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Diversity and effect of meteorological factors on the reduviid bug population from selected habitats of Virudhunagar district, Tamil Nadu, India

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Abstract
The present contribution reports on the study of diversity and population dynamics of reduviids in selected habitats in Virudhunagar district, Tamil Nadu.
Data on the diversity and population dynamics of *Rhynocoris marginatus* (Fab.), *Rhynocoris fuscipes* (Fab.) and *Catamiarus brevipennis* (Serville) from the agricultural field. *Acanthaspis pedestris* (Stål) from the semi-arid zone, *Ectrichodia crux* (Thunberg) and *Lophocephala guerini* (Lap.) from the Scrub jungle area were collected in 12 months from January 2020 to December 2020.
Various diversity indices like the Margalef index (R1), Menhinick index (R2), Simpson's index (λ), Shannon's index (H`), Evenness indices were calculated, and the results were provided.
Predator and prey density levels of Reduviid bugs were observed in the study field. The maximum reduviid population was recorded in August 2020, and the minimum population was followed in November 2020.
The Reduviid diversity was correlated with meteorological data. The results of correlation revealed that rainfall, humidity, and temperature affect reduviid population.
Present study revealed the unstable condition of reduviid bug population. Hence, measures to be taken to uplift the reduviid population by mass culture and field release.

Keywords: reduviid, diverstiy, population dynamics, *Lophocephala guerini*, margalef index, simpson's index, evenness index, meteorological data

Introduction

Biodiversity of insects means the variety or full array of different species on earth. This biodiversity is instead distributed heterogeneously across the earth. While some areas dominate with the rich diversity of insects, others are virtually devoid of life, or they remain somewhere in between. For instance, communities such as the tropical evergreen forests are astonishingly rich in the number and types of species they support, whereas others are relatively species-poor. No doubt, Insects are the world's most successful and diverse group of organisms. They have the most significant number of species relatively in the animal kingdom, and about three-fourths of the known species of animals on earth are insects [1]. In the world, the family Reduviidae is documented with approximately 7000 species that come from 29 subfamilies. Assassin bugs are efficient predators, except for one species, namely *Lophocephala guerini* Laporte, and many of them predate on insect pests. Under their trophic status and their potential to regulate the population of other insects, especially insect pests, assassin bugs play an essential role in community ecology and pest control [2]. The assassin bugs of the family Reduviidae under Order Heteroptera (Insecta: Rhynchota) is one of the most abundant groups and shows significant economics and high scientific value [3]. Biologists have long struggled to describe and catalogue the diversity of animal species found on the surface of the globe. Amongst many vertebrate groups, such as mammals and birds, the rates of discovery of new species are low and declining, suggesting that the majority of extant species are now known to science. However, continuously exploring new tropical habitats among insects yields a profusion of new species [4]. The assassin bugs are the members of the suborder Heteroptera of the order Hemiptera. It is one of the most prominent families in the order Hemiptera, found in the tropical rain forest. However, generally, they occur in the semi-arid zone and scrub jungle. The members of this group are voracious feeders and polyphagous predators. The nonpredatory Reduviidae bugs belong to the subfamily Triatominae are blood-sucking ectoparasites. Some species of this family are pathogenic and transmit various diseases to man and animals. They are known as kissing bugs, which feed on vertebrate blood and in the Neotropical region. This group is primarily associated with the bark of trees, shrubs, herbs, and trees. Reduviidae bugs are mostly predatory insects and are widely diverse in morphology, diet specialization, and microhabitat preference [5]. Hemipteran insects, usually called "true bugs," are of great economic importance as they are pests of various commercial crops. The members of this group show the hemimetabolous metamorphosis as the nymphal stages have a remarkably similar structure to adults [6]. Predatory Heteropterans are potential biocontrol agents. Among them, reduviids are predominant that regulate the population of other insects, especially insect pests.
Moreover, assassin bugs play an essential role in community ecology. However, it has received very little attention as a group of beneficial predators. Knowledge of their distribution and diversity is a prerequisite for utilizing them in biological control programmes [7]. Reduviidae, assassin bugs are one of the largest, most charismatic, and probably the morphologically and behaviorally most diverse group of Heteroptera. They are essential components of ecosystems

but also important in agriculture and medicine. Reduviid bugs are much larger than other hemipteran predators such as *Nabis* (Nabidae), *Geocoris* (Lygaeidae), *Orius* (Anthocoridae), *Lygus* (Miridae), or *Podisus* (Pentatomidae). They are capable of successfully attacking and consuming larger prey and as used as biocontrol agents. Understanding distribution, diversity, abundance and population dynamics is imperative to explore its biocontrol potential [8]. The Triatominae are hematophagous and are well studied due to their role in transmitting Chagas disease. The rest of Reduviidae are lesser-known, but all are predators, primarily generalists feeding on other arthropods, although many groups exhibit prey specializations. Hence, reduviids may play a significant role in maintaining insect populations and the equilibrium in rainforest ecosystems. Reduviidae dwell in various habitats, such as understorey foliage, on flowers, under the bark of trees, on the ground, or within the leaf litter. Most of them are diurnal, including the subfamily Harpactorinae, but others are nocturnal. Many reduviids are winged, but some, including many species of Emesinae, are apterous [9]. The present investigation reports on the diversity and population dynamics of reduviids in selected habitats in Virudhunagar district, Tamil Nadu helps to realize the importance of conservation and augmentation of the reduviid predators and their utilization in biological control of the insect pests of agricultural as well as forest vegetations in India.

Materials And Methods

Study Area and Period

The study was carried out in three ecologically different habitats in SrivilliputturTaluk, Virudhunagar District as agricultural fields, Scrub jungle, and semi-arid areas. The study was extensively carried out from January 2020 to December 2020).

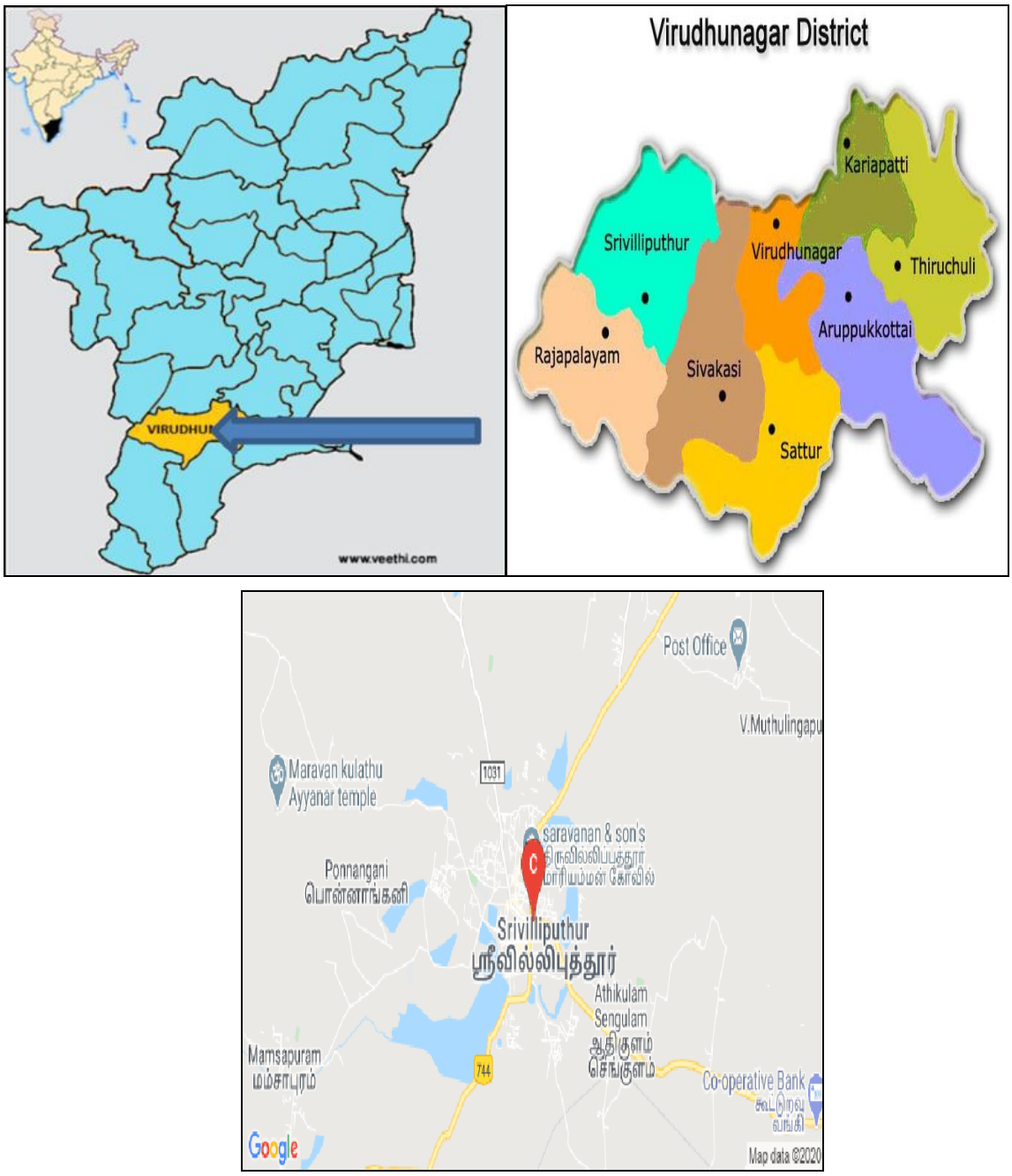

Fig 1: Study Area

Sample Collection and Identification

Reduviid bugs were collected underneath 50 to 100 life table stones, by using forceps and hand picking method. All the collected insects were mounted by pins, it form a single observation unit. Fortnightly collection records of the population of males and females were calculated separately, and meteorological readings were done simultaneously. Extra care was taken to replace the stones after observation to maintain the unit. The camouflaging behaviour of *A. pedestris* presented considerable difficultly in assessing their population in the field. The collected reduviids were identified using the standard key, Fauna of British India and some field experts.

Diversity Indices

Raw data from the field were used to reveal species diversity by the biodiversity indices, namely richness, Margalef index (R1), Menhinick index (R2), Simpson's index (λ), Shannon's index (H`), Evenness indices and correlation coefficient were derived from data collected. PAST software was used to calculate the diversity indices.

Results

The present study was surveyed of *Rhynocoris marginatus* (Fab.), *Rhynocoris fuscipes* (Fab.), and *Catamiarus brevipennis* (Serville) from the agricultural field. *Acanthaspis pedestris* from semiarid zone. *Ectrichodia crux* and *Lophocephala guerini* from the Scrub jungle area were collected in 12 months, from January 2020 to December 2020.

In agricultural fields, the peak population of *Catamirus brevipennis* was recorded from January (2020) to April (2020). The peak population of reduviids coincided with a higher prey population and moderate temperature. In a semi-arid area, the peak population of *Acanthaspis pedestris* was registered from April (2020) to July (2020). Their prey population was also recorded as maximum for those periods. Minimum rainfall and relative humidity occurred. The population of *Lophocephala guerini* was recorded at a peak from September 2020 and October 2020. Its population also coincides with higher prey populations and higher rainfall, relative humidity, and moderate temperature (Table 1).

Likewise, the Shannon - Weiner index's calculated value was ranged between 0.5- 0.8. The lowest diversity index was calculated in September 2020 (0.538). The highest value was found in February (0.806). The computed value of Simpson's diversity index was ranged between 0.9 to 1.7. The lowest diversity index was calculated in September 2020 (0.919). The highest value was found in February (1.701). The computed value of species richness (R1) ranges between 0.5 to 1.3. The highest value was found in January 2020 (1.396). The lowest value was found in August 2020 (0,588). The evaluated value for species calculated value of species richness (R2) ranges between 0.5 to 1. The highest value was found in January 2020 (1). The lowest value was found in April 2020 (0.536). The calculated value species evenness ranges between 0.6 to 0.9. The highest value was found in April 2020 (0.968). The lowest diversity index was calculated in June 2020 (0.696), and the highest number of individuals was found in April 2020 (87). The lowest number of individuals was found in November 2020 (15) (Table 2). Population dynamics of the Reduviid bug show a negative correlation with the minimum and maximum temperature, -0.02 and -0.03, respectively. When the temperature increases, the reduviid bug population suffers and decreases in number. The reduviid bug population positively correlates with rainfall (0.12), which means when precipitation occurs, the favourable condition for reduviid bug arises then the reduviid bug increases in numbers.

Table 1: Showing species occurrence and prey level of reduviid predators in Virudhunagar District, Tamil Nadu, India:

S. No	Species Name	Jan 2020	Feb 2020	Mar 2020	Apr 2020	May 2020	Jun 2020	Jul 2020	Aug 2020	Sep 2020	Oct 2020	Nov 2020	Dec 2020
1	*Rhynocoris Marginatus* (Fab.)	5	8	11	13	6	3	4	-	-	4	5	3
		+	+	++	+++	++	++	++	-	-	+	++	++
2	*Rhynocoris fuscipes* (Fab.)	2	3	6	20	14	15	12	6	-	1	-	5
		+	+	++	+++	+++	+++	+++	++	-	+	-	++
3	Catamiarus brevipennis (Serville,1831)	5	14	8	15	-	11	4	-	5	3	2	6
		++	+++	++	+++	-	+++	++	-	++	++	+	+++
4	Acanthaspis pedestris	5	13	2	25	22	19	11	15	4	5	3	2
		++	+++	+	+++	+++	+++	+++	+++	++	++	+	+
5	Ectrichodia crux	5	7	-	14	12	2	-	-	15	19	-	3
		+	++	-	+++	+++	+	-	-	+++	+++	-	+
6	Lophocephala guerini	14	10	12	-	3	1	3	9	-	14	5	-
		+++	+++	+++	-	+	+	+	++	-	+++	++	-

+ Scanty; ++ Moderate; +++ Abundant

Table 2: Species diversity indices of Reduviid bugs on study area:

Diversity indices	Jan 2020	Feb 2020	Mar 2020	Apr 2020	May 2020	Jun 2020	Jul 2020	Aug 2020	Sep 2020	Oct 2020	Nov 2020	Dec 2020
Number of individuals	36	55	39	87	57	51	34	30	24	46	15	19
Species richness (R1)	1.396	1.248	1.092	0.895	0.989	1.272	1.134	0.588	0.629	1.306	1.108	1.358
Menhinick Index (R2)	1	0.809	0.800	0.536	0.662	0.840	0.857	0.547	0.612	0.884	1.033	1.147
Evenness	0.846	0.912	0.882	0.968	0.837	0.696	0.853	0.933	0.835	0.705	0.938	0.928
Shannon diversity index	0.768	0.806	0.757	0.786	0.732	0.722	0.735	0.62	0.538	0.712	0.72	0.770
Simpson's diversity index	1.625	1.701	1.485	1.577	1.432	1.429	1.45	1.03	0.919	1.442	1.323	1.575

Discussion

In the present investigation 6 species of reduviid bugs belonging to 3 different areas were observed in Srivilliputtur Taluk, Virudhunagar District, TamilNadu, India. Previously [10] reported that 57 reduviid species were distributed in 28 genera in the Central Highlands of Vietnam; 28 species were distributed in 17 genera of subfamily Harpactorinae. In Vietnam, the Harpactorinae is the largest reduviid subfamily, including more than 34 genera and 62 species. Similarly, [11] Surveyed the vegetation in the Tilari forest of Chandgad Tahsil is very rich and related to the Dajipur reserved forest of Radhanagari. A total of 19 Indian species of assassin bugs under Thirteen genera and seven subfamilies were recorded. The present study contains all the species of Reduviidae, which were reported the first time from Tilari forest Chandgad.

The peak population of reduviids coincided with a higher prey population and moderate temperature. Similarly, [12] The distribution and diversity of the reduviid population was found to be directly influenced by prey population and indirectly influenced by meteorological factors such as temperature, humidity, rainfall, and wind velocity.

In the present study, the highest number of individuals was found in April 2020 (87). The lowest number of individuals was found in November 2020 (15). Similarly, [13] reported the Hemiptera was predominant with 29 species belonging to 27 genera and 12 families, followed by Coleoptera with 23 species and 21 genera and ten families. The α diversity (4.60) H' diversity (2.49), richness (R1- 4.14; R2 – 0.98) were found to be higher for Hemiptera. In Isoptera α diversity (1.100), H' diversity (0.48) richness R1 (0.24) was found to be the lowest among all the orders recorded. The heavy rainfall also affected the species diversity.

Population of the Reduviid bug show a negative correlation with the minimum and maximum temperature, -0.02 and -0.03, respectively. Previously [14], the population was agitated from 46th to 48th standard metrological week and attained the maximum incidence of 4.53 mirid bugs/plant during 49th average metrological week with the weathers parameters of maximum temperature (31.07°C), minimum temperature (21.97°C), relative humidity (72.61 %) and rainfall (58.5 mm) during 2014-2015 whereas the maximum incidence of 4.476 mirid bugs/plant was recorded with the weather parameters of maximum temperature (28.71°C), minimum temperature (22.86°C), relative humidity (74.32 %) and rainfall (131.72 mm) during 46th standard meteorological week of 2015-2016. Similarly, [15] observed a large population of most insects following the period of rainfall or immediately after the rainy season. The peaks reported in the present study also coincided with precipitation during May (98 mm) and October (199 mm). Verma and Vaishampayan (1983) observed a similar little peak of Coleoptera (scarabeids) that coincided with the monsoon. They also reported that adult insect activities were limited to the rainy season only.

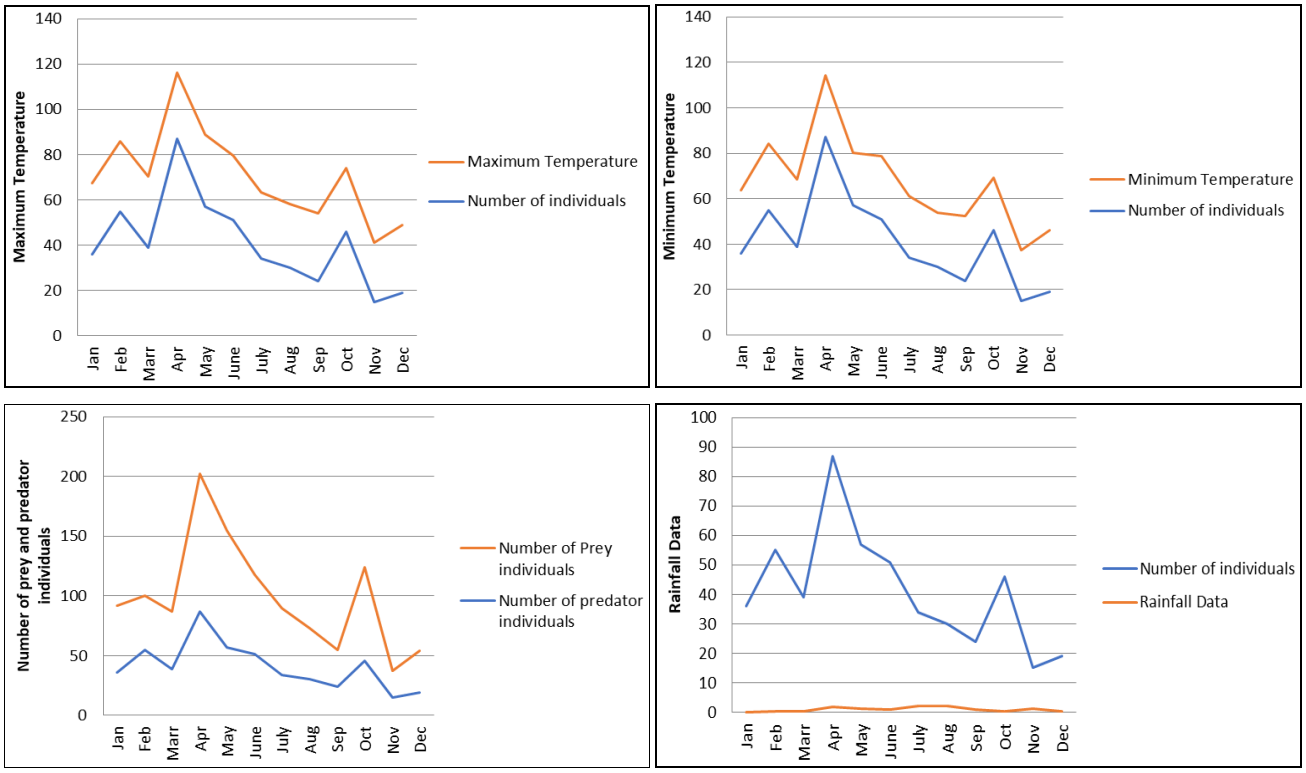

Fig 2: Reduviid bug population with weather parameters represents the graphical data

Conclusion

The main objective of the present research work was to survey the species diversity of reduviids and the effect of meterological factors on their population in three different ecosystems. In that the interaction between Reduviid population dynamics of *Rhynocoris marginatus (Fab.), Rhynocoris fuscipes (Fab.), and Catamiarus brevipennis (Serville, 1831)* from the agricultural fields and *Acanthaspis pedestris* from the semi-arid zone, *Ectrichodia crux,* and *Lophocephala guerini* from Scrub jungle area of Virudhunagar District with their prey and weather factors were studied. The recorded data concluded the species richness', evenness index, shannon index, and simpson index. Focusing on the correlation coefficient indicates that an increase in rainfall and temperature affects the Reduviid bugs population in the

study area. Also the success of evolving strategies for effective utilization of reduviid bugs as biocontrol agents mainly depends upon the knowledge we have on its biology, ecology covering distribution and diversity. The present study revealed the importance of Reduviid bugs conservation in the ecosystem. Further this study excavated the basic suitable environmental factors and prey details of Reduviid bugs which are useful to standardize their mass culture technology for enable us to evolve suitable techniques for employing reduviid bugs as biocontrol component of integrated pest manangement in the agricultural fields. The population studies infer that reduviid bug population is unstable in all the three study areas. Further the present study also conclude that, this is the right time to standarize the mass culture technology and field release, to protect and stabilize the reduviid bug population in all the three ecosystem.

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References

1. Thanasingh PD, Ambrose DP. Biodiversity and distribution of entomofauna in Three ecosystems in thoothukudi district, Tamil nadu. Insect pest management, a current scenario, 2011, 38-57.
2. Weirauch C. Cladistic analysis of Reduviidae (Heteroptera: Cimicomorpha) based on morphological characters. Systematic Entomology,2008:33:229-274.
3. Ambrose DP. *Assassin Bugs*. Oxford & IBH Publishing Company Private Limited, New Delhi, 1999, 337.
4. Ghosh LK, Biswas B. Fauna of conservation areasnumber 6 Fauna of Indravati Tiger Reserve, 1995, 19-29.
5. Hodkinson ID, Casson D. A lesser predilection for bugs: hemiptera (insecta) diversity in tropical rain forests, eiologicul journal of the linneun society,1991:43:101-109.
6. Weirauch C, Schuh RT. "Systematics and evolution of Heteroptera: 25 years of progress". Annual Review of Entomology,2011:56:487-510.
7. Ambrose DP, Livingstone D. Population dynamics of three reduviids from Pennisular India. Bulletin of Entomology,1978:19:201-203.
8. Sivaramakrishnan S, Jesurajan s, Rajan k, Dunston P Ambrose. Field record of harpactorine assassin bugs in tirunelveli district, tamilnadu, south india. Insect pest management, a current scenario, 2011, 198-203.
9. Gil-Santana HR, Forero D, Weirauch CH. Assassin bugs (Reduviidae Excluding Triatominae). True Bugs (Heteroptera) of the Neotropics. (ed. by AR Panizzi and J Grazia), Springer, Dordrecht, Netherlands, 2015, 207-351.
10. Truong XL, Cai W, Tomokuni M, Isikawa T. The assassin bug subfamily Harpactorinae (Hemiptera: Reduviidae) from Vietnam: an annotated checklist of species. Zootaxa,2015:3931(1):101-116.
11. More SV, Prashant MS, Singh A. Fauna of Assassin Bugs (Hemiptera: Reduviidae) from Tilari Forest, Kolhapur, Maharashtra. International Journal of Applied Agricultural Research,2017:12(3):271-277.
12. Raja JM. Reduviid (hemiptera) fauna from courtallam and Pilavaikal tropical rainforests and Marunthuvazhmalai And Muppanthal scrub jungles, Tamil nadu, south india, Insect pest management, a current scenario, 2011, 152-161.
13. Edwin J, Dunston P Ambrose. Diversity and population dynamics light trapped insects from courtallam tropical rainforest, western ghats, tamil nadu, south india. Insect Pest Management, A Current Scenario, 2011, 58-68.
14. Saravanan P, Karthikeyan A, Padmanaban B, Nagasathiya A. The Weather factors responsible for the population dynamics of brown miridbug, creontiadesbiseratense distant (hemiptera: miridae) in bt cotton. Int. J. Zool. Appl. Biosci,2017:2(6):370-376.
15. Janzen DH. Sweep samples of tropical foliage insects: Effects of seasons, vegetation types, elevation, time of day and insularity. Ecology,1973:54(3):687-706.