Journal of Agriculture and Veterinary Science
ISSN: 2959-1198 (Print), 2959-1201 (Online)

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Research Article

Floral Resource Utilization by Butterflies and Moths in Rawalakot, AJK

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ABSTRACT

Pollinators play a crucial role in maintaining biodiversity and ecosystem stability. This study investigates the species diversity and composition of native flora visited by Lepidopteran pollinators (butterflies and moths) in Rawalakot, Azad Jammu and Kashmir. Field surveys were conducted across five locations (Rawalakot, Drake, Banjosa, Kharick, and Dhamni) from March 2022 to October 2023. A total of 51 plant species from 18 families were identified as floral hosts for Lepidopteran pollinators. The Asteraceae family exhibited the highest species richness (9), followed by Rosaceae (6), Lamiaceae (5), and Cucurbitaceae (5). Diversity indices (Shannon-Wiener, Simpson, Margalef, Menhinick, and Evenness) indicated the highest plant diversity in Dhamni (altitude: 1820 m) and the lowest in Banjosa (2000 m). Thirteen Lepidopteran species (12 butterflies and 1 moth) were recorded, with the highest pollinator abundance in Dhamni. A negative correlation was observed between altitude and both plant (−0.054) and pollinator (−0.279) diversity, while a strong positive correlation (0.877) existed between plant and pollinator diversity. These findings highlight the importance of conserving native flora to sustain pollinator populations, particularly in mountainous regions vulnerable to climate change.

Keywords: Pollinators, Lepidoptera, Biodiversity, Floral Hosts, Altitude, Conservation, Rawalakot

OPEN ACCESS

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Article History
Received: May 03, 2025
Accepted: July 10, 2025
Published: July 15, 2025

INTRODUCTION

The Himalayan region, including Azad Jammu and Kashmir (AJK), Pakistan, is recognized as a biodiversity hotspot due to its unique floral and faunal diversity, shaped by altitudinal gradients and climatic variations (Haq et al., 2010; Singh et al., 2016). This region supports a rich array of angiosperms, with approximately 4,758 species reported across 215 families (Ali and Qaiser, 1986). Among these, the Asteraceae family dominates, followed by Poaceae, Papilionaceae, and Rosaceae (Hussain et al., 2016). The intricate relationship between native flora and pollinators, particularly Lepidoptera (butterflies and moths), plays a pivotal role in maintaining ecosystem stability and agricultural productivity (Ollerton, 2017). However, climate change, habitat destruction, and anthropogenic activities threaten these interactions, necessitating urgent research to document and conserve pollinator-dependent flora (Parmesan, 2006; Potts et al., 2010).

Lepidopteran pollinators contribute significantly to plant reproduction and genetic diversity, with butterflies and moths visiting a wide range of flowering plants (Krenn, 2010). Globally, 87.5% of plants rely on animal-mediated pollination, with Lepidoptera accounting for a substantial proportion of these interactions (Ollerton et al., 2011).

In AJK, studies on Lepidoptera have been limited, focusing primarily on species inventories (Khan et al., 2014; Faiz et al., 2015), while comprehensive analyses of plant-pollinator networks remain scarce. The decline of pollinators due to habitat fragmentation, pesticide use, and climate change underscores the need to identify key floral hosts that sustain these populations (Thomson, 2021).

Rawalakot, a district in AJK, exemplifies the Himalayan region's ecological complexity, with elevations ranging from 1,630 to 2,000 meters. Its flora includes economically and ecologically significant species such as *Malus domestica*, *Prunus armeniaca*, and *Helianthus annuus*, which are vital for local livelihoods and biodiversity (Hussain, 2012). Previous studies in Rawalakot have documented angiosperm diversity (Hussain et al., 2016) and butterfly assemblages (Sheikh et al., 2022), but none have systematically examined the native flora visited by Lepidopteran pollinators or their ecological correlations.

This study seeks to document the diversity and composition of native plant species visited by Lepidopteran pollinators in Rawalakot, while also examining how these floral hosts are distributed across different altitudinal gradients and their influence on pollinator abundance. Additionally, the research will evaluate ecological patterns in plant-pollinator interactions using diversity indices such as the Shannon-Wiener and Simpson indices.

By addressing these objectives, the study aims to enhance the understanding of pollinator-dependent flora in the Western Himalayas, offering valuable insights for conservation strategies. The findings will support global initiatives to combat pollinator decline, as emphasized by the IPBES (2016), and underscore the need to protect native plant species as essential resources for sustaining Lepidopteran pollinator populations.

MATERIALS AND METHODS

Study area

The study was conducted in Rawalakot, a mountainous region in the Poonch District of Azad Jammu and Kashmir (AJK), Pakistan. The area lies in the foothills of the Himalayas, characterized by a moderate climate with an average annual rainfall of 500–2000 mm and temperatures ranging from 0°C to 30°C. The landscape features diverse vegetation zones, including subtropical, temperate, and alpine regions. Five distinct study sites were selected based on altitude and geographical variation.

Floral host plant sampling

The study employed the walking transect method, establishing a 200-meter transect with three replications at each site to systematically survey the area. Flowering plants visited by butterflies and moths were carefully collected, with samples including leaves, inflorescences, and flowers when present. High-resolution photographs of both floral hosts and pollinators were taken to aid in accurate identification and comparative analysis. The collected plant specimens were then processed using standard herbarium techniques—dried, labeled with field numbers, and preserved for future reference. Voucher specimens were cataloged with unique accession numbers, ranging from UPR-BOT-2259 to UPR-BOT-2309, to ensure proper documentation and traceability.

Floral identification

A botanical checklist of the native flora in Rawalakot visited by lepidopteran pollinators was compiled. The identification process involved several methods: first, by comparing the collected specimens with taxonomic and pictorial keys of Pakistani flora; second, by analyzing photographs, illustrations, and other visual references, supplemented by expert guidance from taxonomists. Finally, the documented species were indexed and assigned accession numbers for systematic record-keeping.

Table 1. GPS values of study locations.

Locations	Data Collection Sites	Altitude	Latitude	Longitude
Rawalakot	A	1630 m	33.5132^{0}N	73.4534^{0}E
Kharick	D	1750 m	33.8512^{0}N	73.7482^{0}E
Drake	B	1800 m	33.8538^{0}N	73.7309^{0}E
Dhamni	C	1820 m	33.8462^{0}N	73.8020^{0}E
Banjosa	E	2000 m	33.8100^{0}N	73.8164^{0}E

Species composition and floral diversity

The study location was categorized based on varying altitudes and the species composition and distribution of native flora visited by pollinators. Using the walking transect method along floral sites, native flora samples were monitored and collected, with a 200-meter transect replicated three times at each site (Nayak et al., 2010). To assess species

diversity in District Poonch, multiple diversity indices were employed for comparative accuracy. The Simpson index (0 to 1) estimated the likelihood of two randomly selected individuals belonging to the same species, while the Shannon index (1.5 to 3.5) evaluated species richness and evenness within the community. Margalef's index measured species richness relative to the total number of individuals, and species evenness focused on the distribution of individuals across different species. All diversity indices were computed using PAST software, and the data were visualized using Microcal Origin software.

RESULTS

Native plant species visited by Lepidopteran pollinators (Butterflies and Moths)

Results about the native floral host range of lepidopteran pollinators (butterflies and moths) recorded fiftyone plant species belonging to 18 plant families. Asteraceae was recorded with nine plant species including *Celendula officinalis, Echinacea purpurea, Matricaria chamomilla, Taraxacum officinale, Helianthus annuus, Helianthus tuberosus, Artemisia indica, Carpesiumcernuum, and Aster tataricus.*Rosaceae recorded with 06 plant species including *Malus domestica,Prunus armeniaca, P.domestica,Rosa brunonii, R.chinensis.* Lamiaceae with five plants including *Scutellariaprostrata, Lamium album, Mentha arvesis, M. longifolia, M. spicata.*Lamiaceae with five plants including *Scutellariaprostrata, Lamium album, Mentha arvesis, M. longifolia, M. spicata.* Cucurbitaceae was recorded with five plant species *Cucumis sativus, Citrullus lanatus, Luffa cylindrica, Lagenaria siceraria, Solena amplexicaulis.*Convolvulaceaewith four*Convolvulus arvensis, Ipomoea eriocarpa, Ipomoeahederacea, Ipomoea purpurea*. Solanaceae was recorded with 04 plant species including *Solanum nigrum,Capsicum annuum, Lycopersicon esculentum, Solanum melongena.* Malvaceae recorded with 03 plants including *Malvastrumcoromandelianum, Alcearosea, Hibiscus rosa-sinensis.*Papilionaceae recorded with 03 plant species *Robinia pseudo acacia, Trifoliumdubium, Trifoliumrepens.* Acanthaceae plant family was recorded with 02 *Diclipterabupleuroides*and*Strobilantheswallichii*Verbenaceae with 02 plant *Lantana camara, Verbena officinalis.Justicia adhatoda.* Balsaminaceae with one *Senna alexandria.* Caesalpiniaceae with one *Bauhinia variegate,* Ebenaceae with 01 *Diospyros kaki,* Iridaceae with 01 plant *Iris kashmiriana,* Oxalidaceae including 01 plant *Oxalis corniculate,* Plantaginaceae include 01 *Plantago lanceolata* plant species, Ranunculaceae include 01 *Ranunculus arvensis* and Violaceae was recorded with 01 plants species *Viola odorata* (Table 2).

Distribution of floral host range in different locations of Rawalakot

Distribution results of floral host plants in different locations shows that maximum floral host were recorded in Dhamni followed by Darek with 46 plant species. Minimum 35 plant species were observed in Banjosa. Forty two plant species were recorded from Kharcik while 39 plant species were recorded in Rawalakot area. *Celendula officinalis, Echinacea purpurea, Helianthus annuus, H.tuberosus, Taraxacum officinale, Artemisia indica, Diclipterabupleuroides, Cucumis sativus, Luffa cylindrical, Lagenaria siceraria, Convolvulus arvensis, Ipomoea eriocarpa, I. hederacea, I.purpurea, Diospyros kaki, Robiniapseudo acacia, Trifolium repens, Mentha arvesis, M.longifolia, M.spicata, Malus domestica, Pyrus pashia, Prunus armeniaca, P.domestica, R.chinensis, Ranunculus arvensis, S. nigrum, Capsicum annuum, Lycopersicon esculentum, Solanum melongena,* were recorded from all the study locations (Table 3).

Diversity indices of native flora at different locations of Rawalakot

The study assessed species diversity in various areas of Rawalakot using multiple indices. The Shannon-Wiener index revealed the highest diversity in Dhamni (0.744) and the lowest in Rawalakot (0.381). Simpson's index indicated high diversity in Dhamni (0.913) and lower diversity in Darek (0.966). Margalef's index highlighted Dhamni (0.772) as the richest in species, while Kharick (0.388) had the lowest richness. The Menhinck index also showed Dhamni (0.693) with the highest species richness and evenness, whereas Kharick (0.486) scored the lowest. Additionally, the evenness index demonstrated the most balanced species distribution in Dhamni (0.880) and the least in Rawalakot (0.815). Overall, Dhamni consistently exhibited the highest biodiversity across all metrics (Table 4).

Lepidopteran pollinators (Butterflies and Moths)

During the surveys of native flora visited by lepidopteran pollinators, 13 species of lepidopteran pollinators were recorded on native flora. Twelve species of butterflies including *Junoniaorityha, Pieris brassicae, Papiliomachaon, Gonepteryxrahmni, Pieris canidia, Papiliodemoleus, Pontiadaplidice, Pieris ajaka, Argynnis kamala, Argynnishyperbius, Euremahecabe,* and *Danaus genutia*. One species of pollinator moth *Hemaristityus* is found in Dhamni area during the surveys. The distribution result of pollinators shows that maximum pollinators were recorded in Dhamni and minimum pollinators were recorded in Banjosa. (Table 5 and figure 1).

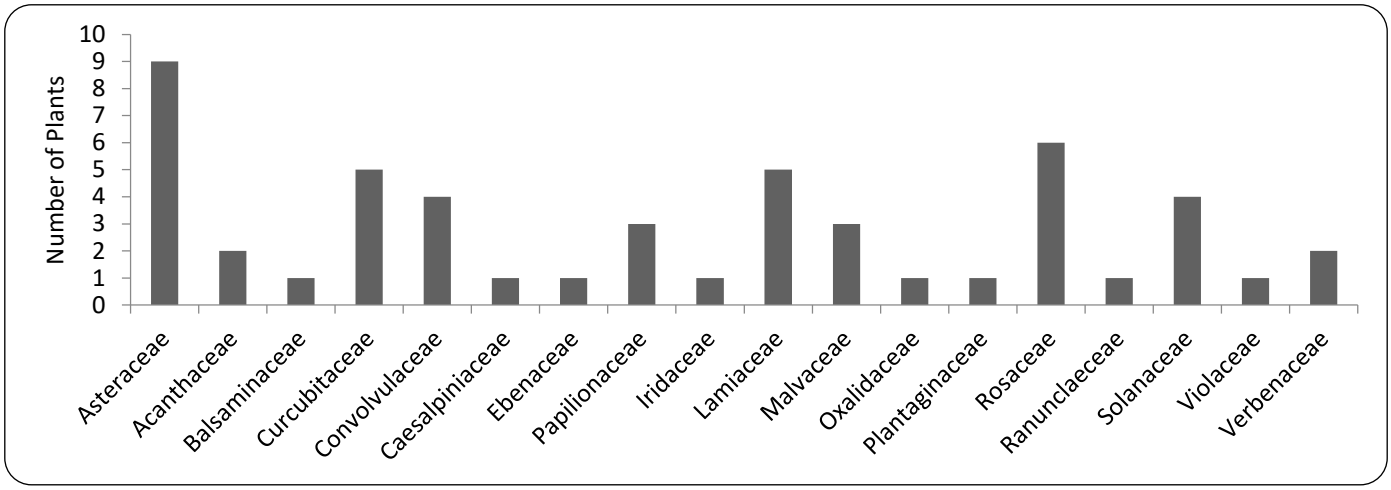

Figure 1. Native plant species composition in different plant families.

Plant species composition in different locations of Rawalakot

Species composition of floral host plants in different location recorded that maximum plants (31.58%) were observed in Dhamni and minimum (13.57%) were recorded in Banjosa. Darek was observed with second highest number (20.73%) of plants while Rawalakot was recorded with 15.38% and Kharick was recorded with 18.74% plants (Figure 2).

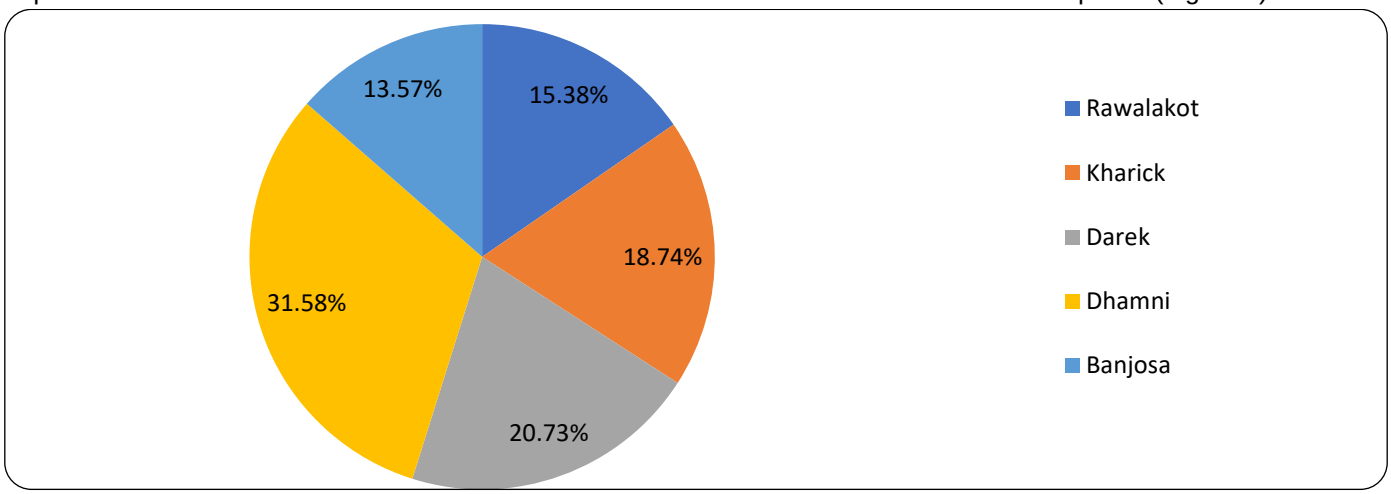

Figure 2. Plant species composition in different locations of Rawalakot.

Table 2. Check list of native flora visited by lapidopteran (Butterflies and Moths) pollinators.

S.No.	Scientific name	Family	F. period
1	*Celendula officinalis*	Asteraceae	June-Sep
2	*Echinacea purpurea*P.C. Pant.	Asteraceae	May-June
3	*Matricaria chamomilla L.*	Asteraceae	April-May
4	*Taraxacum officinale*	Asteraceae	April-May
5	*Helianthus annuus*	Asteraceae	Aug-Sep
6	*H.tuberosus L.*	Asteraceae	Aug-Sep
7	Artemisia indica	Asteraceae	May-Aug
8	*Carpesiumcernuum L.*	Asteraceae	May-Aug
9	*Aster tataricus L.*	Asteraceae	June-Oct
10	*Diclipterabupleuroides*Nees	Acanthaceae	June-Sep
11	*Strobilantheswallichii L.*	Acanthaceae	July-Sep
12	*Impatiens balsamina L.*	Balsaminaceae	July-Aug
13	*Cucumis sativus*	Cucurbitaceae	Aug-Sep
14	*Citrullus lanatus*(Thunb.)	Cucurbitaceae	Aug-Sep

15	*Luffa cylindrica*	Cucurbitaceae	Aug-Sep
16	*Lagenaria siceraria*	Cucurbitaceae	Aug-Sep
17	*Solena amplexicaulis*(Lam.) Gandhi	Cucurbitaceae	Aug-Sep
18	*Convolvulus arvensis*	Convolvulaceae	June-Aug
19	*Ipomoea eriocarpa*R.Br.	Convolvulaceae	Aug-Sep
20	*Ipomoea hederacea* Jacq.	Convolvulaceae	Aug-Sep
21	*Ipomoea purpurea* (L.) Roth.	Convolvulaceae	Aug-Sep
22	*Diospyros kaki*	Ebenaceae	June-July
23	Senna Alexandria	Caesalpiniaceae	May-June
24	*Robinia pseudo acacia*	Papilionaceae	April-May
25	*Trifolium dubium* Sibth.	Papilionaceae	May-June
26	*Trifolium repens*	Papilionaceae	May-June
27	*Iris kashmiriana*Baker	Iridaceae	May-June
28	*Scutellariaprostrata*	Lamiaceae	June-Sep
29	*Lamium album L.*	Lamiaceae	June-July
30	*Mentha arvesis L.*	Lamiaceae	April-Oct
31	*Mentha longifolia* (L.) L.	Lamiaceae	April-Oct
32	*Mentha spicata L.*	Lamiaceae	April-Oct
33	*Malvastrumcoromandelianum*(L.)	Malvaceae	July-Sep
34	*Alcea rosea*	Malvaceae	July-Sep
35	*Hibiscus rosa-sinensis L.*	Malvaceae	July-Sep
36	*Oxalis corniculate*	Oxalidaceae	March-April
37	*Plantago lanceolata L.*	Plantaginaceae	June-Sep
38	*Malus domestica*	Rosaceae	April-May
39	*Pyrus pashia L*	Rosaceae	April-May
40	*Prunus armeniaca L.*	Rosaceae	April-May
41	*Prunus domestica L.*	Rosaceae	April-May
42	*Rosa brunonii*Lindl.	Rosaceae	March-Sep
43	*Rosa chinensis* Jacq.	Rosaceae	March-Sep
44	*Ranunculus arvensis L.*	Ranunculaceae	March-April
45	*Solanum. nigrum L.*	Solanaceae	April-Sep
46	*Capsicum annuum L.*	Solanaceae	July-Aug
47	*Lycopersicon esculentum* Mill.	Solanaceae	July-Aug
48	*Solanum melongena*	Solanaceae	July-Aug
49	*Lantana camara*	Verbenaceae	May-Oct
50	*Verbena officinalis L.*	Verbenaceae	April-Aug
51	*Viola odorata L.*	Violaceae	March-April

Table 3. Distribution of native plants in different locations of Rawalakot

S.No.	Plant Species	Rawalakot	Kharick	Darek	Dhamni	Banjosa
1	*Celendula officinalis*	+	+	+	+	+
2	*Echinacea purpurea*P.C. Pant	+	-	+	+	-
3	*Matricaria chamomilla L.*	-	+	+	+	+
4	*Taraxacum officinale*	+	+	+	+	+
5	*Helianthus annuus*	+	+	+	+	+
6	*Helianthus tuberosus L.*	+	+	+	+	+
7	*Artemisia indica*(D.Don)	+	+	+	+	+
8	*Carpesiumcernuum L.*	-	-	+	+	-
9	*Aster tataricus L.*	+	+	+	+	+
10	*Diclipterabupleuroides*Nees	+	+	+	+	+
11	*StrobilantheswallichiiL.*	-	-	-	+	-
12	*Impatiens balsamina L.*	+	+	-	+	-

13	*Cucumis sativus*	+	+	+	+	+
14	*Citrullus lanatus*(Thunb.)	-	+	-	-	-
15	*Luffa cylindrica*	+	+	+	+	+
16	*Lagenaria siceraria*	+	+	+	+	+
17	*Solena amplexicaulis*(Lam.) Gandhi	-	-	+	+	-
18	*Convolvulus arvensis*	+	+	+	+	+
19	*Ipomoea eriocarpa*R.Br.	+	+	+	+	+
20	*Ipomoea hederacea* Jacq.	+	+	+	+	+
21	*Ipomoea purpurea* (L.) Roth.	+	+	+	+	+
22	*Diospyros kaki*	+	+	+	+	+
23	*Senna Alexandria*	-	+	-	+	-
24	*Robinia pseudo acacia*	+	+	+	+	+
25	*Trifolium dubium* Sibth.	-	+	+	+	+
26	*Trifolium repens*	+	+	+	+	+
27	*Iris kashmiriana*Baker	-	-	+	+	-
28	Scutellariaprostrata	+	-	+	+	-
29	*Lamium album L.*	-	-	-	+	-
30	*Mentha arvesis L.*	+	+	+	+	+
31	*Mentha longifolia* (L.) L.	+	+	+	+	+
32	*Mentha spicata L.*	+	+	+	+	+
33	*Malvastrumcoromandelianum*(L.)	-	-	+	+	+
34	*Alcea rosea*	+	+	+	+	-
35	*Hibiscus rosa-sinensis L.*	-	+	+	+	-
36	*Oxalis corniculate*	-	+	-	-	-
37	*Plantago lanceolata L.*	-	-	+	+	-
38	*Malus domestica*	+	+	+	+	+
39	*Pyrus pashia*	+	+	+	+	+
40	*Prunus armeniaca L.*	+	+	+	+	+
41	*P.domestica L.*	+	+	+	+	+
42	*Rosa brunonii*Lindl.	+	+	+	+	-
43	*R.chinensis*Jacq.	+	+	+	+	+
44	*Ranunculus arvensis L.*	+	+	+	+	+
45	*S. nigrum L.*	+	+	+	+	+
46	*Capsicum annuum L.*	+	+	+	+	+
47	*Lycopersicon esculentum* Mill.	+	+	+	+	+
48	*Solanum melongena*	+	+	+	+	+
49	*Lantana camara*	-	+	-	+	-
50	*Verbena officinalis L.*	-	+	-	+	+
51	*Viola odorata L.*	+	+	+	-	+

.

Table 4. Diversity indices of native flora at different locations of Rawalakot.

Diversity Indices	Rawalakot	Khirck	Darek	Dhamni	Banjos
Simpson_1-D	0.9578	0.9661	0.9693	0.9736	0.9611
Shannon_H	3.38	3.551	3.625	3.744	3.393
Evenness_e^H/S	0.8155	0.8297	0.8725	0.8807	0.8502
Menhinick	1.605	1.696	1.651	1.493	1.661
Margalef	5.626	6.388	6.443	6.772	5.578

DISCUSSION

The study on the species diversity and composition of native flora visited by Lepidopteran pollinators in Rawalakot, Azad Jammu and Kashmir, provides critical insights into the ecological interactions between plants and their

pollinators in a region characterized by rich biodiversity and varying altitudinal gradients. The findings highlight the dominance of certain plant families, the distribution patterns of floral hosts, and the influence of altitude on pollinator diversity, aligning with global trends while offering localized perspectives.

Table 5. Composition of pollinators in different study sites.

Pollinator Species	Rawalakot(%)	Kharick(%)	Darek(%)	Dhamni(%)	Banjosa(%)	Total(%)
Junoniaorityha	14.29	8.09	6.22	9.72	11.11	9.89
Pieris brassicae	13.53	7.51	8.44	8.50	8.64	8.86
Papilio machaon	12.78	9.83	8.00	7.29	7.41	8.64
Gonepteryxrahmni	10.53	6.94	8.44	6.48	9.88	7.84
Pieris canidia	14.29	5.78	9.33	5.67	8.64	8.07
Papilio demoleus	11.28	6.36	8.89	6.88	11.11	8.18
Pontiadaplidice	12.78	8.09	8.00	6.07	12.35	8.98
Pieris ajaka	7.52	7.51	7.56	8.50	14.81	8.30
Argynnis kamala	1.50	8.09	7.11	9.31	8.64	7.05
Argynnishyperbius	0.00	9.83	6.22	9.72	3.70	6.59
Euremahecabe	0.00	6.94	8.44	8.50	2.47	6.14
Danaus genutia	1.50	8.09	8.00	7.69	0.00	6.02
Hemaristityus	0.00	6.94	5.33	5.67	1.23	5.45

The research identified 51 plant species across 18 families as floral hosts for Lepidopteran pollinators, with Asteraceae (9 species) and Rosaceae (6 species) being the most prominent. This dominance is consistent with studies in other Himalayan regions, where Asteraceae is often the largest family due to its adaptability to diverse climates and its role as a key resource for pollinators (Rahman et al., 2008). The high representation of Asteraceae and Rosaceae aligns with findings by Hussain et al. (2016), who noted their prevalence in Rawalakot's angiosperm flora. The abundance of these families may be attributed to their extended flowering periods and generalized pollination systems, which attract a wide range of pollinators, including butterflies and moths (Ollerton et al., 2011).

The presence of Lamiaceae, Cucurbitaceae, and Solanaceae as significant floral hosts further underscores the importance of these families in supporting Lepidopteran pollinators. For instance, species like *Mentha* (Lamiaceae) and *Cucumis sativus* (Cucurbitaceae) are known for their nectar-rich flowers, which are highly attractive to pollinators (Klein et al., 2007). The limited representation of families like Balsaminaceae and Violaceae (1 species each) suggests niche specialization, where certain pollinators may rely on specific plants, as observed in other montane ecosystems (Inouye, 2020).

The study revealed a decline in both plant and pollinator diversity with increasing altitude, particularly at Banjosa (2000 m), which recorded the lowest species richness. This trend is consistent with global patterns where higher altitudes often exhibit reduced biodiversity due to harsher climatic conditions and limited resource availability (Fründ et al., 2013). The negative correlation between altitude and diversity (plants: -0.054; pollinators: -0.279) echoes findings by Hirota et al. (2011), who noted similar declines in tropical and temperate mountain ecosystems.

However, the peak diversity at Dhamni (1820 m) suggests an optimal mid-altitudinal zone where environmental conditions (e.g., temperature, moisture) may favor both plant growth and pollinator activity. This aligns with the "mid-domain effect," where species richness peaks at intermediate elevations due to overlapping ranges of lowland and highland species (Rashid et al., 2017). The positive correlation between pollinators and plants (0.877) further emphasizes their interdependent relationship, as reported by Albrecht et al. (2012), who found that pollinator diversity directly enhances plant reproductive success.

The documentation of 13 Lepidopteran species, including 12 butterflies and 1 moth (*Hemaris tityus*), reflects the region's role as a habitat for both generalist and specialist pollinators. The prevalence of butterflies like *Pieris brassicae* and *Junonia orithya* aligns with studies in neighboring Himalayan regions (Khan et al., 2014), where these species are common due to their adaptability to diverse floral resources. The absence of moths in higher altitudes (e.g., Banjosa) may reflect their nocturnal activity and sensitivity to colder temperatures, as noted by Hahn and Brühl (2016).

The decline in pollinator abundance at higher altitudes raises concerns about climate change impacts, as warming temperatures could further restrict pollinator ranges (Potts et al., 2010).

This study establishes an important baseline for understanding plant-pollinator networks in Rawalakot, paving the

way for further research to explore seasonal fluctuations in pollinator behavior, evaluate the genetic diversity of key pollinators to gauge their resilience, and broaden sampling efforts to include nocturnal moths and their associated host plants. The findings reveal the complex interdependence between native plant species and Lepidopteran pollinators, emphasizing how altitude and plant family composition influence biodiversity patterns. Integrating these insights into regional conservation strategies can help address the challenges posed by climate change and habitat degradation, safeguarding these vital ecological relationships for future sustainability.

CONCLUSION

This study provides a comprehensive assessment of the floral resource utilization by Lepidopteran pollinators in Rawalakot, AJK, revealing significant interactions between native flora and butterfly and moth species across an altitudinal gradient. A total of 51 plant species from 18 families were identified as floral hosts, with Asteraceae and Rosaceae being the most dominant. Thirteen Lepidopteran pollinator species were documented, with Dhamni emerging as the most biodiverse site in terms of both flora and pollinators. A strong positive correlation between plant and pollinator diversity ($r = 0.877$) highlights the ecological interdependence of these taxa, while the negative correlation with altitude suggests a decline in diversity at higher elevations. These findings underscore the importance of conserving mid-altitude habitats and native plant communities to sustain pollinator populations, especially in the face of ongoing climate change. The study establishes a foundational understanding of plant-pollinator dynamics in this Himalayan region and advocates for integrating these insights into regional biodiversity conservation strategies.

AUTHOR CONTRIBUTIONS

Muhammad Faraz Khan and Umar Ayaz Shaikh conceived the idea designed the study, and supervised the research work. Pakeeza Bakhtawar collected field data and drafted the manuscript, Tahsin Razzaq and Shazia Khatoon analyzed the data. Sajjad Hussain identified the plant species.

COMPETING OF INTEREST

The authors declare no competing interests.

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