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A preliminary checklist of the ants (Hymenoptera: Formicidae) of the Mt. Pantaron Range, Bukidnon Province, Mindanao Island, Philippines

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Abstract

The ants of a remote mountain in central Mindanao Island, Philippines are surveyed along a transect with a combination of collecting techniques. Nine species are new distributional records for the Philippines: *Aenictus wayani* Jaitrong and Yamane, 2011; *Aphaenogaster feae* Emery, 1889; *Euprenolepis procera* (Emery, 1900); *Myrmecina grandis* Okido, Ogata and Hosoishi, 2020; *Pheidole plinii* Forel, 1911; *Pheidole rabo* Forel, 1913; *Polyrhachis montana* Hung, 1970; *Ponera incerta* (Wheeler, 1933); and *Strumigenys doriae* Emery, 1887. Eighteen other species are new distributional records for the island of Mindanao.

Keywords: *Formicidae, Mindanao, new species record, Philippines.*

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Introduction

Biodiversity surveys are integral to the understanding of the biogeography of the ants of islands. The biogeography of the ants of the Philippine archipelago is far from clear, for at least three reasons.

First, the geology of the islands of the Philippines is complex. Most of the islands of the archipelago are oceanic, except for the Palawan Island Group (Lohman *et al*., 2011). The two largest islands, Luzon and Mindanao, are hypothesized to be accretions of smaller proto islands (Corpuz, 1992; Hall, 2002; Heaney *et al*., 2016). The complex geography of the islands may provide a wide range of microenvironments and opportunities for vicariance and dispersal of ants throughout the archipelago.

Second, the current knowledge of the diversity and distribution of ants in the Philippines is fragmentary. Many islands remain unexplored for ant diversity. Even the large islands of the central Philippines are scarcely explored. The current knowledge of the distribution of ant species by islands is also too coarse in resolution since the islands vary widely in area and topology.

Third, only a scant handful of researchers are actively surveying the ant diversity of the Philippines. This, together with scarce funding, produces a patchy and incomplete view of the diversity and distribution of ants throughout the archipelago.

Despite limiting factors, even student thesis projects uncover species new to science, such as an undescribed species of *Meranoplus* F. Smith, 1853 from Dinagat Island, northeast of Mindanao Island (P. Buenavente, pers. comm.). Opportunities to survey the ants of the different islands of the Philippines are few and far between, especially during the pandemic, when travel is severely restricted. Hence, it is imperative to publish the results of any surveys immediately to provide building blocks of knowledge towards the understanding of the biogeography of the ants of the Philippines.

This current contribution, presents the preliminary results of an ant transect survey in an area that became an active conflict zone and is now off-limits to outsiders.

Materials and Methods

Study site

Mt. Bungkasan is a part of the Mt. Pantaron Range, the most extensive massif in central Mindanao Island (Amoroso *et al*., 2020). The transect study was conducted near the boundary between the Provinces of Bukidnon and Agusan del Sur, in Sitio Mahayag, Saint Peter Village, Malaybalay City, Bukidnon Province, Mindanao Island (Fig. 1). The vegetation around the transect site is considered Tropical Upper Montane Rainforest and is dominated by *Falcatifolium gruezoi* de Laub. (Podocarpaceae), *Agathis philippinensis* Warb. (Araucariaceae), and *Gymnostoma rumphianum* (Miq.) L.A.S. Johnson (Casuarinaceae) (N. Lagunday, pers. comm.). The transect line itself is in disturbed second-growth forest and crosses a clearing where a tree had just been felled and sawn into rough lumber, indicating that illegal logging is being committed in the area (Fig. 2). The coordinates at the camp site, which is near the transect line are: 8.263986111 N, 125.3303194 E, with an elevation of 1200 masl.

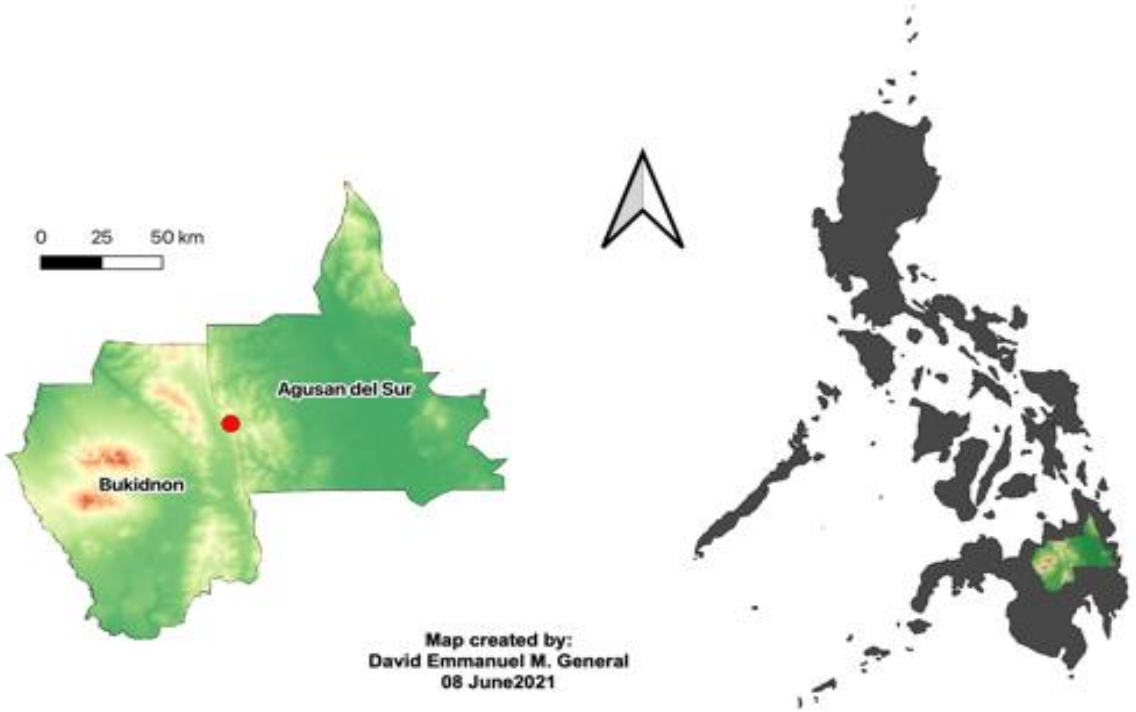

Figure 1: Approximate location of study site (red dot) near the boundary between the provinces of Bukidnon and Agusan del Sur on the Island of Mindanao. False color map indicates elevation from low elevation (green) to high elevation (red).

Collecting methods

Ants were collected using several methods. Ethanol (95% EtOH) was used to preserve all the specimens.

A modified and abbreviated ALL Protocol was applied (Agosti and Alonso, 2000), namely, Winkler extraction of ants from the leaf litter, pitfall trapping, twig and log breaking and opportunistic search through 10 sampling stations in a 100m horizontal transect. Opportunistic collecting was performed outside the transect, e.g., around the campsite.

Winkler extraction – leaf litter was gathered from a randomly selected $1m^2$ area of forest floor, sifted the leaf litter in a sifting bag, and the siftate was placed in a Winkler bag for 48 hours.

Pitfall trapping – at a spot diametrically opposite the leaf litter collection site, a plastic cup (70mm diameter, 85mm depth) about half-filled with a weak soap solution (1-2 drops liquid dish detergent in 1 litre fresh water) was placed in the ground with the edge flush to the ground. The trap contents were retrieved after

24 hours to avoid maceration of the specimens. The soapy specimens were immediately rinsed in fresh water before they were transferred to 95% EtOH.

Twig and log breaking – rotten twigs and logs on the forest floor were broken open and those that contained ant nests were collected. The ants were collected either by hand or by Winkler extraction after the rotten woody material were first comminuted.

Opportunistic search – ants were collected within the transect during a 15-minute search period.

Identification

The ants were identified first to genus using published keys (General and Alpert, 2012; Schmidt and Shattuck, 2014). Then the following species-level keys for individual genera were used to determine species identifications: *Aenictus* (Jaitrong and Yamane, 2011, 2012); *Anochetus* (Brown, 1978); *Echinopla* (Xu and Zhou, 2015); *Euprenolepis* (LaPolla, 2009); *Gnamptogenys* (Lattke, 2004); *Myrmecina* (Okido *et al*., 2020); *Myrmoteras* (Zettel and Sorger, 2011); *Pheidole* (Eguchi, 2001); *Polyrhachis* (*Polyrhachis*) (Kohout, 2014); *Ponera* (Taylor, 1967); *Recurvidris* (Bolton, 1992; Zettel, 2008); *Strumigenys* (Bolton, 2000); *Technomyrmex* (Bolton, 2007); *Tetramorium* (Bolton, 1976, 1977); and *Tetraponera* (Ward, 2001). Online resources were also consulted to confirm our determinations (AntWeb, 2021; AntWiki, 2021). All voucher specimens are deposited in the Entomological Collection of the University of the Philippines Los Baños Museum of Natural History (UPLB), the Natural History Museum of the Central Mindanao University (CMU), and the National Museum of the Philippines (NMP).

Imaging

Specimens were examined with a Leica S6D stereomicroscope. Images were created using a Leica MC120HD digital camera attached to the Leica S8APO stereomicroscope. These images were stacked using Combine ZM. The stacked images were edited with Adobe Photoshop CS5. The map was created in QGIS 3.14, using GIS data from PhilGIS 2021.

Figure 2: Area, where a tree was illegally felled and sawn into lumber, traversed by the transect line of this study.

Results

A total of 1,026 ants were collected, belonging to 75 species of 39 genera in seven subfamilies. Nine species are new distributional records for the Philippines: *Aenictus wayani* Jaitrong and Yamane, 2011; *Aphaenogaster feae* Emery, 1889; *Euprenolepis procera* (Emery, 1900); *Myrmecina grandis* Okido, Ogata and Hosoishi, 2020; *Pheidole plinii* Forel, 1911; *Pheidole rabo* Forel, 1913; *Polyrhachis montana* Hung, 1970; *Ponera incerta* (Wheeler, 1933); and *Strumigenys doriae* Emery, 1887.

The following 18 species are new distributional records for the Island of Mindanao: *Aenictus philippinensis* Chapman, 1963; *Anochetus graeffei* Mayr, 1870; *Calyptomyrmex beccarii* Emery, 1887; *Carebara maccus* (Wheeler, 1929); *Colobopsis vitrea* (F. Smith, 1860); *Cryptopone testacea* Emery, 1893; *Echinopla striata* F. Smith, 1857; *Ectomomyrmex leeuwenhoeki* (Forel, 1886);

Eurhopalothrix philippina Brown and Kempf, 1960; *Leptogenys peuqueti* (André, 1887); *Paraparatrechina iridescens* (Donisthorpe, 1942); *Pheidole fervens* (F. Smith, 1858); *Pheidole sayapensis* Eguchi, 2001; *Pheidole tjibodana* Forel, 1905; *Polyrhachis zopyra* F. Smith, 1861; *Ponera incerta* (Wheeler, 1933); *Strumigenys pedunculata* (Brown, 1953) and *Tetramorium insolens* (F. Smith, 1861).

Figs. 4 and 5 present the images of new Philippine records of species from this study. Fig. 6 presents the rank abundance plot of the collection.

Table 1 presents the list of species collected from the transect site and around the camp.

Behavioral Observations

Polyrhachis montana ants were observed to be foraging in the lumber slabs and sawdust (Fig. 2). They were then offered fish scraps, fish bones, and cooked rice as bait. The ants were strongly attracted to the bait and seemed to bite off small bits of fish bones (Fig. 3). One *P. montana* ant picked up a grain of cooked rice and walked uphill, up a tree, along a vine into the canopy. The ant was about 70 meters from the bait when it was lost to view. There was no evidence of group transport of larger bait items.

On another log, *Pheidole singaporensis* ants dominated some chicken bones as bait. The next day, the same bones, were being processed by a smaller (indeterminate) species of *Pheidole*.

Table 1. Preliminary checklist of the ants of Mt. Bungkasan, St. Peter Village, Malaybalay City, Bukidnon Province, Mindanao Island, Philippines

No.	Species	Transect	Camp
	Subfamily Dolichoderinae		
1	*Dolichoderus thoracicus*	B	
2	*Technomyrmex sundaicus*	W	
	Subfamily Dorylinae		
1	*Aenictus philippinensis**	O	
2	***Aenictus wayani***	O	
3	*Chrysapace jacobsoni*	W	
	Subfamily Ectatomminae		
1	*Gnamptogenys binghamii*	O	
2	*Gnamptogenys* sp. undet1	W	
	Subfamily Formicinae		
1	*Camponotus* sp. undet1	T	
2	*Camponotus* sp. undet2	B	
3	*Camponotus* sp. undet3		O
4	*Colobopsis corallina*	B, O	O
5	*Colobopsis vitrea**	B, T	
6	*Echinopla striata**		O
7	***Euprenolepis procera***	W, T, P	
8	*Lepisiota chapmani*	B	
9	*Myrmoteras insulcatum*	W	
10	*Nylanderia* sp. undet1	W	
11	*Paraparatrechina iridescens**	B, T	

12	*Polyrhachis armata*	B	O
13	***Polyrhachis montana***	O	
14	*Polyrhachis zopyra**		O
15	*Pseudolasius* sp. undet1	W, T	
	Subfamily Myrmicinae		
1	*Acanthomyrmex mindanao*	W	
2	***Aphaenogaster feae***	W, T	
3	*Calyptomyrmex beccarii**	W	
4	*Carebara diversa*		O
5	*Carebara maccus**	W, T, P	
6	*Carebara* sp. undet1	W	
7	*Crematogaster brunnea ruginota*		O
8	*Crematogaster* sp. undet1	B	
9	*Crematogaster* sp. undet2	B	
10	*Eurhopalothrix philippina**	W	
11	***Myrmecina grandis***	W	
12	*Myrmicaria aphidicola*	P, O	O
13	*Pheidole aglae*	W, T, P	
14	*Pheidole fervens**	B	
15	*Pheidole jacobsoni*	T	
16	*Pheidole kikutai*	O	
17	*Pheidole parva*	O	O
18	***Pheidole plinii***	O	
19	*Pheidole quadricuspis*	W	
20	***Pheidole rabo***	W	
21	*Pheidole retivertex*	W	
22	*Pheidole sayapensis**	W	
23	*Pheidole singaporensis*	W, P, O	
24	*Pheidole* sp. undet1	W	
25	*Pheidole tjibodana**	W	
26	*Recurvidris* sp. undet1	W	
27	*Strumigenys arrogantia*	W	
28	***Strumigenys doriae***	W	
29	*Strumigenys koningsbergeri*	W	
30	*Strumigenys pedunculata**	W, T	
31	*Strumigenys* sp. undet1	W	
32	*Strumigenys* sp. undet2	W	
33	*Tetramorium insolens**	W, B	
34	*Tetramorium katypum*	W, B	

35	*Tetramorium pacificum*	B, O	
36	*Tetramorium wroughtonii*	W	O
37	*Vollenhovia ambitiosa*	W, P, O	
38	*Vollenhovia* sp. undet1	W, T	
39	*Vollenhovia* sp. undet2		O
40	*Vombisidris* sp. undet1	B	
	Subfamily Ponerinae		
1	*Anochetus graeffei**	W	
2	*Brachyponera obscurans*	W, T, P	
3	*Brachyponera* sp. undet1	W	
4	*Cryptopone testacea**	W, P	
5	*Ectomomyrmex leeuwenhoeki**	W	
6	*Hypoponera* sp. undet1	T	
7	*Hypoponera* sp. undet2	W, O	
8	*Leptogenys peuqueti**	P	
9	*Leptogenys* sp. undet1	W	
10	*Odontoponera denticulata*		O
11	***Ponera incerta***	W	
12	*Pseudoponera stigma*	W	
	Subfamily Pseudomyrmecinae		
1	*Tetraponera allaborans*		O

Ants were collected at either the transect site or the camp and environs. Collection techniques used were B = Beating of low vegetation; O = Opportunistic collecting; P = Pitfall trapping; T = Twig or wood breaking; and W = leaf litter sifting and Winkler extraction. Species names in boldface are new distributional records for the Philippines. Species names with * are new distributional records for the Island of Mindanao.

Figure 3: *Polyrhachis montana* ants at baits of cooked rice and fish bones

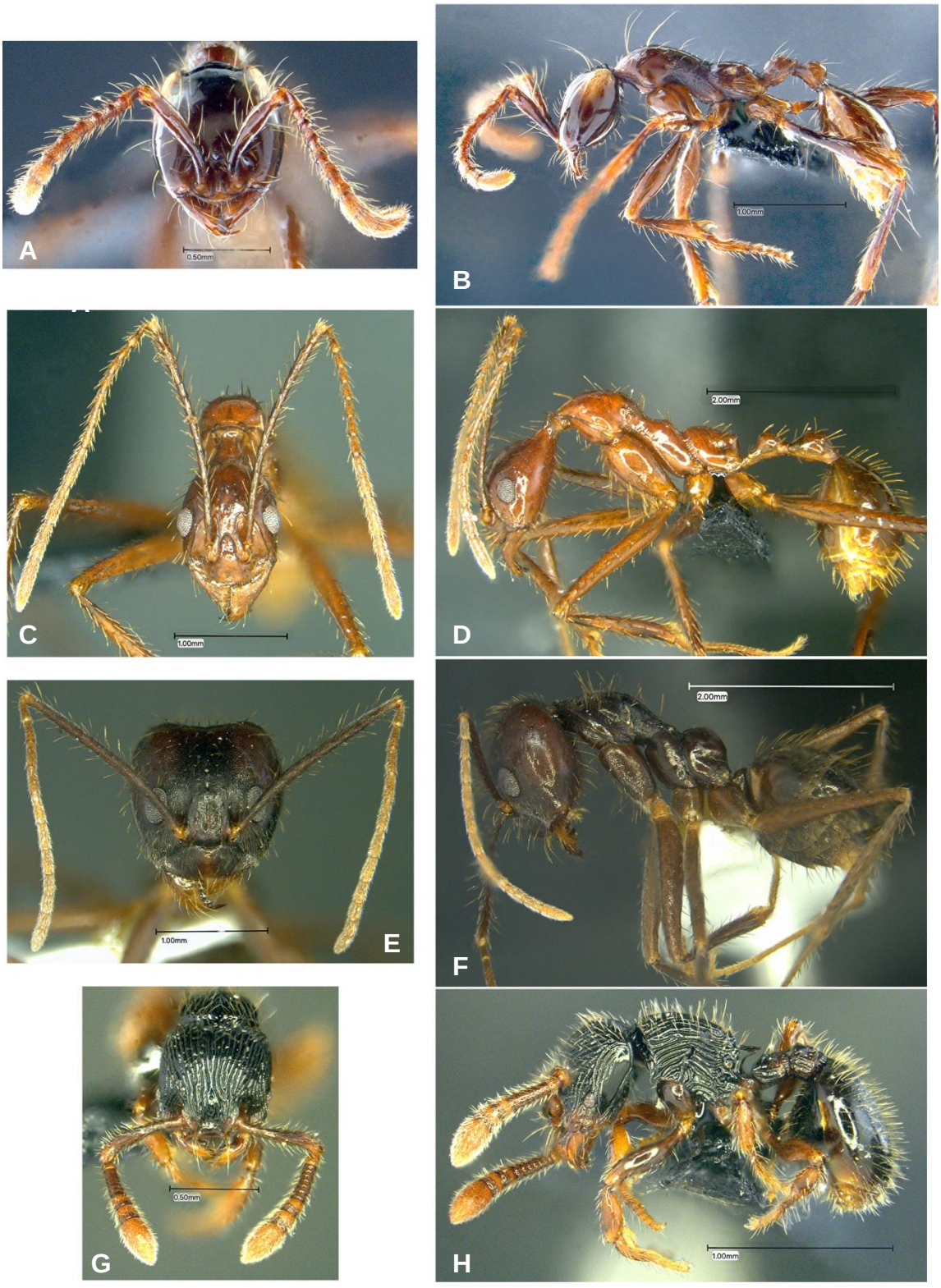

Figure 4: Some new Philippine records of species from Mt. Bungkasan, Bukidnon Province, Mindanao Island, Philippines, full-face view and lateral habitus. **A-B:** *Aenictus wayani*; **C-D:** *Aphaenogaster feae*; **E-F:** *Euprenolepis procera*; **G-H:** *Myrmecina grandis*.

Figure 5: Some new Philippine records of species from Mt. Bungkasan, Bukidnon Province, Mindanao Island, Philippines, full-face view and lateral habitus. **A-B:** *Pheidole plinii*; **C-D:** *Pheidole rabo*; **E-F:** *Polyrhachis montana*; **G-H:** *Ponera incerta*; **I-J:** *Strumigenys doriae*.

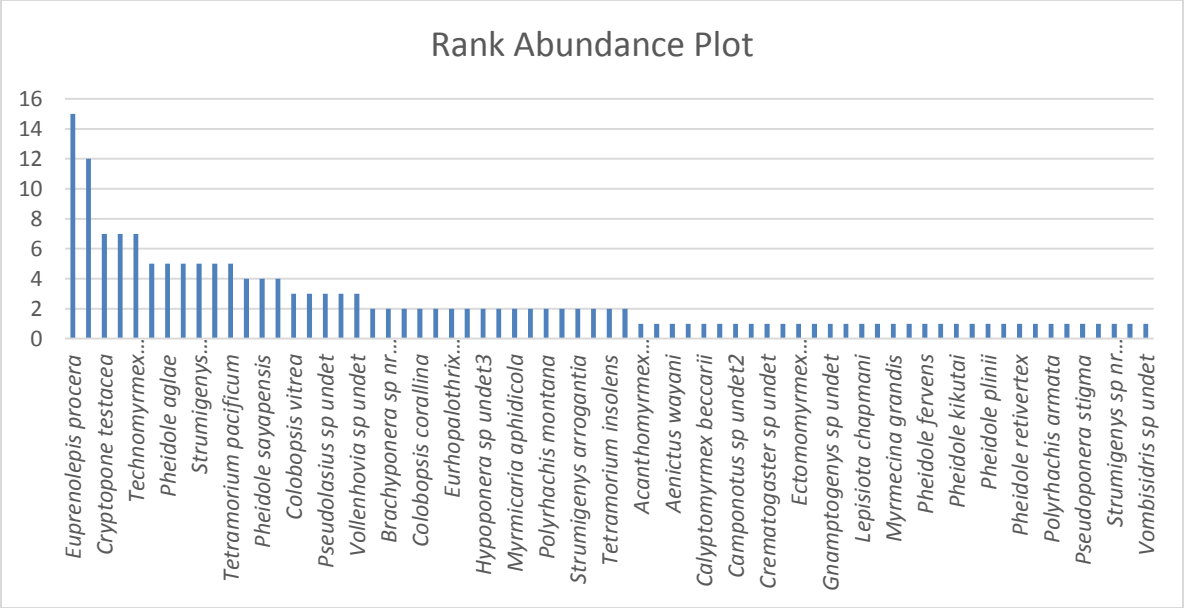

Figure 6: Rank abundance plot of ant collection. The horizontal axis is the partial list of species arranged from the highest number of occurrences in the pooled dataset. The vertical axis is the number of occurrences, or number of times the species was collected in the transect, combining all the collecting techniques.

Discussion

This current contribution provides another small look at the diversity of ants on Mindanao Island, in particular, and the Philippines, in general. The number of new country records and new island records of species is remarkable considering that only one transect was conducted. Unfortunately, the study site is now closed to researchers because it has become an active conflict area. The results suggest that Mindanao is a rich hunting ground for ant diversity studies.

Biodiversity surveys in unexplored regions, such as the mountainous central Mindanao, almost always discover new species records and potentially new species. This current study is no exception, having recorded nine new Philippine distributional records of species and 18 new distributional records for the island of Mindanao.

This study is another small building block for understanding the biogeography of the ants of the Philippines.

Conclusion

The ant diversity of Mindanao Island, despite being the second largest island of the Philippines, is poorly studied. The researcher must overcome many challenges to conduct field work in Mindanao, including a dangerous insurrection. Returning to the study site to conduct further field work is currently impossible. It is uncertain when it becomes safe again to visit the area.

This study is a fortunate output of a collaborative biodiversity survey project among three research institutions, namely UPLB, CMU, and NMP, in the Philippines. Nevertheless, the project itself proceeded haltingly because of the pandemic. And more surveys of Mindanao Island are needed to further elucidate the fine-scale distribution of ants on the island.

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