



Diversity of Hemipteran families at Agri-biodiversity park, Hyderabad, India

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ABSTRACT: The diversity and abundance of Hemipteran families at Agri-biodiversity park of Professor Jayashankar Telangana State Agricultural University, Hyderabad, Telangana, India was studied from September 2019 to January 2020. A total of 12,575 individuals under 22 families of Hemiptera were recorded by using five different collection methods *viz.* pitfall trap, yellow pan trap, manual collection, light trap and yellow sticky trap. Family Cicadellidae was found to be the most abundant family (RA=32.70%), followed by Aleyrodidae (RA=12.47%) and Delphacidae (RA=12.30%), while Eurybrachidae (RA=0.10%), Flatidae (RA=0.10%) and Scutelleridae (RA=0.11%) were the least abundant families. Among the five different collection methods, light trap recorded the maximum number of individuals (6010) followed by yellow sticky trap (3815) whereas, manual collection method (313) recorded the least number of individuals. The Shannon-Weiner diversity Index, Margalef's species richness index and Pielou's evenness index for the Hemipteran fauna of the study area were 2.252, 2.225 and 0.728 respectively. © 2021 Association for Advancement of Entomology

KEYWORDS: Hemiptera, relative abundance, Shannon-Weiner diversity Index, Margalef's species richness index, Pielou's evenness index

INTRODUCTION

Hemipterans, commonly called bugs, are the most diverse group among the exopterygote insects. They are mostly plant sap suckers and vectors of many viral and phytoplasmal plant diseases. Some are also predators of other insects and some are inhabitants of aquatic ecosystem. There are 103,590 species of Hemipteran under 152 families and four suborders known worldwide. The Indian Hemipteran fauna is represented by 6479 species

under 92 families (ZSI, 2012; Chandra, 2011). Professor Jayashankar Telangana State Agricultural University (PJTSAU), Hyderabad, is the first Agricultural University in India to initiate the establishment of Agri-Biodiversity Park (ABP) in August 2008, in 60 ha area with natural ecosystem and half of it is occupied by a pond (Khan and Krishna, 2017). The existing flora of this habitat includes tree species like *Tectona grandis* Linn. f., *Butea monosperma* (Lam.) Taub., *Syzygium cumini* (L.) Skeels, *Ficus* spp. (L.), *Milletia*

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pinnata (L.) Panigrahi, *Madhuca longifolia* (J.Konig) J.F.Macbr., *Albizia lebbek* (L.) Benth., *Cassia* spp. (L.), *Dalbergia sissoo* Roxb., *Vachellia nilotica* (L.) P.J.H.Hurter & Mabb., *Tamarindus indica* L., *Annona reticulata* L., *Azadirachta indica* A.Juss. and *Prosopis juliflora* (Sw.) DC., besides a diverse species of shrubs, herbs and grasses. There was no earlier documentation of the Hemipteran fauna from this habitate, hence the present investigation was taken up.

MATERIALS AND METHODS

Study site: The sampling of hemipterans was carried out from September 2019 to January 2020 at the Agri-biodiversity Park of PJTSAU, Rajendranagar, Hyderabad, which is located at 17°18' N and 78°24' E and an altitude of 559 m from mean sea level.

Collection methods: The collection of hemipteran fauna was carried out at weekly intervals using five different sampling methods: (i) pitfall traps (N=50), (ii) yellow pan traps (N=30), (iii) light traps (N=5), (iv) yellow sticky traps (N=30) and (v) manual collection.

Soap water was used in pitfall traps (transparent plastic cups of 8 cm top diameter and 10 cm height) and yellow pan traps (bright yellow-colored plastic basins with 18 cm diameter and 3 cm depth) to kill the trapped insects. The traps were inspected in 24 hours (the next day) and the trapped insects were collected and preserved in containers with 70% alcohol. Manual collection was done every week by 3 hours of random active sweepings during the day time (9 am-12 noon) with a sweep net of 30 cm hoop diameter and 80 cm handle length. A cotton swab dipped in ethyl acetate was used to anesthetize the collected insects. Light traps fitted with collecting bottles (containing 50% alcohol) were operated in evening hours (6 to 9 pm) to collect nocturnal insects. Yellow sticky traps were also inspected in 24 hours and the trapped insects were counted directly with the help of a magnifying lens. The specimens were identified up to family level with help of the key by Triplehorn and Johnson (2005).

Statistical analysis: Shannon-Wiener Diversity index, Margalef's species richness index and Pielou's Evenness Index were computed by using the software; PAST (Paleontological Statistics Tool) version 3.25. The relative abundance of each Hemipteran family was calculated by the following formula.

$$\text{Relative abundance (\%)} = \frac{ni}{N} \times 100$$

Where, N: the total number of individuals in all families

ni: the number of individuals in i^{th} family

RESULTS AND DISCUSSION

A total of 12,575 individuals belonging to 22 families of Hemiptera were collected. According to the number of individuals collected; following trend was observed among different hemipteran families Cicadellidae (4112) > Aleyrodidae (1568) > Delphacidae (1547) > Aphididae (1199) > Lygaeidae (766) > Cydnidae (673) > Pentatomidae (626) > Miridae (474) > Coreidae (404) > Anthocoridae (337) > Tingidae (172) > Reduviidae (143) > Corixidae (130) > Veliidae (103) > Hydrometridae (76) > Cercopidae (72) > Membracidae (67) > Pyrrhocoridae (42) > Dictyopharidae (26) > Scutelleridae (14) > Eurybrachidae = Flatidae (12) (Table 1).

Out of total 12,575 individuals collected, light trap recorded maximum number of hemipterans with 47.79 per cent (6010 individuals) followed by yellow sticky trap with 30.34 per cent (3815), yellow pan trap with 14.29 per cent (1797) and pitfall trap (5.09%). Manual collection method recorded least with 2.49 per cent (313) (Fig. 1). In terms of number of families, yellow pan trap recorded the maximum number of families (14 families) followed by manual collection and light Trap (13 families each), while yellow sticky trap and pitfall trap recorded the minimum number of families (nine families each). The highest number of hemipterans in light trap was mainly because of major share of leaf hoppers (Cicadellidae) and plant hoppers (Delphacidae). Yellow sticky trap recorded second highest catch in number because of aphids (Aphididae) and

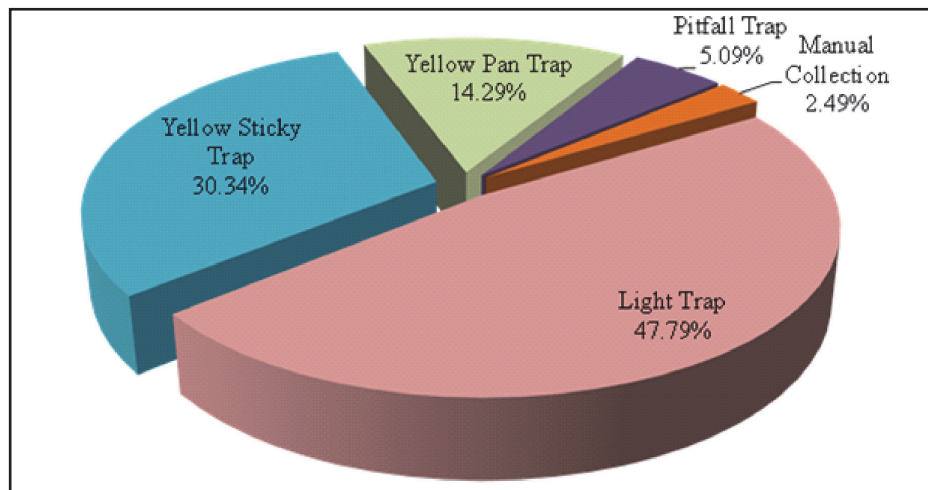


Fig. 1. Percentage of Hemipterans recorded in different collection methods

whiteflies (Aleyrodidae). Manual collection method recorded most of the heteropterans and light traps recorded some aquatic hemipterans along with most Lygaeidae. It is not easy to infer that any particular trap is effective for collecting hemipterans because different families were recorded in different traps. A combination of trapping methods can be used for collecting diversity of hemipterans. However, yellow sticky trap may not be effective, if identification is to be done beyond family level because of difficulty in recovering the trapped insects from the glue.

In earlier studies by Chandra *et al.* (2012), nine families of hemipterans (Pentatomidae, Reduviidae, Lygaeidae, Pyrrhocoridae, Alydidae, Cercopidae, Coreidae, Cydnidae and Dinidoridae) were documented from Veerangana Durgavati Wildlife Sanctuary of Madhya Pradesh. Chandra and Kushwaha (2013a, b) recorded 10 families of Hemipterans (Pentatomidae, Reduviidae, Alydidae, Lygaeidae, Pyrrhocoridae, Coreidae, Dictyopharidae, Asopinidae, Cydnidae and Dinidoridae) from Kheoni Wildlife Sanctuary and 13 families of Hemipterans (Cercopidae, Aphrophoridae, Dictyopharidae, Reduviidae, Coreidae, Lygaeidae, Pyrrhocoridae, Pentatomidae, Alydidae, Asopinidae, Cydnidae, Dinidoridae, Scutelleridae) from Singhori Wildlife Sanctuary, Madhya Pradesh. Kalita *et al.* (2014) recorded 18 species under 12 families of hemipterans from

Jorhat district of Assam. Chandra *et al.* (2015 a, b) recorded 11 families of hemipterans (Reduviidae, Pentatomidae, Coreidae, Lygaeidae, Scutelleridae, Alydidae, Largidae, Pyrrhocoridae, Plataspidae, Cydnidae, Dinidoridae) from Ralamandal Wildlife Sanctuary and 13 families (Reduviidae, Pentatomidae, Coreidae, Lygaeidae, Scutelleridae, Alydidae, Largidae, Pyrrhocoridae, Cercopidae, Nabidae, Asopinidae, Cydnidae, Dinidoridae) from Ratapani wildlife sanctuary of Madhya Pradesh. Similarly, Chandra *et al.* (2017) collected 187 specimens and reported 50 species under 11 families (Pentatomidae, Reduviidae, Cydnidae, Alydidae, Coreidae, Phyrhocoridae, Lygaeidae, Cercopidae, Nabidae, Membracidae, Ricaniidae) of Hemiptera from Daman and Diu.

Among the 22 recorded families of Hemiptera, family Cicadellidae was the most abundant (RA=32.70%), followed by Aleyrodidae (RA=12.47%) and Delphacidae (RA=12.30%), while Eurybrachidae (RA=0.10%), Flatidae (RA=0.10%) and Scutelleridae (RA=0.11%) were the least abundant families. Cicadellidae, Aleyrodidae, Delphacidae, Aphididae, Lygaeidae and Cydnidae were highly abundant (RA > 5%). Pentatomidae, Miridae, Coreidae, Anthocoridae, Tingidae, Reduviidae and Corixidae were moderately abundant (RA=1-5%). While Veliidae, Hydrometridae, Cercopidae, Membracidae, Pyrrhocoridae, Dictyopharidae, Scutelleridae,

Table 1. Number of individuals and Relative Abundance of Hemipteran families in different collection methods

No.	Families	Total No.	RA (%)	Collection methods
1	Aleyrodidae	1568	12.47	YST
2	Anthocoridae	337	2.68	YPT, LT, YST
3	Aphididae	1199	9.53	YPT, YST
4	Cercopidae	72	0.57	YPT, PT, MC
5	Cicadellidae	4112	32.70	YPT, PT, MC, LT, YST
6	Coreidae	404	3.21	YPT, PT, MC, LT, YST
7	Corixidae	130	1.03	LT
8	Cydnidae	673	5.35	YPT, PT, LT
9	Delphacidae	1547	12.30	YPT, PT, MC, LT, YST
10	Dictyopharidae	26	0.21	LT
11	Eurybrachidae	12	0.10	MC
12	Flatidae	12	0.10	MC
13	Hydrometridae	76	0.60	MC, LT
14	Lygaeidae	766	6.09	YPT, PT, LT, YST
15	Membracidae	67	0.53	YPT, MC
16	Miridae	474	3.77	YPT, PT, MC, LT, YST
17	Pentatomidae	626	4.98	YPT, PT, MC, LT, YST
18	Pyrrhocoridae	42	0.33	YPT, MC
19	Reduviidae	143	1.14	YPT, PT, MC
20	Scutelleridae	14	0.11	MC
21	Tingidae	172	1.37	YPT, LT
22	Veliidae	103	0.82	LT
	Total	12575		

LT- Light trap; MC- Manual collection method; PT- Pitfall trap; YPT- Yellow pan trap; YST- Yellow sticky trap

Eurybrachidae and Flatidae were less abundant (RA < 1%) (Table 1).

Hemipterans are mostly plant sap sucking insects and many are serious pests of agricultural crops. The phytophagous families recorded in the present study include agricultural pests from Cicadellidae, Aleyrodidae, Delphacidae, Aphididae, Lygaeidae, Tingidae, Membracidae, Pentatomidae and Pyrrhocoridae. Besides these, Dictyopharidae, Scutelleridae, Cercopidae, Eurybrachidae and Flatidae also have phytophagous members but are less damaging. Cicadellidae and Delphacidae collectively accounted for 45% of the total hemipterans. Whiteflies were found to be the second most abundant group even though they were

collected by only one method of collection i.e. yellow sticky trap. Aphids (Aphididae) were collected by two methods viz. yellow pan trap and yellow sticky trap and ranked 4th in terms of abundance (RA= 9.53%). Family Lygaeidae (commonly called as seed bugs) is the 5th most abundant family (RA= 6.09%). Some members of family Lygaeidae are phytophagous, some inhabit the ground and leaf litter and some are nocturnal. They were collected by four different collection methods viz., pitfall trap, yellow pan trap, light trap and yellow sticky trap. It was followed by family Cydnidae in terms of abundance (RA= 5.35). Family Cydnidae are called as burrowing bugs as they remain in soil burrows. They can also feed on the plant roots but are not much harmful. It is one

of the extensively occurring families next to Pentatomidae under the superfamily Pentatomoidea. There are 72 species under 28 genera recorded from India so far (Biswas, 2013). They were collected in large numbers in pitfall trap, light trap and yellow pan trap after rainfalls.

Some families are also having predators of other insects acting as pests of crops, which includes; Reduviidae, Anthocoridae, Miridae and Pentatomidae. During the study three families of aquatic hemipterans were recorded *viz.*, Corixidae, Veliidae and Hydrometridae. All these three families were recorded from the light trap. The pond present in the area is the reason for their occurrence. Barman and Deka (2015) reported 15 species of aquatic hemipterans under 8 families from Ghaga Beel of Nalbari district of Assam. Vssou *et al.* (2017) reported 6 families of aquatic hemipterans from Sengunam pond, Perambalur, Tiruchirappalli, Tamil Nadu. Aquatic insects play an important role in aquatic food chain and help in nutrient recycling. Besides this, they also act as ecological indicators in the aquatic ecosystems (Vasantkumar and Roopa, 2014).

The Shannon-Weiner diversity, Margalef's species richness and Pielou's evenness indices for the hemipteran fauna of the study area were 2.252, 2.225 and 0.728, respectively, indicating their good diversity in the study area. Vegetation structure and flower abundance are key factors for species richness, abundance and species composition of bugs (Zurbrugg and Frank, 2006). A good vegetation cover throughout the study period can be the reason for the diversity of hemipterans in this area. The present study records the hemipteran fauna for the first time from this area and it provides a preliminary data, which will be helpful for future works focusing on individual hemipteran families and their identification up to species level.

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