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ORIGINAL ARTICLE

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

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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, Shannon-Wiener Index , Pielou evenness Index, Simpson's Index*

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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 (18). 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) (8). Using insects as bio monitors, it has been possible to assess the biodiversity of an area at the community level with varying degrees of success (17), (21). Humans value many insects because they play a crucial role in pollination of crops, such as bees (3). Insect diversity is indirectly influenced by soil and vegetation diversity (16),(1). The diversity of insects presents there is affected by the abundance of vegetation in different parts of a place or at various locations, The functioning of the ecosystem is carried out with the help of insects such as retaining nutrients in the soil, pollinating crops and flowering plants, dispersal of seeds, maintaining soil quality and productivity, as well as controlling the populations of other organisms and offering a significant food 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. The purpose of this study was to record the initial diversity of insect populations in the unexploited region of Kumhari .

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 insects 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 detergent soap (3–4 ml of soap per liter of water) was used to fill bright disposable paper-plastic bowls.; 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 sieved through a 0.5-mm mesh net, rinsed, and preserved in 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-D

Obtaining Simpson's diversity index value is achieved by subtracting Simpson's index value from 1. The value varies from 0 to 1, with 0 indicating zero diversity and 1 indicating infinite diversity, respectively. The SDI measure (Simpson 1949) takes into account both the number of species present in a location and the relative abundance of each species.

- Shannon-Wiener index (H') =– Σ Pi ln(Pi)

where Pi = S / N; S = number of a species' individuals, N = total number of all species' individuals, ln = logarithm to base e. The greater value of H' represent the higher diversity [19].

- The index for Margalef (R) is = (S - 1) / ln (N)

In [11], S represents the total number of species and N represents the total number of individuals of all species.

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

According to [14] H' is the Shannon-Wiener diversity index and S is the total number of species in the sample. Increased species richness and evenness in a field leads to increased diversity. [12].

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) (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 Orders 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 development stages of vegetation types are also influenced by the soil type, which had a significant impact on species density, activity, and composition. 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 by the International Union for Conservation of Nature (IUCN, 2012).

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 Coleoptera (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, which are sometimes referred to as flower flies or syrphid flies. . Frequently, they are spotted hovering or drinking nectar from flowers. The adults of many species mostly consume nectar and pollen, while the larvae (maggots) eat a wide variety of food. Certain species have larvae that feed on decaying plant and animal matter found in soil or ponds and streams, known as saprotrophs. 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, and the most vital pollinators of plants, bees. Parasitic Hymenoptera have been widely utilized by farmers to control agricultural pests and some of the most abundant natural enemies in terrestrial habitats to prevent damage to crops.(24), (25).

The highest diversity was found in the leafy vegetable area, as indicated by the Shannon-Weiner Diversity Index (H') with the value of H' = 3.11, shown in Table 2. 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. The values of (E' = 0.917) and (R' = 3.261) have an impact on the higher value of H' in the leafy vegetable area. he H''s popularity as a measure of species diversity stems from its two properties. If there is only one species in the sample, H' will be 0 and H' will be maximum only when S species have the same number of individuals., A distribution of abundances that is evenly distributed (26). Overall, the results may be very useful on presence and absence of each family of insects recorded at leafy vegetable area of kumhari.

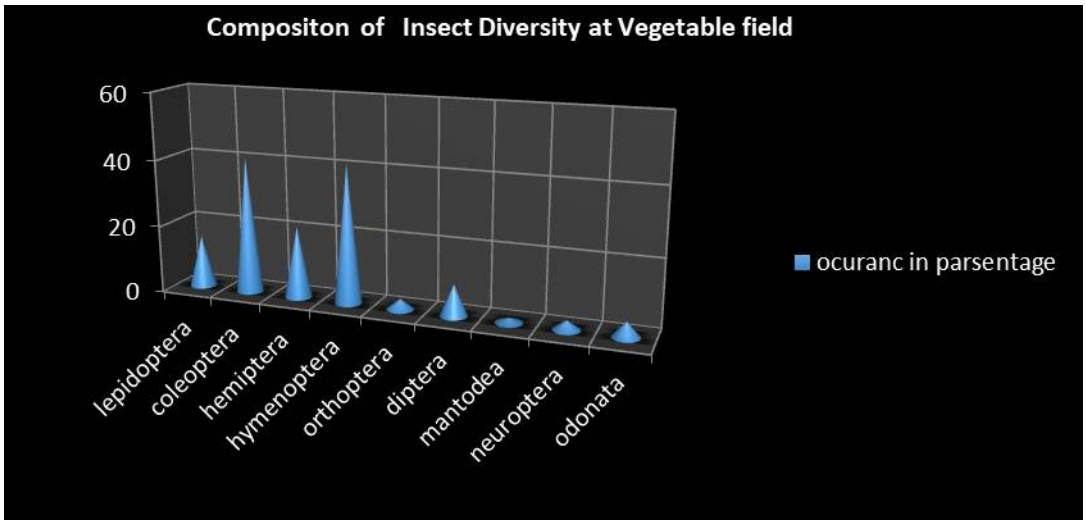
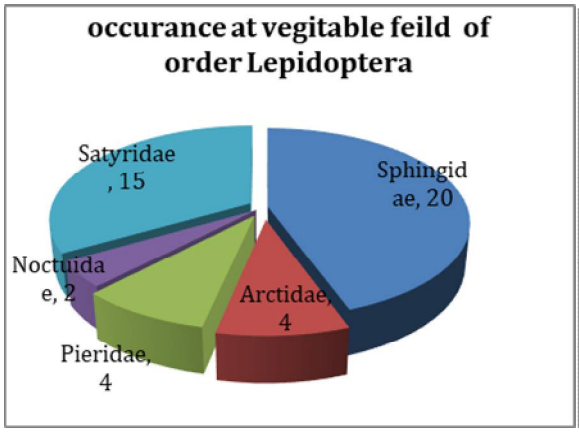
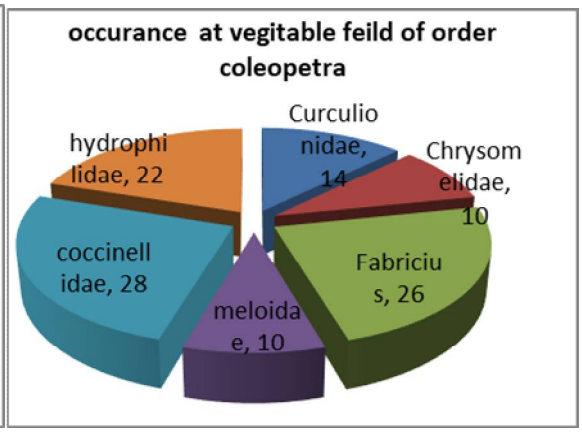


Figure 1: The composition of insect diversity (in percentage) at vegetable field of kumhari



A



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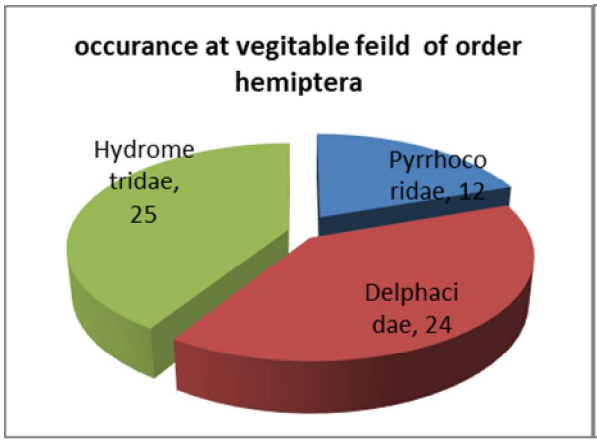

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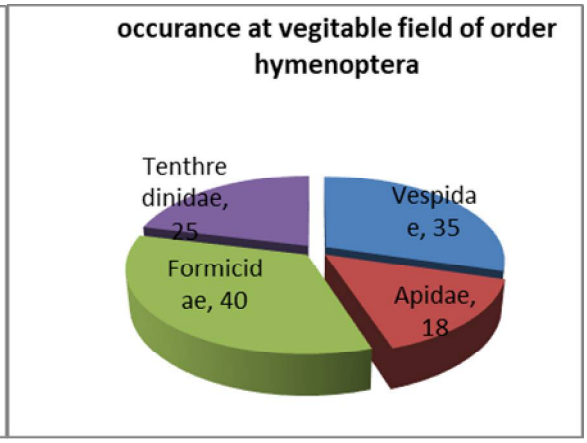

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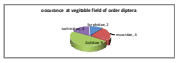

E

Figure 2: Occurrence family individuals (A, B, C, D, 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. Shannon-Wiener Diversity Index (H'), Margalef Richness Index (R'), Pielou Evenness Index (E'), & Simpson's Index (D) For All Insects Collected At Vegetable Field Of Kumhari

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

Fig.-3 Oecophylla sp.

Fig.-4 *Harmonia sp.*

Fig.-5 *Hydrometra sp*

Fig.-6 *Ideopsis sp*

Fig.-7 *Papilio sp.,*

Fig.-8 *Papilio sp.*

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 provide a wide range of ecosystem services and conserve biodiversity, 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.

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