อนุกรมวิธานของแตนเบียนวงศ์ Braconidae ที่ออกหากินเวลากลางคืน บริเวณหมู่เกาะแสมสาร จังหวัดชลบุรี

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TAXONOMY OF NOCTURNAL PARASITIC WASPS FAMILY Braconidae AT SAMAESAN ISLANDS, CHONBURI PROVINCE

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วชิรพงศ์ เจริญนิติวัฒน์ : อนุกรมวิธานของแตนเบียนวงศ์ Braconidae ที่ออกหากินเวลากลางคืนบริเวณหมู่เกาะแสมสาร จังหวัดชลบุรี (TAXONOMY OF NOCTURNAL PARASITIC WASPS FAMILY Braconidae AT SAMAESAN ISLANDS, CHONBURI PROVINCE) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: ผศ. ดร.บัณฑิกา อารีย์กุล บุทเชอร์, อ.ที่ปรึกษาวิทยานิพนธ์ร่วม: ศ. ดร.โดนัล ควิก, 188 หน้า.

แตนเบียนเป็นแมลงในอันดับ Hymenoptera เช่นเดียวกับผึ้ง มด ต่อ และแตนชนิดอื่น ดำรงชีวิตเป็นแมลงเบียน แตนเบียนวงศ์ Braconidae จัดอยู่ใน Superfamily Ichneumonoidea มีความหลากหลายทางชนิดสูง ลักษณะเฉพาะของแตนเบียนวงศ์นี้ คือ ปีกคู่หน้าไม่มีเส้นปีก 2m-cu และส่วนมากมีเส้น 1/Rs+M ปีกคู่หลังมีเส้น 1r-m และพบว่า metasomal tergum ที่ 2 จะมีการรวมกับ metasomal tergum ที่ 3 งานวิจัยนี้ศึกษาอนุกรมวิธานของแตนเบียนวงศ์ Braconidae ที่ออกหากินเวลากลางคืน บริเวณพื้นที่หมู่เกาะแสมสารและเกาะข้างเคียง และสร้างรูปวิธานแบบภาพสำหรับจำแนกแตนเบียนวงศ์นี้ในระดับวงศ์ย่อย รวมถึงสร้างฐานข้อมูลของแตนเบียนที่พบบริเวณพื้นที่ศึกษา พบแตนเบียน 175 ชนิด ใน 17 วงศ์ย่อย (12 koinobionts และ 5 idiobionts) จากตัวอย่างทั้งหมด 652 ตัวอย่าง และพบว่าแตนเบียน koinobionts ส่วนมากมีจำนวนตัวอย่างมากกว่า idiobionts จากการศึกษาโดยใช้กับดักแสง 2 ชนิด คือกับดักแสงแบบผ้าและกับดักแสงแบบถัง เก็บตัวอย่างตั้งแต่เดือนกันยายน 2556 ถึง กันยายน 2557 ซึ่งพบว่าแตนเบียนวงศ์ย่อย Helconinae, Lysiterminae, Pambolinae และ Rhysipolinae เป็นแตนเบียนที่มีการรายงานครั้งแรกในประเทศไทย แตนเบียนที่พบมากที่สุดอยู่ในวงศ์ย่อย Cheloninae พบมากถึง 45% ของตัวอย่างทั้งหมด (291 จากตัวอย่างทั้งหมด 652 ตัวอย่าง) และแตนเบียนวงศ์ย่อย Cheloninae มีจำนวนชนิดที่พบมากที่สุด จากการศึกษานี้พบว่าชนิดของแตนเบียนที่พบบริเวณเขาหมาจอมีความคล้ายคลึงกันกับแตนเบียนที่พบที่บริเวณเกาะแสมสารมากที่สุด จากการประมาณโดยใช้สมการ Chao-1 พบว่าพื้นที่ที่ทำการศึกษาน่าจะมีแตนเบียนวงศ์ Braconidae อยู่ถึง ประมาณ 271 ชนิด นอกจากนี้ยังพบแตนเบียนชนิดใหม่ 1 ชนิด ในสกุล *Aleiodes* Wesmael, 1838

ภาควิชา ชีววิทยา ลายมือชื่อนิสิต .....

สาขาวิชา สัตววิทยา ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

ปีการศึกษา 2558 ลายมือชื่อ อ.ที่ปรึกษาร่วม .....

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VACHIRAPONG CHAROENNITIWAT: TAXONOMY OF NOCTURNAL PARASITIC WASPS FAMILY Braconidae AT SAMAESAN ISLANDS, CHONBURI PROVINCE. ADVISOR: ASST. PROF. BUNTIKA AREEKUL BUTCHER, Ph.D., CO-ADVISOR: PROF. DONALD L.J. QUICKE, Ph.D., 188 pp.

Parasitic wasps are classified in the order Hymenoptera, same group as bees, ants and other wasps. Braconid wasps belong to the extremely diverse superfamily Ichneumonoidea. The characteristics of the braconid wasps are (1) fore wing without vein 2m-cu and/or with 1/Rs+M, (2) hind wing with 1r-m arising basal to split between R and RS, and (3) second and third metasomal tergites fusied. The aims of this research are to study the taxonomy of the nocturnal parasitic wasps, belonging to the family Braconidae on the Samaesan Islands and from the surrounding areas and construct the pictorial key of the parasitic wasp in the family Braconidae in subfamily level, including created the database of nocturnal braconids recorded from the study sites. In this study, 2 types of traps: black light trap and mobile bucket light traps were used to collect the specimens during September 2013 to September 2014. One hundred and seventy five morphospecies within 17 subfamilies (12 koinobionts and 5 idibionts) from 652 specimens have been collected and number of koinobiont specimens has been recorded more than the idiobionts in most of the collecting periods. A new record of Braconid subfamilies in Thailand have been reported for first time: Helconinae, Lysiterminae, Pambolinae, and Rhysipolinae. Most of the specimens are Cheloninae representing about 45% of all specimens (291 from 652 specimens) and the highest number of morphospecies belongs to the subfamily Cheloninae. Number of braconid species collecting from Khao Ma Cho is similar to those of Samaesan Island. Estimated species richness of the braconid species by Chao-1 in the study sites is approximately 271 species. Moreover, a new species of braconid wasp in the genus *Aleiodes* Wesmael, 1838 was also discovered in this study.

Department:	Biology	Student's Signature	.....
Field of Study:	Zoology	Advisor's Signature	.....
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CHAPTER I
INTRODUCTION

1.1 Rationale

Parasitic wasps are classified in the same group as bees, ants and other wasps, in the order Hymenoptera which are highly diverse (Quicke, 1997, 2015). The larvae of parasitoids feed on the bodies of other insects and also members of some other arthropod orders, such as spiders, ticks, mites and centipedes (Newman, 1867, Gauld and Bolton, 1988). Every stage of host development can be attacked. Their development always results in the death of their hosts. Parasitic wasps require only a single host to complete their metamorphosis and development (Godfray, 1994). They can be divided into two groups based on their life histories: idiobionts and koinobionts (Godfray, 1994, Quicke, 1997, 2015). Due to their life histories as parasitoids, they play important roles in both natural ecosystems and agriculture as natural enemies to control insect pests' populations in biological control programmes with high success (Shaw and Huddleston, 1991).

Parasitoid wasps are divided into 11 superfamilies, the three largest superfamilies are the Ichneumonoidea, Chalcidoidea and Cynipoidea. Ichneumonoidea has the highest species diversity among these superfamilies, it has been estimated that there are at least 120,000 ichneumonoid species worldwide (Ghahari et al., 2006) though only 40,000 have been described (approximately 33%).

Ichneumonoidea is divided into 2 large families, the Ichneumonidae and the Braconidae, both of them attack a wide range of host species, mainly insects in the order Lepidoptera (9 out of 18 lepidopteran subfamilies). Braconidae is the smaller of the two families, with over 18,000 species described species from a total estimated number of 60,000 or more species in the world (Yu et al., 2005) and many more to be described (van Achterberg, 1984). They are classified into at least 1,000 genera (Ghahari et al., 2006).

The Braconidae is closely related to the Ichneumonidae, however, there are several morphological characters that can be used to separate these 2 families. In the Braconidae (1) the forewing is without vein 2m-cu and/or with Rs+M, (2) hindwing with vein 1r-m arising basal to vein R, RS split and (3) second and third metasomal tergites fusied (Goulet and Huber, 1993). Although there are a lot of overlap, braconids generally have smaller body sizes as compared with their ichneumonid relatives. Most of the braconid wasps are parasitoids, except for some phytophagous genera (Macêdo and Monteiro, 1989, Infante et al., 1995, Austin and Dangerfield, 1998).

Although the advantages of the braconids covered various aspects of Thai agricultural society for a very long time e.g. pest control, ecological balance and so on, the number of braconid species in Thailand has not been publicity recorded and confirmed. Therefore, the study of braconids will not only lead to improve the

agricultural performances of Thai farmers, it could strengthen the knowledge in academic perspectives and increase general information of the wasps for the global scientists. But, before the integrations or applications of all the world faunas, including the braconid wasps, can happen, fundamental biological knowledge should be better known. This includes the identification of morphological characters, giving the scientific names description, and/or categorization of distinct groups based on their characters. This is called “Taxonomy”.

Entomologists know very little about nocturnal insects because of difficulties in observing them. This might cause inaccurate numbers of braconid wasp diversity as expected by the scientists (18,000 from 60,000 species). However, they are relatively easy to collect, as many species are attracted to light at night. Many parasitic wasps are nocturnal because their insect hosts, principally caterpillars, are only accessible at night (Gauld and Huddleston, 1976). Moreover, nocturnal behaviour may reduce their risk of being eaten by birds (Basset and Springate, 1992). In Thailand, scientific information, biology, taxonomy, host-parasitoid interactions, of Braconidae are still limited due to very few people work on them. Therefore, the aim of this research is to study and survey the diversity of nocturnal braconids. Sharanowski (2009) studied molecular phylogenetic analysis and proposed 47 subfamilies of the Braconidae, most of them are cosmopolitan. However, the faunas of tropical countries, including Thailand, are poorly studied and also lack of

identification keys. Thailand is located at the tropical zone which has high diversity of both floras and faunas, therefore, this country should be an interesting target for biologists to study richness of the equatorial species.

The study area is at Plant Genetic Conservation Project under The Royal Initiative of Her Royal Highness Princess Maha Chakri Sirindhorn area (RSPG) situated at Sattahip District, Chonburi Province, Thailand. Three sites in the area with different types of geography and distance from the mainland had been investigated: (1) Khao Ma Cho (mainland), (2) Samaesan Island (tourist attraction and the biggest island of the Samaesan Islands) and (3) Chuang Island (the farthest island). These 3 sites, are assumed to have high abundances of parasitic wasps, and importantly, there is no report of the parasitic wasps from these areas, except for *Yelicones samaesanensis* Butcher, 2014 (Butcher, 2014), therefore all data obtained is new. This is a starting point for creating database and an identification key of nocturnal braconid recorded from Thailand. This preliminary data can be applied for future works, such as biological control programmes, population genetics, systematics of the braconid wasps and host-parasitoid interactions.

1.2 Objectives

1. To study taxonomy of the nocturnal parasitic wasps family Braconidae collected from Khao Ma Cho, Samaesan and Chuang Islands, Sattahip District, Chonburi Province

2. To produce pictorial key of the nocturnal parasitic wasps collected from the study sites

1.3 Scope of study

The scope of this work is to study taxonomy of nocturnal braconid wasps (Hymenoptera: Ichneumonoidea) at Samaesan areas, Sattahip District, Chonburi Province, Thailand. This locality has reportedly become one of the most important ecotone between main land and sea in the gulf of Thailand. Environmental conditions are unique due to different seasonal monsoon during a year which affects species richness and diversification of the wasp species. The study was conducted in three study sites; Khao Ma Cho, Samaesan and Chuang Islands. The specimens were collected every 2 months for 13 months (7 times in total), started from September 2013 until September 2014 using 2 types of traps; black light trap and mobile bucket light traps. Specimens were sorted only for the braconid wasps, then photographed by cell^D program and identified to the subfamilies, genera and species level using external morphological characters. Nocturnal braconid species database and a pictorial key of the specimens collected from the study sites will be produced. The data from this study were analyzed using Sorensen coefficient of similarity to evaluate similarity of the nocturnal braconid wasp species in the study sites (Jackson et al., 1978).

CHAPTER II
LITERATURE REVIEWS

2.1 Parasitic wasps

Parasitic wasps are classified in the order Hymenoptera same as bees, ants and other wasps (Quicke, 2015). They can parasitize most of the insect orders, including other arthropods such as spiders (Gauld and Bolton, 1988) and centipedes (Newman, 1867). Many species of parasitic wasps have been used as natural enemies in biological control programmes. The parasitic wasp larvae feed either from outside (ectoparasitoid) or inside (endoparasitoid) of the host's body and once the eggs hatch they gradually eat their way around the inside, delaying eating any of the vital organs of their hosts until they are ready to pupate. At that point, parasitic wasps usually kill the host, pupate on or inside the host's body then emerge as adults. The relationship between a parasitoid and its host can be described in another way, depend on the host's active life continues after being parasitized (Haeselbarth, 1979, Askew and Shaw, 1986). Parasitoids that do not permit the host development after parasitized are idiobionts, in contrast, if the host continues to feed and develop after parasitized are called koinobionts. The idiobionts have broader host ranges (generalists) than the koinobionts (specielists) (Askew and Shaw, 1986, Hawkins et al., 1990). The differences between koinobionts and idiobionts are shown in Table 2.1.

Table 2.1 Differences between idiobionts and koinobionts (Quicke, 1997)

Idiobionts	Koinobionts
➢ Hosts arrest the development and movement upon parasitized	➢ Hosts can continue the development and movement upon parasitized
➢ Most are ectoparasitoids	➢ Most are endoparasitoids
➢ Generalists	➢ Specialists
➢ Adults have longer life than koinobionts	➢ Adults have shorter life than idiobionts
➢ Larvae have shorter development time	➢ Larvae have longer development time
➢ Hosts are bigger than parasitic wasps	➢ Hosts are smaller than parasitic wasps

Parasitoids can be either solitary, a single parasitoid larva develops on or in a single host, or they can be gregarious, more than 1 up to 1,000 individuals from a single female wasp, develop inside or outside a single host (Kitano, 1986). The general sex-determination mechanism of parasitic wasps are known as haplodiploidy, in which males are haploid and develop from unfertilized eggs (parthenogenesis) while females are diploid which resulted from fertilized eggs after mating (Kerr et al., 1962, Crozier, 1975).

The parasitic hymenopteran consists of the superfamilies Chalcidoidea, Cynipoidea, Ichneumonoidea and Proctotrupoidea which include an enormous number of small to large insects. The Ichneumonoidea is one of the largest groups in

species diversity (Quicke, 2015). Ichneumonoidea is divided into 2 large families, the Ichneumonidae, the biggest family in the kingdom Animalia, and the Braconidae, both of them have a wide range of host species (Matthews, 1974).

2.2 Braconidae

More than 16,000 braconid species had been described worldwide and most of them are endoparasitoids (Quicke, 2015). General biology of the braconid wasps are poorly known (Shaw and Huddleston, 1991, Quicke, 2015). In the field, the braconid wasps can be separated from the ichneumon wasps by their sizes, most of the braconids (mostly 2–6 mm) are smaller than the ichneumon wasps (mostly 6–17 mm) (Matthews, 1974). Moreover, the colours of Braconidae are brownish or black, not brightly coloured while Ichneumonidae are varies from brightly coloured, yellow to uniform black (Borrow and White, 1970). However, accurate identification requires examination of the wing venation. In Braconidae, vein 2m-cu of the fore wing is absent (this vein is present in 95% of Ichneumonidae). Vein 1/Rs+M of the fore wing is 85% present in Braconidae, but absent in all Ichneumonidae. Vein 1r-m of the hind wing is in 95% of Braconidae basal to the separation of R1 and Rs (Sharkey, 1993) (Figure 2.1). Braconids have only one recurrent vein while ichneumonids have two, resulting in a more complete wing venation (Tobias, 1967, Capek, 1970).

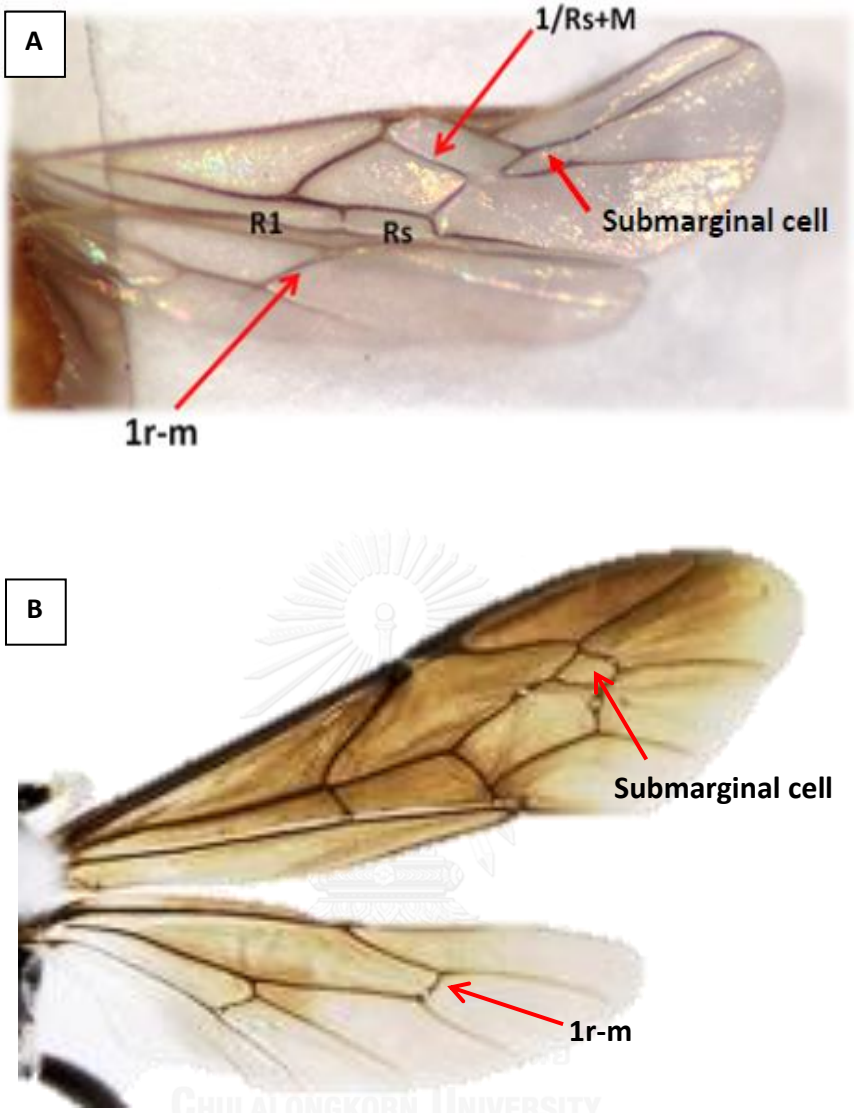


Figure 2.1 Wing of parasitic wasps. A: wing of braconid wasp, submarginal cell looks like trapezoid shape, and B: wing of ichneumon wasp, submaginal cell looks like diamond shape

Braconidae are divided into 2 major groups (non-cyclostome and cyclostome braconids) (Goulet and Huber, 1993). The diagnosis of non-cyclostomes are labrum not concave, usually sculptured, and often concealed beneath mandibles; vein m-cu of hind wing absent; spiracle of 2nd metasomal tergite usually on laterotergite. In contrast, cyclostome's labrum usually concave, smooth, and often glabrous; many

members without these attributes have exodont mandibles; hind wing with vein m-cu oftenly presented; 2nd metasomal tergum with spiracle usually on median tergite; joint between 2nd and 3rd flexible; hind wing with vein 1A and vein cu-a without spectral, never sclerotized (Goulet and Huber, 1993).

2.3 Classification and Taxonomy of Braconidae

Since 1965, eight thousands papers were published on the Braconidae, with 6,000 described species (Shenefelt, 1965). van Achterberg (1984) recognized 35 subfamilies of the Braconidae with estimated number of Braconidae range from 4,000–13,000 species worldwide. Shaw (1988) added the number of Braconid subfamilies to 39. In addition, Dolphin and Quicke (2001) predicted that there should be 15,000 out of 60,000 for the Braconidae. Sharanowski et al (2011). studied molecular phylogenetic analysis of braconid wasps and proposed number of braconid subfamilies to 47.

Braconidae had been studied in many Asian countries. For example, in Iran, first publication of Iranian braconid parasitoids published by Szépligeti (1901). Then, several species were subsequently recorded by Telenga (1936, 1941), Hedwig (1957), Hellén (1958), Mackauer (1960), Fischer (1963), Davatchi and Shojai (1969) and Starý (1974, 1975a, 1975b, 1981). Moreover, there are many studies of Iranian braconid wasps that have been conducted since 1901 (Monajemi and Esmaili, 1981, Al-e-Mansour and Mostafavi, 1993, Mojeni, 1994, Starý et al., 2000, van Achterberg and

Mehrnejad, 2002, Bagheri and Basiri, 2004, Mehrparvar et al., 2005, Dezianian and Quicke, 2006, Rakhshani et al., 2007a, 2007b, 2008a, 2008b), from these studies, 202 species from 64 genera within 19 subfamilies have been recorded (Fallahzadeh and Saghaei, 2010).

Further studies of Braconidae were performed in Vietnam by Long and Belokobylskij (2003). They reported 257 braconid species, from 21 subfamilies. In 2004, 25 new species were added, made the total number of braconids recorded in Vietnam to 282 species. Recently, Long and van Achterberg (2014) published a paper, complied the total number of braconid species from 2004 to 2014 included 210 new species. Therefore, 492 braconid species from 24 families have been discovered in this country.

van Achterberg (1983) reported a new locality of the subfamily Alysiinae, genus *Hylcalosia* Fischer, 1967 in Myanmar. Later, van Achterberg (2007) documented 4 additional new species in the subfamily Rogadinae (*Spinaria albiventris*, *S. sundana*, *S. triangulifera* and *S. vietnamica*) all of them were also collected from Myanmar.

The studies of parasitoid wasps become an interesting topic related to the biological control programmes in Thailand. Butcher and Quicke (2002) discovered a new species of *Yelicones* Cameron (*Y. siamensis*) from Chonburi Province, Thailand.

Then, Quicke and Butcher (2011) reported 2 new genera of Thai Rogadinae (*Confusocentrus panturat* and *Quasimodorogas confusus*). Butcher et al. (2012) discovered 179 new species from only one genus (*Aleiodes* Wesmael) in the title of "A turbo-taxonomic study of Thai *Aleiodes (Aleiodes)* and *Aleiodes (Arcaleiodes)* (Hymenoptera: Braconidae: Rogadinae) based largely on COI barcoded specimens, with rapid descriptions of 179 new species". Quicke (2012) estimated that the Braconidae in Thailand could be about 50-80 genera. Recently, Butcher (2014) discovered a new specie, *Yelicones samaesanensis* Butcher, 2014 from Samaesan Island, Chonburi Province.

According to the Thai's literatures, braconid species are recorded only in a few subfamilies, especially Agathidinae, Aphidiinae, and Rogadinae, they have been studied with more biological information compared to other braconid subfamilies because they are used as natural enermies in biological control progarammes.

Parasitic wasps in the subfamily Agathidinae are medium to large body sizes, 1,061 species have been described worldwide (Yu et al., 2005). Sharkey et al. (2009) reported 17 genera of Agathidinae have been recorded throughout Thailand in many Natural Parks (TIGER programme): *Agathis* Latreille, 1804; *Amputostypos* Sharkey, 2009; *Aneurobracon* Brues, 1930; *Biroia* Szpligeti, 1900; *Braunsia* Kriechbaumer, 1894; *Camptothlipsis* Enderlein, 1920; *Coccygidium* Saussure, 1892; *Cremnops* Foester, 1862; *Cremnoptoides* van Achterberg and Chen, 2004; *Disophrys* Foester, 1862;

Earinus Wesmael, 1837; *Euagathis* Szpligeti, 1900; *Gyrochus* Enderlein, 1920; *Hypsostypos* Baltazar, 1963; *Lytopylus* Frster 1862; *Therophilus* Wesmael 1837 and *Troticus* Brull, 1846.

Braconid wasps in the subfamily Apidiinae are solitary endoparasitoids of aphids (Starý, 1975b). The studies of Apidiinae fauna in Thailand are limited (Starý et al., 2010). Starý (2008) reported 460 specimens, 7 new species of Apidiinae (*Binodoxys indicus*; *Bioxys japonicus*; *Diaeretus leucopterus*; *Ephedrus lacertosus*; *Fissicaudus thailandicus*; *Indaphidius curvicaudatus* and *Parabioxys songbaiensis*) and 11 new recorded species from 11 national parks of Thailand (Doi Inthanon, Khao Kho, Khao Yai, Nam Nao, Pha Hin Ngam, Pha Taem, Phu Kradueng, Phu Phan, Phu Ruea, Tat Tone and Thung Salaeng Luang) using malaise traps and yellow pan traps to collect the specimens.

Like other wasp families, genera and/or species richness of the braconid wasps have been increasingly interested by the taxonomists. Jones et al. (2008) demonstrating the relationship between geographical distribution and a number of regional wasps, as well as indicating species identification bias that occurred within geography and wasp species. Their modeling analysis revealed that estimated number of braconid wasps worldwide could be exceeded 42,000 species but at present, about 60% have been described, and, remarkably, high proportion of undescribed species are the smaller size wasps which was outside of the temperate

zone. In addition, they also summarized that there was a bias obtaining by body size of wasps in the world regions, especially in the tropical areas of Asia and North America. This could be interpreted by many reasons, one of them is that the less abundant species has a lower opportunity to be trapped, which resulted in the lower number of specimens to study. Another reason is could be a group of bigger size had been discovered and classified, the smaller one tends to be newly described as a new species due to the smaller sizes, difficult to collect and no identification key, therefore not many people study on them. As a consequence, the significance of this work did not underpin only the species or genera diversity of the braconid wasps, but also indicated the error of geographical size-effect with regard to the insect identification which should be increasingly concerned.

It is the fact that insects are generally spending their lives during the night time (nocturnal species) which is apparently a little inconvenient for entomologists to collect. This lead to a reduction of numbers of studies and knowledge in the relevant subject of this field. Because of this reason, it could perhaps cause an error reports on the number of braconid populations (Yu et al., 2005). Despite of the difficulties, there is a possible method to collect the specimens using the light trap which would attract the nocturnal insects, the light traps are efficient and easy to operate (Casey, 1981). Benefits of being nocturnal species are obvious, such as a

better ability to search for their hosts at night (Gauld and Huddleston, 1976), or an ability to avoid being prey by birds (Basset and Springate, 1992).

2.4 Light trap

Light source from UV light bulbs and lunartone affect several nocturnal insects, such as moths, some beetles, ants and parasitic wasps (Wagner and Kurina, 1997). Nevertheless, the capability of the light trap depended on the types of the light sources that were specific to the visible wave length of the insect species (Nabli et al., 1999). High diversity and abundance of braconids are usually collected by the light trap (Akhtar et al., 2010).

2.5 Braconidae keys

Braconidae was erected by C. G. Nees von Esenbeck (1811), since then there have been many published identification keys to the subfamilies. The first key was created by Förster (1862) and going recognized as subfamilies from families. Most keys to the subfamilies of Braconidae were made for each geographic region. Whenever the new phylogenetic hypotheses are discovered, classification of the braconid are sometime changed, therefore, the new identification keys should be produced to accommodate all of these new species and replacement taxonomic. Identification keys are very important for each specific region. The keys to subfamilies in the tropical countries, including Thailand, are very limited and a general lack of identification keys. The illustrated key to the subfamilies of the Braconidae that was

designated by van Achterberg (1993) had become the well-suited model for this thesis because the key is the most recent update and the most accurate.

2.6 Samaesan areas

Samaesan area locates at Sattahip district, Chonburi province, in the Eastern Thailand. It belongs to the Plant Genetic Conservation Project under the Royal initiation of Her Royal Highness Princess Maha Chakri Sirindhorn (RSPG) which is managed by the Royal Thai Navy Seal (RTN). These areas consist of Khao Ma Cho (mainland) Samaesan, Chuang, Raet, Chorakhe, Kham, and Chan Islands. Climate condition at each island of Samanesan archipelago is more or less the same. The factors affect types of vegetations are rocks, sand, nutrients, and area altitude. There is a report by Buaglum (2009) that littoral perennial plant, mangrove, littoral dry evergreen forest, cliff plants, and secondary forest are dominant vegetations in all these islands. The variety of habitat types could result in a diversity of wasp species around this area and importantly, there is no report of the parasitic wasps in these areas, so all data obtained would be new.

CHAPTER III
MATERIALS AND METHODS

3.1 Study sites

Field works were carried out at Samaesan Islands and the surrounded areas at Sattahip district, Chonburi province which located in the Eastern Thailand (Figure 3.1). This area belongs to the Plant Genetic Conservation Project under the Royal initiation of Her Royal Highness Princess Maha Chakri Sirindhorn (RSPG). The area is an ecotone of lands and sea in the gulf of Thailand. The ditches between the islands are different in depth and width and the velocity of water flow in each ditch. Typically, Samaesan area consists of many islands such as Samaesan, Raet, Chorakhe, Kham, Chuang and Chan Islands and one mainland called Khao Ma Cho (Figure 3.2). The study areas are divided into two parts: 1) the mainland (Khao Ma Cho) and 2) islands areas (Samaesan and Chuang Islands).

3.1.1 Khao Ma Cho

Khao Ma Cho (12° 36′ 9″ N, 100° 57′ 21″ E) is the mountainous terrain with the area of 0.03 km^2 in which Thai Island and Sea Natural History Museum is located. South side of this mountain connects with the sea. The plant communities in this area are littoral dry evergreen forest and secondary forest.

Figure 3.1 Map of Thailand showing Sattahip District, Chonburi Province (http://www.weather-forecast.com/locations/Sattahip).

3.1.2 Samaesan Island

Samaesan archipelago (12° 36′ 58″ N, 100° 55′ 14″ E) is the largest island of the Samaesan Islands and is one of the most popular tourist attractions in the east coast of Thailand, with the area of approximately 5 km^2. The island is situated 1.3 kilometers from the mainland. Samaesan Island consists of 2 mountains: the bigger mountain 167 meters height and the smaller mountain 159 meters height. Plantations in this area are stand vegetation, mangrove vegetation, littoral dry evergreen forest, cliff vegetation and secondary forest.

3.1.3 Chuang Island

Chuang Island (12° 31′ 22″ N, 100° 57′ 18″ E) is the farthest island in the Samaesan archipelago, the area is about 1.2 km^2. Tourists are not allowed on this island. It is located approximately 14 kilometers from the mainland. The sea around this island is very deep. Vegetations in this island are stand vegetation, littoral dry evergreen forest, cliff vegetation and secondary forest.

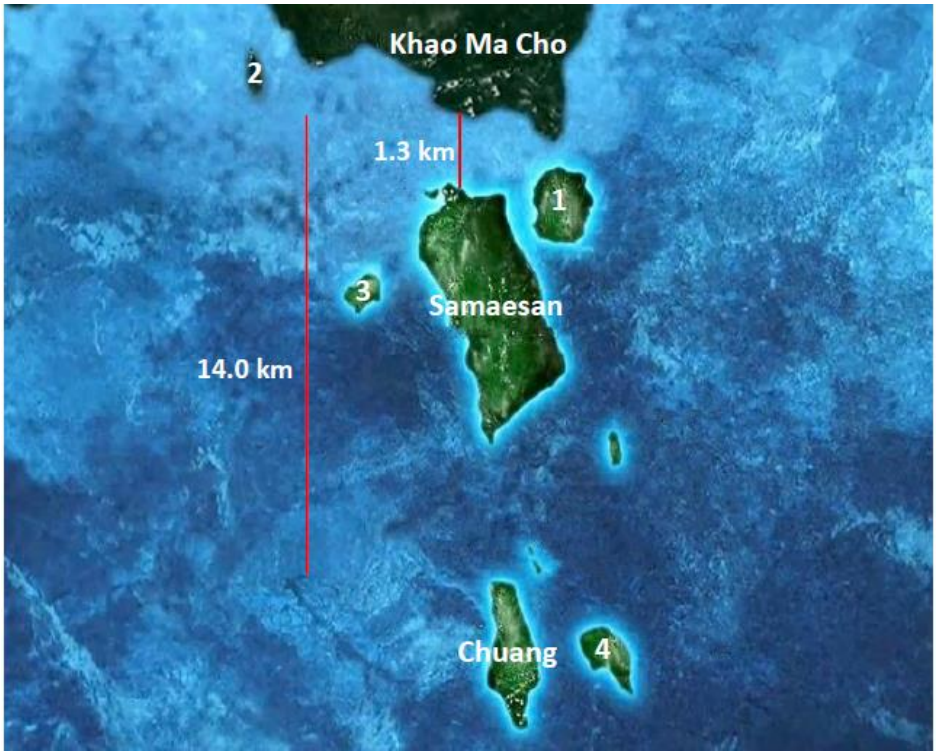


Figure 3.2 Map of Samaesan area: Khao Ma Cho, Samaesan, Chuang Islands (1) Raet Island, (2) Chorakhe Island, (3) Kham Island, and (4) Chan Island. (https://www.youtube.com/watch?v=-umCuwzoKu8)

3.2 Plant communities at samaesan islands

Climate in the Samaesan archipelago is more or less similar in each island, therefore the factors affect types of vegetations in the Samaesan archipelago are rocks, sand, minerals and height of the area. Plants are littoral vegetations which are stand vegetation, mangrove vegetation, littoral dry evergreen forest, cliff vegetation and secondary forest.

3.2.1 Stand vegetation

Stand vegetation is divided into 2 types, sand and rock stands. This vegetation can be found on the sand and/or rock beaches. *Sporobolus diander* is the common vegetation (Figure 3.3).

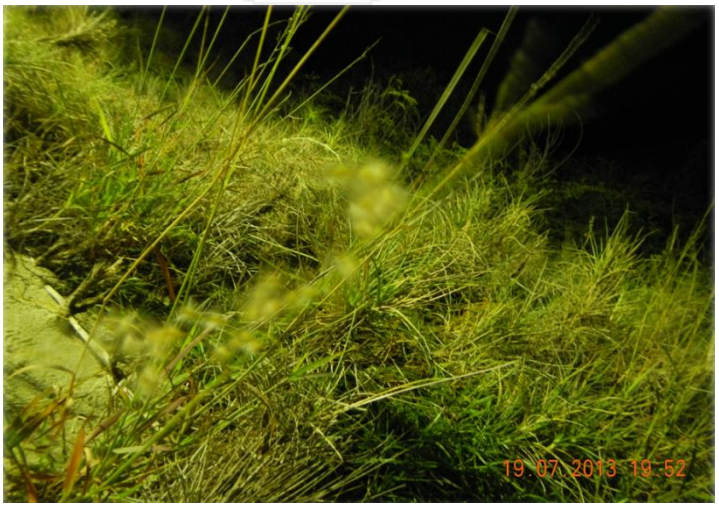


Figure 3.3 *Sporobolus diander* (Retz.) P. Beauv. on the sandy beach.

3.2.2 Mangrove vegetation

Coastal vegetation on the Samaesan archipelago is not a complete mangrove forest (manmade mangrove) due to the ditch in this island is too small for the sedimentation of clays (Figure 3.4). The dominant plants found in this forest are *Sonneratia caseolaris*.

Figure 3.4 *Sonneratia caseolaris* (L.) Engl. (http://www.oknation.net)

3.2.3 Littoral dry evergreen forest

This type of vegetations is the dominant type of the forests which can be found in every island of the Samaesan archipelago, with approximately 1,000 – 1,500 mm annual rainfall.

Figure 3.5 Example of littoral dry evergreen forest found at Chuang Island.

3.2.4 Cliff vegetation

This type of vegetation is found in all cliffs of the Samaesan archipelago. The plants grow on sand with wedged between the rocks on the cliff. The dominant plant is *Flacourtia indica* (Figure 3.6).

Figure 3.6 *Flacourtia indica* (Burm. f.) Merr.

(http://commons.wikimedia.org/wiki/File:Flacourtia_indica_03.JPG)

3.2.5 Secondary forest

This type of forest is normally found in the disturbed area by human activities or natural causes such as fire, wind throw and water fall. After the major disturbance, the plants are re-grown in the area (Figure 3.7). *Senna garrettiana* is the dominant plant in this forest (Figure 3.8).

Figure 3.7 The secondary forest found at Samaesan Island.

Figure 3.8 *Senna garrettian*a (Craib) Irwin and Garneby (http://www.pharmacy.mahidol.ac.th/siri/index.php?page=search_detail&medicinal_id=163)

3.3 Collecting methods

Black light trap and 2 mobile bucket light traps were used to collect the nocturnal braconid wasps between 18:00 – 22:00 every 2 months for 13 months (7 times in total) started from September 2013 – September 2014. The study sites were located at the Khao Ma Cho, Samaesan and Chuang Islands.

3.3.1 Black light trap

This trap is used for collecting nocturnal insects by light attraction (Wagner and Kurina, 1997). Insects have a phototaxis which is a mechanism in organism to makes them react to the light. Black light trap consists of (1) screen for insect resting made from the white fabric (3x2 m^2) (Figure 3.9), (2) two tubes of UV black light bulbs for attracting insects and (3) lunartone (250 watts) uses for attracting insects from long distance to the screen (Figure 3.10). The trap was set before the sunset (the sunset time is varied each day, therefore the black light trap was usually set up at 5:00 PM), the front site of the trap was faced toward the forests. Samples were preserved in 95% ethanol (Figure 3.11). Time for collecting the specimens started from 18:00 to 22:00 (4 hours in total). In case of no electricity in some study areas such as at Samaesan and Chuang Islands, an electric generator power (Yamano YM 900M) was used to produce electric current (Figure 3.12).

Figure 3.9 Insects are resting on the screen (white fabric)

Figure 3.10 Black light trap were setting up; (1) white fabric, (2) black light bulbs and (3) lunartone

Figure 3.11 Specimens were preserved in 95% ethanol.

Figure 3.12 An electric generator power using in the field works.

3.3.2 Mobile bucket light traps

These traps also used to collect nocturnal insects same as the black light trap but traps are suitable for setting in the place where black light trap cannot be set up, such as the top of the rock, the grassland and on the beach. Mobile bucket light trap (Figure 3.13) consists of (1) a plastic tank (25x25x20 cm^3) (Figure 3.14A) containing the mixing of dishwashing liquid and water, (2) Screen for insects holding made from two polypropylene sheets (Figure 3.14B) which put on top of the plastic tank, (3) two LED black long light bulbs (110 V) (Figure 3.14C) were place on the screen and (4) two batteries (6 V) connected with the serial of electrical circuit for producing electric current for the trap (Figure 3.14D). Two mobile bucket light traps were placed 300 m away from the black light trap and 300 m (Figure 3.15).

Figure 3.13 Mobile bucket light trap in the light interference area (left) and in the dark area (right).

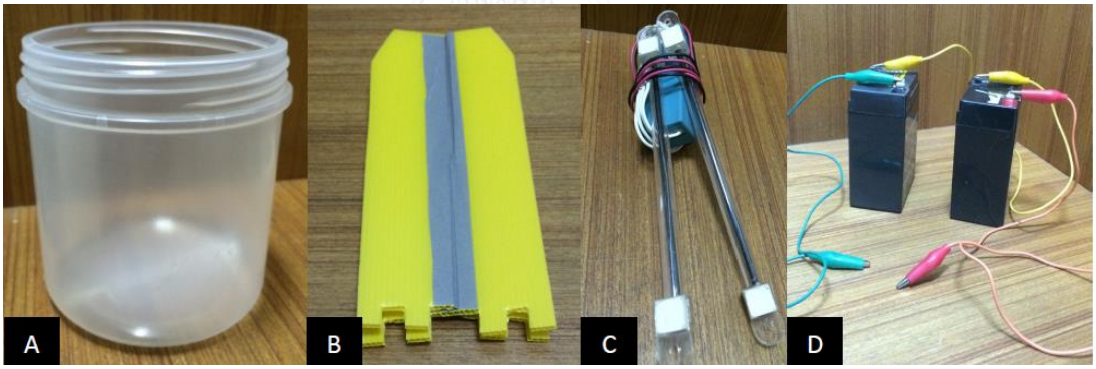


Figure 3.14 Materials for making mobile bucket light trap. (A) a plastic container, (B) a plastic screen, (C) two LED black long light bulbs and (D) two batteries

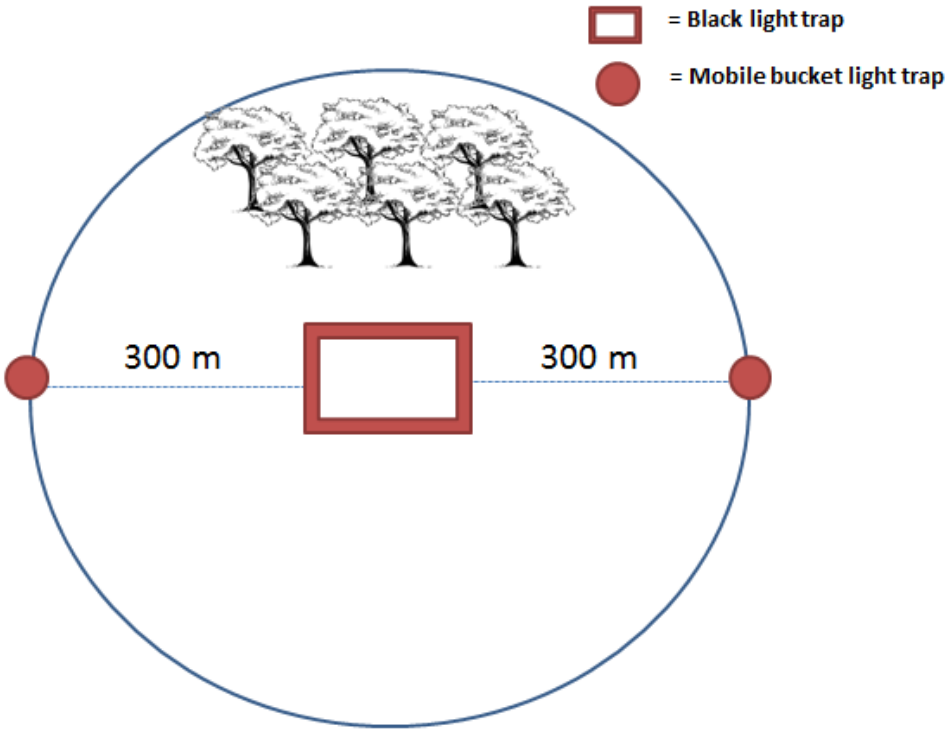


Figure 3.15 Diagram shows the mobile bucket light traps placed away from the black light trap and 300 m on both side.

3.4 Taxonomic methods

The morphological terms used in this thesis followed Achterberg (1993) (Figure 3.16) and Quicke (2015) (Figure 3.17).

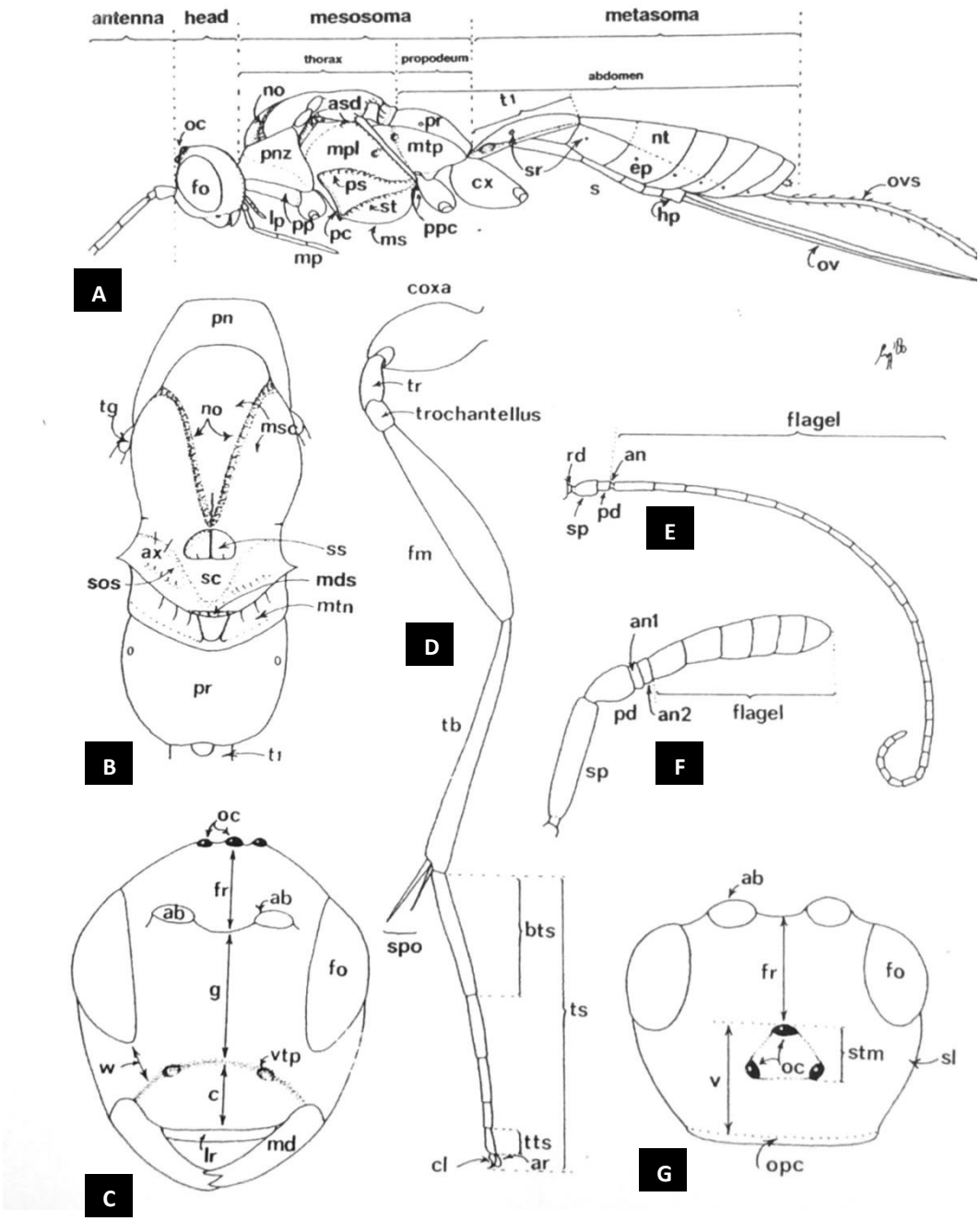


Figure 3.16 Morphology of parasitic wasp. (A) body, (B) mesosoma; dorsal aspect, (C) head; frontal aspect, (D) leg, (E, F) antenna, (G) head; dorsal aspect. Abbreviation: ab = base of antenna, an = anellus, ar = arolium, asd = anterior subalar depression, ax = axilla, bts = basitarsus, c = clypeus, cl = tarsal claw, cx = coxa, ep = epipleuron (or latero-tergite), flagel = flagellum, fm = femur, fo =eye, fr = frons, g =face, hp = hypopygium, lp = labial palp, lr = labrum, md = mandible, mds = medio-posterior

depression of scutellum, mp = maxillary palp, mpl = mesopleuron, ms = mesosternum, msc = mesoscutum, mtn = metanotum, mtp = metapleuron, nt = notum, no = notauli, oc = ocelli, opc = occipiral carina, ov = ovipositor, ovs = ovipositor sheath, pc = prepectal carina, pd = pedicellus, pn = pronotum, pnz = side of pronotum, pp = propleuron, ppc = postpectal carina, pr = propodeum, ps = precoxal sulcus, rd = radix, s = sternite, sc = scutellum, sl = temple, sos = side of scutellum, sp = scapus, spo = spurs, sr = spiracle, ss = scutellar sulcus, st = sternaulus, stm = stemmaticum, t = tergite (t1 = first tergite), tb = tibia, tg = tegula, th = thorax, tr = trochanter, ts = tarsus, tts = telotarsus, v = vertex, vtp = anterior tentorial pit, w = malar space (van Achterberg, 1993)

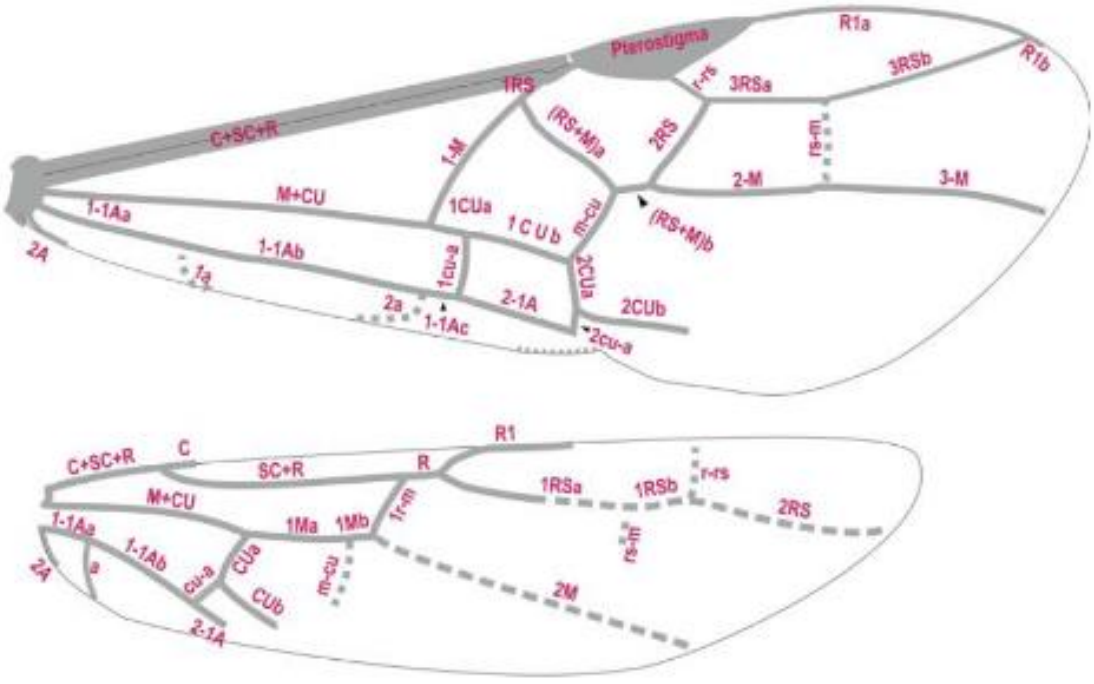


Figure 3.17 Terminology of wing venation according to the modified Comstock-Needham system as applied by Sharkey and Wharton (1997) with the longitudinal vein elements indicated by capital letters (C, costa; SC, subcostal; R, radius; SR, sector radialis; M, medius; CU, cutitus; A, anal. (Quicke, 2015)

3.4.1 Sorting the specimens

Insect specimens collected from the field were sorted at the Integrative Ecology laboratory for only the braconid wasps under the stereo microscope (Olympus SZ60). The ants and braconid wasps are very similar in theirs morphology but ants have petiole on first metasomal tergite which cannot be found in the wasps (Figure 3.18). Specimens were placed in the petri dish (Figure 3.19) and were sorted out only for the braconid wasps by looking at its wing venations; forewing of braconid wasps without vein 2m-cu and/or with Rs+M and second submarginal cell that look like trapezoid shape, hindwing with vein 1r-m arising basal to the R and RS split show in Figure 3.20.

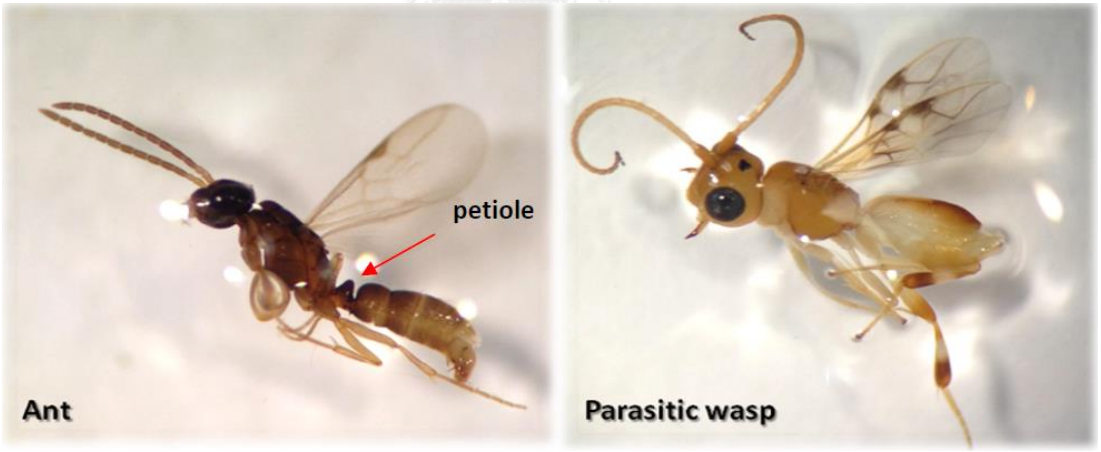


Figure 3.18 Light micrograph shows the difference between an ant and a parasitic wasp, petiole (arrow) is a unique character found in ant but no in the parasitic wasp.

Figure 3.19 Insects were placed on the petri dish for sorting.

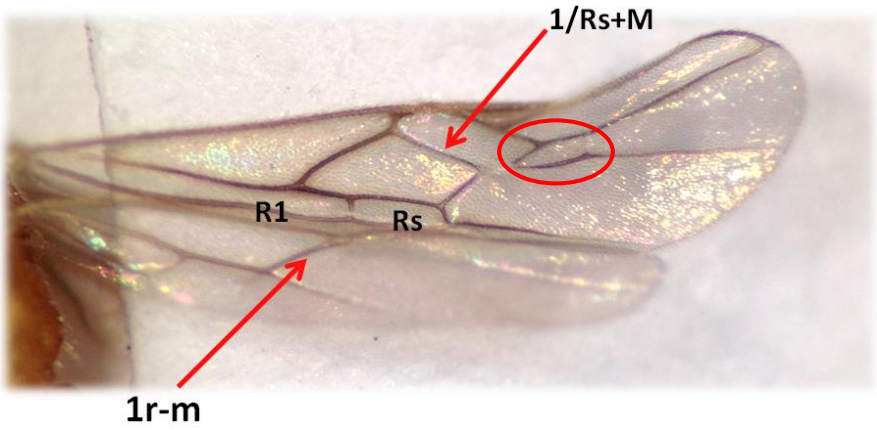


Figure 3.20 Wing venations of braconid wasps. Cell in the red circle is the second submarginal cell in trapezoid shape.

3.4.2 Mounting the specimens

This method is for small insects, it can protect the fragile parts of the insect such as antennae, legs and wings from breaking. Specimens were mounted on one side of the small rectangle paper (14x5 millimeters) using saccharine glue and insert

insect pin (No.5) in another side of the same rectangle paper (Figure 3.21). Then give the label and voucher numbers for every specimen.

Figure 3.21 The specimen was mounted on the small rectangle paper with the label.

3.4.3 Identification and classification

The specimens were identified using keys by Baltazar (1962), van Achterberg and Ortega (1983), Quicke (1987), van Achterberg (1993), Dowton et al. (1998), van Achterberg and Braet (2001), Yu et al. (2005), Belokobylskij et al. (2007), Sharkey et al. (2009), Edmardash et al. (2011) and Butcher et al. (2012) to distinguish the braconid wasps from the others. The characters used for identification are head, thorax, abdomen, wings, and notum (Figure 3.22). The specimens will be stored in the Insect museum, Museum of Natural History, Chulalongkorn University (CUMZ).

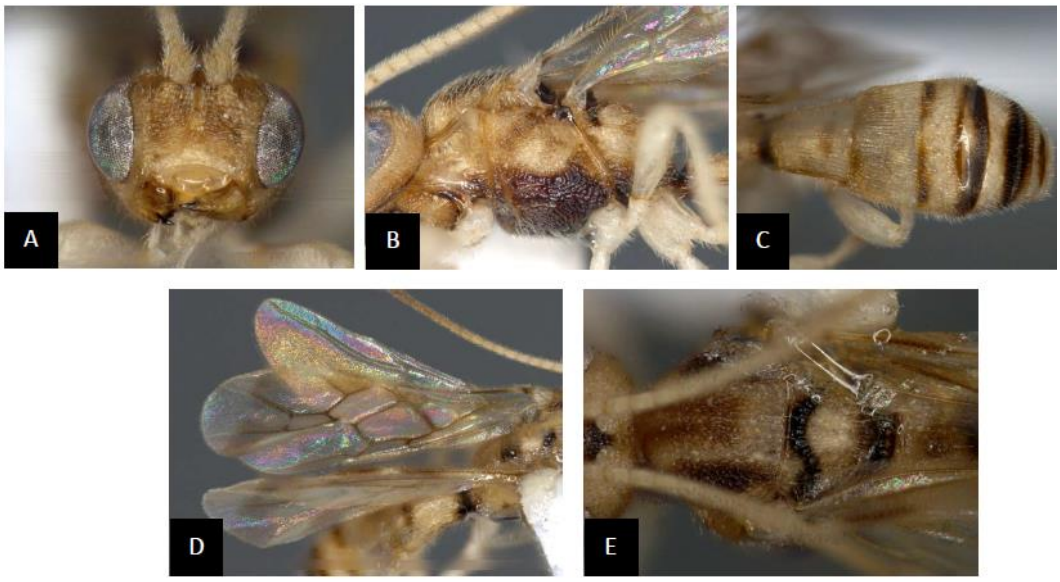


Figure 3.22 The characters used for identification; (A) head, (B) thorax, (C) abdomen, (D) wings and (E) notum (Butcher, 2014).

3.4.4 Photograph the specimens

The specimens were photographed under the stereo microscopes (Olympus SZX16) by Cell^D program. The program is worked by photographing the insect from the top to the end point of specimen with many pictures, then merged all of the pictures together to get one clear photo.

3.4.5 Description

In case of new species discovered in this study, the characteristics of nocturnal braconid wasps were described. The specimens were named according to the ICZN.

3.5 Database

Created the database of all nocturnal braconid wasp specimens collected from this study (Appendix I).

3.6 Data analyses

3.6.1 Sorensen coefficient of similarity

Calculate Sorensen coefficient of similarity (Jackson et al., 1989) of nocturnal braconid wasps in each area, in order to evaluate similarity and difference nocturnal braconid wasps in the study sites.

The Sorensen similarity indices represent variations over 3 parameters: species composition of each site and the species shared between the 2 study sites (Jackson et al., 1989, Novotny and Weiblen, 2005). The Sorensen similarity index measures similarity in the species composition for 2 sites, A and B, follow by the equation:

$$C_{AB} = 2ab / (a+b)$$

Where C_{AB} is Sorensen similarity index between sites A and B; *a* is the number of species found in site A; *b* is the number of species in site B and *ab* is the number of species shared by the two sites.

3.6.2 Species richness

Calculate species richness of all braconid wasps in order to evaluate species richness in the field study areas.

Chao (2005) proposed a non-parametric estimator for specie richness that takes form:

$$S = S_{obs} + (a^2 / 2b)$$

Where S is species richness; S_{obs} is the total number of species observed in this study; *a* is the number of species observed just one specimens (singleton) and *b* is the number of species observed just twice specimens (doubleton).

The idea behind the estimator is that if a community is being sampled, and rare species (singleton) are still being discovered, there is likely still more rare species not found; same as the species that are recovered at least twice (doubleton), there is likely no more species to be found (Chao, 2005).

CHAPTER IV
RESULTS AND DISCUSSION

From this study, a total of 652 specimens of the braconid wasps have been collected from Khao Ma Cho, Samaesan and Chuang Islands, they were classified into 17 subfamilies, 175 morphospecies.

Among these 3 study sites, Samaesan Island has the highest number of collected specimens and morphospecies (300 individuals, 100 morphospecies), followed by Khao Ma Cho (242 individuals, 91 morphospecies) and Chuang Island (100 individuals, 70 morphospecies), respectively (Table 4.1). Samaesan Island is the largest area among the 3 study sites, with 5 km^2 and diverse habitats, these could lead to the highest number of braconid wasps recorded from this area. In contrast, Chuang Island is a rather small island (1.2 km^2) and the smallest area among the 3 study sites as well as the farthest island (14 km) from the mainland in the Samaesan archipelago. Moreover, Samaesan Island has many more habitats such as stand vegetations, mangrove vegetations, littoral dry evergreen forests, cliff vegetations and secondary forests whereas the habitats found at Khao Ma Cho and Chuang Islands are less uniform compared to the Samaesan Island.

4.1 Performance of trap

This research used 2 types of traps to collect the specimens: a black light trap and 2 mobile bucket light traps. Most of the samples (99.2%) were collected by

the black light trap and less than 1% of the samples were collected by the mobile bucket light traps. Black light trap can collected every subfamilies reported in this thesis, while only subfamilies Braconinae, Doryctinae and Rogadinae can be collected from the mobile bucket light traps may be due to the small size of the mobile bucket light traps with the small light bulbs that were not powerful enough. Moreover, light from the mobile bucket light traps was produced from only black light but, in the black light trap, light was produced from both lunartone and black light bulbs.

Table 4.1 Number of subfamilies, species and specimens of the nocturnal braconid wasps collected from each study site during September 2013 – September 2014

Study sites	Subfamilies	Number of species	Number of specimens
Khao Ma Cho	13	91	242
Samaesan Island	17	100	300
Chuang Island	12	70	110

4.2 Subfamilies of braconid wasps found in this study

Only 3 study sites at Sattahip district, Chonburi province, 17 subfamilies (out of 47 subfamilies worldwide) of the braconid wasps are discovered in this study during the short period of time (September 2013 – September 2014). These subfamilies are Agathidinae, Alysiinae, Braconinae, Cheloninae, Doryctinae, Euphorinae, Helconinae, Hormiinae, Lysiterminae, Macrocentrinae, Meteorideinae, Microgastrinae, Opiinae, Orgilinae, Pambolinae, Rhysipolinae and Rogadinae (Table

4.2). Twelve subfamilies (Alysiinae, Braconinae, Cheloninae, Doryctinae, Euphorinae, Hormiinae, Lysiterminae, Microgastrinae, Orgilinae, Pambolinae, Rhysipolinae and Rogadinae) were found in all study sites (Figure 4.1). Subfamilies Agathidinae, Helconinae, Macrocentrinae and Meteorideinae have been recorded only from the Samaesan Island because of various habitats lead to more diversity of the hosts. Subfamily Opiinae was found only from Khao Ma Cho and Samaesan Island, from the field survey there were a large number of fruit flies in these areas, which are hosts of these parasitoids. On the other hand, lack of fruit flies may affect disappearance of these wasps in Chuang Island.

In this study, 8 subfamilies of the non-cyclostomes (Agathidinae, Cheloninae, Euphorinae, Helconinae, Macrocentrinae, Meteorideinae, Microgastrinae and Orgilinae) and 9 subfamilies of the cyclostome braconid wasps (Alysiinae, Braconinae, Doryctinae, Hormiinae, Lysiterninae, Opiinae, Pambolinae, Rhysipolinae and Rogadinae) have been discovered.

Table 4.2 Check list of the braconid wasp subfamilies recorded from Khao Ma Cho, Samaesan and Chuang Islands

Subfamilies	Khao Ma Cho	Samaesan Island	Chuang Island
Agathidinae	-	✓	-
Alysiinae	✓	✓	✓
Braconinae	✓	✓	✓
Cheloninae	✓	✓	✓
Doryctinae	✓	✓	✓
Euphorinae	✓	✓	✓
Helconinae	-	✓	-
Hormiinae	✓	✓	✓
Lysiterminae	✓	✓	✓
Macrocentrinae	-	✓	-
Meteorideinae	-	✓	-
Microgastrinae	✓	✓	✓
Opiinae	✓	✓	-
Orgilinae	✓	✓	✓
Pambolinae	✓	✓	✓
Rhysipolinae	✓	✓	✓
Rogadinae	✓	✓	✓

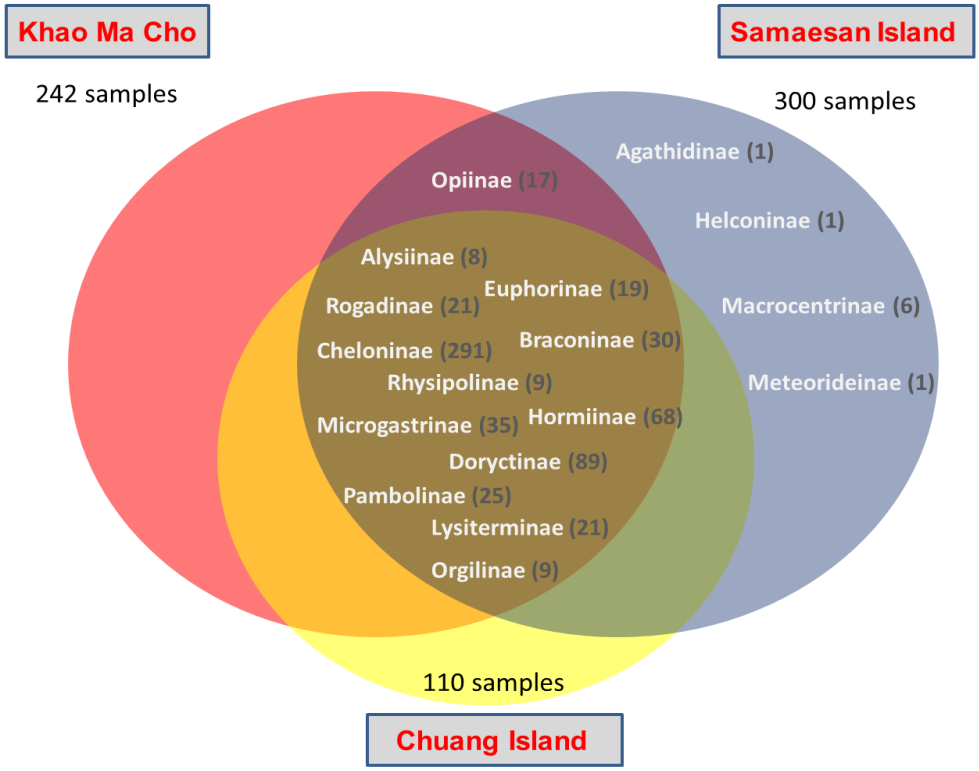


Figure 4.1 Venn diagram of braconid subfamilies recorded from Khao Ma Cho, Samaesan and Chuang Islands, (n) = number of individuals

1. Subfamily Agathidinae

Agathidinae Haliday, 1833 (Sharkey et al., 2006)

Distribution: cosmopolitan

Life history: koinobiont endoparasitoids

Host: Lepidoptera

Diagnosis: fore wing with cell 1Rs small or absent, with last abscissa of vein Rs close to stigma such that cell 2R1 narrow, wing fold between prestigma and vein 1/Rs (Figure 4.2); gena and mouthparts sometime elongate; occipital carina absent; body length about 6–10 mm.

Agathidinae is a moderately large group of braconid wasps, approximately 2,000 species and 50 genera have been recognized, but most of these have not been described (Sharkey et al., 2009). They can be found in terrestrial habitats worldwide, koinobiont endoparasitoids of lepidopteran larvae (Sharkey et al., 2006). They can be nocturnal or diurnal depending on the species. Generally, Agathidinae are solitary parasitoids, attack 1st instar lepidopteran larvae in hidden microhabitats such as leaf-rolls and stems. Then, they eclosed and emerged from the last larval instar. Their life histories have been conducted for a few species and some of them have been used in biological control programme (Janzen and Gámez, 1997). Eighteen genera are recognized in Thailand and the neighbouring countries (Sharkey et al., 2009). In Thailand, 20 species have been recorded (Sharkey and Clutts, 2011).

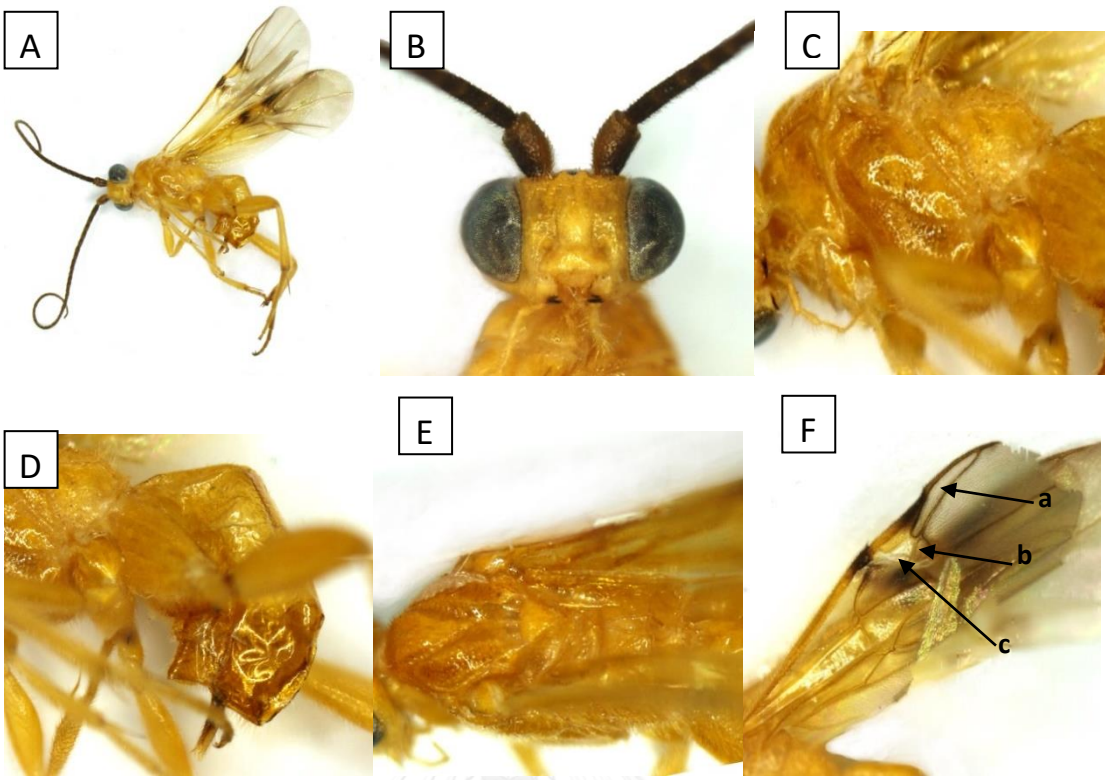


Figure 4.2 Light microscope photograph of the braconid wasp, *Coccygidium mastigion*: A, whole body; B, face; C, lateral part of mesosoma; D, lateral part of metasoma; E, dorsal view of mesosoma and F, Fore wing (a, cell 2R1; b, cell 1Rs and c, wing fold)

Only a single species of Agathidinae, *Coccygidium mastigion* Sharkey, 2011 (Figure 4.2) had been collected from the Samaesan Island in September 2013. Most of Agathidinae found in Thailand were discovered at mixed deciduous forests (Sharkey and Clutts, 2011) therefore the number of Agathidinae found in this study is limited because of the difference of flora and fauna found in the study area.

2. Subfamily Alysiinae

Alysiinae Leach, 1815 (Ghahari et al., World bibliography of the family Baraconidae (Hymenoptera: Ichneumonoidea) (1964-2003), 2006)

Distribution: cosmopolitan

Life history: koinobiont endoparasitoids

Host: Diptera

Diagnosis: mandibles exodont, not touching when closed; epicnemial carina absent; occipital carina absent; hind wing with vein 2m-cu; Body length 2.7–3.0 mm (Figure 4.3)

The Alysiinae are koinobiont endoparasitoids of cyclorrhaphous Diptera (Shaw and Huddleston, 1991) with broad exodont mandibles, occipital and epicnemal carinae absent (Wharton, 1997, 2002). Approximately 2,000 species, 104 genera, are distributed worldwide (Yu et al., 2012).

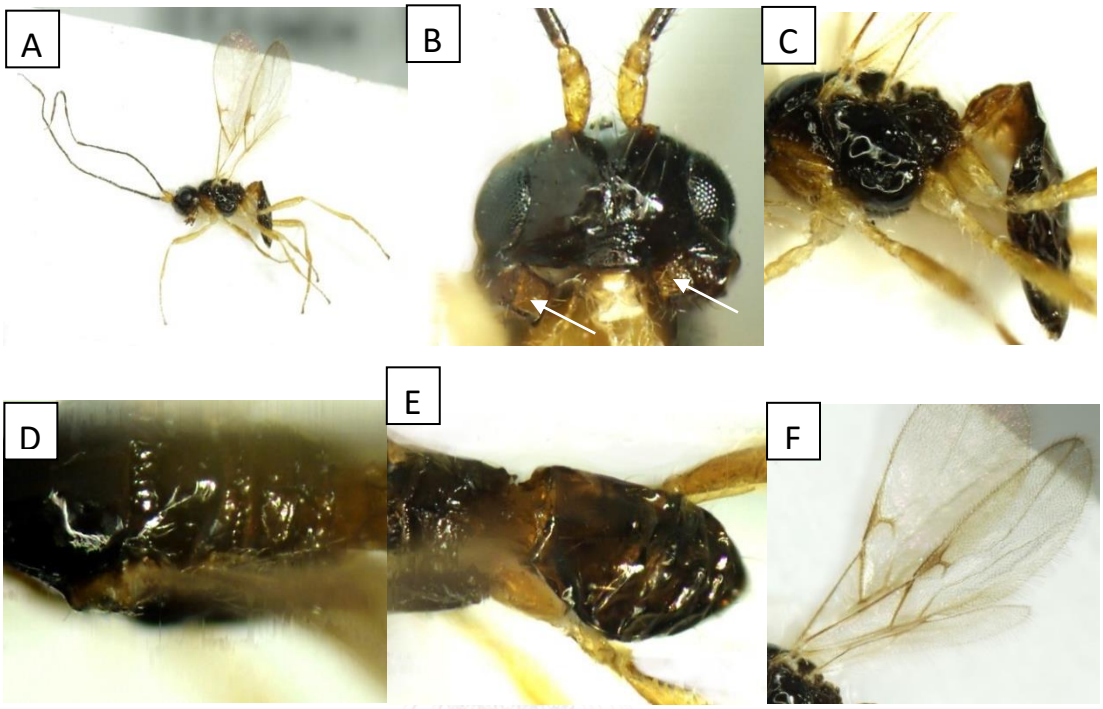


Figure 4.3 Light microscope photograph of a braconid wasp subfamily Alysiinae: A, whole body; B, face (white arrows indicate exodont mandibles); C, lateral view of mesosoma and metasoma; D, dorsal view of mesosoma; E, dorsal view of abdomen and F, wings

Six morphospecies (8 specimens) were recorded from the study areas: Khao Ma Cho (3 specimens), Samaesan Island (4 specimens) and Chuang Island (1 specimen). Only a single morphospecies, *Orthostigma* Ratzeburg, 1844, can be identified to the genus level, another 5 morphospecies are unidentified (Table 4.3).

Orthostigma are parasitoid of fly in the family Phoridae, and their hosts are usually participatory with fungi (Wharton, 1997, Yu et al., 2005). This genus is closely related to the genus *Aspilota* Foerster. They can be separated by thickened stigma at

fore wing (Marshall, 1891, 1894) and broad, scoop-like ventral teeth of mandible (Fischer, 1969) which presented in *Orthostigma* Ratzeburg. Morphological characters of *Orthostigma* are shown in Figure 4.4.

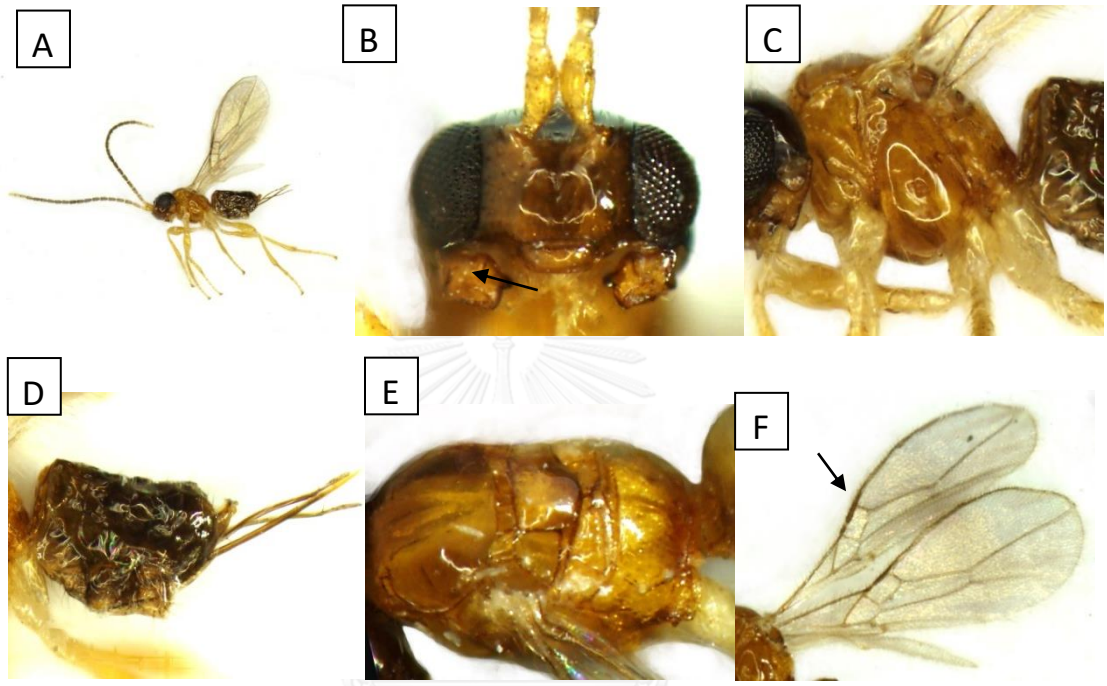


Figure 4.4 Light microscope photograph of *Orthostigma*: A; whole body, B; face (arrow indicates exodant-like mandible), C; lateral view of mesosoma, D; lateral view of metasoma, E; mesosoma and F; fore wings (arrow indicates thickened stigma)

There are eight specimens recored from this study. Only a single specimen could be indentified to the genus *Orthostigma* because its morphological characters: body colour pattern and body size are agreed with the identification key (van Achterberg and Ortega, 1983). The rest of the specimens (7 individuals) were unable to identify to the species level. Unknown species 1–5 were shown in Figure 4.5.

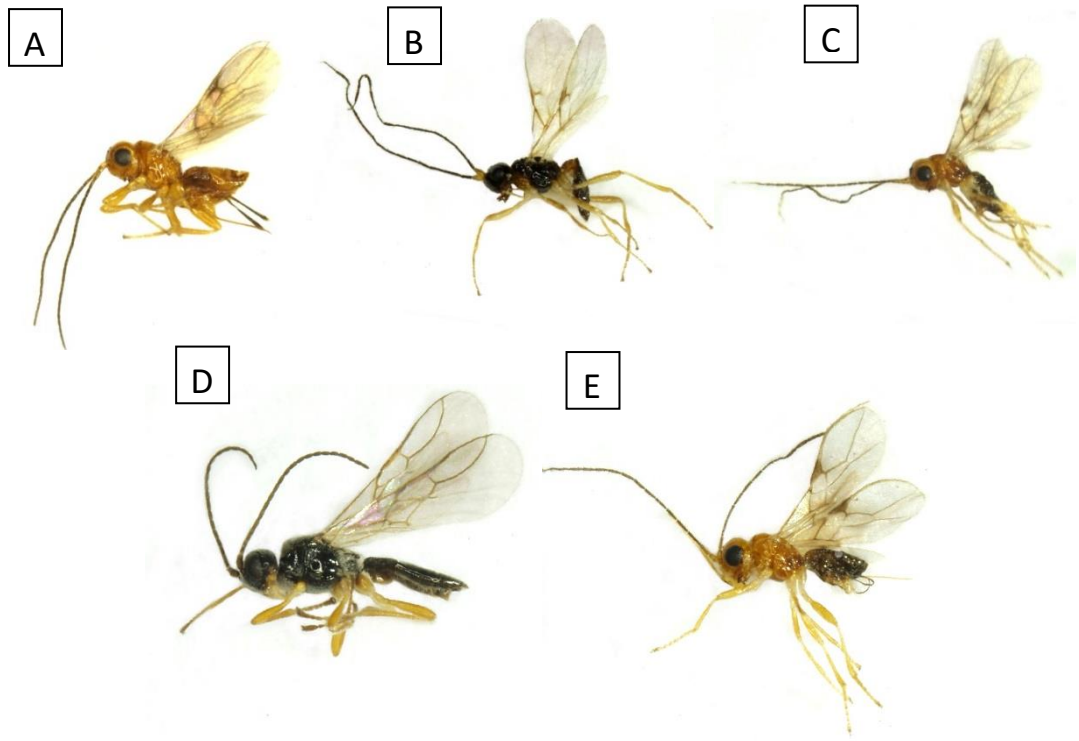


Figure 4.5 Light microscope photograph of the unknown Alysiinae: A, unknown sp. 1; B, unknown sp. 2; C, unknown sp. 3; D, unknown sp. 4 and E, unknown sp. 5

Table 4.3 Number of Alysiinae specimens collected from Khao Ma Cho, Samaesan and Chuang Islands

Species	Number of specimens collected from each study site (individuals)			Total
	Khao Ma Cho	Samaesan Island	Chuang Island	
Orthostigma sp.	-	1	-	1
Unknown sp. 1	-	1	1	2
Unknown sp. 2	1	1	-	2
Unknown sp. 3	1	-	-	1
Unknown sp. 4	-	1	-	1
Unknown sp. 5	1	-	-	1
TOTAL	3	4	1	8

3. Subfamily Braconinae

Braconinae Nees, 1811 (Belokobylskij and Žikić, 2009)

Distribution: cosmopolitan

Life history: mostly idiobiont ectoparasitoids, except for *Aspidobracon* are endoparasitoids

Host: Lepidoptera, Coleoptera, Diptera, Hymenoptera

Diagnosis: labrum concave; occipital carina absent; epicnemial carina absent; hind wing with vein 1/M at least twice as long as M+Cu; body length 2.3–15 mm (Figure 4.6).

The Braconinae is a large subfamily; with more than 2,000 species have been described worldwide (Quicke, 1987, 2015). Most species are brightly coloured; blackish and/or partly orange insects, belong to the genus *Bracon*. Braconinae are easily separated from other subfamilies by having a strongly emarginate clypeus (hypoclypeal depression).

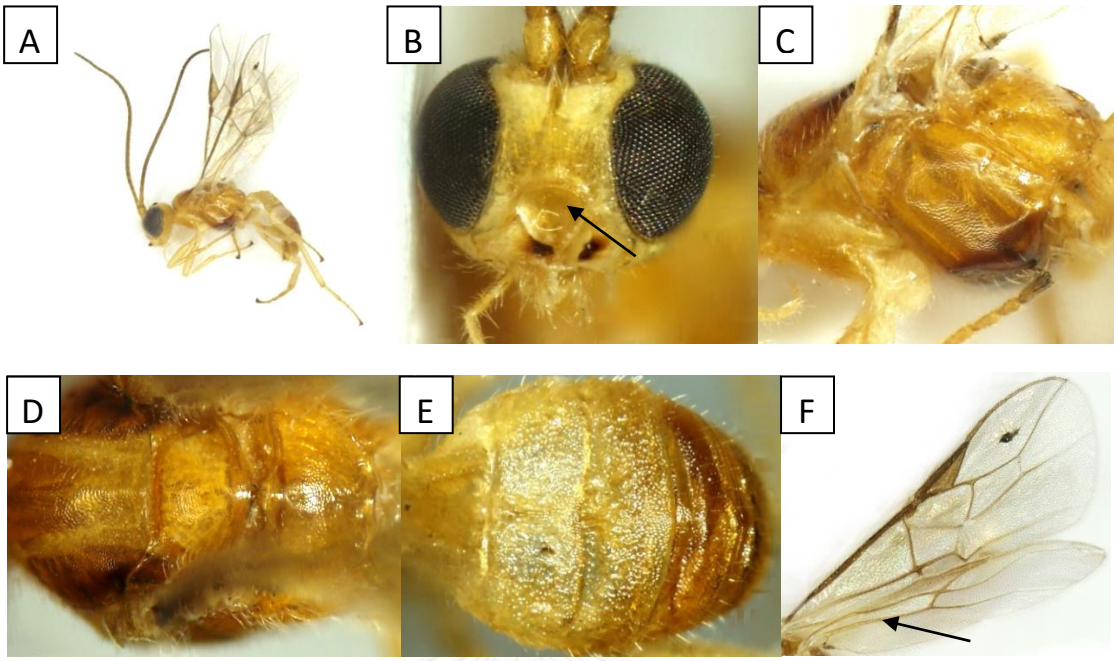


Figure 4.6 Light microscope photograph of braconid wasp subfamily Braconinae: A, whole body; B, face (black arrow indicates concave labrum); C, lateral view of mesosoma; D, dorsal view of mesosoma; E, dorsal view of 1st and 2nd metasomal tergites and F, fore and hind wings (black arrow indicates vein 1/M)

In total, thirty specimens, sixteen species (4% of the total specimens) of Braconinae were collected at Khao Ma Cho (5), Samaesan Island (11) and Chuang Island (14) (Table 4.4). All of these specimens were members of the genus *Bracon* Fabricius, 1804 (Figure 4.7 and 4.8).

Bracon is the largest genus of the subfamily Braconinae with, approximately 800 species worldwide (Fahringer, 1927). Most of the *Bracon* have blackish or brightly orange colour. Due to *Bracon* are highly diverse both in number and species, Tobias (1971) and Fahringer (1927) divided the *Bracon* into 4 subgenera (Quicke, 1987). Characteristics of *Bracon* are face without raised median area and sublateral carinae

extended from clypeus to antennal sockets; basal flagellomeres more or less cylindrical; fore wing vein 3-SR more than 1.6x length of vein r; sclerotized part of median tergite of 1st matasomal segment less than 2.5x longer than medial width; posterior part of propleuron without longitudinal carina (Quicke, 1989).

Figure 4.7 Light microscope photograph of the *Bracon*: A, *Bracon* sp. 1; B, *Bracon* sp. 2; C, *Bracon* sp. 3; D, *Bracon* sp. 4; E, *Bracon* sp. 5; F, *Bracon* sp. 6; G, *Bracon* sp. 7; H, *Bracon* sp. 8; I, *Bracon* sp. 9; J, *Bracon* sp. 10; K, *Bracon* sp. 11 and L, *Bracon* sp. 12

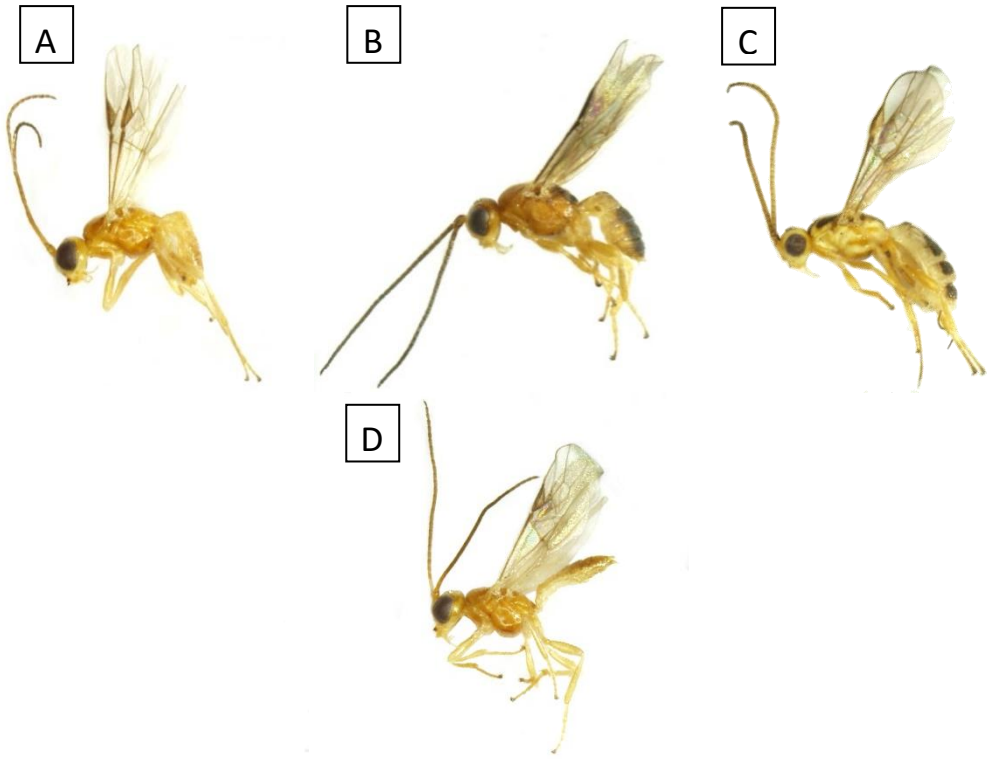


Figure 4.8 Light microscope photograph of the *Bracon*: A, *Bracon* sp. 13; B, *Bracon* sp. 14; C, *Bracon* sp. 15 and D, *Bracon* sp. 16

Table 4.4 Numbers of Braconinae specimens collected from Khao Ma Cho, Samaesan and Chuang Islands

Species	Number of specimens collected from each study site (individuals)			Total
	Khao Ma Cho	Samaesan Island	Chuang Island	
Bracon sp. 1	1	-	1	2
Bracon sp. 2	-	-	2	2
Bracon sp. 3	2	3	-	5
Bracon sp. 4	-	4	-	4
Bracon sp. 5	1	-	1	2
Bracon sp. 6	-	-	1	1
Bracon sp. 7	1	-	-	1
Bracon sp. 8	-	-	1	1
Bracon sp. 9	-	-	1	1
Bracon sp. 10	-	-	1	1
Bracon sp. 11	-	3	-	3
Bracon sp. 12	-	-	2	2
Bracon sp. 13	-	-	1	1
Bracon sp. 14	-	1	-	1
Bracon sp. 15	-	-	1	1
Bracon sp. 16	-	-	2	2
TOTAL	5	11	14	30

4. Subfamily Cheloninae

Cheloninae Förster, 1862 (Beyarslan, 1985)

Distribution: cosmopolitan

Life history: koinobiont endoparasitoids

Host: concealed Lepidoptera

Diagnosis: 1^{st}–3^{rd} metasomal tergites fused and forming a carapace covering remaining tergites; fore wing with vein r-s present though not always tubular and fore

wing vein M+CU at least partly tubular in basal half; postpectal carina present anterior to mesocoxa; epicnemial carina absent (Figure 4.9).

Subfamily Cheloninae comprised of more than 1,300 species, 20 genera, worldwide (Yu et al., 2005). They are small to medium size wasps (1.8–6.0 mm long) with metasomal tergite carapace formed by fusion of 1st to 3rd metasomal tergites. Up until now, only 4 species had been reported from Thailand (Yu et al., 2012). However, from this study Cheloninae were found at the light trap more than any other subfamilies, both in numbers and species.

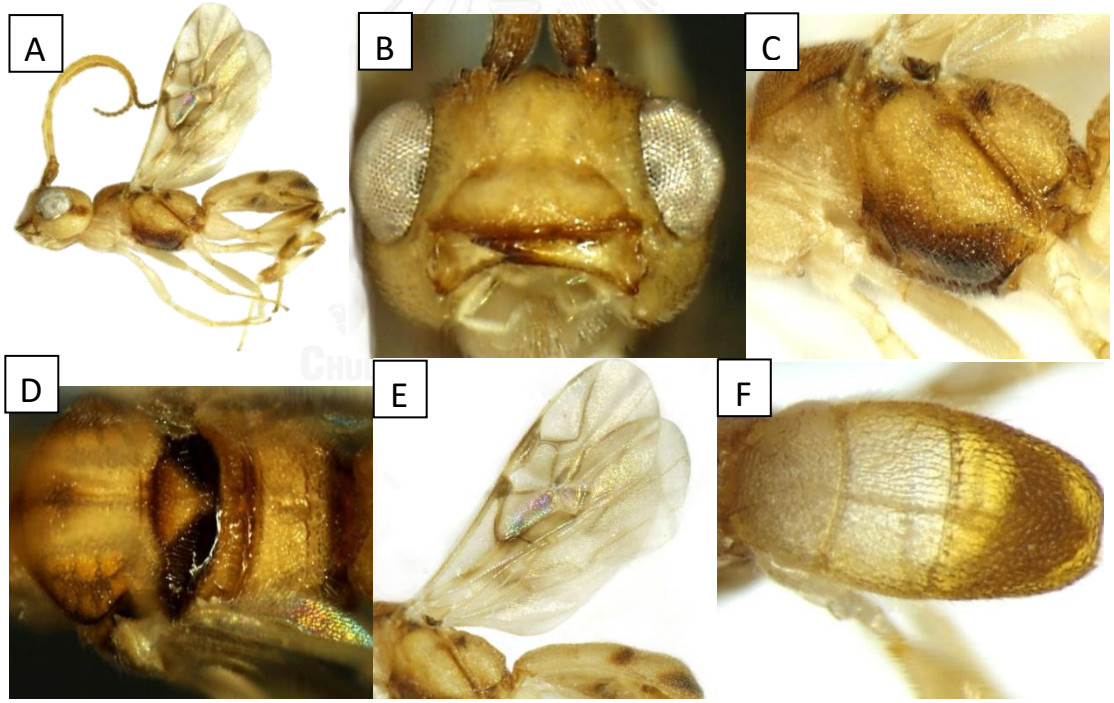


Figure 4.9 Light microscope photograph of braconid wasp genus *Phanerotoma*, subfamily Cheloninae: A, whole body; B, face; C, lateral view of mesosoma; D, dorsal view of mesosoma; E, wings and F, 1st–3rd metasomal tergites fused and formed a carapace

Forty-four percent of the samples (291 from 652 specimens) belong to the subfamily Cheloninae. 114, 142 and 35 specimens were collected from Khao Ma Cho, Samaesan and Chuang Islands, respectively (Table 4.5). Six species of the genus *Adeliini* Viereck, 1918, a species of the genus *Phanerotoma* Wesmael, 1838 and 28 unknown species had been recorded from this study.

The genus *Adeliini* is small cosmopolitan endoparasitoids (1.8–2.2 mm long) of lepidopterans. The first three basal metasomal tergites immovably joined, scutellar sulcus narrow, groove-like and crenulated, hind leg very robust and antennal with 20 flagellomeres (Dowton et al., 1998) (Figure 4.10). The unknown *Adeliini* species are shown in figure 4.11.

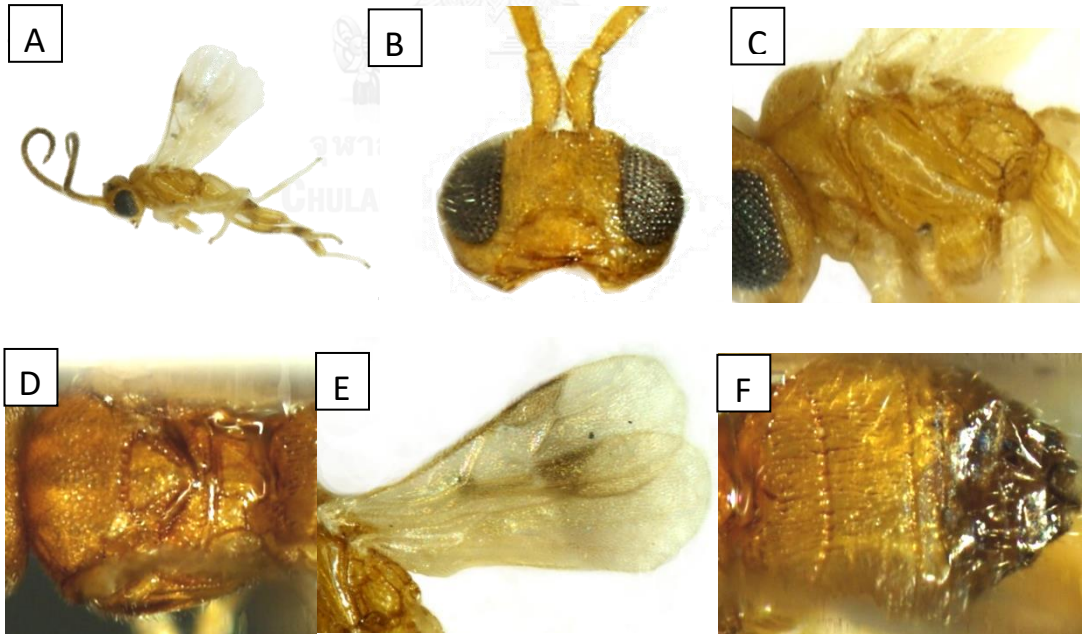


Figure 4.10 Light microscope photograph of *Adeliini*: A, whole body; B, face; C, lateral view of mesosoma; D, dorsal view of mesosoma; E, wings and F, dorsal view of metasoma

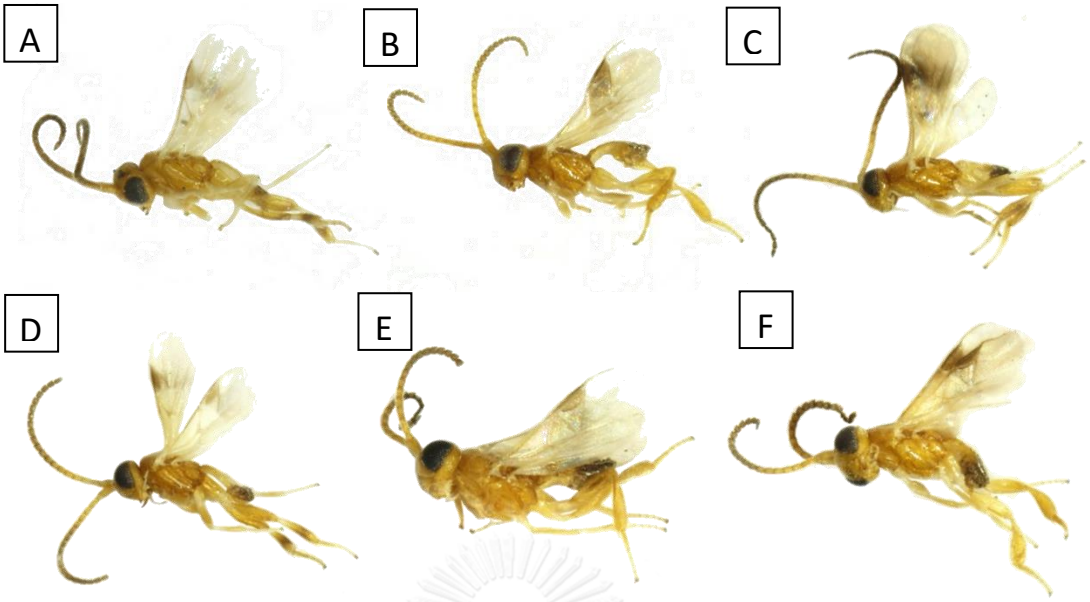


Figure 4.11 Light microscope photograph of *Adeliini*: A, *Adeliini* sp. 1; B, *Adeliini* sp. 2; C, *Adeliini* sp. 3; D, *Adeliini* sp. 4; E, *Adeliini* sp. 5 and F, *Adeliini* sp. 6

These 6 unknown species of *Adeliini* are different in sizes and colour patterns of mesosoma and metasoma.

Two hundred and eighty eight species of the genus *Phanerotoma* had been reported worldwide (Yu et al., 2006). The body length is about 2.0–4.0 mm, eyes comparatively large; ocelli small. A single species with 3 specimens of *Phanerotoma* has been discovered from this study (Figure 4.9).

The 28 unknown species of Cheloninae can be separated to 3 groups according to their size (2–2.5 mm are small Cheloninae, 2.6–3.5 mm are medium Cheloninae and 3.6–5 mm are large Cheloninae). Small, medium and large sizes of unknown Cheloninae are show in Figures 4.12, 4.13 and 4.14, respectively.

Figure 4.12 Light microscope photograph of small Cheloninae (2–2.5 mm): A, unknown sp. 2; B, unknown sp. 6; C, unknown sp. 9; D, unknown sp. 11; E, unknown sp. 12; F, unknown sp. 14; G, unknown sp. 16; H, unknown sp. 19; I, unknown sp. 21; J, unknown sp.22 and K unknown sp. 27

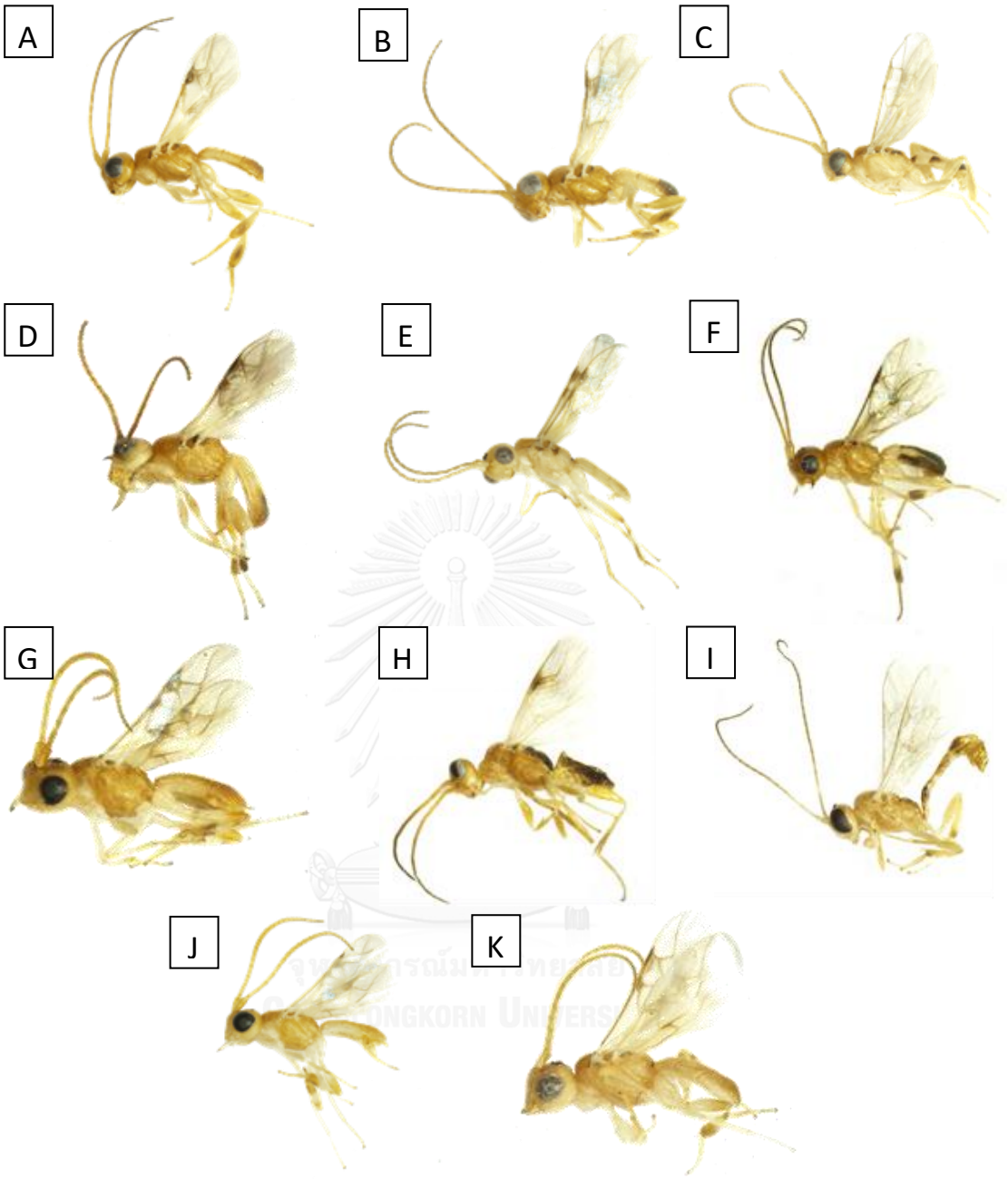


Figure 4.13 Light microscope photograph of medium Cheloninae (2.6–3.5 mm): A, unknown sp. 1; B, unknown sp. 4; C, unknown sp. 7; D, unknown sp. 10; E, unknown sp. 13; F, unknown sp. 15; G, unknown sp. 17; H, unknown sp. 13; I, unknown sp. 24; J, unknown sp.25 and K unknown sp. 28

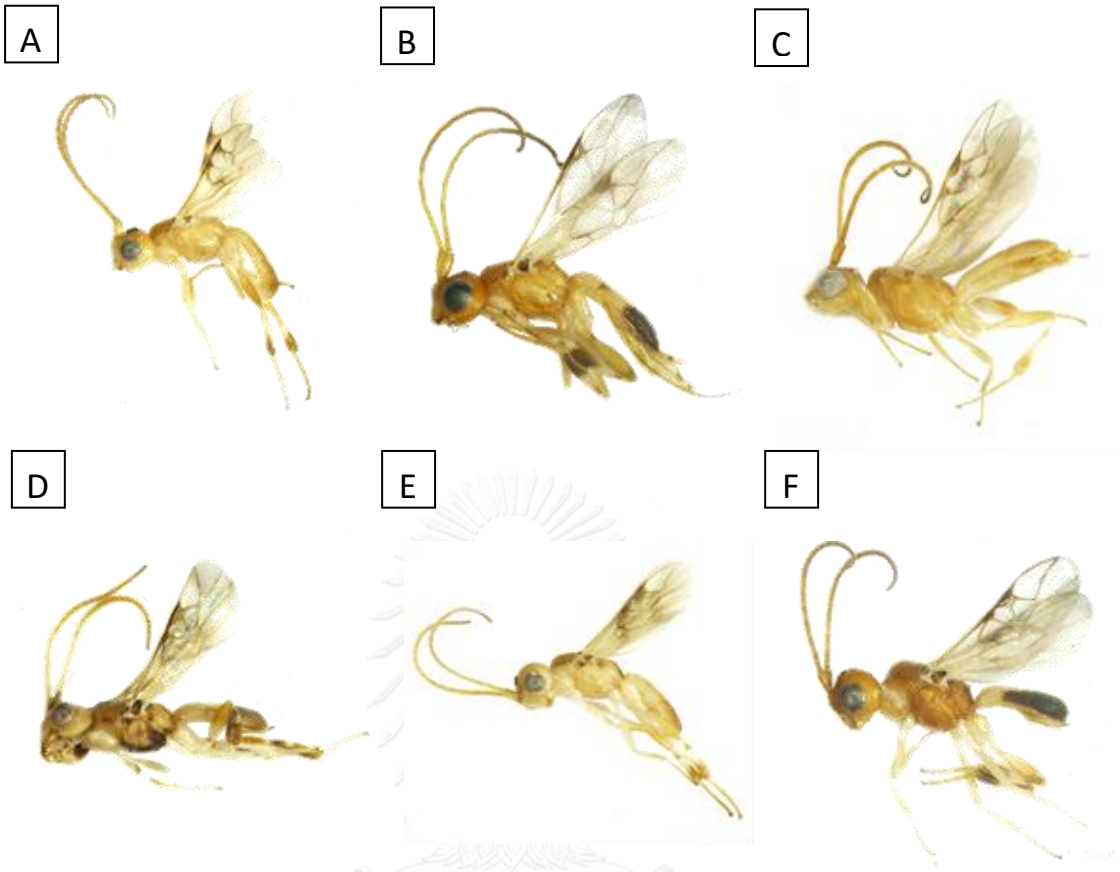


Figure 4.14 Light microscope photograph of large Cheloninae (3.6–5.0 mm): A, unknown sp. 3; B, unknown sp. 5; C, unknown sp. 8; D, unknown sp. 18; E, unknown sp. 20 and F, unknown sp. 26

Table 4.5 Number of Cheloninae specimens collected from Khao Ma Cho, Samaesan and Chuang Islands

Species	Number of specimens collected from each study site (individuals)			Total
	Khao Ma Cho	Samaesan Island	Chuang Island	
Adeliini sp. 1	4	-	1	5
Adeliini sp. 2	2	1	-	3
Adeliini sp. 3	2	-	-	2
Adeliini sp. 4	-	1	-	1
Adeliini sp. 5	-	-	1	1
Adeliini sp. 6	-	1	-	1
Phanerotoma sp.	1	2	-	3
Unknown sp. 1	39	26	7	72
Unknown sp. 2	1	2	1	4
Unknown sp. 3	1	4	2	7
Unknown sp. 4	11	21	3	35
Unknown sp. 5	-	10	1	11
Unknown sp. 6	10	12	1	23
Unknown sp. 7	12	21	-	33
Unknown sp. 8	-	1	-	1
Unknown sp. 9	-	1	-	1
Unknown sp. 10	1	2	-	3
Unknown sp. 11	14	16	3	33
Unknown sp. 12	3	3	-	6
Unknown sp. 13	1	5	-	6
Unknown sp. 14	1	1	-	2
Unknown sp. 15	-	2	-	2
Unknown sp. 16	2	-	-	2
Unknown sp. 17	3	2	1	6

Species	Number of specimens in each study sites (individuals)			Total
	Khao Ma Cho	Samaesan Island	Chuang Island	
Unknown sp. 18	2	-	-	2
Unknown sp. 19	1	-	-	1
Unknown sp. 20	1	5	3	9
Unknown sp. 21	1	-	2	3
Unknown sp. 22	-	-	1	1
Unknown sp. 23	-	-	2	2
Unknown sp. 24	-	-	1	1
Unknown sp. 25	1	3	1	5
Unknown sp. 26	-	-	1	1
Unknown sp. 27	-	-	2	2
Unknown sp. 28	-	-	1	1
TOTAL	114	142	35	291

5. Subfamily Doryctinae

Doryctinae Förster, 1862 (Marsh, 1988)

Distribution: cosmopolitan

Life history: idiobiont ectoparasitoids

Host: Coleoptera (Anobiidae, Bostrichidae, Buprestidae, Cerambycidae, Chrysomelidae and Curculionidae), Lepidoptera (mostly Pyralidae) and Hymenoptera (Cynipidae, Sphecidae and Xiphydriidae)

Diagnosis: Labrum concave; protarsus usually with spine along anterior margin; occipital carina present but usually absent medially and epicnemial carina present (Figure 4.15).

Doryctinae is undoubtly one of the most diverse groups of family Braconidae, with about 1,000 species in 180 valid described genera, many new genera and species recently described (Marsh, 1988, Belokobylskij, 1994a, 1994b, 1995, Barbalho et al., 1999).

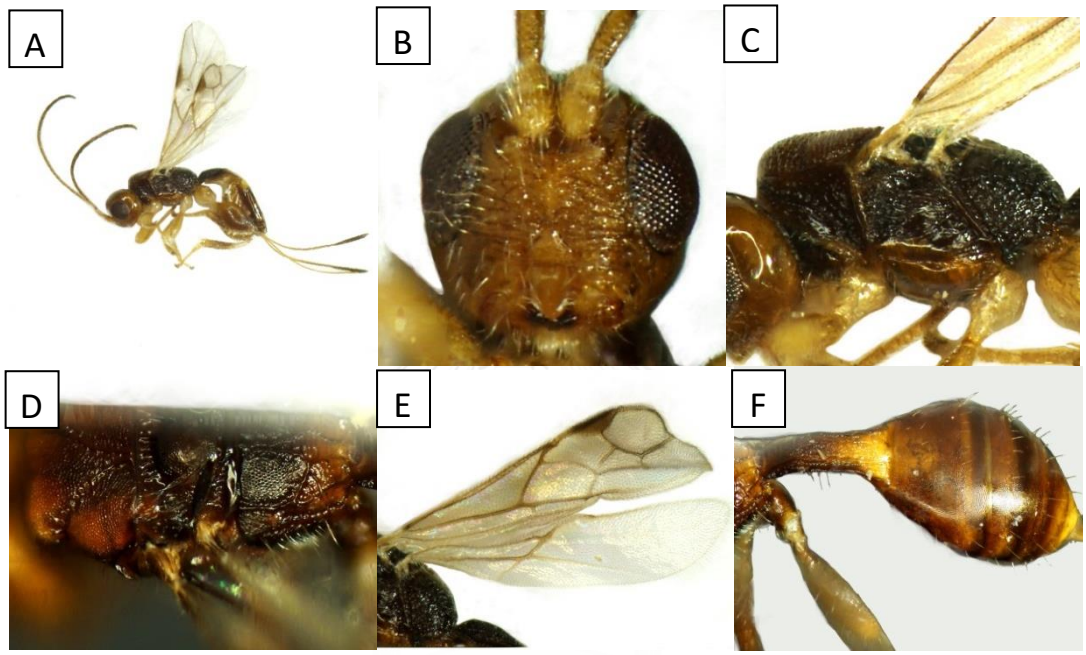


Figure 4.15 Light microscope photograph of *Euscelinus*: A, whole body; B, face; C, lateral view of mesosoma; D, dorsal view of mesosoma; E, wings and F, metasoma

Fourteen percent of the samples (89 from 625 specimens) belong to the Doryctinae, 37, 33 and 19 specimens were collected from Khao Ma Cho, Samaesan and Chuang Islands, respectively (Table 4.6). A species in the genus *Euscelinus* Westwood, 1882 and 34 unknown species have been collected and identified. Most of the Doryctinae specimens are males, with diverse morphological characters, therefore, it is rather difficult to identify to the genus and species level.

Characteristics of the genus *Euscelinus* are the apically closed brachial cell, interstitial parallel vein, presence of a second radiomedial vein, usually postfurcal recurrent vein, male hind wing without stigma-like enlargement, rather short hind wing submedial cell, 5^{th} and 6^{th} metasomal tergites not enlarged, apical tergites without sculpture, the fourth and fifth tergites without distinct basal transverse furrows, and hind coxa often without basoventral tubercle (Baltazar, 1962) (Figure 4.15).

The 34 unknown Doryctinae species are shown in figures 4.16, 4.17, and 4.18.

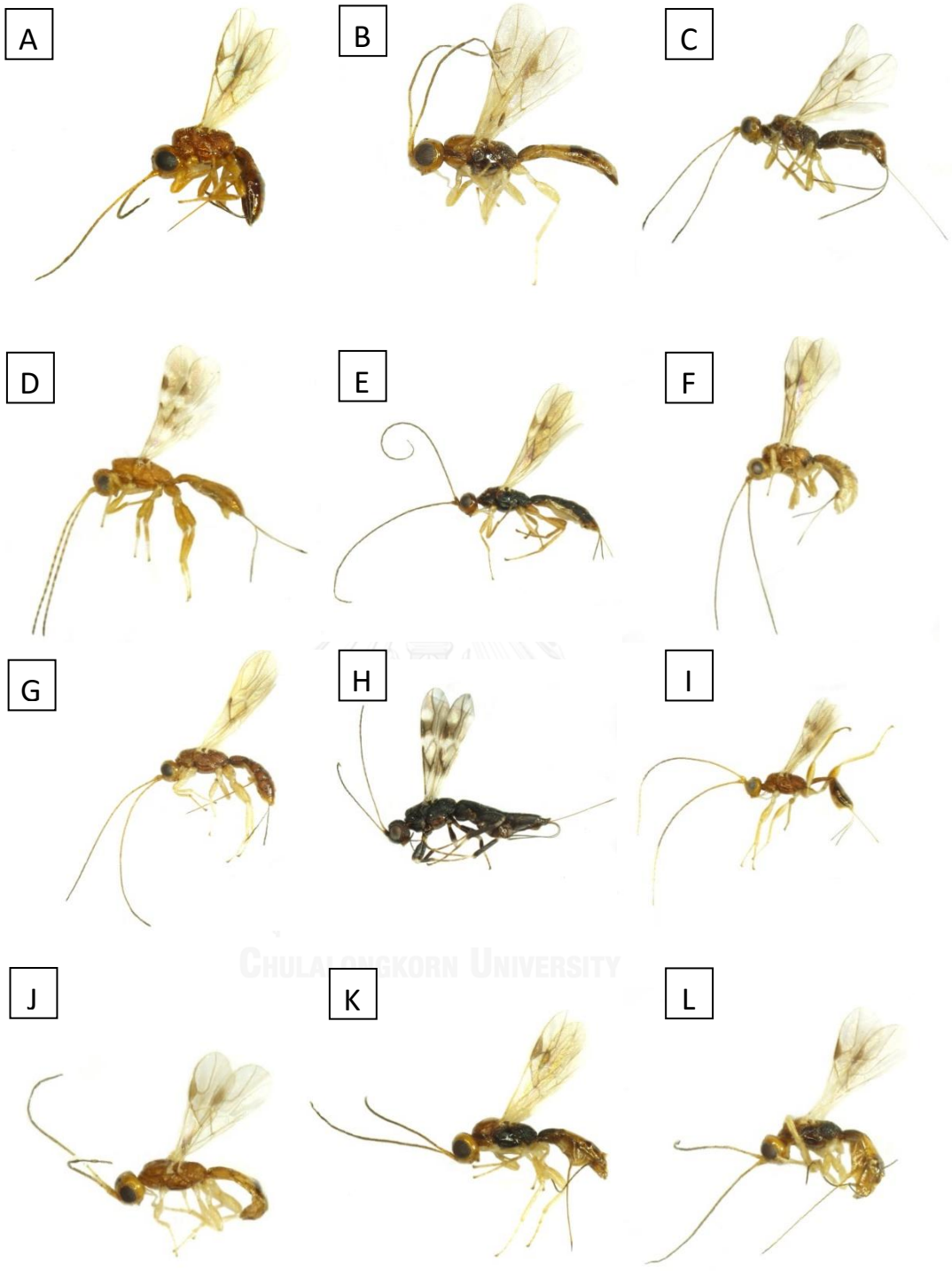


Figure 4.16 Light microscope photograph of the braconid subfamily Doryctinae: A, unknown sp. 1; B, unknown sp. 2; C, unknown sp. 3; D, unknown sp. 4; E, unknown sp. 5; F, unknown sp. 6; G, unknown sp. 7; H, unknown sp. 8; I, unknown sp. 9; J, unknown sp. 10; K, unknown sp. 11 and L, unknown sp. 12

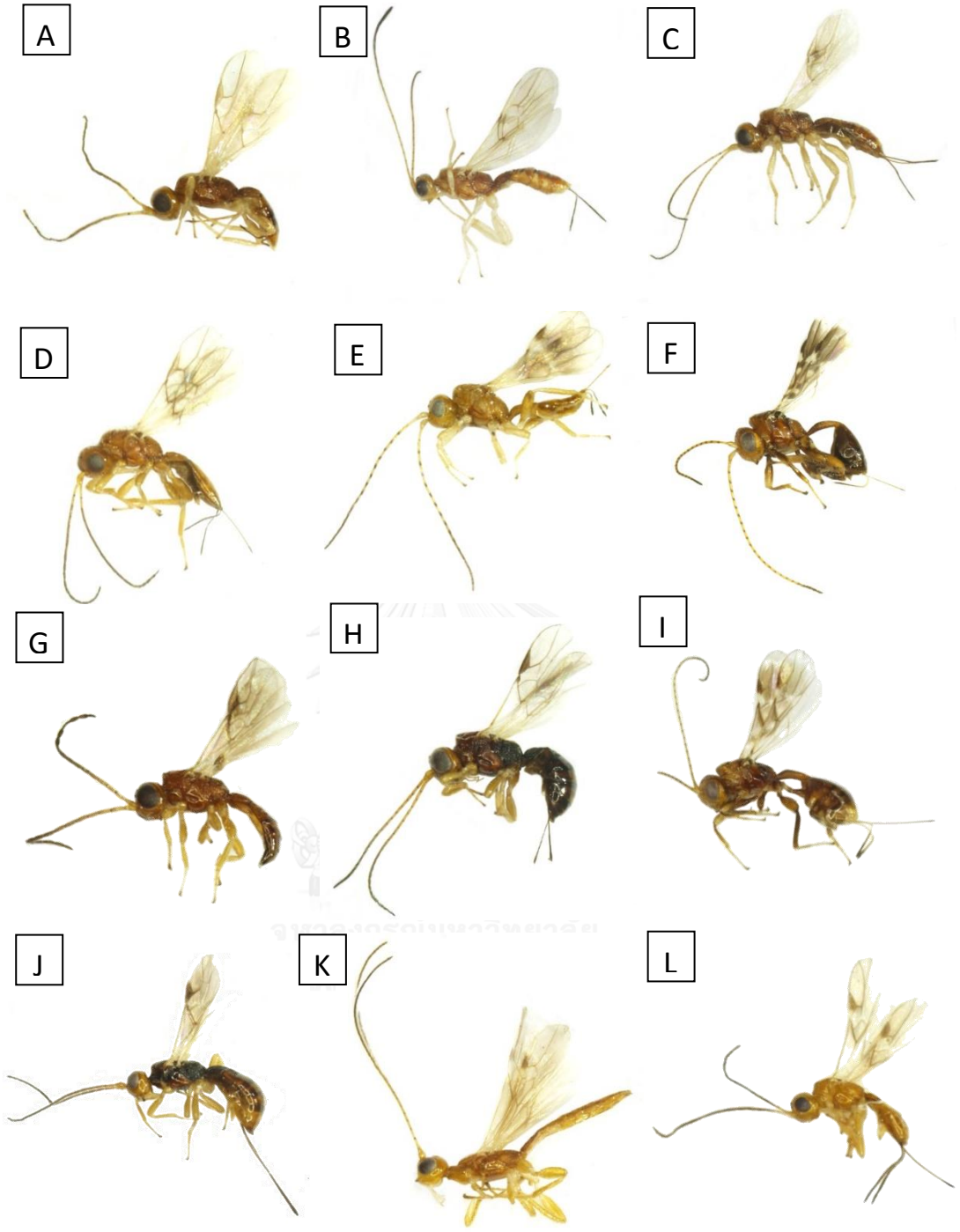


Figure 4.17 Light microscope photograph of the braconid subfamily Doryctinae: A, unknown sp. 13; B, unknown sp. 14; C, unknown sp. 15; D, unknown sp. 16; E, unknown sp. 17; F, unknown sp. 18; G, unknown sp. 19; H, unknown sp. 20; I, unknown sp. 21; J, unknown sp. 22; K, unknown sp. 23 and L, unknown sp. 24

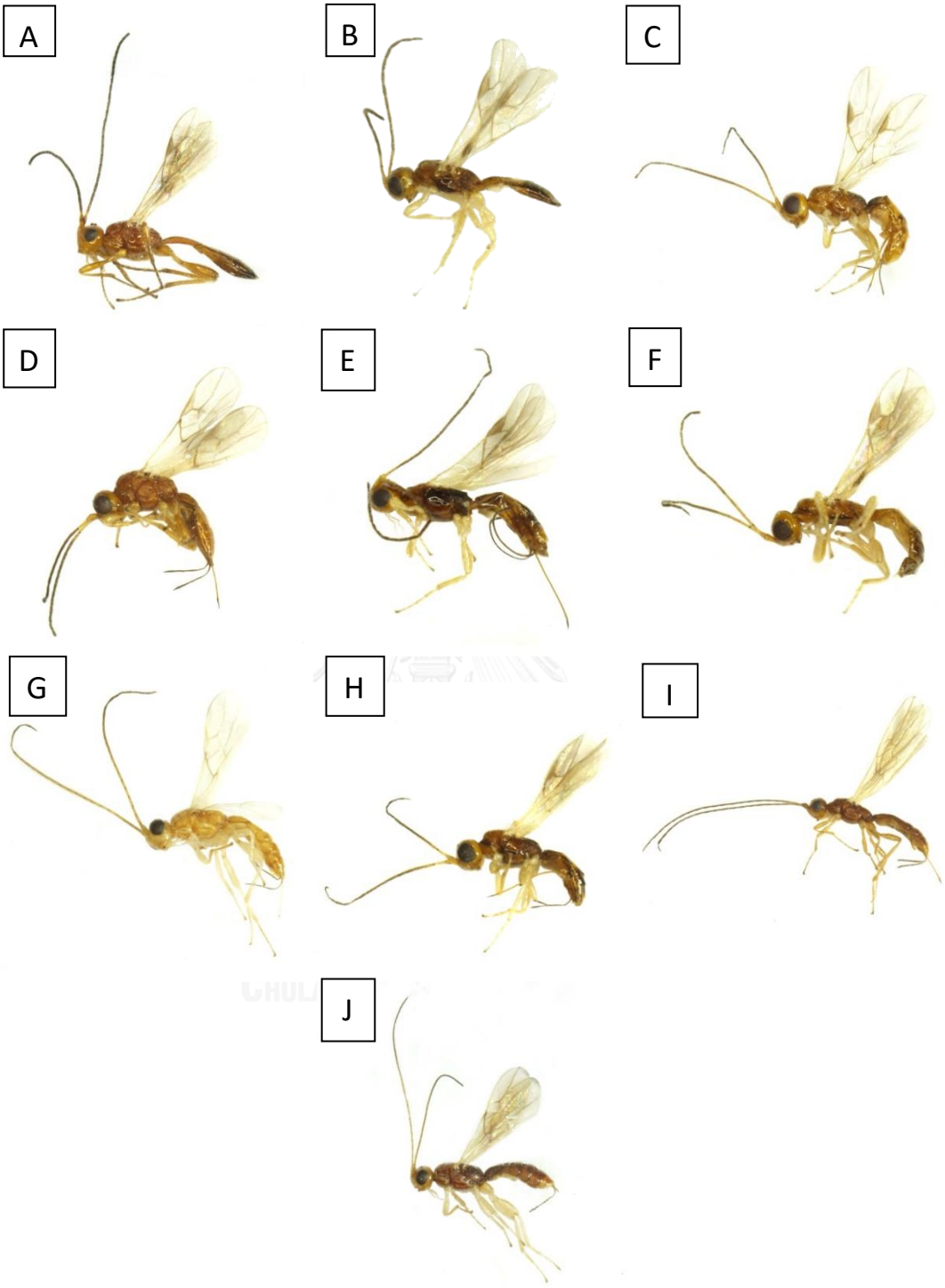


Figure 4.18 Light microscope photograph of the braconid subfamily Doryctinae: A, unknown sp. 25; B, unknown sp. 26; C, unknown sp. 27; D, unknown sp. 28; E, unknown sp. 29; F, unknown sp. 30; G, unknown sp. 31; H, unknown sp. 32; I, unknown sp. 33 and J, unknown sp. 34

Table 4.6 Number of Doryctinae specimens collected from Khao Ma Cho, Samaesan and Chuang Islands

Species	Number of specimens collected from each study site (individuals)			Total
	Khao Ma Cho	Samaesan Island	Chuang Island	
Euscelinus sp.	-	1	-	1
Unknown sp. 1	-	1	1	2
Unknown sp. 2	5	2	2	9
Unknown sp. 3	3	4	1	8
Unknown sp. 4	-	1	1	2
Unknown sp. 5	-	2	-	2
Unknown sp. 6	1	2	-	3
Unknown sp. 7	2	-	-	2
Unknown sp. 8	2	1	-	3
Unknown sp. 9	1	-	-	1
Unknown sp. 10	-	1	-	1
Unknown sp. 11	1	-	-	1
Unknown sp. 12	2	3	1	6
Unknown sp. 13	2	-	-	2
Unknown sp. 14	2	2	3	7
Unknown sp. 15	-	-	1	1
Unknown sp. 16	5	3	2	10
Unknown sp. 17	3	2	1	6
Unknown sp. 18	1	-	-	1
Unknown sp. 19	1	-	-	1
Unknown sp. 20	1	-	-	1
Unknown sp. 21	1	-	-	1
Unknown sp. 22	1	-	-	1
Unknown sp. 23	-	-	1	1

Species	Number of specimens collected from each study site (individuals)			Total
	Khao Ma Cho	Samaesan Island	Chuang Island	
Unknown sp. 24	-	2	1	3
Unknown sp. 25	-	1	1	2
Unknown sp. 26	1	1	-	2
Unknown sp. 27	-	1	-	1
Unknown sp. 28	-	-	1	1
Unknown sp. 29	-	1	-	1
Unknown sp. 30	-	1	1	2
Unknown sp. 31	-	-	1	1
Unknown sp. 32	-	1	-	1
Unknown sp. 33	1	-	-	1
Unknown sp. 34	1	-	-	1
TOTAL	37	33	19	89

6. Subfamily Euphorinae

Euphorinae Förster, 1862 (van Achterberg and Haeselbarth, 2003)

Distribution: Cosmopolitan

Life history: koinobiont endoparasitoids

Host: adult Coleoptera, Hymenoptera, Neuroptera and nymphal and adult Heteroptera and Psocoptera

Diagnosis: 1st metasoma usually elongate; fore wing with vein SR1 curved and maxillary palpus usually 5-segmented (Figure 4.19).

Euphorinae is a very diverse subfamily, including many genera (about 30 genera in the Palaearctic region (Yu et al., 2005) they are parasitoids of adult insects (Shaw and Huddleston, 1991).

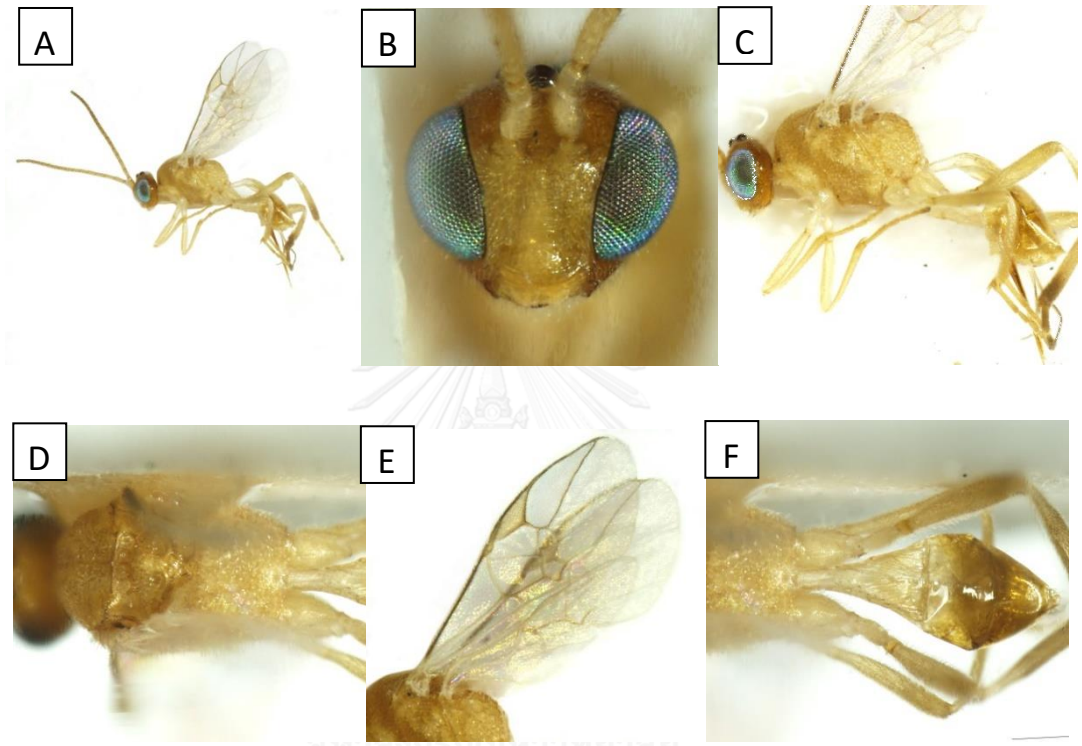


Figure 4.19 Light microscope photograph of *Meteorus*: A, whole body; B, face; C, lateral view of mesosoma; D, dorsal view of mesosoma; E, wings and F, dorsal view of metasoma

Five species, 19 specimens (3% of total specimens), of Euphorinae have been found at Khao Ma Cho (15 specimens), Samaesan Island (1 specimens) and Chuang Island (3 specimens). A single species of the genus *Meteorus* Haliday, 1835 and another species of *Streblocera* Westwood, 1833, including 3 unknown species were recorded and identified (Table 4.7).

The genus *Meteorus* is a cosmopolitan genus with at least 332 species worldwide, 70 species were reported from Central and South America (Jones and Shaw, 2012, Yu et al., 2012, Aguirre and Shaw, 2014a, 2014b). The characteristics of *Meteorus* are labrum completely concealed by clypeus; occipital carina present, either complete or incomplete; epicnemial carina present; fore wing without vein 2cu-a, open first subdiscal cell; vein 3RSb straight; vein r-m present, forming a characteristic rhomboid or quadrate second submarginal cell; marginal cell of hind wing narrowed toward apex; vein m-cu absent; petiole at least 2.5 times wider at posterior margin than at narrowest point; metasomal terga with setae arranged in a single subapical row per tergum (Aguirre et al., 2011) (Figure 4.19).

The *Streblocera* Westwood, 1833 is a cosmopolitan braconid genus. The genus comprises more than 70 species throughout the world (Gauld and Huddleston, 1976). The unique characteristics of *Steblocera* are scape more than 7x longer than its greatest width, antenna raptorial, geniculated twice, scape with a basal blunt horn and flagellum filiform (Figure 4.20)

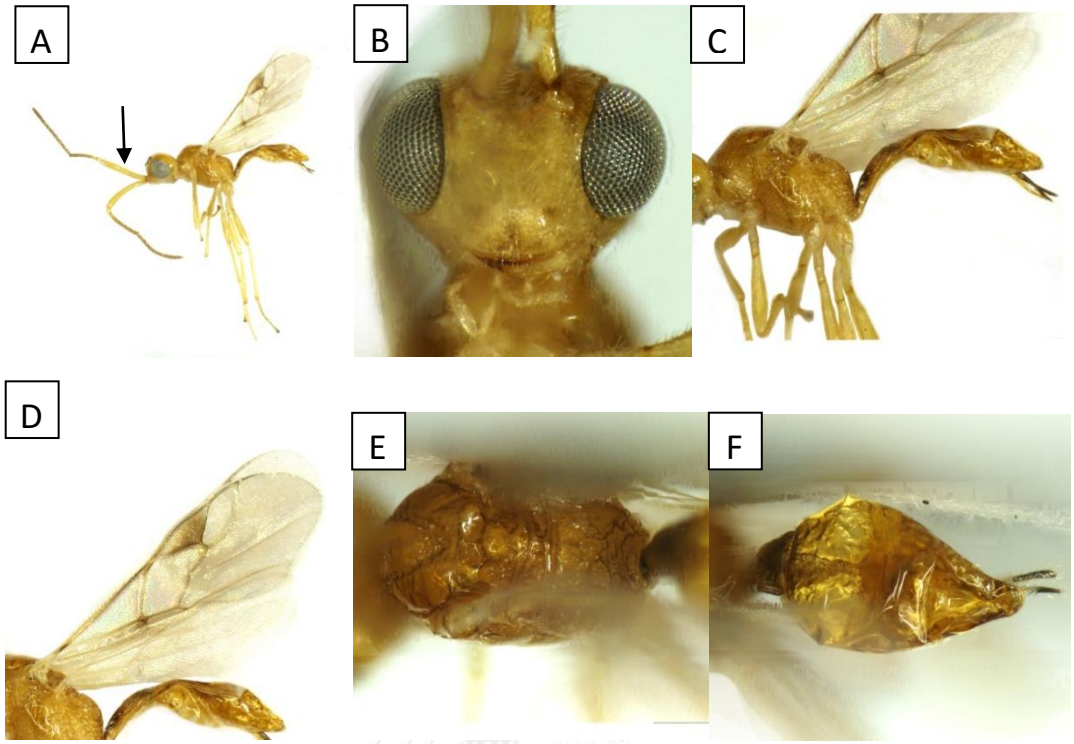


Figure 4.20 Light microscope photograph of *Streblocera*: A, whole body (arrow indicates scape elongated); B, face; C, lateral view of mesosoma; D, dorsal view of mesosoma; E, wings and F, dorsal view of metasoma

The 3 unknown species of Euphorinae are shown in figure 4.21 below.

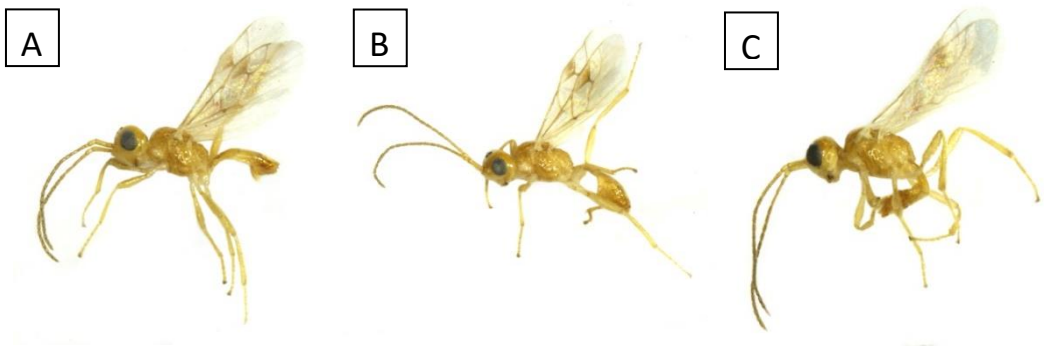


Figure 4.21 Light microscope photograph of the braconid subfamily Euphorinae: A, unknown sp. 1; B, unknown sp. 2 and C, unknown sp. 3

Table 4.7 Number of Euphorinae specimens collected from Khao Ma Cho, Samaesan and Chuang Islands

Species	Number of specimens collected from each study site (individuals)			Total
	Khao Ma Cho	Samaesan Island	Chuang Island	
Meteorus sp.	1	1	3	5
Streblocera sp.	11	-	-	11
Unknown sp. 1	1	-	-	1
Unknown sp. 2	1	-	-	1
Unknown sp. 3	1	-	-	1
TOTAL	15	1	3	19

7. Subfamily Helconinae

Helconinae Förster, 1862 (van Achterberg, 1976)

Distribution: cosmopolitan

Life history: koinobiont endoparasitoids

Host: Coleoptera (Cerambycidae) and some other wood-boring beetles

Diagnosis: Occipital carina present; fore wing vein r-m presents, with cell 1Rs quadrate/pentagonal; 1st metasomal tergite usually rugose, but the remaining terga smooth (Figure 4.22)

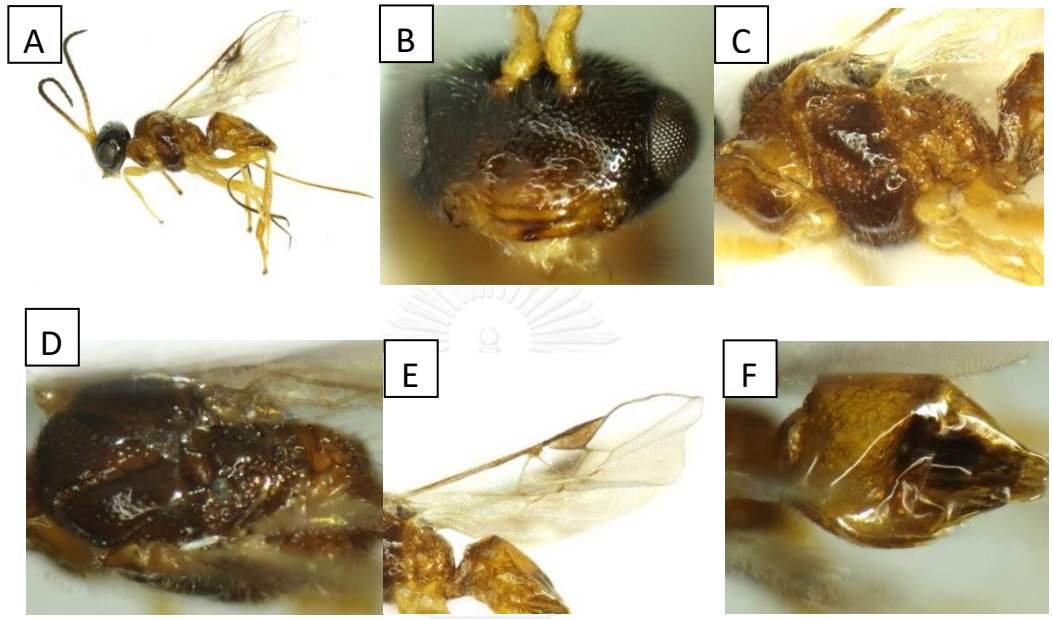


Figure 4.22 Light microscope photograph of the braconid wasp subfamily Helconinae: A, whole body; B, face; C, lateral view of mesosoma; D, dorso-lateral view of mesosoma; E, wings and F, dorsal view of metasoma

This is a moderately large subfamily containing over 400 described species within 10 genera worldwide (van Achterberg, 1984). There are koinobiont endoparasitoids of beetle larvae, excluding several formerly included genera that attack other host groups (Huddleston, 1978).

Only a single species of Helconinae was collected at Samaesan Island in September 2013. The database of this subfamily is very limited, therefore it is rather

difficult to identify to the genus and species level. In addition, this is the first record of Helconinae in Thailand.

8. Subfamily Hormiinae

Hormiinae Förster, 1862 (Yu et al., 2005)

Distribution: cosmopolitan

Life history: idiobiont ectoparasitoids

Host: Lepidoptera

Diagnosis: labrum concave; 2nd metasomal tergite with spiracles on median tergite or near margin of median and lateral tergites; occipital carina absent ventrally/meeting hypostomal carina; 1st metasomal tergum without median longitudinal carina, often with 2 percurrent logitudinal carinae; epicnemial carina present (Figure 4.23).

Ten percent of the samples (68 of 652 specimens) were Hormiinae, 21, 38 and 9 specimens were collected at Khao Ma Cho, Samaesansland and Chuang Islands, respectively (Table 4.8). Thirteen unknown species have been collected. The data and keys of this subfamily were difficult to identify. Because it was a new subfamily which has been separated from tribe Hormiini, Lysterimini and Pambolini (Shaw and Huddleston, 1991).

The 13 unknown species of Hormiinae are shown in figures 4.24 and 4.25.

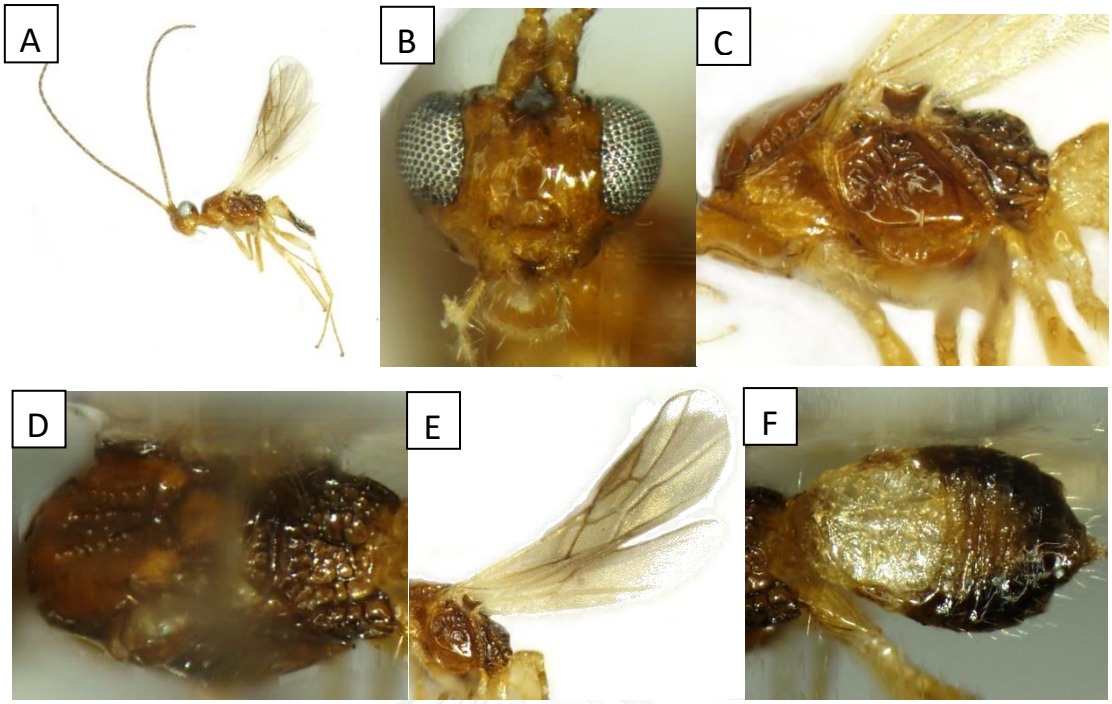


Figure 4.23 Light microscope photograph of parasitic wasp subfamily Hormiinae: A, whole body; B, face; C, lateral view of mesosoma; D, dorso-lateral view of mesosoma; E, wing and F, dorsal view of metasoma

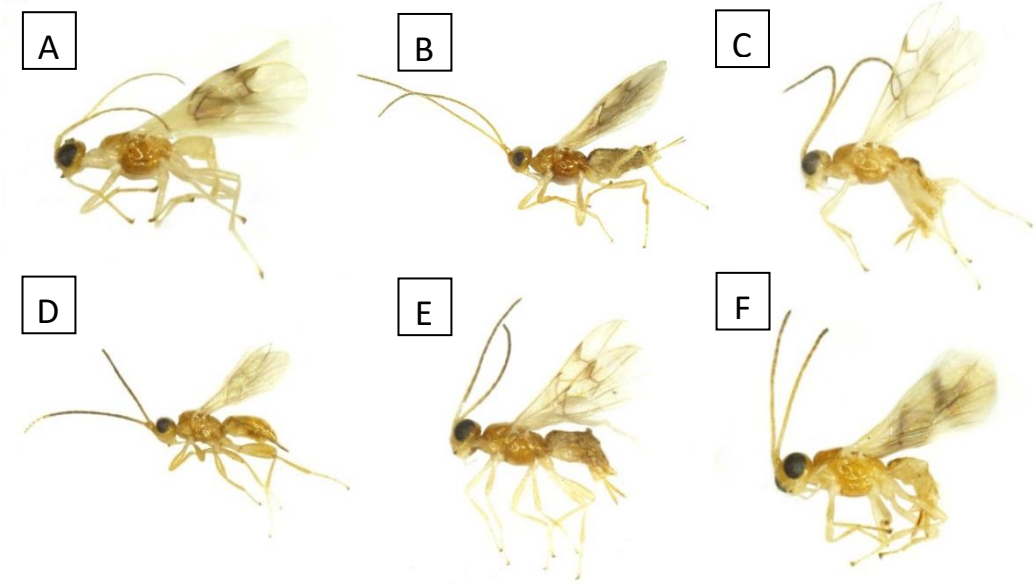


Figure 4.24 Light microscope photograph of the braconid subfamily Hormiinae: A, unknown sp. 1; B, unknown sp. 2; C, unknown sp. 3; D, unknown sp. 4; E, unknown sp. 5 and F, unknown sp. 6

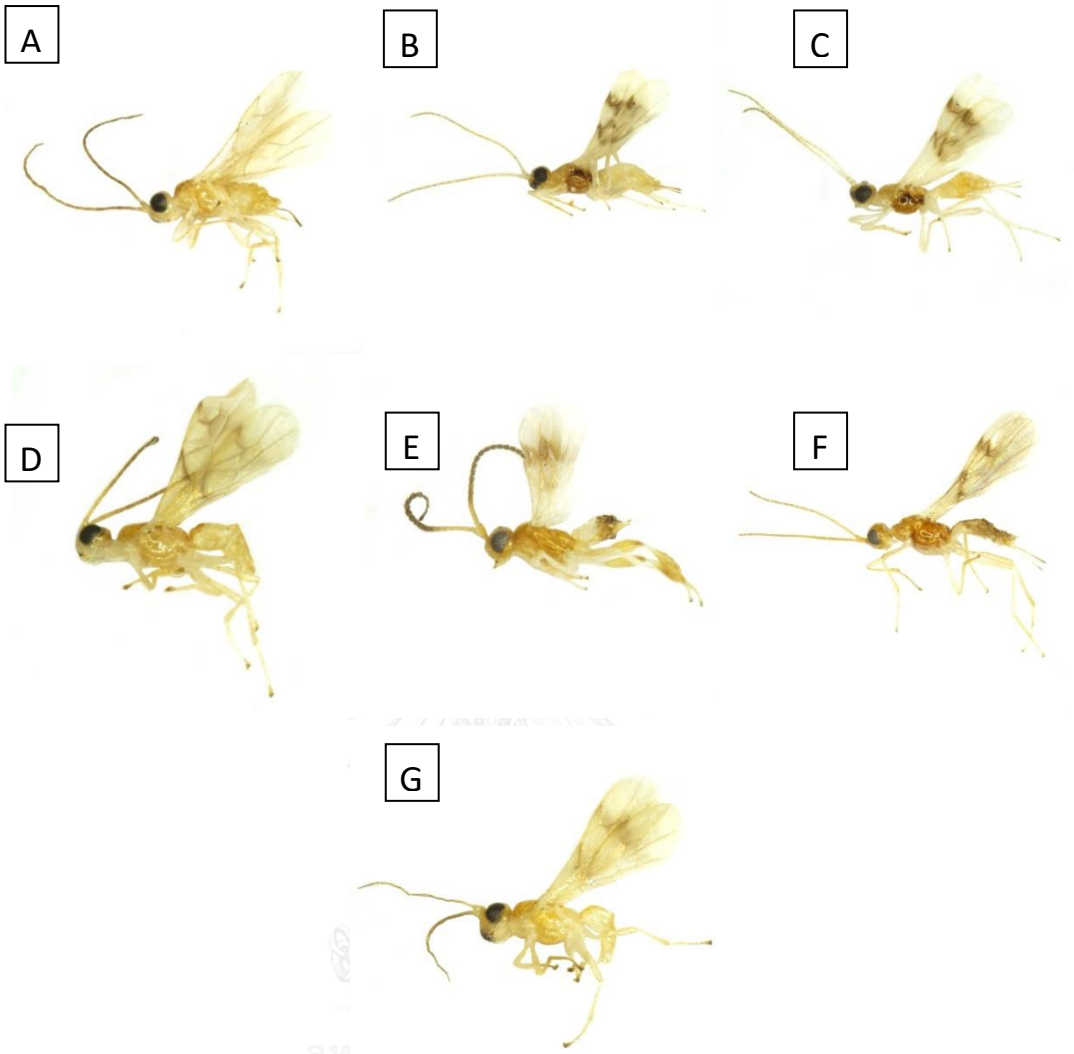


Figure 4.25 Light microscope photograph of the braconid subfamily Hormiinae: A, unknown sp. 7; B, unknown sp. 8; C, unknown sp. 9; D, unknown sp. 10; E, unknown sp. 11; F, unknown sp. 12 and G, unknown sp. 13

Table 4.8 Number of Hormiinae specimens collected from Khao Ma Cho, Samaesan and Chuang Islands

Species	Number of specimens collected from each study site (individuals)			Total
	Khao Ma Cho	Samaesan Island	Chuang Island	
Unknown sp. 1	3	8	6	17
Unknown sp. 2	6	2	-	8
Unknown sp. 3	1	-	1	2
Unknown sp. 4	1	-	-	1
Unknown sp. 5	-	1	-	1
Unknown sp. 6	-	8	-	8
Unknown sp. 7	-	2	1	3
Unknown sp. 8	3	-	-	3
Unknown sp. 9	4	1	1	6
Unknown sp. 10	-	14	-	14
Unknown sp. 11	-	1	-	1
Unknown sp. 12	3	-	-	3
Unknown sp. 13	-	1	-	1
TOTAL	21	38	9	68

9. Subfamily Lysiterminae

Lysiterminae Tobias, 1968 (van Achterberg and Steiner, 1996)

Distribution: Palearctic, Neotropical, Afrotropical, Indo-Malaya, Australasian, and Oceanic

Life history: idiobiont parasitoids

Host: Lepidoptera (mostly Crambidae and Psychidae) and Hemiptera

Diagnosis: Labrum concave; 2nd metasomal tergite with spiracles on median tergite or near margin of median and lateral tergites; occipital carina absent ventrally/meeting hypostomal carina; 1st metasomal tergite without median

longitudinal carina, often with 2 percurrent logitudinal carina; epicnemial carina present; 1^{st}–3^{rd} metasomal tergites heavily sclerotized medially usually covering following terga (Figure 4.26).

This subfamily is a small group represented in the Afrotropical region by 4 genera (Papp and van Achterberg, 1999). Therefore, this is the first record of Lysiterminae in Thailand.

Figure 4.26 Light microscope photograph of *Aulosaphoides*: A, whole body; B, face; C, lateral view of mesosoma; D, dorsal view of mesosoma; E, wings and F, dorsal view of metasoma

Three percent of the samples (22 from 652 specimens) were Lysiterminae. The samples collected from Khao Ma Cho, Samaesan and Chuang Island were 8, 13

and 1 specimens, respectively. Two species of the genus *Aulosaphoides* Achterberg, 1995 and 10 unknown species have been recorded from the study sites (Table 4.9). Lysiterminae is a new subfamily which has been recently erected to separate them from tribe Hormiini, Lysterimini and Pambolini. There is still limited information on this new subfamily (Shaw and Huddleston, 1991).

Characteristics of *Aulosaphoides* are as follow: vein R arising distinctly before middle of pterostigma, mesoscutum anteriorly with median carina or furrow, 3rd tergite with lamella posteriorly and mandible with a tooth (Belokobylskij et al., 2007). Two species of *Aulosaphoides* spp. are shown in Figure 4.27.

Figure 4.27 Light microscope photograph of *Aulosaphoides*: A, *Aulosaphoides* sp. 1 and B, *Aulosaphoides* sp. 2

Eleven unknown species of Lysiterminae are shown in Figure 4.28.

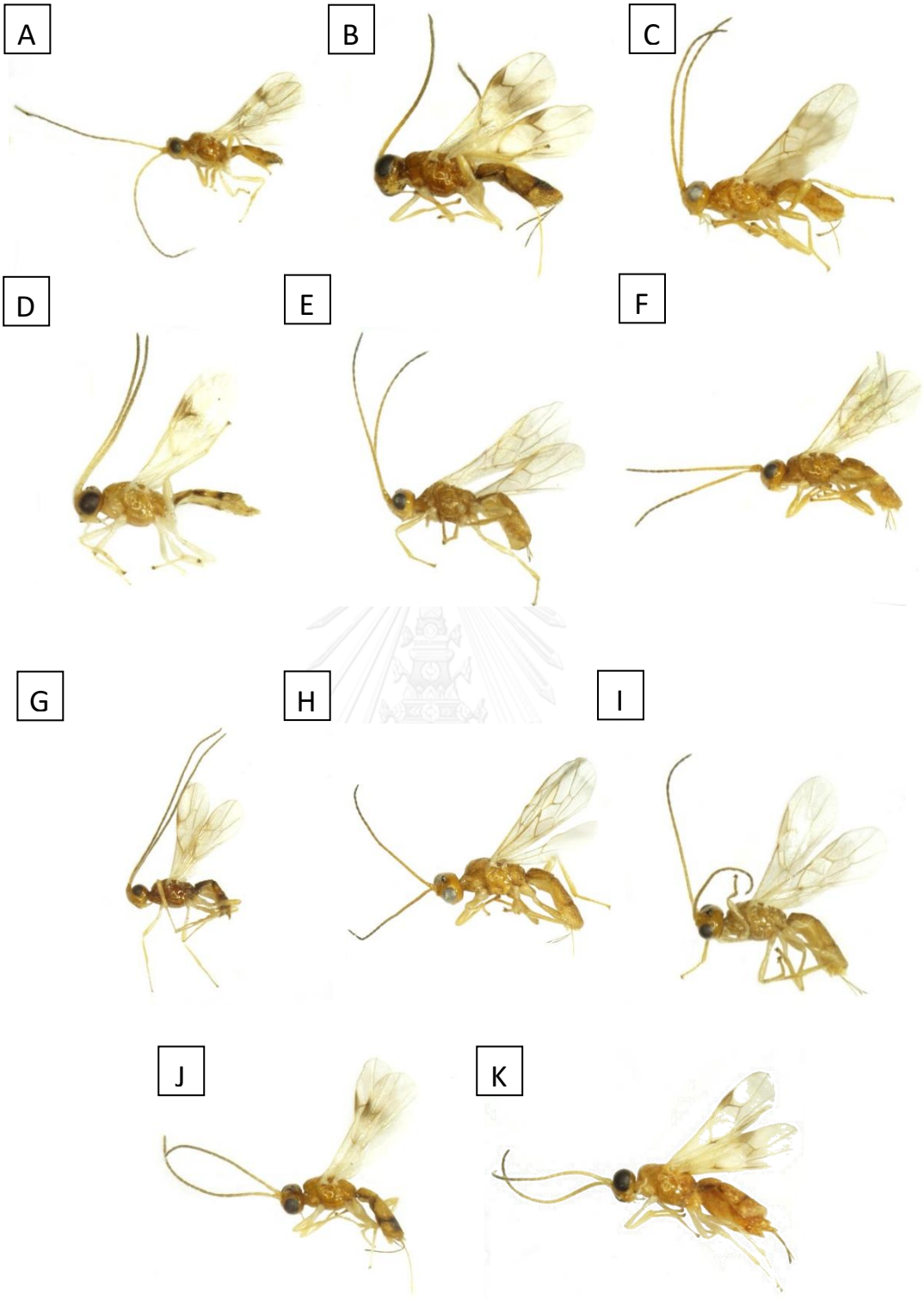


Figure 4.28 Light microscope photograph of the braconid subfamily Lysiterminae: A, unknown sp. 1; B, unknown sp. 2; C, unknown sp. 3; D, unknown sp. 4; E, unknown sp. 5 and F, unknown sp. 6; G, unknown sp. 7; H, unknown sp. 8; I, unknown sp. 9; J, unknown sp. 10 and k, unknown sp. 11

Table 4.9 Number of Lysiterminae specimens collected from Khao Ma Cho, Samaesan and Chuang Islands

Species	Number of specimens collected from each study site (individuals)			Total
	Khao Ma Cho	Samaesan Island	Chuang Island	
Aulosaphoides sp. 1	-	1	-	1
Aulosaphoides sp. 2	-	1	-	1
unknown sp. 1	-	3	-	3
unknown sp. 2	2	-	-	2
unknown sp. 3	1	-	-	1
unknown sp. 4	1	1	-	2
unknown sp. 5	-	3	-	3
unknown sp. 6	-	1	-	1
unknown sp. 7	1	-	-	1
unknown sp. 8	-	-	1	1
unknown sp. 9	-	1	-	1
unknown sp. 10	3	1	-	4
unknown sp. 11	-	1	-	1
TOTAL	8	13	1	22

10. Subfamily Macrocentrinae

Macrocentrinae Förster, 1862 (Yu et al., 2005)

Distribution: Cosmopolitan

Life history: koinobiont endoparasitoids

Host: Lepidoptera (such as Tortricidae, Noctuidae, and Pyralidae)

Diagnosis: Fore wing without vein r-m; occipital carina absent medially and metasoma connected to propodeum above hind coxae (Figure 4.29).

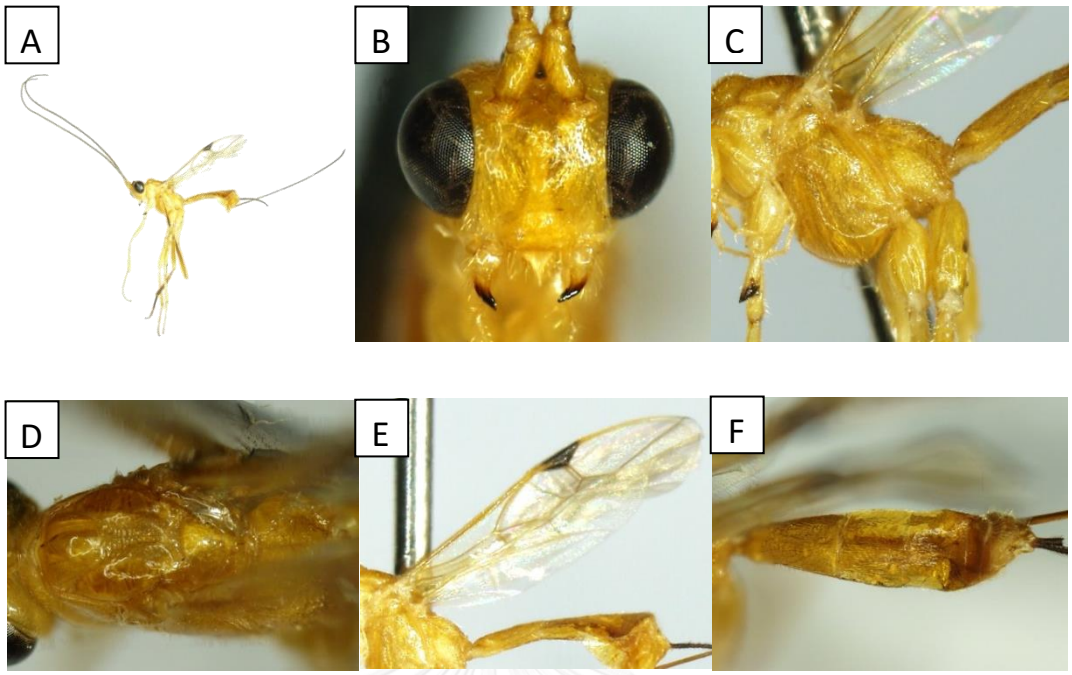


Figure 4.29 Light microscope photograph of *Macrocentrus*: A, whole body; B, face; C, lateral view of mesosoma; D, dorsal view of mesosoma; E, wings and F, dorsal view of metasoma

Characteristics of the genus *Macrocentrus* Curtis, 1833 are 1st metasomal tergite with transversely and semicircularly striate, 1st tergite 3–8 times longer than its apical width, vein SR of hind wing bent moderately to strongly, vein SC+R1 of hind wing bent abruptly (Parker, 1931, Paillot, 1937, Cranham and Danthanarayana, 1966).

Two species (6 specimens) of the genus *Macrocentrus* (Figure 4.30) were collected at Samaesan Island in July 2014 (Table 4.10).

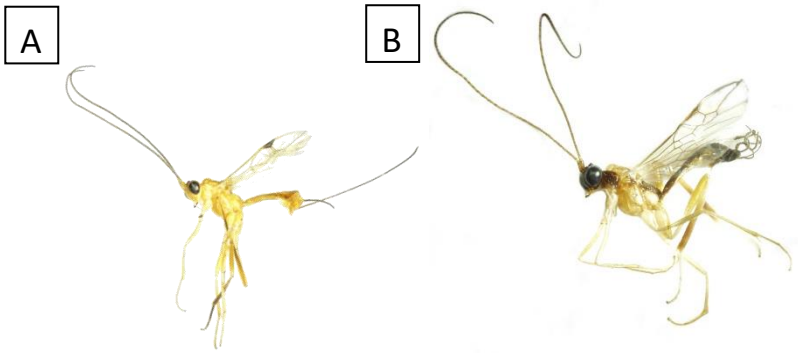


Figure 4.30 Light microscope photograph of the genus *Macrocentrus*: A, *Macrocentrus* sp. 1 and B, *Macrocentrus* sp. 2

Table 4.10 Number of Macrocentrinae specimens collected from Khao Ma Cho, Samaesan and Chuang Islands

Species	Number of specimens collected from each study site (individuals)			Total
	Khao Ma Cho	Samaesan Island	Chuang Island	
Macrocentrus sp. 1	-	5	-	5
Macrocentrus sp. 2	-	1	-	1
TOTAL	-	6	-	6

11. Subfamily Meteorideinae

Meteorideinae Tobias, 1967 (van Achterberg, 1990)

Distribution: Cosmopolitan

Life history: endoparasitoids

Host: mostly Lepidoptera

Diagnosis: hind wing with vein 2/Cu; fore wing with cell 1Rs quadrate and vein 2cu-a present (Figure 4.31)

Meteorideinae is a small subfamily with about 175 described species, remarkable even in its more usual development as a primary parasitoid of lepidopteran pests (Shaw, 1988).

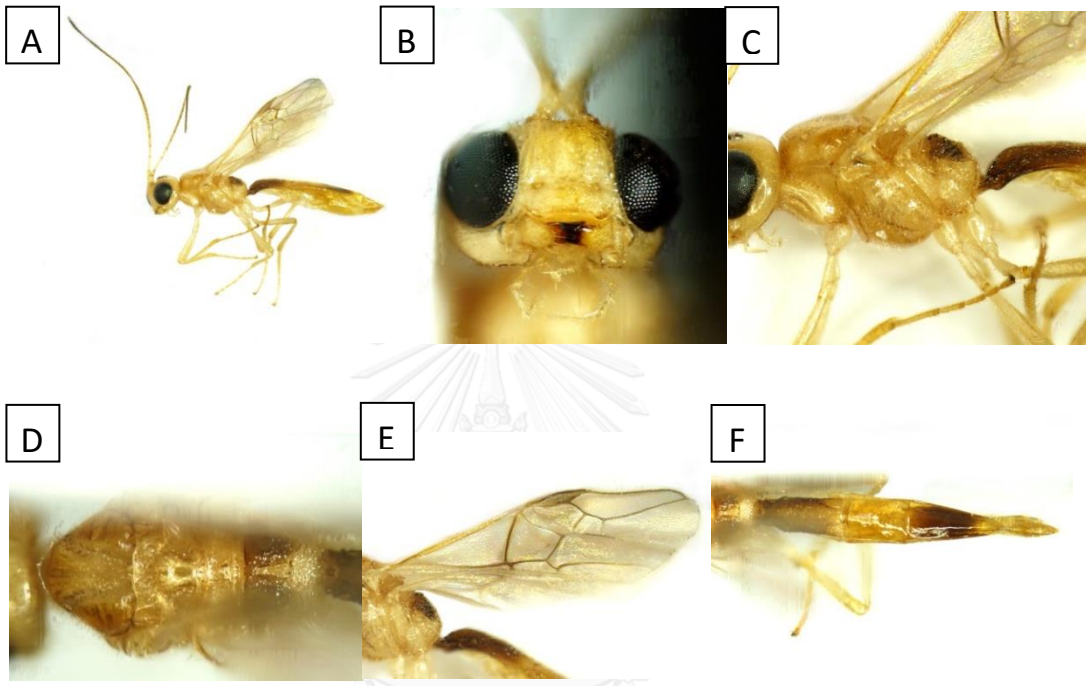


Figure 4.31 Light microscope photograph of *Meteoridea*: A, whole body; B, face; C, lateral view of mesosoma; D, dorsal view of mesosoma; E, wings and F, dorsal view of metasoma

Only a single species of the genus *Meteoridea* Ashmead, 1900 have been recorded at Samaesan Island in November 2013. This small subfamily is defined by its biology (gregarious larval-pupal endoparasitoid of Lepidoptera) and highly modified metasoma of the female (Nixon, 1941, van Achterberg, 1993).

12. Subfamily Microgastrinae

Microgastrinae Förster, 1862 (Yu et al., 2005)

Distribution: cosmopolitan

Life history: koinobiont endoparasitoids

Host: Lepidoptera and Trichoptera

Diagnosis: Fore wing with last abscissa of vein Rs not tubular; 1st metasomal tergite with spiracle on latero-tergite; occipital carina absent; antenna with 18 flagellomeres; ventral margin of clypeus concave (Figure 4.32).

There are approximately 1,300 species of Microgastrinae worldwide. It is one ofthe largest subfamilies of the Braconidae (Mason, 1981).

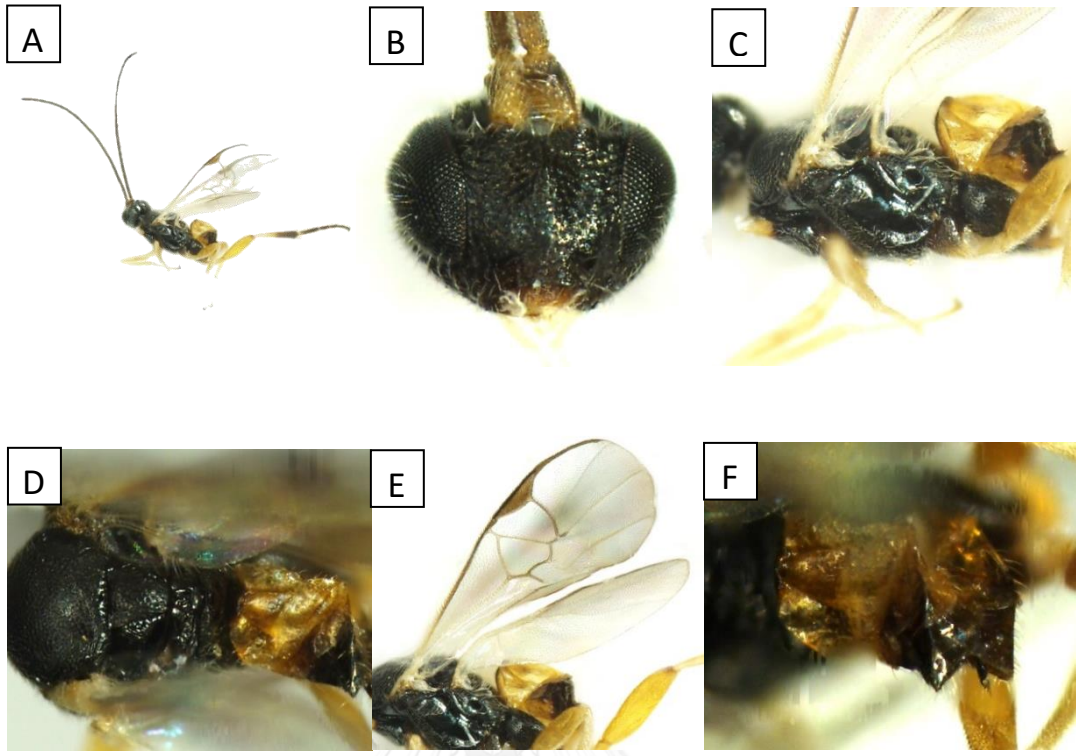


Figure 4.32 Light microscope photograph of parasitic wasps subfamily Microgastrinae: A, whole body; B, face; C, lateral view of mesosoma; D, dorsal view of mesosoma; E, wings and F, dorsal view of metasoma

Thirty-five specimens (5% of the total specimens) were found at Khao Ma Cho (10), Samaesan Island (8) and Chuang Island (17). Fifteen unknown species are recorded (Table 4.11).

Fifteen unknown species of Microgastrinae are shown in Figure 4.33 and 4.34.

Figure 4.33 Light microscope photograph of the braconid subfamily Microgastrinae: A, unknown sp. 1; B, unknown sp. 2; C, unknown sp. 3; D, unknown sp. 4; E, unknown sp. 5; F, unknown sp. 6; G, unknown sp. 7; H, unknown sp. 8; I, unknown sp. 9; J, unknown sp. 10; K, unknown sp. 11 and L, unknown sp. 12

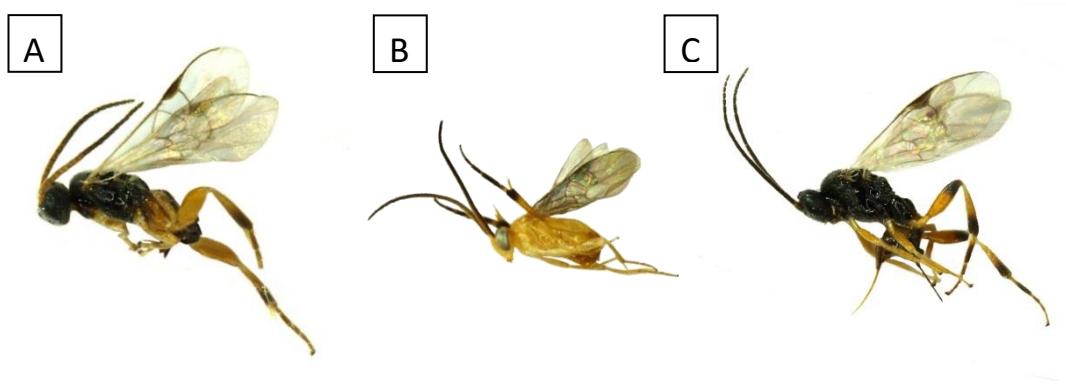


Figure 4.34 Light microscope photograph of the braconid subfamily Microgastrinae: A, unknown sp. 13; B, unknown sp. 14 and C, unknown sp. 15

Table 4.11 Number of Microgastrinae specimens collected from Khao Ma Cho, Samaesan and Chuang Islands

Species	Number of specimens collected from each study site (individuals)			Total
	Khao Ma Cho	Samaesan Island	Chuang Island	
Unknown sp. 1	3	-	-	3
Unknown sp. 2	1	1	-	2
Unknown sp. 3	-	1	1	2
Unknown sp. 4	2	1	3	6
Unknown sp. 5	-	-	3	3
Unknown sp. 6	-	1	-	1
Unknown sp. 7	1	1	1	3
Unknown sp. 8	1	-	1	2
Unknown sp. 9	-	-	1	1
Unknown sp. 10	-	1	4	5
Unknown sp. 11	-	2	1	3
Unknown sp. 12	-	-	1	1
Unknown sp. 13	1	-	-	1
Unknown sp. 14	1	-	-	1
Unknown sp. 15	-	-	1	1
TOTAL	10	8	17	35

13. Subfamily Opiinae

Opiinae Blanchard, 1845 (Wharton, 1997)

Distribution: Cosmopolitan

Life history: koinobiont endoparasitoids

Host: Diptera (mostly Agromyzidae and Tephritidae)

Diagnosis: Epicnemial carina absent; occipital carina often absent medially; occipital carina, when present, usually meeting subgenal carina, not hypostomal carina; hind wing with vein 2m-cu often present; clypeus with ventral margin not concave (Yu et al., 2012) (Figure 4.35).

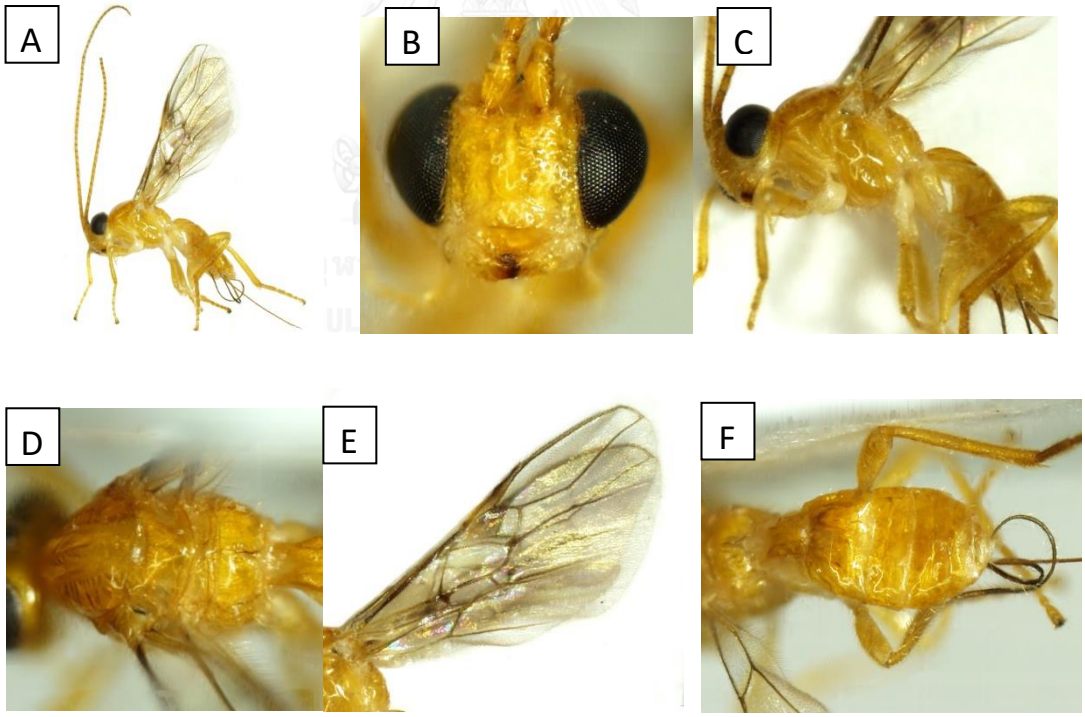


Figure 4.35 Light microscope photograph of *Opius* Wesmael, 1835: A, whole body; B, face; C, lateral view of mesosoma; D, dorsal view of mesosoma; E, wings and F, dorsal view of metasoma

Opiinae is a large subfamily with over 1,300 described species worldwide. They are usually brown or blackish but some are more brightly marked with orange or yellow (Shaw and Huddleston, 1991).

Three percent of the specimens (17 from 652 specimens) were classified as Opiinae, collected from Khao Ma Cho (2 specimens) and Samaesan Island (15 specimens), none of the specimen was recorded from Chuang Island. A species of *Diachasmimorpha* Viereck, 1913, *Opius* Wesmael, 1835 and *Psyttalia* Walker, 1860 and an unknown species had been recorded from this study (Table 4.12).

Diachasmimorpha species are endoparasitoids of tephritid larvae. They have high potential value for being natural enemies to control tephritid pest in Biological control programme (Wharton, 1997). Characteristics of Opiinae are 2nd metasomal tergite coarsely striate or costate medially; pronope absent or nearly so; notauli complete; vein m-cu of fore wing just antefurcal (Figure 4.36).

Psyttalia contains approximately 50 described species, all endemic to the Old World. Host records are available for 24 species, all of these are koinobiont endoparasitoids of Tephritidae, ovipositing in the host larva and emerging from the puparium (Wharton, 1997). Characteristic of *Psyttalia* are shorter second metasomal tergum than the third, presence of a short clypeus, which is widely separated from

the mandibles, and a large hypopygium that is strongly attenuate or tapers, with the apex drawn out to a sharp point (Figure 4.36).

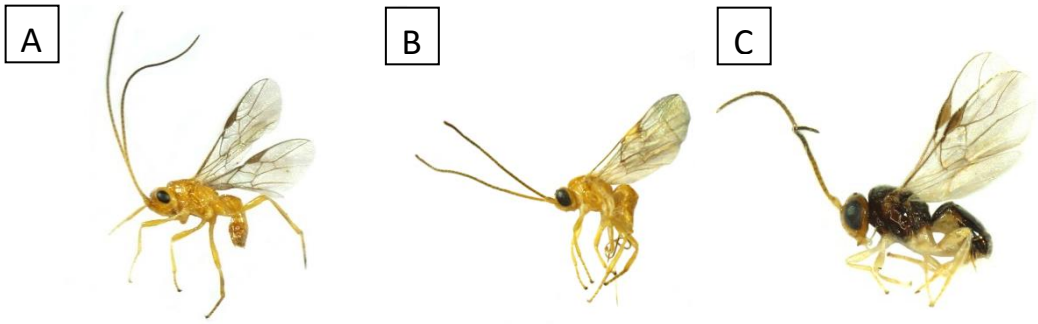


Figure 4.36 Light microscope photograph of braconid subfamily Opiinae: A, *Diachasmimorpha* sp.; B, *Psyttalia* sp. and C, unknown sp.

Opius is the largest genus of the Opiinae, with 33 subgenera and 135 described species (Yu et al., 2012). Only a single species of *Opius* was recorded from this study (Figure 4.35). Characteristic of *Opius* are occipital carina not slightly curved ventrally and remain removed from hypostomal carina; apical half of mandible comparatively narrow and resulting in small teeth, mandible abruptly widened baso-ventrally and more or less tooth-like protruding basally and not only widened by a protruding carina; malar suture deep; mesoscutum strongly shing; propodeum without a transverse carina subbasally (Li et al., 2013).

Table 4.12 Number of Opiinae specimens collected from Khao Ma Cho, Samaesan and Chuang Islands

Species	Number of specimens collected from each study site (individuals)			Total
	Khao Ma Cho	Samaesan Island	Chuang Island	
Diachasmimorpha sp.	-	8	-	8
Opius sp.	1	1	-	2
Psyttalia sp.	1	5	-	6
Unknown sp. 1	-	1	-	1
TOTAL	2	15	-	17

14. Subfamily Orgilinae

Orgilinae Ashmead, 1900 (van Achterberg and Braet, 2001)

Distribution: Cosmopolitan

Life history: koinobiont endoparasitoids

Host: Lepidoptera (mostly micro-lepidoptera)

Diagnosis: fore wing vein r-m usually absent, if present, then cell 1-Rs triangular, vein A lacking anal crossveins; occipital carina usually present; no wing fold between vein 1/Rs and stigma; dorsal pit absent; vein 2cu-a of fore wing present; hind tibia with pegs near base of spurs (Figure 4.37).

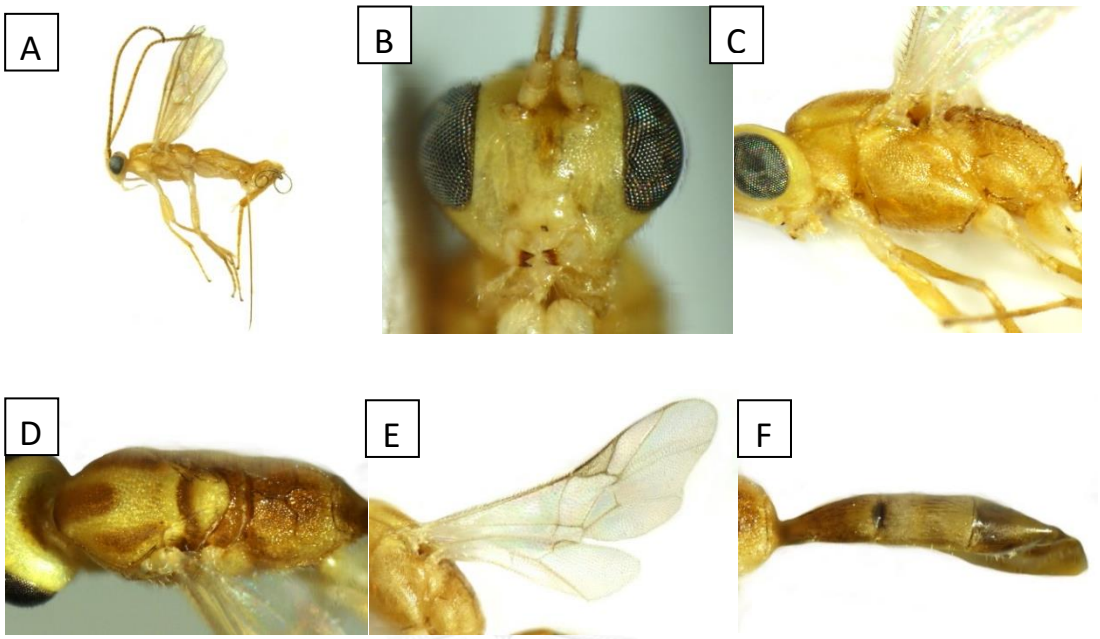


Figure 4.37 Light microscope photograph of *Orgilus*: A, whole body; B, face; C, lateral view of mesosoma; D, dorsal view of mesosoma; E, wings and F, dorsal view of metasoma

Orgilinae is a small subfamily of the Braconidae with only a few genera and most of the genera are cosmopolitan.

Nine specimens of Orgilinae were discovered at Khao Ma Cho (5 specimens), Samaesan Island (2 specimens) and Chuang Island (2 specimens). A species of *Orgilus* Haliday, 1833 and 2 unknown species were recorded (Table 4.13).

Morphological characters of *Orgilus* are face flattened in lateral view, smooth between sparsely punctures, with long setae; clypeus flattened in lateral view; length of malar space 1.5 times the basal width of mandible; malar suture absent; occipital flange small (van Achterberg and Braet, 2001) (Figure 4.37).

The 2 unknown species of Orgilinae are shown in figure 4.38.

Figure 4.38 Light microscope photograph of the braconid subfamily Orgilinae: A, unknown sp. 1 and B, unknown sp. 2

Table 4.13 Number of Orgilinae specimens collected from Khao Ma Cho, Samaesan and Chuang Island

Species	Number of specimens collected from each study site (individuals)			Total
	Khao Ma Cho	Samaesan Island	Chuang Island	
Orgilus sp.	2	1	-	3
Unknow sp. 1	2	1	2	5
Unknow sp. 2	1	-	-	1
TOTAL	5	2	2	9

15. Subfamily Pambolinae

Pambolinae Marshall, 1885 (Yu et al., 2005)

Distribution: Cosmopolitan

Life history: idiobiont parasitoids

Host: Coleoptera (Chrysomelidae, Curculionidae, Anobiidae and others) and Lepidoptera (mostly Tineidae)

Diagnosis: Labrum concave; 2nd metasomal tergite with spiracles on median tergite or near margin of median and lateral tergites; occipital carina absent medially; 1st metasomal tergite without mid longitudinal carina, with 2 percurrent logitudinal carinae; epicnemial carina present; propodeum often with posterolateral spine or bump (Figure 4.39); 2nd and 3rd metasomal tergites, usually smooth, but if sculptured then not covering following terga.

Pambolinae is a derived group of the subfamilies Hormiinae, Lysiterminae, and Betylobraconinae (Belshaw et al., 2000). Therefore, this is the first record of Pambolinae in Thailand.

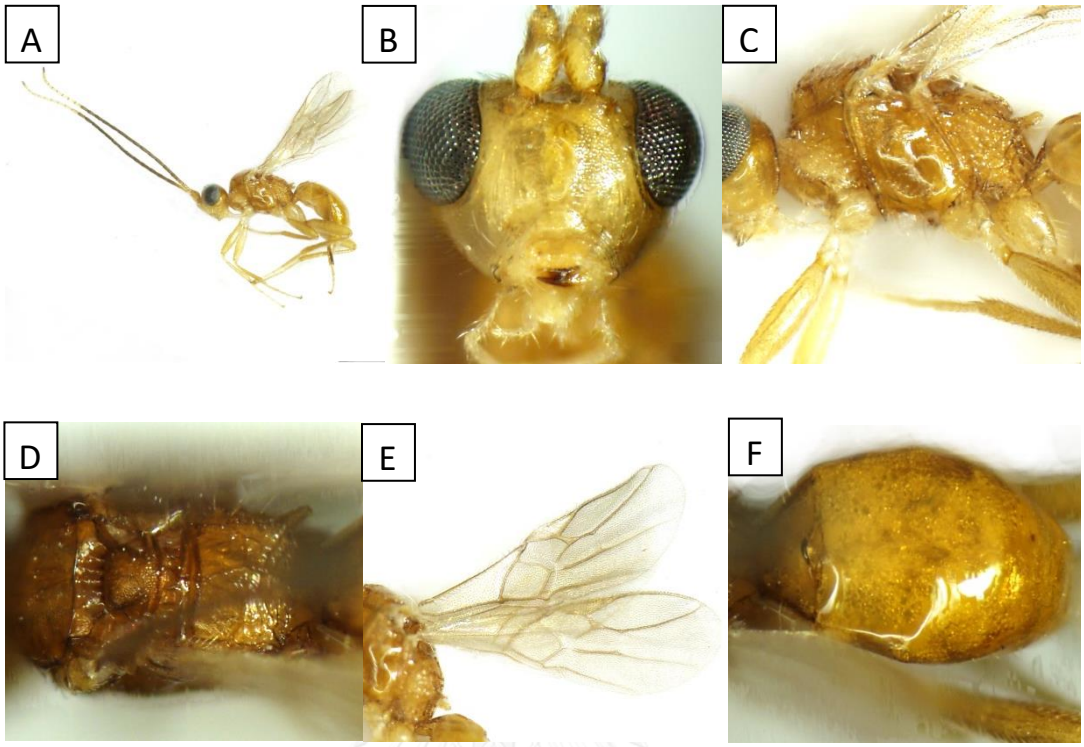


Figure 4.39 Light microscope photograph of *Pambolus*: A, whole body; B, face; C, lateral view of mesosoma; D, dorsal view of mesosoma; E, wings and F, dorsal view of metasoma

Four percent of the specimens (25 of 652 specimens) were Pambolinae. The number of specimens found at Khao Ma cho, Samaesan and Chuang Island were 10, 11 and 4 specimens, respectively (Table 4.14). Three species of *Pambolus* Haliday, 1836 and 6 unknown species were recorded.

Morphological characters of *Pambolus* are having a pair of propodeal spines, the apically oblique scapus, the apically strongly widened first metasomal tergite, largely flat labrum, the presence of the postpectal carina and lack of the malar

suture (Martínez et al., 2012) (Figure 4.39). The 3 species of *Pambolus* collected from this study are shown in figure 4.40.

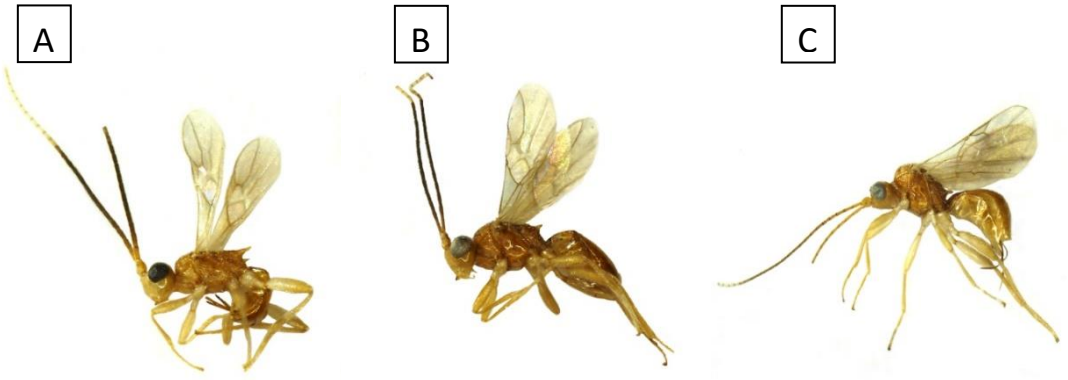


Figure 4.40 Light microscope photograph of the *Pambolus*: A, *Pambolus* sp. 1; B, *Pambolus* sp. 2 and C, *Pambolus* sp. 3

The 6 unknown species of Pambolinae are shown in figure 4.41.

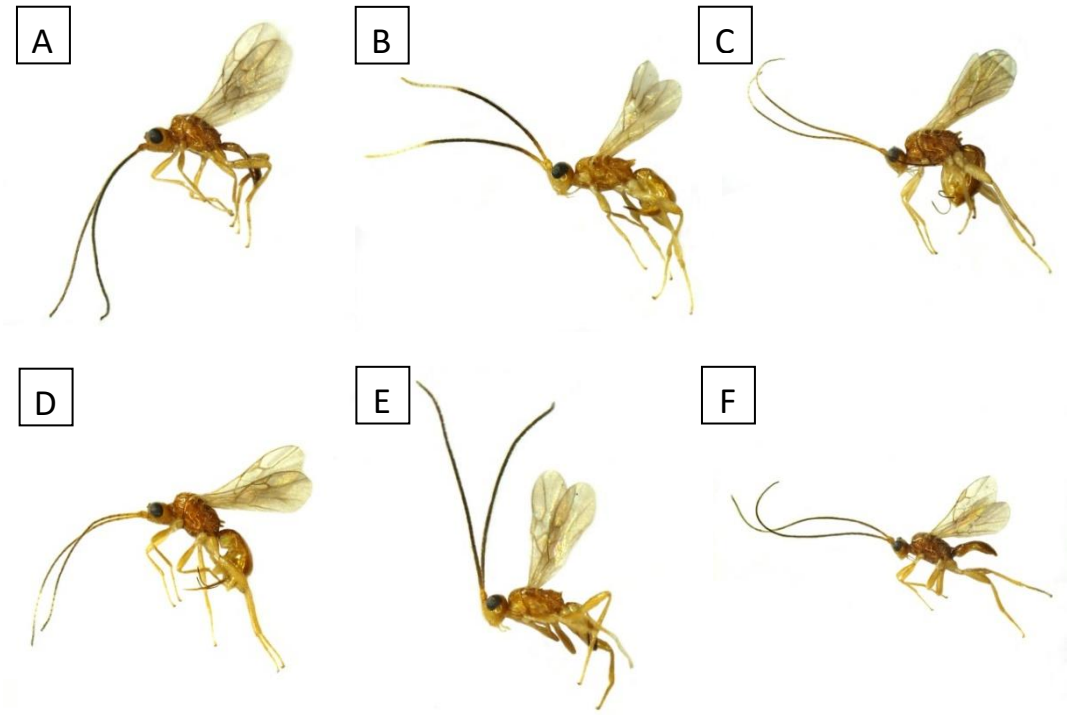


Figure 4.41 Light microscope photograph of the braconid subfamily Pambolinae: A, unknown sp. 1; B, unknown sp. 2; C, unknown sp. 3; D, unknown sp. 4; E, unknown sp. 5 and F, unknown sp. 6

Table 4.14 Number of Pambolinae specimens collected from Khao Ma Cho, Samaesan and Chuang Islands

Species	Number of specimens collected from each study site (individuals)			Total
	Khao Ma Cho	Samaesan Island	Chuang Island	
Pambolus. sp. 1	2	5	2	9
Pambolus. sp. 2	1	2	-	3
Pambolus. sp. 3	-	-	1	1
Unknown sp. 1	4	-	1	5
Unknown sp. 2	-	2	-	2
Unknown sp. 3	1	-	-	1
Unknown sp. 4	-	2	-	2
Unknown sp. 5	1	-	-	1
Unknown sp. 6	1	-	-	1
TOTAL	10	11	4	25

16. Subfamily Rhysipolinae

Rhysipolinae Belokobylskij, 1984 (van Achterberg, 1995)

Distribution: cosmopolitan

Life history: ectoparasitoids

Host: Lepidoptera

Diagnosis: Labrum concave; occipital carina ending ventrally on subgenal carina; 1st metasomal tergite without mid longitudinal carina, or metasoma not coarsely sculptured beyond 1st tergite or both; anterior surface of protibia without pegs and spines; median carina of propodeum long (Figure 4.42).

This group is poorly known both taxonomically and biologically at the generic and species level because species members are rare and small in their size. Moreover, after erected in 1984, only small number of molecular approaches has been used for the species identification which results in alternations of the taxonomic status several times (Spencer and Whitfield, 1999). Therefore, this is the first record of Rhysipolinae in Thailand.

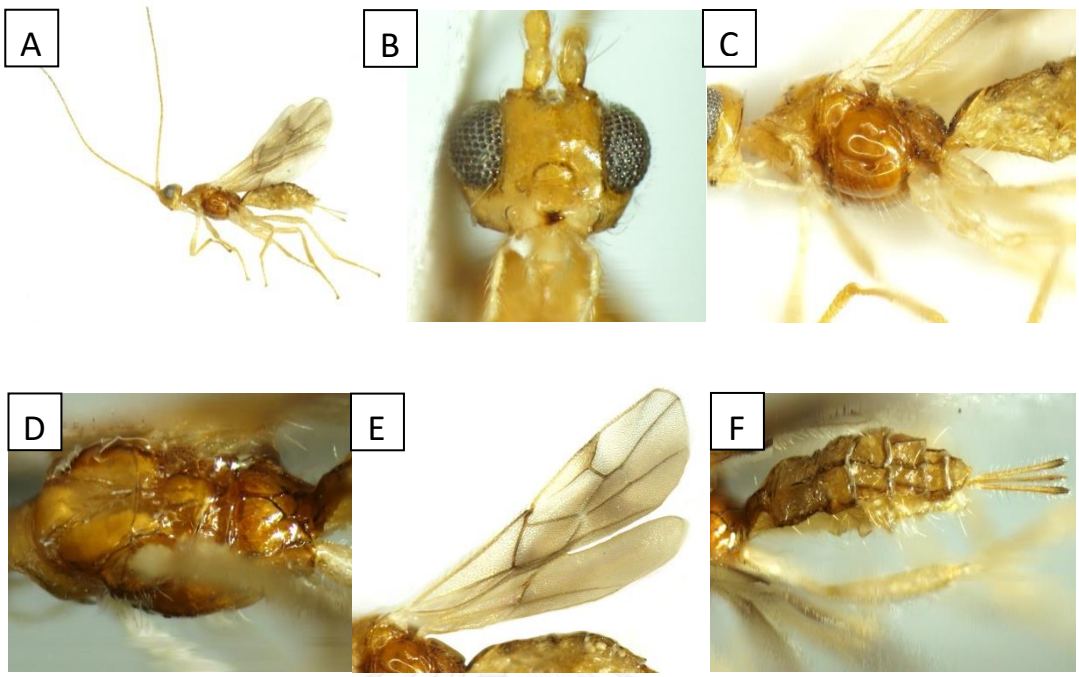


Figure 4.42 Light microscope photograph of braconid wasp subfamily Rhysipolinae: A, whole body; B, face; C, lateral view of mesosoma; D, dorsal view of mesosoma; E, wings and F, dorsal view of metasoma

Nine specimens of Rhysipolinae have been collected from Khao Ma Cho (4 specimens), Samaesan Island (a single specimen) and Chuang Island (4 specimens). Four unknown species have been found (Table 4.15). The data of Rhysipolinae are very limited worldwide and lack of idenfication keys to identify the specimens.

The 4 unknown species of Rhysipolinae are shown in figure 4.43.

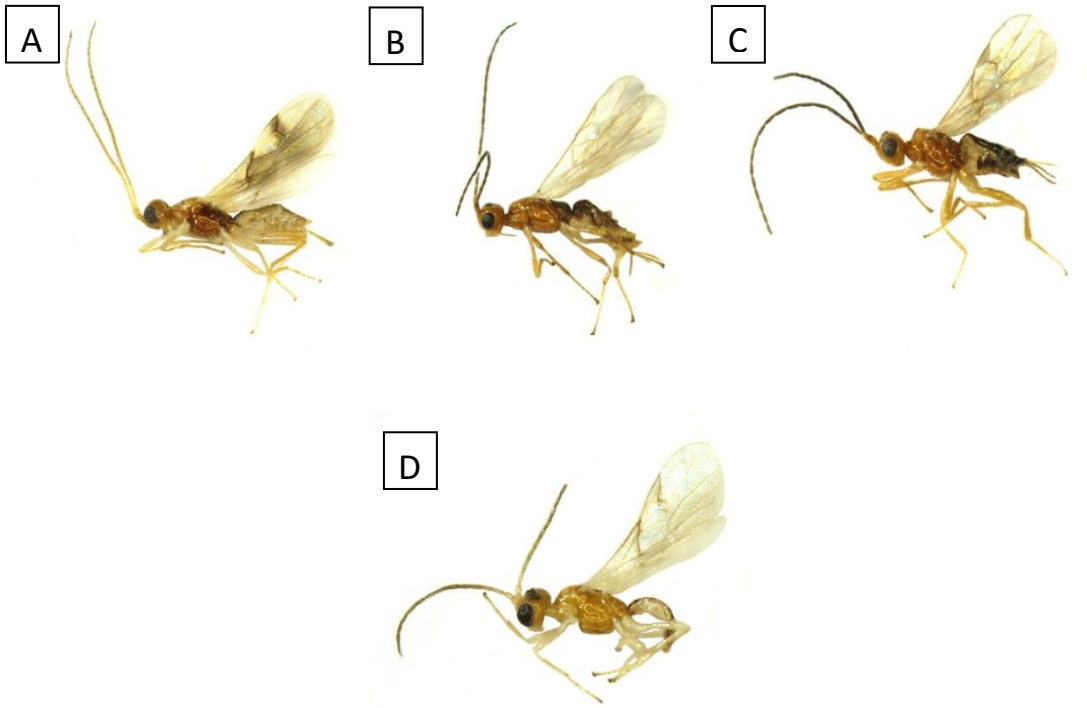


Figure 4.43 Light microscope photograph of the braconids subfamily Rhysipolinae: A, unknown sp. 1; B, unknown sp. 2; C, unknown sp. 3 and D, unknown sp. 4

Table 4.15 Number of Rhysipolinae specimens collected from Khao Ma Cho, Samaesan and Chuang Islands

Species	Number of specimens collected from each study site (individuals)			Total
	Khao Ma Cho	Samaesan Island	Chuang Island	
Unknow sp. 1	4	1	-	5
Unknow sp. 2	-	-	2	2
Unknow sp. 3	-	-	1	1
Unknow sp. 4	-	-	1	1
TOTAL	4	1	4	9

17. Subfamily Rogadinae

Rogadinae Förster, 1862 (Aydogdu and Beyarslan, 2005)

Distribution: cosmopolitan

Life history: koinobiont endoparasitoids

Host: exposed feeding lepidopteran larvae

Diagnosis: Inner side of eyes distinctly emaginate and/or 2nd metasomal spiracles in notum of tegite; median carina of propodeum usually at least half as long as propodeum; dorsal carinae of 1st metasomal tergite frequently with small triangular area medio-basally (Figure 4.44).

Rogadinae is a moderately large subfamily, containing approximately 800 species within 90 genera worldwide (Shaw and Huddleston, 1991).

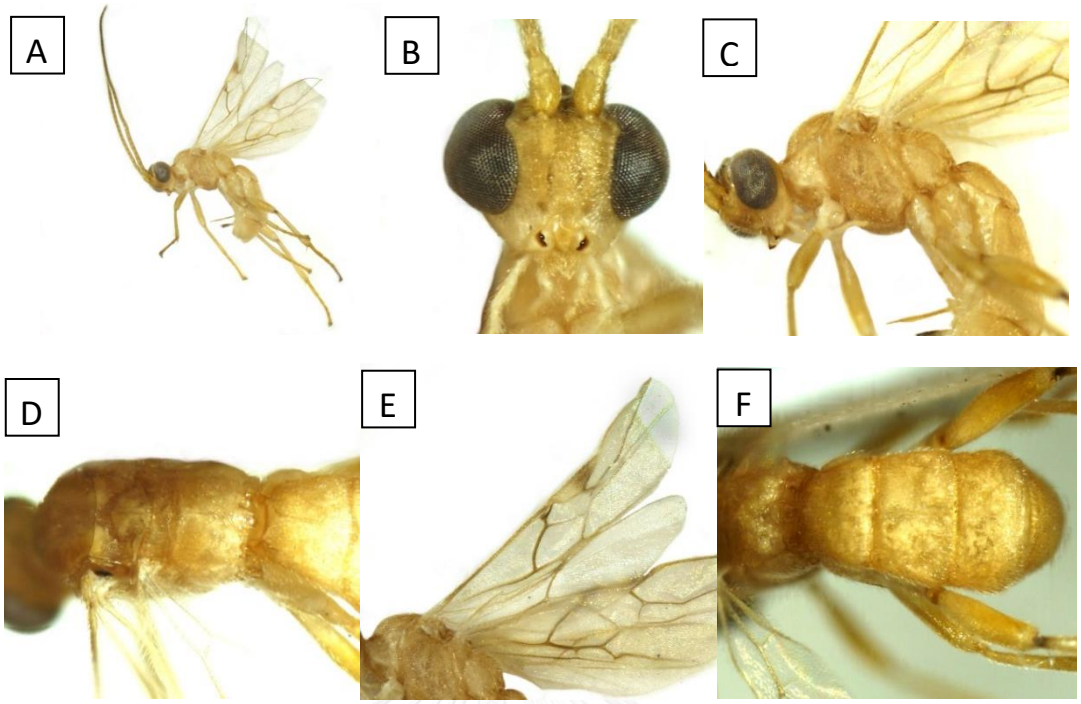


Figure 4.44 Light microscope photograph of *Aleiodes*: A, whole body; B, face; C, lateral view of mesosoma; D, dorsal view of mesosoma; E, wings and F, dorsal view of metasoma

Twenty-one specimens (3% of the total specimens) have been collected from Khao Ma Cho (8 specimens), Samaesan Island (12 specimens) and Chuang Island (1 specimen). Three gerena of Ragadinae; *Aleiodes* Wesmael, 1838 (9 species), *Clinocentrini* Achterberg, 1991 (1 species) and *Yelicones* Cameron, 1887 (2 species) were recorded (Table 4.16). Moreover, new species of *Aleiodes* was discovered from these study sites.

The genus *Aleiodes* comprises 431 species worldwide (Yu et al., 2012), 179 new species had been recently described from Thailand (Butcher et al., 2012). They

have pectinate tarsal claws and strongly protruding clypeal carina (Shaw, 1983, Fortier and Shaw, 1999). *Aleiodes* found in this research are shown in Figure 4.45.

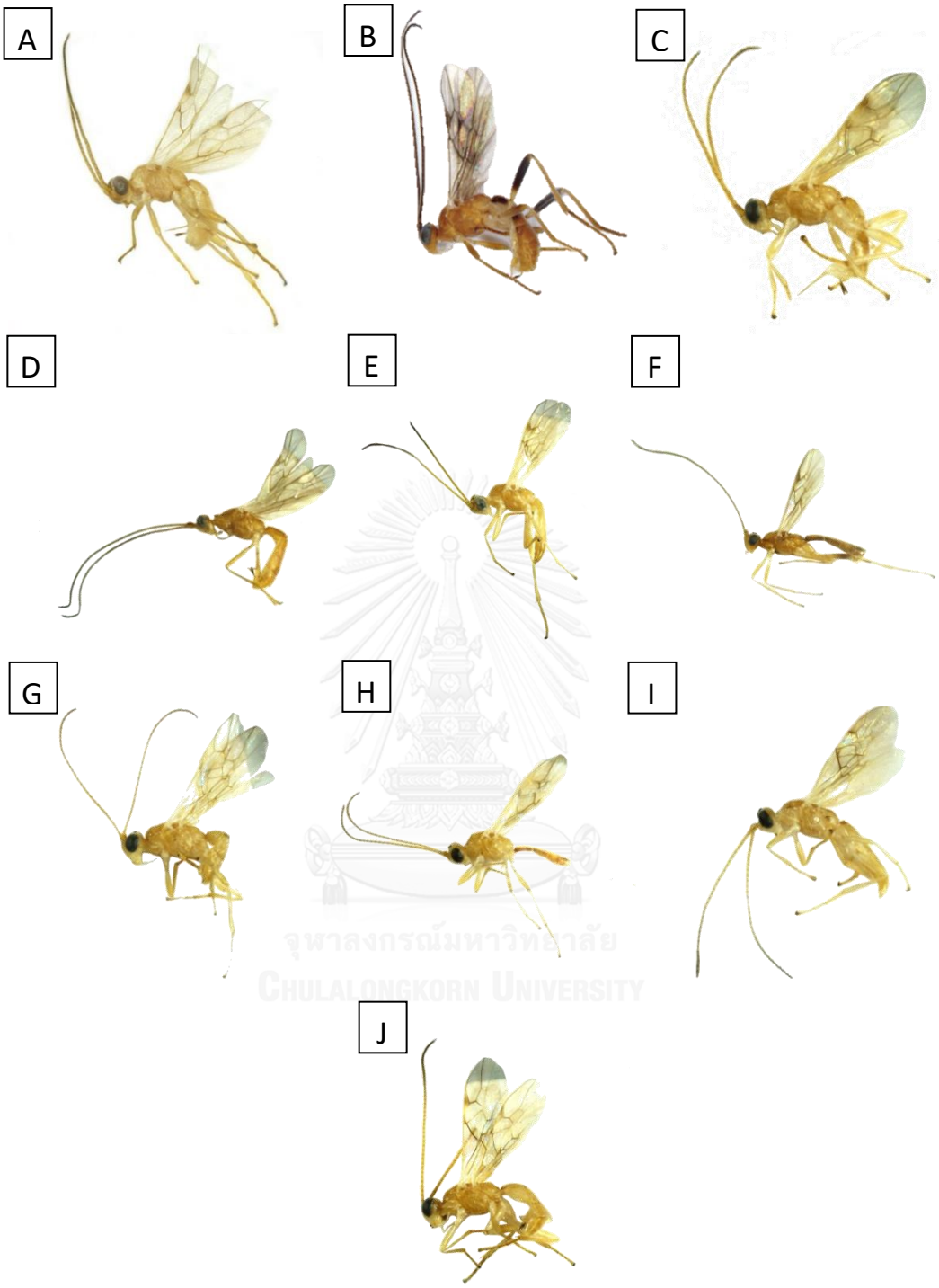


Figure 4.45 Light microscope photograph of *Aleiodes* Wesmael, 1838: A, *Aleiodes bugarae*; B, *Aleiodes* sp. 1; C, *Aleiodes* sp. 2; D, *Aleiodes* sp. 3; E, *Aleiodes* sp. 4; F, *Aleiodes* sp. 5; G, *Aleiodes* sp. 6; H, *Aleiodes* sp. 7; I, *Aleiodes* sp. 8 and J, *Aleiodes* sp. 9

The genus *Clinocentrini* Achterberg, 1991 is cosmopolitan, with more than 30 described species (Belokobylskij, 1995, Chen and He, 1997, Yu et al., 2005). *Clinocentrini* species found in this study are shown in Figure 4.46.

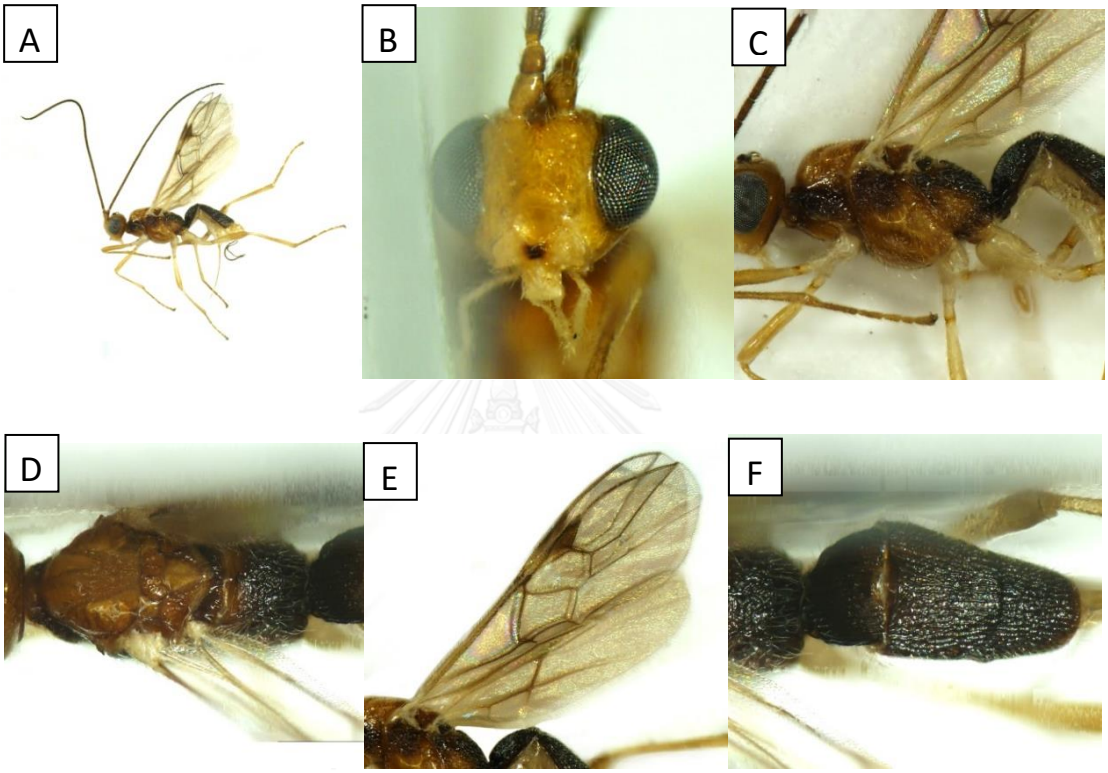


Figure 4.46 Light microscope photograph of *Clinocentrini*: A, whole body; B, face; C, lateral view of mesosoma; D, dorsal view of mesosoma; E, wings and F, dorsal view of metasoma

A decade ago, 76 new species of *Yelicones* have been described from the New World which indicating that its true diversity is still largely unknown (Butcher and Quicke, 2006). Characteristic of *Yelicones* are shown in Figure 4.47.

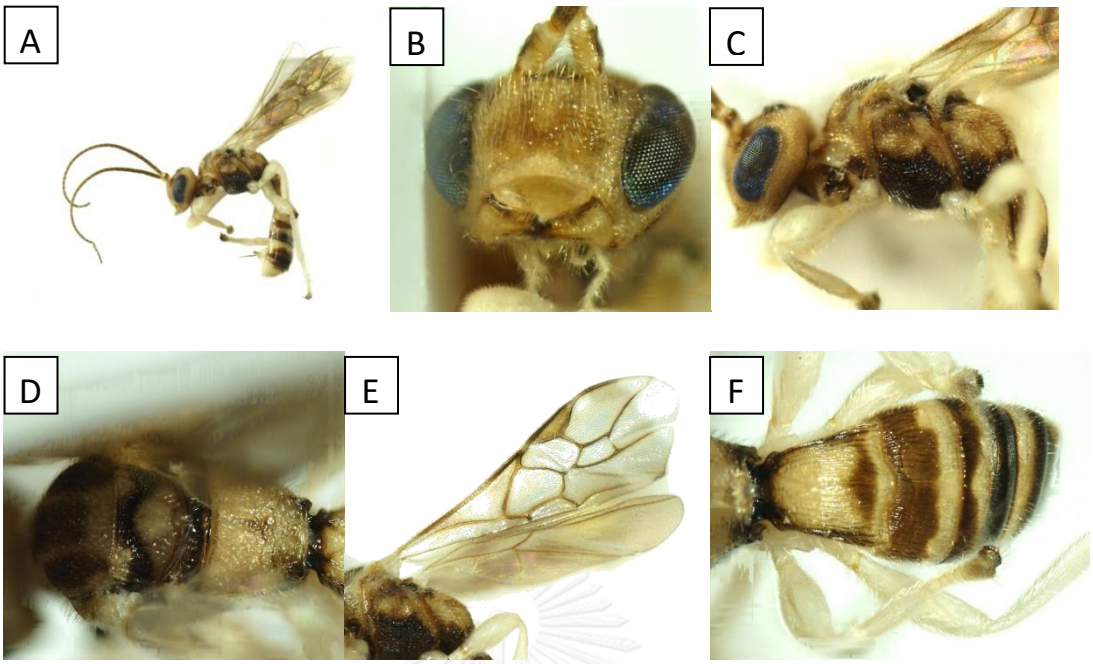


Figure 4.47 Light microscope photograph of *Yelicones*: A, whole body; B, face; C, lateral view of mesosoma; D, dorsal view of mesosoma; E, wings and F, dorsal view of metasoma

Table 4.16 Number of Rogadinae specimens collected from Khao Ma Cho, Samaesan and Chuang Islands

Species	Number of specimens in each study sites (individuals)			Total
	Khao Ma Cho	Samaesan Island	Chuang Island	
Aleiodes n. sp.	1	-	-	1
Aleiodes bugarae	1	-	-	1
Aleiodes sp. 2	1	1	-	2
Aleiodes sp. 3	-	1	-	1
Aleiodes sp. 4	-	1	-	1
Aleiodes sp. 5	-	3	-	3
Aleiodes sp. 6	-	1	-	1
Aleiodes sp. 7	1	-	-	1
Aleiodes sp. 8	2	-	-	2
Aleiodes sp. 9	-	1	-	1
Clinocentrini sp.	-	-	1	1
Yelicones samaesanensis	3	-	-	3
Yelicones sp.	-	3	-	3
TOTAL	9	11	1	21

Taxonomic data of Thai braconid wasps shows a limitation in literature numbers, perhaps due to only a few experts who work on the Braconidae. During the last decade, there are more papers on systematics of tropical parasitic wasps, especially in Thailand (Butcher and Quicke, 2002, Butcher et al., 2012, Quicke, 2012, Butcher, 2014). It has been estimated that there should be many more new species of the parasitic wasps in Thailand.

4.3 Idiobionts and koinobionts

As a result of the fieldwork, 12 koinobiont subfamilies (Agathidinae, Alysiinae, Cheloninae, Euphorinae, Helconinae, Macrocentrinae, Meteorideinae, Microgastrinae, Opiinae, Orgilinae, Rhysipilinae and Rogadinae) and 5 idiobiont subfamilies (Braconinae, Doryctinae, Hormiinae, Lysiterminae and Pambolinae) have been recorded (Table 4.20). Askew and Shaw (1986) predicted that koinobiont braconid wasps should have a narrower host range than idiobionts because of selection to circumvent functioning host defences. Althoff (2003) reported that some koinobiont genera that utilised many host families and, some idiobiont genera utilised only one host family. Therefore, the koinobiont braconid wasps can be found easier than the idiobiont braconid wasps, in the same way of the results in this thesis. Numbers of koinobionts specimens have been recorded more than the idiobionts in most of the collecting periods (Figure 4.48).

Table 4.17 Life history of the Braconidae

Types of braconid wasps	Subfamilies
Idiobiont	Braconinae, Doryctinae, Hormiinae, Lysiterminae and Pambolinae
Koinobiont	Agathidinae, Alysiinae, Cheloninae, Euphorinae, Helconinae, Macrocentrinae, Meteorideinae, Microgastrinae, Opiinae, Orgilinae, Rhysipilinae and Rogadinae

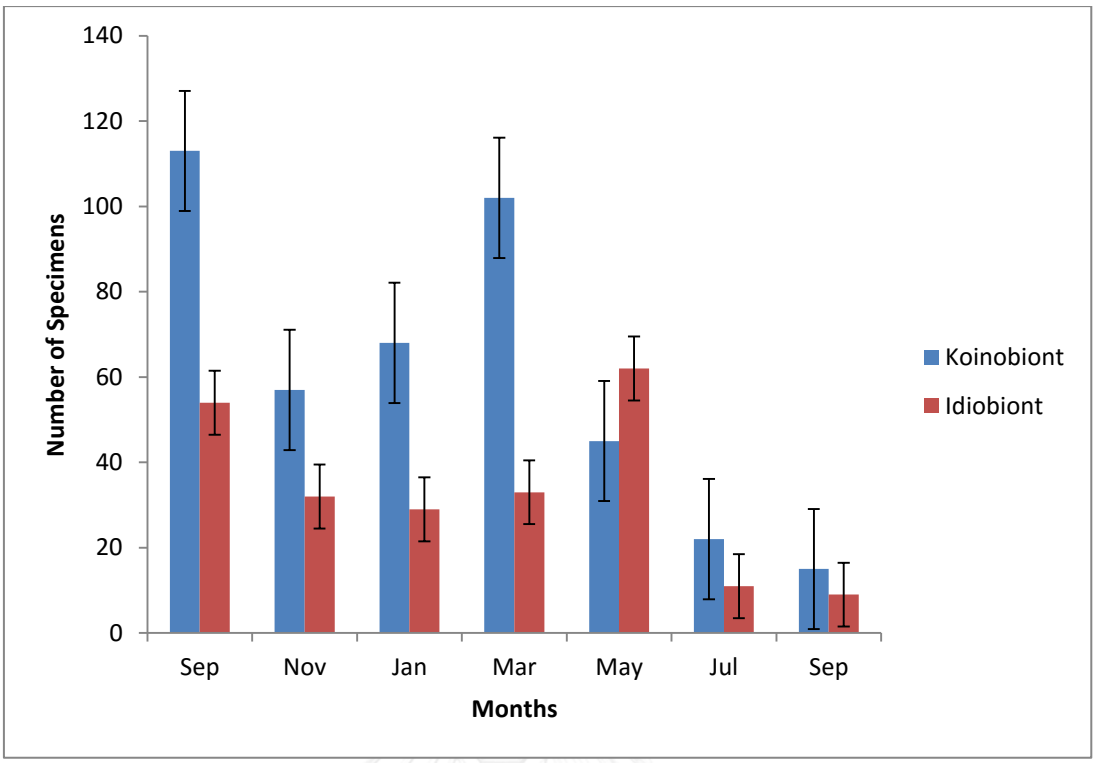


Figure 4.48 Number of koinobiont and idiobiont specimens recorded each month

4.4 New recorded subfamilies of Braconidae in Thailand

From this study, there are 4 new recorded subfamilies of Braconidae in Thailand as follow: Helconinae, Lysiterminae, Pambolinae and Rhysipolinae.

4.5 New species

From this study, at least 5 new species (under period of thorough investigation, identification, and nomenclature) have been found. Yet, there are no identification keys to identify 4 of 5 species. Only one species can be confirmed identification as *Aleiodes* n. sp.

The *Aleiodes* new species (female, Figure 4.49) belongs to the subfamily Rogadinae, it has been collected from Khao Ma Cho, Chonburi Province, Thailand in November 2013. It appears closest to *A. pectunguisella* (from Chaiyaphum, Thailand). *A.* new species keys out to the couplet 175 using Key to the *Aleiodes* (*Aleiodes*) and *Aleiodes* (*Arcaleiodes*) species of Thailand (Butcher et al., 2012).

Holotype, female; data: Thailand. Chonburi: Khao Ma Cho, Samaesan, Sattahip, 24 November 2013, V. Charoennitiwat, light trap; deposited: Insect Collections of Museum of Natural History, Chulalongkorn University, Bangkok, Thailand (CUMZ).

Description (female). Length of body 5.5 mm.

Antenna with 53 flagellomere. Approximately, first flagellomere 2.75x longer than wide; second flagellomere 2x longer than wide; third flagellomere 1.8x longer than wide; terminal flagellomere 2x longer than wide; Height of clypeus: inter-tentorial distance: tentorio-ocular distance = 1: 1.5: 1; clypeus with shallow punctures; face with transverse striate medially, with mid-longitudinal carina between antennal sockets reaching half way to clypeus; height of eye: width of face: width of head = 1.1: 1: 2.2; length of face 0.8 shorter than wide; frons with distinct transverse striate behind antennal sockets, without mid-longitudinal carina; occiput moderately long setose; horizontal length of eye: horizontal length of head behind eye = 2.5: 1;

post ocellar length: tranverse diameter of posterior ocellus: shortest distance between posterior ocellus and eye = 1.7: 2.5: 1; complete occipital carina.

Mesosoma with moderately short setose, 1.6x longer than wide; mesoscutum without mid-longitudinal carina, postero-medially with deep rugose; notauli well-developed deeply impressed throughout; length of mesoscutum; scutellus sulcus with 5 carinae between two outer ones; scutellum smooth; metanotum postero-medially with pit; mesopleuron rugulose antero-medially, without becoming aciculate posteriorly, precoxal suture: propodeum with mid-longitudinal carina present on basal 0.5, coarsely rugose posteriorly.

Fore wing: length of vein SR1: 3SR: r = 3.3: 1.1: 1, vein 1-SR+M weakly sinusoidal; vein r arising 0.5 distance along pterostrigma; lengths of veins 2-SR: 3-SR: r-m = 1.4: 2.2: 1; lengths of veins 2-CU1: 1-CU1 = 1.5: 1.

Hind wing: length of vein M+CU: 1-M = 1.4: 1; evenly moderately setose.

Fore femur 4.7x longer than wide; hind femur 4.6x longer than wide; length of hide femur: tibia: basitarsus = 2.1: 2.7: 1; hind basitarsus 3.6x longer than wide.

Metasomal tergites moderately setose more densely setose laterally; first metasomal tergite with longitudinal striate (0.9x shorter than wide), anteriorly with smooth triangle formed by uniting dorsal carinae, with median carina extending to posterior margin of tergite; second metasomal tergite completely longitudinal striate

(0.8x shorter than wide), with distinct median carina reaching posterior margin of tergite, second suture deep and crenulate; third metasomal tergite (0.6x shorter than wide) basal half striate, 0.5 distal rather smooth, with median carina extended half way to the posterior margin of tergite; metasomal tergies 4-7 shinny and smooth.

Colour: body largely yellow, except for first metasomal tergite laterally; second metasomal tergite basal half; hind femur 0.8 distal, dark brown.

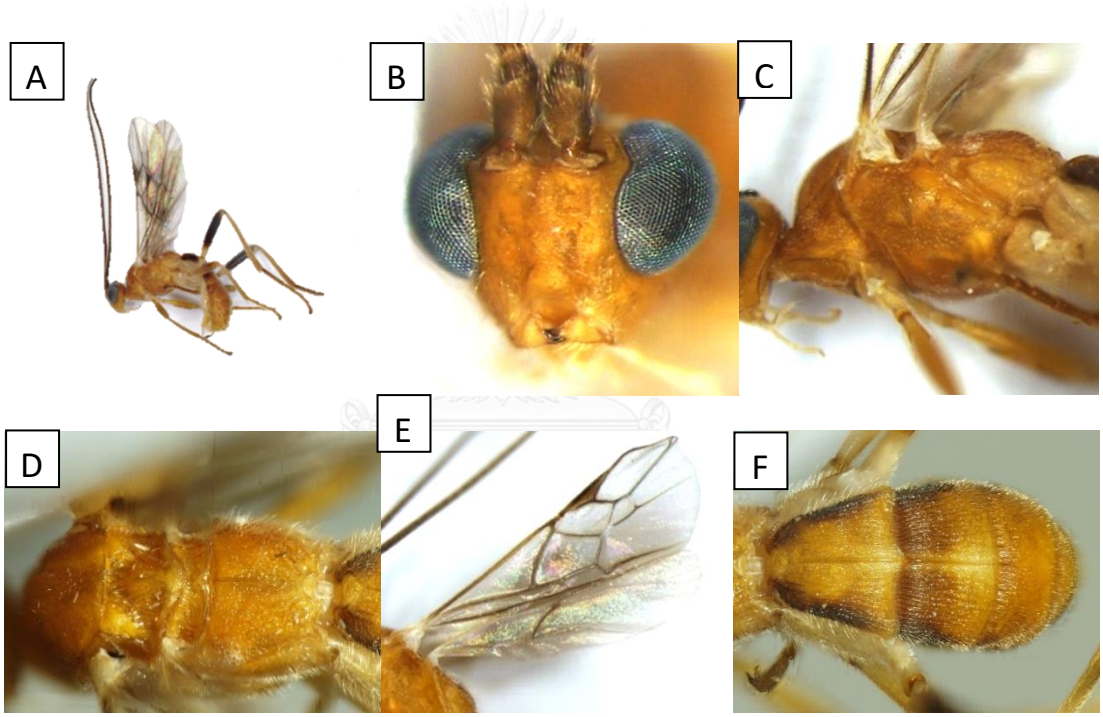


Figure 4.49 Light microscope photograph of *Aleiodes* new species: A, whole body; B, face; C, lateral view of mesosoma; D, dorsal view of mesosoma; E, wings and F, dorsal view of metasoma

4.6 Numbers of nocturnal braconid wasp specimens and species collected each month

In total, six hundred and fifty two specimens (175 morphospecies) were collected from September 2013 – September 2014. The highest number of

specimens and species collected from this study is in the subfamily Cheloninae (36 morphospecies, 291 specimens) (Table 4.18 and 4.19). Cheloninae is a large subfamily of nocturnal parasitoid. They are generalist which can parasitize most of the lepidopterans (Edmardash et al., 2011). Only a single species of Agathidinae, Helconinae, and Meteorideinae were collected from Samaesan Island because Samaesan Island has many different habitats among the 3 study sites.

Table 4.18 Number of nocturnal braconid specimens collected each month

Subfamilies	Number of specimens in each month (individuals)							Total
	Sep 2013	Nov 2013	Jan 2014	Mar 2014	May 2014	Jul 2014	Sep 2014	
Agathidinae	1	0	0	0	0	0	0	**1**
Alysiinae	2	3	1	0	0	0	2	**8**
Braconinae	15	1	1	5	5	2	1	**30**
Cheloninae	75	14	57	86	38	18	3	**291**
Doryctinae	18	17	13	12	25	1	3	**89**
Euphorinae	7	6	0	5	0	0	1	**19**
Helconinae	1	0	0	0	0	0	0	**1**
Hormiinae	15	10	6	9	26	0	2	**68**
Lysiterminae	5	4	9	2	2	0	1	**22**
Macrocentrinae	0	5	0	0	0	1	0	**6**
Meteorideinae	0	1	0	0	0	0	0	**1**
Microgastrinae	5	18	1	4	2	2	3	**35**
Opiinae	16	1	0	0	0	0	0	**17**
Orgilinae	1	1	0	2	0	1	4	**9**
Pambolinae	4	0	0	6	5	8	2	**25**
Rhysipolinae	0	5	2	1	1	0	0	**9**
Rogadinae	3	3	7	3	3	0	2	**21**
TOTAL	**167**	**89**	**97**	**135**	**107**	**33**	**24**	**652**

Table 4.19 Number of nocturnal braconid species collected each month

Subfamily	Number of species in each month							Total
	Sep 2013	Nov 2013	Jan 2014	Mar 2014	May 2014	Jul 2014	Sep 2014	
Agathidinae	1	0	0	0	0	0	0	**1**
Alysiinae	1	2	1	0	0	0	2	**6**
Braconinae	8	1	1	5	5	1	1	**16**
Cheloninae	16	11	14	25	13	7	3	**35**
Doryctinae	11	11	11	7	16	1	3	**35**
Euphorinae	2	3	0	2	0	0	1	**5**
Helconinae	1	0	0	0	0	0	0	**1**
Hormiinae	8	4	5	4	9	0	2	**13**
Lysiterminae	3	4	6	2	2	0	1	**13**
Macrocentrinae	0	1	0	0	0	1	0	**2**
Meteorideinae	0	1	0	0	0	0	0	**1**
Microgastrinae	5	11	1	2	2	2	3	**15**
Opiinae	3	1	0	0	0	0	0	**4**
Orgilinae	1	0	0	1	0	1	2	**3**
Pambolinae	3	0	0	5	3	4	2	**8**
Rhysipolinae	0	3	2	1	1	0	0	**4**
Rogadinae	3	3	5	3	3	0	1	**13**
TOTAL	**65**	**57**	**46**	**56**	**52**	**17**	**21**	**175**

4.7 Sorensen coefficient of similarity

The similarity indices calculated from this study were shown in the table 4.20. The braconid species collected from Samaesan Island are more similar to those collected from Khao Ma Cho more than Chuang Island, because Samaesan Island located nearer to Khao Ma Cho (mainland) than Chuang Island.

Table 4.20 The similarity index coefficient of all experimental areas

Study sites	Khao Ma Cho	Samaesan Island	Chuang Island
Khao Ma Cho	1.00	0.73	0.35
Samaesan	0.73	1.00	0.37
Chuang	0.35	0.37	1.00

4.8 Species richness by Chao-1 estimator

From this study, the number of singletons is 82 species and the number of doubletons is 35. The Chao-1 value from this study is 271 (175 + 96) that mean the estimated number of the braconid species from these study sites should be approximately 271 species.

4.9 Sampling seasons

Typically, there are 3 seasons in Thailand, according to meteorological department: Rainy or southwest monsoon season (mid-May to mid-October), winter or northeast monsoon season (mid-October to mid-February) and summer or pre-monsoon season (mid-February to mid-May). In this study, September 2013, July and

September 2014 were categorized to rainy season, November and January 2014 were winter and March and May 2014 were summer. Then, the data of samples in each season can be converted into the bar graph (Figure 4.50). 224, 186 and 242 of samples were collected on the rainy, winter and summer season, respectively. As can be clearly seen from the figure, wasps population rose highest during the summer then rainy and winter season, respectively, because high temperature during the summer increased host populations of the braconid wasps. An explanation of the relationship between thermal dynamic and insect pressures was remarked by Cossins and Bowler (1987); most of insects are ectotherm, their activities including reproduction, foraging, and so on are regulated by their environment (Henriksen, 2012). This means warmer temperature increases their rate of life cycle.

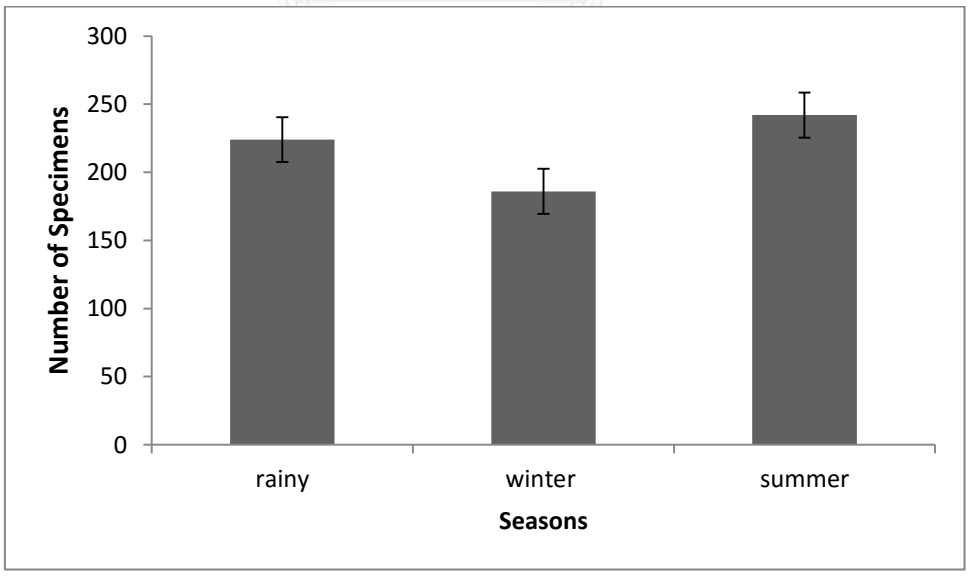


Figure 4.50 Bar graph shows number of specimens collected in each season

Annual rainfall at Sattahip District in days and months which the specimens were collected shown in the appendix I.

This study collected the braconid wasps at the night (18:00–22:00). Most of the annual rainfalls between September 2013 and September 2014 were very low, therefore the annual rainfalls do not affected the number of specimens collected from the sites. However in some days, for example, 23 November 2013, 22 March 2014, 25–27 July 2014 and 5–7 September 2014, the number of specimens collected, were lower than other days because heavy rain affect insect activities, such as feeding, reproduction and flying.

There was a depression and tropical storm in July 2014 (Appendix II), this affected the collecting expedition that month because travelling to Chuang Island by speed boat wasn't possible.

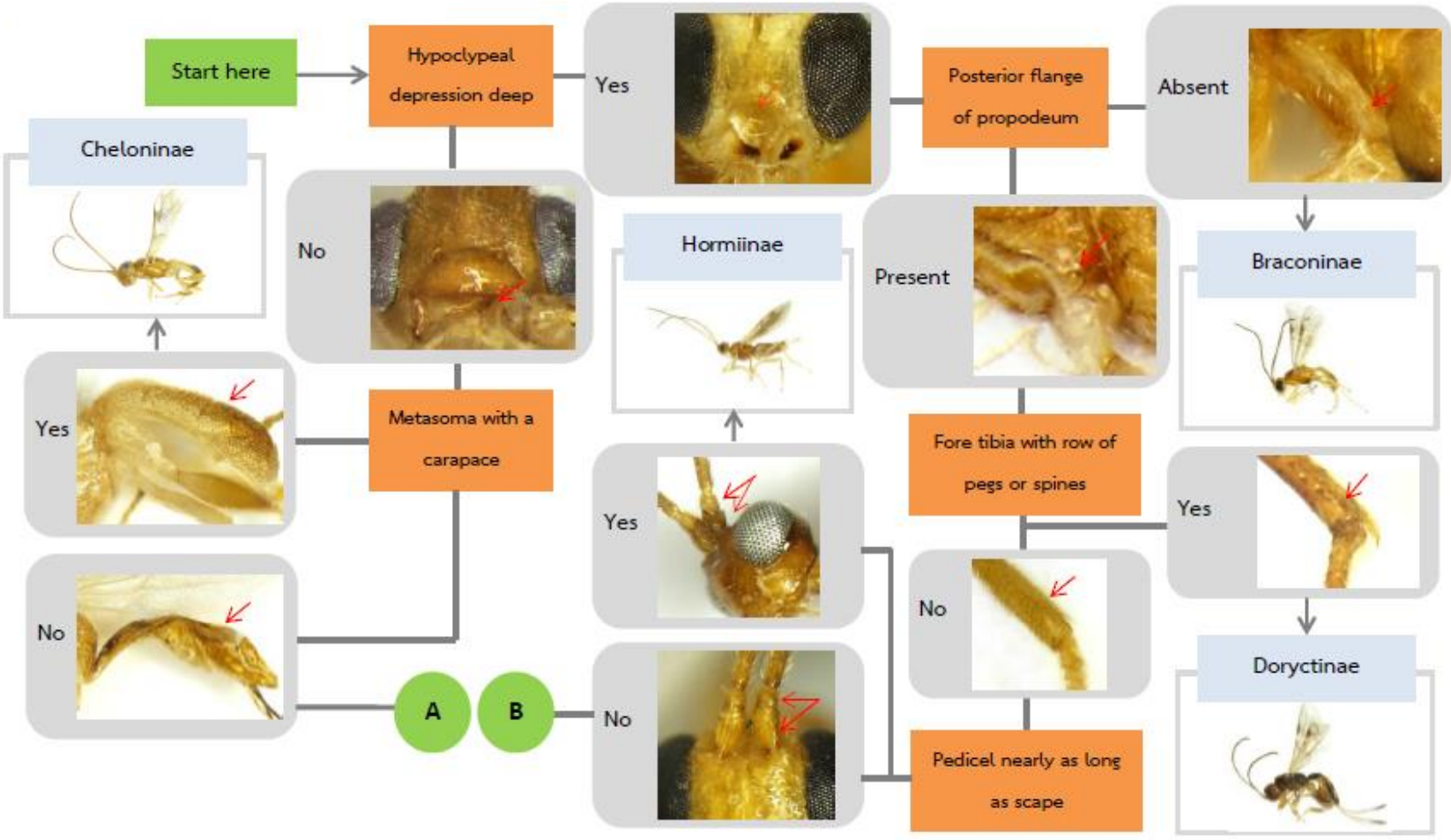
4.10 Database of nocturnal braconid wasps

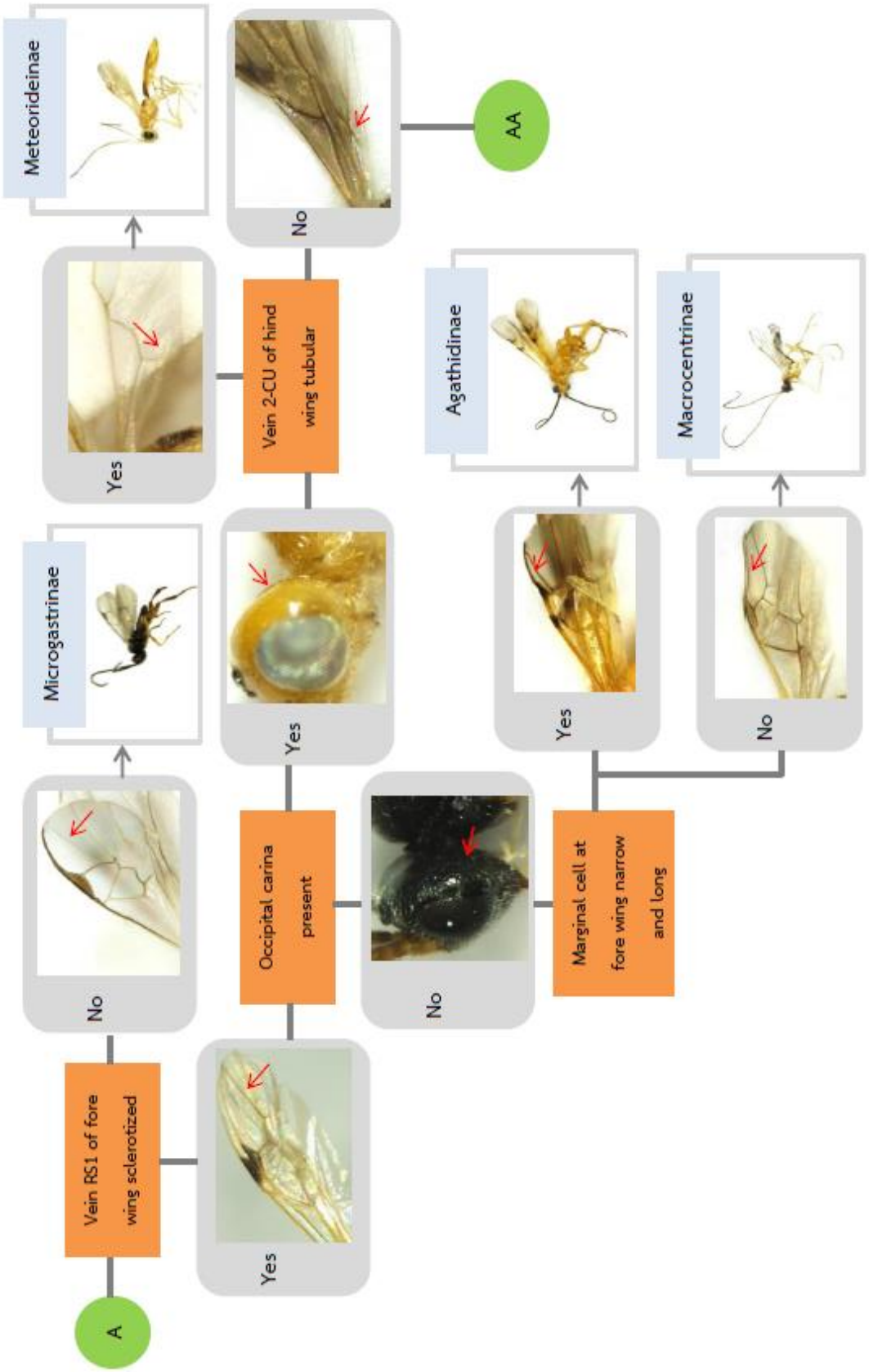
A database of nocturnal braconid parasitoid recorded from the study sites was generated. This included voucher numbers, subfamily name, species name, localities, collectors, type of traps, and collecting date (Appendix III).

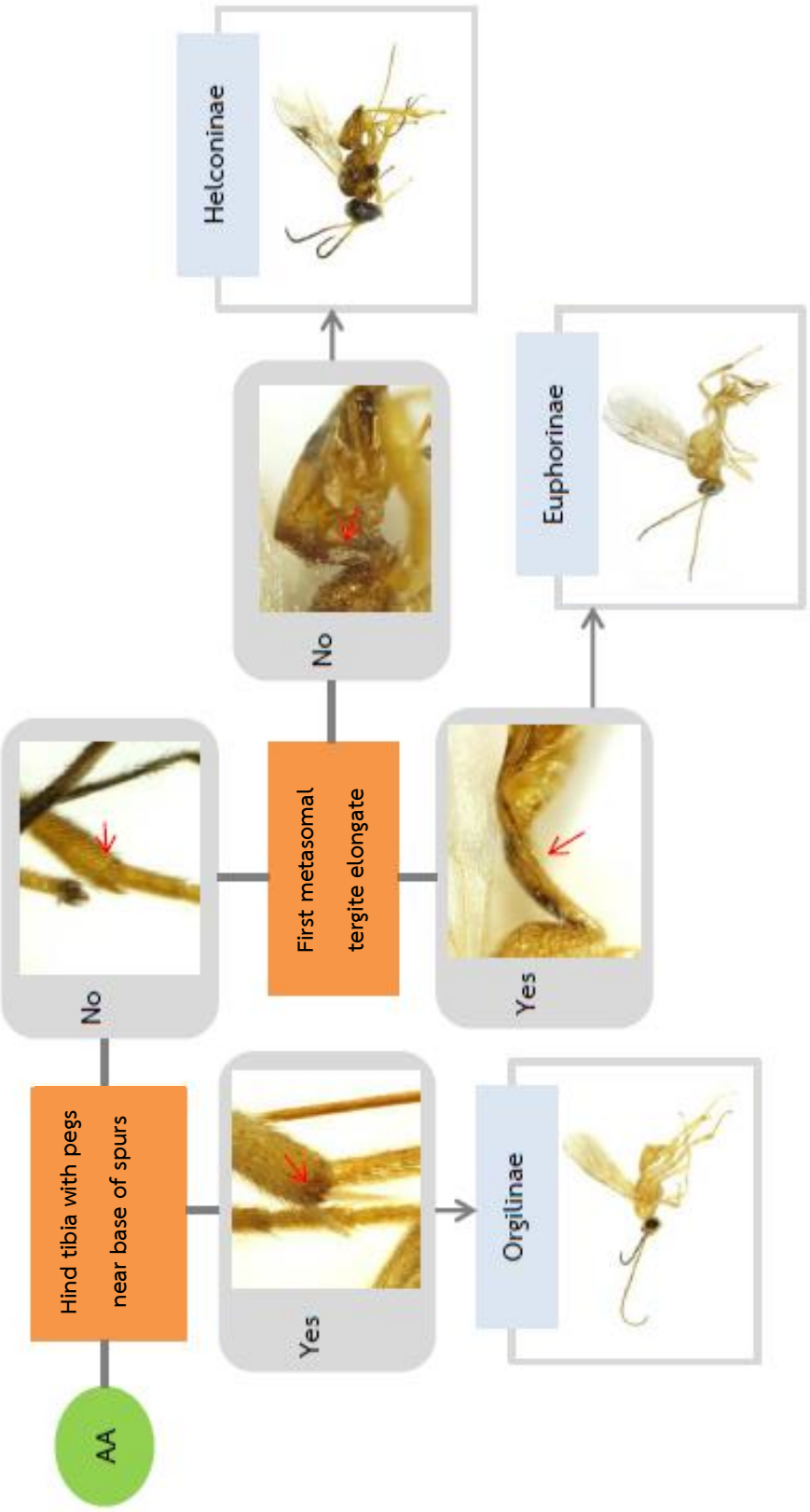
4.11 Pictorial keys to the subfamilies of the Braconidae

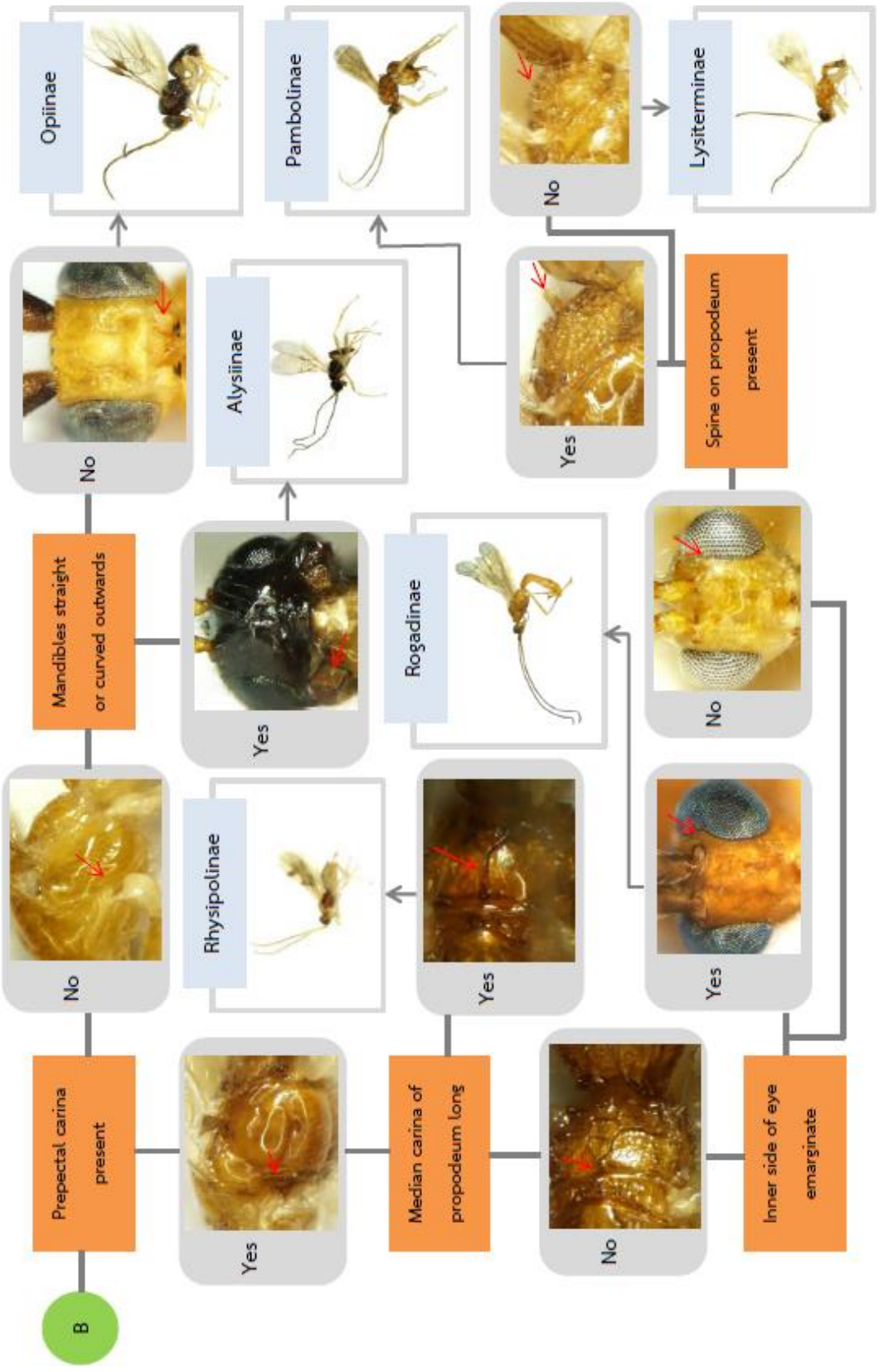
The pictorial key to subfamilies of Braconidae was produced by their morphological characters. (See in next page). This could help amateur entomologists or students who are interested in parasitic wasps to preliminary identify them to the subfamily level in the field or laboratory.

Pictorial keys to the subfamilies of the Braconidae (Hymenoptera: Ichneumonoidea) base on the specimens recorded from Samaesan areas, Sattahip District, Chonburi Province




A
Vein RS1 of fore wing sclerotized
Yes
No
Occipital carina present
Yes
No
Vein 2-CU of hind wing tubular
Yes
No
AA
Meteorideinae
Microgastrinae
Marginal cell at fore wing narrow and long
Yes
No
Agathidinae
Macrocentrinae


AA
Hind tibia with pegs near base of spurs
No
Yes
Orgilinae
First metasomal tergite elongate
No
Yes
Helconinae
Euphorinae


B
Prepectal carina present
Yes
No
Median carina of propodeum long
Yes
No
Inner side of eye emarginate
Yes
No
Mandibles straight or curved outwards
Yes
No
Rogadinae
Alysiinae
Rhysipolinae
Spine on propodeum present
Yes
No
Pambolinae
Opiinae
Lysiterminae

CHAPTER V
CONCLUSION AND RECOMMENDATION

The pictorial key of the parasitic wasps in the family Braconidae collected from the study areas has been constructed. The following subfamilies were included in the key: Agathidinae, Alysiinae, Braconinae, Cheloninae, Doryctinae, Euphorinae, Helconinae, Hormiinae, Lysiterminae, Macrocentrinae, Meteorideinae, Microgastrinae, Opiinae, Orgilinae, Pambolinae, Rhysipolinae and Rogadinae.

Most specimens were collected using the black light trap, only 1 percent of the samples were collected by mobile bucket light traps. The total number of specimens collected from this study is 652 (175 morphospecies), of which 242 specimens are from Khao Ma Cho (91 morphospecies), 300 from Samaesan Island (100 morphospecies), and 110 from Chuang Island (70 morphospecies). The highest number of collected specimens is in the subfamily Cheloninae (291 out of the 652 specimens or 44% of the total number of collected braconid wasps). This subfamily it also has the highest number of the morphospecies (35 morphospecies).

Off the 17 subfamilies recorded from this study, they can be divided into 12 koinobionts and 5 idiobionts. Thus, 418 of the 652 specimens are koinobionts (64%), and the rest are idiobionts (36%). Twelve subfamilies could be found in all studies sites; Alysiinae, Braconinae, Cheloninae, Doryctinae, Euphorinae, Hormiinae,

Lysiterminae, Microgastrinae, Orgilinae, Pambolinae, Rhysipolinae and Rogadinae, while the other 4 subfamilies: Agathidinae, Helconinae, Macrocentrinae and Meteorideinae, recored from the Samaesan Island. Only Opiinae could be found in both Khao Ma Cho and Samaesan Island but not in Chuang Island.

Four subfamilies (Helconinae, Lysiterminae, Pambolinae, and Rhysipolinae) are new record subfamilies for Thailand. Nonetheless, it should be noted that only a single specimen in Helconinae, Agathidinae, and Meteorideinae had been collected. A new species of braconid wasps has been recorded from Khao Ma Cho. It belongs to the subfamily Rogadinae, genus *Aleiodes*.

Similarity index of Sorensen shows the similarity percentage in the species number of braconid wasps at Samaesan Island and to Khao Ma Cho at maximum of 0.73. When estimate the species richness by using Chao-1 estimator it can be explored that the species richness number is equal to 271 species. In this study, seasonal alternation is a factor that results in the number of the wasp species. Collecting the wasp in summer has 242 specimens, rainy has 224, and winter has 186.

Research problems and recommendations

Storing the wasp specimens in insect boxes must be inspected every week to maintain desirable environment, humidity is a very important factor because this can lead to an invasion of fungal and/or insect pests which are mainly harmful for the specimens in the boxes.

Many angles or scientific topics of this organism group are lack of research. Thus, to fulfill the basic knowledge that leads to future applications, the studies of these insects are necessary. We expect that the stored specimens from this study can be used for other works in the future, in particular, DNA barcoding. The molecular technique can be used to identify unknown-species specimens in the collections, apart from morphologically dependent approaches.

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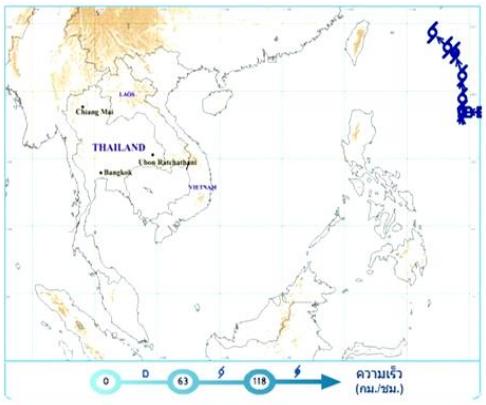
APPENDICES

Appendix I. Annual rainfalls (mm) every 3 hours

Date	Times								Total
	1:00	4:00	7:00	10:00	13:00	16:00	19:00	22:00	
20/9/2013	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21/9/2013	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22/9/2013	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22/11/2013	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23/11/2013	0.0	0.0	0.2	0.0	0.0	0.0	4.1	13.2	17.5
24/11/2013	0.0	8.4	0.0	0.2	1.4	0.8	0.0	0.0	10.8
24/1/2014	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25/1/2014	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26/1/2014	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21/3/2014	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22/3/2014	0.0	0.0	35.0	4.3	0.0	0.0	0.3	13.2	39.5
23/3/2014	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23/5/2014	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
24/5/2014	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25/5/2014	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25/7/2014	0.0	4.0	17.0	0.0	0.0	0.0	0.0	0.0	14.0
26/7/2014	8.6	7.3	0.0	5.5	8.9	0.0	0.0	7.0	13.0
27/7/2014	3.5	0.0	5.1	0.0	8.0	0.0	10.0	0.0	9.5
5/9/2014	0.0	5.3	0.0	0.0	8.0	0.0	13.0	0.0	12.0
6/9/2014	0.1	0.0	10.0	0.0	13.0	0.0	0.0	2.2	12.0
7/9/2014	1.6	0.1	0.0	0.0	0.0	14.0	0.0	0.3	14.0

Appendix II. The Tropical storms (Halong and Nakri) affect to samples collection in July 2014



พายุ "ทะลอง"

ชื่อภาษาไทย:	ทะลอง	**ความหมาย:**	พายุ"ทะลอง"(HALONG)เป็นชื่อที่ตั้งโดยประเทศเวียดนาม แปลว่า ชื่ออำเภอที่สวยงามแห่งหนึ่งของประเทศเวียดนาม
ชื่อภาษาอังกฤษ:	TROPICAL STORM 1411 HALONG (1411)	**ประเทศที่มาของชื่อ:**	

วันที่	เวลา	ระดับความรุนแรง	ความเร็วลมใกล้ศูนย์กลาง	ละติจูด	ลองจิจูด
31 ก.ค. 57	00:00	พายุโซนร้อน	83	14° 54' 00'' เหนือ	142° 00' 00'' ตะวันออก
30 ก.ค. 57	18:00	พายุโซนร้อน	83	14° 18' 00'' เหนือ	143° 00' 00'' ตะวันออก
30 ก.ค. 57	12:00	พายุโซนร้อน	83	14° 11' 60'' เหนือ	143° 48' 00'' ตะวันออก
30 ก.ค. 57	06:00	พายุโซนร้อน	83	14° 11' 60'' เหนือ	144° 24' 00'' ตะวันออก
30 ก.ค. 57	00:00	พายุโซนร้อน	83	13° 48' 00'' เหนือ	145° 48' 00'' ตะวันออก
29 ก.ค. 57	18:00	พายุโซนร้อน	83	13° 35' 60'' เหนือ	146° 30' 00'' ตะวันออก
29 ก.ค. 57	12:00	พายุโซนร้อน	83	13° 11' 60'' เหนือ	147° 00' 00'' ตะวันออก
29 ก.ค. 57	06:00	พายุโซนร้อน	64	12° 48' 00'' เหนือ	147° 30' 00'' ตะวันออก
29 ก.ค. 57	00:00	พายุดีเปรสชัน	55	12° 30' 00'' เหนือ	148° 30' 00'' ตะวันออก
28 ก.ค. 57	18:00	พายุดีเปรสชัน	37	12° 00' 00'' เหนือ	150° 00' 00'' ตะวันออก
28 ก.ค. 57	12:00	พายุดีเปรสชัน	37	12° 00' 00'' เหนือ	150° 00' 00'' ตะวันออก
28 ก.ค. 57	06:00	พายุดีเปรสชัน	37	10° 00' 00'' เหนือ	152° 00' 00'' ตะวันออก
28 ก.ค. 57	00:00	พายุดีเปรสชัน	37	9° 00' 00'' เหนือ	158° 00' 00'' ตะวันออก
	เวลาไทย		**กิโลเมตร/ชั่วโมง**		

พายุ "นากรี"

ชื่อภาษาไทย:	นากรี	**ความหมาย:**	พายุ"นากรี"(NAKRI)เป็นชื่อที่ตั้งโดยประเทศกัมพูชา แปลว่า ชื่อดอกไม้ชนิดหนึ่ง
ชื่อภาษาอังกฤษ:	TROPICAL STORM 1412 NAKRI (1412)	**ประเทศที่มาของชื่อ:**	

วันที่	เวลา	ระดับความรุนแรง	ความเร็วลมใกล้ศูนย์กลาง	ละติจูด	ลองจิจูด
31 ก.ค. 57	00:00	พายุโซนร้อน	74	24° 23' 60'' เหนือ	127° 05' 60'' ตะวันออก
30 ก.ค. 57	18:00	พายุโซนร้อน	74	23° 18' 00'' เหนือ	128° 18' 00'' ตะวันออก
30 ก.ค. 57	12:00	พายุโซนร้อน	74	22° 53' 60'' เหนือ	128° 54' 00'' ตะวันออก
30 ก.ค. 57	06:00	พายุโซนร้อน	64	21° 11' 60'' เหนือ	129° 30' 00'' ตะวันออก
30 ก.ค. 57	00:00	พายุโซนร้อน	64	19° 30' 00'' เหนือ	129° 30' 00'' ตะวันออก
29 ก.ค. 57	18:00	พายุโซนร้อน	64	18° 36' 00'' เหนือ	129° 30' 00'' ตะวันออก
29 ก.ค. 57	12:00	พายุดีเปรสชัน	55	18° 30' 00'' เหนือ	129° 30' 00'' ตะวันออก
29 ก.ค. 57	06:00	พายุดีเปรสชัน	55	18° 30' 00'' เหนือ	130° 00' 00'' ตะวันออก
29 ก.ค. 57	00:00	พายุดีเปรสชัน	55	18° 30' 00'' เหนือ	131° 00' 00'' ตะวันออก
28 ก.ค. 57	12:00	พายุดีเปรสชัน	55	18° 00' 00'' เหนือ	132° 30' 00'' ตะวันออก
28 ก.ค. 57	00:00	พายุดีเปรสชัน	55	16° 30' 00'' เหนือ	133° 30' 00'' ตะวันออก
27 ก.ค. 57	12:00	พายุดีเปรสชัน	55	15° 00' 00'' เหนือ	134° 00' 00'' ตะวันออก
27 ก.ค. 57	00:00	พายุดีเปรสชัน	55	14° 00' 00'' เหนือ	135° 00' 00'' ตะวันออก
	เวลาไทย		**กิโลเมตร/ชั่วโมง**		

รายชื่อ ความหมายและที่มาของพายุ

Appendix III. Database of nocturnal parasitic wasps in this study

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.101	Agathidinae	*Coccygidium mastigion*	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.102	Alysiinae	*Orthostigma* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.103	Alysiinae	unknown sp.1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.104	Alysiinae	unknown sp.1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	26.IX.13
CUMZ-IN-HYM Bra.2014.105	Alysiinae	unknown sp.2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.106	Alysiinae	unknown sp.2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.107	Alysiinae	unknown sp.3	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	7.IX.14
CUMZ-IN-HYM Bra.2014.108	Alysiinae	unknown sp.4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.109	Alysiinae	unknown sp.5	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	7.IX.14
CUMZ-IN-HYM Bra.2014.110	Braconinae	*Bracon* sp.1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.111	Braconinae	*Bracon* sp.1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.112	Braconinae	*Bracon* sp.2	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	26. IX.13
CUMZ-IN-HYM Bra.2014.113	Braconinae	*Bracon* sp.2	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.114	Braconinae	*Bracon* sp.3	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.115	Braconinae	*Bracon* sp.3	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.116	Braconinae	*Bracon* sp.3	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.117	Braconinae	*Bracon* sp.3	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.118	Braconinae	*Bracon* sp.3	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.119	Braconinae	*Bracon* sp.4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.120	Braconinae	*Bracon* sp.4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.121	Braconinae	*Bracon* sp.4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.122	Braconinae	*Bracon* sp.4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.123	Braconinae	*Bracon* sp.5	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.124	Braconinae	*Bracon* sp.5	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	24.I.14
CUMZ-IN-HYM Bra.2014.125	Braconinae	*Bracon* sp.6	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	26. IX.13
CUMZ-IN-HYM Bra.2014.126	Braconinae	*Bracon* sp.7	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26. IX.13
CUMZ-IN-HYM Bra.2014.127	Braconinae	*Bracon* sp.8	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.128	Braconinae	*Bracon* sp.9	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.129	Braconinae	*Bracon* sp.10	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.130	Braconinae	*Bracon* sp.11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.131	Braconinae	*Bracon* sp.11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.132	Braconinae	*Bracon* sp.11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	6.IX.14
CUMZ-IN-HYM Bra.2014.133	Braconinae	*Bracon* sp.12	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.134	Braconinae	*Bracon* sp.12	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.135	Braconinae	*Bracon* sp.13	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.136	Braconinae	*Bracon* sp.14	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.137	Braconinae	*Bracon* sp.15	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.138	Braconinae	*Bracon* sp.16	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.139	Braconinae	*Bracon* sp.16	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.140	Cheloninae	*Adeliini* sp.1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.141	Cheloninae	*Adeliini* sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.142	Cheloninae	*Adeliini* sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	28.IX.13
CUMZ-IN-HYM Bra.2014.143	Cheloninae	*Adeliini* sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.144	Cheloninae	*Adeliini* sp. 1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.145	Cheloninae	*Adeliini* sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.146	Cheloninae	*Adeliini* sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.147	Cheloninae	*Adeliini* sp. 2	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.148	Cheloninae	*Adeliini* sp. 3	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.149	Cheloninae	*Adeliini* sp. 3	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.150	Cheloninae	*Adeliini* sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.151	Cheloninae	*Adeliini* sp. 5	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.152	Cheloninae	*Adeliini* sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.153	Cheloninae	*Phanerotoma* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.154	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.155	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.156	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.157	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.158	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.159	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.160	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.161	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.162	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.163	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.164	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.165	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.166	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.167	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.168	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.169	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.170	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.171	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.172	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.173	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.174	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.175	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.176	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.177	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.178	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.179	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.180	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.181	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.182	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.183	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.184	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.185	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.VII.14
CUMZ-IN-HYM Bra.2014.186	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.VII.14
CUMZ-IN-HYM Bra.2014.187	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.VII.14
CUMZ-IN-HYM Bra.2014.188	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.VII.14
CUMZ-IN-HYM Bra.2014.189	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.VII.14
CUMZ-IN-HYM Bra.2014.190	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.VII.14
CUMZ-IN-HYM Bra.2014.191	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.VII.14
CUMZ-IN-HYM Bra.2014.192	Cheloninae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.VII.14
CUMZ-IN-HYM Bra.2014.193	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.194	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.195	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.196	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.197	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.198	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.199	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.200	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.201	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.202	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	5.I.14
CUMZ-IN-HYM Bra.2014.203	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	5.I.14
CUMZ-IN-HYM Bra.2014.204	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	5.I.14
CUMZ-IN-HYM Bra.2014.205	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	5.I.14
CUMZ-IN-HYM Bra.2014.206	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	5.I.14
CUMZ-IN-HYM Bra.2014.207	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.208	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.209	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.210	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.211	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.212	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.213	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.214	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.215	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.216	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.217	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.218	Cheloninae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.VII.14
CUMZ-IN-HYM Bra.2014.219	Cheloninae	unknown sp. 1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.220	Cheloninae	unknown sp. 1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	24.I.14
CUMZ-IN-HYM Bra.2014.221	Cheloninae	unknown sp. 1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	24.I.14
CUMZ-IN-HYM Bra.2014.222	Cheloninae	unknown sp. 1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.223	Cheloninae	unknown sp. 1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.224	Cheloninae	unknown sp. 1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.225	Cheloninae	unknown sp. 1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	5.IX.14
CUMZ-IN-HYM Bra.2014.226	Cheloninae	unknown sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.227	Cheloninae	unknown sp. 2	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.228	Cheloninae	unknown sp. 2	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.229	Cheloninae	unknown sp. 2	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	6.IX.14
CUMZ-IN-HYM Bra.2014.230	Cheloninae	unknown sp. 3	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.231	Cheloninae	unknown sp. 3	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.232	Cheloninae	unknown sp. 3	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.233	Cheloninae	unknown sp. 3	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.234	Cheloninae	unknown sp. 3	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.235	Cheloninae	unknown sp. 3	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	26.IX.13
CUMZ-IN-HYM Bra.2014.236	Cheloninae	unknown sp. 3	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.237	Cheloninae	unknown sp. 4	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.238	Cheloninae	unknown sp. 4	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.239	Cheloninae	unknown sp. 4	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.240	Cheloninae	unknown sp. 4	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.241	Cheloninae	unknown sp. 4	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.242	Cheloninae	unknown sp. 4	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.243	Cheloninae	unknown sp. 4	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.244	Cheloninae	unknown sp. 4	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.245	Cheloninae	unknown sp. 4	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.246	Cheloninae	unknown sp. 4	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.247	Cheloninae	unknown sp. 4	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.248	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.249	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.250	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.251	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.252	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.253	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.254	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.255	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.256	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.257	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.258	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.259	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.260	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.261	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.262	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.263	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.264	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.265	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.266	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.267	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.VII.14
CUMZ-IN-HYM Bra.2014.268	Cheloninae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.VII.14
CUMZ-IN-HYM Bra.2014.269	Cheloninae	unknown sp. 4	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.270	Cheloninae	unknown sp. 4	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.271	Cheloninae	unknown sp. 4	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.272	Cheloninae	unknown sp. 5	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.273	Cheloninae	unknown sp. 5	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.274	Cheloninae	unknown sp. 5	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.275	Cheloninae	unknown sp. 5	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.276	Cheloninae	unknown sp. 5	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.277	Cheloninae	unknown sp. 5	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.278	Cheloninae	unknown sp. 5	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.279	Cheloninae	unknown sp. 5	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.280	Cheloninae	unknown sp. 5	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.281	Cheloninae	unknown sp. 5	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.VII.14
CUMZ-IN-HYM Bra.2014.282	Cheloninae	unknown sp. 5	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.283	Cheloninae	unknown sp. 6	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.284	Cheloninae	unknown sp. 6	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	28.IX.13
CUMZ-IN-HYM Bra.2014.285	Cheloninae	unknown sp. 6	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.286	Cheloninae	unknown sp. 6	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.287	Cheloninae	unknown sp. 6	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.288	Cheloninae	unknown sp. 6	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.289	Cheloninae	unknown sp. 6	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.290	Cheloninae	unknown sp. 6	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.291	Cheloninae	unknown sp. 6	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.VII.14
CUMZ-IN-HYM Bra.2014.292	Cheloninae	unknown sp. 6	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.293	Cheloninae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.294	Cheloninae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.295	Cheloninae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.296	Cheloninae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.297	Cheloninae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.298	Cheloninae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.299	Cheloninae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.300	Cheloninae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.301	Cheloninae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.302	Cheloninae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.303	Cheloninae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.304	Cheloninae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.305	Cheloninae	unknown sp. 6	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.306	Cheloninae	unknown sp. 7	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.307	Cheloninae	unknown sp. 7	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.308	Cheloninae	unknown sp. 7	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	28.IX.13
CUMZ-IN-HYM Bra.2014.309	Cheloninae	unknown sp. 7	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.310	Cheloninae	unknown sp. 7	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.311	Cheloninae	unknown sp. 7	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.312	Cheloninae	unknown sp. 7	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.313	Cheloninae	unknown sp. 7	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.314	Cheloninae	unknown sp. 7	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.315	Cheloninae	unknown sp. 7	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.316	Cheloninae	unknown sp. 7	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.317	Cheloninae	unknown sp. 7	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.VII.14
CUMZ-IN-HYM Bra.2014.318	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.319	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.320	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.321	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.322	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.323	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.324	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.325	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.326	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.327	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.328	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.329	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.330	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.331	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.332	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.333	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.334	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.335	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.336	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.337	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.338	Cheloninae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.VII.14
CUMZ-IN-HYM Bra.2014.339	Cheloninae	unknown sp. 8	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.340	Cheloninae	unknown sp. 9	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.341	Cheloninae	unknown sp. 10	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.342	Cheloninae	unknown sp. 10	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.343	Cheloninae	unknown sp. 10	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.344	Cheloninae	unknown sp. 11	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.345	Cheloninae	unknown sp. 11	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.346	Cheloninae	unknown sp. 11	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.347	Cheloninae	unknown sp. 11	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.348	Cheloninae	unknown sp. 11	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.349	Cheloninae	unknown sp. 11	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.350	Cheloninae	unknown sp. 11	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.351	Cheloninae	unknown sp. 11	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.352	Cheloninae	unknown sp. 11	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.353	Cheloninae	unknown sp. 11	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.354	Cheloninae	unknown sp. 11	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.355	Cheloninae	unknown sp. 11	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.356	Cheloninae	unknown sp. 11	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.VII.14
CUMZ-IN-HYM Bra.2014.357	Cheloninae	unknown sp. 11	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.358	Cheloninae	unknown sp. 11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.359	Cheloninae	unknown sp. 11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.360	Cheloninae	unknown sp. 11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.361	Cheloninae	unknown sp. 11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.362	Cheloninae	unknown sp. 11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.363	Cheloninae	unknown sp. 11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.364	Cheloninae	unknown sp. 11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.365	Cheloninae	unknown sp. 11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.366	Cheloninae	unknown sp. 11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.367	Cheloninae	unknown sp. 11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.368	Cheloninae	unknown sp. 11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.369	Cheloninae	unknown sp. 11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.370	Cheloninae	unknown sp. 11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.371	Cheloninae	unknown sp. 11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.372	Cheloninae	unknown sp. 11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.373	Cheloninae	unknown sp. 11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.374	Cheloninae	unknown sp. 11	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	26. IX.13
CUMZ-IN-HYM Bra.2014.375	Cheloninae	unknown sp. 11	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	26. IX.13
CUMZ-IN-HYM Bra.2014.376	Cheloninae	unknown sp. 11	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.377	Cheloninae	unknown sp. 12	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	28.IX.13
CUMZ-IN-HYM Bra.2014.378	Cheloninae	unknown sp. 12	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	28.IX.13
CUMZ-IN-HYM Bra.2014.379	Cheloninae	unknown sp. 12	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.380	Cheloninae	unknown sp. 12	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.381	Cheloninae	unknown sp. 12	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.382	Cheloninae	unknown sp. 12	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.383	Cheloninae	unknown sp. 13	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.384	Cheloninae	unknown sp. 13	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.385	Cheloninae	unknown sp. 13	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.386	Cheloninae	unknown sp. 13	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.387	Cheloninae	unknown sp. 13	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.388	Cheloninae	unknown sp. 13	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.389	Cheloninae	unknown sp. 14	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.390	Cheloninae	unknown sp. 14	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.391	Cheloninae	unknown sp. 15	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.392	Cheloninae	unknown sp. 15	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.393	Cheloninae	unknown sp. 16	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.394	Cheloninae	unknown sp. 16	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.395	Cheloninae	unknown sp. 17	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.396	Cheloninae	unknown sp. 17	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.397	Cheloninae	unknown sp. 17	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.398	Cheloninae	unknown sp. 17	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.399	Cheloninae	unknown sp. 17	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.400	Cheloninae	unknown sp. 17	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.401	Cheloninae	unknown sp. 18	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.402	Cheloninae	unknown sp. 18	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.403	Cheloninae	unknown sp. 19	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.404	Cheloninae	unknown sp. 20	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.VII.14
CUMZ-IN-HYM Bra.2014.405	Cheloninae	unknown sp. 20	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.406	Cheloninae	unknown sp. 20	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.407	Cheloninae	unknown sp. 20	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.408	Cheloninae	unknown sp. 20	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.VII.14
CUMZ-IN-HYM Bra.2014.409	Cheloninae	unknown sp. 20	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.410	Cheloninae	unknown sp. 20	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	24.I.14
CUMZ-IN-HYM Bra.2014.411	Cheloninae	unknown sp. 20	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	24.I.14
CUMZ-IN-HYM Bra.2014.412	Cheloninae	unknown sp. 20	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.413	Cheloninae	unknown sp. 21	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.414	Cheloninae	unknown sp. 21	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.415	Cheloninae	unknown sp. 21	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.416	Cheloninae	unknown sp. 22	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.417	Cheloninae	unknown sp. 23	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.418	Cheloninae	unknown sp. 23	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.419	Cheloninae	unknown sp. 24	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.420	Cheloninae	unknown sp. 25	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.421	Cheloninae	unknown sp. 25	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.422	Cheloninae	unknown sp. 25	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.423	Cheloninae	unknown sp. 25	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.424	Cheloninae	unknown sp. 25	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.425	Cheloninae	unknown sp. 26	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.426	Cheloninae	unknown sp. 26	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.427	Cheloninae	unknown sp. 27	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	5.IX.14
CUMZ-IN-HYM Bra.2014.428	Cheloninae	unknown sp. 28	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.429	Cheloninae	unknown sp. 28	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.430	Cheloninae	unknown sp. 29	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.431	Doryctinae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.432	Doryctinae	unknown sp. 1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	26. IX.13
CUMZ-IN-HYM Bra.2014.433	Doryctinae	unknown sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.434	Doryctinae	unknown sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.435	Doryctinae	unknown sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.436	Doryctinae	unknown sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.437	Doryctinae	unknown sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.438	Doryctinae	unknown sp. 2	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.439	Doryctinae	unknown sp. 2	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.440	Doryctinae	unknown sp. 2	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.441	Doryctinae	unknown sp. 2	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.442	Doryctinae	unknown sp. 3	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.443	Doryctinae	unknown sp. 3	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.444	Doryctinae	unknown sp. 3	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.445	Doryctinae	unknown sp. 3	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.446	Doryctinae	unknown sp. 3	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.447	Doryctinae	unknown sp. 3	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.448	Doryctinae	unknown sp. 3	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.VII.14
CUMZ-IN-HYM Bra.2014.449	Doryctinae	unknown sp. 3	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	26. IX.13
CUMZ-IN-HYM Bra.2014.450	Doryctinae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.451	Doryctinae	unknown sp. 4	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.452	Doryctinae	unknown sp. 5	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.453	Doryctinae	unknown sp. 5	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.454	Doryctinae	unknown sp. 6	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.455	Doryctinae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.456	Doryctinae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.457	Doryctinae	unknown sp. 7	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.458	Doryctinae	unknown sp. 7	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.459	Doryctinae	unknown sp. 8	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	28.IX.13

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.460	Doryctinae	unknown sp. 8	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	28.IX.13
CUMZ-IN-HYM Bra.2014.461	Doryctinae	unknown sp. 8	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.462	Doryctinae	unknown sp. 9	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.463	Doryctinae	unknown sp. 10	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.464	Doryctinae	unknown sp. 11	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.465	Doryctinae	unknown sp. 12	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.466	Doryctinae	unknown sp. 12	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.467	Doryctinae	unknown sp. 12	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.468	Doryctinae	unknown sp. 12	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.469	Doryctinae	unknown sp. 12	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.470	Doryctinae	unknown sp. 12	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.471	Doryctinae	unknown sp. 13	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.472	Doryctinae	unknown sp. 13	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.473	Doryctinae	unknown sp. 14	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	28.IX.13
CUMZ-IN-HYM Bra.2014.474	Doryctinae	unknown sp. 14	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.475	Doryctinae	unknown sp. 14	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.476	Doryctinae	unknown sp. 14	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.477	Doryctinae	unknown sp. 14	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.478	Doryctinae	unknown sp. 14	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.479	Doryctinae	unknown sp. 14	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.480	Doryctinae	unknown sp. 15	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.481	Doryctinae	unknown sp. 16	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.482	Doryctinae	unknown sp. 16	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.483	Doryctinae	unknown sp. 16	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.484	Doryctinae	unknown sp. 16	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.485	Doryctinae	unknown sp. 16	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.486	Doryctinae	unknown sp. 16	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.487	Doryctinae	unknown sp. 16	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.488	Doryctinae	unknown sp. 16	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	6.IX.14
CUMZ-IN-HYM Bra.2014.489	Doryctinae	unknown sp. 16	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.490	Doryctinae	unknown sp. 16	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.491	Doryctinae	unknown sp. 17	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.492	Doryctinae	unknown sp. 17	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.493	Doryctinae	unknown sp. 17	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.494	Doryctinae	unknown sp. 17	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.495	Doryctinae	unknown sp. 17	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.496	Doryctinae	unknown sp. 17	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	6.IX.14
CUMZ-IN-HYM Bra.2014.497	Doryctinae	unknown sp. 18	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.498	Doryctinae	unknown sp. 19	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.499	Doryctinae	unknown sp. 20	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.500	Doryctinae	unknown sp. 21	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.501	Doryctinae	unknown sp. 22	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.502	Doryctinae	unknown sp. 23	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	9.IX.14
CUMZ-IN-HYM Bra.2014.503	Doryctinae	unknown sp. 24	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.504	Doryctinae	unknown sp. 24	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.505	Doryctinae	unknown sp. 24	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.506	Doryctinae	unknown sp. 25	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.507	Doryctinae	unknown sp. 25	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.508	Doryctinae	unknown sp. 26	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.509	Doryctinae	unknown sp. 26	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.510	Doryctinae	unknown sp. 27	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.511	Doryctinae	unknown sp. 28	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.512	Doryctinae	unknown sp. 29	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.513	Doryctinae	unknown sp. 30	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.514	Doryctinae	unknown sp. 30	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.515	Doryctinae	unknown sp. 31	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.516	Doryctinae	unknown sp. 32	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.517	Doryctinae	unknown sp. 33	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.518	Doryctinae	unknown sp. 34	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.519	Doryctinae	*Euscelinus* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.520	Euphorinae	*Streblocera* sp.	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.521	Euphorinae	*Streblocera* sp.	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.522	Euphorinae	*Streblocera* sp.	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.523	Euphorinae	*Streblocera* sp.	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.524	Euphorinae	*Streblocera* sp.	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.525	Euphorinae	*Streblocera* sp.	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.526	Euphorinae	*Streblocera* sp.	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.527	Euphorinae	*Streblocera* sp.	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.528	Euphorinae	*Streblocera* sp.	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.529	Euphorinae	*Streblocera* sp.	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.530	Euphorinae	*Streblocera* sp.	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	7.IX.14
CUMZ-IN-HYM Bra.2014.531	Euphorinae	*Meteorus* sp.	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.532	Euphorinae	*Meteorus* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.533	Euphorinae	*Meteorus* sp.	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.534	Euphorinae	*Meteorus* sp.	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.535	Euphorinae	*Meteorus* sp.	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.536	Euphorinae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	28.IX.13
CUMZ-IN-HYM Bra.2014.537	Euphorinae	unknown sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.538	Euphorinae	unknown sp. 3	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.539	Heliconinae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.540	Hormiinae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.541	Hormiinae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.542	Hormiinae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23. IX.13
CUMZ-IN-HYM Bra.2014.543	Hormiinae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23. IX.13
CUMZ-IN-HYM Bra.2014.544	Hormiinae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.545	Hormiinae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.546	Hormiinae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.547	Hormiinae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.548	Hormiinae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.549	Hormiinae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.550	Hormiinae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.551	Hormiinae	unknown sp. 1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	26.IX.13
CUMZ-IN-HYM Bra.2014.552	Hormiinae	unknown sp. 1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	26.IX.13
CUMZ-IN-HYM Bra.2014.553	Hormiinae	unknown sp. 1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.554	Hormiinae	unknown sp. 1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.555	Hormiinae	unknown sp. 1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.556	Hormiinae	unknown sp. 1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.557	Hormiinae	unknown sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.558	Hormiinae	unknown sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	28.IX.13
CUMZ-IN-HYM Bra.2014.559	Hormiinae	unknown sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.560	Hormiinae	unknown sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.561	Hormiinae	unknown sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.562	Hormiinae	unknown sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.563	Hormiinae	unknown sp. 2	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.564	Hormiinae	unknown sp. 2	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.565	Hormiinae	unknown sp. 3	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.566	Hormiinae	unknown sp. 3	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.567	Hormiinae	unknown sp. 4	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.568	Hormiinae	unknown sp. 5	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.569	Hormiinae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.570	Hormiinae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.571	Hormiinae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.572	Hormiinae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.573	Hormiinae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.574	Hormiinae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.575	Hormiinae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.576	Hormiinae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.577	Hormiinae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.578	Hormiinae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.579	Hormiinae	unknown sp. 7	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.580	Hormiinae	unknown sp. 8	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25.IX.13
CUMZ-IN-HYM Bra.2014.581	Hormiinae	unknown sp. 8	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.582	Hormiinae	unknown sp. 8	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.583	Hormiinae	unknown sp. 9	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.584	Hormiinae	unknown sp. 9	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.585	Hormiinae	unknown sp. 9	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.586	Hormiinae	unknown sp. 9	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	7.IX.14
CUMZ-IN-HYM Bra.2014.587	Hormiinae	unknown sp. 9	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.588	Hormiinae	unknown sp. 9	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.589	Hormiinae	unknown sp. 10	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23. IX.13
CUMZ-IN-HYM Bra.2014.590	Hormiinae	unknown sp. 10	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.591	Hormiinae	unknown sp. 10	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.592	Hormiinae	unknown sp. 10	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.594	Hormiinae	unknown sp. 10	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.595	Hormiinae	unknown sp. 10	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.596	Hormiinae	unknown sp. 10	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.597	Hormiinae	unknown sp. 10	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.598	Hormiinae	unknown sp. 10	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.599	Hormiinae	unknown sp. 10	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.600	Hormiinae	unknown sp. 10	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.601	Hormiinae	unknown sp. 10	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.602	Hormiinae	unknown sp. 10	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	6.IX.14
CUMZ-IN-HYM Bra.2014.603	Hormiinae	unknown sp. 11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.604	Hormiinae	unknown sp. 12	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.605	Hormiinae	unknown sp. 12	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.606	Hormiinae	unknown sp. 12	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.607	Hormiinae	unknown sp. 13	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.608	Lysiterminae	*Aulosaphoid es* sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.609	Lysiterminae	*Aulosaphoid es* sp. 2	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.610	Lysiterminae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.611	Lysiterminae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.612	Lysiterminae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.613	Lysiterminae	unknown sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.614	Lysiterminae	unknown sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.615	Lysiterminae	unknown sp. 3	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.616	Lysiterminae	unknown sp. 4	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.617	Lysiterminae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.618	Lysiterminae	unknown sp. 5	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.619	Lysiterminae	unknown sp. 5	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.620	Lysiterminae	unknown sp. 5	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.621	Lysiterminae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.622	Lysiterminae	unknown sp. 7	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.623	Lysiterminae	unknown sp. 8	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.624	Lysiterminae	unknown sp. 9	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.625	Lysiterminae	unknown sp. 10	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.626	Lysiterminae	unknown sp. 10	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.627	Lysiterminae	unknown sp. 10	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	7.IX.14
CUMZ-IN-HYM Bra.2014.628	Lysiterminae	unknown sp. 10	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.629	Lysiterminae	unknown sp. 11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.630	Macrocentrinae	*Macrocentrus* sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.631	Macrocentrinae	*Macrocentrus* sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.632	Macrocentrinae	*Macrocentrus* sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.633	Macrocentrinae	*Macrocentrus* sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.634	Macrocentrinae	*Macrocentrus* sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.635	Macrocentrinae	*Macrocentrus* sp. 2	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.VII.14
CUMZ-IN-HYM Bra.2014.636	Meteorideinae	*Meteoridea* sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.637	Microgastrinae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.638	Microgastrinae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.639	Microgastrinae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.640	Microgastrinae	unknown sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.641	Microgastrinae	unknown sp. 2	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.642	Microgastrinae	unknown sp. 3	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.643	Microgastrinae	unknown sp. 3	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	26. IX.13
CUMZ-IN-HYM Bra.2014.644	Microgastrinae	unknown sp. 4	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.645	Microgastrinae	unknown sp. 4	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	7.IX.14
CUMZ-IN-HYM Bra.2014.646	Microgastrinae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.VII.14
CUMZ-IN-HYM Bra.2014.647	Microgastrinae	unknown sp. 4	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.648	Microgastrinae	unknown sp. 4	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.649	Microgastrinae	unknown sp. 4	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.650	Microgastrinae	unknown sp. 5	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.651	Microgastrinae	unknown sp. 5	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.652	Microgastrinae	unknown sp. 5	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.653	Microgastrinae	unknown sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.654	Microgastrinae	unknown sp. 7	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.655	Microgastrinae	unknown sp. 7	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.656	Microgastrinae	unknown sp. 7	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.657	Microgastrinae	unknown sp. 8	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.658	Microgastrinae	unknown sp. 8	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.659	Microgastrinae	unknown sp. 9	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.660	Microgastrinae	unknown sp. 10	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.661	Microgastrinae	unknown sp. 10	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.662	Microgastrinae	unknown sp. 10	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.663	Microgastrinae	unknown sp. 10	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.664	Microgastrinae	unknown sp.10	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	24.I.14
CUMZ-IN-HYM Bra.2014.665	Microgastrinae	unknown sp.11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.666	Microgastrinae	unknown sp.11	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	6.IX.14
CUMZ-IN-HYM Bra.2014.667	Microgastrinae	unknown sp.11	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.III.14
CUMZ-IN-HYM Bra.2014.668	Microgastrinae	unknown sp.12	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.669	Microgastrinae	unknown sp.13	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.I.14
CUMZ-IN-HYM Bra.2014.670	Microgastrinae	unknown sp.14	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.VII.14
CUMZ-IN-HYM Bra.2014.671	Microgastrinae	unknown sp.15	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	5.IX.14
CUMZ-IN-HYM Bra.2014.672	Opiinae	*Diachamimorpha* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.673	Opiinae	*Diachamimorpha* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.674	Opiinae	*Diachamimorpha* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.675	Opiinae	*Diachamimorpha* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.676	Opiinae	*Diachamimorpha* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.677	Opiinae	*Diachamimorpha* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.678	Opiinae	*Diachamimorpha* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.679	Opiinae	*Diachamimorpha* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.680	Opiinae	*Opius* sp.	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.681	Opiinae	*Opius* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.682	Opiinae	*Psyttalia* sp.	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.683	Opiinae	*Psyttalia* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.684	Opiinae	*Psyttalia* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.685	Opiinae	*Psyttalia* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.686	Opiinae	*Psyttalia* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.687	Opiinae	*Psyttalia* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.688	Opiinae	unknown sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.689	Orgilinae	*Orgilus* sp.	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	7.IX.14
CUMZ-IN-HYM Bra.2014.690	Orgilinae	*Orgilus* sp.	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	7.IX.14
CUMZ-IN-HYM Bra.2014.691	Orgilinae	*Orgilus* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.692	Orgilinae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.693	Orgilinae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.694	Orgilinae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.695	Orgilinae	unknown sp. 1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	5.IX.14
CUMZ-IN-HYM Bra.2014.696	Orgilinae	unknown sp. 1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	5.IX.14
CUMZ-IN-HYM Bra.2014.697	Orgilinae	unknown sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.VII.14
CUMZ-IN-HYM Bra.2014.698	Pambolinae	*Pambolus* sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.699	Pambolinae	*Pambolus* sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.VII.14
CUMZ-IN-HYM Bra.2014.700	Pambolinae	*Pambolus* sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.701	Pambolinae	*Pambolus* sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.702	Pambolinae	*Pambolus* sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.VII.14
CUMZ-IN-HYM Bra.2014.703	Pambolinae	*Pambolus* sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.VII.14
CUMZ-IN-HYM Bra.2014.704	Pambolinae	*Pambolus* sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.VII.14
CUMZ-IN-HYM Bra.2014.705	Pambolinae	*Pambolus* sp. 1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.706	Pambolinae	*Pambolus* sp. 1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	5.IX.14
CUMZ-IN-HYM Bra.2014.707	Pambolinae	*Pambolus* sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.708	Pambolinae	*Pambolus* sp. 2	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.709	Pambolinae	*Pambolus* sp. 2	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.710	Pambolinae	*Pambolus* sp. 3	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	26. IX.13
CUMZ-IN-HYM Bra.2014.711	Pambolinae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.712	Pambolinae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.713	Pambolinae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.714	Pambolinae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.715	Pambolinae	unknown sp. 1	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	23.V.14
CUMZ-IN-HYM Bra.2014.716	Pambolinae	unknown sp. 2	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.VII.14
CUMZ-IN-HYM Bra.2014.717	Pambolinae	unknown sp. 2	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	6.IX.14
CUMZ-IN-HYM Bra.2014.718	Pambolinae	unknown sp. 3	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.719	Pambolinae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.VII.14
CUMZ-IN-HYM Bra.2014.720	Pambolinae	unknown sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.VII.14

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.721	Pambolinae	unknown sp. 5	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.722	Pambolinae	unknown sp. 6	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.VII.14
CUMZ-IN-HYM Bra.2014.723	Rhysipolinae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.724	Rhysipolinae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.725	Rhysipolinae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.726	Rhysipolinae	unknown sp. 1	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.727	Rhysipolinae	unknown sp. 1	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	21.III.14
CUMZ-IN-HYM Bra.2014.728	Rhysipolinae	unknown sp. 2	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.729	Rhysipolinae	unknown sp. 2	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.730	Rhysipolinae	unknown sp. 3	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	22.XI.13
CUMZ-IN-HYM Bra.2014.731	Rhysipolinae	unknown sp. 4	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	24.I.14
CUMZ-IN-HYM Bra.2014.732	Rogadinae	*Yelicones samaesanensis*	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13
CUMZ-IN-HYM Bra.2014.733	Rogadinae	*Yelicones samaesanensis*	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	26.I.14
CUMZ-IN-HYM Bra.2014.734	Rogadinae	*Yelicones samaesanensis*	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25.V.14
CUMZ-IN-HYM Bra.2014.735	Rogadinae	*Yelicones* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.736	Rogadinae	*Yelicones* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	6.IX.14
CUMZ-IN-HYM Bra.2014.737	Rogadinae	*Yelicones* sp.	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	6.IX.14
CUMZ-IN-HYM Bra.2014.738	Rogadinae	*Clinocentrini* sp.	12° 31' 22" N, 100° 57' 18" E	Chuang Island	Light trap	V. Charoennitiwat	24.I.14
CUMZ-IN-HYM Bra.2014.739	Rogadinae	*Aleiodes* n. sp.	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.XI.13

VOUCHER	SUBFAMILIES	SPECIES	LOCALITIES	STUDY SITES	COLLECTED BY	COLECTOR	DATE
CUMZ-IN-HYM Bra.2014.740	Rogadinae	*Aleiodes bugarae*	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	25. IX.13
CUMZ-IN-HYM Bra.2014.741	Rogadinae	*Aleiodes* sp. 2	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.742	Rogadinae	*Aleiodes* sp. 2	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	23.XI.13
CUMZ-IN-HYM Bra.2014.743	Rogadinae	*Aleiodes* sp. 3	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27. IX.13
CUMZ-IN-HYM Bra.2014.744	Rogadinae	*Aleiodes* sp. 4	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	27.IX.13
CUMZ-IN-HYM Bra.2014.745	Rogadinae	*Aleiodes* sp. 5	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.746	Rogadinae	*Aleiodes* sp. 5	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.747	Rogadinae	*Aleiodes* sp. 5	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.748	Rogadinae	*Aleiodes* sp. 6	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	25.I.14
CUMZ-IN-HYM Bra.2014.749	Rogadinae	*Aleiodes* sp. 7	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.750	Rogadinae	*Aleiodes* sp. 8	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	23.III.14
CUMZ-IN-HYM Bra.2014.751	Rogadinae	*Aleiodes* sp. 8	12° 36' 9" N, 100° 57' 21" E	Khao Ma Cho	Light trap	V. Charoennitiwat	24.V.14
CUMZ-IN-HYM Bra.2014.752	Rogadinae	*Aleiodes* sp. 9	12° 36' 58" N, 100° 55' 14" E	Samaesan Island	Light trap	V. Charoennitiwat	24.V.14

VITA

Mr. Vachirapong Charoennitiwat was born on April 13th, 1989. He received his Bachelor's Degree of Science, major Zoology and minor Biology, from the Department of Biology, Faculty of Science, Chulalongkorn University in 2012. He continue Master degree in Zoology, at the Department of Biology, Faculty of Science, Chulalongkorn University, of which this thesis forms a part, was supported by The 90th Anniversary of Chulalongkorn University Fund (Ratchadaphiseksomphot Endowment Fund), Development and Promotion of Science and Technology Talents Project (DPST) and Plant Genetic Conservation Project under the Royal Initiative of Her Royal Highness Princess Maha Chakri Sirindhorn Replied by Chulalongkorn University (RSPG-Chula).

Academic experiences

Research assistant under the title: Diversity of parasitic wasps superfamily Ichneumonoidea and Chalcidoidea in Plant Genetic Conservation Project under the Royal Initiative of Her Royal Highness Princess Maha Chakri Sirindhorn (RSPG) (2012).

Oral and poster presentation under the title: Diversity of fireflies (Coleoptera: Lampyridae) in the Plant Genetic Conservation Project under the Royal Initiative of Her Royal Highness Princess Maha Chakri Sirindhorn (RSPG) area at Bangkok International Trade and Exhibition Centre in the 7th Conference on Science and Technology for Youths, Ministry of Science and Technology (2012)

Teaching assistant in General Biology Laboratory (2013-2015) and Man & Environment (2014) at Department of Biology, Faculty of Science, Chulalongkorn University.

Poster presentations under the title: Taxonomy of nocturnal parasitic wasps family Braconidae at Samaesan Islands, Chonburi Province, Thailand at National University of Singapore in the 19th Biological Science Graduate Congress (BSGC) (2014).

Teaching assistant in Children University's days, Chulalongkorn University (2014-2015).

Oral presentations under the title: Taxonomy of nocturnal parasitic wasps family Braconidae at Samaesan Islands, Chonburi Province at Kasetsart University in the 10th Conference on Science and Technology for Youths, Ministry of Science and Technology (2015).