

DIVERSITY OF VESPID WASPS (Hymenoptera: Vespidae) IN LANG SON PROVINCE, VIETNAM

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ABSTRACT: Species diversity and abundance of vespid wasps (Vespidae: Hymenoptera) in Cai Kinh, Lang Son province, Vietnam, is examined. A total of 43 species in 22 genera of vespid wasps are recognized in the study area. They are 16 social wasp species belonging to 2 subfamilies, Polistinae (13 species) and Vespinae (3 species), and 27 solitary wasps belonging to the subfamily Eumeninae. The nest of *Polistes strigosus* is described for the first time. The genus *Oreumenes* of the subfamily Eumeninae is newly recorded for the Vietnamese fauna, represented by *Oreumenes decoratus* (Smith). When the diversity of vespid wasps in the study area of each year was compared for three years, 2014, 2015 and 2016, the diversity and evenness index were highest in the summer of 2016, suggesting that many vespid species are active in summer. *Eumenes quadratus* and *Delta esuriens* were the most abundant species.

Keywords: Vespidae, diversity, nest description, new record, vespid wasps, Lang Son, Vietnam.

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INTRODUCTION

Vespid wasps including social wasps and solitary wasps, namely Stenogastrinae (hover wasps), Polistinae (paper wasps) and Vespinae (hornets and yellow-jackets) and Eumeninae (potter wasps) in the family Vespidae, consist of about 5000 described species worldwide (Pickett & Carpenter, 2010). Studies on species composition of vespid wasps have been carried out in Vietnam recently (Nguyen et al., 2015a, b), but species diversity has not yet been studied in depth. The northwestern part of Vietnam is considered as one of the most diverse insect areas as it lies in the eastern part of Himalayas and also in the Indo-Burma diversity hotspot. We chose Cai Kinh, Lang Son province, an area in the northeastern part of Vietnam, to compare the diversity and abundance of vespid wasps in different years and seasons. These data will serve as basic knowledge for insect conservation and management in Vietnam.

MATERIALS AND METHODS

Specimens of vespid wasps in Cai Kinh, Lang Son Province (fig. 1), were collected over

three years, 2014, 2015 and 2016, with the same season in 2014 (Autumn, 11/2014) and 2015 (Autumn, 11/2015) and a different season in 2016 (Summer, 7/2016).

Methods for collecting specimens followed Ta et al. (2004) with some minor changes to make it suitable for the study on vespid wasps: the total survey distance was 20 km with 4 sample collectors for each investigation.

The nest characters, including measurements of various parts given below, were examined after immature worms in the nest were removed and the nests were air-dried. The length and thickness (minimum and maximum thicknesses at the mid-length) of the nest pedicel and the distance between opposite sides of a cell containing a pupa or having the trace of a cocoon cap ("cell width") were measured to the nearest 0.1 mm with Vernier calipers. The thickness of cell wall was taken with a micrometer to the nearest 0.01 mm. The terminology of nest characters followed to those in Wenzel (1998). In the description of nest comb shapes, "ventral" and "dorsal" refer to the directions corresponding to cell openings and

cell bottoms, respectively.

Photographic images were made with the Leica EZ4HD 3.0 MegaPixel Digital Stereo Microscope, using LAS exclusive microscopy software (LAS EZ 2.0.0); the plates were finished with Photoshop CS6.

The Shannon-Wiener diversity index (H') (Krebs, 1989) and Bray-Curtis similarity (S) were used in this study. The evenness index (J') (Krebs, 1989) was calculated to determine the equal abundance of wasps in each study site.

The software used in this study is Primer 6.

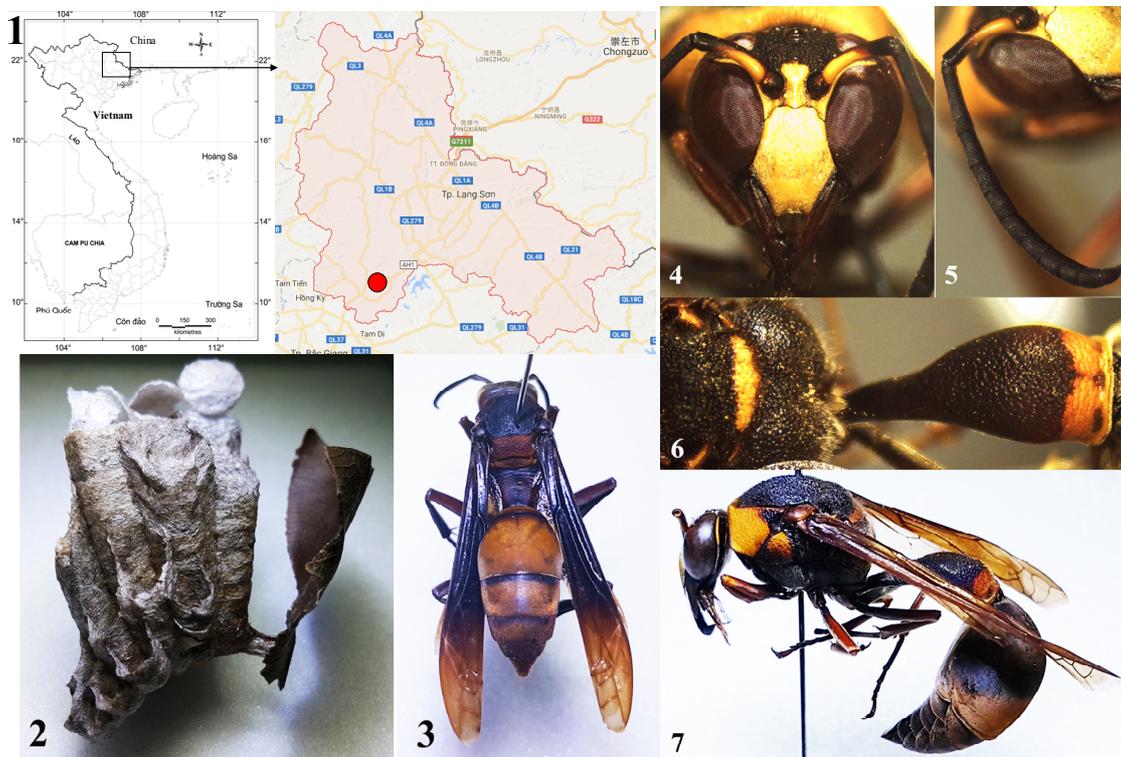
RESULTS AND DISCUSSION

The species composition of vespid wasps collected in Cai Kinh, Lang Son province, over three years from 2014 to 2016 is presented in table 1. A total of 43 species in 22 genera of three subfamilies was recorded from Cai Kinh. Of these, 13, 3 and 27 species are in the subfamily Polistinae, Vespinae and Eumeninae, respectively.

Table 1. Species composition of vespid wasps (Vespidae) in Cai Kinh, Lang Son

No	Taxon	Number of specimens		
		2014	2015	2016
Subfamily Polistinae				
1	<i>Polistes olivaceus</i> (DeGeer, 1773)	3	5	15
2	<i>Polistes rothneyi</i> Cameron, 1900			1
3	<i>Polistes tenebricosus</i> Lepeletier, 1836			1
4	<i>Polistes brunetus</i> Nguyen & Kojima, 2015			1
5	<i>Polistes japonicus</i> de Saussure, 1858	2	3	5
6	<i>Polistes sagittarius</i> de Saussure, 1853			2
7	<i>Polistes trigosus</i> Bequaert, 1940			5
8	<i>Polistes</i> sp.12	1	3	12
9	<i>Ropalidia mathematica</i> (Smith, 1860)			1
10	<i>Ropalidia stigma</i> (Smith, 1858)			3
11	<i>Ropalidia</i> sp.2			2
12	<i>Parapolybia indica</i> (de Saussure, 1853)			1
13	<i>Parapolybia varia</i> (Fabricius, 1787)			2
Subfamily Vespinae				
14	<i>Vespa affinis</i> (Linnaeus, 1763)	2	3	5
15	<i>Vespa bicolor</i> Fabricius, 1787			1
16	<i>Vespa velutina</i> Lepeletier, 1836	3	1	4
Subfamily Eumeninae				
17	<i>Allorhynchium</i> sp.1	1		3
18	<i>Allorhynchium argentatum</i> (Fabricius, 1804)	1		
19	<i>Anterhynchium flavomarginatum flavomarginatum</i> (Smith, 1852)			2
20	<i>Anterhynchium punctatum</i> Nguyen, 2015		2	4
21	<i>Antepipona bigutata</i> (Fabricius, 1787)			1
22	<i>Apodynerus troglodytes troglodytes</i> (de Saussure, 1855)			3
23	<i>Calligaster himalayensis</i> (Cameron, 1904)			1
24	<i>Coeleumenes burmanicus</i> (Bingham, 1897)	1	2	
25	<i>Delta esuriens esuriens</i> (Fabricius, 1787)	5	25	4
26	<i>Delta pyriforme pyriforme</i> (Fabricius, 1775)	5	12	1
27	<i>Eumenes atrophicus</i> (Fabricius, 1798)		1	
28	<i>Eumenes inconspicuus</i> Smith, 1858	3	17	4
29	<i>Eumenes labiatus sinicus</i> Giordani Soika, 1941			5
30	<i>Eumenes congnatus</i> Nguyen, 2016		3	

31	<i>Eumenes quadratus quadratus</i> Smith, 1852	10	23	8
32	<i>Eumenes rubronotatus</i> Pérez, 1905	1	2	2
33	<i>Eumenes</i> sp.6	1	3	5
34	<i>Euodynerus dantici violaceipennis</i> Giordani Soika, 1973			2
35	<i>Euodynerus nipanicus tonkinensis</i> Giordani Soika, 1973		1	7
36	<i>Orancistrocerus aterrimus erythropus</i> (Bingham, 1897)			1
37	<i>Oreumenes decoratus</i> (Smith, 1852)	2		
38	<i>Parancistrocerus</i> sp.1			1
39	<i>Pararrhynchium striatum</i> Nguyen, 2015			2
40	<i>Phimenes flavopictus continentalis</i> (Zimmermann, 1931)	17	17	3
41	<i>Pseudozumia indica indica</i> (de Saussure, 1855)		1	
42	<i>Rhynchium brunneum brunneum</i> (Fabricius, 1793)	2	7	8
43	<i>Subancistrocerus</i> sp.1			1



Figures 1-7: 1. Map showing the study site (• Cai Kinh, Lang Son Province); 2-3. *Polistes strigosus* (2. Nest; 3. Female); 4-7. *Oreumenes decoratus*, male (4. Head in frontal view, 5. Right antenna, 6. Propodeum and tergum 1, dorsal view, 7. Habitus, lateral view)

A nest of *Polistes strigosus* (Nest#VN-LS-2016-P-01) (figs 2-3) was collected in Vietnam for the first time, together with 5 females. The nest was at the early stage, attached to a broad leaf, at about 2 m above the ground, and has 31 cells (11 long cells and 20 short cells), with eggs

but no pupae. The nest characteristics are as follows: Petiole single, terminal, with thick central core of plant fibers, enlarged strictly with adult salivary secretion, brown and lustrous, 4.4 mm long, 1.8 × 3.2 mm thick; salivary coating extended onto substrate and onto back of comb

(small area). Comb tough, pliable in texture, grey, subcircular (about 25 mm × 23 mm) in view from side of cell closing; dorsal surface slightly concave. Nest cells generally arranged regularly and round at open end; cell expanded towards open end, 5.0 mm (range 3.7-5.9 mm; n=5) wide at bottom and 7.8 mm (range 7.4-8.2 mm; n=5) wide at open end, 23.6 mm (range 23.0-24.5) mm; n=5) deep; cell wall about 0.1 mm thick. Cocoon caps whitish grey.

One genus, *Oreumenes* was newly recorded from Vietnam, represented by one species, *Oreumenes decoratus* (Smith) (figs 4-7). In the world, this species has a narrow distribution range, only occurring in Japan, Korea, China, and Taiwan (Carpenter, per. com.).

Of the vespid species occurring in the study area, *Anterhynchium punctatum* was recorded from Son La, Bac Giang, Vinh Phuc, Hoa Binh, Ninh Binh, Dac Lak (Nguyen, 2015a). *Euodynerus dantici violaceipennis* was recorded only from Cao Bang, Lao Cai and Son La (Dang et al., 2012), *Pararrhynchium striatum* was recorded from Tuyen Quang, Thai Nguyen, Hoa Binh, Ha Tinh (Nguyen, 2015b), *Pseudozumia indica indica* was recorded only from Tuyen Quang and Ninh Binh (Nguyen et al., 2014); all are newly recorded from Lang Son in this study. In the world, three species

have a narrow distribution: *Anterhynchium punctatum* and *P. striatum* are only found in Vietnam, while *E. dantici violaceipennis* occurs in China, Taiwan, Korea and Japan. Only *P. indica indica* has a wider distribution range, from India to Indonesia.

Six species were commonly found in the study site in high numbers: *Polistes olivaceus*, *Delta esuriense esuriense*, *D. pyriforme pyriforme*, *Eumenes inconspicuous*, *E. quadratus*, *Phimenes flavopictus continentalis*. They occurred in different seasons of the year. Twenty species occurred only in the summer of 2016: *Polistes rothneyi*, *Polistes tenebricosus*, *Polistes brunnetus*, *Polistes strigosus*, *Ropalidia mathematica*, *Ropalidia stigma*, *Ropalidia* sp.2, *Parapolybia indica*, *Parapolybia varia*, *Vespa bicolor*, *Anterhynchium f. flavomarginatum*, *Antepipona biguttata*, *Apodynerus troglodytes troglodytes*, *Calligaster himalayensis*, *Eumenes labiatus sinicus*, *Euodynerus dantici violaceipennis*, *Orancistrocerus aterrimus erythropus*, *Parancistrocerus* sp.1, *Pseudozumia indica indica* and *Subancistrocerus* sp.1. This means that many vespid species are active in the summer time, an active season for insects in general.

Diversity and evenness indices are different in each year, as shown in table 2.

Table 2. Diversity and evenness index of vespid wasps in Cai Kinh over three years

Years	Number of species	Number of specimen	J'	H'
2014	17	60	0.841	2.382
2015	19	131	0.823	2.424
2016	36	128	0.912	3.269

Table 2 shows that the diversity (H') and evenness index (J') was highest in the summer of 2016. This means that summer is the most suitable time for activity of vespid wasps in the study area.

The Bray-Curtis similarity coefficient (S) of vespid wasps is presented in figure 8. It shows that the composition of vespid wasps in the autumn of two study years 2014 and 2015 was

similar at a high percentage (about 65%), and the species composition in the summer of 2016 diverged from those in 2014 and 2015. The similarity between two branches is slightly more than 40%, which means that the species composition in 2016 is quite different from those in 2014 and 2015. Thus, the season of the year is one factor that influences the occurrence of vespid species in the field.

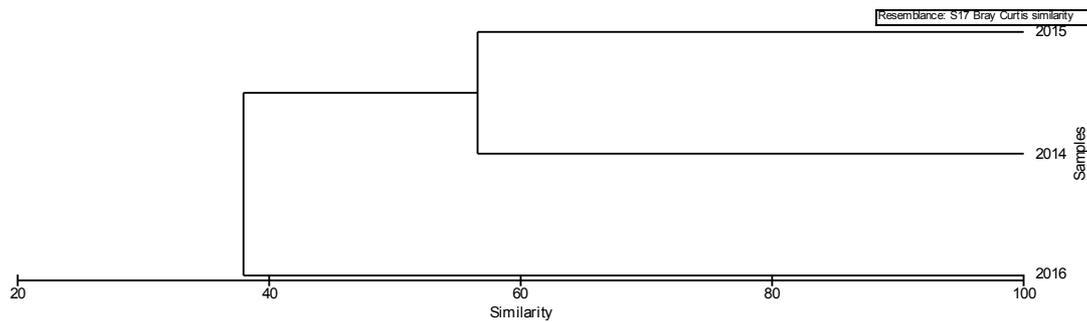


Figure 8. The Bray-Curtis similarity coefficient of vespid wasps in Cai Kinh for three years

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SỰ ĐA DẠNG CỦA CÁC LOÀI ONG BẮT MỒI THUỘC HỌ ONG VÀNG Vespidae (Hymenoptera) Ở CAI KINH, LẠNG SƠN

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TÓM TẮT

Bài báo đề cập đến đa dạng loài và độ phong phú của các loài ong bắt mồi thuộc họ ong Vàng Vespidae (Hymenoptera) ở Cai Kinh, tỉnh Lạng Sơn. Tổng số có 43 loài thuộc 22 giống của các loài này được ghi nhận ở điểm nghiên cứu, trong đó có 13 loài thuộc phân họ Polistinae, 3 loài thuộc phân họ Vespinae và 27 loài thuộc phân họ Eumeninae. Tổ của loài *Polistes strigosus* lần đầu tiên được mô tả. Trong số 22 giống được ghi nhận, giống *Oreumenes* lần đầu tiên được ghi nhận cho khu hệ các loài ong bắt mồi của Việt Nam, được đại diện bởi duy nhất một loài, *Oreumenes decoratus* Smith.

Sự đa dạng của các loài ong bắt mồi thuộc họ Vespidae thu được trong ba năm, từ 2014-2016 ở điểm nghiên cứu được so sánh cho thấy chỉ số đa dạng (H') và chỉ số đồng đều (J') cao nhất vào năm 2016 (mùa hè), chỉ số tương đồng (S) của hai năm 2014 và 2015 khoảng 65% nhưng chỉ số tương đồng của năm 2016 so với hai năm còn lại chỉ là 40%, điều này cho thấy, các mùa khác nhau trong năm có ảnh hưởng rõ rệt tới thành phần và sự đa dạng của các loài ong bắt mồi. Hai loài *Eumenes quadratus* và *Delta esuriens* có số lượng cá thể nhiều nhất trong số các loài ghi nhận được.

Từ khóa: Vespidae, cấu trúc tổ, ghi nhận mới, ong bắt mồi, sự đa dạng, Lạng Sơn, Việt Nam.