

Short Communication

Generic and species richness of ant fauna in different provinces of Nepal (Hymenoptera: Formicidae)

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Suggested citation: Subedi, I. P. 2022. Generic and species richness of ant fauna in different provinces of Nepal (Hymenoptera: Formicidae) Nepalese Journal of Zoology 6(S1):50–55. <https://doi.org/10.3126/njz.v6iS1.50532>

Article History:

Received: 25 September 2022

Revised: 01 December 2022

Accepted: 05 December 2022

Publisher's note: The editorial board and the publisher of the NJZ remain neutral to the opinions expressed and are not responsible for the accuracy of the results and maps presented by the authors.



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Abstract

Nepal, a part of the Himalayan biodiversity hotspot, has a high diversity of habitat and species. Its myrmecofaunal diversity and distribution, however, is little understood. Here, I summarize the provincial distribution of all named species of ants for the seven provinces of Nepal through a literature review and examination of materials available at museum and private collections. The distribution of Nepalese ants in each province reveals that Bagmati province has the highest known generic and species richness with 37 genera and 93 species, followed by Gandaki (32, 68), Province 1 (27, 55), Sudurpashchim (15, 15), Lumbini (12, 13), Madhesh (9, 11), and Karnali (5, 5). The four of the seven provinces, Sudurpashchim, Karnali, Lumbini, and Madhesh have been significantly under sampled in the country in terms of documented species richness. Although the figures cannot accurately represent the real species richness of each province, I hope that by highlighting the research gaps, it will encourage further investigation.

Keywords: Ant records; Bagmati; Himalaya; Myrmecofauna; Nepalese ants

1 | Introduction

Ants are extremely abundant, widely distributed throughout the world, and important ecologically (Hölldobler & Wilson 1990, Andersen 2000, Gibb et al. 2017, Economo et al. 2018). Ants contribute to the conservation and proper operation of ecosystem by providing a number of ecological services and negative effects (Del Toro et al. 2012). Estimated number of ants on Earth corresponds to 20×10^{15} and biomass of almost 12 megatons (Schultheiss et al. 2022). Ant abundance is irregularly distributed in Earth and peaks in the tropics (Kaspari et al. 2004, Economo et al. 2018, Kass et al. 2022, Schultheiss et al. 2022). The Himalayas and other biodiversity hotspots are locations that are crucial for preserving biodiversity globally (Norman 2003). Being a part of the Himalayan biodiversity hotspot, Nepal is anticipated to have an enormous diversity of ants. For

its myrmecofauna, however, there is not much systematic information available.

The first records of ant species from Nepal were published 117 years ago, in 1906 (Forel 1906), and thus marked the beginning of Nepalese Myrmecology. Following then, several ant species descriptions and records from Nepal, have been published, especially by foreign myrmecologists (For example Collingwood 1970, Baroni Urbani 1975, Radchenko 2003, Seifert 2003, Williams & Lapolla 2018). Furthering the knowledge, local researchers have recently made substantial contributions to Nepalese myrmecology. Since the publication of a book "Insect diversity in Nepal" (Thapa 2015) and an updated checklist of Nepalese ants (Subedi et al. 2020), a few more studies focusing on specific genera such as *Buniapone* (Subedi 2021), *Cerapachys* and *Parasyscia* (Subedi et al. 2021a), *Leptogenys* (Subedi et al. 2022a), and *Tetraponera* (Subedi et al. 2022b) and the subgenus *Orthonotomyrmex* (Subedi et al. 2021b) have

included 15 species not previously recorded from Nepal. In addition, five genera and nine species that are new records for Nepal were published in a paper on forest ants (Subedi et al. 2021c). A study on the subfamily Myrmicinae added six new species records (Subedi et al. 2022c). To date (2022), nine subfamilies, 57 genera, and 155 species are formally recorded for Nepal, considering all these recent studies. With the exception of the subfamily Myrmicinae (Subedi et al. 2022), there is no information on the distribution of ant species at the province level. In order to find the knowledge gaps and identify promising areas for further exploratory research, this paper seeks to present an overview of the distribution of ant species in seven provinces (Province 1, Madhesh, Bagmati, Gandaki, Lumbini, Karnali, and Sudurpashchim province) of Nepal.

2 | Materials and methods

The provincial distribution of ant fauna of Nepal has been compiled from published articles, books and online databases. The distribution information is also collected from specimens examined at the Central

Department Zoology Museum of Tribhuvan University and the author's personal ant collection. Only the named species are included for the species counts per genus and the records have been tabulated for each province. The data excludes publications with merely generic level identification. The validity of species has been verified from an online catalogue of ants of the world (Bolton 2022). The locations of ant species collecting sites based upon the available locality data in literature and materials examined during this study for each province is illustrated in a QGIS-created map (QGIS Development Team 2020). A same set of symbols is used in the maps to represent the ant species that are members of the same subfamily.

3 | Results

The distribution of ants in each province of Nepal reveals that Bagmati province (37 genera and 93 species) has the highest documented species richness, followed by Gandaki (32, 68), Province 1 (27, 55), Sudurpashchim (15, 15), Lumbini (12, 13), Madhesh (9, 11) and Karnali (5, 5) (Annex 1). The names of the genera, the number of

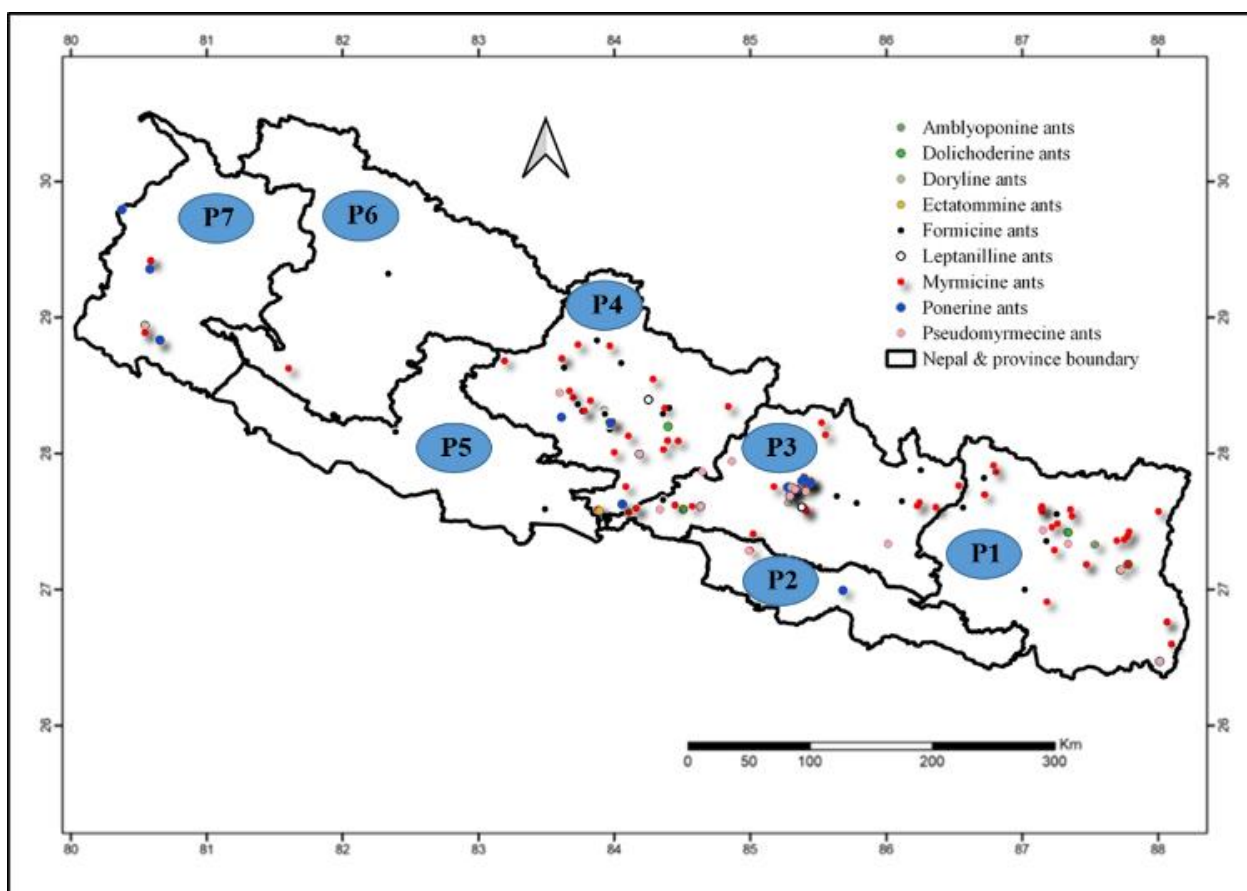


Figure 1. Ant species collecting sites based upon the available locality data for each province in Nepal. (P1: Province 1, P2: Madhesh Province, P3: Bagmati Province, P4: Gandaki Province, P5: Lumbini Province, P6: Karnali Province, P7: Sudurpashchim Province). The same set of symbols represent the ant species belonging to the same subfamily.

species under each of those genera that have been found in Nepal, and in each province are listed below (Annex 1). The listed ant fauna belongs to nine subfamilies, namely Amblyoponinae, Dolichoderinae, Dorylinae, Ectatomminae, Formicinae, Formicinae, Leptanillinae, Myrmicinae, Ponerinae, and Pseudomyrmecinae. Of these subfamilies, Myrmicinae is the most diverse with 21 genera and 69 species in Nepal, followed by Formicinae (12, 44), Ponerinae (9, 19), Dolichoderinae (6, 8), Dorylinae (5, 6), Pseudomyrmecinae (1, 6) and remaining subfamilies with one genus and one species each (Annex 1). Myrmicinae has the highest documented species richness across all the provinces, with the exception of Gandaki and Lumbini provinces, where Formicinae is the largest subfamily in terms of recorded species richness (Annex 1). However, because all the provinces are not adequately sampled, the figures cannot accurately represent the actual diversity of each province when compared province by province.

The locations of collecting sites from where the ant species were recorded based upon the available locality data for each province is given (Figure 1). The figure shows that Bagmati Province, Gandaki Province and Province 1 are well sampled, with ants being recorded from several locations throughout each province. The four of the seven provinces, Sudurpashchim, Karnali, Lumbini, and Madhesh have been largely under sampled areas in the country in terms of documented species richness (Figure 1).

4 | Discussion

Bagmati province has the highest known generic and species richness of ants of Nepal, followed by Gandaki, Province 1, Sudurpashchim, Lumbini, Madhesh, and Karnali (Annex 1). Since the provincial distribution of the genera and named species has been provided based on previously published literature and examination of materials available, this is not a complete list. Thus, the figures may not accurately reflect the actual generic or species richness of each province. The results indicate that four provinces, Sudurpashchim, Lumbini, Madhesh, and Karnali are largely under sampled. Prior studies of Nepalese ants were based on isolated samples and mostly followed trekking routes in the mid-hills

(Subedi & Budha 2020), and the aforementioned provinces are either remote or do not have well-known trekking routes. Additionally, just a small portion of each province was represented among the materials available for the examination, with a sizable portion from Bagmati. This might be one of the reasons behind reported highest richness in Bagmati. Bharti et al. (2016) presented species richness in Indian states, indicating that many states lack ant surveys. Only a small number of species have been recorded from Nepal for several hyperdiverse taxa, Bharti et al. (2016) presented hyperdiverse taxa, such as *Pheidole*, *Camponotus*, and *Crematogaster* indicating that actual richness has not yet been determined. However, because many ant species have only been identified up to a generic level (Neupane & Subedi 2018, Adhikari et al. 2020a, b), the known diversity of ants is incomplete both at the provincial and national levels.

5 | Conclusions

The known generic and species richness of ants by province in Nepal shows Sudurpashchim, Karnali, Lumbini, and Madhesh have much fewer ant species records than Bagmati, Gandaki, and Province 1. The focus of future exploratory research should be on addressing the knowledge gaps that were identified in this study. I hope that this work inspires researchers to carry out regional ant investigation in order to produce and update provincial species checklists.

Acknowledgements

I thank Central Department Zoology Museum of Tribhuvan University for providing me access to the collection so I could examine the specimens there. I am grateful to Prem Bahadur Budha and Jagannath Adhikari for their assistance during the preparation of this work.

Conflicts of interest

Authors declare no conflict of interest

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Annex 1. Species diversity (named species only) for each subfamily and genus in each of the provinces of Nepal

SN	Genus	Subfamily	No. of species	P1	P2	P3	P4	P5	P6	P7
1	<i>Acropyga</i> Roger, 1862	Formicinae	1	-	-	1	-	-	-	-
2	<i>Aenictus</i> Shuckard, 1840	Dorylinae	1	-	-	-	-	-	-	-
3	<i>Aphaenogaster</i> Mayr, 1853	Myrmicinae	4	2	-	2	-	-	-	1
4	<i>Brachyponera</i> Emery, 1900	Ponerinae	2	-	-	2	1	1	1	1
5	<i>Buniapone</i> Schmidt & Shattuck, 2014	Ponerinae	1	-	-	-	1	-	-	-
6	<i>Camponotus</i> Mayr, 1861	Formicinae	14	2	1	12	8	2	-	1
7	<i>Cardiocondyla</i> Emery, 1869	Myrmicinae	7	-	-	4	5	-	1	-
8	<i>Carebara</i> Westwood, 1840	Myrmicinae	4	-	-	2	1	-	1	-
9	<i>Cataglyphis</i> Foerster, 1850	Formicinae	1	-	-	-	-	-	-	-
10	<i>Cataulacus</i> Smith, 1853	Myrmicinae	1	-	-	-	1	-	-	-
11	<i>Cerapachys</i> Smith, 1857	Dorylinae	1	-	-	1	-	-	-	-
12	<i>Chronoxenus</i> Santschi, 1919	Dolichoderinae	1	1	-	-	-	-	-	-
13	<i>Colobopsis</i> Mayr, 1861	Formicinae	1	1	-	-	-	-	-	-
14	<i>Crematogaster</i> Lund, 1831	Myrmicinae	3	3	-	3	-	-	-	-
15	<i>Diacamma</i> Mayr, 1862	Ponerinae	3	1	1	1	-	-	-	-
16	<i>Dolichoderus</i> Lund, 1831	Dolichoderinae	2	1	-	2	1	-	-	-
17	<i>Dorylus</i> Fabricius, 1793	Dorylinae	2	-	-	2	-	-	-	-
18	<i>Emeryopone</i> Forel, 1912	Ponerinae	1	-	-	1	1	-	-	-
19	<i>Formica</i> Linnaeus, 1758	Formicinae	3	-	-	-	3	-	-	-
20	<i>Harpegnathos</i> Jerdon, 1851	Ponerinae	1	-	-	-	1	1	-	-
21	<i>Iridomyrmex</i> Mayr, 1862	Dolichoderinae	1	-	-	-	1	-	-	-
22	<i>Lasius</i> Fabricius, 1804	Formicinae	4	3	-	1	1	-	1	-
23	<i>Lepisiota</i> Santschi, 1926	Formicinae	2	2	-	2	-	-	-	-
24	<i>Leptanilla</i> Emery, 1870	Leptanillinae	1	-	-	1	1	-	-	-

25	<i>Leptogenys</i> Roger, 1861	Ponerinae	6	1	-	6	3	1	-	-
26	<i>Lophomyrmex</i> Emery, 1892	Myrmicinae	1	1	-	-	1	-	-	-
27	<i>Lordomyrma</i> Emery, 1897	Myrmicinae	1	-	-	-	-	-	-	-
28	<i>Mayriella</i> Forel, 1902	Myrmicinae	1	-	-	1	-	-	-	-
29	<i>Meranoplus</i> Smith, 1853	Myrmicinae	3	3	1	2	1	-	-	1
30	<i>Monomorium</i> Mayr, 1855	Myrmicinae	2	-	1	2	1	-	-	-
31	<i>Myrmica</i> Latreille, 1804	Myrmicinae	16	10	-	11	6	-	-	-
32	<i>Myrmecaria</i> Saunders, 1842	Myrmicinae	1	1	-	-	1	1	-	1
33	<i>Nylanderia</i> Emery, 1906	Formicinae	2	-	-	2	-	-	-	-
34	<i>Ochetellus</i> Shattuck, 1992	Dolichoderinae	1	1	-	1	-	-	-	-
35	<i>Odontomachus</i> Latreille, 1804	Ponerinae	1	-	-	1	-	-	-	-
36	<i>Odontoponera</i> Mayr, 1862	Ponerinae	2	-	-	1	2	1	-	1
37	<i>Oecophylla</i> Smith, 1860	Formicinae	1	1	1	1	1	1	1	1
38	<i>Ooceraea</i> Roger, 1862	Dorylinae	1	-	1	-	1	-	-	-
39	<i>Parasyscia</i> Emery, 1882	Dorylinae	1	-	-	1	-	-	-	-
40	<i>Paratrechina</i> Motschoulsky, 1863	Formicinae	1	-	-	1	1	1	-	1
41	<i>Perissomyrmex</i> Smith, 1947	Myrmicinae	1	1	-	-	-	-	-	-
42	<i>Pheidole</i> Westwood, 1839	Myrmicinae	6	4	-	5	-	-	-	-
43	<i>Polyrhachis</i> Smith, 1857	Formicinae	8	3	-	6	6	1	-	1
44	<i>Prenolepis</i> Mayr, 1861	Formicinae	6	-	1	-	6	-	-	-
45	<i>Pristomyrmex</i> Mayr, 1866	Myrmicinae	1	1	-	-	-	-	-	-
46	<i>Pseudoneoponera</i> Donisthorpe, 1943	Ponerinae	2	-	-	-	2	1	-	1
47	<i>Recurvidris</i> Bolton, 1992	Myrmicinae	1	-	-	1	-	-	-	-
48	<i>Stenammas</i> Westwood, 1839	Myrmicinae	1	-	-	1	-	-	-	-
49	<i>Stictoponera</i> (Emery, 1889)	Ectatomminae	1	-	-	-	1	-	-	-
50	<i>Stigmatomma</i> Roger, 1859	Amblyoponinae	1	1	-	-	-	-	-	-
51	<i>Strumigenys</i> Smith, 1860	Myrmicinae	10	3	-	4	3	-	-	-
52	<i>Tapinoma</i> Foerster, 1850	Dolichoderinae	1	-	-	1	1	-	-	1
53	<i>Technomyrmex</i> Mayr, 1872	Dolichoderinae	2	1	-	2	2	-	-	1
54	<i>Temnothorax</i> Mayr, 1861	Myrmicinae	1	1	-	-	-	-	-	1
55	<i>Tetramorium</i> Mayr, 1855	Myrmicinae	3	2	1	2	1	-	-	-
56	<i>Tetraoponera</i> Smith, 1852	Pseudomyrmecinae	6	3	3	3	2	1	-	1
57	<i>Trichomyrmex</i> Mayr, 1865	Myrmicinae	1	1	-	1	-	1	-	1
Total number of species			155	55	11	93	68	13	5	15
Total number of genera			57	27	9	37	32	12	5	15

Note: P1= Province 1, P2= Madhesh Province, P3= Bagmati Province, P4= Gandaki Province, P5= Lumbini Province, P6= Karnali Province, P7= Sudurpashchim Province