



Research Article

DIVERSITY AND DISTRIBUTION OF PREDATORY STINK BUGS FROM INDIA AND THEIR ROLE IN INSECT PEST MANAGEMENT (HEMIPTERA: HETEROPTERA: PENTATOMIDAE: ASOPINAE)

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ABSTRACT

Asopinae is the only subfamily among Pentatomidae (Hemiptera: Heteroptera), whose members exhibit predatory feeding habits. They are called predatory stink bugs as they mainly predate on several soft-bodied arthropods. In this study, we compile a consolidated list of the subfamily Asopinae from India, covering 30 species in 17 genera, supplemented with prey information of selected species based on our observations and literature records.

Keywords: Biogeographic Zone, Taxonomy, Checklist, Insect Pests.

INTRODUCTION

Some true bugs in these families, such as Reduviidae, Anthocoridae, Nabidae, Lygaeidae, Miridae, members of water bug families and some Pentatomidae are predatory in nature. Among Pentatomidae (Hemiptera: Heteroptera) Asopinae is the only subfamily, whose members exhibit predatory feeding habits and known as predatory stink bugs. Asopinae can be distinguished by a four-segmented strong rostrum: the first segment is incrassate, not concealed between bucculae. These predatory bugs mainly predate on larvae of lepidopteran, dipteran, and coleopteran insects, both in the juvenile and adult stages. The first nymphal stage does not predate (De Clercq 2000). Their role in controlling insect pests has become increasingly well recognized in the South-east Asia including India. One such predatory bug, *Perillus bioculatus* (Fabricius, 1775), predate on the pumpkin beetle, *Aulacophora indica* (Gmelin, 1790) (Coleoptera: Chrysomelidae), a pest of the bitter gourd. A checklist of 30 species of Asopinae belonging to 17 genera from India based on secondary data and our observations has been provided. We provide known distributional range of subfamily Asopinae from India to identify gap areas. The present study will contribute in enriching the information on the diversity of these predatory bugs from India and their relevance as biocontrol agents of pests.

MATERIALS AND METHODS

For the present study the subfamily specimens are collected using sweep net. After collection specimens were killed, in a killing jar having ethyl acetate as killing agent. Specimens were set and pinned and then identified. Images were taken using Leica M 205A. The specimens are deposited in the National Zoological Collection of Zoological Survey of India, Kolkata. The nomenclature for the members of the subfamily Asopinae is followed after Thomas (1994).

RESULTS AND DISCUSSION

We have compiled a checklist (Table 1) containing 30 species from 17 genera of subfamily Asopinae from India. Out of this 30 species 11 species were identified from our collection and the rest of the data regarding species distribution was compiled from literature. Genus *Cazira* Amyot & Serville, 1843 includes 8 species followed by genus *Eocanthecona* (Bergroth, 1915) 6 species, genus *Zicrona* (Amyot & Serville, 1843) 2 species and rest of the genera includes 1 species each. Most number of species (8) reported from Assam, Nagaland and West Bengal (Figure 3). There is no information about species distribution from Andhra Pradesh, Gujarat, Madhya Pradesh, Rajasthan and Telangana (Figure 2).

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Information about the predatory nature of these bugs were gathered both from our observations as well as various literatures. In a recent study, *Perillus bioculatus* (Fabricius, 1775) (Figure 1. e), a native of North America, was reported for the first time as predator of adult and immature pumpkin beetle, *Aulacophora indica* (Gmelin, 1790) (Coleoptera: Chrysomelidae) from Bihar. *P.bioculatus* (Fabricius, 1775) also recorded as a predator of grubs of *Zygogramma bicolorata* Pallister, 1953 from Northern part of India (Prasad and Pal 2015; Kaur et al. 2012). *Eocanthecona furcellata* (Wolff, 1801) (Figure 1. c) is also reported as predator and potential bio-control agent of

lepidopterous larvae from Bihar. Shophiya and Sahayaraj (2014) tested the biocontrol potential of *E. furcellata* against *Pericallia ricini* (Fabricius, 1775.) larva. Information about predatory behaviour of three other predatory bug viz. *Amyotea malabarica* (Fabricius, 1775) (Figure 1. a), *Andrallus spinidens* (Fabricius, 1787) (Figure 1. b) and *Zicrona caerulea* (Linnaeus 1758) (Figure 1. f), are taken from various literatures. A list of predatory stink bug as potential bio-control agent has been compiled based on our observation and sources (Bal and Biswas, 2013; Zibae et al., 2020) (Table 2).

Table 1. Checklist of Subfamily Asopinae from India.

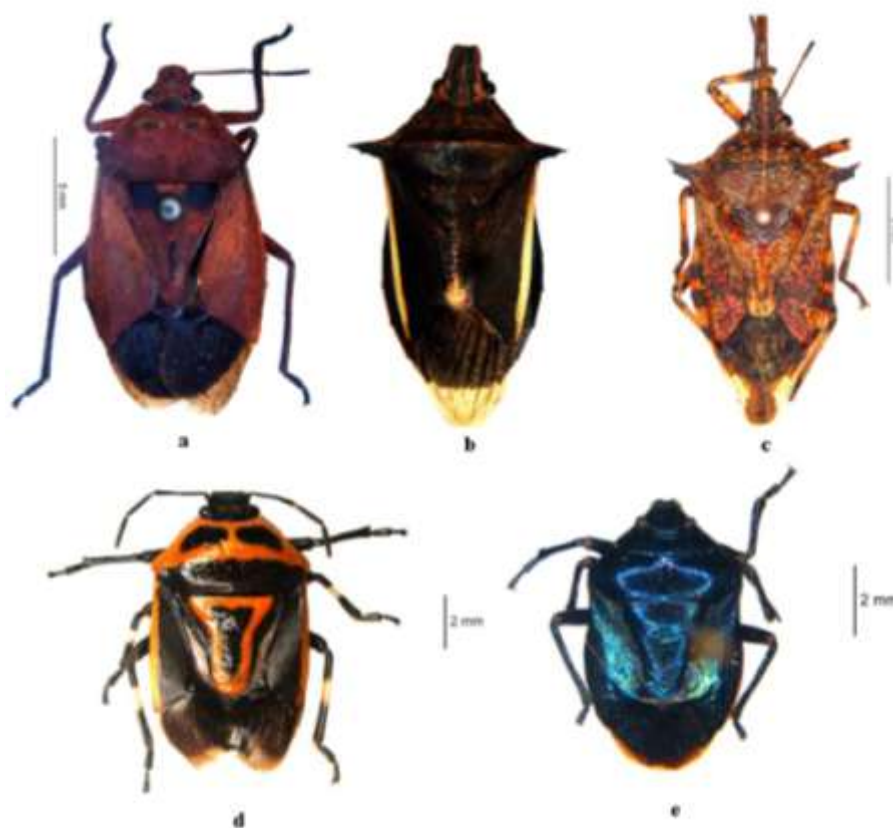
S.No	Taxa	Distribution			References
		States	Biogeographic Zones	World wide	
1.	<i>Amyotea malabarica</i> (Fabricius, 1775)	Assam, Karnataka, Maharashtra, Odisha, Tamil Nadu, Uttar Pradesh and West Bengal	North East, Deccan Peninsula and Gangetic Plains.	Bangladesh, China, Indonesia, Japan, New Guinea, Phillipines, Sumatra, Sri Lanka and Taiwan.	Distant (1902), Chatterjee (1934), Azim and Shafee (1982), Salini (2006) and Azim (2011).
2.	<i>Anasida orientalis</i> Distant 1910	Maharashtra and Karnataka	Deccan Peninsula.	Pakistan	Distant (1918) and Thomas (1994)
3.	<i>Andrallus spinidens</i> (Fabricius, 1787)	Assam, Delhi, Jharkhand, Maharashtra, Meghalaya, Puducherry, Punjab, Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal.	North East, Deccan, Gangetic Plains and Himalayas.	Australia, Azerbaijan, Bangladesh, China, Ethiopia, Indonesia, Iran, North America, South Africa, Sudan and Taiwan.	Distant (1902), Chatterjee (1934), Hegde (1995), Salini (2006), Azim (2011) and Kaur et al. (2012).
4.	<i>Arma velata</i> Walker 1868	India	—	—	Thomas (1994).
5.	<i>Blachia ducalis</i> (Walker 1867)	Sikkim and Nagaland.	North East and Himalayas.	China, Indonesia, Mayanmar and Thailand.	Distant (1902) and Thomas (1994).
6.	<i>Cantheconidea javana</i> (Dallas, 1851)	India	—	Indonesia and Sri Lanka.	Thomas (1994).
7.	<i>Cazira breddini</i> (Schouteden, 1907)	Uttar Pradesh.	Gangetic Plains.	Bhutan and China.	Distant (1907) and Thomas (1994).
8.	<i>Cazira insignis</i> (Schouteden, 1907)	Uttar Pradesh.	Gangetic Plains.	Bhutan.	Distant (1907) and Thomas (1994).
9.	<i>Cazira frivaldskyi</i> (Horvath 188)	—	Himalayas	Bhutan, China and Nepal	Distant (1902) and Thomas (1994).

10.	<i>Cazira internexa</i> Walker, 1867	India	—	Cambodia.	Thomas (1994).
11.	<i>Cazira similis</i> Distant 1902	Assam.	North East.	—	Distant (1902)
12.	<i>Cazira ulcerata</i> (Burmeister, 1835)	Bihar, Sikkim and West Bengal.	North East, Himalayas and Gangetic Plains.	China, Thailand and Indonasia.	Distant (1902), Distant (1918) and Thomas (1994).
13.	<i>Cazira vegeta</i> (Kirkaldy, 1909)	Kerala.	Western Ghats.	China, Japan, Thailand and Vietnam.	Thomas (1994) and Azim (2011).
14.	<i>Cazira verrucosa</i> (Westwood, 1834)	Assam, Kerala, Meghalaya, Sikkim, West Bengal and Nagaland.	North East, Himalayas, Western Ghats and Gangetic Plains.	Bangladesh, Cambodia, China, Japan, Myanmar, Phillipines, Taiwan, Thailand and Vietnam.	Distant (1902) and Thomas (1994).
15.	<i>Cecyrina platyrhinoides</i> (Walker 1867)	Assam and Nagaland.	North East.	Bhutan and China.	Distant (1902) and Thomas (1994).
16.	<i>Eocanthecona binotata</i> (Distant 1879)	Nagaland	North East.	China.	Distant (1902) and Thomas (1994).
17.	<i>Eocanthecona furcellata</i> (Wolff, 1801)	Assam, Bihar, Jharkhand, Jammu & Kashmir, Karnataka, Maharashtra, Nagaland, Odisha, Punjab, Tamil Nadu, Uttarakhand and West Bengal.	North East, Deccan peninsula, Himalayas and Gangetic Plains.	Bangladesh, China, Japan, Myanmar, Sri Lanka, Taiwan and Thailand.	Distant (1902), Chatterjee (1934), Datta <i>et al.</i> (1985), Salini (2006), Azim and Bhat (2010), Salini and Viraktamath (2015) .
18.	<i>Eocanthecona ornatula</i> Distant, 1908	West Bengal.	Gangetic Plains.	Myanmar.	Distant (1907) and Thomas (1994).
19.	<i>Eocanthecona robusta</i> (Distant, 1879)	Assam.	North East.	Australia, China, Phillipines and Sri Lanka.	Distant (1902) and Thomas (1994).
20.	<i>Eocanthecona parva</i> Distant, 1902	Karnataka and West Bengal.	Deccan peninsula and Gangetic Plains.	Myanmar and Tiwan.	Distant (1902) and Thomas (1994).
21.	<i>Eocanthecona tibialis</i> (Distant, 1879)	Nagaland.	North East.	Myanmar.	Distant (1902) and Thomas (1994).
22.	<i>Glypsus fuscispinus</i> (Stål, 1870)	India.	—	South Africa, Tanzania.	Thomas (1994).
23.	<i>Martinina prima</i> (Distant, 1908)	Assam.	North East.	—	Distant (1907).
24.	<i>Perillus bioculatus</i> (Fabricius, 1775)	Bihar, Himachal Pradesh, Punjab and Uttar Pradesh.	Gangetic Plains, Himalayas and Semi-Arid.	Bulgaria, Canada, Czechoslovakia, France, Germany,	Hassan <i>et al.</i> (2022), Kaur <i>et al.</i> (2012) and

				Greece, Mexico, Republic of Moldova, Russia, Serbia, Turkey, USA and Yugoslavia.	Prasad and Pal (2015).
25.	<i>Picromerus griseus</i> (Dallas, 1851)	Sikkim and Nagaland.	North East and Himalayas.	Bangladesh, China, Indonesia, Pakistan.	Distant (1902) and Thomas (1994).
26.	<i>Platynopus indicus</i> Chatterjee 1934	India.	—	—	Chatterjee (1934) and Thomas (1994).
27.	<i>Pseudanasida fallax</i> (Schouteden 1907)	Tamil Nadu.	Deccan Peninsula.	—	Distant (1907) and Thomas (1994).
28.	<i>Troilus luridus</i> (Fabricius 1775)	North India.	—	Austria, Belgium, Burma, China, Czechoslovakia, Denmark, England, Finland, France Germany, Greece, Hungary, India, Indonesia, Ireland, Italy, Java, Korea, Netherlands, Norway, Poland, Russia, Siberia, Sweden, Switzerland.	Distant (1902) and Thomas (1994).
29.	<i>Zicrona caerulea</i> (Linnaeus 1758)	Jammu & Kashmir, Nagaland and West Bengal.	Gangetic Plains, Himalayas and North East.	Afghanistan, Algeria, Austria, Azerbaijan, Belgium, England, Finland, Egypt, Czechoslovakia, Italy, France, Germany, Greece, Ireland, Netherlands, Syria, Israel, Russia, China, Mongolia, Pakistan, Morocco, Japan, Korea, Taiwan; Malaysia, Sweden, Switzerland, Turkey, Spain, Portugal, Pakistan, Vietnam, Burma, Java, Sumatra.	Distant (1902), Chakraborty <i>et al.</i> (1994) and Thomas (1994).
30.	<i>Zicrona hisarensis</i> Chopra & Sucheta 1984	Haryana.	Semi-Arid.	—	Thomas (1994)

Table 2. List of some potential bio-control agents (Figure 1) of insect pests based on our observations and literature records.

S. No	Species	Remarks
1	<i>Amyotea malabarica</i> (Fabricius, 1775)	They are potential predator on rice bug <i>Leptocoris aacuta</i> (Thunberg, 1783) of the family Alydidae (Bal and Biswas, 2013).
2	<i>Andrallus spinidens</i> (Fabricius, 1787)	<i>Andrallus spinidens</i> (Fabricius, 1787) is a predatory bug of caterpillars that naturally resides in paddy fields (Zibae <i>et al.</i> , 2020). This species also predate on Yellow Stem Borer and White Backed Plant hopper (Bal and Biswas, 2013).
3	<i>Eocanthecona furcellata</i> (Wolff, 1811)	The bugs are predaceous on various lepidopterous larvae of <i>Amsacta albistriga</i> (Walker, 1865), <i>Spodoptera exigua</i> (Hübner, 1808), <i>Spodoptera litura</i> (Fabricius, 1775) (Bal and Biswas, 2013).
4	<i>Perillus bioculatus</i> (Fabricius, 1775)	Both adults and late inster nymphs are predaceous on both grub and adult of <i>Aulacophora indica</i> (Gmelin, 1790), serious pest of bitter gourd.
5	<i>Zicrona caerulea</i> (Linnaeus, 1758)	Both adults and late inster nymphs are predaceous on lepidopterous larvae of <i>Sdoptera litura</i> (Fabricius, 1775), <i>Semiothis apervolgata</i> (Walker, 1861), <i>Catopsilia pyranthe</i> (Linnaeus, 1758), <i>Eurema hecabe</i> (Linnaeus, 1758), <i>Anticarsia irrorata</i> (Fabricius, 1781), <i>Helicoverpa armigera</i> (Hübner, 1808), and <i>Pelopidas mathias</i> (Fabricius, 1798) (Bal and Biswas, 2013).

**Figure 1.** a. *Amyotea malabarica* (Fabricius, 1775); b. *Andrallus spinidens* (Fabricius, 1787); c. *Eocanthecona furcellata* (Wolff., 1801); d. Head and thorax, ventral view (Asopinae) (arrow shows incrassate first labial segment not concealed between bucculae); e. *Perillus bioculatus* (Fabricius, 1775); f. *Zicrona caerulea* (Linnaeus, 1758).

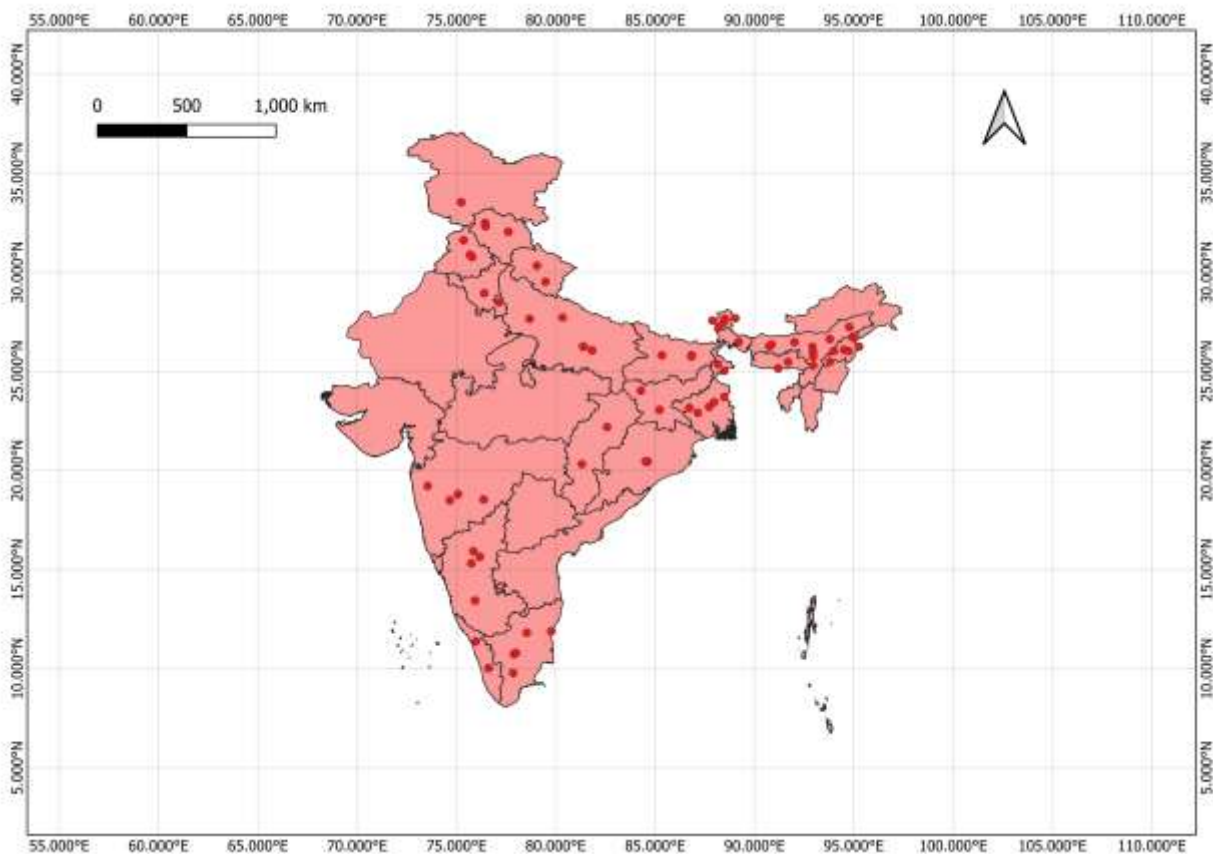


Figure 2. Map of India showing distribution of SubfamilyAsopinae in India.

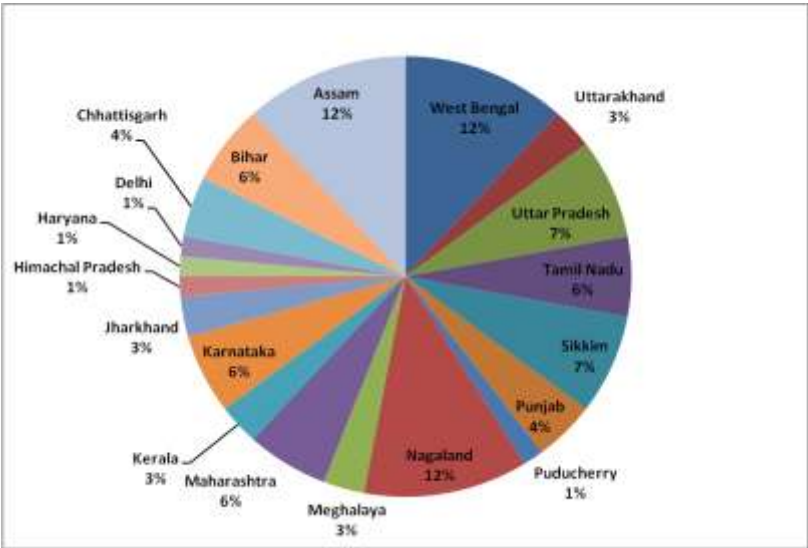


Figure 3. State/Union Territory wise species distribution of Subfamily Asopinae from India.

CONCLUSION

In the present study we have reported the present status as well as the distribution of predatory stink bug in India and also their role as bio-control agent in agro-ecosystem. A list consisting of five species of predatory stink bug as potential bio-control agents of larval as well as adults of some serious insect pests is compiled. Further studies has to be conducted for the estimation of predation potential of these reported species both under laboratory and in natural condition so that these predatory bugs can be introduced in different agro-ecosystems as bio-control agents.

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REFERENCES

- Azim, M.N. & Bhat, M.S. (2010). A Preliminary survey for Pentatomid bugs (Heteroptera: Pentatomidae) in Kashmir Himalaya. *Journal of Entomological Research*, 34 (2), 165-170.
- Azim, M.N. & Shafee, S.A. (1982). A new species of the genus *Asopus* (Heteroptera: Pentatomidae). *Journal of Bombay Natural History Society*, 79 (2), 361-362.
- Azim, M.N. (2011). Taxonomic survey of stink bugs (Heteroptera: Pentatomidae) of India. *Halters*, 3, 1-10.
- Bal, A. & Biswas, B. (2013). Handbook on Major Hemipteran Predators of India. Zoological Survey of India, Kolkata, 1-44.
- Chakrabarty, S.P., Ghosh, L.K. & Basu, R.C. (1994). On a collection of Hemiptera from Namdapha Biosphere Reserve in Arunachal Pradesh, India. *Records of Zoological Survey of India Occasional Paper No.*, 161, 25-33.
- Chatterjee, N.C. (1934). Entomological investigations on the spike disease of sandal (24). Pentatomidae (Hemipt.). *Indian Forest Records*, 20, 1-31.
- Datta, B., Ghosh, L.K. & Dhar, M. (1985). Study on Indian Pentatomidae (Heteroptera: Insecta). *Records of the Zoological Survey of India*, 80, 1-43.
- De Clercq, P. (2000). Predaceous bugs (Pentatomidae: Asopinae). In: Heteroptera of Economic Importance (Eds. C. W. Schaefer & Panizzi, A. R). CRC Press, Boca Raton, FL, 737-789.
- Distant, W.L. (1902). Rhynchota. Vol. I. Heteroptera. In: Blanford, W.T. (Ed.), *The Fauna of British India Including Ceylon and Burma*. Taylor and Francis, London, pp. I-XXXVII + 1-438.
- Distant, W.L. (1907) Rhynchota Vol.IV. Homoptera and appendix (Pt). In: Bingham, C.T. (Ed.), *The Fauna of British India Including Ceylon and Burma*. Taylor and Francis, London, XV + 501 pp.
- Hassan, M.E., Pal, A., Saha, P.C. and Mondal, R. (2022). First record of two spotted stink bug, *Perillus bioculatus* (Fabricius, 1775) (Heteroptera: Pentatomidae: Asopinae) predating upon *Aulacophora indica* (Gmelin, 1790) (Coleoptera: Chrysomelidae) on bitter gourd in Agro-ecosystem of Bihar, India. *Insect environment*, 10-17.
- Hegde, V. (1995). Heteroptera (Insecta) from the Eastern Ghats, India. *Occasional Paper on Records of Zoological Survey of India*, No. 168, 14-39.
- Kaur, R. (2020). Morphotaxonomy and external genitalic attributes of a biological control agent: *Perillusbioculatus*(Fabricius) (Heteroptera: Pentatomidae: Asopinae) with new distributional records from India. *International Journal of Entomology Research*, 5(5), 10-14.
- Kirkaldy, G.W. (1909). *Catalogue of the Hemiptera (Heteroptera) with biological and anatomical references, lists of food plants and parasites etc. Vol.I Cimicidae (M)*. Berlin, XI + 392 pp.
- Prasad, C.S. & Pal, Rishi. (2015). First record of two spotted stink bug, *Perillusbioculatus* (Fab.) from Meerut (U.P.) North India. *International Journal of Environmental & Agriculture Research*, 1, 9-11.
- Salini, S., and C. A. Viraktamath. (2015). Genera of Pentatomidae (Hemiptera: Pentatomidae) from south India-An illustrated key to genera and checklist of species. *Zootaxa* ,3924(1), 1-76.
- Shophiya, N. J. & K. Sahayaraj. (2014). Biocontrol potential of entomophagous predator, *Eocanthecona furcellata* (Wolff.) against *Pericallia ricini* (Fab.) larvae. *International Journal of Current Research* 6(10), 9052-9056.
- Thomas, D.B. (1994). Taxonomic synopsis of old the world Asopine genera (Heteroptera: Pentatomidae). *Insecta Mundi*, 8(3-4), 145-212.
- Walker, F. (1868). *Catalogue of the specimens of Hemiptera-Heteroptera in the collection of the British Museum. Part III*. E. Newman, London, pp. 418-599.
- Zibae, A., Ramzi, S. & Hoda, H. (2020). The stink bug, *Andrallus spinidens* (Hemiptera: Pentatomidae), a potential predator for effective biological control. *Journal of Plant Protection Research*, 60(4), 336-344.