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Ethnobiological use of insects in traditional medicine and cultural practices from the administrative region (Rishikesh) Dehradun-India

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Abstract
Background: Insects, represented as the rich taxa, are found in most of the habitats in the world. These have been utilized for a variety of purposes like medicine, food, etc. Present study was conducted from September to March 2023. Snowball technique was employed to select the respondents and the data collection was done by employing semi-structured questionnaires followed by group discussions. In the ethnobiological domain, the present study identified a total of N=13 species belonging to N=10 genera with Coccinella (31%) as the dominant genus. Upon documenting the cultural uses of the species, a total of N=6 uses of categories (black magic, insecticide, sex determination, and evil eye) were documented. The maximum number (N=8) of species (*Adalia decempunctata*, *Angelis cardoni*, *Chilocorus nigritus*, *Coccinella hieroglyphica*, *Halyzia sanscrita*, *Propylea dissecta*) were employed for black magic, followed by N=2 (*Coccinella leonine*, *Coccinella septempunctata*) as an insecticide. Only N=10 species were enlisted used to treat N=6 diseases (asthma, cough, infertility, sunburn, skin wrinkles, minor injuries). Asthma was recorded to be treated by the maximum number (N=3) of species (*Coccinella septempunctata*, *Coccinella hieroglyphica*, *Coccinella leonine*). Few people were found to practice ethnomedicine, for which in return they get hard cash or livestock like sheep, goats, and lamb, hence insects were also a source of livelihood. The use of documented species was also found to have mythical attributions. It is for the first time, the present study is exploring the ethnobiological usage of the insects from the region, hence can be considered as pioneers for the upcoming studies.

Keywords: Coccinella, ethnomedicine, livelihood

Introduction

From early times, insects have been exploited in the medicinal systems of different cultures (Seabrooks and Hu 2017) [15]. Generally regarded as filthy animals, many of them are used live, cooked, ground, in infusion, as ointments, in magic, and other uses (Costa-Neto 2005) [4]. The use of insects to get against health issues is known as entomotherapy. According to Costa-Neto 1999, the medicinal systems are organized as cultural systems, hence the usage of ethno-usage of insects should be observed from a cultural perspective. Pliny the Elder reported some entomotherapeuticals that were used for a variety of diseases in the Roman Empire during the first century A.D. However, the belief that insects are useful to mankind can be found in the book *Insectotheology* published in 1699 (Berenbaum 1995). The Ebers papyrus, an Egyptian medical treatise also contains numerous medicines obtained from insects (Weiss 1947). Although the practice of using insects for medical purposes is very old, it is still relatively unknown to the academic world (Siddiqui *et al.* 2023) [17].

The use of insects is not limited to medicine but is also utilized for other cultural practices, playing an important role in shaping the customs, and rituals of the communities (Belluco *et al.* 2023) [1]. Many communities employ the insect species for different purposes., (i.e., magic, religion, spirituality, evil eye, evil spirit issue, etc). (Hassan *et al.* 2023) [10]. Himalayas are rich biodiversity spots, inhabiting a variety of fauna, numerous studies have been carried out to explore the traditional values of flora (Sekar *et al.* 2023 [16]; Haq *et al.* 2022; Hassan *et al.* 2022), however, the least number of studies are reported concerning animal fauna especially insects which are due to lack of ethnozoological studies (Mulyanto *et al.* 2021) [14]. Further, across the globe, we are witnessing urbanization, due to which the mode of living is changing, causing the eradication of traditional knowledge. In this regard the present study was carried out with the prime objectives: 1) To document the insect species utilized for traditional medical uses and local cultural practices. 2) To investigate the role of insect fauna in their livelihood. The present study is the first to document the ethnobiological uses of insect species from Rishikesh Dehradun-India, hence can be considered as the baseline for upcoming studies.

Materials and Methods

Study area

Rishikesh, (30.103368oN 78.2947544oE.) is a tehsil in the administrative district Dehradun of Uttarakhand- India (Fig.1). The area is inhabited on the bank of the Ganges River. The region is also known as the gateway to the Garhwal Himalayas and the Yoga Capital of the World. The average height above sea level is 1120 ft. As per the Koppen-Geiger climate classification, the climate is humid subtropical (Cwa) with average maximum and minimum

temperatures of 40 C and 7 C respectively (https://weather-and-climate.com/average-monthly-Rainfall-Temperature-Sunshine,rish-kesh,India). The highest rainfall (444mm) is in July and the driest month (10mm) is November. The population of the region is 70499 with a density of 8851/Km2.

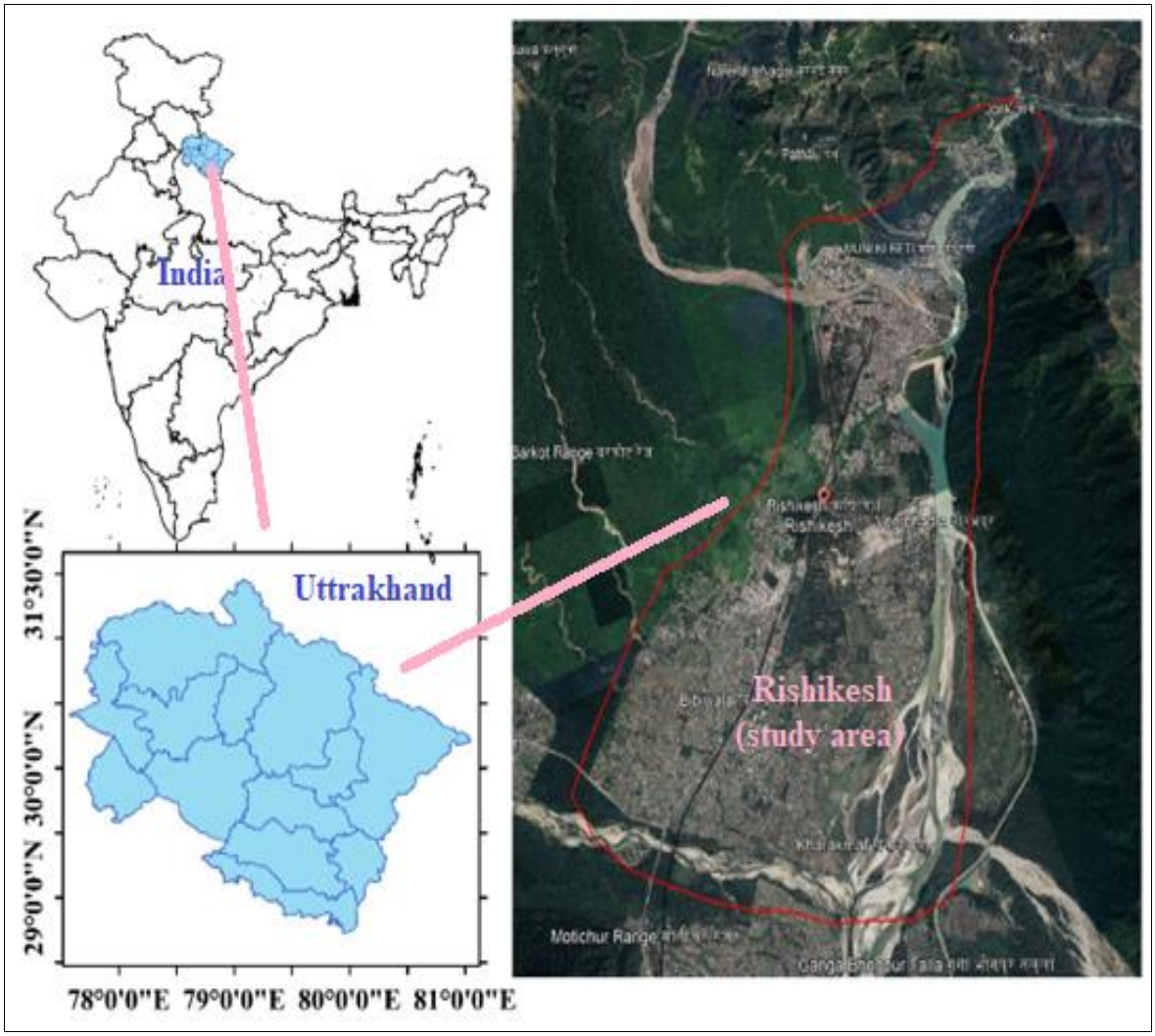

Fig 1: Map showing the study area**.**

Ethnozoological data collection

The present study was conducted from September to March 2023. The snowball technique was employed to select the respondents. The participants who showed potent knowledge of the insect species were selected for the final interview. The code of Ethics was strictly followed (https://www.ethnobiology.net/what-we-do/core-programs/ise-ethics-program/code-of-ethics/), also a prior consent was taken from the respondents. The documentation of traditional knowledge was done via semi-structured interviews followed by group discussions (Haq *et al.* 2022). A total of 63 respondents (49 male, 14 male) were selected belonging to different age groups and a variety of professions (Table 1**)**. The ascendency of the male participant in the study was due to cultural limitations. Taxonomic confirmation was done by employing the online database "Integrated Taxonomic Information System (https://www.itis.gov). MS Excel was used for correlation to confirm the distribution of species across the genera. To analyze the ethnobiological usage, a chord diagram was used by using the online bioinformatics software (http://www.bioinformatics.com.cn/plot_basic_GOplot_chord_plot_085_en).

Table 1: Demographic information of respondents from of Rishikesh Dehradun-India

Demographic features	
Total informants	83
Male	59
Female	24
Profession	
Shopkeepers	15
Farmers	21
Street vendors	24
Herders	12
Govt Employees	11
Age range	
25-45	13
46-65	31
66-85	39
Original Language	Hindi
Religion	Hinduism

Results and Discussion

Taxonomic inventory

In the ethnobiological domain, the present study identified a total of N=13 species (Photo plate 1) (Table.2). The enlisted species were found to belong to the N=10 genera. The

maximum number of species (N=4) were associated with the genus Coccinella and the rest of the genera were monotypic. A complete relationship ((Y=0.0182x + 1.2, R2 = 0.0034)) between species and the genera is presented in Fig 2a

Upon interpretation of the results Coccinella (31%) was found to be the dominant genus. The maximum percentage of Coccinella can be explained by the fact that species of this genus are found abundantly in a variety of habitats (i.e., orchids, vegetable gardens, and agriculture), Kundoo *et al.* 2018 [12] reported the cocinellea as the most thriving genus in Jammu and Kashmir India (nearby Himalayan region). Also, the species from the genus are frequently used in local traditional medicine and other cultural practices.

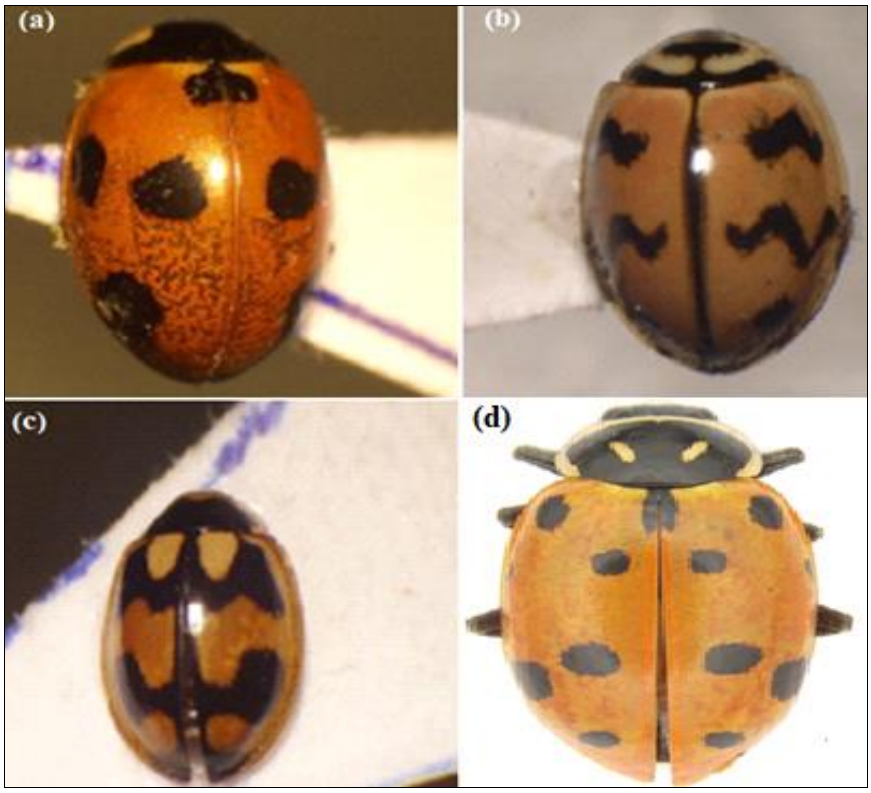

Photo plate 1: Pictures of the some identified species: (a) *Coccinella septempunctata*; (b) *Cheilomenes sexmaculata*; (c) *Propylea dissecta*; (d) *Hippodamia convergens*

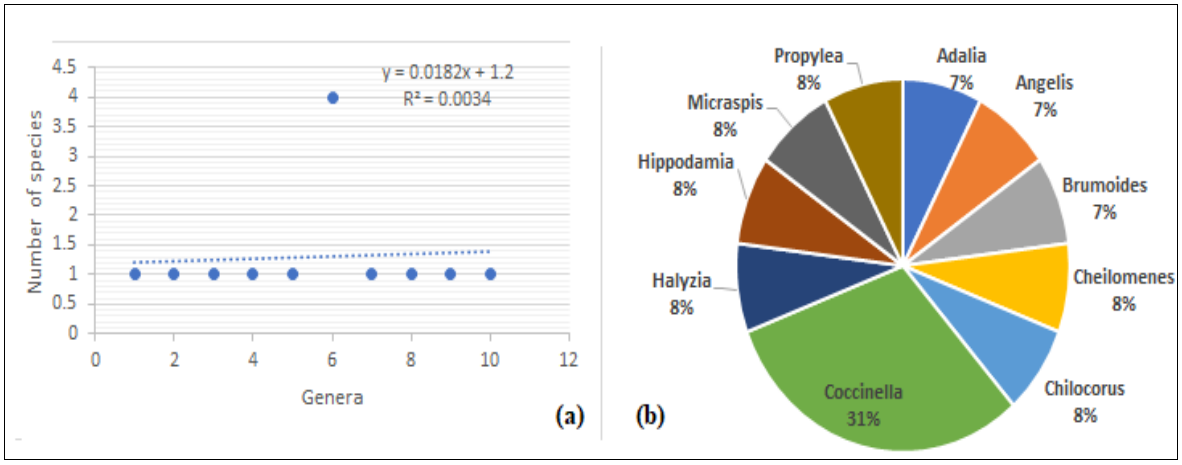

Fig 2: (a) Distribution of species in different genera (b) Percentage of different genera due to the number of species

Ethnobiological profile

Upon documenting the cultural uses of the species, a total of N=6 uses of categories (black magic, insecticide, sex determination, and evil eye) were documented. The maximum number (N=8) of species (*Adalia decempunctata, Angelis cardoni, Chilocorus nigritus, Coccinella hieroglyphica, Halyzia sanscrita, Propylea dissecta*) were employed for black magic, followed by N=2 (*Coccinella leonine, Coccinella septempunctata*) as insecticide, N=2 (*Hippodamia convergens, Micraspis discolor*) to get against evil eye, N=1 (*Cheilomenes sexmaculata*) to attain spirituality and N=1 (*Coccinella undecimpunctata*) for sex determination (Fig. 3a). According to Hassan *et al.* 2023, insects are an integral part of the cultural practices from the Kashmir Himalayas. Likewise, Chakravorty *et al.* 2013 [3] reported the use of insects in local culture from Arunachal Pradesh India.

While documenting the ethnozoological usage, medicinal attributions (zootherapy) are always a major interest. In the present study, among all documented species only N=10

species were enlisted with medical attribution. A total of N=6 diseases (asthma, cough, infertility, sunburn, skin wrinkles, minor injuries) were recorded, and treated by the recorded insect fauna. Asthma was recorded to be treated by the maximum number (N=3) of species (*Coccinella septempunctata, Coccinella hieroglyphica, Coccinella leonine*) (Fig 3b). From the results, it can be concluded that the maximum number of species used against asthma is an indication of the prevalence of this disease in the region. A complete inventory of the documented species is given in Table 2.

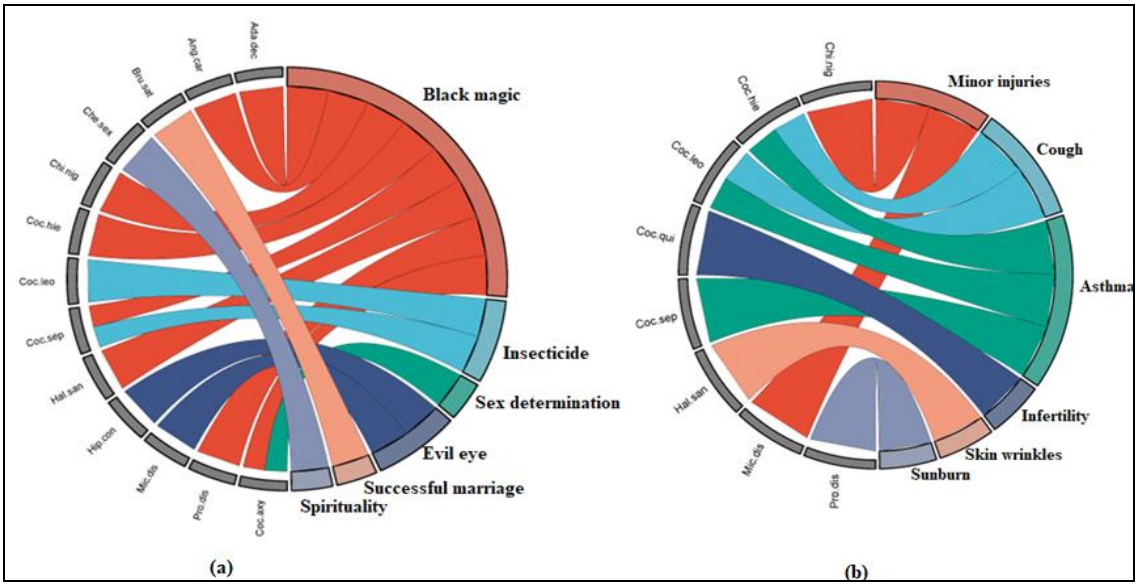

Fig 3: (a) Chord diagram revealing the cultural uses; (b) diseases treated by the documented species. The complete names and uses of the species are provided in the table.2

Use of documented species for livelihood generation

Insects have been utilized for a variety of purposes like, traditional medicine (entomotherapy), and food (entomophagy), creating a potential source of livelihood for many people across the globe (Casas Reátegui *et al.* 2018) [2]. Many studies across the globe report the use of insect fauna as a potent source of livelihood (Chakravorty *et al.* 2013 [3]; Langthasa *et al.* 2018 [13]; Gahukar 2020) [6]. In the present study, In the rural regions of the study area, the modern medical facility is absent, and people depend on nature for primary health care, in this regard variety of people were found to practice ethnomedicine, for which in return they get hard cash or livestock like, sheep goat, lamb, creating a source of livelihood for these selected people. The people who practice this ethnic medicine are generally named *Hakeem* or *Vaidh.*

Identified myths

According to de Silva *et al.* (2020) [5], the importance of the species in a region depends upon the local culture. These cultural practices are influenced by many factors including education level, traditional knowledge, and social awareness (Hassan *et al.* 2022). In the present study, we came across many myths (Table 2), but some of the unique which have never been recorded are:

1. Dead species of *Cheilomenes sexmaculata* are placed in the freshwater in the early morning for some time, then the same water is used for bathing, believed to increase spirituality.
2. *Brumoides saturali*, if found inside gardens during the marriage, is a sign of successful marriage.
3. *Coccinella undecimpunctata* are placed on the belly of pregnant ladies, believed to produce male children

Table 2: Zootherapy and cultural uses of the collected insect fauna across Rishikesh India

Scientific Name	Local name	Abb	Genus	Zootherapy	Cultural usage
Adalia decempunctata (Linnaeus,1758)	Gupillu	Ada.dec	Adalia	----------	Dried burned to produce smoke, the produced smoke is used to get against black magic.
Angelis cardoni (Weise,1990)	Bhundia	Ang.car	Angelis	----------	Dried burned to produce smoke, the produced smoke is used to get against black magic.
Brumoides saturali (Fabricius,1789)	Pillu	Bru.sat	Brumoides	----------	*Brumoides saturali* If found inside gardens during marriage, is a sign of successful marriage.
Cheilomenes sexmaculata (Fabricius,1781)	Gudbinia	Che.sex	Cheilomenes	----------	Dead species are placed in the freshwater in the early morning for some time, then the same water is used for bathing, believed to increase spirituality.
Chilocorus nigritus (Fabricius,1798)	Kala Bhundia	Chi.nig	Chilocorus	Whole body is dried and mixed with spider webs to stop bleeding from minor injuries.	Dried burned to produce smoke, the produced smoke is used to get against black magic.
Coccinella hieroglyphica (Linnaeus 1759)	Kisari	Coc.hie	Coccinella	Whole-body is sun dried and consumed with honey to treat cough, asthma.	Dried burned to produce smoke, the produced smoke is used to get against black magic.

Coccinella leonine (Fabricius,1775)	Sursui	Coc.leo	Coccinella	Sun Dried whole-body is consumed with honey to treat asthma.	Collected and used kept overnight in the traditional homes to avoid spiders
Coccinella quinquepunctata (Linnaeus,1785)	Pissu	Coc.qui	Coccinella	Whole body is dried and consumed with lemon and honey to treat infertility.	
Coccinella septempunctata (Linnaeus 1758)	Quleela	Coc.sep	Coccinella	Sun Dried whole-body is consumed with honey to treat asthma.	Collected and used kept overnight in the traditional homes to avoid spiders
Coccinella undecimpunctata (Linnaeus,1758)	Bugi	Coc.axy	Coccinella	----------	Species are placed on the belly of pregnant ladies, believed to produce male children.
Halyzia sanscrita (Mulsant,1846)	Behoor	Hal.san	Halyzia	Whole body is dried and made into paste by adding egg white and applied topically to treat skin wrinkles.	Black magic
Hippodamia convergens (Guerin-Meneville,1842)	Drakcheeda	Hip.con	Hippodamia	----------	Burned to produce smoke, to treat Evil eye.
Micraspis discolor (Fabricius,1798)	Sooree	Mic.dis	Micraspis	Whole-body is dried mixed with turmeric and resin from *Cedrus deodar* to treat wounds.	Burned to produce smoke, to treat Evil eye.
Propylea dissecta (Mulsant,1846)	Goguu	Pro.dis	Propylaea	Whole-body is dried mixed with turmeric and olive oil to treat sunburns.	Dried burned to produce smoke, the produced smoke is used to get against black magic.

Conclusion

In conclusion, the present study reports that local people are dependent on the recorded species for cultural as well as medicinal uses. However, the traditional knowledge which is transmitted orally from one generation to another is withheld by the elderly class due to changes in the mode of living in the region. In this regard, it is important to document the eroding traditional legacy and to present it in the scientific domain which can assist in the generation of new drugs and further can help in understanding the local people to draft policies by the stakeholder for the betterment and sustainable usage of local natural wealth. It is for the first time, the present study is exploring the ethnobiological usage of the insects from the region, hence can be considered a pioneer for the upcoming studies.

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Author Contributions

All the authors contributed equally.

Conflict of interests

The authors declare that they have no conflict of interest.

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