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STUDIES ON THE EFFECTIVENESS OF SELECTED TRAPS FOR INSECTS DIVERSITY AND DISTRIBUTION IN TEHSIL BAFFA PAKHAL, MANSEHRA PAKISTAN

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ABSTRACT
The current study aimed to determine how well the Pit Fall, Flight Interception, and Light Trapping systems in Tehsil Baffa Pakhal, District Mansehra KP, affected the distribution and diversity of insects. Insect trapping surveys were conducted from June 2022 to September 2022. Three distinct trapping systems were implemented in four specific locations: Hazara University, Baffa, Dhodial, and Shinkiari. Tehsil Pakhal, District Mansehra, is the earliest published report on the use of trapping systems for insect studies. A total of 21 genera, 26 species, and 5 families were identified from a total of 553 specimens. Anomala bengalensis (Blanchard, 1851), Adoretus ictericus (Laporte, 1840), Adalia decempunctata (Linnaeus, 1758), Parcoblatta Americana (Scudder, 1900), Apis mellifera (Linnaeus, 1758), Apis florea (Fabricus, 1787), Copris repertus(Walker, 1858), Anegleis cardoni (Say, 1824) , Camponotus vagus (Scopoli, 1763), Pheropsophus africanus **(**Dejean, 1825), Eurydema ornate (Linnaeus, 1758), Musca domestica (Linnaeus, 1758), Mylabris pustulata (Thunberg, 1821), Mylabris phalerata (Pallas, 1781), Scarities subterraneus (Fabricius, 1775), Hybosorus orientalis (Westwoo, 1845), Stromatium barbatum (Fabricius, 1775), Polistes olivaceus (DeGeer, 1773), Heteronychus artor(Fabricius, 1775), Polistes rothneyi (Cameron, 1900), Polistini canadensis (Linnaeus, 1758), Polistes wattii (Cameron, 1900), Vespa tropica (Linnaeus, 1758), Vespa oreintalis (Linnaeus, 1771), Gryllotalpa orientalus (Burmeister, 1838) and Junonia coenia (Hubner, 1822) were confined during the current study. In terms of the total number of specimens, the orders Coleoptera and Hymenoptera emerged as the most abundant. whereas, the orders Diptera, Hemiptera, Lepidoptera, and Orthoptera produced less specimens overall. The results showed that the flight interception trap was more effective than the pit fall and light traps, but the light trap was less effective than the flight interception trap. It is possible to use these trapping methods for pest management.

Key Words: Coleoptera, Insect, Trap, Light trap, Pit fall

INTRODUCTION

Insects belong to the class Insecta and phylum Arthropoda. The head, thorax, and abdomen are the insect's three body components. The head contains the mouth, antennae, and eyes. The part of the body that joins the legs and wings to the rest of the body is called the thorax. The reproductive structures and digestive and reproductive organs are located both externally and internally in the belly. The ecosystem depends heavily on insects, which also provide environmental services like pollination by visiting flowers and the ability to biologically control pest insects as predatory or parasitic insects [1]. Some insects cause harm to crops and are considered agricultural pests. Therefore, depending on the chosen agricultural practices, crop output will either increase or decrease bug diversity [2]. A crucial first step in achieving a successful agricultural yield is monitoring the local insect fauna in crop areas [3].

Insects are crucial to the ecological processes that occur inside the ecosystem. Approximately 75% of all known animal species are insect species [4]. One hectare of Amazonian rain forests has 1, 00,000 species of arthropods, of which 85% are insects [5] [6]. Of all the insect species on the globe, 38% (3, 87,100 species) belong to the Order Coleoptera, which is the most successful taxon [7]. Based mostly on their wings, insects are classified into two groups: Apterygota and Pterygota. Insects classified as Aperygota are those without wings, and Pterygota are those with wings [8].

1.9 Importance of insects

Insects are closely linked to humans and have a variety of effects on human welfare [9]. The ecology is also impacted by insect activity. Insects are crucial to the health of ecosystems because they recycle nutrients, pollinate plants, disperse seeds, maintain soil fertility, control the population of other organisms, and preserve soil structure [10]. Approximately 10% of all insects are predators, and the remaining 15% are parasitic insects, which are crucial to biological control. The most significant and ancient pollinators of angiosperms are insects. Insects began pollinating blooming plants approximately 140 million years ago. For reproduction, at least one-third of all agricultural craps rely on insect pollination. The largest and most diversified group of insects, hymenopterans, are the most important group of pollination insects [11].

Certain insects manufacture useful materials like silk and lac. The ecology of lac insects features a complex flora and fauna that constitute a rich biodiversity. These include microorganisms, hazardous and beneficial parasites, and a range of pests of host plants, lac insects, and predators of lac insects. In India, around three million indigenous people practice lac farming. About 50–60% of the lac produced worldwide is produced in India [12]. The silk worm, which produces luxurious silk thread in the form of a cocoon while feeding on mulberry leaves, is one of the most important domesticated insects [13].

In addition to being a component of the environment, freshwater insects also directly and indirectly serve humans. For a variety of reasons, aquatic insects are crucial to our ecosystem and serve as the primary biological markers of freshwater environments like lakes, ponds, marshes, and rivers [14]. The percentage of insects with an aquatic life cycle is 3%. Because aquatic insects respond differently to stimuli in their aquatic habitat and because of how that quality is measured, aquatic insects are used to monitor the health of aquatic ecosystems [15]. Although there is a vast diversity of aquatic insects, the following major groups include trichopterans, true flies, drangonflies, damselflies, mayflies, stoneflies, and water beetles [16].

1.10 Insect trapping systems

Systems for trapping insects are employed to capture insects for the purpose of controlling pests and doing research. For the purpose of catching insects, a variety of traps are available, such as light, sticky, adhesive, flying bug, pan, bottle, moth, and bucket traps. Every trap is meant to stop and lower the number of insects. Various types of traps are employed to capture certain insects. There are variations in the trap fitting technique. Pheromones are one type of chemical that we occasionally utilize to draw insects. The most effective method for commonly observing insect fauna is the use of capturing equipment. In contrast to traps that collect insects by capturing them, such as flight intercept, malaise, and pitfall traps, attractant traps use colors, scents, shapes, and other sensory elements to capture insects [17]. Pan traps, for instance, are frequently used to sample or catch agricultural pests and bud visitors, such as winged Hymenoptera, Coleoptera, Diptera, and Hemiptera [18]. Sticky traps, which are less common than pan traps, are placed in homes and agricultural areas to catch a lot of pest insects, including Hemiptera, Diptera, and Thysanoptera [19].

1.11 Pit fall trap
One method of capturing insects for ground-dwelling insects is the pit fall. Herts created this technique for the first time in 1927, and Barber expanded on it in 1931. The earliest and most basic approach for collecting samples of invertebrates is the pit fall sampling method. Using this method, samples of spiders and other ground-dwelling insects are obtained. Foraging Arthropods are collected using it. This approach is less expensive and simpler to set up [20].

1.12 Flight interception trap
Utilizing a flight interception trapping method, ground-dwelling insects are gathered and managed. Typically, this trap is designed to catch insects that are flying near to the ground [21]. A transparent PVC plastic sheet serving as a trapping screen, two metal or wooden poles for support, and an insect collection container (usually made of PVC cups) make up a flight interception trap (FIT). When the flying bug hits a plastic sheet, it falls into a plastic cup. When it comes to capturing flying insects, this technique works better than others [22].

1.13 Light trap
Night-time insects are captured using a light trapping technique. In the designated region, a light trap is positioned on the ground or hanged from a tree branch. The light source is artificial light. Insects that feed at night are drawn to sources of light that emit UV light. Light traps are typically attractive to moths and beetles. Cotton bug population is managed with light trap. This technique is also used to catch insects belonging to the Coleoptera and Lepidoptera orders [23].

MATERIALS AND METHODS
3.1 Study area
The research was carried out at Pakistan's Tehsil Baffa, District Mansehra KP. One of the districts in Pakistan's Khyber Pakhtunkhwa Province's Hazara Division is District Mansehra. Pakistan's North is home to the District of Mansehra. The district capital of Manasehra is Mansehra. Mansehra is the seventh-biggest city in the province of KP and the 71st largest city in Pakistan. Five Tehsils (Tehsil Mansehra, Tehsil Balakot, Tehsil Oghi, Tehsil Darband, and Tehsil Baffa) make up District Mansehra. It is the principal entryway to Gilgit-Baltistan, Azad Kashmir, and the upper valleys of Kaghan and Naran. In 1976, it was first established as a Tehsil in the old Hazara District, and the following year, it became a District [24]. Former Mansehra subdivisions Battagram District (created in 1993) and Torghar District (formed in 2011) [25].
There were 1,555,742 people living in District Mansehra in 2017—783,509 women and 771,976 men. There were 9.31% of people living in urban regions and around 90.69% of people living in rural areas. There are about 427 nonreligious persons. Hindko is spoken by about 66.48 percent of people, and Pashto is spoken by about 17.02 percent. The majority language of the upper Kaghan valley is Kohistani, with a tiny minority speaking Gujri. The location of District Mansehra is 34.6744°N and 73.3709°E. The typical temperature of Mansehra District ranges from 15°C to 30°C. The warmest months of the year are June and July, when highs of 38 C are possible. The coldest months are from December to the end of February. The winter season is longer than the summer one. The average yearly precipitation is approximately 128.22 mm, with 141.7 (38.82% of the time) rainy days. The Mansehra District is located around 1069.9 meters, or 3510.17 feet, above sea level.

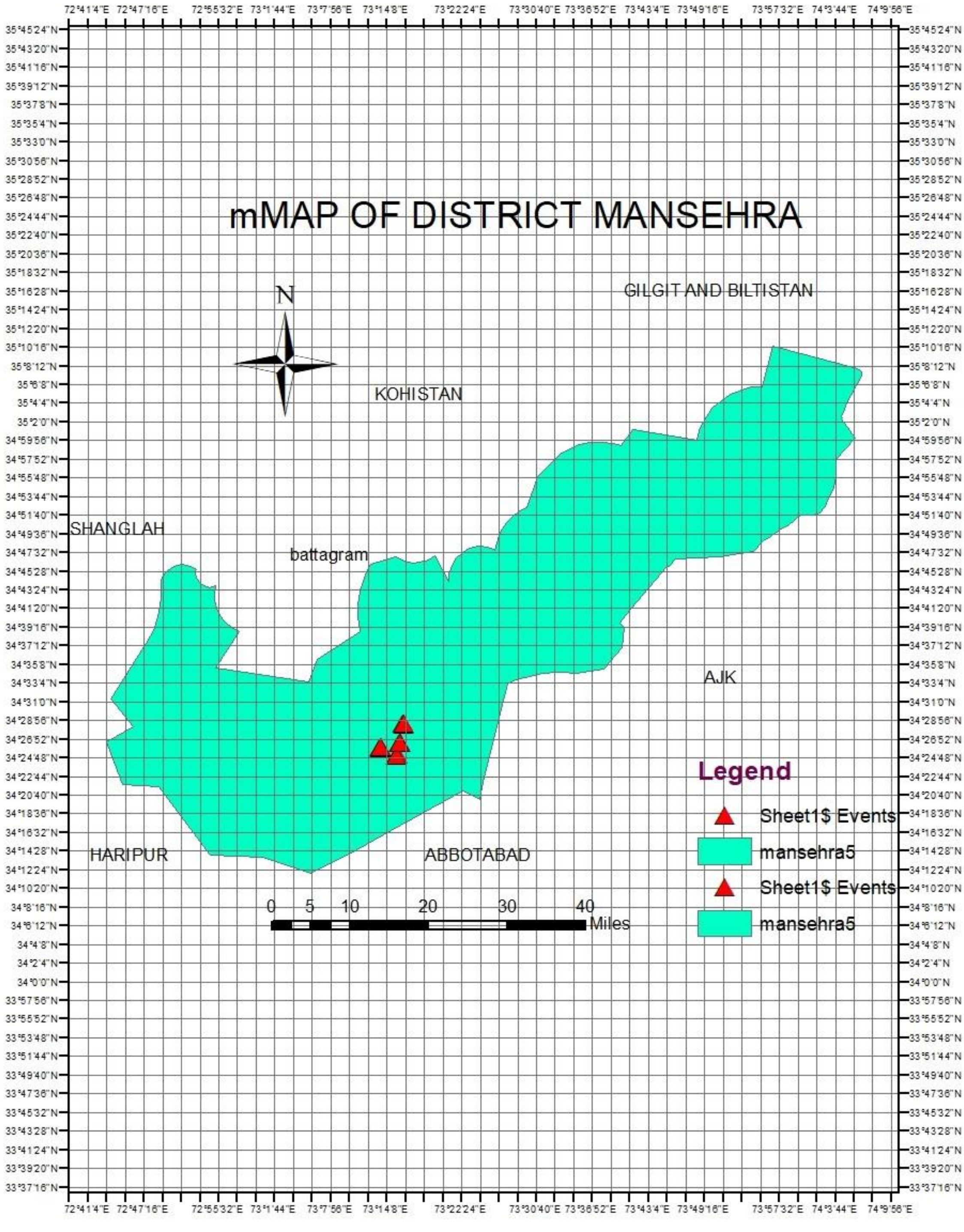

Figure 3.1 Map of District Mansehra.

3.2 Field survey
From June 2022 until September 2022, field work was conducted. Weekly samples of insects were taken from a few different traps (light trap, flight interception trap, and pit fall trap).

3.3 Site selection
The GPS (Global Positioning System) was used to measure the longitude and latitude prior to trap placement, and the results were recorded in a study note book along with the name of the locality. Four locations were chosen to have traps installed. The four locations where the traps were placed were Baffa, Dhodial, Hazara University Mansehra, and Shinkiari in Tehsil Baffa, District Mansehra.

3.4 Sampling frequency
Every trap that was set up was checked after three days, and the easy-to-visit locations were checked every day or every two days. Photographs of the collected insects and traps were taken with a camera and stored with care.

3.5 Materials
Bottles, ropes, jars, transparent plastic sheets, thermometers, wooden rods, thermocouples, magnifying glasses, field note books, trays, plastic wire, and fifteen plastic cups measuring six centimeters in diameter.

Figure 3.2 Materials used during traps construction

3.6 Chemicals
70% ethanol, salt, detergents, and water.

3.7 Sample collection
Several traps were used to catch the insects. For the purpose of collecting insects, the traps were set up in Tehsil Baffa from June to September 2022 at various locations, including Hazara University Mansehra, Shinkiari, Baffa, Dhodial, and Dadar.

Figure 3.3 Trapped samples

3.8 Trap designing

3.8.1 Flight interception trap

The flight interception trap, which was constructed out of one clear plastic sheet, six plastic cups, and two wooden poles, was placed amidst lush foliage. One clear plastic sheet was stretched between two wooden rods that were buried four feet apart in the ground to serve as supports. When two trees were available, they were also used in place of the two wooden rods. For the purpose of collecting insects, six plastic cups were buried six inches apart in a line beneath the transparent plastic sheet. To destroy insects, ethanol, water, and a tiny quantity of detergent were added to the cups. The flying insect falls into the plastic cups after colliding with the clear sheet. This trap also manages to catch a limited number of insects that live on the ground. Using forceps, the insects were removed from the cups and placed in a petri dish.

Figure 3.4 Flight interception trap

3.8.2 Pit fall trap

An eight-inch-tall plastic cup that was buried in the ground served as the pit fall trap. A plastic covering covered the upper part of the cup. Four tiny, roughly six-inch-tall wooden poles held up the plastic covering. Water, ethanol, and a tiny quantity of detergents are all present in the cup. A small number of flying insects were also gathered using pit fall traps.

Pit fall trap

Figure 3.5 Pit fall trap

3.8.3 Light trap

A light bulb that attracts nocturnal insects, an electric line that powers the bulb, and a small spherical box beneath the light were the components of a light trap, which was used to gather nocturnal insects. The bug that fell into the round box after being struck by a lightbulb. The light trap was hung from a tree or set on the ground. From 12 am until 3 am, the majority of insects were drawn to the light trap. After that, the insects were carefully kept after being removed with forceps from the box.

Light trap

Figure 3.6 Light trap

3.9 Preservation

Using forceps, all of the insect samples were removed from the set traps and stored in little vials. The samples that were captured were stored in tiny bottles measuring 3 cm in diameter and 4 cm in height with 70% ethanol. In one container, two or three insects of the same species were maintained. Name, date, and location of trap were written on the bottles. The specimens were first preserved in 70% ethanol before being kept in a refrigerator at 20°C in the Zoological Laboratory at Hazara University Mansehra.

Preservation of specimens

Figure 3.7 Specimens preservation

3.10 Identification

The specimens obtained from all the traps were initially categorized using a microscope at the Hazara University Mansehra Zoological Museum, up to the order level. At the National Agricultural Research Centre (NARC) in Islamabad, the specimens were further identified up to the specie level based on morphological traits using several pictorial and morphological keys found in the National Insect Museum (NIM).

Identification of specimens

Figure 3.8 Identification of specimens

3.11 Temperature

A digital thermometer was used to measure the temperature. Up to four or five temperature readings were taken in each place on visiting days before the mean value for that locality was determined. The research note book had information on the mean temperature.

3.12 Statistical analysis

Various software programs (MS Office 2013, MS Excel 2013) were utilized to identify and examine the captured data.

CHAPTER 4
RESULTS AND DISCUSSION

Three insect traps—the Pit Fall Trap, the Flight Interception Trap, and the Light Trap—were employed in the current study project to capture insects in the Tehsil Baffa District of Mansehra. A total of 553 specimens of insects were gathered. Following identification, the gathered specimens were divided into 26 species, 21 genera, 15 families, and 7 orders. The details of the species, genera, families, orders, and specimens are given in Table 4.1.

Table 4.1 Species information of trapped specimens

NO	ORDER	FAMILY	GENUS	SPECIES	NO OF SPECIMENS (n)
1	Blattodea	Ectobiidae	Parcoblatta	P. americana	22
2	Coleoptera	Carabidae	Pheropsophus	P. africanus	6
			Scarities	S. subterraneus	12
		Cerambycidae	Stromatium	S. barbatum	20
		Chrysomelindae	Anegleis	A. cardoni	15
		Coccinellidae	Adalia	A.decempunctata	16
		Hybosoridae	Hybosorus	H. orientalis	15
		Meloidae	Mylabris	M. phalerata	27
				M. pustulata	26
		Scarabaeidae	Adoretus	A.ictericus	22
			Anomala	A.bengalensis	30
			Copris	C. repertus	27
			Heteronychus	H. artor	45
3	Diptera	Muscidae	Musca	M. domestica	20
4	Hemiptera	Pentatomoidae	Eurydema	E. ornate	15
5	Hymenoptera	Apidae	Apis	Apis florea	23
				Apis mellifera	29
		Formicidae	Camponotus	C. vagus	13
		Vispidae	Polistes	P. olivaceus	30
				P. rothneyi	33
				P. wattii	25
			Polistini	P. Canadensis	29
			Vespa	Vespa oreintalis	11
				Vespa tropica	23
6	Lepidoptera	Nymphalidae	Junonia	J. coenia	11
7	Orthoptera	Gryllotalpidae	Gryllotalpa	G. orientalus	8

4.1 Order wise richness of trapped insects

Orders Blattodea, Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera, and Orthoptera yielded 22, 261, 20, 15, 216, 11, and 8 specimens in each order, respectively. When it comes to the quantity of specimens in these orders, the orders Hymenoptera and Coleoptera turned out to be the most prevalent. In contrast, it was found that the Orders Diptera, Hemiptera, Lepidoptera, and Orthoptera had the lowest number of specimens (Figure 2).

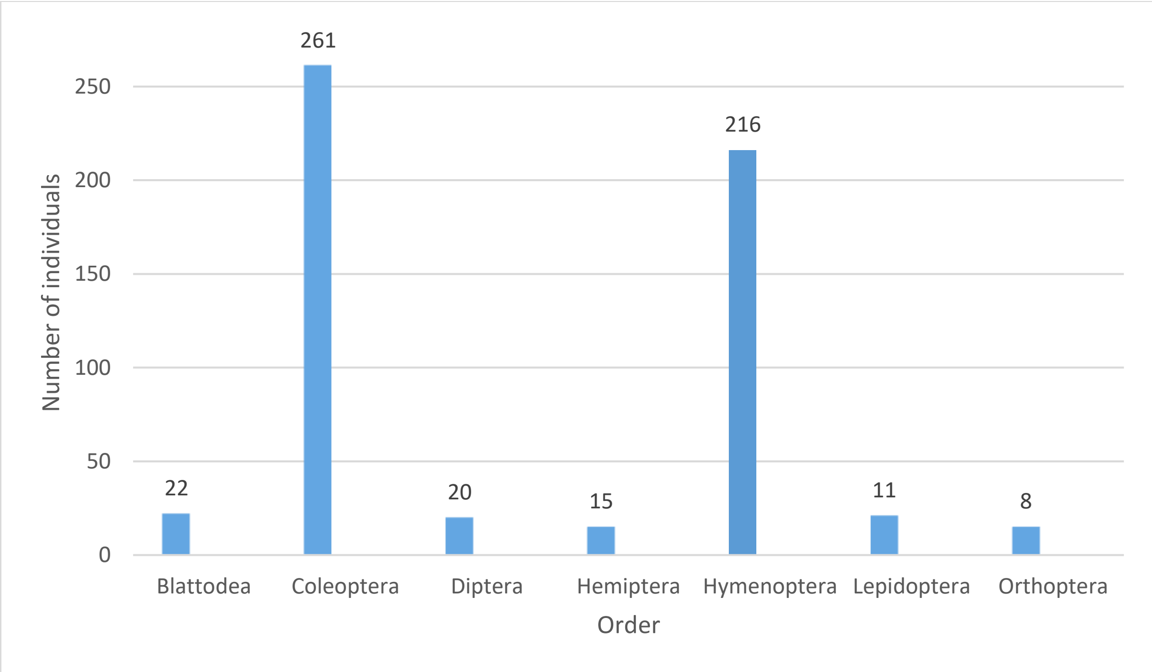

Figure 4.1: Order wise richness/distribution of trapped insects

4.2 Family wise richness of trapped insects

There are 553 specimens in all, from 15 different families, that were caught using various traps. Ectobiidae, Carabidae, Formicidae, Nymphalidae, Gryllotalpidae, Hybosoridae, Meloidae, Scarabaeidae, Muscidae, Pentatomoidae, Apidae, Formicidae, Vispidae, Carabidae, and Hybosoridae are these families. The Vispidae family was found to have the most specimens, whereas the Gryllotalpidae family had the lowest specimens (Figure 3).

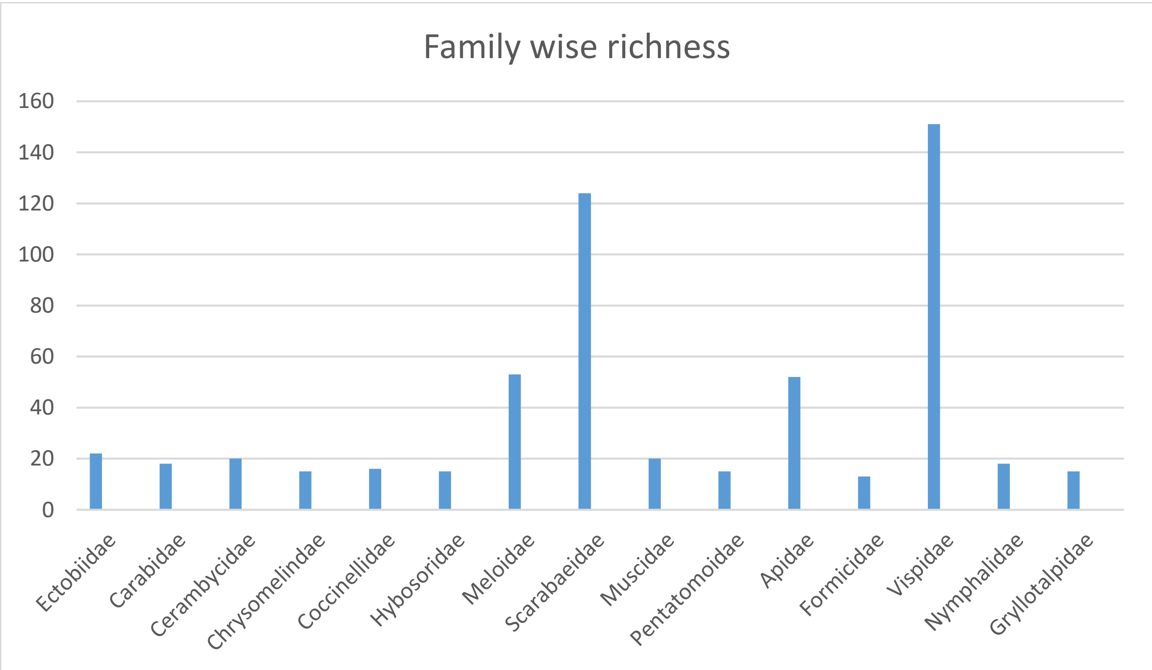

Figure 4.2: Family wise richness/distribution of trapped insects

4.3 Genus wise richness of trapped specimens

The specimens that are trapped belong to the following 21 categories: Adalia, Hybosorus, Mylabris, Adoretus, Anomala, Copris, Heteronychus, Musca, Eurydema, Apis, Camponotus, Polistes, Polistini, Vespa, Junonia, and Gryllotalpa. the trapped specimens fall under these categories. The most specimens belong to the Genus Polistes, whereas fewer specimens are found in the Genus Pheropsophus.

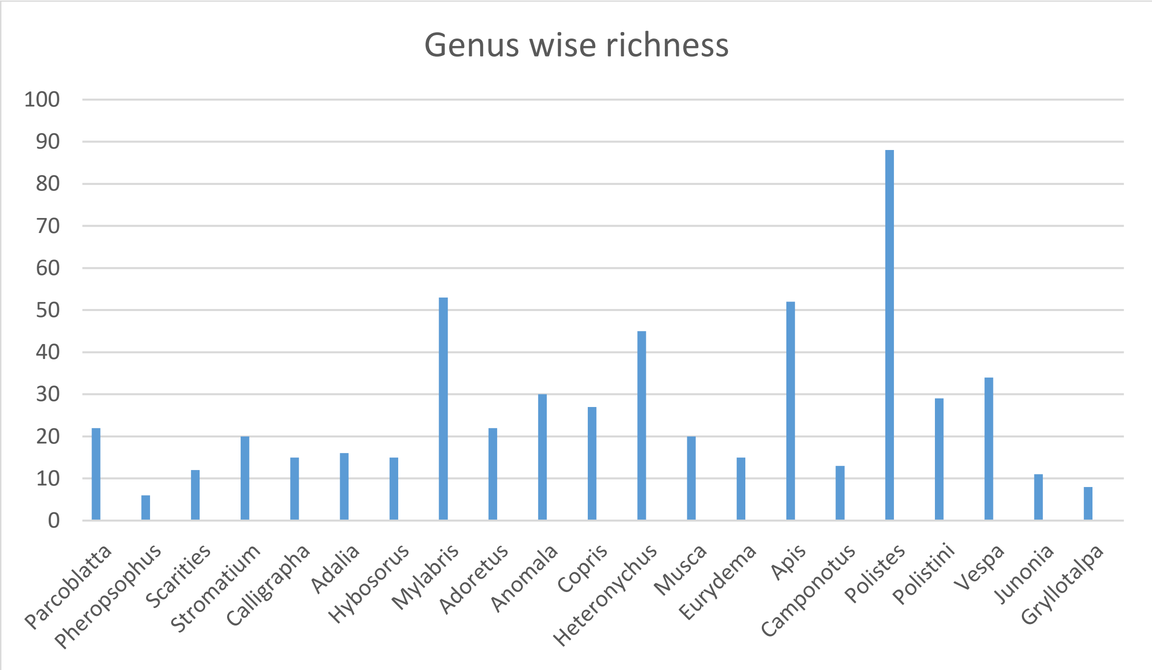

Figure 4.3: Genus wise richness of trapped insects

4.4 Specie wise Richness

In the course of the current study, 26 species were discovered. These species included Adalia decempunctata, Hybosorus orientalis, Mylabris phalerata, Mylabris pustulata, Adoretus ictericus, Pheropsophus africanus, Scarities subterraneus, Stromatium barbatum, Anegleis cardoni, and Adalia decempunctata. Artor Heteronychus, Repertus Copris, Eurydema ornamental, Musca domestica, Among them are Apis florea, Apis mellifera, Camponotus vagus, Vespa oreintalis, Vespa tropica, Junonia coenia, Polistes olivaceus, Polistes rothneyi, Polistes wattii, and Polistini canadensis.

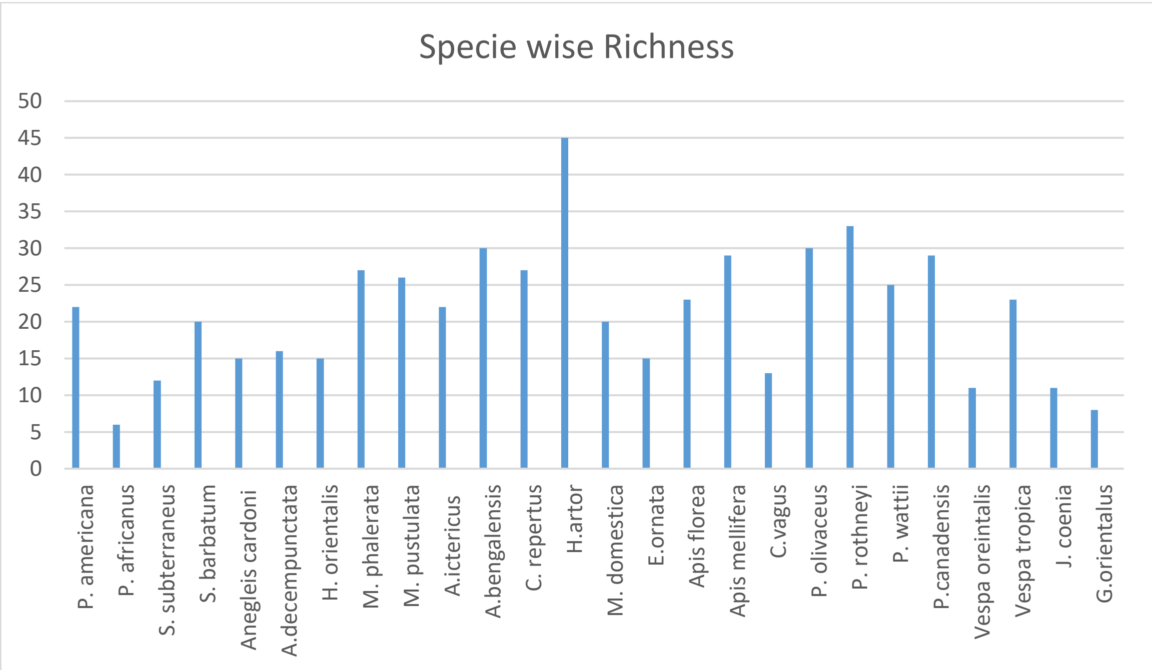

Figure 4.4: Specie wise richness/distribution of trapped insects

4.5 Trap wise richness of trapped specimens

In total, three traps were used in this research study: the light trap, the flight interceptor trap, and the pit fall trap. The flight interception trap was found to be the most effective of the three; it caught 362 specimens and more species than the other two traps. Light traps were shown to be less effective than flight interception traps and more effective than pit fall traps, with a capture rate of 161 specimens. Pitfall traps were found to be less successful than light and flight interception traps, capturing only 30 specimens (Figure).

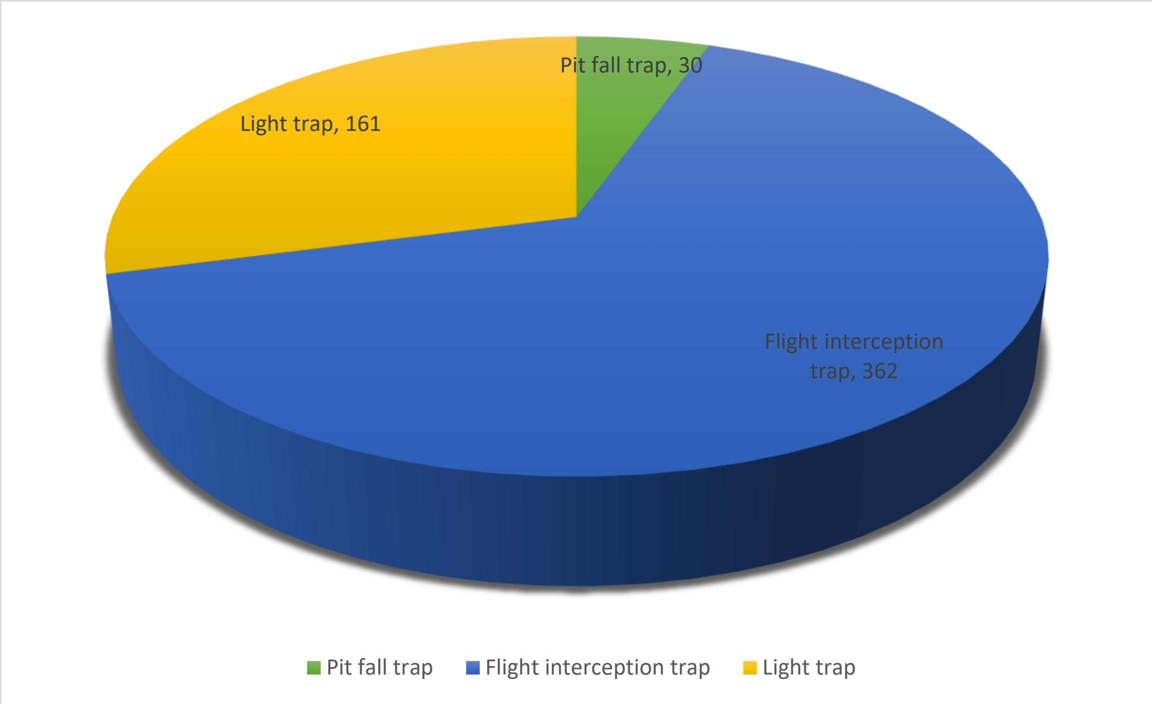

Figure 4.5: Trap wise richness of trapped specimens

4.6 Locality wise richness of trapped specimens

The locations of the traps were Shinkiari, Baffa, Dhodial, and Hazara University Mansehra. Since the Dhodial site was determined to have a high diversity of insects, more specimens and species of insects were captured. The selected places' geographic data is displayed in the (Table 4.2).

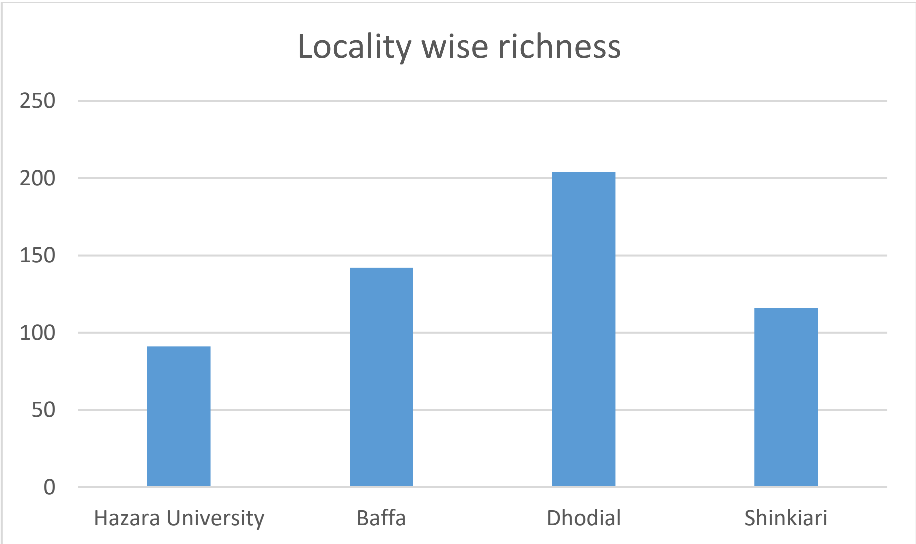

Figure 4.6 Locality wise richness of specimens

Table 4.2: Geographic information of selected localities

S. No	Name of locality	Latitude N	Longitude E
1	Baffa	34.431042	73.222453
		34.431933	73.224392
		34.432592	73.223383
		34.43334	73.22405
2	Hazara University Mansehra	34.419520	73.253952
		34.419559	73.253929
		34.419907	73.255000
		34.417046	73.25248
3	Dhodial	34.440988	73.260375
		34.440882	73.260658
		34.440688	73.259465
		34.439860	73.258410
4	Shinkiari	34.475143	73.267085
		34.474457	73.265668
		34.475928	73.264167
		34.475923	73.266145

CONCLUSION

- ❖ A total of 553 specimens were captured using particular traps. After identification, the specimens were divided into 26 species, 21 genera, 15 families, and 7 orders.
- ❖ The order Coleoptera was discovered to have the greatest number of specimens, whereas the order Orthoptera was found to have the fewest.
- ❖ The Vispidae family had the most specimens documented, while the Gryllotalpidae family had the fewest specimens.
- ❖ The maximum number of specimens was found in the Genus Polistes, while the lowest number was found in the Genus Pheropsophus.
- ❖ The flight interception trap captured 362 specimens of insects with remarkable effectiveness. Out of all the traps, light traps have a greater abundance in the Order Coleoptera, having captured 161 specimens.
- ❖ Pit fall traps only caught 30 specimens, which was the fewest number of specimens ever recorded.
- ❖ Dhodial was determined to have a high level of insect diversity out of the four locations that were chosen, while Hazara University Mansehra had a low level.

REFERENCES

[1] D. Hooper, "Chapin iii FS," Ewel JJ, Hector A, Inchausti P, Lavorel S, Lawton JH, Lodge DM, Loreau M, Naeem S, Schmid B, Setala H, Symstad AJ, Vandermeer J, Wardle DA, pp. 3-35, 2005.

[2] M. Calvo-Agudo et al., "IPM-recommended insecticides harm beneficial insects through contaminated honeydew," Environmental Pollution, vol. 267, p. 115581, 2020.

[3] K. Kiritani, "Integrated biodiversity management in paddy fields: shift of paradigm from IPM toward IBM," Integrated Pest Management Reviews, vol. 5, no. 3, pp. 175-183, 2000.

[4] A. Choudhary and J. Ahi, "Biodiversity of freshwater insects: a review," The International Journal of Engineering and Science, vol. 4, no. 10, pp. 25-31, 2015.

[5] T. L. Erwin, "The biodiversity question: How many species of terrestrial arthropods are there," Forest canopies, vol. 10, pp. 259-269, 2004.

[6] M. Springer, "Marine insects," in Marine Biodiversity of Costa Rica, Central America: Springer, 2009, pp. 313-322.

[7] Z.-Q. Zhang, "Animal biodiversity: an introduction to higher-level classification and taxonomic richness," Zootaxa, vol. 3148, no. 1, pp. 7-12, 2011.

[8] W. Al-Houty, "Recent insect fauna recorded in Kuwait," Kuwait Journal of Science and Engineering, vol. 38, no. 1a, pp. 81-92, 2011.

[9] E. Sankarganesh, "Insect Biodiversity: The Teeming Millions-A review," Bull Environ Pharmacol Life Sci, vol. 6, pp. 101-5, 2017.

[10] J. Majer, "The conservation and study of invertebrates in remnants of native vegetation," 1987.

[11] A. Pannure, "Bee pollinators decline: perspectives from India," International Research Journal of Natural and Applied Sciences, vol. 3, no. 5, pp. 1-10, 2016.

[12] K. Chandra, "Insect fauna of states and union territories in India," ENVIS Bulletin: Wildlife & Protected Areas, vol. 14, no. 1, pp. 189-218, 2011.

[13] V. Rahmathulla, "Management of climatic factors for successful silkworm (Bombyx mori L.) crop and higher silk production: a review," Psyche, vol. 2012, 2012.

[14] J. Majumder, R. K. Das, P. Majumder, D. Ghosh, and B. Agarwala, "Aquatic insect fauna and diversity in urban fresh water lakes of Tripura, Northeast India," Middle-East Journal of Scientific Research, vol. 13, no. 1, pp. 25-32, 2013.

[15] R. Merritt, K. Cummins, and M. Berg, "An introduction to the Aquatic insect of North America.: 1158," Kendal/Hunt Pub. Co, 2008.

[16] J. R. Voshell, A guide to common freshwater invertebrates of North America (no. Sirsi) i9780939923878). McDonald & Woodward Pub. Granville, OH, USA, 2002.

[17] O. Missa et al., "Monitoring arthropods in a tropical landscape: relative effects of sampling methods and habitat types on trap catches," Journal of Insect conservation, vol. 13, no. 1, pp. 103-118, 2009.

[18] Z. M. Portman, B. Bruninga-Socolar, and D. P. Cariveau, "The state of bee monitoring in the United States: a call to refocus away from bowl traps and towards more effective methods," Annals of the Entomological Society of America, vol. 113, no. 5, pp. 337-342, 2020.

[19] D. G. Hall and M. G. Hentz, "Sticky trap and stem–tap sampling protocols for the Asian citrus psyllid (Hemiptera: Psyllidae)," Journal of Economic Entomology, vol. 103, no. 2, pp. 541-549, 2010.

[20] A. H. Sheikh, G. A. Ganaie, M. Thomas, R. Bhandari, and Y. A. Rather, "Ant pitfall trap sampling: An overview," Journal of Entomological Research, vol. 42, no. 3, pp. 421-436, 2018.

[21] S. B. Peck and A. E. Davies, "Collecting small beetles with large-area" window" traps," The Coleopterists' Bulletin, pp. 237-239, 1980.

[22] R. Nie et al., "The application and effectiveness of a flight interception trap for insect collecting," Chinese Journal of Applied Entomology, vol. 54, no. 3, pp. 530-535, 2017.

[23] G. Ma and C.-S. Ma, "Differences in the nocturnal flight activity of insect pests and beneficial predatory insects recorded by light traps: Possible use of a beneficial-friendly trapping strategy for controlling insect pests," European Journal of Entomology, vol. 109, no. 3, p. 395, 2012.

[24] S. H. Saeed, M. Hussain, and G. M. Shah, "Floristic checklist of Datta, district Mansehra Khyber Pakhtunkhwa, Pakistan," Science International, vol. 30, no. 4, pp. 517-522, 2018.

[25] F. Haq, H. Ahmad, and M. Alam, "Traditional uses of medicinal plants of Nandiar Khuwarr catchment (District Battagram), Pakistan," Journal of Medicinal Plants Research, vol. 5, no. 1, pp. 39-48, 2011.