



## The Species Diversity of Assassin Bugs (Heteroptera: Reduviidae) and their Preys in Central Highlands of Vietnam

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**ABSTRACT:** In Central Highlands of Vietnam, field surveys in 3 National Parks, 2 Nature Reserves, Bao Loc and Da Lat in Kon Tum, Dak Lak, Gia Lai and Lam Dong provinces shows that the 57 species of 28 genera, 6 subfamilies (Reduviidae) were recorded, among them 4 species are newly recorded in Vietnam. Among 28 genera, the genera *Polytoxus*, *Sycanus* and *Sphedanolestes* with 4 species, genera *Ectrychotes*, *Acanthaspis*, *Reduvius*, *Canthesancus*, *Pygolampis*, *Oncocephalus* with 3 species, remaining genera with 1-2 species. In five habitats, the higher montane evergreen forest and lower montane evergreen forest is the largest containing 51 species, the lowland evergreen forest and lowland semi-evergreen forest are the second largest 22 species, agricultural ecosystems is containing 16 species, buffer zone is the containing 13 species and grass land is the containing 12 species. The preys of 52 species of Reduviidae were texted.

**Key words:** Diversity, assassin bugs, Reduviidae, preys

### INTRODUCTION

The species of the assassin bugs of family Reduviidae under Order Heteroptera (Insecta: Rhynchota) is not only one of the most abundant groups but also showing significant economics and high scientific value. In the world, the family Reduviidae is documented with approximately 7000 species that come from 29 subfamilies (Weirauch, 2008). They are present in all ecosystems and even the near human. Many species play an important role in the food chain of animals and plants, as well as the ecological balance. Besides that, many species are either known as predators of many dangerous pests or their indicative role for forest habitats. Furthermore, many species of the subfamily Triatominae (139 species) are blood sucking bugs while several species of Triatominae are dangerous vectors of disease to humans and animals (Ambrose, 1999; Lent & Wygodzinsky, 1979).

The Central Highlands of Vietnam is a plateau bordering the lower part of Laos and northeastern Cambodia. The Kon Tum province shares a border with both Laos and Cambodia but Gia Lai province and Dak Lak province only share borders with Cambodia. The Lam Dong province is landlocked, and thus has no international border. Actually, Central Highlands of Vietnam is not situated on a unique plateau, instead it lies on series of contiguous plateaus, namely Kon Tum plateau at the height of 500 m, Kon Plong plateau, Kon Ha Nung plateau, Pleiku plateau with the height of around 800m, Mdrak plateau of approximately 500 m, Dak Lak plateau of

around 800m, Mo Nong plateau with the height of about 800–1000 m, Lam Vien plateau of approximately 1500 m and Di Linh plateau of about 900–1000 m. All of these plateau are surrounded by the high mountain ranges and mounts (South Annamite Range) (Anon, 1995). Many new discoveries for the study of the species from the family Reduviidae had been documented in the Central Highlands of Vietnam is supposed as one of the areas with the richest the species of family Reduviidae in Vietnam and the Oriental region (Randall & James, 1995). So far, the study on the species of the family Reduviidae in Vietnam only focused in the North of Vietnam such as the check list 105 species (family Reduviidae) were identified. There are some results about the preys of assassin bugs (Reduviidae) and biological characteristics of some common species on Agricultural system. The study on the species of the family Reduviidae in Vietnam Central Highlands and South of Vietnam is very little or not conducted. Many new taxon for science and new record are not discovered and published. The information and data about the species diversity of family Reduviidae in the Central Highlands of Vietnam and their preys are incomplete. The data (habits, biology and ecology) of the common species, economic significant and indicative role for forest habitats as well as for the relationship between them with their prey are not interested and attentive. Therefore we studied “The species diversity of assassin bugs (Heteroptera: Reduviidae) and their preys in Central Highlands of Vietnam”.

## MATERIAL AND METHODS

### A. Field surveys

The proposed field surveys on reduviids will be carried out in the following national parks and nature reserves, which contain typical habitats in the Central Highlands Vietnam including:

1) Chu Mom Ray National Park (Kon Tum province) with an area of 56,621 ha, spreading 22°07' - 22°23'N, 103°00' - 104°00'E. The two main forest types at Chu Mom Ray National Park are lowland evergreen forest, and lower montane evergreen forest. The buffer zone of Chu Mom Ray National Park covers 188,749 ha (Anon, 1995).

2) Chu Yang Sin National Park is located in Lak and Krong Bong districts (Dak Lak province). The national park is centred on Mount Chu Yang Sin (H= 2,442 m) with proposed establishing a 32,328 ha nature reserve, spreading 12°14' - 12°31'N, 108°18' - 108°35'E. The national park supports lowland semi-evergreen forest and lowland evergreen forest. Montane evergreen forest is widely distributed above 800 m. Montane evergreen forest at Chu Yang Sin is also characterised by conifers. Coniferous forest occupies more than 10,600 ha of the national park (Anon, 1999).

3) Ta Dung Proposed Nature Reserve (Dak Lak Province). Spreading 11°48' - 12°1'N, 107°53' - 108°7'E. Elevations at the site range from 800 m to 1,982 m at the summit of Mount Ta Dung. The forest at Ta Dung is predominantly evergreen in nature, although some areas of semi-evergreen forest. Lowland forest occurs up to an altitude of 1,000 m. Lower montane forest continues from 1,000 to 1,600 (Anon, 1999).

4) Kon Cha Rang Nature Reserve (Gia Lai province). Spreading 14°26' - 14°35'N, 108°30' - 108°39'E. The topography of the nature reserve is dominated by a montane plateau. The highest point is Mount Kon Cha Rang at 1,452 m. A number of other summits attain altitudes greater than 1,000 m in the northern part of the nature reserve, and the lowest point at the site is 800 m. The main forest type is lower montane evergreen forest, distributed at elevations between 900 and 1,500 m in the north-west of the nature reserve. Lowland evergreen forest occurs at elevations below 900 m (Anon, 1999).

5) Bidoup-Nui Ba National Park, Bao Loc (Lam Dong province) was the forest block on the southern side of the Dong Nai River that stretches eastward from the Cat Loc sector of Cat Tien National Park. The area is also important because it forms part of the corridor of natural forest that links the lowland habitats at Cat Tien National Park with the montane habitats on the Da Lat Plateau (Anon, 1999).

### B. The study on diversity and preys

Investigation assassin bugs was conducted in some habitats as 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); Grass-land (GL) and Agricultural ecosystems focus on the important group of plants as 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 light trap, beating net, sweeping net when sorting litter by hand and very many other similar situations. The experimental study (Ambrose, 1999) with adults and nymph instars of reduviids were collected from different habitats, they will be test in the laboratory on plastic bottle (h = 20 cm, d = 10 cm; 8 × 6 × 4 cm) or the cage (50 × 50 × 100 cm; 40 × 40 × 40cm) by different preys both in the field condition and in the laboratory. Tested preys were the larvae and eggs of some species of order Lepidoptera, Homoptera, Coleoptera and Othoptera include species *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 bicolor* (11), *Chrysomela* sp. (12), *Rhopalosiphum* sp. (13), *Oxya* sp. (14) and *Corcyra cephalonica* (15).

### C. Taxonomy

By morphology of species of Reduviidae basis on morphological characteristics. The analysis of morphology were conducted with a SZX7 Olympus microscope. The morphological structure was painted on SZX7 Olympus. The documents for reference and comparative morphological description based on of Cai Wanzhi (2004); Hsiao *et al.* (1981); Yongxi Li *et al.* (1988); Maldonado and Capriles (1990).

### D. Statistics

The experimental data with the tracking indicators will be analysis and calculate the probability level (P < 0.05) by Primer-e (Clarke & Gorley, 2001).

## RESULTS AND DISCUSSION

### A. The species diversity of reduviid in Central Highlands of Vietnam

The research on assassin bugs reduviid is conducted based on the specimens in the Institute of Ecology and Biological Resources, (VAST) were collected from April to July, 2016 year on habitats in the Central Highlands of Vietnam with nearly 150 specimens of reduviids of 6 subfamilies (Harpactorinae, Saicinae, Reduviinae, Ectrichodinae, Emesinae and Stenopodainae), and preys of some species of which them.

Table 1: The list of species reduviid and their preys in Central Highlands of Vietnam.

No	Name of species	Habitats	Their preys
<b>I</b>	<b>Subfamily ECTRICHODIINAE Amy. &amp; Ser. 1843</b>		
	<b>Genus Ectrychotes</b> Burmeister, 1835		
1.	<i>Ectrychotes andreae</i> (Thunberg, 1784)	(EM), (ES)	(4),(8),(9),(12),(15)
2.	<i>Ectrychotes comottoi</i> Lethierry, 1883	(EM), (GL)	(4),(8),(9),(12),(15)
3.	<i>Ectrychotes lingnanensis</i> China, 1940	(EM), (ES)	(4),(8) (9),(12),(15)
	<b>Genus Mendis</b> Stal, 1859		
4.	<i>Mendis rufus</i> Hsiao & Ren, 1981	(EM), (SF)	(5), (15)
5.	<i>Mendis chinensis</i> Stal,1902	(EM), (SF)	(5), (15)
<b>II</b>	<b>Subfamily REDUVIINAE Latre., 1807</b>		
	<b>Genus Acanthaspis</b> Amyot & Serville, 1843		
6.	<i>Acanthaspis geniculata</i> Hsiao, 1976	(EM), (AE)	(3),(4),(12), (13)
7.	<i>Acanthaspis ruficeps</i> Hsiao, 1976	(EM), (GL), (AE)	(3),(4), (12), (15)
8.	<i>Acanthaspis collaris</i> Hsiao, 1976	(EM), (GL), (AE)	(3),(4),(12), (15)
	<b>Genus Reduvius</b> Fabricius, 1775		
9.	<i>Reduvius tenebrosus</i> (Stal, 1863)	(EM),(SF)	(5) (12), (14)
10.	<i>Reduvius decliviceps</i> Hsiao, 1976	(EM), (SF)	(2), (12),(14)
11.	<i>Reduvius gregoryi</i> China, 1925	(EM)	(12),(14),(15)
<b>III</b>	<b>Subfamily SAICINAE Stal, 1859</b>		
	<b>Genus Polytoxus</b> Spinola,1850		
12.	<i>Polytoxus femoralis</i> Distant ,1903	(GL), (AE)	(5),(6),(7),(12),(15)
13.	<i>Polytoxus fuscipennis</i> Hsiao, 1965	(GL), (AE)	(6),(7), (12), (15)
14.	<i>Polytoxus ruficeps</i> Hsiao, 1965	(EM), (AE)	(6),(7), (12), (15)
15.	<i>Polytoxus rufinervis</i> Hsiao, 1965 *	(EM), (SF), (ES)	(12), (13)
<b>IV</b>	<b>Subfamily STENOPODANAE Amyot &amp; Ser., 1843</b>		
	<b>Genus Canthesancus</b> Amy.& Serv., 1843		
16.	<i>Canthesancus geniculatus</i> Distant, 1902	(EM), (AE)	(1), (2), (3), (4), (14), (15)
17.	<i>Canthesancus helluo</i> Stål, 1863	(EM), (SF)	(1), (2), (3), (4), (14), (15)
18.	<i>Canthesancus trimaculatus</i> Amyot & Serville, 1843 *	(EM), (SF)	(1), (2), (3), (4), (14), (15)
	<b>Genus Pygolampis</b> Germar,1817		
19.	<i>Pygolampis angusta</i> Hsiao, 1977	(EM), (AE)	(10)
20.	<i>Pygolampis biguttata</i> Reuter ,1887	(EM), (AE)	(10), (13)
21.	<i>Pygolampis rufescens</i> Hsiao, 1977	(EM), (SF), (AE), (ES)	(10)
	<b>Genus Oncocephalus</b> Klug, 1830		
22.	<i>Oncocephalus purus</i> Hsiao, 1977 *	(EM), (SF)	(12)
23.	<i>Oncocephalus scutellaris</i> Reuter, 1882	(ES), (GL), (AE), (ES)	(12), (15)
24.	<i>Oncocephalus lineosus</i> Distant, 1903	(ES), (GL), (AE), (ES)	(12), (15)
	<b>Genus Staccia</b> Stål ,1866		
25.	<i>Staccia diluta</i> (Stål, 1859)	(EM)	unknown
26.	<i>Staccia plebeja</i> Stål, 1866	(EM)	unknown
<b>V</b>	<b>Subfamily EMESINAE Amyot &amp; Serville, 1834</b>		
	<b>Genus Emesopsis</b> Uhler, 1984		
27.	<i>Emesopsis nubilus</i> Uhler, 1984	(EM)	unknown
	<b>Genus Empicoris</b> Wolff, 1811		
28.	<i>Empicoris rubromaculatus</i> (Blackburn, 1889)*	(EM), (SF)	unknown
29.	<i>Empicoris minutus</i> Usinger, 1946	(EM), (SF)	unknown
<b>VI</b>	<b>Subfamily HARPACTORINAE Amy. &amp; Serv., 1843</b>		
	<b>Genus Agriosphodrus</b> Stål, 1866		
30.	<i>Agriosphodrus dohrni</i> (Signoret, 1862)	(EM)	(1), (2),(3)
	<b>Genus Astinus</b> Stål, 1843		
31.	<i>Astinus siamensis</i> Distant, 1903	(EM)	(9), (10)
	<b>Genus Biasticus</b> Stål 1866		
32.	<i>Biasticus confucuss</i> Hsiao, 1979	(EM)	(1), (2),(3)
33.	<i>Biasticus flavus</i> (Distant, 1903)	(EM), (SF)	(1), (2),(3)
	<b>Genus Coranus</b> Curtis, 1833		
34.	<i>Coranus fuscipennis</i> Reuter, 1881	(EM), (GL), (AE), (ES)	(1), (2),(3)
35.	<i>Coranus spiniscutis</i> Reuter, 1881	(EM), (GL), (AE), (ES)	(1), (2),(3)
	<b>Genus Cosmolestes</b> Stål, 1866		

Continued.....

No	Name of species	Habitats	Their preys
36.	<i>Cosmolestes annulipes</i> Hsiao, 1879 <b>Genus</b> <i>Endochus</i> Stål, 1861	(EM)	(1)
37.	<i>Endochus nigricornis</i> Stål, 1859 <b>Genus</b> <i>Epidaus</i> Stål, 1859	(EM), (GL)	(3)
38.	<i>Epidaus famulus</i> (Stål), 1863	(EM), (SF)	(5)
39.	<i>Epidaus bachmaensis</i> Truong, Zhao & Cai, 2009 <b>Genus</b> <i>Euagoras</i> Burmeister, 1835	(EM)	(8)
40.	<i>Euagoras plagiatus</i> (Burmeister, 1834) Genus <i>Rhynocoris</i> Hahn, 1834	(EM),(SF)	(9)
41.	<i>Rhynocoris marginellus</i> Fabr., 1803	(EM)	(1), (2),(3)
42.	<i>Rhynocoris mendicus</i> (Stål, 1866 ) <b>Genus</b> <i>Isyndus</i> Stål, 1868	(EM)	(6), (7),(8)
43.	<i>Isyndus reticulatus</i> Stål, 1868 <b>Genus</b> <i>Panthous</i> Stål, 1863	(GL), (ES)	(1), (2), (3)
44.	<i>Panthous ruber</i> Hsiao, 1979 <b>Genus</b> <i>Polididus</i> Stål, 1858	(EM)	(3)
45.	<i>Polididus armatissimus</i> Stål, 1859 <b>Genus</b> <i>Rihirbus</i> Stål, 1861	(EM), (SF)	(4)
46.	<i>Rihirbus trochantericus</i> Stål, 1861 <b>Genus</b> <i>Sphedanolestes</i> Stål, 1866	(EM)	(5)
47.	<i>Sphedanolestes annulipes</i> Distant, 1903	(ES), (GL), (AE), (ES)	(1)
48.	<i>Sphedanolestes pubinotum</i> Reuter, 1881	(EM),(SF), (AE)	(1)
49.	<i>Sphedanolestes impressicollis</i> (Stål, 1861)	(EM), (SF)	(2)
50.	<i>Sphedanolestes gularis</i> Hsiao 1979 <b>Genus</b> <i>Sycanus</i> Amyot & Serville, 1843	(EM)	(3) , (11)
51.	<i>Sycanus croceus</i> Hsiao, 1979	(EM), (SF)	(1), (2), (3)
52.	<i>Sycanus croceovittatus</i> Dohrn, 1859	(EM), (SF)	(1), (2), (3)
53.	<i>Sycanus falleni</i> Stål, 1863	(EM), (SF)	(1), (2), (3)
54.	<i>Sycanus pyrromelas</i> Walker, 1873 <b>Genus</b> <i>Velinus</i> Stål, 1865	(EM), (SF)	(1), (2), (3)
55.	<i>Vesbius purpureus</i> (Thunberg, 1783)	(EM)	(1), (2), (3)
56.	<i>Velinus malayus</i> (Stål, 1863) <b>Genus</b> <i>Villanovanus</i> Distant 1904	(EM), (SF)	(1)
57.	<i>Villanovanus nigrorufus</i> Hsiao, 1982	(EM)	(3)

Notes: \* Newly recorded for Vietnam

The Table 1 shows that: 57 species assassin bugs of 6 subfamilies (family Reduviidae) in the Central Highlands of Vietnam were recorded, including: 5

species of 2 genera belonging to the subfamily Ectrichodinae are recognized. 6 species of 2 genera belonging to the subfamily Reduviinae are recognized.

The number genus and species

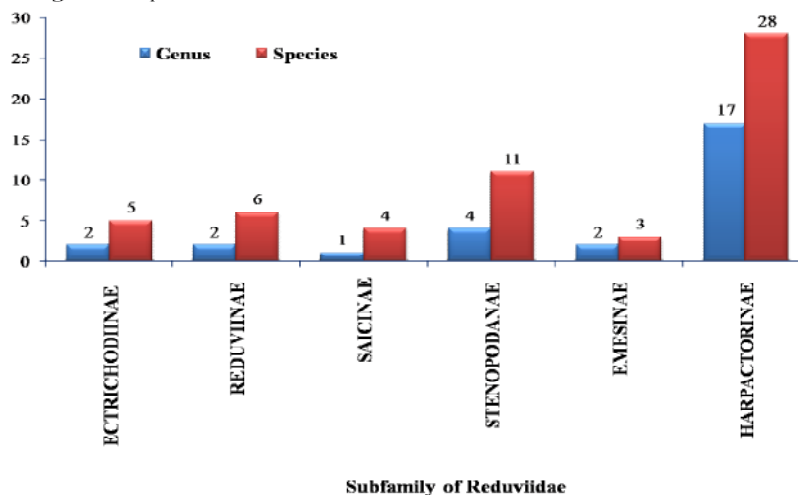


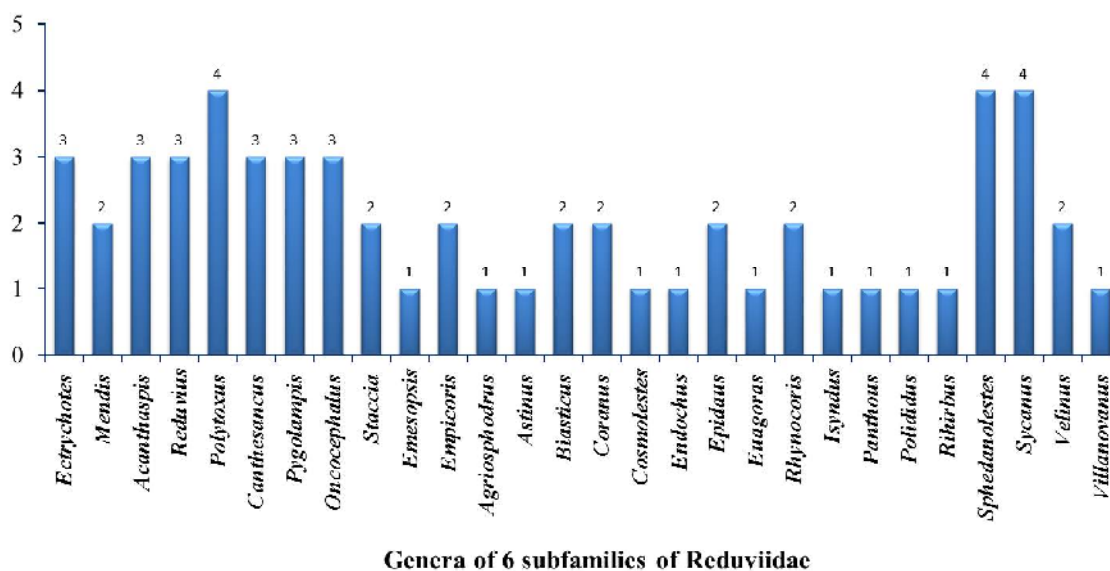
Fig. 1. The number genus and species of the subfamilies (Reduviidae) in Central Highlands of Vietnam.

4 species of genus *Polytoxus* of subfamily Saicinae are recognized with species *Polytoxus rufinervis* Hsiao, 1965 is newly recorded in Vietnam. 11 species of 4 genera belonging to the subfamily Stenopodainae are recognized with 2 species are newly recorded to Vietnam species *Canthesancus trimaculatus* Amyot & Serville, 1843 and *Oncocephalus purus* Hsiao, 1977. 3 species of 2 genera belonging to the subfamily Emesinae are recognized, species *Empicoris rubromaculatus* (Blackburn) is newly recorded in Vietnam and the 28 species of 17 genera of subfamily Harpactorinae are recognized (Fig. 1).

There are 57 species distributed in 28 genera in Central Highlands of Vietnam, among them, 28 species distributed in 17 genera of subfamily Harpactorinae. In

Vietnam, the Harpactorinae is the largest reduviid subfamily, including more than 34 genera and 62 species (Truong *et al.*, 2015). Among the 28 genera in Central Highlands of Vietnam, genus *Polytoxus*, *Sycanus* and *Sphedanolestes* with 4 species, genera *Ectrychotes*, *Acanthaspis*, *Reduvius*, *Canthesancus*, *Pygolampis*, *Oncocephalus* with 3 species, remaining genera with 1-2 species (Fig. 2). In agricultural crops in Central Highlands of Vietnam, a few species of the subfamily Harpactorinae (Reduviidae) were studied biology, ecology and breed for biological control of pest insects in the field as *Coranus fuscipennis*, *Coranus spiniscutis*, *Sycanus croceovittatus* and *Sycanus fallen*. However, the biology of most reduviids still remains unknown.

### Species diversity



**Fig. 2.** Species diversity in each genera of family Reduviidae in the Central Highlands of Vietnam.

### B. The preys of assassin bugs and distribution in habitats

In habitats of the Central Highlands of Vietnam, the higher montane evergreen forest and lower montane evergreen forest (EM) were the highest recorded 51 species (rate 44.74%); the lowland evergreen forest and lowland semi-evergreen forest (SF) were the second highest recorded 22 species (rate 19.30%); The buffer zone (ES) recorded 13 species (rate 11.40%); Grassland (GL) recorded 12 species (rate 10.53%) and agricultural ecosystems focus on the important group of plants as fruit trees and industrial crops (AE) recorded 16 species (rate 14.04%) (Fig. 3)

The testing preys that are the larvae of 15 species pest insects of order Lepidoptera, Homoptera, Coleoptera

and Othoptera. Among 52 species of assassin bugs (family Reduviidae) were recorded shows that the prey of 19 species is the *Anomis flava*, the prey of 17 species is *Helicoverpa armigera*, the prey of 22 species is *Spodoptera litura*, the prey of 10 species is *Plusia* sp., the prey of 6 species is *Nephotettix bipunctatus*, the prey of 4 species is *Empoasca biguttula*, the prey of 4 species is *Empoasca flavescens*, the prey of 5 species is *Erianthus* sp. the prey of 5 species is *Pieris brassicae*, the prey of 4 species is *Aphis* sp., the prey of 1 species is *Aulacophora bicolor*, the prey of 15 species is *Chrysomela* sp., the prey of 3 species is *Rhopalosiphum* sp., the prey of 6 species is *Oxya* sp. and the prey of 16 species is *Corcyra cephalonica*.

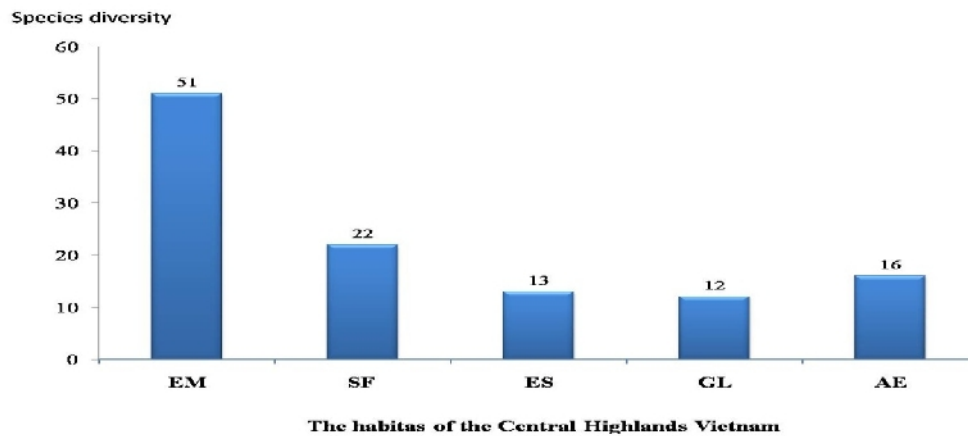


Fig. 3. Species diversity on the habitats in the Central Highlands of Vietnam.

## CONCLUSION

The 57 species assassin bugs of 6 subfamilies (Reduviidae) in the Central Highlands of Vietnam were recorded, species *Polytoxus rufinervis* Hsiao, 1965, *Canthesancus trimaculatus* Amyot & Serville, 1843, *Oncocephalus purus* Hsiao, 1977 and *Empicoris rubromaculatus* (Blackburn) are newly recorded in Vietnam.

Among the 28 genera in Central Highlands of Vietnam, genus *Polytoxus*, *Sycanus* and *Sphecanolestes* with 4 species, genera *Ectrychotes*, *Acanthaspis*, *Reduvius*, *Canthesancus*, *Pygolampis*, *Oncocephalus* with 3 species, remaining genera with 1-2 species

On habitats higher montane evergreen forest and lower montane evergreen forest were highest recorded 51 species; lowland evergreen forest and lowland semi-evergreen forest were second highest recorded 22 species; buffer zone were recorded 13 species; grassland recorded 12 species and agricultural ecosystems were recorded 16 species. Tested preys of 52 species (Reduviidae) were recorded.

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