RESEARCH REPORT

The NEF Bio-ecological Nature Conservation Project in Mountainous Region of North Vietnam

Prepared by

INSECTS GROUP

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TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CRES	Central Institute For Natural Resources and Environmental Studies, Vietnam National University, Hanoi
DARD	Department of Agriculture and Rural Development
FPD	Forest Protection Department
GIS	Geographic Information System
HSCA	Habitat and Species Conservation Area
IEBR	Institute of Ecology and Biological Resources
IUCN	International Union for Conservation of Nature
MARD	Ministry of Agriculture and Rural Development
NEF	Nagao Natural Environment Foundation
NP	National Park
NR	Nature Reserve

1. GENERAL INFORMATION

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2. RESEARCH

2.2 Abstract

The study on diversity of 4 orders Hymenoptera, Hemiptera, Lepidoptera and Coleoptera in the mountain region in the northeastern part of Vietnam with Eight field surveys were conducted in Tuyen Quang Ha Giang, Cao Bang, and Bac Kan provinces in the three years, from October 2018 to December 2021 show that:

Recored 380 species of 32 families of 4 orders. Among them we have recorded orders Hymenoptera with 127 species of 50 genera 6 families; orders Hemiptera with 116 species of 69 genera 10 families; orders Coleoptera with 75 species of 42 genera 11 families and orders Lepidoptera with 59 species of 34 genera 7 families. In agricultural ecosystems (vegetable and fruit crops, food crops and forest trees), recored 172 species, among them 60 pests and 112 species of natural enemies. Describe 5 new species, 15 species newly recorded for Vietnam fauna. Four species of the genus *Stenodyneriellus* Giordani Soika, 1962 are recorded from Vietnam. Of them, *S. capillus* Nguyen, new species from Bac Kan province is described and illustrated. In addition, one species, *S. similiguttulatus* Li & Chen, 2016 is newly recorded from Vietnam. A key to species from Vietnam is given. Orders Hymenoptera have the highest number of species with 100 species (26.32%) in Tuyen Quang, 95 species (25.00%) in Cao Bang, 71 species (18.68%) in Bac Kan and 61 species (16.05%) in Ha Giang. Next Orders Hemiptera have the number of species 89 species (23.42%) in Cao Bang, 84 species (22.11%) in Bac Kan and 83 species (21.84%) in Tuyen Quang. The lowest is the order Lepidoptera with 55 species (14.47%) in Cao Bang, 39 species (10.26%),34 species (8.95%), 25 species (6.58%) in Bac Kan, Tuyen Quang and Ha Giang respectively. Recorded in the higher montane evergreen forest and lower montane evergreen forest with 246 species of 31 families of 4 orders; Lowland evergreen forest and lowland semi-evergreen forest with 232 species of 31 families of 4 orders, The buffer zone (Ecosystem transitional buffer zone between forest, regenerated forests and agricultural ecosystems) with 208 species of 30 families of 4 orders, Agricultural ecosystems focus on the important group of plants like fruit trees and industrial crops with 151 species of 30 families of 4 orders, Grassland with 166 species of 29 families of 4 orders. Recorded in < 200m altitude with 279 species of 20 families of 4 orders, 200-500m altitude 216 species of 20 families of 4 orders, 500-1000m altitude 187 species of 28 families of 4 orders, 1000-1500m altitude 219 species of 30 families of 4 orders, >1500m altitude with 151 species of 18 families of 4 orders. Recorded 12 insect species of conservation value in the study area, 60 species pest were recorded on crops belonging to 3 main groups (vegetable and fruit crops, food crops and forest trees) belonging to 18 families; 2 species of mosquitoes that transmit dengue fever: *Aedes aegypti* (Linnaeus) and *Aedes albopictus* (Skuse), a Japanese mosquito *Culex tritaeniorhynchus* Giles, and a blood-sucking bug, *Triatoma rubrofasciatta* Dorh. 112 species of natural enemies on the plantations, in which species of the beetle order Coleoptera have the most recorded species

(accounting for 35.05%), followed by the order Coleoptera. the other wing Heteroptera (23.71%) and the membranous order Hymenoptera (21.65%). The other 4 sets had a low rate of 2.06-9.28%; 5 species act as insects pollinate; 4 species of bees with high economic value were recorded at the study site, of which 3 species were exploited and eradicated (*Polistes olivaceus* (DeGeer), *Polistes strigosus* Bequaert and *Vespa affinis* (Linnaeus)); 15 species that were used as food for humans in the study site. There are 3 common species including *Apis cerana* (honey bee), *Apis mellifela* (Honey bees) and *Bombyx mori* (mulberry silkworm); 12 species were reported to be used as pharmaceuticals. There are 3 species: *Apis cerana* honey bee; Honey bees enter *Apis mellifela* and mulberry silkworm *Bombyx mori*.

Determining the causes of resource degradation of 4 orders and proposing solutions to sustainably protect these insect resources: Unsustainable exploitation and use, Forest fire, Change of land use mode, Environmental pollution. Conservation of 4 orders Hymenoptera, Hemiptera, Lepidoptera and Coleoptera is the process of managing the interaction between humans and their genetic resources. In order to conserve the quality and effectively, it is necessary to minimize the main causes of the decline of the Apidae, Vespidae, Reduviidae, Coccinellidae, Papilionidae and Formicidae families in forest habitats in the limestone mountains of Northeast Vietnam.

PUBLICATIONS: 3 international articles of SCI-E and 01 national articles (had Thank The NEF Bio-ecological Nature Conservation Project in Mountainous Region of North Vietnam).

EDUCATION AND TRAINING: 1 Bachelor, 3 Masters and 1 Doctorate

2.2 Background of the study

Vietnam is a tropical monsoon with varied topography, soil type and landscape. We can see the typical forest types in Vietnam as confidential lowland forests, woodlands, maturity, closed forest uplands, upland consular relations. There's also the type of other natural ecosystems and agricultural ecosystems (Thai Van Trung, 1971). In recent years, the natural forest was reduced and seriously destroyed by fires, deforestation and the overexploitation of forest resources of humans. Many carpet plants in the natural forest habitat began moving into the grasslands, shrubs or barren hills. The forest land was transformed into agricultural land, and appear interspersed area of agricultural crops in the forest ecosystem to constitute patchy forest habitats. In other natural ecosystems and agricultural ecosystems due to rapid population increase, urbanization, the development of tourism and the use of chemicals in agricultural crops have increased the toxic residue and not biodegradable chemicals (Wege et al., 1999). Under the above adverse impacts has seriously degraded insect resources on both the composition and the number of individuals of the species, including species of the order Hemiptera, Coleoptera, Hymenoptera and Lepidoptera no exception (Vu Quang Con and Nguyen Ngoc Chau, 2001).

Coleoptera is an insect in the superorder Endopterygota. Their front pair of wings are hardened into wing-cases, elytra, distinguishing them from most other insects. The Coleoptera, with about 400,000 described species, is the largest of all orders, constituting almost 40% of described insects and 25% of all known animal life-forms; new species are discovered frequently, with estimates suggesting that there are between 0.9 to 2.1 million total species. Beetles often feed on plants and fungi, break down animal and plant debris, and eat other invertebrates. Some species are serious agricultural pests, while others such as Coccinellidae (ladybirds or ladybugs) eat aphids, scale insects, thrips, and other plant-sucking insects that damage crops. Order Lepidoptera about 180,000 species of butterflies, moths. This order of insects is second in size only to Coleoptera. Because of their day-flying habits and bright colours, the butterflies are more familiar than the chiefly night-flying and dull-coloured moths, but the latter is far more varied and abundant. Order Hemiptera is an order of insects, commonly called true bugs, comprising over 80,000 species within groups such as the cicadas, aphids, planthoppers, leafhoppers, bed bugs, and shield bugs. They range in size from 1 mm (0.04 in) to around 15 cm (6 in) and share a common arrangement of sucking mouthparts. Most hemipterans feed on plants, using their sucking and piercing mouthparts to extract plant sap. Some are hematophagous, while others are predators that feed on other insects or small invertebrates. They live in a wide

variety of habitats, generally terrestrial, though some species are adapted to live in or on the surface of freshwater. Hymenoptera is a large order of insects, comprising sawflies, wasps, bees, and ants. Over 150,000 living species of Hymenoptera have been described, in addition to over 2,000 extinct ones. Many of the species are parasitic. Females typically have a special ovipositor for inserting eggs into hosts or places that are otherwise inaccessible. The young develop through holometabolism (complete metamorphosis)—that is, they have a wormlike larval stage and an inactive pupal stage before they mature. However, in Vietnam, many families belonging to 4 orders Hemiptera, Coleoptera, Hymenoptera and Lepidoptera have been studied. However, the overall studies of these four orders in Cham Chu NR (Tuyen Quang Province), Bac Me NR (Ha Giang Province), Phia Oac-Phia Den NP (Cao Bang Province) and Nam Xuan Lac HSCA (Bac Kan Province) is rarely done.

The NEF Bio-ecological Nature Conservation Project in the Mountainous Region of North Vietnam aims to explore the biodiversity and to evaluate conservation potentials of limestone karst forests of northeastern Vietnam. As a part of this project, the insect group intends to evaluate the species diversity (Order Hemiptera, Coleoptera, Hymenoptera and Lepidoptera), distribution and conservation value of insects in four target protected areas, namely Cham Chu NR (Tuyen Quang Province), Bac Me NR (Ha Giang Province), Phia Oac-Phia Den NP (Cao Bang Province) and Nam Xuan Lac HSCA (Bac Kan Province).

2.3. Literature review

2.3.1 Natural features of the study area

Topography: The northeastern region's geology is of largely south Chinese origin with hilly and montane areas in the north and the Red River Delta in the south. The landscape here is formed by a combination of exposed ancient metamorphic basement rock and eroded marine sediments deposited in the late mid-Devonian (370–360 million years ago) and early Triassic (245–224 million years ago) (Averyanov et al. 2003). Northeastern Vietnam contains both karst and granite formations: Ngan Son and Bac Son are two large karst formations, stand at 1000 m a.s.l., their hilltops rising between 100–600 m over the intervening lowland valleys and flat depressions. The karst formations are normally at an elevation of 300–700 m, however nearer to the border with China they often reach 1400–1600 m. A number of isolated granite mountain systems are Tay Con Linh (2419 m), Pu Tha Ca (2274 m), Pia Da (1980 m), and Pia Oac (1930 m) (Averyanov et al. 2003). The northeastern coastline is dotted by more than 2000 offshore islands in the Gulf of Tonkin (Sterling et al. 2006).

Climate: The northeastern region is characterized by the monsoon tropical climate with cold winter and summer rains. This coldness and seasonality are caused by the northeast monsoon winds that bring cold air from the edge of the Tibetan Plateau into northern Vietnam in the winter (from November to March). The hot weather and rain in summer result from the arrival of southwestern monsoon winds blowing in from southerly oceans. The average annual temperature in the region is from 18ºC to 23.5ºC; average annual rainfall varies considerably from 1343.5 mm (in Cho Ra, Bac Kan Province) to 2749.0 mm (in Huu Lung, Lang Son Province); and the average annual humidity ranges between 81–84% (Nguyen et al. 2000) (Table 1).

Table 1. Average temperatures in various locations in Vietnam in °C (°F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Cao Bang	13.8 (56.8)	15.1 (59.2)	18.8 (65.8)	22.9 (73.2)	25.9 (78.6)	27.0 (80.6)	27.0 (80.6)	26.7 (80.1)	25.4 (77.7)	22.5 (72.5)	18.5 (65.3)	15.1 (59.2)	21.6 (70.9)
Ha Giang	15.5 (59.9)	16.9 (62.4)	20.3 (68.5)	24.0 (75.2)	26.7 (80.1)	27.6 (81.7)	27.6 (81.7)	27.4 (81.3)	26.3 (79.3)	23.7 (74.7)	20.1 (68.2)	16.7 (62.1)	22.7 (72.9)
Bac Kan	15.7 (60.3)	16.8 (62.2)	19.7 (67.5)	23.5 (74.3)	26.7 (80.1)	28.0 (82.4)	28.1 (82.6)	27.8 (82.0)	26.6 (79.9)	24.1 (75.4)	20.6 (69.1)	17.3 (63.1)	22.9 (73.2)
Tuyen Quang	16.4 (61.5)	17.2 (63.0)	20.0 (68.0)	23.9 (75.0)	27.4 (81.3)	28.9 (84.0)	29.2 (84.6)	28.6 (83.5)	27.5 (81.5)	24.9 (76.8)	21.5 (70.7)	18.2 (64.8)	23.6 (74.5)

Vegetation and habitats: The dominant habitat type in northeastern Vietnam is evergreen, including both broad-leaved and coniferous plants (Averyanov et al. 2003). The forests developed on highly eroded rocky limestone mountains are an important element of the natural landscape in northeastern Vietnam and house a number of endemic species. The limestone forests are restricted to Ha Giang, Tuyen Quang, Bac Kan, Cao Bang, and Lang Son provinces in the mainland, as well as to many isolated islands in the Ha Long Bay. Mangrove forests can also be found in coastal areas from Quang Ninh to Nam Dinh provinces. The main dominants in these floristically richest forests are subendemic coniferous trees: *Pinus kwangtungensis*, *Pseudotsuga brevifolia*, and *Tsuga chinensis*. Other rare gymnosperm species like *Amenthotaxus argotaenia*, *A. hatuyensis*, *A. yunnanensis*; *Cupressus torulosa*, *Fokienia hodginsii*, *Kateleeria davidiana*, *Nageia fleurii*,

N. wallichiana, *Podocarpus brevifolius*, *P. neriifolius*, *Taxus chinensis*, and *Xanthocyparis vietnamensis* are also more or less regular components of the limestone forests within the Vietnamese part of the South-Chinese Province (Averyanov et al. 2003).

2.3.2 Overview of study sites

Field surveys were conducted in four protected areas in northern Vietnam: Cham Chu Nature Reserve in Tuyen Quang Province, Bac Me Nature Reserve in Ha Giang Province, Phia Oac - Phia Den National Park in Cao Bang Province and Nam Xuan Lac Habitat and Species Conservation Area in Bac Kan Province. General information about study sites was provided as the following, which was based on the Sourcebook of Existing and Proposed Protected Areas in Vietnam and official websites of provincial governments.

Cham Chu Nature Reserve

Cham Chu Nature Reserve with an area of 58,187 ha, spreading 22º04'-22 º21'N, 104 º53'-105 º14'E and height from 300 to 1000 m. The Cham Chu proposed NR is located in Chiem Hoa and Ham Yen districts, Tuyen Quang province, with mount Cham Chu having the highest point (1,587 m). Near mount Cham Chu, there are several other peaks above 1,000 m, although most of the proposed NR is below 800 m in elevation. Cham Chu proposed NR supports lowland evergreen forest, lower montane evergreen forest and limestone forest, and below 500 to 600 m, the only secondary forest remains (Dang Ngoc Can et al., 1999). Management history: Cham Chu NR was established in 2001 by Decision No 1536/QĐ-UBND of Tuyen Quang PC, however, without a management board. An investment plan for Cham Chu proposed nature reserve was prepared by Tuyen Quang Provincial FPD (2000). The total area of the proposed nature reserve given in this investment plan is 58,187 ha, comprising a strict protection area of 17,904 ha and a forest rehabilitation area of 40,283 ha. Cham Chu was included on a list of Special-use Forests to be established by the year 2010, prepared by the FPD of MARD, as a 58,187 ha nature reserve (FPD 2003). The NR has been under the management of the Cham Chu Special-use Forest Management Board since 2008.

Topography and hydrology: Cham Chu NR is located in Chiem Hoa and Ham Yen districts, Tuyen Quang Province. The nature reserve is centred on Mount Cham Chu, which, at 1,587 m, is the highest point in Tuyen Quang province. Near Mount Cham Chu, there are several other peaks above 1,000 m, although most of the proposed nature reserve is below 800 m in elevation. In the southwest of the proposed nature reserve, about 8 km from Mount Cham Chu, there is a large area of limestone karst, which is bisected by the Lo river.

The west of the proposed nature reserve is drained by the Lo river, while the east is drained by the Gam river, which joins the Lo river upstream of Tuyen Quang town. The Lo river joins the Red River at Viet Tri City.

Biodiversity values: A total of 443 medicinal plant species were recorded in Cham Chu Nature Reserve Area belonging to 325 genera and 120 families. Most of the medicinal plant species in Cham Chu Nature Reserve Area are Angiosperms with 425 species (95.94%) (360 Dicotyledonae, 65 Monocotyledonae), 6 species belong to the Gymnosperms (1.35%), 10 species are Polypodiophyta (2.26%), Psilotophyta and Lycopodiophyta are only one species (0.23%). The richest 3 families are Euphorbiaceae with 22 (4.97%) species, Rubiaceae with 17 (3.83%) species and Asteraceae ranks third, with 16 (3.61%) species, respectively. When the medicinal plant of the area are analysed by Raunkiaer's life form system, the results follow as phanerophytes 311 (73.18%), chamaephytes 45 (10.59%), hemicryptophytes 10 (2.355%), cryptophytes 33 (7.76%), and therophytes 26 (6.12%) species, respectively (Pham Thi Oanh et al.,2018*)*. Cham Chu NR supports lowland evergreen forest, lower montane evergreen forest and limestone forest. In November 1999, Fauna & Flora International and the Institute of Ecology and Biological Resources conducted a rapid survey in Trung Ha and Ha Lang communes, Chiem Hoa district (Dang Ngoc Can and Nguyen Truong Son 1999). This survey concentrated on the endemic and critically endangered Tonkin Snub-nosed Monkey *Rhinopithecus avunculus*, which, before the survey, was only known to survive at Na Hang NR. Based on interview data and the remains of hunted animals, the authors estimated that the Cham Chu area may support five groups of Tonkin Snub-nosed Monkey, totalling 75 to 89 animals (Dang Ngoc Can and Nguyen Truong Son 1999). Subsequent surveys have provided additional information about the Tonkin Snub-nosed Monkey population at the site and confirmed that Cham Chu NR is a globally important site for the conservation of this species.

Conservation issues: Tuyen Quang Provincial FPD (*in litt.* 2000) identified the main threats to biodiversity at the site as illegal exploitation of forest products, clearance of forest for agriculture, forest fire and hunting. Dang Ngoc Can and Nguyen Truong Son (1999) received reports of five individuals of the Tonkin Snub-nosed Monkey being hunted there between 1998 and 1999.

Bac Me Nature Reserve, Ha Giang Province

Management history: In 1994, Ha Giang Provincial DARD prepared an investment plan for Bac Me, which proposed establishing a 27,800 ha special-use forest, comprising a strict protection area of 9,450 ha, a forest rehabilitation area of 17,125 ha and an administration

and services area of 1,225 ha. This investment plan was approved by Official Letter No. 88/NL-TL of MARD, dated 8 March 1994, and by Decision No. 142/QD-UB of Ha Giang Provincial People's Committee, dated 22 April 1994. According to Bac Me Special-use Forest Management Board (*in litt.* 2003), the proposed nature reserve also contains a historical site, called Cang Bac Me (http://hagiang.gov.vn, 2020).

Topography and hydrology: Bac Me NR is situated in Bac Me District in southeastern Ha Giang Province. The topography of the proposed nature reserve is mountainous, and there are several peaks above 1,000 m, the highest of which is 1,420 m, on the border with Tuyen Quang Province. The lowest point in the proposed nature reserve is under 200 m. Streams originating in the north and west of the proposed nature reserve feed the Gam River, which flows south, into Tuyen Quang Province, and eventually meets the Lo river. Streams originating in the southeast of the proposed nature reserve feed the Pao Nam river, a tributary of the Gam River.

Biodiversity values: Field surveys of mammals in two protected areas of the northeastern limestone region of Vietnam, Bac Me (Ha Giang Province) Nature Reserves were conducted in 2018 and 2019. Thirty-five species of small mammals were recorded based both on field observations and on morphological and/or molecular evidence, as follows: one Scandentia species, four Euli-potyphla species, 14 Chiroptera species, and 16 Rodentia species. New records of Aselliscus dongbacanus and Chiromyscus thomasi in northeastern Vietnam have been confirmed. Interestingly, the mole specimens collected during this study resemble Euroscaptor orlovi morphologically but are significantly different from it genetically. The present study has revealed that Chiroptera (38.9%) and Rodentia (47.2%) are the dominant groups in terms of their species diversity. Yet, the number of bat species is much lower as compared to that revealed by the previous study conducted in the same region (16 vs. 35). Although a couple of abundant species-Aselliscus dongbacanus (40 of 176 specimens) and Hipposideros cf. larvatus (37 of 176 specimens)-have been found during the present survey, other common species, such as Callosciurus inornatus and Rhizomys pruinosus, were very scarce, suggesting the occurrence of severe anthropogenic pressure on small mammal fauna. More studies to assess the conservation status of and anthropogenic threats to small mammals are needed to protect them from serious population decline in the future. Bac Me NR supports a representative example of the limestone forest ecosystem typical of north-eastern Vietnam (Bac Me Special-use Forest Management Board *in litt.* 2003). To date, however, the biodiversity of the site has not been comprehensively surveyed.

Conservation issues: In 2003, around 7,000 people lived inside the nature reserve, and over 5,000 more lived in the buffer zone. The majority of these people belong to the H'Mong, Tay and Dao ethnic groups. These people practice both fixed and shifting cultivation, and there were 411 ha of wet rice land and 884 ha of hill agricultural land inside the nature reserve (Bac Me Forest Enterprise *in litt.* 2000, Bac Me Special-use Forest Management Board *in litt.* 2003). In recent years, human pressures on the proposed nature reserve have increased, particularly clearance of forest for agriculture.

Other documented values: Bac Me NR protects part of the catchment of the Gam River. In addition, with its beautiful landscape and scenic caves, the nature reserve has potential for ecotourism development. Furthermore, Bac Me NR includes the Cang Bac Me historical site, where political prisoners, including some senior members of the Vietnamese Communist Party, were held by the French Colonial Regime, between 1938 and 1942 (Bac Me Special-use Forest Management Board *in litt.* 2003).

***Phia Oac - Phia Den National Park,* Cao Bang province**

Phia Oac - Phia Den National Park (Cao Bang province) stretches through the communes of Thanh Cong, Quang Thanh, Phan Thanh, and Hung Dao and the town of Tinh Tuc in Nguyen Binh district. The park has a total area of over 10,500ha, with its highest peak at nearly 2,000 meters above sea level with spreading 22°35′ - 22°55′ N; 105°53′ - 106°13′ E (Anon. 1990).

Management history: Mount Phia Oac NR is located in Tinh Tuc Town and Quang Thanh, Thanh Cong, Phan Thanh, Mai Long, Ca Thanh, Vu Nong and Hung Dao communes, Nguyen Binh District, Cao Bang Province (Tordoff *et al.* 2000). Mount Phia Oac was included on Decision 194/CT of the Chairman of the Council of Ministers, dated 9 August 1986 (MARD 1997), which decreed the establishment of a 10,000 ha nature reserve for the protection of "subtropical mountain forests" (Cao Van Sung 1995). An investment plan for Mount Phia Oac was prepared by the Vietnam Forestry University in 1994. This investment plan was approved by Cao Bang Provincial People's Committee in the same year. This investment plan proposed establishing a 13,312 ha nature reserve, comprising a 5,244 ha strict protection area, an 8,053 ha forest rehabilitation area, and a 15 ha administration and services area (Anon. 1999).

Recently, Phia Oac - Phia Den was upgraded to the National Park by the Decision No. 57/QD-TTg of the Prime Minister, dated 11 January 2018. The national park has a total area of 10,593.5 ha, located in Thanh Cong, Quang Thanh, Phan Thanh, Hung Dao communes and Tinh Tuc Town of Nguyen Binh District, Cao Bang Province (http://vpcp.chinhphu.vn, http://tapchimoitruong.vn, 2020).

Topography and hydrology: The NP is centred on Mount Phia Oac (1,931 m) and characterised by steep topography. In the west of the NP, there are patches of limestone karst (Tordoff *et al.* 2000).

Biodiversity values: The results of our research at Phia Oac - Phia Den National Park show that: number of medicinal plant species found in the surveyed area is 472 species, belonging to 323 genera, 128 families. There are 110 species of Angiospermae (85.94%), 10 species of Pteridophyta (7.81%), 6 species of Gymnospermae (4.69%) and 2 species of Lycopodiophyta (1.56%). Nine richness families are Asteraceae, Araliaceae, Euphorbiaceae, Fabaceae, Rubiaceae, Rutaceae, Verbenaceae, Poaceae, and Zingiberaceae. The life form of medicinal plants in Phia Oac - Phia Den National Park is SB = 56.57Ph + 9.11Ch + 16.52Hm + 9.96Cr + 7.84Th. The most popular parts in medical utilization are leaves (71.82%), roots or tubers (40.25%) and sap or essential oil (40.04%), which was used for 21 groups of medical treatments, mostly for dermatologic preparations. The medical plants were mainly found in forest ecosystems (56.36%), scrubs or grasslands (42.37%), and agricultural ecosystems (37.92%). Based on life forms and used parts, distributing habitats, we suggest the medical plants at Phia Oac - Phia Den National Park would be exploited within scrubs or grasslands, agricultural ecosystems and in some areas under the canopy of plantation forests in the purpose of natural resource sustainable utilization integrated with local economic development (Nguyen Ngan Ha, 2019). According to the investment plan (Anon. 1999), Mount Phia Oac NR contained 11,839 ha of natural forest. However, 1998 land-use data provided by the Cao Bang Provincial FPD and ground-truthed during a rapid field survey in 1999 indicated that the nature reserve supported only 3,174 ha of natural forest, which was mainly distributed above 1,000 m. The forest has been subjected to high levels of disturbance in the past and is secondary in places. Natural regeneration does, however, appear to be taking place. Below 700 m, the vegetation is dominated by scrub and grassland. In the west of the NP, there were areas of limestone karst without forest, and, at lower elevations in the south, there were *Pinus massoniana* plantations (Tordoff *et al.* 2000).

Mammal diversity at Mount Phia Oac has been severely reduced by hunting, and it would appear that the site supports few viable populations of species of global conservation importance. However, the area supports a number of bird species restricted to the broadleaf evergreen forest above 800 m and may support one of the few remaining areas of suitable habitat for such species in north-eastern Vietnam (Tordoff *et al.* 2000).

Conservation issues: Below 1,000 m, most of the natural forest in the NP has been cleared for cultivation. Above, 1,000 m, however, the natural forest is distributed on steep hillsides at high elevations, which are unsuitable for cultivation. Consequently, clearance for agriculture is not a major threat to biodiversity at Mount Phia Oac (Tordoff *et al.* 2000).

Mount Phia Oac and the surrounding area are rich in minerals, particularly zinc. Mining activities during the French colonial era resulted in clearance of large areas of forest and high levels of disturbance to remaining areas. Although these activities have now largely ceased, the forest is under continued pressure from local people, who extract bamboo, bamboo shoots, medicinal plants and firewood from the natinal park (Tordoff *et al.* 2000).

Another threat to biodiversity at Mount Phia Oac is hunting, as a result of which population sizes of large and medium-sized mammal species have reportedly declined dramatically (Tordoff *et al.* 2000).

The proposed boundary defined in the investment plan for Mount Pia Oac (Anon. 1999) includes 10,073 ha of non-forest land, a town, a zinc mine and several thousand people. Consequently, both Wege *et al.* (1999) and Tordoff *et al.* (2000) recommended that the boundary be revised to exclude all areas of scrub, grassland, agricultural land and habitation.

Nam Xuan Lac, Bac Kan province

Nam Xuan Lac is situated in western Bac Kan province. To the west, the site is contiguous with the Ban Bung sector of Na Hang proposed nature reserve. The topography of the site is characterised by steep limestone karst formations, separated by flat-bottomed valleys with spreading $22^{0}17'12''$ - $22^{0}19'45''$ N; $105^{0}28'31''$ - $105^{0}33'20''$ E (Anon. 1990). Management history: Nam Xuan Lac had not been included in any government decision or official set of proposals regarding the national Special-use Forests system until the year 2000 (MARD 1997, FPD 2003). However, in 2001, a survey of Ban Thi and Xuan Lac communes, Cho Don District, was conducted as part of the *Creating Protected Areas for Resource Conservation Using Landscape Ecology (PARC) Project*. The objectives of this survey were to evaluate the biodiversity values of the site and to assess the suitability of the site for Special-use Forest status, either as part of a habitat extension of Na Hang proposed nature reserve or as a separate protected area. The survey revealed that the site supports the biodiversity of international importance (Le Trong Trai *et al.* 2001). Consequently, Bac Kan Provincial FPD proposed establishing a 1,788 ha species/habitat conservation area (a

sub-category of the nature reserve), called Nam Xuan Lac, at the site (Bac Kan Provincial FPD *in litt.* 2003).

In 2003, with the support of the PARC Project, Bac Kan Provincial FPD submitted a formal proposal and five-year investment plan (2004-2008) to Bac Kan Provincial People's Committee and MARD for the establishment of a species/habitat conservation area at Nam Xuan Lac. This proposal was approved in November 2003 (PARC Project *in litt.* 2003).

With support from the PARC Project, Bac Kan Provincial FPD developed a trial management structure for Nam Xuan Lac, which aimed to introduce a co-management approach for the site. It was proposed that the management board included representatives of the provincial FPD, Xuan Lac commune and nearby villages in the buffer zone (PARC Project *in litt.* 2003).

The Nam Xuan Lac SHCA was officially established by Decision No. 342/QD-UB, dated 17 March 2004 by Bac Kan PC, with a total area of 1,788 ha, located in NaDa and Ban Khang villages of Xuan Lac commune, Cho Don District. According to the Decision No. 109/QD-UB of Bac Kan PC, dated 14 January 2014, the area of Nam Xuan Lac HSCA was extended to 4,155.67 ha, comprising a core zone of 2,552.5 ha, a rehabilitation zone of 1,586.12 ha and an administration zone of 9.04 ha (http://kiemlam.backan.gov.vn, 2020).

Topography and hydrology: Nam Xuan Lac is situated in western Bac Kan province. To the west, the site is contiguous with the Ban Bung sector of Na Hang Nature Reserve. The topography of the site is characterised by steep limestone karst formations, separated by flat-bottomed valleys.

Biodiversity values: In 2001, a globally endangered bird species, the White-eared Night Heron *Gorsachius magnificent*, was recorded at the site (Le Trong Trai *et al.* 2001). This is the first confirmed record of this restricted-range bird species in Vietnam since at least 1975 and indicates that Nam Xuan Lac may lie within the Southeast China Mountains Endemic Bird Area. Because of the occurrence of White-eared Night Heron, and the importance of the site for biome-restricted bird species, some of which are known from few other sites in Vietnam, the site qualifies as an Important Bird Area, called Ban Thi-Xuan Lac (Tordoff 2002).

Le Trong Trai *et al.* (2001) recorded a number of other globally threatened species based on reports by local people, including the Francois's Leaf Monkey *Trachypithecus francoisi*, a primate species endemic to northern Vietnam and southern China. Additional surveys, by the Institute of Ecology and Biological Resources, have also revealed that the Nam

Xuan Lac area is particularly important for several plant taxa, notably slipper orchids *Paphiopedilum*.

Of particular significance, Nam Xuan Lac might support a population of the globally critically endangered, endemic primate, the Tonkin Snub-nosed Monkey *Rhinopithecus avunculus*, or at least provide additional habitat for the population that occurs in the Ban Bung sector of Na Hang Nature Reserve in Tuyen Quang Province. During a field survey for the species in 1999, Dang Ngoc Can and Nguyen Truong Son (1999) received reports of a group of 18 to 20 individuals, which ranged occasionally into the forest in Xuan Lac commune. During interviews with PARC Project staff in October 2003, residents of Na Da village, near the north-western border of the site, stated that they had seen four or five individuals at the site in 2002 (Bezuijen and Trinh Thang Long 2003).

Conservation issues: The principal threats to biodiversity at Nam Xuan Lac HSCA were habitat fragmentation and loss, due to agricultural expansion and mining; and exploitation of wildlife, timber and non-timber forest products by local communities and mine workers in and around the site (Le Trong Trai *et al.* 2001, Bezuijen and Trinh Thang Long 2003, Momberg and Fredriksson 2003). The exploitation of forest products by local communities and mine workers was for both domestic and commercial trade, particularly in the case of wildlife (Bezuijen and Trinh Thang Long 2003, Nguyen Xuan Dang *et al.* 2003). The FPD and the PARC Project had initiated environmental management activities with local communities and mine companies in an attempt to address these issues.

2.4 Group's purpose and subjects

Purpose and subjects

1. To access the diversity of insects in 4 orders Hymenoptera, Hemiptera, Lepidoptera and Coleoptera, described new taxa and newly recorded taxa in the four orders in the mountain region in the northeastern part of Vietnam and publish scientific work in International high standard journals (SCI and SCI-E).
2. The study on the distribution according to study sites, habitats and altitude of 4 orders Hymenoptera, Hemiptera, Lepidoptera and Coleoptera in the northeastern part of Vietnam
3. To train young scientists.

Objectives

Specific objectives of this study are:

1. To access the diversity of insects in 4 orders Hymenoptera, Hemiptera, Lepidoptera and Coleoptera, described new taxa and newly recorded taxa in the four orders in the mountain region in the northeastern part of Vietnam
2. The study on the distribution according to study sites, habitats and altitude of 4

orders Hymenoptera, Hemiptera, Lepidoptera and Coleoptera in the northeastern part of Vietnam

3. Identify the role of orders Hymenoptera, Hemiptera, Lepidoptera and Coleoptera in the use of insect resources for conservation, biological struggle, crop pollination, materials, food and medicine)
4. Determining the causes of resource degradation of orders Hymenoptera, Hemiptera, Lepidoptera and Coleoptera and proposing solutions to sustainably protect these insect resources

2.5 Materials and Methods

2.5.1 Working schedule and study sites

Eight field surveys were conducted in Tuyen Quang Ha Giang, Cao Bang, and Bac Kan provinces in the three years, from October 2018 to December 2021.

Trip 1: From 24 to 31 October 2018 in Cham Chu Nature Reserve,

+) The route from the centre of Nam Luong Village, Phu Luu Commune, Ham Yen District: this is the site with citrus gardens, forest restored after farming, and primary forest.

Coordinates: Start point: 22°17’41.8’’N, 104°59’18.2’’E, 661m
End point: 22°18’0,9” N, 104°57’55,3” E, 300m.

+) The route from the centre of Nam Luong Village, Phu Luu Commune, Ham Yen District: this is the site with citrus gardens, forest restored after farming, and primary forest.

Coordinated: Start point: 22°17’08.6’’N, 104°59’27.4’’E, 691m
End point: 22°17’26.6’’N, 104°59’09.7’’E, 695m

Trip 2: From May 11 to 18, 2019 in Cham Chu NR, Ham Yen, Tuyen Quang, three sites were surveyed, including:

+) The route from the centre of Cao Duong village to Khau Lang village: this is the site with citrus gardens, forest restored after farming, and primary forest.

Coordinates: Start point: 22°17’41.8’’N, 104°59’18.2’’E, 661m
End point: 22°18’0,9” N, 104°57’55,3” E, 300m.

+) The route from the centre of Cao Duong village to the waterfall: the habitats here are mainly citrus gardens, rice fields, cornfields and poorly degraded secondary forest.

Coordinated: Start point: 22°20’16.4’’N, 103°51’09.4’’E, 670m
End point: 22°17’32.5’’N, 104°59’28.0’’E, 643m.

+) The route from the centre of Cao Duong village to the top of the hill: the habitats here are mainly palm gardens, acacia plantations and shrubs (SC3).

Coordinated: Start point: 22°17’08.6’’N, 104°59’27.4’’E, 691m
End point: 22°17’26.6’’N, 104°59’09.7’’E, 695m

With the three survey sites mentioned above, the insect group collected samples during the daytime (from 8 am to 4 pm) with hand nets. The light trap was also set at the centre

of Cao Duong village to collect insects.

Trip 3: From July 18 to 25, 2019 in Bac Me NR, Ha Giang Hà Giang provinces, two sites were surveyed, including*:*

+) The route from the centre of Minh Ngoc village to Lung Cang village: this is the site with the field of rice and corn; forest restored after farming and primary forest.

Coordinates: Start point: 21°39'33.7''N, 106°21'55.1''E, 188m
End point: 22°42'46" N, 105°11'09" E, 318m.

+) The route from the centre of Minh Ngoc village to the Km 40 Lac Nong village: the habitats here are mainly rice and corn filed and secondary forests.

Coordinated: Start point: 21°39'33.7''N, 106°21'55.1''E, 188m
End point: 22°45'43" N, 105°13'33" E, 484m.

Trip 4: From December 9 to 16, 2019 in Bac Me NR, Ha Giang Hà Giang provinces, two sites were surveyed, including*:*

+) The route from the centre of Minh Ngoc village to Lung Cang village: this is the site with the field of rice and corn; forest restored after farming and primary forest.

Coordinated: Start point: 22°44′39″B 105°15′23″Đ, 188m
End point: 22°45'43" N, 105°13'33" E, 484m.

+) The route from the centre of Minh Ngoc village to Lac Nong village: the habitats here are mainly rice and corn filed and secondary forests include Ban Khen, Dong village, Ban Noong, Ha Son 1, Ha Son 2.

Coordinated: Start point: 21°39'33.7''N, 106°21'55.1''E, 188m
End point: 22°45'43" N, 105°13'33" E, 484m.

The insect group collected samples during the daytime (from 8 am to 4 pm) sweep net, light traps, Pitfall traps and Beating net are used to efficiently collect the species of 4 orders (Hymenoptera, Coleoptera, Hemiptera and Lepidoptera). Adult morphology, except for male genitalia and colouration, are examined under a stereoscopic dissecting microscope with a drawing tube. The prey, behaviour of insects as well as adaptive ecotypic of them would be observed, recorded and photographed.

Trip 5: From 3 to 10 June 2020, in the Phia Oac - Phia Den National Park, Cao Bang Province:

The route in Thanh Cong is Commune: the habitats here are natural forest habitat; forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs. The route in Quang Thanh is Commune: the habitats here are natural forest habitat; forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs. The route in Phan Thanh is Commune: the habitats here are natural forest habitat; forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs. The route in Hung Dao Commune: the habitats here are natural forest habitat; forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs. The route in the town of Tinh Tuc: the habitats here are natural forest habitat; forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs. Including:

+) The route in Thanh Cong Commune: the habitats here are natural forest habitat; forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs
From June 5 to 6, 2020, four sites were surveyed, including:
+) The route in Quang Thanh Commune: the habitats here are natural forest habitat; forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs
From June 6 to 7, 2020, four sites were surveyed, including:
+) The route in Phan Thanh Commune: the habitats here are natural forest habitat); forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs.
From June 7 to 8, 2020, four sites were surveyed, including:
+) The route in Hung Dao Commune: the habitats here are natural forest habitat; forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs.
From June 8 to 9, 2020, four sites were surveyed, including:
+) The route in the town of Tinh Tuc: the habitats here are natural forest habitat; forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs.

Trip 6: From 11 to 18 August 2020, in Nam Xuan Lac Conservation Area of Bac Kan province:

the insect group were surveyed including The route in Ban Thi commune, the habitats here are natural forest habitat; forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs. The route in Xuan Lac commune: the habitats here are natural forest habitat; forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs. The route in Đong Lac commun: forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs.

Trip 7: From 7 May 2021 to 15 May 2021 in the Phia Oac - Phia Den National Park, Cao Bang Province.

+) The route in Thanh Cong commune: the habitats here are natural forest habitat; forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs
From May 7 to 15, four sites were surveyed, including:

+) The route in Quang Thanh commune: the habitats here are natural forest habitat; forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs

+) The route in Phan Thanh commune: the habitats here are natural forest habitat); forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs.

+) The route in Hung Dao commune: the habitats here are natural forest habitat; forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs.

+) The route in the town of Tinh Tuc: the habitats here are natural forest habitat; forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs.

Trip 8: From 28 October 2021 to 4 November, in Nam Xuan Lac Conservation Area of Bac Kan province:

The insect group were surveyed including The route in Ban Thi commune, the habitats here are natural forest habitats; forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs. The route in Xuan Lac commune: the habitats here are

natural forest habitat; forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs. The route in Đong Lac commune: forest habitat has been devastated mixed with planted forests; grassland habitats, shrubs.

2.5.2 Materials and methods

2.5.1. Investigation

Investigation insects in 4 orders Hymenoptera, Hemiptera, Lepidoptera and Coleoptera were conducted in Tuyen Quang Ha Giang, Cao Bang, and Bac Kan provinces in the three years, from October 2018 to December 2021. In each survey area in "The range of projects" depend on the target of research to conducted following methods:

i) Random investigation

We select the points in the study site randomly. However, this method will only be used when the study habitat is homogeneous. The investigation unit is the tree, canopy of tree or m^2. Co-ordinate of chosen points were assessed by GPS

ii) Route investigation

In study sites we identify and choose the survey routes, the length of a route about from 6 to 12 km, and co-ordinate of investigational points in routes were assessed by GPS. Observing and collecting bugs by insect net with Φ = 35-40 cm or Φ = 60 cm), by hand or by Fogging method. Specimens will keep on insect boxes or Alcohol 90%.

iii) Research on insect by traps in potential points

The investigation bugs by light trap or hole trap at potential points in the study site. Light trap includes from 1 to 2 light bulbs. The power of a light bulb is 160 W. The time for collecting insects by light trap is from 6 to 10 hours pm. Hole trap (Φ = 8 cm) put underground with a distance of hole trap is from 2 to 3 m with 50 hole traps at one study site.

2.5.2. Methods of collecting specimens

i) Sweep net: The insects occur on the foliage of herbaceous plants or grasses and can be effectively collected using an atypical sweep net with a sturdy bag. Circular aerial nets with handles of different lengths (about 2, 3.5, 6 m) will be used to collect relatively large specimens on vegetation.

ii) Lights and Light trap: The light trap is designed to collect nocturnal insects. However, some members of collect nocturnal insects can be collected easily with the use of lights or light traps, particularly sources containing a certain amount of ultraviolet. Only simple light traps consisting of a bulb and a white sheet spread behind the bulb can be collected reduviid. In this study, used, if when electric supply is not available then can be the electric generator.

iii) *Malaise trap:* Malaise trap is a stationary intercept-type trap, made of fine insect mesh, with a rectangular tent-like shape. It is normally set on the ground. Malaise traps can capture various kinds of insects with relatively strong flying ability, including vespid wasps, bees, … when they are properly set along their “fly-ways” such as at forest edges, along ridges and stream banks.

iv) Aspirator: The aspirator is the single most effective tool available for capturing small and delicate bugs, ladybugs, small beetles which are attached to the light and are found alighting on vegetation for collecting directly in the litter, crevices, concealed microhabitat etc. The aspirator can also be used effectively when collecting from the light trap, beating net, sweeping net when sorting litter by hand and very many other similar situations

2.5.3. Preservation

i) Pin mounting: Large insects can be pinned directly. In tropical environments only stainless steel pins should be used.

ii) Card mounting: Specimens can be glued on small rectangular cardboards. The use of water-soluble adhesive makes the removal of specimens relatively easy.

iii) Point mounting: the small insects are mounted on small elongate triangular cards. The triangular card does not obscure the ventral view but it offers no protection to the specimens.

iv) Ethanol Preservation: Ethyl alcohol (90%) is an excellent short-and long-term preservation for assassin bugs. Preservation can be enhanced by changing the alcohol a few hours after collection. A part will be kept in alcohol (99%) to analyzing the DNA.

2.5.4. **The study on habitats, altitude and preys**

Investigation 4 orders Hymenoptera, Hemiptera, Lepidoptera and Coleoptera were conducted in some habitats as the higher montane evergreen forest and lower montane evergreen forest (EM); Lowland evergreen forest and lowland semi-evergreen forest (SF); The buffer zone (Ecosystem transitional buffer zone between forest, regenerated forests and agricultural ecosystems) (ES); Grassland (GL) and Agricultural ecosystems focus on the important group of plants like fruit trees and industrial crops (AE) following methods of collecting specimens by Steyskal et al., (1986), Schuh and Slater (1995), including sweep net, lights trap, pitfall traps, beating net and the aspirator can also be used effectively when collecting from the light trap, beating net, sweeping net when sorting litter by hand and very many other similar situations. The number species (the rate of the number) of 4 order at altitude including: < 200m, 200-500m; 500-1000m; 1000-1500 m, > 1500m).

Investigation assassin bugs with the experimental study (Ambrose,1999) with adults and nymph instars of reduviids were collected from different habitats, they will be tested in the laboratory on the plastic bottle (h = 20 cm, d = 10 cm; 8 x 6 x 4 cm) or the cage (50x50 x100 cm; 40 x 40 x 40cm) by different preys both in the field condition and in the laboratory. The preys of assassin bugs were the larvae of some pests of order Lepidoptera, Homoptera, Coleoptera and Orthoptera include *Anomis flava (1), Helicoverpa armigera (2)*, *Spodoptera litura* (3)*, Plusia* sp. (4), *Nephotettix bipunctatus (5), Empoasca biguttula* (6), *Empoasca flavescens* (7), *Erianthus* spp. (8), *Pieris brassicae (9)*, *Aphis* sp. (10), *Aulacophora* spp. (11), *Chrysomela* spp. (12), *Rhopalosiphum* spp. (13), *Oxya* spp. *(14)* and *Corcyra cephalonica (15).*

2.6.4. Taxonomy by morphology

Taxonomy by the morphology of species of insects basis on morphological characteristics of antenna, anteocular, ocelli, eyes, rostrum, thorax (pronotum anterior lobe, posterior lobe of pronotum, legs etc.), scutellum, abdomen, wings, the spines on the body and especially the genitals (pygophore, right clasper, phallus, phallobase, phallosoma). The analysis of morphology was conducted with a SZX7 Olympus microscope. The morphological structure was painted on SZX7 Olympus. The coordinative ranks of taxa are respectively arranged alphabetically. The information for each species is given in the following sequence: valid name, specimen examined, distribution (provinces of Vietnam listed alphabetically), and notes (if necessary). The details of specimens examined are included only for those from Vietnam.

2.5.5. Method for getting DNA data will be used if necessary.

In case necessity, DNA data will be combined with morphological data for describing new taxa for science when studying complex species or cryptic species. DNA data will also be used in taxonomy and phylogeny study of some species groups that have very similar morphological characteristics.

2.7. RESULTS

2.6.1. The study on the diversity of insects in 4 orders Hymenoptera, Hemiptera, Lepidoptera and Coleoptera.

Appendix 1 shows that the distribution of the species of insects in 4 orders Hymenoptera, Hemiptera, Lepidoptera and Coleoptera in the mountain region in the northeastern part of Vietnam. In all time we collected and analyzed, as a result, it indicates that 380 species of 32 families of 4 orders. Among them we have recorded orders Hymenoptera with 127 species of 50 genera 6 families; orders Hemiptera with 116 species of 69 genera 10 families; orders Coleoptera with 75 species of 42 genera 11 families and orders Lepidoptera with 59 species of 34 genera 7 families.

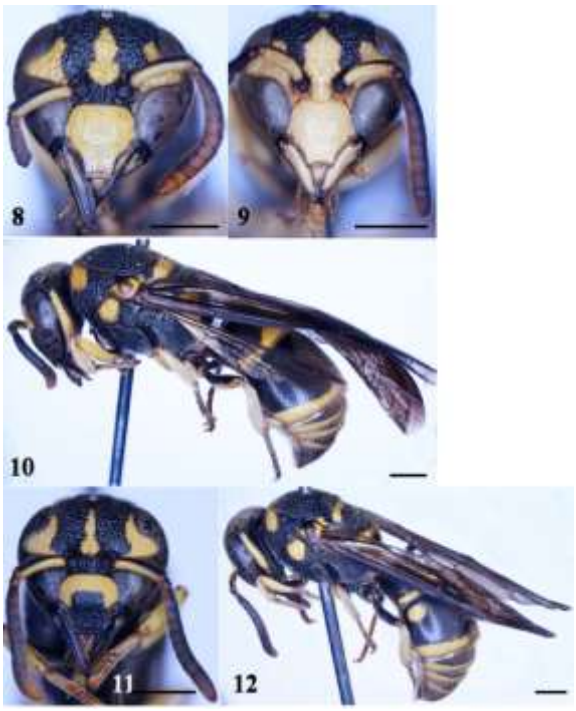
Among 380 species we describe 5 new species, 15 species newly recorded for Vietnam fauna. Four species of the genus *Stenodyneriellus* Giordani Soika, 1962 are recorded from Vietnam. Of them, *S. capillus* Nguyen, new species from Bac Kan province is described and illustrated. In addition, one species, *S. similiguttulatus* Li & Chen, 2016 is newly recorded from Vietnam. A key to species from Vietnam is given.

The describe new taxa

1. *Stenodyneriellus capillus*, new species

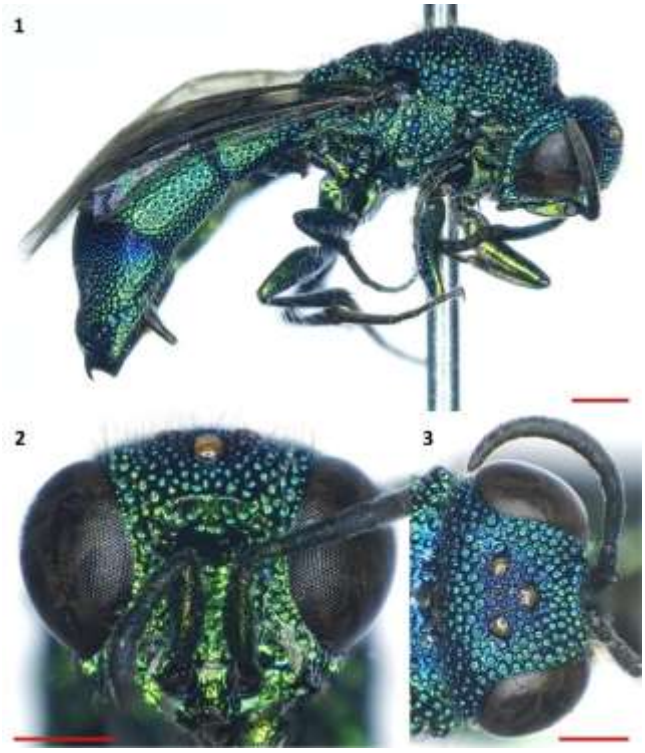
Figs 1–7. *Stenodyneriellus capillus*, new species, holotype, male. 1, head, frontal view; 2, vertex and pronotum, dorsal view; 3, head, lateral view; 4, right antenna; 5, mesoscutum, scutellum, metanotum, propodeum, T1&2, dorsal view; 6, propodeum, dorsoposterior view; 7, habitus. Scale = 1 mm.

Description. Male (Fig. 7). Body length 10.5–11 mm (holotype: 10.5 mm); fore wing length 8.6–9.6 mm (holotype: 8.6 mm). Head in frontal view subcircular, 1.1× as wide as high (Fig. 1). Vertex sloping down behind posterior ocelli towards occipital carina, with cephalic foveae each bearing dense pubescence, situated close to each other with distance between foveae about half diameter of front ocellus. Distance from posterior ocelli to apical margin of vertex 1.5× distance from posterior ocelli to inner eye margin (Fig. 2). Gena much narrower than eye, in lateral view 0.3X as wide as eye (Fig. 3). Occipital carina complete, present clearly along entire length of gena, widen at lower half of the gena. Inner eye margins strongly convergent ventrally; in frontal view 1.5X as further apart from each other at vertex as at clypeus. Clypeus in lateral view convex at basal two-third, then straight to apical margin; in frontal view slightly higher than wide (Fig. 1), with basal margin slightly concave medially and distinctly separated from antennal sockets; apical margin emarginate medially (Fig. 1); width of emargination greater than 1/3 width of clypeus between inner eye margins (about 0.38X). Mandible with prominent teeth, fourth tooth long and pointed apically. Antennal scape 3.3× as long as its maximum width; F1 short, 1.2× as long as wide, F2 slightly longer than wide, F3–9 wider than long, F10 small, as long as wide, F11 slightly curved, slightly more than 2× as long as its basal width, not reaching the base of F10 (Fig. 4).



Figs. 8–12. 8–10, *Stenodyneriellus heterospilus*. 8, female, head, frontal view; 9, male, head, frontal view; 10, female; habitus. Scale = 1 mm. 11, 12, *Stenodyneriellus similiguttulatus*, female. 11, head, frontal view; 12, habitus. Scale = 1 mm

2. Trichrysis aliciae, new species

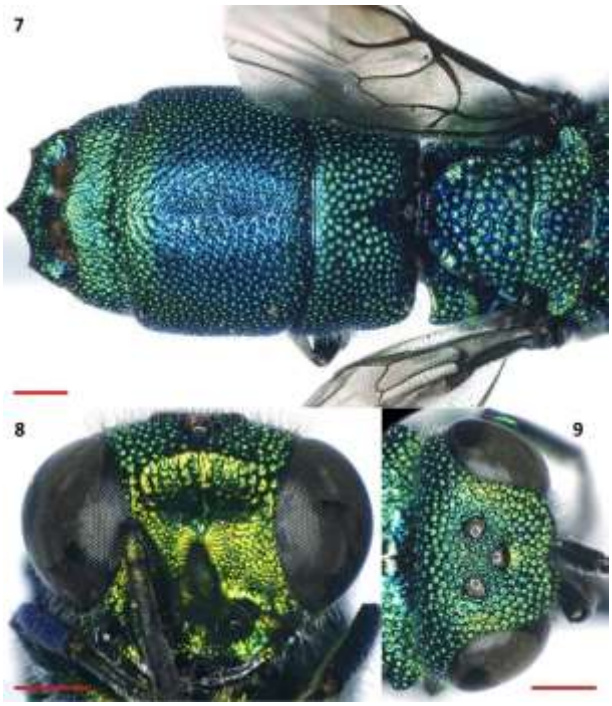


Trichrysis aliciae **sp. nov.**, holotype ♀. 1. Habitus, lateral view. 2. Head, frontal view. 3. Head, dorsal view. Scale bar = 0.5 mm.

Description: Scapal basin concave, moderately deep, punctate, in upper part with small polished area. Brow promi-nent; TFC single, only laterally with traces of second carina, slightly outcurved, its length about 2/3 of brow: area below TFC polished, turning into

elongated punctures toward scapal basin (Fig. 2). Brow above TFC flattened, with dense punctures. BOL 1.9 × MOD. Relative length of P:F1:F2:F3=1.0:1.3:0.8:0.7; F1 l/w=2.6; OOL 1.6 × MOD; POL 1.7 × MOD; MS 1.3 × MOD; clypeus slightly incised medially, rather flattened in lateral view. Mandible without subapical tooth. Malar space with large, polished punctures, their diameter 0.7–1.0 × MOD, genal carina.

3. *Trichrysis chamchuensis*, new species



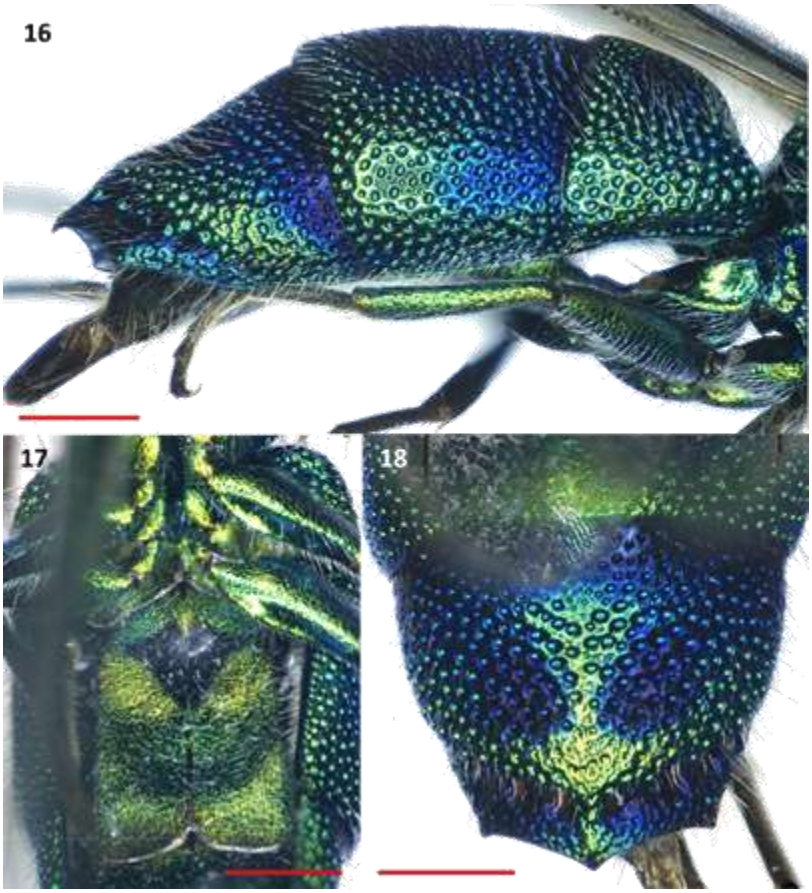
Trichrysis chamchuensis **sp. nov.**, holotype ♀. 7. Mesosoma and metasoma, dorsal view. 8. Head, frontal view. 9. Head, dorsal view. Scale bar = 0.5 mm

Description: Scapal basin deep and punctate, in middle part punctures partly fused forming transverse striae (Fig. 8). Brow prominent, TFC single, slightly inverted V-shaped, recurved laterally. Brow raised between TFC and scapal basin, flattened, polished medially, with elongated shallow punctures. Brow above TFC flattened, with dense punc-tures. BOL 1.7 × MOD. Relative length of P:F1:F2:F3=1.0:2.0:1.0:0.9; F1 l/w=3.0; OOL 1.4 × MOD; POL 1.5 × MOD; MS 1.2 × MOD; clypeal apex incised medially. Mandible without subapical tooth. Malar space with few small punctures, and with genal carina reaching up to 2/3 of head height. Setae on vertex yellowish, not longer than MOD. Ocellar triangle obtuse, densely punctured.

4. ***Trichrysis kylan***, new species

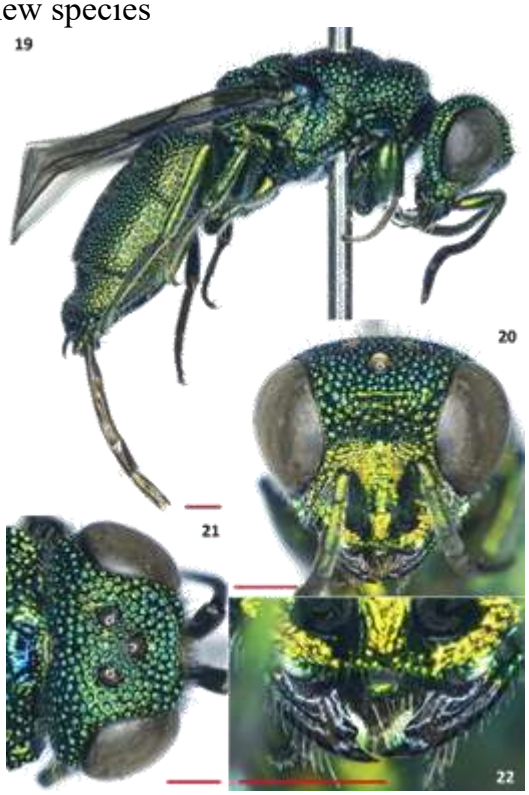
Description: Scapal basin deep and punctate, in central and lower part punctures shallower and interspaces wider, shining. Brow slight, TFC single, slightly inverted V-shaped, the area below with elongated punctures, with pol-ished, shining interspaces (Fig. 14). Brow above TFC slightly concave, with dense punctures (Figs 13, 15). Relative length of P:F1:F2:F3=1.0:1.3:0.9:0.7; F1 l/w=2.4; OOL 2.0 × MOD; BOL 1.7 × MOD; POL 2.3 × MOD; MS 1.6 MOD; clypeus almost truncated. Mandible without subapical tooth. Malar

space with large punctures, and with genal carina reaching up to 2/3 of height of head, the carina branching at margin of compound eye. Setae on vertex whitish, longer than 1.0 × MOD. Ocellar triangle obtuse, densely punctured and punctures with black interspaces.



Trichrysis kylan **sp. nov.**, holotype ♀. 16. Metasoma, lateral view. 17. S2, ventral view. 18. T3, dorsal view. Scale bar = 0.5 mm.

5. ***Trichrysis raymundi,*** new species



Trichrysis raymundi **sp. nov.**, holotype ♀. 19. Habitus, lateral view. 20. Head, frontal view. 21. Head, dorsal view. 22. Mandibles, frontal view. Scale bar = 0.5 mm

Description: Brow prominent, TFC short, single, and almost straight, with polished margin (Fig. 20). Frons slightly raised between TFC and scapal basin. Scapal basin concave, moderately deep, striate medially and punctate later-ally, with white pubescence. Brow above TFC flattened, with dense punctures. BOL 1.6 × MOD. Clypeus incised medially, with black margin, in lateral view conical. Mandible with subapical tooth, bidentate (Fig. 22). Malar space, 2.2 × MOD, base of mandible with pit, genal carina reaching up to 3/4 of height of head. Relative length of P:F1: F2:F3=1.0:1.4:0.8:0.7: F1 l/w=2.7; OOL 1.5 × MOD; POL 2.0 × MOD. Erect setae on vertex yellowish, some of them longer than MOD. Ocellar triangle obtuse, densely punctured and punctures with greenish interspaces, 0.2–1.0 × PD

The describe newly recorded for Vietnam fauna

1. *Euaspis divercarinata* Pasteels, 1980 (Fig. 1a-d)

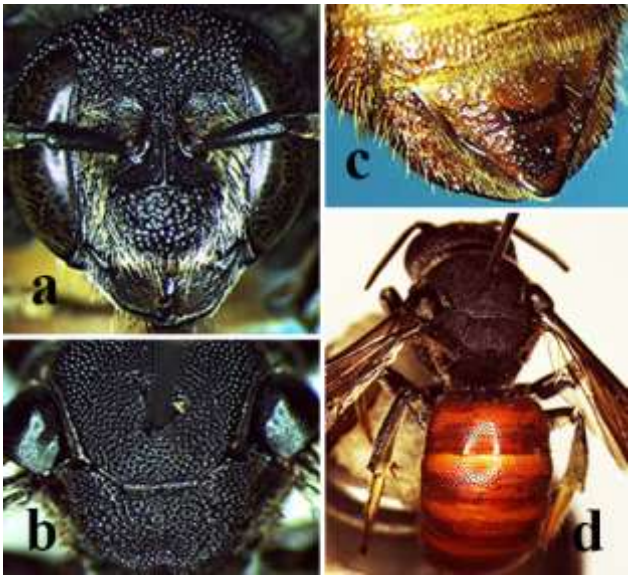


FIG. 1. *Euaspis divercarinata* PasteelS, 1980

2.*Coelioxys capitata* Smith, 1854 (Fig. 2a-h)

Fig. 2. *Coelioxys capitata* Smith, 1854

3. Coelioxys decipiens Spinola, 1838 (Fig. 3a-e)

Fig. 3. *Coelioxys decipiens* Spinola, 1838

4.Coelioxys sexmaculata Cameron, 1897 (Fig. 4a-d)

Fig. 4. *Coelioxys sexmaculata* Cameron, 1897

5. Megachile subrixator Cockerell, 1915 (Fig. 5a-d)

Fig. 5. *Megachile subrixator* Cockerell, 1915

6. Megachile trichorhytisma Engel, 2006 (Fig. 6a-e)

Fig. 6. *Megachile trichorhytisma* Engel, 2006

7. Ectopioglossa taiwana (Sonan) (Fig.7)

Fig. 7. *Ectopioglossa taiwana* (Sonan)

8. *Elaphropoda khasiana* (Schulz); *9.Thyreus centrimacula* (Pérez); *10.Ceratina collusor* Cockerell. *11. Ceratina simillima* Smith; 12. *Ceratina sutepensis* Cockerell; 13. *Xylocopa dejeanii* Lepeletier; 14. *Astinus siamensis* Distant; 15. *Endochus nigricornis* Stål

2.6.2. The study on the distribution according to study sites, habitats and altitude of 4 orders Hymenoptera, Hemiptera, Lepidoptera and Coleoptera

The study on the distribution according to study sites

Among 380 species of 32 families of 4 orders. We were recorded in Phia Oac - Phia Den NP, Cao Bằng province 306 species of 32 families of 4 orders; in Cham Chu NR, Tuyen Quang province 272 species of 32 families of 4 orders; Nam Xuan Lac NR, Tuyen Quang province 253 species of 32 families of 4 orders and Bac Me NR, Ha Giang 183 species of 32 families of 4 orders (Table 1, Fig.1).

Orders Hymenoptera have the highest number of species with 100 species (26.32%) in Tuyen Quang, 95 species (25.00%) in Cao Bang, 71 species (18.68%) in Bac Kan and 61 species (16.05%) in Ha Giang. Next Orders Hemiptera have the number of species 89 species (23.42%) in Cao Bang, 84 species (22.11%) in Bac Kan and 83 species (21.84%) in Tuyen Quang. The lowest is the order Lepidoptera with 55 species (14.47%) in Cao Bang, 39 species (10.26%),34 species (8.95%), 25 species (6.58%) in Bac Kan, Tuyen Quang and Ha Giang respectively.

Table 1: The number species (the rate of the number) of 4 order at the study site in the mountainous region of Northern Vietnam

Order	The number of species (the rate of the number %)			
	Cao Bang	Bac Kan	Tuyen Quang	Ha Giang
HYMENOPTERA	95 (25.00%)	71 (18.68%)	100 (26.32%)	61(16.05%)
HEMIPTERA	89 (23.42%)	84 (22.11%)	83 (21.84%)	55 (14.47%)
COLEOPTERA	67 (17.63%)	59 (15.53%)	55 (14.47%)	42 (11.05%)
LEPIDOPTERA	55 (14.47%)	39 (10.26%)	34 (8.95%)	25 (6.58%)
Total	306	253	272	183

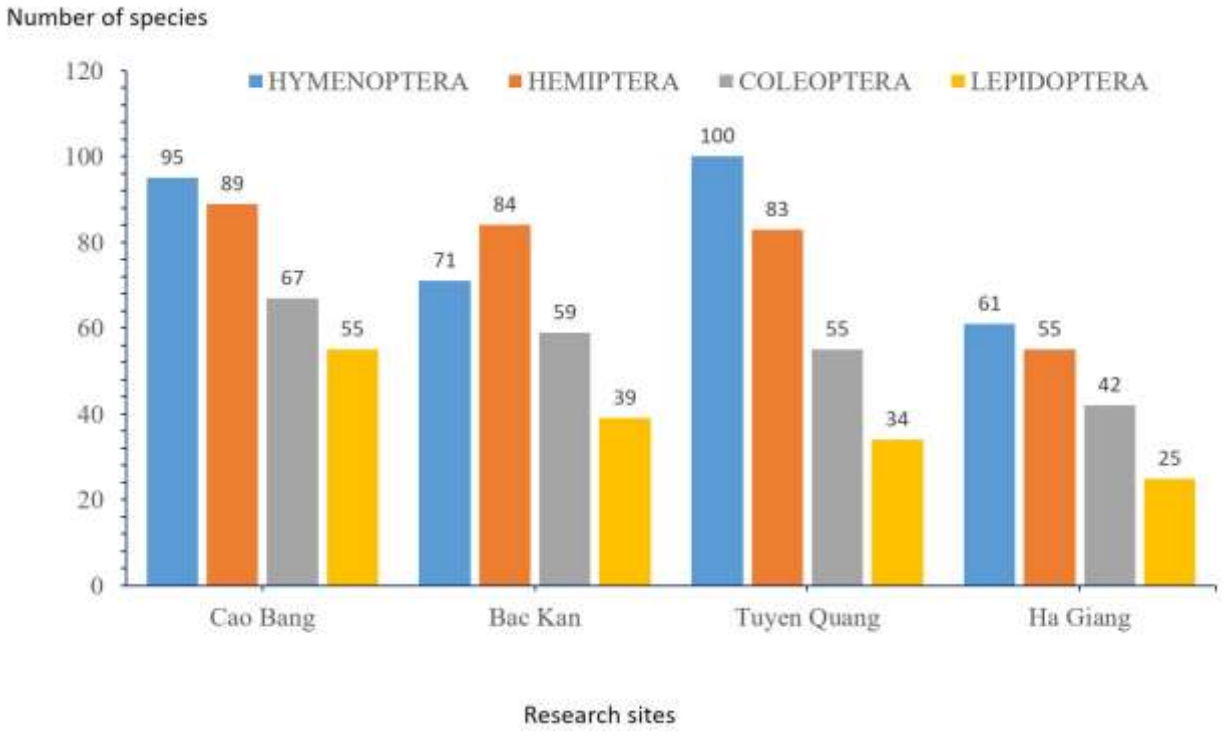


Figure 1: The number species of 4 order at the study site in the mountainous region of Northern Vietnam

At the family taxonomy: Table 2 and Figure 2 show that on order Hymenoptera, family Vespidae has the highest number of species with 43 species in Tuyen Quang, 36 species in Cao Bang, 33 species in Bac Kan and 23 species in Ha Giang. Next Family Apidae has the number of species 29 species in Cao Bang, 22 species in Tuyen Quang and 18 species in Ha Giang and 16 species in Bac Kan. The lowest is the Family Halictidae with 3-5 species in Cao Bang, Tuyen Quang and Ha Giang respectively.

On order Hemiptera, family Reduviidae has the highest number of species with 56 species in Cao Bang, 53 species in Tuyen Quang, 49 species in Bac Kan and 23 species in Ha Giang. Next Family Apidae has the number of species 29 species in Cao Bang, 37 species in Ha Giang. The lowest is the families Membracidae, Fulgoridae and water bugs (Corixidae, Nepidae, Naucoridae)

Table 2: The number of species of some families at the study site in the mountainous region of Northern Vietnam

No	Families	The number of species of families			
		Cao Bang	Bac Kan	Tuyen Quang	Ha Giang
	Order HYMENOPTERA				
1.	Family Apidae	29	16	22	18
2.	Family Megachilidae	10	5	12	5
3.	Family Halictidae	5	0	5	3
4.	Family Vespidae	36	33	43	23
5.	Family Pompilidae	6	8	7	6
6.	Family Sphecidae	9	9	10	6
	Order HEMIPTERA			1	
7.	Family Coreidae	6	8	6	5
8.	Family Pyrrhocoridae	1	1	0	1
9.	Family Pentatomidae	6	7	7	2
10.	Family Reduviidae	56	49	53	37
11.	Family Cicadellidae	4	5	3	3
12.	Family Membracidae	1	1	1	1
13.	Family Fulgoridae	1		1	
14.	Family Corixidae	3	3	1	1
15.	Family Nepidae	1	3	1	2
16.	Family Naucoridae	5	5	4	1
	Order COLEOPTERA				
17.	Family Carabidae	6	5	6	4

18.	Family Chrysomelidae	9	9	5	4
19.	Family Curculionidae	6	5	4	3
20.	Family Lucanidae	2	3	3	2
21.	Family Coccinellidae	10	9	10	8
22.	Family Cicindelidae	3	2	1	2
23.	Family Meloidae	1	1	1	1
24.	Family Scarabaeidae	15	14	13	8
25.	Family Cerambycidae	6	4	4	3
26.	Family Hydrophilidae	5	4	2	2
27.	Family Mordellidae	3	3	3	2
	Order LEPIDOPTERA				
28.	Family Papilionidae	10	6	9	6
29.	Family Pieridae	7	4	5	2
30.	Family Nymphalidae	7	6	6	4
31.	Family Danaidae	9	6	3	5
32.	Family Noctuidae	3	3	1	1
33.	Family Sphingidae	16	12	8	7
34.	Family Lycaenidae	3	2	1	0

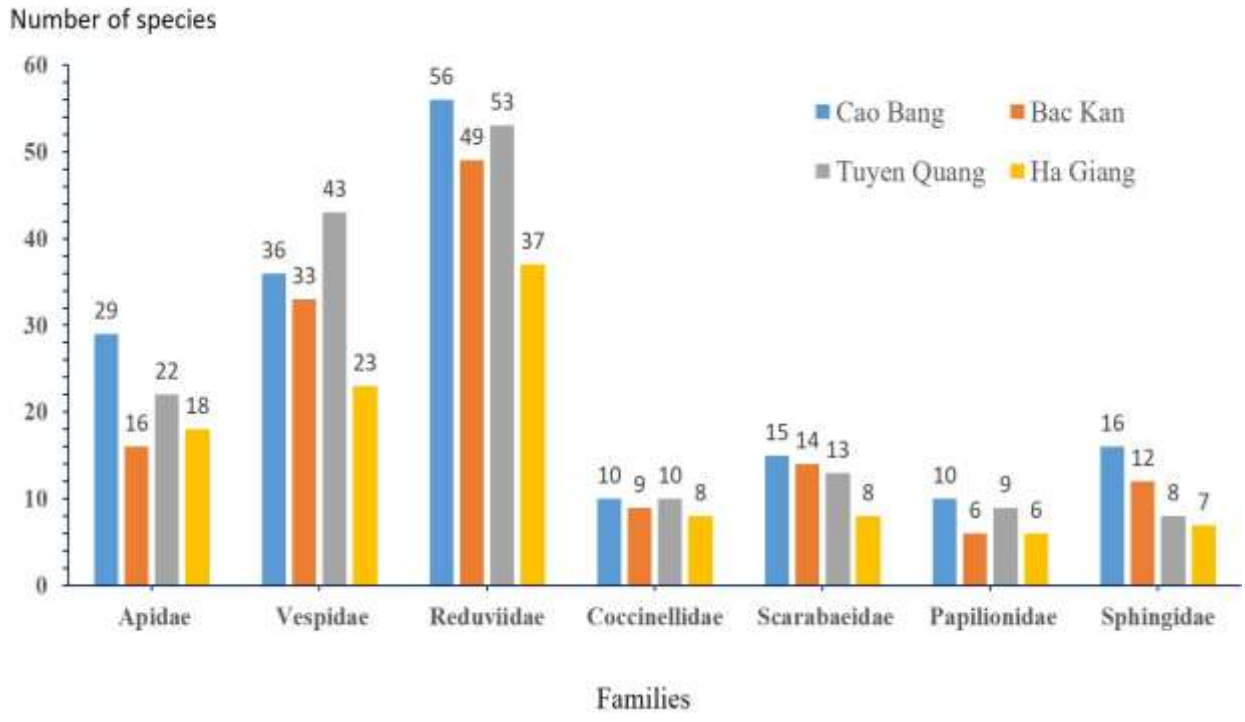


Figure 2: The number of species of some families at the study site in the mountainous region of Northern Vietnam

On order Coleoptera, family Coccinellidae has the highest number of species with 10 species in Cao Bang, Tuyen Quang and 8-8 species in Bac Kan, Ha Giang. The lowest in

the water beetle (Hydrophilidae, Mordellidae). On order Lepidoptera, family Papilionidae has the highest number of species with 10 species in Cao Bang, 9 species in Bac Kan, 6 species in Tuyen Quang, Ha Giang (Fig. 2)

The study on the distribution according to habitats

Table 3: The number species (the rate of the number) of 4 order at habitat in the mountainous region of Northern Vietnam

Order	The rate of the number species				
	EM	**SF**	**ES**	**AE**	**GL**
HYMENOPTERA	89 (28.16%)	94 (29.75%)	69 (21.84%)	56 (17.72%)	58 (18.35%)
HEMIPTERA	72 (22.78%)	69 (21.84%)	68 (21.52%)	47 (14.87%)	67 (21.20%)
LEPIDOPTERA	40 (12.66%)	29 (9.18%)	29 (9.18%)	20 (6.33%)	9 (2.85)
COLEOPTERA	45 (14.24%)	40 (12.66%)	42 (13.29%)	28 (8.86%)	32 (10.13%)
Total (species)	246	232	208	151	166

Note: EM- the higher montane evergreen forest and lower montane evergreen forest; SF- Lowland evergreen forest and lowland semi-evergreen forest; ES- The buffer zone (Ecosystem transitional buffer zone between forest, regenerated forests and agricultural ecosystems); GL- Grassland; AE- Agricultural ecosystems focus on the important group of plants like fruit trees and industrial crops.

Appendix 2 shows that, among 316 species of 31 families of 4 orders in 5 habitats. We were recorded in EM habitat with 246 species of 31 families of 4 orders, SF habitat 232 species of 31 families of 4 orders, ES habitat 208 species of 30 families of 4 orders, AE habitat 151 species of 30 families of 4 orders, GL habitat 166 species of 29 families of 4 orders (Table 3, Fig.3).

Orders Hymenoptera have the highest number of species with 94 species (29.75%) in SF, 89 species (28.16%) in EM, 56 species (17.72%) in AE. Next orders Hemiptera have the number of species 72 species (22.78%) in EM, 69 species (22.84%) in SF and 67 species (21.20%) in GL. The lowest is the order Lepidoptera with 40 species (12.66%) in EM, 29 species in SF and ES, 9 species in AE.

At the family taxonomy: Table 4 and Figure 4 show that on order Hymenoptera, family Vespidae has the highest rate of the number species (%) with 8.23 in EM, Vespidae with 15.82% in SF. On order Hemiptera, family Reduviidae has the highest rate of the number species (%) 17.72 in EM, 16,77 % in SF and 15.51% in ES. On order Coleoptera, family

Coccinellidae has the highest rate of the number species (%) 3,16% in EM and SF, 2.53% in AE. Lepidoptera, family Papilionidae has the highest number of species 2.53 in EM and SF

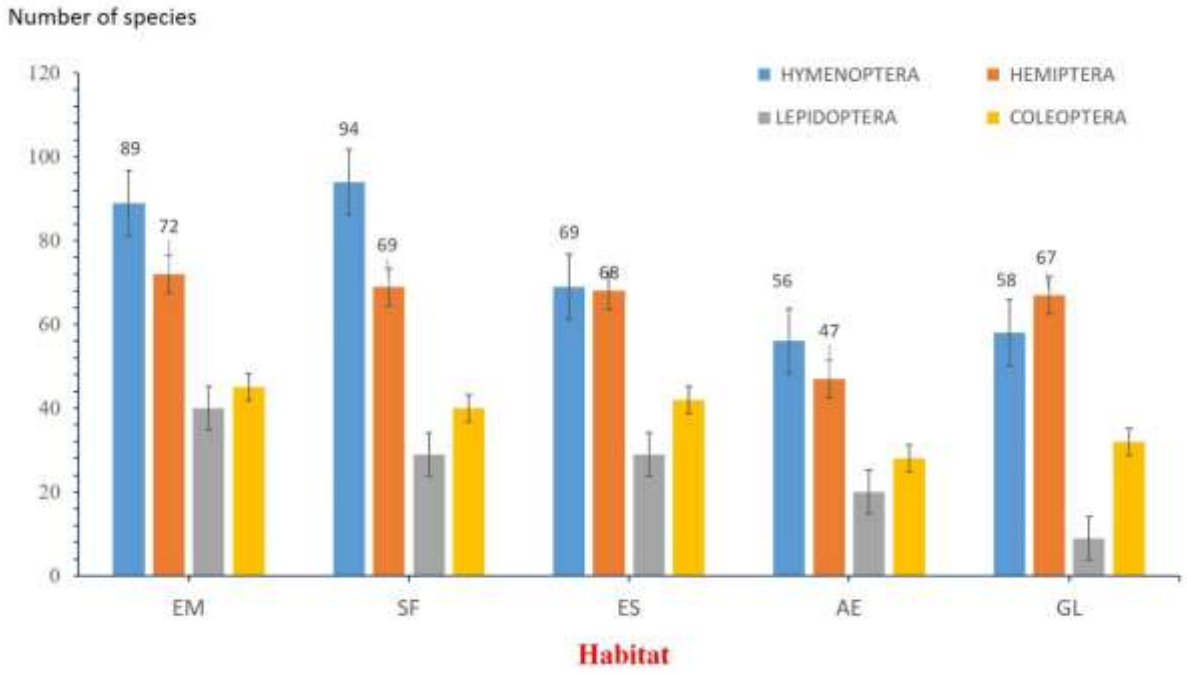


Figure 3: The number species of 4 order at habitat in the mountainous region of Northern Vietnam

Table 4: The rate of the number species of some families at habitat in the mountainous region of Northern Vietnam

Families	The rate of the number species				
	EM	SF	ES	AE	GL
Apidae	8.23	6.33	5.06	5.06	4.75
Vespidae	13.29	15.82	12.66	9.18	8.86
Reduviidae	17.72	16.77	15.51	11.71	17.09
Chrysomelidae	2.85	1.58	2.85	1.27	1.90
Coccinellidae	3.16	3.16	2.85	2.53	1.58
Scarabaeidae	4.11	3.80	3.80	2.53	2.22
Papilionidae	2.53	2.53	1.58	1.58	0.95
Sphingidae	2.85	1.90	2.53	1.27	0.32

Note: EM- the higher montane evergreen forest and lower montane evergreen forest; SF- Lowland evergreen forest and lowland semi-evergreen forest; ES- The buffer zone (Ecosystem transitional buffer zone between forest, regenerated forests and agricultural ecosystems) ; GL- Grassland ; AE- Agricultural ecosystems focus on the important group of plants like fruit trees and industrial crops.

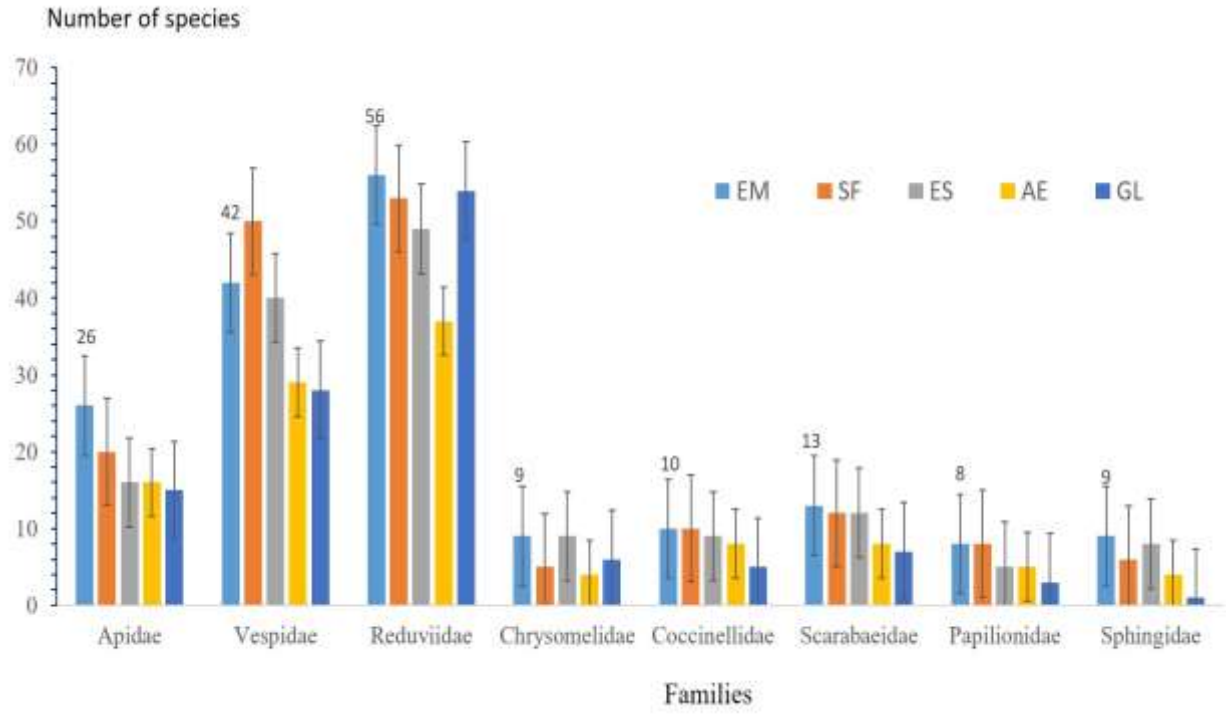


Figure 4: The number of species of some families at habitat in the mountainous region of Northern Vietnam

The study on the distribution according to altitude

Table 5: The number species (the rate of the number) of 4 order at altitude in the mountainous region of Northern Vietnam

Order	The rate of the number species %				
	< 200m	**200-500m**	**500-1000m**	**1000-1500m**	**>1500m**
HYMENOPTERA	106 (34.75%)	83 (27.21%)	72 (23.61%)	87 (28.52%)	58 (19.02%)
HEMIPTERA	93 (30.49%)	72 (23.61%)	61 (20.00%)	68 (22.30%)	47 (15.41%)
COLEOPTERA	49 (16.07%)	36 (11.80%)	30 (9.84%)	38 (12.46%)	29 (9.51%)
LEPIDOPTERA	31 (10.16%)	24 (8.20%)	24 (7.87%)	26 (8.52%)	17 (5.57%)
Total	279	216	187	219	151

Appendix 3 shows that among 305 species of 20 families of 4 orders in 5 altitudes. We were recorded in < 200m altitude with 279 species of 20 families of 4 orders, 200-500m altitude 216 species of 20 families of 4 orders, 500-1000m altitude 187 species of 28 families of 4 orders, 1000-1500m altitude 219 species of 30 families of 4 orders, >1500m with 151 species of 18 families of 4 orders (Table 5, Fig.5).

Orders Hymenoptera have the highest number of species with 106 species (34.75%) in < 200m altitude, 87 species (28.52%) in 1000-1500m altitude, 83 species (27.21%) in 200-500m altitude. Next orders Hemiptera have the number of species 93 species (30.49%) in < 200m altitude, 72 species (23.61%) in 200-500m altitude and 47 species (15.41%) in >1500m. The lowest is the order Lepidoptera with 31 species (10.16%) in < 200m altitude, 24 species in in 200-500m altitude and 500-1000m altitude, 17 species in >1500m.

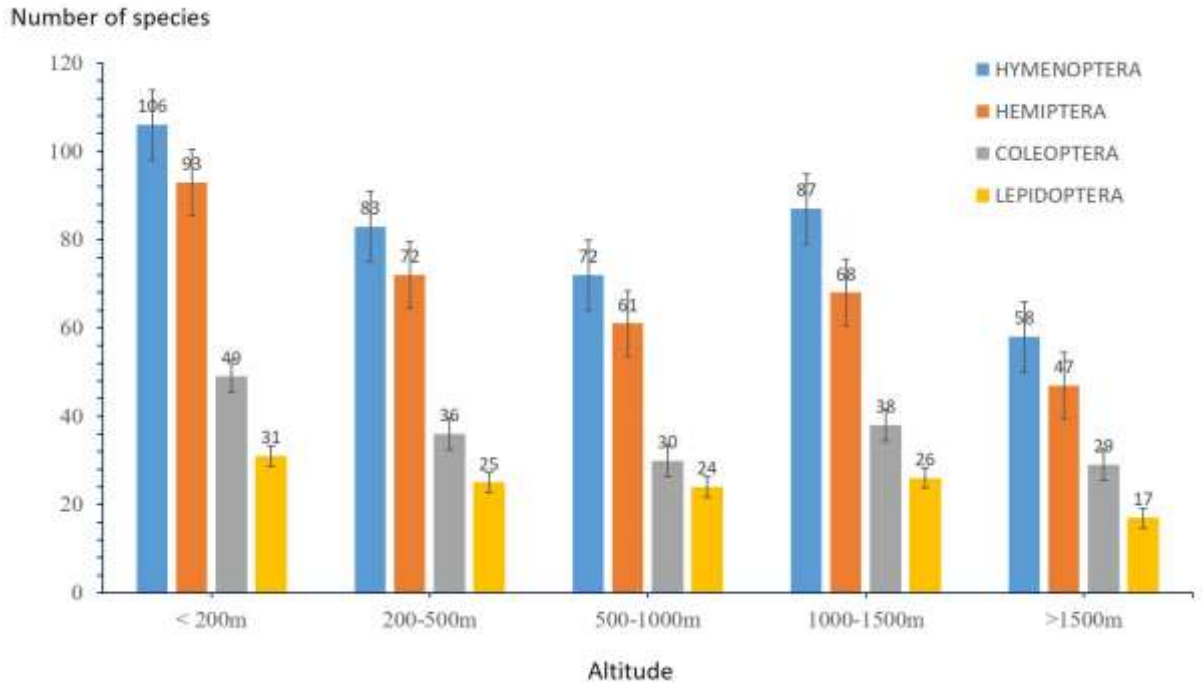


Figure 5: The number species of 4 order at altitude in the mountainous region of Northern Vietnam

At the family taxonomy: Table 6 and Figure 6 show that on order Hymenoptera, family Vespidae has the highest number species with 26 species in < 200m altitude, Vespidae with 43 species in < 200m altitude. On order Hemiptera, family Reduviidae has the highest number of species 71 in < 200m altitude. On order Coleoptera, family Coccinellidae has the highest number of species 11 species in < 200m altitude. Lepidoptera, family Papilionidae has the highest number of species 9 species in < 200m altitude. In >1500m, family Reduviidae has the highest number of species 36 species, Vespidae with 24 species and Apidae with 14 species.

Table 6: The number of species of some families at altitude in the mountainous region of Northern Vietnam

No	Families name	The number species				
		< 200m	**200-500m**	**500-1000m**	**1000-1500m**	**>1500m**
1.	Apidae	26	20	17	20	14

2.	Vespidae	43	34	28	35	24
3.	Pompilidae	12	8	10	10	7
4.	Sphecidae	13	11	6	10	7
5.	Coreidae	7	3	6	7	4
6.	Pentatomidae	8	8	3	4	3
7.	Reduviidae	71	54	49	53	36
8.	Chrysomelidae	9	5	9	9	5
9.	Coccinellidae	11	8	5	8	7
10.	Scarabaeidae	16	12	10	12	8
11.	Papilionidae	9	7	9	9	5
12.	Pieridae	7	5	5	4	5
13.	Nymphalidae	8	8	3	5	2
14.	Danaidae	8	6	8	8	5

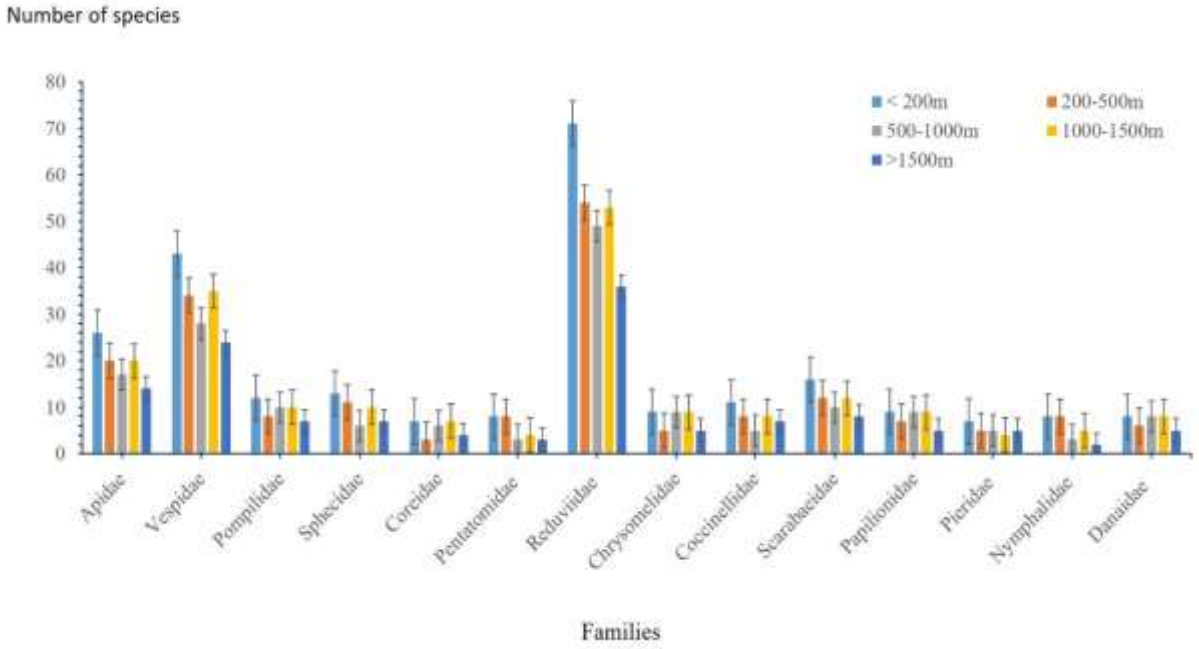


Figure 6: The number of species of some families at altitude in the mountainous region of Northern Vietnam

2.6.3. Identify the role of 4 orders in the use of insect resources for conservation, biological struggle, crop pollination, materials, food and medicine

+ Insect species of conservation value

Based on the level of threat due to the impacts of local people, the economic and scientific value, the habitat of some violated or threatened species (rare, low number) we have recorded 12 insect species of conservation value in the study area (Table 7).

Among 12 insect species of conservation value in Cham Chu Nature Reserve in Tuyen Quang Province, Bac Me Nature Reserve in Ha Giang Province, Phia Oac - Phia Den National Park in Cao Bang Province and Nam Xuan Lac Habitat and Species Conservation

Area in Bac Kan Province, 8 species of butterflies are recorded, mainly phoenix butterflies of the family Papilionidae, which are beautiful butterflies that have both aesthetic, tourist and commercial value.

Table 7: The number species of conservation value in the mountainous region of Northern Vietnam

No	Science name	Decree 32/ 2006	Decree 160 /2013	VNĐVN, 2007	IUCN, 2014
1.	*Huechys sanguinae* (Geer)	IIB	IIB		*
2.	*Byasa crassipes* (Oberthur)	IB	IB	E	*
3.	*Papilio noblei* De Nice.	IB	IB	VU	*
4.	*Troides helena* (Felder.)	IB	IB	VU	*
5.	*Troides aeacus* (L. & Felder)	IB	IB	VU	*
6.	*Graphium agamemnon* (Linn.)	IIB	IIB		*
7.	*Graphium antiphates* (Cramer)	IIB	IIB		*
8.	*Papilio arcturus* Westwood	IIB	IIB		*
9.	*Kallima inachus* (Doyere)	IB	IB	VU	*
10.	*Jumnos ruckeri* Saunders	IB	IB	VU	*
11.	*Megacorma obliqua* (Walker)	IB	IB		
12.	*Amplypterus panopus* (Cramer)	IIB	IIB		

Notes: - VNĐVN, 2007: Vietnam Red Book (2007): E: endangered; VU: endangered.

- Decree 32/2006: Decree 32/2006/ND-CP of the Government (2006): IB - Prohibited exploitation and use; IIB - Limit exploitation and use.

+ Insect species of pests of plants in agricultural ecosystems

The composition of pests of plants, the surveys on agricultural ecosystems at the study sites (in Cham Chu Nature Reserve in Tuyen Quang Province, Bac Me Nature Reserve in Ha Giang Province, Phia Oac - Phia Den National Park in Cao Bang Province and Nam Xuan Lac Habitat and Species Conservation Area in Bac Kan Province) showed that 60 species pest were recorded on crops belonging to 3 main groups (vegetable and fruit crops, food crops and forest trees) belonging to 18 families. In which, the group of fruit and vegetable crops recorded 34 species, the group of food crops recorded 52 species and the least forest trees recorded 27 species (Table 8).

Table 8: The species of pests of plants in agricultural ecosystems of Northern Vietnam

No	Science name	Occurrence level		
		Vegetables and fruit trees	Food crops	Forest trees
	Order COLEOPTERA			
	Family Chrysomelidae			
1.	*Phyllostreta striolata (*Fabr.)	+++		

2.	*Phyllotreta rectilineata* Chen	++		
3.	*Aulacophora rectilineata* Chen		++	+
4.	*Dactylispa lameyi* Uhmann		+	
5.	*Dicladispa Armigera boutani* Weise		++	
6.	*Lema oryzae* Kuwayana		+++	
	Family Curculionidae			
7.	*Hypomeces squamosus* Fabr.	+	++	+++
8.	*Platymycterus sieversi* Reitter	+	+++	++
	Family Cerambycidae			
9.	*Apriona germari* (Hope)	+	++	+++
10.	*Chelidonium argentatum* (Dalmann)	+	++	+++
	Order HEMIPTERA			
	Family Coreidae			
11.	*Cletus puntiger* Dall.		+++	
12.	*Cletus trigonus* Thunb.		+++	
13.	*Homoeocerus marginellus* Herr.		++	
14.	*Leptocorisa acuta* Fabr.	+	+++	
15.	*Leptocorisa varicornis* Fabr.		+++	
16.	*Riptotus pedestris* (Fabr.)	+++	+	++
17.	*Riptotus linearis* (Fabr.)	++	+	+
18.	*Riptotus parvus* Hsiao	++	+	+
	Family Pentatomidae			
19.	*Nezara viridula* Lin.	++	+++	+
20.	*Tessaratoma papilosa* Dall.	+++		
21.	*Rhynchocoris humeralis* Thunb.	+++	+	+
	Family Cicadellidae			
22.	*Deltocephalus dorsalis* Motsch.		+++	
23.	*Deltocephalus oryzae* Motsch.		+++	
24.	*Empoasca flavescens* (Fabr.)		+++	
25.	*Nephotettix apicalis* (Motsch.)	+	+++	+
26.	*Nephotettix bipunctatus* (Fabr.)	+	+++	+
27.	*Tettigoniella spectra* Distant	+	+++	+
28.	*Tettigoniella viridis* (Linn.)		+++	
29.	*Nilaparvata lugens* Stal		+++	
30.	*Lawana imitata* Melichar	++	+	++
31.	*Diaphorina citri* Kuwayana	+++		
	Family Aphididae			
32.	*Aphis citricidus* Kirkaldy	+++		

33.	*Aphis maydis* Fitch		+++	
34.	*Ceratovacuna lanigera* Zehntner		++	
	Order ORTHOPTERA			
	Family Acrididae			
35.	*Acrida chinensis* (Westw.)	++	++	++
36.	*Atractomorpha chinensis* Bolivar	++	++	++
37.	*Oxya chinensis* (Thunberg)		+++	
38.	*Oxya diminuta* (Walker)		++	
39.	*Oxya velox* Fabr.		+++	
	Family Gryllidae			
40	*Brachytrupes portentosus* (Licht.)	++	++	+++
	Order LEPIDOPTERA			
	Family Pieridae			
41.	*Pieris brassicae* (Linn.)	+++		
	Family Spingidae			
42.	*Herse convolvuli* Linn.		+++	
	Family Arctiidae			
43.	*Amsacta lactinea* Cramer		++	
44.	**Family Noctuidae**			
45.	*Agrotis ypsilon* Rott.	+	+	+
46.	*Heliothis armigera* Hubner	+++	++	+
47.	*Leucania separata* Walker	+	+++	+
48.	*Naranga aenescens* Moore	+++	+++	++
49.	*Prodenia litura* Fabr.	+++	+++	++
	Family Lymantriidae			
50.	*Orgyia posticata* Walker	+	+++	+
51.	*Porthesia scintillans* Walker	+	++	+
52.	*Psalis securis* Hubner	+	+++	+
	Family Limacodidae			
53.	*Scopelodes sp.*	++		
	Family Pyralidae			
54.	*Cnaphalocrocis medinalis* Guenee		+++	
55.	*Nacoleia comixta* Butler		+++	
56.	*Pyrausta nubilalis* Hubner		+++	
57.	*Schoenobius incertellus* Walker		+++	
	Family Tortricidae			
58.	*Cacoecia micaceana* (Walker)		+++	
	Family Trypetidae			
59.	*Chaetodacus cucurbitae* oquille	++	+	+

60.	*Chaetodacus ferruginea* (Fabr.)	+++	+	+

Notes: +: Less common > 5 - 20%; ++: Popularity > 20 - 50%; +++: Very common > 50%

Very common pests include *Phyllostreta striolata* (Fabr.), *Leptocorisa acuta* Fabr., *Nezara viridula* Lin., *Tessaratoma papilosa* Dall., *Nephotettix bipunctatus* (Fabr.), *Tettigoniella viridis* (Linn.), *Nilaparvata lugens* Stal, *Diaphorina citri* Kuway, *Ceratovacuna lanigera* Zehntner, *Ceratovacuna lanigera* Zehntner, *Oxya chinensis* (Thunberg), Butterfly *Pieris brassicae* (Linn.), *Heliothis armigera* Hubner, *Prodenia litura* Fabr., *Cnaphalocrocis medinalis* Guenee, Corn borer *Pyrausta nubilalis* Hubner, *Schoenobius incertellus* Walker, fruit fly *Chaetodacus cucurbitae* Coquille.

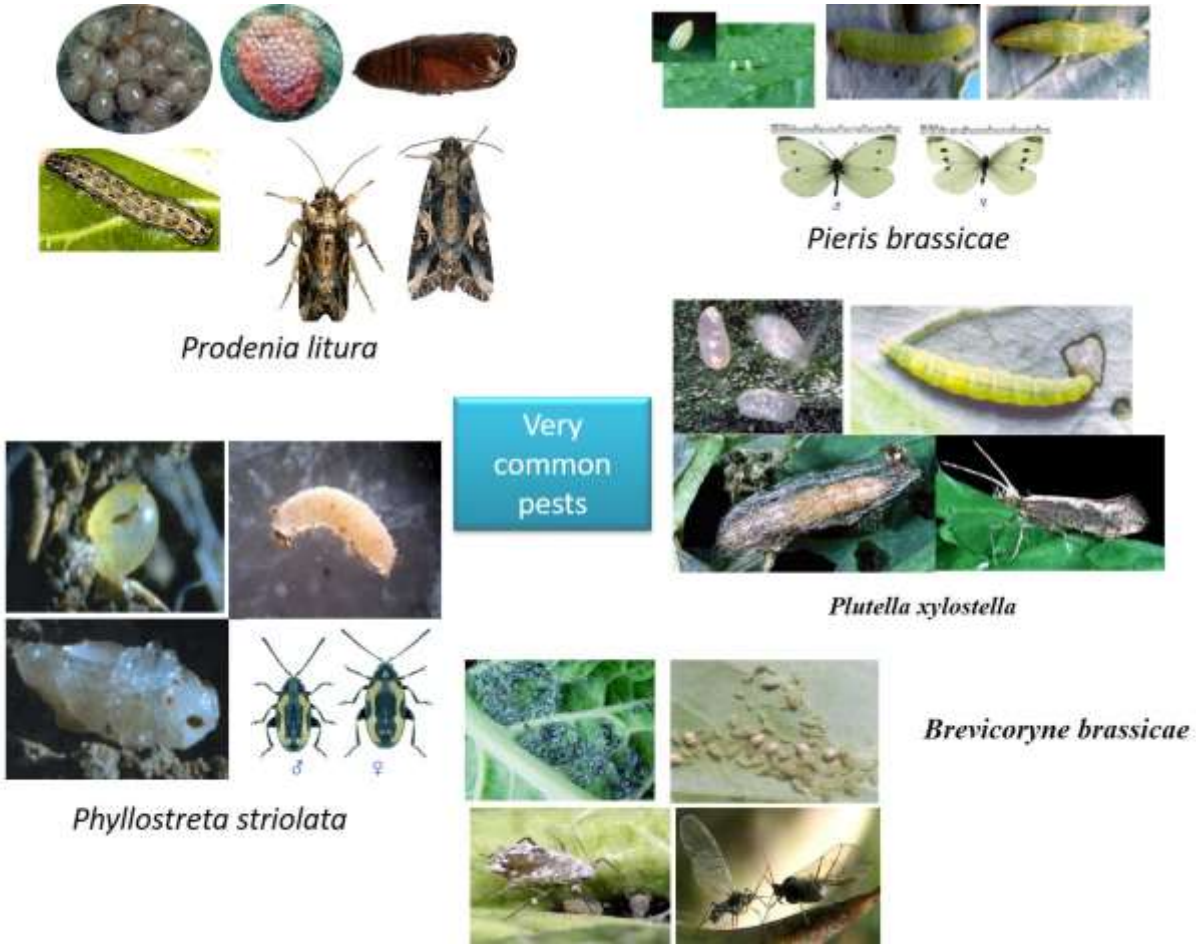


Figure 7: The very common pests of plants in agricultural ecosystems

+ Insects with an epidemiological role in human health

Figure 8: The insects with an epidemiological role in human health

Includes 2 species of mosquitoes that transmit dengue fever: *Aedes aegypti* (Linnaeus) and *Aedes albopictus* (Skuse), a Japanese mosquito *Culex tritaeniorhynchus* Giles, and a blood-sucking bug, *Triatoma rubrofasciatta* Dorh. Some other species that transmit diseases caused by flies and house cockroaches include The house cockroach *Periplaneta americana* (Linn.), the house fly *Musca domestica* Lineaus. There are 3 species of blood-sucking flies in the genus *Tabanus*: *Tabanus angustistriatus* Stekhoven and *Tabanus rubidus* Wied., and *Tabanus quadritriangularis* Stel. (Fig.8)

+ *Natural enemies of pests on crops in agricultural ecosystems*

A survey in agricultural ecosystems at the study sites (in Cham Chu Nature Reserve in Tuyen Quang Province, Bac Me Nature Reserve in Ha Giang Province, Phia Oac - Phia Den National Park in Cao Bang Province and Nam Xuan Lac Habitat and Species Conservation Area in Bac Kan Province) has recorded 112 species of natural enemies on the plantations, in which species of the beetle order Coleoptera have the most recorded species (accounting for 35.05%), followed by the order Coleoptera. the other wing Heteroptera (23.71%) and the membranous order Hymenoptera (21.65%). The other 4 sets had a low rate of 2.06-9.28% (Table 9).

Table 9: The species of natural enemies of pests on crops in agricultural ecosystems of Northern Vietnam

No	Science name	Distribution	Preys
	Family Reduviidae		

1.	*Ectrychotes andreae* (Thunberg, 1784)	CB	(4),(8),(9)
2.	*Ectrychotes comottoi* Lethierry, 1883	BK, TQ	(4),(8),(9)
3.	*Ectrychotes lingnanensis* China, 1940	CB	(8), (9)
4.	*Mendis rufus* Hsiao & Ren, 1981	TQ	(5), (15)
5.	*Bayerus pilosus* Hsiao, 1973	CB, TQ	(15)
6.	*Neozirta orientalis* Distant, 1919	CB	(15), (11)
7.	*Parascadra rubida* Hsiao, 1973	CB, TQ	(15)
8.	*Vilius melanopterus* (Stål, 1863)	CB, TQ	(15), (11)
9.	*Sirthenea dimidiate* Horvath, 1911	TQ	(15), (13)
10.	*Sirthenea flavipes* (Stål, 1855)	BK, LS, CB	(3),(4)
11.	*Sirthenea nigra* Cai et Tomokuni, 2004	TQ	(3),(4)
12.	*Lestomerus affinis* (Serville, 1831)	CB	(3),(4),(12)
13.	*Peirates arcuatus* (Stal, 1871)	BK, CB, TQ	(3),(4),(12)
14.	*Peirates leptidoides* (Wolff, 1804)	CB, TQ	(4),(12)
15.	*Peirates atromaculatus* Stal, 1870	TQ	unknown
16.	*Peirates turpis* Walker, 1873	CB	unknown
17.	*Ectomocoris atrox* (Stål, 1855)	TQ	(3),(4),(12)
18.	*Ectomocoris elegans* (Fabricius, 1803)	CB	(3),(4),(12)
19.	*Ectomocoris yunnanensis* Ren, 1990	TQ	unknown
20.	*Ectomocoris biguttulus* Stal, 1870	CB, TQ	(3), 12)
21.	*Acanthaspis geniculata* Hsiao, 1976	CB	(3),(4),(12)
22.	*Acanthaspis ruficeps* Hsiao, 1976	BK, LS, CB, TQ	(3), 12),
23.	*Acanthaspis collaris* Hsiao, 1976	TQ	(3),(12), (15)
24.	*Gerbelius typicus* Distant	CB, TQ	(3),(4),(12)
25.	*Brachytonus nigripes* Hsiao	CB	unknown
26.	*Durganda rubra* Amyot & Serville	TQ	unknown
27.	*Reduvius tenebrosus* (Stal, 1863)	CB	(5) (12), (14)
28.	*Reduvius decliviceps* Hsiao, 1976	TQ	(2), (12),(14)
29.	*Reduvius gregoryi* China, 1925	CB, TQ	(12),(14)
30.	*Polytoxus femoralis* Distant ,1903	CB, TQ	(1), (2), (3), (4)
31.	*Polytoxus fuscipennis* Hsiao, 1965	BK, CB, TQ	(1), (2), (6), (7)
32.	*Polytoxus ruficeps* Hsiao, 1965	CB, TQ	(1), (2), (3), (4)
33.	*Lisarda pilosa* Hsiao, 1974	CB, TQ	(3),(4),(12)
34.	*Lisarda uniformis* Distant, 1903	CB, TQ	(3), (4), (14)
35.	*Lisarda rhypara* (Stål, 1859)	BK, CB	(1), (2), (3)
36.	*Petalocheirus spinosissimus* Distant, 1903	TQ	unknown
37.	*Valentia hoffmanni* China, 1940	BK, CB, TQ	(1), (2), (3)
38.	*Aulacogenia corniculata* Stål, 1870	CB	unknown
39.	*Canthesancus geniculatus* Distant, 1902	TQ	(1), (2), (3), (4)

40.	*Canthesancus helluo* Stål, 1863	BK, CB, TQ	(1), (2), (3), (4)
41.	*Canthesancus trimaculatus* Amyot & Serville	BK, CB, TQ	((1), (2), (3), (4)
42.	*Pygolampis biguttata* Reuter, 1887	CB, TQ	(10), (11)
43.	*Pygolampis longipes* Hsiao, 1977	CB, TQ	(1), (2), (10), (13)
44.	*Pygolampis rufescens* Hsiao, 1977	CB, TQ	unknown
45.	*Oncocephalus pudicus* (Hsiao, 1977)	LS, CB, TQ	(1), (2), (3), (4)
46.	*Oncocephalus purus* Hsiao, 1977	TQ	(12), (11)
47.	*Oncocephalus scutellaris* Reuter, 1882	CB, TQ	(1), (2),(12), (15)
48.	*Oncocephalus lineosus* Distant, 1903	CB	(12), (15)
49.	*Staccia diluta* (Stål, 1859)	CB	unknown
50.	*Staccia plebeja* Stål, 1866	BK, CB, TQ	unknown
51.	*Emesopsis nubilus* Uhler, 1984	CB	unknown
52.	*Empicoris rubromaculatus* (Blackburn, 1889)	CB, TQ	unknown
53.	*Ploiaria glabella* Wygodzinsky, 1966	TQ	unknown
54.	*Astinus siamensis* Distant, 1903	CB, TQ	(9), (10)
55.	*Biasticus confucuss* Hsiao, 1979	CB, TQ	(1), (2),(3)
56.	*Biasticus flavinotus* (Matsumura)	CB, TQ	unknown
57.	*Biasticus flavus* (Distant, 1903)	TQ	(1), (2),(3)
58.	*Coranus fuscipennis* Reuter, 1881	BK, CB, TQ	(1), (2),(3)
59.	*Endochus nigricornis* Stål, 1859	BK	(3)
60.	*Euagoras plagiatus* (Burmeister, 1834)	BK, CB, TQ	(9), (11)
61.	*Rhynocoris marginellus* Fabricius, 1803	CB, TQ	(1), (2),(3)
62.	*Rhynocoris fuscipes* (Fabricius)	TQ	(6), (7),(8)
63.	*Isyndus reticulatus* Stål, 1868	BK, CB, TQ	(1), (2), (3)
64.	*Panthous ruber* Hsiao, 1979	CB, TQ	(3), (13)
65.	*Poliditus armatissimus* Stål, 1859	CB, TQ	(4)
66.	*Rihirbus trochantericus* Stål, 1861	CB, TQ	(5)
67.	*Sphedanoletes impressicollis* (Stål, 1861)	CB, TQ	(2)
68.	*Sycanus croceus* Hsiao, 1979	CB, TQ	(1), (2), (3)
69.	*Sycanus croceovittatus* Dohrn, 1859	BK, CB, TQ	(1), (2), (3)
70.	*Sycanus falleni* Stål, 1863	BK, CB, TQ	(1), (2), (3)
71.	*Vesbius purpureus* (Thunberg, 1783)	BK, CB, TQ	(1), (2), (3)
72.	*Vesbius sanguinosus* Stål	TQ	
73.	*Velinus malayus* (Stål, 1863)	CB	(1), (13)
74.	*Velinus annulatus* Distant	CB, TQ	unknown
75.	*Velinus rufiventris* Hsiao	TQ	unknown
76.	*Villanovanus nigrorufus* Hsiao, 1982	TQ	(3), (13)

	Family Carabidae		
77.	*Chlaenius circumdatus* Brulle	CB, TQ	(15)
78.	*Chlaenius costiger* Chau.	CB	(15), (11)
79.	*Chlaenius inops* Chaudoir	CB, TQ	(15)
80.	*Chlaenius nigricans* Wied.	CB, TQ	(15), (11)
81.	*Ophinea indica* (Thun.)	TQ	(15), (13)
	Family Coccinellidae		
82.	*Coccinella transversalis* Fabricius	TQ	(10)
83.	*Hasmonia octomaculata*	CB	(10)
84.	*Lemnia biplagiata* (Swartz)	BK, CB, TQ	(10)
85.	*Lemnia bissellata* (Mulsant)	CB, TQ	(10)
86.	*Menochilus sexmaculatus* (Fabricius)	TQ	unknown
87.	*Micraspis discolor* (Fabricius)	CB	unknown
88.	*Propylea japonica* (Thunb.)	TQ	(3),(4),(12)
	Family Cicindelidae		
89.	*Cicindela aurulenta* Thunb.	TQ	unknown
90.	*Cicindela kaleea* Thunb.	CB, TQ	(3), 12)
91.	*Neocollyris juscitarsis* (Schm.-Goeb.)	CB	(3),(4),(12)
	Family Mantidae		
92.	*Manti religiosa* Linnaeus	TQ	(3),(12), (15)
93.	*Tenodera aridiforia* (Stoll)	CB, TQ	(3),(4),(12)
94.	*Theoprobus elegans*	CB	unknown
	Family Forficulidae		
95.	*Euborellia annulipes* (Lucas)	CB	(5) (12), (14)
96.	*Euborellia annulata* (Fabricius)	TQ	(2), (12),(14)
	Family Sphecidae		
97.	*Sphex* sp1.	CB, TQ	(1), (2), (5), (6),
	Family Vespidae		
98.	*Polistes gigas* (Kirby)	CB, TQ	(1), (2), (3), (4)
99.	*Polistes rothneyi* van der Vechr	CB, TQ	(3),(4),(12)
100.	*Polistes sagittarius*	CB, TQ	(3), (4), (14)
101.	*Ropalidia cysthyformis*	BK, CB	(1), (2), (3)
102.	*Ropalidia flavopicta*	TQ	unknown
103.	*Vespa affinis* (Linnaeus)	BK, CB, TQ	(1), (2), (3)
104.	*Vespa analis* Fabricius	CB	unknown
105.	*Vespa mocsaryana*	TQ	(1), (2), (3), (4)
106.	*Vespa soror* du Buysson	BK, CB, TQ	(1), (2), (3), (4)
107.	*Vespula koreensis*	BK, CB, TQ	(3),(4),(12)
	Family Ichneumonidae		

108.	*Enicospilus nigrienalis* Cushman	CB, TQ	(1), (2), (3)
109.	*Theronia zebra diluta* Gupta	CB, TQ	unknown
110.	*Xanthopimpla punctata* Fabricius	CB, TQ	(1), (2)
	Family Braconidae		
111.	*Apanteles* sp1.	CB, TQ	(1), (2)
112.	*Apanteles* sp2.	CB	(1), (2)

Note: *Anomis flava (1), Helicoverpa armigera (2)*, *Spodoptera litura* (3)*, Plusia* sp. (4), *Nephotettix bipunctatus (5), Empoasca biguttula* (6), *Empoasca flavescens* (7), *Erianthus* spp. (8), *Pieris brassicae (9)*, *Aphis* sp. (10), *Aulacophora* spp. (11), *Chrysomela* spp. (12), *Rhopalosiphum* spp. (13), *Oxya* spp. *(14)* and *Corcyra cephalonica (15).* Bac Kan-BK, Cao Bang-CB, Tuyen Quang-TQ

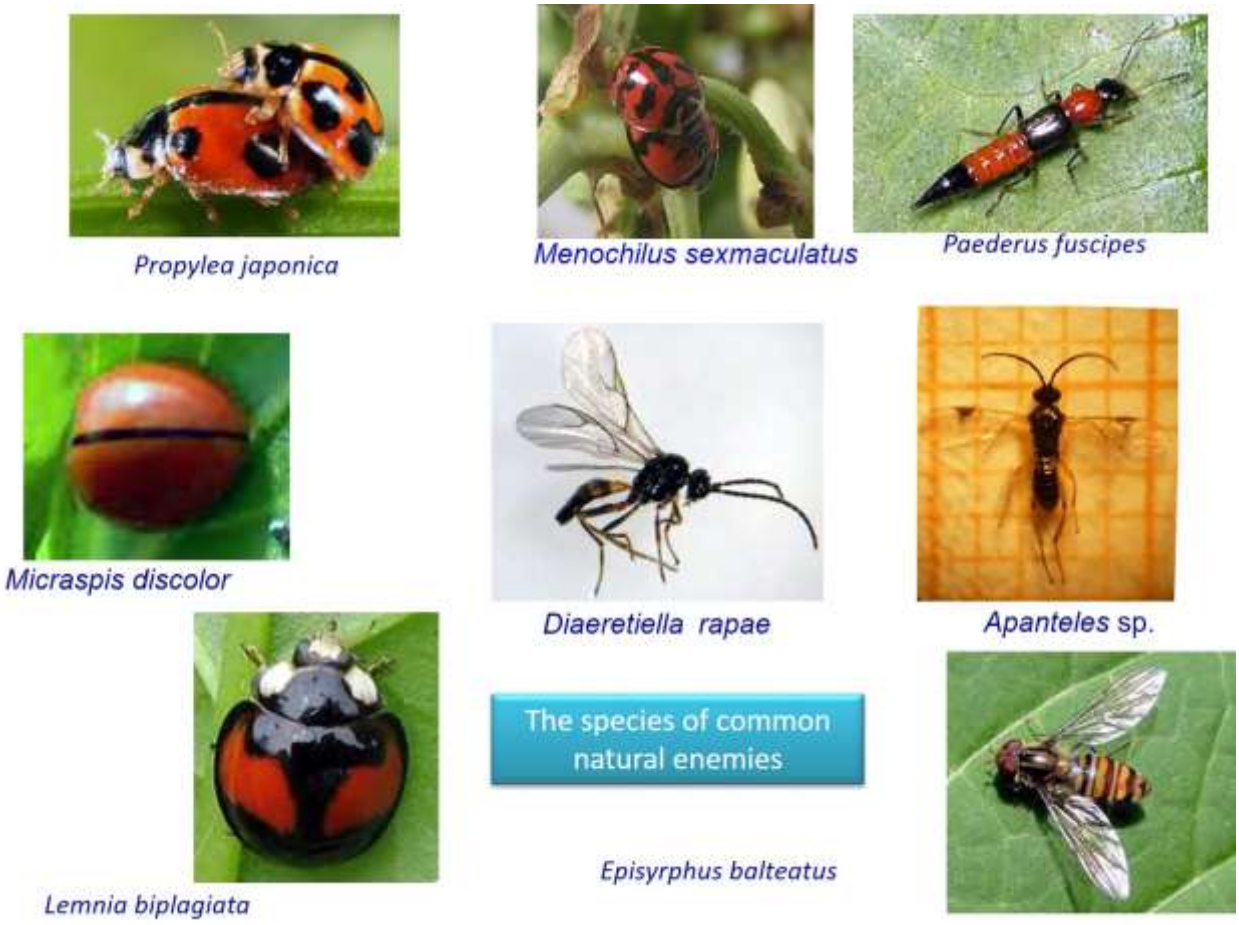


Figure 9: The species of common natural enemies in agricultural ecosystems

The species of common natural enemies have occurrences such as *Opinea indica* (Thun.), *Coccinella transversalis* Fabricius, *Lemnia biplagiata* (Swartz), *Menochilus sexmaculatus* (Fabricius), *Micraspis discolor* (Fabricius), *Propylea japonica* (Thunb.), *Sycanus croceovittatus* Dohrn, *Sycanus falleni* Stal, *Euborellia annulipes* (Lucas), *Euborellia annulata* (Fabricius), *Polistes gigas* (Kirby), *Vespa affinis* (Linnaeus),

Xanthopimpla punctata Fabricius, *Apanteles* sp1. (Fig.9)

+ *Insects pollinate of plants*

Figure 10: The insects pollinate plants in agricultural ecosystems

Notes: a - Imported Italian bee (*A. mellifera*), b - Honey bee 1 (*Lasioglossum* sp.1), c - Honey bee (*Apis cerana*), d - Honey bee 2 (*Lasioglossum* sp.2)

Among the insects pollinate recorded 5 species act as pollinators include: the *Apis cerana* (honey bee Fig. 10c), the imported Italian bee *A. mellifera* (Fig.10a), the honey bee 1 *Lasioglossum* sp.1 (Fig. 10b) and the honey bee 2 *Lasioglossum* sp.2 (Fig. 10d) and honey bee *Xylocopa* sp1. There are 3 species recorded in Bac Kan, Cao Bang, Tuyen Quang and ha Giang: *Apis cerana* honey bee with the pollinator visit frequency of 95%, species *A. mellifera* with the pollinator visit frequency of 85%, and this bee with visit frequency of 23%, and bee honey 1 *Lasioglossum* sp.1 with visit frequency of 22%. The species *Apis cerana* and *A. mellifera* were the main pollinators here. This activity is achieved by the habit of taking pollen and nectar back to the nest to feed their flock.

+ *The bee species of economic value at the study site*

4 species of bees with high economic value were recorded at the study site, of which 3 species were exploited and eradicated (*Polistes olivaceus* (DeGeer), *Polistes strigosus* Bequaert and *Vespa affinis* (Linnaeus))

Table 10. The bee species of economic value at the study site

No	Science name	Distribution	Record honey bee nest
1)	*Polistes olivaceus* (DeGeer)	HG, CB, TQ, BK	+

2)	*Polistes strigosus* Bequaert	HG, CB, TQ, BK	+
3)	*Parapolybia varia* (Fabricius)	HG, CB, TQ, BK	+
4)	*Vespa affinis* (Linnaeus)	HG, CB, TQ, BK	+

Note: HG, CB, TQ, BK are abbreviations of Ha Giang, Cao Bang, Tuyen Quang, Bac Kan, provinces. (+): Get the nest.

Polistes olivaceus

Polistes olivaceus

Polistes strigosus

Polistes strigosus

Parapolybia varia

Parapolybia varia

Parapolybia varia

Parapolybia varia

Figure 11. The bee species of economic value at the study site

+ Insects as food for humans

We recorded 15 species that were used as food for humans in the study site. There are 3 common species including *Apis cerana* (honey bee), *Apis mellifela* (Honey bees) and *Bombyx mori* (mulberry silkworm). The remaining species are mainly exploited from natural sources, many species are only a small number such as *Cybister tripunctatus* and *Cybister* sp1. (Table 11), among them, the grasshopper species are used the most, especially in the suburbs after the rice harvests, followed by the litchi bug and two species of earthworm.

Table 11. The species of food for humans at the study site

No	Science name	Distribution	Food for humans
1.	*Tessaratoma papilosa*	HG, CB, TQ, BK	+
2.	*Oxya chinensis*	HG, CB, TQ, BK	+++
3.	*Oxya diminuta*	HG, CB, TQ, BK	++
4.	*Oxya velox*	HG, CB, TQ, BK	+
5.	*Conocephalus maculatus*	HG, CB, TQ, BK	+
6.	*Euconocephalus pallidus*	HG, CB, TQ, BK	+
7.	*Apis cerana Fabricius*	HG, CB, TQ, BK	+++
8.	*Apis mellifela Fabricius*	HG, CB, TQ, BK	+++
9.	*Lasioglossum* sp.1	HG, CB, TQ, BK	+
10.	*Lasioglossum* sp.2	HG, CB, TQ, BK	+
11.	*Xylocopa* sp1.	HG, CB, TQ, BK	+
12.	*Vespa affinis*	HG, CB, TQ, BK	++
13.	*Cybister tripunctatus*	HG, CB, TQ, BK	+
14.	*Cybister* sp1.	HG, CB, TQ, BK	+
15.	*Bombyx mori*	HG, CB, TQ, BK	+++

Note: HG, CB, TQ, BK are abbreviations of Ha Giang, Cao Bang, Tuyen Quang, Bac Kan, provinces. +: Less common > 5 - 20%; ++: Popularity > 20 - 50%; +++: Very common > 50%

+ Insects used as pharmaceuticals

Table 12. The species insects used as pharmaceuticals at the study site

No	Science name	Used as medicine
1.	*Blaiseus bedeli*	Dry roasted and soaked in alcohol
2.	*Conoderus elegans*	Dry roasted and soaked in alcohol
3.	*Pulchronotus brevis*	Dry roasted and soaked in alcohol
4.	*Mylabris cichorii*	Mature to make medicine
5.	*Mylabris halerata*	Mature to make medicine
6.	*Tricentrus lavipes*	Medicinal corpses
7.	*Apis cerana*	Take honey, cure disease
8.	*Apis mellifela*	Take honey, cure disease
9.	*Polistes gigas*	Lack of food production, high status of curable vegetables
10.	*Vespa affinis*	Larvae and adults soaked in alcohol, cure disease
11.	*Vespa soror*	Larvae and adults soaked in alcohol, cure disease
12.	*Bombyx mori*	Roasted larvae soaked in honey to cure diseases and make food

Figure 12. Some species of insects used as pharmaceuticals at the study site

At the study site, 12 species were reported to be used as pharmaceuticals (Table 12). There are 3 species: *Apis cerana* honey bee; Honey bees enter *Apis mellifela* and mulberry silkworm *Bombyx mori*. These are the three species that have the greatest medicinal use, in which honey is of great value in pharmaceuticals. Dried mulberry silkworm larvae are used for newborns to promote health. The remaining species are mainly exploited from natural sources. Each species is used as a medicinal product to protect human health, such as *Blaiseus bedeli*, *Conoderus elegans*, *Pulchronotus brevis*, people or people use dried roasted and soaked adults to cure some diseases. Yellow wasp species larvae and adults are used to soak in alcohol to cure diseases

2.6.4. Determining the causes of resource degradation of 4 orders and proposing solutions to sustainably protect these insect resources

2.6.4.1. Determining the causes of resource degradation of 4 orders

+ Unsustainable exploitation and use

Exploiting bees and ants (family Apidae, Vespidae and Formicidae): soaking, making medicine, selling. In the forms and means of fishing, the most dangerous is the use of manual methods and chemicals to eradicate and exploit species of bees and ants (family Apidae, Vespidae and Formicidae), especially honey bees to make food and drink wine.

It can be seen that the exploitation of wild bees without a plan to conserve, protect and compensate for both the number of individuals as well as the quality of the forest, the number of forest bees and ants (family Apidae, Vespidae and Formicidae) decline not only in individuals in the population but also in species diversity.

Exterminate wasps


Exterminate wasps




Burning and catching honey bees

Yellow bee Vespidae soaked in wine
Ong vàng Vespidae ngâm rượu

Figure 13. Unsustainable exploitation and use

+ *Forest fire*

The main cause of forest fires is man-made, which is the next stage of deforestation, clearing, burning to prepare land for swidden cultivation, planting industrial crops or clearing natural lawns. to raise cattle and buffaloes. The consequences of forest fires on biodiversity appear both instantaneously and in the long term in many aspects; especially in tropical forest conditions, the consequences of forest fires are enormous. The main causes of forest fires are swidden cultivation, burning of vegetation and dry weather. Moreover, the improper construction of water intake ditches has caused the forest to be fragmented into many small pieces, the wind will be stronger, the humidity will decrease and the temperature of the border of the forest will be higher, leading to the risk of fire. more forests. Fires from regular annual slash-and-burn sites can spread into the forest or from areas where leaves are burned during harvest, or from places where farmers burn forests for cultivation, burn coal, and smoke for honey. It is the result of forest fragmentation encroaching on land for farming, or selective exploitation. Shrubs thrived after large trees were cut down and man-made forest fires (Pham Binh Quyen, 2002)


Forest fire in Tuyen Quang


Forest fire in Ha Giang

Figure 14. Forest fire in Ha Giang and Tuyen Quang

+ ***Change of land use mode***

Converting protection forests to maize land: the function of protection forests is to retain water, prevent erosion, and protect the core zone. Statistical results show that previously, the area of protection forest in Tuyen Quang, Ha Giang alone was about 250,000 ha, a significant part of the area was exploited for firewood, maize and upland rice cultivation. The formation of upland rice fields in karst lands in Cao Bang, Tuyen Quang and Ha Giang has been documented. This action has shown the impact of humans to speed up the ecological succession of the habitats on the rocky mountains. Especially in Ha Giang, the formation of buckwheat planting areas and there was a time when the forest was massively cleared to switch to buckwheat.

Growing upland rice and maize

Planting buckwheat buckwheat in Ha Giang

Figure 15. Change of land use mode

+ *Environmental pollution*

The effects of toxic chemicals used in agriculture have also had a lasting effect on the membrane winged insects here. Most of the membrane-wing insect communities in different terrestrial habitats show signs of being affected with varying levels of toxic chemicals from chemical fertilizers, chemical pesticides. and toxic sources from cement factories, stone factories, etc. The natural food web of many species of bees and ants has either not been restored or is contaminated.

The excessive increase in the use of chemical pesticides not only destroys pests, but also seriously degrades insect resources in nature, many species that were previously common beneficial species on crops. Up to now, either disappearing or appearing only in very small numbers and frequencies are species belonging to the group of honey bees and bees. Moreover, many species that survive after spraying, their ability to lay, life expectancy and behavior are most severely affected are honey bees.

Quarrying and dumping in Bac Kan

Landfill and pesticide in Ha Giang

Figure 16. Environmental pollution

2.6.4.2. The proposing solutions to sustainably protect these insect resources

+ Conservation of 4 orders Hymenoptera, Hemiptera, Lepidoptera and Coleoptera is the process of managing the interaction between humans and their genetic resources, 4 orders Hymenoptera, Hemiptera, Lepidoptera and Coleoptera and their habitats in order to bring the greatest benefit to the people. maintain their potential to meet the needs of future generations. In order to conserve quality and effectively, it is necessary to minimize the main causes of the decline of the Apidae, Vespidae, Reduviidae, Coccinellidae, Papilionidae and Formicidae families in forest habitats in the limestone mountains of Northeast Vietnam.

+Currently, there are conservation methods of 4 orders Hymenoptera, Hemiptera, Lepidoptera and Coleoptera (focus Apidae, Vespidae, Reduviidae, Coccinellidae, Papilionidae and Formicidae) mainly in situ (In-situ) and transposition (Ex-situ) conservation with honey bees. These two conservation methods are complementary. Individuals from Ex-situ conserved populations may be introduced into the wild in their natural range to enhance In-situ conserved populations and the study of protected

populations. Ex-situ conservation can provide insights into the biology of species and thereby aid in the formulation of more effective conservation strategies for In-situ conserved populations. .

+In situ conservation is the conservation of natural habitats to maintain and restore populations of membrane winged insects (Apidae, Vespidae, Reduviidae, Coccinellidae, Papilionidae and Formicidae) in their natural environment, including including:

+ Establishment of a system of protected areas as an area of land and/or sea defined to protect and maintain biodiversity and natural resources incorporated and managed through regulatory means and other effective means such as Ha Giang, Phja Den - Phja Oac eco-tourism area (Cao Bang), Tuyen Quang and Nam Xuan Lac, Bac Kan. All conservation areas are designed taking into account land availability, funding, population distribution in and around the protected area, community perceptions, and conservation concerns. Large protected areas will be better able to preserve species, biomes, and target ecosystems because they can maintain ecological processes taking place in protected areas more holistically than areas. small conservation.

+Enhance educational activities to raise awareness and encourage stakeholders to participate in the protection of target species, communities or ecosystems that need to be conserved. It is necessary to find alternative sources of income for income from membrane winged insects (Apidae, Vespidae, Reduviidae, Coccinellidae, Papilionidae and Formicidae). Prohibit over-exploitation of membrane-winged insect resources (Apidae, Vespidae, Reduviidae, Coccinellidae, Papilionidae and Formicidae) and develop long-term strategies and short-term action plans for forest management.

+To increase the socio-economic development of local people, it is necessary to conduct discussions and agreements with local people living around protected areas on ways of participatory conservation and solutions to find solutions. alternative livelihood sources and improve income, improve socio-economic life for local communities.

+ Limit exploitation and hunting of membrane winged insects (Apidae, Vespidae, Reduviidae, Coccinellidae, Papilionidae and Formicidae), especially honey bees, there should be instructions for selective exploitation and prohibition of eradication exploitation.

+ Handling of waste, industrial chemicals, pesticides in agriculture

+ Method of conservation of displacement (Ex-situ) with honey bee species

+ Move bee colonies to habitats with a source of flowering plants to attract and provide honey to bees. Enhance quality seed and tame wild bees, protect the bees when they are sick or cold, so they die in mass or leave the nest to fly into the forest and be attacked by enemies.

+ Improve the quality of the original herd; effective and sustainable development orientation of honey bees; remove difficulties and obstacles between beekeeping and crops;

Quarantine and transportation issues.

+Expand production in large-scale commodity chains for export, together with the development of small-scale beekeeping and farming households to increase income for farmers and contribute to hunger eradication and poverty alleviation.Selective research to improve the quality of existing domestic and foreign bee varieties in Vietnam. Improve honey yield

+ Building and protecting the Vietnamese honey brand, especially against commercial fraud. Strengthening information and propaganda work so that people know about honey bee farming with plants, raise awareness as well as comply with laws and regulations on safe and sustainable livestock development.

CONCLUSION

The study on diversity of 4 orders Hymenoptera, Hemiptera, Lepidoptera and Coleoptera in the mountain region in the northeastern part of Vietnam with Eight field surveys were conducted in Tuyen Quang Ha Giang, Cao Bang, and Bac Kan provinces in the three years, from October 2018 to December 2021 show that:

- Recored 380 species of 32 families of 4 orders. Among them we have recorded orders Hymenoptera with 127 species of 50 genera 6 families; orders Hemiptera with 116 species of 69 genera 10 families; orders Coleoptera with 75 species of 42 genera 11 families and orders Lepidoptera with 59 species of 34 genera 7 families. In agricultural ecosystems (vegetable and fruit crops, food crops and forest trees), recored 172 species, among them 60 pests and 112 species of natural enemies

- Describe 5 new species, 15 species newly recorded for Vietnam fauna. Four species of the genus *Stenodyneriellus* Giordani Soika, 1962 are recorded from Vietnam. Of them, *S. capillus* Nguyen, new species from Bac Kan province is described and illustrated. In addition, one species, *S. similiguttulatus* Li & Chen, 2016 is newly recorded from Vietnam. A key to species from Vietnam is given.

- Orders Hymenoptera have the highest number of species with 100 species (26.32%) in Tuyen Quang, 95 species (25.00%) in Cao Bang, 71 species (18.68%) in Bac Kan and 61 species (16.05%) in Ha Giang. Next Orders Hemiptera have the number of species 89 species (23.42%) in Cao Bang, 84 species (22.11%) in Bac Kan and 83 species (21.84%) in Tuyen Quang. The lowest is the order Lepidoptera with 55 species (14.47%) in Cao Bang, 39 species (10.26%),34 species (8.95%), 25 species (6.58%) in Bac Kan, Tuyen Quang and Ha Giang respectively.

- Recorded in the higher montane evergreen forest and lower montane evergreen forest with 246 species of 31 families of 4 orders; Lowland evergreen forest and lowland semi-evergreen forest with 232 species of 31 families of 4 orders, The buffer zone (Ecosystem transitional buffer zone between forest, regenerated forests and agricultural ecosystems)

with 208 species of 30 families of 4 orders; Agricultural ecosystems focus on the important group of plants like fruit trees and industrial crops with 151 species of 30 families of 4 orders and Grassland with 166 species of 29 families of 4 orders

- Recorded in < 200m altitude with 279 species of 20 families of 4 orders, 200-500m altitude 216 species of 20 families of 4 orders, 500-1000m altitude 187 species of 28 families of 4 orders, 1000-1500m altitude 219 species of 30 families of 4 orders, >1500m altitude with 151 species of 18 families of 4 orders.

- Recorded 12 insect species of conservation value in the study area, 60 species pest were recorded on crops belonging to 3 main groups (vegetable and fruit crops, food crops and forest trees) belonging to 18 families; 2 species of mosquitoes that transmit dengue fever: *Aedes aegypti* (Linnaeus) and *Aedes albopictus* (Skuse), a Japanese mosquito *Culex tritaeniorhynchus* Giles, and a blood-sucking bug, *Triatoma rubrofasciatta* Dorh.

- 112 species of natural enemies on the plantations, in which species of the beetle order Coleoptera have the most recorded species (accounting for 35.05%), followed by the order Coleoptera. the other wing Heteroptera (23.71%) and the membranous order Hymenoptera (21.65%). The other 4 sets had a low rate of 2.06-9.28%; 5 species act as insects pollinate; 4 species of bees with high economic value were recorded at the study site, of which 3 species were exploited and eradicated (*Polistes olivaceus* (DeGeer), *Polistes strigosus* Bequaert and *Vespa affinis* (Linnaeus)); 15 species that were used as food for humans in the study site. There are 3 common species including *Apis cerana* (honey bee), *Apis mellifela* (Honey bees) and *Bombyx mori* (mulberry silkworm); 12 species were reported to be used as pharmaceuticals. There are 3 species: *Apis cerana* honey bee; Honey bees enter *Apis mellifela* and mulberry silkworm *Bombyx mori*.

- Determining the causes of resource degradation of 4 orders and proposing solutions to sustainably protect these insect resources: Unsustainable exploitation and use, Forest fire, Change of land use mode, Environmental pollution. Conservation of 4 orders Hymenoptera, Hemiptera, Lepidoptera and Coleoptera is the process of managing the interaction between humans and their genetic resources. In order to conserve the quality and effectively, it is necessary to minimize the main causes of the decline of the Apidae, Vespidae, Reduviidae, Coccinellidae, Papilionidae and Formicidae families in forest habitats in the limestone mountains of Northeast Vietnam.

Appendix 1: **List and distribution of the species of insect at study site in the mountainous region of Northern Vietnam**

No	Species name	Cao Bang	Bac Kan	Tuyen Quang	Ha Giang
	Order HYMENOPTERA				
I	**Family Apidae**				
1.	*Amegilla confuse* (Smith)	+		+	+
2.	*Amegilla himalajensis* (Radoszkowski)	+	+	+	+
3.	*Amegilla zonata* (Linnaeus)	+	+	+	+
4.	*Amegilla* sp.	+		+	+
5.	*Anthophora* sp.	+			+
6.	*Apis cerana* Fabricius	+	+	+	+
7.	*Apis dorsata* Fabricius	+			+
8.	*Apis florea* Fabricius	+	+	+	+
9.	*Apis laborisa* Smith	+			
10.	*Apis mellifera* (Linnaeus)	+	+	+	+
11.	*Bombus campestris* (Panzer)	+	+		+
12.	*Bombus eximus* Smith	+	+	+	
13.	*Bombus flavescens* Smith	+		+	
14.	*Bombus trifasciatus* Smith	+	+	+	
15.	*Bombus* sp.	+		+	
16.	*Ctenoplectra cornuta* Gribodo	+		+	
17.	*Elaphropoda khasiana* (Schulz)	+	+		+
18.	*Elaphropoda percarinata* (Cockerell)		+		+
19.	*Elaphropoda* sp.	+			+
20.	*Tetralonioidella wuae* Niu & Zhu	+			
21.	*Thyreus centrimacula* (Pérez)	+		+	+
22.	*Thyreus himalajensis* (Radoszkowski)	+	+	+	+
23.	*Ceratina hieroglyphica* Smith	+	+	+	
24.	*Ceratina collusor* Cockerell	+		+	
25.	*Ceratina simillima* Smith		+	+	
26.	*Ceratina sutepensis* Cockerell	+	+	+	+
27.	*Xylocopa latipes* (Drury)	+		+	
28.	*Xylocopa phalothorax* Lepeletier	+		+	
29.	*Xylocopa dejeanii* Lepeletier	+			
30.	*Xylocopa tenuiscapa* Westwood	+	+	+	+
31.	*Xylocopa tranquebarorum* (Swederus)	+	+	+	+
II	**Family Megachilidae**				

32.	*Coelioxys decipiens* Spinola		+	+	+
33.	*Euaspis polyensis* Vachal		+	+	+
34.	*Euaspis divercarinata Pasteels*	+		+	+
35.	*Heriades* sp.	+	+	+	+
36.	*Coelioxys capitate* Smith	+	+	+	
37.	*Coelioxys decipiens* Spinola	+		+	
38.	*Coelioxys sexmaculata* Cameron	+		+	+
39.	*Megachile subrixator* Cockerell	+		+	
40.	*Megachile conjuncta* Smith	+		+	
41.	*Megachile fluvovestita* Spinola	+	+	+	
42.	*Megachile trichorhytisma* Spinola	+		+	
43.	*Megachile umbripennis* Vachal	+		+	
III	**Family Chrysididae**			+	
44.	*Trichrysis aliciae* Wiśniowski	+		+	+
45.	*Trichrysis chamchuensis* Wiśniowski & Nguyen	+		+	+
46.	*Trichrysis kylan* Wiśniowski & Cuong	+		+	
47.	*Trichrysis raymundi* Wiśniowski.	+		+	
48.	*Nomia thoracica* Smith	+		+	+
IV	**Family Vespidae**				
49.	*Eustenogaster nigra* Saito & Nguyen	+	+	+	
50.	*Liostenogaster filicis* Turillazzi	+	+	+	
51.	*Polistes gigas* (Kirby)	+	+	+	+
52.	*Polistes olivaceus* (DeGeer)	+	+	+	
53.	*Polistes tenebricosus* Lepeletier	+	+	+	+
54.	*Polistes dawnae* Dover and Rao	+		+	+
55.	*Polistes delhiensis* Das and Gupta		+	+	+
56.	*Polistes brunetus* Nguyen & Kojima		+	+	+
57.	*Polistes clandestinus* Nguyen, Kojima & Saito	+		+	+
58.	*Polistes communalis* Nguyen, Vu & Carpenter		+	+	+
59.	*Polistes japonicus* de Saussure		+	+	+
60.	*Polistes mandarinus* de Saussure	+		+	
61.	*Polistes nigerrimus* Gusenleitner	+		+	
62.	*Polistes sagittarius* de Saussure	+		+	+
63.	*Polistes strigosus* Bequaert	+		+	
64.	*Polistes* sp.		+	+	
65.	*Ropalidia artifex* (de Saussure)	+		+	

66.	*Ropalidia bicolorata* van der Vecht	+		+	
67.	*Ropalidia m. magnanima* van der Vecht		+	+	
68.	*Ropalidia rufocollaris* (Cameron)	+	+	+	+
69.	*Ropalidia ornaticep* (Cameron)		+	+	+
70.	*Ropalidia stigma* (Smith)		+	+	
71.	*Parapolybia indica* (de Saussure)	+	+	+	
72.	*Parapolybia varia* (Fabricius)	+	+	+	+
73.	*Parapolybia* sp.		+		
74.	*Provespa barthelemyi* (du Buysson)	+			
75.	*Vespa affinis* (Linnaeus)	+	+	+	+
76.	*Vespa analis* Fabricius	+	+	+	+
77.	*Vespa basalis* Smith		+	+	
78.	*Vespa bicolor* Fabricius		+		
79.	*Vespa ducalis* Smith	+			+
80.	*Vespa soror* du Buysson	+			
81.	*Vespa tropica* (Linnaeus)	+		+	
82.	*Vespa velutina* Lepeletier	+	+	+	+
83.	*Allorhynchium argentatum* (Fabricius)	+		+	+
84.	*Anterhynchium flavomarginatum* (Smith)	+	+		
85.	*Antepipona biguttata* (Fabricius)	+			+
86.	*Caligaster himalayensis* (Cameron)	+		+	
87.	*Coeleumenes burmanicus* (Bingham)		+		+
88.	*Delta esuriens esuriens* (Fabricius)	+	+	+	
89.	*Delta pyriforme pyriforme* (Fabricius)	+	+	+	+
90.	*Ectopioglossa taiwana* (Sonan)	+		+	
91.	*Eumenes inconspicuus* Smith	+	+	+	
92.	*Euodynerus dantici* Giordani Soika	+		+	
93.	*Euodynerus nipanicus* Giordani Soika	+		+	+
94.	*Euodynerus trilobus* (Fabricius)	+		+	
95.	*Orancistrocerus erythropus* (Bingham)		+	+	
96.	*Pareumenes quadrispinosus acutus* Liu	+	+	+	
97.	*Phimenes flavopictus* (Zimmermann)		+	+	+
98.	*Rhynchium brunneum* (Fabricius)	+	+	+	
99.	*Stenodyneriellus capillus* Nguyen		+	+	+
100.	*Zethus angulatus* Nguyen & Carpenter		+		
V	**Family Pompilidae**				
101.	*Cyphononyx peregrinus* (Smith)	+	+	+	+
102.	*Dichelonyx madraspatanus* (Smith)	+	+		
103.	*Hemipepsis fenestrate* (Smith)	+		+	+

104.	*Leptodialepis bipartitus* Lepeletier				+
105.	*Leptodialepis suginarai* (Uchida)		+	+	
106.	*Macromerella honesta* (Smith)	+	+		
107.	*Colpacampsomeris indica* (de Saussure)		+	+	
108.	*Campsomeriella annulata* (Fabricius)			+	+
109.	*Phalerimeris phalerata* (de Saussure)			+	+
110.	*Megacampsomeris binghami* (Betrem)		+	+	
111.	*Megascolia azurea* (Betrem & Guiglia)		+		
112.	*Scolia binotata* Fabricius	+	+		+
113.	*Scolia cyanipennis* Fabricius	+			
VI	**Family Sphecidae**				
114.	*Isodontia aurifrons* (Smith)		+	+	+
115.	*Isodontia chrysorrhoea* (Kohl)	+	+	+	+
116.	*Prionyx viduatus* (Christ)	+	+		
117.	*Sphex argentutus* Fabricius		+		
118.	*Sphex sericeus* (Fabricius)			+	+
119.	*Sphex diabonicus* Smith			+	
120.	*Ammophila clavus* (Fabricius)		+		+
121.	*Ammophila laevigata* Smith	+			
122.	*Chlorion lobatum* (Fabricius)	+		+	+
123.	*Chalybion bengalense* (Dahlbom)	+	+	+	
124.	*Chalybion japonicum* (Gribodo)	+	+	+	
125.	*Chalybion malignum* (Kohl)	+	+	+	
126.	*Sceliphron madraspatanum* (Fabr.)	+	+	+	+
127.	*Sceliphron deforme* (Smith)	+		+	
	Order HEMIPTERA			+	
VII	**Family Coreidae**				
128.	*Cletus punctifer* Dallas		+	+	+
129.	*Leptocorisa acuta* Fabr.	+	+	+	
130.	*Leptocorisa varicornis* Fabr.	+	+	+	+
131.	*Riptotus pedestris* (Fabr.)	+	+		
132.	*Riptotus linearis* (Fabr.)	+	+	+	+
133.	*Riptotus parvus* Hsiao	+	+	+	+
134.	*Riptortus* sp.		+		
135.	*Serinetha abdominalis* Fabr.	+	+	+	+
VIII	**Family Pyrrhocoridae**				
136.	*Dysdercus cingulatus* Fabricius	+	+		+
VII	**Family Pentatomidae**				
137.	*Dalpada oculata* Fabricius	+	+	+	+

138.	*Erthesina fullo* Thunb.	+	+	+	
139.	*Nezara viridula* Linnaeus	+	+		
140.	*Tessaratoma papillosa* Drury	+	+	+	
141.	*Erthesina* sp.			+	+
142.	*Cazira verrucosa* Wertn	+	+	+	
143.	*Cazira verrucosa* Wertn	+	+	+	
144.	*Rhynchocoris* sp.		+	+	
IX	**Family Reduviidae**				
145.	*Astinus siamensis* Distant	+		+	
146.	*Biasticus confusus* Hsiao		+	+	+
147.	*Biasticus flavinotus* (Matsumura)	+			
148.	*Biasticus flavus* (Distant)		+	+	+
149.	*Coranus fuscipennis* Reuter	+	+	+	+
150.	*Endochus nigricornis* Stål		+		
151.	*Euagoras plagiatus* (Burmeister)		+	+	+
152.	*Isyndus reticulatus* Stål	+	+		
153.	*Rhynocoris fuscipes* (Fabricius)	+	+		
154.	*Rhynocoris marginellus* (Fabricius)	+	+	+	
155.	*Sphedanolestes impressicollis* (Stål)	+	+	+	+
156.	*Sycanus croceovittatus* Dohrn	+	+	+	+
157.	*Sycanus croceus* Hsiao	+	+	+	+
158.	*Sycanus falleni* Stål	+	+	+	+
159.	*Vesbius purpureus* (Thunberg)	+	+		+
160.	*Vesbius sanguinosus* Stål		+	+	
161.	*Velinus annulatus* Distant	+	+	+	
162.	*Velinus malayus* (Stål)	+	+	+	+
163.	*Velinus rufiventris* Hsiao	+		+	+
164.	*Villanovanus nigrorufus* Hsiao				
165.	*Ectrychotes andreae* (Thunberg)	+			
166.	*Ectrychotes comottoi* Lethierry		+	+	+
167.	*Ectrychotes lingnanensis* China	+	+		
168.	*Bayerus pilosus* Hsiao	+			+
169.	*Mendis rufus* Hsiao & Ren			+	+
170.	*Neozirta orientalis* Distant	+	+	+	+
171.	*Parascadra rubida* Hsiao	+	+	+	
172.	*Vilius melanopterus* Stål	+	+		
173.	*Sirthenea dimidiate* Horvath	+		+	
174.	*Sirthenea flavipes* (Stål)	+	+	+	+
175.	*Sirthenea nigra* Cai et Tomokuni	+	+	+	

176.	*Lestomerus affinis* (Serville)		+	+	
177.	*Peirates arcuatus* (Stal)	+	+	+	
178.	*Peirates. leptidoides* (Wolff)	+	+	+	+
179.	*Peirates atromaculatus* Stal			+	
180.	*Peirates turpis* Walker			+	+
181.	*Ectomocoris atrox* (Stål)	+			
182.	*Ectomocoris elegans* (Fabricius)			+	+
183.	*Ectomocoris yunnanensis* Ren	+			
184.	*Ectomocoris biguttulus* Stal	+	+		
185.	*Acanthaspis geniculata* Hsiao		+	+	+
186.	*Acanthaspis subinermis* Hsiao	+	+		+
187.	*Acanthaspis ruficeps* Hsiao	+	+		
188.	*Gerbelius typicus* Distant	+	+	+	+
189.	*Brachytonus nigripes* Hsiao		+		
190.	*Durganda rubra* Amyot & Serville	+			
191.	*Reduvius tenebrosus* (Stal)			+	
192.	*Reduvius decliviceps* Hsiao	+		+	
193.	*Tapeinus singularis* (Walker)	+	+	+	+
194.	*Polytoxus femoralis* Distant	+	+	+	
195.	*Polytoxus ruficeps* Hsiao	+	+	+	+
196.	*Polytoxus rufinervis* Hsiao	+		+	
197.	*Lisarda pilosa* Hsiao		+	+	+
198.	*Lisarda spinosa* Hsiao	+	+	+	
199.	*Lisarda uniformis* Distant		+	+	+
200.	*Lisarda rhypara* Stål	+		+	
201.	*Petalocheirus spinosissimus* Distant	+		+	
202.	*Valentia hoffmanni* China	+	+	+	+
203.	*Aulacogenia corniculata* Stål	+	+		
204.	*Canthesancus geniculatus* Distant	+	+	+	+
205.	*Canthesancus helluo* Stål	+	+	+	+
206.	*Oncocephalus pudicus* Hsiao		+		+
207.	*Oncocephalus scutellaris* Reuter	+		+	+
208.	*Oncocephalus lineosus* Distant	+		+	
209.	*Oncocephalus fasciatus* Reuter	+			
210.	*Staccia diluta* (Stål)	+		+	
211.	*Staccia plebeja* Stål	+	+	+	+
212.	*Sastrapada baerensprungi* (Stål)	+	+	+	+
213.	*Pygolampis angusta* Hsiao	+	+	+	
214.	*Pygolampis biguttata* Reuter		+		

215.	*Pygolampis longipes* Hsiao	+			+
216.	*Pygolampis rufescens* Hsiao	+	+		
217.	*Triatoma rubrofasciata* (De Geer)			+	
218.	*Opistoplatys mustela* Miller	+		+	+
219.	*Opistoplatys perakensis* Miller	+		+	+
220.	*Opistoplatys majusculus* Distant		+	+	
221.	*Ploiaria glabella* Wygodzinsky	+			+
X	**Family Cicadellidae**				
222.	*Deltocephalus dorsalis* Motsch.	+	+		
223.	*Deltocephalus oryzae* Motsch.	+	+		+
224.	*Empoasca flavescens* (Fabr.)		+	+	+
225.	*Erythroneura subrufa* (Motsch.)	+		+	+
226.	*Nephotettix apicalis* (Motsch.)	+	+	+	
227.	*Nephotettix bipunctatus* (Fabr.)		+		
XI	**Family Cicadidae**				
228.	*Huechys sanguinae* (Geer)	+	+	+	+
XII	**Family Fulgoridae**				
229.	*Pyrops candelaria* (Linnaeus)	+	+	+	
230.	*Huechys sanguinae* Degeer	+		+	
231.	*Huechys beata* Distant	+	+	+	+
232.	*Meimuna* sp1.	+		+	
233.	*Neotanna* sp1.	+		+	+
XIII	**Family Corixidae**				
234.	*Agraptocorixa hyalinipennis* (Fabricius)	+	+	+	+
235.	*Micronecta quadristrigata* Breddin	+	+		
236.	*Sigara septemlineala* (Paiva)	+	+		
XIV	**Family Nepidae**				
237.	*Cercotmetus asiaticus* Amyot & Serville	+	+		+
238.	*Ranatra gracilis* Dallas		+		
239.	*Ranatra varipes* Stal		+	+	+
	Family Naucoridae				
240.	*Ctenipocoris asiaticus* Montandon	+	+		
241.	*Gestroiella limnocoroides* Montandon	+	+	+	
242.	*Gestroiella* sp.	+	+	+	
243.	*Naucoris scutellaris* Stal	+	+	+	+
244.	*Heleocoris strabus* Montandon	+	+	+	
	Order COLEOPTERA				
XV	**Family Carabidae**				
245.	*Ophinea indica* (Thun.)	+	+	+	+

246.	*Stenolophus smaragdulus* (Fabricius)		+	+	
247.	*Chlaenius circumdatus* Brulle	+	+	+	+
248.	*Chlaenius costiger* Chau.	+		+	
249.	*Chlaenius inops* Chaudoir	+	+	+	+
250.	*Chlaenius nigricans* Wied.	+	+		
251.	*Chlaenius* sp1.	+		+	+
XVI	**Family Chrysomelidae**				
252.	*Aspidomorpha miliaris* (Fabricius)	+	+		
253.	*Aspidomorpha sanctaecrucis* (Fabricius)		+	+	+
254.	*Aulacophora bicolor* (Web.)	+	+		
255.	*Lema coromandeliana* (Fabricius)	+	+		
256.	*Altica cyanea* (Web.)	+		+	
257.	*Aspidomorpha miliaris* (Fabr.)	+	+	+	+
258.	*Dactylispa lameyi* Uhmann	+	+	+	+
259.	*Dicladispa armigera* Weise	+	+	+	
260.	*Lema cyanea* Fabricius	+	+		
261.	*Lilioceris discrepans* (Baly)	+	+		+
XVII	**Family Curculionidae**				
262.	*Aplotes roelofsi* (Chevrolat)	+	+	+	
263.	*Hypomeces squamosus* Fabricius	+		+	+
264.	*Mecopomorphus griseus* Hustache		+	+	+
265.	*Platymycterus sieversi* Reutter	+			
266.	*Cossonus* sp1.	+	+		
267.	*Phytoscaphus triangularis* Olivier	+	+	+	+
268.	*Syscerus* sp1.	+	+		
XVIII	***Family Lucanidae***				
269.	*Aegus chelifer* MacLeay	+	+	+	+
270.	*Dorcus curvidens* (Hope)		+	+	+
271.	*Neolucanus sinicus* (Saunders)	+	+	+	
XIX	**Family Coccinellidae**				
272.	*Coccinella septempunctata* (Fabricius)	+	+	+	+
273.	*Coccinella transversalis* Fabricius	+	+	+	+
274.	*Harmonia sedecimnotata* (Fabricius)	+	+	+	+
275.	*Hasmonia octomaculata* Fabricius		+	+	+
276.	*Lemnia biplagiata* (Swartz)	+	+	+	+
277.	*Lemnia bissellata* (Mulsant)	+		+	+
278.	*Menochilus sexmaculatus* (Fabricius)	+	+	+	+
279.	*Micraspis discolor* (Fabricius)	+	+	+	+
280.	*Phrynocaria congener* (Billberg)		+	+	

281.	*Phymatosternus lewisii* (Crotch)	+		+	
282.	*Propylea japonica* (Thunb.)	+			
283.	*Melanotus legatus*	+	+		
XX	**Family Cicindelidae**			+	+
284.	*Cicindela kaleea* Bates	+	+		+
285.	*Cicindela aurulenta*	+			
286.	*Neocollyris juscitarsis* (Schm.-Goeb.)	+	+	+	+
XXI	**Family Meloidae**				
287.	*Mylabris cichorii* Linnaeus	+	+	+	+
XXII	**Family Scarabaeidae**			+	
288.	*Oryctes rhinoceros* Linnaeus	+	+	+	
289.	*Lepidiota amoena* Felche		+	+	+
290.	*Melolontha alboplagiata* Brenske		+	+	
291.	*Jumnos ruckeri* Saunders	+	+		
292.	*Sophrops simplex* Frey	+	+	+	
293.	*Adoretus convexus* Burmeister	+	+	+	+
294.	*Anomala antiqua* Gyllenhal	+	+	+	
295.	*Mimela splendens* Gyllenhal	+		+	+
296.	*Catharsius javanus* Lansberge	+	+		
297.	*Onitis falcatus* Wulfen	+	+	+	
298.	*Onthophagus laevis* Harold	+		+	+
299.	*Onthophagus lunatus* Harold	+	+		
300.	*Onitis falcatus* Wulfen	+	+	+	+
301.	*Onitis lama* Lanbsberge	+	+	+	+
302.	*Onthophagus laevis* Harold		+		
303.	*Onthophagus rectecornutus* Lansb.	+		+	+
304.	*Onthophagus sasaji* Ochi & Kon	+			+
305.	*Onthophagus* sp.	+	+		
XXIII	**Family Cerambycidae**				
306.	*Alidus biplagiatus*	+	+	+	+
307.	*Anoplophora macularia* Thunberg	+	+	+	+
308.	*Apriona germari*	+	+	+	
309.	*Batocera lineolata*	+	+		
310.	*Batocera* sp1.	+			+
311.	*Chelodenium* sp1.	+			
312.	*Mesosa* sp1.			+	
XXIV	**Family Hydrophilidae**				
313.	*Cercyon incretus* Orchymont	+	+	+	+
314.	*Pachysternum apicatum* Motschulsky	+	+		

315.	*Pachysternum nigrovittatum* Motschulsky	+	+		
316.	*Peltocercyon* sp.	+	+	+	+
317.	*Sternolophus rufipes* (Fabricius, 1792)	+			
XXV	**Family Mordellidae**				
318.	*Glipa rectefasciata* Pic	+	+	+	+
319.	*Variimorda shiyakei* Horák	+	+	+	+
320.	*Falsomordellina luteoloides* (Nomura)	+	+	+	
	Order LEPIDOPTERA				
XXVI	***Family Papilionidae***				
321.	*Graphium antiphates* (Cramer)	+		+	+
322.	*Graphium agamemnon* (Linn.)	+	+	+	
323.	*Menelaides memnon* Linnaeus	+	+	+	
324.	*Papilio arcturus* Westwood		+	+	
325.	*Papilio memnon* Linnaeus			+	+
326.	*Papilio nephelus* Boiduval	+		+	
327.	*Papilio noblei noilei* de Nice.	+		+	+
328.	*Papilio paris* Linnaeus		+		
329.	*Papilio polytes* Linnaeus	+	+	+	+
330.	*Troides aeacus* (L. & Felder)	+			
331.	*Troides helena cerberus* Felder	+			
332.	*Lamproptera curius* (Fabricius)	+	+	+	+
333.	*Byasa crassipes* (Oberthur)	+			+
XXVII	**Family Pieridae**				
334.	*Artogeia canidia* Sparrman	+		+	+
335.	*Catopsilia pomona* (Fabricius)	+	+		
336.	*Cepora nerissa* (Fabricius)	+	+		
337.	*Eurema blanda* (Boiduval)	+		+	
338.	*Hebomoia glaucippe* (Linnaeus)	+	+	+	
339.	*Pieris brassicae* (Linnaeus)	+	+	+	+
340.	*Delias belladonna* (Fabricius)	+		+	
XXVIII	**Family Nymphalidae**			+	
341.	*Amathusidia amythaon* Drury	+	+	+	
342.	*Ariadne ariadne* (Linnaeus)	+	+	+	+
343.	*Cethosia biblis* (Drury)	+		+	
344.	*Cyrestis thyodamas* (Fabricius)	+		+	+
345.	*Kallima inachus* (Doyere)	+	+		
346.	*Doleschallia bisaltide* Drury	+	+	+	
347.	*Polyura athamas* (Drury)		+	+	+
348.	*Euthalia lubentina* (Cramer)	+	+		+

XXIX	**Family Danaidae**				
349.	*Danaus genutia* (Cramer)	+	+	+	+
350.	*Ideopsis vulgaris* Butler	+	+		+
351.	*Parantica aglea* (Stoll)	+			
352.	*Euploea core* (Cramer)	+	+		+
353.	*Euploea eunice* Godart	+	+		
354.	*Parantica aglea* (Stoll)	+		+	
355.	*Parantica melaneus* (Cramer)	+	+		+
356.	*Parantica sita* (Kolla)	+		+	
357.	*Tirumala limniace* (Cramer)	+	+		+
XXX	**Family Noctuidae**				
358.	*Heliothis armigera* Hubn.	+	+		
359.	*Spodoptera litura* (Fabricius, 1775)	+	+	+	
360.	*Agrotis ipsilon* Rott	+	+		+
XXXI	**Family Sphingidae**				
361.	*Ambulyx sericeipennis* Linnaeus	+	+		
362.	*Cechenena lineosa* (Walker)		+	+	
363.	*Cechenena minor* Butter	+		+	+
364.	*Megacorma obliqua* (Fabricius)	+	+		+
365.	*Theretra alecto* Linnaeus	+	+	+	
366.	*Theretra clotho* Drury.	+	+		+
367.	*Theretra silhetensis* Walker	+	+	+	
368.	*Macroglossum pyrrhosticta* Butler	+	+	+	
369.	*Theretra nessus* Drury	+	+		+
370.	*Theretra latreillii* Walker	+		+	
371.	*Megacorma obliqua (Walker)*	+		+	
372.	*Ambulux* sp.	+	+	+	
373.	*Clanis* sp.	+	+		+
374.	*Opistoclanis* sp.	+	+		+
375.	*Polyptychus* sp.	+			+
376.	*Eupanacra* sp.	+	+		
377.	*Amplypterus panopus* (Cramer)	+			
XXXII	**Family Lycaenidae**				
378.	*Heliophorus* sp1.	+		+	
379.	*Miletus chinensis* Felder	+	+		
380.	*Spindasis syama* (Horsfield)	+	+		

Appendix 2: **List of the species of insect at habitat in the mountainous region of Northern Vietnam**

No	Species name	Habitat				
		EM	**SF**	**ES**	**AE**	**GL**
	Order HYMENOPTERA					
I	**Family Apidae**					
1.	*Amegilla confuse* (Smith)	+	+		+	
2.	*Amegilla himalajensis* (Radoszkowski)	+	+	+	+	+
3.	*Amegilla zonata* (Linnaeus)	+	+	+	+	+
4.	*Anthophora* sp.	+			+	
5.	*Apis cerana* Fabricius	+	+	+	+	+
6.	*Apis dorsata* Fabricius	+			+	
7.	*Apis florea* Fabricius	+	+	+	+	+
8.	*Apis laborisa* Smith	+				
9.	*Apis mellifera* (Linnaeus)	+	+	+	+	+
10.	*Bombus campestris* (Panzer)	+		+	+	
11.	*Bombus eximus* Smith	+	+	+		+
12.	*Bombus flavescens* Smith	+	+			
13.	*Bombus trifasciatus* Smith	+	+	+		+
14.	*Ctenoplectra cornuta* Gribodo	+	+			
15.	*Elaphropoda khasiana* (Schulz)	+		+	+	
16.	*Elaphropoda percarinata* (Cockerell)			+	+	+
17.	*Tetralonioidella wuae* Niu & Zhu	+				+
18.	*Thyreus centrimacula* (Pérez)	+	+		+	+
19.	*Thyreus himalajensis* (Radoszkowski)	+	+	+	+	
20.	*Ceratina hieroglyphica* Smith	+	+	+		
21.	*Xylocopa bryorum* (Fabricius)	+	+			+
22.	*Xylocopa caerulea* (Fabricius)		+	+		
23.	*Xylocopa dejeanii* Lepeletier	+	+	+	+	+
24.	*Xylocopa latipes* (Drury)	+	+			
25.	*Xylocopa phalothorax* Lepeletier	+	+			+
26.	*Xylocopa ruficornis* Fabricius	+				+
27.	*Xylocopa tenuiscapa* Westwood	+	+	+	+	+
28.	*Xylocopa tranquebarorum* (Swederus)	+	+	+	+	
II	**Family Megachilidae**					
29.	*Coelioxys decipiens* Spinola		+	+	+	

30.	*Euaspis polyensis* Vachal		+	+	+	
31.	*Euaspis divercarinata Pasteels*	+	+	+		
32.	*Coelioxys capitate* Smith	+	+			
33.	*Coelioxys decipiens* Spinola	+	+			+
34.	*Coelioxys sexmaculata* Cameron	+	+			+
35.	*Megachile subrixator* Cockerell	+	+	+		
36.	*Megachile conjuncta* Smith	+	+			
37.	*Megachile fluvovestita* Spinola	+	+			+
III	**Family Halictidae**					
38.	*Nomia curvipes* (Fabricius)	+	+		+	+
39.	*Nomia incerta* Gribodo	+	+		+	
40.	*Nomia iridescens* Smith	+	+			+
41.	*Nomia terminata* Smith	+	+			+
42.	*Nomia thoracica* Smith	+	+		+	+
IV	**Family Vespidae**					
43.	*Eustenogaster nigra* Saito & Nguyen	+	+	+		+
44.	*Liostenogaster filicis* Turillazzi	+	+	+		
45.	*Polistes gigas* (Kirby)	+	+	+	+	
46.	*Polistes olivaceus* (DeGeer)	+	+	+		+
47.	*Polistes tenebricosus* Lepeletier	+	+	+	+	+
48.	*Polistes dawnae* Dover and Rao	+	+		+	
49.	*Polistes delhiensis* Das and Gupta		+	+	+	
50.	*Polistes brunetus* Nguyen & Kojima		+	+	+	
51.	*Polistes clandestinus* Nguyen, Kojima & Saito	+	+		+	
52.	*Polistes communalis* Nguyen, Vu & Carpenter		+	+	+	+
53.	*Polistes japonicus* de Saussure		+	+	+	+
54.	*Polistes mandarinus* de Saussure	+	+			
55.	*Polistes nigerrimus* Gusenleitner	+	+			
56.	*Polistes sagittarius* de Saussure	+	+		+	+
57.	*Polistes strigosus* Bequaert	+	+			
58.	*Polistes* sp.		+	+		+
59.	*Ropalidia artifex* (de Saussure)	+	+			
60.	*Ropalidia bicolorata* van der Vecht	+	+			+
61.	*Ropalidia m. magnanima* van der Vecht		+	+		+
62.	*Ropalidia rufocollaris* (Cameron)	+	+	+	+	+
63.	*Ropalidia ornaticep* (Cameron)		+	+	+	

64.	*Ropalidia stigma* (Smith)		+	+		+
65.	*Parapolybia indica* (de Saussure)	+	+	+		
66.	*Parapolybia varia* (Fabricius)	+	+	+	+	
67.	*Provespa barthelemyi* (du Buysson)	+				+
68.	*Vespa affinis* (Linnaeus)	+	+	+	+	
69.	*Vespa analis* Fabricius	+	+	+	+	
70.	*Vespa basalis* Smith		+	+		+
71.	*Vespa bicolor* Fabricius			+		+
72.	*Vespa ducalis* Smith	+			+	
73.	*Vespa soror* du Buysson	+				
74.	*Vespa tropica* (Linnaeus)	+	+			+
75.	*Vespa velutina* Lepeletier	+	+	+	+	
76.	*Allorhynchium argentatum* (Fabricius)	+	+		+	+
77.	*Anterhynchium flavomarginatum* (Smith)	+		+		
78.	*Antepipona biguttata* (Fabricius)	+			+	+
79.	*Caligaster himalayensis* (Cameron)	+	+			
80.	*Coeleumenes burmanicus* (Bingham)			+	+	
81.	*Delta esuriens esuriens* (Fabricius)	+	+	+		
82.	*Delta pyriforme pyriforme* (Fabricius)	+	+	+	+	+
83.	*Ectopioglossa keiseri* van der Vecht	+	+			
84.	*Eumenes inconspicuus* Smith	+	+	+		
85.	*Euodynerus dantici* Giordani Soika	+	+			+
86.	*Euodynerus nipanicus* Giordani Soika	+	+		+	+
87.	*Euodynerus trilobus* (Fabricius)	+	+			
88.	*Orancistrocerus erythropus* (Bingham)		+	+		
89.	*Pareumenes quadrispinosus acutus* Liu	+	+	+		
90.	*Phimenes flavopictus* (Zimmermann)		+	+	+	
91.	*Rhynchium brunneum* (Fabricius)	+	+	+		
92.	*Stenodyneriellus capillus* Nguyen		+	+	+	
93.	*Zethus angulatus* Nguyen & Carpenter			+		
V	**Family Pompilidae**					
94.	*Cyphononyx peregrinus* (Smith)	+	+	+	+	+
95.	*Dichelonyx madraspatanus* (Smith)	+		+		+
96.	*Hemipepsis fenestrate* (Smith)	+	+		+	
97.	*Leptodialepis bipartitus* Lepeletier				+	
98.	*Leptodialepis suginarai* (Uchida)		+	+		+

99.	*Macromerella honesta* (Smith)	+		+		
100.	*Colpacampsomeris indica* (de Saussure)		+	+		+
101.	*Campsomeriella annulata* (Fabricius)		+		+	
102.	*Phalerimeris phalerata* (de Saussure)		+		+	+
103.	*Megacampsomeris binghami* (Betrem)		+	+		+
104.	*Megascolia azurea* (Betrem & Guiglia)			+		+
105.	*Scolia binotata* Fabricius	+		+	+	
106.	*Scolia cyanipennis* Fabricius	+				+
VI	**Family Sphecidae**					
107.	*Isodontia aurifrons* (Smith)		+	+	+	+
108.	*Isodontia chrysorrhoea* (Kohl)	+	+	+	+	+
109.	*Prionyx viduatus* (Christ)	+		+		
110.	*Sphex argentutus* Fabricius			+		
111.	*Sphex sericeus* (Fabricius)		+		+	+
112.	*Sphex diabonicus* Smith		+			
113.	*Ammophila clavus* (Fabricius)			+	+	+
114.	*Ammophila laevigata* Smith	+				
115.	*Chlorion lobatum* (Fabricius)	+	+		+	+
116.	*Chalybion bengalense* (Dahlbom)	+	+	+		+
117.	*Chalybion japonicum* (Gribodo)	+	+	+		+
118.	*Chalybion malignum* (Kohl)	+	+	+		
119.	*Sceliphron madraspatanum* (Fabr.)	+	+	+	+	+
120.	*Sceliphron deforme* (Smith)	+	+			
	Order HEMIPTERA		+			
VII	**Family Coreidae**					+
121.	*Cletus punctifer* Dallas		+	+	+	+
122.	*Leptocorisa acuta* Fabr.	+	+	+		
123.	*Leptocorisa varicornis* Fabr.	+	+	+	+	
124.	*Riptotus pedestris* (Fabr.)	+		+		+
125.	*Riptotus linearis* (Fabr.)	+	+	+	+	+
126.	*Riptotus parvus* Hsiao	+	+	+	+	
127.	*Serinetha abdominalis* Fabr.	+	+	+	+	+
VIII	**Family Pentatomidae**					
128.	*Dalpada oculata* Fabricius	+	+	+	+	+
129.	*Erthesina fullo* Thunb.	+	+	+		

130.	*Nezara viridula* Linnaeus	+		+		+
131.	*Tessaratoma papillosa* Drury	+	+	+		+
132.	*Erthesina fullo* Thunb.		+		+	+
133.	*Cazira verrucosa* Wertn	+	+	+		
134.	*Cazira verrucosa* Wertn	+	+	+		+
135.	*Rhynchocoris* sp.		+	+		
IX	**Family Reduviidae**					
136.	*Astinus siamensis* Distant	+	+			+
137.	*Biasticus confusus* Hsiao		+	+	+	+
138.	*Biasticus flavinotus* (Matsumura)	+				+
139.	*Biasticus flavus* (Distant)		+	+	+	+
140.	*Coranus fuscipennis* Reuter	+	+	+	+	
141.	*Endochus nigricornis* Stål			+		+
142.	*Euagoras plagiatus* (Burmeister)		+	+	+	+
143.	*Isyndus reticulatus* Stål	+		+		
144.	*Rhynocoris fuscipes* (Fabricius)	+		+		+
145.	*Rhynocoris marginellus* (Fabricius)	+	+	+		
146.	*Sphedanolestes impressicollis* (Stål)	+	+	+	+	
147.	*Sycanus croceovittatus* Dohrn	+	+	+	+	+
148.	*Sycanus croceus* Hsiao	+	+	+	+	+
149.	*Sycanus falleni* Stål	+	+	+	+	+
150.	*Vesbius purpureus* (Thunberg)	+		+	+	+
151.	*Vesbius sanguinosus* Stål		+	+		+
152.	*Velinus annulatus* Distant	+	+	+		
153.	*Velinus malayus* (Stål)	+	+	+	+	+
154.	*Velinus rufiventris* Hsiao	+	+		+	+
155.	*Villanovanus nigrorufus* Hsiao					+
156.	*Ectrychotes andreae* (Thunberg)	+				+
157.	*Ectrychotes comottoi* Lethierry		+	+	+	
158.	*Ectrychotes lingnanensis* China	+		+		
159.	*Bayerus pilosus* Hsiao	+			+	+
160.	*Mendis rufus* Hsiao & Ren		+		+	
161.	*Neozirta orientalis* Distant	+	+	+	+	
162.	*Parascadra rubida* Hsiao	+	+	+		+
163.	*Vilius melanopterus* Stål	+		+		+
164.	*Sirthenea dimidiate* Horvath	+	+			+
165.	*Sirthenea flavipes* (Stål)	+	+	+	+	
166.	*Sirthenea nigra* Cai et Tomokuni	+	+	+		+
167.	*Lestomerus affinis* (Serville)		+	+		+

168.	*Peirates arcuatus* (Stal)	+	+	+		+
169.	*Peirates. leptidoides* (Wolff)	+	+	+	+	+
170.	*Peirates atromaculatus* Stal		+			+
171.	*Peirates turpis* Walker		+		+	+
172.	*Ectomocoris atrox* (Stål)	+				+
173.	*Ectomocoris elegans* (Fabricius)		+		+	+
174.	*Ectomocoris yunnanensis* Ren	+				
175.	*Ectomocoris biguttulus* Stal	+		+		+
176.	*Acanthaspis geniculata* Hsiao		+	+	+	
177.	*Acanthaspis subinermis* Hsiao	+		+	+	
178.	*Acanthaspis ruficeps* Hsiao	+		+		+
179.	*Gerbelius typicus* Distant	+	+	+	+	
180.	*Brachytonus nigripes* Hsiao			+		
181.	*Durganda rubra* Amyot & Serville	+				+
182.	*Reduvius tenebrosus* (Stal)		+			
183.	*Reduvius decliviceps* Hsiao	+	+			
184.	*Tapeinus singularis* (Walker)	+	+	+	+	+
185.	*Polytoxus femoralis* Distant	+	+	+		+
186.	*Polytoxus ruficeps* Hsiao	+	+	+	+	+
187.	*Polytoxus rufinervis* Hsiao	+	+			+
188.	*Lisarda pilosa* Hsiao		+	+	+	+
189.	*Lisarda spinosa* Hsiao	+	+	+		+
190.	*Lisarda uniformis* Distant		+	+	+	+
191.	*Lisarda rhypara* Stål	+	+			+
192.	*Petalocheirus spinosissimus* Distant	+	+			+
193.	*Valentia hoffmanni* China	+	+	+	+	+
194.	*Aulacogenia corniculata* Stål	+		+		+
195.	*Canthesancus geniculatus* Distant	+	+	+	+	+
196.	*Canthesancus helluo* Stål	+	+	+	+	
197.	*Oncocephalus pudicus* Hsiao			+	+	+
198.	*Oncocephalus scutellaris* Reuter	+	+		+	+
199.	*Oncocephalus lineosus* Distant	+	+			
200.	*Oncocephalus fasciatus* Reuter	+				+
201.	*Staccia diluta* (Stål)	+	+			+
202.	*Staccia plebeja* Stål	+	+	+	+	
203.	*Sastrapada baerensprungi* (Stål)	+	+	+	+	+
204.	*Pygolampis angusta* Hsiao	+	+	+		+
205.	*Pygolampis biguttata* Reuter			+		+
206.	*Pygolampis longipes* Hsiao	+			+	+

207.	*Pygolampis rufescens* Hsiao	+		+		
208.	*Triatoma rubrofasciata* (De Geer)		+			
209.	*Opistoplatys mustela* Miller	+	+		+	
210.	*Opistoplatys perakensis* Miller	+	+		+	+
211.	*Opistoplatys majusculus* Distant		+	+		+
212.	*Ploiaria glabella* Wygodzinsky	+			+	+
X	**Family Cicadellidae**					
213.	*Deltocephalus dorsalis* Motsch.	+		+		+
214.	*Deltocephalus oryzae* Motsch.	+		+	+	+
215.	*Empoasca flavescens* (Fabr.)		+	+	+	
216.	*Erythroneura subrufa* (Motsch.)	+	+		+	+
217.	*Nephotettix apicalis* (Motsch.)	+	+	+		+
218.	*Nephotettix bipunctatus* (Fabr.)			+		
	Order COLEOPTERA					
XI	**Family Carabidae**					
219.	*Ophinea indica* (Thun.)	+	+	+	+	
220.	*Stenolophus smaragdulus* (Fabricius)		+	+		+
221.	*Chlaenius circumdatus* Brulle	+	+	+	+	+
222.	*Chlaenius costiger* Chau.	+	+			+
223.	*Chlaenius inops* Chaudoir	+	+	+	+	+
224.	*Chlaenius nigricans* Wied.	+		+		+
XII	**Family Chrysomelidae**					
225.	*Aspidomorpha miliaris* (Fabricius)	+		+		+
226.	*Aspidomorpha sanctaecrucis* (Fabricius)		+	+	+	+
227.	*Aulacophora bicolor* (Web.)	+		+		+
228.	*Lema coromandeliana* (Fabricius)	+		+		
229.	*Altica cyanea* (Web.)	+	+			
230.	*Aspidomorpha miliaris* (Fabr.)	+	+	+	+	+
231.	*Dactylispa lameyi* Uhmann	+	+	+	+	
232.	*Dicladispa armigera* Weise	+	+	+		
233.	*Lema cyanea* Fabricius	+		+		+
234.	*Lilioceris discrepans* (Baly)	+		+	+	+
XIII	**Family Curculionidae**					
235.	*Aplotes roelofsi* (Chevrolat)	+	+	+		
236.	*Hypomeces squamosus* Fabricius	+	+		+	+
237.	*Mecopomorphus griseus* Hustache		+	+	+	+
238.	*Platymycterus sieversi* Reutter	+				+
239.	*Phytoscaphus triangularis* Olivier	+	+	+	+	+

XIV	**Family Coccinellidae**					+
240.	*Coccinella septempunctata* (Fabricius)	+	+	+	+	+
241.	*Coccinella transversalis* Fabricius	+	+	+	+	
242.	*Harmonia sedecimnotata* (Fabricius)	+	+	+	+	+
243.	*Hasmonia octomaculata* Fabricius		+	+	+	
244.	*Lemnia biplagiata* (Swartz)	+	+	+	+	
245.	*Lemnia bissellata* (Mulsant)	+	+		+	+
246.	*Menochilus sexmaculatus* (Fabricius)	+	+	+	+	
247.	*Micraspis discolor* (Fabricius)	+	+	+	+	
248.	*Phrynocaria congener* (Billberg)		+	+		+
249.	*Phymatosternus lewisii* (Crotch)	+	+			
250.	*Propylea japonica* (Thunb.)	+				
251.	*Melanotus legatus*	+		+		+
XV	**Family Scarabaeidae**		+			+
252.	*Oryctes rhinoceros* Linnaeus	+	+	+		+
253.	*Lepidiota amoena* Felche		+	+	+	
254.	*Melolontha alboplagiata* Brenske		+	+		
255.	*Sophrops simplex* Frey	+	+	+		
256.	*Adoretus convexus* Burmeister	+	+	+	+	
257.	*Anomala antiqua* Gyllenhal	+	+	+		+
258.	*Mimela splendens* Gyllenhal	+	+		+	+
259.	*Catharsius javanus* Lansberge	+		+		
260.	*Onitis falcatus* Wulfen	+	+	+		
261.	*Onthophagus laevis* Harold	+	+		+	
262.	*Onthophagus lunatus* Harold	+		+		+
263.	*Onitis falcatus* Wulfen	+	+	+	+	+
264.	*Onitis lama* Lanbsberge	+	+	+	+	
265.	*Onthophagus laevis* Harold			+		+
266.	*Onthophagus rectecornutus* Lansb.	+	+		+	+
267.	*Onthophagus sasaji* Ochi & Kon	+			+	
XVI	**Family Cerambycidae**					+
268.	*Alidus biplagiatus*	+	+	+	+	+
269.	*Anoplophora macularia* Thunberg	+	+	+	+	+
270.	*Apriona germari*	+	+	+		
271.	*Batocera lineolata*	+		+		
	Order LEPIDOPTERA					
XVII	***Family Papilionidae***					
272.	*Graphium agamemnon* (Linnaeus)	+	+		+	

273.	*Menelaides memnon* Linnaeus	+	+	+		
274.	*Papilio helenus* Linnaeus		+	+		
275.	*Papilio memnon* Linnaeus		+		+	+
276.	*Papilio nephelus* Boiduval	+	+			
277.	*Papilio noblei noilei* de Nice.	+	+		+	
278.	*Papilio paris* Linnaeus			+		
279.	*Papilio polytes* Linnaeus	+	+	+	+	+
280.	*Troides aeacus* (L. & Felder)	+				+
281.	*Troides helena cerberus* Felder	+				
282.	*Lamproptera curius* (Fabricius)	+	+	+	+	
XVIII	**Family Pieridae**					
283.	*Artogeia canidia* Sparrman	+	+		+	
284.	*Catopsilia pomona* (Fabricius)	+		+		+
285.	*Cepora nerissa* (Fabricius)	+		+		+
286.	*Eurema blanda* (Boiduval)	+	+			
287.	*Hebomoia glaucippe* (Linnaeus)	+	+	+		+
288.	*Pieris brassicae* (Linnaeus)	+	+	+	+	+
289.	*Delias belladonna* (Fabricius)	+	+			
XIX	**Family Nymphalidae**		+			
290.	*Amathusidia amythaon* Drury	+	+	+		
291.	*Ariadne ariadne* (Linnaeus)	+	+	+	+	
292.	*Cethosia biblis* (Drury)	+	+			
293.	*Cyrestis thyodamas* (Fabricius)	+	+		+	
294.	*Cyrestis cocles* (Fabricius)	+		+		
295.	*Doleschallia bisaltide* Drury	+	+	+		
296.	*Polyura athamas* (Drury)		+	+	+	
297.	*Euthalia lubentina* (Cramer)	+		+	+	
XX	**Family Danaidae**					
298.	*Danaus genutia* (Cramer)	+	+	+	+	+
299.	*Ideopsis vulgaris* Butler	+		+	+	
300.	*Parantica aglea* (Stoll)	+				
301.	*Euploea core* (Cramer)	+		+	+	
302.	*Euploea eunice* Godart	+		+		
303.	*Parantica aglea* (Stoll)	+	+			
304.	*Parantica melaneus* (Cramer)	+		+	+	+
305.	*Parantica sita* (Kolla)	+	+			
306.	*Tirumala limniace* (Cramer)	+		+	+	
XXI	**Family Sphingidae**					
307.	*Ambulyx sericeipennis* Linnaeus	+		+		

308.	*Cechenena lineosa* (Walker)		+	+		
309.	*Cechenena minor* Butter	+	+		+	
310.	*Megacorma obliqua* (Fabricius)	+		+	+	
311.	*Theretra alecto* Linnaeus	+	+	+		
312.	*Theretra clotho* Drury.	+		+	+	
313.	*Theretra silhetensis* Walker	+	+	+		
314.	*Macroglossum pyrrhosticta* Butler	+	+	+		
315.	*Theretra nessus* Drury	+		+	+	
316.	*Theretra latreillii* Walker	+	+			

Appendix 3: **List of the species of insect at altitude in the mountainous region of Northern Vietnam**

No	Species name	Altitude				
		< 200m	**200-500m**	**500-1000m**	**1000-1500m**	**>1500m**
	Order HYMENOPTERA					
I	**Family Apidae**					
1.	*Amegilla confuse* (Smith)	+		+	+	+
2.	*Amegilla himalajensis* (Radoszkowski)	+		+	+	+
3.	*Amegilla zonata* (Linnaeus)	+	+	+	+	+
4.	*Anthophora* sp.	+	+	+	+	+
5.	*Apis cerana* Fabricius	+	+			
6.	*Apis dorsata* Fabricius	+	+			+
7.	*Apis florea* Fabricius	+	+	+		
8.	*Apis laborisa* Smith	+	+			
9.	*Apis mellifera* (Linnaeus)	+	+		+	
10.	*Bombus campestris* (Panzer)	+	+	+	+	
11.	*Bombus eximus* Smith	+	+		+	+
12.	*Bombus flavescens* Smith	+	+			
13.	*Bombus trifasciatus* Smith	+	+	+		
14.	*Ctenoplectra cornuta* Gribodo	+	+		+	
15.	*Elaphropoda khasiana* (Schulz)	+	+		+	+
16.	*Elaphropoda percarinata* (Cockerell)		+	+		
17.	*Tetralonioidella wuae* Niu & Zhu	+			+	+
18.	*Thyreus centrimacula* (Pérez)	+		+	+	+

19.	*Thyreus himalajensis* (Radoszkowski)	+		+	+	+
20.	*Ceratina hieroglyphica* Smith	+	+		+	+
21.	*Xylocopa bryorum* (Fabricius)	+	+	+	+	+
22.	*Xylocopa caerulea* (Fabricius)			+		
23.	*Xylocopa dejeanii* Lepeletier	+	+	+	+	
24.	*Xylocopa latipes* (Drury)	+	+	+	+	
25.	*Xylocopa phalothorax* Lepeletier	+	+	+	+	+
26.	*Xylocopa ruficornis* Fabricius	+	+	+	+	
27.	*Xylocopa tenuiscapa* Westwood	+		+	+	
28.	*Xylocopa tranquebarorum* (Swederus)	+			+	+
II	**Family Megachilidae**					
29.	*Coelioxys decipiens* Spinola	+	+		+	+
30.	*Euaspis polyensis* Vachal	+	+	+	+	+
31.	*Euaspis divercarinata Pasteels*			+		
32.	*Coelioxys capitate* Smith	+	+	+	+	
33.	*Coelioxys decipiens* Spinola	+	+	+	+	
34.	*Coelioxys sexmaculata* Cameron	+	+	+	+	+
35.	*Megachile subrixator* Cockerell	+	+	+	+	
36.	*Megachile conjuncta* Smith	+		+	+	
37.	*Megachile fluvovestita* Spinola	+			+	+
III	**Family Halictidae**					
38.	*Nomia curvipes* (Fabricius)	+	+		+	+
39.	*Nomia incerta* Gribodo	+	+	+	+	+
40.	*Nomia iridescens* Smith			+		
41.	*Nomia terminata* Smith	+	+	+	+	
42.	*Nomia thoracica* Smith	+	+	+	+	
IV	**Family Vespidae**					
43.	*Eustenogaster nigra* Saito & Nguyen	+	+	+	+	
44.	*Liostenogaster filicis* Turillazzi	+		+	+	
45.	*Polistes gigas* (Kirby)	+			+	+
46.	*Polistes olivaceus* (DeGeer)	+		+	+	+
47.	*Polistes tenebricosus* Lepeletier	+		+	+	
48.	*Polistes dawnae* Dover and Rao	+	+	+	+	
49.	*Polistes delhiensis* Das and Gupta	+	+	+	+	+
50.	*Polistes brunetus* Nguyen & Kojima	+	+			

51.	*Polistes clandestinus* Nguyen, Kojima & Saito	+	+			+
52.	*Polistes communalis* Nguyen, Vu & Carpenter	+	+	+		
53.	*Polistes japonicus* de Saussure	+	+			
54.	*Polistes mandarinus* de Saussure	+	+		+	
55.	*Polistes nigerrimus* Gusenleitner	+	+	+	+	
56.	*Polistes sagittarius* de Saussure	+	+		+	+
57.	*Polistes strigosus* Bequaert	+	+			
58.	*Ropalidia artifex* (de Saussure)	+	+		+	
59.	*Ropalidia bicolorata* van der Vecht	+	+		+	+
60.	*Ropalidia m. magnanima* van der Vecht		+	+		
61.	*Ropalidia rufocollaris* (Cameron)	+			+	+
62.	*Ropalidia ornaticep* (Cameron)	+		+	+	+
63.	*Ropalidia stigma* (Smith)	+		+	+	+
64.	*Parapolybia indica* (de Saussure)	+	+		+	+
65.	*Parapolybia varia* (Fabricius)	+	+	+	+	+
66.	*Provespa barthelemyi* (du Buysson)			+		
67.	*Vespa affinis* (Linnaeus)	+	+	+		
68.	*Vespa analis* Fabricius	+	+	+	+	
69.	*Vespa basalis* Smith	+	+	+	+	+
70.	*Vespa bicolor* Fabricius	+	+	+	+	
71.	*Vespa ducalis* Smith	+		+	+	
72.	*Vespa soror* du Buysson	+			+	+
73.	*Vespa tropica* (Linnaeus)	+		+	+	+
74.	*Vespa velutina* Lepeletier			+	+	+
75.	*Allorhynchium argentatum* (Fabricius)	+	+	+	+	+
76.	*Anterhynchium flavomarginatum* (Smith)			+	+	+
77.	*Antepipona biguttata* (Fabricius)		+			
78.	*Caligaster himalayensis* (Cameron)		+			+
79.	*Coeleumenes burmanicus* (Bingham)	+	+	+		
80.	*Delta esuriens esuriens* (Fabricius)	+	+			
81.	*Delta pyriforme pyriforme* (Fabricius)	+	+		+	

82.	*Ectopioglossa keiseri* van der Vecht	+	+	+	+	
83.	*Eumenes inconspicuus* Smith	+	+		+	+
84.	*Euodynerus dantici* Giordani Soika	+	+			
85.	*Euodynerus nipanicus* Giordani Soika	+	+	+		
86.	*Euodynerus trilobus* (Fabricius)	+	+		+	
87.	*Orancistrocerus erythropus* (Bingham)	+	+		+	+
88.	*Pareumenes quadrispinosus acutus* Liu		+	+		
89.	*Phimenes flavopictus* (Zimmermann)	+			+	+
90.	*Rhynchium brunneum* (Fabricius)	+		+	+	+
91.	*Stenodyneriellus capillus* Nguyen	+		+	+	+
92.	*Zethus angulatus* Nguyen & Carpenter	+	+		+	+
V	**Family Pompilidae**					
93.	*Cyphononyx peregrinus* (Smith)			+		
94.	*Dichelonyx madraspatanus* (Smith)	+	+	+	+	
95.	*Hemipepsis fenestrate* (Smith)	+	+	+	+	
96.	*Leptodialepis bipartitus* Lepeletier	+	+	+	+	+
97.	*Leptodialepis suginarai* (Uchida)	+	+	+	+	
98.	*Macromerella honesta* (Smith)	+		+	+	
99.	*Colpacampsomeris indica* (de Saussure)	+			+	+
100.	*Campsomeriella annulata* (Fabricius)	+		+	+	+
101.	*Phalerimeris phalerata* (de Saussure)	+		+	+	+
102.	*Megacampsomeris binghami* (Betrem)	+	+	+	+	+
103.	*Megascolia azurea* (Betrem & Guiglia)	+	+	+	+	+
104.	*Scolia binotata* Fabricius	+	+			
105.	*Scolia cyanipennis* Fabricius	+	+			+
VI	**Family Sphecidae**					
106.	*Isodontia aurifrons* (Smith)	+	+			
107.	*Isodontia chrysorrhoea* (Kohl)	+	+		+	
108.	*Prionyx viduatus* (Christ)	+	+	+	+	

109.	*Sphex argentutus* Fabricius	+	+		+	+
110.	*Sphex sericeus* (Fabricius)	+	+			
111.	*Sphex diabonicus* Smith	+	+	+		
112.	*Ammophila clavus* (Fabricius)	+	+		+	
113.	*Ammophila laevigata* Smith	+	+		+	+
114.	*Chlorion lobatum* (Fabricius)		+	+		
115.	*Chalybion bengalense* (Dahlbom)	+			+	+
116.	*Chalybion japonicum* (Gribodo)	+		+	+	+
117.	*Chalybion malignum* (Kohl)	+		+	+	+
118.	*Sceliphron madraspatanum* (Fabr.)	+	+		+	+
119.	*Sceliphron deforme* (Smith)	+	+	+	+	+
	Order HEMIPTERA					
VII	**Family Coreidae**	+	+	+	+	
120.	*Cletus punctifer* Dallas	+	+	+	+	
121.	*Leptocorisa acuta* Fabr.	+	+	+	+	+
122.	*Leptocorisa varicornis* Fabr.	+	+	+	+	
123.	*Riptotus pedestris* (Fabr.)	+		+	+	
124.	*Riptotus linearis* (Fabr.)	+			+	+
125.	*Riptotus parvus* Hsiao	+		+	+	+
126.	*Serinetha abdominalis* Fabr.	+		+	+	+
VIII	**Family Pentatomidae**					
127.	*Dalpada oculata* Fabricius	+	+	+	+	+
128.	*Erthesina fullo* Thunb.	+	+			
129.	*Nezara viridula* Linnaeus	+	+			+
130.	*Tessaratoma papillosa* Drury	+	+	+		
131.	*Erthesina fullo* Thunb.	+	+			
132.	*Cazira verrucosa* Wertn	+	+		+	
133.	*Cazira verrucosa* Wertn	+	+	+	+	
134.	*Rhynchocoris* sp.	+	+		+	+
IX	**Family Reduviidae**					
135.	*Astinus siamensis* Distant	+	+	+		
136.	*Biasticus confusus* Hsiao	+	+		+	
137.	*Biasticus flavinotus* (Matsumura)	+	+		+	+
138.	*Biasticus flavus* (Distant)		+	+		
139.	*Coranus fuscipennis* Reuter	+	+	+		
140.	*Endochus nigricornis* Stål	+		+	+	+
141.	*Euagoras plagiatus* (Burmeister)	+		+	+	+
142.	*Isyndus reticulatus* Stål	+	+		+	+
143.	*Rhynocoris fuscipes* (Fabricius)	+	+	+	+	+

144.	*Rhynocoris marginellus* (Fabricius)		+	+		
145.	*Sphedanolestes impressicollis* (Stål)	+	+	+	+	
146.	*Sycanus croceovittatus* Dohrn	+	+	+		
147.	*Sycanus croceus* Hsiao	+	+	+		+
148.	*Sycanus falleni* Stål	+	+	+		
149.	*Vesbius purpureus* (Thunberg)	+		+	+	
150.	*Vesbius sanguinosus* Stål	+			+	+
151.	*Velinus annulatus* Distant	+		+	+	+
152.	*Velinus malayus* (Stål)	+		+	+	+
153.	*Velinus rufiventris* Hsiao	+	+	+	+	+
154.	*Villanovanus nigrorufus* Hsiao	+	+	+	+	+
155.	*Ectrychotes andreae* (Thunberg)	+	+			
156.	*Ectrychotes comottoi* Lethierry	+	+			+
157.	*Ectrychotes lingnanensis* China	+	+	+		
158.	*Bayerus pilosus* Hsiao	+	+			
159.	*Mendis rufus* Hsiao & Ren	+	+		+	
160.	*Neozirta orientalis* Distant	+	+	+	+	
161.	*Parascadra rubida* Hsiao	+	+		+	+
162.	*Vilius melanopterus* Stål	+	+			
163.	*Sirthenea dimidiate* Horvath	+	+	+		
164.	*Sirthenea flavipes* (Stål)	+	+		+	
165.	*Sirthenea nigra* Cai et Tomokuni	+	+		+	+
166.	*Lestomerus affinis* (Serville)		+	+		
167.	*Peirates arcuatus* (Stal)	+			+	+
168.	*Peirates. leptidoides* (Wolff)	+		+	+	+
169.	*Peirates atromaculatus* Stal	+		+	+	+
170.	*Peirates turpis* Walker	+	+		+	+
171.	*Ectomocoris atrox* (Stål)	+	+	+	+	+
172.	*Ectomocoris elegans* (Fabricius)			+		
173.	*Ectomocoris yunnanensis* Ren	+	+	+	+	
174.	*Ectomocoris biguttulus* Stal	+	+	+	+	
175.	*Acanthaspis geniculata* Hsiao	+	+	+	+	+
176.	*Acanthaspis subinermis* Hsiao	+	+	+	+	
177.	*Acanthaspis ruficeps* Hsiao	+		+	+	
178.	*Gerbelius typicus* Distant	+			+	+
179.	*Brachytonus nigripes* Hsiao	+		+	+	+
180.	*Durganda rubra* Amyot & Serville	+		+	+	+
181.	*Reduvius tenebrosus* (Stal)	+	+	+	+	+

182.	*Reduvius decliviceps* Hsiao	+	+	+	+	+
183.	*Tapeinus singularis* (Walker)	+	+			
184.	*Polytoxus femoralis* Distant	+	+			+
185.	*Polytoxus ruficeps* Hsiao	+	+	+		
186.	*Polytoxus rufinervis* Hsiao	+	+			
187.	*Lisarda pilosa* Hsiao	+	+		+	
188.	*Lisarda spinosa* Hsiao	+	+	+	+	
189.	*Lisarda uniformis* Distant	+	+		+	+
190.	*Lisarda rhypara* Stål	+	+			
191.	*Petalocheirus spinosissimus* Distant	+	+	+		
192.	*Valentia hoffmanni* China	+	+		+	
193.	*Aulacogenia corniculata* Stål	+	+		+	+
194.	*Canthesancus geniculatus* Distant					
195.	*Canthesancus helluo* Stål	+			+	+
196.	*Oncocephalus pudicus* Hsiao	+		+	+	
197.	*Oncocephalus scutellaris* Reuter	+		+	+	
198.	*Oncocephalus lineosus* Distant	+	+		+	+
199.	*Oncocephalus fasciatus* Reuter	+	+	+	+	+
200.	*Staccia diluta* (Stål)			+		
201.	*Staccia plebeja* Stål	+	+	+	+	
202.	*Sastrapada baerensprungi* (Stål)	+	+	+	+	
203.	*Pygolampis angusta* Hsiao	+	+	+	+	+
204.	*Pygolampis biguttata* Reuter	+	+	+	+	
205.	*Pygolampis longipes* Hsiao	+		+	+	
206.	*Pygolampis rufescens* Hsiao	+			+	+
207.	*Triatoma rubrofasciata* (De Geer)	+		+	+	+
208.	*Opistoplatys mustela* Miller	+		+	+	
209.	*Opistoplatys perakensis* Miller	+	+	+	+	+
210.	*Opistoplatys majusculus* Distant	+	+	+	+	+
211.	*Ploiaria glabella* Wygodzinsky	+	+			
X	**Family Cicadellidae**					
212.	*Deltocephalus dorsalis* Motsch.	+	+	+		+
213.	*Deltocephalus oryzae* Motsch.	+	+			
214.	*Empoasca flavescens* (Fabr.)	+	+		+	+
215.	*Erythroneura subrufa* (Motsch.)	+	+	+	+	+
216.	*Nephotettix apicalis* (Motsch.)	+	+		+	+
217.	*Nephotettix bipunctatus* (Fabr.)	+	+			
	Order COLEOPTERA	+	+	+		

XI	**Family Carabidae**					
218.	*Ophinea indica* (Thun.)	+	+		+	+
219.	*Stenolophus smaragdulus* (Fabricius)					
220.	*Chlaenius circumdatus* Brulle	+			+	+
221.	*Chlaenius costiger* Chau.	+		+	+	+
222.	*Chlaenius inops* Chaudoir	+		+	+	+
223.	*Chlaenius nigricans* Wied.	+	+		+	+
XII	**Family Chrysomelidae**					
224.	*Aspidomorpha miliaris* (Fabricius)			+		
225.	*Aspidomorpha sanctaecrucis* (Fabricius)	+	+	+	+	
226.	*Aulacophora bicolor* (Web.)	+	+	+	+	
227.	*Lema coromandeliana* (Fabricius)	+	+	+	+	+
228.	*Altica cyanea* (Web.)	+	+	+	+	
229.	*Aspidomorpha miliaris* (Fabr.)	+		+	+	
230.	*Dactylispa lameyi* Uhmann	+			+	+
231.	*Dicladispa armigera* Weise	+		+	+	+
232.	*Lema cyanea* Fabricius	+		+	+	+
233.	*Lilioceris discrepans* (Baly)	+	+	+	+	+
XIII	**Family Curculionidae**					
234.	*Aplotes roelofsi* (Chevrolat)	+	+			
235.	*Hypomeces squamosus* Fabricius	+	+			+
236.	*Mecopomorphus griseus* Hustache	+	+	+		
237.	*Platymycterus sieversi* Reutter	+	+			+
238.	*Phytoscaphus triangularis* Olivier	+	+		+	
XIV	**Family Coccinellidae**					
239.	*Coccinella septempunctata* (Fabricius)	+	+		+	+
240.	*Coccinella transversalis* Fabricius	+	+			
241.	*Harmonia sedecimnotata* (Fabricius)	+	+	+		
242.	*Hasmonia octomaculata* Fabricius	+	+		+	
243.	*Lemnia biplagiata* (Swartz)	+	+		+	+
244.	*Lemnia bissellata* (Mulsant)	+	+	+		
245.	*Menochilus sexmaculatus* (Fabricius)	+			+	+
246.	*Micraspis discolor* (Fabricius)	+		+	+	+
247.	*Phrynocaria congener* (Billberg)	+		+	+	+

248.	*Phymatosternus lewisii* (Crotch)	+	+		+	+
249.	*Propylea japonica* (Thunb.)	+	+	+	+	+
250.	*Melanotus legatus*			+	+	+
XV	**Family Scarabaeidae**					
251.	*Oryctes rhinoceros* Linnaeus	+	+	+	+	
252.	*Lepidiota amoena* Felche	+	+	+	+	+
253.	*Melolontha alboplagiata* Brenske	+	+	+	+	
254.	*Sophrops simplex* Frey	+		+	+	
255.	*Adoretus convexus* Burmeister	+			+	+
256.	*Anomala antiqua* Gyllenhal	+		+	+	+
257.	*Mimela splendens* Gyllenhal	+		+	+	+
258.	*Catharsius javanus* Lansberge	+	+	+	+	+
259.	*Onitis falcatus* Wulfen	+	+	+	+	+
260.	*Onthophagus laevis* Harold	+	+			
261.	*Onthophagus lunatus* Harold	+	+			+
262.	*Onitis falcatus* Wulfen	+	+	+		
263.	*Onitis lama* Lanbsberge	+	+			
264.	*Onthophagus laevis* Harold	+	+		+	
265.	*Onthophagus rectecornutus* Lansb.	+	+	+	+	
266.	*Onthophagus sasaji* Ochi & Kon	+	+		+	+
XVI	**Family Cerambycidae**					
267.	*Alidus biplagiatus*	+	+	+		
268.	*Anoplophora macularia* Thunberg	+	+		+	
269.	*Apriona germari*	+	+		+	+
270.	*Batocera lineolata*		+	+		
	Order LEPIDOPTERA					
XVII	***Family Papilionidae***					
271.	*Graphium agamemnon* (Linnaeus)	+		+	+	+
272.	*Menelaides memnon* Linnaeus	+	+		+	+
273.	*Papilio helenus* Linnaeus	+	+	+	+	+
274.	*Papilio memnon* Linnaeus			+		
275.	*Papilio nephelus* Boiduval	+	+	+	+	
276.	*Papilio noblei noilei* de Nice.	+	+	+	+	
277.	*Papilio paris* Linnaeus	+	+	+	+	+
278.	*Papilio polytes* Linnaeus	+	+	+	+	
279.	*Troides aeacus* (L. & Felder)	+		+	+	
280.	*Troides helena cerberus* Felder	+			+	+
281.	*Lamproptera curius* (Fabricius)					
XVIII	**Family Pieridae**		+	+		

282.	*Artogeia canidia* Sparrman	+		+	+	+
283.	*Catopsilia pomona* (Fabricius)	+		+	+	+
284.	*Cepora nerissa* (Fabricius)	+	+	+	+	+
285.	*Eurema blanda* (Boiduval)	+	+	+	+	+
286.	*Hebomoia glaucippe* (Linnaeus)	+	+			
287.	*Pieris brassicae* (Linnaeus)	+	+			+
288.	*Delias belladonna* (Fabricius)	+	+	+		
XIX	**Family Nymphalidae**					
289.	*Amathusidia amythaon* Drury	+	+		+	
290.	*Ariadne ariadne* (Linnaeus)	+	+	+	+	
291.	*Cethosia biblis* (Drury)	+	+		+	+
292.	*Cyrestis thyodamas* (Fabricius)	+	+			
293.	*Cyrestis cocles* (Fabricius)	+	+	+		
294.	*Doleschallia bisaltide* Drury	+	+		+	
295.	*Polyura athamas* (Drury)	+	+		+	+
296.	*Euthalia lubentina* (Cramer)					
XX	**Family Danaidae**					
297.	*Danaus genutia* (Cramer)	+		+	+	+
298.	*Ideopsis vulgaris* Butler	+		+	+	+
299.	*Parantica aglea* (Stoll)	+	+		+	+
300.	*Euploea core* (Cramer)	+	+	+	+	+
301.	*Euploea eunice* Godart			+		
302.	*Parantica aglea* (Stoll)	+	+	+	+	
303.	*Parantica melaneus* (Cramer)	+	+	+	+	
304.	*Parantica sita* (Kolla)	+	+	+	+	+
305.	*Tirumala limniace* (Cramer)	+	+	+	+	

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PUBLICATIONS

3 international articles of SCI-E and 01 national articles (had Thank The NEF Bio-ecological Nature Conservation Project in Mountainous Region of North Vietnam

1. NGUYEN THI PHUONG LIEN, TRAN THI NGAT & HOANG GIA MINH, 2020. Taxonomic notes on the genusPseumenesGiordani Soika, 1935 (Hymenoptera: Vespidae: Eumeninae) from Vietnam with key to all known species in the Oriental region. Zootaxa 4822 (2): 293–299 (SCI-E)

2. NGUYEN THI PHUONG LIEN, TRAN THI NGAT, DANG THI HOA & MAI VAN THAI, 2019. Potter wasps of the genus Stenodyneriellus Giordani Soika (Hymenoptera: Vespidae: Eumeninae) from Vietnam, with description of a new species. Raffles Bulletin of Zoology 67: 396–402. (SCI-E).

3. BOGDAN WIŚNIOWSKI, NGUYEN THI PHUONG LIEN & NGUYEN QUANG CUONG, 2020. Discovery of four new species of Trichrysis Lichtenstein, cyanea species group (Hymenoptera, Chrysididae) from Vietnam. Zootaxa 4881 (1): 165–178. (SCI-E)

4. **MAI VĂN THÁI, TRẦN THỊ NGÁT, NGUYỄN THỊ PHƯƠNG LIÊN**, 2020. Dẫn liệu bước đầu thành phần và sự phân bố của các loài ong xã hội bắt mồi (Hymenoptera: Vespidae) tại khu bảo tồn Chàm Chu Tuyên Quang. Hội nghị côn trùng học quốc gia lần thứ 10, Nhà xuất bản Nông nghiệp:181-185.

EDUCATION AND TRAINING

1 Bachelor, 3 Masters and 1 Doctorate

Bachelor's Training

Graduation thesis of **Mai Van Thai**: Research on the composition of predatory wasps of

the yellow wasp family (Hymenoptera: Vespidae) at different altitudes of Tuyen Quang province.

Training 3 masters

1. Graduation Thesis of **MSc. Luong Viet Tuan**: Research on the composition and distribution of bees of the family Chrysididae (Hymenoptera: Chrysidoidea) in some areas of Northern Vietnam.

2. Graduation Thesis of **MSc. Doan Hong Ngan**: Studying the diversity of single-living wasps of the yellow wasp family (Hymenoptera: Vespidae) in different elevation belts of the Northeast region.

3. Graduation Thesis of **MSc. Tran Thi Phuong Uyen**: Research on the composition of water insect belonging to orders Hemitera and Coleoptera in Mountainous Region of North Vietnam

Support to train 1 PhD student

PhD thesis of PhD student **Tran Thi Ngat**: Study on taxonomy of little-known taxon belonging to the superfamily Apoidea (Hymenoptera) in Vietnam, biological characteristics of some species and the influence of environmental conditions on the quality of their products.

Assistants

Ms. MAI Van Thai

+ Research Report for Assistants_final:

- Objective 1: Study in composition and popularity of wasps in the family Vespidae in Tuyen Quang province

- Objective 2: Comparison of the diversity of wasps in Vespidae at two altitudes in Tuyen Quang province (Nam Nuong and Cao Duong).

+ Completed Graduation thesis with title "*Study on the composition species of yellow bee family Vespidae (Hymenoptera) in Tuyen Quang province* "