tarsomere longer than third. Fore wing length 12.5 mm, vein *Rs*&*M* opposite *cu-a*, vein 2*rs-m* about 0.9x length of 3*rs-m*, hind wing with vein *M*+*Cu* straight posteriorly, first abscissa of vein *Cu*1 0.25x as long as vein *cu-a*.

Metasoma. Tergites with dense, medium-sized punctures, pubescent; first tergite 1.2x as long as apical width, with low humps, median longitudinal carina indistinct; second tergite 0.7x as long as apical width, 1.1x as long as third tergite, tergites 2–4 with basal oblique grooves moderately deep; first sternite weakly convex centrally; fourth laterotergite 2.8x as long as wide; ovipositor depressed at tip, lower valve with apical ridges, ovipositor sheath equal to hind tibia length.

Colour. Ferruginous. Mesoscutum with a median longitudinal black stripe, narrower anteriorly, wider posteriorly, lateral ridges of mesoscutum at level of tegula black; propodeum with median black spot; metasomal tergites with narrow black stripes basally; ovipositor reddish, ovipositor sheath black; wings pale reddish brown with infuscate margin.

Male. Unknown.

Distribution. Currently known only from Thuong Cuu, Thanh Son, Phu Tho Province, North Vietnam (Pham *et al*., 2013a).

Ecological notes. The single specimen was collected in secondary forest at an elevation of 350–400 m a.s.l. (Pham *et al*., 2013a).

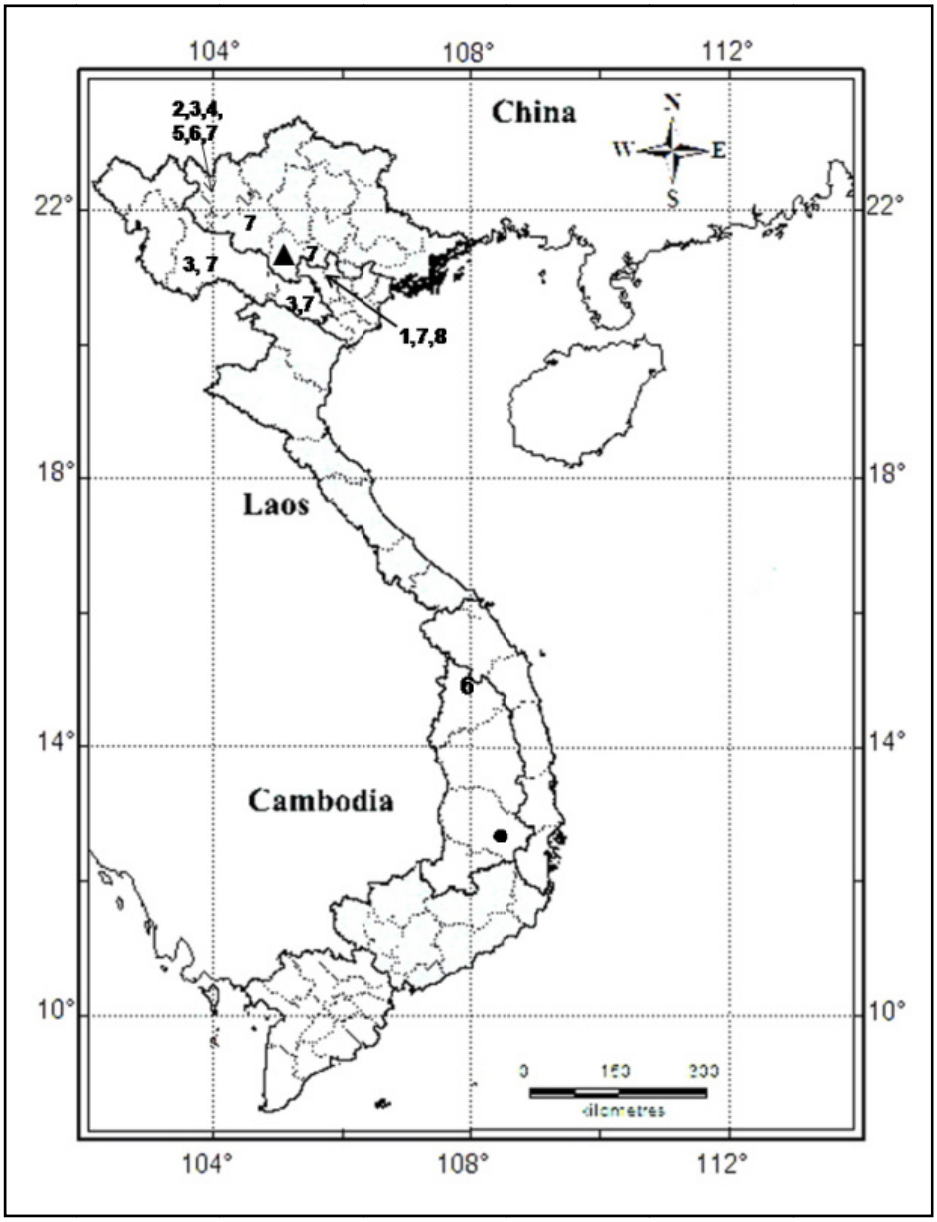

Figure 36. Distribution map of *Pimpla* species: 1. *P. aethiops*; 2. *P. bilineata*; 3. *P. cameronii;* 4. *P. carinifrons*; 5. *P. ereba*; 6. *P. flavipalpis*; 7. *P. laothoe*; 8. *P. nipponica;* (•). *P. chuyangsinensis*; (▲). *P. lexuanhuei*

***Pimpla nipponica* UCHIDA, 1928**

(Figure 36)

Pimpla nipponica Uchida, 1928. Jour. Faculty Agr. Hokkaido Imp. Univ. 25 : 45. Lectype: ♀, Japan: Hokkaido: Sapporo (EIHU).

Material examined. None.

Diagnosis. Black, with legs largely reddish; mesopleuron finely, sparsely punctate; trochanters and trochantelli reddish; fourth laterotergite broad; antenna of male without tyloids (Uchida, 1928; Bui, 1990).

Distribution. Bui (1990) recorded this species from Hanoi as a parasitoid of lepidopteran pests in rice fields: *Parnara guttata* (Bremer and Grey), *Pelopidas mathias* Fabricius (Hesperiidae), *Cnaphalocrocis medialis* (Guenée) (Pyralidae), *Brachmia* sp. (Gelechiidae) and *Naranga aenescens* Moore (Noctuidae). I have not seen any Vietnamese specimens of this species. Outside Vietnam, this species has been recorded widely from Finland in the west to Japan in the east and south to India and Yunnan Province in China (Yu *et al*., 2005).

Xanthopimpla **Saussure, 1892**

Xanthopimpla Saussure 1892: 13. Type-species: *Xanthopimpla hova* Saussure, by subsequent designation, Ashmead, 1900: 56.

Diagnosis. Small to moderately large species; clypeus divided into basal and apical part by a transverse suture; clypedeal margin thin, truncate or concave; mandible strongly narrowed apically and twisted about 90°, therefore the lower tooth invisible in anterior view; pronotum short, with anterior margin recurved, epomia short; mesoscutum with notauli impressed anteriorly, bounded in front by strong raised triangular flange; mesopleuron with epicnemial carina present, mesopleural suture weakly angled centrally; mesepisternum with postpectal carina present centrally; propodeum usually with carinae, but sometimes with so few carinae that there are no enclosed areas; tarsal claws of female without basal lobes, usually with spatulate bristles; body stout, lemon yellow, often with black marks (Townes, 1969; Gauld, 1984, 1991).

Xanthopimpla, with a total of 261 recognized species, is the largest tropicopolitan genus of the subfamily Pimplinae (Ichneumonidae) (Yu *et al.*, 2005; Izfa & Idris, 2006; Khalaim, 2008; Gómez *et al*., 2009; Pham *et al.*, 2011c). Most species of *Xanthopimpla* occur in the Indo-Australian region and 149 species are known from the Oriental region; species richness is much lower in Africa and the Neotropics (Townes & Chiu, 1970; Gauld, 1991; Yu *et al.*, 2005; Izfa & Idris, 2006; Gómez *et al.*, 2009; Pham *et al.*, 2011c). Species of *Xanthopimpla* are easily recognized by their stout, predominantly lemon-yellow bodies and by their narrowed, apically twisted mandibles. Confusion is most likely with the *Theronia* genus-group of the same tribe, Pimplini, but species of this group always have straight, broader mandibles, the furrow of the mesospleuron is curved at the episternal scrobe and they are duller yellow in colour.

Where known, all species of *Xanthopimpla* are idiobiont endoparasitoids of the pupae of Lepidoptera (Townes & Chiu, 1970; Gauld, 1991), and it is likely that all species develop in this manner, as do other genera of the Pimplini (except for some of the more basal *Theronia* group; Gauld *et al*., 2002).

Townes & Chiu (1970) published by far the most significant work on the fauna of *Xanthopimpla*

from the Indo-Australian area which still provides a reliable framework for taxonomic work in this region. These authors assigned the Indo-Australian *Xanthopimpla* to 20 species-groups and 15 of these are now known from Vietnam. Compared to our prior, limited knowledge of the Vietnamese *Xanthopimpla* fauna, we now know that the genus is species-rich in Vietnam, with 60 recognised species, which is not surprising given the wide range of habitats in the country, covering a wide latitudinal range.

Key to Vietnamese species of *Xanthopimpla* (modified from Townes & Chiu 1970)

1. Fore wing with areolet open on outer side, vein 3*rs-m* completely absent (Figure 46d).....2

-. Fore wing with areolet closed, vein 3*rs-m* present (Figure 19) 6

2. Mesoscutum and mesopleuron with moderately dense hairs; mid and hind tibiae with bristles only at apex, plus a few near apex; fore wing with vein *cu-a* basad of *Rs*&*M*; shaft of dorsal valve of ovipositor enclosing shaft of ventral valve, in lateral view the ventral valve visible only at tip (Figure 46e).....3 (the *incompleta* species group)

-. Mesoscutum with several hairs on median lobe; upper half of mesopleuron entirely or almost hairless; mid and hind tibiae with stout bristles on the apical 0.25 or more; fore wing with vein *cu-a* opposite or a little distad of *Rs*&*M*; shaft of dorsal valve of ovipositor not enclosing shaft of ventral valve (Figure 64c).....5 (the *rhopaloceros* species group)

3. Propodeum with area superomedia entirely confluent with area dentipara (Figure 46c); hind femur with black stripe beneath..... *X. connexa* Krieger

-. Propodeum with area superomedia partly or completely separated from area dentipara (Figure 46g); hind femur black apically or entirely yellow.....4

4. Mesoscutum medially with three separate black spots (Figure 46f); femur black apically.....*X. pulvinaris* Townes & Chiu

-. Mesoscutum medially with three confluent black spots; femur entirely yellow.....*X. naenia* Morley

5. Malar space about 0.5 times as long as mandible basal width; submetapleural carina entirely absent; propodeum with basal transverse carina usually absent or weakly present; occipital area, mesopleuron and hind coxa with black spots; metaepisternum and tergites 2–7 each with two black spots (Figure 66a).....*X. melanacantha* Krieger

-. Malar space about 0.85 times as long as mandible basal width (Figure 64d); submetapleural carina present on anterior half (Figure 64b); propodeum with basal transverse carina present (Figure 64e); occipital area, mesopleuron, metaepisternum, hind coxa, tergites 2 and 6 entirely yellow; tergite 3 with black band (Figure 64a).....*X. morsei* Pham, Broad, Matsumoto & Wägele

6. Mid and hind tibiae with dense bristles on apical 0.7 (Figure 76c); face distinctly swollen (Figure

76d); scutellum flat, without lateral carina (Figure 76e); ovipositor tip with apical vertical and basal oblique ridges (Figure 76f); posterior 0.4 of submetapleural carina weakly present (Figure 76b).....*Xanthopimpla boehmei* Pham, Broad, Matsumoto & Wägele (the *xystra* species group)

-. Mid and hind tibiae with some apical bristles but never covering entire apical 0.7; face flat or weakly convex; scutellum convex or conical, lateral carina forming low to high flange; ovipositor tip with more or less apical oblique ridges, never separated into two series of ridges; submetapleural carina present or absent.....7

7. Propodeum with hill-like or tubercle-like swelling in front of spiracle (Figures 56d, 61c)…….....8 (the *regina* species group)

-. Propodeum never with hill-like or tubercle-like swelling in front of spiracle.....17

8. Lateral black mark on mesoscutum nearly joined posteriorly to black spot in front of scutellum (Figure 57a); area superomedia 0.45–0.55 times as long as wide; propodeum entirely yellow (Figure 57d) [ovipositor sheath about 0.8 times as long as hind tibia].....*X. flavapropodea* Pham, Broad, Matsumoto & Wägele

-. Lateral black mark on mesoscutum at level of tegula or joined posteriorly to black mark in front of scutellum; area superomedia 0.7–1.05 times as long as wide; propodeum always marked with black.....9

9. Median and lateral black marks on mesoscutum joined posteriorly to black mark in front of scutellum (Figure 59a); [area superomedia as long as wide (Figure 59c); tergite 3 with sparse, coarse punctures (Figure 59d); tergite 4 onwards with dense, minute punctures].....*X. omega* Pham, Broad, Matsumoto & Wägele

-. Lateral black marks on mesoscutum never joined posteriorly to black mark in front of scutellum.....10

10. First tergite elongate, 1.6 times as long as apical width; ovipositor sheath short, about 0.27 times as long as hind tibia [scutellum conical, with median point (Figure 61c)].....*X. porrecta* Pham, Broad, Matsumoto & Wägele

-. First tergite broader, about 1.0–1.3 times as long as apical width; ovipositor sheath longer, about 0.5–2.1 times as long as hind tibia.....11

11. Black marks on mesoscutum not extending to anterior 0.25–0.35, median black mark always joined to black mark in front of scutellum (Figure 62d); hind femur entirely yellow or with very small black spot on posterior face.....12

-. Black marks on mesoscutum not extending to anterior 0.15–0.2, median black mark joined to or separated from black mark in front of scutellum (Figures 58b, 62e, 62f, 62g); hind femur always

marked with black.....13

12. Scutellum strongly convex; tergites 2, 6 and hind trochanter entirely yellow; tergite 3 with sparse punctures (Figure 62a); ovipositor sheath about 0.65 times as long as hind tibia.....*X. brevicarina* Wang

-. Scutellum conical, with median point (Figure 56d); hind trochanter marked with black; metasomal tergites each with two black spots (Figure 56a); tergite 3 with moderately dense punctures (Figure 56c); ovipositor sheath 0.8 times as long as hind tibia.....*X. flavafemora* Pham, Broad, Matsumoto & Wägele

13. Face without sublateral, vertical ridge on each side (Figure 58a); median black mark on mesoscutum always joined with black mark in front of scutellum (Figure 58b); scutellum convex (Figure 58c); ovipositor sheath about 0.5 times as long as hind tibia..... *X. leviuscula* Krieger

-. Face with sublateral, vertical ridge on each side; median black mark on mesoscutum separated from or joined posteriorly to black mark in front of scutellum; ovipositor sheath longer than hind tibia.....14

14. First tergite without black spots; tergite 3 with dense, coarse punctures (Figure 60d); scutellum strongly convex, rarely conical (Figure 60a); ovipositor sheath long, about 1.8–2.1 times as long as hind tibia.....*X. regina* Morley

-. First tergite with small to large black spots; ovipositor sheath shorter; tergite 3 with sparse to dense punctures.....15

15. Tergites 3–5 with dense, coarse punctures (Figure 62b); scutellum more or less conical [ovipositor sheath 1.05–1.25x hind tibia].....*X. pedator* Fabricius

-. Tergite 3 sparsely punctate (Figure 62c); scutellum convex to conical.....16

16. Face about 0.8 times as high as wide (Figure 62i); median black mark on mesoscutum joined posteriorly to black mark in front of scutellum (Figure 62f); ovipositor sheath about 1.7 times as long as hind tibia; ovipositor distinctly decurved.....*X. sticta* Townes & Chiu

-. Face about 0.6–0.7 times as high as wide (Figure 62h); median black mark on mesoscutum not joined posteriorly to black mark in front of scutellum (Figure 62g); ovipositor sheath 1.1–1.3 times as long as hind tibia; ovipositor straight, slightly decurved at tip.....*X. konowi* Krieger

17. Largest bristles on mid and hind tarsal claws not widened apically, or rarely widened but pale in colour and gradually tapered to end.....18

-. Largest bristles on mid and hind tarsal claws more or less widened apically, the widened part usually black.....27

18. Mesoscutum with moderately dense hairs between tegulae, most hairs sockets closer together

than length of hairs.....19 (the *brachycentra* species group)

-. Mesoscutum with sparse hairs or lacking hairs between tegulae.....24

19. Scutellum conical (Figure 40d); mid and hind tibiae with small bristles near and at apex; hind coxa with black mark on anterior face; ovipositor tip depressed, ovipositor sheath 0.3 times as long as hind tibia (Figure 40e).....*X. spicula* Pham, Broad, Matsumoto & Wägele

-. Scutellum convex; mid and hind tibiae with several stouter bristles near and at apex; hind coxa without black mark; ovipositor tip cylindrical, or very flat in *X. platyura*.....20

20. Lateral carina of scutellum wide, medially as wide as first flagellomere width; propodeum with area superomedia longer than wide, bounded by strong carinae (Figure 37b); ovipositor tip strongly flattened [ovipositor sheath 0.6 times as long as hind tibia].....*X. platyura* Townes & Chiu

-. Lateral carina of scutellum narrower; propodeum with area superomedia wider than long, bounded by rather weak or moderately strong carinae (Figures 37a, 37c, 37d, 38d); ovipositor tip cylindrical.....21

21. Tergites 1–3 with black bands; lateral black band on mesoscutum strongly curved, extending far posterior to tegula (Figure 39c) [ovipositor sheath about 0.65 times as long as hind tibia].....*X. transmaculata* Wang & He

-. Tergite 2 with black spots or entirely yellow, never with black band; lateral black band on mesoscutum weakly curved, ending before posterior level of tegula or slightly extending beyond.....22

22. Hind tibia with two preapical bristles; tergites 1–5 each with two black spots (Figure 39a) [ovipositor sheath 0.3 times as long as hind tibia.....*X. brachycentra* Krieger

-. Hind tibia with 4–6 preapical bristles; tergites 1, 3 and 7 with black bands (rarely tergite 3 with two large black spots) (Figures 38a, 39d).....23

23. Hind side of vertex with two black spots opposite two black spots on occipital area; hind trochanter mostly black; hind femur with black bands on upper and lower sides; two black spots on tergite 2 with fine punctures (Figure 38c).....*X. punctatissima* Pham, Broad, Matsumoto & Wägele

-. Hind side of vertex and occipital area entirely yellow; hind leg yellow except apical 0.2 of tibia black; tergite 2 entirely yellow, nearly without punctures [ovipositor sheath 0.5–0.6 times as long as hind tibia].....*X. reicherti* Krieger

24. Area superomedia entirely closed by carinae [about 0.5–0.6 times as long as wide] (Figure 48h); ovipositor sheath 1.7–1.8x hind tibia.....*X. punctata* (Fabricius) (the *punctata* species group)

-. Area superomedia closed or open posteriorly; ovipositor sheath 0.45–0.9 times as long as hind tibia.....25 (the *occidentalis* species group)

25. Mesoscutum with three separated black spots medially; metasomal tergites 1–6 each with two

black spots (Figure 50a); area superomedia closed by distinct carinae (Figure 50b); ovipositor straight, lower valve with six apical transverse ridges; ovipositor sheath 0.65 times as long as hind tibia (Figure 50d).....*X. amplamaculosa* Pham, Broad, Matsumoto & Wägele

-. Mesoscutum with three continuous black spots medially; area superomedia open posteriorly (Figures 48e, 48f); tergite 2 or tergite 6 or both entirely yellow.....26

26. Lateral black marks on mesoscutum long, nearly extending posteriorly to scutellum (Figure 48i); hind tibia with 1–2 preapical bristles; ovipositor sheath 0.45 times as long as hind tibia.....*X. despinosa* Krieger

-. Lateral black marks on mesoscutum rounded, as large as median spot; hind tibia with 4–7 preapical bristles; ovipositor sheath 0.8–0.9x hind tibia.....*X. honorata* Cameron

27. Lower anterior corner of pronotum a sharp angle, nearly always making an angle of 90°–100° (Figure 46b); areolet receiving vein 2*m-cu* almost at or near its outer corner.....28 (the *elegans* species group)

-. Lower anterior corner of pronotum more broadly to angle, rounded, often making an angle of more than 100°.....32

28. Mid and hind tibiae without stout bristles at or near apex; ovipositor sheath about 0.3 times as long as hind tibia.....29

-. Mid and hind tibiae with several stout bristles at and near apex; ovipositor sheath about 0.8–1.15 times as long as hind tibia.....30

29. Face wider than high; subtegular ridge subtriangular; hind trochanter entirely yellow; area superomedia well defined or partly confluent with area dentipara; area dentipara of propodeum smooth, without longitudinal ridges (Figure 44c); first tergite about 1.2x apical width.....*X. curvimaculata* Cameron

-. Face quadrate or slightly higher than wide; subtegular ridge evenly convex; hind trochanter marked with black; area superomedia well defined; area dentipara of propodeum with several strong, longitudinal ridges (Figure 44d); first tergite as long as apical width.....*X. nigritarsis* Cameron

30. Mesoscutum medially with three distinctly separate black spots; posterior part of tegula light brown, transparent; propodeum without basal transverse carina, first and area dentiparas completely confluent (Figure 44e).....*X. tricapus* Townes & Chiu

-. Mesoscutum medially with three continuous black spots; posterior part of tegula black; propodeum with basal transverse carina present.....31

31. Propodeum without median part of posterior transverse carina, lateromedian longitudinal carina partly or entirely absent behind basal transverse carina; area superomedia confluent with

area dentipara and area petiolaris (Figure 44f); tergite 3 with black, V-shaped mark.....*X. varimaculata* Cameron

-. Propodeum with posterior transverse carina complete; area superomedia well defined; tergite 3 with two large black spots or with black band.....*X. elegans* Vollenhoven

32. Body entirely yellow, except black ocellar area.....33 (the *citrina* species group)

-. Body always with black marks on mesosoma, metasoma and legs.....34

33. Pterostigma light brown; area superomedia 0.8–1.3 times as long as wide, receiving basal transverse carina behind centre (Figure 44a); ovipositor sheath 4.8–5.0 times as long as wide.....*X. flavolineata* Cameron

-. Pterostigma dark brown to blackish; area superomedia 1.05–1.4x as long as wide, receiving basal transverse carina near centre; ovipositor sheath 3.9 times as long as wide.....*X. enderleini* Krieger

34. Notaulus usually longer than length of tegula; lower anterior corner of pronotum very broadly rounded, making an angle of more than 130° (Figure 74i); first tergite with dorsolateral carina complete.....35 (the *trunca* species group)

-.Notaulus usually shorter or as long as tegula; lower anterior corner of pronotum rounded, making an angle of 100°–120°; first tergite with dorsolateral carina present or absent.....40

35. Propodeum with strong carinae; area superomedia closed, 0.9 times as long as wide; propodeum without basal transverse carina so that area externa and area dentipara confluent (Figure 74d); pleural part divided by posterior transverse carina [ovipositor sheath 0.3 times as long as hind tibia].....*X. pleuroschista* Townes & Chiu

-. Propodeum with area superomedia not defined or open posteriorly; pleural part not divided.....36

36. Propodeum without carinae, except lateral longitudinal carina apically and small basal stub of lateromedian longitudinal carina (Figures 74a, 74f).....37

-. Propodeum with several carinae, the basal transverse carina always present.....38

37. Mesoscutum black only in front of scutellum (Figure 74h); first tergite longer than apical width; tergites 3 and 5 entirely yellow; ovipositor sheath about 0.45 times as long as hind tibia.....*X. trias* Townes & Chiu

-. Mesoscutum with black mark medially, plus small black mark in front of scutellum; first tergite shorter than apical width; tergites 3 and 5 each with two black spots (Figure 66d); ovipositor sheath 0.35 times as long as hind tibia.....*X. calva* Townes & Chiu

38. Lateromedian longitudinal carina of propodeum completely absent except in front of basal transverse carina; propodeum with black band basally (Figure 74b); first tergite with black band;

ovipositor sheath 0.9 times as long as hind tibia.....*X. fastigiata* Krieger

-. Lateromedian longitudinal carina of propodeum present behind basal transverse carina; propodeum entirely yellow or with black spot in area externa (Figures 74c, 74e); first tergite with two black spots or none; ovipositor sheath shorter, about 0.3 times as long as hind tibia.....39

39. Notaulus ending before posterior level of tegula; mesoscutum with three large continuous black spots; scutellum conical, centrally with low blunt cone, laterally with short transverse ridge attached to lateral carina (Figure 74e); hind wing with vein 1*A* pigmented almost to wing margin; tergites 2–7 with black transverse bands subbasally.....*X. sexlineata* Cameron

-. Notaulus extending to posterior level of tegula (Figure 74g); mesoscutum without or with 1–2 black spots medially; scutellum convex, centrally without cone, laterally without short transverse ridge (Figure 74c); hind wing with posterior part of vein 1*A* indistinct; metasomal tergites 2 and 6 entirely yellow.....*X. minuta* Cameron

40. Pleural part of propodeum subdivided into two areas by posterior transverse carina; outer margin of subtegular ridge moderately sharp (Figure 46a) [scutellum conical; area superomedia bounded by strong carinae; ovipositor decurved; ovipositor sheath 0.3 times as long as hind tibia].....*X. clivulus* Townes & Chiu (the *cuneata* species group)

-. Pleural part of propodeum not subdivided into two areas; outer margin of subtegular round or sharp.....41

41. Postpectal carina in form of high flange that is triangularly widened medially and with deep median notch at apex of triangle (Figure 52f).....42 (the *ochracea* species group)

-. Postpectal carina in form of low or high flange, only a little widened medially, with or without shallow or broad median notch.....44

42. Hind coxa entirely yellow; hind tibia black basally; first tergite equal to or shorter than apical width; ovipositor sheath as long as hind tibia.....*X. ochracea* (Smith)

-. Hind coxa with black spot on anterior side; mid and hind tibiae with black marks both basally and medially; first tergite equal to or longer than apical width; ovipositor sheath longer than hind tibia.....43

43. Hind slope of vertex with two median continuous black spots; median black mark on mesoscutum joined posteriorly to black mark in front of scutellum (Figure 52a); lateral carina of scutellum forming high flange from base toward apex, abruptly narrowed at apex (Figure 52e); metasomal tergites with sparse, fine punctures, black spots on tergite 3 polished and almost impunctate (Figure 52c); ovipositor sheath 1.4–1.55 times as long as hind tibia.....*X. chuiae* Pham, Broad, Matsumoto & Wägele

-. Hind slope of vertex with large black area continuously with black area on occipital area; lateral black mark on mesoscutum joined posteriorly to black mark in front of scutellum (Figure 53a); lateral carina of scutellum forming high flange, gradually narrowed from middle to apex (Figure 53d); metasomal tergites with dense, coarse punctures (Figure 53c); ovipositor sheath 1.1 times as long as hind tibia.....*X. pseudosternata* Pham, Broad, Matsumoto & Wägele

44. Posterior transverse carina of propodeum absent or present as two stubs laterally; area superomedia not defined.....45 (the *nana* species group)

-. Posterior transverse carina of propodeum distinct across midline, except *X. panthera*, with carina present only medially; area superomedia closed or in *X. pleuralis*, fused with area dentipara.....48

45. Mid and hind tibiae each with 1–2 preapical bristles; posterior transverse carina present as short stubs laterally (Figure 48b) [metasomal tergites each with two black spots; ovipositor sheath 0.65–0.7 times as long as hind tibia].....*X. glaberrima* Roman

-. Mid and hind tibiae each with 5–11 preapical bristles; posterior transverse carina entirely absent or when present nearly as long as basal transverse carina.....46

46. Hind side of head marked with black; posterior face of fore and mid femora and tibiae with black stripes medially; hind tibia with basal 0.2 black, plus two median black stripes laterally; ovipositor sheath 1.45 times as long as hind tibia.....*X. jacobsoni* Krieger

-. Hind side of head entirely yellow; fore and mid legs without black stripes; hind tibia with basal 0.2 black, without black marks medially; ovipositor shorter than hind tibia.....47

47. Posterior transverse carina of propodeum entirely absent (Figure 48d); mesoscutum with black mark in front of scutellum; hind femur entirely yellow or sometimes with black marks on anterior and posterior faces; ovipositor sheath 0.6–0.8 times as long as hind tibia.....*X. nana* Schulz

-. Posterior transverse carina of propodeum present laterally (Figure 48a); mesoscutum without black mark in front of scutellum; hind femur with apical black mark; ovipositor sheath 0.9 times as long as hind tibia.....*X. alternans* Krieger

48. Mid tibia with 8–17, hind tibia with 9–18 preapical bristles; hind trochanter and femur entirely yellow.....49 (the *stemmator* species group)

-. Mid tibia with 0–9, hind tibia with 3–10 preapical bristles; hind trochanter and femur always marked with black.....50 (the *terebatrix* species group)

49. Hind side of head with two black spots; mesoscutum always with black spot in front of scutellum; hind tibia with 9–11 preapical bristles; propodeum with black spot in area externa; first tergite with two lateral black spots; tergite 6 entirely yellow (Figure 66c); ovipositor sheath about 1.1 times as long as hind tibia.....*X. stemmator* Thunberg

-. Hind side of head with median black area connecting with black inter-ocellar area; mesoscutum without black spot in front of scutellum; hind tibia with 12–18 preapical bristles; propodeum and first tergite entirely yellow; tergite 6 with two black spots or none (Figure 66b); ovipositor sheath 1.3–1.4 times as long as hind tibia.....*X. modesta* Smith

50. Median black mark on mesoscutum with anterior deeply notched (Figure 68b); scutellum conical with sharp point; area petiolaris of propodeum with two longitudinal black spots (Figure 69c); mid and hind tibiae without any bristles near apex; [metasomal tergites each with black band medially; ovipositor sheath 0.25 times as long as hind tibia].....*X. conica* Cushman

-. Median black mark on mesoscutum not or only shallowly notched anteriorly; scutellum simply convex; area petiolaris of propodeum without black spots; mid and hind tibiae with several bristles near apex 51

51. Propodeum with lateral part of posterior transverse carina absent so that area dentipara confluent with area petiolaris (Figure 72c); ovipositor sheath 0.7 times as long as hind tibia [area superomedia 0.5–0.6 times as long as wide; ovipositor with six apical ridges (Figure 72e)].....*X. panthera* Pham, Broad, Matsumoto & Wägele

-. Propodeum with posterior carina completely present; ovipositor sheath much shorter, 0.25–0.33 times, or much longer, 1.1–2.2 times, longer than hind tibia.....52

52. Lateral flange of scutellum relatively high, medially about half width of first flagellomere; lateral and median black marks on mesoscutum joined posteriorly to black mark in front of scutellum; metasomal tergites with sparse, fine punctures [black spots on tergite 3 and 4 with only several minute punctures; ovipositor lower valve with three apical ridges; ovipositor sheath 1.25 times as long as hind tibia].....*X. quatei* Townes & Chiu

-. Lateral flange of scutellum lower; lateral and median black marks on mesoscutum not all joined posteriorly to black mark in front of scutellum; metasomal tergites with dense, fine or coarse punctures.....53

53. Mesopleuron with black spot medially; propodeum with area superomedia confluent with area dentipara (Figure 69f); spatulate bristles of mid and hind tarsal claws very broad at apex; ovipositor sheath very long, about 1.8−2.2 times longer than hind tibia.....*X. pleuralis* Cushman

-. Mesopleuron entirely yellow or, in *X. annulata*, with anterior black mark; propodeum with area superomedia well defined, bounded by moderate to strong carinae; spatulate bristles of mid and hind tarsal claws not unusually broad; ovipositor sheath shorter.....54

54. Upper half of occiput entirely yellow or with narrow black mark.....55

-. Upper half of occiput and adjacent part of hind slope vertex black.....57

55. Hind slope of vertex with two small, oblique blackish spots; mid tibia with one preapical bristle; area superomedia 0.6 times as long as wide (Figure 70c); metasomal tergites each with black band except tergite 2 with two black spots (Figure 70a); ovipositor sheath 0.25 times as long as hind tibia (Figure 70d).....*X. hienae* Pham, Broad, Matsumoto & Wägele

-. Hind slope of vertex entirely yellow or with black area medially; mid tibia with three preapical bristles; area superomedia 0.8–1.0 times as long as wide; metasomal tergites usually with black bands on tergites 1, 3 and 7; ovipositor slightly to distinctly longer.....56

56. Hind slope of vertex entirely yellow; notaulus shallow, extending to anterior level of tegula; hind femur with black mark posteriorly; hind tibia with one apical, one preapical bristle; tergite 3 with two black spots (Figure 71a); ovipositor sheath 0.33 times as long as hind tibia; ovipositor tip straight (Figure 71e).....*X. oriole* Pham, Broad, Matsumoto & Wägele

-. Hind slope of vertex with median black area; notaulus moderately deep, extending to median level of tegula; hind femur with black marks anteriorly, posteriorly and apically; hind tibia with three apical, 2–3 preapical bristles; tergite 3 with black band; ovipositor sheath equal to or longer than hind tibia; ovipositor tip distinctly down-curved.....*X. sikkimensis* Cameron

57. Mesoscutum with three continuous black spots, of which two lateral oblique spots larger than median spot (Figure 68d); apex of hind tibia blackish; area superomedia receiving basal transverse carina near its basal 0.3 (Figure 69b); ovipositor sheath 0.33 times as long as hind tibia.....*X. atriclunis* Townes & Chiu

-. Mesoscutum with three separate, longitudinal black spots (Figures 68a, 68c, 68e); apex of hind tibia yellow; area superomedia receiving basal transverse carina at middle or near apical 0.3 (Figures 69a, 69d, 69e).....58

58. Punctures on tergites 3−5 large and deep (Figure 68g); mesopleuron anteriorly and metaepisternum marked with black; first tergite elongate, 1.3–1.4 times longer than apical width; metasomal tergites each with two black spots, except first tergite sometimes entirely yellow [ovipositor sheath as long as hind tibia].....*X. annulata* Cushman

-. Punctures on tergites 3−5 small and shallow (Figures 68h, 68i); first tergite broader, about 1.0–1.2 times longer than apical width; metasomal tergites each with two black spots or black band; mesopleuron and metaepisternum yellow.....59

59. Face finely punctate (Figure 69i); area superomedia usually with two small basal black spots (Figure 69d); ovipositor sheath about 1.6 times longer than hind tibia.....*X. polyspila* Cameron

-. Face coarsely punctate (Figure 69h); area superomedia always yellow (Figure 69e); ovipositor sheath 0.25 times as long as hind tibia.....*X. decurtata* Krieger

The *brachycentra* species group

Diagnosis. Scutellum convex to conical with lateral carina low to high, extending to apex; largest bristles of mid and hind tarsal claws not widened apically; mesoscutum with moderately dense hairs; fore wing with areolet closed; ovipositor sheath 0.3–0.7x as long as hind tibia (Townes & Chiu, 1970; Pham *et al*., 2011c).

***Xanthopimpla brachycentra* KRIEGER, 1914**

(Figures 37a, 39a, 41)

Xanthopimpla brachycentra Krieger, 1914. Arch. f. Naturgesch., (A) 80 (6): 40, 86. Lectotype: ♀, Taiwan: Chulotung [= Teraso] in Kaohsiung (ZMHB).

Material examined. Ha Noi, Ba Vi NP: 1♀ (IEBR), 03.vi.2001, hand net, N. T. Pham leg.; Phu Tho, Xuan Son NP: 1♂ (IEBR), 300 m a.s.l., 08.v.2005, hand net, N. T. Pham leg.; Bac Can, Ba Be NP: 1♀ (OMNH), 200 m a.s.l., 22°23'N 105°37'E, 05.v.2006, hand net, R. Matsumoto leg.; Nghe An, Pu Mat NP: 1♀ (IEBR), 200 m a.s.l., 21.vii.2006, hand net, H. X. Le leg.; Bac Giang, Tay Yen Tu NR: 1♀ (IEBR), 330 m a.s.l., 04.vii.2010, hand net, N. T. Pham leg.; Ha Tinh, Vu Quang NP: 1♀ (IEBR), 19.iii.2011, hand net, L. D. Khuat leg.

Diagnosis. Hind tibia with two preapical bristles; tergites 1–5 each with two black spots; tergites 3–5 densely, coarsely punctate; ovipositor sheath 0.3x hind tibia.

Distribution. Pham *et al.* (2011c) recorded this species from Vietnam for the first time. Outside Vietnam, this species has been recorded from China, India and Taiwan (Yu *et al.,* 2005).

Remarks. Two subspecies are currently recognised: *X. brachycentra brachycentra* from China and Taiwan and *X. brachycentra obscuricornis* Townes & Chiu from India. They differ from each other by the colour of the antenna and shape of black marks on the mesoscutum (Townes & Chiu, 1970; Yu *et al*., 2005). Specimens from Vietnam belong to *X. brachycentra brachycentra* (Pham *et al*., 2011c).

***Xanthopimpla platyura* TOWNES & CHIU, 1970**

(Figures 37b, 39b, 41)

Xanthopimpla platyura Townes & Chiu, 1970. Mem. Amer. Ent. Inst. 14: 199. Holotype: ♀, Devala, Nilgiri Hills, south India (CNC).

Material examined. Ninh Binh, Cuc Phuong NP: 1♀ (RMNH), 225 m a.s.l., 01.xi–20.xii.2000, Malaise trap, Q. P. Mai leg.

Diagnosis. Scutellum convex, lateral carina forming high flange, medially as wide as first flagellomere width; area superomedia longer than wide, with small black spot basally, tergite 2

densely punctate; ovipositor strongly flattened; ovipositor sheath 0.6x hind tibia.

Distribution. Pham *et al.* (2011c) recorded this species from Vietnam for the first time. Outside Vietnam, this species has been known from India and Indonesia (Yu *et al.,* 2005).

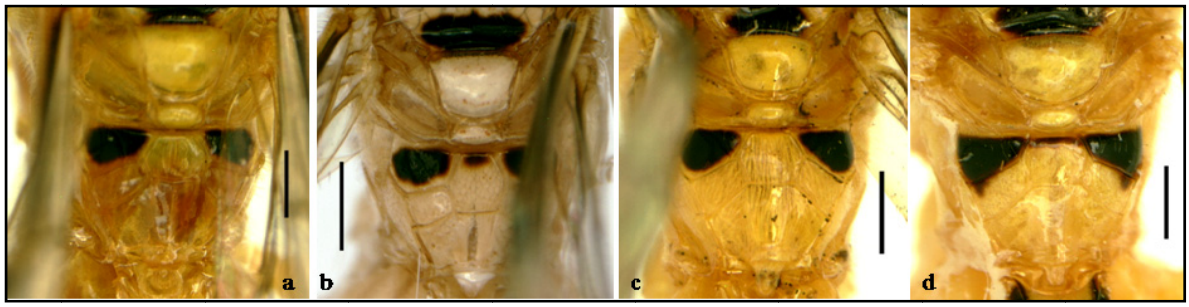

Figure 37. Dorsal views of scutellum and propodeum of *Xanthopimpla* species (scales 0.5 mm): a. *X. brachycentra*; b. *X. platyura*; c. *X. reicherti*; d. *X. transmaculata*

***Xanthopimpla punctatissima* PHAM, BROAD, MATSUMOTO & WÄGELE, 2011**

(Figures 38, 41)

Xanthopimpla punctatissima Pham, Broad, Matsumoto & Wägele, 2011. Zootaxa, 3056: 11. Holotype: ♂, Vietnam: Dong Nai Province, Cat Tien NP (RMNH)

Material examined. Dong Nai, Cat Tien NP: 1♂ (RMNH, holotype), 100 m a.s.l., 13–19.v.2007; 1♂ (IEBR, paratype), 100 m a.s.l., 15–20.v.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Face with small, shallow punctures; two black spots on hind slope of vertex opposite two black spots on occipital area; scutellum convex; area superomedia 0.75x as long as wide, with black band basally; hind femur with black bands on upper and lower faces; metasomal tergites with fine punctures.

Description (Male). Body length 7.8 mm, fore wing 6.7 mm. *Head*. Antenna with 33 flagellomeres, apical half slightly thicker than basal half, first antennal flagellomere 1.6x length of second; diameter of lateral ocellus 1.4x ocellar-ocular distance; front smooth; face 1.1x as high as wide, with small, shallow punctures, pubescent; clypeus 0.5–0.6x as high as wide; malar space about 0.3x basal width of mandible.

Mesosoma. Epomia short; lower anterior corner of pronotum rounded, forming obtuse angle of about 120°; mesoscutum as long as wide at anterior level of tegulae, with moderately dense, minute hairs; notaulus present on anterior 0.25 of mesoscutum, extending to level of front edge of tegula; scutellum convex, pubescent, lateral carina moderately low, extending to apex; mesopleuron subpolished, lower part with dense, small punctures, pubescent; epicnemial carina present on lower half of mesopleuron; postpectal carina medially forming low and wide flange; metapleuron polished, submetapleural carina complete; propodeum with area superomedia 0.7x

as long as wide; propodeal spiracle elongated, 2.2x as long as wide. Hind leg with femur 2.3x as long as wide, 0.8x length of tibia, tibia longer than tarsus, basitarsus 0.3x length of tarsus, 2.0x second tarsomere, third tarsomere 1.3x as long as wide; mid tibia with 4–5 subapical and three apical bristles; hind tibia with four subapical and two apical bristles; largest bristles on mid and hind tarsal claws without widened tip. Fore wing with vein 2*rs-m* 0.8x vein 3*rs-m*; *cu-a* opposite *Rs*&*M*; hind wing with first abscissa of vein *Cu*1 about 0.45x length of vein *cu-a*; veins complete, except distal end of hind wing vein 1*A*.

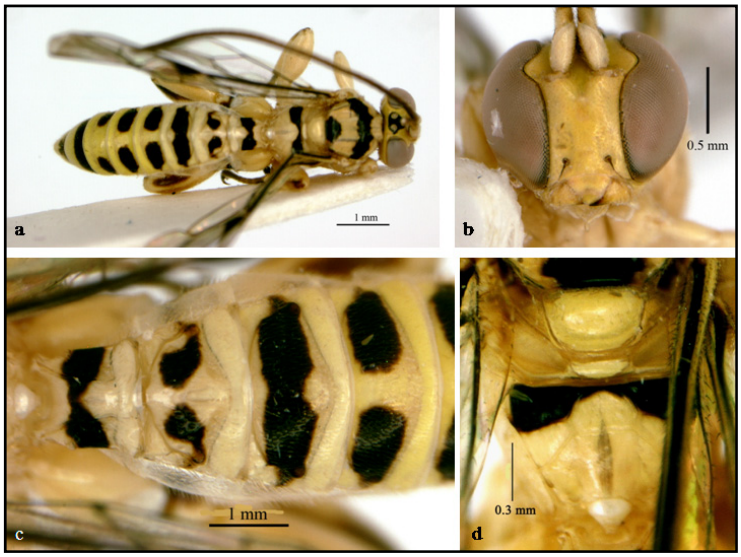

Figure 38. *X. punctatissima*: a. dorsal view; b. face; c. dorsal view of metasomal tergites 1–4; d. dorsal view of scutellum and propodeum

Metasoma. First tergite 1.0–1.1x as long as apical width, median longitudinal carina extending to oblique groove, lateral carina present from base to spiracle; tergites 3 onwards densely, finely punctate.

Colour. Antenna light brown; hind side of head with two black spots opposite two black spots on occipital area; mesoscutum with three continuous transverse black spots medially and black spot in front of scutellum; propodeum with area externa and base of area superomedia black; basal 0.2 and apical band of mid tibia and mid tarsus brown; hind leg with trochanter mostly black; femur with two brown stripes dorsally and blackish stripe on lower face; basal 0.25 and apical band of hind tibia and hind tarsus black; wings hyaline with lightly infuscate margins, pterostigma and veins black, except basal 0.6 of costa yellowish; tergites 1, 3, 7 with black bands, tergites 2, 4, 5, 6 with two lateral black spots.

Female. Unknown.

Distribution. Currently known only from Cat Tien NP, Dong Nai Province (Pham *et al*., 2011c).

Ecological notes. The specimens were collected in lowland evergreen forest (Pham *et al*., 2011c).

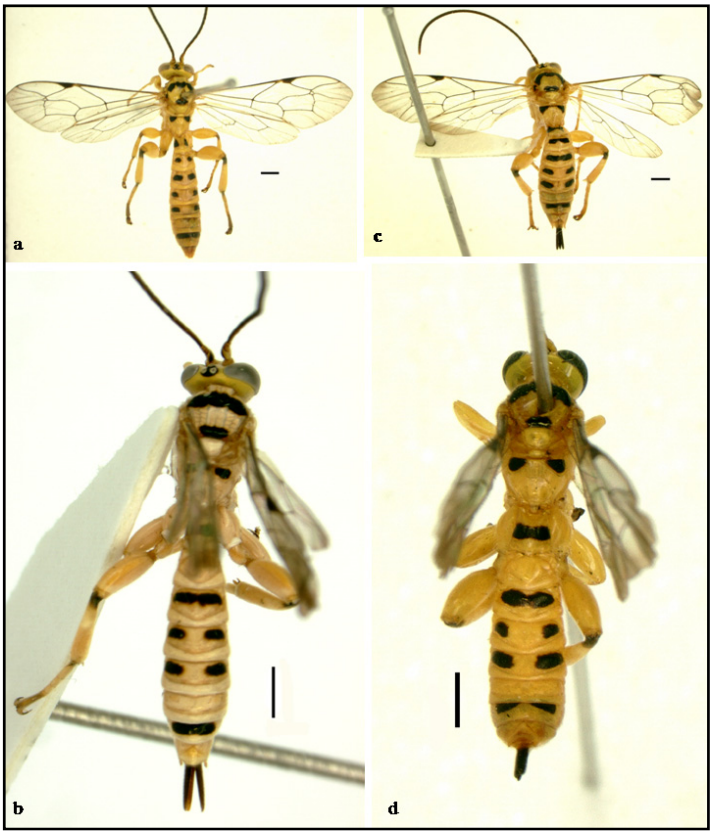

Figure 39: Dorsal views of *Xanthopimpla* species (scales 1 mm): a. *X. brachycentra*; b. *X. platyura*; c. *X. transmaculata*; d. *X. reicherti*

***Xanthopimpla reicherti* KRIEGER, 1914**

(Figures 37c, 39d, 41)

Xanthopimpla reicherti Krieger, 1914. Arch. f. Naturgesch., (A) 80 (6): 40, 89. Lectotype: ♀, Myanmar: Pekon on Loikaw River, Karenni State (ZMHB).

Material examined. Ninh Binh, Cuc Phuong NP: 1♀ (OMNH), 200–300 m a.s.l., 24.iv.1998; 1♀ (OMNH), same locality, 25.iv.1998, hand net, R. Matsumoto leg.; Hoa Binh, Cao Phong: 1♀ (IEBR), 14.iv.2002, hand net, L. D. Khuat leg.; Hoa Binh, Pa Co, Mai Chau: 1♀1♂ (IEBR), 1100 m a.s.l., 20.iv.2002; 1♀1♂ (IEBR), 22.iv.2002, hand net, L. D. Khuat leg.; 1♀ (IEBR), 23.iv.2002, hand net, T. V. Hoang leg.; Lao Cai, Sa Pa: 1♀ (IEBR), 08.x.2004, hand net, L. D. Khuat leg.; Nghe An, Pu Mat NP: 1♀ (ZFMK), 150−200 m a.s.l., 14.vi.2006, hand net, H. X. Le leg.

Diagnosis. Hind tibia with 5–6 preapical bristles; metasomal tergites 1, 3, 7 each with black band, tergites 4–5 each with two black spots; tergite 2 nearly impunctate; tergites 3–5 densely, coarsely punctate; ovipositor sheath 0.5–0.6x hind tibia.

Distribution. Townes & Chiu (1970) previously recorded this species from North Vietnam, Pham & Le (2007) recently recorded it from Pu Mat NP, Nghe An Province (Central Vietnam). Outside Vietnam, it has been recorded from China, India, Myanmar and Thailand (Yu *et al.*, 2005).

Remarks. Two subspecies are currently known: *X. reicherti reicherti* from China, India, Myanmar, Thailand, and Vietnam; and *X. reicherti separata* Townes & Chiu from China. They are distinguished from each other in the shape of black marks on the mesoscutum and the first tergite (Townes & Chiu, 1970; Yu *et al*., 2005).

***Xanthopimpla spicula* PHAM, BROAD, MATSUMOTO & WÄGELE, 2011**

(Figures 40, 41)

Xanthopimpla spicula Pham, Broad, Matsumoto & Wägele, 2011. Zootaxa, 3056: 12. Holotype: ♀, Vietnam: Dak Lak Province, Ea So NR (IEBR).

Material examined. Dak Lak, Ea So NR: 1♀ (IEBR, holotype), 310 m a.sl, 12°55.93'N 108°37.96'E, 27.vii.2008, Malaise trap, H. T. Ngo leg.

Diagnosis. Face as high as wide; scutellum conical; first tergite with dorsolateral carina complete, median longitudinal carina strong and extending to oblique groove; median area of second tergite densely coarsely punctate except centrally; ovipositor tip flattened; ovipositor sheath 0.3x as long as hind tibia.

Description (Female). Body length 9.0 mm, fore wing 7.0 mm, ovipositor sheath 0.6 mm. *Head*. Antenna with 36 flagellomeres, gradually thinner apically, first flagellomere 1.55x length of second; diameter of lateral ocellus 1.6x ocellar-ocular distance; frons smooth; face as high as wide, with shallow, small punctures; clypeus 0.6x as high as wide; malar space about 0.25x basal width of mandible.

Mesosoma. Epomia present, about 0.3x basal width of mandible; lower anterior corner of pronotum rounded, forming obtuse angle of about 100°; mesoscutum as long as wide at anterior level of tegulae, with moderately dense, minute hairs; notauli present on anterior 0.25 of mesoscutum, extending nearly to anterior level of tegula; scutellum conical, lateral carina moderately high, medially 0.45x as high as first flagellomere width, gradually lower toward apex; mesopleuron subpolished, sternaulus present, area below sternalus with dense, small hairs; epicnemial carina present on lower 0.65 of mesopleuron; postpectal carina medially forming low flange; metapleuron polished, submetapleural carina complete, pleural carina indistinct near anterior margin; propodeum with area superomedia as long as wide; propodeal spiracle elongated, 3.0x as long as wide. Hind leg with femur 2.15x as long as wide, 0.85x length of tibia, tibia as long as tarsus, basitarsus 0.3x length of tarsus, 2.0x second tarsomere, third tarsomere 1.3x as long as wide, fifth tarsomere longer than third; mid and hind tibiae with some very small bristles at and near apex; largest bristles on mid and hind tarsal claws slightly widened. Fore wing with areolet rhombic; *cu-a* opposite *Rs*&*M*; hind wing with first abscissa of vein *Cu*1 about 0.4x length of vein *cu-a*; veins complete, except distal end of hind wing vein 1*A*.

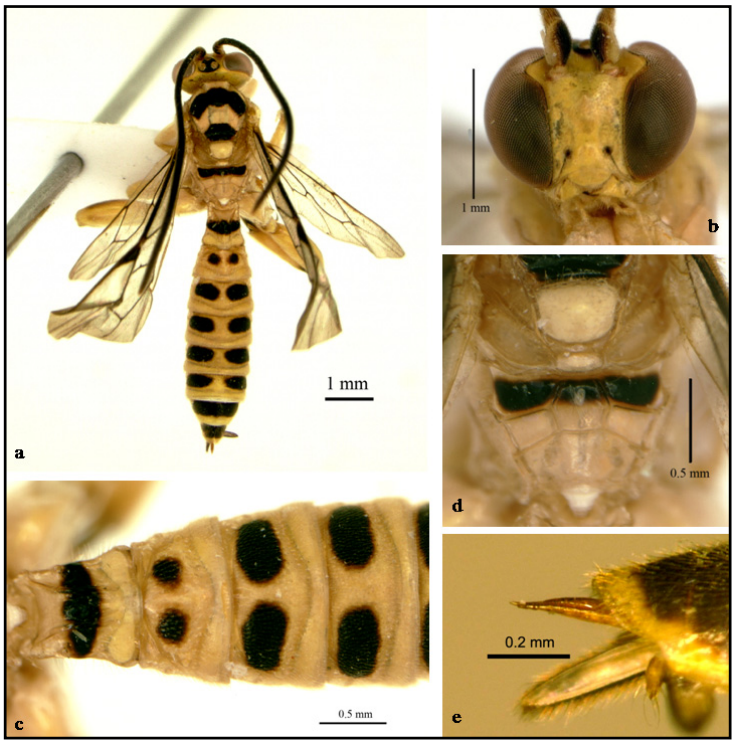

Figure 40. *X. spicula*: a. dorsal view; b. face; c. dorsal view of metasomal tergites 1–4; d. dorsal view of scutellum and propodeum; e. ovipositor

Metasoma. First tergite as long as apical width, median longitudinal carina strong, extending to oblique groove, lateral carina complete; median area of second tergite densely, coarse punctate laterally, subpolished centrally; ovipositor down-curved, depressed at tip, upper valve mostly enclosing lower valves; ovipositor sheath 0.3x as long as hind tibia.

Colour. Antenna black, except outer side of scape, pedicel, first and last flagellomeres yellowish; mesoscutum with three continuous black spots medially, of which two lateral oblique spots larger than rounded median spot, and black spot in front of scutellum; base of propodeum with black band; base of mid tibia and lateral side of hind trochanter brown; anterior face of hind coxa with rounded black spot; basal 0.15 of hind tibia black, hind tarsus blackish; wings hyaline, pterostigma and veins black, except basal 0.6 of costa yellowish; tergites 1, 7 and 8 with black bands, tergites 2–6 with two lateral black spots; black spots on tergite 2 smallest, sub-rounded; ovipositor reddish brown; ovipositor sheath black.

Male. Unknown.

Distribution. Currently known only from Ea So NR, Dak Lak Province (Pham *et al*., 2011c).

Ecological notes. The single specimen was collected in evergreen forest (Pham *et al*., 2011c).

***Xanthopimpla transmaculata* WANG & HUANG, 1993**

(Figures 37d, 39c, 41)

Xanthopimpla transmaculata Wang & Huang, 1993. Animals of Longqi Mountain: 729. Holotype: ♀,

China: Mt. Longqi, Fujian (IZCAS).

Material examined. Thua Thien-Hue, Bach Ma NP: 1♀ (IEBR), 1380 m a.s.l., 14.viii.2005, X. L. Truong leg.

Diagnosis. Lateral black marks on mesoscutum strongly curved posteriorly; tergites 1–3 each with black band; ovipositor sheath 0.65x hind tibia.

Distribution. This species was described on the basis of material from China (Wang & Huang, 1993). Pham *et al.* (2011c) recently recorded this species from Vietnam.

Remarks. Compared with the original description, the specimen from Vietnam has a slightly longer ovipositor sheath (0.65x hind tibia versus 0.57x) and a more strongly curved black band on the mesoscutum, extending to the apical 0.3 of the mesoscutum.

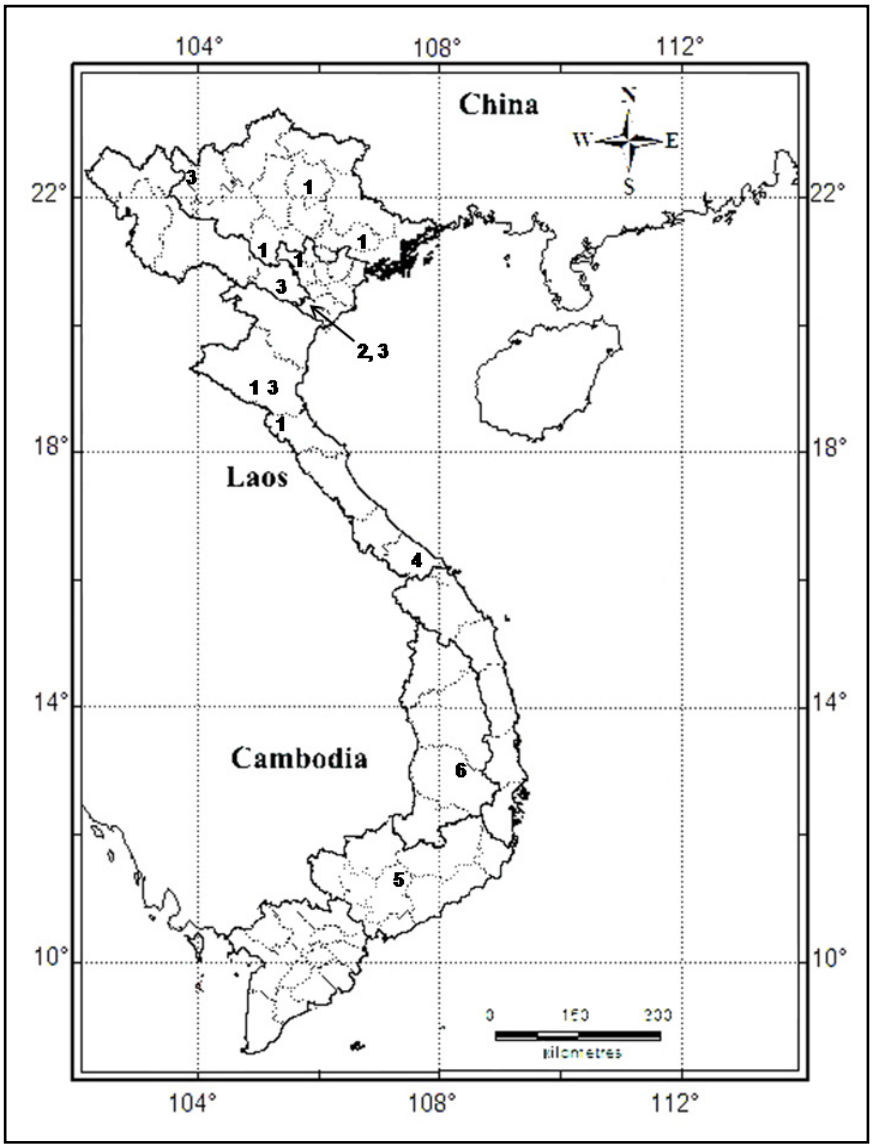

Figure 41. Distribution map of *Xanthopimpla brachycentra* species group: 1. *X. brachycentra*; 2. *X. platyura*; 3. *X. reicherti*; 4. *X. transmaculata*; 5. *X. punctatissima*; 6. *X. spicula*

The *citrina* species group

Diagnosis. Mesoscutum with notaulus almost extending to anterior level of tegula; scutellum evenly convex, lateral flange moderately high, reaching to apex; fore wing with areolet closed; largest bristles of mid and hind tarsal claws distinctly widened, black apically; area superomedia closed, nearly as long as to distinctly longer than wide; ovipositor stout; ovipositor sheath about 0.65x hind tibia; body entirely yellow, except black ocellar area (Townes & Chiu, 1970).

***Xanthopimpla enderleini* KRIEGER, 1915**

(Figure 42)

Xanthopimpla enderleini Krieger, 1914. Arch. f. Naturgesch., (A) 80 (6): 35. Lectotype: ♀, Indonesia: Sumatra (MZPW).

Material examined. None.

Diagnosis. Stigma dark brown to blackish; area superomedia as long as or much longer than wide, receiving costula near the centre; ovipositor sheath 3.9x as long as wide, wider near base than at middle (Krieger, 1915; Townes & Chiu, 1970).

Distribution. Pham (1997) has previously recorded this species from Vietnam on the basis of specimens collected from Hanoi, Hung Yen, Tien Giang, Binh Dinh and Phu Yen provinces. Outside Vietnam, this species has been recorded from China, India, Malaysia, Indonesia, and the Philippines (Yu *et al.,* 2005).

Remarks. *Xanthopimpla enderleini* was first reported from Vietnam by Pham (1991) and recognized as a parasitoid of *Cnaphalocrocis medinalis* (Lepidoptera: Pyralidae), *Parnara guttata* (Lepidoptera: Hesperiidae), and *Sesamia inferens* (Lepidoptera: Noctuidae) on rice (Pham, 1997). However, I did not find any specimens of this species in recent collections. The presence of *X. enderleini* in Vietnam needs to be confirmed due to its morphological similarity to *X. flavolineata*.

***Xanthopimpla flavolineata* CAMERON, 1907**

(Figures 42, 44a)

Xanthopimpla flavolineata Cameron, 1907. Tijdschr. v. Ent., 50: 48. Holotype: ♀, New Guinea: Merauke (ZMAN).

Material examined. Ha Noi, Tu Liem, Co Nhue: 4♀ (IEBR), 17.vi.1995, hand net, L. D. Khuat leg.; Ha Noi, Thuong Tin: 2♀ (IEBR), 30.xii.1998, L. D. Khuat leg.; Ha Noi, Ha Dong, Van Phu: 1♀ (IEBR), 25.x.1996, L. D. Khuat leg.; Ha Noi, Tu Liem, Minh Khai: 1♀1♂ (IEBR), 21.x.2001, L. D. Khuat leg.; Ha Noi, Ba Vi NP: 1♂ (IEBR), 400–500 m a.s.l., 02.vi.2001, hand net, N. T. Pham leg.; Vinh Phuc, Phuc Yen, Ngoc Thanh: 1♂ (IEBR), 02.x.2000, hand net, N. T. Pham leg.; Ha Noi, Gia Lam, Da Ton: 1♂ (IEBR), 25.ix–05.x.2001; 1♀ (IEBR), 15–25.x.2001, Malaise trap, L. D. Khuat leg.; Hoa Binh, Yen

Thuy, Da Phuc: 1♀ (IEBR), 05.vii.2000; 1♀ (IEBR), 01.iii.2004, L. D. Khuat leg.; Hoa Binh, Yen Thuy, Bao Hieu: 1♀ (IEBR), 07.ix.2000, hand net, N. T. Pham leg.; 1♀ (IEBR), 30.v.2003; 1♂ (IEBR), 10.vi.2003; 1♀ (IEBR), 20.vi.2003, L. D. Khuat leg.; Hoa Binh, Yen Thuy, Lac Thinh: 1♀ (IEBR), 01–10.i.2002; 1♀ (IEBR), 20–30.vi.2002, Malaise trap, L. D. Khuat leg.; Hoa Binh, Yen Thuy, Yen Lac: 10♀ (IEBR), 16.x.2002; L. D. Khuat leg.; Hoa Binh, Cao Phong: 1♀4♂ (IEBR), 15.xi.2006, hand net, H. D. Nguyen leg.; Ha Nam, Phu Ly: 1♀ (IEBR), 30.viii.2003; 1♂, 30.ix.2003, Malaise trap, V. H. Bach leg.; Phu Tho, Xuan Son NP: 1♀ (IEBR), 250 m a.s.l., 17.iv.2004, hand net, L. X. Truong leg.; Phu Tho, Thanh Son, Xuan Dai: 1♀ (IEBR), 25–30.xii.2009, Malaise trap, L. D. Khuat leg.; Thai Nguyen, Phuc Xuan: 1♂ (IEBR), 24.ix.2004, L. D. Khuat leg.; Nghe An, Pu Mat NP: 1♀ (IEBR), 150–200 m a.s.l., 08.ix.2005, hand net, N. T. Pham leg.; Quang Tri, Khe Sanh: 2♀2♂ (IEBR), 26.iii.2003; Quang Tri, Dakrong, Ba Long: 1♀ (IEBR), 29.viii.2005, hand net, L. D. Khuat leg.; Nghe An, Anh Son, Phuc Son: 1♀1♂ (IEBR), 250–300 m a.s.l., 27.x.2006, hand net, H. X. Le leg.; Bac Giang, Thanh Son, Son Dong: 2♀1♂ (ZFMK), 200 m a.s.l., 04.vii.2010, hand net, N. T. Pham leg.; Ha Tinh, Vu Quang NP: 1♀1♂ (RMNH), 29.ix.2009, hand net, R. de Vries leg.; Ninh Binh, Cuc Phuong NP: 2♀ (RMNH), 08.x.2009, light trap, E. Gasso Miracle leg.

Diagnosis. Stigma light brown; area superomedia receiving costula behind the centre; ovipositor sheath 4.8x as long as wide, as wide near base as at middle.

Distribution. This species was previously recorded from Lai Chau, Son La, Vinh Phuc, Ha Noi, Hung Yen, Hai Phong, Quang Ninh, Quang Ngai, Phu Yen, Tien Giang and Ba Ria-Vung Tau (Pham, 1997). Our records filled the distribution gaps of this species in Vietnam. Outside Vietnam, this species has been reported from Australia, Bangladesh, China, India, Indonesia, Japan, Laos, Malaysia, Nepal, New Caledonia, Pakistan, Palau, Papua New Guinea, Sri Lanka, the Philippines and Vanuatu (Yu *et al.*, 2005).

Remarks. In Vietnam, this species has been reared from pupae of *C. medinalis*, *P. guttata* and *Naranga aenescens* (Lepidoptera: Noctuidae) on rice and *Lamprosema indica* (Lepidoptera: Pyralidae) on soybean (Plant Protection Research Institute, 1976; Khuat & Pham, 2007; Vu, 2007).

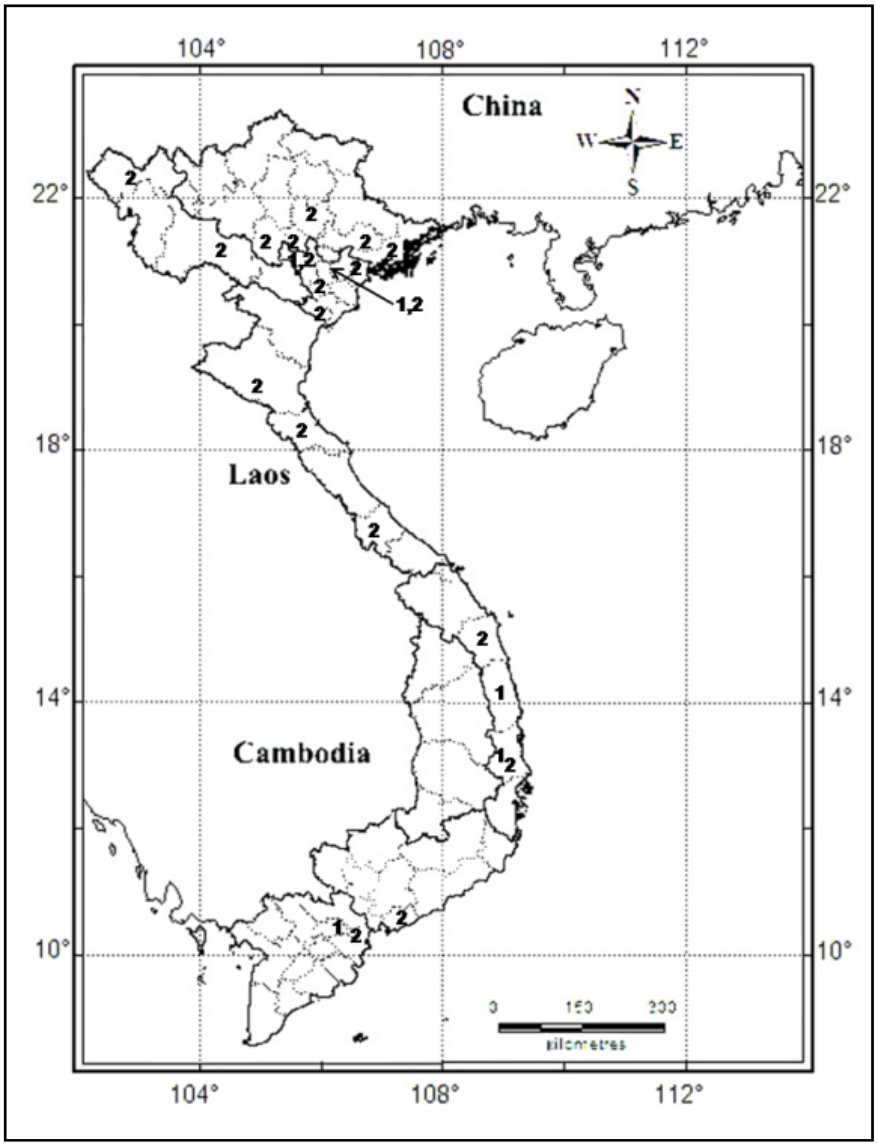

Figure 42. Distribution map of *Xanthopimpla citrina* species group:

1. *X. enderleini*; 2. *X. flavolineata*

The *cuneata* species group

Diagnosis. Mesoscutum with sparse hairs; scutellum conical or pyramidal; subtegular ridge sharp; fore wing with areolet closed; largest bristles of mid and hind tarsal claws distinctly widened, black apically; hind tibia with some small apical bristles; propodeum with pleural area divided into two areas by posterior transverse carina; ovipositor sheath 0.2–0.3x hind tibia (Townes & Chiu, 1970).

***Xanthopimpla clivulus* TOWNES & CHIU, 1970**

(Figures 43, 44b, 46a)

Xanthopimpla clivulus Townes & Chiu, 1970. Mem. Amer. Ent. Inst., 14: 160.

Xanthopimpla clivulus clivulus Townes & Chiu, 1970. Holotype: ♀, Indonesia: Java (AEIC).

Xanthopimpla clivulus indica Townes & Chiu, 1970. Holotype: ♀, India (GPTA). Secondary homonym.

Xanthopimpla clivulus indicata Gupta, 1987, replacement name. Synonymized with *X. clivulus clivulus* by Pham *et al.,* 2011c.

Material examined. Vinh Phuc, Phuc Yen, Ngoc Thanh: 1♀ (IEBR), 150 m a.s.l., 11.x.2005, hand net, N. T. Pham leg.; Bac Can, Ba Be NP: 1♀ (OMNH), 200 m a.s.l., 22°23'N 105°37'E, 01.v.2006, hand net, R. Matsumoto leg.; Thai Nguyen, Dai Tu, Cat Ne: 1♀ (IEBR), 15.xii.2006, Malaise trap, L. D. Khuat leg.; Dak Lak, Ea So NP: 1♂ (IEBR), 310 m a.s.l., 12°55.93'N 108°37.964'E, 27.vii.2008, Malaise trap, H. T. Ngo leg.; Phu Tho, Xuan Son NP: 1♂ (IEBR), 06–10.vi.2009, Malaise trap, L. D. Khuat leg.

Diagnosis. Mesoscutum with vertical crest anteriorly; scutellum conical with sharp point; outer margin of subtegular ridge moderately sharp; ovipositor decurved; ovipositor sheath 0.3x hind tibia.

Distribution. This species was reported from Vietnam for the first time by Pham & Khuat (2008) from Vinh Phuc and Thai Nguyen provinces (northern Vietnam). Our recent records extended the distribution of this species southwards to Dak Lak Province. Outside Vietnam, *X. clivulus* has been recorded from India, Indonesia, Malaysia and Singapore (Yu *et al*., 2005).

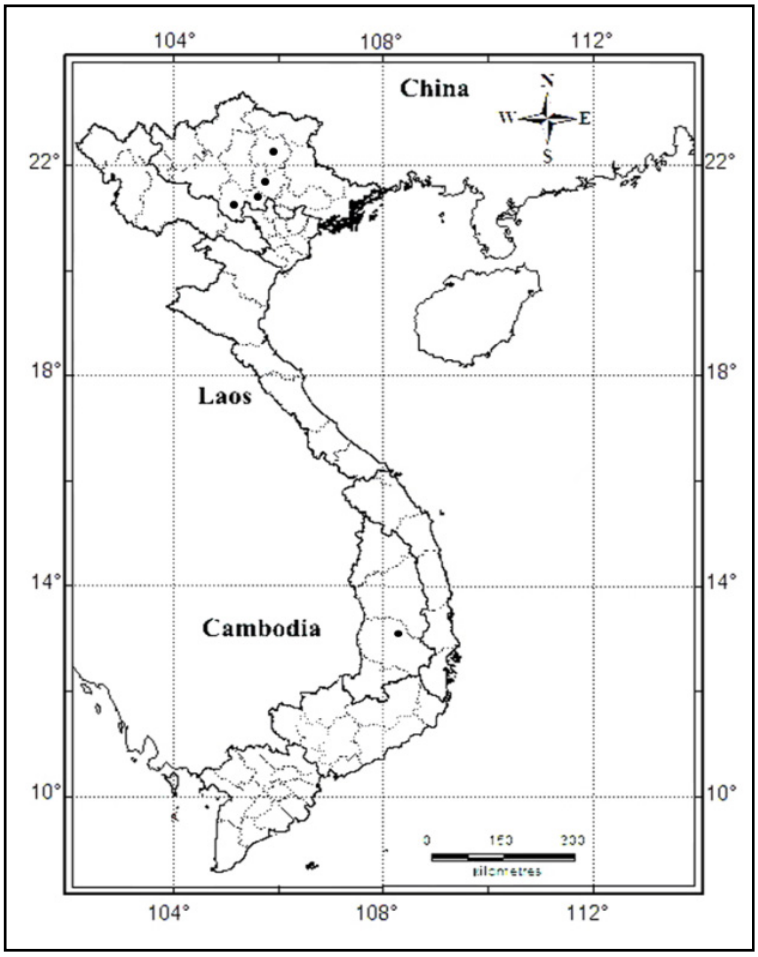

Figure 43. Distribution map of *X. clivulus*

Remarks. Previously two subspecies were recognised: *X. clivulus clivulus* from Malaysia, Singapore and Indonesia (Java) and *X. clivulus indicata* Gupta from India (Townes & Chiu, 1970; Yu *et al*., 2005). They differ from each other by the presence or absent of black spots on the second tergite and a median black mark on the posterior face of the hind tibia (Townes & Chiu, 1970). The Vietnamese specimens collected from Thai Nguyen, Phu Tho and Dak Lak provinces agree well with *X. clivulus clivulus*; the specimens collected from Vinh Phuc and Bac Can provinces have the second tergite entirely yellow but with a postmedian black mark on the hind tibia. Pham *et al.* (2011c) stated that the two 'subspecies' intergrade along a geographical cline in the extent of black markings, therefore, the authors synonymized these names.

The *elegans* species group

Diagnosis. Lower anterior corner of pronotum a sharp angle, making an angle of 90°–100°; mesoscutum with moderately long, deep notaulus; scutellum strongly convex, lateral carina extending to apex; fore wing with areolet closed, receiving vein 2*m-cu* almost at or near its outer corner (Townes & Chiu, 1970).

***Xanthopimpla curvimaculata* (CAMERON, 1899)**

(Figures 44c, 45)

Pimpla curvimaculata Cameron, 1899. Mem. & Proc. Manchester Lit. Phil. Soc. 43 (3): 158. Holotype: ♂, India: Khasi Hills in Assam (OUMNH).

Xanthopimpla cuvimaculata: Krieger (1914).

Xanthopimpla curvimaculata pendleburyi, Townes & Chiu, 1970. Mem. Amer. Ent. Inst, 14: 264. Holotype: ♀, Malaysia: Kuala Lumpur, Selangor (GPTA). Synonymized with the nominate subspecies by Pham *et al.*, 2011c.

Material examined. Phu Tho, Xuan Son NP: 1♀ (IEBR), 300 m a.s.l., 08.v.2005, hand net, N. T. Pham leg.; Dong Nai, Cat Tien NP: 1♀ (RMNH), 100 m a.s.l., 13–20.v.2005; 1♂, same locality, 13–19.v.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.; Dak Lak, Chu Yang Sin NP: 1♂ (RMNH), 550–600 m a.s.l., 21–26.x.2005, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Face wider than high; median and lateral black marks on mesoscutum jointed posteriorly to black mark in front of scutellum; scutellum strongly convex, lateral flange about 0.8x first flagellomere width; subtegular ridge subtriangular; mid and hind tibiae without stout bristles; area superomedia closed or partly confluent with area dentipara; ovipositor sheath about 0.3x hind tibia.

Distribution. Pham *et al.* (2011c) recorded this species from Vietnam for the first time. Outside Vietnam, it has been recorded from India, Malaysia and Thailand (Yu *et al.*, 2005).

Remarks. Two subspecies was previously recognised: *X. curvimaculata curvimaculata* from India and Thailand, and *X. curvimaculata pendleburyi* Townes & Chiu from Malaysia. The latter subspecies differs from the nominate subspecies by the presence of large black spots on the second tergite and by more extensive black marks on the hind leg and metasomal tergites (Townes & Chiu, 1970; Yu *et al*., 2005). The specimen recorded in Phu Tho Province (northern Vietnam) agrees well with the nominate subspecies. The specimens collected from Dak Lak and Dong Nai provinces are closer to *X. curvimaculata pendleburyi* in their more extensive black marks on the tergites, but they have only two small black spots on the second tergite, and a black stripe on the underside of the hind femur (as in the nominate subspecies). In addition, they have large black spots on tergite 3 and a black band on tergite 5. As the differences between the two subspecies have not proved to be stable Pham *et al.* (2011c) synonymised the two names.

***Xanthopimpla elegans* (VOLLENHOVEN, 1879)**

(Figures 45, 46b)

Pimpla elegans Vollenhoven, 1879. Stettin. Ent. Ztg. 40: 147. Holotype: ♀, Indonesia: Java (RMNH).

Xanthopimpla elegans: Krieger (1914).

Pimpla apicipennis Cameron, 1899. Mem. & Proc. Manchester Lit. Phil. Soc. 43 (3): 161. Holotype: ♀, India: Khasi Hills in Assam (OUMNH).

Xanthopimpla elegans apicipennis: Townes & Chiu (1970). Synonymized with the nominate subspecies by Pham *et al.*, 2011c.

Material examined. Ninh Binh, Cuc Phuong NP: 1♀ (RMNH), 225 m a.s.l., 14.iv–01.v.2000, Malaise trap, Q. P. Mai leg.; Thua Thien-Hue, Phong Dien, Phong My: 1♀ (IEBR), 600 m a.s.l., 31.iii.2001, hand net, L. X. Truong leg.; Lam Dong, Bao Loc, Dambri: 2♀ (OMNH), 800 m a.s.l., 01.v.2000, hand net, R. Matsumoto leg.; 1♀ (IEBR), same locality, 04.v.2003, hand net, T. V. Hoang leg.; Ha Tinh, Huong Son, Son Kim: 1♀ (IEBR), 07.v.2004, hand net, L. X. Truong leg.; Ha Tinh, Vu Quang: 1♀ (RMNH), 98 m a.s.l., 18°19. 40'N 105°26.47'E, 23.ix–05.x.2009, Malaise trap, C. v. Achterberg & R. de Vries leg.; Phu Tho, Xuan Son NP: 3♀ (IEBR), 250 m a.s.l., 05.v.2005; 1♀ (ZFMK), 300 m a.s.l., 07.v.2005, hand net, N. T. Pham leg.; Dong Nai, Cat Tien NP, 100 m a.s.l.: 2♀ (IEBR), 08.viii.2005; 1♂ (IEBR), 10.viii.2005, hand net, J. Kojima leg.; 1♀ (IEBR), 10.viii.2005, hand net, L. X. Truong leg.; 1♀1♂ (RMNH), 06.x.2005, R. de Vries leg.; 1♀ (RMNH), 02–09.x.2005; 4♀ (RMNH), 13–19.v.2007; 1♀ (RMNH), 15−20.v.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.; 3♀ (RMNH), 09–30.iv.2007, Malaise trap, Q. P. Mai & M. T. Nguyen leg.; Nghe An, Pu Mat NP: 1♀ (OMNH), 300−400 m a.s.l., 17.iv.2006, hand net, N. T. Pham leg.; 3♀ (IEBR), 250−400 m a.s.l., 23.iv.2006; 1♀1♂ (IEBR), 350 m a.s.l., 26.iv.2006; 1♀1♂ (IEBR), 300 m a.s.l., 27.iv.2006, hand net, H. X. Le leg.; Quang Tri, Huong Hoa, Huong Phung: 1♀ (ZFMK), 900−1000 m a.s.l., hand net, N. T. Pham leg.; Kon

Tum, Sa Thay, Sa Son: 1♀ (IEBR), 22.v.2009, hand net, T. V. Hoang leg.

Diagnosis. Mesoscutum with three continuous black spots, plus black mark in front of scutellum; area superomedia closed; tergites 3, 5, and 7 always with large black spots or with black bands; ovipositor sheath about 1.0–1.15x hind tibia.

Distribution. Townes & Chiu (1970) recorded this species from Vietnam for the first time from Buon Ma Thuot (Dak Lak Province). Our records extended the distribution of this species from North to South Vietnam. Outside Vietnam, it is known from India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Singapore, Sri Lanka, Taiwan, Thailand and the Philippines (Yu *et al.*, 2005).

Remarks. This species was previously divided into four subspecies: *X. elegans elegans* from India, Sri Lanka, Myanmar, Thailand, Vietnam, Malaysia, Singapore, Indonesia; *X. elegans apicipennis* (Cameron) from India, Nepal, Myanmar, Laos, Thailand; *X. elegans cristaminor* Townes & Chiu from the Philippines; and *X. elegans insulana* Krieger from Taiwan (Townes & Chiu, 1970; Yu *et al*., 2005). Most of the specimens collected in Cat Tien NP (Dong Nai Province) belong to the nominate subspecies characterized by the presence of small black spots on tergites 2, 4, and 6 (sometimes black spots on tergite 6 absent, or in one male tergite 2 with a black band) and the black hind tarsus. Some specimens belong to *X. elegans apicipennis*, with entirely yellow tergites 2, 4, and 6 and yellow hind tarsomeres 1–3. All northern specimens seem to belong to this subspecies. Some other specimens, ranging from Central to Southern Vietnam are close to *X. elegans apicipennis* in the colour of the hind tarsomeres 1–3 but they have small black spots on tergite 2. The difference in black markings on the specimens from North to South Vietnam may reveal a cline between populations, Pham *et al.* (2011c) therefore synonymised *X. elegans apicipennis* to the nominate subspecies.

***Xanthopimpla nigritarsis* CAMERON, 1903**

(Figures 44d, 45)

Xanthopimpla nigritarsis Cameron, 1903. Jour. Straits Branch Roy. Asiatic Soc. 39: 138. Lectotype: ♀, Malaysia: Sarawak, Kuching (BMNH).

Material examined. Nghe An, Pu Mat NP: 1♂ (IEBR), 250−400 m a.s.l., 23.iv.2006; 1♂ (IEBR), 350 m a.s.l., 27.iv.2006, hand net, H. X. Le leg.; Kon Tum, Chu Mom Ray NP: 1♀ (RMNH), 700–900 m a.s.l., 26.ix–05.x.2006, Malaise trap, Q. P. Mai & M. T. Nguyen leg.; Dong Nai, Hieu Liem, Vinh Cuu: 1♀ (IEBR), 29.xii.2007, hand net, T. V. Hoang leg.

Diagnosis. Face as high as or higher than wide; area superomedia closed; area dentipara of propodeum with strong longitudinal ridges; mid and hind tibiae without stout bristles; tergites 1, 3, 5, and 7 with large black spots or black bands; ovipositor sheath about 0.3x hind tibia.

Distribution. Pham *et al.* (2011c) recorded this species from Vietnam. Outside Vietnam, it has been recorded from India, Indonesia, Malaysia and the Philippines (Yu *et al.*, 2005).

Remarks. Three subspecies are currently recognised: *X. nigritarsis nigritarsis* from Malaysia and Indonesia; *X. nigritarsis punctiger* Townes & Chiu from the Philippines; and *X. nigritarsis reciprocata* Townes & Chiu from India (Townes & Chiu, 1970; Yu *et al*., 2005). The specimens from Vietnam are closest to the nominate subspecies, recognized by the presence of small punctures on the mesopleuron and black spots on tergites 2, 4, and 6. However, these black spots on Vietnamese specimens are much smaller than in the original description.

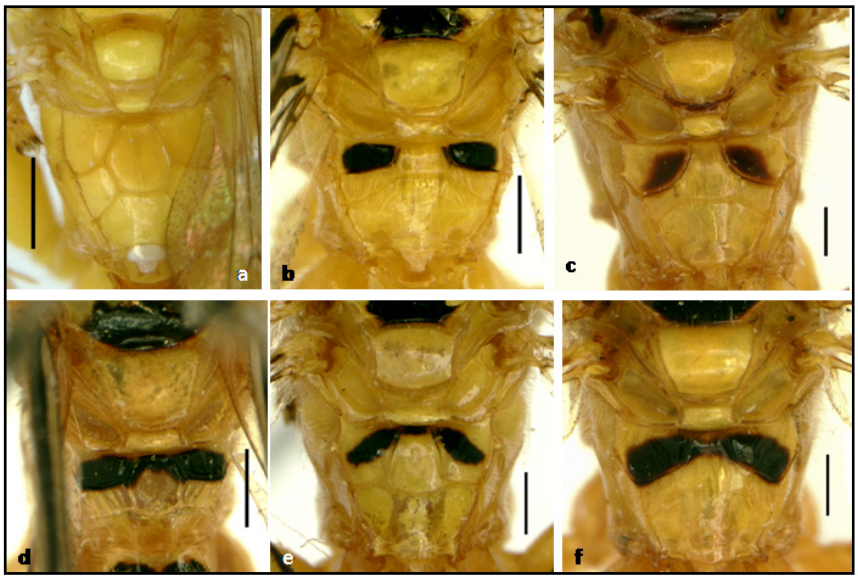

Figure 44: Dorsal views of scutellum and propodeum of *Xanthopimpla* species (scales 0.5 mm): a. *X. flavolineata*; b. *X. clivulus*; c. *X. curvimaculata*; d. *X. nigritarsis*; e. *X. tricapus*; f. *X. varimaculata*

***Xanthopimpla tricapus* TOWNES & CHIU, 1970**

(Figures 44e, 45)

Xanthopimpla tricapus Townes & Chiu, 1970. Mem. Amer. Ent. Inst., 14: 260.

Xanthopimpla tricapus impressa Townes & Chiu, 1970. Mem. Amer. Ent. Inst., 14: 260. Holotype: ♀, Myanmar: Toungoo, Karenni (ZMHB).

Material examined. Nghe An, Pu Mat NP: 1♂ (ZFMK), 350 m a.s.l., 26.iv.2006; 1♀ (IEBR), 400−500 m a.s.l., 16.vii.2006, hand net, H. X. Le leg.; Vinh Phuc, Phuc Yen, Ngoc Thanh: 2♂ (IEBR), 15.vii.2007; 1♂ (OMNH), hand net, T. H. Pham leg.; Dak Lak, Chu Yang Sin NP: 1♀ (RMNH), 750 m a.s.l., 01–10.vi.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.; Dong Nai, Cat Tien NP: 1♀ (RMNH), 01–09.x.2005, Malaise trap, C. v. Achterberg & R. de Vries leg.; Dong Nai, Vinh Cuu, Phu Ly: 1♀ (IEBR), 02.viii.2008, hand net, T. V. Hoang leg.

Diagnosis. Mesoscutum medially with three separate black spots; area superomedia closed;

propodeum without basal transverse carina so that first and area dentipara confluent; ovipositor sheath equal to length of hind tibia.

Distribution. Pham & Le (2007) recently recorded this species from Vietnam for the first time from Pu Mat NP (Nghe An Province). Our records extended the distribution of this species northwards to Vinh Phuc Province and southwards to Dak Lak and Dong Nai provinces. Outside of Vietnam, it is known from India, Indonesia, Malaysia, Myanmar, Thailand and the Philippines (Yu *et al.*, 2005).

Remarks. Two subspecies are currently recognised: *X. tricapus tricapus* from the Philippines and *Xanthopimpla tricapus impressa* Townes & Chiu from India, Myanmar, Thailand, Vietnam, Malaysia and Indonesia (Townes & Chiu, 1970, Yu *et al*., 2005). The latter subspecies differs from the nominate by the presence of a shallow notaulus, small punctures on the mesoscutum and an entirely yellow tergite 6 and probably warrants separate species status, although the material from the Philippines have not been examined to confirm this.

***Xanthopimpla varimaculata* CAMERON, 1907**

(Figures 44f, 45)

Xanthopimpla varimaculata Cameron, 1907. Tijdschr. v. Ent., 50: 103. Holotype: ♂, India: Sikkim (BMNH).

Material examined. Vinh Phuc, Tam Dao NP: 1♀ (OMNH), 02.v.1996, hand net, Y. Okushima leg.; Thua Thien-Hue, Bach Ma NP: 1♀ (IEBR), 1200−1300 m a.s.l., 12.x.2002, hand net, T. V. Hoang leg.; Ha Tinh, Huong Son, Son Hong: 1♀ (IEBR), 24.iv.2004, hand net, L. X. Truong leg.; Nghe An, Pu Mat NP: 1♀ (ZFMK), 300 m a.s.l., 12.ix.2005, hand net, N. T. Pham leg.; 1♂ (IEBR), 300−400 m a.s.l., 23.iv.2006, hand net, H. X. Le leg.; Dong Nai, Cat Tien NP: 1♀ (RMNH), 100 m a.s.l., 09–30.iv.2007, Malaise trap, Q. P. Mai & M. T. Nguyen leg.; Dak Lak, Chu Yang Sin NP: 1♀ (RMNH), 500 m a.s.l., 03–09.vi.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.; Hoa Binh, Hang Kia–Pa Co NR: 1♀ (RMNH), 1381m, 20°44.43'N 104°53.135'E, 10–24.x.2009, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Lateral black spots on mesoscutum joined posteriorly to black mark in front of scutellum; propodeum with area superomedia confluent with second lateral and area petiolaris; median part of posterior transverse carina absent; tergite 3 with V-shaped black mark; ovipositor 0.8–1.0x hind tibia.

Distribution. This species was reported for the first time from Vietnam in Pu Mat NP (Nghe An Province) by Pham & Le (2007). Our recent records extended the distribution of this species from North to South Vietnam. Outside of Vietnam, this species has been recorded from China and India

(Yu *et al.*, 2005).

Remarks. The specimen from Cat Tien NP (Dong Nai Province) has a V-shaped black band on the second tergite while the specimen from Chu Yang Sin NP (Dak Lak Province) has three black spots on the second tergite.

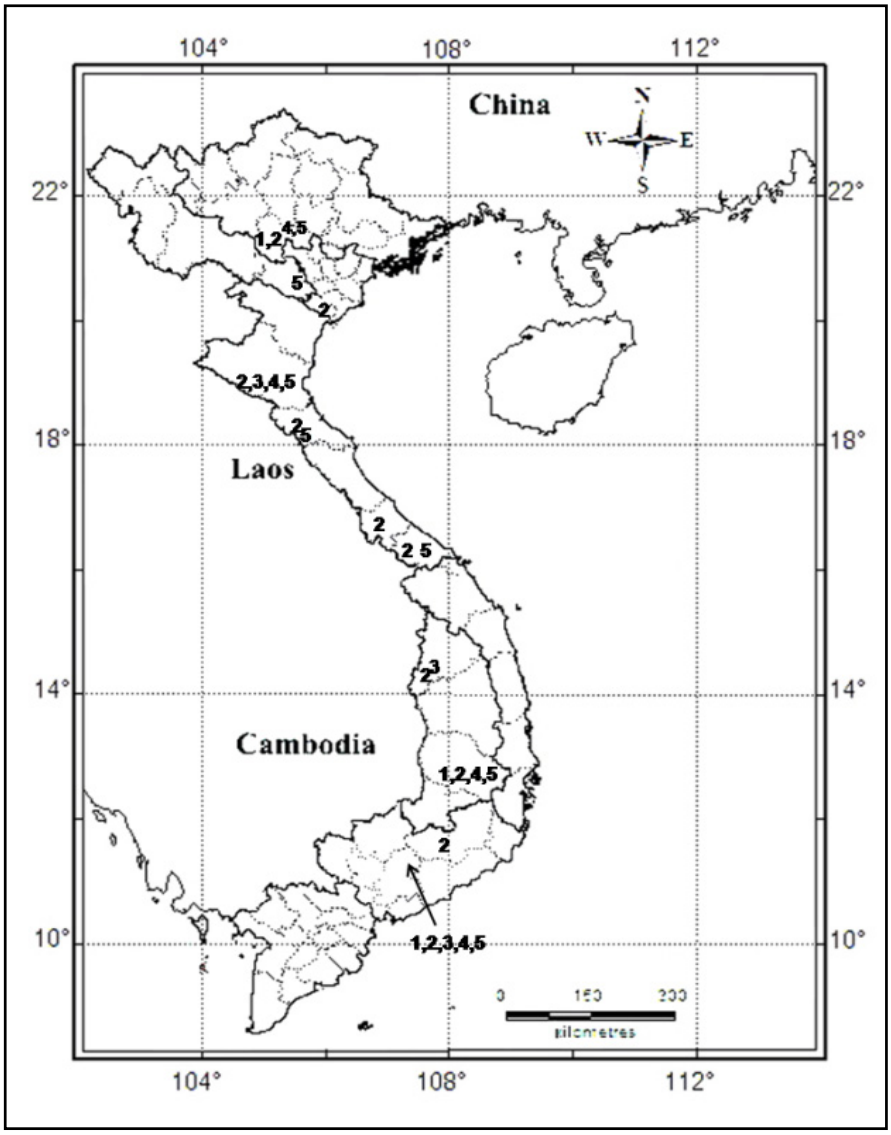

Figure 45. Distribution map of *Xanthopimpla elegans* species group: 1. *X. curvimaculata*; 2. *X. elegans*; 3. *X. nigritarsis*; 4. *X. tricarpus*; 5. *X. varimaculata*

The *incompleta* species group

Diagnosis. Fore wing with areolet open on outer side, vein 3*rs-m* completely absent, vein *cu-a* basad of *Rs*&*M*; mesoscutum with moderately dense hairs; scutellum strongly convex, lateral carina extending to apex; mid and hind tibiae with a few preapical bristles; largest bristles of mid and hind tarsal claws not widened or blackened apically; ovipositor with shaft of dorsal valve enclosing shaft of ventral valve, ovipositor sheath about 0.2–0.6x hind tibia (Townes & Chiu, 1970).

Figure 46. *Xanthopimpla* species (scales 0.5 mm): a & b – Lateral views of mesosoma: a. *X. clivulus*; b. *X. elegans*; from c to e – *X. connexa*: c. dorsal view of scutellum and propodeum; d. wings; e. ovipositor; f & g – *X. pulvinaris*: f. dorsal view of head and mesoscutum; g. dorsal view of scutellum and propodeum

***Xanthopimpla connexa* KRIEGER, 1914**

(Figures 46c, 46d, 46e, 47)

Xanthopimpla connexa Krieger, 1914. Arch. f. Naturgesch. (A) 80 (6): 22. Holotype: ♀, the Philippines (ZMHB).

Promethus poonaensis Rao, 1953. Indian Forest Rec. (n. s., Ent.) 8: 186. Holotype: ♀, India: Poona in Bombay (IFRI).

Xanthopimpla connexa poonaensis: Townes & Chiu, 1970.

Material examined. Dong Nai, Cat Tien NP: 1♀ (RMNH), 100 m a.s.l., 13–20.v.2005; 1♀ (RMNH), 13–20.v.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.; Ninh Thuan, Nui Chua NP: 1♀ (RMNH), 90–150 m a.s.l., 20–30.v.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Face with small punctures; propodeum with area superomedia confluent with area dentipara, posterior transverse carina concave medially; hind femur with black stripe on the lower side; ovipositor decurved, ovipositor sheath 0.35x hind tibia.

Distribution. Pham *et al*. (2011c) recorded this species from Vietnam for the first time. Outside Vietnam, it has been recorded from India and the Philippines (Yu *et al*., 2005).

Remarks. This species currently is divided into two subspecies: *X. connexa connexa* from the Philippines and *X. connexa poonaensis* (Rao) from India. They are separated from each other by differences in the size of punctures on the face, the size of black spots on tergite 6 and the pattern of black spots on the mesoscutum (Townes & Chiu, 1970; Yu *et al*., 2005). The specimens from Vietnam, with small facial punctures and small black spots on tergite 6, agree well with *X. connexa poonaensis* but three median continuous black spots on the mesoscutum are more similar to the nominate subspecies.

***Xanthopimpla naenia* MORLEY, 1913**

(Figure 47)

Xanthopimpla naenia Morley, 1913. Faun. British India, Hymenoptera, 3(1): 115. Holotype: ♀, India (OUMNH).

Material examined. None.

Diagnosis. Face with moderate-sized punctures; propodeum with area superomedia partly or completely separate from area dentipara; mesoscutum medially with three continuous black spots; femur entirely yellow; ovipositor sheath 0.2–0.4x hind tibia.

Distribution. Townes & Chiu (1970) previously recorded this species from Da Lat, Lam Dong Province (Central Highlands of Vietnam). Outside Vietnam, *X. naenia* is known from India, Malaysia, Japan, Taiwan and the Philippines (Yu *et al.*, 2005).

***Xanthopimpla pulvinaris* TOWNES & CHIU, 1970**

(Figures 46f, 46g, 47)

Xanthopimpla pulvinaris Townes & Chiu, 1970. Mem. Amer. Ent. Inst., 14: 271. Holotype: ♀, Taiwan: Shinchu (TARI).

Material examined. Dak Lak, Ea So NP: 1♂ (IEBR), 300 m a.s.l., 12°55.93'N 108°37.96'E, 27.vii.2008, Malaise trap, H. T. Ngo leg.; Phu Tho, Thanh Son, Xuan Son NP: 1♂ (IEBR), 200 m a.s.l., 04–09.i.2009; 1♀ (IEBR), 19–24.vi.2009; 1♀ (IEBR), 05–10.vii.2009, Malaise trap, L. D. Khuat leg.

Diagnosis. Face with small punctures; propodeum with area superomedia partly or completely separate from area dentipara; mesoscutum medially with three separated black spots; femur black apically; ovipositor sheath 0.5x hind tibia.

Distribution. Pham *et al.* (2011c) recorded this species from Vietnam for the first time. Outside Vietnam, it has been known from China, Laos, Malaysia, Taiwan and Thailand (Yu *et al.*, 2005).

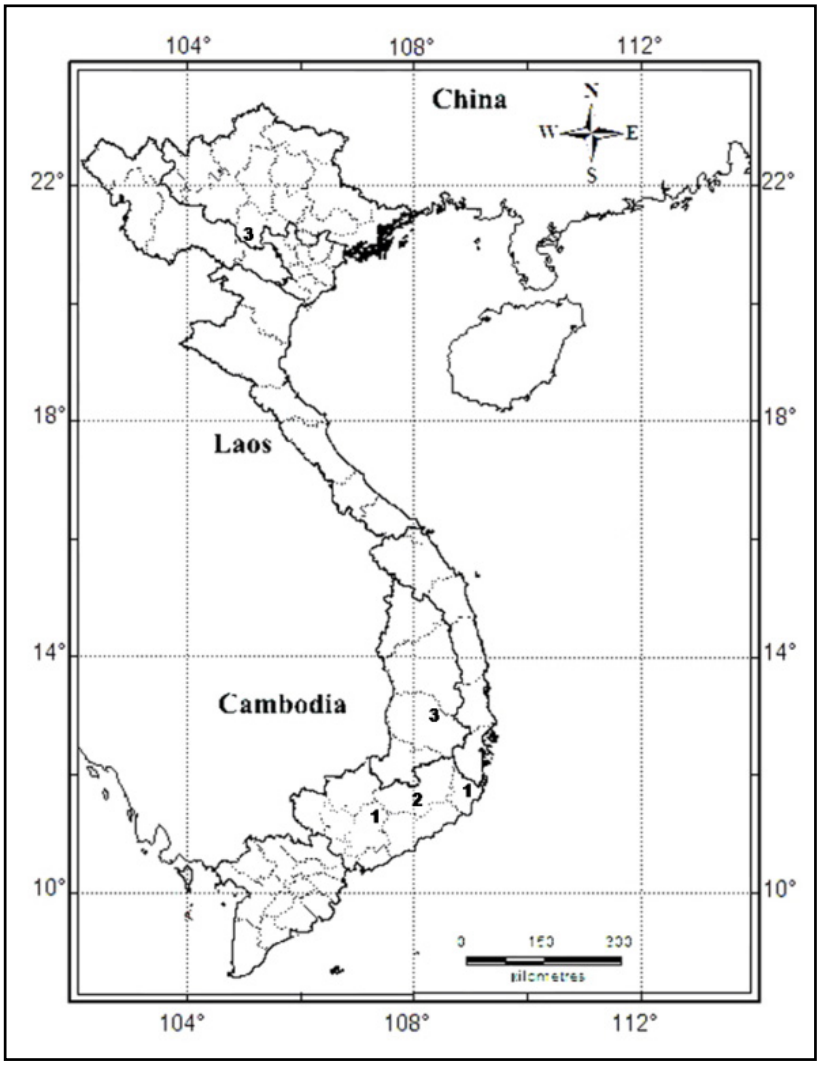

Figure 47. Distribution map of *Xanthopimpla incompleta* species group: 1. *X connexa*; 2. *X. naenia*; 3. *X. pulvinaris*

The *nana* species group

Diagnosis. Mesoscutum with short notaulus, not extending to anterior level of tegula; scutellum convex, lateral flange extending to apex; propodeum with posterior transverse carina absent or present as two lateral stubs, area superomedia not defined; largest bristles of mid and hind tarsal claws distinctly widened, curved and blackened apically; fore wing with areolet closed (Townes & Chiu, 1970).

***Xanthopimpla alternans* KRIEGER, 1914**

(Figures 48a, 49)

Xanthopimpla alternans Krieger, 1914. Arch. f. Naturgesch., (A) 80 (6): 31. Holotype: ♀, Taiwan: Chiayi (ZMHB).

Material examined. Thua Thien-Hue, A Luoi, Tra Ve: 1♀ (IEBR), 100–200 m a.s.l., 16°15.282'N 107°26.296'E, 16–21.viii.2005, Malaise trap, T. Q. Nguyen leg.; Nghe An, Pu Mat NP: 1♀ (IEBR), 250

m a.s.l., 13.ix.2005, hand net, N. T. Pham leg.

Diagnosis. Propodeum with posterior transverse carina present as two stubs laterally; hind femur black apically; tergites 1, 3, 5, 7 with black band or black spots; ovipositor sheath about 0.9x hind tibia.

Distribution. Townes & Chiu (1970) previous recorded *X. alternans* for the first time from Vietnam in Nha Trang (Khanh Hoa Province) and Pleiku (Gia Lai Province). Outside Vietnam, this species has been recorded from China, India, Indonesia, Malaysia, Sri Lanka and Taiwan (Yu *et al.*, 2005).

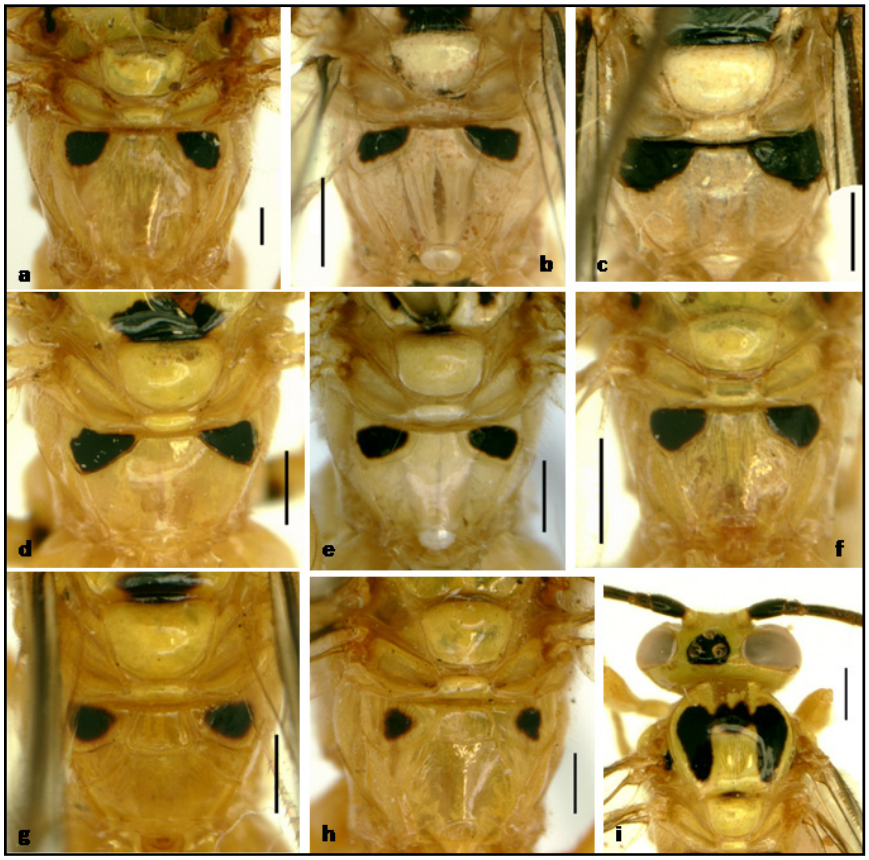

Figure 48. *Xanthopimpla* species (scales 0.5 mm): From a to h – Dorsal views of scutellum and propodeum: a. *X. alternans*; b. *X. glaberrima*; c. *X. jacobsoni*; d. *X. nana*; e. *X. despinosa*; f. *X. honorata*; g. *X. ochracea*; h. *X. punctata*; i. Dorsal view of head and mesonotum of *X. despinosa*

***Xanthopimpla glaberrima* ROMAN, 1913**

(Figures 48b, 49)

Xanthopimpla glaberrima Roman, 1913. Arkiv för Zool. 8 (15): 22. Holotype: ♀, the Philippines (NHRS).

Material examined. Hoa Binh, Yen Thuy, Lac Thinh: 1♀ (IEBR), 20–30.iii.2002; 1♀, 20–30.iv.2002, Malaise trap, L. D. Khuat leg.; Thai Nguyen, Cat Ne, Dai Tu: 1♂ (IEBR), 25.iv.2007; 1♀

(OMNH), 25–30.xii.2007; 1♀ (BMNH), 15–20.iv.2008; 1♀ (ZFMK), 05–10.v.2008, Malaise trap, L. D. Khuat leg.; Phu Tho, Xuan Son NP: 1♀ (IEBR), 10–15.v.2009, Malaise trap, L. D. Khuat leg.

Diagnosis. Mid and hind tibiae with 1–2 preapical bristles; posterior transverse carina present as two small lateral stubs; metasomal tergites each with two black spots, of which black spots on tergite 6 always smallest; ovipositor sheath 0.65–0.7x hind tibia.

Distribution. Pham *et al.* (2011c) recorded this species from Vietnam for the first time. Outside Vietnam, it has been recorded from India, Indonesia, Malaysia, Thailand, Taiwan and the Philippines (Yu *et al.*, 2005).

***Xanthopimpla jacobsoni* KRIEGER, 1914**

(Figures 48c, 49)

Xanthopimpla jacobsoni Krieger, 1914. Arch. f. Naturgesch. (A) 80 (6): 32. Holotype: ♀, Java: Semarang (HNHM).

Material examined. Dak Lak, Ea So NR: 1♀ (IEBR), 310 m a.s.l., 12°55.93'N 108°37.96'E, 27.vii.2008, Malaise trap, H. T. Ngo leg.

Diagnosis. Hind slope of vertex marked with black; fore and mid femora and tibiae with median black stripe on posterior sides; hind coxa with basal black spot anteriorly; hind tibia with basal 0.2 black plus two black stripes medially; propodeum without stubs of posterior transverse carina; ovipositor sheath about 1.45x hind tibia.

Distribution. Pham *et al.* (2011c) recorded this species from Vietnam for the first time. Outside Vietnam, it has been known from Indonesia, Malaysia, New Guinea, Singapore, Sri Lanka, Thailand and the Philippines (Yu *et al.*, 2005).

Remarks. Two subspecies are currently known: *X. jacobsoni jacobsoni* from the Oriental region and *X. jacobsoni sedlaceki* Townes & Chiu from New Guinea (Townes & Chiu, 1970; Yu *et al*., 2005). The unique female specimen in our collection belongs to the nominate subspecies, which differs from the second subspecies by the black mark on the hind side of the vertex and black spots on tergites 3–5.

***Xanthopimpla nana* SCHULZ, 1906**

(Figures 48d, 49)

Xanthopimpla parva Cameron, 1905. Spolia Zeylanica 3: 136. Holotype: ♂, Sri Lanka: Peradeniya (BMNH). Junior homonym of *Xanthopimpla parva* Krieger, 1899.

Xanthopimpla nana Schulz, 1906. Spolia Hymenopterologica: 114. Replacement name.

Xanthopimpla nana brevisulcus Wang, 1987. Acta Ent. Sinica 30 (3): 332. Holotype: ♀, China: Xishuangbanna Dai Aut, Yunnan (IZCAS). Synonymized with the nominate subspecies by Pham *et*

al., 2011c.

Xanthopimpla aequabilis Krieger, 1914. Arch. f. Naturgesch. (A) 80 (6): 31. Holotype: ♀, Taiwan: Hengchun (ZMHB).

Xanthopimpla nana aequabilis: Townes & Chiu (1970). Synonymized with the nominate subspecies by Pham *et al.*, 2011c.

Material examined. Ninh Binh, Cuc Phuong NP: 1♀ (OMNH), 200–300 m a.s.l., 24.iv.1998, hand net, R. Matsumoto leg.; Ha Noi, Gia Lam, Da Ton: 1♀ (IEBR), 25.v–05.vi.2001; 2♀ (IEBR), 22.vi–02.vii.2001; 1♀ (IEBR), 02–14.vii.2001; 1♀ (IEBR), 22.vii–02.viii.2001; 1♀ (ZFMK), 15–25.x.2001; 1♀ (IEBR), 25.x–05.xi.2001, Malaise trap, L. D. Khuat leg.; Hoa Binh, Yen Thuy, Lac Thinh: 1♀ (IEBR), 25.vii–05.viii.2002; 1♀ (IEBR), 01–10.ix.2002, Malaise trap, L. D. Khuat leg.; Dong Nai, Cat Tien NP: 1♀ (IEBR), 100 m a.s.l., 09.viii.2005, hand net, L. X. Truong leg.; Nghe An, Pu Mat NP: 1♀ (IEBR), 200 m a.s.l., 17.iv.2006, hand net, N. T. Pham leg.; Thai Nguyen, Cat Ne, Dai Tu: 1♀ (IEBR), 20.xi.2007, Malaise trap, L. D. Khuat leg.; Phu Tho, Xuan Son NP: 1♀ (IEBR), 21–25.vii.2009, Malaise trap, L. D. Khuat leg.

Diagnosis. Hind slope of vertex entirely yellow; propodeum with posterior transverse carina entirely absent; tergites 1, 3, 4, 5, and 7 with two black spots; ovipositor sheath about 0.6–0.8x hind tibia.

Distribution. Townes & Chiu (1970) previously recorded this species for the first time from Vietnam in Lam Dong Province (Central Highlands) and Khanh Hoa Province (South Vietnam). Our records extended the distribution of this species northwards to North Central and North Vietnam. Outside Vietnam, this species has been recorded from Cambodia, China, India, Indonesia, Nepal, Sri Lanka, Taiwan, Thailand and the Philippines (Yu *et al.*, 2005).

Remarks. Previously five subspecies were recognised: *X. nana nana* from China, India, Nepal, Sri Lanka, Thailand, Cambodia, Indonesia; *X. nana aequabilis* Krieger from China and Taiwan, *X. nana brevisulcus* Wang from China, *X. nana dama* Roman and *X. nana stictoprocta* Krieger from the Philippines (Townes & Chiu, 1970; Yu *et al.*, 2005). Specimens collected from northern Vietnam belong to subspecies *X. nana nana*, one female collected in Nghe An resembles the subspecies *X. nana aequabilis* (characterized by two larger lateral black spots on the mesoscutum), and one female from Dong Nai belongs to the subspecies *X. nana brevisulcus*, which differs from other subspecies by the presence of large black stripes on the anterior and posterior faces of the hind femur and a black stripe on the posterior face of the hind tibia. Pham *et al.* (2011c) stated that the differences between the nominate subspecies, *X. nana aequabilis* and *X. nana brevisulcus* were minor and unclear. Therefore the authors treated the three names as synonyms.

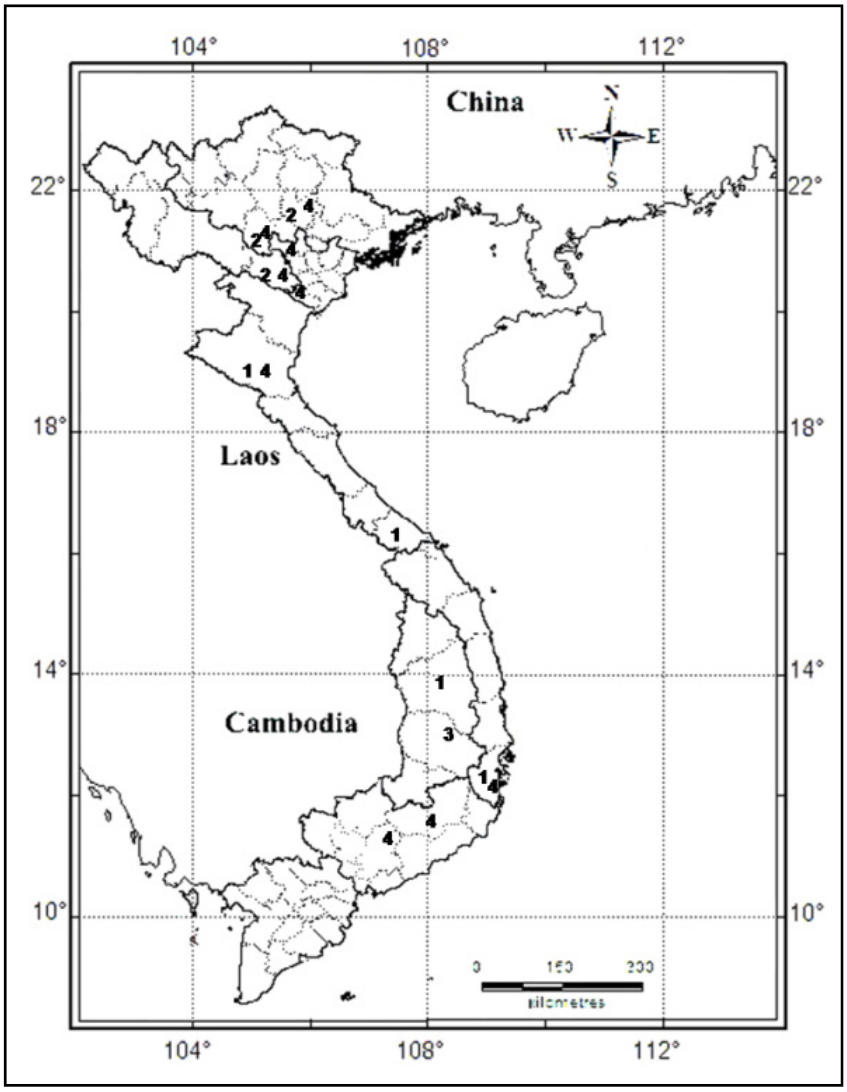

Figure 49. Distribution map of *Xanthopimpla nana* species group: 1. *X. alternans*; 2. *X. glaberrima*; 3. *X. jacobsoni*; 4. *X. nana*

The *occidentalis* species group

Diagnosis. Mesoscutum with sparse punctures anteriorly, notaulus short, not reaching to anterior level of tegula; scutellum convex, lateral flange extending to apex; largest bristles of mid and hind tarsal claws not widened or blackened apically; propodeum with area superomedia closed or open posteriorly; ovipositor sheath 0.45–0.9x hind tibia (Townes & Chiu, 1970; Pham *et al*., 2011c).

***Xanthopimpla amplamaculosa* PHAM, BROAD, MATSUMOTO & WÄGELE, 2011**

(Figures 50, 51)

Xanthopimpla amplamaculosa Pham, Broad, Matsumoto & Wägele, 2011. Zootaxa, 3056: 20. Holotype: ♀, Vietnam: Ninh Binh, Cuc Phuong NP (IEBR).

Material examined. Ninh Binh, Cuc Phuong NP: 1♀ (IEBR, holotype), 200–300 m a.s.l., 24.iv.1998, hand net, R. Matsumoto leg.; Vinh Phuc, Phuc Yen, Ngoc Thanh: 1♀, (OMNH, paratype),

150–200 m, 11.v.2005, hand net, N. T. Pham leg.

Diagnosis. Mesoscutum medially with three longitudinal separate black spots; scutellum convex, lateral carina of scutellum high, medially about 0.5x as high as first flagellomere width, area superomedia closed, 0.65x as long as wide; tergites 4–5 densely, coarsely punctate, ovipositor sheath 0.65x as long as hind tibia; ovipositor lower valve with six transverse apical ridges.

Description (Female). Body length 10.0 mm, fore wing 9.0 mm, ovipositor sheath 1.3 mm. *Head*. Antenna with 35–36 flagellomeres, apical half thicker than basal half, first antennal flagellomere 1.55x length of second; diameter of lateral ocellus 1.1–1.2x ocellar-ocular distance; frons smooth; face 0.85x as high as wide, with numerous fine punctures; clypeus 0.6x as high as wide, apical margin truncate; malar space about 0.25x basal width of mandible.

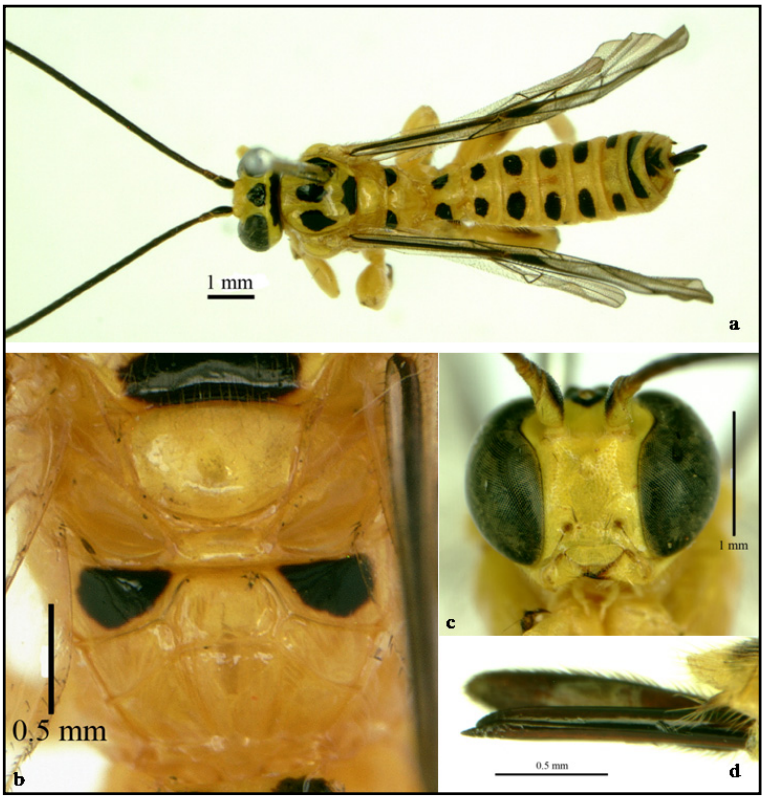

Figure 50. *X. amplamaculosa*: a. dorsal view; b. dorsal view of scutellum and propodeum; c. face; d. ovipositor

Mesosoma. Epomia short; mesoscutum as long as wide at anterior level of tegulae, with sparse hairs, notaulus on anterior 0.2 of mesoscutum, ending before anterior level of tegula; scutellum moderately convex, pubescent, lateral carina forming lateral flange, medially 0.5x as high as first flagellomere width, gradually narrow to apex; mesopleuron with sparse, minute punctures on upper half, moderate-sized punctures dense on lower half, pubescent, epicnemial carina present on lower 0.6, postpectal carina forming medially wide and narrow flange; metapleuron polished; propodeum polished with strong carinae, area superomedia 0.65x as long as wide; propodeal spiracle elongate,

about 3.0x as long as wide. Hind leg with femur 2.1x as long as wide, 0.8x length of tibia, tibia longer than tarsus, basitarsus 0.3x length of tarsus; 2.0x second tarsomere, third tarsomere 1.4x as long as wide, fifth tarsomere longer than third; mid and hind tibiae both with four bristles near apex, three bristles at apex. Fore wing vein 2*rs-m* 0.75x length of 3*rs-m*; *cu-a* opposite of *Rs*&*M*; hind wing with first abscissa of vein *Cu*1 about 0.3–0.37x length of vein *cu-a*.

Metasoma. First tergite 1.1x as long as apically wide, dorsolateral carina absent or present before spiracle, median longitudinal carina extending nearly to oblique groove; tergite 3 moderately to densely punctate; tergites 4–6 with dense, coarse punctures; ovipositor straight, ovipositor sheath 0.65x length of hind tibia, lower valves with six apical transverse ridges.

Colour. Antenna darkish brown, scape and pedicel yellow on lower side; ocellar area black; hind slope of vertex with black area medially connecting to black area on occiput; mesoscutum with three longitudinal black spots medially and black spot in front of scutellum; tegula transparent posteriorly; propodeum with black spot in area externa; hind trochanter marked with black, posterior face of hind femur with brown spot; basal 0.2 of hind tibia and apex of fifth tarsomere black; wings hyaline, pterostigma and veins darkish brown, except basal 0.7 of costa yellowish; tergites 1–6 each with two black spots, tergite 7 with black band; ovipositor dark brown; ovipositor sheath black.

Male. Unknown.

Distribution. Currently known only from Vietnam: Ninh Binh (Cuc Phuong NP) & Vinh Phuc (Ngoc Thanh commune) (Pham *et al*., 2011c).

Ecological notes. The specimens were collected in lowland forest and plantation forest at elevations between 150−300 m a.s.l. (Pham *et al*., 2011c).

***Xanthopimpla despinosa* KRIEGER, 1914**

(Figures 48e, 48i, 51)

Xanthopimpla despinosa Krieger, 1914. Arch. f. Naturgesch., (A) 80 (6): 32. Holotype: ♂, Indonesia: Sumatra (MZPW).

Xanthopimpla despinosa leipephelis Townes & Chiu, 1970. Mem. Amer. Ent. Inst, 14: 212. Holotype: ♀, India: Dawki, Jainta Hill, Assam (GPTA). Synonymized with the nominate subspecies by Pham *et al.,* 2011c.

Xanthopimpla despinosa subquadrata Chao, 1997. Wuyi Sci. J. 13: 46. Holotype: ♀, Malaysia: Malaysia primary forest (AEIC). Synonymized with the nominate subspecies by Pham *et al.*, 2011c.

Material examined. Phu Tho, Xuan Son NP: 2♂ (IEBR), 250 m a.s.l., 05.v.2005, hand net, N. T. Pham leg.; Nghe An, Pu Mat NP: 1♂ (IEBR), 300 m a.s.l., 12.ix.2005, hand net, N. T. Pham leg.; Dong

Nai, Cat Tien NP: 1♀ (RMNH), 100 m a.s.l., 06.x.2005, hand net, R. de Vries leg.; 1♀ (RMNH), 100 m a.s.l., 01–09.x.2005, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Lateral black marks on mesoscutum long, extending posteriorly nearly to scutellum; area superomedia open; hind tibia with 1–2 preapical bristles; ovipositor sheath 0.45x hind tibia.

Distribution. Townes & Chiu (1970) previously recorded this species from Lai Chau Province (northern Vietnam) for the first time. Our records extended the distribution of this species southwards to Nghe An and Dong Nai provinces. Outside Vietnam, *X. despinosa* is known from India, Indonesia, Malaysia, Nepal and the Philippines (Yu *et al.*, 2005).

Remarks. Four subspecies were previously recognised: *X. despinosa despinosa* from Vietnam, Malaysia, Indonesia and the Philippines; *X. despinosa leipephelis* from India, Nepal and Thailand; *X. despinosa subquadrata* Chao from Malaysia; and *X. despinosa xanthonema* from the Philippines (Townes & Chiu, 1970; Chao, 1997; Yu *et al.*, 2005). They differ from each other by the colour of the antenna and the presence or absence of black spots on tergite 2. Two female specimens from our collections agree well with *X. despinosa leipephelis*, although one of them has two small black spots on the second tergite; the three male specimens are closer to the nominate subspecies but the tergites 1 and 2 are entirely yellow. As there did not seem to be clear differences between *X. despinosa despinosa, X. despinosa leipephelis* and *X. despinosa subquadrata* Pham *et al.* (2011c) treated these names as synonyms.

***Xanthopimpla honorata* (CAMERON, 1899)**

(Figures 48f, 51)

Pimpla honorata Cameron, 1899. Mem. & Proc. Manchester Lit. Phil. Soc., 43 (3): 170. Holotype: ♀, India: Khasi Hills in Assam (OUMNH).
Xanthopimpla honorata: Morley (1913).

Material examined. Ninh Binh, Cuc Phuong NP: 2♀ (OMNH), 200–300 m a.s.l., 24.iv.1998; 1♀ (OMNH), 29.iv.1998, hand net, R. Matsumoto leg.; Vinh Phuc, Tam Dao NP: 2♀ (OMNH), 1200 m a.s.l., 08.v.1998, hand net, R. Matsumoto leg.; 1♂ (RMNH), 1050–1175 m a.s.l., 14–17.vi.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.; Vinh Phuc, Phuc Yen, Ngoc Thanh: 1♀ (IEBR), 150 m a.s.l., 15.viii.2005, hand net, N. T. Pham leg.; 1♀ (IEBR), 15.vii.2007, Malaise trap, T. H. Pham leg.; Thua Thien-Hue, Phong Dien NR: 1♂ (RMNH), 50–100 m a.s.l., 29.iii.2001, Malaise trap, C. v. Achterberg leg.; Thua Thien-Hue, A Luoi, A Roang: 1♀ (IEBR), 800 m a.s.l., 29.v.2006, hand net, N. T. Pham leg.; Hoa Binh, Yen Thuy, Lac Thinh: 1♀ (IEBR), 25.vii–05.viii.2002, Malaise trap, L. D. Khuat leg.; Hoa Binh, Yen Thuy, Da Phuc: 1♀ (IEBR), 27.iv.2012, hand net, H. T. Dang leg.; Quang Tri, Khe Sanh: 1♀ (IEBR), 17.viii.2005, hand net, J. Kojima leg.; Nghe An, Pu Mat NP: 1♀ (IEBR), 250 m a.s.l.,

17.x.2005, hand net, H. T. T. Nguyen leg.; 1♀ (ZFMK), 150–200 m a.s.l., 17.iv.2006, hand net, N. T. Pham leg.; Ha Noi, Ba Vi NP: 1♀ (IEBR), 800 m a.s.l., 14.viii.2006, hand net, H. T. T. Nguyen leg.; Ha Giang, Vi Xuyen, Thuan Hoa: 1♀1♂ (IEBR), 18.x.2006, hand net, L. D. Khuat leg.; Quang Binh, Phong Nha-Ke Bang NP: 1♀ (IEBR), 600 m a.s.l., 04.xi.2006, hand net, H. X. Le leg.

Diagnosis. Mesoscutum with three rounded, transverse continuous black spots; area superomedia open; hind tibia with 4–7 preapical bristles; tergites 1, 3, 5, and 7 each with two black spots; ovipositor sheath 0.8–0.9x hind tibia.

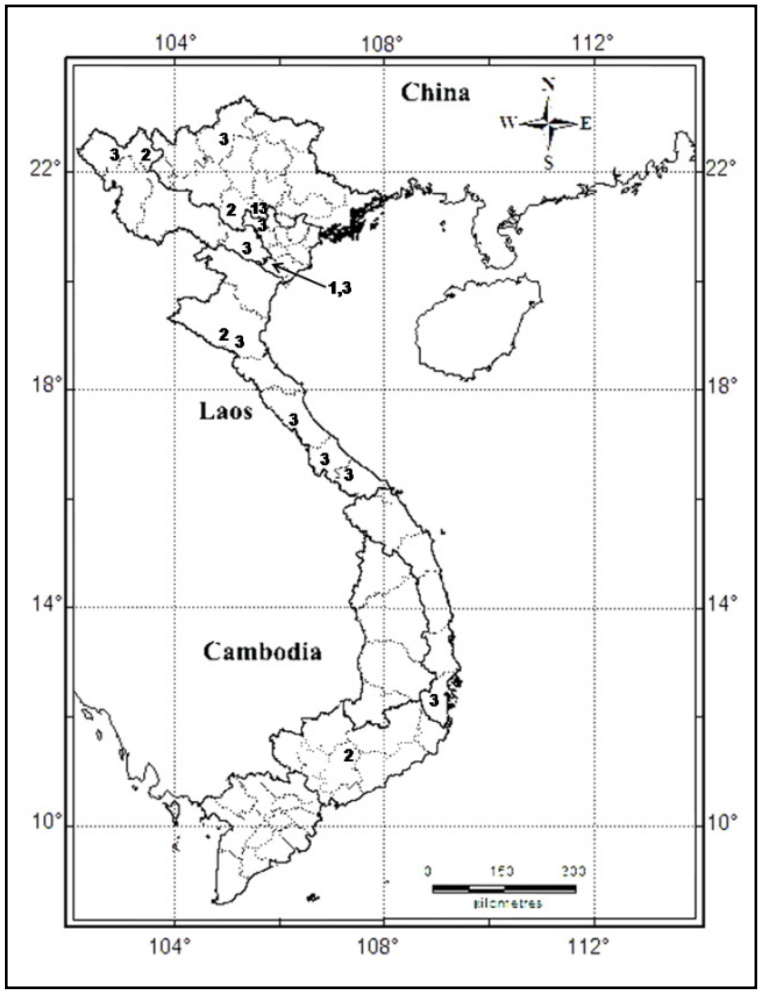

Figure 51. Distribution map of *Xanthopimpla occidentalis* species group:

1. *X. amplamaculosa*; 2. *X. despinosa*; 3. *X. honorata*

Distribution. Townes & Chiu (1970) recorded this species from Vietnam for the first time. Our records extended the distribution of this species in Vietnam. Outside Vietnam, this species has been recorded from China, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Singapore, Taiwan, Thailand and the Philippines (Yu *et al.*, 2005).

Remarks. Three subspecies are currently known: *X. honorata honorata* from China, Taiwan, India, Nepal, Myanmar, Laos, Vietnam, Thailand, Malaysia, Singapore, Indonesia and the

Philippines; *X. honorata munda* Krieger from the Philippines; and *X. honorata atriclinata* Chao from Malaysia (Townes & Chiu, 1970; Chao, 1997; Yu *et al.*, 2005). The nominate subspecies is the form that has been found in Vietnam. It differs from *X. honorata munda* by the presence of black marks on the propodeum and first tergite and from *X. honorata atriclinata* by the hind slope of the vertex entirely yellow and black marks on the mesoscutum and tergites less extensive.

The *ochracea* species group

Diagnosis. Postpectal carina in form of high triangular flange with deep median notch at apex of triangle; scutellum convex, lateral flange extending to apex; propodeum with area superomedia closed, wider than long; fore wing with areolet closed; largest bristles on mid and hind tibia claws widened, black apically (Townes & Chiu, 1970; Pham *et al*., 2011c).

***Xanthopimpla chiuae* PHAM, BROAD, MATSUMOTO & WÄGELE, 2011**

(Figures 52, 54)

Xanthopimpla chiuae Pham, Broad, Matsumoto & Wägele, 2011. Zootaxa, 3056: 22. Holotype: ♀, Vietnam: Dak Lak, Chu Yang Sin NP (RMNH).

Material examined. Dak Lak, Chu Yang Sin NP: 1♀ (RMNH, holotype), 800–940 m a.s.l., 02–10.vi.2007; 1♀ (RMNH), 740 m a.s.l., 01–10.vi.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Occipital area black; median black mark on mesoscutum joined posteriorly to black mark in front of scutellum; lateral flange of scutellum high from base to apex; base of hind coxa with black spot anteriorly; metasomal tergites with sparse, fine punctures, black spots on tergite 3 almost impunctate; ovipositor lower valve with five low, vertical ridges apically; ovipositor sheath 1.4–1.55x hind tibia.

Description (Female). Body length 8.3–10.0 mm, fore wing 7.8–9.0 mm, ovipositor sheath 2.8–3.3 mm. *Head*. Antenna with 37–39 flagellomeres, first antennal flagellomere 1.5x length of second; diameter of lateral ocellus 1.1x ocellar-ocular distance; frons polished; face 0.95x as high as wide, with moderate-sized to large punctures, pubescent; clypeus 0.6x as high as wide, apical margin thin and emarginate; malar space about 0.3x basal width of mandible.

Mesosoma. Epomia short; lower anterior corner of pronotum subrounded, about 95°; mesoscutum as long as wide at anterior level of tegulae, with moderately dense, long hairs; notaulus present anteriorly, ending before half distance to anterior level of tegula; scutellum convex, pubescent, lateral carina forming high flange from base to apex, medially half as wide as first flagellomere width; mesopleuron with sparse, fine punctures on upper half, large, dense punctures at level of sternaulus, pubescent; sternaulus present on posterior half of mesopleuron; epicnemial carina present on lower half; metapleuron polished, submetapleural carina strong;

propodeum with area superomedia 0.6–0.7x as long as wide, bounded by strong carinae; propodeal spiracle elongate, about 3.0x as long as wide. Hind leg with femur 2.2x as long as wide, 0.9x length of tibia, tibia as long as tarsus, hind basitarsus 0.3x length of tarsus, 1.8x second tarsomere, third tarsomere 1.5x as long as wide, fifth tarsomere longer than third; mid tibia with three subapical, four apical stout bristles; hind tibia with three subapical, three apical stout bristles; largest bristles on mid and hind tarsal claws widened. Fore wing with vein 2*rs-m* equal to vein 3*rs-m*; *cu-a* opposite *Rs*&*M*; hind wing with first abscissa of vein *Cu*1 about 0.6x length of vein *cu-a*, vein 1*A* absent distally.

Figure 52. *X. chiuae*: a. Dorsal view; b. face; c. dorsal view of metasomal tergite 1–4; d. ovipositor tip; e. dorsal view of scutellum and propodeum; f. mesepisternum

Metasoma. First tergite 1.2–1.3x as long as apical width; dorsolateral carina present basally, median longitudinal carina ending before shallow oblique groove; metasomal tergites with sparse, fine punctures, black spots on tergite 3 almost impunctate; ovipositor decurved, with five low vertical ridges apically; ovipositor sheath 1.4–1.55x hind tibia.

Colour. Antenna black, outer side of scape, pedicel, first two flagellomeres yellow; black ocellar area extending to frons and joined posteriorly to black area on hind slope of head and occipital area; mesoscutum with median black mark elongate, joined posteriorly to black mark in front of

scutellum, lateral black mark joined to lateral ridge of mesoscutum, one specimen deposited at RMNH with both lateral and median black marks joined posteriorly to back mark in front of scutellum; tegula black posteriorly; propodeum with black band basally; mid leg with basal 0.2 and median part of tibia, base of basitarsus, fourth and fifth tarsomeres black; base of hind coxa with black spot on anterior face; trochanter marked with black, hind femur with black marks on anterior and posterior faces; basal 0.2 of hind tibia black, median part of hind tibia with anterior and posterior black marks; hind tarsus black; wings hyaline, margins infuscate, pterostigma and veins dark brown, except basal 0.7 of costa yellowish; tergites 1–6 each with black spots, tergite 7 with black band.

Male. Unknown.

Distribution. Currently known only from its type locality: Chu Yang Sin NP, Dak Lak Province, Central Highlands of Vietnam (Pham *et al*., 2011c).

Ecological notes. The single known specimen was collected in evergreen forest (Pham *et al*., 2011c).

***Xanthopimpla ochracea* (SMITH, 1858)**

(Figures 48g, 54)

Pimpla ochracea Smith, 1858. Jour. Proc. Linn. Soc. London Zool., 4: 172. Holotype: ♀, Indonesia: Molucca Island, Aru (OUMNH).

Xanthopimpla ochracea: Krieger (1899).

Xanthopimpla valga Kriger, 1914. Arch. f. Naturgesch., (A) 80 (6): 41, 94. Holotype: ♂, Indonesia: Sumatra, Sarik (ZMHB).

Xanthopimpla ochracea valga Krieger, 1914: Townes & Chiu (1970).

Material examined. Ninh Binh, Cuc Phuong NP: 1♀ (OMNH), 200–300 m a.s.l., 29.iv.1998, hand net, R. Matsumoto leg.; Phu Tho, Xuan Son NP: 1♂ (IEBR), 300 m a.s.l., 17.x.2004, hand net, L. X. Truong leg.; Dak Lak, Ea So NR: 2♀ (IEBR), 310 m a.s.l. 12°55.93'N 108°37.96'E, 27.vii.2008, Malaise trap, H. T. Ngo leg.

Diagnosis. Propodeum with inner side of area dentipara shorter than outer side, area superomedia about 0.65–0.7x as long as wide; ovipositor sheath as long as hind tibia.

Distribution. Townes & Chiu (1970) previously recorded this species from Lai Chau Province (North Vietnam) for the first time. Our records extended the distribution of this species southwards to Dak Lak Province. Outside Vietnam, it has been known from Australia, China, India, Indonesia, Myanmar, Papua New Guinea, Taiwan, Thailand, and the Philippines (Yu *et al.*, 2005).

Remarks. Seven subspecies are currently known: *X. ochracea ochracea* and *X. ochracea*

peterseni Townes & Chiu from the Australian region; *X. ochracea axis* Roman from Malaysia, Indonesia and the Philippines; *X. ochracea kriegeri* Ashmead from the Philippines; *X. ochracea parva* Krieger from Indonesia; *X. ochracea valga* Krieger from India, Myanmar, Thailand, Vietnam, Indonesia and the Philippines; and *X. ochracea yami* Uchida from Hungtau Island (near Taiwan) (Townes & Chiu, 1970; Yu *et al.*, 2005). Two specimens from northern Vietnam resemble *X. ochracea valga*, which is characterized by three separated black spots on the mesoscutum, plus a black mark in front of the scutellum and the hind tibia black basally. Two female specimens from Dak Lak Province have the hind tibia black basally, but one specimen has three continuous black spots on the mesoscutum, the other without a black spot on the median lobe of the mesoscutum. The current subspecies classification is probably untenable but I have not examined enough material from different parts of their ranges to make any firm conclusion.

***Xanthopimpla pseudosternata* PHAM, BROAD, MATSUMOTO & WÄGELE, 2011**

(Figures 53, 54)

Xanthopimpla pseudosternata Pham, Broad, Matsumoto & Wägele, 2011. Zootaxa, 3056: 24. Holotype: ♀, Vietnam: Dak Lak, Chu Yang Sin NP (RMNH).

Material examined. Dak Lak, Chu Yang Sin NP: 1♀ (RMNH, holotype), 550–610 m a.s.l., 21–26.x.2005, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Occipital area yellow; lateral black mark on mesoscutum joined posteriorly to black mark in front of scutellum; base of hind coxa with black spot anteriorly; metasomal tergites densely, coarsely punctate; ovipositor lower valve with six, small ridges apically; ovipositor sheath 1.1x hind tibia.

Description (Female). Body length 10.5 mm, fore wing 9.5 mm, ovipositor sheath 2.5 mm. *Head*. Antenna with 41 flagellomeres, first antennal flagellomere 1.6x length of second; diameter of lateral ocellus 1.1x ocellar-ocular distance; frons polished; face 0.9x as high as wide, moderate-sized to large punctures, pubescent; clypeus 0.6x as high as wide, apical margin thin and emarginate; malar space about 0.3x basal width of mandible.

Mesosoma. Epomia short; lower anterior corner of pronotum rounded, about 100°; mesoscutum 0.95x as long as wide at anterior level of tegulae, with sparse hairs anteriorly; notaulus distinct on anterior 0.25 of mesoscutum, extending to anterior level of tegula; scutellum convex, pubescent, lateral carina forming high flange, medially half as wide as first flagellomere width, gradually narrower to apex; mesopleuron with sparse, small punctures on upper half, dense, large punctures at level of sternaulus and along epicnemial carina; sternaulus long, distinctly impressed; epicnemial carina present on lower half; metapleuron polished, submetapleural carina

strong; propodeum with area superomedia 0.55x as long as wide, bounded by strong carinae; propodeal spiracle elongate, 3.0x as long as wide. Hind leg with femur 2.2x as long as wide, 0.9x length of tibia, tibia as long as tarsus, hind basitarsus 0.3x length of tarsus, 2.3x second tarsomere, third tarsomere as long as wide; mid tibia with four subapical, three apical bristles; hind tibia with three subapical, three apical stout bristles; largest bristles on mid and hind tarsal claws widened. Fore wing with vein 2*rs-m* 0.67x vein 3*rs-m*; *cu-a* opposite *Rs*&*M*; hind wing with first abscissa of vein *Cu*1 about 0.3x length of vein *cu-a*, of vein 1*A* absent distally.

Metasoma. First tergite as long as apical width; dorsolateral carina shortly present basally, median longitudinal carina ending before shallow oblique groove; tergite 2 impunctate medially; tergite 3 onwards densely, coarsely punctate; ovipositor weakly decurved, with six small vertical ridges apically, ovipositor sheath 1.1x hind tibia.

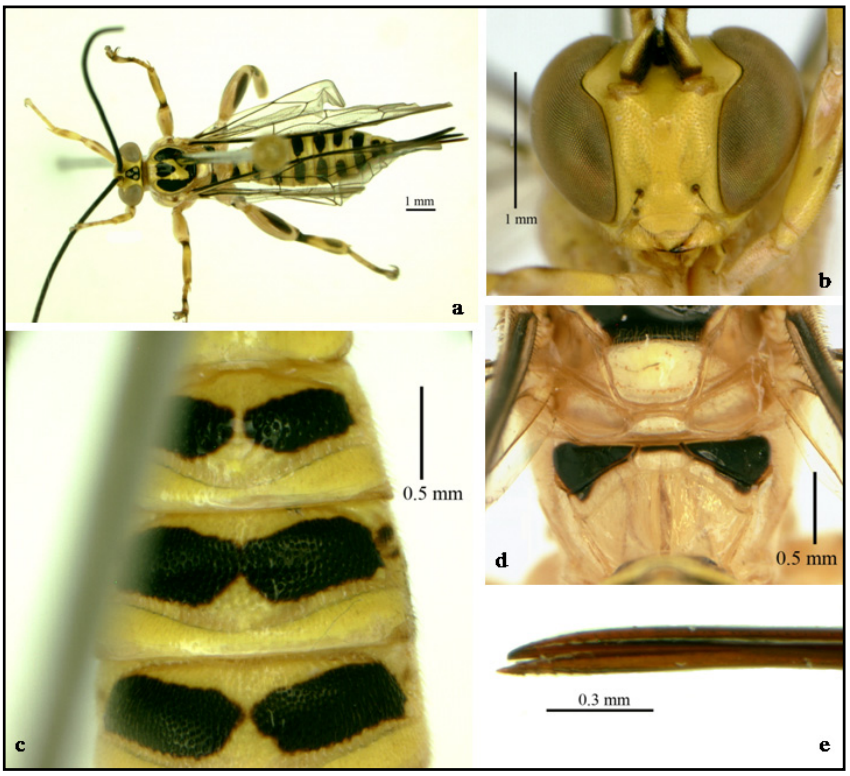

Figure 53. *X. pseudosternata*: a. dorsal view; b. face; c. dorsal view of metasomal tergites 2–4; d. dorsal view of scutellum and propodeum; e. ovipositor tip

Colour. Antenna black, outer side of scape, pedicel, first two flagellomeres yellow; black ocellar area extending to frons; hind slope of head with two connected black spots; mesoscutum with lateral black mark elongate, joined posteriorly to black mark in front of scutellum; tegula brown and transparent; mesepisternum with two oblique blackish spots; propodeum with area externa, base of area superomedia and area dentipara black; fore femur with brown stripe posteriorly; mid trochanter marked with brown; mid femur and tibia with brown stripes posteriorly; basal 0.15 of

mid tibia blackish; hind coxa with two black spots anteriorly, one small brown spot posteriorly; trochanter marked with black, hind femur and tibia with black marks on anterior and posterior faces; basal 0.2 of hind tibia and hind tarsomeres 4–5 black; wings hyaline, margins infuscate, pterostigma and veins dark brown, except basal 0.6 of costa yellowish; tergites 1–6 each with black spots, tergite 7 with black band.

Male. Unknown.

Distribution. Currently known only from its type locality: Chu Yang Sin NP, Dak Lak Province, Central Highlands of Vietnam (Pham *et al*., 2011c).

Ecological notes. The single known specimen was collected in evergreen forest (Pham *et al*., 2011c).

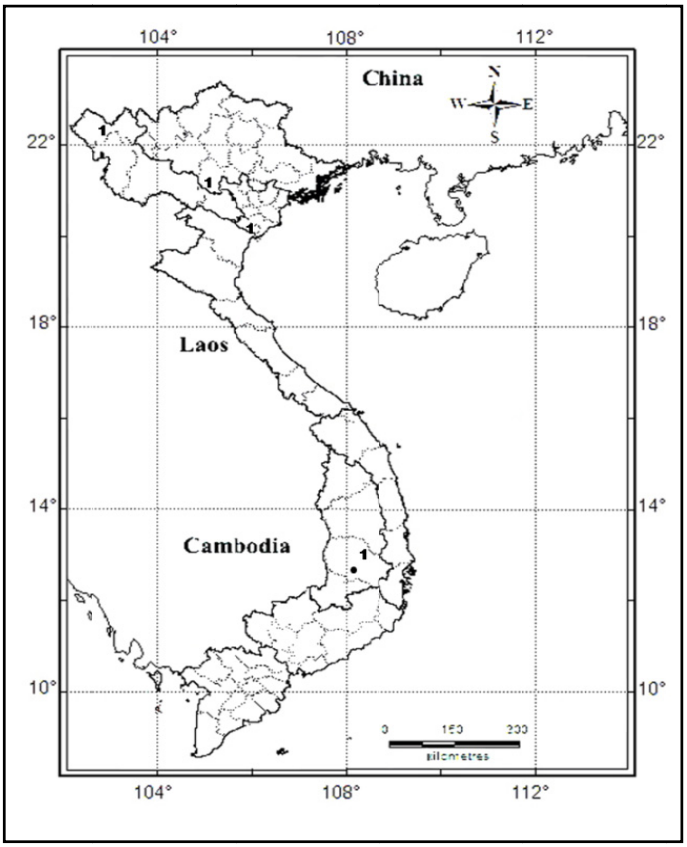

Figure 54. Distribution map of *Xanthopimpla ochracea* species group:

1. *X. ochracea*; (•). *X. chiuae* & *X. pseudosternata*

The *punctata* species group

Diagnosis. Mesoscutum with sparse hairs anteriorly, posteriorly almost hairless; notaulus extending to anterior level of tegula; scutellum convex, lateral flange reaching to apex; propodeum with area superomedia closed, wider than long; fore wing with areolet closed; largest bristles on mid and hind tibia claws weakly widened, pale subapically; ovipositor sheath 1.4–2.4x hind tibia; ovipositor stout, distinct decurved, gradually tapered to apex (Townes & Chiu, 1970).

***Xanthopimpla punctata* (FABRICIUS, 1781)**

(Figures 48h, 55)

Ichneumon punctatus Fabricius, 1781. Species Insectorum, 1: 437. Holotype: ♂, India: Coromadel (ZMUC).

Xanthopimpla punctata: Krieger (1899).

Material examined. Bac Ninh, Tien Son, Minh Dao: 1♀1♂ (IEBR), 01.vi.1995, L. D. Khuat leg.; Ha Noi, Tu Liem, Mai Dich: 1♀ (IEBR), 23.v.1995, L. D. Khuat leg.; Ha Noi, Quoc Oai, Dong Quang: 1♀ (IEBR), 07.viii.1997, L. D. Khuat leg.; Ha Noi, Ba Vi NP: 1♀1♂ (IEBR), 400–500 m a.s.l., 02.vi.2001, hand net, N. T. Pham leg.; Ha Noi, Gia Lam, Da Ton: 3♀1♂ (IEBR), 02–13.vii.2001, Malaise trap, L. D. Khuat leg.; Ha Noi, Thach That, Tan Xa: 1♀ (IEBR), 15–25.iv.2002, Malaise trap, L. D. Khuat leg.; Ha Noi, Soc Son, Quang Tien: 1♀1♂ (IEBR), 09.vi.2005, hand net, N. T. Pham leg.; Hoa Binh, Yen Thuy, Da Phuc: 1♂ (IEBR), 09.ix.2000, hand net, N. T. Pham leg.; 1♀ (IEBR), 01.iii.2004, L. D. Khuat leg.; Hoa Binh, Yen Thuy, Bao Hieu: 1♂ (IEBR), 07.ix.2000, hand net, N. T. Pham leg.; 2♀, 30.v.2003, L. D. Khuat leg.; Hoa Binh, Yen Thuy, Lac Thinh: 2♀1♂ (IEBR), 20–30.ix.2002, Malaise trap, L. D. Khuat leg.; Hoa Binh, Mai Chau, Tan Son, 850–900 m a.s.l.: 1♀, 10–15.viii.2010, Malaise trap, L. D. Khuat leg.; Ha Tinh, Huong Son, Rao An: 2♀ (IEBR), 18.v.1998, hand net, L. D. Khuat leg.; Ha Tinh, Huong Khe, Huong Trach: 1♂ (IEBR), 22.v.2008, hand net, H. T. Ta leg.; Son La, To Hieu: 3♀1♂ (IEBR), 20.ix.2000, hand net, L. X. Truong leg.; Ninh Binh, Cuc Phuong NP: 1♀ (OMNH), 200–300 m a.s.l., 06.vi.1997, hand net, R. Matsumoto leg.; Thai Nguyen, Phu Dinh, Dinh Hoa: 2♀ (IEBR), 03.iv.2005, hand net, T. V. Hoang leg.; Thua Thien-Hue, Bach Ma NP: 1♀ (IEBR), 1200–1300 m a.s.l., 12.xi.2002, hand net, T. V. Hoang leg.; Thua Thien-Hue, A Luoi, A Roang: 1♂ (IEBR), 29.v.2006, hand net, N. T. Pham leg.; Phu Tho, Xuan Son NP: 4♀2♂ (IEBR), 300 m a.s.l., 05.v.2005, hand net, N. T. Pham leg.; Vinh Phuc, Phuc Yen, Ngoc Thanh: 2♀2♂ (IEBR), 16.iv.2006, hand net, N. T. Pham leg.; Vinh Phuc, Tam Dao NP: 1♀1♂ (IEBR), 400 m a.s.l., 20.viii.2005, hand net, N. T. Pham leg.; Nghe An, Pu Mat NP: 1♀1♂ (IEBR), 150–200 m a.s.l., 07.ix.2005, hand net, N. T. Pham leg.; Nghe An, Tuong Duong, Tam Quang: 1♀ (IEBR), 250–350 m a.s.l., 22.x.2005, hand net, H. X. Le leg.; Nghe An, Anh Son, Phuc Son: 1♀ (IEBR), 250–300 m a.s.l., 27.x.2006, hand net, H. X. Le leg.; Dong Nai, Cat Tien NP: 1♀1♂ (RMNH), 100 m a.s.l., 03–08.x.2005, Malaise trap, R. de Vries leg.; Dak Lak, Chu Yang Sin NP: 2♀ (RMNH), 550–600 m a.s.l., 23–25.x.2005, Malaise trap, R. de Vries leg.; Ha Giang, Vi Xuyen, Thuan Hoa: 1♂ (IEBR), 19.x.2006, hand net, L. D. Khuat leg.; Bac Can, Ba Be NP: 1♀ (OMNH), 200m a.s.l., 22°23'N 105°37'E, hand net, R. Matsumoto leg.; Quang Binh, Phong Nha-Ke Bang NP: 2♂ (IEBR), 600 m a.s.l., 04.xi.2006, hand net, H. X. Le leg.; Thanh Hoa, Nhu Xuan, Xuan Hoa: 2♂ (IEBR), 30.v.2008, hand net, D. T. Tran leg.; Bac Giang, Thanh Son, Son Dong: 1♀1♂ (ZFMK), 200 m a.s.l., 05.vii.2010, hand net, N. T. Pham leg.

Diagnosis. Area superomedia 0.5–0.6x as long as wide; tergites 1, 3, 5, and 7 always with two

black spots; ovipositor sheath long, about 1.7–1.8x hind tibia.

Distribution. This species occurs in a wide variety of habitats in Vietnam (Townes & Chiu, 1970; Plant Protection Research Institute, 1976; Pham, 1997; Pham & Le, 2007, Pham *et al.*, 2011c). Outside Vietnam, this species has been recorded from Afghanistan, Australia, China, India, Indonesia, Japan, Pakistan, Bangladesh, Guam, Laos, Malaysia, Mauritius, Myanmar, Nepal, Nigeria, Papua New Guinea, Russia, Sri Lanka, Singapore, Taiwan, Thailand, the Philippines and Togo (Yu *et al.*, 2005).

Remarks. In Vietnam, *X. punctata* has been known as a parasitoid of Lepidoptera pupae: *Cnaphalocrocis medinalis* (Guenée) (Pyralidae), *Parnara guttata* (Bremer and Grey) (Hesperidae), *Naranga aenescens* Moore (Noctuidae) on rice and of *Lamprosema indica* Linneaus (Pyralidae) on soybean (Bui, 1990; Khuat & Pham, 2007; Vu, 2007).

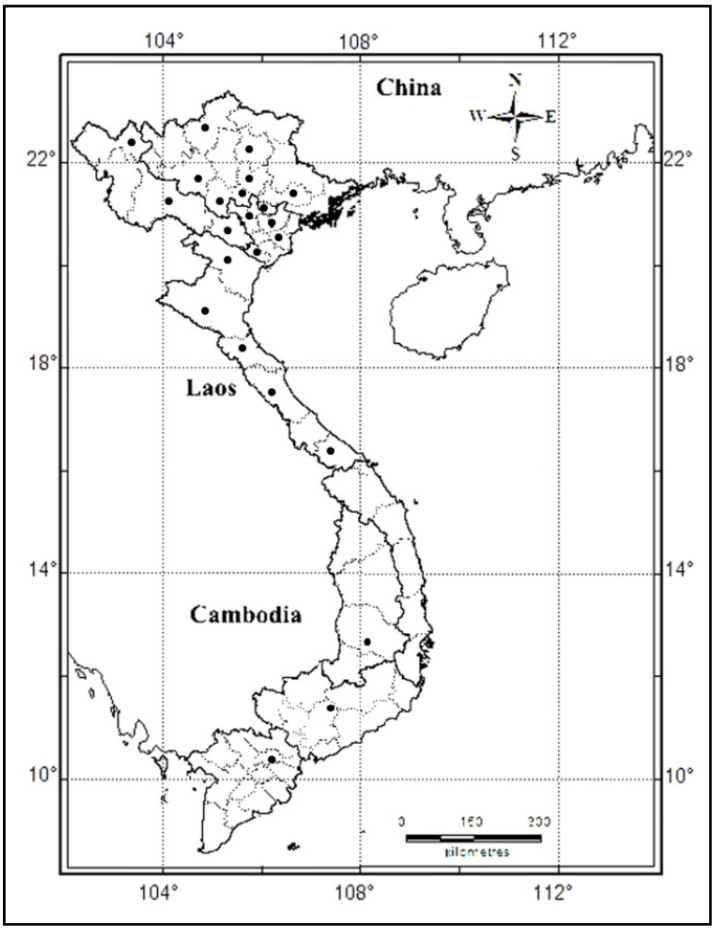

Figure 55. Distribution map of *X. punctata*

The *regina* species group

Diagnosis. Face nearly always with sublateral vertical ridges on each side; mesoscutum with notaulus short, not extending to anterior level of tegula; scutellum evenly convex to conical, lateral flange reaching to apex; propodeum with area superomedia usually completely bounded by carinae; pleural area with tubercle-like or hill-like in front of spiracle; fore wing with areolet closed;

largest bristles on mid and hind tibia claws weakly to distinctly widened, pale to black subapically (Townes & Chiu, 1970; Pham *et al*., 2011c).

***Xanthopimpla brevicarina* WANG, 1987**

(Figures 62a, 62d, 63)

Xanthopimpla brevicarina Wang, 1987. Acta Entomol. Sinica, 30 (3): 328. Holotype: ♀, China: Ningming Co. Guangxi (IZCAS).

Material examined. Ninh Binh, Cuc Phuong NP: 1♀ (OMNH), 200–300 m a.s.l., 24.iv.1998; 1♀ (OMNH), 26.iv.1998, hand net, R. Matsumoto leg.; Ha Noi, Gia Lam, Da Ton: 1♀ (IEBR), 02–14.vii.2001, Malaise trap, L. D. Khuat leg.

Diagnosis. Black marks present on posterior 0.7 of mesoscutum; tergite 3 sparse punctures; hind trochanter, tergites 2 and 6 entirely yellow; ovipositor sheath 0.65x hind tibia.

Distribution: This species was described on the basis of material from China (Wang, 1987). Pham *et al.* (2011c) recorded it from Vietnam for the first time.

***Xanthopimpla flavafemora* PHAM, BROAD, MATSUMOTO & WÄGELE, 2011**

(Figures 56, 63)

Xanthopimpla flavafemora Pham, Broad, Matsumoto & Wägele, 2011. Zootaxa, 3056: 26. Holotype: ♀, Vietnam: Nghe An, Pu Mat NP (IEBR).

Material examined. Nghe An, Pu Mat NP: 1♀ (IEBR, holotype), 150–200 m a.s.l., 14.iv.2006, hand net, N. T. Pham leg.

Diagnosis. Scutellum conical with median point, lateral flange higher apically than medially; tergite 3 moderately densely punctate; metasomal tergites each with two black spots; ovipositor sheath 0.8x length of hind tibia.

Description (Female). Body length 17.0 mm, fore wing 15.0 mm, ovipositor sheath 3.0 mm. *Head*. Antenna with 46 flagellomeres, first flagellomere 1.55x length of second; diameter of lateral ocellus 1.9x ocellar-ocular distance; frons smooth; face 0.8x as high as wide, with low vertical curved carina beneath each antennal socket, between carinae densely, coarsely punctate; clypeus 0.55x as high as wide, apical margin concave medially; malar space about 0.2x basal width of mandible.

Mesosoma. Epomia short; lower anterior corner of pronotum rounded, making obtuse angle of 100°; mesoscutum 1.2x as long as wide at anterior level of tegulae, with sparse hairs; notaulus shallow on anterior 0.2 of mesoscutum, extending nearly to anterior level of tegula; scutellum conical, with median point, pubescent, lateral carina extending to apex, forming lateral flange

higher apically than medially; mesopleuron with sparse, minute punctures on upper half, dense, coarse punctures on lower half, epicnemial carina present on lower half of mesopleuron, postpectal carina medially forming low flange; metapleuron subpolished, submetapleural carina complete; pleural carina weaker before meeting anterior margin; pleural part of propodeum subdivided by posterior transverse carina; propodeum with strong, complete carinae, area superomedia as long as wide, propodeal spiracle elongate, 5.5x as long as wide. Hind leg with femur 2.4x longer than wide, 0.8x length of tibia, tibia shorter than tarsus, basitarsus 0.3x length of tarsus, 1.7x second tarsomere, third tarsomere 1.8x as long as wide, fifth tarsomere longer than third; mid tibia with three apical bristles; hind tibia with two apical bristles. Fore wing with vein 2*rs-m* 0.8x vein 3*rs-m*; *cu-a* opposite *Rs*&*M*; hind wing with first abscissa of vein *Cu*1 about 0.3x length of vein *cu-a*.

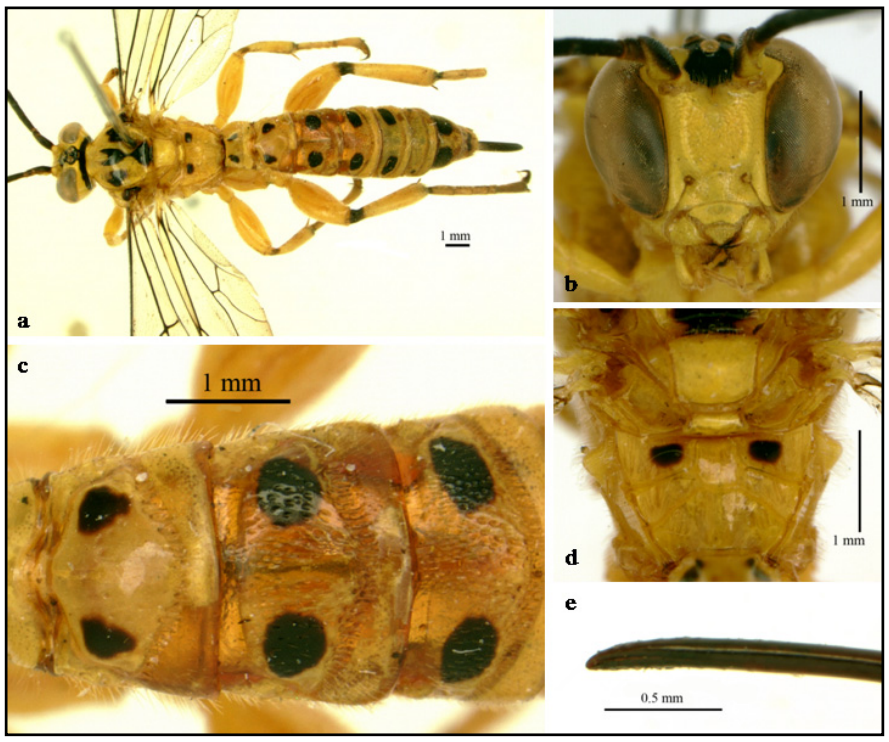

Figure 56: *X. flavafemora*: a. dorsal view; b. face; c. dorsal view of metasomal tergites 2–4; d. dorsal view of scutellum and propodeum; e. ovipositor tip

Metasoma. First tergite 1.25x as long as apical width, median longitudinal carina ending before oblique groove, dorsolateral carina strong from base to spiracle, weak from spiracle to apex; tergite 3 with moderately dense, coarse punctures; ovipositor sheath 0.8x hind tibia; ovipositor lower valve with nine apical ridges, upper valve with five shallow transverse apical ridges.

Colour. Antenna black, scape, pedicel and first flagellomere yellowish beneath; ocellar area and frons black; hind slope of vertex and occipital area largely black; mesoscutum with median black stripe joined posteriorly to black mark in front of scutellum, two lateral black marks present

at level of tegula, not connected to lateral ridge of mesoscutum; tegula black posteriorly; propodeum with black spot in area externa; mid leg with basal 0.2 of tibia and base of basitarsus black; hind trochanter marked with black; basal 0.15 of tibia and base of basitarsus black; wings hyaline with infuscate margin, pterostigma and veins black, except basal 0.6 of costa yellowish; metasomal tergites each with two black spots, black spots on tergite 6 small, about 0.25x width of black spots on tergite 5.

Male. Unknown

Distribution. Currently known only from Nghe An, Pu Mat NP, Central of Vietnam (Pham *et al*., 2011c).

Ecological notes. The single specimen was collected in secondary forest at elevation of 150–200 m a.s.l. (Pham *et al*., 2011c).

***Xanthopimpla flavapropodea* PHAM, BROAD, MATSUMOTO & WÄGELE, 2011**

(Figures 57, 63)

Xanthopimpla flavapropodea Pham, Broad, Matsumoto & Wägele, 2011. Zootaxa, 3056: 27. Holotype: ♀, Vietnam: Bac Giang: Thanh Son (IEBR).

Material examined. Bac Giang, Son Dong, Thanh Son: 1♀ (IEBR, holotype), 100 m a.s.l., 05.vii.2010, hand net, N. T. Pham leg.; Bac Can, Ba Be NP: 1♀ (OMNH, paratype), 1000 m a.s.l., 22°23'N 105°37'E, 05.v.2006, hand net, R. Matsumoto leg.; Nghe An, Phuc Son, Anh Son: 1♂ (IEBR, paratype), 250–300 m a.s.l., 23.iv.2006, hand net, H. X. Le leg.

Diagnosis. Mesoscutum with black marks present on posterior 0.7, lateral black mark nearly joined posteriorly to black mark in front of scutellum; propodeum entirely yellow, area superomedia much wider than long; tergites 3–5 densely, coarsely punctate; ovipositor down-curved at tip, ovipositor sheath about 0.8x as long as hind tibia.

Description (Female). Body length 14.7 mm, fore wing 13.0 mm, ovipositor sheath 2.5 mm. *Head*. Antenna with 40 flagellomeres, gradually thinner apically, first flagellomere 1.55x length of second; diameter of lateral ocellus 1.5–1.7x times ocellar-ocular distance; frons smooth; face 0.8–0.9x as high as wide, with vertical curved carina beneath each antennal socket, dense, coarse punctures between carinae; clypeus 0.6x as high as wide; malar space about 0.2x basal width of mandible.

Mesosoma. Epomia present, about 0.2x basal width of mandible; lower anterior corner of pronotum round, making obtuse angle of about 100°; mesoscutum 1.05x as long as wide at anterior level of tegulae, with sparse hairs; notaulus shallowly present on anterior 0.15 of mesoscutum, extending half way to anterior level of tegula; scutellum convex to conical, lateral

carina extending to apex, forming lateral flange medially 0.3–0.4x as high as first flagellomere width; mesopleuron with moderately dense, fine punctures on upper half and coarse punctures on lower half, epicnemial carina present on lower 0.5 of mesopleuron, postpectal carina medially forming low flange; metapleuron subpolished, submetapleural carina complete; pleural carina extending to anterior margin; propodeum with strong and complete carinae, except lateromedian longitudinal carina sometimes weak at level of area dentipara, area superomedia 0.45–0.55x as long as wide; propodeal spiracle elongate, 4.5x as long as wide. Hind leg with femur 2.5x as long as wide, 0.9x length of tibia, tibia slightly shorter than tarsus, basitarsus 0.3x length of tarsus, 2.0x second tarsomere, third tarsomere 1.5x as long as wide, fifth tarsomere longer than fifth; mid tibia with 4–5 bristles at apex, 2–5 small bristles near apex, hind tibia with three bristles at apex, 0–2 small bristles near apex. Fore wing with vein 2*rs-m* 0.8x as long as vein 3*rs-m*; *cu-a* opposite *Rs*&*M*; hind wing with first abscissa of vein *Cu*1 about 0.3x length of vein *cu-a*.

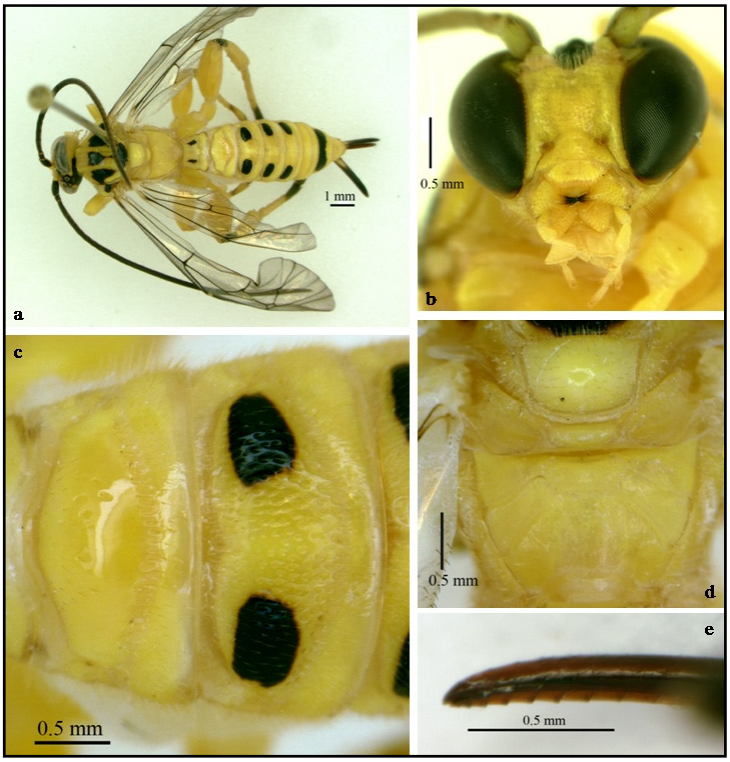

Figure 57. *X. flavapropodea*: a. dorsal view; b. face; c. dorsal view of metasomal tergites 2–3; d. dorsal view of scutellum and propodeum; e. ovipositor tip

Metasoma. First tergite 1.1–1.3x as long as apical width, median longitudinal carina ending before oblique groove, dorsolateral carina complete; tergites 3–5 densely, coarsely punctate; ovipositor slightly down-curved at tip, lower valve with nine vertical ridges at tip; ovipositor sheath 0.8x as long as hind tibia.

Colour. Antenna dull yellow beneath and blackish on upper side; ocellar area, frons and hind slope of vertex black; mesoscutum with median black spot joined posteriorly to black spot in front

of scutellum and two black marks on lateral lobes, all black marks on posterior 0.7 of mesocutum; tegula black posteriorly; propodeum without black spots; hind leg with basal 0.2 of tibia, base of basitarsus, fifth tarsomere black; wings hyaline, pterostigma and veins blackish, except costa yellowish; first tergite entirely yellow or with two small black spots, tergites 3, 4, and 5 each with two black spots, tergite 7 with black band; ovipositor reddish brown; ovipositor sheath black, except dorsal, basal 0.15 yellowish.

Male. As female but with additional black marks on legs and metasomal tergites: mid tibia blackish basally; hind trochanter marked with black; hind femur with black stripes on anterior and posterior face; metasomal tergites 1, 2 and 6 each with two small black spots.

Distribution. Currently known only from Bac Can and Bac Giang provinces of northeastern Vietnam and in Nghe An Province of Central Vietnam (Pham *et al*., 2011c).

Ecological notes. The specimens were collected in secondary forest at an elevation of 100–1,000 m a.s.l. (Pham *et al*., 2011c).

***Xanthopimpla konowi* KRIEGER, 1899**

(Figures 60b, 60e, 62g, 62h, 63)

Xanthopimpla konowi Krieger, 1899. Sitzber. Natur. Gesell. Leipzig, 1897/98: 87. Holotype: ♀, Japan (ZMHB).

Material examined. Vinh Phuc, Tam Dao NP: 1♀ (IEBR), 1000 m a.s.l., 08.ix.2000, hand net, L. T. P. Nguyen leg.; Ha Noi, Gia Lam, Da Ton: 1♀ (IEBR), 22.vii–02.viii.2001, Malaise trap, L. D. Khuat leg.; Hoa Binh, Yen Thuy, Lac Thinh: 2♀1♂ (IEBR), 20–30.vii.2002, Malaisde trap, L. D. Khuat leg.; Bac Can, Ba Be NP: 1♀ (OMNH), 600 m a.s.l., 22°23'N 105°37'E, 01.v.2006, hand net, R. Matsumoto leg.

Diagnosis. Face short and wide, median black mark on mesoscutum well separated from black mark in front of scutellum; scutellum convex; tergite 3 with relatively sparse, coarse punctures; ovipositor straight, slightly decurved at tip; ovipositor sheath 1.1–1.3x hind tibia.

Distribution. Townes & Chiu (1970) previously recorded this species from Lai Chau Province (North Vietnam) for the first time. Our records extended the distribution of this species in northern Vietnam. Outside Vietnam, this species has been recorded from China, India, Indonesia, Japan, Myanmar, Malaysia, and Thailand (Yu *et al.*, 2005).

***Xanthopimpla leviuscula* KRIEGER, 1914**

(Figures 58, 63)

Xanthopimpla leviuscula Krieger, 1914. Arch. f. Naturgesch., (A) 80 (6): 45, 79. Holotype: ♀, Vietnam: Tonkin [now northern Vietnam], Than-Moi (ZMHB).

Material examined. Ha Tinh, Huong Son, Rao An: 1♀ (IEBR), 18.v.1998, hand net, L. D. Khuat leg.; Ha Noi, Ba Vi, Khoang Xanh: 1♀ (ZFMK), 100 m a.s.l., 01.vi.2001, hand net, N. T. Pham leg.; Hoa Binh, Yen Thuy, Lac Thinh: 1♀ (OMNH), 01–10.v.2002; 1♂ (IEBR), 01–10.vii.2002; 1♂ (IEBR), 10–20.vii.2002, Malaise trap, L. D. Khuat leg.; Thua Thien-Hue, Nam Dong: 1♀ (IEBR), 23.i.2005, hand net, T. K. Cao leg.; Dong Nai, Cat Tien NP: 1♀ (RMNH), 100 m a.s.l.; 01–09.x.2005, Malaise trap, C. v. Achterberg & R. de Vries leg.; Quang Binh, Phong Nha-Ke Bang NP: 1♀ (IEBR), 05.xi.2006, hand net, H. X. Le leg.; Ninh Thuan, Nui Chua NP: 1♀ (RMNH), 150 m a.s.l., 24–30.v.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.

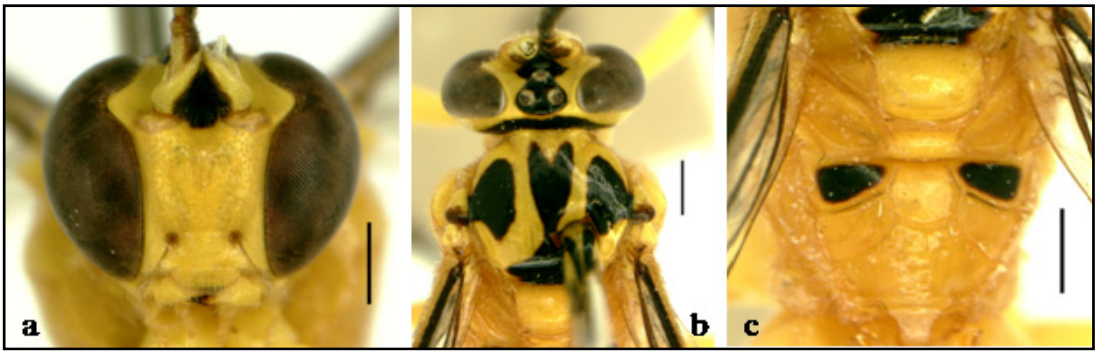

Figure 58: *X. leviuscula* (scales 0.5 mm): a. face; b. dorsal view of head and mesonotum; c. dorsal view of scutellum and propodeum

Diagnosis. Face without sublateral, vertical ridges; median black mark on mesoscutum joined posteriorly to black mark in front of scutellum; scutellum convex; metasomal tergites each with two black spots; tergite 3 sparse of fine punctures; ovipositor sheath about 0.5x hind tibia.

Distribution. Krieger (1914) described *X. leviuscula* based on the female holotype collected from northern Vietnam. Our records extended the distribution southwards to Central and South Vietnam. Outside Vietnam, this species is known from China, Laos, Myanmar and the Philippines (Yu *et al.*, 2005).

Xanthopimpla omega PHAM, BROAD, MATSUMOTO & WÄGELE, 2011

(Figures 59, 63)

Xanthopimpla omega Pham, Broad, Matsumoto & Wägele, 2011. Zootaxa, 3056: 28. Holotype: ♂, Vietnam: Ninh Binh, Cuc Phuong NP (IEBR).

Material examined. Ninh Binh, Cuc Phuong NP: 1♂ (IEBR, holotype), 200–300 m a.s.l., 26.iv.1998, R. Matsumoto leg.

Diagnosis. Median and lateral black marks on mesoscutum joined posteriorly to black mark in front of scutellum; area superomedia as long as wide; scutellum convex; metasomal tergites each with black spots, tergite 3 sparsely punctate, tergites 4 onwards with fine punctures.

Description (Male). Body length 16.7 mm, fore wing 14.3 mm. *Head*. Antenna with 45 flagellomeres, thinner apically, first flagellomere 1.55x length of second; diameter of lateral ocellus 1.55x ocellar-ocular distance; frons smooth; face 0.75x as high as wide, with low vertical curved carina beneath each antennal socket, dense, coarse punctures between carinae; clypeus 0.55x as high as wide, apical margin concave medially and laterally; malar space about 0.3x basal width of mandible.

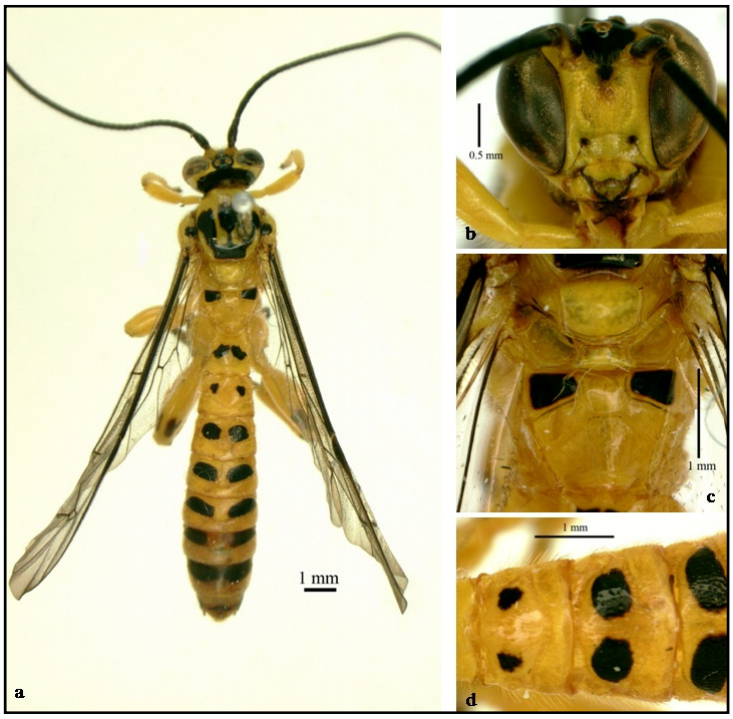

Figure 59. *X. omega*: a. dorsal view; b. face; c. dorsal view of scutellum and propodeum; d. dorsal view of metasomal tergites 2–4

Mesosoma. Epomia short; lower anterior corner of pronotum round, making obtuse angle of 100°; mesoscutum 1.1x as long as wide at anterior level of tegulae, with sparse hairs; notaulus weakly present anteriorly, extending half distance to anterior level of tegula; scutellum strongly convex, pubescent, lateral carina extending to apex, forming lateral flange medially 0.35x as high as first flagellomere width; mesopleuron with sparse, minute punctures on upper half, dense, coarse punctures on lower half, epicnemial carina present on lower half of mesopleuron, postpectal carina medially forming low flange; metapleuron subpolished, submetapleural carina complete; pleural carina weaker before anterior margin; pleural part of propodeum divided by posterior transverse carina; propodeum with strong, complete carinae, area superomedia as long as wide, propodeal spiracle elongate, 4.8x as long as wide. Hind leg with femur 2.3x longer than wide, 0.8x length of tibia, tibia longer than tarsus, basitarsus 0.3x length of tarsus, 1.8x second tarsomere, third tarsomere 2.15x as long as wide, fifth tarsomere longer than third; mid tibia with three bristles at apex, one bristle near apex, hind tibia with three apical bristles. Fore wing with vein 2*rs-m* 0.8x vein 3*rs-m*; *cu-a*

opposite *Rs*&*M*; hind wing with first abscissa of vein *Cu*1 about 0.25x length of vein *cu-a*.

Metasoma. First tergite 1.25x as long as apical width, median longitudinal carina ending before oblique groove, dorsolateral carina complete; tergite 3 sparsely punctate; tergites 4 onwards with dense, fine punctures.

Colour. Antenna blackish, scape and pedicel yellowish beneath; ocellar area and frons black; hind slope of vertex and occipital area largely black; mesoscutum with median and lateral black marks joined posteriorly to black mark in front of scutellum; tegula black posteriorly; propodeum with black spot in area externa; mid leg with basal 0.2 of tibia, basitarsus basally and fifth tarsomere blackish; hind trochanter with small black area, hind femur with small brown mark anteriorly and large black mark posteriorly, basal 0.2 of tibia, basitarsus basally and fifth tarsomere black; wing hyaline, margin infuscate, pterostigma and veins black, except basal 0.3 of costa yellowish; metasomal tergites 1–6 each with two black spots, tergite 7 with black band.

Female. Unknown

Distribution. Currently known only in Cuc Phuong NP, Ninh Binh Province, North Vietnam (Pham *et al*., 2011c).

Ecological notes. The single specimen was collected in evergreen forest at an elevation of 200–300 m a.s.l. (Pham *et al*., 2011c).

***Xanthopimpla pedator* (FABRICIUS, 1775)**

(Figures 62b, 62e, 63)

Ichneumon pedator Fabricius, 1775. Systema Entomologiae: 828. Holotype: ♀, India (HMUG).
Xanthopimpla pedator: Krieger (1899).

Material examined. Ninh Binh, Cuc Phuong NP: 1♀ (OMNH), 200–300 m a.s.l., 24.iv.1998, hand net, R. Matsumoto leg.; Vinh Phuc, Phuc Yen, Ngoc Thanh: 1♂ (IEBR), 14.iv.2001, emerged from Lymatidae (Lepidoptera) on lychee, N. T. Pham leg.; Vinh Phuc, Tam Dao NP: 1♀ (RMNH), 300 m a.s.l., 21°27'N 105°29'E, 09–12.xi.2001, Malaise trap, Q. P. Mai leg.; Ha Noi, Gia Lam, Da Ton: 1♂ (IEBR), 04.vi.2001, hand net, L. D. Khuat leg.; 1♀ (IEBR), 02–14.vii.2001, 1♂ (IEBR), 22.vii–02.viii.2001, Malaise trap, L. D. Khuat leg.; Hoa Binh, Yen Thuy, Lac Thinh: 1♀ (IEBR), 01−10.vi.2002; 1♀ (IEBR), 10–20.viii.2002, Malaise trap, L. D. Khuat leg.; Ha Tinh, Huong Son, Son Hong: 1♀ (IEBR), 24.iv.2004, hand net, L. X. Truong leg.; Ha Tinh, Vu Quang NP: 1♀ (IEBR), 06.iii.2011, hand net, L. D. Khuat leg.; Nghe An, Pu Mat NP: 1♀ (IEBR), 300 m a.s.l., 17.x.2005, hand net, H. T. T. Nguyen leg.; 1♀ (IEBR), 22.x.2005, hand net, H. X. Le leg.; 1♀ (IEBR), 150−200 m a.s.l., 15.xi.2005; 1♂ (IEBR), 17.xi.2005, hand net, T. V. Hoang leg.; 1♀ (ZFMK), 150−200 m a.s.l., 16.iv.2006, hand net, N. T. Pham leg.; Bac Can, Ba Be NP: 1♀ (OMNH), 1000 m a.s.l., 22°23'N 105°37'E, 02.v.2006; 1♀

(OMNH), 200 m a.s.l., 03.v.2006, hand net, R. Matsumoto leg.; Thua Thien-Hue, A Luoi, Hong Trung: 1♀ (IEBR), 31.v.2006, hand net, N. T. Pham leg.

Diagnosis. Scutellum conical; tergites 3–5 densely, coarsely punctate; female without black spots on tergite 6; ovipositor sheath 1.05–1.25x hind tibia.

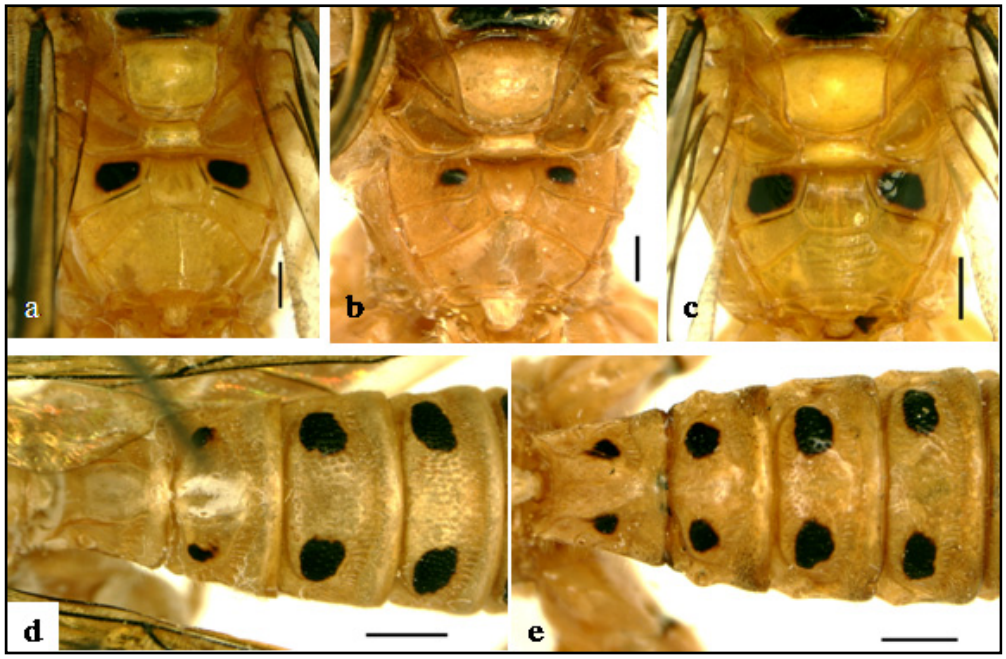

Figure 60. *Xanthopimpla* species: from a to c – dorsal views of scutellum and ropodeum (scales 0.5 mm): a. *X. regina*; b. *X. konowi*; c. *X. sticta*; d & e – dorsal views of metasomal tergites 1–4 (scales 1 mm): d. *X. regina*; e. *X. konowi*

Distribution. Townes & Chiu (1970) and Plant Protection Research Institute (1976) previously recorded *X. pedator* from North Vietnam for the first time. Our records extended the distribution of this species southwards to Thua Thien-Hue Province. Outside Vietnam, this species has been recorded from Bangladesh, China, India, Indonesia, Japan Malaysia, Myanmar, Pakistan, Singapore, Taiwan and the Philippines (Yu *et al.*, 2005).

Remarks. One of our *X. pedator* specimens has been reared from a species of Lymantriidae (Lepidoptera) on lychee.

Xanthopimpla porrecta PHAM, BROAD, MATSUMOTO & WÄGELE, 2011

(Figures 61, 63)

Xanthopimpla porrecta Pham, Broad, Matsumoto & Wägele, 2011. Zootaxa, 3056: 29. Holotype: ♀, Vietnam: Bac Can, Ba Be NP (IEBR).

Material examined. Bac Can, Ba Be NP: 1♀ (IEBR, holotype), 200 m a.s.l., 22°23'N 105°37'E, 01.v.2006, hand net, R. Matsumoto leg.

Diagnosis. Scutellum conical with median point; first tergite elongate, 1.6x apical width; metasomal tergites each with two black spots; ovipositor sheath short, 0.27x length of hind tibia.

Description (Female). Body length 18.5 mm, fore wing 15.0 mm, ovipositor sheath 1.0 mm. *Head*. Antenna with 38 flagellomeres, thinner apically, first flagellomere 1.55x length of second; diameter of lateral ocellus 1.8x ocellar-ocular distance; frons smooth; face 0.8x as high as wide, with low vertical curved carina beneath each antennal socket, between carinae densely coarsely punctate; clypeus 0.6x as high as wide, apical margin concave medially; malar space about 0.2x basal width of mandible.

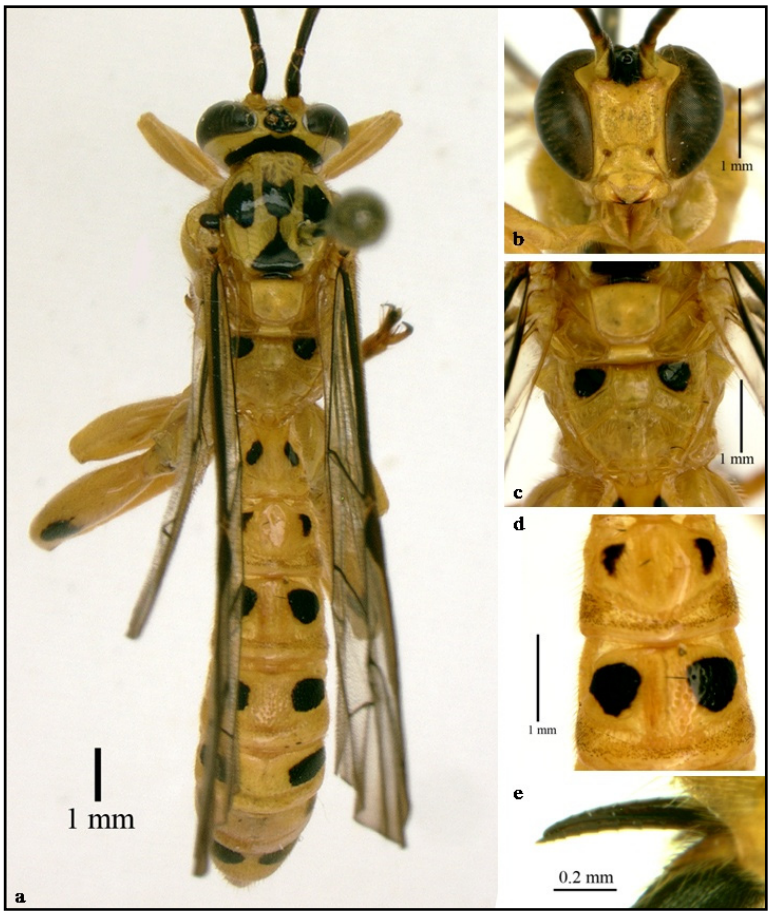

Figure 61. *X. porrecta*: a. dorsal view; b. face; c. dorsal view of head and mesonotum; d. dorsal view of metasomal tergites 2–3; e. ovipositor

Mesosoma. Epomia short; lower anterior corner of pronotum rounded, making obtuse angle of 100°; mesoscutum 1.15x as long as wide at anterior level of tegulae, with sparse hairs; notaulus shallow on anterior 0.2 of mesoscutum, extending nearly to anterior level of tegula; scutellum conical with median point, pubescent, lateral carina extending to apex, forming lateral flange, medially 0.5x as high as first flagellomere width; mesopleuron with sparse, minute punctures on upper half, dense, coarse punctures on lower half, epicnemial carina present on lower half of mesopleuron, postpectal carina medially forming low flange; metapleuron subpolished,

submetapleural carina complete; pleural carina extending to anterior margin; propodeum with strong, complete carinae, area superomedia as long as wide, propodeal spiracle elongate, 5.0x as long as wide. Hind leg with femur 2.4x longer than wide, 0.8x length of tibia, tibia shorter than tarsus, basitarsus 0.3x length of tarsus, 2.0x second tarsomere, third tarsomere 2.0x as long as wide, fifth tarsomere longer than third; mid and hind tibiae with three bristles at apex, one bristle near apex. Fore wing with vein 2*rs-m* equal to vein 3*rs-m*; *cu-a* opposite *Rs*&*M*; hind wing with first abscissa of vein *Cu*1 about 0.25x length of vein *cu-a*.

Metasoma. First tergite 1.6x as long as apical width, median longitudinal carina ending before oblique groove, dorsolateral carina strong from base to spiracle, weak from spiracle to apex; tergite 3 with sparse, coarse punctures; ovipositor sheath 0.27x hind tibia; ovipositor lower valve with ten apical ridges, upper valve with six transverse apical ridges.

Colour. Antenna blackish, outer face of scape and pedicel yellowish; ocellar area and frons black; hind slope of vertex and occipital area marked with black; mesoscutum with median black spot joined posteriorly to black mark in front of scutellum, lateral black mark present at level of tegula; tegula black posteriorly; propodeum with black spot in area externa; hind trochanter marked with black; hind femur with black mark on posterior face, basal 0.15 of tibia black; wings hyaline with margin infuscate, pterostigma and veins black, except basal 0.6 of costa yellowish; metasomal tergites each with two black spots.

Male. Unknown.

Distribution. Currently known only from Bac Can Province, Ba Ne NP, North Vietnam (Pham *et al*., 2011c).

Ecological notes. The single specimen was collected in secondary forest at an elevation of 200 m a.s.l. (Pham *et al*., 2011c).

***Xanthopimpla regina* MORLEY, 1913**

(Figures 60a, 60d, 63)

Xanthopimpla regina Morley, 1913. Faun. British India, Hymenoptera, 3 (1): 118. Holotype: ♀, East Pakistan: Sylhet (BMNH).

Material examined. Vinh Phuc, Tam Dao NP: 1♀ (OMNH), 1000 m a.s.l., 01.vi.1997, hand net, R. Matsumoto leg.; Hoa Binh, Yen Thuy, Lac Thinh: 1♀ (IEBR), 01–10.vi.2002; 1♀, 10–20.vii.2002, Malaise trap, L. D. Khuat leg.; Ninh Binh, Cuc Phuong NP: 1♀ (IEBR), 20–30.vi.2002; 1♀, 20–30.xi.2002, Malaise trap, L. D. Khuat leg.; Kien Giang, U Minh Thuong NP: 1♀ (IEBR), 01.xii.2003, hand net, L. P. T. Nguyen leg.; Thai Nguyen, Dinh Hoa, Phu Dinh: 1♂ (IEBR), 100 m a.s.l., 02.iv.2005; 1♂ (IEBR), 150 m a.s.l., 03.iv.2005, hand net, T. V. Hoang leg.; Thai Nguyen, Dai Tu, Cat Ne: 1♀

(IEBR), 25–30.xii.2007, Malaise trap, L. D. Khuat leg.; Bac Can, Ba Be NP: 1♀ (OMNH), 200 m a.s.l., 22°23'N 105°37'E, 01.v.2006; 1♀1♂ (OMNH), 02.v.2006, hand net, R. Matsumoto leg.; Phu Tho, Xuan Son NP: 1♂ (IEBR), 300 m a.s.l., 25.ix.2005, hand net, L. P. T. Nguyen leg.; 1♀ (ZFMK), 10–15.v.2009; 1♀ (IEBR), 15–20.v.2009; 1♂ (IEBR), 05–10.vii.2009, Malaise trap, L. D. Khuat leg.; Dak Lak, Ea So NP: 1♀ (IEBR), 310 m a.s.l., 12°55.93'N 108°36.96'E, 27.vii.2008, Malaise trap, H. T. Ngo leg.

Diagnosis. First tergite entirely yellow, tergite 3 densely, coarsely punctate; ovipositor sheath long, 1.85–2.1x hind tibia; ovipositor with about 11 apical transverse ridges.

Distribution. Townes & Chiu (1970) previously recorded this species from North Vietnam for the first time. Our records extended the distribution of this species southwards to Dak Lak and Kien Giang provinces. Outside Vietnam, this species has been recorded from Bangladesh, China, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Pakistan, Singapore, Taiwan and Thailand (Yu *et al.*, 2005).

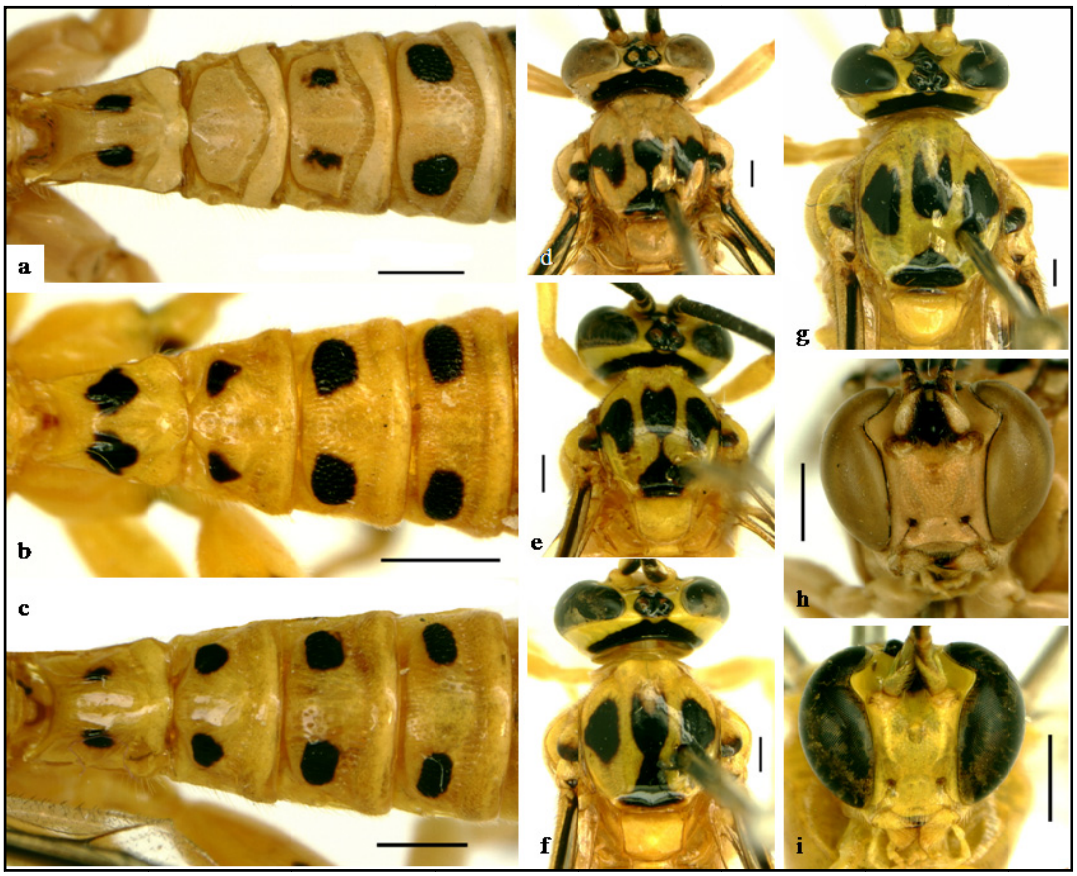

Figure 62. *Xanthopimpla* species: from a to c – dorsal view of metasomal tergites 1–4 (scales 1 mm): a. *X. brevicarina*; b. *X. predator*; c. *X. sticta*; from d to g – dorsal view of head and mesonotum (scales 0.5 mm): d. *X. brevicarina*; e. *X. predator*; f. *X. sticta*; g. *X. konowi*; h & i – faces (scales 1 mm): h. *X. konowi*; i. *X. sticta*

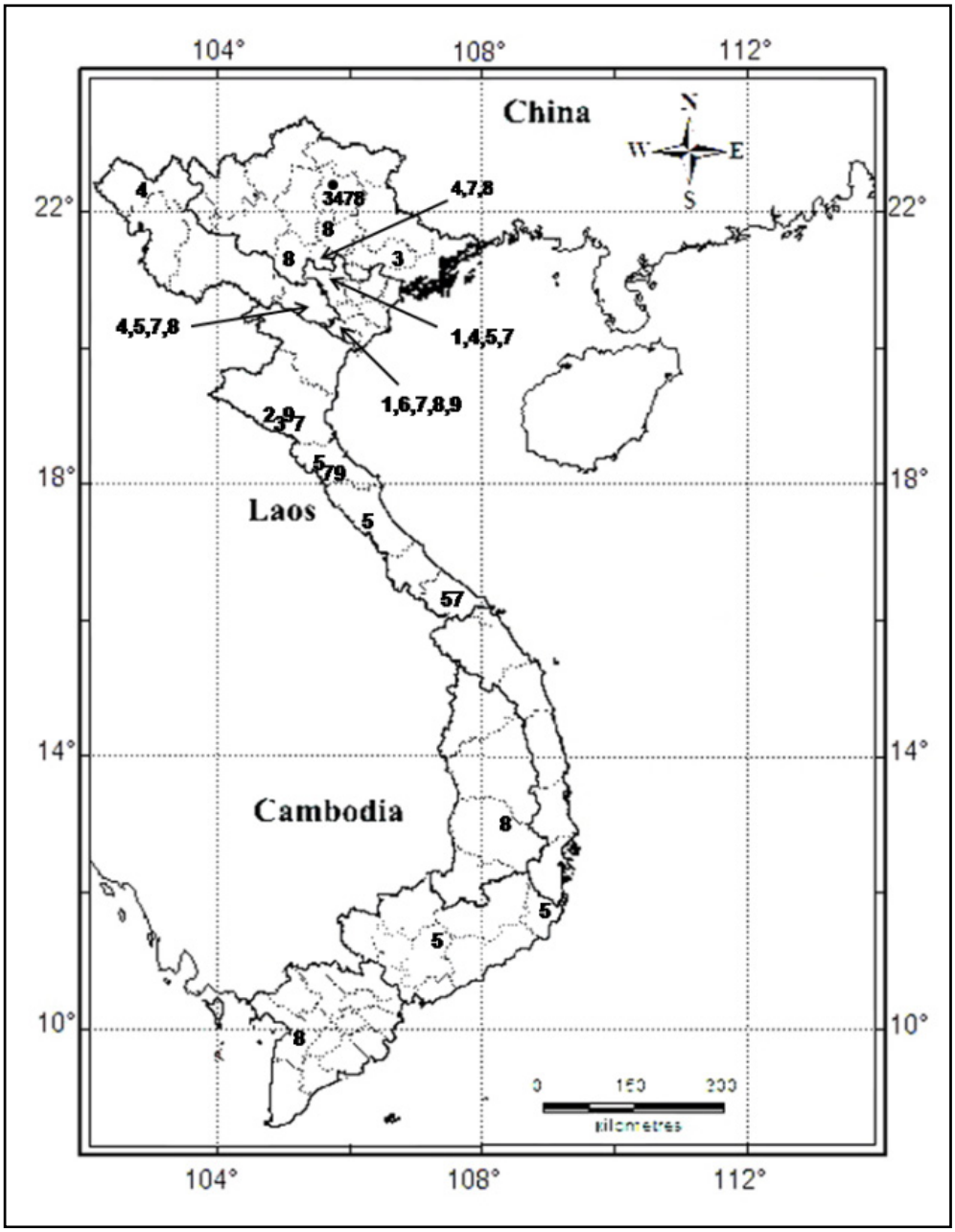

Figure 63. Distribution map of *Xanthopimpla regina* species group: 1. *X. brevicarina*; 2. *X. flavafemora*; 3. *X. flavapropodea*; *4. X. konowi*; 5. *X. leviuscula*; 6. *X. omega*; 7. *X. predator*; 8. *X. regina*; 9. *X. sticta*; (•). *X. porrecta*

***Xanthopimpla sticta* TOWNES & CHIU, 1970**

(Figures 60c, 62c, 62f, 62i, 63)

Xanthopimpla sticta Townes & Chiu, 1970. Mem. Amer. Ent. Inst, 14: 53. Holotype: ♀, Indonesia: Sandakan, Borneo (USNM).

Material examined. Ninh Binh, Cuc Phuong NP: 1♀1♂ (OMNH), 200–300 m a.s.l., 24.iv.1998, hand net, R. Matsumoto leg.; 1♀ (IEBR), 08.v.2000, hand net, T. V. Hoang leg.; 1♀ (IEBR), 30.iv.2006, hand net, T. H. Pham leg.; Nghe An, Tuong Duong, Tam Quang: 1♀ (IEBR), 12.vii.2006,

hand net, H. T. T. Nguyen leg; Ha Tinh, Vu Quang NP: 1♀ (RMNH), 66 m a.s.l., 18°20'47N 105°26'29E, 22.ix–06.x.2009, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Median black mark on mesoscutum broadly joined posteriorly to black mark in front of scutellum; scutellum more or less conical; tergite 3 with relatively sparse, coarse punctures; ovipositor sheath about 1.7x hind tibia; ovipositor distinctly decurved.

Distribution. Pham *et al.* (2011c) recorded this species from Vietnam for the first time. Outside Vietnam, it has been known from Malaysia, Singapore and Thailand (Yu *et al.*, 2005).

The *rhopaloceros* species group

Diagnosis. Fore wing with areolet open on outer side, vein 3*rs-m* absent; mesoscutum with several hairs on median lobe; upper half of mesopleuron entirely hairless; notaulus moderately deep, extending at least to anterior level of tegula; submetapleural carina complete, sometimes incomplete or absent; propodeum carinae varying from complete to incomplete or absent; largest bristles on mid and hind tibia claws not widened or blackened subapically (Townes & Chiu, 1970; Pham *et al*., 2011c).

***Xanthopimpla melanacantha* KRIEGER, 1914**

(Figures 65, 66a)

Xanthopimpla melanacantha Krieger, 1914. Arch. f. Naturgesch. (A) 80 (6): 22. Holotype: ♀, Thailand: Puket (ZMHB).

Xanthopimpla melanacantha oblongata Chao, 1997. Wuyi Sci. J. 13: 54. Holotype: ♀, Malaysia: Pasoh Forest Res. Negri S. (AEIC). Synonymized with the nominate subspecies by Pham *et al.*, 2011c.

Xanthopimpla melanacantha subtriangulata Chao, 1997. Wuyi Sci. J. 13: 54. Holotype: ♀, Malaysia: Pasoh Forest Res. Negri S. (AEIC). Synonymized with the nominate subspecies by Pham *et al.*, 2011c.

Material examined. Dong Nai, Cat Tien NP, 100 m a.s.l.: 1♀1♂ (RMNH), 01–09.x.2005; 2♂ (RMNH), 15−20.V.2007; 1♂ (RMNH), 13−20.V.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.; 1♂ (RMNH), 10–30.ix.2007, Malaise trap, Q. P. Mai & M. T. Nguyen leg.; Ha Tinh, Vu Quang NP: 1♂ (RMNH), 66 m a.s.l., 18°20.47'N 105°26.29'E, 22.ix–06.x.2009, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Submetapleural carina entirely absent; propodeum with basal transverse carina absent or weakly present; lateral black mark on mesoscutum joined posteriorly to black mark in front of scutellum; mesopleuron with black spot medially; metaepisternum with two black spots; metasomal tergites with two black spots or with black bands; ovipositor sheath 0.57x hind tibia.

Distribution. Pham *et al.* (2011c) recorded this species from Vietnam for the first time. Outside

Vietnam, it has been known from Indonesia, Malaysia, Thailand and the Philippines (Yu *et al.*, 2005).

Remarks. Five subspecies of *X. melanacantha* Krieger were previously recognised: *X. melanacantha melanacantha* from Thailand and Indonesia, *X. melanacantha citripes* Townes & Chiu and *X. melanacantha coxalis* Townes & Chiu from the Philippines, *X. melanacantha oblongata* Chao and *X. melanacantha subtriangulata* Chao from Malaysia (Townes & Chiu, 1970; Chao, 1997; Yu *et al.*, 2005). The Vietnamese specimens with lateral black marks on the mesoscutum joined posteriorly to black marks in front of the scutellum agree well with either of the two subspecies from Malaysia. However, they differ from the described populations in that the lateral carina of the scutellum does not extend to the apex. Pham *et al.* (2011c) found that the differences between the subspecies *X. melanacantha melanacantha*, *X. melanacantha oblongata* and *X. melanacantha subtriangulata* were minor and unreliable, given that the Vietnamese population could not be placed unambiguously to subspecies. The authors therefore synonymised *X. melanacantha oblongata* and *X. melanacantha subtriangulata* with *X. melanacantha melanacantha*.

***Xanthopimpla morsei* PHAM, BROAD, MATSUMOTO & WÄGELE, 2011**

(Figures 64, 65)

Xanthopimpla morsei Pham, Broad, Matsumoto & Wägele, 2011. Zootaxa, 3056: 32. Holotype: ♀, Vietnam: Dong Nai, Cat Tien NP (RMNH).

Material examined. Dong Nai, Cat Tien NP: 1♀ (RMNH, holotype), 100 m a.s.l., 15−20.v.2007; 1♀ (IEBR, paratype), 1♀ (RMNH, paratype), 13–20.v.2007; 2♀ (RMNH), 14–20.v.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Antennal flagellum with apical half a little thicker than basal half; malar space long, about 0.85x basal width of mandible; scutellum without lateral carina on apical 0.25; submetapleural carina present on anterior 0.5 of metapleuron; ovipositor down-curved, ovipositor sheath 0.6x length of hind tibia.

Description (Female). Body length 5.8–7.3 mm, fore wing 4.7–5.2 mm, ovipositor sheath 0.75–0.85 mm. *Head*. Antenna with 30–31 flagellomeres, thicker apically; first flagellomere 1.7–1.8x length of second; diameter of lateral ocellus 0.65–0.8x ocellar-ocular distance; frons smooth; face 1.1x as high as wide, with shallow, small punctures; clypeus with apical margin rounded, 0.6–0.7x as high as wide; malar space about 0.85x basal width of mandible.

Mesosoma. Epomia about 0.3x basal width of mandible; lower anterior corner of pronotum rounded, forming obtuse angle of about 135°; mesoscutum 0.95x as long as wide at anterior level of tegulae, smooth, with several small punctures anteriorly; notaulus present on anterior 0.3 of

mesoscutum, extending to anterior level of tegula; scutellum weakly convex, lateral carina absent from posterior 0.25; mesopleuron smooth, with some small punctures on lower part; epicnemial carina present on lower half of mesopleuron; submetapleural carina medially forming high flange; metapleuron polished, submetapleural carina present on anterior 0.5, pleural carina extending to anterior margin; propodeum with area superomedia confluent with area dentipara; posterior transverse carina strong, a little concave medially; costula present; lateral longitudinal carina not complete, nearly reaching to above propodeal spiracle; propodeal spiracle oval, 2.0x as long as wide. Hind leg with femur 2.5–2.8x as long as wide, 0.85x length of tibia, tibia longer than tarsus, basitarsus 0.3x length of tarsus, 2.0x second tarsomere, third tarsomere 1.2x as long as wide, fifth tarsomere longer than third; mid tibia with two bristles at apex, 5–6 bristles near apex; hind tibia with three bristles at apex, five bristles near apex, all bristles stout. Fore wing with vein *cu-a* opposite *Rs*&*M*; hind wing with first abscissa of vein *Cu*1 about 0.45–0.55x length of vein *cu-a*; veins 1*A*, *Cu*1, *M*, and *Rs* indistinct distally.

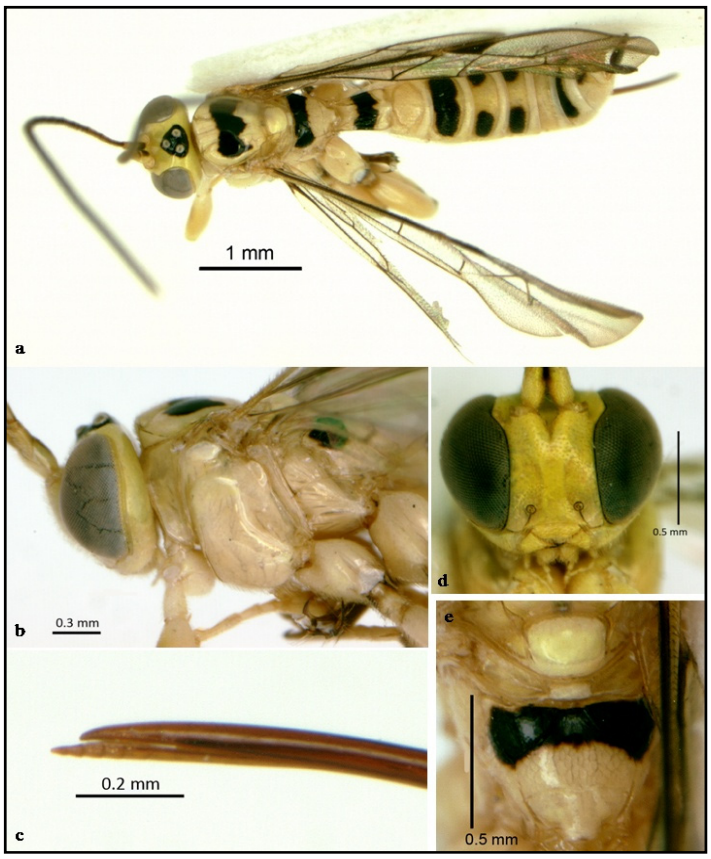

Figure 64. *X. morsei*: a. dorsal view; b. lateral view of head and mesosoma; c. ovipositor tip; d. face; e. dorsal view of scutellum and propodeum

Metasoma. First tergite 1.3x as long as apical width, median longitudinal carina ending at oblique groove, dorsolateral carina complete; tergite 3 onwards densely, coarsely punctate; ovipositor down-curved, lower valve with 5–6 apical ridges, upper valve not enclosing lower valve;

ovipositor sheath 0.6x length of hind tibia.

Colour. Antenna brown basally, dark brown apically; mesoscutum with three continuous black spots medially; tegula brown, transparent posteriorly; base of propodeum with black band extending little over area externa; mid trochanter with basal 0.4 of ventral and 0.6 of lateral side brown; base and apex of mid tibia with dark brown stripes; hind trochanter blackish; hind tibia basally and apically black; fifth tarsomeres of mid and hind legs brown; wings hyaline, pterostigma and veins brown, except basal half of costa yellowish; tergites 1, 3, and 7 with black bands; tergites 4 and 5 with two lateral black spots, tergite 8 with median black spot; ovipositor reddish brown; ovipositor sheath black.

Distribution. Currently known only from Cat Tien NP, Dong Nai province, southern Vietnam (Pham *et al.*, 2011c).

Ecological notes. The specimens were collected in lowland evergreen forest (Pham *et al.*, 2011c).

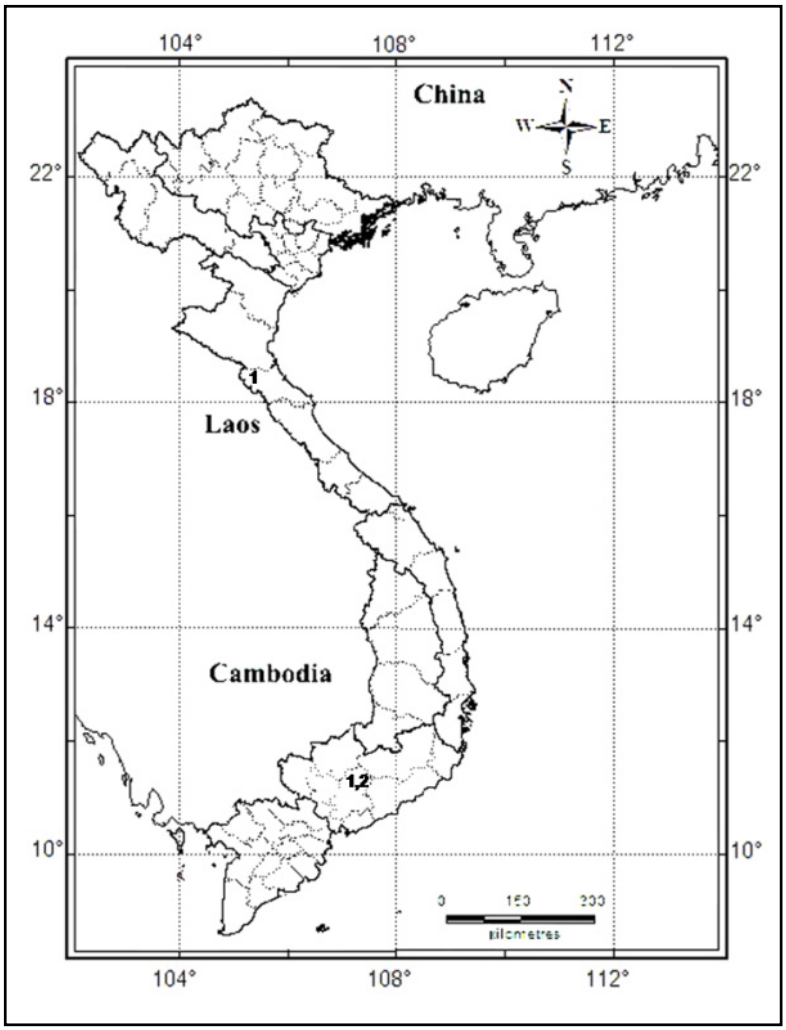

Figure 65. Distribution map of *Xanthopimpla rhopaloceros* species group:

1. *X. melanacantha*; 2. *X. morsei*

The *stemmator* species group

Diagnosis. Mesoscutum with moderately dense hairs on anterior half, sparse hairs posteriorly, notaulus extending to or a little behind anterior level of tegula; scutellum evenly convex, lateral flange extending to apex; propodeum with area superomedia complete, 0.8–1.8x as long as wide; hind tibia with 9–18 preapical bristles; hind trochanter and femur entirely yellow; fore wing with areolet closed; ovipositor moderately stout (Townes & Chiu, 1970).

***Xanthopimpla modesta* (SMITH, 1859)**

(Figures 66b, 67)

Pimpla modesta Smith, 1859. Jour. Proc. Linn. Soc. London Zool., 5: 64. Holotype: ♀, Celebes: Macassar (OUMNH).

Xanthopimpla modesta: Krieger (1899).

Material examined. Thua Thien-Hue, Phong Dien NR: 1♀1♂ (RMNH), 50–100 m a.s.l., 29.iii.2001, C. v. Achterberg leg.; Ha Noi, Gia Lam, Da Ton: 1♂ (IEBR), 05–15.x.2001, Malaise trap, L. D. Khuat leg.; Ha Noi, Thach That, Tan Xa: 1♂ (IEBR), 10–20.xi.2002, Malaise trap, L. D. Khuat leg.; Hoa Binh, Yen Thuy, Lac Thinh: 1♀ (ZFMK), 01–10.vii.2002; 2♀ (IEBR), 10–20.x.2002, Malaise trap, L. D. Khuat leg.; Hoa Binh, Kim Boi, Thuong Tien NR: 1♀ (IEBR), 26.iv.2012. hand net, H. T. Dang leg; Ninh Binh, Cuc Phuong NP: 1♀ (IEBR), 10–20.xi.2002, Malaise trap, L. D. Khuat leg.; Vinh Phuc, Phuc Yen, Ngoc Thanh: 1♂ (IEBR), 150 m a.s.l., 07.vi.2004, hand net, N. T. Pham leg.; 1♀ (IEBR), 15.vii.2007, Malaise trap, T. H. Pham leg.; Bac Can, Ba Be NP: 1♂ (OMNH), 02.v.2005, hand net, leg. M. Wakabayashi; Thai Nguyen, Dai Tu, Cat Ne: 1♀ (IEBR), 20.x.2006; 1♀2♂ (IEBR), 05–10.xii.2007, Malaise trap, L. D. Khuat leg.

Diagnosis. Hind side of head with black area; mesoscutum without black mark in front of scutellum, black mark on median lobe with deep notch anteriorly; hind tibia with 12–18 preapical bristles; propodeum and first tergite without black marks; ovipositor sheath about 1.3–1.4x hind tibia.

Distribution. Pham (1997) previously recorded this species from Nghe An Province for the first time. Our records filled the distribution gaps of this species in the North and extended the distribution of this species southwards to Thua Thien-Hue Province. Outside Vietnam, *X. modesta* is known from China, Indonesia, Japan, Malaysia, Singapore, Taiwan, Thailand, and the Philippines (Yu *et al.*, 2005).

Remarks. Two subspecies are currently recognised, namely *X. modesta modesta* and *X. modesta microcephala* Krieger (Townes & Chiu, 1970; Yu *et al.*, 2005). The Vietnamese specimens belong to the nominate subspecies which differs from *X. modesta microcephala* by the presence of

black marks on the mesoscutum and metasomal tergites. In Vietnam, this species has been recorded as a parasitoid of *Chilo suppresalis* (Lepidoptera: Pyralidae) on rice (Khuat & Pham, 2007).

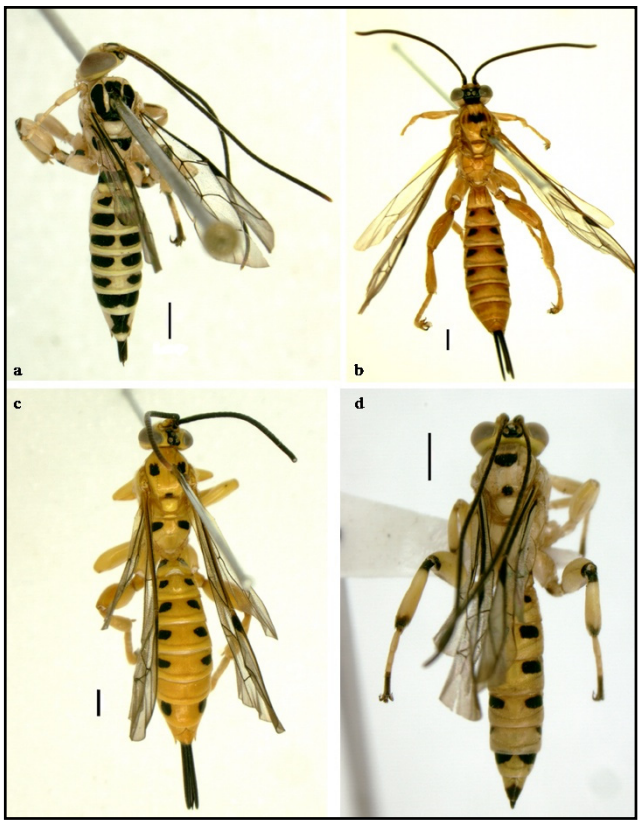

Figure 66. Dorsal views of *Xanthopimpla* species (scales 1 mm):
a. *X. melanacantha*; b. *X. modesta*; c. *X. stemmator*; d. *X. calva*

***Xanthopimpla stemmator* (THUNBERG, 1822)**

(Figures 66c, 67)

Ichneumon stemmator Thunberg, 1822. Mem. Acad. Imp. Sci., St. Peterbourg, 8: 262. Holotype: ♂, China (UUZM).

Xanthopimpla stemmator: Roman (1912).

Material examined. Hoa Binh, Yen Thuy, Lac Thinh: 1♀ (IEBR), 10–20.iv.2002; 1♂ (IEBR), 10–20.viii.2002, Malaise trap, L. D. Khuat leg.; Ha Noi, Thach That, Tan Xa: 1♂ (IEBR), 25.vii–05.viii.2002; 1♀ (ZFMK), 05–15.viii.2002, Malaise trap, L. D. Khuat leg.; Thai Nguyen, Cat Ne, Dai Tu: 1♀1♂ (IEBR), 15–20.xi.2006, Malaise trap, L. D. Khuat leg.; Phu Tho, Xuan Son NP: 1♂ (IEBR), 300 m a.s.l., 24.ix.2005, hand net, T. V. Hoang leg.; Nghe An, Pu Mat NP: 1♀3♂ (IEBR), 250 m a.s.l., 12.ix.2005, hand net, N. T. Pham leg.; Thanh Hoa, Thuong Xuan, Tan Thanh: 1♂ (IEBR), 01.vi.2008, hand net, T. V. Hoang leg.; Dong Nai, Cat Tien NP: 1♀ (RMNH), 100 m a.s.l., 03–08.x.2005, Malaise trap, R. de Vries leg.

Diagnosis. Hind side of head with two black spots; hind tibia with 9–11 preapical bristles;

propodeum and metasomal tergites each with two black spots (except tergite 6 entirely yellow); ovipositor sheath about 1.1x hind tibia.

Distribution. Previously recorded from Tien Giang for the first time by the Plant Protection Research Institute (1976). Our records extended the distribution of this species to North Vietnam. Outside Vietnam, *X. stemmator* is known from China, India, Indonesia, Japan, Laos, Malaysia, Mauritius, Pakistan, Singapore, Sri Lanka, South Africa, Taiwan, Thailand, and the Philippines (Yu *et al.*, 2005).

Remarks. In Vietnam, this species was reared from pupae of *Chilo suppresalis* (Lepidoptera: Pyralidae) on rice (Pham, 1997). *Xanthopimpla stemmator* has been extensively studied for its potential as a biocontrol agent against lepidopteran pests of rice (Townes & Chiu, 1970).

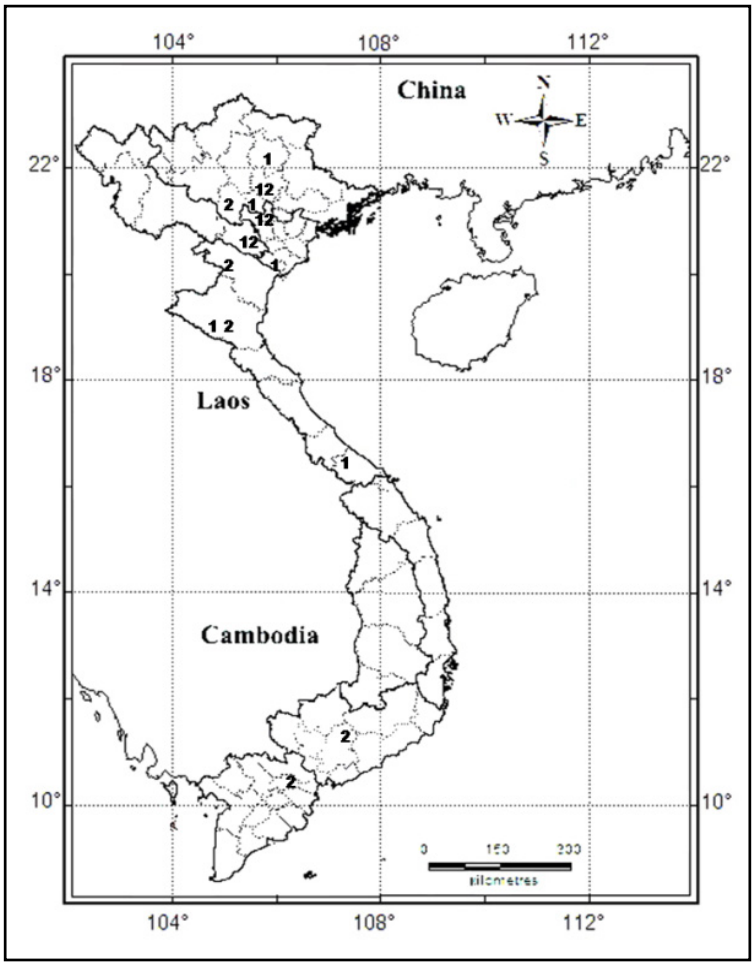

Figure 67. Distribution map of *Xanthopimpla stemmator* species group:

1. *X. modesta*; 2. *X. stemmator*

The *terebatrix* species group

Diagnosis. Scutellum with notaulus short, not extending to anterior level of tegula; scutellum evenly convex to sharply conical, lateral flange extending to apex; propodeum with area superomedia complete bounded by carinae or rarely confluent laterally with area dentipara;

largest bristles on mid and hind tibia claws distinctly widened, blackened subapically; hind trochanter and femur always marked with black (Townes & Chiu, 1970; Pham *et al*., 2011c).

Figure 68. *Xanthopimpla* species: From a to f – dorsal views of head and mesonotum (scales 0.5 mm): a. *X. annulata*; b. *X. conica*; c. *X. polyspila*; d. *X. atriclunis*; e. *X. decurtata*; f. *X. pleuralis*; from g to i – dorsal views of metasomal tergites 1–4 (scales 1 mm): g. *X. annulata*; h. *X. decurtata*; i. *X. polyspila*

***Xanthopimpla annulata* CUSHMAN, 1925**

(Figures 68a, 68g, 69a, 73)

Xanthopimpla annulata Cushman, 1925. Ent. Mitt. 14: 47. Holotype: ♀, Taiwan: Kangkou [= Kankau], Hengchun (DEI).

Material examined. Phu Tho, Ha Hoa, Y Son: 1♀ (IEBR), 10.ix.2000, hand net, T. H. Ta leg.; Phu Tho, Xuan Son NP: 1♀ (BMNH), 26–30.iv.2009, Malaise trap, L. D. Khuat leg.; Hoa Binh, Pa Co, Mai Chau: 1♂ (IEBR), 1100 m a.s.l., 22.iv.2002, hand net, T. V. Hoang leg.; Hoa Binh, Yen Thuy, Lac Thinh: 2♂ (IEBR), 01–10.v.2002; 1♂ (IEBR), 10–20.vi.2002, Malaise trap, Khuat D. L.; Ha Noi, Thach That, Tan Xa: 1♀ (IEBR), 05–15.viii.2002, Malaise trap, L. D. Khuat leg.

Diagnosis. Hind slope of vertex and occipital area widely black; anterior part of mesopleuron, metaepisternum, and lower part of metapleuron marked with black; first tergite elongate; tergites 3–5 densely, coarsely punctate; ovipositor sheath as long as hind tibia.

Distribution. Pham *et al.* (2011c) recently recorded this species from Vietnam for the first time. Outside Vietnam, it has been known from China, India, Taiwan and the Philippines (Yu *et al.*, 2005).

Remarks. Two male specimens from Lac Thinh (Hoa Binh Province) differ from other specimens as they have black stripes on the posterior faces of the fore and mid femora and tibiae.

***Xanthopimpla atriclunis* TOWNES & CHIU, 1970**

(Figures 68d, 69b, 73)

Xanthopimpla atriclunis Townes & Chiu, 1970. Mem. Amer. Ent. Inst., 14: 157. Holotype: ♀, the Philippines: Alcate, Victoria, Mindoro Oriental (AEIC).

Material examined. Dong Nai, Cat Tien NP: 1♀ (RMNH), 100 m a.s.l., 20.v.2005, Malaise trap, C. v. Achterberg & R. de Vries leg.; Thua Thien-Hue, Nam Dong, Tra Mang: 1♂ (IEBR), 20–27.viii.2005, Malaise trap, T. Q. Nguyen leg.; Dak Lak, Ea So NR: 1♀2♂ (IEBR), 1♂ (ZFMK), 1♀ (BMNH), 310 m a.s.l., 12°55.93'N 108°37.96'E, 27.vii.2008, Malaise trap, H. T. Ngo leg.

Diagnosis. Hind slope of vertex and occipital area widely black; mesoscutum with three continuous black spots; hind tibia black apically; propodeum with area superomedia receiving basal transverse carina near its basal 0.3; ovipositor sheath 0.33x hind tibia.

Distribution. Pham *et al.* (2011c) recently recorded this species from Vietnam for the first time. Outside Vietnam, it has been known from the Philippines (Yu *et al.*, 2005).

***Xanthopimpla conica* CUSHMAN, 1925**

(Figures 68b, 69c, 73)

Xanthopimpla conica Cushman, 1925. Ent. Mitt., 14: 45. Holotype: ♀, Taiwan: Kangkou [= Kankau], Hengchun (DEI).

Material examined. Phu Tho, Xuan Son NP: 1♀ (OMNH), 300 m a.s.l., 29.ix.2005, hand net, T. V. Hoang leg.; 1♀ (IEBR), 24–29.vi.2009; 1♂ (IEBR), 29.VI–05.vii.2009; 1♀ (ZFMK), 20–25.vii.2009, Malaise trap, L. D. Khuat leg.; Dong Nai, Cat Tien NP: 1♀ (RMNH), 100 m a.s.l., 13–20.v.2005, Malaise trap, C. v. Achterberg & R. de Vries leg.; 1♀ (RMNH), 100 m a.s.l., 09.iv–19.v.2007, Malaise trap, Q. P. Mai & M. T. Nguyen leg.; Quang Nam, Phuoc Son, Phuoc Xuan: 1♀ (BMNH), 400 m a.s.l., 26.v.2006, hand net, N. T. Pham leg.; Hoa Binh, Mai Chau, Tan Son: 1♀, 850–900 m a.s.l.; 05–09.v.2010, Malaise trap, L. D. Khuat leg.

Diagnosis. Scutellum conical with sharp point; median and lateral black marks on mesoscutum almost jointed posteriorly to black mark in front of scutellum, median black mark with deep notch anteriorly; mid and hind tibiae without bristles near apex; metasomal tergites each with black band; ovipositor sheath 0.25x hind tibia.

Distribution. Townes & Chiu (1970) previously recorded this species for the first time from Vietnam in Lai Chau and Hoa Binh provinces. Our records extended the distribution of this species southwards to Quang Nam and Dong Nai provinces. Outside Vietnam, *X. conica* has been recorded from China, India, Indonesia, Malaysia, Sri Lanka and Taiwan (Yu *et al.*, 2005).

Figure 69. *Xanthopimpla* species (scales 0.5 mm): from a to g – dorsal views of scutellum and propodeum: a. *X. annulata*; b. *X. atriclunis*; c. *X. conica*; d. *X. polyspila*; e. *X. decurtata*; f. *X. pleuralis*; g. *X. sikkimensis*; from h & i – faces: h. *X. decurtata*; i. *X. polyspila*

***Xanthopimpla decurtata* KRIEGER, 1914**

(Figures 68e, 68h, 69e, 69h, 73)

Xanthopimpla decurtata Krieger, 1914. Arch. f. Naturgesch., (A) 80 (6): 39, 113. Lectotype: ♀, the Philippines: Atimonan on Luzon (ZMHB).

Xanthopimpla decurtata detruncata Krieger, 1914. Arch. f. Naturgesch., (A) 80 (6): 39, 115. Lectotype: ♀, Taiwan: Fengyüan (ZMHB).

Material examined. Nghe An, Tuong Duong, Tam Quang: 1♂ (IEBR), 1♂ (BMNH), 300 m a.s.l., 18.iv.2006, hand net, N. T. Pham leg.; Dong Nai, Cat Tien NP: 2♀ (RMNH), 100 m a.s.l., 13–20.v.2005; 1♂ (RMNH), 01–09.x.2005; 2♀ (RMNH), 13–19.v.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.; 1♀ (RMNH), 09–30.iv.2007, Malaise trap, Q. P. Mai & M. T. Nguyen leg.; Vinh Phuc, Phuc Yen, Ngoc Thanh: 3♂ (IEBR), 1♂ (ZFMK), 150 m a.s.l., 15.vii.2007, Malaise trap, T. H. Pham leg.

Diagnosis. Hind slope of vertex and occipital area widely black; face densely, coarsely punctate; wings with infuscate margin; metasomal tergites each with two black spots; ovipositor sheath 0.25x hind tibia.

Distribution. Townes & Chiu (1970) previously recorded this species from Lai Chau Province (North Vietnam) for the first time. Our records extended the distribution of this species southwards to Dong Nai Province. Outside Vietnam, this species has been recorded from India, Malaysia, Taiwan, Thailand and the Philippines (Yu *et al.*, 2005).

Remarks. Two subspecies are currently recognised: *X. decurtata decurtata* from the Philippines differs from *X. decurtata detruncata* from India, Thailand, Malaysia, Vietnam, and Taiwan by the absence of black markings on the propodeum and hind femur and its generally smaller size (Townes & Chiu, 1970, Yu *et al.*, 2005).

***Xanthopimpla hienae* PHAM, BROAD, MATSUMOTO & WÄGELE, 2011**

(Figures 70, 73)

Xanthopimpla hienae Pham, Broad, Matsumoto & Wägele, 2011. Zootaxa, 3056: 35. Holotype: ♀, Vietnam: Dak Lak, Ea So NR (IEBR).

Material examined. Dak Lak, Ea So NR: 1♀ (IEBR, holotype), 310 m a.s.l., 12°55.93'N 108°37.96'E, 27.vii.2008, Malaise trap, H. T. Ngo leg.

Diagnosis. Hind slope of vertex with two small oblique brown marks, nearly forming a V-shape medially; scutellum moderately convex; propodeum with area superomedia 0.6x as long as wide; metasomal tergites with median black bands (except tergite 2 with two black spots); ovipositor straight, ovipositor sheath 0.25x length of hind tibia.

Description (Female). Body length 9.0 mm, fore wing 7.5 mm, ovipositor sheath 0.5 mm. *Head*. Antenna with 35 flagellomeres, first antennal flagellomere 1.6x length of second; diameter of lateral ocellus 1.15x ocellar-ocular distance; frons polished; face quadrate, with numerous, minute punctures; clypeus 0.6x as high as wide, apical margin thin and emarginate; malar space about 0.3x basal width of mandible.

Mesosoma. Epomia short; mesoscutum as long as wide at anterior level of tegulae, with moderately dense hairs, notaulus present on anterior 0.3 of mesoscutum, extending to anterior

level of tegula; scutellum convex, lateral carina forming lateral flange, medially 0.3x as high as first flagellomere width, gradually narrowed to apex; mesopleuron subpolished, with sparse minute punctures on upper half and dense punctures on lower part, epicnemial carina present on lower 0.6, postpectal carina medially forming wide and moderately high flange; metapleuron polished; propodeum with strong carinae, area superomedia 0.6x as long as wide; propodeal spiracle elongate, 4.0x as long as wide. Hind leg with femur 2.2x as long as wide, 0.9x length of tibia, tibia as long as tarsus, basitarsus 0.3x length of tarsus, 2.0x second tarsomere, third tarsomere 1.5x as long as wide, fifth tarsomere longer than third; mid tibia with one bristle near apex, three bristles at apex; hind tibia with one bristle near apex, two bristles at apex; largest bristles on mid and hind tarsal claws widened. Fore wing with vein 2*rs-m* equal to vein 3*rs-m*; *cu-a* opposite *Rs*&*M*; hind wing with first abscissa of vein *Cu*1 about 0.4x length of vein *cu-a*.

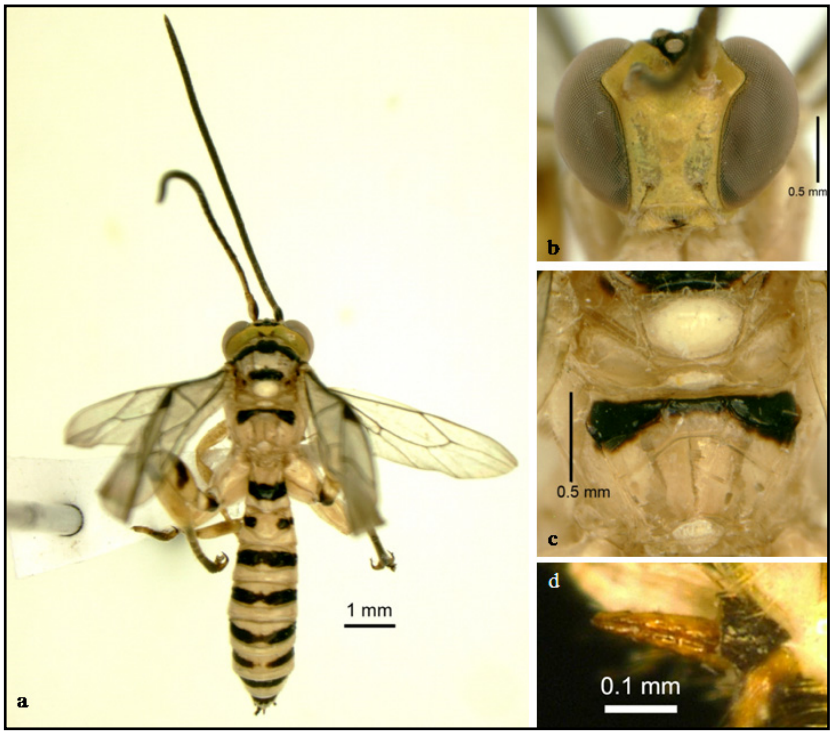

Figure 70. *X. hienae*: a. dorsal view; b. face; c. dorsal view of scutellum and propodeum; d. ovipositor

Metasoma. First tergite as long as apical width; dorsolateral carina weakly present behind spiracle, median longitudinal carina extending to oblique groove; tergite 3 onwards densely, finely punctate; ovipositor straight; ovipositor sheath 0.25x length of hind tibia, lower valve with several small apical ridges.

Colour. Antenna dark brown, except outer side of scape, pedicel and some first flagellomeres yellowish; ocellar area black; hind slope of vertex with two small oblique brown, forming nearly V-shape medially; mesoscutum with three transverse continuous black spots medially and black spot

in front of scutellum; tegula dark and transparent posteriorly; propodeum with black band at base, slightly broad laterally to area dentipara; basal 0.2 of mid tibia and mid tarsus dark brown; hind leg with 0.7 under and lateral side of trochanter black, posterior face of femur with large black spot; anterior face with small brown spot along upper margin, basal 0.2 of tibia and tarsus black; wings hyaline, pterostigma and veins dark brown, except basal 0.6 of costa yellowish; metasomal tergites with median black bands, except tergite 2 with two subrounded black spots, black band on tergite 6 indistinct medially; ovipositor reddish brown; ovipositor sheath black.

Male. Unknown.

Distribution. Currently known only from Ea So NR, Dak Lak Province, Central Highlands of Vietnam (Pham *et al*., 2011c).

Ecological notes. The single specimen was collected in evergreen forest (Pham *et al*., 2011c).

***Xanthopimpla oriole* PHAM, BROAD, MATSUMOTO & WÄGELE, 2011**

(Figures 71, 73)

Xanthopimpla oriole Pham, Broad, Matsumoto & Wägele, 2011. Zootaxa, 3056: 36. Holotype: ♀, Vietnam: Thua Thien-Hue, Phong Dien NR (RMNH).

Material examined. Thua Thien-Hue, Phong Dien NR: 1♀ (RMNH, holotype) 1♂ (IEBR, paratype), 80–210 m a.s.l., 23.iii–06.iv.2001, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Face as high as wide; hind slope of vertex and occipital area entirely yellow; hind femur with large black stripe posteriorly; hind tibia with one apical, one preapical stout bristle; metasomal tergites densely, finely punctate; ovipositor sheath 0.33x hind tibia; ovipositor straight with seven apical ridges.

Description (Female). Body length 8.5 mm, fore wing 7.3 mm, ovipositor sheath 0.8 mm. *Head*. Antenna with 36 flagellomeres, first flagellomere 1.4x length of second; diameter of lateral ocellus 1.3x ocellar-ocular distance; frons polished; face as high as wide, finely punctate, pubescent; clypeus 0.6x as high as wide, apical margin thin and emarginated; malar space about 0.3x basal width of mandible.

Mesosoma. Epomia short; mesoscutum nearly as long as wide at anterior level of tegulae, with dense, short hairs, notaulus present on anterior 0.25 of mesoscutum, ending before anterior level of tegula; scutellum convex, pubescent, lateral carina forming low flange; upper half of mesopleuron polished, impunctate, lower half with fine punctures, pubescent, epicnemial carina present on lower half, postpectal carina medially forming wide and low flange; metapleuron polished; propodeum with area superomedia 0.8x as long as wide; propodeal spiracle elongate, 4.0x as long as wide. Hind leg with femur 2.3x as long as wide, 0.8x length of tibia, tibia longer than

tarsus, basitarsus 0.3x length of tarsus, 2.0x second tarsomere, third tarsomere 1.4x as long as wide, fifth tarsomere longer than third; mid tibia with three bristles near apex, two bristles at apex; hind tibia with one bristle near apex, one bristle at apex; largest bristles on mid and hind tarsal claws widened. Fore wing with vein 2*rs-m* equal to vein 3*rs-m*; *cu-a* opposite *Rs&M*; hind wing with first abscissa of vein *Cu*1 about 0.3x length of vein *cu-a*.

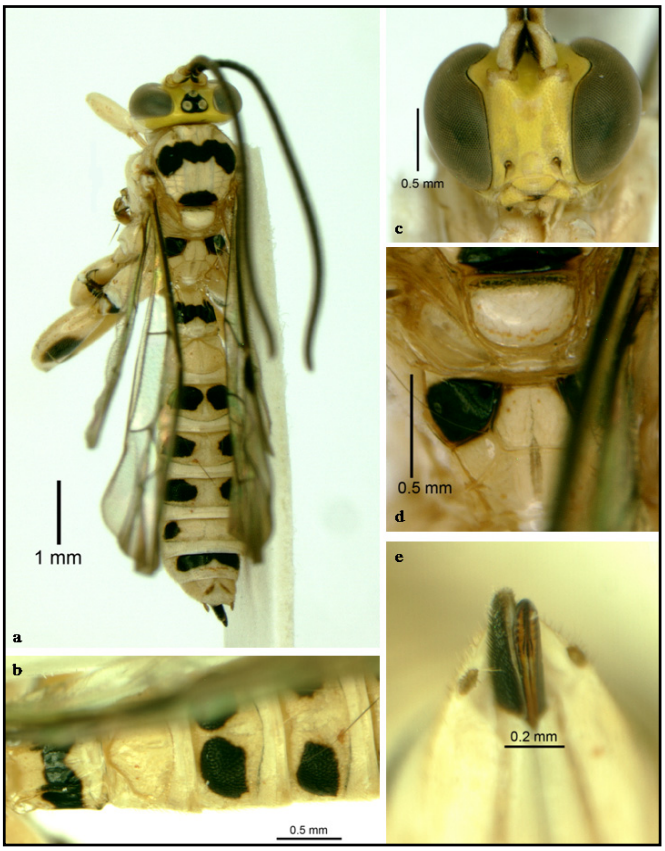

Figure 71. *X. oriole*: a. dorsal view; b. dorsal view of metasomal tergites 1–4; c. face; d. dorsal view of scutellum and propodeum; e. ovipositor

Metasoma. First tergite 1.15x as long as apical width; dorsolateral carina weakly present, median longitudinal carina strong, extending to oblique groove; tergite 2 onwards densely finely punctate; ovipositor straight with seven ridges apically, ovipositor sheath 0.33x length of hind tibia.

Colour. Antenna dark brown, outer side of scape and pedicel yellow; ocellar area black; mesoscutum with three continuous black spots medially and black spot in front of scutellum; tegula brown, transparent posteriorly; propodeum with black spot in area externa; basal 0.15 of mid tibia and base of mid basitarsus black; hind leg with trochanter black, femur with black stripe on posterior face, tibia with large basal, narrow apical black bands, base of basitarsus and fifth tarsomere black; wings hyaline with infuscate margins, pterostigma and veins dark brown, except costa yellowish; tergites 1 and 7 with black bands, tergites 3–6 each with two black spots.

Male. Similar to female, slightly smaller, antenna with 35 flagellomeres.

Distribution. Currently known only from Phong Dien NR, Thua Thien-Hue Province, Central Vietnam (Pham *et al*., 2011c).

Ecological notes. The specimens were collected in lowland evergreen forest (Pham *et al*., 2011c).

***Xanthopimpla panthera* PHAM, BROAD, MATSUMOTO & WÄGELE, 2011**

(Figures 72, 73)

Xanthopimpla panthera Pham, Broad, Matsumoto & Wägele, 2011. Zootaxa, 3056: 37. Holotype: ♀, Vietnam: Dong Nai, Cat Tien NP (RMNH).

Material examined. Dong Nai, Cat Tien NP: 1♀ (RMNH, holotype), 100 m a.s.l., 13–20.v.2005, 1♀ (IEBR, paratype), 02–09.x.2005; 1♀ (RMNH), 14–20.v.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Face 0.9x as high as wide, with minute punctures; mesoscutum polished, only punctate anteriorly; propodeum with area superomedia much wider than long, lateral part of posterior transverse carina absent, area dentipara confluent with area petiolaris; metasomal tergites each with two black spots; ovipositor sheath 0.7x hind tibia; ovipositor lower valve with six apical ridges.

Description (Female). Female. Body length 16.0 mm, fore wing 13.5 mm, ovipositor sheath 2.3 mm. *Head*. Antennal with 40 flagellomeres, first flagellomere 1.75x length of second; diameter of lateral ocellus 1.1x ocellar-ocular distance; frons polished; face 0.9x as high as wide, with numerous minute punctures; clypeus 0.5x as high as wide, apical margin thin and emarginate; malar space about 0.4x basal width of mandible.

Mesosoma. Epomia short; mesoscutum as long as wide at anterior level of tegulae, polished, with small punctures anteriorly, notaulus on anterior 0.2 of mesoscutum, ending before anterior level of tegula; scutellum convex, lateral carina forming lateral flange medially 0.7x as high as first flagellomere width, gradually narrowed at apex; mesopleuron with fine punctures, pubescent, epicnemial carina present on lower half, postpectal carina medially forming wide and moderately high flange; metapleuron polished; propodeum without lateral part of posterior carina, area superomedia 0.5–0.6x as long as wide, area dentipara confluent with area petiolaris; propodeal spiracle elongate, 4.0x as long as wide. Hind leg with femur 2.2x as long as wide, 0.8x length of tibia, tibia as long as tarsus, basitarsus 0.3x length of tarsus, 2.0x second tarsomere, third tarsomere 1.3x as long as wide, fifth tarsomere longer than third; mid tibia with four bristles near apex, five bristles at apex; hind tibia with 3–6 bristles near apex, three bristles at apex; largest bristles on mid and hind tarsal claws widened. Fore wing with vein 2*rs-m* 0.7x vein 3*rs-m*; *cu-a* opposite *Rs*&*M*; hind wing with first abscissa of vein *Cu*1 about 0.3x length of vein *cu-a*.

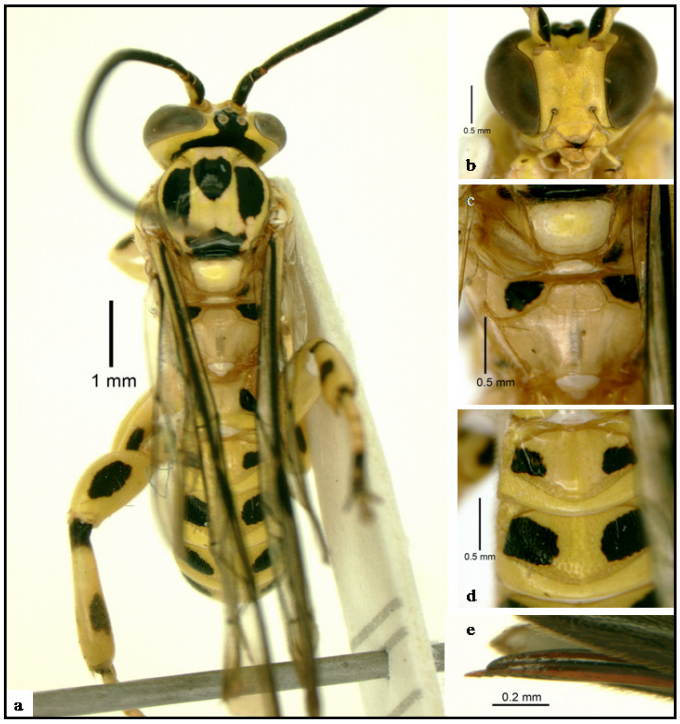

Figure 72. *X. panthera*: a. dorsal view; b. face; c. dorsal view of scutellum and propodeum; d. dorsal view of metasomal tergites 2–3; e. ovipositor tip

Metasoma. First tergite as long as apical width, dorsolateral carina weakly present from base to spiracle, median longitudinal carina nearly extending to oblique groove; tergite 3 onwards densely, coarsely punctate; ovipositor weakly decurved at tip, lower valve with six small ridges at tip, ovipositor sheath 0.75x length of hind tibia.

Colour. Antenna dark brown, except outer side of scape, pedicel and first flagellomere yellow; ocellar area black; hind slope of vertex to occipital area black; mesoscutum with three separate longitudinal black spots medially and black spot at base of scutellum; tegula brown, transparent posteriorly; propodeum with black spot in area externa; metaepisternum with two lateral black spots; fore and mid femora with black bands on outer side; base of hind coxa with oval black spot anteriorly, hind trochanter black laterally, hind femur with postmedian back stripe larger than anteromedian black stripe, basal 0.2 of tibia black, lower side of hind tarsus black, upper side yellowish; wings hyaline with infuscate margins, pterostigma and veins dark brown, except basal half of costa yellowish; metasomal tergites 1–6 each with two black spots, tergites 7–8 with median black spots; ovipositor reddish brown; ovipositor sheath black.

Male. Unknown.

Distribution. Currently known only from Cat Tien NP, Dong Nai Province, South Vietnam (Pham *et al*., 2011c).

Ecological notes. The specimens were collected in lowland evergreen forest (Pham *et al*., 2011c).

***Xanthopimpla pleuralis* CUSHMAN, 1925**

(Figures 68f, 69f, 73)

Xanthopimpla pleuralis Cushman, 1925. Ent. Mitt., 14: 49. Holoype: ♂, Taiwan: Kangkou [= Kankau], Hengchun (DEI).

Material examined. Hoa Binh, Yen Thuy, Lac Thinh: 1♀ (IEBR), 20−30.iii.2002; 1♀ (IEBR), 20−30.v.2002; 1♀ (IEBR), 10−20.vi.2002; 1♀1♂ (IEBR), 10−20.viii.2002, Malaise trap, L. D. Khuat leg.; Yen Bai, Luc Yen, Phuc Loi: 1♀ (IEBR), 07.x.2004, hand net, L. D. Khuat leg.; Nghe An, Pu Mat NP: 1♀ (ZFMK), 150−200 m a.s.l., 16.iv.2006, hand net, N. T. Pham leg.; Bac Can, Ba Be NP: 1♀ (OMNH), 200 m a.s.l., 22°23'N 105°37'E, 03.v.2006, hand net, R. Matsumoto leg.; Thai Nguyen, Cat Ne, Dai Tu: 1♀ (IEBR), 20.iv.2008, Malaise trap, L. D. Khuat leg.; Ha Tinh, Huong Khe, Huong Trach: 1♀ (IEBR), 22.v.2008, hand net, T. V. Hoang leg.; Phu Tho, Xuan Son NP: 1♀ (BMNH), 21−25.iv.2009; 1♀ (IEBR), 09−14.vi.2009; 1♀ (IEBR), 19−24.vi.2009, Malaise trap, L. D. Khuat leg.

Diagnosis. Median black mark on mesoscutum rounded, lateral black marks usually joined posteriorly to black mark in front of scutellum; mesopleuron with black spot medially; propodeum with area superomedia confluent with area dentipara; mid and hind tarsal claws with very broad bristles apically; ovipositor sheath long, about 1.8–2.2x hind tibia.

Distribution. Pham & Le (2007) recorded this species from Vietnam for the first time on the basis of the material collected from Pu Mat NP, Nghe An Province (Central Vietnam). Our records filled the distribution gaps of this species in northern Vietnam. Outside Vietnam, it has been reported from China, Indonesia, Nepal, Taiwan and the Philippines (Yu *et al.,* 2005).

Remarks. Three subspecies are currently recognised: *X. pleuralis pleuralis* from China, Nepal, Vietnam and Taiwan; *X. pleuralis luzonica* Townes & Chiu from the Philippines; and *X. pleuralis maculicollis* Townes & Chiu from Indonesia and the Philippines (Townes & Chiu, 1970; Yu *et al.,* 2005). The specimens from Vietnam belong to the nominate subspecies, characterized by the presence of black marks on the propodeum and mesopleuron, the absence of a black mark on the pronotum and black spots on female tergites 2, 4 and 6 (Pham & Le, 2007; Pham *et al*., 2011c).

***Xanthopimpla polyspila* CAMERON, 1907**

(Figures 68c, 68i, 69d, 69i, 73)

Xanthopimpla polyspila Cameron, 1907. Tijdschr. v. Ent., 50: 101. Holoype: ♀, India: Sikkim (BMNH).

Material examined. Nghe An, Pu Mat NP: 1♀ (IEBR), 250 m a.s.l., 11.ix.2005, hand net, N. T. Pham leg.; Nghe An, Phuc Son, Anh Son: 1♂ (ZFMK), 300–400 m a.s.l., 22.iv.2006, hand net, H. X. Le leg.; Thua Thien-Hue, A Luoi, A Roang: 1♀ (IEBR), 700 m a.s.l., 29.v.2006, hand net, N. T. Pham leg.;

Thai Nguyen, Dai Tu, Cat Ne: 1♂ (IEBR), 25–30.xii.2006; 1♂ (IEBR), 20.iv.2007, Malaise trap, L. D. Khuat leg.; Dong Nai, Cat Tien NP: 1♂, 100 m a.s.l., 15–20.v.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.; Vinh Phuc, Phuc Yen, Ngoc Thanh: 1♂ (IEBR), 150 m a.s.l., 15.vii.2007, Malaise trap, T. H. Pham leg.; Ha Tinh, Vu Quang NP: 1♂ (RMNH), 66 m a.s.l., 18°20.47'N 105°26.29'E, 22.ix–6.x.2009, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Hind slope of vertex and occipital area widely black; face densely, finely punctate; area superomedia usually with two small black spots; metasomal tergites each with two black spots; ovipositor sheath 1.6x hind tibia.

Distribution. The Plant Protection Research Institute (1976) previously recorded this species from Vietnam on the basis of the material from Ha Tay Province (now Hanoi City). Our records extended the distribution of this species to Central and South Vietnam. Outside Vietnam, *X. polyspila* is known from China, India, Indonesia and Taiwan (Yu *et al.*, 2005).

***Xanthopimpla quatei* TOWNES & CHIU, 1970**

(Figure 73)

Xanthopimpla quatei Townes & Chiu, 1970. Mem. Amer. Ent. Inst., 14: 150. Holotype: ♀, Vietnam: 30 km north of Pleiku [now in Gia Lai Province], South Vietnam (BPBM).

Material examined. None.

Diagnosis. Lateral and median black marks on mesoscutum joined posteriorly to black mark in front of scutellum; lateral carina of scutellum forming relatively high flange, medially about 0.5x first flagellomere width; metasomal tergites smooth, with sparse punctures; ovipositor sheath 1.25x hind tibia; ovipositor lower valve with three apical ridges.

Distribution. Townes & Chiu (1970) described this species on the basis of the female holotype collected from Pleiku (now in Gia Lai Province). Outside Vietnam, *X. quatei* has been reported from Malaysia (Idris *et al*., 2003).

Remarks. Pham *et al.* (2011c) recorded this species from Dak Lak Province based on a single specimen. However, that specimen is herein reidentified as *X. chiuae*.

***Xanthopimpla sikkimensis* CAMERON, 1907**

(Figures 69g, 73)

Xanthopimpla sikkimensis Cameron, 1907. Tijdschr. v. Ent., 50: 100. Holotype: ♀, India: Sikkim (BMNH).

Material examined. Thua Thien-Hue, Phong Dien NR: 1♀ (RMNH), 80–210 m a.s.l., 23.iii–06.iv.2001, Malaise trap, C. v. Achterberg & R. de Vries leg.; Ha Tinh, Huong Son, Son Hong: 1♀

(IEBR), 24.iv.2004, hand net, L. X. Truong leg.

Diagnosis. Hind slope of vertex with black area medially; notaulus deep, extending to median level of tegula; hind tibia with black marks anteriorly, posteriorly, apically; propodeum and metasomal tergites 1, 3, 7 with black bands; ovipositor sheath about 1.0–1.2x hind tibia; ovipositor decurved at tip.

Distribution. Townes & Chiu (1970) previously recorded this species from Vietnam for the first time on the basis of material from Lai Chau and Hoa Binh provinces (North Vietnam). Our records extended the distribution of this species to Central Vietnam. Outside Vietnam, *X. sikkimensis* has been reported from India and Myanmar (Yu *et al*., 2005).

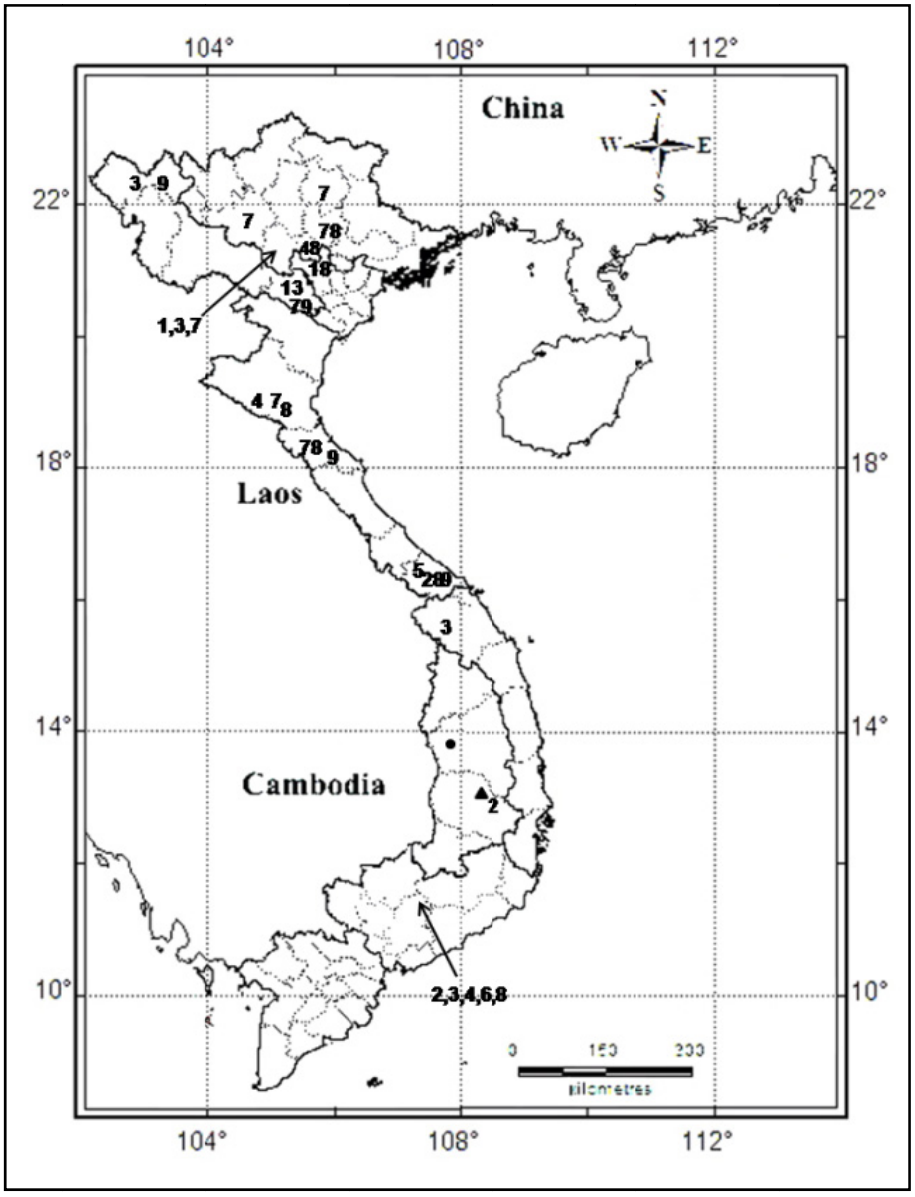

Figure 73. Distribution map of *Xanthopimpla terebatrix* species group: 1. *X. annulata*; 2. *X. atriclunis*; 3. *X. conica*; 4. *X. decurtata*; 5. *X. oriole*; 6. *X. panthera*; 7. *X. pleuralis*; 8. *X. polyspila*; 9. *X. sikkimensis*; (•). *X. hienae*; (▲). *X. quatei*

The *trunca* species group

Diagnosis. Lower anterior corner of pronotum very broadly rounded, forming an angle of more than 130°; notaulus usually longer than tegula length; scutellum strongly convex to low conical; propodeal carinae incomplete or entirely absent; fore wing with areolet closed; largest bristles of mid and hind tibia widened apically; first tergite with dorsolateral carina complete, strong between spiracle and apex (Townes & Chiu, 1970).

***Xanthopimpla calva* TOWNES & CHIU, 1970**

(Figures 66d, 74a, 75)

Xanthopimpla calva Townes & Chiu, 1970. Mem. Amer. Ent. Inst., 14: 240. Holotype: ♀, the Philippines: Gapan, Nueva Ecija (AEIC).

Xanthopimpla calva sexcincta Townes & Chiu, 1970. Mem. Amer. Ent. Inst., 14: 241. Holotype: ♂, Malaysia: North Borneo (BPBM).

Material examined. Nghe An, Pu Mat NP: 1♂ (IEBR), 300–400 m a.s.l., 23.iv.2006, hand net, H. X. Le leg.; Dak Lak, Ea So NR: 1♀ (IEBR), 310 m a.s.l., 12°55.93'N 108°37.96'E, 27.vii.2008, Malaise trap, H. T. Ngo leg.

Diagnosis. Propodeum without carinae, except apical part of lateral longitudinal carina present; first tergite broad, shorter than apical width; metasomal tergites 1, 3, 4, 5, and 7 each with two black spots; ovipositor sheath 0.35x hind tibia.

Distribution. Pham & Le (2007) recorded this species for the first time from Vietnam on the basis of material collected from Nghe An Province, Central Vietnam. Pham et al. (2011c) reported an additional record of this species from Dak Lak Province. Outside Vietnam, this species has been recorded from India, Malaysia, Myanmar and the Philippines (Yu *et al.*, 2005).

Remarks. Four subspecies are currently recognised: *X. calva calva*, *X. calva calcis* Townes & Chiu*, X. calva periscelis* Townes & Chiu from the Philippines, and *X. calva sexcincta* Townes & Chiu from India, Myanmar and Malaysia (Townes & Chiu, 1970; Yu *et al.,* 2005). The Vietnamese specimens belong to *X. calva sexcincta*, which differs from the nominate subspecies and from *X. calva periscelis* by the presence of black marks on the first tergite, and can be distinguished from *X. calva calcis* by the apically black mid and hind tibiae (Pham & Le, 2007; Pham *et al*., 2011c).

***Xanthopimpla fastigiata* KRIEGER, 1914**

(Figures 74b, 75)

Xanthopimpla fastigiata Krieger, 1914. Arch. f. Naturgesch., (A) 80 (6): 30. Holotype: ♂, Indonesia: Sumatra, Sarik (ZMHB).

Xanthopimpla fastigiata evittipes Townes & Chiu, 1970. Mem. Amer. Ent. Inst., 14: 234. Holotype:

♂, India: Charduar forest, Rangapara, Assam (GPTA).

Material examined. Phu Tho, Thuong Cuu: 1♀1♂ (IEBR), 350–400 m a.s.l., 20°59'N 105°8'E, 11–16.x.1999, Malaise trap, R. de Vries leg.; Thua Thien-Hue, Phong Dien NR: 1♂ (RMNH), 80–210 m a.s.l., 23.iii–06.iv.2001, Malaise trap, C. v. Achterberg leg.; Phu Tho, Xuan Son NP: 1♀ (IEBR), 300 m a.s.l., 08.xiiI.2003, hand net, L. X. Truong leg.; Ha Noi, Ba Vi NP: 1♀ (IEBR), 800 m a.s.l., 14.viii.2006, hand net, H. T. T. Nguyen leg.; Dak Lak, Chu Yang Sin NP: 1♂ (RMNH), 750 m a.s.l., 01–10.vi.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Propodeum with basal transverse carina, lateromedian longitudinal carina present only in front of basal transverse carina; tergites 1, 3, 5, and 7 each with black band; ovipositor sheath 0.9x hind tibia.

Distribution. Pham *et al.* (2011c) recently recorded this species for the first time from Vietnam. Outside Vietnam it has been known from India, Indonesia, Malaysia, Singapore, Thailand and the Philippines (Yu *et al*., 2005).

Remarks. Two subspecies are currently recognised: *X. fastigiata fastigiata* from Malaysia, Singapore, Indonesia, and the Philippines, which differs from *X. fastigiata evittipes* Townes & Chiu from India and Thailand by its more profuse black markings (including the hind slope of the head; mid and hind femora, tergites 2, 4, and 6) (Townes & Chiu, 1970; Yu *et al.*, 2005). The specimens from northern Vietnam belong to *X. fastigiata evittipes*. The male specimens collected from Thua Thien-Hue and Dak Lak provinces belong to the nominate subspecies. Whether these subspecies represent clinal variation in the extent of black markings or are different species remains to be tested.

***Xanthopimpla minuta* CAMERON, 1905**

(Figures 74c, 74g, 75)

Xanthopimpla minuta Cameron, 1905. Spolia Zeylanica, 3: 137. Holotype: ♀, Sri Lanka: Kandy (BMNH).

Material examined. Thua Thien-Hue, Phong Dien NR: 1♀ (RMNH), 50–100 m a.s.l., 26.iii.2001; 1♀ (RMNH), 29.iii.2006, C. v. Achterberg leg.; Phu Tho, Xuan Son NP: 1♂ (IEBR), 300 m a.s.l., 09.v.2005, hand net, N. T. Pham leg.; Quang Tri, Huong Hoa, Huong Phung: 1♀ (IEBR), 900–1000 m a.s.l., 04.vi.2006, hand net, N. T. Pham leg.; Nghe An, Pu Mat NP: 1♀ (IEBR), 400–500 m a.s.l., 16.vii.2006, hand net, H. X. Le leg.

Diagnosis. Notaulus extending to posterior level of tegula; scutellum convex; hind wing with vein 1*A* indistinct; propodeum with lateromedian longitudinal carina present behind basal transverse carina; tergites 2 and 6 entirely yellow; ovipositor sheath about 0.3x hind tibia.

Distribution. Townes & Chiu (1970) recorded this species from Vietnam for the first time on the basis of material collected from Dak Lak Province (Central Highlands of Vietnam). Our record extended the distribution of this species northwards to Central and North Vietnam. Outside Vietnam, this species was known from China, India, Malaysia, Nepal, Sri Lanka, Taiwan, Thailand and the Philippines (Yu *et al.*, 2005).

Remarks. Five subspecies are currently recognised, but they differ only in colour characters that can be expected to vary geographically. The nominate subspecies was described from a Sri Lanka specimen and was recognised by Townes & Chiu (1970) as occurring in India, Nepal, Sri Lanka, Taiwan, Thailand and Vietnam. Patil & Nikam (1995) subsequently described *X. minuta aurangabadensis* from India. The nominate subspecies differs from *X. minuta lita* Townes & Chiu from Malaysia by its entirely yellow propodeum, apex of the hind tibia, tergites 2 and 6. Another subspecies, *X. minuta lotipes* Townes & Chiu, is recognised from the Philippines and Chao (1997) described a further subspecies, *X. minuta quadrula*, from Malaysia. Specimens from Vietnam are closer to the nominate subspecies but specimens from Central Vietnam have apically blackish hind tibiae. Probably all of these subspecies could readily be synonymised, but I am not sure of the identity of *X. minuta aurangabadensis*, *X. minuta lotipes* or *X. minuta quadrula*.

***Xanthopimpla pleuroschista* TOWNES & CHIU, 1970**

(Figures 74d, 75)

Xanthopimpla pleuroschista Townes & Chiu, 1970. Mem. Amer. Ent. Inst, 14: 232. Holotype: ♀, India: Khasi Hill (GPTA).

Material examined. Vinh Phuc, Tam Dao NP: 1♀ (OMNH), 900–1200 m a.s.l., 08.v.1998, hand net, R. Matsumoto leg.

Diagnosis. Area superomedia closed by strong carinae, 0.9x as long as wide; basal transverse carina absent; pleural area of propodeum divided by posterior transverse carina; ovipositor sheath 0.3x hind tibia.

Distribution. Pham *et al.* (2011c) recently recorded this species for the first time from Vietnam. Outside Vietnam, it has been known from India (Yu *et al.,* 2005).

***Xanthopimpla sexlineata* CAMERON, 1907**

(Figures 74e, 74i, 75)

Xanthopimpla sexlineata Cameron, 1907. Tijdschr. v. Ent. 50: 103. Holotype: ♂, India: Sikkim (BMNH).

Material examined. Kon Tum, Chu Mom Ray NP: 2♀ (RMNH), 700–900 m a.s.l., 26.ix–05.x.2006, Malaise trap, Q. P. Mai & M. T. Nguyen leg.

Diagnosis. Centre of scutellum with low blunt cone, laterally with short transverse ridge

attached to lateral carina; propodeum with lateromedian longitudinal carina present behind basal transverse carina; tergites 2–7 each with black transverse band subbasally; ovipositor sheath 0.25x hind tibia.

Distribution. Pham *et al.* (2011c) recently recorded this species from Vietnam for the first time. Outside Vietnam, it has been known from India and Thailand (Yu *et al.,* 2005).

Remarks: The specimens in Vietnam have the dark markings on the metasomal tergites more extensive than specimens from India and Thailand and also have a shorter ovipositor sheath (0.25x hind tibia versus 0.44x). Otherwise, they are morphologically very close to the type of *X. sexlineata*.

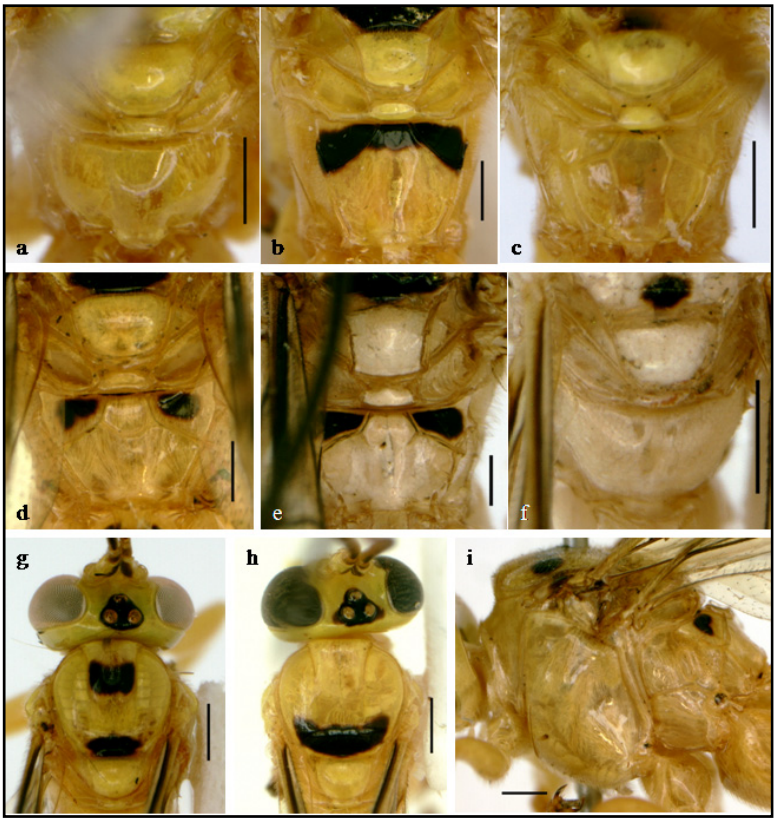

Figure 74. *Xanthopimpla* species (scales 0.5 mm). From a to f – dorsal views of scutellum and propodeum: a. *X. calva*; b. *X. fastigiata*; c. *X. minuta*; d. *X. pleurochista*; e. *X. sexlineata*; f. *X. trias*; g & h – dorsal views of head and mesonotum: g. *X. minuta*; h. *X. trias*; i. lateral view of mesosoma of *X. sexlineata*

***Xanthopimpla trias* TOWNES & CHIU, 1970**

(Figures 74f, 74h, 75)

Xanthopimpla trias Townes & Chiu, 1970. Mem. Amer. Ent. Inst., 14: 242. Holotype: ♀, India: Mercara, Mysore (GPTA).

Material examined. Vinh Phuc, Tam Dao NP: 1♂ (OMNH), 900–1200 m a.s.l., 08.v.1998; 1♀ (OMNH), 28.iv.2000, hand net, R. Matsumoto leg.; Dak Lak, Chu Yang Sin NP: 1♀ (RMNH), 270 m

a.s.l., 01–10.vi.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Propodeum without carinae, except apical part of lateral longitudinal carina and small stub of lateromedian longitudinal carina; tergites 1, 4, 7 each with black band or sometimes tergites 1 and 3 with two black spots; ovipositor 0.45x hind tibia.

Distribution. Townes & Chiu (1970) recorded this species for the first time from Vietnam on the basis of material collected from Dak Lak Province (Central Highlands of Vietnam). Our records extended the distribution of this species northwards to Vinh Phuc Province. Outside Vietnam, this species has been recorded from China, India, Nepal, Taiwan and Thailand (Yu *et al.,* 2005).

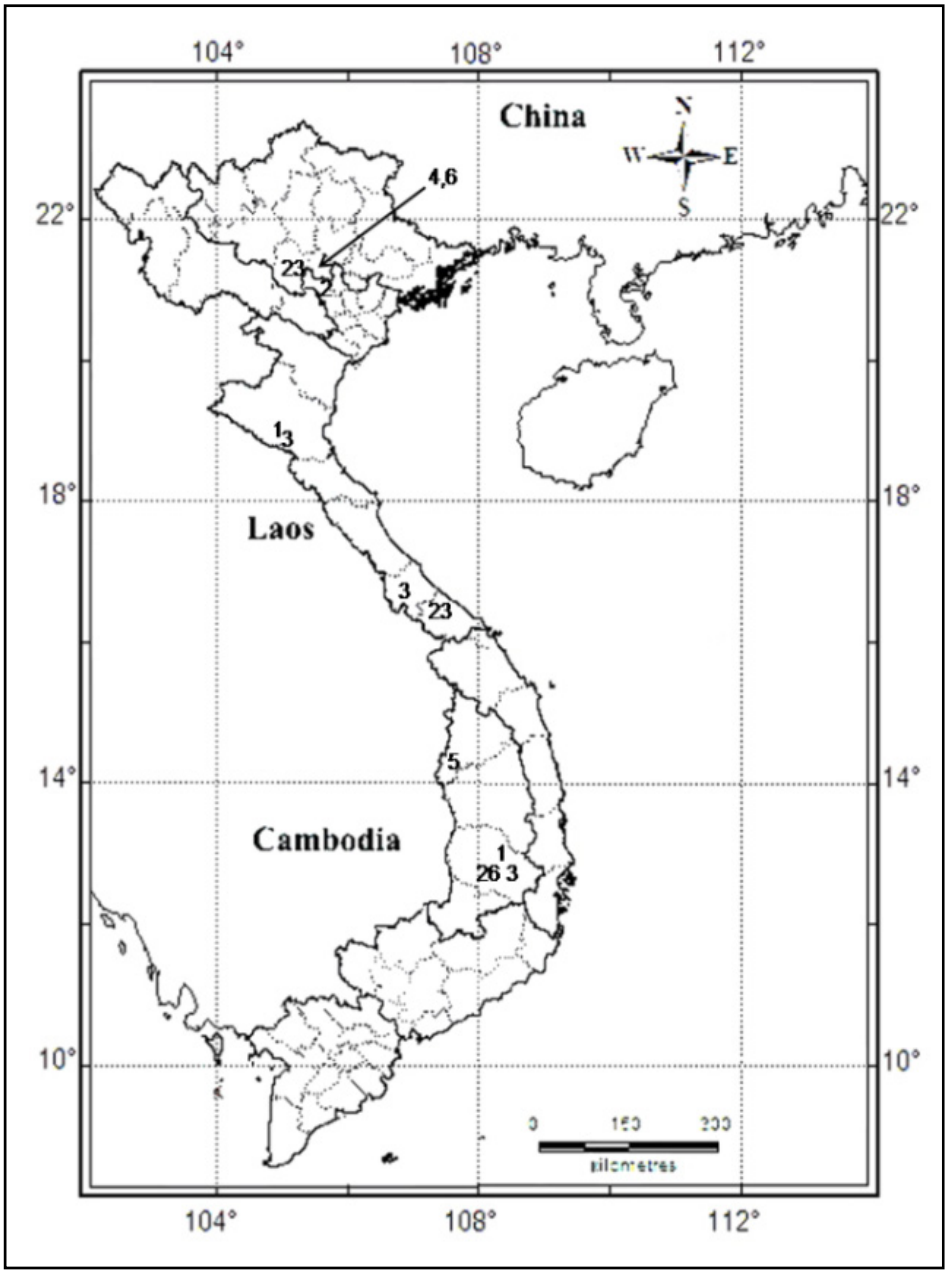

Figure 75. Distribution map of *Xanthopimpla trunca* species group: 1. *X. calva*; 2. *X. fastigiata*; 3. *X. minuta*; 4. *X. pleuroschista*; 5. *X. sexlineata*; 6. *X. trias*

The *xystra* species group

Diagnosis. Scutellum without lateral carina; propodeum long, flattened, almost without carinae; submetapleural carina partly or entirely absent; mid and hind tibiae with dense, stout bristles; fore wing with areolet closed; ovipositor lower valve with apical vertical and subapical oblique ridges, tip of lower valve enclosing tip of upper valve (Townes & Chiu, 1970; Pham *et al*., 2011c).

***Xanthopimpla boehmei* PHAM, BROAD, MATSUMOTO & WÄGELE, 2011**

(Figures 76, 77)

Xanthopimpla boehmei Pham, Broad, Matsumoto & Wägele, 2011. Zootaxa, 3056: 41. Holotype: ♀, Vietnam: Dak Lak, Chu Yang Sin NP (IEBR).

Material examined. Dak Lak, Chu Yang Sin NP: 1♀ (IEBR, holotype) 1♂ (BMNH, paratype), 28.vii.2008, Malaise trap, H. T. Ngo leg.

Diagnosis. Face swollen, 0.75x as high as wide; scutellum flat, without lateral carina; metapleuron with posterior 0.4 of submetapleural carina present; mid and hind tibiae with extensive areas of densely packed, stout bristles; ovipositor tip lower valve with apical vertical and basal oblique ridges, enclosing tip of upper valve; ovipositor sheath 0.45x hind tibia.

Description (Female). Body length 10.0 mm, fore wing 9.0 mm, ovipositor sheath 1.0 mm. *Head*. Antenna with 32 flagellomeres, first flagellomere 1.6x length of second; diameter of lateral ocellus equal to ocellar-ocular distance; frons polished; face swollen, distinctly protruding anterior to level of compound eyes, 0.75x as high as wide, with moderate-sized punctures, densely pubescent; clypeus 0.45x as high as wide, apical margin thin, emarginate; malar space about 0.35x basal width of mandible.

Mesosoma. Epomia short; lower anterior corner of pronotum rounded at about 95°; mesoscutum 1.15x as long as wide at anterior level of tegulae, weakly convex, with moderately dense, short hairs anteriorly; notaulus short, shallowly present anteriorly; scutellum flat, pubescent, without lateral carina; mesopleuron with sparse, fine punctures, pubescent, subtegular ridge narrow; epicnemial carina present on lower half, postpectal carina medially forming wide, low flange; metapleuron polished, posterior 0.4 of submetapleural carina weakly present; propodeum without carinae, except pleural carina and posterior 0.2 of lateral longitudinal carina; propodeal spiracle elongate, located at centre of pleural area. Hind leg with femur 2.3x as long as wide, 0.7x length of tibia, tibia as long as tarsus, basitarsus 0.3x length of tarsus, 2.15x second tarsomere, third tarsomere as long as wide, fifth tarsomere longer than third; mid and hind tibiae with extensive patch of densely packed, stout bristles covering apical 0.7; largest bristles on mid and hind tarsal claws widened. Fore wing with vein 2*rs-m* about 0.77x vein 3*rs-m*; *cu-a* opposite

Rs&*M*; hind wing with first abscissa of vein *Cu*1 about 0.2x length of vein *cu-a*.

Metasoma. First tergite 1.05x as long as apical width; dorsolateral carina present from base to spiracle, median longitudinal carina shortly present at base; oblique groove absent; tergite 3 impunctate medially; tergites 4–5 with dense, moderate-sized punctures; ovipositor straight, lower valve with apical vertical and subapical oblique ridges enclosing tip of upper valve, ovipositor sheath 0.45x length of hind tibia.

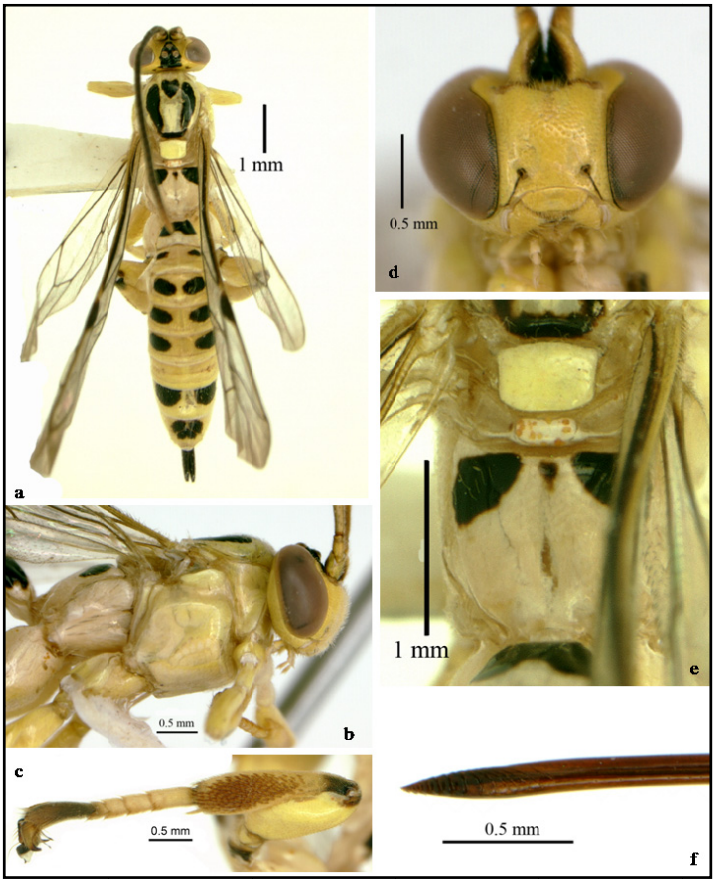

Figure 76. *X. boehmei*: a. dorsal view; b. lateral view of head and mesosoma; c. hind leg; d.face; e. dorsal view of scutellum and propodeum; f. ovipositor tip

Colour. Upper face of antenna black, lower face brown to dark brown, outer side of scape and pedicel yellow, three apical flagellomeres reddish brown; black ocellar area extending to frons and narrowly to hind slope of head; mesoscutum with lateral black mark elongate, joined posteriorly to black mark in front of scutellum, median black spot heart-shaped; propodeum with large lateral and small median black spots basally; mid leg with fifth tarsomere blackish; hind trochanter marked with black, hind femur black apically; basal 0.2 of hind tibia and fifth tarsomere black; wings hyaline with infuscate margins, pterostigma and veins dark brown, except costa yellowish; tergite 1 with black band; tergite 2 with two small, tergites 3–5 with medium-sized and tergite 7 with large black spots.

Male. Similar to female, slightly smaller.

Distribution. Currently known only from Chu Yang Sin NP, Dak Lak Province, Central Highlands of Vietnam (Pham *et al*., 2011c).

Ecological notes. The specimens were collected in evergreen forest (Pham *et al*., 2011c).

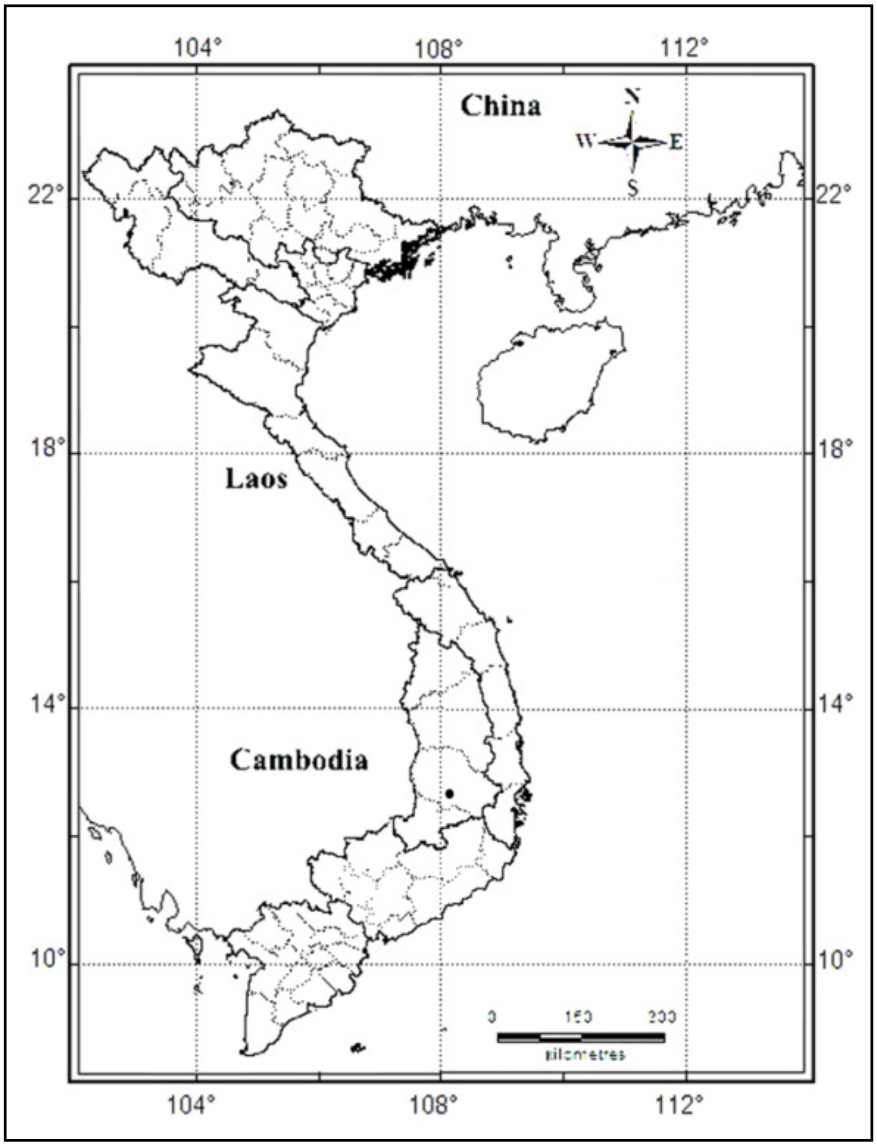

Figure 77. Distribution map of *X. boehmei*

CHAPTER 2. THE *THERONIA* GENUS-GROUP

Diagnosis. Head in profile at vertex moderately long, weakly and evenly rounded down to occipital carina; clypeus not divided by a transverse carina; mandible not twisted; anterior margin of pronotum reflexed centrally and produced into a backwardly directed point; mesoscutum centrally evenly pubescent; mesopleuron with epicnemial carina always present, at least on lower half, mesopleural suture with an angulation in the middle; metapleuron with submetapleural carina complete, strongly expanded into an anterior lobe; fore wing with vein 3*rs-m* present, areolet closed; hind wing with first abscissa of vein *Cu*1 shorter than length of vein *cu-a*; hind tarsal claws large, simple, enlarged setae of claws with flattened tips, in female without basal lobe; propodeum more or less areolated, lateral longitudinal and basal part of lateromedian longitudinal carinae always present, propodeal spiracle elongate; metasomal tergites smooth or with indistinct punctures, pubescent; body yellow, frequently banded with black or ferruginous (Gupta, 1962; Townes, 1969; Gauld *et al*., 2002).

The *Theronia* genus-group comprises a distinctive assemblage of pimplines, characterised by large, spatulate bristles at the bases of the tarsal claws, generally conspicuous black and yellow markings and a series of character states that are probably plesiomorphic within the tribe Pimplini (Gauld *et al.*, 2002). The generic classification of the *Theronia* genus-group is complicated by their paraphyly with respect to the *Pimpla* genus-group, coupled with the probable paraphyly of at least *Neotheronia* and *Theronia*, based on morphological phylogenetic analysis (Gauld *et al.*, 2002). This group comprises six genera: viz. *Augerella*, *Epitheronia*, *Neotheronia*, *Nomosphecia*, *Parema* and *Theronia*. These were previously treated as subgenera of the genus *Theronia*, and classified within the tribe Theroniini (Ephialtinae) (Gupta, 1962; Townes, 1969; Gauld, 1984). Subsequently, they were elevated to distinct genera (Gupta, 1987) and transferred them to the tribe Pimplini Gauld (1991). Of the six genera, *Neotheronia* is species-rich in the Neotropical region with two species in the Nearctic region and a few Afrotropical species (Townes & Townes, 1973). Some species of *Nomosphecia* have been recorded from the Neotropics and species of *Theronia* are found in the Nearctic, Afrotropical and Palearctic realms (Yu *et al.*, 2005); otherwise, all genera other than *Neotheronia* are most species-rich in the Indo-Australian region (Gupta, 1962).

In Vietnam, all genera are represented except *Neotheronia* (Krieger, 1906; Gupta, 1962; Pham *et al.*, 2010; Pham *et al.*, 2011a; 2013b).

The biology of the *Theronia* genus-group is generally poorly known. Some *Nomosphecia* species have been reared from vespid nests in Malaysia and in the Philippines (Gupta, 1962). The genera *Neotheronia* and *Theronia* are known to be parasitoids or more commonly pseudohyperparasitoids via ichneumonoid primary parasitoids (Gauld, 1984, 1991); they have also

been reared from pupae and cocooned larvae of a variety of Lepidoptera (Gupta, 1962; Gauld, 1984, 1991). No species of the *Theronia* genus-group have been reared in Vietnam.

***Augerella* Gupta, 1962**

Theronia (*Augerella*) Gupta, 1962: 86. Type: *Theronia* (*Augerella*) *orientalis orientalis* Gupta; by original designation.

Augerella Gupta: Gupta (1987).

Diagnosis. Mandible teeth equal in length; clypeus without tubercles or swellings, flat, basally slightly raised or basally strongly convex and apically deeply concave; frons with or without a short vertical carina between antennal sockets; notaulus indistinct or shallow present anteriorly; epicnemial carina present on lower half of mesopleuron, erased on upper half; ovipositor with tip compressed laterally, upper valve with tip bulb-like or with oblique ridges near apex (Gupta, 1962; Townes, 1969).

Gupta (1962) recognised three species of *Augerella*: *A. orientalis* (Gupta) from India, Malaysia and the Philippines, *A. compressa* (Gupta) and *A. inserta* (Gupta), both from the Philippines. Pham *et al.* (2010) recorded *A. orientalis* as new for Vietnam and Pham *et al.* (2011a) described two new species, *A. achterbergi* and *A. vriesi*.

Cushman (1933) described *Theronia brevicauda* from Taiwan which was subsequently transferred to *Nomosphecia* by Gupta (1962). Our examination of the holotype of this species deposited at DEI showed that the upper and lower teeth of the mandible are equal in length and the ovipositor tip is compressed, which fits the diagnosis of *Augerella*. Therefore Pham *et al.* (2013b) reallocated this species to the genus *Augerella*. Morphological comparison between the holotype of *T. brevicauda* and the origin description of *Augerella orientalis* by Gupta (1962) revealed that they are conspecific. Consequently, *Theronia* (*Augerella*) *orientalis* Gupta, 1962 was regarded as a junior synonym of *Augerella brevicauda* (Cushman, 1933) (Pham *et al*., 2013b).

Key to Vietnamese species of *Augerella*

1. Lower valves of ovipositor with vertical ridges near apex; upper valve without ridges, bulb-like near apex (Figure 79d); metapleuron with distinct ridges extending from submetapleural carina to posterior margin near hind coxa (Figure 79c); body lemon yellow with black marks (Figure 79a).....*A. brevicauda* (Cushman)

-. Lower and upper valves of ovipositor both with slanting ridges and tapering at apex (Figures 78d, 80f); metapleuron without ridges or with some small ridges along submetapleural carina, not extending to posterior margin near hind coxa; body light yellow with ferruginous or black marks (Figures 78a, 80a).....2

2. Clypeus basally strongly convex, apically deeply concave (Figure 78b); ovipositor 0.7 times as long as hind tibia.....*A. achterbergi* Pham, Broad & Lampe

-. Clypeus mostly flat, basally slightly raised (Figure 80b); ovipositor 1.0 times as long as hind tibia.....*A. vriesi* Pham, Broad & Lampe

***Augerella achterbergi* PHAM, BROAD & LAMPE, 2011**

(Figures 78, 81)

Augerella achterbergi Pham, Broad & Lampe, 2011. Zootaxa, 2745: 68. Holotype: ♀, Vietnam: Dak Lak, Chu Yang Sin NP (RMNH).

Material examined. Dak Lak, Chu Yang Sin NP: 1♀ (RMNH, holotype), 740–900 m a.s.l., 02–10.vi.2007; 1♀ (IEBR, paratype), 500 m a.s.l., 03–09.vi.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Clypeus basally strongly convex, apically deeply concave; ovipositor 0.73x as long as hind tibia, with slanting ridges at the tip of both lower and upper valves.

Description (Female). Body length 11.7 mm, fore wing 10.5 mm, ovipositor sheath 1.3 mm. *Head*. Antenna with 36–37 flagellomeres, first flagellomere 1.4x length of second; diameter of lateral ocellus 0.75x ocellar-ocular distance; frons smooth, slightly convex in front of median ocellus; face 0.8–0.85x as high as wide, slightly convex medially, with shallow and moderate-sized punctures, pubescent; clypeus basally strongly convex, apically strongly concave; malar space about 0.2x basal width of mandible.

Mesosoma. Epomia present, length about 0.5x basal width of mandible; mesoscutum 1.1x as long as wide at anterior level of tegulae, with dense, minute hairs, notauli shallowly present on anterior 0.25 of mesoscutum, ending before line connecting front edges of tegulae; scutellum strongly convex, apically smooth, without striations, lateral carinae present on basal half; mesopleuron with moderately small-size punctures, epicnemial carina present on lower half of mesopleuron, postpectal carina extending only to outer half of mid coxa; submetapleural carina higher next to mid coxa, anterior lobe prominent, smooth, lacking ridges; lower part of metapleuron with some small ridges along submetapleural carina; propodeum with lateromedian longitudinal carinae parallel or slightly widened posteriorly, superomedia area wider than long, posterior transverse carina appearing only as two stubs attached to lateromedian longitudinal carinae, pleural part weakly present, dividing pleural area into two sub-areas; costula absent; petiole smooth, with some transverse wrinkles; propodeal spiracle elongate, 3.8x as long as wide. Hind leg with femur 3.0x as long as wide, length 0.8x tibia, tibia as long as tarsus, basitarsus 0.3x hind tarsus, 1.7x second tarsomere, fifth tarsomere longer than third. Fore wing vein 2*rs-m* about

0.6x length of 3*rs-m*; *cu-a* distad of *Rs*&*M*; hind wing with first abscissa of vein *Cu*1 about 0.4x length of vein *cu-a*.

Metasoma. First tergite 1.5x as long as apically wide, median longitudinal carina tergite extending over spiracle, dorsolateral carina present from base to spiracle; second tergite 0.83x as long as first tergite, 0.8x as long as apical width; third tergite 0.8x longer than second; ovipositor straight, 0.73x length of hind tibia, 1.43x longer than first tergite, lower valves with seven and upper valve with five slanting ridges at tip.

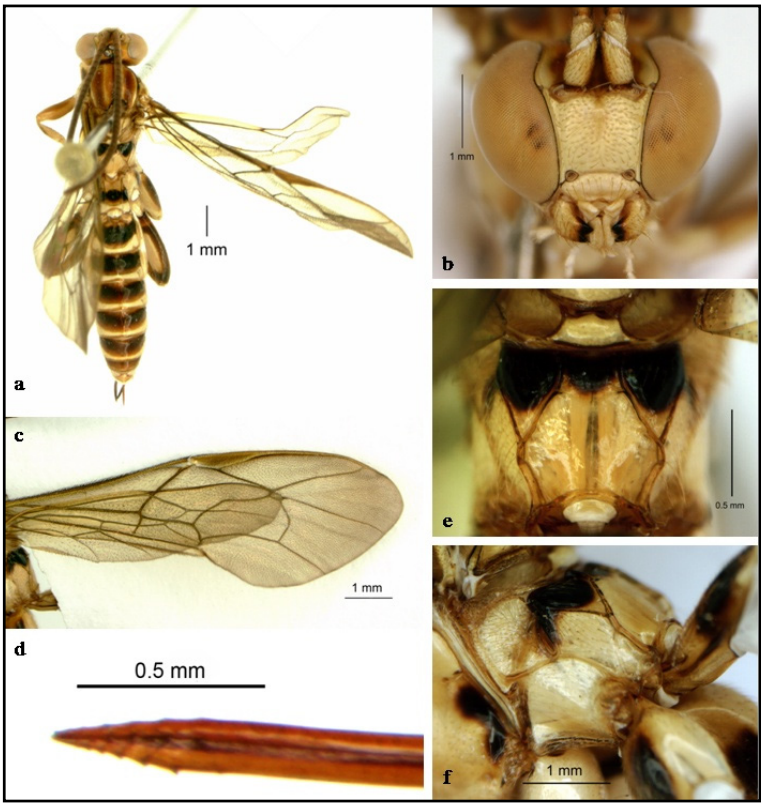

Figure 78. *A. achterbergi*: a. dorsal view; b. face; c. wings; d. ovipositor tip; e. dorsal view of propodeum; f. lateral view of metapleuron

Colour. Light yellow; antenna brown, scape and pedicel yellow on lower side; ocellar area blackish; hind slope of vertex dark brown; frons light brown to reddish brown; mesoscutum with three reddish brown to ferruginous stripes meeting posteriorly at base of scutellum, central stripe black medially, base of scutellum black, lateral carina of mesoscutum blackish on anterior half; tegula brown and transparent posteriorly; scutellum with large, central, black spot; mesopleuron with black stripe on upper margin, black stripe along posterior margin of mesopleuron not extending to mesopleural fovea; propodeum with black spots on area externa and area superomedia, area surrounding propodeal spiracle black; upper side of fore femur light brown; upper and lower side of mid femur black; upper side of mid tibia and mid tarsus dark brown; hind coxa with outer surface almost black, inner surface with dark brown spot near apex; trochantellus

dark brown; anterior side of hind femur surrounded by black stripe, on ventral side interrupted near apex; hind tibia with lower side yellow, upper side dark brown; hind tarsus blackish; wings brownish yellow, pterostigma and veins brown; each metasomal tergite with blackish brown area extending over basal 0.8, and tergites centrally blackish, except first tergite blackish brown only apically; second to fifth sternites, each with two blackish spots; ovipositor light brown; ovipositor sheath blackish.

Distribution. This new species is currently known only from Chu Yang Sin NP, Dak Lak Province, Central Highlands of Vietnam (Pham *et al.*, 2011a).

Ecological note. The specimens were collected in the secondary rainforest at an elevation between 500−900 m a.s.l. (Pham *et al.*, 2011a).

***Augerella brevicauda* (CUSHMAN, 1933)**

(Figures 79, 81)

Theronia brevicauda Cushman, 1933. Ins. Matsumurana 8: 49. Holotype: ♀, Taihorin (DEI).

Theronia (Augerella) orientalis Gupta, 1962. Pac. Ins. Mon. 4: 87. Holotype: ♀, Philippines: Mt. Canlaon, 1100 m, Negros Oriental (AEIC). Synonimized with *A. brevicauda* by Pham *et al*., 2013b.

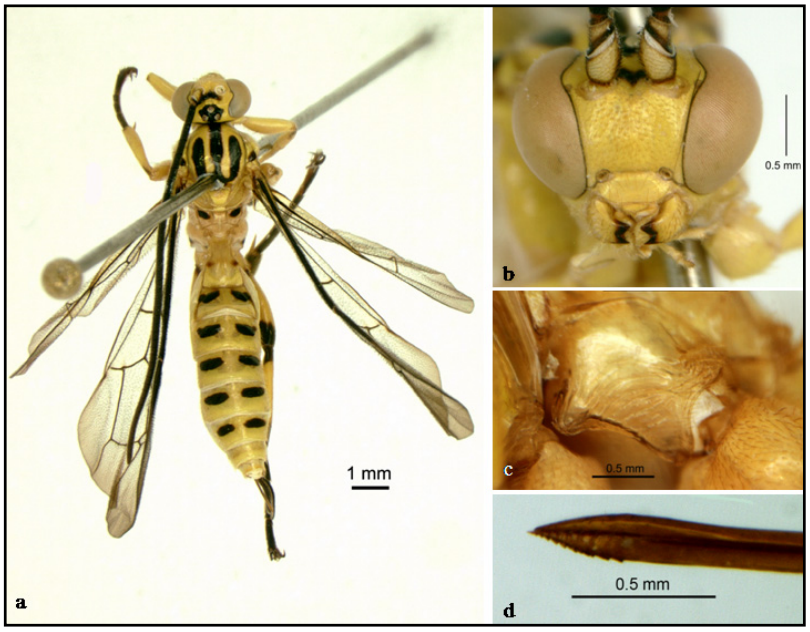

Figure 79. *A. brevicauda*: a. dorsal view; b. face;
c. lateral view of metapleuron; d. ovipositor tip

Material examined. Hanoi, Gia Lam, Da Ton: 1♀ (IEBR), 02–14.vii.2001, Malaise trap, L. D. Khuat leg.; Ha Noi, Ba Vi, Khanh Thuong: 1♀ (IEBR), 16.viii.2006, hand net, H. T. T. Nguyen leg.; Vinh Phuc, Phuc Yen, Ngoc Thanh: 1♀ (IEBR), 150–200 m a.s.l., 11.x.2005; 1♀ (ZFMK), 21.vii.2010, hand net, N. T. Pham leg.; 1♀ (IEBR), 150–200 m a.s.l., 15.vii.2007, Malaise trap, T. H. Pham leg.;

Dong Nai, Cat Tien NP: 2♀ (RMNH), 100 m a.s.l., 01–09.x.2005, Malaise trap, C. v. Achterberg & R. de Vries leg.; Nghe An, Tuong Duong, Tam Quang: 1♀ (IEBR), 150–170 m a.s.l., 14.iv.2006; 1♂ (IEBR), 150–170 m a.s.l., 17.iv.2006; 1♀ (IEBR), 400–600 m a.s.l., 12.vii.2006; 1♀ (IEBR), 400–600 m a.s.l., 16.vii.2006, hand net, H. X. Le leg.; Ninh Thuan, Phuoc Binh NP: 1♀ (IEBR) 1♀ (BMNH), 300 m a.s.l., 12.xi.2008, hand net, L. X. Truong leg.

Diagnosis*.* Clypeus flat, slightly convex at base; mesopleuron without black marks; upper valve of ovipositor bulb-like near apex, without ridges.

Distribution. Pham *et al.* (2010) recorded this species from Vietnam for the first time. Outside Vietnam, it is known from China, India, Indonesia, Malaysia and the Philippines (Yu *et al.,* 2005; Amanda *et al.,* 2011).

***Augerella vriesi* PHAM, BROAD & LAMPE, 2011**

(Figures 80, 81)

Augerella vriesi Pham, Broad & Lampe, 2011. Zootaxa, 2745: 68. Holotype: ♀, Vietnam: Dak Lak, Chu Yang Sin NP (RMNH).

Material examined: Dak Lak, Chu Yang Sin NP: 1♀ (RMNH, holotype), 800−1000 m a.s.l.; 1♀ (IEBR, paratype), 840−940 m a.s.l.; 1♂ (RMNH, paratype), 740−900 m. a.s.l., 02−10.vi.2007, C. v. Achterberg & R. de Vries leg.

Diagnosis. Clypeus flat, basally slightly convex; ovipositor as long as hind tibia with slanting ridges at the tips of both lower and upper valves.

Description (Female). Body length 9.0–10.3 mm, fore wing 8.5–10 mm, ovipositor sheath 1.1–1.5 mm. *Head*. Antenna with 35 flagellomeres, first flagellomere 1.5x length of second; diameter of lateral ocellus 0.75x ocellar-ocular distance; frons smooth, elevated as two ridges above level of median ocellus; face about 0.9x as high as wide, slightly convex medially, with shallow and moderate-sized punctures, pubescent; clypeus flat, basally slightly convex, apical margin slightly emarginated; malar space about 0.2x basal width of mandible.

Mesosoma. Epomia present, length about 0.4x basal width of mandible; mesoscutum 1.1x as long as wide at anterior level of tegulae, with dense, minute hairs, notauli shallowly present on anterior 0.4 of mesoscutum, ending before line connecting centers of tegulae; scutellum strongly convex, apically smooth, without striations, lateral carinae extending to summit; mesopleuron polished with moderately small punctures; epicnemial carina present on lower half of mesopleuron, postpectal carina absent medially; submetapleural carina higher next to mid coxa, with prominent lobe, lower part of metapleuron smooth, without any ridges; propodeum with areola parallel-sided, 0.77x as high as wide, apical transverse carina weak medially, pleural part

weakly present, dividing pleural area into two sub-areas; costula absent; petiole smooth; propodeal spiracle elongated, 3.25x as long as wide. Hind femur 3.13x as long as wide, length 0.85x hind tibia, hind basitarsus 0.33x hind tarsus, second hind tarsomere 0.55x basitarsus. Fore wing vein 2*rs-m* 0.5x length of 3*rs-m*; *cu-a* slightly distad of *Rs+M*; hind wing with first abscissa of vein *Cu*1 about 0.44 times length of vein *cu-a*.

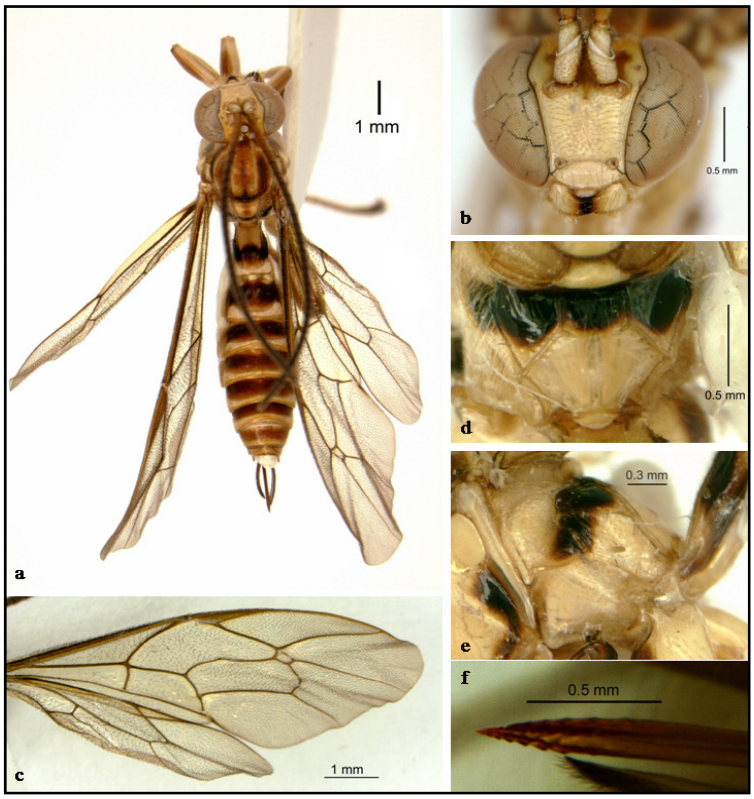

Figure 80. *A. vriesi*: a. dorsal view; b. face; c. wings; d. dorsal view of propodeum; e. lateral view of metapleuron; f. ovipositor tip

Metasoma. First tergite 1.67x as long as apically wide, lateral carina on first tergite extending over spiracle; second tergite 0.8x as long as first tergite, 0.8x as long as apical width; third tergite 0.8x second; ovipositor straight, 1.0x as long as hind tibia, 1.9x longer than first tergite, lower valves with seven and upper valve with five slanting ridges at tip.

Colour. Light yellow; antenna dark brown, except lower side of first three segment; scape and pedicel with upper side blackish and lower side light yellow; ocellar area, frons and hind slope of vertex yellowish ferruginous; mesoscutum with three longitudinal brown stripes meeting posteriorly in black mark at base of scutellum, central stripe lighter but median part dark brown; lateral carina of mesoscutum blackish on anterior half; tegula brown and transparent posteriorly; scutellum with small, central, light brown spot; mesopleuron with black stripe along anterior margin, from level of base of fore coxa to upper margin, black stripe along posterior margin of mesopleuron nearly extending to mesopleural fovea; propodeum with back spots on area externa

and area superomedia, area surrounding propodeal spiracle black; fore and mid femora, mid tibia ferruginous; mid tarsus brown; hind coxa with outer surface dark brown, inner side near apex light brown; trochantellus, hind femur on basal 0.2, apical 0.15 and lower 0.25 of anterior side and upper side dark ferruginous; hind tibia ferruginous; hind tarsus brown; wings light yellow, pterostigma and veins brown; each matasomal tergite with dark ferruginous to blackish brown area over basal 0.85, except first tergite with blackish brown area only medially; second to fourth sternites each with two blackish spots; spots on fifth sternite paler; ovipositor light brown, ovipositor sheath blackish brown.

Male**.** Morphologically similar to the female. Body length 9.0 mm, fore wing 7.5 mm, with larger lateral ocelli (0.8x times ocellar-ocular distance), and shorter first antennal flagellomere (1.47x second flagellomere).

Distribution. This species is currently known only from the type locality in Chu Yang Sin NP, Dak Lak Province (Pham *et al.,* 2011a).

Ecological notes. The specimens were collected in the secondary rainforest at an elevation between 740−1,000 m a.s.l. (Pham *et al.*, 2011a).

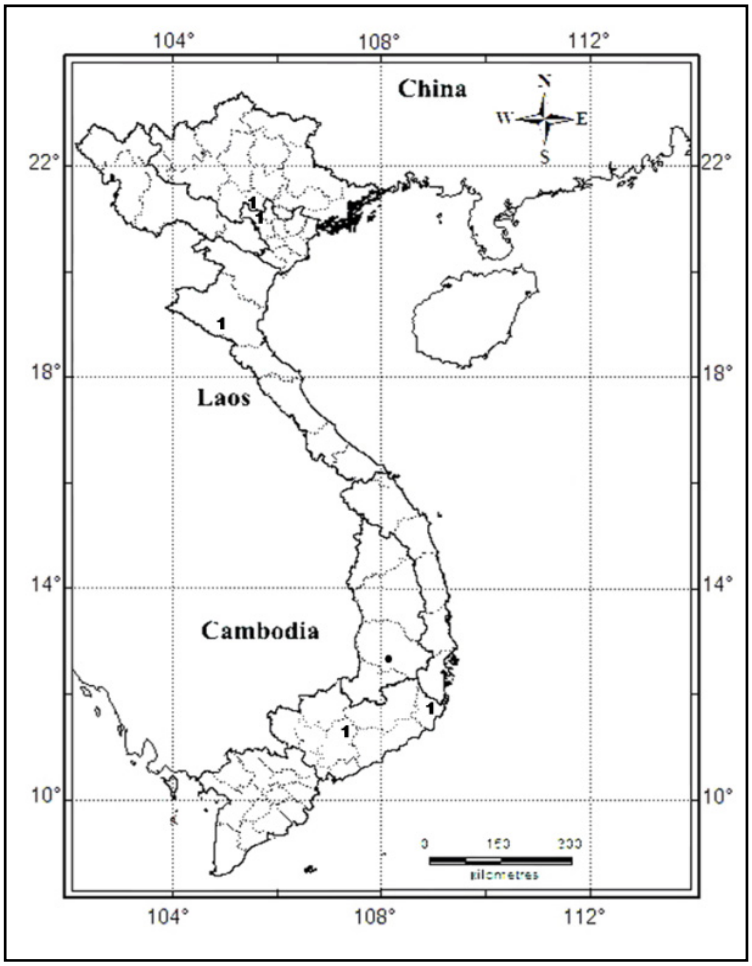

Figure 81. Distribution map of *Augerella* species: 1. *A. brevicauda*; (•). *A. achterbergi* & *A. vriesi*

Epitheronia Gupta, 1962

Theronia (Epitheronia) Gupta, 1962: 92. Type: *Theronia* (*Epitheronia*) *fidentia* Gupta; by original designation.

Epitheronia Gupta: Gupta (1987).

Diagnosis. Mandible upper tooth broader and longer than lower tooth; clypeus thin, flat, without tubercles or swellings; frons with a vertical carina between antennal sockets; face rugose-punctate; notaulus distinct on at least anterior 0.25; lateral carina of scutellum forming high flange anteriorly; epicnemial carina present on lower half of mesopleuron, erased on upper half, sternaulus usually distinct, at least anteriorly; propodeum with strong carinae, area superomedia always well defined; first tergite with dorsolateral carinae converging posteriorly, reaching to oblique groove; ovipositor with tip of lower valve slightly broader than tip of upper valve, with some oblique ridges (Gupta, 1962; Townes, 1969).

Gupta (1962) recognised four species of *Epitheronia*: *E. tomeus* (Gupta) from Malaysia, Singapore and Indonesia, *E. baltazarae* (Gupta), *E. fidentia* (Gupta) and *E. rugosa* (Gupta), all from the Philippines. Pham *et al.* (2013b) reported this genus from Vietnam for the first time with description of one new species *E. vinhanensis*.

Epitheronia vinhanensis PHAM, BROAD & WÄGELE, 2013

(Figures 82, 83)

Epitheronia vinhanensis Pham, Broad & Wägele, 2013. Journal of Natural History, http://dx.doi.org/10.1080/00222933.2012.763105: 9.

Material examined. Dong Nai, Vinh Cuu, Vinh An: 1♀ (IEBR, holotype), 100 m a.s.l., 28.vii.2008, hand net, T. V. Hoang leg.

Diagnosis. Scutellum strongly convex, lateral carina strong to middle then weak to apex, at middle with transverse carina connecting to lateral carina; propodeum with area superomedia wider posteriorly, area petiolaris with striations below posterior transverse carina; first tergite 1.5x as long as apical width; ovipositor straight, 1.6x as long as hind tibia.

Description (Female). Body length 11.7 mm, fore wing 10.2 mm, ovipositor 10.7 mm. *Head*. Antenna with first flagellomere 1.5x length of second; diameter of lateral ocellus 0.9x ocellar-ocular distance; frons smooth and impunctate; inner margins of eyes distinctly concave opposite antennal sockets, convergent ventrally; face 0.7x as high as wide, rugose punctate, pubescent, upper margin broadly concave between antennal sockets; clypeus flat with sparse, long hairs, about 0.45x as high as wide, apical margin rounded; malar space about 0.3x basal width of mandible; mandible broad, upper tooth broader than and about 1.7x length of lower tooth; gena punctate, pubescent;

occipital carina complete, meeting hypostomal carina about 0.4x basal mandible width from base of mandible.

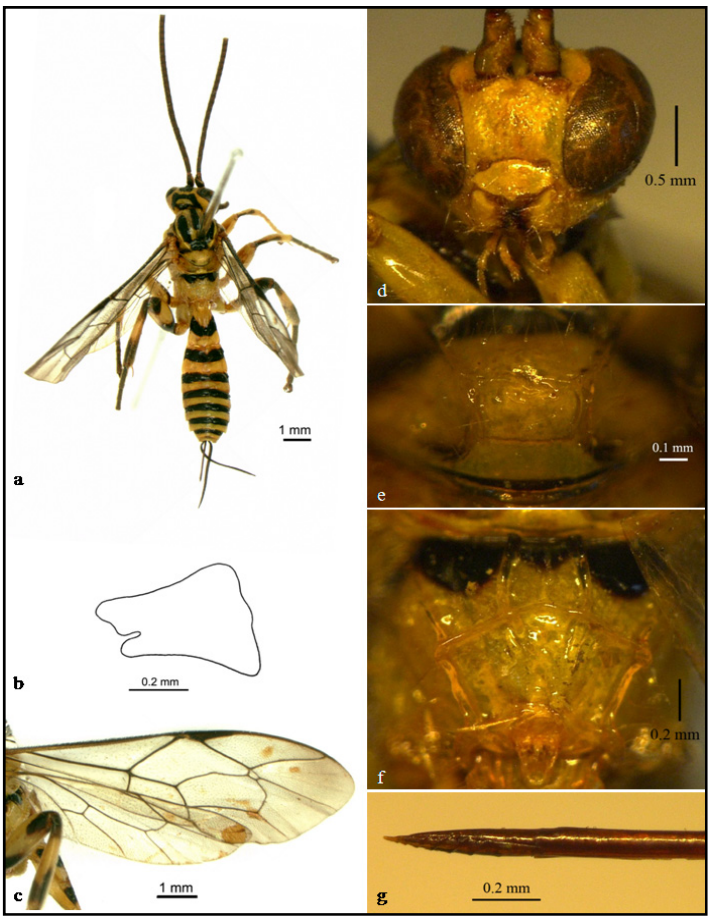

Figure 82. *E. vinhanensis*: a. dorsal view; b. mandible; c. wings; d. face;
e. dorsal view of scutellum; f. dorsal view of propodeum; g, ovipositor tip

Mesosoma. Epomia present, length 0.5x mandible basal width; pronotum impunctate and polished, except dorsal margin and posterior corner pubescent; mesoscutum with dense short hairs, 1.2x as long as wide at front edges of tegulae, notauli distinct on anterior 0.4 of mesoscutum; scutellum strongly convex, pubescent, lateral carina forming high flange from base to middle, then weaker to apex, transverse carina connecting to lateral carina at summit of scutellum; mesopleuron subpolished, pubescent, epicnemial carina strong on lower half, lateral section of postpectal carina present as short stub in front of mid coxa, sternaulus impressed on anterior half of mesopleuron; metapleuron subpolished, with sparse hairs, submetapleural carina complete, forming large anterior lobe, juxtacoxal carina present; propodeum with very strongly raised carinae, basal transverse carina absent, area superomedia wider posteriorly, as long as wide, posterior transverse carina curved medially, area petiolaris with striations below posterior transverse carina; propodeal spiracle elongate, about 2.5x as long as wide; fore femur 2.8x as long as wide; hind femur 2.8x as long as wide, 0.8x tibia length, tibia 6.3x as long as apical width;

basitarsus 0.35x hind tibia, 0.35x tarsus, 2.0x second tarsomere; fourth tarsomere extremely short; fifth tarsomere 2.2x third. Fore wing with vein *Rs*&*M* basad of *cu-a*, 2*rs-m* about half length of 3*rs-m*, vein *Cu*1*a* separated from 1*m-cu* by 1.7x length of vein *Cu*1*b*; hind wing with vein *M+Cu* straight posteriorly, first abscissa of vein *Cu*1 about 0.6x vein *cu-a*.

Metasoma. Tergites subpolished, with basal and apical oblique grooves deep; first tergite 1.5x as long as apical width, dorsolateral carina strong from base to spiracle then weak to apex, median longitudinal carina extending to oblique groove; second tergite 0.6x length of first tergite, 0.6x as long as apical width, third tergite shorter than second; ovipositor straight, 1.6x as long as hind tibia, tip of lower valve slightly broader than tip of upper valve, with six oblique ridges.

Colour. Yellow. Antenna blackish dorsally, brown ventrally, scape and pedicel yellow ventrally; frons with two black spots behind antennal sockets, posterior margin of vertex and occipital area marked with black; mesoscutum with three longitudinal black stripes, lateral black stripes joined posteriorly to black spot in front of scutellum; mesopleuron with black stripe along anterior margin and with black spot at lower half of posterior margin; propodeum black basally; fore and mid legs with black stripes extending about 0.67x length of posterior face from base of femur and tibia, mid tarsus black; outer side of hind coxa with large black spot, inner side with small black spot apically, hind femur and tibia with black bands basally and apically, hind tarsus black; wings hyaline, pterostigma and veins black, except basal 0.7 of costa yellowish; first tergite with median black band, tergite 2 onwards each with basal black band; ovipositor reddish, ovipositor sheath black and hairy.

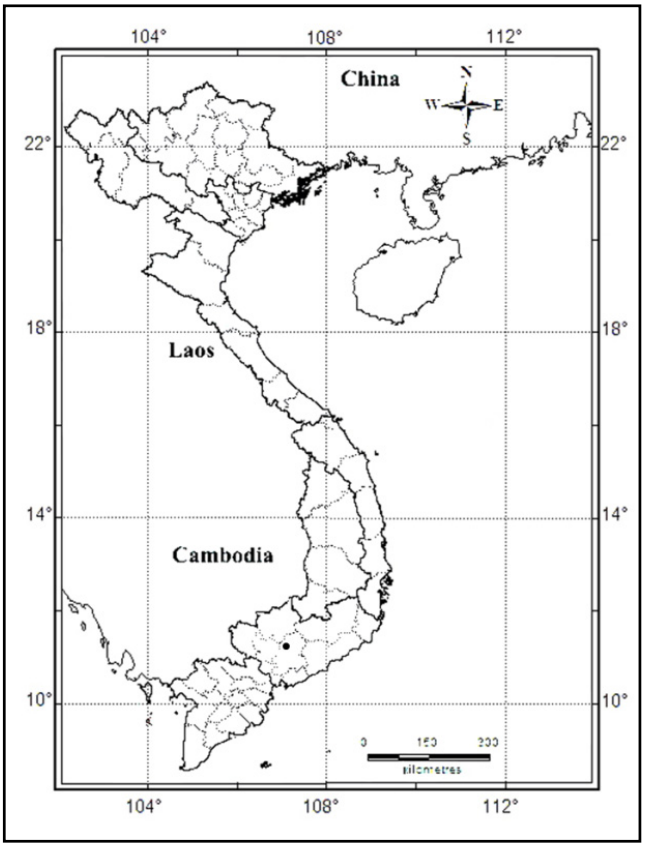

Figure 83. Distribution map of *E. vinhanensis*

Distribution. Currently known only from Vinh An, Vinh Cuu, Dong Nai Province, South Vietnam (Pham *et al.*, 2013b).

Ecological note. The single specimen was collected in lowland evergreen forest at an elevation of 100 m a.s.l. (Pham *et al.*, 2013b).

***Nomosphecia* Gupta, 1962**

Theronia (Nomosphecia) Gupta, 1962. Pac. Ins. Mon. 4: 68. Type: *Theronia (Nomosphecia) zebroides zebroides* Krieger, by original designation.

Nomosphecia Gupta: Gupta (1987).

Diagnosis. Mandible very strongly tapered, not twisted, lower tooth longer and broader than upper; clypeal margin thin, truncate to weakly concave; occipital carina complete, weakly concave mediodorsally; pronotum moderately long, epomia discernible on upper part of pronotum as an oblique ridge; mesoscutum smooth with notaulus strongly impressed anteriorly; propodeum with posterior transverse carina complete or reduced medially; metasoma moderately stout though first tergite quite slender; female with ovipositor projecting beyond apex of subgenital plate usually by more than hind tibia length; apex of ovipositor depressed with lower valve expanded to partially enclose upper (Gupta, 1962; Townes, 1969).

Previously, 19 *Nomosphecia* species were recognized, of which eight species are represented in the Oriental region (Gupta, 1962; Yu *et al.*, 2005). However, *N. brevicauda* (Cushman, 1933) was transferred to *Augerella* (see discussion for the genus *Augerella*) (Pham *et al*., 2013b). In Vietnam, Pham *et al.* (2013b) recorded this genus for the first time with descriptions of one new species *N. carinicurvata* and recorded two further species new to this country: *N. scutellata* and *N. zebroides*. Gupta (1962) erected two species groups for the Indo-Australian *Nomosphecia* species: the *zebroides* and *pyramida* groups. The *zebroides* group is distinguised by the more strongly developed lower mandibular tooth, the longer ovipositor and the moderately convex scutellum (versus a more or less pyramidal scutellum). Of the Vietnamese species, *Nomosphecia zebroides* belongs in the *zebroides* group, *N. carinicurvata* and *N. scutellata* belong in the *pyramida* group.

Key to Vietnamese species of *Nomosphecia* (modified from Gupta, 1962)

1. Clypeus with lateral swellings; mandibular teeth strongly developed, lower tooth 1.7–2.0 times longer than upper tooth (Figure 86b); scutellum moderately convex (Figure 86d); ovipositor long, 2.2–2.5 times longer than hind tibia.....*N. zebroides* Krieger

-. Clypeus without swellings; mandibular teeth weaker, lower tooth 1.1–1.5 times longer than the upper (Figures 84e, 85b); scutellum strongly convex, nearly pyramidal; ovipositor shorter, 1.1–1.2 times longer than hind tibia.....2

2. Scutellum conical with a curved carina at summit (Figure 84g); first tergite 2.2 times longer than apical width.....*N. carinicurvata* Pham, Broad & Wägele

-. Scutellum strongly convex with an extra longitudinal carina on anterior slope extending to summit (Figure 85d); first tergite 1.8 times longer than apical width.....*N. scutellata* (Gupta)

***Nomosphecia carinicurvata* PHAM, BROAD & WÄGELE, 2013**

(Figures 84, 87)

Nomosphecia carinicurvata Pham, Broad & Wägele, 2013. Journal of Natural History, http://dx.doi.org/10.1080/00222933.2012.763105: 14.

Material examined. Dong Nai, Cat Tien NP: 1♀ (RMNH, holotype), 100 m, 13–19.v.2007, Malaise trap, C.v. Archterberg & R. de Vries leg; 1♀ (IEBR, paratype), same data as holotype except 13–20.v.2005.

Diagnosis. Scutellum conical with a curved carina pointing posteriorly at summit; ovipositor slightly down-curved, 1.2x as long as hind tibia.

Description (Female). Body length 8.2–8.5 mm, fore wing 7.5–8.0 mm, ovipositor sheath 1.6–1.7 mm. Head. Antenna with 29 flagellomeres, first flagellomere 1.5x length of second; diameter of lateral ocellus slightly shorter than ocellar-ocular distance; frons polished, impunctate, with small

median swelling in front of median ocellus; inner margins of eyes strongly concave opposite antennal sockets, convergent ventrally; face as high as wide, with shallow, small punctures, pubescent, upper half with median vertical ridge; clypeus flat, 0.45x as high as wide, basally pubescent, apical margin thin, emarginate; mandible with lower tooth 1.5x as long as upper tooth; malar space short, about 0.15x basal width of mandible; occipital carina complete, meeting hypostomal carina at about 0.7x basal mandible width.

Mesosoma. Pronotum polished, pubescent along upper margin; epomia absent; mesoscutum 1.1x as long as wide at anterior level of tegulae, with dense, short hairs; notaulus impressed, extending to level of middle of tegula; scutellum pyramidal, posterior impunctate area without small striations, lateral carina extending to middle, at summit with transverse carina curving posteriorly; mesopleuron with dense, short hairs, outer margin of subalar prominence moderately sharp, epicnemial carina present on lower half; metapleuron with dense, short hairs; propodeum pubescent basally, area superomedia open posteriorly, basal transverse carina entirely absent, lateral longitudinal carina interrupted below posterior transverse carina; pleural area with dense, long hairs, pleural part of posterior transverse carina partly present, propodeal spiracle elongate, 3.0x as long as wide. Hind femur 3.3x as long as wide, length 0.85x hind tibia, tibia 5.7x as long as apical width, basitarsus 0.35x length of tibia, 0.37x tarsus, 1.9x second tarsomere, fifth tarsomere 2.0x length of third. Fore wing with vein *Rs*&*M* basad of *cu-a*, vein 2*rs-m* about 0.6x vein 3*rs-m*, vein *Cu*1*a* separated from 1*m-cu* by 1.3x length of *Cu*1*b*; hind wing with distal part of vein *M*+*Cu* straight, first abscissa of vein *Cu*1 0.37x as long as vein *cu-a*.

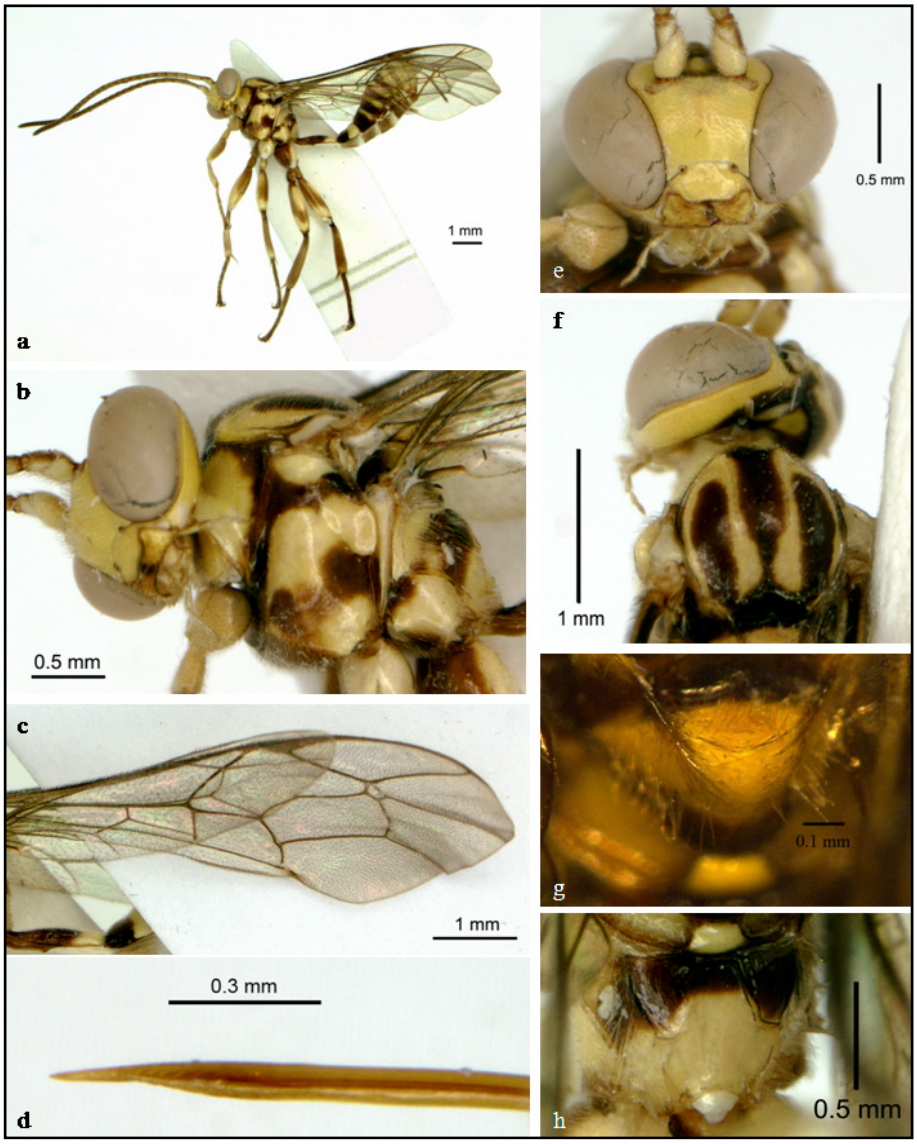

Figure 84. *N. carinicurvata*: a. dorsal view; b. lateral view of head and mesosoma; c. wings; d. ovipositor tip; e. face; f. dorsal view of head and mesoscutum; g. dorsal view of scutellum; h. dorsal view of propodeum

Metasoma. Tergites with dense, short hairs; first tergite elongate, 2.2x as long as apical width, lateral carina present basally; second tergite 0.6x as long as apical width, 0.6x length of first tergite, basal and apical oblique grooves moderately deep; third tergite shorter than second; median areas of tergites 2–3 divided into two lateral swellings; first sternite smooth, extending to level of spiracle; ovipositor slightly down-curved, length from tip of hypopygium 1.2x hind tibia length, ovipositor tip depressed, tapered to sharp point, lower valve apically with eight curved ridges.

Colour. Pale yellow, black in following areas: ocellar area, hind side of vertex, hind corner of pronotum, three stripes on mesoscutum merging posteriorly with black mark in front of scutellum, median stripe narrower apically, apical part of scutellum, basal part of propodeum dorsally and laterally, mid tibia, hind tarsus. Mesopleuron with dark brown stripe below subalar prominence and a

brown oblique band extending from posterior margin at the level of episternal scrobe to epicnemial carina, mesepisternum and metepisternum widely brown; posterior face of fore femur marked with light brown; mid leg with inner face of coxa, posterior and ventral faces of tibia marked with light brown; hind leg with outer face of coxa, trochanter, trochantellus dark brown, lateral and ventral faces of femur brown; wings hyaline, pterostigma and veins brown; metasomal tergites with brown basal bands broader than yellow apical bands; ovipositor reddish brown; ovipositor sheath black and hairy.

Male. Unknown

Distribution. Currently known only from Cat Tien NP, Dong Nai Province (South Vietnam) (Pham *et al.*, 2013b).

Ecological note. The specimens were collected in lowland evergreen forest at an elevation of 100 m a.s.l. (Pham *et al.*, 2013b).

***Nomosphecia scutellata* (GUPTA, 1962)**

(Figures 85, 87)

Theronia (Nomosphecia) scutellata Gupta, 1962. Pac. Ins. Mon. 4: 81.

Theronia (Nomosphecia) scutellata scutellata Gupta, 1962. Pac. Ins. Mon. 4: 82. Holotype: ♀, Singapore (USNM).

Nomosphecia scutellata scutellata: Gupta (1987).

Material examined. Ninh Binh, Cuc Phuong NP: 1♀ (RMNH), 225 m a.s.l., 15.iv–01.v.2000, Malaise trap, Q. P. Mai leg.; Dak Lak, Chu Yang Sin NP: 1♀ (RMNH), 740 m a.s.l., 01–10.vi.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.; Dong Nai, Cat Tien NP: 1♀ (IEBR), 100 m a.s.l., 14–20.v.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Scutellum strongly convex, lateral carina extending to middle, plus median longitudinal carina present on anterior slope; epicnemial carina present on lower half; ovipositor straight, 1.1x as long as hind tibia.

Distribution. Previously known from Malaysia, Singapore and the Philippines (Gupta 1962; Yu *et al.*, 2005; Amanda *et al.*, 2011). Pham *et al.* (2013b) recorded this species for the first time from Vietnam.

Remarks. Gupta (1962) recognised four subspecies: *N. scutellata scutellata* from Malaysia and Singapore; *N. scutellata davidi*, *N. scutellata marjoriae* and *N. scutellata samarensis* from the Philippines. The Vietnamese specimens agree with the nominate subspecies which differs from the other three in lacking a black mark at the level of the sternaulus, the presence of the epicnemial carina is only on the lower half of the mesopleuron, and the presence of a dorsolateral carina on

the first tergite (distinct to the level of the spiracle). The specimen from Dak Lak Province has the lower mandibular tooth only slightly longer than the upper tooth in comparison with the specimens from Ninh Binh and Dong Nai provinces.

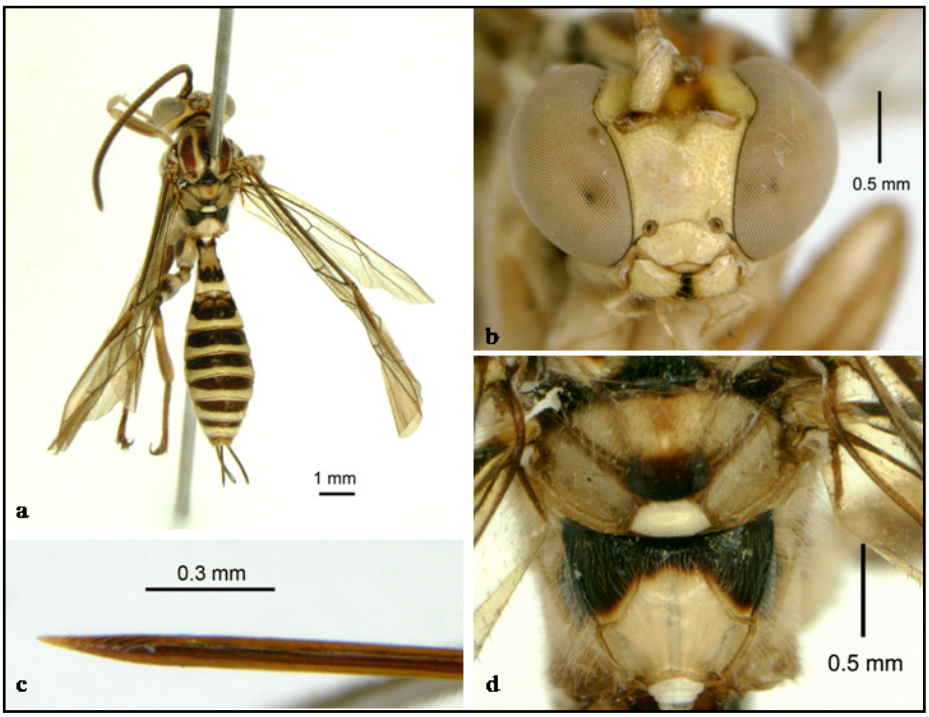

Figure 85. *N. scutellata*: a. dorsal view; b. face; c. ovipositor tip;
d. dorsal view of scutellum and propodeum

***Nomosphecia zebroides* (KRIEGER, 1906)**

(Figures 86, 87)

*Theronia zebroide*s Krieger, 1906. Ztschr. Syst. Hymen. Dipt. 6: 236. Holotype: ♀, Indonesia: Sumatra (ZMHB).

Nomosphecia zebroides: Gupta (1987).

Nomosphecia zebroides indicus (Gupta, 1962). Pac. Ins. Mon. 4: 72. Holotype: ♀, India: Sikkim (BMNH). Synonymized with the nominate subspecies by Pham *et al.* (2013b).

Material examined. Vinh Phuc, Phuc Yen, Ngoc Thanh: 4♂ (RMNH), 04.iv–12.v.2000, Malaise trap, Q. P. Mai leg.; 1♀ (IEBR), 15.vii.2007, Malaise trap, T. H. Pham leg.; Hanoi, Ba Vi, Yen Bai: 1♀ (IEBR), 01.vi.2001, hand net, N. T. Pham leg.; Phu Tho, Xuan Son NP: 1♂ (IEBR), 01.v.2003, hand net, H. X. Le leg.; 1♀ (IEBR), 250–300 m a.s.l., 15.vi.2004, T. V. Hoang leg.; Vinh Phuc, Tam Dao NP: 1♀ (IEBR), 900 m a.s.l., 03.vii.2003, T. H. Ta leg.; Nghe An, Pu Mat NP: 1♀ (IEBR), 15.iv.2006, hand net, H. X. Le leg.; Quang Tri, Dakrong, Ta Rut: 1♂ (IEBR), 300 m a.s.l., 02.vi.2006, hand net, N. T. Pham leg.; Quang Binh, Quang Ninh, Truong Son: 1♂ (IEBR), 100 m a.s.l., 09.vi.2006, hand net, T. V. Hoang leg.; Dong Nai, Cat Tien NP: 2♀ (RMNH), 100 m a.s.l., 13–20.v.2007, Malaise trap, C. v. Achterberg & R. de

Vries leg.; Dak Lak, Chu Yang Sin NP: 2♂ (RMNH), 740 m a.s.l., 01–10.vi.2007; 1♂ (RMNH), 840–940 m a.s.l., 1♂ (RMNH), 800–1000 m a.s.l., Malaise trap, C. v. Achterberg & R. de Vries leg.

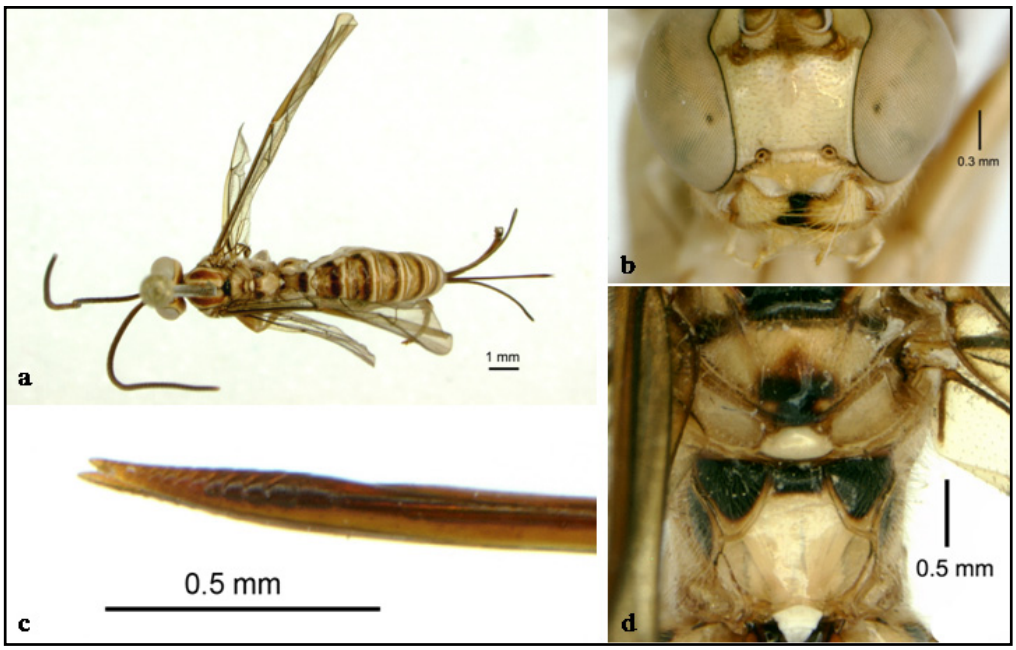

Figure 86. *N. zebroides*: a. dorsal view; b. face; c. ovipositor tip;
d. dorsal view of scutellum and propodeum

Diagnosis. Clypeus with distinct lateral swellings, stronger in male than in female; scutellum convex, lateral carina extending to posterior impunctate area; ovipositor straight, 2.2–2.5x as long as hind tibia.

Distribution. Previously known from India, Indonesia, Japan, Malaysia and Taiwan (Gupta, 1962; Yu *et al.,* 2005; Amanda *et al.*, 2011). Pham *et al.* (2013b) recorded this species for the first time from Vietnam.

Remarks. Two subspecies were previously recognised: *N. zebroides zebroides* (Krieger) and *N. zebroides indicus* (Gupta) (Gupta, 1962; Yu *et al*., 2005). The two subspecies differ from each other only in the colour pattern: the nominate subspecies has rather black markings while *N. zebroides indicus* has rather ferruginous marks. Most of the Vietnamese specimens agree well with *N. zebroides indicus* except two male specimens from Quang Binh and Quang Tri provinces, which are closer to the nominate subspecies. As the differences between the two subspecies had not proved to be stable, Pham *et al.* (2013b) synonymised the two names.

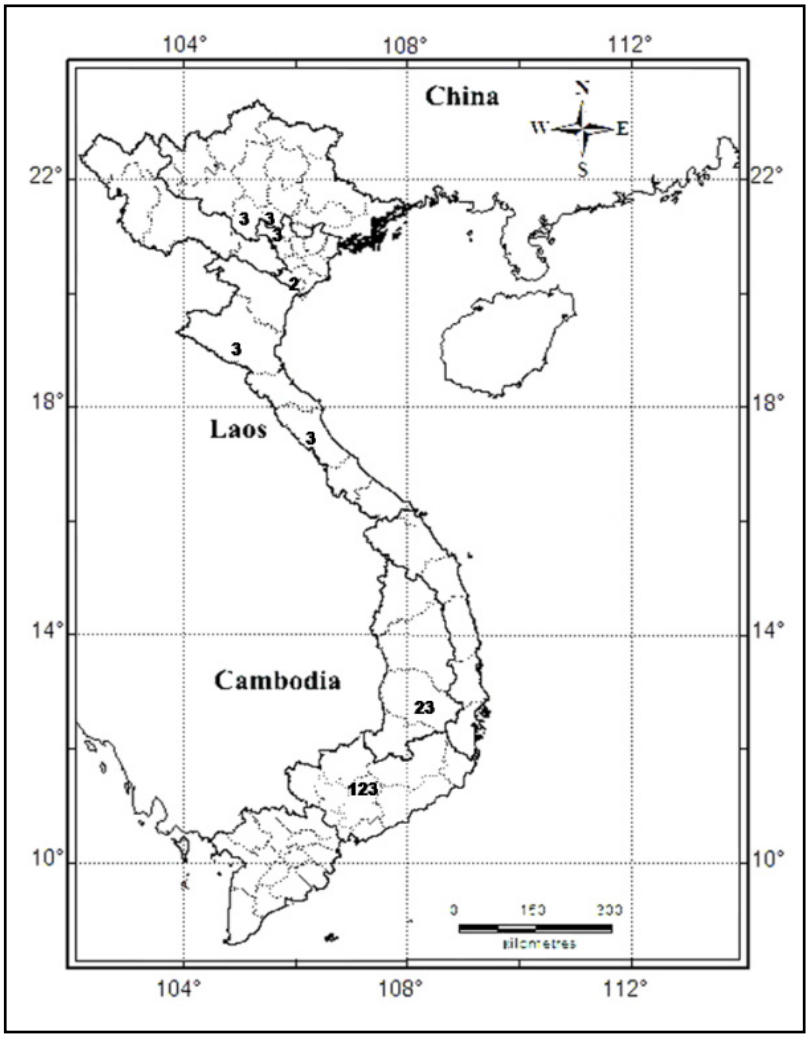

Figure 87. Distribution map of *Nomosphecia* species:

1. *N. carinicurvata*; 2. *N. scutellata*; 3. *N. zebroides*

***Parema* Gupta, 1962**

Theronia (Parema) Gupta, 1962: 54. Type species: *Theronia (Parema) nigrobalteata nigrobalteata* Gupta; by original designation.

Parema Gupta: Gupta (1987).

Diagnosis. Mandible teeth equal in length; clypeus almost truncate or with a weak median notch, in male with a weak median submarginal swelling; frons without a vertical carina between antennal sockets; notaulus distinct on anterior 0.3–0.4 of mesoscutum, lateral carina of scutellum strong, reaching at least to middle; epicnemial carina complete, reaching to anterior margin of mesopleuron; propodeum without anterior transverse carina, median section of posterior transverse carina weak or lacking; ovipositor tip weakly depressed, lower valve partly enclosing upper valve, with oblique ridges (Gupta, 1962; Townes, 1969).

Gupta (1962) recognised five species of *Parema*: *P. caudata* (Gupta), *P. dravida* (Gupta), *P.*

nigrobalteata (Cameron), *P. penetrans* (Smith), and *P. sulcata* (Krieger). In Vietnam, *Parema* is represented by a single species, *P. nigrobalteata* (Krieger, 1906; Pham *et al.*, 2013b).

***Parema nigrobalteata* (CAMERON, 1899)**

(Figures 88, 89)

Theronia nigrobalteata Cameron, 1899. Mem. & Proc. Manchester Lit. Phil. Soc. 43 (3): 153. Holotype: ♀, India: Khasi Hills, Assam (OUMNH).

Theronia gracilis Cameron, 1899. Mem. & Proc. Manchester Lit. Phil. Soc. 43 (3): 143. Holotype: ♀, India: Khasi Hills, Assam (OUMNH).

Theronia continentalis Krieger, 1906. Ztschr. Sys. Hymen. Dipt. 6: 236. Lectotype: ♀, Sri Lanka: Toungoo, Karenni Dist. (ZMHB).

Theronia (Parema) nigrobalteara Cameron: Gupta (1962).

Parema nigrobalteata (Cameron): Gupta (1987).

Material examined. Phu Tho, Thanh Son, Thuong Cuu: 1♀3♂ (RMNH), 20°59'N 105°8'E, 250–400 m a.s.l., 11–16.x.1999, Malaise trap, R. de Vries leg.; Phu Tho, Xuan Son NP: 1♀ (IEBR), 300 m a.s.l., 05.v.2005, hand net, N. T. Pham leg.; Thua Thien-Hue, Phong Dien NR: 1♀ (RMNH), 100 m a.s.l., 22.iii–06.iv.2001, Malaise trap, C. v. Achterberg & R. de Vries leg.; Ninh Binh, Cuc Phuong NP, 225 m a.s.l.: 1♀1♂ (RMNH), 14.iv–01.v.2000; 1♀ (RMNH), 01.xi–20.xii.2000, Malaise trap, Q. P. Mai leg.; Hoa Binh, Yen Thuy, Lac Thinh: 1♀ (IEBR), 20.iv.2003; 1♀ (IEBR), 10–20.vii.2004, Malaise trap, L. D. Khuat leg.; Vinh Phuc, Tam Dao NP, 900–1000 m a.s.l.: 1♀ (IEBR), 16.iv.2004; 1♀ (IEBR), 21.v.2003, hand net, T. V. Hoang leg.; Vinh Phuc, Phuc Yen, Ngoc Thanh, 150–200 m a.s.l.: 1♀ (IEBR), 08.vi.2005; 2♂ (IEBR), 11.ix.2005; 1♂ (BMNH), 21.vii.2010, hand net, N. T. Pham leg.; 1♂ (IEBR), 31.vii.2007, hand net, T. H. Pham leg.; Nghe An, Pu Mat NP: 1♀ (IEBR), 150–200 m a.s.l., 25.vii.2004, hand net, L. X. Truong leg.; 2♀1♂ (ZFMK), 150–200 m a.s.l., 14–17.iv.2006, hand net, N. T. Pham leg.; Nghe An, Pu Huong NR: 1♂ (IEBR), 09.viii.2005, hand net, H. T. T. Nguyen leg; Nghe An, Tuong Duong, Tam Quang: 4♀3♂ (IEBR), 200–300 m a.s.l., 12.vii.2006, hand net, H. T. T. Nguyen leg.; Dong Nai, Cat Tien NP, 100 m a.s.l.: 1♂ (IEBR), 08.viii.2005, hand net, L. P. T. Nguyen leg.; 2♀3♂ (RMNH), 01–09.x.2005; 3♀1♂ (RMNH), 13–20.v.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.; 2♀ (RMNH), 01–08.iv.2007; 2♀2♂ (RMNH), 09–30.iv.2007, Malaise trap, Q. P. Mai & M. T. Nguyen leg.; Quang Nam, Phuoc Son, Phuoc Xuan: 2♀ (IEBR), 300–400 m a.s.l., 26.v.2006, hand net, T. H. Ta leg.; Dak Lak, Chu Yang Sin NP: 2♀1♂ (RMNH), 550–610 m a.s.l., 21–26.x.2005; 3♀1♂ (RMNH), 750 m a.s.l., 01–10.vi.2007; 1♀ (RMNH), 500 m a.s.l., 03–09.vi.2007; 4♀5♂ (RMNH), 740–940 m a.s.l., 02–10.vi.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.; Kon Tum, Chu Mom Ray NP: 3♀ (RMNH), 700–900 m a.s.l., 26.ix–05.x.2006, Malaise trap, Q. P. Mai & M. T. Nguyen leg.; 1♀ (IEBR), 550 m a.s.l., 18.v.2009, hand net, T. V. Hoang leg.; Ninh Thuan, Nui

Chua NP: 1♂ (RMNH), 90–150 m a.s.l., 23–30.v.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.; Ha Tinh, Huong Trach, Huong Khe: 1♂ (IEBR), 20.iv.2009, hand net, T. V. Hoang leg.; Bac Giang, Thanh Son, Son Dong: 1♀ (IEBR), 200 m a.s.l., 05.vii.2010, hand net, N. T. Pham leg.; Ha Tinh, Vu Quang NP: 4♂ (RMNH), 116 m a.s.l., 18°19'38N 105°26'28E, 23.ix–05.x.2009, Malaise trap, C. v. Achterberg & R. de Vries leg.; Tuyen Quang, Cham Chu NR: 1♀ (BMNH), 12.iv.2011, H. P. Pham leg.

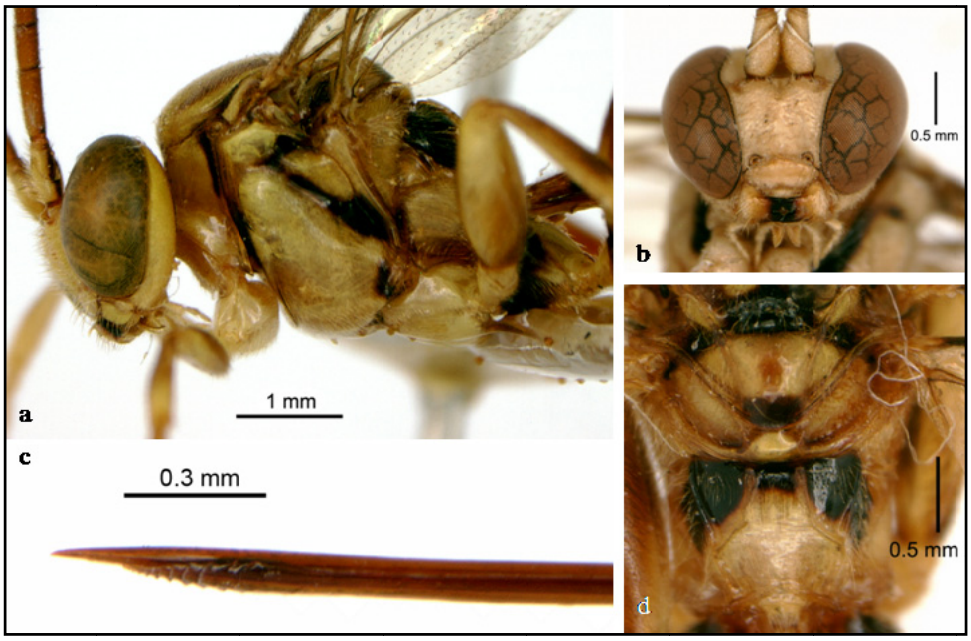

Figure 88. *P. nigrobalteata*: a. lateral view of head and mesosoma; b. face; c. ovipositor tip; d. dorsal view of scutellum and propodeum

Diagnosis. Face with moderately dense, large punctures, pubescent; notaulus with low transverse crest across anterior margin; first tergite about 1.4–1.6x as long as apical width, median longitudinal carina distinct on basal half then weaker, reaching nearly to oblique groove, dorsolateral carina often not extending beyond spiracle; ovipositor straight, about 1.9x hind tibia length; pronotum with black stripe at posterior corner; mesosoma and metasomal tergites marked with black.

Distribution. Krieger (1906) recorded this species from South Vietnam for the first time. Our records extended the distribution of this species northwards to Central and North Vietnam. Outside Vietnam, it has been recorded from India, Indonesia, Malaysia, Myanmar, Singapore, Thailand and the Philippines (Gupta, 1962; Yu *et al.*, 2005; Amanda *et al.*, 2011).

Remarks. Five subspecies are currently known, viz. *P. nigrobalteata nigrobalteata* from India, Indonesia, Malaysia, Myanmar, Singapore, Taiwan, Thailand, the Philippines and Vietnam; *P. nigrobalteata bakeri* (Gupta) from the Philippines; *P. nigrobalteata callida* (Tosquinet) from Indonesia, Malaysia and Singapore; *P. nigrobalteata formosana* (Cushman) from Taiwan; and *P. nigrobalteata nathani* (Gupta) from India (Gupta, 1961; Yu *et al.*, 2005). All of our specimens fit *P.*

nigrobalteata nigrobalteata, which is characterized by the following characters: mesoscutal stripes are mostly reddish brown, lateral stripe is separated from the black margin of the mesoscutum and the metasomal tergites have black markings.

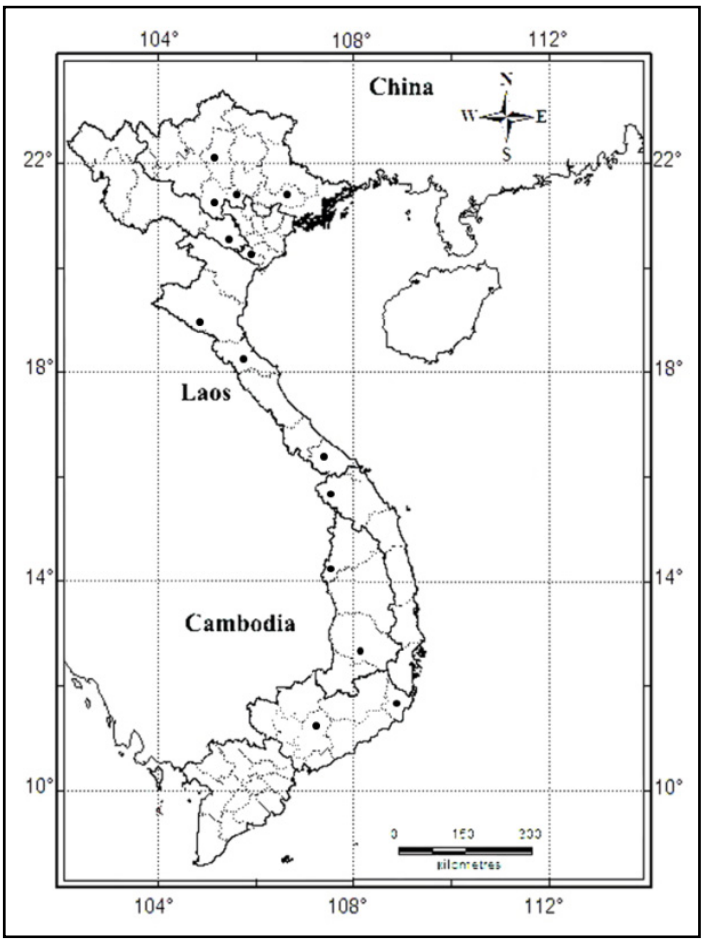

Figure 89. Distribution map of *P. nigrobalteata*

Theronia Holmgren, 1859

Theronia Holmgren, 1859. Öfvers. Svenska Vetensk. Akad. Förh. 16: 123. Type-species: *Pimpla flavicans* Fabricius = *atalantae* Poda, by monotypy.

Synonyms:

Pseudacoenites Kriechbaumer, 1892. Ent. Nachr. 18: 219. Type-species: *Pseudacoenites moravicus* Kriechbaumer = *laevigata* Tschek, by monotypy.

Poecilopimpla Cameron, 1903. Straits Branch R. Asiatic Soc. Jour. 39: 141. Type-species: *Poecilopimpla lucida*, by monotypy.

Erythrotheronia Cameron, 1905. Spolia Zeylanica 3: 134. Type-species: *Erythrotheronia flavolineata* Cameron = *clathrata flavolineata* Cameron, by monotypy.

Orientotheronia Morley, 1913. Fauna of India, Hymenopt. 3 (1): 146. Type-species: *Orientotheronia rufescens* Morley = *zebra iridipennis* Cameron, by original designation.

Diagnosis. Mandible with teeth equal in length; clypeus with or without sexual dimorphism; carina between antennal sockets present or absent; ovipositor almost cylindrical near apex, valves meeting in straight line, lower ovipositor valve with slanting teeth, upper valve without or with only weak ridges .

Currently, 42 species of *Theronia* were recognized, of which 20 are known from the Oriental region (Gupta, 1962; Yu *et al.,* 2005, Pham *et al*., 2013b). In Vietnam, six species of this genus have been recorded, of which three species have been described recently (Gupta, 1962; Pham *et al.*, 2013b).

Key to Vietnamese species of *Theronia* (modified after Gupta, 1962)

1. Pleural part of posterior transverse carina of propodeum entirely absent (Figure 91b); mesoscutum, propodeum and metasomal tergites largely marked with reddish brown or brown (Figures 91c, 91f, 91g).....*T. ferruginaterga* Pham, Broad & Wägele

-. Pleural part of posterior transverse carina of propodeum more or less present (Figures 90g, 90h, 90i); mesoscutum, propodeum and metasomal tergites marked with black.....2

2. Face with median depressed area, upper margin with deep U-shaped cleft medially (Figure 90a); propodeum with strong basal transverse carina, area superomedia closed (Figure 90d)...*T. clathrata* Krieger

-. Face evenly convex, upper margin with shallower and broader concavity (Figures 90b, 90c); propodeum without or with only lateral vestige of basal transverse carina, area superomedia open or partly closed posteriorly.....3

3. Face with small, fine punctures (Figure 92d); ovipositor 2.3 times as long as hind tibia.....*T. longihastata* Pham, Broad & Wägele

-. Face with moderate-sized, coarse punctures (Figures 90b, 90c, 93e); ovipositor no longer than 2.0 times as long as hind tibia.....4

4. Clypeus flat, basal half slightly raised, without apical swellings or median carina laterally (Figure 93e); frons without carina between antennal sockets; propodeum with area superomedia elongate, about 1.4–1.6 times as long as wide (Figure 93g); ovipositor 1.25 times as long as hind tibia.....*T. tahuythinhi* Pham, Broad & Wägele

-. Clypeus with apical swellings which are more distinct in male, in female swellings weaker or sometimes with only faint transverse ridge at lateral corner (Figures 90b, 90c); frons often with carina between antennal sockets; propodeum with area superomedia usually wider than long, sometimes as long as wide; ovipositor about 2.0 times as long as hind tibia.....5

5. Mesopleuron with oblique black mark joining black mark along lower half of mesopleural suture

(Figure 90h); propodeum without vestige of anterior transverse carina (Figure 90e); metasomal tergites usually with black band.....*T. maskeliyae* Cameron

-. Mesopleuron with drop-like black mark joining or nearly joining black stripe below subalar prominence (Figure 90i); propodeum with vestige of anterior transverse carina laterally (Figure 90f); metasomal tergites with two large black spots.....*T. zebra* (Vollenhoven)

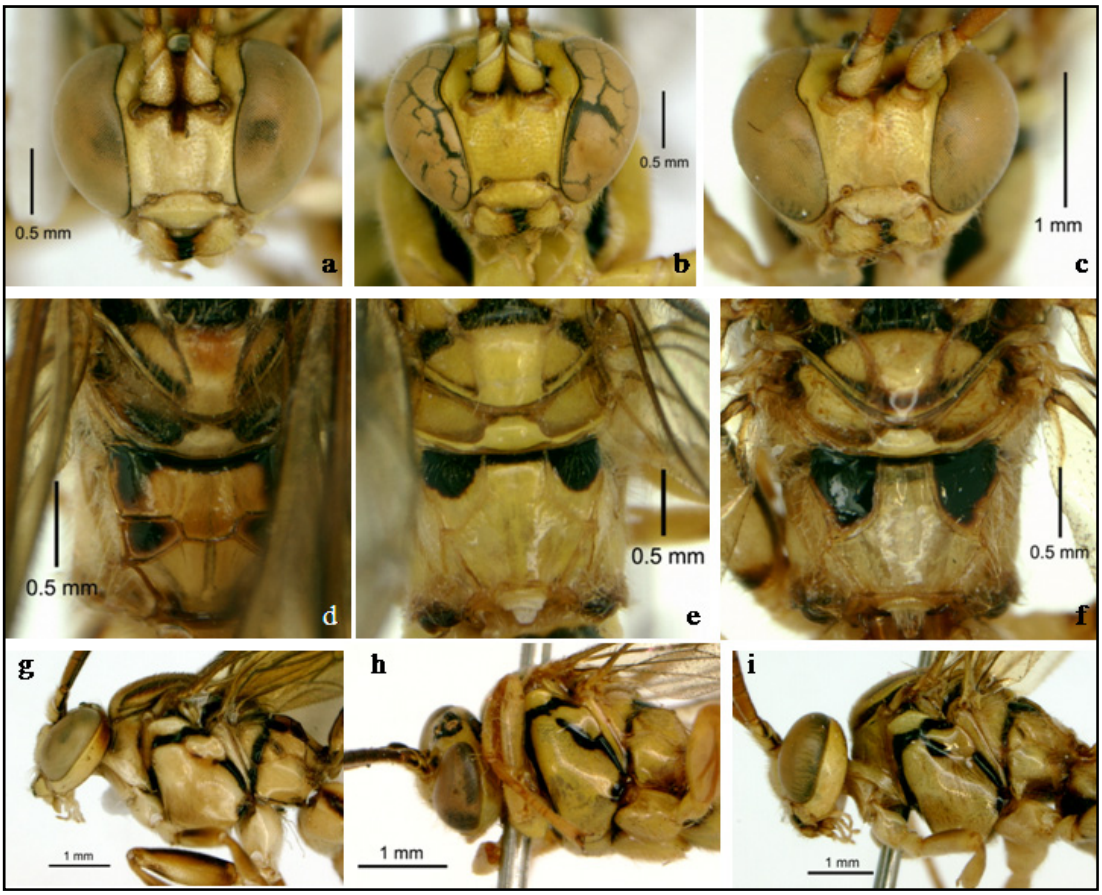

Figure 90. *Theronia* species: From a to c – faces (a. *T. clathrata*; b. *T. maskeliyae*; c. *T. zebra*); from d to f: dorsal views of scutellum and propodeum (d. *T. clathrata*; e. *T. maskeliyae*; f. *T. zebra*); from g to i – lateral views of head and mesosoma (g. *T. clathrata*; h. *T. maskeliyae*; i. *T. zebra*)

***Theronia clathrata* KRIEGER, 1899**

(Figures 90a, 90d, 90g, 94)

Theronia clathrata Krieger, 1899. Naturf. Gesell. Leipzig, Sitzber. 1897/98: 111. Holotype: ♀: India: Khasi Hills, Assam (ZMHB).

Theronis clathrata malayensis Gupta, 1962. Pac. Ins. Mon. 4: 50. Holotype: ♀: Malaysia Peninsula: Fraser's Hill, Pahang (BMNH).

Material examined. Dak Lak, Chu Yang Sin NP: 2♂ (RMNH), 800–940 m a.s.l., 02–10.vi.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.; Ha Tinh, Vu Quang NP: 1♂ (RMNH), 69 m a.s.l.,

18°19.50'N 105°20.24'E, 04.iii–15.iv.2011; 1♀ (RMNH), 106 m a.s.l., 18°17.41'N 105°25.42'E, 05.iii–15.iv.2011, Malaise trap, C. v. Achterberg leg.

Diagnosis. Face with lateral part swollen, median part concave, upper margin U-shaped medially; propodeum with strong basal transverse carina, area superomedia closed; first tergite with median longitudinal carinae nearly extending to oblique grooves.

Distribution. Pham *et al.* (2013b) recorded this species for the first time from Vietnam. Outside Vietnam, it has been known from China, India, Indonesia, Malaysia, Sri Lanka, Taiwan and the Philippines (Gupta, 1962; Yu *et al*., 2005; Amanda *et al.*, 2011).

Remarks. Five subspecies are currently recognised, viz. *T. clathrata clathrata*, *T. clathrata asaphia* Gupta, *T. clathrata flavolineata* (Cameron), *T. clathrata javensis* Gupta and *T. clathrata malayensis* Gupta. The Vietnamese specimens belong to *T. clathrata malayensis*, which differs from the others by its mesosoma and metasomal tergites with distinct black marks and epicnemial carina strong, extending to the anterior margin of the mesopleuron.

***Theronia ferruginaterga* PHAM, BROAD & WÄGELE, 2013**

(Figures 91, 94)

Theronia ferruginaterga Pham, Broad & Wägele, 2013. Journal of Natural History, http://dx.doi.org/10.1080/00222933.2012.763105: 25.

Material examined. Kon Tum, Chu Mom Ray NP: 1♀ (RMNH, Holotype), 700–900 m a.s.l., 26.ix–05.x.2006, Malaise trap, Q. P. Mai & M. T. Nguyen leg.; Hoa Binh, Mai Chau, Hang Kia - Pa Co: 1♀ (IEBR, paratype), 1100 m a.s.l., 21.iv.2002, hand net, T. V. Hoang leg.; Thua Thien-Hue, Bach Ma NP: 1♀ (IEBR, paratype), 1300–1400 m a.s.l., 14.viii.2005, hand net, T. V. Hoang leg.

Diagnosis. Pleural part of posterior transverse carina of propodeum entirely absent; mesoscutum, propodeum and metasomal tergites largely marked with ferruginous; ovipositor 1.6x as long as hind tibia.

Description (Female). Body length 13.0–13.5 mm, fore wing 12.8–13.0 mm, ovipositor 5.5 mm. *Head*. Antenna with first flagellomere 1.5–1.6x length of second; diameter of lateral ocellus 0.8–1.0x ocellar-ocular distance; frons pubescent dorsally, without carina between antennal sockets; inner margins of eyes strongly concave above antennal sockets, convergent ventrally; face 0.85x as high as wide, with coarse punctures, pubescent, upper margin moderately deeply concave between antennal sockets; clypeus about 0.4x as high as wide, flat, pubescent basally, apical margin thin, emarginate; malar space about 0.1x basal width of mandible; occipital carina complete, meeting hypostomal carina about 0.55x basal mandible width from base of mandible.

Mesosoma. Epomia about half length of basal mandible width; pronotum impunctate and

polished laterally, punctate and pubescent along dorsal margin and posterior corner; mesoscutum densely pubescent, about 1.25x as long as width at anterior level of tegulae, notaulus weakly present on anterior 0.3 of mesoscutum, extending to level of centre of tegula; scutellum strongly convex, pubescent, lateral carina strong on basal half; mesopleuron with small punctures, pubescent, sternaulus moderately impressed anteriorly; metapleuron polished, with fine punctures, pubescent dorsally, posterior part of juxtacoxal carina present; propodeum polished, impunctate dorsally except scattered hairs basally, anterior transverse carina entirely absent, remaining carinae strong, area superomedia open posteriorly, 0.8–1.2x as long as wide, pleural part of posterior transverse carina entirely absent, pleural area with small punctures, pubescent, propodeal spiracle elongate, about 3.7x as long as wide. Hind leg with femur 3.0x as long as wide, length about 0.8x tibia, basitarsus length 0.32x tibia, 0.32x tarsus, 2.0x second tarsomere, fifth tarsomere longer than third. Fore wing vein *Rs*&*M* basad of *cu-a*, vein 2*rs-m* about 0.65x length of 3*rs-m*, hind wing with posterior part of vein *M+Cu* straight, first abscissa of vein *Cu*1 0.4x as long as vein *cu-a*.

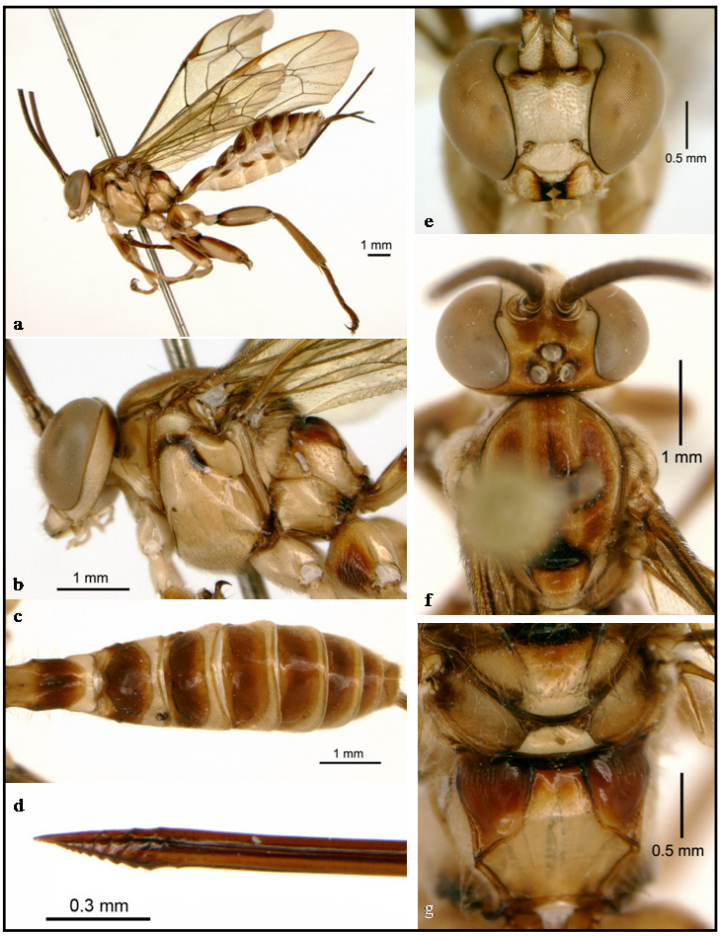

Figure 91. *T. ferruginaterga*: a. lateral view; b. lateral view of head and mesosoma; c. dorsal view of metasomal tergites; d. ovipositor tip; e. face; f. dorsal view of head and mesonotum; g. dorsal view of scutellum and propodeum

Metasoma. Tergites with very small punctures, pubescent, first tergite 1.8–1.9x as long as apical width, medially with shallow hollow, median longitudinal carina ending before level of spiracle, lateral carina weakly extending to spiracle; second tergite 0.75–0.85x as long as apical width, 0.7–0.8x as long as first tergite, 1.2–1.3x longer than third tergite, basal and apical oblique grooves moderately deep; ovipositor straight, length of ovipositor from tip of hypopygium 1.5–1.6x length of hind tibia, pointed tip, lower valve with nine teeth, upper valve with three low serrations.

Colour. Antenna reddish brown ventrally, upper side darker; frons to hind vertex marked reddish brown; mesoscutum with three reddish stripes (sometimes median stripe blackish) and black mark in front of scutellum; mesopleuron with black mark on groove below subalar prominence joined with oblique black spot; propodeum reddish basally; fore leg with posterior faces of femur and tibia reddish brown, mid femur with broad posterior and narrow ventral reddish brown stripes, mid tibia posteriorly and tarsus reddish brown, hind coxa marked with reddish on anterior and posterior faces, hind trochantellus, upper and ventral face of hind femur, hind tibia and tarsus reddish; wings brownish yellow, veins blackish, pterostigma reddish brown; tergites marked with reddish.

Male. Unknown

Distribution*.* Currently known from Hang Kia - Pa Co NR (Hoa Binh Province), Bach Ma NP (Thua Thien-Hue Province) and Chu Yang Sin NP (Dak Lak Province) (Pham *et al.*, 2013b).

Ecological notes*.* The specimens were collected in evergreen forest at elevations between 700 and 1,400 m a.s.l. (Pham *et al.*, 2013b).

***Theronia longihastata* PHAM, BROAD & WÄGELE, 2013**

(Figures 92, 94)

Theronia longihastata PHAM, BROAD & WÄGELE, 2013. Journal of Natural History, http://dx.doi.org/10.1080/00222933.2012.763105: 28.

Material examined. Dak Lak, Chu Yang Sin NP: 1♀ (RMNH, holotype), 800–940 m a.s.l., 02–10.vi.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Frons without carina between antennal sockets; face with small, fine punctures; clypeus without apical swelling, basal half slightly raised, transverse ridge at lateral corner present; ovipositor 2.3x as long as hind tibia.

Description*.* Body length 13.2 mm, fore wing 12.0 mm, ovipositor 7.0 mm. *Head*. Antenna with more than 35 flagellomeres (apical part missing), first flagellomere 1.6x length of second; diameter of lateral ocellus 0.9x ocellar-ocular distance; frons impunctate, without carina between antennal sockets; inner margins of eyes strongly concave above antennal sockets, convergent ventrally; face

0.8x as high as wide, slightly raised medially, with small, fine punctures, pubescent, upper margin broadly concave between antennal sockets; clypeus smooth, about 0.35x as high as wide, flat with basal half slightly raised, apical margin thin, emarginate; malar space short, about 0.15x basal width of mandible; occipital carina complete, meeting hypostomal carina about 0.55x basal mandible width from base of mandible.

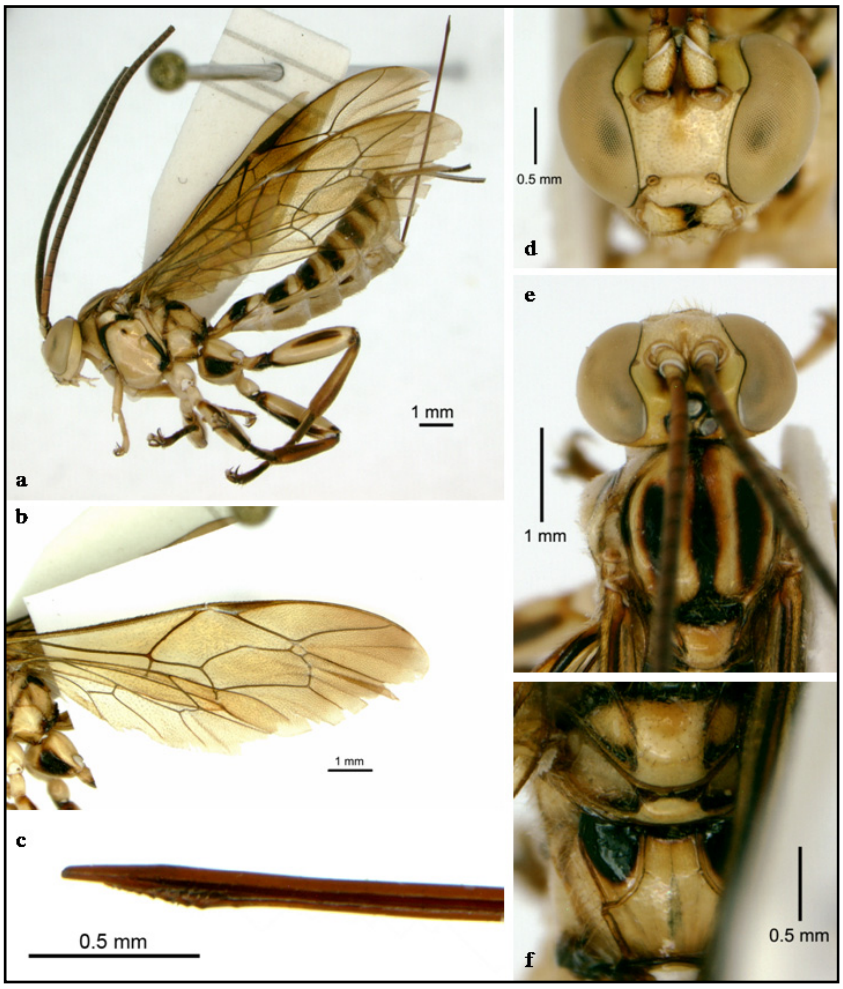

Figure 92. *T. longihastata*: a. lateral view; b.wings; c. ovipositor tip; d. face;
e. dorsal view of head and mesonotum; f. dorsal view of scutellum and propodeum

Mesosoma. Epomia about 0.33x as long as mandible basal width; pronotum impunctate and polished laterally, punctate and pubescent dorsally; mesoscutum densely pubescent, about 1.25x as long as width at anterior level of tegulae, notaulus indistinct; scutellum strongly convex, pubescent, lateral carina strong on basal half; mesopleuron with small punctures, pubescent, epicnemial carina strong on lower half of mesopleuron, sternaulus moderately impressed anteriorly; metapleuron polished, with fine punctures, pubescent dorsally, anterior lobe of submetapleural carina with carinae, posterior part of juxtacoxal carina present; propodeum polished, impunctate dorsally except lateral areas with sparse hairs, anterior transverse carina entirely absent, area superomedia open behind, 0.7x as long as wide, pleural part of posterior

transverse carina partly present, propodeal spiracle elongate, about 3.4x as long as wide. Hind leg with femur 3.2x as long as wide, length about 0.8x tibia, basitarsus length 0.3x tibia, 0.33x tarsus, 1.9x second tarsomere, fifth tarsomere longer than third. Fore wing vein *Rs*&*M* basad of *cu-a*, vein 2*rs-m* about 0.5x length of 3*rs-m*, hind wing with distal part of vein *M+Cu* straight, first abscissa of vein *Cu*1 0.4x as long as vein *cu-a*.

Metasoma. Tergites with very small punctures, pubescent, first tergite 1.6x as long as apical width, median longitudinal carina present basally, lateral carina weakly extending to spiracle; second tergite 0.65x as long as apical width, 0.7x as long as first tergite, 1.3x longer than third tergite, basal and apical oblique grooves moderately deep; ovipositor straight, length of ovipositor from tip of hypopygium 2.3x length of hind tibia, tip truncate, lower valve with seven weak teeth.

Colour. Antenna brown; frons and hind side of vertex marked with black; mesoscutum with three black stripes, median stripe joined posteriorly to black mark in front of scutellum; mesopleuron with black stripe at anterior margin, extending from above fore coxa to groove below subalar prominence and another black stripe at ventral half of mesopleural sulcus, plus a small round spot medially, under subalar prominence; propodeum with black patches in area externa; mid femur with black stripes on posterior face dorsally and on anterior face ventrally, hind leg with anterior face of coxa blackish, posterior face with round, black spot medially, trochantellus, basal and apical parts of tibia reddish, ventral reddish stripe of tibia long, connecting to reddish stripes at base and apex, upper part of posterior and anterior faces of tibia with reddish stripes medially, tibia and tarsus brown; wings brownish yellow; tergites with two lateral blackish brown to black spots.

Male. Unknown.

Distribution. Currently known only from Chu Yang Sin NP, Dak Lak Province, Central Highlands of Vietnam (Pham *et al.*, 2013b).

Ecological notes. The single specimen was collected in evergreen forest at an elevation of 800–940 m a.s.l. (Pham *et al.*, 2013b).

***Theronia maskeliyae* CAMERON, 1905**

(Figures 90b, 90e, 90h, 94)

Theronia maskeliyae Cameron, 1905. Spolia Zeylanica 3: 133. Lectotype: ♀, Sri Lanka: Maskeliya (BMNH).

Theronia hippotigris Krieger, 1906. Ztschr. Sys. Hymen. Dipt. 6: Lectotype: ♀, Sri Lanka (ZMHB).

Orientotheronia acheron Morley, 1913. Fauna of India, Hymenopt. 3 (1): 149. Holotype: ♂, Sri Lanka: Pundaluoya (BMNH)

Orientotheronia maculipes Morley, 1913. Fauna of India, Hymenopt. 3 (1): 148. Lectotype: ♀, Sri Lanka: Pundaluoya (BMNH)

Theronia maskeliyae: Gupta (1962).

Material examined. Vinh Phuc, Phuc Yen, Ngoc Thanh: 1♂ (IEBR), 150–200 m a.s.l., 24.v.2000, hand net, L. P. T. Nguyen leg.; Thai Nguyen, Dinh Hoa, Phu Dinh: 1♀ (IEBR), 100 m a.s.l., 02.iv.2005, hand net, T. V. Hoang leg.; Thai Nguyen, Dai Tu, Cat Ne: 1♀ (IEBR), 10–20.xii.2006, Malaise trap, L. D. Khuat leg.; Nghe An, Pu Mat NP, 150–200 m a.s.l.: 3♂ (IEBR), 16–17.iv.2006; 1♂ (BMNH), 14.iv.2006; 1♂ (ZFMK), 17.iv.2006, hand net, N. T. Pham leg.; 1♀ (IEBR), 150 m a.s.l., 16.iv.2006, hand net, H. X. Le leg.

Diagnosis. Clypeus with median swellings; oblique black mark on mesopleuron connecting with black mark along lower half of mesopleural suture; first tergite 1.5–2.0x longer than its apical width, with black bands, or sometimes with two nearly conjoined black spots.

Distribution. Pham *et al.* (2013b) recorded this species for the first time from Vietnam. Outside Vietnam, it has been known from China, India, Indonesia, Singapore, Sri Lanka, Thailand and the Philippines (Gupta, 1962; Yu *et al.*, 2005; Amanda *et al.*, 2011).

Remarks. Three subspecies are currently recognised, viz. *T. maskeliyae maskeliyae*, *T. maskeliyae flavifemorata* Gupta, and *T. maskeliyae schmiedeknechti* Krieger (Gupta, 1962; Yu *et al*., 2006). The Vietnamese specimens belong to the nominate subspecies, which is characterized by its mesopleuron with black marks, mid and hind femora with black stripes and metasomal tergites with black stripes rather than spots. Specimens from Vietnam have denser, moderate-sized punctures on the face.

***Theronia tahuythinhi* PHAM, BROAD & WÄGELE, 2013**

(Figures 93, 94)

Theronia tahuythinhi Pham, Broad & Wägele, 2013. Journal of Natural History, http://dx.doi.org/10.1080/00222933.2012.763105: 31.

Material examined. Dak Lak, Chu Yang Sin NP: 1♀ (RMNH, holotype), 500 m a.s.l., 03–09.vi.2007, Malaise trap, C. v. Achterberg & R. de Vries leg. 1♀ (IEBR, paratype) 2♂ (RMNH, paratype), same data as holotyle; Dak Lak, Chu Yang Sin NP: 1♂ (IEBR, paratype), 740–900 m a.s.l., 02–10.vi.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Face with dense, coarse punctures; clypeus flat, slightly raised basally, without tubercles; propodeum with elongate area superomedia; ovipositor straight, length of ovipositor from tip of hypopygium 1.25x length of hind tibia.

Description (Female). Body length 11.2–11.7 mm, fore wing 9.7–10.8 mm, ovipositor 3.5–3.8

mm. *Head*. Antenna with 39 flagellomeres, first flagellomere 1.7x length of second; diameter of lateral ocellus 0.8x ocellar-ocular distance; frons pubescent dorsally, without carina between antennal sockets; inner margins of eyes strongly concave above antennal sockets, convergent ventrally; face 0.87x as high as wide, with coarse punctures, pubescent, upper margin moderately deeply concave between antennal sockets; clypeus about 0.4x as high as wide, flat with basal half slightly raised, pubescent, apical margin thin, emarginate; malar space about 0.1x basal width of mandible; occipital carina complete, meeting hypostomal carina about 0.55x basal mandible width from base of mandible.

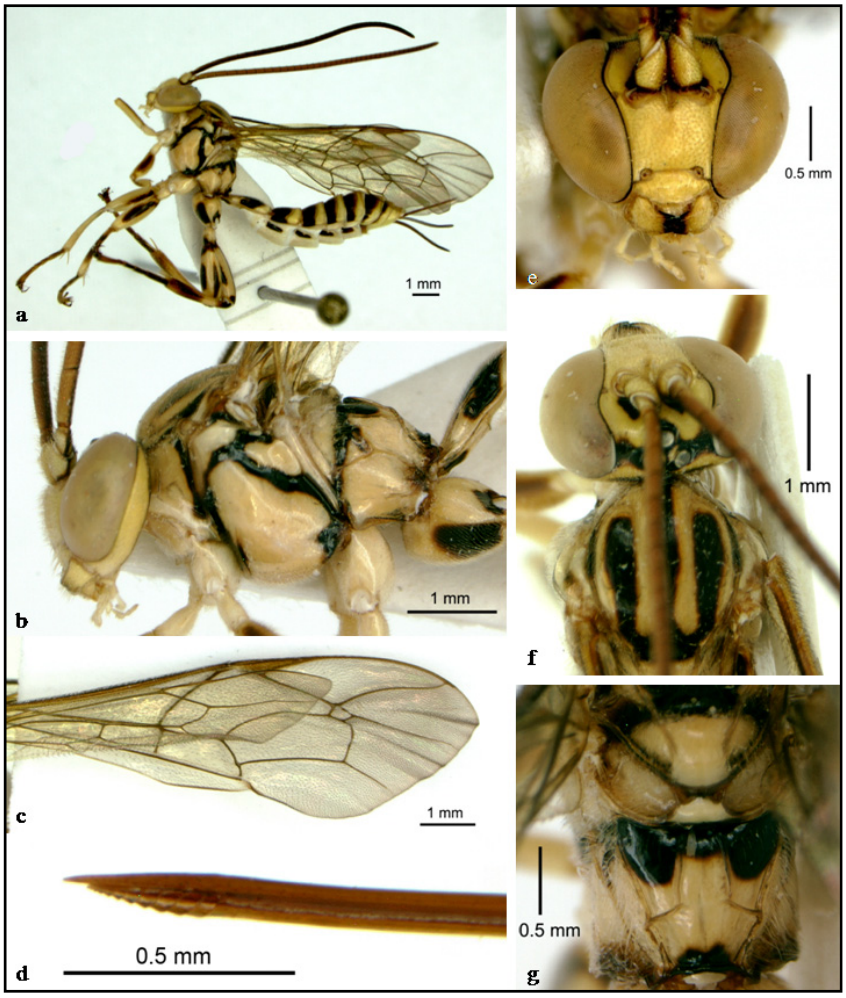

Figure 93. *T. tahuythinhi*: a. lateral view; b. lateral view of head and mesosoma; c. wings; d. ovipositor tip; e. face; f. dorsal view of head and mesoscutum; d. dorsal view of scutellum and propodeum

Mesosoma. Epomia about half length of basal mandible width; pronotum impunctate and polished laterally, punctate and pubescent along dorsal and posterior margins; mesoscutum densely pubescent, about 1.2x as long as width at anterior level of tegulae, notaulus present on anterior 0.2–0.3 of mesoscutum; scutellum strongly convex, pubescent, lateral carina strong on

basal half; mesopleuron with small punctures, pubescent, epicnemial carina strong on lower half, sometime extending weakly to anterior margin of mesopleuron, sternaulus distinctly impressed anteriorly; metapleuron polished, with fine punctures, pubescent dorsally, submetapleural carina smooth or with some small carinae attached along its length, posterior part of juxtacoxal carina present; propodeum polished, impunctate dorsally except lateral areas with scattered hairs, anterior transverse carina entirely absent, remaining carinae strong, area superomedia open behind, about 1.4–1.6x as long as apical width, pleural part of posterior transverse carina partly present, propodeal spiracle elongate, about 3.4x as long as wide. Hind leg with femur 3.1x as long as wide, length about 0.8x tibia, basitarsus length 0.3x tibia, 0.33x tarsus, 1.9x second tarsomere, fifth tarsomere longer than third. Fore wing vein *Rs*&*M* basad of *cu-a*, vein 2*rs-m* about 0.6x length of 3*rs-m*, hind wing with posterior part of vein *M+Cu* straight, first abscissa of vein *Cu*1 0.4x as long as vein *cu-a*.

Metasoma. Tergites with very small punctures, pubescent, first tergite 1.8x as long as apical width, median longitudinal carina extending level of spiracle or sometimes to median distance from spiracle to oblique groove, lateral carina weakly extending to spiracle; second tergite 0.7–0.9x as long as apical width, 0.7x as long as first tergite, 1.2x longer than third tergite, basal and apical oblique grooves moderately deep; ovipositor straight, length of ovipositor from tip of hypopygium 1.25x length of hind tibia, pointed tip, lower valve with eight teeth.

Colour. Antenna brown; frons with black spots behind antennal sockets, black stripe connecting compound eye to lateral ocellus, hind side of vertex marked with black; pronotum with black mark along posterior margin; mesoscutum with three black stripes joined posteriorly to black mark in front of scutellum; mesopleuron with black mark at groove below subalar prominence separating or connecting to black mark at anterior margin and black mark at ventral half of mesopleural sulcus; propodeum with black marks in area externa, area superomedia anteriorly, along posterior, median edge and in area dentipara; fore leg with posterior faces of femur and tibia reddish brown, mid leg with femur with broad posterior and narrow anterior dark stripes, tibia with blackish band dorsally, tarsus blackish, hind leg with anterior and posterior faces of coxa black, dorsal face of coxa with black spot posteriorly, trochantellus and base of femur reddish, anterior and posterior faces of femur with black stripes dorsally and ventrally, apex of femur black dorsally, tibia with basal black band, apical half of tibia with blackish stripe on anterior and posterior faces, tarsus with three first tarsomeres blackish, fourth and fifth tarsomeres reddish; wings hyaline, veins and pterostigma brownish yellow; tergites with black bands basally.

Male. Similar to female except mandible with upper tooth slightly broader than lower tooth; antenna varies from 37 to 40 flagellomeres, first flagellomere 1.5x length of second; two of three

male specimens with area superomedia weakly closed.

Distribution. Currently known only from Chu Yang Sin NP, Dak Lak Province, Central Highlands of Vietnam (Pham *et al.*, 2013b).

Ecological notes. The specimens were collected in evergreen forest at elevations of 500–900 m a.s.l. (Pham *et al.*, 2013b).

***Theronia zebra* (VOLLENHOVEN, 1879)**

(Figures 90c, 90f, 90i, 94)

Pimpla zebra Vollenhoven, 1879. Stett. Ent. Ztg. 40: 147. Holotype: ♀, Indonesia: Java, Ambarawa (RMNH).

Theronia zebra iriddidennis Cameron, 1907. Tijdschr. Ent. 50: 99. Holotype: ♂, India: Sikkim (BMNH).

Material examined. Ha Tinh, Huong Son, Rao An: 1♀ (IEBR), 19.v.1998, hand net, L. D. Khuat leg.; Vinh Phuc, Phuc Yen, Ngoc Thanh: 1♀1♂ (IEBR), 150–200 m a.s.l., 25–27.v.2000, hand net, L. P. T. Nguyen leg.; Ha Noi, Gia Lam, Da Ton: 2♀ (IEBR), 22.vi–02.vii.2002; 1♂ (IEBR), 22.vii–02.viii.2002, Malaise trap, L. D. Khuat leg.; Hoa Binh, Yen Thuy, Lac Thinh: 1♀ (IEBR), 10–20.vii.2002, Malaise trap, L. D. Khuat leg.; Hoa Binh, Mai Chau, Pa Co: 1♀ (IEBR), 23.viii.2005, hand net, L. P. T. Nguyen leg.; Hoa Binh, Mai Chau, Tan Son: 1♀ (BMNH), 850–900 m a.s.l., 17.iv.2011, Malaise trap, L. D. Khuat leg.; Thua Thien-Hue, Bach Ma NP: 1♀ (IEBR), 1300 m a.s.l., 12.xi.2002, hand net, T. V. Hoang leg.; Phu Tho, Xuan Son NP: 1♀ (ZFMK), 250–300 m a.s.l., 09.v.2005, hand net, N. T. Pham leg.; Nghe An, Pu Mat NP: 10♀4♂ (IEBR) 1♂ (BMNH), 150–200 m a.s.l., 14–17.iv.2006, hand net, N. T. Pham leg.; 2♀ (IEBR), 150 m a.s.l., 15.iv.2006; 2♀ (IEBR), 350 m a.s.l., 15–16.iv.2006, hand net, H. X. Le leg.; Nghe An, Tuong Duong, Tam Dinh: 2♀1♂ (ZFMK), 18.iv.2006, hand net, N. T. Pham leg.; Nghe An, Phuc Son, Cao Veu: 1♀ (IEBR), 300–400 m a.s.l., 22.iv.2006, hand net, H. X. Le leg.; Ha Giang, Vi Xuyen, Cao Bo: 1♀ (IEBR), 200 m a.s.l., 21.x.2006, hand net, L. D. Khuat leg.; Son La, Thuan Chau NR: 1♀ (IEBR), 500 m a.s.l., hand net, L. X. Truong leg.; Gia Lai, Kon Ka Kinh NP: 1♀ (IEBR), light trap, 10.vi.2011, T. Q. Nguyen & T. V. Hoang leg.; Cao Bang, Ha Lang, Duc Quang: 1♀ (IEBR), 01–13.v.2012, Malaise trap, T. Q. Nguyen leg.

Diagnosis. Clypeus with two median swellings, more distinct in male than in female; mesopleuron with drop-like black mark joined or nearly joined to black stripe below subalar prominence; propodeum with vestige of basal transverse carina, pleural part of posterior transverse carina complete or partly present; first tergite 1.2–1.5x longer than its apical width.

Distribution. According to Gupta (1962), this species was recorded from Vietnam for the first time by Garthwaite & Desai (1939). Our records extended the distribution of this species in Vietnam. Outside Vietnam, it has been recorded from Brunei, China, India, Indonesia, Malaysia,

Myanmar, Singapore, Sri Lanka, Taiwan, Thailand and the Philippines (Gupta, 1962; Yu *et al.*, 2005; Amanda *et al.*, 2011).

Remarks. Three subspecies are currently recognised, viz. *T. zebra zebra, T. zebra diluta* Gupta and *T. zebra iridipennis* Cameron. Diagnostic features to distinguish these subspecies are the colour patterns. The specimens from Vietnam belong to *T. zebra iridipennis*, which is characterized by mostly black body markings, hyaline wings, dark brown antenna and dorsally separated, dark stripes on the hind femur.

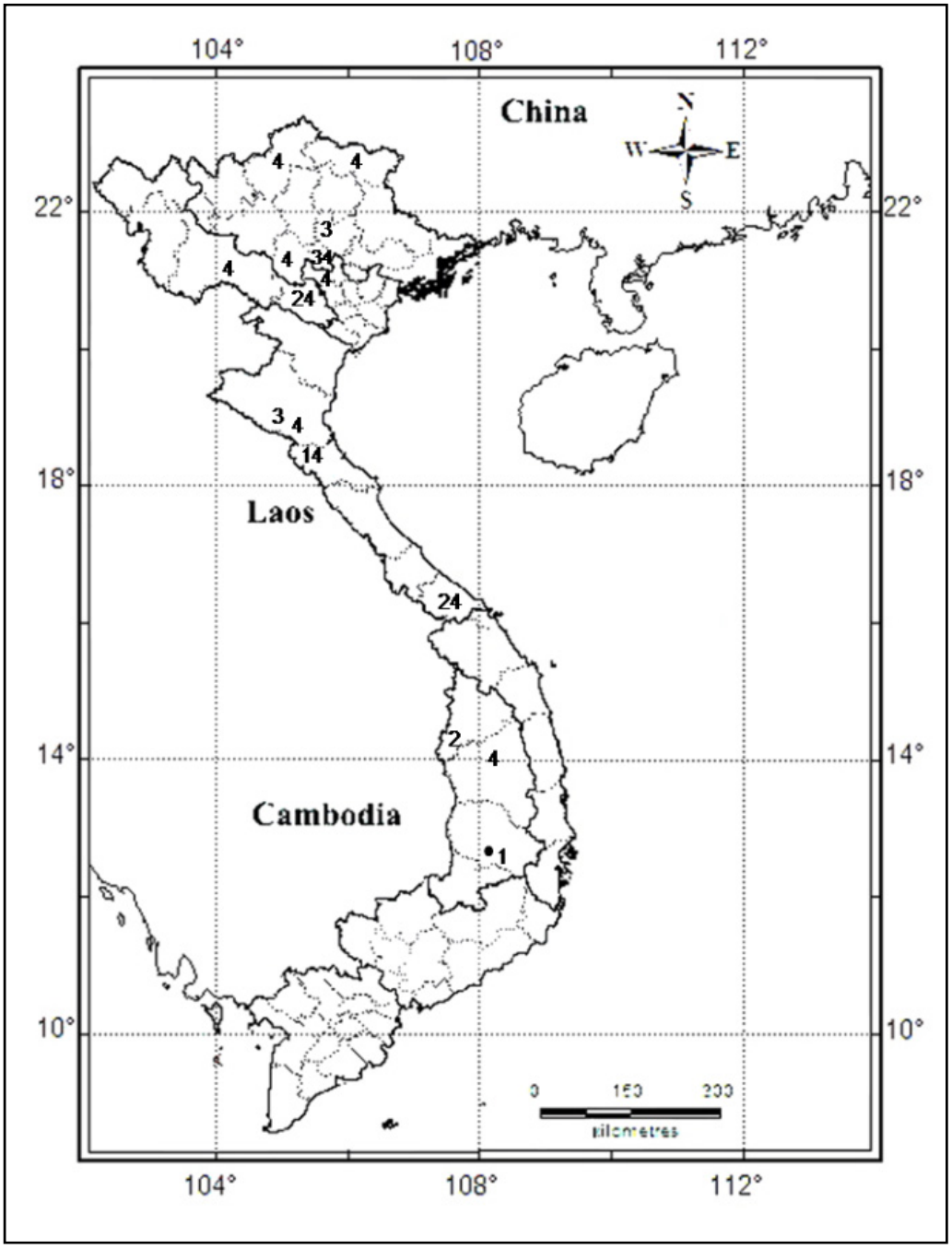

Figure 94. Distribution map of *Theronia* species: 1. *T. clathrata*; 2. *T. ferruginaterga*; 3. *T. maskeliyae*; 4. *T. zebra*; (•). *T. longihastata* & *T. tahuythinhi*

CHAPTER 3. THE *CAMPTOPYPUS* GENUS-GROUP

Diagnosis. Medio-dorsally section of occipital carina reduced; head in profile at vertex steepy declivous; mandibular teeth not twisted, the upper tooth slightly broader and longer than the lower; mesoscutum smooth and impunctate; intercoxal carinae abruptly angled posteriorly to meet its fellow and not joined to rim of foramen, instead making a sharp carina between or in front of coxal foramen; female tarsal claws all with a basal lobe; hind tarsal claw with a membranous poison vesicle; body in bright colour with patterned wings (Gauld *et al*., 2002; Sääksjarvi *et al.,* 2004).

This group comprises six genera, viz. *Amazonpimpla*, *Camptotypus*, *Clydonium*, *Odontopimpla*, *Parvipimpla*, and *Zonopimpla*. Most species of this genus-group are rarely collected insects, so their host-relationships are poorly known. However, the information available suggests these pimplines are idiobiont ectoparasitoids of the pupae and prepupae of holometabolous insects, especially of Lepidoptera, concealed in plant tissue or coccons (Sonan, 1930; Seyrig, 1932; Costa Lima, 1945; LePelley, 1954). Two *Camptotypus* species from the Afrotropics are known to parasite vespid prepupae or pupae inside the nests (Keeping & Crewe, 1983; Brooks & Wahl, 1987). Among this genus-group, *Camptotypus* is the only genus with members occuring in the Oriental region (Yu *et al.,* 2005; Alia & Idris, 2006). Morphologically, *Camptotypus* can be distinguished from *Clydonium*, *Odontopimpla*, and *Zonopimpla* by the form of the anterior part of the pronotum, which is more or less vertical in lateral view. It differs from *Amazonpimpla* by the absence of apical low serrations on the upper valve of the ovipositor, and from *Parvipimpla* by the presence of fore wing vein 3*rs-m*, so that the areolet is always closed and the occipital carina present ventrally as a short vestige before joining the hypostomal carina (Sääksjarvi *et al.*, 2003, 2004).

Camptotypus Kriechbaumer, 1889

Camptotypus Kriechbaumer, 1889: 311. Type-species: *Camptotypus sellatus* Kriechbaumer, by subsequent designation, Viereck, 1914: 27.

Synonyms:

Erythropimpla Ashmead, 1900: 57. Type-species: *Erythropimpla abbottii* Ashmead (= *Pimpla olynthia* Cameron), by original designation.

Trichiothecus Cameron, 1903: 136. Types-species: *Trichiothecus ruficeps* Cameron (= *Ichneumon rugosus* De Geer), by monotypy.

Diagnosis. Face wider than high, sparsely punctate; clypeus with median apical notch; inner margins of eyes weakly concave opposite antennal sockets; malar space 0.5–1.0x basal mandible width; occipital carina absent or indistinct mediodorsally; epomia weak or absent; notaulus

impressed on anterior 0.2–0.6 of mesoscutum; mesopleuron polished, finely punctate, epicnemial carina weak; metapleuron polished, submetapleural carina complete; propodeum without carina, except posterior stub of lateral longitudinal carina; fore wing with vein 3*rs-m* present, longer than 2*rs-m*; hind wing with first abscissa of vein *Cu*1 longer than *cu-a*; first tergite usually with weak to strong hump; tergites 2–5 with deep basal and apical oblique grooves, median area convex; ovipositor straight; wings often with infuscate margins (Gupta & Tikar, 1976; Gauld, 1984).

Up to present, 49 species of *Camptotypus* have been recognised, 15 of them are known from the Oriental region (Gupta & Tikar, 1976; Yu *et al.,* 2005; Alia & Idris, 2006; Pham *et al.,* 2012c). In Vietnam, four *Camptotypus* species are recorded so far (Gupta & Tikar, 1976; Pham *et al.,* 2012c).

Gupta & Tikar (1976) previously erected three species groups: the *rugosus*, the *stigmaticus* and the *testaceus*, based on the present of tooth-like prominences at apicolateral corners of tergites 2–5; the differences in the shape of first and second sternite; and the present of median longitudinal carinae on metasomal tergites. Of four Vietnamese species, *C. arianus* belongs to the *rugosus* group, *C. olynthius* and *C. trui* belong to the *stigmaticus* group, and *C. testaceus* belong to the *testaceus* group (Gupta & Tikar, 1976; Pham *et al.*, 2012c).

Key to Vietnamese species of *Camptotypus*

1. Inner margins of eyes convergent ventrally (Figure 95a); metasomal tergites black, densely, coarsely punctate; tergites 2–6 with median longitudinal carina basally and apically (Fig 99a); [first sternite with median prominence; ovipositor 4.0 times as long as hind tibia].....*C. arianus* (Cameron) (the *rugosus* group)

-. Inner margins of eyes parallel or divergent ventrally (Figures 95b, 95c, 95d); metasomal tergites reddish brown, sparsely to densely, coarsely punctate (Figures 99b, 99c, 99d); tergites 3–4 sometimes with median longitudinal carina crossing basal and apical grooves.....2

2. Apicolateral corners of tergites 1–5 with distinct tooth-like projections; sternites 1–2 without median prominences (Figure 98c); tergites 3–4 without median longitudinal carinae (Figure 99b); [metasomal tergites with dense, coarse puntures; ovipositor about 3.5–3.7 times as long as hind tibia].....*C. testaceus* (Cameron) (the *testaceus* group)

-. Apicolateral corners of tergites 1–5 rounded, without tooth-like projections; sternites 1–2 with median prominences (Figures 98a, 98b); tergite 3 always with median longitudinal carina crossing basal and apical grooves (Figures 99c, 99d).....3 (the *stigmaticus* group)

3. Inner margins of eyes divergent ventrally (Figure 95c); metasomal tergites sparsely punctate (Figure 99c); median prominence on first sternite with transverse carina subbasally (Figure 98a); ovipositor 4.0 times as long as hind tibia.....*C. olynthius* (Cameron)

-. Inner margins of eyes parallel ventrally (Figure 95d); metasomal tergites densely, coarsely punctate (Figure 99d); median prominence on first sternite without transverse carina subbasally (Figure 98b); ovipositor 3.3 times as long as hind tibia.....*C. trui* Pham, Broad & Wägele

Figure 95. Faces of *Camptotypus* species (scales: 0.5 mm): a. *C. arianus*; b. *C. testaceus*; c. *C. olynthius*; d. *C. trui*

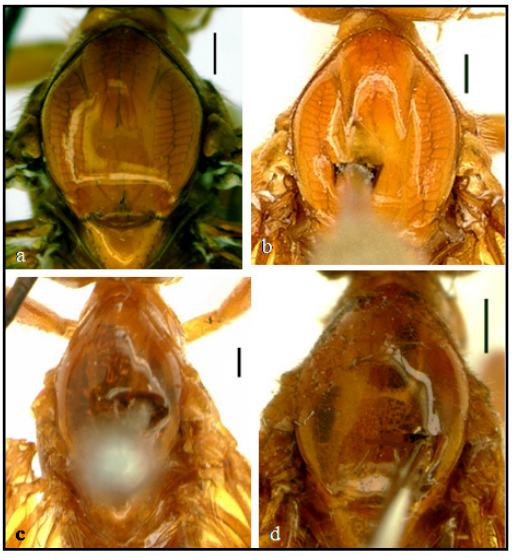

Figure 96. Dorsal views of mesoscutum of *Camptotypus* species (scales: 0.5 mm): a. *C. arianus*; b. *C. testaceus;* c. *C. olynthius*; d. *C. trui*

***Camptotypus arianus* (CAMERON, 1899)**

(Figures 95a, 96a, 97a, 99a, 100)

Pimpla ariana Cameron, 1899. Mem. Proc. Manchester. Lit. Phil. Soc., 43 (3): 157. Lectotype: ♀, India: Khasi Hills (now in Meghalaya) (OUMNH).

Camptotypus arianus: Townes, Townes & Gupta (1961).

Material examined. Dong Nai, Cat Tien NP: 1♀ (RMNH), 100 m a.s.l., 13–20.v.2005, Malaise trap, C. v. Achterberg & R. de Vries leg.; Thua Thien Hue, near Bach Ma NP: 1♀ (RMNH), 30 m a.s.l., 16°15.03'N 107°52.19'E, 11.iv.2011, hand net, C. v. Achterberg leg.

Diagnosis. Face 0.7x as high as wide; inner margins of eyes convergent ventrally; first sternite with median prominence; tergites 2–6 with median longitudinal carina present basally and apically; tergites 3 onwards with dense, coarse punctures; head, thorax, fore and mid legs reddish brown; hind leg and metasoma black; wings pale reddish brown, except apical 0.3 blackish.

Distribution. Gupta and Tikar (1976) previously recorded *C. arianus* from Vietnam (Hoa Binh Province). Our records extended the distribution of this species to Central and South Vietnam. Outside Vietnam, this species has been recorded from China, India, Indonesia, Laos, Myanmar and Taiwan (Yu *et al.*, 2005).

Remarks. Two subspecies are currently known: *C. arianus arianus* (Cameron) and *C. arianus formosanus* (Matsumura) (Gupta & Tikar, 1976; Yu *et al*., 2005). They can be distinguished from each other by the pale reddish brown wings with the infuscate margin of the first subspecies and the entirely black wings of the second subspecies. The specimens from Vietnam belong to the nominate subspecies.

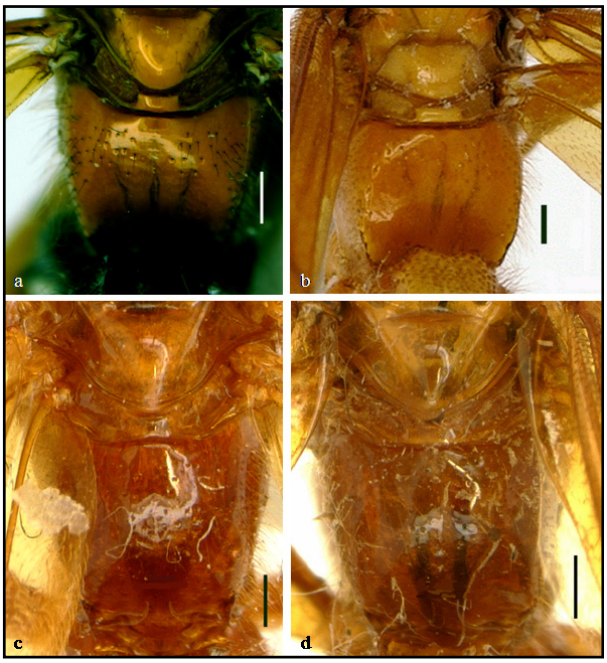

Figure 97. Dorsal views of scutellum and propodeum of *Camptotypus* species (scales 0.5 mm): a. *C. arianus*; b. *C. testaceus*; c. *C. olynthius*; d. *C. trui*

***Camptotypus olynthius* (CAMERON, 1899)**

(Figures 95c, 96c, 97c, 98a, 99c, 100)

Pimpla olynthia Cameron, 1899. Mem. Proc. Manchester Lit. Phil. Soc., 43 (3): 156. Holotype: ♀, India: Khasi Hills (OUMNH)

Camptotypus olynthius: Townes, Townes & Gupta (1961).

Material examined. Vinh Phuc, Tam Dao NP: 1♀ (IEBR), 900 m a.s.l., 01.vii.2003, hand net, T. V. Hoang leg.; Thua Thien-Hue, Bach Ma NP: 1♂ (IEBR), 11.iv.2011, hand net, L. D. Khuat leg.

Diagnosis. Face 0.6x as high as wide; inner margins of eyes divergent ventrally; fore wing with *cu-a* slightly distad of *Rs*&*M*; metasomal tergites with scattered punctures; tergite 3 with median longitudinal carina crossing the basal and apical transverse grooves; sternites 1–2 with median prominences; body reddish brown; wings pale reddish brown with infuscate outer margin and apical 0.1 of costa black.

Distribution. Pham *et al.* (2012c) recently recorded this species from Vietnam. Outside Vietnam, it has been known from India, Indonesia, Myanmar and Thailand (Gupta & Tikar, 1976).

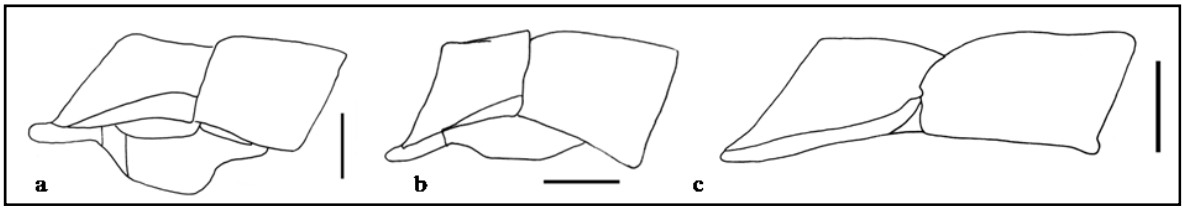

Figure 98. Lateral views of tergites 1–2 of *Camptotypus* species (scales 1 mm):
a. *C. olynthius*; b. *C. trui*; c. *C. testaceus*

***Camptotypus testaceus* (CAMERON, 1907)**

(Figures 95b, 96b, 97b, 98c, 99b, 100)

Erythropimpla testaceus Cameron, 1907. Tijdschr. Ent., 50: 98. Holotype: ♀, India: Sikkim (BMNH).
Camptotypus testaceus: Gupta & Tikar (1976).

Material examined. Ha Tinh, Huong Son, Son Kim: 1♀ (IEBR), 07.v.2004, hand net, L. X. Truong leg.; Dong Nai, Cat Tien NP: 1♀ (RMNH), 100 m a.s.l., 01–09.x.2005, Malaise trap, C. v. Achterberg & R. de Vries leg.; Thanh Hoa, Nhu Xuan, Xuan Hoa: 1♀ (IEBR), 30.v.2008, hand net, T. V. Hoang leg.

Diagnosis. Face 0.7x as high as wide; inner margins of eyes divergent ventrally; fore wing with *cu-a* opposite *Rs&M*; metasomal tergites densely punctate; tergites 1–5 with tooth-like projections at apicolateral corners; sternites 1–2 without median prominences; body reddish brown; wings pale reddish brown, infuscated beyond stigma.

Distribution. Pham *et al.* (2012c) recently recorded this species from Vietnam. Outside Vietnam, it has been known from China, India and Myanmar (Gupta & Tikar, 1976; Yu *et al.*, 2005).

***Camptotypus trui* PHAM, BROAD & WÄGELE, 2012**

(Figures 95d, 96d, 97d, 98b, 99d, 100)

Camptotypus trui Pham, Broad & Wägele, 2012. Dtsch. Entomol. Z. 59 (1): 134. Holotype: ♀, Vietnam: Kon Tum, Chu Mom Ray NP (IEBR).

Material examined. Kon Tum, Chu Mon Ray NP: 1♀ (IEBR, holotype), 700 m a.s.l., 14°25.347'N 107°43.141'E, 01.vii.2003, hand net, T. V. Hoang leg.; Nghe An, Anh Son, Phuc Son: 1♀ (ZFMK, paratype), 350 m a.s.l., 23.iv.2006, hand net, H. X. Le leg.

Diagnosis. Face 0.7x as high as wide; inner margins of eyes parallel ventrally; fore wing with vein *cu-a* opposite *Rs&M*; tergites densely punctate; tergite 3 with median longitudinal carina crossing basal and apical grooves; sternites 1–2 with median prominences; body reddish brown; wings pale reddish brown with infuscate outer margin and apical 0.1 of costa black.

Description (Female). Body length 17.0–17.5 mm, fore wing 16.5–16.7 mm, ovipositor 14.5–15.0 mm. *Head.* Antenna gradually thinner apically, 33 flagellomeres, first flagellomere 1.6x length

of second; second flagellomere 1.9x as long as wide; diameter of lateral ocellus 0.6x ocellar-ocular distance; frons polished; face 0.7x as high as wide, medially weakly convex, sparsely punctate; inner margins of eyes parallel; clypeus with median apical notch, apex thin and emarginate; malar space about 0.5x basal width of mandible; upper tooth of mandible 1.2x length of lower tooth; occipital carina absent above and indistinct before meeting hypostomal carina.

Mesosoma. Epomia absent; pronotum polished; mesoscutum 1.4x as long as wide at front edges of tegulae, subpolished, sparsely setose at anterior margin of mesonotum; notauli shallowly present on anterior 0.3 of mesoscutum, extending to level of front edges of tegulae; scutellum weakly convex, lateral carina absent; mesopleuron polished with scattered setose, epicnemial carina weakly present on lower 0.6 of mesopleuron, postpectal carina weakly present; metapleuron polished, pubescent, submetapleural carina forming flange anteriorly; pleural carina absent; propodeum moderately convex, with apical 0.2 of lateral longitudinal carina present, propodeal spiracle elongate and narrow, about 3.0x as long as wide. Legs with ridge of bristles on outer, apical side of tibiae; hind leg with femur 4.6x as long as wide, length 0.8x tibia, basitarsus 0.5x tibia, 0.5x tarsus, 3.3x second tarsomere, fifth 1.5x as long as third; fore wing vein 2*rs-m* 0.7x length of 3*rs-m*; *cu-a* opposite *Rs*&*M*; vein *Cu*1*a* separated from 1*m-cu* by 2.0x length of vein *Cu*1*b*; cell 1+2*Rs* trapezoidal, receiving vein 2*m-cu* near apex; hind wing with first abscissa of vein *Cu*1 about 1.6x length of vein *cu-a*; second abscissa of vein *Cu*1 present.

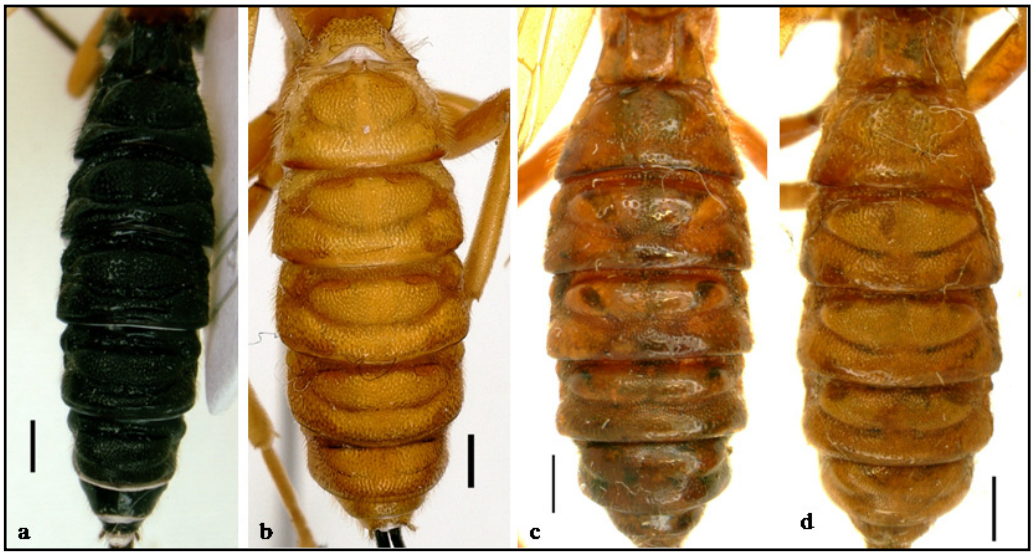

Figure 99. Dorsal views of metasomal tergites of *Camptotypus* species (scales 1 mm): a. *C. arianus*; b. *C. testaceus*; c. *C. olynthius*; d. *C. trui*

Metasoma. Tergite 2 onwards densely, coarsely punctate; first tergite 0.9x as long as apical width, dorsolateral carina present between spiracle and apex, median longitudinal carina present, weak at apex, forming median hump, angled about 110°; second tergite length 0.6x apical width;

1.1x length of third tergite; tergite 3 with median longitudinal carina crossing basal and apical grooves; tergite 4 with median longitudinal carina across basal transverse groove; sternites 1–2 with median prominences; ovipositor straight and cylindrical, length from tip of hypopygium 3.3x length of hind tibia, tip of lower valves with oblique ridges.

Colour. Reddish brown; antennal brown; wings pale reddish brown with weakly fuscous margin and apical 0.1 of costa black; ovipositor and ovipositor sheath black.

Male. Unknown.

Distribution. Currently known only from Kon Tum and Nghe An provinces, Central of Vietnam (Pham *et al*., 2012c).

Ecological notes. The specimens were collected in evergreen forest at an elevation between 350–700 m a. s. l. (Pham *et al.*, 2012c).

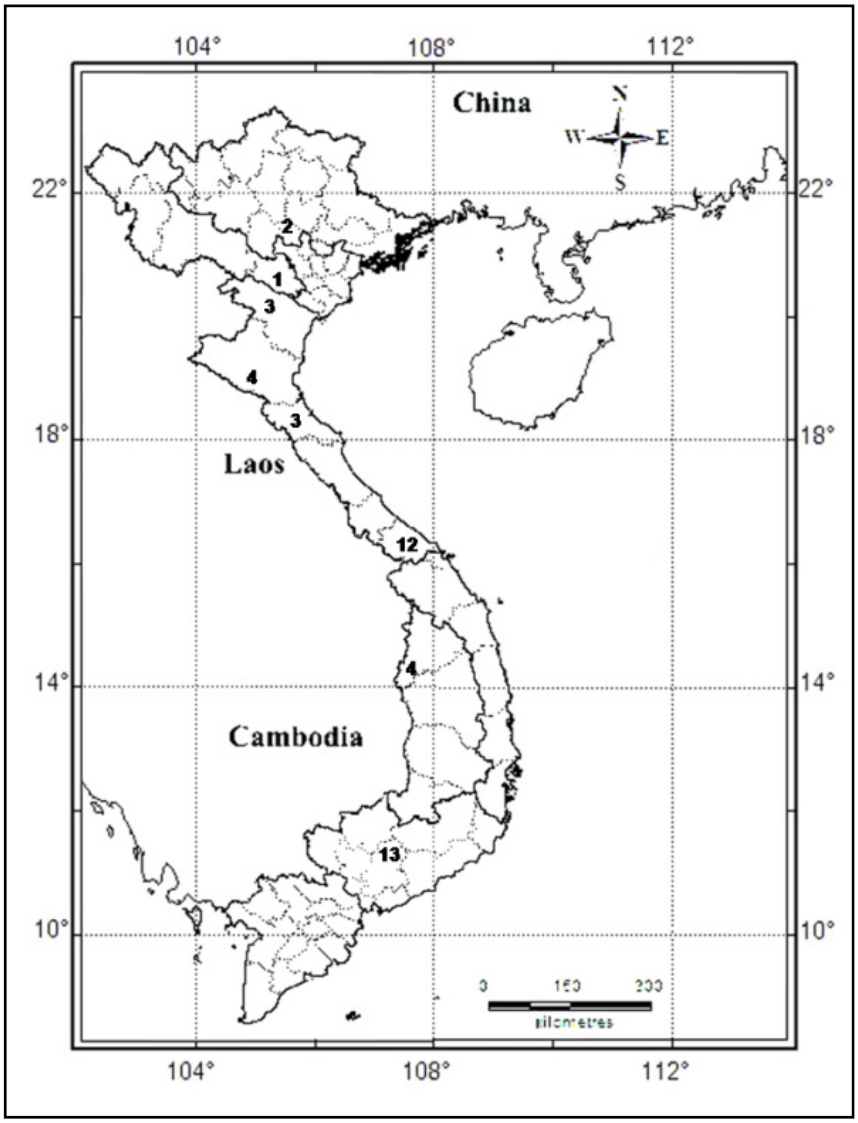

Figure 100. Distribution map of *Camptotypus* species:

1. *C. arianus*; 2. *C. olynthius*; 3. *C. testaceus*; 4. *C. trui*

CHAPTER 4. THE *EPHIALTES* GENUS-GROUP

Diagnosis. Occipital carina more or less complete, slightly to strongly concave medio-dorsally; pronotum with anterior margin mediodorsally reflexed, and directed backwards as a strong pointed tubercle; propodeum with lateromedian longitudinal carinae present anteriorly as raised lines that extend at least 0.1 length of propodeum, anterior and posterior transverse carinae entirely absent; second to fourth tarsomeres of female hind leg with spines ventrally are obviously thicker than the dorsal pubescence; tarsal claws of female all with a basal lobe; posterior 0.2 of tergites 2–4 of female with sculpture differing from the rest of tergites, usually smooth and impunctate; metasomal of male with sternite 6 flat and evenly sclerotized; tergite 3 of female usually with conspicuous lateromedian rounded swellings; ventral region of labial sclerite of final instar larva with small lobes (Gauld *et al*., 2002).

The *Ephialtes* genus-group comprises 18 genera (Townes, 1969; Gauld *et al.*, 2002). Most species of this group are solitary or less commonly gregarious idiobiont ectoparasitoid of the immature stages of holometabolous insects boring in stems, shoots or leaves, inhabiting galls, pupating in crevices in plant tissues or nesting in pre-existing borings in plants (Gauld, 1991).

In Vietnam, only three genera are represented: *Dolichomitus*, *Flavopimpla* and *Leptopimpla* (Gupta & Tikar, 1976; Pham *et al*., 2012d; under review-a).

Dolichomitus Smith, 1877

Closterocerus Hartig, 1847. Name preoccupied by Westwood, 1833. Type-species: *Closterocerus sericeus* Hartig, by monotypy.

Dolichomitus Smith, 1877. Proc. Zool. Soc. London 1877: 411. Type-species: *Dolichomitus longicauda* Smith, by monotypy.

Synonyms:

Mesoephialtes Schmiedeknecht, 1906. Opuscula ichneumonologica 3: 1014. Type-species: *Mesoephialtes coracinus* Schmiedeknecht (= *Pimpla zonata* Cresson), by monotypy.

Diclosterocerus Viereck, 1914. U.S. Natl. Mus. Bul. 83: 45 [Replacement name for *Closterocerus* Hartig].

Exeristoidea Viereck, 1924. Canad. Ent. 56: 202. Type-species: *Ichneumon* (*Exeristoidea*) *watsoni* Viereck (= *cephalotes* Holmgren), by original designation

Tuberculephialtes Ozols, 1962. Latvijas Ent. 6: 19. Type-species: *Ichneumon tuberculatus* Fourcroy, by original designation.

Paucdolichomitus Constantineanu & Pisica, 1970. An. Stiint. Univ. Al. I. Cuza Iasi. Mon. 2: 92. Type-species: *Ephialtes imperator* Kriechbaumer, by original designation.

Diagnosis. Body moderate to large sized (fore wing length 5.0–22.0 mm); clypeus with median apical notch, apical margin thin, emarginate; mandible not twisted; occipital carina complete, more or less concave mediodorsally; pronotum moderate to very long, epomia from entirely absent to short and distinct; mesoscutum from smooth, polished to finely and evenly punctate, pubescent, notauli moderately to strongly impressed anteriorly; epicnemial carina present ventrally and at least partially dorsally, mesopleural suture angled centrally; submetapleural carina from more or less complete to only present anteriorly; propodeum quite short and convex, usually with lateromedian longitudinal carinae or a deep furrow anteriorly; fore tarsal claw with lobe; metasomal tergite 2 with oblique grooves deeply impressed, extending about 0.5 the length of tergite, sometimes grooves weaker and shorter; tergites 3–5 often with tubercles; ovipositor projecting beyond apex of metasoma by 4.3–12.8 times length of hind tibia, with subapical lobe of lower valve partly enclosing upper valve (Townes, 1969; Gupta & Tikar, 1976; Gauld, 1991).

Dolichomitus Smith, 1877 is a relatively large genus of the tribe Ephialtini (Pimplinae), with 73 described species from around the world, except the Ethiopian and Australian regions. Species richness is highest in the Palearctic with a total of 37 described species, followed by the Nearctic (22 species), the Orient (16 species) and the Neotropics (11 species) (Wang *et al.*, 1997; Yu *et al.*, 2005; Sheng & Sun, 2009; Zwakhals, 2010; Pham *et al*., 2012d). Townes & Townes (1960) identified the heterogeneous nature of this genus, a conclusion supported by the morphological phylogenetic analysis of Gauld *et al.* (2002). However, phylogenetic analyses have not included enough species to enable a reappraisal of the generic limits.

Morphologically, *Dolichomitus* species may be confused with several genera of Ephialtini with long ovipositors in the Oriental and Palearctic regions. Townes's (1969) and Gupta & Tikar's (1976) generic keys should enable recognition of *Dolichomitus*. Useful distinguishing characters are as follows: clypeus normal (twice as wide as high in *Ephialtes*); lower mandibular tooth at most slightly longer than upper tooth (lower tooth about twice as long as upper in *Ephialtes*); mandible indistinctly punctate (striate in *Paraperithous*); propodeum usually with distinct lateromedian longitudinal carinae or furrow (carinae or furrow absent or weak in *Exeristes* and *Liotryphon*); fore tarsal claw with basal lobe (some *Exeristes* lacking lobe); metasomal tergites not coarsely punctate (coarsely punctate in *Exeristes*); tergite 2 with oblique grooves usually strong (weak in *Exeristes*, *Flavopimpla* and *Liotryphon*); tergite 2 with relatively narrow apical impunctate area (broad, at least 6.0 x puncture diameter, impunctate area in *Liotryphon*); male with setae on fore wing leading edge normal length (markedly elongate in *Ephialtes* and *Townesia*); ovipositor with lower valves apically lobed, partially enclosing upper valve, and lacking small teeth on upper valve (lower valves not lobed in *Exeristes*, *Flavopimpla*, *Liotryphon*, verging on lobed in *Paraperithous* but with

row of minute teeth on upper valve).

Townes & Townes (1960) recognized six species-groups within *Dolichomitus* for the Nearctic region, viz. the *taeniatus*, *tuberculatus*, *ephalotes*, *irritator*, *imperator* and *sericeus* groups. In the Oriental region, Gupta & Tikar (1976) recorded a total of 13 species, of which seven belong to the *irritator* species-group. These authors erected the *mandibularis* species-group for *D. khasianus* Gupta & Tikar from India and China and *D. mandibularis* (Uchida) from Japan. They also transfered *D. crassus* (Morley) from the *tuberculatus* species-group (Townes & Townes, 1960) to the *celophates* species-group. Pham *et al.* (2012d) recorded this genus for the first time from Vietnam with description of one new species, *D. lami* Pham, Broad & Zwakhals, and reported *D. melanomerus* (Vollenhoven) as new for this country. The two Vietnamese species can be readily placed in the *irritator* species-group (Pham *et al*., 2012d).

Where known, *Dolichomitus* species are ectoparasitoids of xylophagous Coleoptera larvae (Buprestidae, Cerambycidae, Curculionidae – including scolytines – and Melandryidae) (Townes & Townes, 1960; Aubert, 1965; Fitton *et al.*, 1988).

Key to Vietnamese species of *Dolichomitus*

Frons without longitudinal impression laterally; teeth of mandible equal in length; epicnemial carina extending nearly to groove below subalar prominence, then turning forward to anterior margin of mesopleuron (Figure 101a); fore wing with vein 2*rs-m* shorter than 3*rs-m*; fifth tarsomere of hind tarsus slightly shorter than third.....*D. lami* Pham, Broad & Zwakhals

-. Frons with deep longitudinal impression laterally (Figure 102a); mandible with upper tooth longer than lower tooth; epicnemial carina extending nearly to groove below subalar prominence, not turning forward anterior margin of mesopleuron; fore wing with vein 2*rs-m* equal to 3*rs-m*; fifth tarsomere of hind tarsus slightly longer than third……..*D. melanomerus* (Vollenhoven)

***Dolichomitus lami* PHAM, BROAD & ZWAKHALS, 2012**

(Figures 101, 103)

Dolichomitus lami Pham, Broad & Zwakhals, 2012. Zootaxa, 3519: 78. Holotype: ♀, Vietnam: Lao Cai (Hoang Lien NP) (IEBR).

Material examined. Lao Cai, Hoang Lien NP: 1♀ (IEBR, Holotype), 1940 m a.s.l., 30.vii.2008, hand net, L. X. Truong leg.

Diagnosis. Face as high as wide, with dense, moderate-sized punctures, long hairs; mandibular upper tooth shorter than lower; mesoscutum and mesopleuron with moderately dense, small punctures; epicnemial carina extending nearly to groove below subalar prominence, then turning

forward to anterior margin of mesopleuron; tubercles on tergites 3–5 weak, punctate; ovipositor down-curved at tip, 5.1x hind tibia length, ventral valve with four preapical and nine apical grooves.

Description (Female). Body length 27.5 mm, fore wing 19.2 mm, ovipositor 32.5 mm. *Head*. Antenna with 42 flagellomeres, first flagellomere 1.4x length of second; diameter of lateral ocellus equal to ocellar-ocular distance; frons polished, with several hairs; face as high as wide, with dense, moderate-sized punctures, long hairs; clypeus pubescent, 0.55x as high as wide, basally weakly convex, apex thin, emarginate; malar space about 0.3x basal width of mandible; upper tooth shorter than lower tooth; occipital carina complete, meeting hypostomal carina at about 0.6x basal mandible width from base of mandible; vertex and gena polished, moderately dense small punctate, pubescent.

Mesosoma. Epomia present, 0.3x as long as mandible basal width; pronotum polished, impunctate except dorsal margin and posterior corner punctate, pubescent; mesoscutum 1.5x as long as wide at anterior level of tegulae, with moderately dense, small punctures, pubescent, notauli distinctly present on anterior 0.3 of mesoscutum, nearly extending to front level of tegulae; scutellum moderately convex, pubescent, lateral carinae absent; mesopleuron with moderately dense, small punctures, pubescent, polished and impunctate posteriorly near mesopleural suture, epicnemial carina extending nearly to groove below subalar prominence, then turning forward to anterior margin of mesopleuron; metapleuron polished with moderately dense, low punctures, pubescent, submetapleural carina complete, forming anterior lobe; propodeum with dense, coarse punctures, long hairs, mediodorsal furrow moderately deeper basally than medially, above area petiolaris with transverse striae; pleural area with dense, coarse punctures, long hairs, propodeal spiracle oval, about 2.0x as long as wide, not touching pleural carina. Hind leg with femur 5.5x as long as wide, length 0.6x tibia, tarsus longer than tibia, basitarsus 0.5x tarsus, 2.4x second tarsomere, fifth tarsomere slightly shorter than third. Fore wing with areolet trapezoidal, vein 2*rs-m* 0.7x length of 3*rs-m*; *cu-a* opposite *Rs*&*M*; hind wing with vein *M*+*Cu* straight, first abscissa of vein *Cu*1 about 0.6x length of vein *cu-a*.

Metasoma. Tergites with coarse, coalescent punctures, except apical transverse smooth bands; first tergite 2.0x as long as apical width, dorsolateral carina distinct and strong from spiracle to apex, median longitudinal carina distinct on basal 0.3, weaker and forming shallow hollow posteriorly; second tergite 1.4x length of apical width, equal to first tergite, 1.1x length of third, basal oblique groove deep, extending about half length of tergite; tergites 3–5 with weak, punctate tubercles; apical transverse smooth bands on tergites 2–4 extending about 0.1x length of each tergite; ovipositor down-curved at tip, 5.1x length of hind tibia, lower valve with four preapical and nine apical grooves.

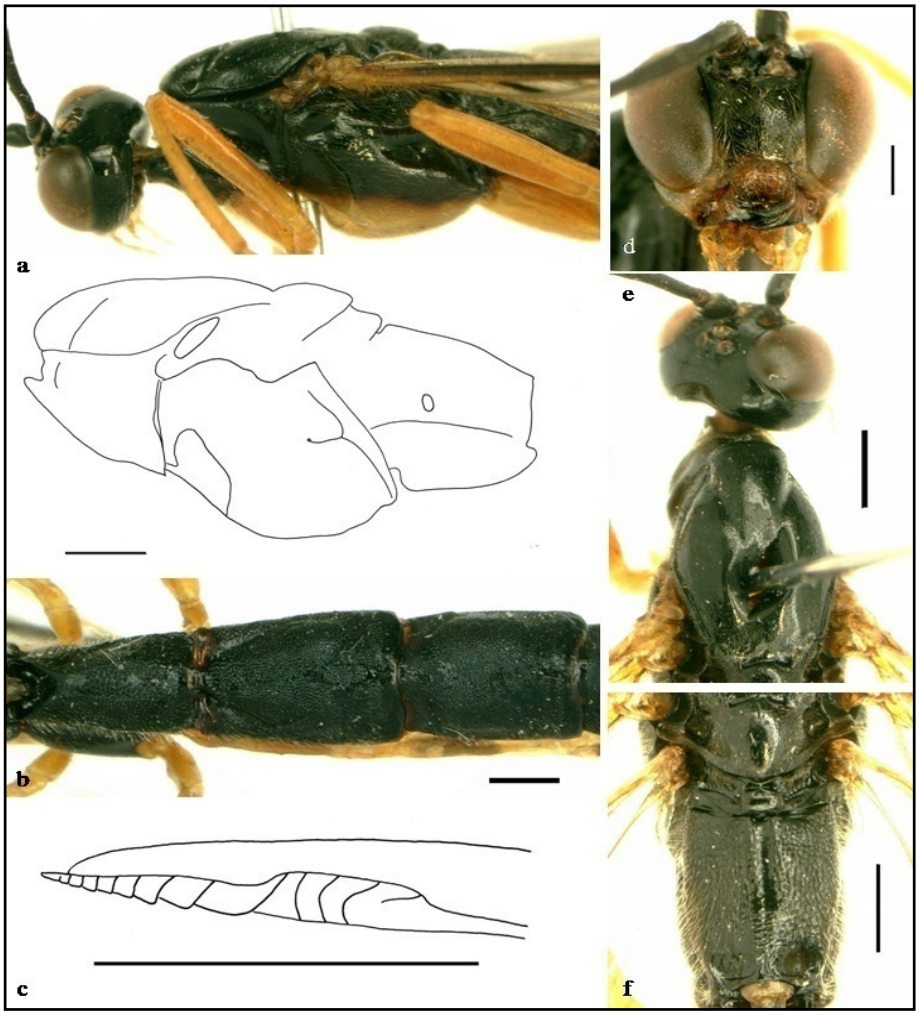

Figure 101. *D. lami* (scales 1 mm): a. lateral view of mesosoma; b. metasomal tergites 1–3; c. ovipositor tip; d. face; e. dorsal view of head and mesoscutum; f. dorsal view of scutellum and propodeum

Colour. Black. Clypeus, malar, mandibles basally, ventral part of gena, tegula, mesothorax ventrally, legs (except hind coxa black, hind tibia to tarsus dull reddish to blackish) reddish brown; wings yellowish brown, pterostigma and veins black; ovipositor yellow.

Male. Unknown.

Distribution. Currently known only from Hoang Lien NP, Lao Cai Province (Pham *et al*., 2012d).

Ecological note. The single specimen was collected in montane evergreen forest (Pham *et al*., 2012d).

***Dolichomitus melanomerus* (VOLLENHOVEN, 1878)**

(Figures 102, 103)

Ephialtes melanomerus Vollenhoven, 1878. Tijdschr. Ent. 21: 48. Holotype: ♀, Java (RMNH)

Dolichomitus melanomerus: Townes & Townes (1960)

Ephialtes tinctipennis Cameron, 1899. Mem. Proc. Manchester Lit. Phil. Soc. 43: 151. Holotype: ♀, India: Khasi Hills (BMNH).

Dolichomitus tinctipennis: Townes, Townes & Gupta (1961).

Dolichomitus melanomerus tinctipennis: Gupta & Tikar (1976).

Material examined. Vinh Phuc, Tam Dao NP: 1♀ (IEBR), 900 m a.s.l., 13.v.2003, hand net, T. V. Hoang leg.; Hoa Binh, Hang Kia-Pa Co NR: 2♂ (IEBR), 10–20.iv.2002, Malaise trap, L. D. Khuat leg.; 1♂ (RMNH), 1319 m a.s.l., 20°44'35N 104°53'45E, 10–24.x.2009, Malaise trap, C. v. Achterberg & R. de Vries leg.

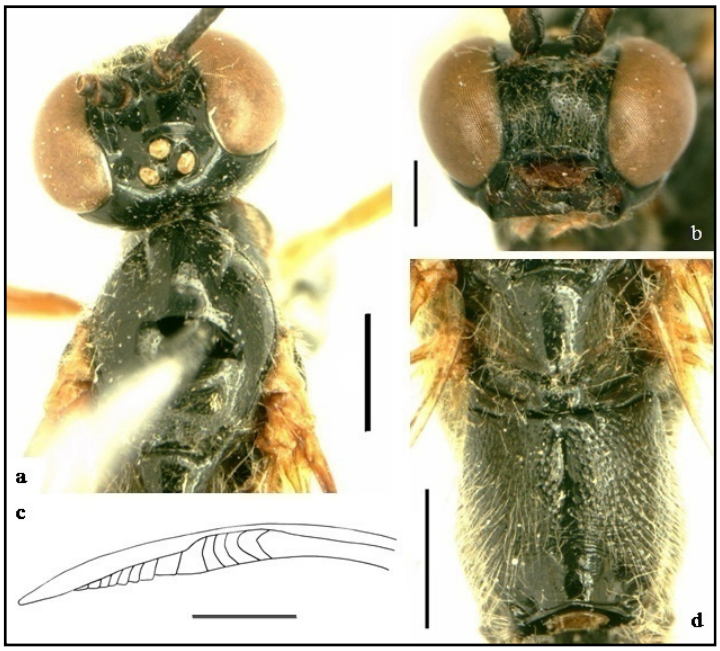

Figure 102. *D. melanomerus* (scales 1 mm): a. lateral view of mesosoma; b. face; c. ovipositor tip; d. dorsal view of scutellum and propodeum

Diagnosis. Face slightly shorter than wide, with dense, moderate-sized punctures, long hairs; mandibular teeth equal in length; mesoscutum and mesopleuron with moderately dense, small punctures; tubercles on tergites 3–5 distinct, punctate; ovipositor down-curved at tip, 7.6x length of hind tibia, lower valve with five preapical and eight apical grooves.

Distribution. Pham *et al.* (2012d) recorded this species for the first time from Vietnam. Outside Vietnam, it has been known from India, Indonesia, Japan, Russia, Sri Lanka, Taiwan and the Philippines (Yu *et al*., 2005).

Remarks. The Vietnamese specimens were designed to *D. melanomerus* using Gupta & Tikar's (1976) key and closely resemble the holotype (in BMNH) of *D. melanomerus tinctipennis*. Gupta & Tikar (1976) separated the subspecies of *D. melanomerus* mainly on the basis of colour patterns of the legs. Whether these differences reflect genetic separation of populations is unknown.

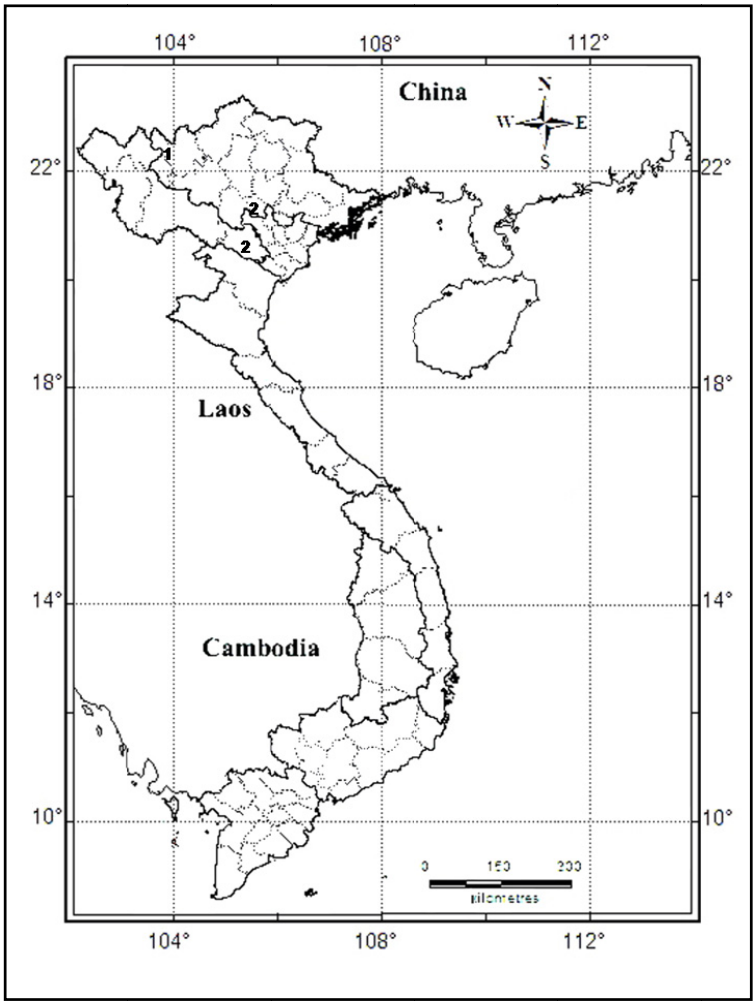

Figure 103. Distribution map of *Dolichomitus* species: 1. *D. lami*; 2. *D. melanomerus*

***Flavopimpla* Betrem, 1932**

Flavopimpla Betrem, 1932. Treubia, 14: 21. Type species: *Flavopimpla mangae* Betrem, 1932 = *nigromaculata* (Cameron, 1899); designated by Townes, Townes & Gupta, 1961.

Synonym:

Afrephialtes Benoit, 1953. Rev. de Zool. Bot. Africaines, 48: 81. Type species: *Ephialtes navus* Tosquinet; synonymised by Townes (1969).

Diagnosis. Body moderately long; face almost flat, weakly convex medially; clypeus convex subbasally, depressed apically, with median apical notch; mandible teeth subequal; occipital carina complete, concave medio-dorsally; pronotum with epomia; mesoscutum moderately to strongly punctate, notauli short to moderately long, usually strong and sharp but sometimes weak; scutellum and metascutellum weakly to moderately convex, moderately to strongly punctate; mesopleuron polished, with sparse to moderately dense punctures, pubescent; metapleuron with submetapleural carina complete; propodeum without longitudinal groove medially, with posterior part of lateral longitudinal carina present; fore wing with areolet nearly trapezoidal, vein 2*rs-m*

always shorter than 3*rs-m*; hind wing with first abscissa of vein *Cu*1 shorter than vein *cu-a*; first tergite rather short; second tergite with basolateral groove deep and short; tergites 2–5 with strongly punctate; tubercles on tergites 3–6 more or less distinct; ovipositor longer than fore wing, lower valve not lobed subapically, tip of lower valve with strong teeth (Townes, 1969; Gupta & Tikar, 1976).

Various authors have treated *Flavopimpla* and *Afrephialtes* as separate genera (e.g., Gupta & Tikar, 1969; Fitton *et al.,* 1988; Sheng & Sun, 2010) and the conspicuous yellow-marked, stouter species of the traditional *Flavopimpla* are superficially distinct from the more monochrome, slender species assigned to *Afrephialtes*. However, Townes (1969) synonymised *Afrephialtes* under *Flavopimpla* and Gauld *et al.* (2002) found '*Afrephialtes*' to be paraphyletic with respect to *Flavopimpla sensu stricto*, supporting Townes's synonymy.

Gauld *et al.* (2002) found one apomorphic character supporting the monophyly of *Flavopimpla* (including *Afrephialtes*), namely the intercoxal carinae on the metasternum abruptly angled posteriorly and meeting in a sharp carina between or in front of the hind coxal foramina.

I followed Gauld *et al.* (2002) to assign the specimens from Vietnam to the genus *Flavopimpla.* Three Vietnamese *Flavopimpla* species have been recorded, of which two species have recently described (Pham *et al.*, 2011e, under review-a).

There are no host records from Vietnam for any of the three *Flavopimpla* species. Outside Vietnam, the few reliable host records for the genus are from wood-boring Lepidoptera (Pyralidae: Pyraustinae and Sesiidae) (Yaseen & Bennett, 1972; Gupta & Tikar, 1976; Fitton *et al.*, 1988).

Key to Vietnamese species (based on female only since the males of *F. lanugo* and *F. vinhcuuensis* are unknown).

1. Ovipositor with upper valve slightly to distinctly broader than lower valve (Figures 104e, 105c); posterior carina of first sternite more broadly notched medially (Figure 104d); face about 0.7 times as high as wide (Figure 104f); hind wing with first abscissa of vein *Cu*1 about 0.45 times length of vein *cu-a*……2

-. Ovipositor with upper valve subapically slightly narrower than lower valve (Figure 106f); posterior carina of first sternite deeply notched medially (Figure 106d); face 0.9 times as high as wide (Figure 106g); hind wing with first abscissa of vein *Cu*1 about 0.7 times length of vein *cu-a*……*F. vinhcuuensis* Pham, Broad & Wägele

2. Metasternum with carina between hind coxal foramina strongly curved (Figure 104c); first tergite 1.05 times as long as apical width; tergites 2–4 with transverse smooth bands extending over apical 0.2–0.25 of tergites (Figure 104b); ovipositor 5.4–5.6 times as long as hind tibia, with

upper valve subapically only slightly broader than lower valve (Figure 104e)……*F. lanugo* Pham, Broad & Wägele

-. Metasternum with carina between hind coxal foramina evenly curved (Figure 105d); first tergite 1.25 times as long as apical width; tergites 2–4 with transverse smooth bands extending over apical 0.15–0.17 of tergites (Figure 105b); ovipositor 6.5 times as long as hind tibia, with upper valve subapically distinctly broader than lower valve (Figure 105c)…….. …*F. latiannulata* (Cameron)

***Flavopimpla lanugo* PHAM, BROAD & WÄGELE (under review)**

(Figures 104, 107)

Material examined. Phu Tho, Xuan Son NP: 1♀ (BMNH, holotype), 300 m a.s.l., 05–10.vii.2009, Malaise trap, L. D. Khuat leg.; 1♀ (ZFMK, paratype), same data as holotype, except 10–30.iii.2010.

Diagnosis. Metapleuron with sparse hairs, ventral part entirely impunctate; carina between hind coxal foramina strongly curved; first tergite nearly as long as apical width; tergites 2–4 with apical transverse smooth bands extending about 0.2–0.25x length of each tergite; ovipositor decurved, 5.4x as long as hind tibia, tip weakly swollen, upper valve slightly broader than lower valve.

Description (Female). Body length 13.0–15.0 mm, fore wing 10.0–12.0 mm, ovipositor 16.0–18.0 mm. *Head*. Antenna with 33–34 flagellomeres, first flagellomere 1.4x length of second; diameter of lateral ocellus 0.67x ocellar-ocular distance; frons subpolished; face 0.7x as high as wide, with long, dense white hairs, upper margin of face with broad concavity; clypeus pubescent, apex thin and emarginate; malar space about 0.3x basal width of mandible; upper tooth of mandible slightly broader than lower tooth; occipital carina meeting hypostomal carina at about 0.55x basal mandible width from base of mandible; gena slightly swollen, polished, with sparse hairs, about 0.67x compound eye width laterally.

Mesosoma. Epomia length about 0.75x basal width of mandible; pronotum polished, impunctate except dorsal margin and posterior corner pubescent; mesoscutum 1.3x as long as width at anterior level of tegulae, with dense, minute hairs, notauli distinct on anterior 0.25 of mesoscutum, extending nearly to front level of tegulae; mesopleuron with moderately dense, long, white hairs except posterior area near mesopleural suture, epicnemial carina weakly present on lower 0.7 of mesopleuron, lateral sections of postpectal carina present to middle of mid coxa; metapleuron polished and impunctate dorsally and ventrally, pubescent anteriorly and posteriorly, submetapleural carina rounded anteriorly, angled before posterior fork; metasternum with carina between hind coxal foramina strongly curved; propodeum strongly convex, densely, coarsely

punctate, with long, white hairs except mediodorsally and area petiolaris, without carinae except short posterior stub of lateral longitudinal carina, propodeal spiracle oval, about 2.0x as long as wide, not touching pleural carina. Hind leg with femur 4.0–4.2x as long as wide, length 0.7x tibia, basitarsus 0.45x tarsus, 2.25x second tarsomere, fifth tarsomere slightly longer than third. Fore wing vein 2*rs-m* 0.6x length of 3*rs-m*; *cu-a* slightly basad of *Rs&M*; hind wing with vein *M+Cu* moderately straight, first abscissa of vein *Cu*1 about 0.45x length of vein *cu-a*; distal end of vein *Cu*1 present.

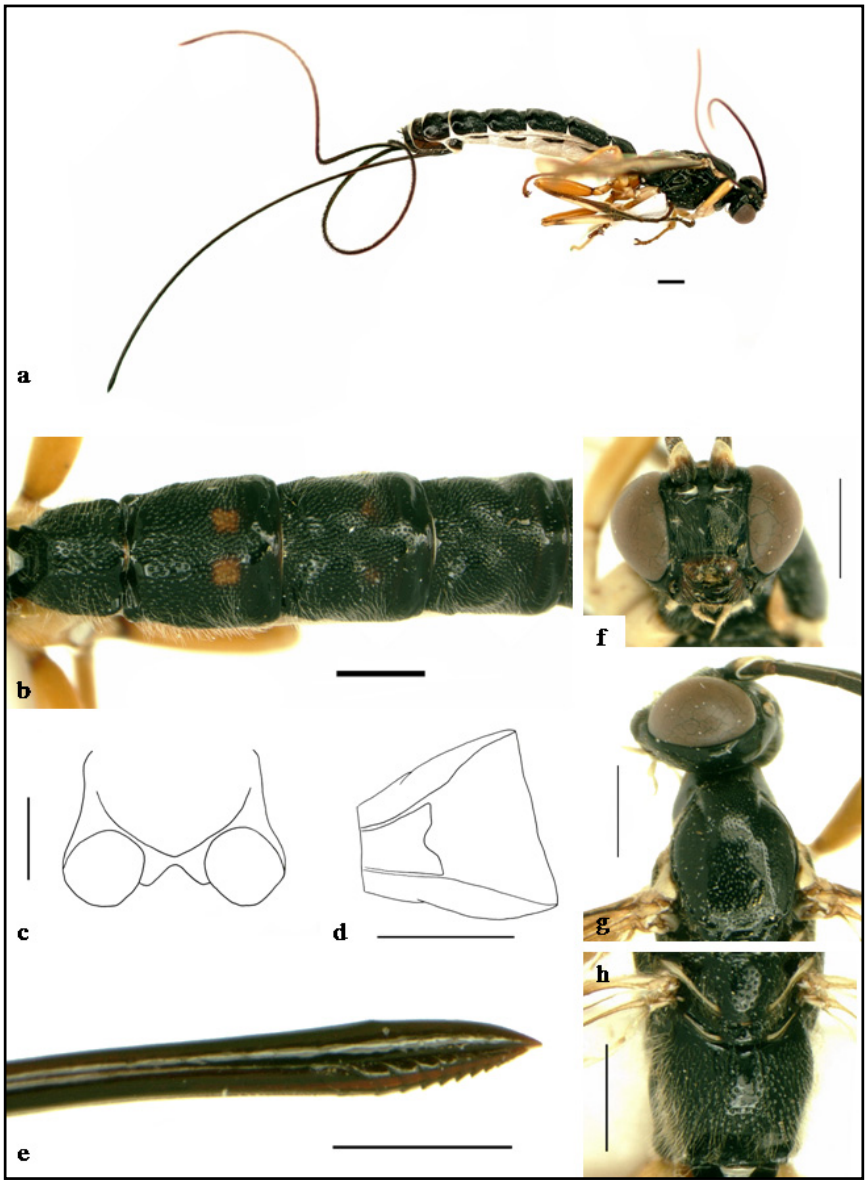

Figure 104. *F. lanugo* (scales 1 mm, except 0.5 mm for ovipositor tip): a. lateral view; b. dorsal view of tergites 1–4; c. metasternum; d. first sternite; e. ovipositor tip; f. face; g. dorsal view of head and mesoscutum; h. dorsal view of scutellum and propodeum

Metasoma. Tergites densely punctate except apical, transverse, smooth bands; first tergite 1.05x as long as apical width, dorsolateral carina weakly present, median longitudinal carina

distinct at base then weaker, not extending to apex; first sternite without tubercles, apex broadly notched medially; second tergite 1.05x length of apical width; 1.1x length of third tergite; ovipositor decurved, 5.4–5.6x length of hind tibia, ovipositor tip weakly swollen, upper valve slightly broader than lower valve, lower valve with 11 apical ridges.

Colour. Black. Antenna black, except apical half of scape yellow ventrally; clypeus and mandible reddish brown; palpi, upper margin of pronotum and tegula yellow, legs reddish, except hind tibia fuscous with outer side yellow medially, hind tarsus black; wings brown, pterostigma and veins blackish; metasomal tergites black or with two subapical reddish spots on tergites 2–3; ovipositor reddish, ovipositor sheath black with long setae.

Male. Unknown.

Distribution. Currently known only from Xuan Son NP, Phu Tho Province (Pham *et al*., under review-a).

Ecological note. The specimens were collected in secondary lowland forest (Pham *et al*., under review-a).

***Flavopimpla latiannulata* (CAMERON, 1907)**

(Figures 105, 107)

Ephialtes latiannulatus Cameron, 1907. Tijdschr. Ent., 50: 96. Holotype: ♀, India: Sikkim (BMNH).
Flavopimpla latiannulata: Townes, Townes & Gupta (1961).

Material examined. Ha Noi, Thach That, Tan Xa: 1♀ (IEBR), 05–15.vi.2002, Malaise trap, L. D. Khuat leg.; Dong Nai, Cat Tien NP: 1♀ (RMNH), 100 m a.s.l., 09–30.iv. 2007, Malaise trap, Q. P. Mai & M. T. Nguyen leg.

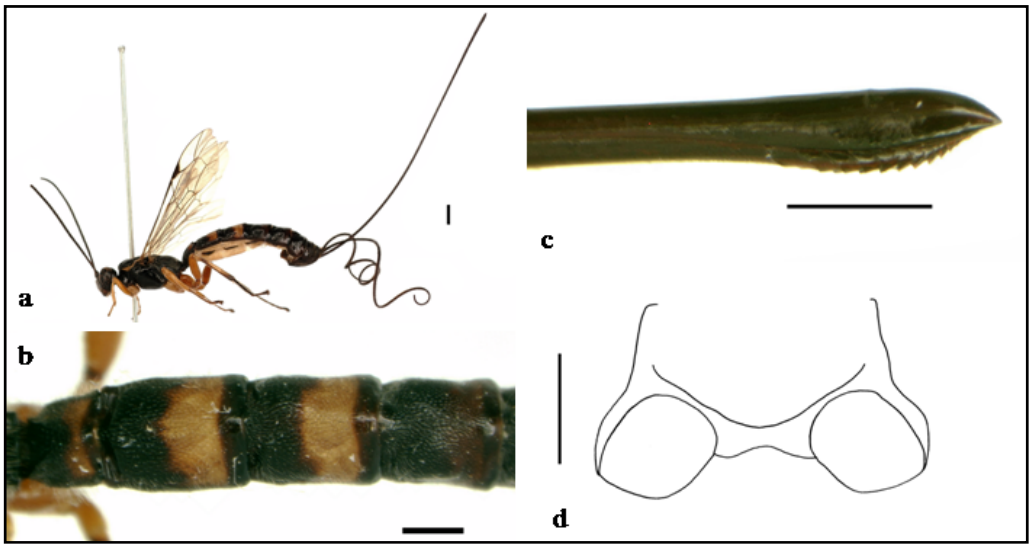

Figure 105. *F. latiannulata* (scales 1 mm, except 0.5 mm for ovipositor tip):
a. lateral view; b. dorsal view of tergites 1–4; c. ovipositor tip; d. metasternum

Diagnosis. Ovipositor about 6.5x as long as hind tibia, with bulbous tip, upper valve distinctly deeper than lower; body black with reddish markings on tergites 1–3.

Distribution. *Flavopimpla latiannulata* was assigned to the genus *Afrephialtes* by Gupta & Tikar (1969), which was followed by Sheng & Sun (2010) and Pham *et al.* (2011e). Pham *et al*. (2011e) recorded this species from Vietnam for the first time. Outside Vietnam, it has been recorded from China, India and Sri Lanka (Yu *et al.,* 2005) and has been reared from the pyralid moth genus *Hypsipyla* (Yaseen & Bennett, 1972).

***Flavopimpla vinhcuuensis* PHAM, BROAD & WÄGELE (under review)**

(Figures 106, 107)

Material examined. Dong Nai, Vinh Cuu, Phu Ly: 1♀ (IEBR, holotype), 100 m a.s.l., 04.iv.2009, hand net, T. V. Hoang leg.

Diagnosis. Metasternum with carina between hind coxal foramina weak and almost straight; metasomal tergites with dense, coarse punctures; first sternite deeply notched posteriorly; ovipositor straight, 5.4x length of hind tibia, ovipositor tip weakly swollen, lower valve slightly broader than upper valve; body black, legs reddish.

Description (Female). Body length 10.0 mm, fore wing 7.0 mm, ovipositor 9.0 mm. *Head*. Antenna with 27 flagellomeres, first flagellomere 1.3x length of second; diameter of lateral ocellus 0.55x ocellar-ocular distance; frons polished; face 0.9x as high as wide, long hairs moderately dense, upper margin of face straight; clypeus pubescent, apex thin and emarginate; malar space about 0.3x basal width of mandible; occipital carina meeting hypostomal carina at about 0.67x basal mandible width from base of mandible; gena slightly swollen, polished, with sparse hairs, about half width of compound eye laterally.

Mesosoma. Epomia length about 0.5x basal width of mandible; pronotum polished, impunctate except dorsal margin and posterior corner pubescent; mesoscutum 1.3x as long as width at anterior level of tegulae, with dense, minute hairs, notauli distinct on anterior 0.25 of mesoscutum, ending before front level of tegulae; mesopleuron subpolished, finely punctate, pubescent, epicnemial carina weakly present on lower 0.8 of mesopleuron, lateral sections of postpectal carina present to middle of mid coxa; metapleuron polished, evenly finely punctate, submetapleural carina forming small lobe anteriorly, angled before posterior fork; metasternum with carina between hind coxal foramina weak, mostly straight; propodeum convex, with dense, coarse punctures, long hairs except mediodorsally and area petiolaris, without carinae except short posterior stub of lateral longitudinal carina, propodeal spiracle round, not touching pleural carina. Hind leg with femur 3.9x as long as wide, length 0.7x tibia, basitarsus 0.45x tarsus, 2.1x second

tarsomere, fifth tarsomere slightly longer than third. Fore wing vein 2*rs-m* 0.6x length of 3*rs-m*; *cu-a* slightly basad of *Rs&M*; hind wing with vein *M+Cu* moderately straight, first abscissa of vein *Cu*1 about 0.7x length of vein *cu-a*; distal end of vein *Cu*1 present.

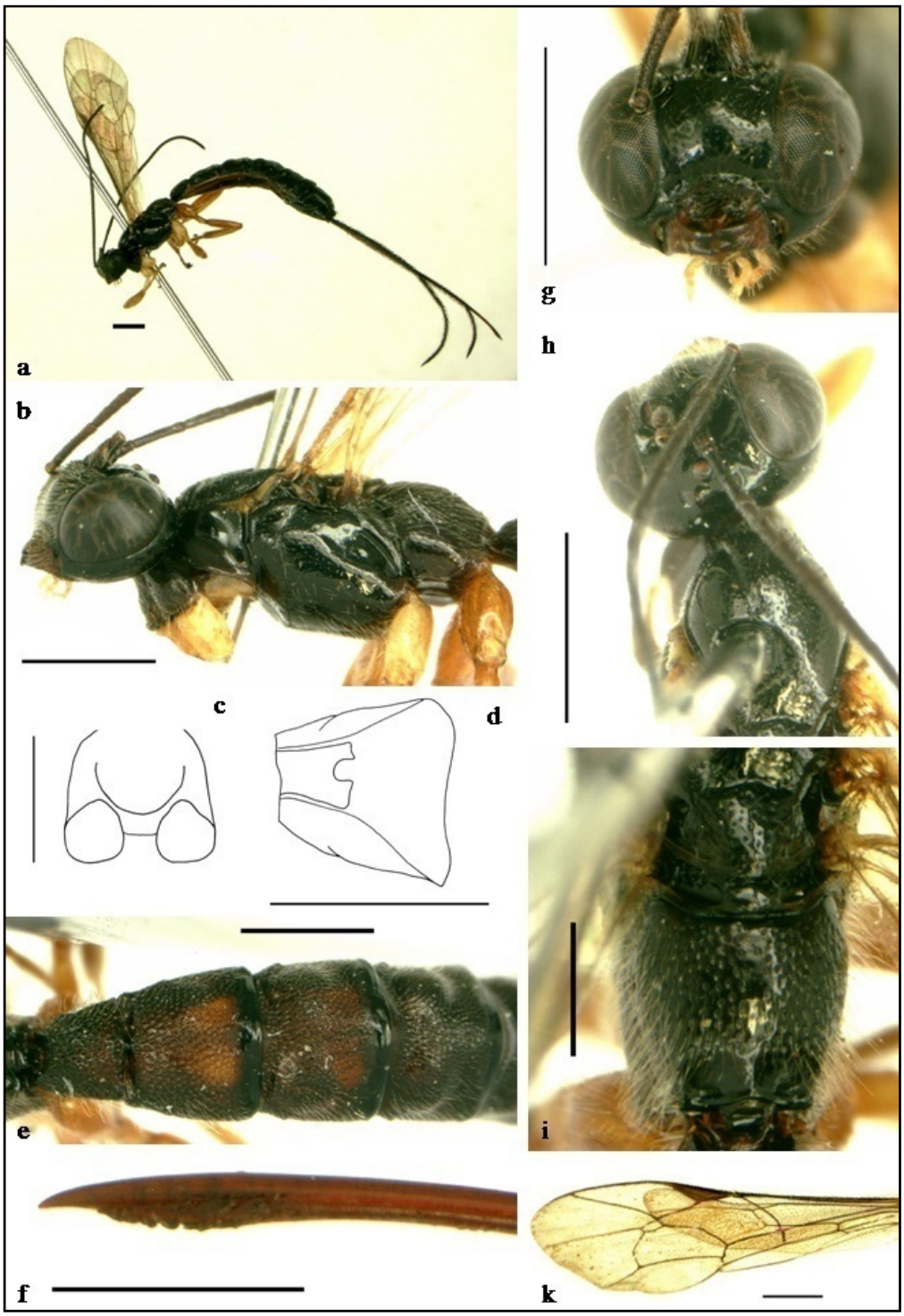

Figure 106. *F. vinhcuuensis* (scales 1 mm, except 0.5 mm for ovipositor tip):
a. lateral view; b. lateral view of head and mesosoma; c. metasternum; d. first sternite; e. dorsal view of tergites 1–4; f. ovipositor tip; g. face; h. dorsal view of head and mesoscutum; i. dorsal view of scutellum and propodeum; k. wings

Metasoma. Tergites densely punctate except transverse smooth bands apically; first tergite 1.05x as long as apical width, dorsolateral carina weakly present, median longitudinal carina distinct at base then weaker, not extending to apex; first sternite without tubercles, apex deeply notched medially; second tergite 0.9x length of apical width; 1.1x length of third tergite; ovipositor straight, 5.4x length of hind tibia, ovipositor tip weakly swollen, lower valve slightly broader than upper valve, with nine apical ridges.

Colour. Black. Clypeus brown; mandible reddish brown; palpi, posterior corner of pronotum, tegula, and legs reddish; wings brown, pterostigma and veins blackish; ovipositor reddish, ovipositor sheath black with long setae.

Male. Unknown.

Distribution. Currently known only from Phu Ly, Vinh Cuu, Dong Nai Province (Pham *et al*., under review-a).

Ecological note. The single specimen was collected in secondary lowland forest (Pham *et al*., under review-a).

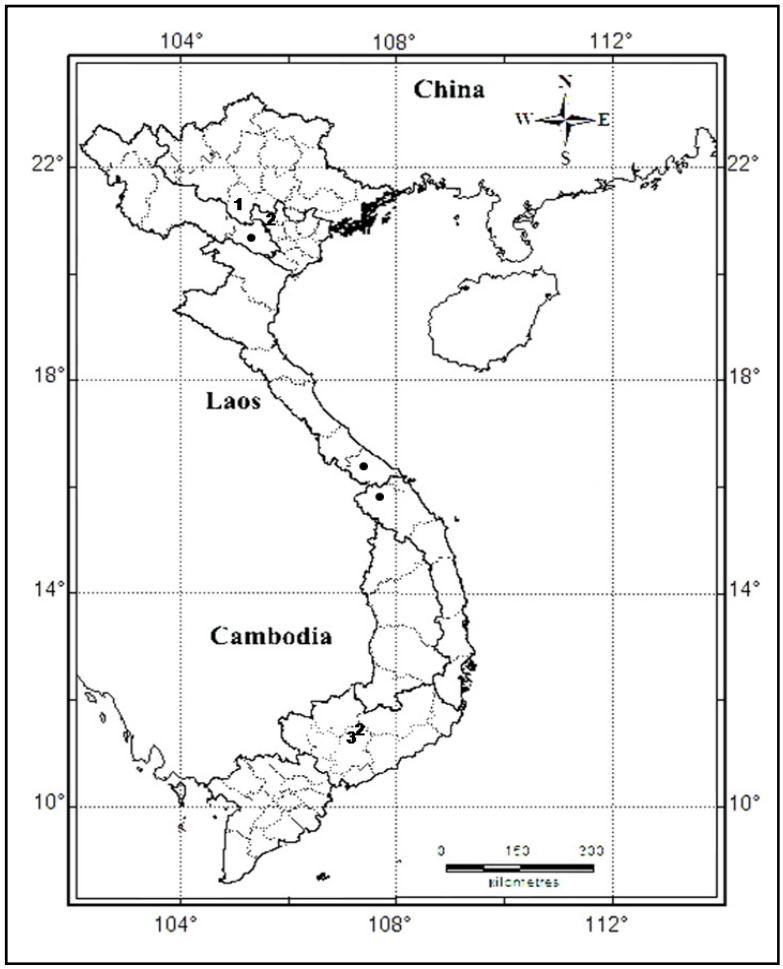

Figure 107. Distribution map of *Flavopimpla* species: 1. *F. lanugo*; 2. *F. latiannulata*; 3. *F. vinhcuuensis* and *Leptopimpla longiventris* (•)

Leptopimpla Townes 1961

Leptopimpla Townes, *In* Townes, Townes & Gupta, 1961: 471. Type-species: *Ephialtes longtiventris* Cameron; by original designation.

Diagnosis. Body exceptionally elongate; face black; clypeus black to reddish; clypeus slightly convex basally, depressed apically; mandible with teeth more or less equal; occipital carina complete, concave mediodorsally; mesoscutum dense, evenly distributed hairs; notaulus distinct anteriorly; submetapleural carina complete; propodeum longish, evenly punctate, pubescent, without carinae except posterior stub of lateral longitudinal carina; fore wing with areolet wider than high, 2*m*-*cu* distinct basad of 3*rs*-*m*; hind wing with first abscissa of vein *Cu*1 shorter than *cu*-*a*; first tergite short, about 0.5 times length of second, median longitudinal carina short and confined to basal declivity; first sternite about 0.85 times length of first tergite; second tergite without any oblique grooves cutting off basolateral corners; second to fifth tergites exceptional long, strongly convex; metasomal tergites about 3.0 times length of head and mesosoma combined; ovipositor long and slender, tip of upper valve slightly convex, without nodus, lower valve with apical ridges (Gupta & Tikar, 1976, Gauld, 1991).

This genus includes only three recognized species, two from the Oriental region and one from the Neotropics (Momoi, 1971; Gauld, 1991, Yu *et al.*, 2005). One species, *L. longiventris*, has been recorded from Vietnam (Gupta & Tikar, 1976).

Nothing is known about the biology of species of this genus, but their long ovipositor and very slender appearance suggests they may be attacking hosts boring in twigs (Gauld, 1991).

Leptopimpla longiventris (CAMERON, 1908)

(Figures 107, 108)

Ephialtes longiventris Cameron, 1908. Ztschr. System. Hymen. Dept., 8: 37. Holotype: ♀, India: Sikkim (BMNH).

Leptopimpla longiventris: Townes, Townes & Gupta, 1961.

Ephialtes lachesis Morley, 1913. Fauna Bristish India, Hymenoptera, 3 (1): 180. Holotype : ♀, Myanmar : Karen Hills (MSNG)

Leptopimpla lachesis: Townes, Townes & Gupta, 1961.

Material examined. Thua Thien-Hue, Phong Dien NR: 1♂ (RMNH), 50–100 m a.s.l., 04.iv.2001, hand net, R. de Vries leg.; Quang Nam, Phuoc Son, Kham Duc: 1♂ (IEBR), 19.vii.2009, hand net, L. D. Khuat leg.

Diagnosis. Face higher than wide, pubescent; frons and vertex shiny, sparsely punctate; mandible short, teeth blunt, upper tooth slightly longer than lower tooth; scutellum weakly convex, strongly

punctate, pubescent, without lateral carina; fore wing with cu-a slightly basad of *Rs*&*M*, 2*rs-m* equal to 3*rs-m*; hind wing with first abscissa of *Cu*1 about 0.33x *cu-a*; metasomal tergite dense of coarse punctures, 3.5–3.7x length of head and mesosoma combined.

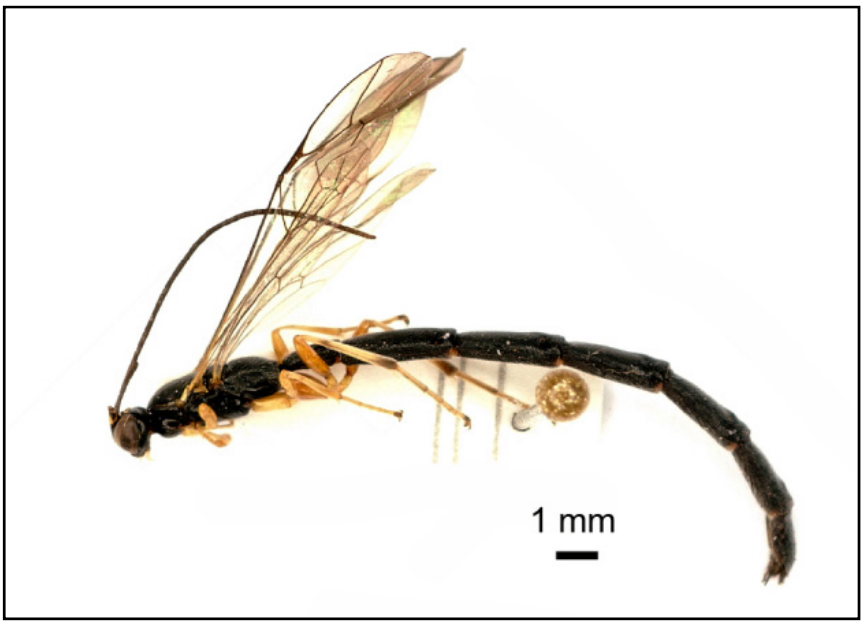

Figure 108. *L. longiventris* (lateral view)

Distribution. Previously recorded from Hoa Binh Province (Gupta & Tikar, 1976). Our records extended the distribution of this species southwards to Thua Thien-Hue and Quang Nam provinces. Outside Vietnam, this species has been known from Nepal, India, Myanmar, Malaysia, Indonesia, and Taiwan (Yu *et al.*, 2005).

CHAPTER 5. THE *SERICOPIMPLA* GENUS-GROUP

Diagnosis. Dorsal surface of mandible with sparse scattered pubescence, sometimes glabrous; fore leg of female with fifth tarsomere usually exceptional swollen; tarsal claws of female all with a basal lobe; hind tarsal claw of male with a small membranous vesicle on inside of apical tooth; posterior 0.2 of tergites 2–4 of female with sculpture differing from the rest of tergites, usually smooth and impunctate; tergite 3 of female usually with conspicuous lateromedian rounded swellings; metasomal terga of final instar larva hooked projections (Gauld *et al*., 2002).

The *Sericopimpla* genus-group includes 31 genera. It comprises the *Tromatobia* genus-complex and Polysphinctini of Townes (Wahl & Gauld, 1998; Gauld *et al.*, 2002). These genera are parasitoids on cocoons of various kinds, including spider egg cocoons (Townes, 1969; Gauld *et al.*, 2002).

In Vietnam, the *Sericopimpla* genus-group is represented by seven genera: *Acrodactyla*, *Acropimpla*, *Brachyzapus*, *Chablisea*, *Gregopimpla*, *Sericopimpla* and *Zagyptus* (Gupta & Tikar, 1976; Pham *et al.*, 2011b, 2012a, b, under review-b).

Acrodactyla Haliday, 1838

Barypus Haliday in Curtis, 1837: 37. Type-species: *Barypus degener* Haliday by subsequent designation (Westwood, 1840). Junior homonym of *Barypus* Laporte, 1835.

Acrodactyla Haliday, 1838: 117. Replacement name for Barypus Haliday

Diagnosis. Eyes with minute hairs; clypeus convex, separated from face by a more or less distinct groove; mandible narrow, tapered to apex, upper tooth slightly longer than the lower; pronotum in profile moderately long, mediodorsally flat or slightly concave, epomia strong, extending from ventral nearly to dorsal margin; mesoscutum with sharp vertical carina on each side of median lobe anteriorly, lateral ridge of mesoscutum forming flange near tegula; notauli strong and long, convergent posteriorly in shallow hollow; propodeum usually with carinae, propodeal spiracle round, nearly touching pleural carina; fore wing with areolet absent; hind wing with first abscissa of *Cu*1 when present always longer than vein *cu-a*; metasoma insertion separated from hind coxal cavities by strong sclerotized bridge; tergites 2–4 with rhombic, polished area more or less convex; lower valve of ovipositor with distinct swollen base, slightly swollen medially, tapered to sharp point (Townes & Townes, 1960; Townes, 1969; Gauld & Dubois, 2006).

Townes & Townes (1960) characterised two species groups within *Acrodactyla*: viz. the *quadrisculpta* and the *degener* groups. Subsequently, Townes (1969) added a third group, the *madida* group, for two Palearctic species. The distinction of three groups is based mostly on differences of hair density on the mesoscutum and the size of punctures on the metapleuron.

Lately, Gauld & Dubois (2006) erected a new genus, *Megaetaira*, for the aberrant species, *M. madida*. By moving the other species *A. varicarinata* Uchida & Momoi from the *madida* group to the *quadrisculpta* group, these authors included two groups within *Acrodactyla* as did Townes & Townes (1960). Among the six *Acrodactyla* species occuring in Vietnam *A. elongata*, *A. maiphuquyi* and *A. tami* belong to the *degener* group; *A. lachryma*, *A. phuthoensis* and *A. shawi* belong to the *quadrisculpta* group (Pham *et al.*, 2012a).

Where known, *Acrodactyla* species are parasitoids of Linyphiidae and Tetragnathidae (Araneae) (Gauld & Dubois, 2006).

Key to Vietnamese species of *Acrodactyla*

1. Mesoscutum with hairs along lateral sides of median lobe and on posteromedian part of lateral lobes (Figures 111a, 111b, 111f); metapleuron finely punctate (Figures 110a, 110c, 110f); second abscissa of hind wing vein *Cu*1 absent or faintly present; propodeum without or with short apical stub of lateromedian longitudinal carina (Figures 113a, 113c, 113f)……2 (the *degener* group)

-. Mesoscutum polished, impunctate (Figures 111c, 111d, 111e); metapleuron coarsely, rugosely punctate (Figures 110b, 110d, 110e); second abscissa of hind wing vein *Cu*1 present; propodeum with lateromedian longitudinal carina complete (Figures 113b, 113d, 113e)…….4 (the *quadrisculpta* group)

2. Propodeum with short stub of lateromedian longitudinal carina attached to posterior transverse carina (Figure 113a); hind wing with second abscissa of vein *Cu*1 entirely absent (Figure 112a); first tergite extremely long and thin, 3.2 times as long as apical width……..*A. elongata* Pham, Broad, Matsumoto & Böhme

-. Propodeum with lateromedian longitudinal carina entirely absent, posterior transverse carina either strong, thickened medially or curved medially (Figures 113c, 113f); hind wing with second abscissa of vein *Cu*1 faintly present (Figures 112c, 112f); first tergite 2.3–2.5 times as long as apical width……3

3. Propodeum with posterior transverse carina strong, thickened medially, area petiolaris divided into two subareas by longitudinal carina (Figure 113c); ovipositor 0.63 times as long as hind tibia; mesosoma black (Figures 110f, 111b).....*A. maiphuquyi* Pham, Broad, Matsumoto & Böhme

-. Propodeum with posterior transverse carina convex medially, area petiolaris normal, not divided into subareas by carinae (Figure 113f); ovipositor 0.83 times as long as hind tibia; mesosoma marked with reddish and reddish brown (Figures 110c, 111f)…….*A. tami* Pham, Broad, Matsumoto & Böhme

4. Mesosoma entirely black (Figures 110e, 111c); propodeum with some additional transverse carinae, area superomedia closed, area petiolaris divided into three subareas by longitudinal carinae (Figure 113e)……*A. shawi* Pham, Broad, Matsumoto & Böhme

-. Mesososoma largely marked with reddish brown (Figures 110b, 110d, 111d, 111e); propodeum with area petiolaris normal, not divided into subareas by carinae, area superomedia absent……..5

5. Fore and mid femora with median ventral tooth; fore wing with vein 2*rs-m* about 0.8 times as long as distance between 2*rs-m* and 2*m-cu*; hind wing with first abscissa of vein *Cu*1 about 3.2 times length of vein *cu-a*, second abscissa of vein *Cu*1 distinct present (Figure 112b)……*A. lachryma* Pham, Broad, Matsumoto & Böhme

-. Fore and mid femora normal, without median ventral tooth; fore wing with vein 2*rs-m* about 0.5 times as long as distance between 2*rs-m* and 2*m-cu*; hind wing with first abscissa vein *Cu*1 about 1.3 times length of vein *cu-a*, second abscissa of vein *Cu*1 present but faint (Figure 112d)……*A. phuthoensis* Pham, Broad, Matsumoto & Böhme

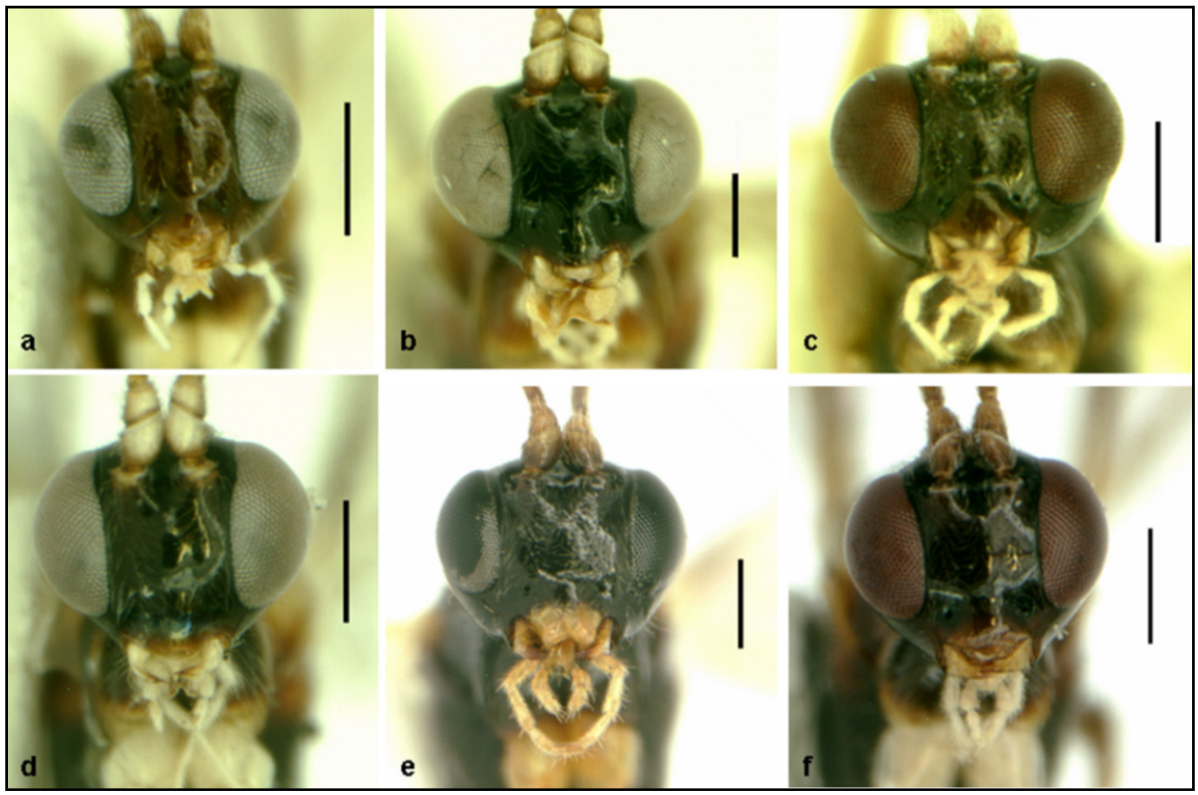

Figure 109. Faces of *Acrodactyla* species (scales 0.3 mm): a. *A. elongata*; b. *A. lachryma*; c. *A. maiphuquyi*; d. *A. phuthoensis*; e. *A. shawi*; f. *A. tami*

***Acrodactyla elongata* PHAM, BROAD, MATSUMOTO & BÖHME, 2012**

(Figures 109a, 110a, 111a, 112a, 113a, 114a, 115)

Acrodactyla elongata Pham, Broad, Matsumoto & Böhme, 2012. Zootaxa, 3207: 2. Holotype: ♀ Vietnam: Lao Cai, Hoang Lien NP (RMNH).

Material examined. Lao Cai, Hoang Lien NP: 1♀ (RMNH, holotype), 1900 m a.s.l., 15–21.x.1999, Malaise trap, C. v. Achterberg leg.

Diagnosis. Mesoscutum with few hairs along lateral side of median lobe and on posteromedian part of lateral lobes; propodeum with posterior transverse carina strong, lateromedian longitudinal carinae present as short stubs attached to posterior transverse carina, hind wing with second abscissa of vein *Cu*1 entirely absent; first tergite extremely long and thin, 3.5x as long as apical width.

Description (Female). Body length 4.2 mm, fore wing 3.2 mm, ovipositor 1.0 mm. *Head*. Antenna with 19 flagellomeres, first flagellomere 1.3x length of second; diameter of lateral ocellus equal to ocellar-ocular distance; frons polished, with scattered hairs; inner margins of eyes straight above antennal sockets, parallel ventrally; face 1.15x as high as wide, pubescent; clypeus convex, about 0.67x as high as wide, separated from face by distinct impressed clypeofacial suture, apical margin round; malar space equal to basal width of mandible; mandible upper tooth slightly longer than lower tooth; palpi formula 5:3; occipital carina complete, meeting hypostomal carina about 1.5x basal mandible width from base of mandible, forming flange ventrally after meeting hypostomal carina.

Mesosoma. Pronotum polished with scattered hairs; mesoscutum pubescent posteriorly, 1.25x as long as wide at anterior level of tegulae; scutellum strongly convex, pubescent, lateral carina present at base; mesopleuron with sparse hairs dorsally, moderately dense hairs ventrally, epicnemial carina present on lower half of mesopleuron; metapleuron polished with sparse hairs, submetapleural carina complete; propodeum moderately convex, dorsally bare with shallow hollow medially, posterior transverse carina complete, lateromedian longitudinal carinae present as small stubs attached to posterior transverse carina, short transverse striations attached to lateromedian and lateral longitudinal carinae, pleural area with sparse, long hairs. Legs long and thin, fore and mid femora without teeth ventrally; fore femur 7.6x longer than wide; hind leg with femur 7.5x as long as wide, length 0.75x tibia, tibia 13.8x as long as apical width; basitarsus 0.35x tibia, 0.4x tarsus, 1.5x second tarsomere, fifth tarsomere weakly swollen, shorter than third. Fore wing with vein *Rs*&*M* basad of *cu-a*, vein *cu-a* inclivous, 2*rs-m* about half distance between 2*rs-m* and 2*m-cu*, vein *Cu*1*a* separated from 1*m-cu* by 0.7x length of vein *Cu*1*b*; hind wing with vein *M+Cu* strongly curved, first abscissa of vein *Cu*1 2.0x as long as vein *cu-a*, second abscissa of vein *Cu*1 absent.

Metasoma. Tergites polished, with sparse, short hairs; first tergite extremely long and narrow, 3.5x as long as apical wide, dorsolateral carina complete, median longitudinal carina extending over oblique groove; second tergite 0.8x length of first tergite, 1.3x apical width, basal and apical oblique grooves moderately deep, rhombic area convex; third tergite shorter than second, basal and apical oblique grooves weak; first sternite round convex apically, extending slightly beyond level of spiracle, with weak longitudinal ridges; ovipositor straight, weakly up-curved at tip, length from tip of hypopygium 0.84x as long as hind tibia.

Colour. Brown. Antenna brown, except scape and pedicel yellowish ventrally, mandible, palpi, tegula, legs (except apex of hind tibia to hind tarsus) and ovipositor yellow; wings hyaline, pterostigma and veins brownish yellow.

Male. Unknown.

Distribution. Currently known only from Hoang Lien NP, Lao Cai Province, North Vietnam (Pham *et al.*, 2012a).

Ecological notes. The single specimen was collected in mountain evergreen forest at an elevation of 1,900 m a.s.l. (Pham *et al.*, 2012a).

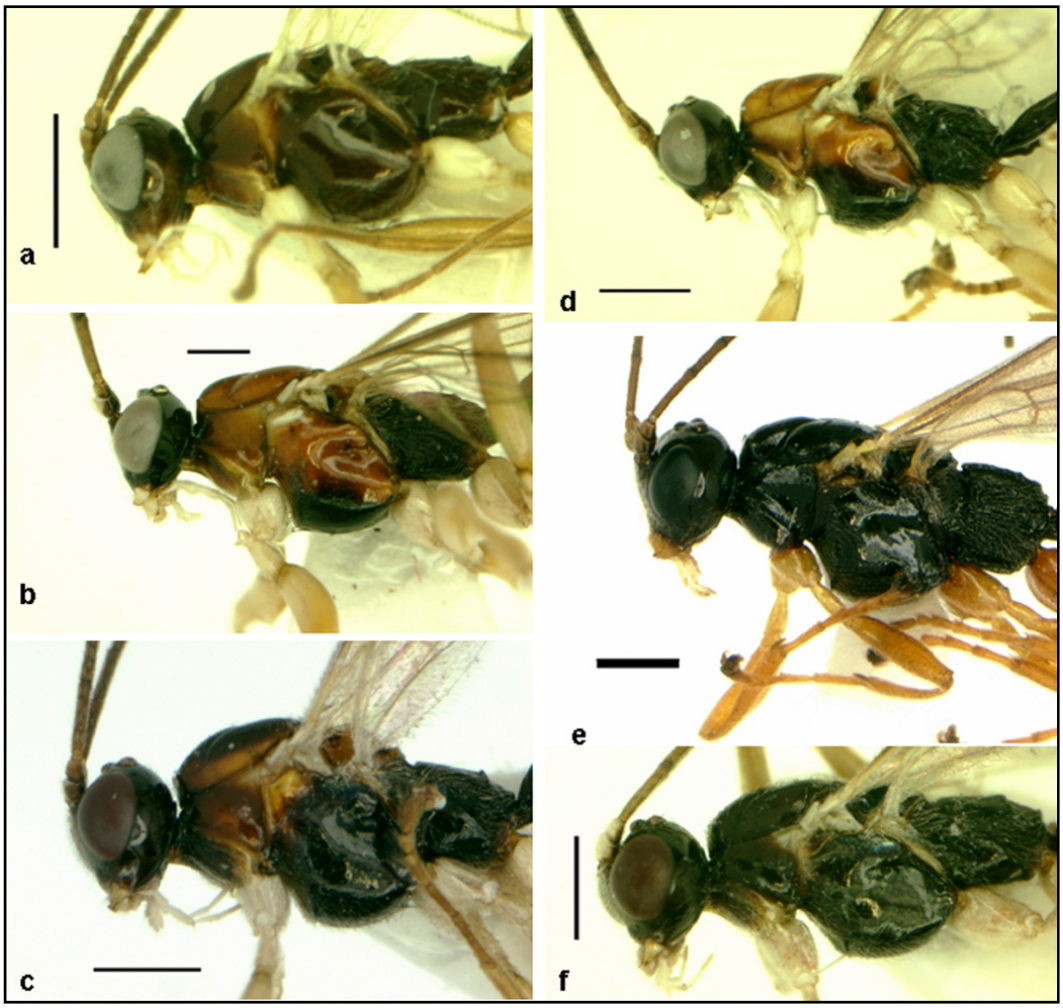

Figure 110. Lateral views of mesosoma of *Acrodactyla* species (scales 0.5 mm): a. *A. elongata*; b. *A. lachryma*; c. *A. tami*; d. *A. phuthoensis*; e. *A. shawi*; f. *A. maiphuquyi*

***Acrodactyla lachryma* PHAM, BROAD, MATSUMOTO & BÖHME, 2012**

(Figures 109b, 110b, 111d, 112b, 113b, 114c, 115)

Acrodactyla lachryma Pham, Broad, Matsumoto & Böhme, 2012. Zootaxa, 3207: 6. Holotype: ♀, Vietnam: Kontum, Chu Mom Ray NP (RMNH).

Material examined. Kon Tum, Chu Mom Ray NP: 1♀ (RMNH, holotype), 700–900 m a.s.l., 26.ix–05.x.2006, Malaise trap, Q. P. Mai & M. T. Nguyen leg.

Diagnosis. Mesoscutum reddish, except median lobe largely black, polished, almost without hairs; metapleuron coarsely rugose-punctate; propodeum with lateromedian longitudinal and posterior transverse carinae strong; fore and mid femora with median ventral tooth continuous with short median ventral carina; first abscissa of hind wing vein *Cu*1 about 3.2x vein *cu-a*, second abscissa of vein *Cu*1 distinct; ovipositor 0.85x hind tibia, up-curved at tip.

Description (Female). Body length 8.8 mm, fore wing 6.0 mm, ovipositor 1.7 mm. *Head*. Antenna with 30 flagellomeres, first flagellomere 1.4x length of second; diameter of lateral ocellus 1.15x ocellar-ocular distance; frons impunctate, polished; inner margins of eyes weakly concave above antennal sockets, parallel ventrally; face as high as wide, pubescent; clypeus convex, about 0.75x as high as wide, separated from face by impressed clypeofacial suture, apical margin round; malar space equal to basal width of mandible; mandible upper tooth slightly longer than lower tooth; palpi formula 5:4; occipital carina complete, meeting hypostomal carina about 1.5x basal mandible width from base of mandible, forming flange ventrally after meeting hypostomal carina.

Mesosoma. Pronotum and mesoscutum impunctate, polished; mesoscutum 1.35x as long as wide at anterior level of tegulae; scutellum strongly convex, pubescent, lateral carina present at base; mesopleuron densely setose except concave area near mesopleural suture bare and polished, epicnemial carina present on lower half of mesopleuron; metapleuron coarsely rugose-punctate, pubescent, submetapleural carina complete, forming small lobe anteriorly with some transverse ridges; propodeum moderately convex, dorsally bare, lateral longitudinal, lateromedian longitudinal and posterior transverse carinae present, many transverse striations attached to lateromedian and lateral longitudinal carinae, area petiolaris convex medially, pleural area rugose, pubescent. Legs with fore and mid femora swollen, each with obtuse, compressed median ventral tooth; ventral face of fore and mid tibiae with carina from base extending nearly to apex; hind leg with femur 4.3x as long as wide, length 0.75x tibia, tibia 10.0x as long as apical width; basitarsus 0.3x tibia, 0.35x tarsus, 1.5x second tarsomere, fifth tarsomere swollen, slightly longer than third. Fore wing with vein *Rs*&*M* opposite *cu-a*, vein *cu-a* strongly inclivous, 2*rs-m* about 0.8x distance between 2*rs-m* and 2*m-cu*, vein *Cu*1*a* separated from 1*m-cu* by 1.25x length of vein *Cu*1*b*; hind wing with vein *M+Cu* strongly curved, first abscissa of vein *Cu*1 3.2x as long as vein *cu-a*, second abscissa of vein *Cu*1 present.

Metasoma. Tergites polished, with scattered short hairs; first tergite 1.7x as long as apical width, dorsolateral carina complete, median longitudinal carina extending over oblique groove; second tergite 0.8x length of first tergite, nearly as long as apical width, basal and apical oblique

grooves deep, rhombic area convex; third tergite shorter than second, basal and apical oblique grooves moderately deep; first sternite rugose, extending to level of spiracle, round convex apically; ovipositor slightly up-curved at tip, length from tip of hypopygium 0.85x as long as hind tibia.

Colour. Black. Antenna black, except scape and pedicel yellow ventrally; mandible, palpi, tegula, subalar prominence, fore and mid legs yellow; hind tibia with subbasal and apical fuscous bands, hind tarsus with tarsomeres 1–4 apically and fifth tarsomere black; mesosoma reddish brown, except median lobe of mesoscutum, pronotum mediodorsally and mesosternum black; wings hyaline, pterostigma and veins brownish yellow; tergites brown to blackish brown; ovipositor brown.

Male. Unknown.

Distribution. Currently known only from Chu Mom Ray NP, Kon Tum Province, Central Highlands of Vietnam (Pham *et al.*, 2012a).

Ecological notes. The single specimen was collected in evergreen forest at an elevation between 700–900 m a.s.l. (Pham *et al*., 2012a).

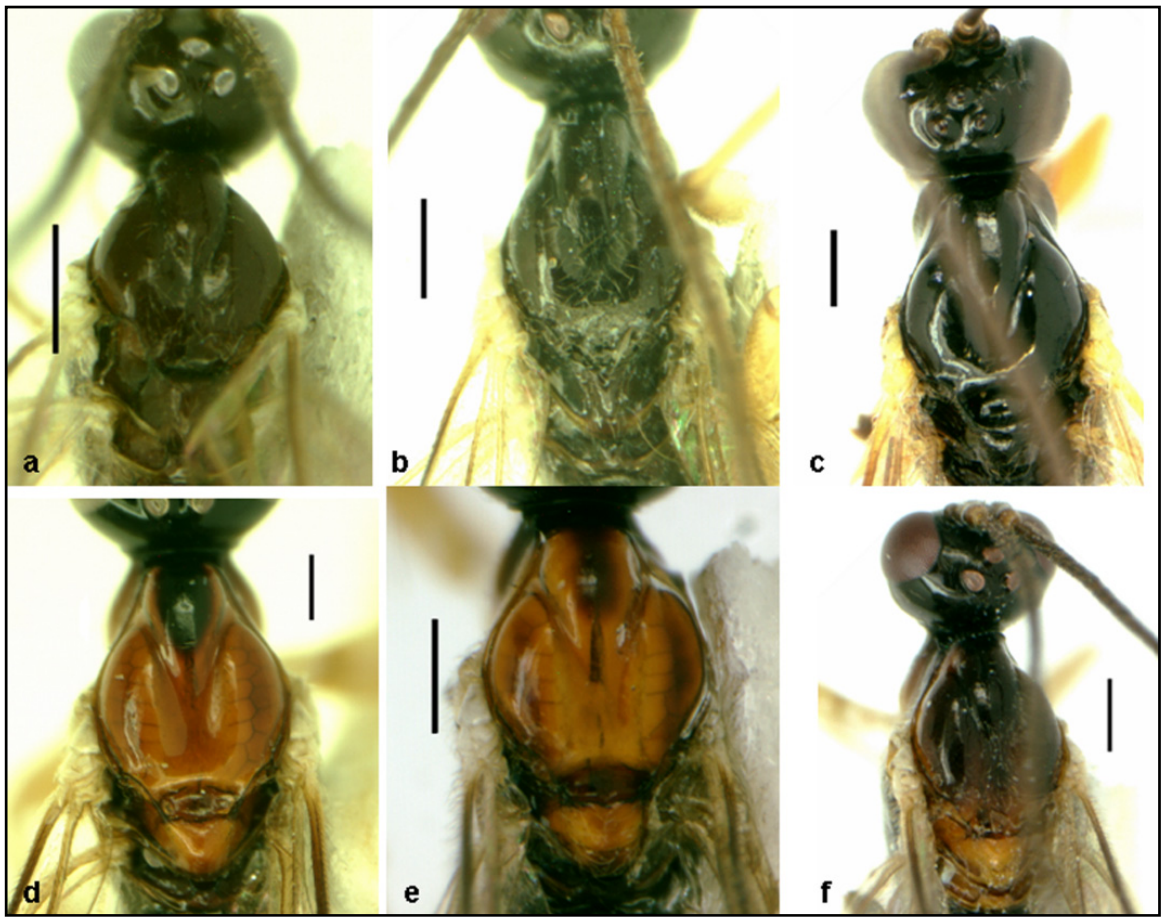

Figure 111. Dorsal views of mesoscutum of *Acrodactyla* species (scales 0.3 mm):
a. *A. elongata*; b. *A. maiphuquyi*; c. *A. shawi*; d. *A. lachryma*; e. *A. phuthoensis*; f. *A. tami*

***Acrodactyla maiphuquyi* PHAM, BROAD, MATSUMOTO & BÖHME, 2012**

(Figures 109c, 110f, 111b, 112c, 113c, 114b, 115)

Acrodactyla maiphuquyi Pham, Broad, Matsumoto & Böhme, 2012. Zootaxa, 3207: 9. Holotype: ♀, Vietnam: Lao Cai, Hoang Lien NP, Fansipan Montane (RMNH).

Material examined. Lao Cai, Hoang Lien NP, Fansipan Montane: 1♀ (RMNH, holotype), 2320 m a.s.l., 24.iv–02.v.2000, Malaise trap, Q. P. Mai & T. M. Nguyen leg.

Diagnosis*.* Mesoscutum with few hairs along lateral side of median lobe and on posteromedian part of lateral lobes; propodeum with posterior transverse carina strong, thickened medially, lateromedian longitudinal carinae entirely absent, area petiolaris divided into two areas by longitudinal carina; hind wing with second abscissa of vein *Cu*1 faintly present; hind femur long and thin, 8x as long as wide; ovipositor 0.63x hind tibia.

Description (Female). Body length 6.2 mm, fore wing 4.2 mm, ovipositor 1.2 mm. *Head*. Antenna with 21 flagellomeres, first flagellomere 1.5x length of second; diameter of lateral ocellus equal to ocellar-ocular distance; frons impunctate, polished; inner margins of eyes weakly concave above antennal sockets, parallel ventrally; face 1.1x as high as wide, pubescent; clypeus convex, about 0.67x as high as wide, separated from face by impressed clypeofacial suture, apical margin round; malar space 0.8x basal width of mandible; mandible upper tooth weakly longer than lower tooth; palpi formula 5:3; occipital carina complete, meeting hypostomal carina about 1.25x basal mandible width from base of mandible, forming flange ventrally after meeting hypostomal carina.

Mesosoma. Pronotum polished with scattered hairs; mesoscutum pubescent posteriorly, 1.4x as long as wide at anterior level of tegulae; scutellum strongly convex, pubescent, lateral carina present at base; mesopleuron densely setose except concave area near mesopleural suture bare and polished, epicnemial carina present on lower half of mesopleuron; metapleuron pubescent dorsally, bare ventrally, submetapleural carina complete, forming small lobe anteriorly; propodeum moderately convex, dorsally almost bare, posterior transverse carina strong, thickened medially, apical 0.6 of lateral longitudinal carina present, area petiolaris divided into two areas by longitudinal carina, pleural area pubescent. Legs long and thin, fore and mid femora without teeth ventrally; fore femur 7.8x longer than wide; hind leg with femur 8.0x as long as wide, length 0.8x tibia, tibia 12.7x as long as apical width; basitarsus 0.3x tibia, 0.35x tarsus, 1.5x second tarsomere, fifth tarsomere swollen, as long as third. Fore wing with vein *Rs&M* opposite *cu-a*, vein *cu-a* inclivous, 2*rs-m* about 0.67x distance between 2*rs-m* and 2*m-cu*, vein *Cu*1*a* separated from 1*m-cu* by length of vein *Cu*1*b*; hind wing with vein *M+Cu* strongly curved, first abscissa of vein *Cu*1 1.5x as long as vein *cu-a*, second abscissa of vein *Cu*1 faintly present.

Metasoma. Tergites polished, with short hairs; first tergite 2.3x as long as apical width, dorsolateral carina complete, median longitudinal carina extending over oblique groove; second tergite 0.8x length of first tergite, as long as apical width, basal and apical oblique grooves deep, rhombic area convex; third tergite shorter than second, basal and apical oblique grooves moderately deep; first sternite evenly convex, extending beyond level of spiracle, with longitudinal ridges; ovipositor straight, weakly up-curved at tip, length from tip of hypopygium 0.63x as long as hind tibia.

Colour. Black. Antenna brown, except scape and pedicel yellow ventrally; mandible, palpi, posterior corner of pronotum, tegula, fore and mid legs yellow; hind leg yellow, except femur with two lateral brown stripes, tibia with subbasal and apical fuscous bands, tarsus blackish; wings hyaline, pterostigma and veins brownish yellow; tergites brown to blackish brown; ovipositor brown.

Male. Unknown.

Distribution. Currently known only from Hoang Lien NP, Fansipan Mountain, Lao Cai Province, North Vietnam (Pham *et al*., 2012a)

Ecological notes. The single specimen was collected in mountain evergreen forest at an elevation of 2,320 m a.s.l. (Pham *et al.*, 2012a).

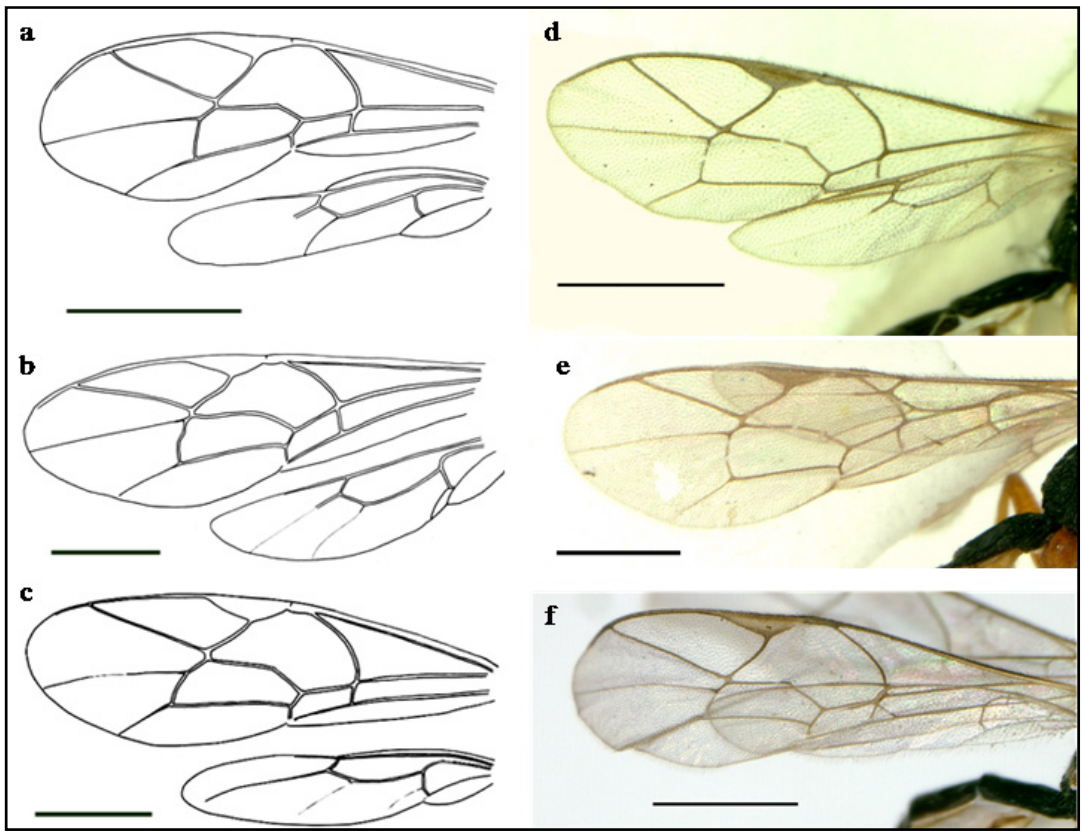

Figure 112. Wings of *Acrodactyla* species (scales 1 mm): a. *A. elongata*; b. *A. lachryma*; c. *A. maiphuquyi*; d. *A. phuthoensis*; e. *A. shawi*; f. *A. tami*

***Acrodactyla phuthoensis* PHAM, BROAD, MATSUMOTO & BÖHME, 2012**

(Figures 109d, 110d, 111e, 112d, 113d, 114d, 115)

Acrodactyla phuthoensis Pham, Broad, Matsumoto & Böhme, 2012. Zootaxa, 3207: 10. Holotype: ♀, Vietnam: Phu Tho, Thuong Cuu, Thanh Son (RMNH).

Material examined. Phu Tho, Thanh Son, Thuong Cuu: 1♀ (RMNH, holotype), 20°59'N 105°8'E, 350–400 m a.s.l., 11–16.x.1999, Malaise trap, R. de Vries leg.

Diagnosis. Mesoscutum reddish, polished, almost without hairs; metapleuron coarse, rugose-punctate; propodeum with lateromedian longitudinal and posterior transverse carinae strong; fore and mid femora normal, without median ventral tooth; first abscissa of hind wing vein *Cu*1 about 1.3x vein *cu-a*, second abscissa of vein *Cu*1 present but faint; ovipositor 0.9x hind tibia, up-curved at tip.

Description (Female). Body length 5.0 mm, fore wing 3.8 mm, ovipositor 1.0 mm. *Head*. Antenna with 26 flagellomeres, first flagellomere 1.5x length of second; diameter of lateral ocellus 1.3x ocellar-ocular distance; frons impunctate and polished; inner margins of eyes weakly concave above antennal sockets, parallel ventrally; face as high as wide, pubescent; clypeus convex, separated from face by weakly impressed clypeofacial suture, about 0.8x as high as wide, apical margin round; malar space equal to basal width of mandible; mandible upper tooth slightly longer than lower tooth; palpi formula 5:4; occipital carina complete, meeting hypostomal carina about 1.2x basal mandible width from base of mandible, forming narrow flange ventrally after meeting hypostomal carina.

Mesosoma. Pronotum and mesoscutum impunctate, polished; mesoscutum 1.3x as long as wide at anterior level of tegulae; scutellum strongly convex, pubescent, lateral carina present at base; mesopleuron densely setose except concave area near mesopleural suture bare and polished, epicnemial carina present on lower half of mesopleuron; metapleuron coarsely rugose, pubescent, submetapleural carina complete, forming small lobe anteriorly with some transverse ridges; propodeum moderately convex, dorsally bare, lateral longitudinal, lateromedian longitudinal and posterior transverse carinae present, short transverse striations attached to lateromedian longitudinal carina, pleural area rugose and pubescent. Legs unmodified, fore and mid femora without teeth ventrally; fore femur 4.6x longer than wide; hind leg with femur 4.3x as long as wide, length 0.75x tibia, tibia 9.0x as long as apical width; basitarsus 0.27x tibia, 0.33x tarsus, 1.5x second tarsomere, fifth tarsomere swollen, distinctly longer than third. Fore wing with vein *Rs*&*M* basad of *cu-a*, vein *cu-a* inclivous, 2*rs-m* about half distance between 2*rs-m* and 2*m-cu*, vein *Cu*1*a* separated from 1*m-cu* by 0.85x length of vein *Cu*1*b*; hind wing with vein *M+Cu* strongly curved, first abscissa of vein *Cu*1 1.3x as long as vein *cu-a*, second abscissa of vein *Cu*1 faintly present.

Metasoma. Tergites polished with scattered, short hairs; first tergite 2.0x as long as apical width, dorsolateral carina complete, median longitudinal carina extending over oblique groove; second tergite 0.7x length of first tergite, 0.9x as long as apical width, basal and apical oblique grooves deep, rhombic area convex; third tergite shorter than second, basal and apical oblique grooves moderately deep; first sternite ended before level of spiracle, round convex apically with weak curved ridges; ovipositor slightly up-curved at tip, length from tip of hypopygium 0.9x hind tibia length.

Colour. Black. Antenna black, except scape and pedicel yellow ventrally, mandible, palpi, tegula, subalar prominence, legs yellow, except hind tibia with subbasal and apical fuscous bands, hind tarsus with tarsomeres 1–3 black apically; mesosoma reddish brown, except centre of median lobe of mesoscutum to pronotum mediodorsally, narrow stripe on lateral lobe of mesoscutum and lower half of mesopleuron to mesosternum black; wings hyaline, pterostigma and veins brownish yellow; tergites brown to blackish brown; ovipositor brown.

Male. Unknown.

Distribution. Currently known only from Thuong Cuu (near Xuan Son NP), Phu Tho Province, North Vietnam (Pham *et al.*, 2012a).

Ecological notes. The single specimen was collected in secondary forest at an elevation between 350–400 m a.s.l. (Pham *et al.*, 2012a).

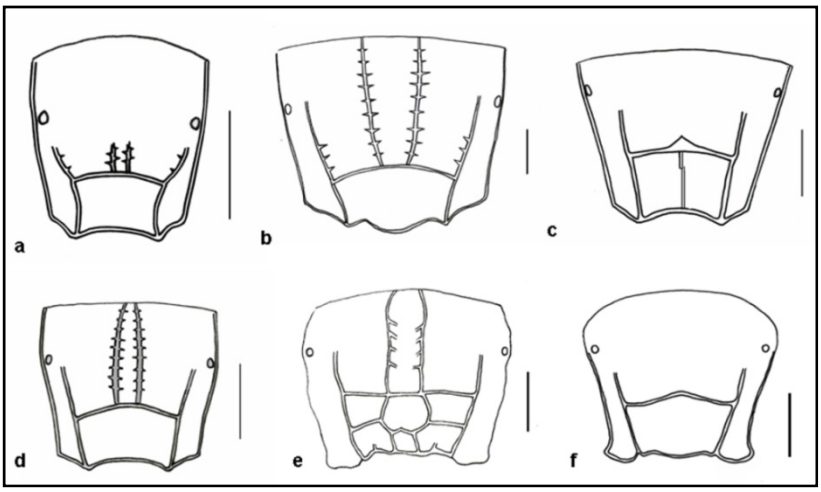

Figure 113. Dorsal views of propodeum of *Acrodactyla* species (scales 0.2 mm): a. *A. elongata*; b. *A. lachryma*; c. *A. maiphuquyi*; d. *A. phuthoensis*; e. *A. shawi*; f. *A. tami*

***Acrodactyla shawi* PHAM, BROAD, MATSUMOTO & BÖHME, 2012**

(Figures 109e, 110e, 111c, 112e, 113e, 115)

Acrodactyla shawi Pham, Broad, Matsumoto & Böhme, 2012. Zootaxa, 3207: 12. Holotype: ♂, Vietnam: Lao Cai, Sa Pa (OMNH).

Material examined. Lao Cai, Sa Pa: 1♂ (OMNH, holotype), 1700 m a.s.l., 30.v.1997, hand net, R. Matsumoto leg.

Diagnosis. Body black, except tergite 2 onwards reddish brown; mesoscutum polished, almost without hairs; metapleuron coarsely rugose-punctate; propodeum with additional transverse carinae, area superomedia closed, area petiolaris divided into three subareas by longitudinal carinae; fore and mid femora normal, without median ventral tooth.

Description (Male). Body length 6.2 mm, fore wing 4.7 mm. *Head*. Antenna with 24 flagellomeres, first flagellomere 1.4x length of second; diameter of lateral ocellus 0.7x ocellar-ocular distance; frons polished, with sparse hairs; inner margins of eyes weakly concave above antennal sockets, parallel ventrally; face 0.8x as high as wide, pubescent; clypeus convex, about 0.5x as high as wide, separated from face by weak clypeofacial suture, apical margin round; malar space equal to basal width of mandible; mandible upper tooth slightly longer than lower tooth; palpi formula 5:4; occipital carina complete, meeting hypostomal carina about 1.4x basal mandible width from base of mandible, forming flange ventrally after meeting hypostomal carina.

Mesosoma. Pronotum polished, with some hairs on posterior corner; mesoscutum polished, impunctate; mesoscutum 1.2x as long as wide at anterior level of tegulae; scutellum strongly convex, pubescent, lateral carina present at base; mesopleuron densely setose except concave area near mesopleural suture bare and polished, epicnemial carina present on lower half of mesopleuron; metapleuron coarsely rugose-punctate, pubescent, submetapleural carina complete, forming small lobe anteriorly; propodeum moderately convex, dorsally striate, lateral longitudinal, lateromedian longitudinal and posterior transverse carinae present, many transverse striations attached to lateromedian and lateral longitudinal carinae, area petiolaris foveolate by carinae, pleural area rugose, pubescent. Legs unmodified, fore and mid femora without teeth ventrally; fore femur 4.0x as long as wide; hind leg with femur 4.7x as long as wide, length 0.7x tibia, tibia 10.0x as long as apical width; basitarsus 0.3x tibia, 0.35x tarsus, 1.6x second tarsomere, fifth tarsomere longer than third. Fore wing with vein *Rs*&*M* basad of *cu-a*, vein *cu-a* strongly inclivous, 2*rs-m* about 0.8x distance between 2*rs-m* and 2*m-cu*, vein *Cu*1*a* separated from 1*m-cu* by 1.25x length of vein *Cu*1*b*; hind wing with vein *M+Cu* strongly curved, first abscissa of vein *Cu*1 1.3x as long as vein *cu-a*, second abscissa of vein *Cu*1 present.

Metasoma. Tergites polished, with scattered short hairs; first tergite 1.7x as long as apical width, dorsolateral carina complete, median longitudinal carina extending over oblique groove; second tergite 0.8x length of first tergite, 0.85x as long as apical width; third tergite shorter than second, basal and apical oblique grooves of tergites 2–3 moderately deep, rhombic areas convex; first sternite rugose, extending to level of spiracle, round convex apically.

Colour. Black, except mandible, palpi, tegula, subalar prominence, legs reddish brown; metasomal tergite 2 onwards reddish except smooth transverse apical bands black; wings yellowish brown.

Female. Unknown.

Distribution. Currently known only from Sa Pa, Lao Cai Province, North of Vietnam (Pham *et al*., 2012a).

Ecological notes. The single specimen was collected in montane evergreen forest at an elevation of 1,700 m a.s.l. (Pham *et al.*, 2012a).

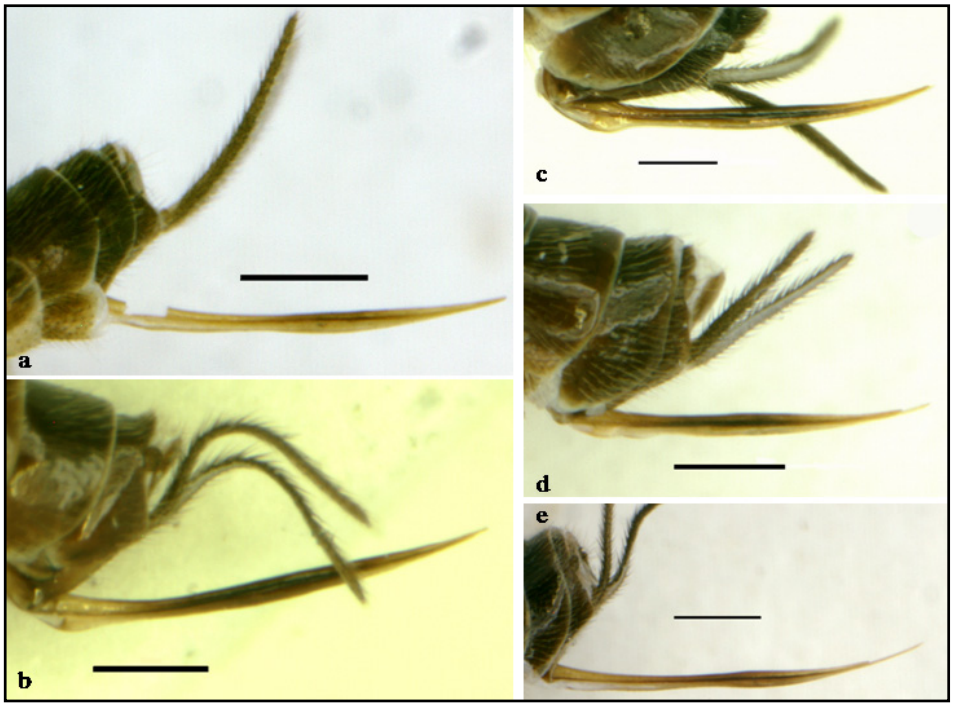

Figure 114. Ovipositors of *Acrodactyla* species (scales 0.3 mm): a. *A. elongata*; b. *A. maiphuquyi*; c. *A. lachryma*; d. *A. phuthoensis*; e. *A. tami*

***Acrodactyla tami* PHAM, BROAD, MATSUMOTO & BÖHME, 2012**

(Figures 109f, 110c, 111f, 112f, 113f, 114e, 115)

Acrodactyla tami Pham, Broad, Matsumoto & Böhme, 2012. Zootaxa, 3207: 13. Holotype: ♀, Vietnam: Lao Cai, Hoang Lien NP, Fansipan Montane (RMNH).

Material examined. Lao Cai, Hoang Lien NP, Fansipan Montane: 1♀ (RMNH, holotype), 2320 m a.s.l., 24.iv–02.v.2000, Malaise trap, Q. P. Mai & T. M. Nguyen leg.

Diagnosis. Mesosoma marked with reddish and reddish brown, with hairs posteriorly; propodeum with posterior transverse carina curved medially, lateromedian longitudinal carinae entirely absent; hind wing with second abscissa of vein *Cu*1 faintly present; hind tibia long and thin, 14.7x as long as wide; ovipositor 0.83x hind tibia.

Description (Female). Body length 5.6 mm, fore wing 4.5 mm. *Head*. Antenna with 22 flagellomeres, first flagellomere 1.2x length of second; diameter of lateral ocellus 0.85x ocellar-ocular distance; frons subpolished, with sparse hairs; inner margins of eyes weakly concave above antennal sockets, parallel ventrally; face as high as wide, pubescent; clypeus convex, about 0.55x as high as wide, separated from face by distinct clypeofacial suture, apical margin round; malar space 0.85x basal width of mandible, mandible upper tooth distinctly longer than lower tooth; palpi formula 5:3; occipital carina complete, meeting hypostomal carina about 1.2x basal mandible width from base of mandible, forming flange ventrally after meeting hypostomal carina.

Mesosoma. Pronotum polished, with sparse hairs on posterior corner; mesoscutum pubescent posteriorly, 1.4x as long as wide at anterior level of tegulae; scutellum strongly convex, pubescent, lateral carina present at base; mesopleuron densely setose except concave area near mesopleural suture bare and polished, epicnemial carina present on lower half of mesopleuron; metapleuron finely punctate, pubescent, submetapleural carina complete; propodeum moderately convex, almost impunctate dorsally, posterior part of lateral longitudinal and posterior transverse carinae present, pleural area pubescent. Legs long and thin; fore and mid femora without teeth ventrally; fore femur 5.8x longer than wide hind leg with femur 6.2x as long as wide, length 0.7x tibia, tibia 14.7x as long as apical width; basitarsus 0.3x tibia, 0.4x tarsus, 1.7x second tarsomere, fifth tarsomere as long as third. Fore wing with vein *Rs*&*M* basad of *cu-a*, vein *cu-a* strongly inclivous, 2*rs-m* about 0.5x distance between 2*rs-m* and 2*m-cu*, vein *Cu*1*a* separated from 1*m-cu* by 1.2x length of vein *Cu*1*b*; hind wing with vein *M+Cu* strongly curved, first abscissa of vein *Cu*1 2.0x as long as vein *cu-a*, second abscissa of vein *Cu*1 faintly present.

Metasoma. Tergites polished; first tergite 2.5x as long as apical width, dorsolateral carina weakly complete, median longitudinal carina extending beyond oblique groove; second tergite 0.8x length of first tergite, 1.1x as long as apical width, basal and apical oblique grooves moderately deep, rhombic convex area smooth and shiny; third tergite shorter than second, moderately dense punctate, except two lateral swellings; tergite 4 onwards dense punctate; first sternite slightly extending beyond spiracle, smooth, rounded convex centrally; ovipositor up-curved at tip, length from tip of hypopygium 0.83x as long as hind tibia.

Colour. Black. Mandible, palpi, tegula, and legs yellow, except hind femur with light brown stripes laterally, apical of hind tibia and tarsus fuscous; pronotum laterally, lateral margins of mesoscutum, scutellum, metascutellum and subalar prominence of mesopleuron reddish; central part of mesoscutum reddish brown; wings hyaline, pterostigma and veins brownish yellow; tergite 2 onwards brown with black smooth transverse bands; ovipositor reddish.

Male. Unknown.

Distribution. Currently known only from Hoang Lien NP, Fansipan Mountain, Lao Cai Province, North Vietnam (Pham *et al.*, 2012a).

Ecological notes. The single specimen was collected in mountain evergreen forest at an elevation of 2,320 m a.s.l. (Pham *et al.*, 2012a).

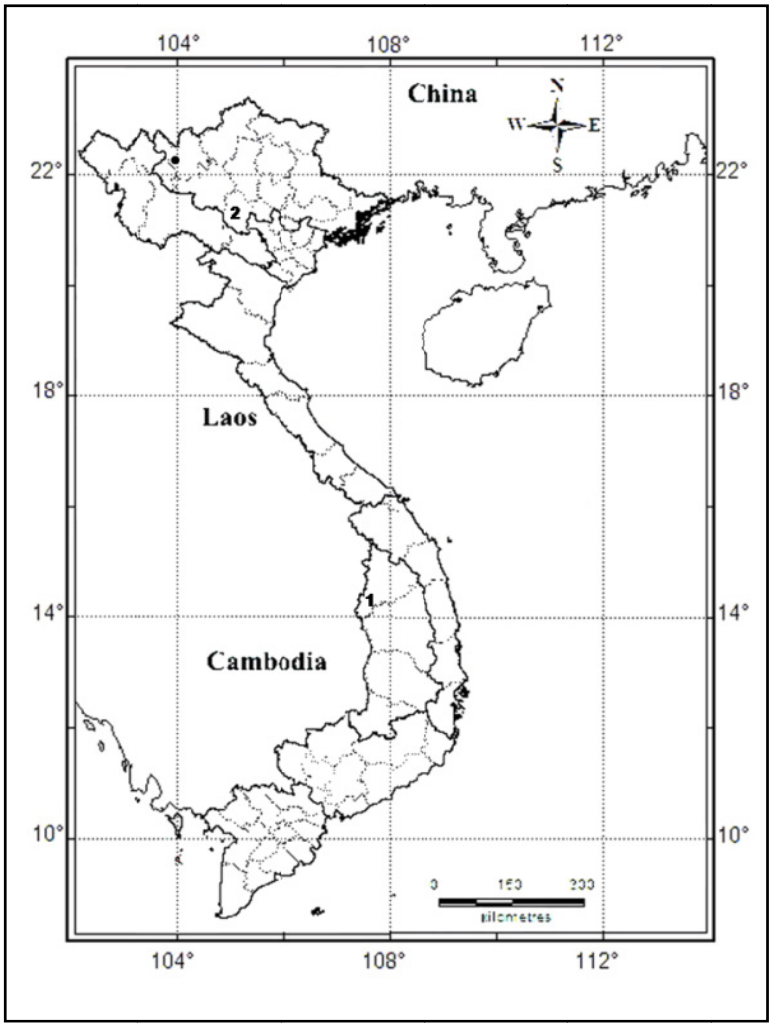

Figure 115. Distribution map of *Acrodactyla* species: 1. *A. lachryma*; 2. *A. phuthoensis*; (•). *A. elongata*; *A. maiphuquyi*; *A. shawi* & *A. tami*

Acropimpla **Townes, 1960**

Selenaspis Roman, 1910: 191. Name preoccupied by Bleeker, 1858 and by Leonardi, 1898. Type: *Hemipimpla alboscutellaris* Szepligeti; original designation.

Acropimpla Townes, 1960: 159. Type species: *Charitopimpla leucostoma* Cameron; original designation.

Diagnosis. Body moderately long; clypeus with median apical notch; malar space short; propodeum short and convex, with or without median longitudinal carina; fore wing with areolet nearly triangular, receiving vein 2*m-cu* near apex, vein 2*rs-m* always shorter than vein 3*rs-m*; hind wing with

first abscissa of vein *Cu*1 much longer than vein *cu-a*; first tergite short and wide; second tergite with short, oblique groove cutting off basolateral corner; tergites 3–4 with distinct tubercles; ovipositor straight, tip of dorsal valve in profile a little concave behind nodus, lower valve with oblique ridges apically (Gupta & Tikar, 1976).

Currently, this genus comprises 41 recognised species, predominantly occuring in the Oriental and eastern Palearctic regions. No species have been reported from the Neotropics (Yu *et al.*, 2005; Liu *et al.*, 2010; Pham *et al.*, 2011d). In Vietnam, six species have been recorded (Gupta & Tikar, 1976; Pham *et al.*, 2011d).

No species of *Acropimpla* have been reared from Vietnam. Outside the country, *Acropimpla* species are known to parasitize a variety of Microlepidoptera, especially Pyralidae, Thyrididae and Hablaeidae (Gupta & Tikar, 1976). Oviposition may be through silk (Townes, 1969).

Key to Vietnamese species of *Acropimpla*

1. Propodeum without or with short stub of median longitudinal carina (Figures 119a, 119b, 119c)....2

-. Propodeum with median longitudinal carina distinct present (Figures 119d, 119e, 119f).....4

2. Face black with two small yellow spots below antennal sockets (Figure 117b); metasomal tergites black, each with two yellow apicolateral spots (Figure 116b); ovipositor 2.8 times as long as hind tibia length.....*A. lampei* Pham, Broad & Wägele

-. Face yellow with or without black mark; metasomal tergites entirely black or black with yellow bands.....3

3. Face yellow, clypeus blackish (Figure 117a); tergite 5 with basal large black and apical narrow yellow band (Figure 116a); ovipositor 3.0 times as long as hind tibia length.....*A. hapaliae* (Rao)

-. Face with median black mark, clypeus yellow (Figure 117c); tergite 5 entirely black (Figure 116c); ovipositor 2.5 times as long as hind tibia length.....*A. leucostoma* (Cameron)

4. Face entirely yellow (Figure 117e); ovipositor with distinct constriction subapically (Figure 120e) [2.9 times as long as hind tibia length]).....*A. phongdienensis* Pham, Broad & Wägele

-. Face marked with black; ovipositor without distinct constriction subapically.....5

5. Face with small triangular black mark connecting with black clypeus (Figure 117d); metasomal tergites reddish with narrow black bands on first tergite basally, on second and third tergites posteriorly (Figure 116d); ovipositor 3.1 times as long as hind tibia length....*A. mucronis* Pham, Broad & Wägele

-. Face with pentagonal black mark, clypeus yellow (Figure 117f); metasomal tergites black with yellowish apicolateral stripes (Figure 116c); ovipositor 2.2 times as long as hind tibia length.....*A. taishunensis* Liu, He & Chen

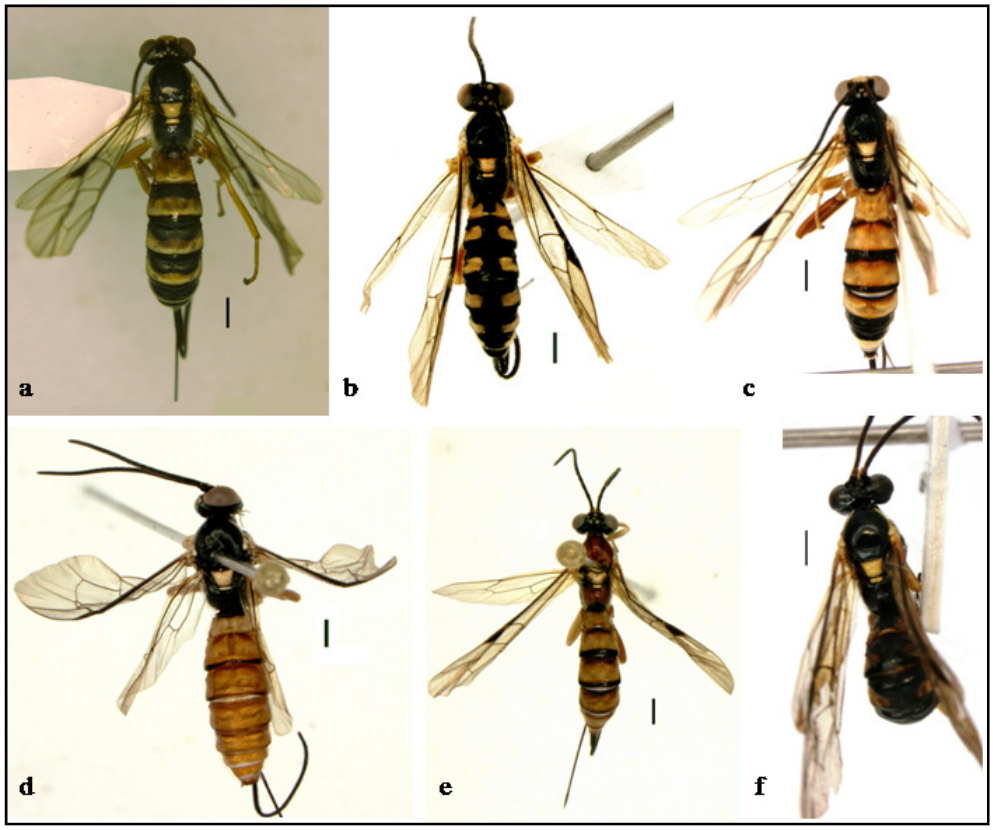

Figure 116. Dorsal views of *Acropimpla* species (scales 1 mm): a. *A. hapaliae*; b. *A. lampei*; c. *A. leucostoma*; d. *A. mucronis*; e. *A. phongdienensis*; f. *A. taishunensis*

***Acropimpla hapaliae* (RAO, 1953)**

(Figures 116a, 117a, 119a, 120a, 121)

Philopsyche hapaliae Rao, 1953. Indian Forest Rec. Ent., 8: 168. Holotype: ♀, India: Mallipatna in Coorg, Mysore (IFRI).

Acropimpla hapaliae: Townes, Townes & Gupta (1961).

Material examined. Son La, To Hieu: 1♀ (IEBR), 20.iv.2000, hand net, L. X. Truong leg.; Hoa Binh, Lac Thinh: 1♀ (IEBR), 10–20.iv.2002, Malaise trap, L. D. Khuat leg.; Nghe An, Pu Mat NP: 1♀ (ZFMK), 200 m a.s.l., 15.iv.2006, hand net, N. T. Pham leg., ZFMK HYM 2011/1; Dong Nai, Cat Tien NP: 1♀ (RMNH), 100 m a.s.l., 15–20.v.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.; Phu Tho, Xuan Son NP: 1♀ (IEBR), 150–200 m a.s.l., 01–05.v.2009, Malaise trap, L. D. Khuat leg.

Diagnosis. Face yellow, extending on inner orbit beyond antennal sockets; propodeum with short stubs of median longitudinal carinae; clypeus black; scutellum and metascutellum yellow; metasomal tergites with yellowish or whitish apical bands; ovipositor 3.0x as long as hind tibia (Gupta & Tikar 1976).

Distribution. Pham *et al.* (2011d) recorded this species for the first time. Outside Vietnam, it has been known from China, India and Myanmar (Yu *et al.*, 2005).

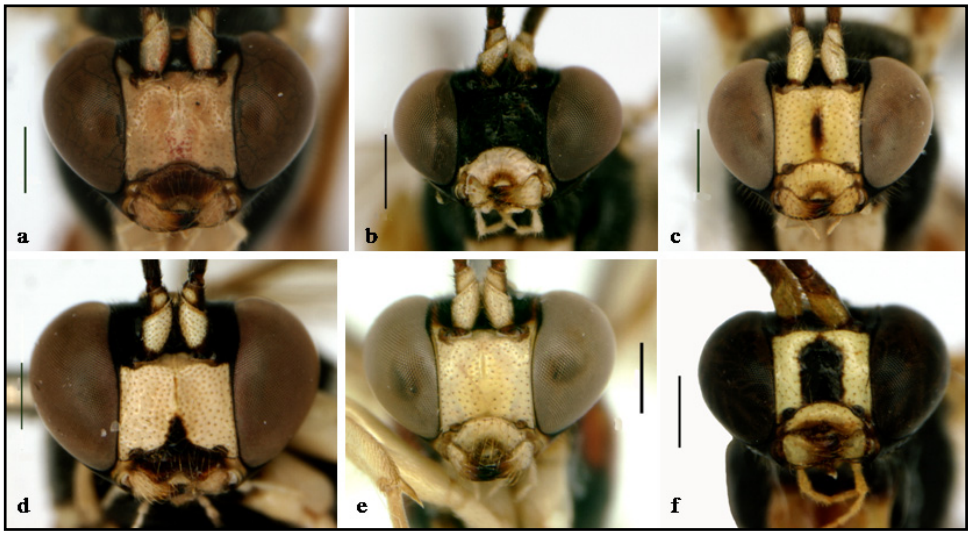

Figure 117. Faces of *Acropimpla* species (scales 0.5 mm): a. *A. hapaliae*; b. *A. lampei*; c. *A. leucostoma*; d. *A. mucronis*; e. *A. phongdienensis*; f. *A. taishunensis*

***Acropimpla lampei* PHAM, BROAD & WÄGELE, 2011**

(Figures 116b, 117b, 118a, 119b, 120b, 121)

Acropimpla lampei Pham, Broad, Wägele, 2011. Zootaxa, 2921: 6. Holotype: ♀ (IEBR), Dak Lak, Ea So NR.

Material examined. Dak Lak, Ea So NR: 1♀ (IEBR, holotype), 310 m a.s.l., 12°55.93'N–108°37.96'E, 27.vii.2008, Malaise trap, H. T. Ngo leg.

Diagnosis. Face black with two very small yellow marks below antennal sockets; propodeum with very short stubs of median longitudinal carinae; clypeus, scutellum and metascutellum yellow; metasomal tergites black, each with two yellow apical, lateral spots; ovipositor 2.8x as long as hind tibia.

Description (Female). Body length 10.0 mm, fore wing 8.7 mm, ovipositor 7.0 mm. *Head*. Antenna with 23 flagellomeres, first flagellomere 1.2x length of second; diameter of lateral ocellus 0.8x ocellar-ocular distance; frons subpolished; face 0.75x as high as wide, slightly convex medially, with shallow, small punctures, pubescent, upper margin of face straight; clypeus with median apical notch, slightly swollen medially, apex thin and emarginate; malar space about 0.25x basal width of mandible; upper tooth of mandible slightly longer than lower tooth; occipital carina complete, meeting hypostomal carina far from base of mandible.

Mesosoma. Epomia present, about 0.65x basal width of mandible; pronotum polished; mesoscutum 1.2x as long as wide at anterior level of tegulae, with dense, minute hairs, notauli shallowly present on anterior 0.35 of mesoscutum, extending to line connecting front edges of tegulae; scutellum weakly convex, pubescent, apically smooth, without striations, lateral carinae absent; mesopleuron moderately densely punctate anteriorly, polished and impunctate posteriorly,

epicnemial carina weakly present on lower 0.8 of mesopleuron, lateral sections of postpectal carina present to middle of mid coxa; metapleuron polished, pubescent on upper half, pleural carina complete; propodeum moderately convex, with very short stubs of median longitudinal carinae, lateral and pleural areas with dense rugose punctures, pubescent; propodeal spiracle round. Hind leg with femur 4.3x as long as wide, length 0.77x tibia, basitarsus 0.37x tibia, 0.5x tarsus, 3.0x second tarsomere, fifth tarsomere longer than third. Fore wing vein 2*rs-m* 0.55x length of 3*rs-m*; *cu-a* opposite *Rs*&*M*; cell 1+2*Rs* trapezoidal, receiving vein 2*m-cu* near apex; hind wing with first abscissa of vein *Cu*1 about 2.7x length of vein *cu-a*; vein *Cu*1 present.

Metasoma. Tergites densely punctate except transverse smooth bands apically and concave area at base of first tergite; first tergite 0.7x as long as apical width, dorsolateral carina complete, dorsal median carina extending to declivity; second tergite 0.6x length of apical width; nearly as long as length of third tergite; ovipositor straight, 2.8x length of hind tibia, cylindrical; tip of lower valves with oblique ridges.

Colour. Antenna blackish, except lower side of scape and pedicel yellow; face black with two very small yellowish spots below antennal sockets; clypeus, mandible, upper margin of pronotum, subtegular ridge, tegula, scutellum, metascutellum yellow; fore and mid legs yellow; hind coxa, femur red, trochanter, trochantellus pale yellow; tibia pale yellow with broad apical and basal black bands, tarsomeres pale yellow with apical black bands; wings hyaline, pterostigma and veins black, except basal 0.6 of costa yellowish; metasomal tergites black with two apical, lateral yellow spots on each tergite; metasomal sternites whitish with two blackish spots on sternites 2–5 laterally; ovipositor reddish, ovipositor sheath black and hairy.

Male: Unknown.

Distribution. Currently known only from Ea So NR, Dak Lak, Central Highlands of Vietnam (Pham *et al.*, 2011d).

Ecological note. The single specimen was collected in evergreen forest (Pham *et al.,* 2011d).

***Acropimpla leucostoma* (CAMERON, 1907)**

(Figures 116c, 117c, 119c, 120c, 121)

Charitopimpla leucostoma Cameron, 1907. Tijdschr. Ent., 50: 97. Holotype: ♀, India: Sikkim (BMNH).

Acropimpla leucostoma: Townes & Townes (1960).

Material examined. Ninh Binh, Cuc Phuong NP: 1♂ (RMNH), 225 m a.s.l., 01.xi–20.xii.2000, Malaise trap, Q. P. Mai leg.; Thua Thien-Hue, Phong Dien NR: 3♀ (RMNH), 50–210 m a.s.l., 23.iii–06.iv.2001, Malaise trap, C. v. Achterberg & R. de Vries leg.; 1♀ (RMNH), 50–100 m a.s.l.,

24.iii.2001, at light, C. v. Achterberg leg.; 1♀ (RMNH), 50–100 m a.s.l., 25.iii.2001, hand net, C. v. Achterberg leg.; Dong Nai, Cat Tien NP: 1♀ (RMNH), 100m a.s.l., 01–09.x.2005; 2♀ (RMNH), 100 m a.s.l., 13–20.v.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.; Kon Tum, Chu Mom Ray NP: 1♀ (RMNH), 700–900 m a.s.l., 26.ix–05.x. 2006, Malaise trap, Q. P. Mai & M. T. Nguyen leg.; Dak Lak, Chu Yang Sin NP: 2♀ (RMNH), 800–940 m a.s.l., 02–10.vi.2007; 1♀ (RMNH), 750 m a.s.l., 01–10.vi.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.; Phu Tho, Xuan Son NP: 1♀ (IEBR), 200 m a.s.l., 07.xii.2003, hand net, L. X. Truong leg.; 1♀ (IEBR), 300 m a.s.l., 10.v.2005, hand net, N. T. Pham leg.; Lai Chau, Hi Ngay, Muong Lay: 1♀ (IEBR), 10.x.2004, hand net, L. D. Khuat leg.; Ha Tinh, Huong Son, Son Kim: 1♀ (IEBR), 07.v.2004, hand net, L. X. Truong leg.; Vinh Phuc, Tam Dao NP: 1♀ (ZFMK, HYM 2011/2), 900 m a.s.l., 09.viii.2005, hand net, N. T. Pham leg.; Hoa Binh, Mai Chau, Tan Son: 1♀ (IEBR), 850–900 m a.s.l., 10–15.viii.2010, Malaise trap, L. D. Khuat leg.

Diagnosis. Face yellow, usually with central black mark, yellow extending on inner orbits beyond antennal sockets; propodeum without or with very short stubs of median longitudinal carinae; clypeus, scutellum and metascutellum yellow; tergite 5 entirely black; ovipositor 2.50x as long as hind tibia (Gupta & Tikar, 1976).

Distribution. Gupta & Tikar (1976) previously recorded *A. leucostoma* from North Vietnam. Our records extended the distribution of this species southwards to Central and South Vietnam. Outside Vietnam, this species has been known from China, India, Indonesia, Japan, Laos, Myanmar and Sri Lanka (Yu *et al.*, 2005).

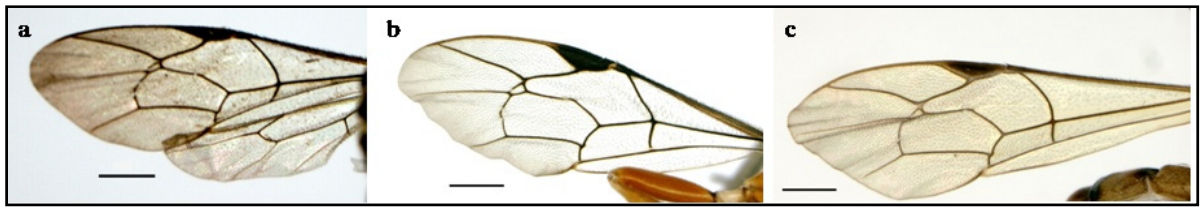

Figure 118. Wings of *Acropimpla* species (scales 1 mm):
a. *A. lampei*; b. *A. mucronis*; c. *A. phongdienensis*

***Acropimpla mucronis* PHAM, BROAD & WÄGELE, 2011**

(Figures 116d, 117d, 118b, 119d, 120d, 121)

Acropimpla mucronis Pham, Broad, Wägele, 2011. Zootaxa, 2921: 7. Holotype: ♀ (RMNH), Dong Nai, Cat Tien NP.

Material examined. Dong Nai, Cat Tien NP: 1♀ (RMNH, holotype), Ficus trail, 100 m a.s.l., 09–30.iv.2007, Malaise trap, Q. P. Mai & M. T. Nguyen leg.

Diagnosis. Face yellow with small triangular black mark centrally connecting with black clypeus, yellow inner orbits extending beyond antennal sockets; propodeum with median

longitudinal carinae distinct; scutellum and metascutellum yellow; metasomal tergites reddish with first tergite basally and second and third tergites narrowly apically black; ovipositor 3.1x as long as hind tibia.

Description (Female). Body length 12.0 mm, fore wing 10.3 mm, ovipositor 9.2 mm. *Head*. Antenna with 23 flagellomeres, first flagellomere 1.3x length of second; diameter of lateral ocellus 0.8x ocellarocular distance; frons subpolished; face 0.67x as high as wide, slightly convex medially, with shallow and moderate-sized punctures, pubescent, upper margin of face nearly straight, with very broad concavity; clypeus with median apical notch, basally moderately convex, apex thin and emarginate; malar space about 0.33x basal width of mandible; upper tooth of mandible slightly longer than lower tooth; occipital carina complete, meeting hypostomal carina above base of mandible.

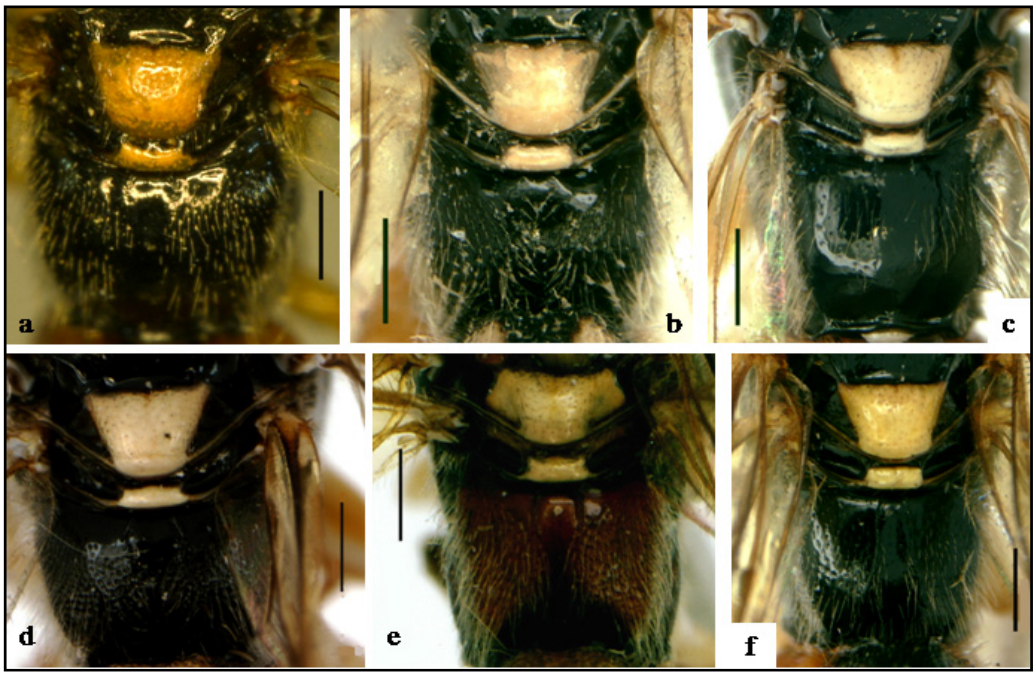

Figure 119. Dorsal views of scutellum and propodeum of *Acropimpla* species (scales: 0.5 mm): a. *A. hapaliae*; b. *A. lampei*; c. *A. leucostoma*; d. *A. mucronis*; e. *A. phongdienensis*; f. *A. taishunensis*

Mesosoma. Epomia present, about 0.6x basal width of mandible; pronotum polished; mesoscutum 1.1x as long as wide at anterior level of tegulae, with dense, minute hairs, notauli shallowly present on anterior 0.25 of mesoscutum, nearly extending to front edges of tegulae; scutellum weakly convex, with moderately dense punctures, apically smooth, without striations, lateral carinae absent; metascutellum polished; mesopleuron subpolished, anterior half with moderately small punctures, pubescent, posterior half smooth and shiny, epicnemial carina strong and reaching anterior margin of mesopleuron, lateral sections of postpectal carina present to

middle of mid coxa; metapleuron with lower half polished, upper half with some small punctures, pubescent, pleural carina complete; propodeum strongly convex, declivous, lateral and pleural areas of propodeum with dense, rugose punctures, pubescent, median longitudinal carinae present on basal 0.67, diverging; propodeal spiracle round. Hind leg with femur 4.0x as long as wide, 0.76x length of tibia, basitarsus 0.4x length of tibia, 0.53x tarsus, 3.0x length of second tarsomere, fifth tarsomere longer than third. Fore wing vein 2*rs-m* 0.5x length of 3*rs-m*; *cu-a* opposite *Rs*&*M*; cell 1+2*Rs* trapezoidal, vein 2*m-cu* slightly basad of 3*rs-m*; hind wing with first abscissa of vein *Cu*1 about 2.3x length of vein *cu-a*; vein *Cu*1 present.

Metasoma. Tergites densely punctate except apical transverse, smooth bands and concave area at base of first tergite; first tergite 0.76x as long as apical width, dorsolateral carina complete, dorsal median carina extending to declivity; second tergite 0.6x apical width; 1.1x third tergite; ovipositor straight, 3.1x length of hind tibia, cylindrical, with oblique ridges at tip of lower valves.

Male. Unknown.

Colour. Antenna blackish, except lower side of scape and pedicel yellow; face yellow except small, blackish triangular area connecting with clypeus, yellow inner orbits extending beyond antennal sockets; clypeus black; head and mesosoma black except upper margin of pronotum, subtegular ridge, scutellum, metascutellum, fore and mid leg yellow; hind leg reddish; wings hyaline, pterostigma and veins black, except basal 0.70 of costa yellowish; metasomal tergites reddish except concave area at base of first tergite and transverse smooth bands at apex of second and third tergites black; metasomal sternites whitish with two blackish spots laterally on sternites 2–6 black; spots on sixth sternite largest, nearly touching each other; ovipositor reddish, ovipositor sheath black and hairy.

Distribution. Currently known only from Cat Tien NP, Dong Nai Povince, southern Vietnam (Pham *et al.*, 2011d).

Ecological note. The single specimen was collected in secondary evergreen forest in a lowland area (Pham *et al.*, 2011d).

***Acropimpla phongdienensis* PHAM, BROAD & WÄGELE, 2011**

(Figures 116e, 117e, 118c, 119e, 120e, 121)

Acropimpla phongdienensis Pham, Broad, Wägele, 2011. Zootaxa, 2921: 9. Holotype: ♀, Thua Thien-Hue, Phong Dien NR (RMNH).

Material examined. Thua Thien-Hue, Phong Dien NR: 1♀ (RMNH, holotype), 80–210 m a.s.l., 23.iii–06.iv.2001; 1♀ (IEBR, paratype), 100 m a.s.l., 22.iii–06.iv.2001, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Face yellow, yellow inner orbits extending beyond antennal sockets; propodeum with median longitudinal carinae distinct; clypeus, scutellum and metascutellum yellow; metasomal tergites reddish with apices of second to fifth tergites black; ovipositor 2.9x as long as hind tibia, with distinct constriction near tip.

Description (Famale). Body length 10.7–11.0 mm, fore wing 8.0–8.5 mm, ovipositor 7.2–7.5 mm. *Head*. Antenna with 22 flagellomeres, first flagellomere 1.2–1.3x length of second; diameter of lateral ocellus 0.85x ocellarocular distance; frons subpolished; face 0.8–0.83x as high as wide, slightly convex medially, with shallow, sparse and small punctures, pubescent, upper margin of face straight; clypeus with median apical notch, basally slightly convex, apex thin and emarginate; malar space about 0.33x basal width of mandible; upper tooth of mandible 1.3x longer than lower tooth; occipital carina complete, meeting hypostomal carina nearly at base of mandible.

Mesosoma. Epomia present, about 0.7x basal width of mandible; pronotum polished; mesoscutum 1.2x as long as wide at anterior level of tegulae, with dense, minute hairs, notauli shallowly present on anterior 0.4 of mesoscutum, nearly extending to middle of tegulae; scutellum weakly convex, apically smooth, without striations, lateral carinae absent; scutellum and metascutellum pubescent; mesopleuron subpolished on upper half and densely punctate on lower half, epicnemial carina strong and reaching anterior margin of mesopleuron, lateral sections of postpectal carina present to middle of mid coxa; metapleuron with lower half polished, upper half with some small punctures, pubescent, pleural carina complete; propodeum weakly convex, lateral and pleural areas with dense rugose punctures, pubescent, median longitudinal carinae present on basal 0.33, subparallel; propodeal spiracle rounded. Hind leg with femur 4.8x as long as wide, 0.8x length of tibia, basitarsus 0.4x tibia, 0.53x tarsus, 3.0x second tarsomere, fifth tarsomere longer than third. Fore wing vein 2*rs-m* 0.5x length of 3*rs-m*; *cu-a* opposite *Rs*&*M*; cell 1+2*Rs* nearly triangular, receiving vein 2*m-cu* near apex; hind wing with first abscissa of vein *Cu*1 about 2.2x length of vein *cu-a*; vein *Cu*1 present.

Metasoma. Tergites densely punctate except for transverse smooth bands apically and concave area at base of first tergite; first tergite 0.9–1.0x as long as apical width, dorsolateral carina complete, dorsal median carina extending to declivity; second tergite 0.8–0.9x as long as apically wide; 1.1x length of third tergite; ovipositor straight, 2.9x length of hind tibia, cylindrical and distinctly constricted near apex; tip of lower valves with oblique ridges.

Colour. Antenna blackish, except lower side of scape and pedicel yellow; face and clypeus yellow, yellow inner orbits extending beyond antennal sockets; head black; mesosoma with extensive red areas, pronotum red medially and yellow laterally, mesoscutum red, scutellum, metascutellum, and subtegular ridge yellow, mesopleuron black with oblique red band; fore and mid legs yellow, hind leg

reddish; wings hyaline and yellowish, pterostigma and veins black, except costa yellowish; metasomal tergites reddish yellow except transverse smooth bands at apex of second to fifth tergites black; metasomal sternites whitish with two black spots on sternites 2–6 laterally, of which spots on sixth sternite largest, touching each other; ovipositor reddish, ovipositor sheath black and hairy.

Male. Unknown.

Distribution. Currently known only from Phong Dien NR, Thua Thien-Hue, Central of Vietnam (Pham *et al.*, 2011d).

Ecological note. Specimens were collected in lowland evergreen forest (Pham *et al*., 2011d).

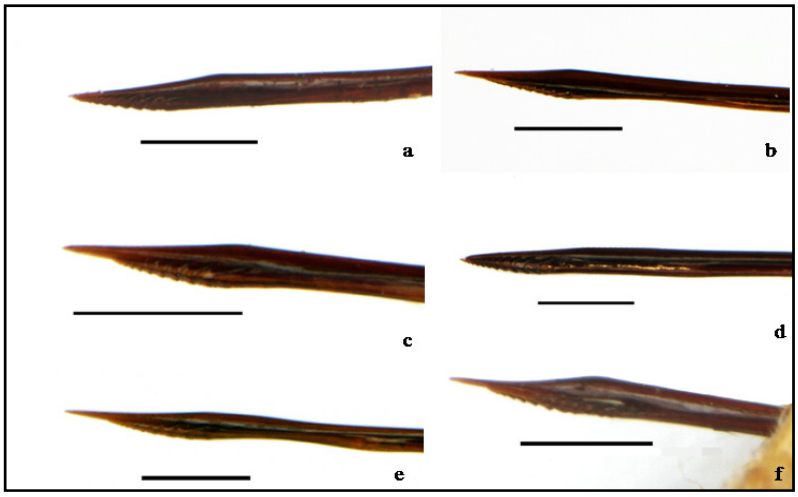

Figure 120. Ovipositor tips of *Acropimpla* species (scales 0.5 mm): *A. hapaliae*; b. *A. lampei*; c. *A. leucostoma*; d. *A. mucronis*; e. *A. phongdienensis*; f. *A. taishunensis*

***Acropimpla taishunensis* LIU, HE & CHEN, 2010**

(Figures 116f, 117f, 119f, 120f, 121)

Acropimpla taishunensis Liu, He & Chen, 2010. Zootaxa, 2394: 23–40. Holotype: ♀, China: Zhejiang (ZJUH).

Material examined. Nghe An, Phuc Son, Anh Son: 1♀ (IEBR), 250–300 m a.s.l., 23.iv.2006, hand net, H. X. Le leg.

Diagnosis. Face yellow with pentagonal black mark centrally, yellow extending up inner orbits to antennal sockets; propodeum with median longitudinal carinae distinct; clypeus, scutellum and metascutellum yellow; metasomal tergites black with yellowish apical and lateral stripes; ovipositor 2.2x as long as hind tibia.

Distribution. Pham *et al.* (2011d) recorded this species in Vietnam for the first time. Outside Vietnam, it has been known only from China (Liu *et al.*, 2010).

Remarks. The specimen from Vietnam has a shorter malar space (0.2x basal width of mandible

versus 0.4x), a longer hind femur (4.6x as long as wide versus 3.9x), and darker metasomal tergites compared with the original description of the species by Liu *et al.* (2010).

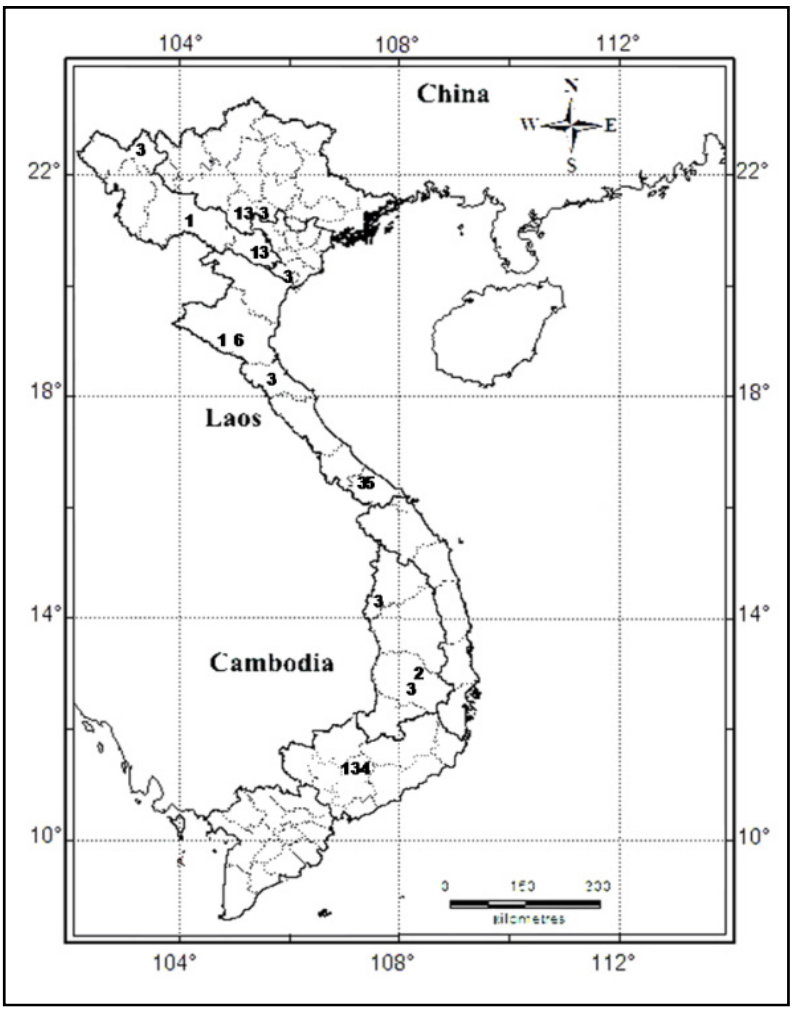

Figure 121. Distribution map of *Acropimpla* species: 1. *A. hapaliae*; 2. *A. lampei*; 3. *A. leucostoma*; 4. *A. mucronis*; 5. *A. phongdienensis*; 6. *A. taishunensis*

Brachyzapus **Gauld & Dubois, 2006**

Brachyzapus Gauld and Dubois, 2006: 544. Type-species: *Polysphincta tenuiabdominalis* Uchida, by original designation.

Diagnosis. Eyes with scattered, minute hairs; mandible twisted about 60°–85°, narrow, upper tooth slightly to distinctly longer than lower; clypeus moderately to strongly convex, separated from face by more or less impressed clypeofacial suture; palpi formula 5:4; pronotum with upper part of epomia strong and subvertical; mesoscutum moderately long, with impressed notauli, posterolateral flange of mesoscutum strongly broadened; mesopleuron with epicnemial carina well developed, its upper end remote from anterior margin of pleuron; mesopleural sulcus angled opposite mesepisternal crobe; submetapleural carina complete; propodeum with at least posterior

part of lateral longitudinal carina present, posterior transverse carina strong when complete, propodeal spiracle round, not touching pleural carina; tarsal claws of female moderately long, with high basal lobe; fore wing with 3*rs-m* entirely absent; hind wing with basal abscissa of *M*+*Cu* evenly bowed; distal abscissa of *Cu*1 present, spectral; metasoma insertion separated from hind coxal cavities by strong sclerotized bridge; first tergite elongate; second tergite usually with weak anterolateral oblique grooves; ovipositor straight or up-curved at tip, slender, awl-like, without basal ventral swelling (Gauld & Dubois, 2006).

Brachyzapus was a small genus, with only three previously included species (Gauld & Dubois, 2006). It was erected to accommodate species previously placed in the genus *Zabrachypus*, which was not a monophyletic genus (Gauld & Dubois, 2006). Pham *et al.* (2012b) recorded this genus for the first time from Vietnam with descriptions of six new species on the basis of specimens collected in the Hoang Lien Range, northern Vietnam. In addition, judging by the original descriptions (Wang *et al*., 1997; Sheng & Pan, 2011; Hao & Sheng, 2002), Pham *et al*. (2012b) also transferred formally three species from *Zabrachypus,* viz. *Z. atripedalis* Sheng, 2001; *Z. nitidus* Hao & Sheng, 2002 and *Z. nonareaeidos* Wang, 1997, to *Brachyzapus* and compiled an identification key to all 12 recognized species of this genus.

Little is known of *Brachyzapus* biology, but *B. nikkoensis* (Uchida, 1928) has been recorded as parasitoid of *Tegenaria domestica* Clerck and *Agelena limbata* Thorell (Araneae: Agelenidae) (Gauld & Dubois, 2006).

Key to Vietnamese species of *Brachyzapus*

1. Face narrow, 1.9 times as high as wide; malar space 0.25 times basal width of mandible (Figure 122f); notaulus less impressed, usually extending to middle of mesoscutum, weakly or not convergent posteriorly; scutellum and postscutellum black (Figure 123f); propodeum with some transverse ridges at level of posterior transverse carina laterally (Figure 125f).....*B. politus* Pham, Broad, Matsumoto & Wägele

-. Face broader, 1.3–1.6 times as high as wide; malar space 0.5–0.7 times basal width of mandible (Figures 122a–e); notaulus strongly impressed, distinctly convergent posteriorly in shallow hollow (Figures 123a–e); propodeum with posterior transverse carina strong, complete (Figures 125a–e).....2

2. First tergite distinctly convex centrally, without distinct median longitudinal carina (Figures 127b, 127d); first sternite weakly convex medially.....3

-. First tergite evenly convex, with median longitudinal carina extending to middle or nearly to posterior margin (Figures 127a, 127c, 127e); first sternite weakly to strongly convex apically.....4

3. Metasternum with only two parallel transverse ridges at level of posterior angulation; scutellum

with weak transverse ridges laterally (Figures 123b, 125b); second tergite narrow, 1.4x as long as apical width (Figure 127b); first sternite with some transverse ridges at base.....*B. convexus* Pham, Broad, Matsumoto & Wägele

-. Metasternum with many parallel transverse ridges from above level of posterior angulation to middle of hind coxa; scutellum with strong transverse ridges laterally (Figures 123d, 125d); second tergite broader, 1.1x as long as apical width (Figure 127d); first sternite with transverse ridges present on basal 0.4.....*B. fansipanensis* Pham, Broad, Matsumoto & Wägele

4. Mesopleural suture smooth, not foveolate (Figure 124e); lateral side of scutellum without transverse ridges (Figures 123e, 125e); body reddish brown.....*B. hoanglienensis* Pham, Broad, Matsumoto & Wägele

-. Mesopleural suture foveolate (Figures 124a, 124c); lateral side of scutellum with transverse ridges (Figures 123a, 123c); body black.....5

5. Epicnemial carina strongly sinuous ventrally (Figure 124a); propodeum with basal and apical part of lateromedian longitudinal carina present (Figure 125a).....*B. carinatus* Pham, Broad, Matsumoto & Wägele

-. Epicnemial carina less sinuous ventrally (Figure 124c); propodeum with lateromedian longitudinal carina entirely absent (Figures. 125c).....*B. duboisi* Pham, Broad, Matsumoto & Wägele

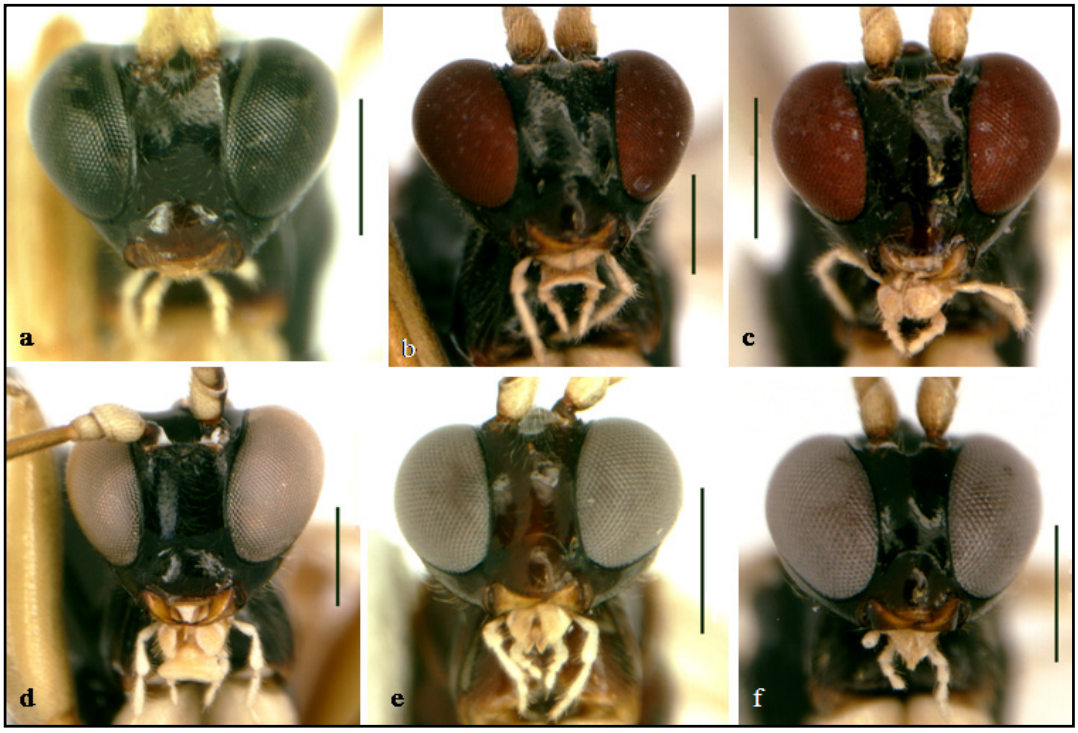

Figure 122. Faces of *Brachyzapus* species (scales 0.5 mm): a. *B. carinatus*; b. *B. convexus*; c. *B. duboisi*; d. *B. fansipanensis*; e. *B. hoanglienensis*; f. *B. politus*

***Brachyzapus carinatus* PHAM, BROAD, MATSUMOTO & WÄGELE, 2012**

(Figures 122a, 123a, 124a, 125a, 126a, 127a, 128a, 129)

Brachyzapus carinatus Pham, Broad, Matsumoto & Wägele, 2012. J. Nat. Hist. 46 (27–28): 1640. Holotype: ♀, Vietnam: Lao Cai, Sa Pa (OMNH).

Material examined. Lao Cai, Sa Pa: 1♀ (OMNH, holotype), 1700 m a.s.l., 30.v.1997, hand net, R. Matsumoto leg.

Diagnosis. Inner margins of eyes slightly convergent medially; malar space 0.65x basal width of mandible; scutellum with lateral carina present basally, laterally with weak transverse ridges; mesopleuron with epicnemial carina strongly sinuous, mesopleural suture foveolate; propodeum with posterior transverse carina strong, basal and apical stubs of lateromedian longitudinal carina present; first sternite strongly convex, rounded apically.

Description. (Female). Body length 7.0 mm, fore wing 6.3 mm, ovipositor 1.75 mm. *Head*. Antenna with more than 17 flagellomeres (apical flagellomeres missing), first flagellomere 1.3x length of second; diameter of lateral ocellus 0.75x ocellar-ocular distance; frons impunctate and polished; inner margins of eyes slightly convergent medially; face 1.6x as high as wide, pubescent, upper margin broadly concave between antennal sockets; clypeus moderately convex, about 0.65x as high as wide, apical margin thin, emarginate; malar space about 0.65x basal width of mandible; mandible weakly twisted and narrow, upper tooth longer than lower tooth; occipital carina complete, meeting hypostomal carina about 1.2x length of mandible basal width from base of mandible.

Mesosoma. Epomia length 2.0x basal mandible width, extending from collar to dorsal margin of pronotum; pronotum impunctate and polished laterally, sparsely pubescent dorsally and at collar; mesoscutum moderately densely setose, with notauli deep, convergent at posterior 0.3 in shallow hollow; scutellum strongly convex, pubescent basally, laterally with weak transverse ridges, lateral carina present basally; mesopleuron subpolished, moderately dense hairs dorsally, ventrally scattered hairs, mesopleural suture foveolate, epicnemial carina present on lower 0.6, strongly sinuous; metapleuron convex, bare and polished, pubescent dorsally along pleural carina, submetapleural carina forming small lobe anteriorly, angled about 120° posteriorly; metasternum with some transverse ridges emerging from posterior angulation of submetapleural carina; propodeum moderately convex, pubescent laterally, dorsally mostly bare, area petiolaris polished, lateromedian longitudinal carina with basal and posterior parts present, lateral longitudinal carina present on apical 0.5, posterior transverse carina strong. Legs with mid and hind tibiae slightly swollen subbasally; fore femur 4.2x as long as wide; hind femur 5.0x longer than wide, length 0.83x tibia, tibia 8.1x as long as apical width; basitarsus longer than following three tarsomeres combined, 0.33x length of tibia, 0.45x tarsus, 2.3x second tarsomere, fourth tarsomere very short,

fifth 2.0x as long as third. Fore wing with vein *Rs&M* opposite *cu-a*, 2*rs-m* about 0.75x distance between 2*rs-m* and 2*m-cu*, vein *cu-a* slightly inclivous, vein *Cu*1*a* separated from 1*m-cu* by 1.2x length of vein *Cu*1*b*; hind wing with first abscissa of vein *Cu*1 about 1.15x as long as vein *cu-a*.

Metasoma. Metasoma 1.6x head and mesosoma combined; tergites with fine punctures, weakly coriaceous; first tergite 2.3x as long as apical width, dorsolateral carina weakly complete, median longitudinal carina faint before transverse smooth band; second tergite 0.8x length of first, 1.15x as long as apical width, basal and apical oblique grooves moderately deep, rhombic area moderately convex; third tergite shorter than second, basal and apical oblique grooves weakly present; first sternite rounded, strongly convex apically; ovipositor straight, length of ovipositor from tip of hypopygium 0.75x length of hind tibia, tapered to sharp point.

Colour. Black. Antenna yellowish brown, clypeus and mandible brown, palpi and tegula yellow; scutellum and postscutellum reddish; legs yellowish brown, except hind tibia with subbasal and apical parts slightly darker; wings yellowish, pterostigma and veins yellowish brown; ovipositor reddish.

Male. Unknown.

Distribution. Currently known only from Sa Pa, Lao Cai Province, Northern Vietnam (Pham *et al*., 2012b).

Ecological note. The single specimen was collected in montane evergreen forest at an elevation of 1,700 m a.s.l. (Pham *et al.*, 2012b).

***Brachyzapus convexus* PHAM, BROAD, MATSUMOTO & WÄGELE, 2012**

(Figures 122b, 123b, 124b, 125b, 126d, 127b, 128b, 129)

Brachyzapus convexus Pham, Broad, Matsumoto & Wägele, 2012. J. Nat. Hist. 46 (27–28): 1643. Holotype: ♀, Vietnam: Lao Cai, Hoang Lien NP, Fansipan Mt (RMNH).

Material examined. Lao Cai, Hoang Lien NP, Fansipan Mt: 1♀ (RMNH, holotype), 2320 m a.s.l., 24.iv–02.v.2000, Malaise trap, P. Q. Mai & M. T. Nguyen leg.

Diagnosis. Inner margins of eyes slightly convergent medially; malar space 0.5x basal width of mandible; scutellum with lateral carina present basally, laterally with weak transverse ridges; metasternum with two parallel transverse ridges at level of posterior angulation; propodeum with posterior transverse carina strong; metasoma tergites narrow, first tergite without distinct median longitudinal carina; first sternite weakly convex, rounded centrally.

Description (Female). Body length 12.2 mm, fore wing 9.5 mm, ovipositor 2.7 mm. *Head*. Antenna with 30 flagellomeres, first flagellomere 1.35x length of second; diameter of lateral ocellus 1.15x ocellar-ocular distance; frons impunctate and polished; inner margins of eyes slightly

convergent medially; face 1.4x as high as wide, pubescent, upper margin concave between antennal sockets; clypeus strongly convex, about 0.6x as high as wide, apical margin thin, emarginate; malar space about 0.5x basal width of mandible; mandible twisted and narrow, upper tooth much longer than lower tooth; occipital carina complete, meeting hypostomal carina about 1.25x length of mandible basal width from mandible base.

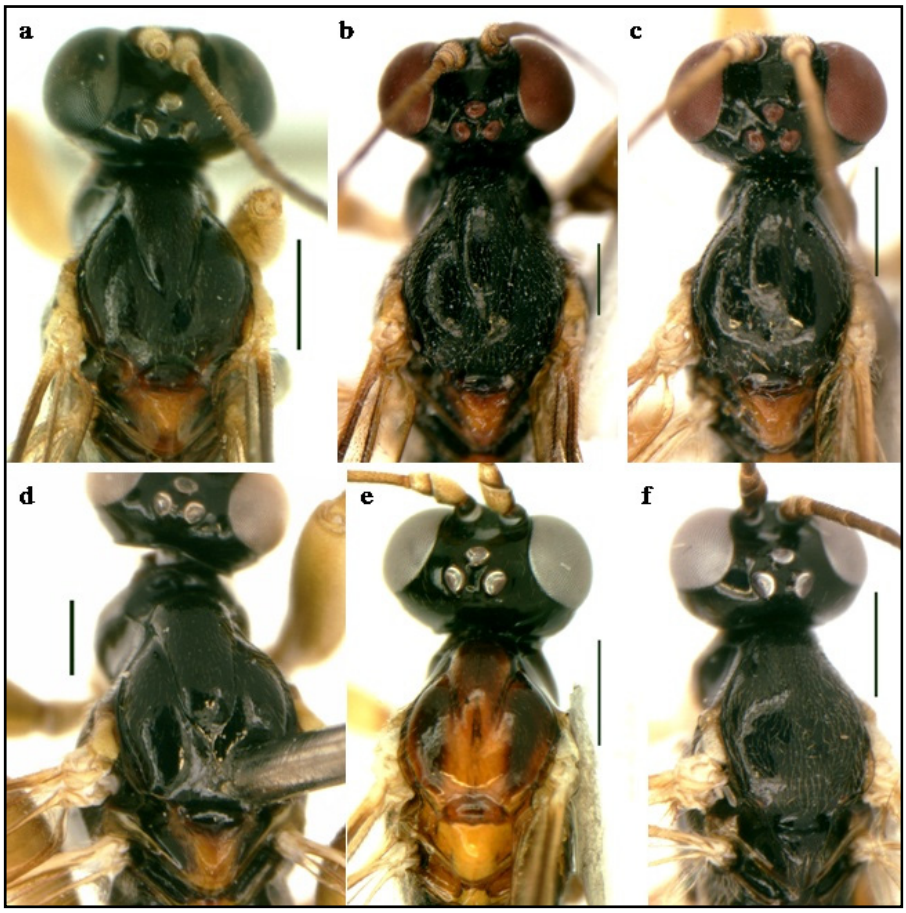

Figure 123. Dorsal views of head and mesonotum of *Brachyzapus* species (scales 0.5 mm): a. *B. carinatus*; b. *B. convexus*; c. *B. duboisi*; d. *B. fansipanensis*; e. *B. hoanglienensis*; f. *B. politus*

Mesosoma. Epomia length 2.0x mandible width, extending from collar to dorsal margin of pronotum; pronotum impunctate and polished laterally, collar pubescent dorsally; mesoscutum densely setose, with notauli deep, convergent at posterior 0.3 in shallow hollow; scutellum strongly convex, pubescent basally, laterally with weak transverse ridges, lateral carina present basally; mesopleuron moderately densely pubescent except median concave area bare and polished, mesopleural suture foveolate, epicnemial carina present on lower 0.6 of mesopleuron; metapleuron convex, bare and polished, pubescent dorsally along pleural carina, submetapleural carina forming small lobe anteriorly, angled posteriorly about 130°; metasternum with two parallel transverse ridges from posterior angulation of submetapleural carina extending about 0.7 distance to median longitudinal groove; propodeum moderately convex, pubescent laterally, dorsally mostly

bare, area petiolaris polished, lateral longitudinal carina present on apical 0.5, posterior transverse carina strong. Legs slender, tibiae slightly swollen subbasally, fore femur 4.8x as long as wide; hind femur 5.9x as long as wide, length 0.8x tibia, tibia 10.0x as long as apical width; basitarsus longer than following three tarsomeres combined, length 0.3x tibia, 0.45x tarsus, 2.4x second tarsomere, fourth tarsomere very short, fifth 1.7x as long as third. Fore wing with vein *Rs&M* slightly basad of *cu-a*, 2*rs-m* about 0.7x distance between 2*rs-m* and 2*m-cu*, vein *cu-a* slightly inclivous, vein *Cu*1*a* separated from 1*m-cu* by 1.3x length of vein *Cu*1*b*; hind wing with first abscissa of vein *Cu*1 1.2x as long as vein *cu-a*.

Metasoma. Metasoma 2.0x longer than head and mesosoma combined; tergites coriaceous with dense, short hairs, except transverse smooth bands apically and first two tergites polished with scattered hairs; first tergite 2.7x as long as apical width, median part convex, dorsolateral carina complete, weaker apically, median longitudinal carina indistinct; second tergite 0.85x length of first tergite, 1.4x as long as apical width, basal and apical oblique grooves moderately deep, rhombic area moderately convex; third tergite shorter than second tergite, basal and apical oblique grooves weak; first sternite with some transverse ridges basally, weakly convex and rounded centrally; ovipositor slightly up-curved at tip, length from tip of hypopygium 0.75x length of hind tibia, lower valve slightly swollen medially, tapered to sharp point.

Colour. Black. Antenna yellowish brown, clypeus brown, mandible yellowish brown, palpi and tegula yellow; scutellum and postscutellum reddish; legs reddish brown, except fore and mid coxae yellow, mid and hind trochantellus slightly darker; wings yellowish, pterostigma and veins brownish yellow; metasoma brownish posteriorly; ovipositor reddish.

Male. Unknown.

Distribution. Currently known only from Hoang Lien NP, Fansipan Mountain, Lao Cai Province, North Vietnam (Pham *et al.*, 2012b).

Ecological note. The single specimen was collected in montane evergreen forest at an elevation of 2,320 m a.s.l. (Pham *et al.*, 2012b).

***Brachyzapus duboisi* PHAM, BROAD, MATSUMOTO & WÄGELE, 2012**

(Figures 122c, 123c, 124c, 125c, 126e, 127c, 128c, 129)

Brachyzapus duboisi Pham, Broad, Matsumoto & Wägele, 2012. J. Nat. Hist. 46 (27–28): 1646. Holotype: ♀, Vietnam: Lao Cai, Hoang Lien NP, Fansipan Mt (RMNH).

Material examined. Lao Cai, Hoang Lien NP, Fansipan Mt: 1♀ (RMNH, holotype), 2320 m a.s.l., 24.iv–02.v.2000, Malaise trap, P. Q. Mai & M. T. Nguyen leg.; Lao Cai, Sa Pa: 1♀ (OMNH, paratype), 1700 m a.s.l., 29.v.1997; 1♀ (OMNH, paratype), 1700 m a.s.l., 30.v.1997 hand net, R. Matsumoto leg.

Diagnosis. Inner margins of eyes slightly convergent medially; malar space 0.75x basal width of mandible; scutellum with lateral carina present basally, laterally with weak transverse ridges; mesopleuron with mesopleural suture foveolate; propodeum with posterior transverse carina strong; first tergite with median longitudinal carina strong to transverse smooth band; first sternite strongly convex, rounded apically.

Description (Female). Body length 7.0 mm, fore wing 6.2 mm, ovipositor 1.7 mm. *Head*. Antenna with 24–27 flagellomeres, first flagellomere 1.4–1.6x length of second; diameter of lateral ocellus 0.7–0.85x ocellar-ocular distance; frons impunctate and polished; inner margins of eyes slightly convergent medially; face 1.3–1.4x as high as wide, pubescent, upper margin broadly concave between antennal sockets; clypeus moderately convex, about 0.67x as high as wide, apical margin thin, emarginate; malar space about 0.6–0.75x basal width of mandible; mandible twisted and narrow, upper tooth longer than lower tooth; occipital carina complete, meeting hypostomal carina about 1.5x length of mandible basal width from base of mandible.

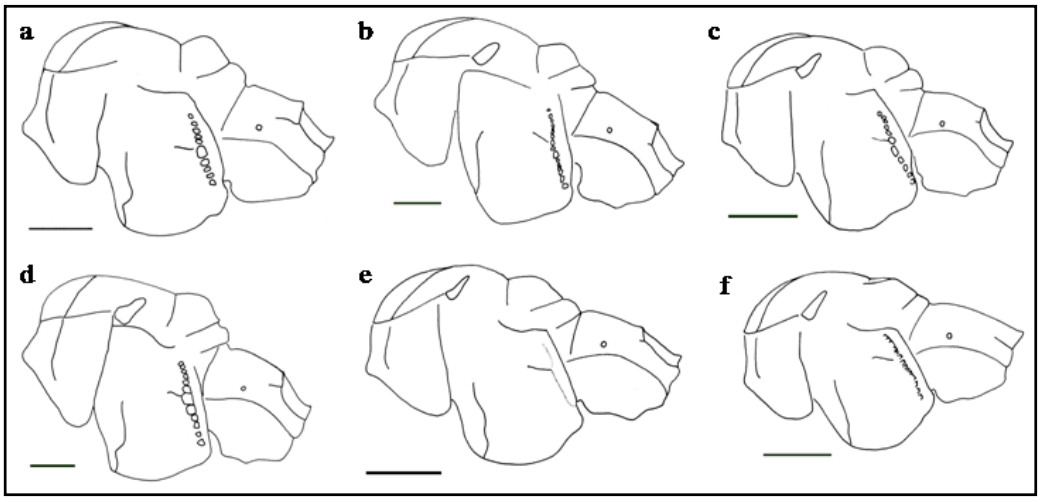

Figure 124. Lateral views of mesosoma of *Brachyzapus* species (scales 0.5 mm):
a. *B. carinatus*; b. *B. convexus*; c. *B. duboisi*; d. *B. fansipanensis*;
e. *B. hoanglienensis*; f. *B. politus*

Mesosoma. Epomia length 2.0x mandible width, extending from collar to dorsal margin of pronotum; pronotum impunctate and polished laterally, pubescent dorsally; mesoscutum moderately densely setose, with notauli deep, convergent at posterior 0.3 in shallow hollow; scutellum strongly convex, pubescent basally, laterally with weak transverse ridges, lateral carina present basally; mesopleuron subpolished, scattered hairs, mesopleural suture foveolate, epicnemial carina present on lower 0.6; metapleuron convex, bare and polished, pubescent dorsally along pleural carina, submetapleural carina forming small lobe anteriorly, angled about 120° posteriorly; metasternum with several to dense, transverse ridges from posterior angulation of submetapleural carina nearly to median longitudinal groove; propodeum moderately convex, pubescent laterally,

dorsally mostly bare, area petiolaris polished, lateral longitudinal carina present on apical 0.5, posterior transverse carina strong. Legs with mid and hind tibiae slightly swollen subbasally; fore femur 3.9x as long as wide; hind femur 5.0x longer than wide, length 0.8x tibia, tibia 10.0x as long as apical width; basitarsus longer than following three tarsomeres combined, 0.3x length of tibia, 0.45x tarsus, 2.5–3.0x second tarsomere, fourth tarsomere very short, fifth 2.0x as long as third. Fore wing with vein *Rs*&*M* slightly basad of *cu-a*, 2*rs-m* about 0.8x distance between 2*rs-m* and 2*m-cu*, vein *cu-a* slightly inclivous, vein *Cu*1*a* separated from 1*m-cu* by 1.2–1.5x length of vein *Cu*1*b*; hind wing with first abscissa of vein *Cu*1 as long as vein *cu-a*.

Metasoma. Metasoma 1.8x head and mesosoma combined; tergites with fine punctures, except second tergite and apical transverse bands smooth, base of tergite 3–5 weakly coriaceous; first tergite 2.5–2.8x as long as apical width, dorsolateral carina complete, median longitudinal carina strong to transverse smooth band, median part convex; second tergite 0.8x length of first, 1.15–1.3x as long as apical width, basal and apical oblique grooves moderately deep, rhombic area moderately convex; third tergite shorter than second, basal and apical oblique grooves weakly present; first sternite rounded, strongly convex apically; ovipositor slightly up-curved at tip, length of ovipositor from tip of hypopygium 0.75–0.85x length of hind tibia, lower valve slightly swollen medially, tapered to sharp point.

Colour. Black. Antenna yellowish brown, face and clypeus dark brown, mandible yellowish brown, palpi and tegula yellow; scutellum and postscutellum reddish; legs reddish brown, except hind tibia with subbasal and apical parts slightly darker; wings hyaline, pterostigma and veins yellowish brown; ovipositor reddish.

Male. Unknown.

Distribution. Currently known only from Hoang Lien NP, Fansipan Mt, Lao Cai Province, Northern Vietnam (Pham *et al.*, 2012b).

Ecological note. The specimen was collected in montane evergreen forest at an elevation of 1,700–2,320 m a.s.l. (Pham *et al.*, 2012b).

***Brachyzapus fansipanensis* PHAM, BROAD, MATSUMOTO & WÄGELE, 2012**

(Figures 122d, 123d, 124d, 125d, 126b, 127d, 128d, 129)

Brachyzapus fansipanensis Pham, Broad, Matsumoto & Wägele, 2012. J. Nat. Hist. 46 (27–28): 1649. Holotype: ♀, Vietnam: Lao Cai, Hoang Lien NP, Fansipan Mt (RMNH).

Material examined. Lao Cai, Hoang Lien NP, Fansipan Mt: 1♀ (RMNH, holotype), 2100 m a.s.l., 22°19'N–103°47'E, 23–26.x.2001, Malaise trap, P. Q. Mai leg.

Diagnosis. Inner margins of eyes slightly convergent medially; malar space 0.5x basal width of

mandible; scutellum with lateral carina present basally, laterally with strong transverse ridges; mesopleuron with mesopleural suture foveolate, epicnemial carina ventrally strongly sinuous; metasternum dense with transverse ridges; propodeum with posterior transverse carina strong; first tergite without distinct median longitudinal carina, first sternite with transverse ridges on basal 0.4, centrally rounded, weakly convex.

Description (Female). Body length 11.0 mm, fore wing 9.5 mm, ovipositor 2.6 mm. *Head*. Antenna with 27 flagellomeres, first flagellomere 1.4x length of second; diameter of lateral ocellus 1.15x ocellar-ocular distance; frons impunctate, polished; inner margins of eyes slightly convergent medially; face 1.4x as high as wide, pubescent, upper margin broadly concave between antennal sockets; clypeus moderately convex, about 0.6x as high as wide, apical margin thin, emarginate; malar space about 0.5x basal width of mandible; mandible twisted, upper tooth much longer than lower tooth; occipital carina complete, meeting hypostomal carina about 1.4x length of mandible basal width from base of mandible.

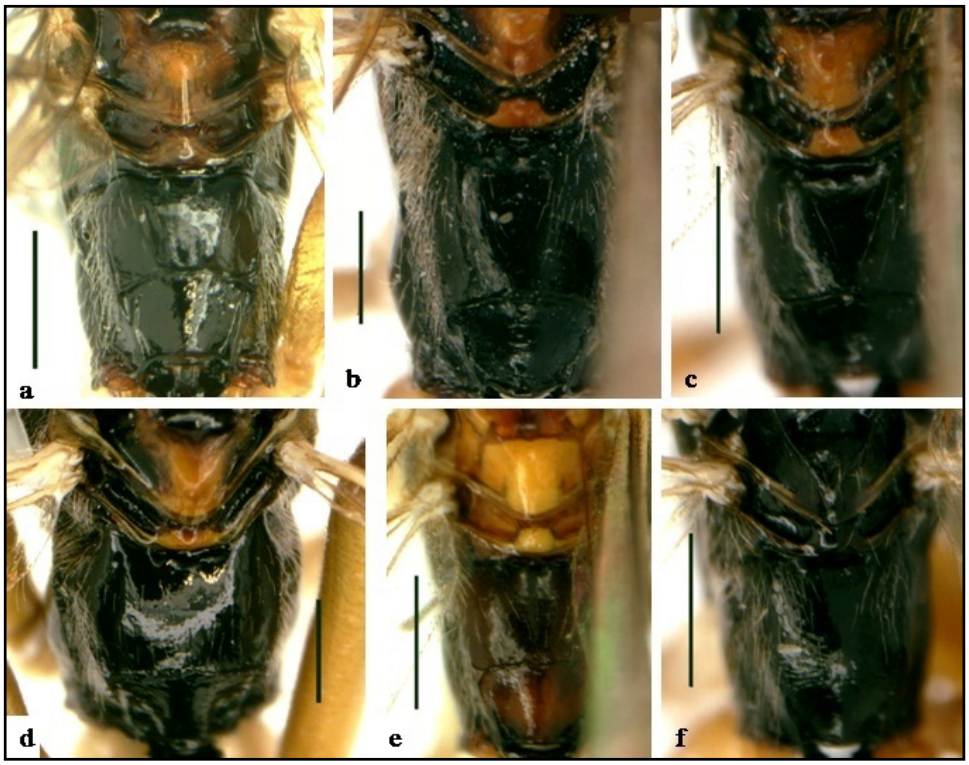

Figure 125. Dorsal views of scutellum and propodeum of *Brachyzapus* species (scales 0.5 mm): a. *B. carinatus*; b. *B. convexus*; c. *B. duboisi*; d. *B. fansipanensis*; e. *B. hoanglienensis*; f. *B. politus*

Mesosoma. Epomia length 2.0x basal mandible width, extending from collar to dorsal margin of pronotum; pronotum polished, dorsal part and posterior corner pubescent; mesoscutum convex, moderately densely setose, with notauli deep, convergent at posterior 0.3 in shallow hollow; scutellum strongly convex, pubescent basally, laterally with strong transverse ridges, lateral

carina present basally; mesopleuron subpolished, with scattered hairs, mesopleural suture foveolate, epicnemial carina present on lower 0.6, ventrally strongly sinuous; metapleuron convex, bare and polished, pubescent dorsally along pleural carina, submetapleural carina forming small lobe anteriorly, posteriorly angled about 120°; metasternum with many strong transverse ridges from above level of posterior angulation onward to middle of hind coxa, almost touching median longitudinal groove; propodeum moderately convex, pubescent laterally, dorsally mostly bare and polished, lateral longitudinal carina present on apical 0.5, posterior transverse carina strong. Legs with mid and hind tibiae slightly swollen subbasally; fore femur 4.0x as long as wide; hind femur 5.2x longer than wide, length 0.8x tibia, tibia 10.0x as long as apical width; basitarsus longer than following three tarsomeres combined, length 0.35x tibia, 0.47x tarsus, 2.6x second tarsomere, fourth tarsomere very short, fifth 1.9x as long as third. Fore wing with vein *Rs*&*M* slightly basad of *cu-a*, 2*rs-m* about 0.7x distance between 2*rs-m* and 2*m-cu*, vein *cu-a* slightly inclivous, vein *Cu*1*a* separated from 1*m-cu* by 1.5x length of vein *Cu*1*b*; hind wing with first abscissa of vein *Cu*1 1.15x longer than vein *cu-a*.

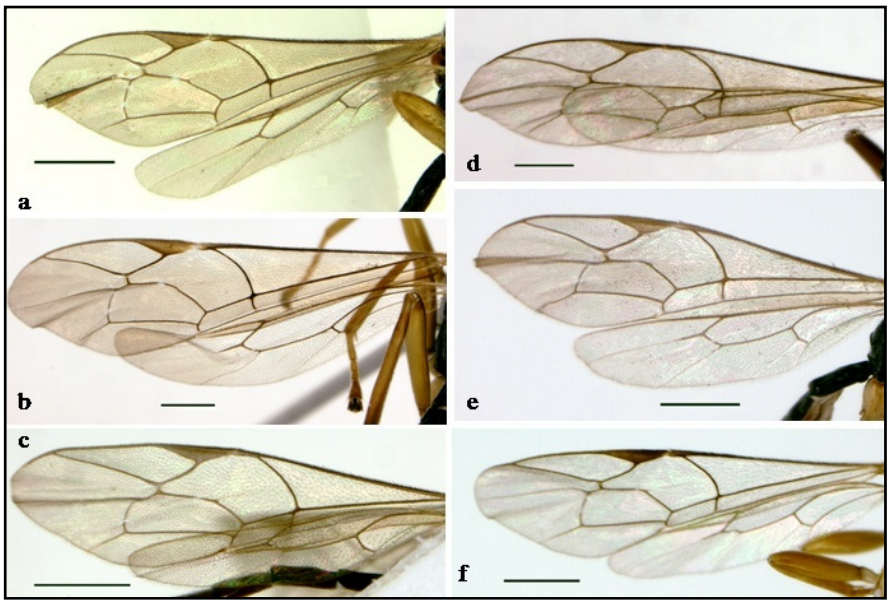

Figure 126. Wings of *Brachyzapus* species (scales 1 mm): a. *B. carinatus*; b. *B. fansipanensis*; c. *B. hoanglienensis*; d. *B. convexus*; e. *B. duboisi*; f. *B. politus*

Metasoma. Metasoma 1.8x longer than head and mesosoma combined; tergites with fine punctures, except first two tergites polished, base of tergites 3–5 coriaceous; first tergite 2.6x as long as apical width, median part convex, dorsolateral carina complete, median longitudinal carina indistinct; second tergite 0.75x length of first tergite, 1.1x as long as apical width, basal and apical oblique grooves moderately deep, rhombic area moderately convex; third tergite 0.83x as long as second tergite, basal and apical oblique grooves weak; first sternite with transverse ridges present on 0.4 basally, weakly convex and rounded centrally; ovipositor slightly up-curved at tip, length

from tip of hypopygium 0.82x length of hind tibia, lower valve slightly swollen medially, tapered to sharp point.

Colour. Black. Antenna brownish yellow, mandible, palpi and tegula yellow; scutellum and postscutellum reddish; legs reddish brown, except fore and mid coxae yellow, mid and hind trochantellus slightly darker; wings yellowish, pterostigma and veins brownish yellow; metasoma brown; ovipositor reddish brown.

Male. Unknown.

Distribution. Currently known only from Hoang Lien NP, Fansipan Mt., Lao Cai Province, North Vietnam (Pham *et al.*, 2012b).

Ecological note. The single specimen was collected in montane evergreen forest at an elevation of 2,100 m a.s.l. (Pham *et al*., 2012b).

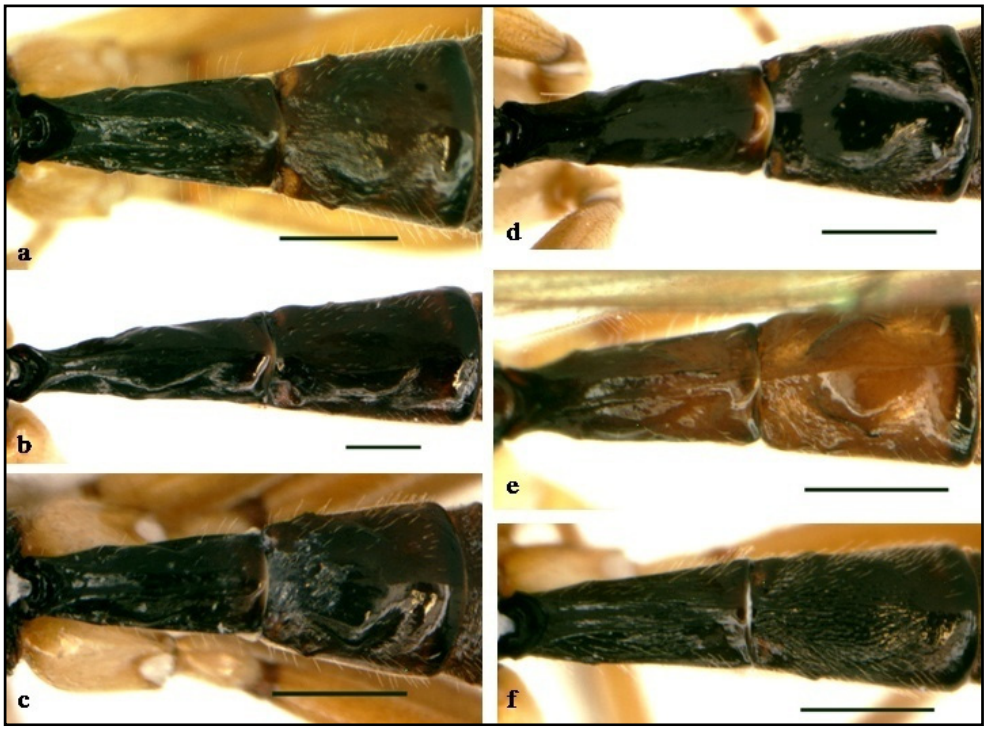

Figure 127. Dorsal views of metasomal tergites 1–2 of *Brachyzapus* species (scales 0.5 mm): a. *B. carinatus*; b. *B. convexus*; c. *B. duboisi*; d. *B. fansipanensis*; e. *B. hoanglienensis*; f. *B. politus*

***Brachyzapus hoanglienensis* PHAM, BROAD, MATSUMOTO & WÄGELE, 2012**

(Figures 122e, 123e, 124e, 125e, 126e, 127e, 128e, 129)

Brachyzapus hoanglienensis Pham, Broad, Matsumoto & Wägele, 2012. J. Nat. Hist. 46 (27–28): 1652. Holotype: ♀, Vietnam: Lao Cai, Hoang Lien NP (RMNH).

Material examined. Lao Cai, Hoang Lien NP: 1♀ (RMNH, holotype), 1550 m a.s.l., 22–

29.x.1999, Malaise trap, C. v. Achterberg leg.

Diagnosis. Inner margins of eyes slightly convergent medially; malar space 0.6x basal width of mandible; scutellum with lateral carina present basally, laterally without transverse ridges; mesopleural suture smooth, not foveolate; legs slender, fore femur 5.8x as long as width; propodeum with posterior transverse carina strong; first sternite with some oblique ridges basally, strongly convex, rounded apically; body reddish brown.

Description (Female). Body length 7.3 mm, fore wing 6.0 mm, ovipositor 1.5 mm. *Head*. Antenna with 26 flagellomeres, first flagellomere 1.45x length of second; diameter of lateral ocellus as long as ocellar-ocular distance; frons impunctate, polished; inner margins of eyes slightly convergent medially; face 1.5x as high as wide, pubescent, upper margin concave between antennal sockets; clypeus moderately convex, about 0.65x as high as wide, apical margin thin, emarginate; malar space about 0.6x basal width of mandible; mandible narrow, weakly twisted, upper tooth much longer than lower tooth; occipital carina complete, meeting hypostomal carina about 0.9x length of mandible basal width from base of mandible.

Mesosoma. Epomia length 1.9x mandible width, extending from collar nearly to dorsal margin of pronotum; pronotum polished, scattered hairs dorsally; mesoscutum convex, moderately densely setose, with notauli deep, convergent at posterior 0.3 in shallow hollow; scutellum strongly convex, pubescent basally, laterally without transverse ridges, lateral carina present basally; mesopleuron subpolished, pubescent dorsally and ventrally, mesopleural suture not foveolate, epicnemial carina present on lower 0.5; metapleuron convex, bare and polished, pubescent dorsally along pleural carina, submetapleural carina, forming small lobe anteriorly, angled about 120° posteriorly; metasternum with some short transverse ridges at level of posterior angulation; propodeum moderately convex, pubescent laterally, dorsally mostly bare and polished, lateral longitudinal carina present on apical 0.4, posterior transverse carina strong. Legs slender, mid and hind tibiae slightly swollen subbasally; fore femur 5.8x as long as wide; hind femur 6.15x longer than wide, length 0.8x tibia, tibia 10.0x as long as apical width; basitarsus longer than following three tarsomeres combined, length 0.3x tibia, 0.45x tarsus, 3.0x second tarsomere, fourth tarsomere very short, fifth 1.9x as long as third. Fore wing with vein *Rs*&*M* slightly basad of *cu-a*, 2*rs-m* about 0.7x distance between 2*rs-m* and 2*m-cu*, vein *cu-a* slightly inclivous, vein *Cu*1*a* separated from 1*m-cu* by length of vein *Cu*1*b*; hind wing first abscissa of vein *Cu*1 1.2x longer than vein *cu-a*.

Metasoma. Metasoma 1.7x head and mesosoma combined; tergites with fine punctures, pubescent, base of tergites 3–5 coriaceous; first tergite 2.3x as long as apical width, dorsolateral carina weakly complete, median longitudinal carina strongly present to oblique groove; second

tergite 0.8x length of first, 1.15x as long as apical width, basal and apical oblique grooves deep, rhombic area convex and polished; third tergite slightly shorter than second, basal and apical oblique grooves moderately deep, median area convex; first sternite with some oblique ridges basally, strongly convex and rounded apically; ovipositor straight, length from tip of hypopygium 0.75x length of hind tibia, lower valve slightly swollen medially, tapered to sharp point.

Colour. Reddish brown. Antenna brownish yellow, mandible, palpi, and tegula yellow; scutellum and postscutellum reddish; legs reddish, except fore and mid coxae and trochanters yellow, subbasal and apical bands of hind tibia and hind tarsus fuscous; wings hyaline, pterostigma and veins brownish yellow; ovipositor reddish.

Male. Unknown.

Distribution. Currently known only from Hoang Lien NP, Fansipan Mt, Lao Cai Province, North Vietnam (Pham *et al*., 2012b).

Ecological note. The single specimen was collected in montane evergreen forest at an elevation of 1,550 m a.s.l. (Pham *et al*., 2012b).

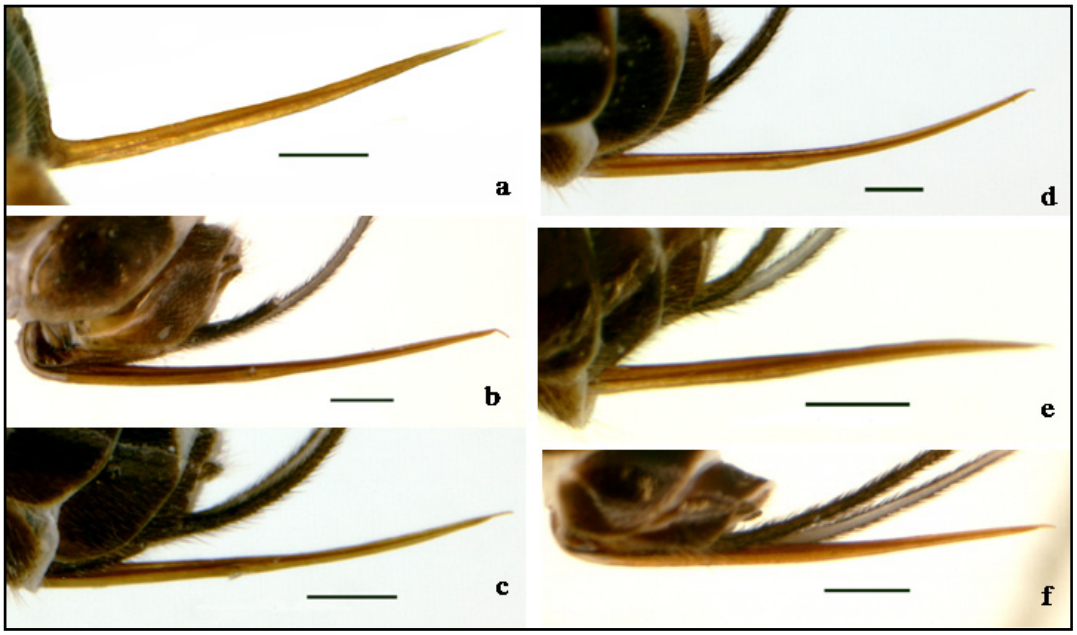

Figure 128. Ovipositors of *Brachyzapus* species (scales 0.3 mm): a. *B. carinatus*; b. *B. convexus*; c. *B. duboisi*; d. *B. fansipanensis*; e. *B. hoanglienensis*; f. *B. politus*

***Brachyzapus politus* PHAM, BROAD, MATSUMOTO & WÄGELE, 2012**

(Figures 122f, 123f, 124f, 125f, 126f, 127f, 128f, 129)

Brachyzapus politus Pham, Broad, Matsumoto & Wägele, 2012. J. Nat. Hist. 46 (27–28): 1654. Holotype: ♀, Vietnam: Lao Cai, Hoang Lien NP (RMNH).

Material examined. Lao Cai, Hoang Lien NP: 1♀ (RMNH, holotype), 1550 m a.s.l., 22–

29.x.1999, Malaise trap, C. v. Achterberg leg.

Diagnosis. Inner margins of eyes distinctly convergent ventrally; face narrow, 1.9x as high as wide, sparsely finely punctate; malar space short, 0.25x basal width of mandible; notauli present basally, indistinct posteriorly; scutellum with lateral carina strong to middle, without lateral transverse ridges; propodeum dorsally sparsely punctate, laterally with some transverse ridges at level of posterior transverse carina; first sternite convex, angled apically.

Description (Female). Body length 8.0 mm, fore wing 5.5 mm, ovipositor 1.9 mm. *Head*. Antenna with 25 flagellomeres, first flagellomere 1.4x length of second; diameter of lateral ocellus 1.2x ocellar-ocular distance; frons impunctate, polished; inner margins of eyes distinctly convergent ventrally; face narrow, 1.9x as high as wide, subpolished, with very small punctures, upper margin concave between antennal sockets; clypeus strongly convex, about 0.75x as high as wide, apical margin thin, emarginate; malar space 0.25x basal width of mandible; mandible weakly twisted, narrow, upper tooth slightly longer than lower tooth; occipital carina complete, meeting hypostomal carina about 1.3x basal mandible width from base of mandible.

Mesosoma. Epomia length 2.0x basal mandible width; pronotum impunctate and polished laterally, punctate and pubescent dorsally; mesoscutum densely setose with notauli moderately deep on basal 0.3, indistinct posteriorly; scutellum strongly convex, pubescent, lateral carina extending to middle; mesopleuron moderately densely setose except posterior concave area near mesopleural suture bare and polished, mesopleural suture foveolate, epicnemial carina present on lower 0.6 of mesopleuron; metapleuron bare and polished medially, pubescent basally, dorsally and apically, submetapleural carina forming small lobe anteriorly and angled about 135° posteriorly; metasternum with transverse ridge from posterior angulation of submetapleural carina extending about 0.6x distance to median longitudinal groove; propodeum moderately convex, pubescent, except dorso-medially and area petiolaris polished, posterior stub of lateral longitudinal carina present, several transverse ridges present at level of posterior transverse carina laterally. Legs with mid and hind tibiae slightly swollen subbasally; fore femur 3.4x as long as wide; hind femur 4.5x as long as wide, length 0.8x tibia, tibia 9.0x as long as apical width; basitarsus longer than following three segments combined, length 0.33x tibia, 0.45x tarsus, 3.0x second tarsomere, fourth tarsomere very short, fifth 2.0x as long as third. Fore wing with vein *Rs*&*M* slightly basad of *cu-a*, 2*rs-m* about 0.7x distance between 2*rs-m* and 2*m-cu*, vein *cu-a* slightly inclivous, vein *Cu*1*a* separated from 1*m-cu* by 1.15x length of vein *Cu*1*b*; hind wing with first abscissa of vein *Cu*1 as long as vein *cu-a*.

Metasoma. Metasoma 2.0x longer than head and mesosoma combined; tergites coriaceous, with scattered short hairs; first tergite 2.3x as long as apical width, dorsolateral carina complete,

median longitudinal carina extending to oblique groove; second tergite 0.9x length of first tergite, 1.5x as long as apical width, basal and apical oblique grooves moderately deep, rhombic area moderately convex; third tergite shorter than second, basal and apical oblique grooves weakly present; first sternite with some transverse ridges at base, convex and angled apically; ovipositor straight, length from tip of hypopygium slightly longer than hind tibia, basal half of upper valve slightly swollen, tapered to sharp point.

Colour. Black. Antenna yellowish brown, mandible brown, palpi and tegula yellow; legs reddish brown, except fore and mid coxae yellow, hind tibia with subbasal and apical fuscous bands; wings hyaline, pterostigma and veins brownish yellow; ovipositor reddish brown.

Male. Unknown.

Distribution. Currently known only from Hoang Lien NP, Lao Cai Province, North Vietnam (Pham *et al*., 2012b).

Ecological notes. The single specimen was collected in montane evergreen forest at an elevation of 1,550 m a.s.l. (Pham *et al*., 2012b).

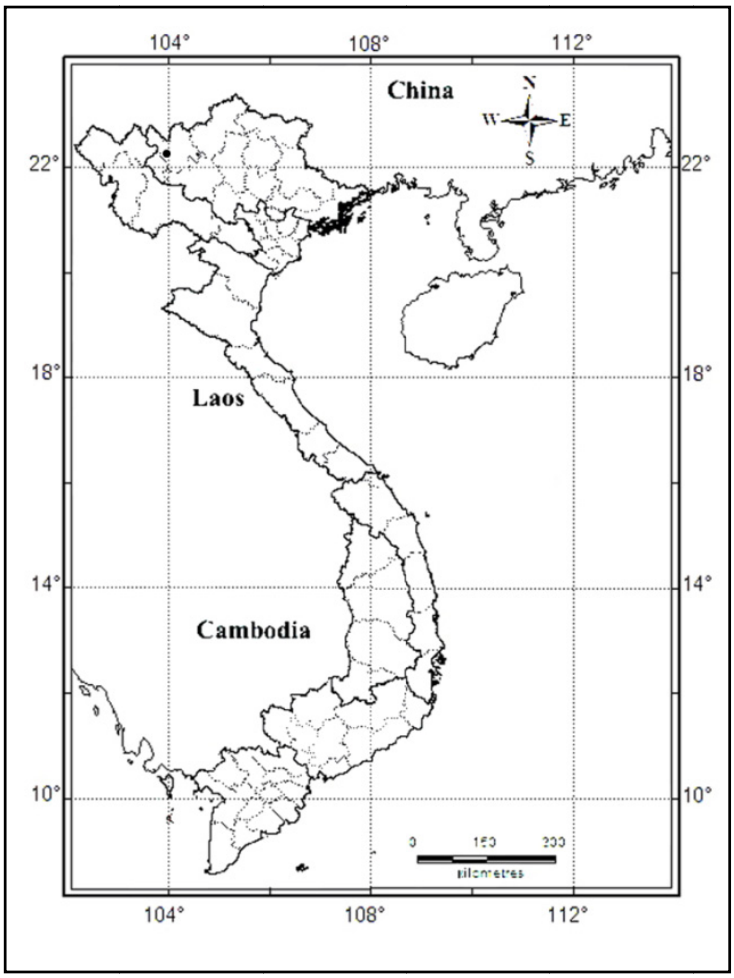

Figure 129. Distribution map of *Brachyzapus* species

Chablisea Gauld & Dubois, 2006

Chablisea Gauld & Dubois, 2006: 544. Type-species: *Chablisea imbiba*, by original designation.

Diagnosis. Mandibles tapered, weakly twisted; metasomal insertion confluent with hind coxal cavities; metasomal tergites slightly to distinctly divided into three swellings; ovipositor straight, without dorsal and ventral swellings at the base; lower valve of ovipositor with some small, basal, ventral denticles (Gauld & Dubois, 2006).

Chablisea was erected based on the type species from Papua New Guinea. Subsequently, two new species of this genus were reported from China (Liu *et al*., 2010). Recently, Pham *et al*. (2011b) recorded the representatives of *Chablisea* for the first time from Vietnam, with descriptions of two new species: *Chablisea condimeta* and *C. khuatdanglongi*. Based on examination of the type specimen of *Zabrachypus albifacialis* Kusigemati, 1984, Pham *et al*. (2011b) also transferred this species to *Chablisea* and compiled the key to all six described species of this genus.

Key to Vietnamese species of *Chablisea*

Face 1.9 times as high as wide, entirely light yellow (Figure 130e); propodeum without carinae, except posterior part of lateral longitudinal carina (Figure 130g); hind wing with distal abscissa of vein *Cu*1 absent (Figure 130b); first tergite elongate, 1.55 times longer than apical width (Figure 130c)…….*C. condimeta* Pham, Broad, Matsumoto & Wägele

-. Face as high as wide, with median black stripe extending from front to transverse black band at base of clypeus (Figure 132d); propodeum with several carinae (Figure 132f); hind wing with distal abscissa of vein *Cu*1 present (Figure 132b); first tergite as long as apical width (Figure 132c)…….*C. khuatdanglongi* Pham, Broad, Matsumoto & Wägele

Chablisea condimenta PHAM, BROAD, MATSOMOTO & WÄGELE, 2011

(Figures 130, 131a, 133)

Chablisea condimenta Pham, Broad, Matsomoto & Wägele, 2011. Biologia 66/6: 1134. Holotype: ♀, Vietnam: Lao Cai, Hoang Lien NP (RMNH).

Material examined. Lao Cai, Hoang Lien NP: 1♀ (RMNH, holotype) 1♀ (RMNH, paratype), 2♀ (IEBR, paratype), 1900 m a.s.l., 15–21.x.1999; 1♀ (RMNH, paratype), 1550 m a.s.l., 23.x.1999, C. v. Achterberg leg.

Diagnosis. Face narrow, 1.9x as high as wide, yellow; propodeum with only apical 0.2 of lateral longitudinal carina present; hind wing with distal abscissa of vein *Cu*1 entirely absent; first tergite distinctly longer than apical width; ovipositor as long as hind tibia, ovipositor sheath 0.65x as long as hind tibia.

Description. (Female). Body length 5–5.7 mm, fore wing 3.8–4.5 mm, ovipositor 1.2–1.3 mm.

Head. Antenna with 21 flagellomeres, first flagellomere 1.6x second; diameter of lateral ocellus 0.8x ocellar-ocular distance; frons and hind side of vertex impunctate and polished; eye with very short hairs, inner margin moderately convergent at lower 0.4 of face, then slightly divergent near clypeus; face narrow, strongly convex, 1.9x as high as wide, with small punctures, pubescent, upper margin slightly concave between antennal sockets; clypeus convex with sparse, long hairs, about 0.6x as high as wide, apical margin rounded; malar space about 0.7x basal width of mandible; mandible narrow, pointed, upper tooth slightly longer than lower tooth; palpi formula 5:4; occipital carina complete, meeting hypostomal carina at about basal mandible width from base of mandible.

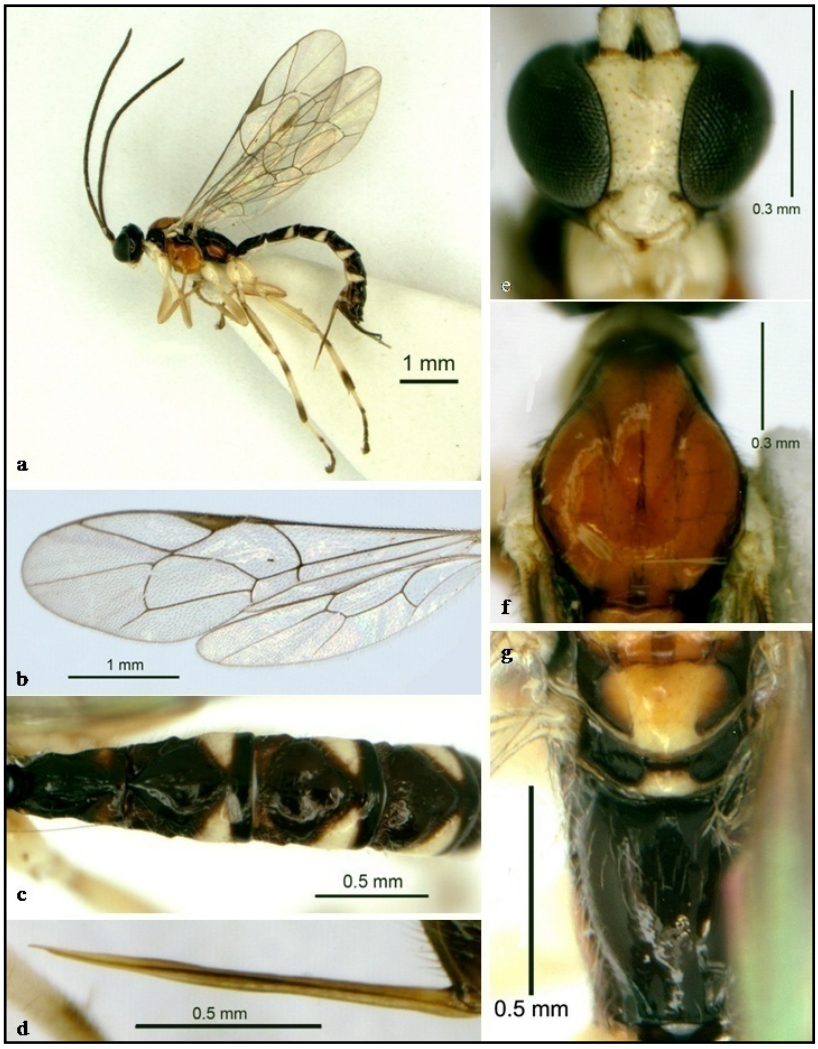

Figure 130. *C. condimenta*: a. lateral view; b. wings; c. dorsal view of metasomal tergites 1–4; d. ovipositor; e. face; f. mesoscutum; g. dorsal view of scutellum and propodeum

Mesosoma. Epomia present, length 2.0x mandible basal width, nearly extending to dorsal margin; pronotum impunctate, polished, pubescent dorsally; mesoscutum polished with short hairs, notauli deep, convergent at posterior 0.4 of mesoscutum in shallow hollow, lateral ridge of mesoscutum forming flange behind tegula; scutellum strongly convex, pubescent, lateral carina

present at base; mesopleuron almost impunctate, bare and polished dorsally, pubescent ventrally, epicnemial carina present on lower 0.6 of mesopleuron, lateral section of postpectal carina present as short stub in front of mid coxa; metapleuron polished, impunctate, submetapleural carina complete forming small lobe anteriorly; propodeum moderately convex, subpolished to polished, pubescent laterally and basally, without carinae except apical 0.2 of lateral longitudinal carina; propodeal spiracle round, touching pleural carina. Fore femur 4.1x as long as wide; hind leg with femur 5.2x as long as wide, length 0.77x tibia, tibia 10.0x as long as apical width; basitarsus slightly longer than second and third tarsomeres combined, length 0.38x tibia, 0.4x tarsus, 1.9x second tarsomere, fifth tarsomere slightly shorter than third. Fore wing with vein *Rs&M* slightly basad of *cu-a*, 2*rs-m* about 0.4x distance between 2*rs-m* and 2*m-cu*, vein *cu-a* slightly inclivous, vein *Cu*1*a* separated from 1*m-cu* by length of vein *Cu*1*b*; hind wing with vein *M+Cu* bowed posteriorly, vein *cu-a* slightly inclivous, distal abscissa of vein *Cu*1 absent.

Metasoma. Tergites subpolished, sparsely punctate medially; first tergite about 1.55x as long as apical width, convex medially, dorsolateral carina complete, weaker at apex, median longitudinal carina extending nearly to apex; second tergite slightly longer than first tergite, 1.1x as long as apical width, basal and apical oblique grooves deep, rhombic area moderately convex; third tergite slightly shorter than second tergite; median convex areas of tergite 2–6 slightly to distinctly divided into three swellings (two anterolateral sweelings connecting with a median rounded swelling posteriorly), ovipositor straight, as long as hind tibia, upper valve slightly thickened near apex, lower valve slightly thickened medially, tapered to sharp point, ventrally with some minute denticles at base, ovipositor sheath 0.65x as long as hind tibia.

Colour. Predominantly black. Antenna blackish, except lower side of scape and pedicel yellow; face, clypeus, mandible and palpi yellow; pronotum black except collar and posterior corner yellow; mesoscutum, scutellum, metascutellum, mesopleuron (except dorsally) and metapleuron medially reddish brown; subtegular ridge and subalar prominence yellow; legs yellow, except front side of hind femur, subbasal and apical bands of hind tibia and apical band of hind basitarsus onward brown; wings hyaline, pterostigma and veins brown; abdominal tergites black, subapicolateral spots of tergites 2–5 yellow; ovipositor brown, ovipositor sheath black and hairy.

Male. Unknown.

Distribution. Currently known only from Hoang Lien NP, Lao Cai Province, northern Vietnam (Pham *et al.*, 2011b).

Ecological note. The specimens were collected in the montane evergreen forest at elevations between 1,550–1,900 m a.s.l. (Pham *et al.*, 2011b).

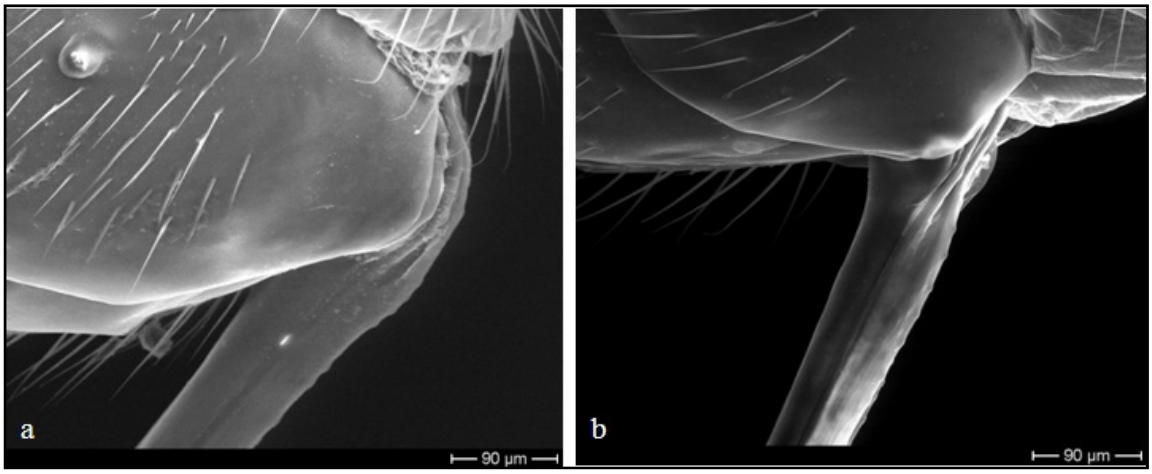

Figure 131. Ventral, small denticles on ovipositor bases of *Chablisea* species:

a. *C. condimenta*; b. *C. khuatdanglongi*

***Chablisea khuatdanglongi* PHAM, BROAD, MATSOMOTO & WÄGELE, 2011**

(Figures 131b, 132, 133)

Chablisea khuatdanglongi Pham, Broad, Matsomoto & Wägele, 2011. Biologia 66/6: 1136. Holotype: ♀, Vietnam: Hanoi, Thach That, Tan Xa (IEBR).

Material examined. Hanoi, Thach That, Tan Xa: 1♀ (IEBR, holotype), 1♀ (IEBR, paratype), 80 m a.s.l., 10–20.iii.2002, Malaise trap, L. D. Khuat leg.; Hoa Binh, Yen Thuy, Lac Thinh: 1♀ (IEBR, paratype), 10–20.i.2002; 1♀ (OMNH, paratype), 10–20.iii.2002; 1♀ (IEBR, paratype), 20–30.iii.2002; 1♀ (OMNH, paratype), 10–20.vi.2002; 1♀ (ZFMK, paratype), 20–30.ix.2002, ZFMK HYM 2011/6; 1♀ (ZFMK, paratype), 10–20.x.2002, ZFMK HYM 2011/7; 1♀ (IEBR, paratype), 01–10.iv.2003, L. D. Khuat leg.; Ninh Binh, Cuc Phuong NP: 1♀ (IEBR, paratype), 01–10.x.2002, 1♀ (IEBR, paratype), 10–20.x.2002, 1♀ (IEBR, paratype), 20–30.x.2002, 2♀ (BMNH, paratype), 01–10.xi.2002, L. D. Khuat leg.; Kon Tum, Kon Plong, Xa Hieu: 1♀ (IEBR, paratype), 1200 m a.s.l., 14°30.853'N 108°23.941'E, 19–29.v.2006, T. Q. Nguyen leg.; Dak Lak, Chu Yang Sin NP: 1♀ (RMNH, paratype), 500 m a.s.l., 03–09.vi.2007, C. v. Achterberg & R. de Vries leg.; 2♀ (IEBR, paratype), 28.vii.2008, H. T. Ngo leg.

Diagnosis. Face as high as wide, yellow with median black stripe extending from frons to black transverse band at base of clypeus; propodeum with median longitudinal carina, apex of lateral longitudinal carina and lateral section of posterior transverse carina present; first tergite quadrate, ovipositor sheath 0.8x as long as hind tibia.

Description. (Female). Body length 5.7–7.5 mm, fore wing 4.0–5.3 mm, ovipositor 1.5–2.0 mm. *Head*. Antenna with 23–26 flagellomeres, first flagellomere 1.5–1.1.6x length of second; diameter of lateral ocellus equal to ocellar-ocular distance; frons impunctate and polished; eye with very short hairs, inner margin convergent ventrally; face as high as wide, with small punctures,

pubescent, upper margin slightly concave between antennal sockets; clypeus moderately convex, about 0.5x as high as wide, apical margin rounded; malar space about 0.7x basal width of mandible; mandible narrow, pointed, upper tooth slightly longer than lower tooth; palpi formula 5:4; occipital carina complete, meeting hypostomal carina about 1.5x basal mandible width from base of mandible.

Mesosoma. Epomia present, length 2.0x mandible width; pronotum impunctate and polished, mediodorsally with longitudinal carina extending from front margin to collar; mesoscutum subpolished, pubescent, notauli deep, convergent at posterior 0.4 of mesoscutum in shallow hollow, lateral ridge of mesoscutum forming flange behind tegula; scutellum strongly convex, pubescent, lateral carinae present at base; mesopleuron almost impunctate and polished laterally and dorsally, pubescent ventrally, epicnemial carina present on lower 0.6 of mesopleuron, lateral section of postpectal carina present as short stub in front of mid coxa; metapleuron subpolished, pubescent, submetapleural carina complete forming large lobe anteriorly; propodeum strongly convex, pubescent, median longitudinal carinae divergent posteriorly, posterior transverse carina present laterally, lateral longitudinal carina present at apical 0.3; propodeal spiracle round, touching pleural carina. Fore femur broad, 3.3x as long as wide; hind leg with femur 4.3x as long as wide, length 0.8x tibia, tibia 10.0x as long as apical width; basitarsus as long as second and third tarsomeres combined, length 0.38x tibia, 0.4x tarsus, 1.8x second tarsomere, fifth tarsomere slightly shorter than third. Fore wing with vein *Rs*&*M* opposite *cu-a*, 2*rs-m* about 0.5x distance between 2*rs-m* and 2*m-cu*, vein *cu-a* inclivous, vein *Cu*1*a* separated from 1*m-cu* by 1.2x length of vein *Cu*1*b*; hind wing with vein *M+Cu* bowed posteriorly, first abscissa of vein *Cu*1 about 2.5x length of vein *cu-a*; vein *Cu*1 present distally.

Metasoma. Tergites with median area between deep basal and apical oblique grooves densely punctate; first tergite as long as apical width, dorsolateral carina complete but weaker at apex, median longitudinal carina extending to apical oblique groove; second tergite 1.1x length of first tergite, nearly as long as apical width, slightly longer than third tergite; median convex areas of tergite 2–5 slightly divided into three swellings, ovipositor straight, 1.1x as long as hind tibia, lower valve with weak denticles at base, upper valve slightly thickened near apex, lower valve slightly thickened medially, tapered to sharp point, ovipositor sheath 0.8x as long as hind tibia.

Colour. Antenna brown, scape and pedicel yellow ventrally; face yellow with median black stripe extending from black frons to transverse black band at base of clypeus; clypeus, mandible and palpi yellow; mesosoma reddish brown or sometimes propodeum partly to entirely black dorsally; legs yellow, except hind tibia with subbasal and apical bands black; hind tarsus with apex of tarsomeres 1–3 and whole of tarsomeres 4–5 blackish; wing hyaline, pterostigma and veins

brown; metasomal tergites brown to black, apical band of tergite 1 and subapical bands of tergites 2–6 yellow; ovipositor light brown, ovipositor sheath black and hairy.

Male. Unknown.

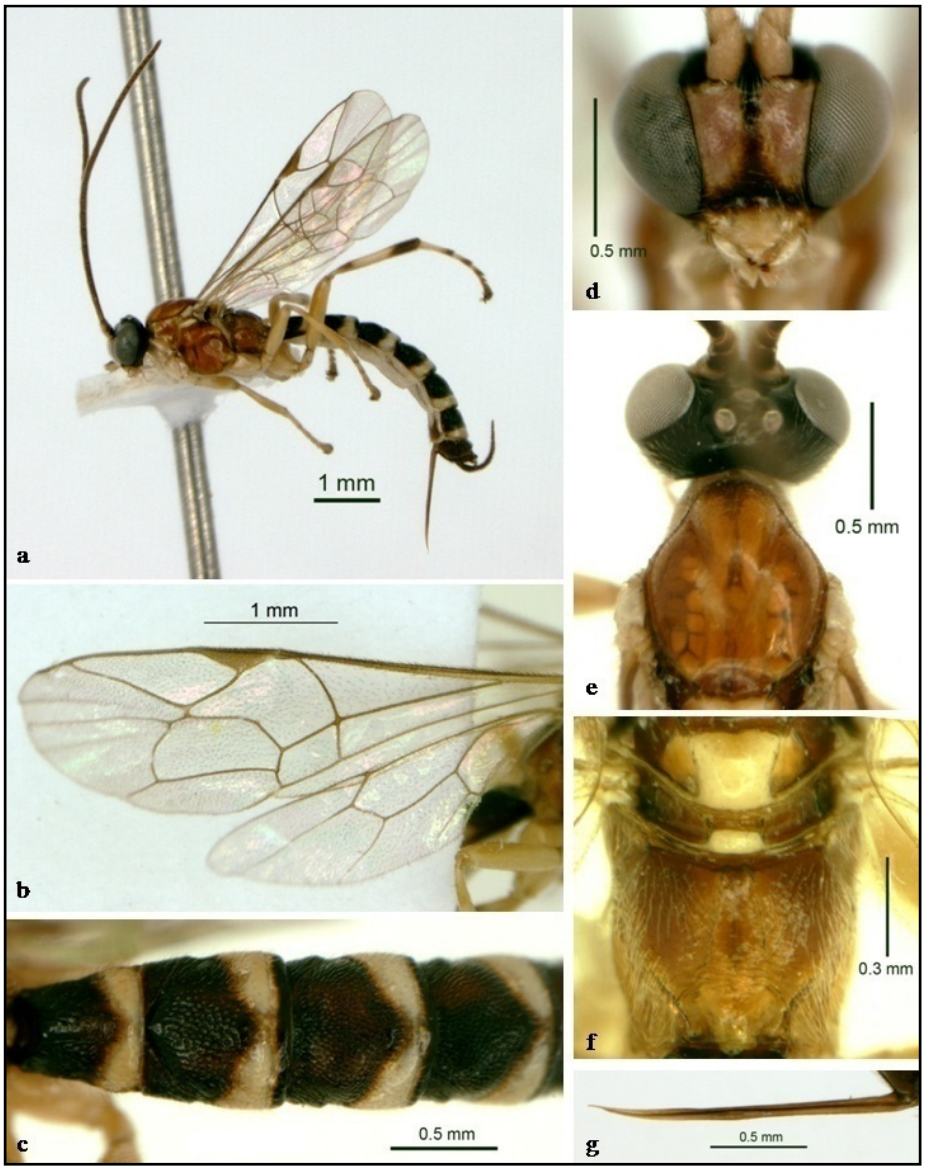

Figure 132. *C. khuatdanglongi*: a. lateral view; b. wings; c. dorsal view of metasomal tergites 1–4; d. face; e. dorsal view of head and mesoscutum; f. dorsal view of scutellum and propodeum; g. ovipositor

Distribution. Currently known from Hanoi, Hoa Binh, Ninh Binh, Kon Tum and Dak Lak provinces (Pham *et al.*, 2011b).

Ecological note. The specimens were collected in different habitat types, from lowland agricultural areas at elevations below 100 m a.s.l. to secondary forest at the altitude up to 1,200 m a.s.l. (Pham *et al.*, 2011b).

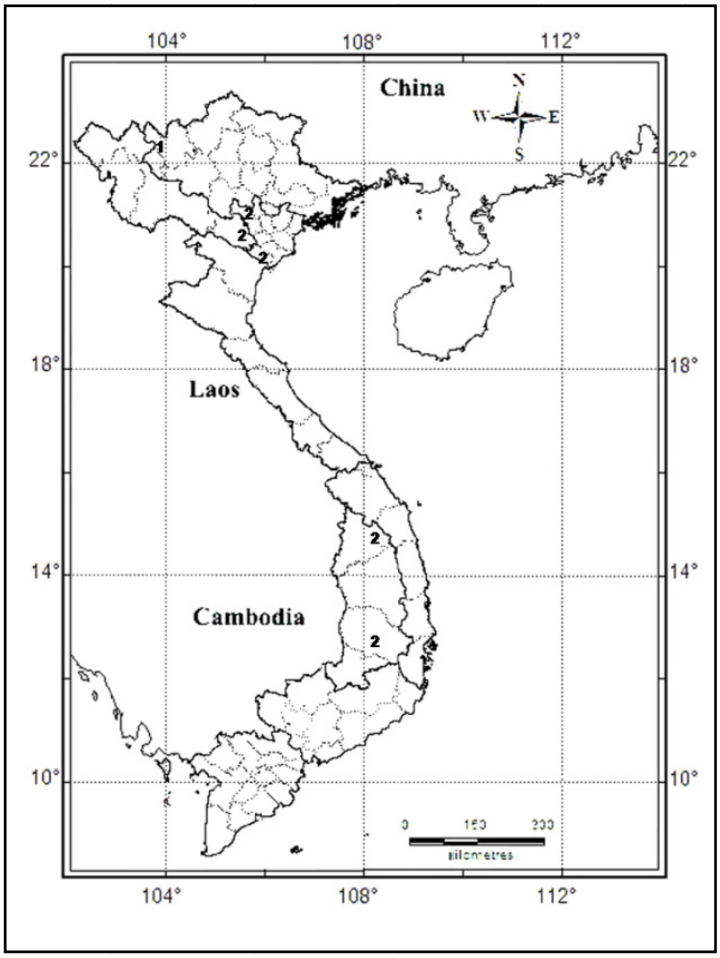

Figure 133. Distribution map of *Chablisea* species: 1. *C. condimenta*; 2. *C. khuatdanglongi*

***Gregopimpla* Momoi, 1965**

Gregopimpla Momoi, *In* Townes, Momoi & Townes, 1965: 601. Type-species: *Pimpla kuwanae* Viereck, by original designation.

Diagnosis. Inner margin of eye weakly opposite antennal socket; clypeus weakly convex basally, apical margin with median notch, clypeus of male always black; occipital carina complete, weakly concave mediodorsally; mesoscutum moderately dense, evenly distributed hairs; mesopleuron with epicnemial carina weak, not extending to groove below subalar prominence, mesopleural suture angled above middle; metapleuron with submetalpleural carina somplete; propodeum strong convex, pubescent, with median longitudinal carina present; fore wing with vein 3*rs-m* present, disctinctly distad of 2*m-cu*; hind wing with first abscissa of vein *Cu*1 about 0.7–1.0x as long as vein *cu-a*; tarsal claws of female with basal lobe; metasomal tergites dense punctate, except apical transverse smooth bands; tergite 2 with oblique basolateral impression less strong; ovipositor sheath about 0.6–0.8x fore wing length (Townes *et al*., 1965; Gupta & Tikar, 1976).

This genus comprises eight described species from the Palearctic and Oriental regions (Yu

et al., 2005; Kasparyan, 2007). Members of this genus are usually gregarious parasites of macrolepidopterous larvae within dense cocoons, a rather small number of individuals issuing from a single host cocoon (Townes *et al.*, 1965). In Vietnam, only one species, *G. himalayensis* has been documented (Pham *et al.*, 2011e).

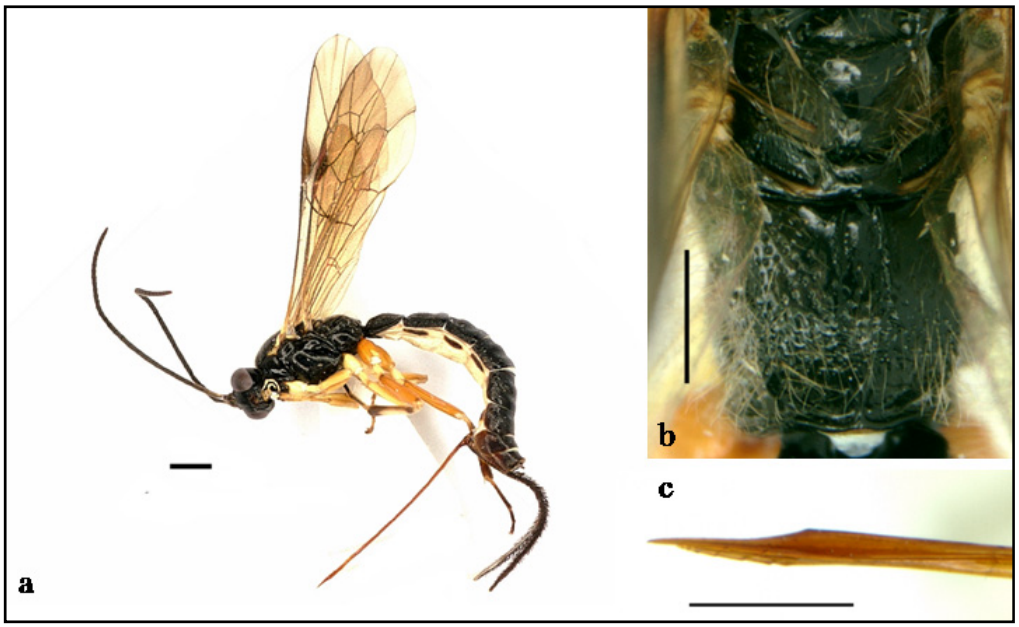

Figure 134. *G. himalayensis*: a. lateral view (scale 1 mm);
b. propodeum & c. ovipositor tip (scales 0.5 mm)

***Gregopimpla himalayensis* (CAMERON, 1899)**

(Figures 134, 136)

Pimpla himalayensis Cameron, 1899. Mem. & Proc. Manchester Lit. Phil. Soc., 43 (3): 178. Holotype: ♀, India: Khasil Hills in Assam (OUMNH)

Epiurus hakonensis Ashmead, 1906. Proc. U. S. Natl. Mus., 30: 179. Lectotype: ♀, Japan: Mt. Hakone (USNM).

Pimpla japonica Ulbricht, 1911. Soc. Ent. Stuttgart, 26: 54. Holotype: ♀, Japan: Yokohama in Kanagawa (ZMHB), preoccupied by Dalla Torre (1901)

Itoplectis attaci Habermehl, 1917. Ztschr. f. Wiss. Insektenbiol. 13: 17; new name for *japonica* Ulbricht, 1911.

Gregopimpla himalayensis: Townes, Momoi & Townes, 1965.

Material examined. Lao Cai, Hoang Lien NP: 1♀ (RMNH), 1900 m a.s.l., 15–21.x.1999, Malaise trap, C. v. Achterberg leg.

Diagnosis. Face nearly as high as wide, weakly convex medially, pubescent; mandible broad, upper tooth slightly longer than lower tooth; propodeum dense, coarse puncture, except basal and apical part of dosal face, median longitudinal carina and apical stub of lateral longitudinal carina

present; ovipositor compressed, 2.2x hind tibia length, dorsal valve strongly depressed apically, lower valve with some oblique apical ridges.

Distribution. Pham *et al.* (2011e) recorded this species from Vietnam for the first time. Outside Vietnam, is has been known from China, India, Japan, and Korea (Yu *et al*., 2005).

***Sericopimpla* Kriechbaumer, 1895**

Sericopimpla Kriechbaumer, 1895: 135. Type-species: *Pimpla sericata* Kriechbaumer, 1895, by monotypy.

Synonyms:

Charitopimpla Cameron, 1902: 48. Type-species: *Charitopimpla flavobalteata* Cameron, by monotypy.

Philopsyche Cameron, 1905: 137. Type-species: *Philopsyche albobalteata* Cameron (= *Pimpla sagrae sagrae* Vollenhoven), by monotypy.

Diagnosis. Face slightly convex, with median longitudinal swelling or weak carina, puntures small, not dense, long hairs; clypeus weakly convex, impressed apically, with median apical rounded notch; mandible moderately short, teeth equal in length; eye very large, inner margin strongly notched opposite antennal sockets; malar space very short; occipital carina complete; epomia strong; notaulus present on anterior 0.15–0.4 of mesoscutum; epicnemial carina extending to groove below subalar prominence; submetapleural carina complete forming anterior lope; propodeum short, without carinae except posterior stub of lateral longitudinal carina; Fore wing with areolet triangular or subtriangular, 2*m-cu* basad of or opposite 3*rs-m*; hind wing with first abscissa of *Cu*1 distinct longer than *cu-a*; first tergite short and broad, median longitudinal carina not reaching to posterior margin; tergites 2–5 with strong median sublateral swellings; ovipositor weakly compressed, tip of upper valve rather stout, tip of lower valve with moderately strong, oblique teeth (Townes, 1969; Gupta & Tikar, 1976; Gauld, 1984).

This genus comprises 20 described species, of which 10 species occur in the Oriental region (Yu *et al*., 2005). As far as known the hosts of *Sericopimpla* are psychids (Lepidoptera) (Gupta & Tikar, 1976; Gauld, 1984). This genus is represented in Vietnam by a single species, namely *S. sagrae* (Pham *et al.*, 2011e).

***Sericopimpla sagrae* (VOLLENHOVEN, 1879)**

(Figure 135, 136)

Pimpla sagrae Vollenhoven, 1879. Stettin. Ent. Ztg., 40: 149. Lectotype: ♀, Indonesia: Java (RMNH).

Sericopimpla sagrae: Townes, Townes & Gupta (1961).

Material examined: Ha Noi, Gia Lam, Da Ton: 1♂ (IEBR), 22.vi–02.vii.2001, Malaise trap, L. D. Khuat

leg.; Hoa Binh, Yen Thuy, Lac Thinh: 1♀ (IEBR), 10–20.iv.2002; 1♀ (IEBR), 30.iii–10.iv.2003, Malaise trap, L. D. Khuat leg.; Phu Tho, Xuan Son NP: 1♀ (IEBR), 250 m a.s.l., 15.vi.2004, T. V. Hoang leg.; 1♀ (IEBR), 200 m a.s.l., 11–15.vi.2009; 1♂ (IEBR), 10–15.viii.2009, Malaise trap, L. D. Khuat leg.; Ha Tinh, Huong Son, Son Kim: 1♀ (IEBR), 07.v.2004, hand net, L. X. Truong leg.; Dong Nai, Cat Tien NP: 1♀ (RMNH), 13–20.v.2005; 1♂ (RMNH), 13–20.v.2005, Malaise trap, C. v. Achterberg & R. de Vries leg.; Nghe An, Pu Mat NP: 1♀ (IEBR), 200 m a.s.l., 16.iv.2006, hand net, H. X. Le leg.; Thua Thien-Hue, A Luoi, A Roang: 1♀ (ZFMK, HYM 2011/5), 800 m a.s.l., 29.v.2006, hand net, N. T. Pham leg.; Thai Nguyen, Dai Tu, Cat Ne: 1♀ (IEBR), 10.xii.2006, Malaise trap, L. D. Khuat leg.; Ha Tinh, Huong Trach, Huong Khe: 1♀ (IEBR), 22.v.2008, hand net, T. V. Hoang leg.; Dak Lak, Ea So NR: 1♂ (IEBR) 1♂ (IEBR), 310 m a.s.l., 12°55.93'N 108°37.96'E, 27.vii.2008, Malaise trap, H. T. Ngo leg.

Diagnosis. Face as long as or slightly higher than wide; mesosoma and metasoma dense of coarse and deep punctures; hind wing with first abscissa of vein *Cu*1 about 4.0x length of vein *cu-a*; ovipositor about 2.9x hind tibia length, with slight constriction before nodus; body black with whitish band on metasomal tergites apically; legs yellowish with black marks.

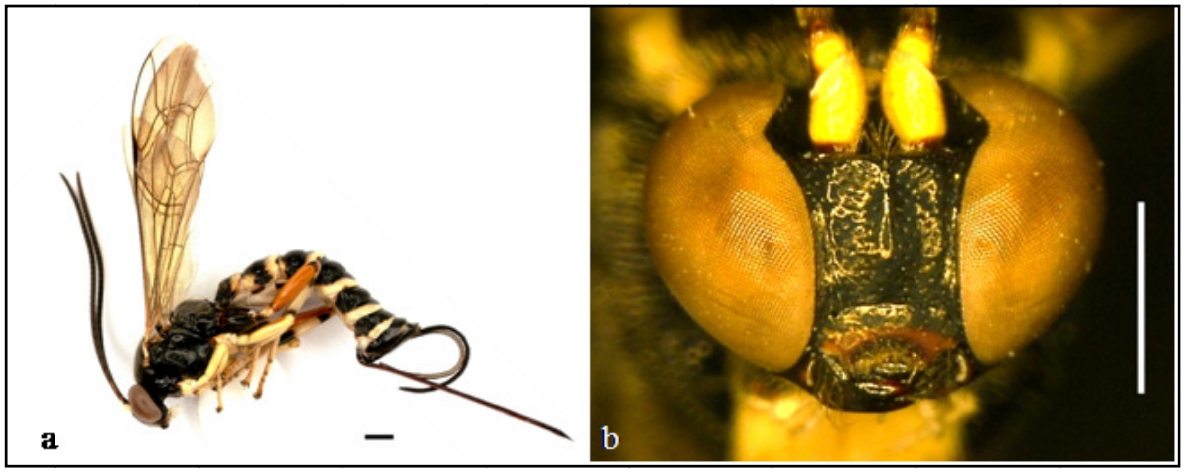

Figure 135. *S. sagrae* (scales 1 mm): a. lateral view; b. face

Distribution. Pham *et al.* (2011e) recorded this species from Vietnam for the first time. Outside Vietnam, it has been known from China, India, Indonesia, Malaysia, Philippines, Sri Lanca, Taiwan, Japan, and Korea (Yu *et al*., 2005).

Remarks. Four subspecies are currently known: *S. sagrae albobalteata* Cameron, *S. sagrae baltazarae* Gupta & Tikar, *S. sagrae sagrae* Vollenhoven, and *S. sagrae sauteria* (Cushman) (Gupta & Tikar, 1976; Yu *et al*., 2005). The subspecies recorded from Vietnam is *S. sagrae sagae*. It differs from other three subspecies in having basal and apical black bands on hind femur (Gupta & Tikar, 1976).

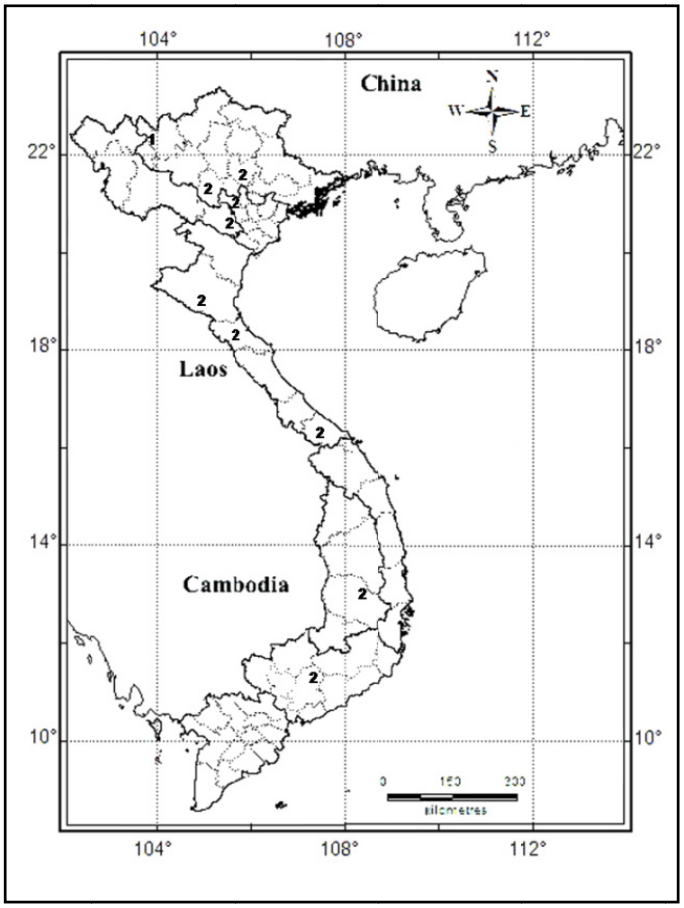

Figure 136. Distribution map of *G. himalayensis* (1) and *S. sagrae* (2)

***Zaglyptus* Foerster, 1869**

Zaglyptus Foerster, 1869. Verh. Naturh. Ver. Rheinlande 25: 166. Type-species: *Polysphincta varipes* Gravenhorst, by subsequent designation, Woldstedt, 1877: 17.

Diagnosis. Face with a pair of furrows arising from supraclypeal suture; clypeus strongly convex, apical margin thin, broadly concave medially; mandible stout, swollen near apex, pointed at tip, upper tooth longer than lower; palpi formula 5:4; occipital carina complete, mediodorsally more or less convex; mesoscutum finely punctate, with notauli moderately deep anteriorly; mesopleural suture weak but quite distinctly angled centrally; submetapleural carina complete or present only anteriorly; propodeum with paired posterolateral swellings; claws of female with a pointed basal lobe; fore wing lacking vein 3*rs-m*; metasomal tergites 2–5 (sometimes also tergite 6) with paired lateral swellings; ovipositor lower valve with distinct teeth, the most proximal with an elongate free tip; male with subgenital plate subquadrate, posteriorly truncate (Townes, 1969; Gauld, 1991).

Zaglyptus is a cosmopolitan genus with a total of 25 recognized species. Species richness of this genus is highest in the Oriental region (12 species), followed by the Palearctic and Neotropics (five species each), with three Australian (including Oceanics) and two Afrotropical species

(Baltazar, 1961; Gupta, 1961; Momoi, 1970; Gauld, 1984; He, 1984; Pham *et al.*, under review-b).

Cushman (1933) described *Zaglyptus formosa* from Formosa (now Taiwan) as the first representative of this genus in the Oriental region. In 1961, Baltazar described two *Zaglyptus* species from the Philippines. In the same year, Gupta revised this genus from the Orient and described five new species. He also divided the species of *Zaglyptus* in the region into four species groups, viz. *multicolor*, *nigrolineatus*, *simonis* and *varipes*. Momoi (1970) described *Z. semirufus* based on material from the Japanese Ryukyus archipelago. He (1984) reported a list of seven *Zaglyptus* species from China with the description of *Z. wuyiensis*, added two new records for the Oriental region and erected a new species-group (the *formosus* group) for *Z. formosus* which was grouped previously in the *varipes* group by Gupta (1961). Among three Vietnamese species, *Zaglyptus nigrolineatus* Gupta and *Z. glaber* Gupta belong in the *nigrolineatus* group, which is characterized by the yellow/white face, deep notaulus and incomplete submetapleural carina. *Zaglyptus guptai* does not entirely fit in any of these species-groups; it is similar to both the *simonis* group (characterized by having only a short section of submetapleural carina anteriorly) and the *multicolor* (with a complete submetapleural carina). The division of this genus into many small, narrow defined species groups makes it difficult to accommodate the inevitable intermediate species (Pham *et al*., under review-b).

Zaglyptus species are gregarious idiobiont ectoparasitoids of nest-making spiders (Baltazar, 1961; Gupta, 1961; Townes, 1969; Gauld, 1984; Fitton *et al*., 1988). The larvae develop on paralysed, mature spiders and their eggs (Fitton *et al*., 1988). However, there are no host records from Vietnam and most *Zaglyptus* species remain unknown biologically.

Key to Vietnamese species of *Zaglyptus* (based mainly on females since males of *Z. nigrolineatus* and *Z. guptai* are unknown)

1. Face yellow (Figures 137c, 139d); notauli impressed, convergent posteriorly in shallow hollow (Figures 137a, 139a); metapleuron with submetapleural carina present on anterior 0.35 (Figures 137b, 139b); metasomal tergites with punctate swellings (Figures 137a, 139a); ovipositor shorter, length from tip of hypopygium about 1.5–1.6 times as long as hind tibia.....2

-. Face black (Figure 138e); notaulus defined anteriorly, not convergent posteriorly (Figure 138a); metapleuron with submetapleural carina nearly complete (Figure 138f); metasomal tergites 3–6 with nearly impunctate swellings (Figure 138b); length of ovipositor from tip of hypopygium about 2.0 times as long as hind tibia.....*Z. guptai* Pham, Broad & Wägele

2. Mesoscutum almost hairless (Figure 137a); hind wing with first abscissa of vein *Cu*1 as long as or longer than *cu-a* (Figure 137d); metasomal tergites 2–5 with m-shaped black marks.. .....*Z. glaber* Gupta

-. Mesoscutum evenly pubescent (Figure 139a); hind wing with first abscissa of vein *Cu*1 slightly shorter than *cu-a* (Figure 139e); metasomal tergites with transverse black marks.....*Z. nigrolineatus* Gupta

***Zaglyptus glaber* GUPTA, 1961**

(Figures 137, 140)

Zaglyptus glaber Gupta, 1961. Indian Journal of Entomology, 22 (1960): 252.

Zaglyptus glaber glaber Gupta, 1961. Indian Journal of Entomology, 22 (1960): 253. Holotype: ♀, India: Namkum (GPTA).

Zaglyptus glaber singaporensis Gupta, 1961. Indian Journal of Entomology, 22 (1960): 254. Holotype: ♀, Singapore, Baker Coll. (USNM). Synonymized with the nominate subspecies by Pham *et al*., under review-b.

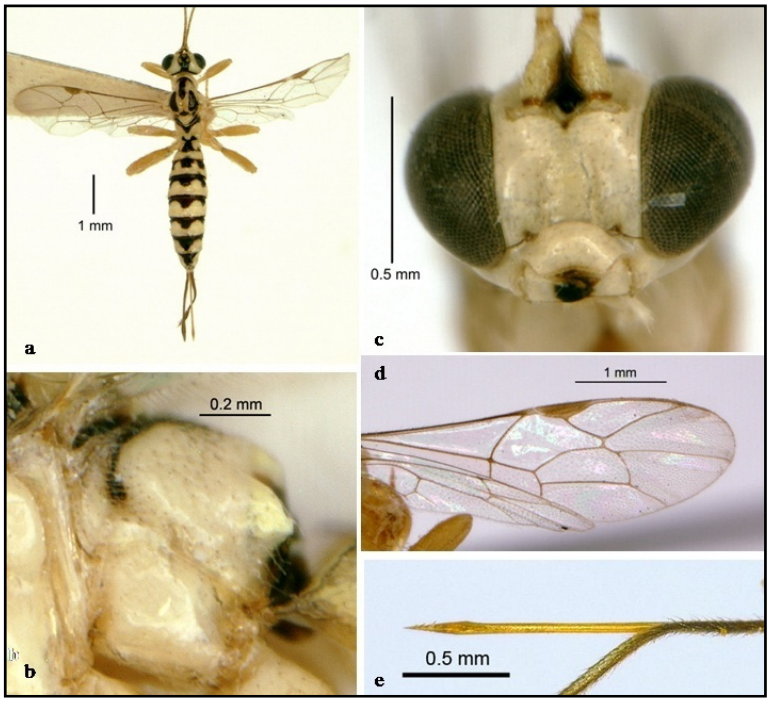

Figure 137. *Z. glaber*: a. dorsal view; b. metapleuron and lateral view of propodeum; c. face; d. wings; e. ovipositor tip

Material examined. Vinh Phuc, Vinh Yen, Ngoc Thanh: 1♀2♂ (IEBR), 11–25.x.2000; 1♂ (IEBR), 16.xi–05.xii.2000, Malaise trap, L. D. Khuat leg.; 1♀ (ZFMK), 28.iii.2001, hand net, N. T. Pham leg.; Thai Nguyen, Dai Tu, Cat Ne: 1♂ (IEBR), 15–20.v.2007, Malaise trap, L. D. Khuat leg.; Ninh Thuan, Nui Chua NP: 1♀ (RMNH), 22–29.v.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.; Phu Tho, Xuan Son NP: 1♀ (IEBR), 20–30.iii.2009; 1♂ (IEBR), 06–10.vii.2009, Malaise trap, L. D. Khuat leg.

Diagnosis. Face yellow, wider than high, minute and shallow punctures; notaulus strong; anterior 0.35 of submetapleural carina present; metasomal tergites 2–5 each with m-shaped black

marks basally; swellings on tergites punctate; ovipositor straight, about 1.5x hind tibia.

Distribution. Pham *et al*. (under review-b) recorded this species for the first time from Vietnam. Outside Vietnam, it has been known from China, India and Singapore (Yu *et al.*, 2005).

Remarks. Two subspecies have been recognised: *Z. glaber glaber* from China and India and *Z. glaber singaporensis* from Singapore (Gupta, 1961; Yu *et al*., 2005). They differ from each other by the length of the submetapleural carina and by the black pattern on the mesopleuron and metapleuron. Except for one female specimen collected between 20 to 30.iii.2009 from Phu Tho Province, all other Vietnamese specimens lack the central black spot on the mesopleuron and their metapleura are entirely yellow, resembling the nominate subspecies, but the submetapleural carinae are shorter (present on anterior 0.35), resembling the subspecies from Singapore. As the differences between two subspecies have not proved to be stable Pham *et al*. (under review-b) synonymized the two names.

***Zaglyptus guptai* PHAM, BROAD & WÄGELE (under review)**

(Figures 138, 140)

Material examined. Dak Lak, Chu Yang Sin NP, Krong K'Mar: 1♀ (RMNH, holotype), 740–900 m a.s.l., 02–10.vi.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Face black, quadrate, minute and shallow punctures; notaulus weak; submetapleural carina nearly complete; swellings on second tergite desely coarsely punctate; swellings on tergites 3–6 polished, nearly impunctate; ovipositor straight, 2.0x hind tibia.

Description (Female). Body length 5.6 mm, fore wing 4.5 mm, ovipositor 2.7 mm. *Head*. Antenna with 23 flagellomeres, first flagellomere 1.45x length of second; diameter of lateral ocellus equal to ocellar-ocular distance; frons pubescent; inner margin of eye weakly concave above antennal sockets, parallel ventrally; face quadrate, pubescent, upper margin slightly concave between antennal sockets; clypeus convex, about 0.55x as high as wide, apical margin truncate; malar space about 0.3x basal width of mandible; occipital carina meeting hypostomal carina at about basal mandible width from base of mandible.

Mesosoma. Epomia present, as long as mandible width; pronotum impunctate and polished; mesoscutum 1.3x as long as wide at front edges of tegulae, pubescent, notauli moderately deep, convergent at posterior 0.4 of mesoscutum in shallow hollow; scutellum strongly convex, pubescent, lateral carina present basally; mesopleuron pubescent, epicnemial carina present on lower 0.7 of mesopleuron, lateral section of postpectal carina present as short stub in front of mid coxa; metapleuron polished, submetapleural carina nearly complete, posterior end indistinct; propodeum moderately convex, pubescent, without carinae, with mediobasal hollow; propodeal

spiracle round, touching pleural carina. Fore femur 4.1x as long as wide; hind leg with femur 4.5x as long as wide, length 0.8x tibia, tibia 8.0x as long as apical width; basitarsus 0.45x length of tibia, 0.45x tarsus, 2.8x second tarsomere, fifth tarsomere 1.8x third, hind tibia slightly swollen subbasally. Fore wing with vein Rs&M opposite *cu-a*, 2*rs-m* about 0.7x distance between 2*rs-m* and 2*m-cu*, vein *cu-a* inclivous, vein *Cu*1*a* separated from 1*m-cu* by 0.9x length of vein *Cu*1*b*; hind wing with vein *M+Cu* moderately bowed posteriorly, first abscissa of vein *Cu*1 about 0.85x length of vein *cu-a*; distal abscissa of vein *Cu*1 present.

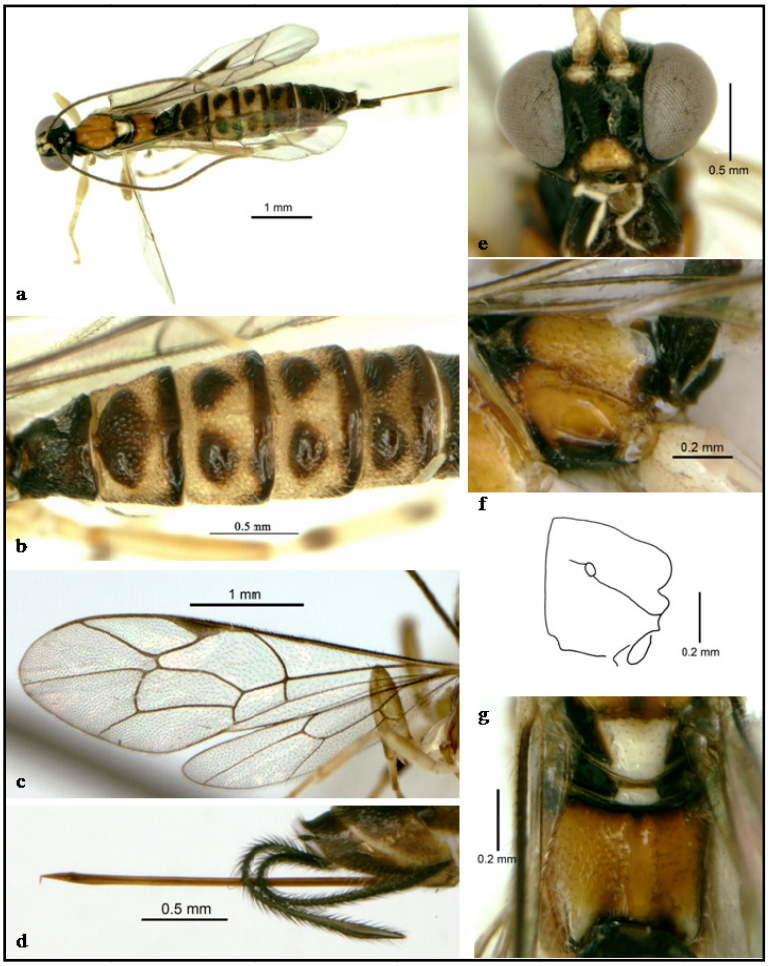

Figure 138. *Z. guptai*: a. dorsal view; b. dorsal view of metasomal tergites; c. wings; d. ovipositor; e. face; f. metapleuron and lateral view of propodeum; g. dorsal view of scutellum and propodeum

Metasoma. Tergites densely coarsely punctate, except transverse smooth bands apically; first tergite 0.95x as long as apical width, dorsolateral carina present from base to spiracle, median longitudinal carina present basally; second tergite 0.9x length of first tergite, 0.65x as long as apical width, basal and apical oblique grooves moderately deep, rhombic area convex, lateral swellings densely coarsely punctate; third tergite slightly shorter than second tergite; swellings on tergites 3–6 polished, almost impunctate; ovipositor straight, cylindrical, 2.0x as long as hind tibia.

Colour. Antenna brown, scape, pedicel and first two flagellomeres yellow ventrally; frons and hind side of head black, face black except two yellow spot in front of antennal sockets; clypeus reddish brown; palpi and tegula yellow; pronotum black; mesoscutum reddish brown; scutellum and metascutellum yellow; mesopleuron reddish brown, except transverse black stripe below subalar prominence; metapleuron reddish brown, black ventrally; propodeum reddish brown, apically black; subbasal and apical bands of mid tibia and apical band of mid basitarsus brown; hind leg with basal band of femur, subbasal and apical bands of tibia and apical band of basitarsus black; wing hyaline, pterostigma and veins light brown, except coxa yellow; tergites 1, 6, 7, 8 entirely black, tergite 2 yellowish brown, except median rhombic convex area and apical transverse smooth band dark brown; tergites 3–5 yellowish brown, except two lateral swellings and apical transverse smooth bands blackish; ovipositor riddish brown, ovipositor sheath black and hairy.

Male. Unknown.

Distribution. Currently known only from Chu Yang Sin NP, Dak Lak Province, Central Highlands of Vietnam (Pham *et al*., under review-b).

Ecological note. The single specimen was collected in the secondary rainforest at elevations between 740–900 m a.s.l. (Pham *et al*., under review-b).

***Zaglyptus nigrolineatus* GUPTA, 1961**

(Figures 139, 140)

Zaglyptus nigrolineatus Gupta, 1961. Indian Journal of Entomology, 22 (1960): 255. Holotype: ♀, India: Cherangode (CNC).

Material examined. Dak Lak, Chu Yang Sin NP: 1♀ (RMNH), 840–940 m a.s.l., 02–10.vi.2007, Malaise trap, C. v. Achterberg & R. de Vries leg.

Diagnosis. Face yellow, quadrate, minute and shallow punctures; notaulus strong; anterior 0.35 of submetapleural carina present; metasomal tergites each with basal black band and smooth black band apically; swellings on tergites punctate; ovipositor straight, 1.6x hind tibia.

Distribution. Pham *et al*. (under review-b) recorded this species for the first time from Vietnam. Outside Vietnam, it has been known from India (Gupta, 1961; Yu *et al*., 2005).

Remarks. The specimen from Vietnam has less extensive black marks compared with the specimens from India (including the holotype): yellow frons, black patch surrounding the ocelli weakly extending below, the occipital area entirely yellow, yellow pronotum, narrow, basal black band of tergites. Morever, the Vietnamese specimen has basally polished and impunctate tergites 6–7 and the hind wing with six hamuli (versus five in material from India).

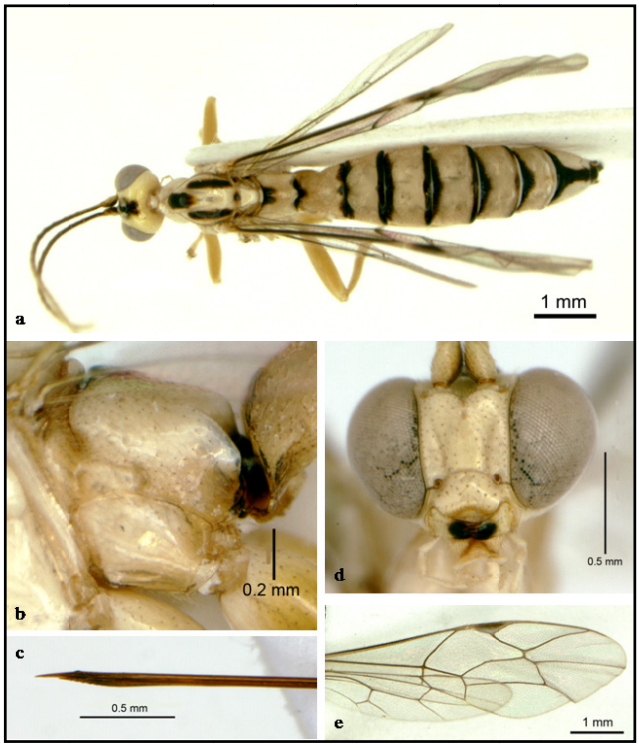

Figure 139. *Z. nigrolineatus*: a. dorsal view; b. metapleuron and lateral view of propodeum; c. ovipositor tip; d; face; e. wings

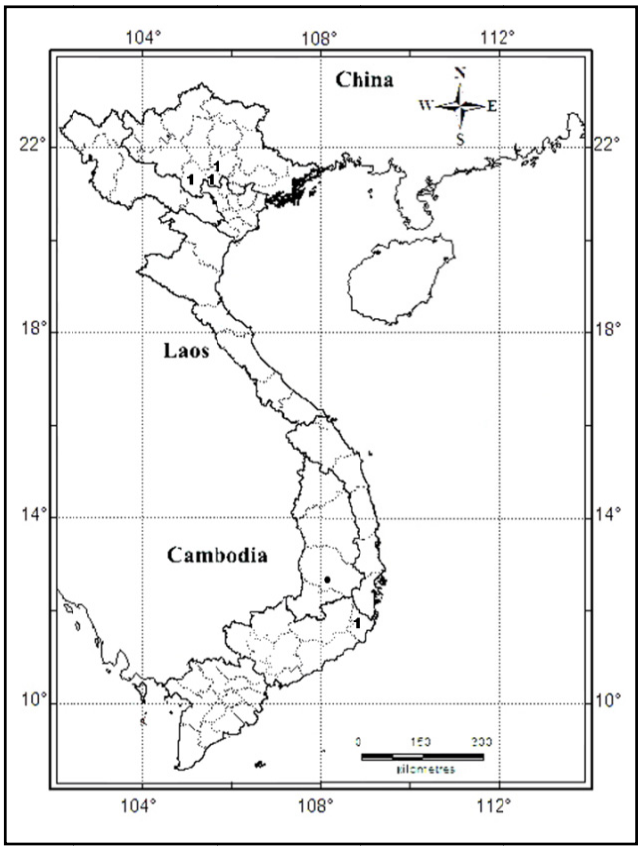

Figure 140. Distribution map of *Zaglyptus* species:

1. *Z. glaber*; (•) *Z. guptai* and *Z. nigrolineatus*

DISCUSSION

DIVERSITY OF PIMPLINAE FROM VIETNAM

The knowledge about the diversity of the Pimplinae fauna of Vietnam is strikingly increased from 39 species in 2009 to 122 species in 2013 (Figure 141). That means in recent four years, 83 additional species (or 68% of the currently total species number) have been newly reported from Vietnam.

A total of 21 genera have been documented, of which 12 genera were recorded as new from Vietnam: viz. *Augerella*, *Epitheronia*, *Nomosphecia*, *Acrodactyla*, *Brachyzapus*, *Chablisea*, *Gregopimpla*, *Sericopimpla*, *Zaglyptus*, *Dolichomitus*, *Flavopimpla*, *Lissopimpla*. Furthermore, 38 species were recorded for the first time from Vietnam: *Lissopimpla basalis*, *Pimpla bilineata*, *P. cameronii*, *P. ereba*, *P. flavipalpis*, *P. laothoe*, *X. annulata*, *X. atriclunis*, *X. brachycentra*, *X. brevicarina*, *X. connexa*, *X. curvimaculata*, *X. fastigiata*, *X. glaberrima*, *X. jacobsoni*, *X. melanacantha*, *X. nigritarsis*, *X. platyura*, *X. pleuroschista*, *X. pulvinaris*, *X. sexlineata*, *X. sticta*, *X. transmaculata*, *Augerella brevicauda*, *Nomosphecia scutellata*, *N. zebroides*, *Theronia clathrata*, *T. maskeliyae*, *Camptotypus olynthius*, *C. testaceus*, *Acropimpla hapaliae*, *A. taishunensis*, *Gregopimpla himalayensis*, *Sericopimpla sagrae*, *Zaglyptus glaber*, *Z. nigrolineatus*, *Dolichomitus melanomerus*, and *Flavopimpla latiannulata*.

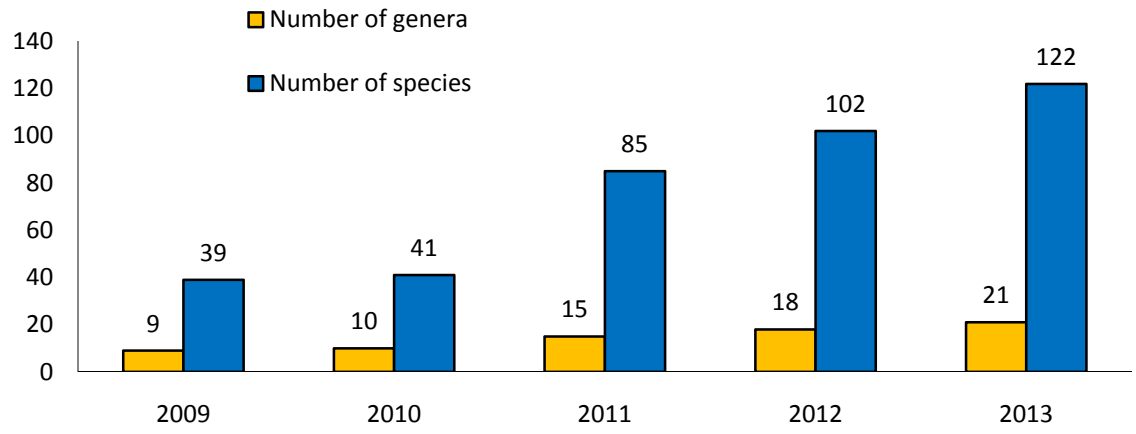

Figure 141. Diversity of Pimplinae fauna in Vietnam

Remarkably, 45 species have been described as new to science: *Pimpla chuyangsinensis*, *P. lexuanhuei*, *Xanthopimpla amplamaculosa*, *X. boehmei*, *X. chiuae*, *X. flavafemora*, *X. flavapropodea*, *X. hienae*, *X. morsei*, *X. omega*, *X. oriole*, *X. panthera*, *X. porrecta*, *X. pseudosternata*, *X. punctatissima*, *X. spicula*, *Augerella achterbergi*, *A. vriesi*, *Epitheronia vinhanensis*, *Nomosphecia carinicurvata*, *Theronia ferruginaterga*, *T. longihastata*, *T. tahuythinhi*, *Camptotypus trui*, *Acrodactyla elongata*, *A. lachryma*, *A. maiphuquyi*, *A. phuthoensis*, *A. shawi*, *A. tami*, *Acropimpla*

lampei, *A. mucronis*, *A. phongdienensis*, *Brachyzapus carinatus*, *B. convexus*, *B. duboisi*, *B. fansipanensis*, *B. hoanglienensis*, *B. politus*, *Chablisea condimenta*, *C. khuatdanglongi*, *Zaglyptus guptai*, *Dolichomitus lami*, *Flavopimpla lanugo*, and *F. vinhcuuensis*.

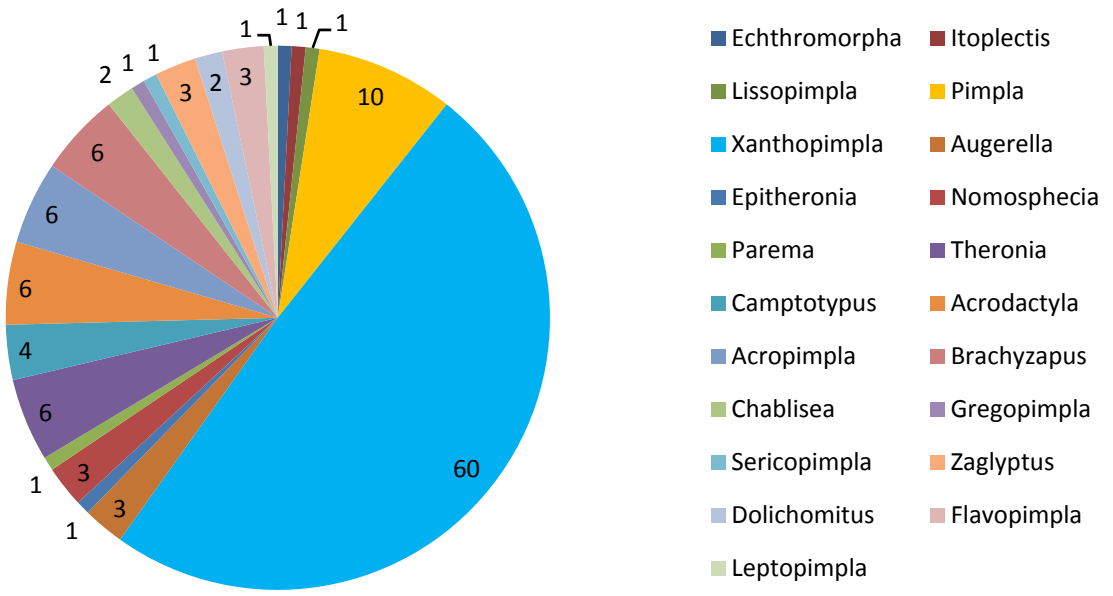

Figure 142. Species richness of pimpline genera in Vietnam

Xanthopimpla is the most species-rich genus of Pimplinae in Vietnam, with 60 representatives or 49.2% of the total species number, followed by the genus *Pimpla* with 10 species (8.9%) (Figure 142). Worldwide, *Xanthopimpla* and *Pimpla* are also the most diverse genera of the subfamily Pimplinae, with 261 and 205 recognized species, respectively (Yu *et al*., 2005; Pham *et al*., 2011c, 2013a). Whereas most species of *Xanthopimpla* occur in the Indo-Australian region, the species richness of the genus *Pimpla* is higher in the Neotropics and the Palearctic than in other regions (Yu *et al*., 2005; Pham *et al*., 2013a). Four other Vietnamese genera contain six species each, including: *Acrodactyla*, *Acropimpla*, *Brachyzapus* and *Theronia* (Pham *et al*., 2011d, 2012a, 2012b, 2013b). The genus *Camptotypus* has four recognized species from Vietnam (Pham *et al*., 2012c). The following four genera have three species each in the country: *Augerella*, *Flavopimpla*, *Nomosphecia*, *Zaglyptus* (Pham *et al*., 2013b, under review-a, b). *Chablisea* and *Dolichomitus* are represented by two Vietnamese species (Pham *et al*., 2011b, 2012d). Eight genera, *Echthromorpha*, *Itoplectis*, *Lissopimpla*, *Epitheronia*, *Parema*, *Gregopimpla*, *Sericopimpla* and *Leptopimpla*, are represented in Vietnam by only a single species (Gupta & Tikar, 1976; Plant Protection Research Institute, 1976; Vu, 1986; Pham *et al*., 2011e, 2013b). The genus *Itoplectis*, with 61 recognized species, is a moderately large genus. The species richness of this genus is higher in the Palearctic

and Neotropical regions than in other regions (Yu *et al*., 2005). In Vietnam, *Itoplectis* is represented by a single species, *I. narange.* This species was recorded as a parasitoid of lepidopteran species in the rice fields (Vu, 1986; Bui, 1990). However, I have not seen any Vietnamese specimens of this species. It may be extinct in Vietnam.

DISTRIBUTION OF PIMPLINAE IN VIETNAM

Biogeographic relationships

According to Averyanov *et al*. (2003) and Sterling *et al*. (2006) Vietnam can be divided into five major geographical regions: Northeast (NE), Northwest (NW), North Central (NCT), South Central and Central Highlands (SCT-HL), and South Vietnam (SVN). In northern Vietnam, the Red River is considered as a barrier which separates the NE from the NW region. Whereas the Ca River in Nghe An Province is the border between the NW and the NCT regions. Connecting with the NCT, the SCT-HL stretches from Kon Tum Province southward to Di Linh Plateau. South Vietnam covers the remaining part of the country.

In terms of species richness, the NW harbours 74 species, following by the SCT-HL (55 species), the NCT (50 species), the SVN (40 species) and the NE (39 species). In addition, the NW and SCT-HL regions also have the highest level of endemicity with 22 species and 18 species (29.7% and 32.7% of the total species number known from these regions, respectively). The high level of species diversity and endemicity of Pimplinae in these regions can be explained by the complex topography along with diverse climatic and ecological conditions. The NW and SCT-HL regions also have the highest level of discovery of hitherto unknown Pimplinae in Vietnam with 20 and 16 new species, respectively, which were recently described by the author. Especially, Hoang Lien NP (12 new species) and Chu Yang Sin NP (10 new species) are two hotspots which harbour a high number of the new species.

Hoang Lien Range in the NW region is considered as an emphatic point to the distribution pattern of Pimplinae. Among 14 pimpline species in three genera (*Acrodactyla*, *Brachyzapus* and *Chablisea*) of the *Polysphincta* genus-group, 11 species have been known only from Hoang Lien NP. Especially, all six species of Vietnamese *Brachyzapus* have recently been described based on material collected from this mountain range.

In contrary, 11 species were found in all five regions: *Acropimpla leucostoma*, *Augerella brevicauda*, *Echthromorpha agrestoria*, *Nomosphecia zebroides*, *Parema nigrobalteata*, *Sericopimpla sagrae*, *Xanthopimpla flavolineata*, *X. honorata*, *X. nana*, *X. punctata* and *X. varimaculata*. The four most common species with a high number of collected specimens are: *P. nigrobalteata* (77 specimens), *X. punctata* (62 specimens), *E. agrestoria* (60 specimens) and *X. flavolineata* (56 specimens).

Table 3. The similarity index (Sorensen coefficient) of the species composition of Pimplinae in five geographical regions of Vietnam

	NE	NW	NCT	SCT-HL	SVN
NE	—				
NW	0.53	—			
NCT	0.52	0.54	—		
SCT-HL	0.38	0.43	0.48	—	
SVN	0.43	0.49	0.58	0.47	—

Notes: NE = Northeast, NW = Northwest, NCT = North Central, SCT-HL = South Central and Central Highland, SVN = South Vietnam

The species composition of Pimplinae in the NE region is most similar to that of the NW (d_{jk} = 0.53). Among 39 pimpline species known from the NE, 30 species also occur in the NW region. The Pimplinae fauna of the NW is also closely related to that of the NCT, with 34 species present in both regions. The highest value of similarity index is between the NCT and SVN regions (d_{jk} = 0.58) with 26 co-occurring species. Except the SVN, the species compositions of Pimplinae in three other regions (NE, NW and NCT) are distinctly different to that of the SCT-HL region. This result may be explained by a high number of endemic species recorded in the SCT-HL (16 recently described species plus numerous new records).

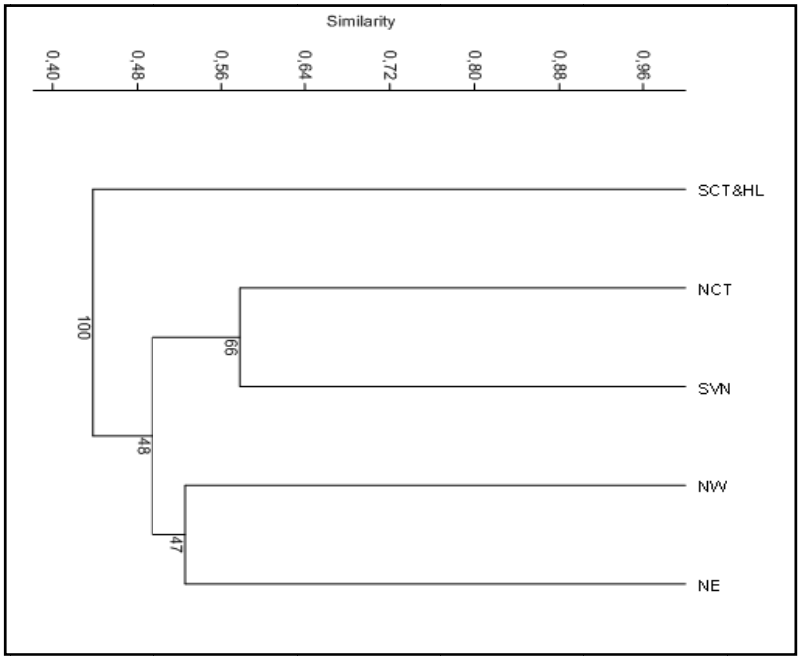

Figure 143. Cluster analysis of species composition of the Pimplinae fauna in different geographical regions (Bootstrap replication: 100)

Altitudinal distribution of Pimplinae in Vietnam

Because the distribution of animals is often restricted to well-defined altitudinal ranges (Gagné, 1976), in this study I also investigated the altitudinal distribution of Pimplinae in Vietnam. Collecting sites of Pimpline in Vietnam can be divided into three levels of elevation (Figure 144): (I) below 700 m a.s.l., (II) between 700 and 1,100 m a.s.l.; and (III) above 1,100 m a.s.l. Most species were found at altitude zone I (90 species or 73.8% of the total number species). The diversity decreases at higher elevations: 47 species (or 38.5%) occur in zone II and 27 species (or 22.1%) in zone II. In zone III, 20 species were collected from Hoang Lien NP in Lao Cai Province. At present, the highest record of Pimplinae species in Vietnam is at the elevation of 2,320 m a.s.l.

The major relationship between insects and plants is the trophic one. In Pimplinae, and in other Ichneumonidae, it is also the relationship between host plants – herbivorous hosts – parasititoids. The change of altitude is always accompanied with changes of temperature, moisture and vegetation types. Air temparature is colder, food sources and hosts of pimpline wasps in montane evergreen forests at higher elevation are also not as plentiful as in lowland habitat types.

The similarity indexes of the species composition among altitudinal zones are 0.70 between zones I and II, 0.30 between zones II and III, and 0.22 between zones I and III. Many species have a distribution restricted to one altitudinal zone: 56 species from zone I; 11 species from zone II and 18 species from zone III. However, it should be noted that nearly half of these (37 species) were only recently described and the actual species compositions of Vietnamese Pimplinae is still not perfesctively known. Only five species can be found in all three altitudinal zones, namely *Pimpla laothoe*, *Theronia zebra*, *Xanthopimpla riecherti*, *X. punctata* and *X. varimaculata*.

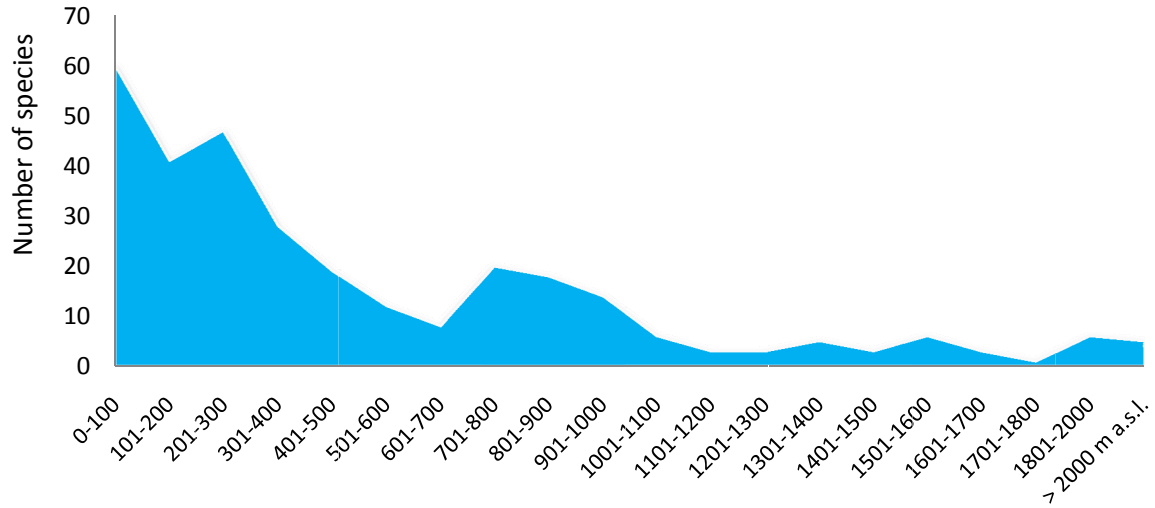

Figure 144. Altitudinal distribution of Pimplinae in Vietnam

Xanthopimpla is the largest genus of Pimplinae in Vietnam with its representatives occuring in a wide variety of habitats from north to south. However, only a few species have been found at zone III: *X. reicherti* (up to 1,500 m a.s.l), *X. varimaculata* and *X. transmaculata* (reach to 1,380 m a.s.l), and *X. punctata* (maximum at 1,300 m a.s.l). In contrast, some other genera have a lower species richness but are currently known only from high altitude are: *Brachyzapus*, *Dolichomitus* and *Gregopimpla.*

Species diversity and habitat types

Averyanov *et al*. (2003) defined eight major types of vegetation in Vietnam: (1) evergreen broad-leaved lowland forests on alkaline soils; (2) evergreen and semi-deciduous broad-leaved, mixed and coniferous limestone montane forests; (3) evergreen lowland forests on silicate rocks at elevations 0–1000 m a.s.l.; (4) evergreen montane and highland forests on silicate rocks between 1000–3000 m a.s.l.; (5) semi-deciduous dry lowland forests; (6) deciduous dry lowland forests and savanna-like woodlands; (7) coastal vegetation, lowland wetlands and mangrove thickets; (8) secondary, wet and agricultural plant communities, timber and industrial plantations. Among 122 pimpline species recorded from Vietnam, 94 species have been found in the habitat type 3. In the past, this kind of forest covered vast lowland, hilly and eroded low mountain areas all over Vietnam. These forests are very moist, with a closed canopy of tropical plants (Averyanov *et al*., 2003).

The species richness of Vietnamese Pimplinae in the habitat types 4 (41 species) and 8 (37 species) and habitat type 1 (30 species) is much higher than in habitat type 6 (6 species), habitat type 2 (5 species) and habitat type 5 (2 species each). Only one species, *Xanthopimpla regina*, was recorded from the habitat type 7. The species compositions of Pimplinae in habitat types 1, 3, 4 and 8 are more similar in comparison with the other four habitat types: 31 species are known from both habitat types 3 and 8; 25 species co-occurred in habitat types 1 and 3; 23 species between habitat types 3 and 4, and 16 species between habitat types 4 and 8.

Up to 70 species were restricted to only one habitat type (type 1: 3 species; type 3: 44 species; type 4: 18 species; type 5: 1 species; type 8: 4 species). Many of them have been recently described (42 species) or reported as new from this country (18 species). No species is known from all eight habitat types, but six species were found in five habitat types: *Echthromorpha agrestoria*, *Theronia zebra* and *Xanthopimpla punctata* (habitat types: 1, 2, 3, 4 & 8), *Parama nigrobalteata* (habitat types: 1, 3, 4, 6 & 8), *X. honorata* (habitat types: 2, 3, 4, 6 & 8) and *X. regina* (habitat types: 1, 3, 4, 7 & 8).

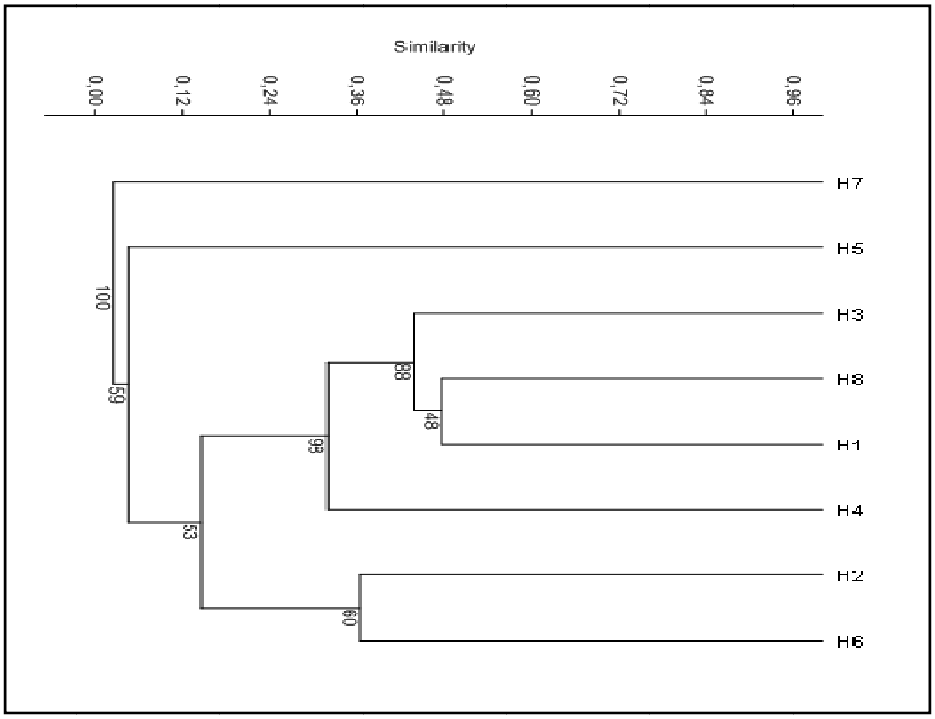

Figure 145. Cluster analysis of species composition of the Pimplinae fauna in different habitat types in Vietnam (Bootrap replication: 100)

SUMMARY

This monographic study of Vietnamese Pimplinae is based on several recent publications of the author that are integrated herein to a complete review.

Although Vietnam is one of the global biodiversity hotspots, the ichneumonid fauna of this country is still poorly studied. Pimplinae is a moderately large subfamily of Ichneumonidae with more than 1500 recognised species in 77 genera. However, only 39 pimpline species belonging to nine genera were documented from Vietnam until 2009. Our recent collection revealed that the diversity of the Vietnamese Pimplinae is in fact considerably higher, with numerous hitherto new records and undescribed species. Taking this situation, this study aims to fill the taxonomic gaps and to improve the knowledge about species richness and distributional patterns of pimpline wasps in Vietnam.

Field surveys were conducted for a period of 15 years (1997–2012) in 31 provinces, including 26 national parks and nature reserves. Taxonomic decisions were based on morphological examination of more than 900 specimens.

In the first part, a taxonomic review of pimpline waps in Vietnam and an identification key to the 21 genera is provided. All Vietnamese genera can be assigned to five genus-groups of two tribes: The *Pimpla* and *Theronia* groups belong to the tribe Pimplini, and the *Camptotypus*, *Ephialtes* and *Sericopimpla* groups belong to the tribe Ephialtini. A taxonomic review of each genus-group is presented in separate chapter.

Chapter 1 is a taxonomic revision of the *Pimpla* genus-group in Vietnam. Five genera are included in this genus-group: *Echthromorpha*, *Itoplectis*, *Lissopimpla*, *Pimpla* and *Xanthopimpla*. A total of 73 species are listed with descriptions of 14 new species of the genus *Xanthopimpla* and two new species of the genus *Pimpla*. Twenty-three species were reported as new for Vietnam, including 17 species of *Xanthopimpla*, five species of *Pimpla* and one species of *Lissopimpla.* One species, *Pimpla rufipes* (Miller, 1759), was found as a misidentification and excluded from the ichneumonid fauna of the country. In addition, a number of subspecies of the genus *Xanthopimpla* were synonymized. Keys to the species of the two genera, *Pimpla* and *Xanthopimpla*, are also presented.

Chapter 2 is a taxonomic review of the Vietnamese species of the *Theronia* genus-group. This genus-group is represented in Vietnam by 14 species in five genera, viz. *Augerella*, *Epitheronia*, *Nomosphecia*, *Parema* and *Theronia*. An identification key to the species is provided for each genus. Seven new species were discovered (*Theronia*: 3 new species, *Augerella*: 2 new species, *Epitheronia* and *Nomosphecia*: 1 species each). Five species are recorded for the first time from

Vietnam, comprising two species of *Theronia*, two species of *Nomosphecia* and one species of *Augerella*. The species *Nomosphecia brevicauda* (Cushman, 1933) is transferred to the genus *Augerella*, *A. orientalis* (Gupta, 1962) is synonymized with *A. brevicauda*. Moreover, one subspecies, *Nomosphecia zebroides indicus* (Gupta, 1962), is synonymized with the nominate subspecies.

Chapter 3 presents a taxonomic review of the Vietnamese species of the *Camptotypus* genus-group. Only the genus *Camptotypus*, with four species, is known from this country. One new species, *C. trui* Pham, Broad & Wägele, 2012, was described based on material collected from Central Vietnam. The two species, *C. olynthius* and *C. testaceus*, are recorded as new for the country. A key to four Vietnamese species of *Camptotypus* is compiled.

Chapter 4 is a taxonomic revision of the *Ephialtes* genus-group. This genus-group is represented by three genera: *Dolichomitus*, *Flavopimpla* and *Leptopimpla*, with six species in Vietnam. Descriptions of three new species: *Dolichomitus lami* Pham, Broad & Zwakhals, 2012, *Flavopimpla lanugo* Pham, Broad & Wägele (under review) and *F. vinhcuuensis* Pham, Broad & Wägele (under review) are provided. Moreover, two species are recorded as new for Vietnam: *Dolichomitus melanomerus* (Vollenhoven) and *Flavopimpla latiannulatus* (Cameron). Keys to species are compiled.

In chapter 5, a taxonomic review of the Vietnamese species of the *Sericopimpla* genus-group is provided. Of this genus-group seven genera are represented in the country: *Acrodactyla*, *Acropimpla*, *Brachyzapus*, *Chablisea*, *Gregopimpla*, *Sericopimpla* and *Zaglyptus*. An identification key to species is compiled for each genus. A total of 25 species are documented. Descriptions of 18 new species are provided (*Acrodactyla* and *Brachyzapus*: 6 new species each, *Acropimpla*: 3 new species, *Chablisea*: 2 new species and *Zaglyptus*: 1 new species). In addition, six species are reported as new for Vietnam, including 2 species of *Acropimpla*, 2 species of *Zaglyptus*, 1 species of *Gregopimpla* and 1 species of *Sericopimpla*.

The discussion summarizes the current knowledge of the diversity and taxonomy of Pimplinae from Vietnam. Of 122 recognized species in 21 genera, 12 genera and 38 species are new records for the country and 45 species are new for science. The distributional patterns of pimpline wasps are discussed. Comparisons of species compositions among geographical regions, habitat types and altitudinal zones were made on the basis of cluster analyses. In terms of geographical distribution, most species of Pimplinae occur in the northwestern region (74 species). The species richness of Pimplinae in the South Central and Central Highland (55 species) and in the North Central region (50 species) is higher than in South Vietnam (40 species) and in the northeastern region (39 species). The northwestern and South Central and Central Highland regions have also the highest level of endemicity with 22 species and 18 species (29.7% and 32.7% of the total species number

known from these regions respectively). The northwestern and South Central and Central Highland regions also harbour the highest level of new discoveries of Pimplinae in Vietnam, with 20 and 16 newly described species. Two hotspots of new discovery of Pimplinae in Vietnam are Hoang Lien NP (12 new species) and Chu Yang Sin NP (10 new species). The similarity of species compositions between the northeastern and northwestern regions, between the North Central Vietnam and South Vietnam are closer than those of other regions. Except the species composition of Pimplinae in South Vietnam, those of other geographical regions are clearly different from the South Central and Central Highland region. Concerning the altitudinal distribution, the collecting sites of Pimpline in Vietnam can be divided into three levels of elevation: (I) below 700 m a.s.l., (II) between 700 and 1,200 m a.s.l.; and (III) above 1,200 m a.s.l. Zone I harbours 90 species (73.8% of the total number species). The species diversity decreases at higher elevations: the species numbers found in zones II and III are 47 and 27 species, respectively. Most species in zone III (20 species) were collected from Hoang Lien NP in Lao Cai Province. In terms of habitat types, there are eight major vegetation types in Vietnam. A total of 94 species were found in evergreen lowland forests on silicate rocks at elevations of 0–1000 m a.s.l. The species richness of Vietnamese Pimplinae in the evergreen montane and highland forests on silicate rocks between 1000–3000 m a.s.l. (41 species), the secondary, wet and agricultural plant communities, timber and industrial plantations (37 species each) and in the evergreen broad-leaved lowland forests on alkaline soils (30 species) is much higher than in the deciduous dry lowland forests and savanna-like woodlands (6 species) as well as in the evergreen and semi-deciduous broad-leaved, mixed and coniferous limestone montane forests (5 species) and the semi-deciduous dry lowland forests (2 species). The species compositions in evergreen forests and agricultural habitats are more similar to each other (clustered in the same group) than the four other habitat types (semi-deciduous and deciduous forest and coastal habitat).

ZUSAMMENFASSUNG

Diese Monographie der vietnamesischen Pimplinae basiert auf mehreren aktuellen Publikationen der Autorin und sind hier zu einem monographischen Überblick zusammengefasst.

Obwohl Vietnam einer der globalen Biodiversitäts-Hotspots ist, ist die Ichneumoniden-Fauna dieses Landes noch wenig untersucht. Pimplinae ist eine mäßig artenreiche Unterfamilie der Ichneumonidae mit mehr als 1500 beschriebenen Arten in 77 Gattungen. Aus Vietnam allerdings wurden bis 2009 nur 39 Arten der Unterfamilie Pimplinae aus neun Gattungen nachgewiesen. Unsere jüngsten Aufsammlungen zeigten jedoch, dass die Vielfalt der vietnamesischen Pimplinen in Wirklichkeit deutlich höher ist, mit zahlreichen neuen Nachweisen und unbeschriebenen Arten. Ziel der vorliegenden Studie ist nun, die taxonomischen Lücken zu füllen und das Wissen über die Artenvielfalt und die Verteilungsmuster der Pimplinen in Vietnam zu verbessern.

Felduntersuchungen wurden über einen Zeitraum von 15 Jahren (1997–2012) in 31 Provinzen Vietnams durchgeführt, darunter 26 Nationalparks und Naturschutzgebiete. Die taxonomischen Entscheidungen basieren auf der morphologischen Untersuchung von mehr als 900 Exemplaren.

Im ersten Teil werden eine taxonomische Überprüfung der Pimplinae in Vietnam und ein Bestimmungsschlüssel zu den 21 Gattungen präsentiert. Alle vietnamesischen Gattungen können fünf Gattungsgruppen in zwei Triben zugeordnet werden: Die *Pimpla* und die *Theronia* Gruppe gehören zur Tribus Pimplini, und die *Camptotypus*, die *Ephialtes* und die *Sericopimpla* Gruppe gehören zur Tribus Ephialtini. In je einem separaten Kapitel werden taxonomische Revisionen aller Gattungsgruppen vorgestellt.

Kapitel 1 ist eine taxonomische Revision der *Pimpla* Gattungsgruppe in Vietnam. Fünf Gattungen sind in dieser Gattungsgruppe enthalten: *Echthromorpha*, *Itoplectis*, *Lissopimpla*, *Pimpla* und *Xanthopimpla*. Insgesamt 73 Arten werden aufgeführt, mit Beschreibungen von 14 neuen Arten der Gattung *Xanthopimpla* und zwei neuen Arten der Gattung *Pimpla*. Dreiundzwanzig Arten wurden als neu für Vietnam nachgewiesen, darunter 17 Arten der Gattung *Xanthopimpla*, fünf Arten der Gattung *Pimpla* und eine Art der Gattung *Lissopimpla*. Eine Art, *Pimpla rufipes* (Miller, 1759), wurde als Fehlbestimmung klassifiziert und von der Liste der Ichneumonidenarten des Landes gestrichen. Darüber hinaus wurde eine Reihe von Unterarten in der Gattung *Xanthopimpla* synonymisiert. Bestimmungsschlüssel zu den Arten der beiden Gattungen *Pimpla* und *Xanthopimpla* werden ebenfalls präsentiert.

Kapitel 2 ist eine taxonomische Revision der vietnamesischen Arten der *Theronia* Gattungsgruppe. Diese Gattungsgruppe ist in Vietnam mit 14 Arten in fünf Gattungen vertreten, nämlich *Augerella*, *Epitheronia*, *Nomosphecia*, *Parema* und *Theronia*. Zu jeder Gattung wird ein

Bestimmungsschlüssel für die Arten angeboten. Sieben neue Arten wurden entdeckt (*Theronia*: 3 neue Arten, *Augerella*: 2 neue Arten, *Epitheronia* und *Nomosphecia*: je 1 neue Art). Fünf Arten werden zum ersten Mal für Vietnam aufgeführt: zwei Arten der Gattung *Theronia*, zwei Arten der Gattung *Nomosphecia* und eine Art der Gattung *Augerella*. Die Art *Nomosphecia brevicauda* (Cushman, 1933) wird in die Gattung *Augerella* transferiert, *A. orientalis* (Gupta, 1962) wird mit *A. brevicauda* synonymisiert. Darüber hinaus wird eine Unterart, *Nomosphecia zebroides indicus* (Gupta, 1962), mit der nominotypischen Unterart synonymisiert.

Kapitel 3 stellt eine taxonomische Revision der vietnamesischen Arten der *Camptotypus* Gattungsgruppe vor. Lediglich die Gattung *Camptotypus*, mit vier Arten, ist aus diesem Land bekannt. Eine neue Art, *C. trui* Pham, Broad & Wägele, 2012, wurde basierend auf in Zentralvietnam gesammeltem Material beschrieben. Zwei Arten, *C. olynthius* und *C. testaceus*, werden als neu für das Land gelistet. Ein Schlüssel zu den vier vietnamesischen Arten der Gattung *Camptotypus* wird gegeben.

Kapitel 4 ist eine taxonomische Revision der *Ephialtes* Gattungsgruppe. Diese Gattungsgruppe wird mit drei Gattungen (*Dolichomitus*, *Flavopimpla* und *Leptopimpla*), und mit sechs Arten in Vietnam vertreten. Beschreibungen von drei neuen Arten werden gegeben: *Dolichomitus lami* Pham, Broad & Zwakhals, 2012, *Flavopimpla lanugo* Pham, Broad & Wägele (im Review-Prozess) und F. vinhcuuensis Pham, Broad & Wägele (im Review-Prozess). Darüber hinaus werden zwei Arten, Dolichomitus melanomerus (Vollenhoven) und *Flavopimpla latiannulatus* (Cameron), als neu für Vietnam gelistet. Schlüssel zu den Arten wurden ausgearbeitet.

In Kapitel 5 wird eine taxonomische Revision der vietnamesischen Arten der *Sericopimpla* Gattungsgruppe vorgestellt. Diese Gattungsgruppe ist in dem Land durch sieben Gattungen vertreten: *Acrodactyla*, *Acropimpla*, *Brachyzapus*, *Chablisea*, *Gregopimpla*, *Sericopimpla* und *Zaglyptus*. Ein Bestimmungsschlüssel zu den Arten wird für jede Gattung präsentiert. Insgesamt 25 Arten werden aufgeführt. 18 neuen Arten werden beschrieben (*Acrodactyla* und *Brachyzapus*: je 6 neue Arten, *Acropimpla*: 3 neue Arten, *Chablisea*: 2 neue Arten und *Zaglyptus*: 1 neue Art). Zusätzlich werden sechs Arten als neu für Vietnam gelistet: 2 Arten der Gattung *Acropimpla*, 2 Arten der Gattung *Zaglyptus,* und je 1 Art der Gattungen *Gregopimpla* und *Sericopimpla*.

Der Diskussionsteil fasst den aktuellen Wissensstand zur Vielfalt und Taxonomie der Pimplinae aus Vietnam zusammen. Von den 122 vorkommenden Arten in 21 Gattungen sind 12 Gattungen und 38 Arten neue Nachweise für das Land und 45 Arten sind neu für die Wissenschaft. Die Verteilungsmuster der Pimplinen werden diskutiert. Vergleiche der Artenzusammensetzung zwischen geographischen Regionen, Lebensraumtypen und Höhenstufen wurden auf der Basis von Cluster-Analysen durchgeführt. In Bezug auf die geografische Verteilung kommen in der

nordwestlichen Region die meisten Arten von Pimplinae vor (74 Arten). Der Artenreichtum der Pimplinae in der zentralsüdlichen und zentralen Hochlandregion (55 Arten) und in der zentralnördlichen Region (50 Arten) ist höher als in Südvietnam (40 Arten) und in der nordöstlichen Region (39 Arten). Die nordwestliche Region und die zentralsüdliche und zentrale Hochlandregion haben auch den höchsten Anteil an endemischen Arten, mit 22 Arten bzw. 18 Arten (entspricht 29,7% bzw. 32,7% der gesamten aus diesen Regionen bekannten Arten). Die nordwestliche Region und die zentralsüdliche und zentrale Hochlandregion beherbergen auch die höchste Zahl von neu entdeckten Arten von Pimplinae in Vietnam, mit 20 bzw. 16 neu beschriebenen Arten. Zwei Hotspots der Neuentdeckungen von Pimplinen in Vietnam sind Hoang Lien NP (12 neue Arten) und Chu Yang Sin NP (10 neue Arten). Die Ähnlichkeit der Artenzusammensetzung zwischen der nordöstlichen und der nordwestlichen Region sowie die zwischen der zentralnördlichen Region und Südvietnam sind größer als die zwischen den anderen Regionen.

Mit Ausnahme der Artenzusammensetzung in Südvietnam unterscheiden sich die Artenzusammensetzungen der Pimplinae der anderen Regionen deutlich von der zentralsüdlichen und zentralen Hochlandregion. Bezüglich der Verbreitung der Pimplinae in Anhängigkeit von der Höhenlage können die Sammelorte in Vietnam in drei Höhenlagenstufen unterteilt werden: (I) unter 700 m ü.M., (II) zwischen 700 und 1.200 m ü.M., und (III) über 1.200 m ü.M. Zone I beherbergt 90 Arten (73,8% der Gesamtartenzahl). Die Artenvielfalt vermindert sich in höheren Lagen: Die in den Zonen II und III gefundenen Artenzahlen betragen 47 bzw. 27. Die meisten Arten in der Zone III (20 Arten) wurden im Hoang Lien NP in der Provinz Lao Cai gesammelt.

Hinsichtlich des Vergleichs der Artenzusammensetzungen in verschiedenen Lebensraumtypen gibt es acht wichtige Vegetationstypen in Vietnam. Insgesamt 95 Arten wurden in immergrünen Auwäldern auf Silikatgestein in Höhen von 0 bis 1000 m ü.M. gefunden. Der Artenreichtum der vietnamesischen Pimplinae in den immergrünen Berg- und Hochlandwäldern auf Silikatgestein zwischen 1000 und 3000 m ü.M. (41 Arten), in den sekundären Feucht- und Nutzpflanzengemeinschaften und Nutzforsten (37 Arten) sowie in den immergrünen Laub-Auwäldern auf alkalischen Böden (30 Arten) ist viel höher als in den sommergrünen trockenen Tiefland- und savannenähnlichen Wäldern (6 Arten) sowie in den immergrünen und halbimmergrünen Kalkstein-Laub-, Misch- und Nadelbergwäldern (5 Arten) und den halbimmergrünen trockenen Tieflandwäldern (2 Arten). Die Artenzusammensetzungen in immergrünen Wäldern und landwirtschaftlich genutzten Lebensräumen sind einander ähnlicher (in der gleichen Gruppe in den Cluster-Analysen) als die Artenzusammensetzungen in den vier anderen Lebensraumtypen (halbimmergrüne und sommergrüne Wald- und Küstenhabitate).

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APPENDIX 1. PUBLICATIONS OF KEY PARTS OF THE THESIS

Section	Publication
Chapter 1	**Pham, N.T.,** Broad, G.R., Dang, H.T. & Böhme, W. (2013a). A review of the genus *Pimpla* Fabricius, 1804 (Hymenoptera: Ichneumonidae: Pimplinae) from Vietnam with description of two new species. Organisms Diversity and Evolution. DOI: 10.1007/s13127-013-0125-7
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Flavopimpla (Hymenoptera: Ichneumonidae: Pimplinae) from Vietnam with descriptions of two new species. Biologia.

Chapter 5

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