Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 13 [3] February 2024 : 86-91

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD

ORIGINAL ARTICLE **OPEN ACCESS**

A Survey on Diversity of Insects in Vegetable Field of Kumhari, Durg

Ajay Singh, Bindushree Baghel
School of Science. Mats university Raipur, Chhattisgarhi, India
Corresponding Author: Email: inwins077@gmail.com

ABSTRACT
The current study was conducted to identify different varieties of insect fauna found within the vegetable fields in Kumhari, Durg (C.G.). For the collection of insect samples, various methods like pitfall trapping, insect-catching nets, photographic sampling, and handpicking were used. A total of 285 individual varieties belonging to 30 species, 09 orders, and 30 families of insect fauna were successfully identified from vegetable fields in the Kumhari village area. This study shows that Hymenoptera (41.4%), Coleoptera (40.7%), Hemiptera (21.4%), Lepidoptera (15.7%), and Diptera (9.4%) were the most abundant orders in the vegetable sites of Kumhari, and less than 5% species of Orthoptera (grasshoppers and leafhoppers) were recorded. Neuroptera (alderflies and fishflies), Odonata (dragonflies and damselflies), and Mantodea (praying mantises) were also collected. The insect diversity (Shannon-Wiener Index = 3.11), species richness (Margalef's Index = 4.834), species evenness (Pielou evenness Index = 0.917), and species dominance (Simpson's Index = 0.053) were observed. In general, it can be concluded that the vegetable fields of Kumhari, Durg (C.G.) accommodate a rich insect diversity, that natural living conditions should be sustained, and that natural habitats must be conserved and enhanced further.
***Keyword**: biodiversity, insect, orders, Kumhari village, Margalef's Index.*

Received 05.11.2023 Revised 19.12.2023 Accepted 22.01.2024

INTRODUCTION

Approximately 80% of fauna on earths are insects. Almost all kinds of the natural or artificial ecosystems including terrestrial as well as aquatic support a variety of insect communities. The presence and absence of each insect species within a larger community has an effect on the abundance and complexity of other organisms [1]. With over 100 million species having ever survived, insects are now the most abundant group in the earth's biodiversity.[2]. [3] offered a list of 174 Central Indian species and subspecies, of which 153 and 113 are species of butterflies from the states of Madhya Pradesh and Chhattisgarh. Insects are essential for ecosystem functions such as in recycling of nutrients, by leaf litter and wood degradation, disposal of fungi, in decay and decomposition of waste material of plants and animals, soil turnover, in the propagation of plants, by pollination and dispersal of seeds, maintaining the structure and composition of plant community, insects are used as food for variety of fauna and flora (insectivores animal & plants) [4]. It has been possible to examine a community's biodiversity with various degrees of effectiveness by utilizing insects as biosensors [5], [6]. Humans value many insects because they play a crucial role in pollination of crops, such as bees [7]. Insect diversity is indirectly influenced by soil and vegetation diversity [8], [9]. The diversity of insects present there is affected by the abundance of vegetation in different parts of a place or at various locations, Insects contribute to ecosystem functioning by retaining nutrients in the soil, pollinating crops and flowering plants, dispersing seeds, maintaining soil quality and productivity, regulating the number of other living things, and providing a significant nutrition source for other subspecies. [10]. In Chhattisgarh, relatively less attention has been given to the insects for environmental bio assessment. Kumhari, a small town area which is situated in Durg district of Chhattisgarh, has a very diverse range of habitats that support many interesting insect communities. This investigation sought to record the early variety of insect populations in the unexplored Kumhari area.

MATERIAL AND METHODS

Study Sites:

The study was conducted from 21st February to 21st April 2022 in the vegetable field of Kumhari Durg. The selected areas were of Kumhari village (vegetable field). The vegetable field considered was to have different vegetation characteristics, microhabitats, and components of substrates.

Sampling Techniques of Insects:

Three commonly used techniques were used to document species occurrence, diversity, and identification. The techniques used for the collection of insect were by using insect net, visual sampling & hand picking, and pitfall trapping. Sample collections were conducted early in the morning,

Insect net:

Flying insects were caught by using a light and strong insect net that was set randomly along the vegetable field. The insect caught were placed in small plastic bottles with labels outside for writing the collected data. Identification and documentation were done in a laboratory through microscopic observation. Visual sampling and hand-picking were conducted almost all the time by observing insects' habitats or preferred places; open areas with limited sunlight. Insects were collected directly using forceps and insect nets. The samples were then put into vials or killing jars containing 75% of ethanol. The date, time, place, and the name of the collector were recorded on a data sheet.

DISPOSABLE BOWLS FOR PITFALL TRAPPING;

At least two traps were set along a row of the vegetable field and were regularly checked. Catching flying insects was made easier by disposable bowl traps, the trap's bright colour enticed certain species, such as Diptera, Hymenoptera, Hemiptera, and others., In the traps, a mixture of water and washing-up liquid(3–4 ml of washing-up liquid per litre of water) was used to fill bright disposable paper-plastic bowls.(11) approximately 3 cm deep. The bowls were placed on the flat clear soil surface for about 12 hours, after that In order to identify the insects, the Disposable bowl trap had them passed using a 0.5-mm mesh net filter, cleaned, and then preserved in a 70% alcohol solution in the lab. This technique is useful for capturing live insects, which are insects that live on the surface, like Coleoptera (beetles) and Formicidae (ants).

Statistical analysis:

The species diversity of the vegetable field in Kumhari was determined by calculating it using ecological keys.

Getting the Simpson's Index (D) involves subtracting (n*(n-1))/N*(N-1)

Where n = a species' individuals number and N = total number of all species' individuals.

- **Simpson's Diversity Index (SDI): 1-** Simpson's Index (D)

Obtaining Diversity Index by Simpson (SDI) value is achieved by dividing the value of Simpson's index(D) by 1. Between 0 and 1, which represent zero and infinite diversity, respectively, is the range of values for the variable. The Simpson's Diversity Index measure [12] considers the quantity of species found in a given area as well as the proportionate number of each species.

- (H') = Σ Pi ln(Pi) is the Shannon-Wiener index.

where Pi is equal to S / N, S is the total number of individuals in a species, N is the total number of individuals in all species, and ln is the logarithm to base e. More variety is represented by a larger value of H' [13].

- The index of Margalef (R) is equal to (S - 1) / ln (N).

In [14], N stands for all the individuals in all species, and S stands for all the species in total.

- Pielou's Evenness Index E1 is calculated by dividing H' by ln(S)

According to [15] S is the total number of species in the sample, and H' is the Shannon-Wiener diversity index. Increased species richness and evenness in a field leads to increased diversity. [16].

Laboratory work

The respective trap Sample ware taken to the laboratory and live larvae were kept in a big container with the killed specimens kept in the refrigerator to keep them fresh before the pinning process.

Pinning and Drying of Specimens

Samples were pinned using different pin sizes ranging from 0 to 7. Samples were pinned through the left side of the thorax. After the pinning process was done, the samples were kept in an oven at 45°C to dehydrate the liquid inside the specimens' bodies to preserve them. For flying insects, , firstly their wings were spread with the help of a spreading box and the wings were moved in to position by, pin then after the specimens were pinned with insect pins. The specimens that have been spread were dried in an oven for 2 to 3 days at 35°C to dry out their body liquid.

Identification

[1], [17], [18], [19] and [20], [21] means were used to identify the specimens and use a dissecting microscope to identify the samples.

RESULTS AND DISCUSSION

Total 285 individuals belonging to 30 species, 09 orders and 30 Family of insect fauna were successfully identified from 20 March to 21st April 2022 in kumhari vegetable felid. This study shows that Hymenoptera (41.4%), Coleoptera (40.7%), Hemiptera (21.4%), Lepidoptera (15.7%), Diptera (9.4%), were the most abundant order in the vegetable site of Kumhari and below to 5% species of Orthoptera (grasshoppers and leafhoppers). Neuroptera (alderflies and fishflies), Odonata (dragonflies and damselflies), and Mantodea (praying mantises) were also collected. Table 1. shows the list of insect diversity collected at Kumhari. Figure 1. Shows the composition of insect diversity (in percentage) in the vegetable field of Kumhari.and figure2. Related to the occurrence of family individuals (A, B.C, D, E,) of different Oders in vegetable filed of kumhari. In vegetable ecosystems, ants (Hymenoptera: Formicidae) comprised the largest proportion of insect diversity. The most abundant ant species found were Solenopsis sp., Oecophylla sp. (Figure 3), and Camponatus sp. Factors that might affect the ant diversity are the vegetation type, soil structure, and land use pattern. Ants that live both on the ground and in trees are significantly influenced by vegetation types. The kind of soil has a big impact on species concentration, mobility, and structure, and it also affects the development phases of different plant types.. Furthermore, the level of vegetation stages could affect the diversity and distribution of ant species (22). At present, all hymenopterans found in this study were neither listed nor assessed as stated in the International Union for Conservation of Nature's 2012 report. However, sustaining good quality of ecosystems will attract more species of Hymenoptera which is important for supporting a larger fauna food chain within their ecosystem pools within Kumhari vegetation areas. Many species of Coleopteran (beetles) are very common and breed in open and disturbed habitats. In general, the beetles were widely distributed and the species that were found the most were *Harmonia sp.* (Figure 4), and *Catharsius* sp., Most of the species were classified as 'Least Concern' where the population trends were generally stable or unknown (IUCN, 2012). For Hemiptera (bugs), the most abundant species at the site were from family of Hydrometridae (*Hydrometra sp.)* (Figure 5) and Delphacidae (*Sogotella sp.*) are pest of summer squash and monocot vegetables. Lepidoptera (butterflies and moths), were also the most abundant at the site, were from families of Nymphalidae (*Ideopsis sp.*) (Figure 6), and Papilionidae (*Papilio sp., Papilio sp.)* (Figures 7 and 8). The vegetated environment at the site provided a prevailing conducive niche for (butterfly species) to thrive in this unexploited area. The specific plant species that were mostly used as perching points by the butterflies were berry shrubs (*Lantana camara*) and citrus plants. This might be due to the flowering of the plant during the sampling period. Species diversity and richness increased with increasing vegetative structure. We also found Katydids (Order: Orthoptera) and mantids (Order: Mantodea) ,their mimicry and camouflage were observed, and they often had shapes and colors that resembled leaves. In nurseries, there was a large amount of hoverflies, They are occasionally called syrphid wings or bloom floats. Frequently, they are spotted soaring or drinking sap from florae. The grown-ups of many classes mostly consume essence and pollen, while The creepy crawlies (maggots) devour a range of nutrients. Saprotrophs are worms of some species that eat rotting vegetables and visceral matter that may be found in tarns, watercourses, and soils. Hymenoptera is widely acknowledged as the most advantageous group in the insect classification [23]. There are numerous remarkable and valuable species in it, including parasites and insect pest predators, & the greatest vital pollinators of plants, bees. Farmers have long used parasitic hymenoptera to manage agricultural pests and as one of the most prevalent natural enemies in native environments to shield crops from harm. [24], [25]. As can be seen in Table 2, the leafy vegetable fields had the most diversity according to the Shannon-Weiner Diversity Index (H'), which had a value of H' = 3.11.Despite having the highest value of E' =4.834 in the leafy vegetable area, the evenness of species remains high (E' > 1.00). This indicates that there is an elevated population of individuals in the particular habitat. An influence on the greater value of H' in the leafy vegetable region comes from the values of (E' = 0.917) and (R' = 3.261). Due to its two characteristics, H is a widely used indicator of species diversity. Just when S species has an equal number of individuals does H' reach its maximum if there is just one species in the sample. . An equitable distribution of abundance [26] . The findings might be extremely helpful in identifying the existence or absence of any bug family found in the Kumhari leafy produce region.

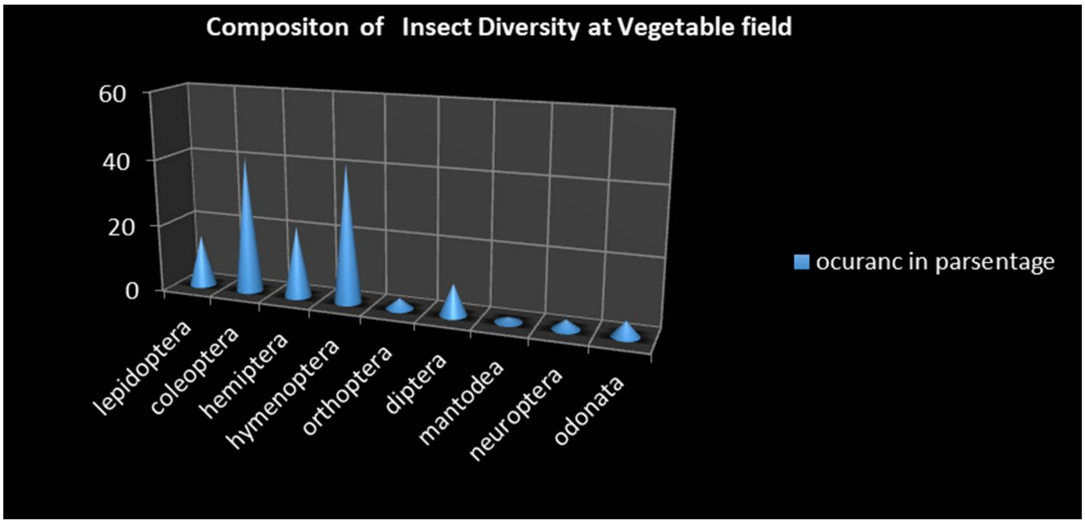
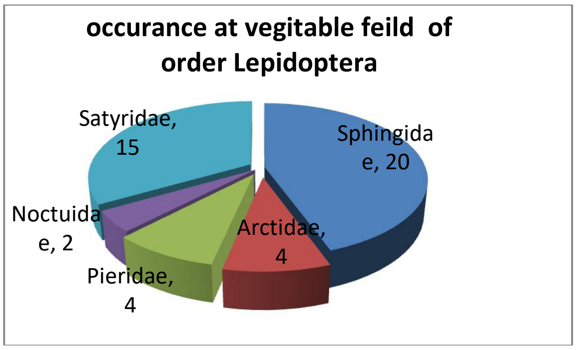
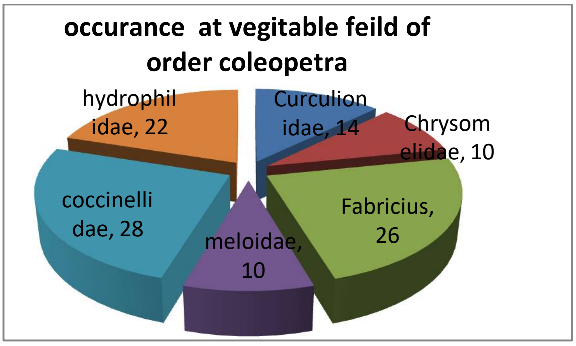


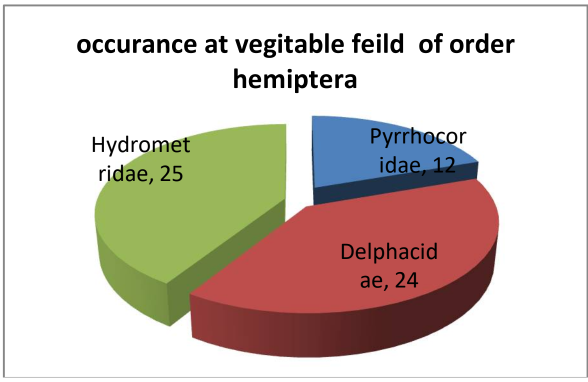
Figure 1: The composition of insect diversity (in percentage) at vegetable field of kumhari



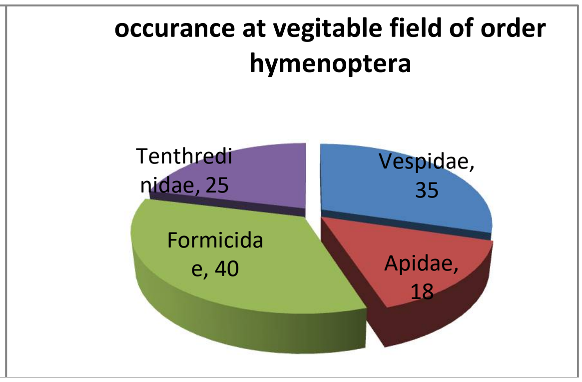
A



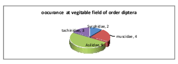
B



C



D



E

Figure 2: Occurrence family individuals (A, B, C, D, and E) of different Orders in Vegetables field in kumhari.

Table:1 Checklist of insects collected from the vegetable field of kumhari. (Self)

S. No.	Order	Family	Scientific Name	Occurrence	Collection method
1	Lepidoptera	Sphingidae	*Acherontia styx sp.*	20	IN
2.	Lepidoptera	Arctidae	*Spilosoma obliqua sp.*	04	IN
3.	Lepidoptera	Pieridae	*Pieris brasicae sp.*	04	IN
4	Lepidoptera	Noctuidae	*Helicoverpa armigera sp.*	02	IN
5	Lepidoptera	Satyridae	*Mycalesis porsens sp.*	15	IN
6	Coleoptera	Curculionidae	*Sitophilus oryzae sp.*	14	PT & IN
7	Coleoptera	Chrysomelidae	*Aulocophora foveicollis sp.*	10	PT & IN
8	Coleoptera	Fabricius	*Catharsius pithecius sp.*	26	PT & IN
09	Coleoptera	meloidae	*Mylabris pustulata sp.*	10	PT & IN
10	Coleoptera	coccinellidae	*Harmonia axyridis sp.*	28	PT & IN
11	Coleoptera	hydrophilidae	*Helophilus Mulsant sp.*	22	PT & IN
12	Coleoptera	Dytiscidae	*Copelatus distinctus sp.*	06	PT & IN
13	Hemiptera	Pyrrhocoridae	*Dysdercus koengii sp.*	12	PT & IN
14	Hemiptera	Delphacidae	*Sogotella furcifera sp.*	24	PT & IN
15	Hemiptera	Hydrometridae	*Hydrometra sp.*	25	PT & IN
16	Hymenoptera	Vespidae	*Vespa cincta sp.*	35	PT
17	Hymenoptera	Apidae	*Lepidotrigona arcifera sp.*	18	PT
18	hymenoptera	Formicidae	*Oecophylla smargdina sp.*	40	PT
19	hymenoptera	Tenthredinidae	*Athalia rosae sp.*	25	PT
20	Orthoptera	Tettigonidae	*Suthrophylla sp.*	03	IN
21	Orthoptera	Gryllotalpidae	*Gryllotalpa Africana sp.*	06	IN
22	Diptera	Syrphidae	*Syrphus balteatus sp.*	02	IN &PT
23	Diptera	muscidae	*Musca domestica sp.*	04	IN &PT
24	Diptera	Asilidae	*Empis opaca sp.*	09	IN &PT
25	diptera	tachinidae	*Tachinid fly sp.*	03	IN &PT
26	Diptera	culicidae	*Culiseta longiareolata sp.*	11	IN &PT
27	Mantodea	mantidae	*Mantis religiosa sp.*	04	IN
28	Neuroptera	Chrysopidae	*Chrysopa flava sp.*	08	PT &IN
29	Odonata	Coenagnonidae	*Nehalennia gracilis sp.*	07	IN
30	Odonata	Aeshnidae	*Anaxparthanope sp.*	06	IN

Table 2. All insects collected from the Kumhari vegetable field were included in the following indexes: Simon's Index (D), Pielou Evenness Index (E'), Margalef Richness Index (R'), Shannon-Wiener Diversity Index (H'),

S.No.	insect diversity	species richness	species evenness	species dominance
1	Shannon-Wiener Index(H’)	Margalef’s Index(R’)	Pielou evenness Index(E’)	simpson’s Index (D)
	3.11	4.834	0.917	0.053

CONCLUSION

In general, it can be concluded that the unexplored area of Kumhari, Durg accommodates such a high diversity of insect fauna. To protect the diversity of insect communities in these areas, the conservation and enhancement of natural habitats should be taken seriously. Thus, The data gathered from this article has the potential to be beneficial in future planning and maintaining ecosystem diversity to sustain the insect diversity in the Kumhari vegetation field. The conservation of biodiversity and ecosystems in particular areas is heavily influenced by factors such as food resources, disturbances, and anthropogenic effects, as indicated by the results. Hence, the designation of leafy vegetable fields to maintain biodiversity and offer a variety of ecological benefits, it is important to operate it in a healthier and more sustainable way. Such a work will provide us with more diverse data and will also help us to understand whether there is any fluctuation in the number of species in the area studied.

REFERENCES

1. Romoser, W. S. and Stoffolano, J. G. (1998). The Science of Entomology, 4th Edition. Mcgraw-Hill, United States.357.
2. Grimaldi D. & Engel M. (2005): Evolution of the Insects. Cambridge University Press, New York and Cambridge, xv + 755 pp., 41.
3. K. Chandra , R.M. Sharma , Ajit Singh and R.K. Singh (2007) a checklist of butterflies of madhya pradesh and chhattisgarh states, india

4. Gullan, P. J. and Cranston, P. S. (2010). The Insects: An Outline of Entomology (4th Edition). Wiley-Blackwell, New York, United States.
5. Rakosy, L. and Schmitt, T. (2011). Are butterflies and moths suitable ecological indicator systems for restpration measures of semi-natural calcareous grassland habitats. Ecological Indicators 11 : 1040-1045.
6. Shuey, J., Labus, P., Carneiro, E., Dias, F. M. S., Leite, L. A. R. and Mielke, O. H. H. (2017). Butterfly communities respond to structural changes in forest restorations and regeneration in lowland Atlantic Forest, Parana, Brazil. Journal of Insect Conservation. 21(3): 545–557
7. Berenbaum M, Bernhardt P, Buchmann S, Calderone NW, Goldstein P, Inouye DW, Kevan P, Kremen C, Medellin R, Ricketts T, Robinson GE, Snow AA, Swinton SM, Thien LB, Thompson FC (2006). Statusof Pollinators in North America. National Academies Press, Washington, DC 307 pp.
8. Pouget M. (1980), Les Relations Sol-V´eg´etation dans les Steppes Sud-Alg´eroises, ORSTOM, Paris, France.
9. Bennett A. (2010). "The role of soil community biodiversity in insect biodiversity," Insect Conservation and Diversity, vol. 3,pp. 157–171,
10. Majer, J. D.(1987). The conservation and study of invertebrates in remnants of native vegetation. Pp. 333–335. In D. A. Saunders, G. W. Arnold, A. A. Burbridge, and A. J. M. Hopkins (eds). Nature Conservation: The Role of Remnants of Native Vegetation. Surrey Beatty and Sons, Sydney.
11. LeBuhn, G., T. Roulston, V. Tepedino, T. Griswold, J. Cane, N. Williams, R. Minckley, F. Parker, C.Kremen, S. Droege, S. Buchmann, and O. Messenger (2003).A standardized method for monitoring bee populations: the bee inventory (BI) plot.,http://online.sfsu.edu/,beeplot/pdfs/Bee%20Plot%202003.pd
12. Simpson EH. 1949. Measurement of species diversity. Nature. 163:688. https://doi.org/10.1038/163688a0
13. Shannon CE, and W Wiener. 1949. The Mathematical Theory of Communication. Urbana, University of Illinois Press, 177 p.
14. Margalef R. (1958). Temporal succession and spatial heterogeneity in phytoplankton, pp. 323-347. In: Perspectives in Marine Biology. University of California Press, Berkeley. https://doi.org/10.1525 /9780520350281-02
15. Pielou EC. 1966. The measurement of diversity in different types of biological collections. J. The or. Biol. 13:131–144. https://doi.org/10.1016/0022-5193(66)90013-0.
16. Magurran EA. (1988). Ecological diversity and its measurement. Croom Helm, Australia, 215 pp. https://doi.org/10.1007/978-94-015-7358-0.
17. Hämäläinen, M. & Pinratana, A. (1999) Atlas of the dragonflies of Thailand – distribution maps by provinces. Brothers of St. Gabriel in Thailand, Bangkok, vi + 176 pp., incl. 28 col. pls.
18. Orr, A. G. (2003). A Guide to the dragonfly of Borneo: Their Identification and Biology. Natural History Publication (Borneo) Sdn. Bhd. Kota Kinabalu, Sabah, Malaysia.
19. Corbet, A. S., Pendlebury, H. M. and Eliot, J. N. (1992). The Butterflies of the Malay Peninsula. 4th ed. Tweeddale Court, London.
20. Kazuhisa, O. (2001). A Field Guide to the Butterflies of Borneo and South East Asia. Hornbill Books.
21. Borror D. J, Triplehorn C. A. and Johnson N. F. (1989). An Introduction to the study of insects, 6th edition, Saunders College, United States.
22. Deblauwe, I. and Dekoninck, W. (2007). Diversity and distribution of ground dwelling ants in lowland rainforest in southeast Cameroon. Insectes Sociaux 54(4) : 334–342.
23. Triplehorn, C.A. and Johnson, N.F. (2005). Borror and Delong's Introduction to the Study of Insects 7th Edition Brooks/Cole, Cengage Learning, pp. 745-778.
24. Goulet, H. and Huber, J.T. (1993). Hymenoptera of the World: An Identification Guide to Families. Centre for Land and Biological Resources Research, Ottawa, Ontario, pp. 1-508.
25. Schneider, M.I. and Viñuela, E. (2007). Improvements in rearing method for Hyposoter didymator (Hymenoptera: Ichneumonidae), considering sex allocation and sex determination theories used for Hymenoptera. Biological Control 43, pp. 271-277.
26. Meerman, J. (2004). Rapid Ecological Assessment Columbia River Forest Reserve: Past Hurricane Iris. Retrieved on Nov. 2012

CITATION OF THIS ARTICLE

Ajay Singh , Dr. Bindushree Baghel . A Survey On Diversity Of Insects In Vegetable Field Of Kumhari , Durg. Bull. Env.Pharmacol. Life Sci., Vol 13 [3] February 2024: 86-91