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Taxonomic documentation of the insect pest complex associated with paddy ecosystems in Raipur district, Madhya Pradesh, India

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Abstract

The study titled Taxonomic documentation of total insect Pest complex of paddy ecosystem. Information on insect pest fauna of rice ecosystem collected in Raipur region during the period between the last weeks of June 2022 to last week of December 2023 seasons. Taxonomic analysis revealed that 69 species belonging to 11 orders and 38 families were recorded throughout the season (*khari*). Based on number of species collected, largest collection was represented by order Lepidoptera (20 species) followed by order Coleoptera (15 species), Hemiptera (15 species), Orthoptera (6 species) & Hymenoptera (5 species) in descending order respectively (*khari*). Orders of minor significance were represented by Odonata and Neuroptera having 2 species each while Isoptera, Diptera, Dermaptera & Dictyoptera were represented by one species only. The present study also reveals that documented information on these species gives broader scope of using light trap as Integrated Pest Management tool against these insect pests of vegetables and other crops.

Keywords: Taxonomic, paddy, light trap, insect pest, documentation

Introduction

Rice (*Oryza sativa* L.) is an important cereal crop in the world serving as staple diet for millions of peoples. Almost 90% of rice is grown and consumed in Asia. In India average losses in paddy production due to insect pests are 25-30% and in Madhya Pradesh about 40-100% losses were observed reported that over 100 insect pest species attacks paddy crop at various stages of its growth in which 20 species cause the economic damage. Light trap is an important tool for minimizing the insect pests damage without any toxic hazards. Other than this light trap has been used to supplement the knowledge of pest fauna of given locality, geographical distribution and their seasonal activity etc. Many insects are positively phototrophic in nature and use of light traps for insect catches produces valuable faunistic data. This data can be seen as a parameter of health of biodiversity of the concerned vicinity. The data provided by light trap catches could throw light on period of maximum activity of insects. The phototropic behavior of insects makes the scientist capable to use light trap for capturing insects either for study or destruction. The forecasting and predication of insect occurrence or outbreak can be made by using light trap. These studies are helpful in the rational and timely application of insecticide which may lead to better and cheaper insect control with least hazards. The present study reveals that documented information on these species gives broader scope of using light trap as Integrated Pest Management tool against these insect pests of vegetables and other crops. The trap catch data also provide valuable information on bio control agents (predatory) active in rice ecosystem.

Materials and Methods

The study was conducted in a paddy-growing region during *Khari* seasons of 2022 and 2023 in Raipur district of Madhya Pradesh. Insect pests were collected weekly using a light trap, and their abundance was recorded. The insects collected in the chamber of light trap were killed by the exposure of Dichlorvos 76 EC vapours (as fumigating agent) which is directly placed in collection tray for instant killing of trapped insects. For the taxonomic documentation, the light trap was operated every night and collection was observed on the next day morning.

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Observations will be recorded every day throughout the Rabi season. Total insects were observed and sorted out on the basis of species and their family. Identification of insects was done on the basis of specimens available in insect museum of the Department, Department of Entomology, UAS, Bangalore and Zoological Survey of India, Jabalpur. After counting, dried specimens were prepared by keeping the pinned insects in oven for 24 hours at 30 °C and thereafter well labeled specimens were stored in insect boxes and show cases.

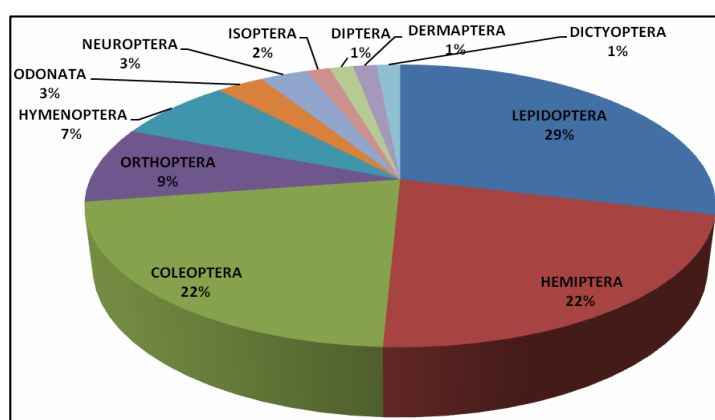
3. Results and Discussion

Taxonomic analysis revealed the presence of 69 species belonging to 11 orders and 38 families throughout the study period (Kharif 2022-2023). Based on species richness, the order Lepidoptera exhibited the highest representation (20 species), followed by Coleoptera (15 species), Hemiptera (15 species), Orthoptera (6 species), and Hymenoptera (5 species), in descending order. Orders of minor significance

included Odonata and Neuroptera, each represented by two species, whereas Isoptera, Diptera, Dermaptera, and Dictyoptera were represented by a single species each.

To study the relative size of trap catches of various species collected in different taxonomic groups, collection of entire season (June to Dec.) was recorded species wise. These species were grouped on the basis of their economic importance in three major categories viz. Harmful insects-as crop pests, beneficial insects-as bio-control agents (predators and parasites) and beneficial insects-as commercially important.

In accordance with present findings Sharma *et al.* also reported a record of 62 species through light trap catches during the cropping season of paddy at Jabalpur (2002-03). These species belonging to 8 orders and 33 families. Lepidoptera was the largest order with 27 species, followed by Hemiptera (14 species), Coleoptera (12 species) and Orthoptera (4 species). Odonata, Hymenoptera, Isoptera and Dictyoptera were the other orders of minor significance.



Percent distribution of insect pest species of different orders trapped in light trap installed in paddy during kharif 2022 and 2023 (June to December) at Raisen district of Madhya Pradesh.

3.1 Group I: Harmful insects-as crop pests

Group of Harmful insects-as crop pests, was represented by 6 orders, 21 families & 38 species as crop pests species. Among the harmful crop pest species, order Lepidoptera was represented by the highest number of 8 families including 20 species, in which, family Noctuidae has the highest 7 species. This family includes 7 species as important pests of different crops. Among these species *Spodoptera litura* (fabricius) has the highest size of trap catch (940 moths) followed by *Hyblaea puer* (Cramer) (760 moths), while the lowest size of trap catch was of *Helicoverpa armigera* (Hubner) (170 moths). In accordance to the present findings, Butler *et al.* (2001) [2] observed a total of 438 species of Lepidoptera in 13 selected families were identified including Noctuids (222 species), Geometrids (127 species), Notodontids (27 species), Arctiids (26 species), Sphingids (10 species) and Saturniids (9 species). Similarly Kumar *et al.* also reported that family Noctuidae was the dominant and important family of order Lepidoptera in light trap catches. Four other major lepidopteran pests were reported in considerable numbers in trap catches during the study season. These included *Chrysodeixis chalcites* (Esper) with 520 moths recorded, *Asota ficus* (Fabricius) with 436 individuals, *Thysanoplusia orichalcea* (Fabricius) with 421 moths, *Mythimna separata* (Walker) with 397 individuals, and *Helicoverpa armigera* (Hübner). These findings underscore the diversity and abundance of lepidopteran pests in the region, particularly

during the cropping seasons when light trap catches peak. Similarly, Sharma and Vaishampayan (2009) [9] and Sharma (2004) [11] also reported that *Helicoverpa armigera*, *Agrotis ipsilon* and *Spodoptera litura* were the major polyphagous pests of family Noctuidae through trap catches at Jabalpur. Dangi (2004) [3] also reported that *Spodoptera litura* Fabricius, *Helicoverpa armigera* (Hubner), *Agrotis ipsilon* (Hufnagel) and *Plusia orichalcea* (Fabricius) as polyphagous pests of family Noctuidae, in light trap catches at Jabalpur.

Among the major pests of paddy, *Melanitis leda ismene* (Cramer) of the family Nymphalidae showed significantly higher trap catches—867 butterflies in 2022 and 169 in 2023. *Mythimna separata* (Walker), a Noctuid moth, was also prevalent, with 397 and 382 individuals recorded over the two years. *Cnaphalocrocis medinalis* (Guene), a key pest from the family Pyralidae, was caught in 283 and 81 instances during 2022 and 2023, respectively. Interestingly, while Sharma *et al.* (2006) previously reported *Cnaphalocrocis medinalis* as the most dominant paddy pest with a maximum trap catch of 1327 individuals, the current study found this species to be among the least trapped throughout the paddy-growing season.

After Lepidoptera, Hemiptera was the next highest order of pest species in trap catch with 5 families and 8 species. The family Cicadellidae was represented by *Nephotettix virescens* (Distant) with a highest trap catch of (60693 hoppers) and (12908 hoppers) followed by *Pyrilla*

perpusilla Walker (399 hoppers) and (390 hoppers), *Nezara viridula* Linnaeus (495 bugs) and (480 bugs), *Leptocoris acuta* (Thunberg) (2908 bugs) and (599 bugs), *Dysdercus koenigii* Fabricius (316 bugs) and (307 bugs), *Cofana spectra* (Distant) (353 hoppers) and (357 hoppers), *Antestiopsis cruciata* (Fabricius) (50 bugs) and (44 bugs), *Plautia crossota* (Dallas) (35 bugs) and (51 bugs) in 2022 and 2023 respectively. While Brown plant hopper, *Nilaparvata lugens* (Stal) & White backed plant hopper, *Sogatella furcifera* (Harvath) family Delphacidae were surprisingly absent throughout the season in trap catches.

Order Orthoptera was represented by 4 families and 5 species. Among all the pest species of this order highest trap catch was of Field cricket, *Euscirtus concinnus* (de Haan) (8539 crickets) and (2547 crickets) followed by Short horn grass hopper, *Tetrix subulata* Linnaeus (1735 hoppers) and (501 hoppers), Mole cricket, *Gryllotalpa orientalis* Burmeister (1058 crickets) and (245 crickets), Grass hopper, *Oxya yezoensis* Shiraki (34 hoppers) and (40 hoppers) & *Gryllus bimaculatus* De Geer (182 crickets) and (158 crickets) in 2022 and 2023 respectively.

Order Coleoptera was represented by 2 families and 4 species. In terms of relative size of trap catch Red pumpkin beetle, *Aulacophora foveicollis* (Lucas) has the highest trap catch of (512 beetles) and (497 beetles) followed by *Holotrichia consanguinea* Blanch (94 beetles) and (83 beetles), *Chiloloba acuta* (Wiedemann) (20 beetles) and (27 beetles) *Cryptocephalus schestedti* Fabricius was represented by the lowest size of trap catch of (19 beetles) and (15 beetles) in 2022 and 2023 respectively. In conformity with the present findings Sharma *et al.* (2010) [12] also recorded highest trap catch of *Aulacophora foveicollis* (451 beetles) among coleopterous at Jabalpur.

Order Isoptera was represented by only one family i.e. Termitidae with single species Termite, *Odontotermes obesus* (Rambur). The size of catch was (81 adults) and (70 adults) in 2022 and 2023 respectively Medrios *et al.* (1999) reported 24 species of Termites belonging to 3 families including Termitidae through light trap catches at Atlantic forest of North East Brazil.

Order Diptera was represented by only one family i.e. Bibionidae with single species *Plecia ampliipennis* Skuse. The size of catch was (36 adults) and (35 adults) in 2022 and 2023 respectively. In conformity with the present findings Muchala (2014) also reported that order Diptera was represented by only one family i.e. Bibionidae with single species *Plecia ampliipennis* (Skuse.) The size of catch was 2941 adults.

Group-II) Beneficial insects as predators and parasites

Group of beneficial insects as natural biocontrol agents was represented by 7 orders, 15 families & 25 species as predators and 1 order, 3 families & 4 species as parasites. Among the predatory species order Coleoptera was represented by the highest number of 4 families including 11 species in which family Carabidae has the highest 8 predatory species namely *Prothyma* sp. (380 beetles) & (370 beetles), *Chlaenius nigricans* Wiedemann (41 beetles) & (47 beetles), *Diplocheila polita* Fab. (62 beetles) & (56 beetles), *Chlaenius pictus* Choudoir (68 beetles) & (56 beetles), *Brachinus sexmaculeatus* Dejean (34 beetles) & (27 beetles), *Crosopodophorus elegans* Dejean (35 beetles) & (48 beetles), *Cicindela flexuosa* (Distant) (27 beetles) & (32 beetles) and *Brachinus longipalpis* Wiedemann (61 beetles) & (79 beetles). While family Scarabaeidae was reported by one species Dug beetle, *Onitis falcatus* (Wulfen) (176

beetles) & (172 beetles) in 2022 and 2023 respectively. Similar to the present findings Muchala (2014) also reported 7 orders, 15 families & 25 species as predators and 1 order, 3 families & 4 species as parasites. Family Scarabaeidae was reported by one species Dung beetle, *Onitis falcatus* (Wulfen) (106 beetles) among all the species of order Coleoptera.

Order Hemiptera was represented by 4 families and 7 species. Major predatory species were *Sirthena carinata* (Fabricius) (137 bugs) & (131 bugs), *Sirthena* sp. (79 bugs) & (68 bugs), *Eocanthecona furcellata* (Wolff) (34 bugs) & (28 bugs), *Ectomocoris ululans* (Rossi) (55 bugs) & (49 bugs) and *Carbula scutellata* Distant (16 bugs) & (17 bugs) in 2022 and 2023. Similarly Sharma *et al.* (2013) [13] reported that order Hemiptera was represented by 4 families and 6 species in trap catches including major predatory species viz. *Canthacoma furcellata* (176), *Antilochus* sp. (126), *Geocoris bullatus* S. (105) and *Sirthena* sp. (96)

The order Hymenoptera has been documented to comprise a variety of parasitic species across different families. In a recent study, a total of three families and four parasitic species were recorded from trap collections conducted in the years 2022 and 2023. Among the species captured, *Myrmecaria brunnea* Saunders showed the highest relative abundance, with trap catches of 368 and 369 wasps in 2022 and 2023, respectively. This was followed by *Enicospilus purgatus* (Say), which yielded 169 wasps in 2022 and 145 in 2023. *Dorylus* species were less abundant, with catches of 38 and 29 wasps, while *Vespa orientalis* Linnaeus recorded the lowest number of individuals, with 86 wasps in 2022 and 76 in 2023. Mishra (2016) [6] also reported that order Hymenoptera was represented by 3 families and 4 species as parasites. In terms of relative size of trap catch *Enicospilus purgatus* (Say) (227 wasps) has the highest trap catch followed by *Dorylus* sp. (69 wasps).

Order Odonata contained two species namely *Coenagrion* sp. (180 flies) & (173 flies) and *Pantala flavescens* (Fabricius) (355 flies) & (356 flies) which belongs to family Coenagrionidae and Libellulidae in 2022 and 2023. Similarly Sharma *et al.* (2013) [13] also reported that predatory orders Odonata was represented by *Libellula* sp. (213) & *Coenagrion* sp. (48) belonging to family Libellulidae and Conenagriidae, respectively.

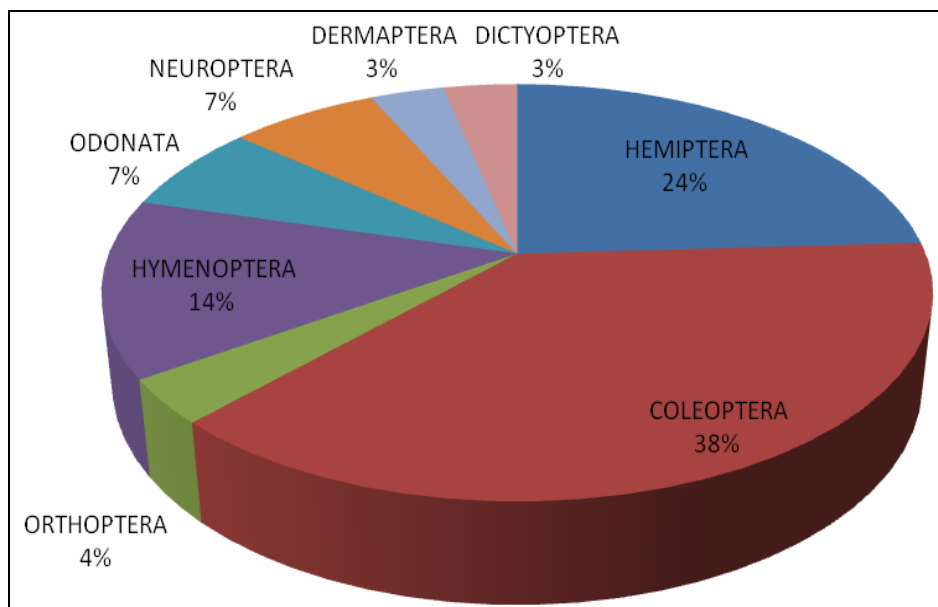
Order Neuroptera was represented by two species namely *Ascalaphus* sp. (262 flies) & (250 flies) and *Chrysoperla sillemi* (Esben-petersen) (159 green lace wings) & (157 green lace wings) which belongs to family Ascalaphidae and Chrysopidae in 2022 and 2023 respectively. Similarly, Honek and Kraus (1981) [4] also reported that *Chrysoperla sillemi* (Esben88-petersen) (Neuroptera: Chrysopid ae) active from though light trap catches.

Order Dermaptera, Dictyoptera and Orthoptera were represented by only one species each i.e. Ear wing, *Elaunon bipartitus* (Kirby) (232 ear wings) & (227 ear wings) family Forficulidae; Mantis, *Archimantis latistyla* (Serville) (84 mantis) & (59 mantis) family Mentidae and Long horn predatory grass hopper, *Conocephalus* sp. (81 hoppers) & (52 hoppers) family Tettigoniidae in 2022 and 2023 respectively. In conformity to the present findings Muchala also reported Orders Dermaptera, Dictyoptera and Orthoptera were represented by only one species each i.e. Earwigs, *Elaunon bipartitus* (Kirby) (240 earwigs) family Forficulidae; Mantis, *Archimantis latistyla* (Serville) (8 mantis) family Mentidae and Long horn predatory grass hopper, *Conocephalus* sp. (238 hoppers) family Tettigoniidae respectively.

Table 1: Taxonomic distribution of insect pest species collected in light trap in paddy ecosystem in *kharif* 2022 and 2023.

Group-I) Harmful insects-as crop pests.

S. No.	Insect species collected	Total of seasons collection (June to Dec.)		Economic status As crop pest
		2022	2023	
	Order-Lepidoptera			
	A) Family-Noctuidae			
1)	<i>Spodoptera litura</i> Fabricius Tobacco caterpillar	940	929	Major polyphagous pest of soybean, cabbage, cucurbits, potato, chilli and pea etc.
2)	<i>Helicoverpa armigera</i> (Hubner) Gram pod borer	170	219	Major polyphagous pest of pulses, potato, tomato, chilli, okra and cotton
3)	<i>Chrysodeixis chalcites</i> (Esper) Green semi looper	520	509	Pest of soybean, potato, tomato and bean etc
4)	<i>Thysanoplusia orichalcea</i> (Fabricius)	421	411	Major pest of sunflower, potato and soybean
5)	<i>Mythimna separata</i> (Walker) Army worm	397	382	Major pest of paddy
6)	<i>Hyblaea puera</i> Cramer	760	751	Major pest of teak
7)	<i>Asota ficus</i> (Fabricius)	436	196	Fodder pest
	B) Family-Arctiidae			
8)	<i>Cretonotos gangis</i> (Linnaeus) Tiger moth	578	563	Polyphagous pest
9)	<i>Amata</i> sp.	260	262	Fodder pest
10)	<i>Spilosoma obliqua</i> Walker Bihar hairy caterpillar	281	269	Major polyphagous pest of sesame, linseed and minor pest of cabbage and sweet potato
11)	<i>Amsacta moorei</i> Butler Red hairy caterpillar	123	108	Major pest of sun hemp, maize and jowar
	C) Family-Sphingidae			
12)	<i>Agrius convolvuli</i> (Linnaeus)	164	148	Major pest of sweet potato, sunflower and soybean
13)	<i>Acherontia styx</i> (Westwood) Til hawk moth	48	38	Major pest of sesame and minor pest of potato
	D) Family-Pyralidae			
14)	<i>Cnaphalocrocis medinalis</i> (Guene) Rice leaf folder	283	81	Major pest of paddy
15)	<i>Chilo partellus</i> Swinhoe Maize stem borer	43	34	Major pest of maize and sorghum
	E) Family-Nymphalidae			
16)	<i>Melanitis leda ismene</i> Cramer Rice butter fly	867	169	Major pest of paddy
	F) Family-Lymantriidae			
17)	<i>Euproctis similis</i> (Moore)	53	46	Minor pest of paddy and ragi
18)	<i>Psalis pennatula</i> (Fabricius)	16	15	Minor pest of paddy and sorghum
	G) Family-Crambidae			
19)	<i>Palpita vitrealis</i> (Rossi)	46	36	Pest of ornamental Jasmine plant.
	H) Family-Saturniidea			
	Order-Hemiptera			
	A) Family-Pentatomidae			
20)	<i>Nezara viridula</i> Linnaeus Green sting bug	495	480	Major polyphagous pest of soybean, pigeon pea and vegetable crops
21)	<i>Antestiopsis cruciate</i> (Fabricius) Coffee plant bug	23	17	Pest of coffee and jasmine
22)	<i>Plautia crossota</i> (Dallas)	35	51	Pest of pulse and cotton crop
	B) Family-Cicadellidae			
23)	<i>Nephotettix virescens</i> (Distant) Green leaf hopper	60693	12908	Major pest of paddy
24)	<i>Cofana spectra</i> (Distant)	353	357	Pest of paddy
	C) Family-Lophopidae			
25)	<i>Pyrilla perpusilla</i> Walker Sugarcane leaf hopper	399	390	Major pest of sugarcane, wheat and maize,
	D) Family-Pyrrhocoridae			
26)	<i>Dysdercus koenigii</i> Fabricius Red cotton bug	316	307	Major pest of cotton and okra
	E) Family-Coreidae			
27)	<i>Leptocoris acuta</i> (Thunberg) Rice gundhi bug	2908	599	Major pest of paddy
	Order-Coleoptera			
	A) Family-Scarabaeidae			
28)	<i>Holotrichia consanguinea</i> Blanch White grub	94	83	Major pest of ground nut, sugarcane, chilli and soybean
29)	<i>Chiloloba acuta</i> (Wiedemann)	20	27	Pest of maize, sorghum and folder grasses
	B) Family-Chrysomelidae			
30)	<i>Aulacophora foveicollis</i> (Lucas) Red pumpkin beetle	512	497	Major pest of cucurbitaceous particularly pumpkin
31)	<i>Cryptocephalus schestedi</i> Fabricius	19	15	Pest of paddy and folder grasses
	Order-Orthoptera			
	A) Family-Gryllidae			
32)	<i>Euscyrtus concinnus</i> (de Haan) Field cricket	8539	2547	Pest of paddy and folder grasses
33)	<i>Gryllus bimaculatus</i> De Geer Gryllid	182	158	Pest of folder grasses
	B) Family-Acridae			
34)	<i>Oxya yezoensis</i> Shiraki	34	40	Pest of paddy and maize
	C) Family-Gryllotalpidae			
35)	<i>Gryllotalpa orientalis</i> Burmeister Mole cricket	1058	245	Pest of paddy
	D) Family-Tetrigidae			
36)	<i>Tetrix subulata</i> Linnaeus Short horn grass hopper	1735	501	Pest of paddy
	Order-isoptera			
	A) Family-Termitidae			
37)	<i>Odontotermes obesus</i> (Rambur) Termite	81	70	Major pest of Wheat, gram and sugarcane & minor pest of many cereals and pulses crops
	Order-Diptera			
	A) Family-Bibionidae			
38)	<i>Plecia amplipennis</i> Skuse	36	35	Fodder pest



Percent distribution of number of Beneficial insects-as bio-control agents (Predators and parasites) of different order trapped in light trap installed paddy during *kharif* 2022 and 2023 (June to December) at Raisen district of Madhya Pradesh.

Table 2: Taxonomic distribution of insect pest species collected in light trap in paddy ecosystem *kharif* 2022 and 2023.

Group-II) Beneficial insects-as bio-control agents (Predators and parasites).

S. No.	Insect species collected	Total of seasons collection (June to Dec.)		Economic status Beneficial-Predatory/parasitic as bio control agents
		2022	2023	
	Order-Coleoptera			
	A) Family-Carabidae			
1)	<i>Prothyma</i> sp. Tiger beetle	380	370	Predator of Colorado potato beetle and small insects
2)	<i>Cicindela flexuosa</i> (Distant)	27	32	General predator of small insects
3)	<i>Chlaenius pictus</i> Choudoir	68	56	General predator of Lepidopterous larvae
4)	<i>Chlaenius nigricans</i> Wiedemann	41	47	Predaceous upon <i>Laphygma pyrausta nubilalis</i> and <i>Pinusinsiguos</i> sp.
5)	<i>Diplocheila polita</i> Fab.	62	56	General predator
6)	<i>Brachinus sexmaculeatus</i> Dejean	34	27	General predator
7)	<i>Brachinus longipalpis</i> Wiedemann	61	79	General predator
8)	<i>Crosopodophorus elegans</i> Dejean	35	48	Predator of Lepidoptera larvae and soft body insects
	B) Family-Hydrophilidae			
9)	<i>Hydrochara caraboides</i> Latreille Water scavenger	643	633	General predator of aquatic insects
	C) Family-Scarabaeidae			
10)	<i>Onitis falcatus</i> (Wulfen) Dug beetle	176	172	General predator of aphid, coccids, white fly and bugs
	D) Family-Scirtidae			
11)	<i>Cyphon padi</i> Fleming Lady bird beetle	435	421	General predator of small insects
	Order-Hemiptera			
	A) Family-Reduviidae			
12)	<i>Sirthena carinata</i> (Fabricius)	137	131	Predator of mole cricket and <i>Gryllus</i> sp.
13)	<i>Sirthena</i> sp.	79	68	Generally feed upon <i>Oryctes</i> sp., <i>Scapterisus</i> sp. and small insects
14)	<i>Ectomocoris ululans</i> (Rossi)	55	49	Predator of caterpillars and small insects
	B) Family-Pentatomidae			
15)	<i>Eocanthcona furcellata</i> (Wolff)	34	28	Predator of caterpillars and small insects
16)	<i>Carbula scutellata</i> Distant	16	17	General predator
	C) Family-Belostomatidae			
17)	<i>Diplonychus rusticus</i> Fabricius Water bug	1677	1663	Feed on aquatic insects
	D) Family-Pyrrhocoridae			
18)	<i>Antilochus conqueberti</i> (Fabricius)	50	44	Predator of nymph of red cotton bug
	Order-Hymenoptera			
+	A) Family-Vespidae			
19)	<i>Vespa orientalis</i> Linnaeus	86	76	General parasite of Lepidopterous, Coleopterous and Dipterous insects
	B) Family-Formicidae			
20)	<i>Myrmicaria brunnea</i> Saunders	368	369	Egg parasite of Lepidopteran insects

21)	<i>Dorylus</i> sp.	38	29	General parasite of Lepidopterous and Dipterous insects
	C) Family-Ichneumonidae			
22)	<i>Enicospilus purgatus</i> (Say)	169	145	Larval parasite of stem borer, leaf folder and Lepidopterous insects
	Order-Odonata			
	A) Family-Coenagrionidae			
23)	<i>Coenagrion</i> sp. Damselfly	180	173	Predator of monarch butterfly, stem borer, gall midge and leaf eating caterpillar
	B) Family-Libellulidae			
24)	<i>Pantala flavescens</i> (Fabricius)	355	356	General predators on Lepidopterous, Dipterous and Hymenopterous insects
	Order-Neuroptera			
	A) Family-Chrysopidae			
25)	<i>Chrysoperla sillemi</i> (Esben-petersen) Green lace wing	159	157	General predator on leaf hoppers and aphids
	B) Family-Ascalaphidae			
26)	<i>Ascalaphus</i> sp. Owl fly	262	250	Adult feed on caterpillars and grubs
	Order-Dictyoptera			
	A) Family-Mentidae			
27)	<i>Archimantis latistyla</i> (Serville) Mantis	84	59	Nymph feed on leaf hopper and aphids while adult feed on caterpillars
	Order-Orthoptera			
	Family-Tettigoniidae			
28)	<i>Conocephalus</i> sp. Long horn grass hopper	81	52	Predator of Lepidopteran eggs
	Order-Dermaptera			
	A) Family-Forficulidae			
29)	<i>Elaunon bipartitus</i> (Kirby) Ear wing	232	227	General predator on Lepidopteran larvae

Conclusions

Taxonomic analysis revealed that 69 species belonging to 11 orders and 38 families were recorded throughout the season (kharif 2022 to 2023). Based on number of species collected, largest collection was represented by order Lepidoptera (20 species) followed by order Coleoptera (15 species), Hemiptera (15 species), Orthoptera (6 species) & Hymenoptera (5 species) in descending order respectively (kharif 2022 to 2023). Orders of minor significance were represented by Odonata and Neuroptera having 2 species each while Isoptera, Diptera, Dermaptera & Dictyoptera were represented by one species only.

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