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Cover: Green Sea Turtle *Chelonia mydas* watercolour by Elakshi Mahika Molur.

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COMMUNICATION

First documentation of diversity of the Heteroptera of Cotton University Campus, Kamrup (Metropolitan), Assam, India

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Abstract: Cotton University, a developing university in Guwahati city of Kamrup district from Assam is undergoing a lot of developmental changes leading to a change in land use pattern which will have an impact on insect distribution. Heteroptera studies being severely lacking from this region needs attention for their documentation. A survey conducted on the campus from July 2018 to July 2019 every week between 0700–0900 h on all types of vegetation documented a total of 163 bugs of 20 different species under 10 families of Heteroptera. Pentatomidae was found to be the most dominant family with eight recorded species. Wild vegetation supported more diverse bug forms than the other garden plants. This survey is the first record of these insects from the Cotton University campus and such data forms an important database of available bugs from this region in the wake of the developmental changes the university is going through. Any change in their distribution, if found in the future, will reflect the impact of anthropogenic activities on their existence and distribution. Studies of this kind may be minuscule in level, but it forms an important record of their presence before we lose them to time.

Keywords: Abundance, anthropogenic activities, evenness, host-switching behaviour, insect distribution, insect inventory, nature, pentatomidae, polyphagous, species richness, vegetation.

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Author contributions: Concept & Supervision-ASN; Data collection and survey—SS; Data analysis—ASN & SS; Manuscript writing—SS; Manuscript editing and reviewing—ASN.

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INTRODUCTION

Northeastern region of India is one of the biodiversity hotspots. Assam with tropical monsoon rainfall type region with a mix of hot and humid climate serves as one of the best places for insect population to flourish. However, literature report on Heteroptera diversity from this region is almost negligible. Most of the literature reports about Heteroptera diversity are from northern India or southern India and a few are from western India (Azim 2011; Salini & Viraktamath 2015). Heteroptera is the largest suborder under the order Hemiptera comprising more than 40,000 reported species and possibly 25,000 species are still to be identified (Schaefer & Panizzi 2000). This group of insects are economically very important as they include pests, predators, and vectors of plant pathogens (Mitchell 2004; Kaur et al. 2012; Halder et al. 2020).

Heteropterans are not just insect pests but some of them are important predators of insect pests and they are an important component of our ecosystem. Unfortunately, literature reports on the terrestrial heteropteran studies are lacking from this region despite its faunistic richness. Due to increasing anthropogenic activities related to the developmental work and urbanisation, existence of many organisms, invertebrates, in particular, have become critical, many of them even get extinct over time without having been noticed for their existence. Heteroptera is one such neglected insect group whose records are sparse and limited. Therefore, this work was undertaken to build a biodiversity inventory of heteropteran fauna of Cotton University campus (α diversity) which is a developing university and many new constructions are under way, so an attempt was made to record the available Heteroptera diversity of the campus before much tampering with the natural ecosystem of the campus is done. Study of such insect diversity and their documentation is important to understand the systematics, ecological role, and significance of the insects in an ecosystem. Change in land use pattern, habitat fragmentation, etc., result in distributional variation in insect fauna (Kruess & Tscharntke 2000). So, the objective of this study was to record all the available heteropteran diversity of Cotton University campus before more habitat destruction/fragmentation occurs.

MATERIAL AND METHODS

Study area

Cotton University campus (26.1868 N & 91.7476 E) is situated in the heart of the city Kamrup (M)**,** Assam on the south bank of the mighty Brahmaputra River covering an area of 12.04-acre land (Figure 1). The weather of this location during summer is very hot and humid with heavy rainfall but relatively cooler during winter. The temperature during our study period ranged 10.3–34.4 °C. University campus has the residential area of staff, hostels and cafeteria apart from the main university building. There is a mixed vegetation of wild plants, trees, some herbaceous plants, and vegetable garden but the vegetation distribution is patchy.

Collection

A survey of Heteroptera diversity of the Cotton University campus was carried out from July 2018 to July 2019. For insect collection, random sampling method was used as the vegetation distribution was patchy and not a continuous kind and there is also no specific sampling method for Heteroptera (Fauvel 1999). Insects were collected directly by hand or sweep net and transferred directly into plastic containers. Time of collection was 0700–0900 h as insects are generally active during this time period. The host plants from where the insects were collected were also recorded.

Identification

After collection, insects were observed under stereozoom microscope (Magnus, 2X to 4X) and then they were identified on the basis of morphological characters, using suitable keys (Distant 1902) and book (Rider et al. 2018). Photographs were taken with mobile camera (Samsung M 51, 64 MP camera) and processed in Adobe Photoshop (Version 24.0.1, 2022).

Preservation

Large and hard bodied insects were pinned and dried for 15 days. Dry preserved bugs were kept in wooden boxes provisioned with naphthalene balls to prevent any insect attack. For wet preservation, insects were kept in 70% ethanol along with few drops of glycerine (Mouhoubi et al. 2019). All the dried and wet preserved insects were labelled properly.

Statistical Analysis

Measurement of Diversity

Heteroptera diversity of the Cotton University was calculated using Shannon-Wiener diversity index (H)

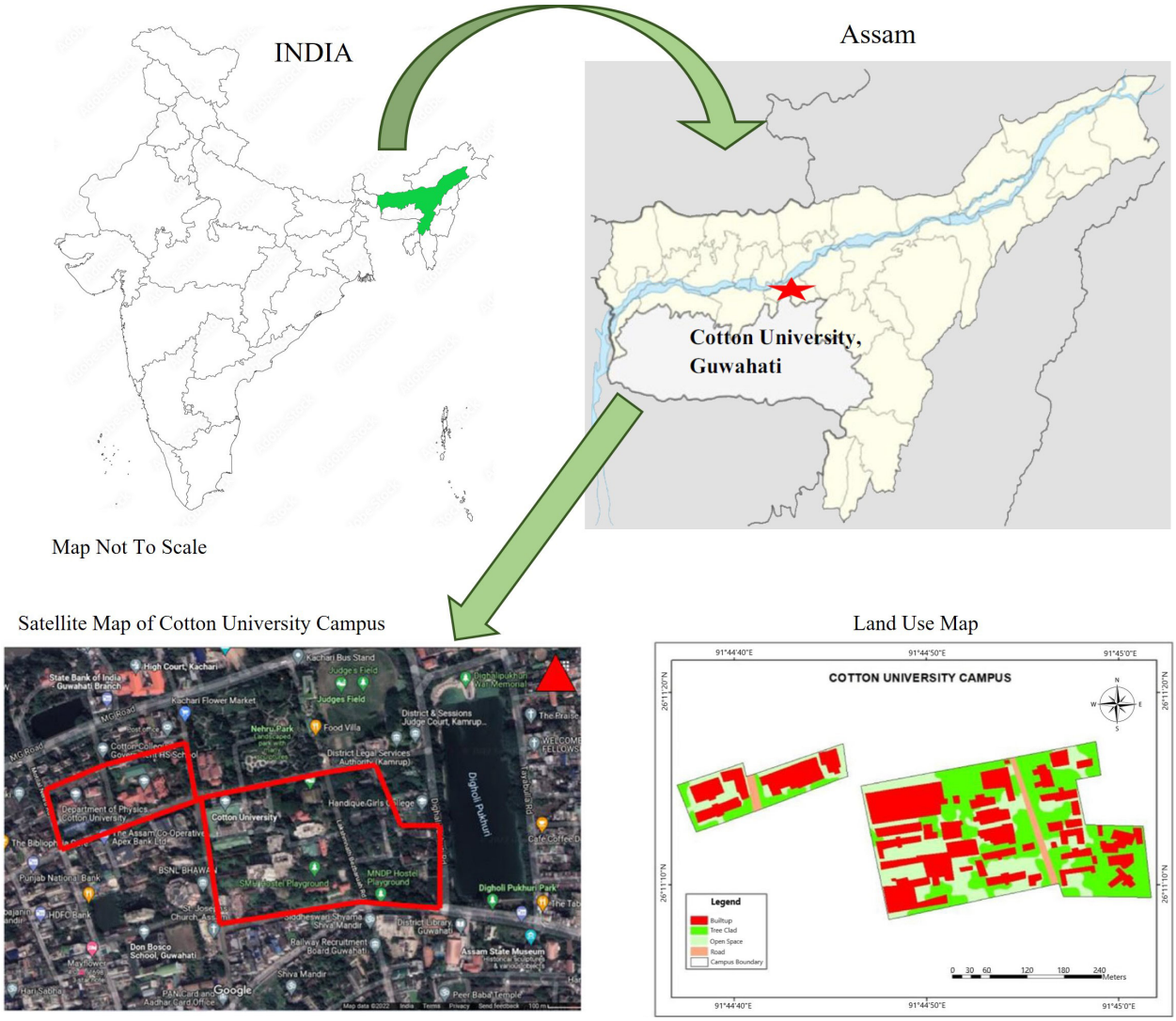

Figure 1. Map of Cotton University Campus (Yumnam & Dey 2022).

(Shannon & Wiener 1949), Simpson's index (D) (Simpson 1949), Margalef's species richness (Margalef 1958), and Pielou's species evenness (Pielou 1966). Dominance status of various species were described on the basis of relative abundance following Engelmann's scale (Engelmann 1973).

RESULTS

During the collection period, July 2018 to July 2019, a total of 163 Heteroptera samples were recorded with 20 species under 10 families (Table 1, Images 1–20). Pentatomidae family was the most diverse in species (40%) in the university campus and three families, viz., Coreidae, Alydidae, and Plataspidae represented nearly 10% each of the Heteroptera diversity and the remaining families represented only 5% of the diversity (Table 1, Figure 2). Bugs like *Carbula scutellata, Megacopta cribraria*, and *Cochlochila bullita* were abundant as compared to other bugs which were either subdominant or recedent.

Bugs were observed and collected from both wild plants as well as some garden plants. Though the plants like *Ocimum sanctum* and *Lablab pururens* were observed to harbour large number of individuals of a particular bug species but the bug diversity was more on either wild vegetation or on *Acalypha indica,* a herbaceous wild plant under the family Euphorbiaceae or on *Solanum* plant (Figure 3).

Both the Shannon-Wiener index (H) (0.90781) and Simpson index (D) (0.205635) clearly indicated good

Table 1. List of heteropteran insects from Cotton University Campus along with their host plant from where they were collected.

	Family	Name of the insect	Plant/ place of collection	Number of individuals	Relative abundance (%)	Dominance status
1.	Pentatomidae	*Carbula scutellata* Distant, 1887	*Acalypha indica*	27	16.56	Dominant
		Plautia crossota Dallas, 1851	-do-	6	3.68	Subdominant
		Halyomorpha picus Fabricius, 1794	*Solanum melongena*	5	3.07	Recedent
		Tolumnia latipes Dallas, 1851	*Acalypha indica*	2	1.23	Recedent
		Eocanthecona furcellata Wolff, 1811	*Solanum melongena*	1	0.61	Subrecedent
		Piezodorus hybnerii Gmelin, 1789	-do-	1	0.61	Subrecedent
		Eysarcoris guttiger Thunberg, 1783	*Acalypha indica*	9	5.52	Subdominant
		Acrozangis antica Vollenhoven, 1868	Found dead	1	0.61	Subrecedent
2.	Coreidae	*Cletus* sp. Stål, 1860	Wild vegetation	2	1.23	Recedent
		Acanthocoris scabrator Fabricius, 1803	-do-	3	1.84	Recedent
3.	Alydidae	*Riptortus pedestris* Fabricius, 1775	-do-	4	2.45	Recedent
		Leptocorisa acuta Stål, 1825	-do-	4	2.45	Recedent
4.	Plataspidae	*Megacopta cribraria* Fabricius, 1789	*Lablab purpureus*	65	39.88	Eudominant
		Brachyplatys subaeneus Westwood, 1837	-do-	4	2.45	Recedent
5.	Urostylidae	*Urolabida histrionica* Westwood, 1837	*Ficus elastica*	1	0.61	Subrecedent
6.	Lygaeidae	*Graptostethus servus* Fabricius, 1787	Wild vegetation	5	3.07	Recedent
7.	Largidae	*Physopelta* sp. Amyot & Serville, 1843	Found dead	1	0.61	Subrecedent
8.	Scutelleridae	*Chrysocoris stollii* Wolff, 1801	*Solanum lycopersicum*	1	0.61	Subrecedent
9.	Dinidoridae	*Coridius nepalensis* Westwood, 1837	*Solanum melongena*	1	0.61	Subrecedent
10.	Tingidae	*Cochlochila bullita* Stål, 1873	*Ocimum sanctum*	20	12.27	Dominant

RA <1 = Subrecedent; RA = 1.1–3.1 = Recedent; RA = 3.2–10 = Subdominant; RA = 10.1–31.6 = Dominant; RA >31.7 = Eudominant. (Jana et al. 2009; Engelmann 1973).

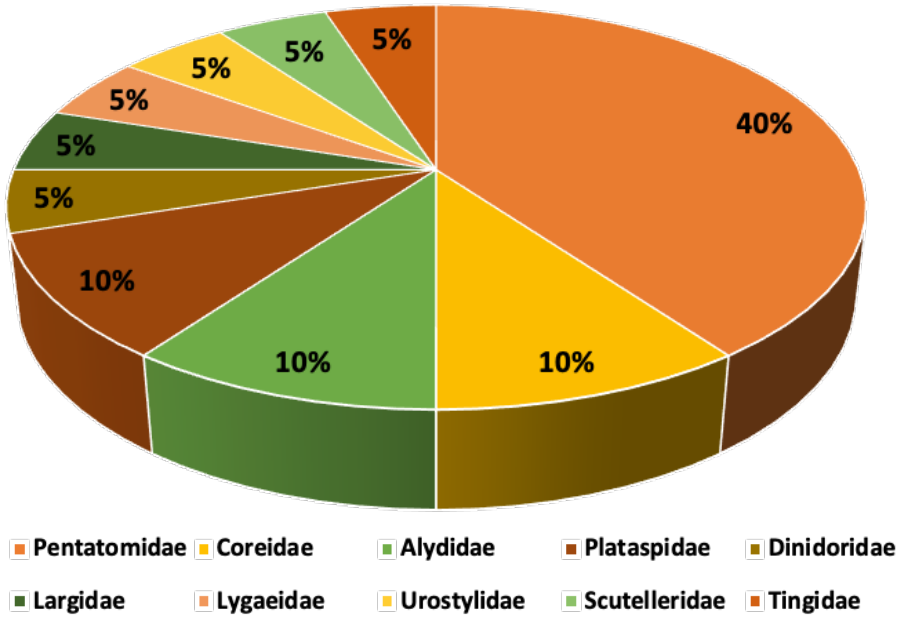

Figure 2. Percentage of bugs according to their number of species collected from a particular Heteroptera family from Cotton University Campus.

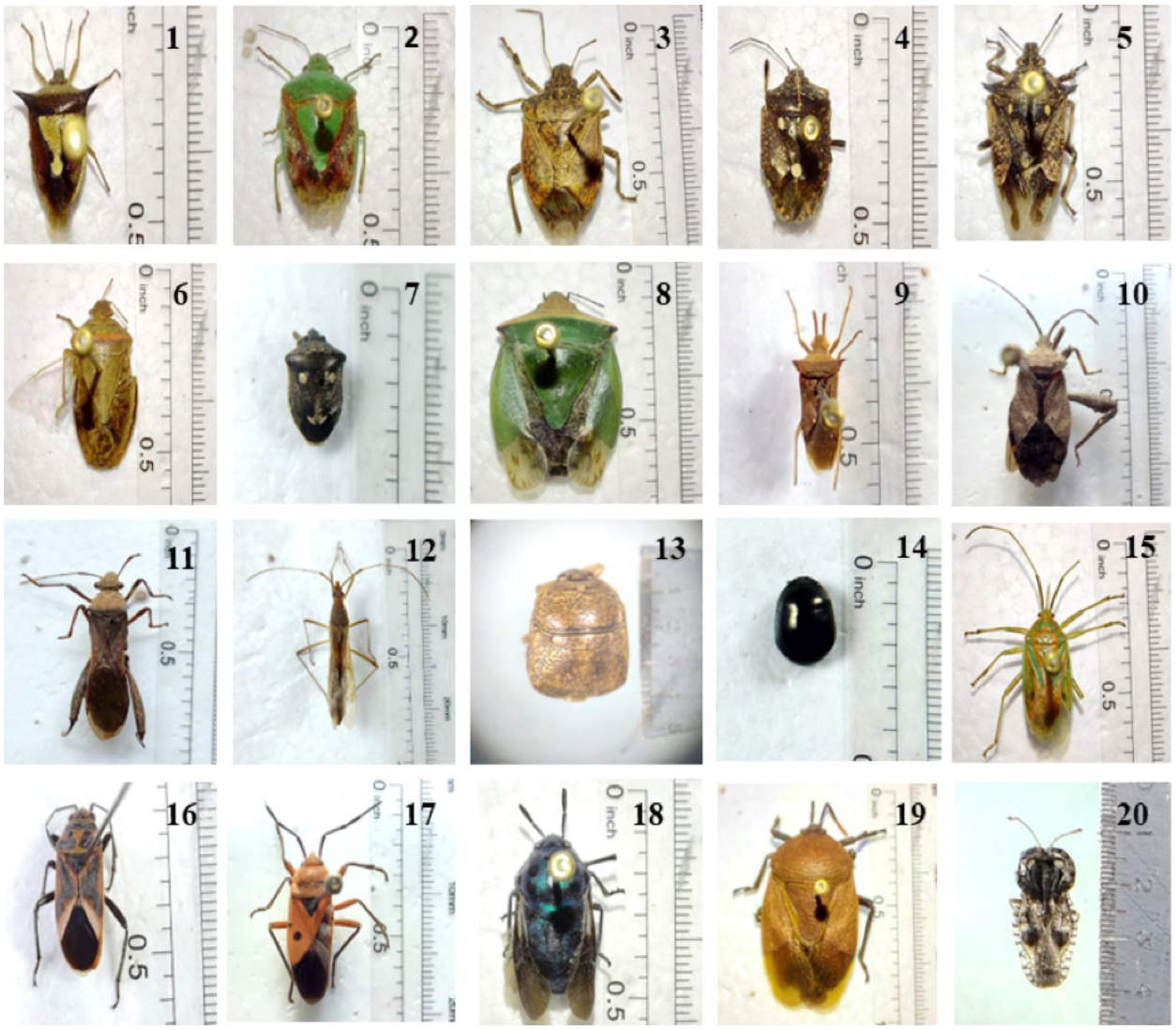

Image 1–20. Heteroptera Diversity of Cotton University Campus.
1—*Carbula scutellata* Distant, 1887 | 2—*Plautia crossota* Dallas, 1851 | 3—*Halyomorpha picus* Fabricius, 1794 | 4—*Tolumnia latipes* Dallas, 1851 | 5—*Eocanthecona furcellata* Wolff, 1811 | 6—*Piezodorus hybnerii* Gmelin, 1789 | 7—*Eysarcoris guttiger* Thunberg, 1783 | 8—*Acrozangis antica* Vollenhoven, 1868 | 9—*Cletus* sp. Stål, 1860 | 10—*Acanthocoris scabrator* Fabricius, 1803 | 11—*Riptortus pedestris* Fabricius, 1775 | 12—*Leptocorisa acuta* Stål, 1825 | 13—*Megacopta cribraria* Fabricius, 1789 | 14—*Brachyplatys subaeneus* Westwood, 1837 | 15—*Urolabida histrionica* Westwood, 1837 | 16—*Graptostethus servus* Fabricius, 1787 | 17—*Physopelta* sp. Amyot & Serville, 1843 | 18—*Chrysocoris stollii* Wolff, 1801 | 19—*Coridius nepalensis* Westwood, 1837 | 20—*Cochlochila bullita* Stål, 1873 . © Santana Saikia.

amount of Heteroptera diversity in the university campus. Margalef's richness was 8.58878 and Pielou's evenness index (0.697762) indicated moderate evenness in the distribution of the species.

DISCUSSION

Heteroptera are one of the most successful insects that almost occupy all the diverse array of habitat owing to their diverse feeding habits (Schuh & Slater 1995). In the present study, Heteroptera bugs were sampled from different kinds of plants some wild and some home-grown garden vegetables. Availability of bugs on these diverse plants could be associated with their polyphagous nature (Panizzi & Grazia 2015) and host switching behaviour to sustain their population. Amongst the 10 different families of Heteroptera recorded from the university campus, Pentatomidae family exhibited most diverse species as compared to others that could be due to their choice of wider range of host plants and ability to thrive well on both cultivated and non-cultivated plants (Panizzi 1997). Presence of large number of Pentatomid bugs may also be because

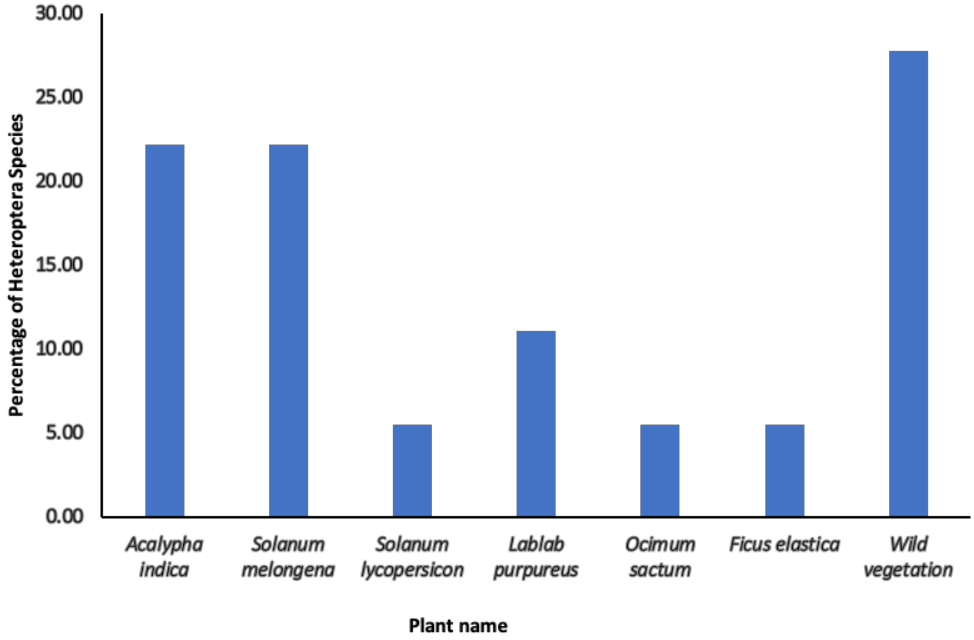

Figure 3. Percentage of different bug species collected from different plants from Cotton University Campus.

of the availability of their suitable host plants/alternate host plants/insect hosts in the university campus. The suborder Heteroptera has 91 different families recorded worldwide (Henry 2017) and among all, Miridae is the most diverse family, followed by Reduviidae, Pentatomidae, Lygaeidae (Schaefer 2013). But deviation from such findings in the present study where we did not find even a single species of Miridae and Reduviidae could be related to the absence of their host/hosts. Pentatomidae was the most diverse family in terms of eight recorded species followed by Coreidae, Alydidae, Plataspidae and so on. Abundance of *M. cribraria* and *C. bullita* in the present study as compared to other bugs was due to the availability of their primary host plant (Zhang et al. 2012; Kumar 2014) in the campus.

Despite the patchy distribution of vegetation in the campus, the diversity indices indicated good diversity in the university campus and the moderate evenness indicated by the Pielou's evenness index was due to the predominance of one species over the other in the region.

CONCLUSION

Insects contribute a lot to the ecosystem services like, source of food, biocontrol agent, and medicine. Their diversity and distributional knowledge therefore, would be of use to mankind in many ways. Study on distribution status of Heteroptera is often neglected primarily due to two reasons; firstly, they are not as attractive as butterflies and secondly their invisible feeding damage to the food crops often goes unnoticed and hence their economic importance is not realised. Moreover, many of them are important as predator of agricultural pests and as vectors of plant pathogen, therefore knowledge of such heteropteran bugs will be helpful in designing pest management strategies. Besides this any studies pertaining to biodiversity like taxonomic identification or report of new species helps in enriching the knowledge of faunal diversity of that region and documenting the insect inventory. The present study was carried out in a small university campus for just one year and it revealed a good amount of Heteroptera diversity. Studies like this forms a base for further research on different aspects of Heteroptera and will lead us to better understanding of diverse group of insects existing in this region. This university, under development is experiencing a lot of changes in terms of land use as well as land cover, thereby having a direct influence on faunal distribution, especially insects. So, any change in the bug diversity in future will be an indication of the impact of anthropogenic activities on their existence and distribution.

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