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Cover: Long-tailed Shrike *Lanius schach* resting on a dry branch after courtship. Digital illustration on Procreate. © Aakanksha Komanduri.



Diversity and distribution of wasps and bees (Insecta: Hymenoptera: Vespidae, Apidae) in the Gauhati University Campus, Kamrup Metro, Assam, India

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Abstract: The diversity and distribution of wasps and bees in the Gauhati University campus, Kamrup Metro, Assam was investigated in four different habitats: campus gardens, grasslands, residential areas, and areas adjacent to wetlands. Specimens were observed or collected from March 2022 to February 2023. A total of 23 species were recorded from five subfamilies; Polistinae, Eumeninae, and Vespinae under the family Vespidae, Apinae, and Xylocopinae under the family Apidae. The most abundant subfamily was Polistinae (44%) and the least Xylocopinae (8%). Shannon-Weiner diversity index values indicated the highest diversity in residential areas (3.4) followed by gardens (3.3), grasslands (2.2), and areas adjacent to wetlands (2.0). Species abundance exhibited seasonal variations, peaking during the monsoon months.

Keywords: Apinae, diversity indices, eumeninae, habitat, northeastern India, polistinae, seasonal variation, species abundance, vespinae, xylocopinae.

Editor: Anonymity requested.

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Author contribution: BK: Field data collection, conceptualization, methodology, investigation, data curation, writing - original draft. JD: Field data collection, formal analysis. MKS: Validation, Writing - review and editing. PKS: Supervision, visualization, validation, writing - review and editing.

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INTRODUCTION

The wasps in the family Vespidae (Hymenoptera), commonly known as paper wasps, potter wasps, pollen wasps, yellow jackets, hornets, and hover wasps (Gawas et al. 2020), are a specialized group of insects. Globally, this family consists of about 5,000 species (Varghese & Kumar 2023), with 288 species reported in India (Mazumdar et al. 2021). This cosmopolitan family consists of six subfamilies: Polistinae, Eumeninae, Euparagiinae, Masarinae, Stenogastrinae, and Vespinae, of which only Euparagiinae is not reported in India (Gawas et al. 2020). Mazumdar et al. (2021) reported 116 species of Vespidae under four subfamilies from six northeastern states of India, including Assam. The family Apidae (Hymenoptera) comprises bees, and there are approximately 25,000 named species globally (Gupta 2014). Some of the earliest literature available on the diversity and distribution of wasps and bees from the Indian subcontinent were by Bingham (1897), Das & Gupta (1983, 1989). In the last decades, many studies were conducted from various regions of India. Some of those studies include (Kumar 2010, 2013, 2018; Kumar & Nguyen 2010; Kumar & Srinivasan 2010; Kumar & Lambert 2010; Kumar & Carpenter 2013, 2018; Kumar & Sharma 2013, 2014, 2015; Kumar et al. 2014, 2016, 2017, 2019; Gawas et al. 2020; Mazumdar et al. 2021; Varghese & Kumar 2023). From the Indian state of Assam, no consolidated works on Vespidae wasps have been reported (Mazumdar et al. 2021).

Vespid wasps forage for fuel, water, and resources to construct their nests (Lima & Prezoto 2003). Their primary food source is insects, which account for 90–95% of the prey gathered (Gobbi & Machado 1986). The aggregation arrangement of social wasps is mostly clustered, indicating that they are extremely territorial insects with populations exhibiting significant species concentration in the same area (Richards 1971). Wasps contribute vital ecosystem services as bioindicators (de Souza et al. 2010), pollinators, predators, and biocontrol agents of agricultural pests (Ferreira et al. 2020). Bees visit flowers to collect nectar for the production of honey and in the process carry pollen. They are cosmopolitan, eusocial insects that play a vital role in preserving biodiversity by pollinating a vast variety of plants. Bees that produce honey are essential to humankind for both biological and commercial reasons.

For the survival of many plant species and overall maintenance of the biodiversity in ecosystems, plant-pollinator networks are essential. Social wasps and bees are unique in these networks because of their extensive

foraging range and exceptional connectedness. These insects visit a wide variety of flowering species, as they are generalist pollinators, in contrast to many other pollinators, which may specialize in certain plants. This inclination is strongly associated with their social structure, in which numerous foraging workers gather nectar from the most abundant plant species within their area from a single nest. With a great deal of overlap between the plants and their pollinators, these wasps and bees build a network of plants and pollinators that is more resilient to disturbances or extinctions on both sides of the mutualistic interaction. In environments that are fragmented or deteriorated, social wasps may become more common than bees, and they are important 'backup' pollinators that help maintain the integrity of ecosystems (Brock et al. 2021).

Despite the ecological importance of wasps and bees, studies on their diversity and distribution pattern in different habitats remain limited in the northeastern region of India. In this context, the present study was conducted with a focus on the following objectives: 1. to document and identify the Vespidae and Apidae species, and 2. to highlight their diversity and distribution patterns across different habitat types.

MATERIALS AND METHODS

Study area

Kamrup Metropolitan District of Assam comprises various habitats that harbor a rich variety of flora and fauna, and the Gauhati University campus encompasses an array of ecosystems, including wetlands, rugged landscapes, green spaces, and human habitats. The region has an abundance of both native and cultivated vegetation. Spreading over an area of 508.8 ac, the Gauhati University campus is situated at 26.154° N and 91.663° E. The campus lies on the southern bank of the river Brahmaputra towards the northern edge of the Shillong Plateau in the southwestern corner of the Kamrup Metropolitan District of Assam, India. The elevation of the area is 45 m. Temperature ranges 10.6–32 °C, and annual average precipitation is 300–400 mm (Hazarika & Kalita 2018). Natural habitats in the University Campus include hills, marshes, grasslands, forests and small to medium-sized ponds (Hazarika & Kalita 2018) along with human-modified habitats like gardens, residential areas. The campus of Gauhati University exhibits a vast diversity of fauna, particularly insects. In the present study, the insects were surveyed and collected from eight study sites located in four

Table 1. Study sites with geographic coordinates within the Gauhati University campus.

Study site	Habitat type	Geographic coordinates
Site 1	Garden	26.152° N, 91.661° E
Site 2	Garden	26.154° N, 91.660° E
Site 3	Garden	26.151° N, 91.669° E
Site 4	Grassland	26.154° N, 91.659° E
Site 5	Grassland	26.153° N, 91.664° E
Site 6	Grassland	26.154° N, 91.668° E
Site 7	Residential Area	26.153° N, 91.671° E
Site 8	Areas adjacent to wetlands	26.155° N, 91.669° E

distinct habitats: 1) gardens, 2) residential areas, 3) grasslands, and 4) areas adjacent to wetlands within the university campus (Table 1).

Insect collection and identification

Four plots of 100 x 100 m for each of the eight study sites were selected randomly, from which the surveys were conducted from March 2022 to February 2023 at 0800–1700 h and were repeated two to three times a week. The microhabitats from which the insects were observed and collected were recorded. The insects were collected by sweeping using insect collecting nets and were sacrificed in killing jars using benzene/ethyl acetate (Kumar et al. 2015). The sacrificed insects were kept in insect envelopes with proper labelling mentioning the date, time and site of collection, geographic coordinates, and the name of the collector. These were then preserved dry using naphthalene and carbolic acid in appropriate boxes (Kumar et al. 2015). In the laboratory, the specimens were pinned and mounted to display appropriately and observed under a Leica stereo zoom microscope for identification. The specimens were identified using taxonomic keys and diagnostic features available (Bingham 1897; Carpenter & Cumming 1985; Das & Gupta 1989; Carpenter & Nguyen 2003; Kumar & Sharma 2015; Kumar et al. 2015; Pannure et al. 2016).

Data analysis

An independent-samples Kruskal-Wallis test was used to test whether the relative abundance across the four habitat types differs significantly. Post hoc pairwise comparisons were conducted using Dunn's test to identify which habitat types differ significantly. The significance level was set at 0.05. Statistical analysis was performed using IBM SPSS Statistics 20 software. Shannon-Weiner index (H'), Pielou's index (J'), Margalef's

index (R), Simpson's index (1-D) and Brillouin index (HB) were calculated using the PAST4.17 programme.

RESULTS AND DISCUSSION

In this study, a total of 71 individuals were documented, representing 17 species, 10 genera, and three subfamilies within the family Vespidae, as well as six species, three genera, and two subfamilies under the family Apidae from the four habitats of Gauhati University campus (Table 2). These findings are comparable to earlier reports (Kumar & Sharma 2014, 2015; Kumar et al. 2015; Siddiqui et al. 2015; Gawas et al. 2020; Mazumdar et al. 2021) from this region and other parts of Indian subcontinent. The findings of this study indicate that the subfamily Polistinae within the family Vespidae with nine species (Table 2; Figure 1) is the most dominant group in the study area. Mazumdar et al. (2021) also reported 40 species of Polistinae from six northeastern states of India including Assam. This dominance can be attributed to their social structure, which enables them to utilize resources and maintain colonies efficiently and their adaptability to various habitats.

The high abundance and diversity of wasp and bee species in the human-modified habitats (gardens and residential areas) (Table 3; Figure 2 & 3), suggest their preference for these habitats. This is congruent with the role of these species as essential pollinators in both natural and human-modified ecosystems (Khan et al. 2020). The relative abundance of the species across the four habitats were found to differ significantly (Independent-Samples Kruskal-Wallis test: $p = 0.001$). Post-hoc pairwise comparisons (Dunn's test) (Table 4) revealed that significant difference in relative abundance of the species occurred between four pairs of habitats (garden & grassland, garden & area adjacent to wetland, grassland & residential area, residential area & area adjacent to wetland) ($p < 0.05$). These findings suggest that habitat heterogeneity significantly influences species distribution, with distinct assemblages associated with specific habitat types.

The species diversity, richness, and evenness across various habitats differ to some extent (Gawas & Gupta 2022). In the present study, residential areas were found to have the highest species diversity and richness with a Shannon-Wiener Index of 3.394 and Margalef's Index of 6.188, respectively (Table 5). These areas are also relatively evenly diverse with Pielou's Evenness Index of 1.295 (Table 5). Gardens are not far behind the

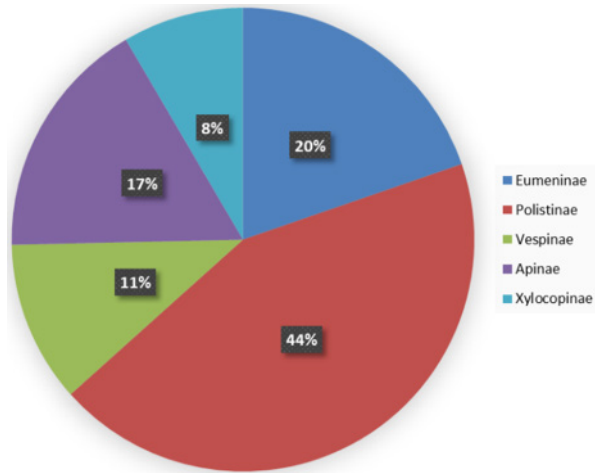


Figure 1. Subfamily-wise percentage occurrence of wasp and bee species found in the Gauhati University campus.

residential areas in terms of species diversity, with a Shannon-Wiener Index of 3.246 and a Margalef’s Index of 5.592 (Table 5). This is likely due to the availability of diverse foraging and suitable nesting resources such as ornamental plants, buildings, and other man-made structures. This also infers the ecological success of these species in adapting to urban environments. The natural habitats (grasslands and areas near wetlands) have lower species richness and diversity, with a much lower Shannon-Wiener and Margalef’s indices (2.208

Table 2. List of wasp and bee species recorded in the four habitats of Gauhati University campus.

Family	Subfamily	Species
Vespidae	Eumeninae	<i>Allorhynchium argentatum</i>
		<i>Antodynerus flavescens</i>
		<i>Antodynerus limbatus</i>
		<i>Labus pusillus</i>
		<i>Phimenes flavopictus</i>
		<i>Rhynchium brunneum</i>
	Polistinae	<i>Parapolybia varia</i>
		<i>Polistes olivaceus</i>
		<i>Polistes sagittarius sagittarius</i>
		<i>Polistes wattii</i>
		<i>Ropalidia cyathiformis</i>
		<i>Ropalidia fasciata</i>
		<i>Ropalidia jacobsoni</i>
<i>Ropalidia ornaticeps</i>		
<i>Ropalidia stigma</i>		
Vespinae	<i>Provespa barthelemyi</i>	
	<i>Vespa tropica leefmansii</i>	
Apidae	Apinae	<i>Apis cerana</i>
		<i>Apis dorsata</i>
		<i>Tetragonula iridipennis</i>
	Xylocopinae	<i>Xylocopa latipes</i>
		<i>Xylocopa aestuans</i>
		<i>Xylocopa fenestrata</i>

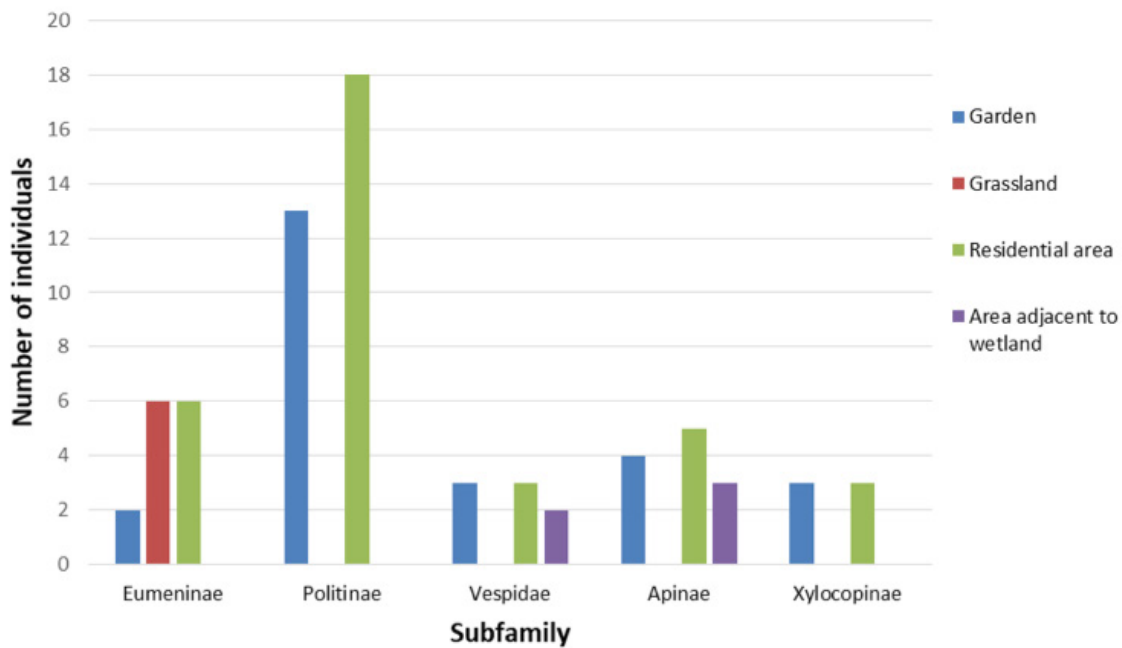


Figure 2. Abundance of each of the subfamilies in the four habitats of Gauhati University campus.

Table 3. Habitat-wise distribution of wasp and bee species found in the Gauhati University campus.

Species	Habitat							
	Garden		Grassland		Residential area		Area adjacent to wetland	
	Abundance	Relative abundance (%)	Abundance	Relative abundance (%)	Abundance	Relative abundance (%)	Abundance	Relative abundance (%)
<i>Allorhynchium argentatum</i>	0	0	1	16.66	1	2.86	0	0
<i>Antodynerus flavescens</i>	0	0	1	16.66	1	2.86	0	0
<i>Antodynerus limbatus</i>	0	0	1	16.66	1	2.86	0	0
<i>Labus pusillus</i>	0	0	1	16.66	1	2.86	0	0
<i>Phimenes flavopictus</i>	1	4	1	16.66	1	2.86	0	0
<i>Rhynchium brunneum</i>	1	4	1	16.66	1	2.86	0	0
<i>Parapolybia varia</i>	2	8	0	0	2	5.71	0	0
<i>Polistes olivaceus</i>	2	8	0	0	2	5.71	0	0
<i>Polistes sagittarius sagittarius</i>	2	8	0	0	2	5.71	0	0
<i>Polistes watti</i>	2	8	0	0	2	5.71	0	0
<i>Ropalidia cyathiformis</i>	1	4	0	0	2	5.71	0	0
<i>Ropalidia fasciata</i>	1	4	0	0	2	5.71	0	0
<i>Ropalidia jacobsoni</i>	1	4	0	0	2	5.71	0	0
<i>Ropalidia ornaticeps</i>	1	4	0	0	2	5.71	0	0
<i>Ropalidia stigma</i>	1	4	0	0	2	5.71	0	0
<i>Provespa barthelemyi</i>	1	4	0	0	2	5.71	1	20
<i>Vespa tropica leefmansii</i>	2	8	0	0	1	2.86	1	20
<i>Apis cerana</i>	1	4	0	0	2	5.71	1	20
<i>Apis dorsata</i>	1	4	0	0	2	5.71	1	20
<i>Tetragonula iridipennis</i>	2	8	0	0	1	2.86	1	20
<i>Xylocopa latipes</i>	1	4	0	0	1	2.86	0	0
<i>Xylocopa aestuans</i>	1	4	0	0	1	2.86	0	0
<i>Xylocopa fenestrata</i>	1	4	0	0	1	2.86	0	0

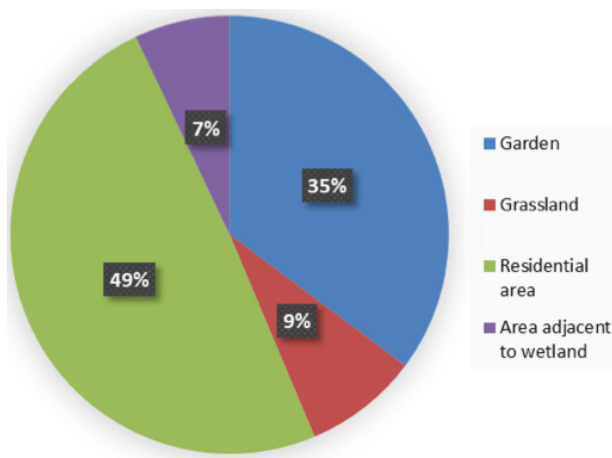


Figure 3. Percentage composition of wasps and bees across the four habitats of Gauhati University campus.

and 2.009, respectively) (Table 5). Pielou’s Evenness Index of these two habitats (1.517 and 1.492) (Table 5) reflects the lowest species richness and diversity. This may indicate lesser preference, limited resources or more competition in these regions.

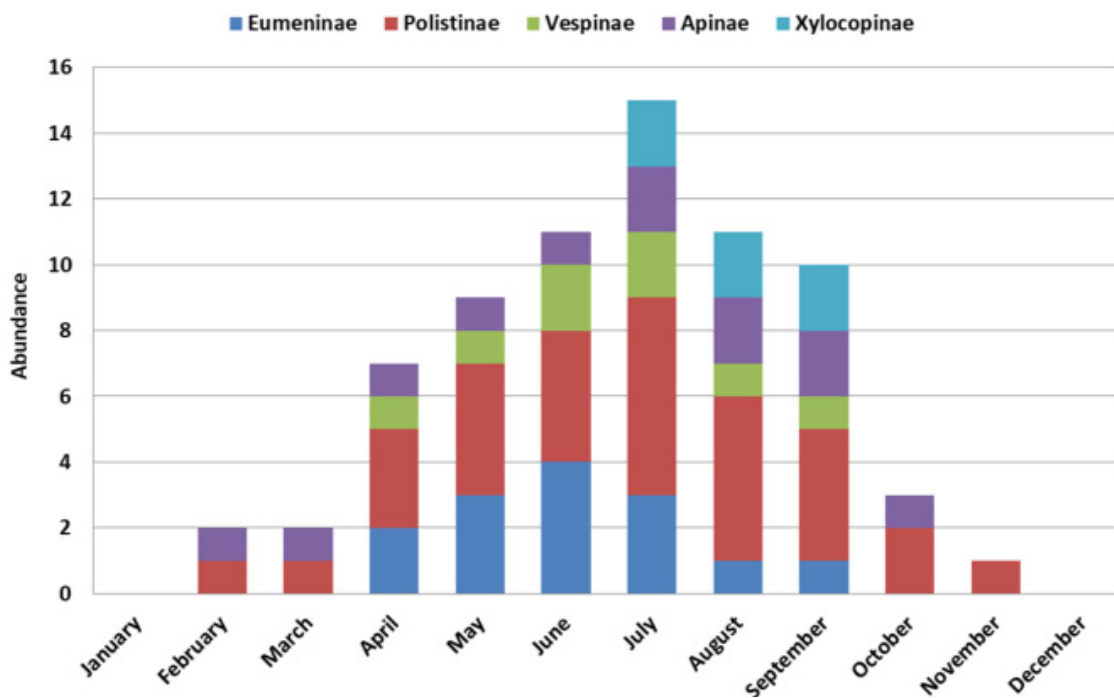
Simpson’s and Brillouin indices (Table 5) also supports this data, where the diversity of these species is high in residential areas and gardens and low in grasslands and wetland adjacent areas. This indicates that ecological niches that are man-made, including gardens and residential areas, are capable of supporting many wasp and bee species, and these species can be distributed rather evenly, while ecological niches that are more natural, such as grasslands and wetlands, can support only a few dominant species. This is congruent

Table 4. Pairwise Kruskal-Wallis p-values between habitat types.

Habitat	p-value	Significance
Garden vs. Grassland	0.010	+
Garden vs. Area adjacent to Wetland	0.005	+
Grassland vs. Residential area	0.005	+
Residential area vs. Area adjacent to wetland	0.003	+
Garden vs. Residential area	0.831	
Grassland vs. Area adjacent to Wetland	0.831	

Table 5. Diversity indices of wasp and bee species found in the Gauhati University campus.

Diversity indices	Garden	Grassland	Residential area	Area adjacent to the wetland
Shannon-Weiner index	3.246	2.208	3.394	2.009
Pielou's index	1.352	1.517	1.295	1.492
Margalef's index	5.592	2.791	6.188	2.485
Simpson's index	0.98	1.000	0.9798	1.000
Brillouin index	2.154	1.097	2.395	0.957

**Figure 4. Month-wise abundance of wasp and bee subfamilies across the four habitats of Gauhati University campus.**

with earlier studies (Jacques et al. 2017), where they reported high diversity of wasps in anthropized habitats like agricultural fields.

The high abundance of wasps and bees in the months of April–September and very low in the months of October–March (Figure 4) indicates that these insects mostly prefer warm and humid conditions for foraging, nesting, and reproduction. In this study, it was found that social wasp species initiate colonies in spring, colony growth and foraging activity peak in mid to late summer and starts declining in autumn, which was also reported by Spradbery (1973).

The findings of this study add valuable data to the wasp and bee diversity of the Gauhati University campus, which will help in continuous monitoring and conservation efforts for these ecologically important

species in this region. Habitats such as residential areas and gardens, which support a wide array of these species, should be protected and managed sustainably.

This study is the first report on the diversity and distribution of wasps and bees, their habitat-wise diversity comparisons from the Gauhati University campus and is also one of the few such studies conducted from Assam, filling a critical gap in the existing literature from this region. The findings of this study provide a baseline for future research on the distribution and diversity of wasp and bee species from this region and contribute to a deeper understanding of the ecological roles of these species. The results of this study are based on a single year of data collection and a restricted geographic scope. So, further studies with increased duration of data collection, a broader geographic region

and exploring the underlying factors contributing to the higher abundance and diversity of these species in human-modified habitats is encouraged.

REFERENCES

- Bingham, C.T. (1897). *The Fauna of British India, Including Ceylon and Burma. Hymenoptera-Vol. 1. Wasps and Bees*. Taylor and Francis, London, xxix + 579 pp.
- Brock, R.E., A. Cini & S. Sumner (2021). Ecosystem services provided by aculeate wasps. *Biological Reviews* 96(4): 1645–1675. <https://doi.org/10.1111/brv.12719>
- Carpenter, J.M. & J.M. Cumming (1985). A character analysis of the North American potter wasps (Hymenoptera: Vespidae; Eumeninae). *Journal of Natural History* 19(5): 877–916. <https://doi.org/10.1080/00222938500770551>
- Carpenter, J.M. & L.P.T. Nguyen (2003). Keys to the genera of social wasps of south-east Asia (Hymenoptera: Vespidae). *Entomological Science* 6(3): 183–192. <https://doi.org/10.1046/j.1343-8786.2003.00016.x>
- Das, B.P. & V.K. Gupta (1983). A catalogue of the families Stenogastridae and Vespidae from the Indian subregion (Hymenoptera: Vespoidea). *Oriental Insects* 17(1): 395–464. <https://doi.org/10.1080/00305316.1983.10433698>
- Das, B.P. & V.K. Gupta (1989). The social wasps of India and the adjacent countries (Hymenoptera: Vespidae). An illustrated account of the vespid fauna of the Indian Subregion. *Oriental Insects* 23(1): 1–389. <https://doi.org/10.1080/00305316.1989.11835532>
- de Souza, M.M., J. Louzada, J.E. Serrão & J.C. Zanuncio (2010). Social wasps (Hymenoptera: Vespidae) as indicators of conservation degree of riparian forests in southeast Brazil. *Sociobiology* 56(2): 387–396.
- Ferreira, J.V.A., D. Storck-Tonon, R.J. da Silva, A. Somavilla, M.J.B. Pereira & D.J. da Silva (2020). Effect of habitat amount and complexity on social wasps (Vespidae: Polistinae): implications for biological control. *Journal of Insect Conservation* 24(4): 613–624. <https://doi.org/10.1007/s10841-020-00221-7>
- Gawas, S.M. & A. Gupta (2022). Diversity of vespid wasps (Hymenoptera: Vespidae) in agroecosystem and forest ecosystem of Western Ghats region of Goa, India. *Journal of Biological Control* 36(1): 71–79. <https://doi.org/10.18311/jbc/2022/30215>
- Gawas, S.M., P.G. Kumar, A. Pannure, A. Gupta & J.M. Carpenter (2020). An annotated distributional checklist of Vespidae (Hymenoptera: Vespoidea) of India. *Zootaxa* 4784(1): 1–87. <https://doi.org/10.11646/zootaxa.4784.1.1>
- Gobbi, N. & V.L. Machado (1986). Material capturado e utilizado na alimentação de *Polybia* (*Trichothorax*) *ignobilis* (Haliday, 1836) (Hymenoptera, Vespidae). *Anais da Sociedade Entomológica do Brasil* 15(supl.): 117–124.
- Gupta, R.K. (2014). Taxonomy and distribution of different honeybee species, pp. 63–103. In: Gupta, R.K., W. Reybroeck, J.W. van Veen & A. Gupta (eds). *Beekeeping for Poverty Alleviation and Livelihood Security: Technological Aspects of Beekeeping*. Springer, Dordrecht, 665 pp.
- Hazarika, H.N. & J. Kalita (2018). Diversity of Beetles (Insecta: Coleoptera) in Gauhati University Campus. *Research Journal of Social and Life Sciences* 24(1): 279–284.
- Jacques, A., M. Laurent, Epilobee Consortium, M. Ribière-Chabert, M. Saussac, S. Bougeard, G.E. Budge, P. Hendrikx & M.P. Chauzat (2017). A pan-European epidemiological study reveals honey bee colony survival depends on beekeeper education and disease control. *PLoS one* 12(3): e0172591. <https://doi.org/10.1371/journal.pone.0172591>
- Khan, M.A., S. Afsheen & M. Ahmad (2020). Pollination services of honeybees: Enhancing biodiversity and agricultural production. *Journal of Agricultural Research* 58(1): 19–27.
- Kumar, P.G. (2010). New distributional records of some species of the subgenus *Polistes* (*Gyrostoma*) Kirby (Hymenoptera: Vespidae) from various states of India and adjacent countries. *Records of the Zoological Survey of India* 110(4): 41–45. <https://doi.org/10.26515/rzsi/v110/i4/2010/158917>
- Kumar, P.G. (2013). A taxonomic study on the genus *Anterhynchium* de Saussure (Hymenoptera: Vespidae: Eumeninae) from Indian subcontinent. *Records of the Zoological Survey of India* 113(4): 139–158. <https://doi.org/10.26515/rzsi/v113/i4/2013/121783>
- Kumar, P.G. (2018). Taxonomic review on the potter wasp genus *Pseumenes* Giordani Soika (Hymenoptera: Vespidae: Eumeninae) from India. *ENVIS News Letter, ENVIS Centre on Biodiversity (Fauna)* 24(3): 2–6.
- Kumar, P.G. & G. Sharma (2013). A taxonomic study on the genus *Rhynchium* Spinola (Hymenoptera: Vespidae: Eumeninae) from the Indian subcontinent. *Records of the Zoological Survey of India* 113(2): 105–122. <https://doi.org/10.26515/rzsi/v113/i2/2013/121836>
- Kumar, P.G. & G. Sharma (2014). Taxonomic studies on vespid wasps (Hymenoptera: Vespoidea: Vespidae) of Sunderbans Biosphere Reserve, West Bengal, India. Part 1. *Records of the Zoological Survey of India* 114(4): 563–580. <https://doi.org/10.26515/rzsi/v114/i4/2014/121607>
- Kumar, P.G. & G. Sharma (2015). Taxonomic studies on vespid wasps (Hymenoptera: Vespoidea: Vespidae) of Chhattisgarh, India. *Journal of Threatened Taxa* 7(14): 8096–8127. <https://doi.org/10.11609/jott.2426.7.14.8096-8127>
- Kumar, P.G. & G. Srinivasan (2010). Taxonomic studies of hornet wasps (Hymenoptera: Vespidae) *Vespa* Linnaeus of India. *Records of the Zoological Survey of India* 110(2): 57–80. <https://doi.org/10.26515/rzsi/v110/i2/2010/158949>
- Kumar, P.G. & J.M. Carpenter (2013). A taxonomic review of the genus *Antodynerus* de Saussure, 1855 (Hymenoptera: Vespidae: Eumeninae) from the Indian subcontinent. *Zootaxa* 3731(2): 267–278. <https://doi.org/10.11646/zootaxa.3731.2.7>
- Kumar, P.G. & J.M. Carpenter (2018). A taxonomic review of the genus *Vespula* Thomson (Hymenoptera: Vespidae: Vespinae) from the Indian subcontinent. *Halteres* 9: 86–110.
- Kumar, P.G. & K. Lambert (2010). New record of *Polistes* (*Polistes*) *indicus* Stofla from India (Hymenoptera: Vespidae: Polistinae). *Uttar Pradesh Journal of Zoology* 30(2): 193–196.
- Kumar, P.G. & L.T. Nguyen (2010). New distributional records of the nocturnal wasp *Provespa barthelemyi* (du Buysson) (Hymenoptera: Vespidae; Vespinae) from various states of India. *Journal of Experimental Zoology* 13(2): 379–382.
- Kumar, P.G., B.G. Kundu & S.I. Kazmi (2015). Insecta: Hymenoptera: Vespidae. *Zoological Survey of India, Fauna of Uttar Pradesh, State Fauna Series* 22(2): 581–595.
- Kumar, P.G., J.M. Carpenter & L. Kishore (2014). A review of the genus *Epsilon* de Saussure (Hymenoptera: Vespidae: Eumeninae) from India. *Journal of Threatened Taxa* 6(1): 5380–5385. <https://doi.org/10.11609/jott.o3626.5380-5>
- Kumar, P.G., J.M. Carpenter & L. Kishore (2017). A review of the genus *Pararrhynchium* de Saussure (Hymenoptera: Vespidae: Eumeninae) from India with the description of a new species. *Halteres* 8: 85–91.
- Kumar, P.G., J.M. Carpenter & P.M. Sureshan (2016). A taxonomic review of the genus *Antepipona* de Saussure, 1855 (Hymenoptera: Vespidae: Eumeninae) from India. *Zootaxa* 4150(5): 501–536. <https://doi.org/10.11646/zootaxa.4150.5.1>
- Kumar, P.G., K.M. Shareef, L. Kishore & J.M. Carpenter (2013). A taxonomic review of the Oriental genus *Labus* de Saussure, 1867 (Hymenoptera: Vespidae: Eumeninae) from the Indian subcontinent. *Biosystematica* 7(2): 29–37.
- Lima, M.A.P. & F. Prezoto (2003). Foraging activity rhythm in the Neotropical Swarm-founding Wasp *Polybia platycephala* sylvestris (Hymenoptera: Vespidae) in different seasons of the year. *Sociobiology* 42(3): 745–752.
- Mazumdar, P.C., P.G. Kumar & S.I. Kazmi (2021). Hymenoptera: Vespidae, pp. 361–366. In: *Faunal Diversity of Biogeographic Zones of India: North-East*. Zoological Survey of India, Kolkata.

- Pannure, A., V.V. Belavadi & J.M. Carpenter (2016).** Taxonomic studies on Potter Wasps (Hymenoptera: Vespidae: Eumeninae) of south India. *Zootaxa* 4171(1): 1–50. <https://doi.org/10.11646/zootaxa.4171.1.1>
- Richards, O.W. (1971).** The biology of the social wasps (Hymenoptera, Vespidae). *Biological Reviews* 46(4): 483–528.
- Siddiqui, J.A., I. Bodlah, J.M. Carpenter, M. Naeem, M. Ahmad & M.A. Bodlah (2015).** Vespidae (Hymenoptera) of the Pothwar region of Punjab, Pakistan. *Zootaxa* 3914(5): 501–524. <https://doi.org/10.11646/zootaxa.3914.5.1>
- Spradbery, J.P. (1973).** *Wasps: An Account of the Biology and Natural History of Solitary and Social Wasps*. University of Washington Press, Seattle, 408 pp.
- Varghese, T. & P.G. Kumar (2023).** A review of the taxonomy, biology and distribution of the social wasps (Hymenoptera: Vespidae) of the Indian Subcontinent. *Journal of the Indian Institute of Science* 103(4): 1019–1047. <https://doi.org/10.1007/s41745-023-00411-7>



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