



ISSN (E): 2277-7695  
ISSN (P): 2349-8242  
NAAS Rating: 5.23  
TPI 2022; 11(5): 1775-1779  
© 2022 TPI

[www.thepharmajournal.com](http://www.thepharmajournal.com)

Received: 01-02-2022

Accepted: 09-03-2022

#### Rukshana

Department of Entomology,  
College of Agriculture, Swami  
Keshwanand Rajasthan  
Agricultural University, Bikaner,  
Rajasthan, India

#### VS Acharya

Department of Entomology,  
College of Agriculture, Swami  
Keshwanand Rajasthan  
Agricultural University, Bikaner,  
Rajasthan, India

#### Deendyal Saini

Department of Entomology,  
College of Agriculture, Swami  
Keshwanand Rajasthan  
Agricultural University, Bikaner,  
Rajasthan, India

#### Mahendra

Department of Entomology,  
College of Agriculture, Swami  
Keshwanand Rajasthan  
Agricultural University, Bikaner,  
Rajasthan, India

#### Corresponding Author:

#### Rukshana

Department of Entomology,  
College of Agriculture, Swami  
Keshwanand Rajasthan  
Agricultural University, Bikaner,  
Rajasthan, India

## Faunal diversity of different hemipterans in Bikaner (Rajasthan) associated with *kharif* crops

Rukshana, VS Acharya, Deendyal Saini and Mahendra

#### Abstract

The present investigation entitled “Faunal diversity of different hemipterans in and around Bikaner associated with *kharif* crops” was carried out during the *kharif* 2020. The collection of hemipteran insects was started in the last week of July from different crops grown in the vicinity of district Bikaner and continued up to the mid October. During this period a total 2476 insects were explored, preserved, labelled, and characterization and further morphological and identification studies were made. The peak activity of hemipteran insects was noticed in 37<sup>th</sup> meteorological week (10-16 Sept). The maximum number (761 insects out of 2327) of hemipteran insects were associated with the crop family Gramineae followed by family Leguminosae and Malvaceae. Twenty- three families of order Hemiptera were identified during the investigation *viz*; Pentatomidae, Lygaeidae, Cicadellidae, Miridae, Delphacidae, Cydnidae, Corixidae, Aleyrodidae, Alydidae, Coreidae, Dinidoridae, Aphididae, Reduviidae, Pyrrhocoridae, Geocoridae, Rhyparochromidae, Tingidae, Belastomidae, Stenocephalidae, Scutelleridae, Anthocoridae, Membracidae and Hydrometridae. whereas, Stenocephalidae, Geocoridae, Scutelleridae, Anthocoridae, Rhyparochromidae, Cydnidae, Corixidae, Hydrometridae and Dinidoridae recorded first time from this area. Among these, family Pentatomidae was largest family followed by Lygaeidae, Cicadellidae and Miridae. Shannons diversity index revealed that Pentatomidae family showed the abundance in population followed by Lygaeidae while Simpson’s index indicated that Pentatomidae family fauna showed high richness followed by Lygaeidae.

**Keywords:** Hemiptera, Family, *Kharif*, specimens, fauna

#### Introduction

The term biological diversity was first articulated by Norse and Mc Manus (1980) and contracted as “biodiversity” apparently by W.G. Rosen in 1985. Biological diversity means the variability among the living organisms from all sources including, interalia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems (Harper and Hawksworth, 1994) [1]. Insects are the world’s most diverse group of animals on earth, in terms of both taxonomic diversity and ecological function. Insects represent the vast majority of species in terrestrial and fresh water ecosystem (Belamkar and Jadesh, 2014) [2]. Approximately 30 million species are found worldwide, of which about 1.4 million have been briefly described. There are about 7,51,000 known species of insects, which is about three-fourth so fall species of animals on the planet (Choudhary and Ahi, 2015) [6]. Presently, 63,760 species of insect (Hexapoda) in 658 families representing 27 orders and three class are reported from India.

Among these orders, Hemiptera is a large diverse group of insects. Earlier authorities recognize the two orders of these insects, the Hemiptera or true bugs and the homoptera including cicadas, hoppers, aphids, and their allies. Earlier classification had the homopteran divided into two suborders; the auchenorrhyncha, containing the cicades and hoppers and the sternorrhyncha, containing the psyllids, whiteflies, aphids and scale insects. Within the suborder heteroptera, family Pentatomidae is known to form the third of largest family, followed Reduviidae and Miridae. Pentatomidae is one of largest families of the order, spread over the tropical and temperate zones, most abundant in tropical regions. There are 133 families of hemipteran found worldwide, ranging from 184000-193000 species (Hodkinson and Casson 1991) [13]. According to recent estimate about 80,000 hemipteran species are present worldwide. In India 77 families having 6500 species are found. Out of these, 2421 species are endemic to India (Alfred, 2003) [1].

Hemipteran insects that are usually are of great economic importance as most of them are pests

of various commercial crops. A detailed account of hemipteran fauna of central India had been done by Distant (1904) [7]. Later on, brief account of this order was described by Ghosh and Biswas (1995) [10], Chandra (2008) [3] but so far, no comprehensive account of hemipteran of Bikaner in Rajasthan is available only the scattered information on faunal diversity of hemipteran has been published by some workers including Sima and Srivastava (2012) [20]. The crops grown in *Kharif* ecosystem of Bikaner district are bajra, moth bean, moong bean, cluster bean, groundnut and cotton. The present study would help to know the prevailing hemipterans in Bikaner vicinity. By knowing the prevailing species of hemipterans in vicinity and by correctly identifying them up to family, biodiversity of insects could be summarizing with of its components species richness and evenness.

### Materials and Methods

The study site is located 9 km away from Bikaner city on Sriganganagar road. It is located in North direction Bikaner at 28.01°N latitude and 73.22°E longitude with an altitude of 234.70 meters above mean sea level. This region falls under Agro Climatic Zone I C [Hyper Arid Partially Irrigated Western Plain Zone] of Rajasthan and Agro Climatic Zone XIV (Western Dry Region) of India. The climate of this zone is typically arid, which is characterized with low rainfall and wide range of temperature in summer and winter. During the summers, temperature may go as high as 48° C, while in winters, it may fall as low as 0° C. The annual rainfall of this tract is 250 mm which is mostly received from July to September. The relative humidity varies between 8 to 92 per cent. This region prone to high wind velocity and soil erosion, soil drifting due to high wind velocity leads to soil erosion. The study was conducted at research farms of College of Agriculture, Agricultural Research Station, landscape area of Swami Keshwanand Rajasthan Agricultural University and vicinity of Bikaner. Moth bean, cluster bean, groundnut, cotton, pearl millet, cowpea, mung bean, millets, brinjal, okra and sponge guard were grown during the study period. The research farms of the university were surrounded by neem, khejri, peepal and other trees species.

The material required for collecting the hemipterans were insect collecting net, insect killing bottles, forceps, hand lens, entomological pins, drying chamber, small hair brush, ethyl alcohol (90%), stereo zoom microscope, different colour century papers, insect preservation boxes etc. Family level identification of hemipteran fauna with the help of following taxonomic key (Choate, 2010 and Wilson, 2005) [5, 22] and collected during the investigations was done in Post Graduate Laboratory, Department of Entomology, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner during 2020-21. Some of the specimens were submitted to Department of Entomology, University of Agricultural Science, GKVK, Bengaluru for species identification and got identified.

### Measures of Diversity

Species abundance data were tabulated and analyzed suitably to elicit information on pattern species richness, Shannon-Wiener diversity index (1948) and Simpson's index (Simpson's, 1949) were estimated. These diversity indices were calculated for all data collected across the time to ascertain the temporal change in the diversity of hemipteran insects at campus of S. K. Rajasthan Agricultural university. Diversity indices used for analysis are listed below.

### Shannon- Wiener diversity index (1948)

Shannon's diversity index was worked out from the data of identified fauna by using following formula.

$$H = - \sum_{i=1}^s p_i \ln(p_i)$$

H = Shannon's diversity index

Pi = ni/N

N = Total number of individuals of all species

Pi = Relative abundance of species

S = Total number of species

### Simpson's index (Simpson's, 1949)

The measure equals the probability that two entities taken at random from the dataset of interest represent the same species.

$$D = \sum_{i=1}^R p_i^2$$

D = Simpson's diversity index

R = Richness

Pi = proportion of i<sup>th</sup> species and calculated as "ni/N" where, 'ni' is the number of individuals in "i<sup>th</sup>" species and 'N' is the total number of individuals in the sample.

### Results and Discussion

The collection of Hemipteran insects was started in the last week of July to the mid October. During this period, a total 2476 Hemipterans were collected from field of different places by using net, hand picking and preserved for further study and some Hemipterans were collected from light source of study area (table 1). The similar study was conducted by Chandra and Kushwaha (2012) [4] on the true bugs (Hemiptera) fauna at Pachmarghi biosphere reserve, M.P., India. They were recorded more than 250 specimens of true bugs from different localities. Identification was made through the current literature including the volumes of Fauna of British by Distant (1902 & 1904) [7, 8]. In the line of present investigation, Chandra *et al.* (2012) [4] carried out the study on distribution and diversity of Hemiptera fauna of Veerangana Durgavati Wildlife Sanctuary, Damoh, Madhya Pradesh (India). They were recorded that a total 136 specimens of hemipteran fauna and data also presented in table 1 and figure 1 indicated that, during the study twenty- three families of hemipterans fauna have recorded *viz.*, Pentatomidae, Lygaeidae, Cicadellidae, Miridae, Delphacidae, Cydnidae, Corixidae, Aleyrodidae, Alydidae, Coreidae, Dinidoridae, Aphididae, Reduviidae, Pyrrhocoridae, Geocoridae, Rhyparochromidae, Tingidae, Belastomidae, Stenocephalidae, Scutelleridae, Anthocoridae, Membracidae and Hydrometridae. The results indicated that 22.90 per cent of the total collection of hemipteran insects was represented by family Pentatomidae with the number of 567 insects. This was largest family of order hemiptera in *kharif* crop ecosystem and within this family major insect was *Nezara virudala*. It was followed by family Lygaeidae (17.12%), in which 424 insects were identified, this was second largest family of order hemiptera and within this family major form recorded were *Oxycarenus hyalinipennis*, *Graptostethus quadrisignatus* (Distant), *Spilostethus pandurus* (Scopoli), *Spilostethus hospes* (Fabricius). The Cicadellidae (13.33%), was third largest family comprised of 330 insects and the major species was *Amrasca biguttula biguttula* and family Miridae with 10.14 per cent was fourth largest family in *kharif* crops.

However, family Delphacidae (6.02%) and Cydnidae (5.29%) showed moderate population of Hemipterans fauna. Family Anthocoridae (0.74%), Membracidae (0.41%) and Hydrometridae (0.20%) also showed lower population of hemipterans fauna in *kharif* crops, Bikaner. These present observations are in agreement to that of Henry (2009) [12] who reported that Pentatomidae was one of the largest super families of Heteroptera comprising of 1301 genera and 7182 species distributed in 16 families all over the world. Of these, family Pentatomidae alone represent 896 genera and 4722 species distributed in 8 subfamilies. Similarly Chandra *et al.* (2012) [14] observed 8 families such as Reduviidae, Lygaeidae, Pyrrhocoridae, Coreidae, Alydidae, Pentatomidae, Dinidoridae and Cydnidae, while study on distribution and diversity of Hemiptera fauna of Veerangana Durgavati Wildlife Sanctuary, Damoh, Madhya Pradesh (India) support the present findings. The results are also in accordance with Kumar and Naidu (2010) [14] who recorded that in Hemiptera, family Pentatomidae was maximum (17%), followed by Coriidae (15%), Reduviidae (10%), Aphididae (8%), Lygaeidae (7%) and the remaining 17 families were less abundant with the percentage of 2 to 5. Pentatomid bugs like *Halys dentatus*, *Eusarcocoris montivagus*, *Nezara graminea* and *Eucanthecona furcellata* were found in all the habitats. Contrary to the present investigation Narayan (2016) [18] recorded that family Aphididae had rich fauna during the course of study contributing about 28.11 per cent, followed by Pentatomidae 18.83 per cent, Cicadellidae 18.56 per cent, Pyrrhocoridae 17.50 per cent and family Belostomatidae and Eurybrachidae had the minimum fauna in Akola vicinity. The diversity indices *i.e.*, Shannon-Wiener index of biodiversity clearly indicated that the diversity of hemipteran fauna was in good state in *kharif* crops at the vicinity of district Bikaner (Rajasthan). The data given in Table 2 indicates that Pentatomidae family fauna showed the abundance in population (-0.3376) followed by Lygaeidae (-0.3022), Cicadellidae (-0.2686), Miridae (-0.2320), Delphacidae (-0.1691) and Cydnidae (-0.1555) had moderate

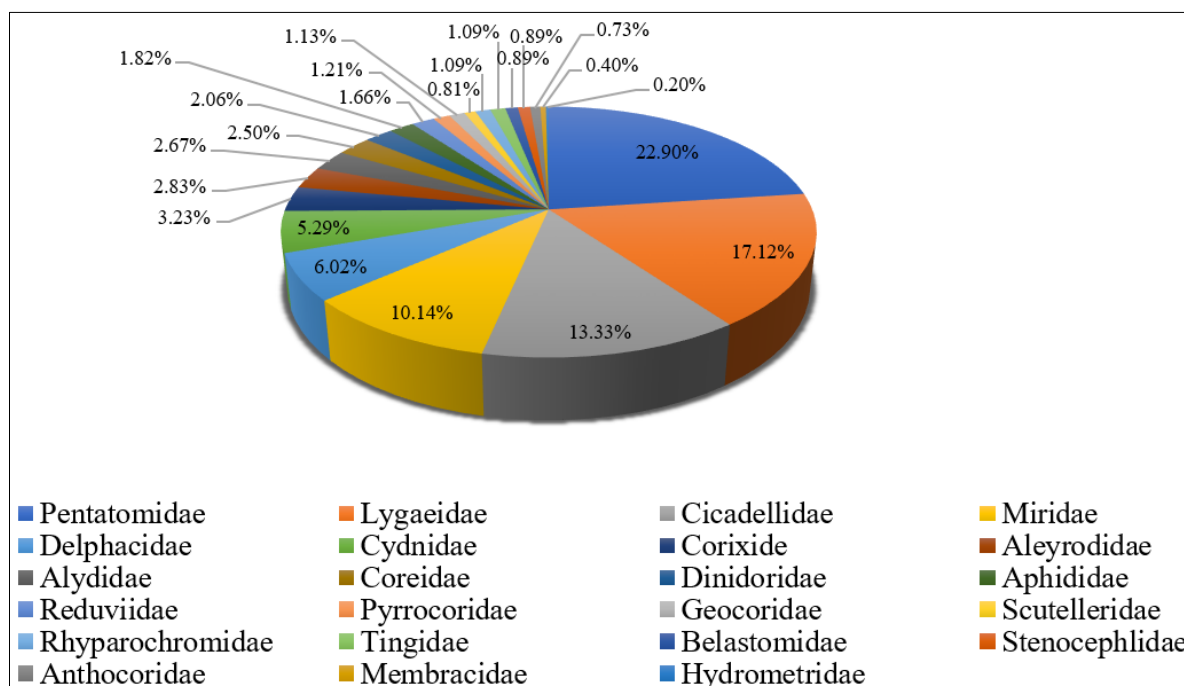
abundance of hemipterans fauna. However, Hydrometridae (-0.0125), Membracidae (-0.0226), Anthocoridae (-0.0364), Scutelleridae (-0.0389) showed lower abundance of hemipteran fauna. However, rich Shannon biodiversity index ( $H = 2.4825$ ) was noticed in terms of families abundance of hemipteran in *kharif* crops, Bikaner. Many workers have calculated the diversity indices in this direction among them Kumar and Naidu (2010) [14] recorded the value of Shannon Weiner index was (3.727) of hemipteran fauna in agricultural fields habitat and main food plants of hemipterans in agriculture fields are paddy, sugarcane, pigeon pea and gram etc. Similarly, Nandini and Jadesh (2012) [17], recorded the Shannon-Wiener index of order Hemiptera and value 1.609. The results obtained in the present investigations are also similar with the results of Dorlikar (2018) [9] who recorded the Shannon-Wiener index values are in the range of 2.91 to 1.85. Maximum value of Shannon-Wiener index was reported in the month of June during monsoon season and minimum value was reported in the month of April during the summer. The similar results are found in investigations of Gogoi and Guha (2015) who reported that Shannon-Wiener diversity Index was found maximum in pre-monsoon (0.58) and minimum in post monsoon (0.28) and also in Table 2 indicates the Simpson's index that Pentatomidae family fauna (0.05244) showed high richness followed by Lygaeidae (0.02932), Cicadellidae (0.01776) had moderate richness in Hemipteran fauna. However, Hydrometridae (0.0001), Membracidae (0.00002), Anthocoridae (0.00005), Scutelleridae (0.00007), Stenocephlidae (0.00008) and Belostomatidae (0.00008) showed lower richness in hemipteran fauna and Simpson's index value was observed 0.1213. However, moderate Simpson's index that indicate diversity of hemipteran fauna in *kharif* crops, Bikaner (Rajasthan). The similar results are found in investigations of Meeran *et al.* (2021) [15] they recorded the Simpson's Index was 0.01 in term of diversity and richness of Hemiptera order in paddy field.

**Table 1:** Family wise per cent composition of hemipteran insects on *kharif* crops during 2020

| S.N. | Suborder       | Family           | No. of insects collected | Percent (%) |
|------|----------------|------------------|--------------------------|-------------|
| 1.   | Heteroptera    | Pentatomidae     | 567                      | 22.90       |
| 2.   | Heteroptera    | Lygaeidae        | 424                      | 17.12       |
| 3.   | Achenorrhyncha | Cicadellidae     | 330                      | 13.33       |
| 4.   | Heteroptera    | Miridae          | 251                      | 10.14       |
| 5.   | Achenorrhyncha | Delphacidae      | 149                      | 6.02        |
| 6.   | Heteroptera    | Cydnidae         | 131                      | 5.29        |
| 7.   | Heteroptera    | Corixidae        | 80                       | 3.23        |
| 8.   | Stenorrhyncha  | Aleyrodidae      | 70                       | 2.83        |
| 9.   | Heteroptera    | Alydidae         | 66                       | 2.67        |
| 10.  | Heteroptera    | Coreidae         | 62                       | 2.50        |
| 11.  | Heteroptera    | Dinidoridae      | 51                       | 2.06        |
| 12.  | Stenorrhyncha  | Aphididae        | 45                       | 1.82        |
| 13.  | Heteroptera    | Reduviidae       | 41                       | 1.66        |
| 14.  | Heteroptera    | Pyrrhocoridae    | 30                       | 1.21        |
| 15.  | Heteroptera    | Geocoridae       | 28                       | 1.13        |
| 16.  | Heteroptera    | Rhyparochromidae | 27                       | 1.09        |
| 17.  | Heteroptera    | Tingidae         | 27                       | 1.09        |
| 18.  | Heteroptera    | Belostomatidae   | 22                       | 0.89        |
| 19.  | Heteroptera    | Stenocephlidae   | 22                       | 0.89        |
| 20.  | Heteroptera    | Scutelleridae    | 20                       | 0.81        |
| 21.  | Heteroptera    | Anthocoridae     | 18                       | 0.73        |
| 22.  | Heteroptera    | Membracidae      | 10                       | 0.40        |
| 23.  | Heteroptera    | Hydrometridae    | 5                        | 0.20        |
|      |                | Total            | 2476                     | 100.00      |

**Table 2:** Family wise Shannon- Wiener biodiversity index and Simpson index of hemipteran fauna in *kharif* crops during 2020

| S.N. | Family          | Shannon's index Pi (LN (pi)) | Simpson index $\sum pi^2$ |
|------|-----------------|------------------------------|---------------------------|
| 1.   | Pentatomidae    | -0.3376                      | 0.05244                   |
| 2.   | Lygaeidae       | -0.3022                      | 0.02932                   |
| 3.   | Cicadellidae    | -0.2686                      | 0.01776                   |
| 4.   | Miridae         | -0.2320                      | 0.01028                   |
| 5.   | Delphacidae     | -0.1691                      | 0.00362                   |
| 6.   | Cydnidae        | -0.1555                      | 0.00280                   |
| 7.   | Corixide        | -0.1109                      | 0.00104                   |
| 8.   | Aleyrodidae     | -0.1008                      | 0.00080                   |
| 9.   | Alydidae        | -0.0966                      | 0.00071                   |
| 10.  | Coreidae        | -0.0923                      | 0.00063                   |
| 11.  | Dinidoridae     | -0.0800                      | 0.00042                   |
| 12.  | Aphididae       | -0.0728                      | 0.00033                   |
| 13.  | Reduviidae      | -0.0679                      | 0.00027                   |
| 14.  | Pyrrocoridae    | -0.0535                      | 0.00015                   |
| 15.  | Geocoridae      | -0.0507                      | 0.00013                   |
| 16.  | Rhyprochromidae | -0.0493                      | 0.00012                   |
| 17.  | Tingidae        | -0.0493                      | 0.00012                   |
| 18.  | Belastomidae    | -0.0420                      | 0.00008                   |
| 19.  | Stenocephlidae  | -0.0420                      | 0.00008                   |
| 20.  | Scutelleridae   | -0.0389                      | 0.00007                   |
| 21.  | Anthocoridae    | -0.0358                      | 0.00005                   |
| 22.  | Membracidae     | -0.0223                      | 0.00002                   |
| 23.  | Hydrometridae   | -0.0125                      | 0.00001                   |
|      | H               | H' - 2.4825                  | D' - 0.1213               |



**Fig 1:** Family wise per cent composition of hemipteran insects on *kharif* crops during 2020

**Acknowledgement**

The authors are grateful to Department of Entomology, Swami Keshwanand Rajasthan Agriculture University, Bikaner for providing research facilities. I also take this opportunity to express my cordial thanks to Dr. H. M. Yeshwanth, Department of Entomology, University of Agricultural Sciences, GKVK, Bengaluru for identified the specimens of hemipteran fauna.

**Reference**

1. Alfred JRB. Diversity, dimension and significance of insects: an overview in the Indian context. India:

proceedings of the national symposium on Frontier Areas of Entomological Research Nov. 5-7, IARI, New Delhi, 2003.

2. Belamkar NV, Jadesh M. A preliminary study on abundance and diversity of insect fauna in Gulbarga district, Karnataka, India. International Journal of Science and Research. 2014;3(12):1670-1675.  
 3. Chandra K. Insecta; Hemiptera, faunal diversity of Jabalpur district, M.P. 2008, 141-157.  
 4. Chandra K, Kushwaha S, Sambath S, Biswas B. Distribution and diversity of Hemiptera Fauna of Veerangana Durgavati Wildlife Sanctuary, Damoh,



- Madhya Pradesh (India). Biological Forum – An International Journal. 2012;4(1):68-74.
5. Choate PM. Identification key to the principal families of Florida Hemiptera, sub order Heteroptera, 2010.
  6. Choudhary A, Ahi J. Biodiversity of freshwater insects: A review. International Journal of Engineering Science. 2015;10:25-31.
  7. Distant WL. The fauna of British India including Ceylon and Burma, *Rhynchota*, Taylor & Francis, London, 1904;1:438.
  8. Distant WL. The fauna of British India including Ceylon and Burma, *Rhynchota*, Taylor & Francis, London, 1902;2:503.
  9. Dorlikar AV. Seasonal variation of heteroptera community of a Gorewada reservoir, Nagpur (Maharashtra). Journal of Entomology and Zoology Studies. 2018;6(2):2431-2434.
  10. Ghosh LK, Biswas B. Fauna of conservation areas number 6 Fauna of Indravati Tiger Reserve, 1995, 19-29.
  11. Harper JL, Hawksworth DL. Biodiversity: measurement and estimation. Proceedings of the Royal Society of London. 1994;345:5-12.
  12. Henry TJ. Biodiversity of heteroptera in insect biodiversity science and society ed. By Robert, G. Footitt and Peter, H. Alder. 2009, 224-263.
  13. Hodkinson TH, Casson RT. Note on 133 families of Hemiptera found worldwide. A review of fauna. Canadian Journal of Arthropod. Identification, 1991, 24.
  14. Kumar D, Naidu B. A contribution towards the insect fauna of Vadodara, Gujarat (India): the order Hemiptera. *Halteres*, 2010, 1(2).
  15. Meeran M, Fathima S, Priya S, Arivoli S, Tennyson S. Assessment of insect diversity in paddy fields of Uthamapalayam, Theni district, Tamil Nadu, India. Journal of Wildlife and Biodiversity. 2021;5(2):88-98.
  16. Menon MGR, DAS JN. Taxonomic studies on the Indian Membracidae. Proceedings of the Indian Science Congress, Calcutta, 1958;3:348.
  17. Nandini VB, Jadesh M. A Preliminary Study on Abundance and Diversity of Insect Fauna in Gulbarga District, Karnataka, India. International Journal of Science and Research (IJSR). 2012, 3(12).
  18. Narayan GG. Faunistic studies on Hemipterans in Akola vicinity. (Agricultural entomology), Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra. M.Sc. 2016. Print. xii, 70p. (Unpublished), 2016.
  19. Norse EA, McManus RE. 'Ecology and living resources: biological diversity' in environmental quality: the eleventh annual report of the council on environmental quality (council on environmental quality, 1980).
  20. Sima, Srivastava M. Entomo-fauna associated with bajra crop as observed in an agro-ecosystem in Rajasthan, India. International Journal of Theoretical & Applied Science. 2012;4(2):109-121.
  21. Solbrig OT. Biodiversity: Scientific Issues and Collaborative Research Proposals. UNESCO, 1991, 77p.
  22. Wilson SW. Keys to the families of Fulgoromorpha with emphasis on planthopper of potential economic importance in the southeastern United States (Hemiptera: Auchenorrhyncha). Florida Entomologist. 2005;88(4):464-481.