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Integrative survey for ant diversity: exhaustive deployment of several ant collection methods in Biological Education and Research Forest of Universitas Andalas, Indonesia

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Abstract

A long period of ant sampling has been conducted in Biological Education and Research Forest (BERF), Universitas Andalas, West Sumatra, Indonesia by deploying several methods i.e. direct hand collection in rotten logs, at flowering plants and at bird nests, Quadra Protocol for sampling diurnal and nocturnal ground ants and subterranean trap for soil ants. A total of 100 ant species which taxonomically grouped into 41 genera, 15 tribes and eight subfamilies resulted from this study. Myrmicinae became subfamily with the most species recorded (46 species), after the Formicinae with 28 species and Ponerinae with 11 species. On the other hand, the rest subfamilies were represented with less species e.g. Dolichoderinae (6 species), Dorylinae (3 species), Pseudomyrmicinae (3 species), Ectatommine (2 species) and Ambliponinae (1 species). *Pheidole* was genus with the most species recorded (17 species) followed by *Crematogaster* (7 species) and *Polyrhachis* (6 species). Quadra Protocol became the most effective method to record ant species in this study (42 species), subsequently followed by purposive hand collection method (40 species), subterranean trap (10 species), direct collection in rotten logs (8 species), observation at flowering plants (8 species) or collection from within bird nests (4 species). Despite the robustness of inventory produced from this study, it is indicated that BERF area still holds more ant species that are not recorded by research done so far.

Keywords: Ant diversity, Biology Education and Research Forest, ground ants, subterranean ants, arboreal ants

1. Introduction

Ants are estimated to comprise around 30% of terrestrial faunal biomass in the world (Hölldobler and Wilson, 1990). Ants are essential ecological components as they have direct interaction with plants (Putri *et al.* 2016), soil organisms (Meer, 2012) and other organisms in the most of trophic levels. Their roles usually relate to seed consumption (Andersen, 1990; Majer, 1990) and dispersal (Majer, 1990). Acting as predators for pest insects (Choate and Drummond, 2011), ants retain equal value with other predators such as lady beetles, lacewings and mantis (Saleh et al., 2010; Sanda and Sunusi, 2014).

Ants have been recognized as a useful ecological indicator as similar as with bees, as they exist in abundant numbers and ubiquitously, even at a disturbed area (Andersen, 1990; Schreven at al., 2018; Munyuli, 2012). Ants are very sensitive to environmental disturbances, hence they rapidly respond to any change in their habitat (Van Der Woude *et al*., 1997; Andersen, 1990). On the other hand, ants build stationary nests with limited foraging range, which helps with avoiding competition among species and colonies (Agosti *et al.*, 2000).

Ants have become long-standing research objects. They are reported to have high diversity in tropical rainforest of Southeast Asia (Yamane, 1996; Chung and Maryati, 1996; Brühl *et al*, 1998; Idris *et al*., 2002). In Indonesia, ant diversity was studied from various locations in Java, such as at Bogor Botanical Garden, West Java, where 216 ant species inventoried (Ito *et al*., (2001); 48 species were recorded from conservation area in Kepulauan Seribu, Jakarta (Rizali *et al*., 2008); 37 species were reported from around Mount Krakatou in Sunda Strait (Asfiya *et al*., 2010. Meanwhile in Sumatra, 76 ant species were recorded from oil palm plantation in West Sumatra and Riau (Herwina *et al*., 2020), 27 ant species were collectively observed across altitudinal gradients in Mt. Talang, West Sumatra (Herwina *et al*., 2020), in addition to 18 species

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that were found associated with white germ in potato plantation of highland agricultural area (Herwina, 2020).

Universitas Andalas is located in Limau Manis, Pauh Subdistrict, approximately 15 km from the downtown of Padang City, West Sumatra Province. Universitas Andalas covers 500-hectare area, where its forested surrounding is considerably representative to hold various topics of field research, including those in entomology. The prominent forested area is situated within the Biological Education and Research Forest of approximate 150-hectare area. The BERF site harbors lowland tropical rainforest connected with the Bukit Barisan Range (Rizaldi *et al*., 2018). It has been the ground for ant research since more than two decades ago (Herwina *et al*, 2018). This study aimed to trackback the progress of works on ants in Universitas Andalas campus complex, as well as to analyze the ecological aspects of ants, such as species diversity and composition.

2. Materials and Methods

2.1. Study area and sampling methods

The data used in this study was synthesized from published and unpublished works mainly conducted within Biological Education and Research Forest (hereinafter BERF), Universitas Andalas, Indonesia (GPS coordinates 1°00'S, 100°30'E; Figure 1). The samplings were undertaken at ten sites established between 250 to 450 m elevation in BERF, with measured temperature between 28 to 32°C. Sampling sites can be detailed as Site 1 (permanent plots for plant ecological study, dominated by secondary vegetation and medium trees), Site 2 (water dam 1, located at forest edge with early successive vegetation), Site 3 (camping ground with grasses and tall trees), Site 4 (water dam 2 inside forested area of BERF), Site 5 (bushy area in the border of BERF), Site 6 (Puncak Ixora, a peak of small hill with big trees and other primary vegetation), and Site 7 (bushy area in adjacent to Site 1). Site 8 to 11 are located on the borderline between BERF and campus area, separated by concrete road and each marked with field station or research lodge. Methodology applied in preceding and recent works conducted at those sites can be summarized as follow (also see Table 1): at Site 1 to 6, quadra protocol for ant collection (Hashimoto *et al*., 2001), which repeated between 2013 to 2016 (*unpublished*); Site 7, subterranean trap and probe (Herwina *et al*., 2018); Site 8, rotten log ant collection (*unpublished*); Site 9, ant collection in bird nests (Herwina *et al*., 2021); Site 10, hand collection method (ongoing since 2010; *unpublished*); and Site 11, hand collection and recording ant visitation at flowering plants (2019, *unpublished*). The exact position of sampling sites in BERF can be seen in Figure 1 below.

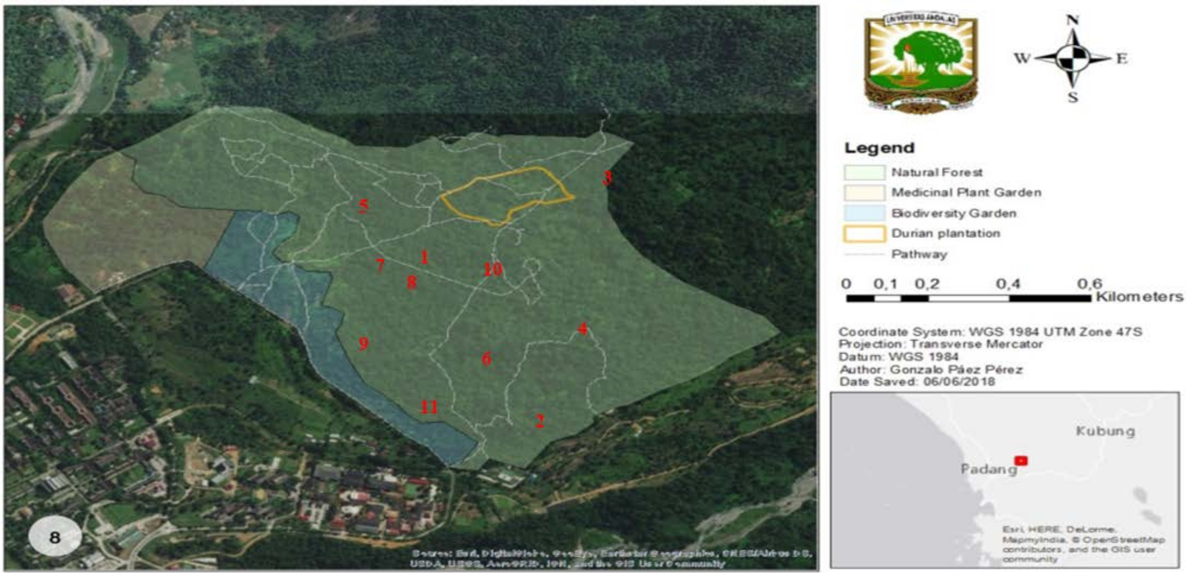

Figure 1. Sampling sites for ant collection at Biological Education and Research Forest (BERF), Universitas Andalas. No 1-11 = sites numbers.

2.2. Species Species Identification

Sampled ants were sorted to morphospecies and genus level before prepared according to the standard preparation for ant specimen. Identification process was guided by appropriate literatures (Hashimoto, 2003; Jaitrong, 2011; Bolton, 2014) in addition to being compared with specimen housed at the Animal Taxonomy Laboratory of Biology Department, Universitas Andalas. Any specimen resulted from the works listed here was also stored in this place.

2.3. Data Analysis

Ants were grouped into their taxonomic orders as follows; species, genus and subfamily. Individual and species number were counted and tabulated. The Shannon-Wiener formula (Magurran, 2004) was used to calculate species diversity, while Estimate S Veers. 9.0 was for calculating the rarefaction curves of observed and estimated number of ant species. The formula for species diversity is below:

$$H' = -\sum_{i=1}^{n} pi \ln pi$$

H'= Species diversity index

pi = Total proportion of sample from the i^{th} species

3. Results and Discussion

This study recorded a total of 100 ant species from 43 genera and eight subfamilies. They were identified from overall sampling efforts within BERF that spanned from 2010 to 2019 (Table 1, Apendix 1). The subfamily Myrmicinae was observed with the highest species number (46 species), followed by 28 species of Formicinae, 11 species of Ponerinae, 3 species each for Dorylinae and Pseudomirmicinae, two species of Ectatomminae and one species of Ambliponinae (Appendix 1). Myrmicinae was frequently reported as family with the highest species number observed in many previous studies (such as Shattuck, 1999; Herwina *et al*., 2013). *Pheidole* was genus with the most species recorded (17 species) in this study, followed by *Crematogaster* (7 species) and *Polyrhachis* (6 species). *Pheidole* was reported as genus with the highest species number in previous studies, including among subterranean ants (Herwina *et al.*, 2018), within the species inventory from conservation forest and oil palm plantation in West Sumatra (Herwina *et al*., 2020) or from the protected forest in Riau (Putri *et al.*, 2021). *Crematogaster* and *Polyrhachis* were also previously recorded as genera with high species number (Herwina *et al*., 2020).

Table 1. Sampling times, sites, methods, total number of species (S), total number of individuals (N), species increment (SI), and species accumulation (SA) synthesized from works on ants in BERF, Universitas Andalas

Site #	Time	Site remark	Methodology	S	N	SI	SA
1	2013	Permanent plots inside primary forest	Quadra protocol	25	336	0	25
2	2014	Water dam 1, secondary forest	Quadra protocol	34	1289	12	37
3	2014	Camping ground, open grassland with trees	Quadra protocol	35	1510	12	49
4	2014	Water dam 2, secondary forest	Quadra protocol	19	1121	0	49
5	2016	Bushes	Quadra protocol	32	931	13	62
6	2016	Hilly forested area	Quadra protocol	42	2316	16	78
7	2017	Bushes and thickets	Subteranean ant collection	10	369	3	81
8	2018	Primary forest interior	Rotten log ant collection	8	62	4	85
9	2018	Forest edge	Collection from bird nests	4	19	1	86
10	2010, 2012, 2018	Primary forest interior	Hand collection applied purposively	40	-	14	100
11	2019	Forest edge	Hand collection, photography documentation	8	-	0	100
Diversity Index (H')			3.25				

The inventory of ant species and subfamilies recorded in this study exceeded any previous study from other locations in West Sumatra, which included natural reserves, agricultural and household area. The BERF, in overall, can be considered as good habitat for ants, as high species diversity observed in this study (H'=3.25, Table 1) . The ants recorded here were more diverse than those observed at white germ and potato plantation in Sumatran highland agricultural area (Herwina *et al*., 2020c), at oil-palm plantations and its conservation forest in Solok Selatan, West Sumatra (Herwina *et al*., 2020d), at some altitudes of Mount Talang, West Sumatra (Herwina *et al*., 2020e), or at several islands offshore of Sulawesi (Asfiya *et al*., 2010).

Site six contributed the highest among other sites, in terms of collecting 2,316 ant individuals that identified into 42 species recorded and increased 16 new records into the species accumulation record (Table 1). Site 3 (1,510 individuals, 35 total species, 12 new records), Site 2 (1,280 individuals, 34 total species, 12 new records) and Site 5 (931 individuals, 32 total species, 13 new records) were also significantly increasing species inventory to BERF area. The works on Site 10 and 11 were majority based on sporadic rapid assessment on ant species without paying much attention on collecting individual, hence no exact number provided for collected individual. The work on Site 10, however, recorded total 40 species with additional 14 new records to the BERF's ant species inventory. In addition to sampling efforts and methodology applied in collecting ants, physical-ecological factors were also thought to play role in having high sampling result. Sites with high individual number, total species and/or species increment (Site 2, 3, 4, 5, 6 and 10) were with denser secondary or primary cover, thicker leaf litter coverage on ground surface and more organic resources needed by ants than the other sites. The abundance of organic materials within the tropical vegetated area are useful for food, nesting site or other purposes for ants; hence the high ant diversity and population found in this type of habitat (Rizali *et al.*, 2008; Sabu *et al.*, 2008; Souza-Campana *et al.*, 2017).

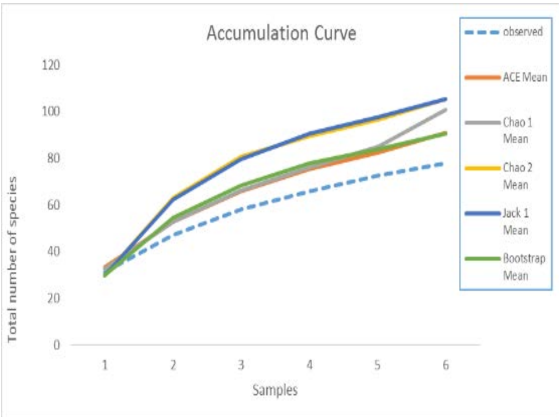

Figure 2. Accumulation curve of ant species collected by using quadra protocol at BERF

When counting the result method-wise, there was difference observed on the number of species resulted from each sampling method. Quadra protocol singly and remarkably accumulated a total of 78 ant species from six sites within the BERF area (Figure 2). Moreover, the computerized calculation performed using the data from quadra protocol provided estimation curve that predicted the possibility of actual number of 85-100 ant species could be recorded at BERF if this method continuously applied. Quadra protocol involved thorough sampling procedure by simultaneously applying four collection techniques (hand collection, leaf litter sifting, soil core sampling and honey bait trap) within three sections of a 180 m transect. Hence, the techniques can be complimentary in collecting various ants with different life habits, instead of single technique or method that focus on one specific life habit. Given the species increasing trend that showed in Figure 2, indicated that further sampling efforts will potentially enrich the inventory of ant species in BERF.

Lophomyrmex bedoti was frequently collected in BERF (82%), along with *Pheidole aristotelis* and *Pheidole* sp 3. of HH (73% each), tailed by *Diacamma holosericum* and *Acanthomyrmex ferox* (64%). *Lophomyrmex* was reported as generalist foragers and tropical climate specialist, which explain their successfulness in adapting to various habitats (Brown, 2000). Genus *Pheidole* was recorded with many species in this study, while *D. holosericum* and *A. feroxs* were the two species with prominent frequency. All of these taxa were collected using quadra protocol, which may emphasize the effectiveness of this sampling method to detect common and abundant ant species.

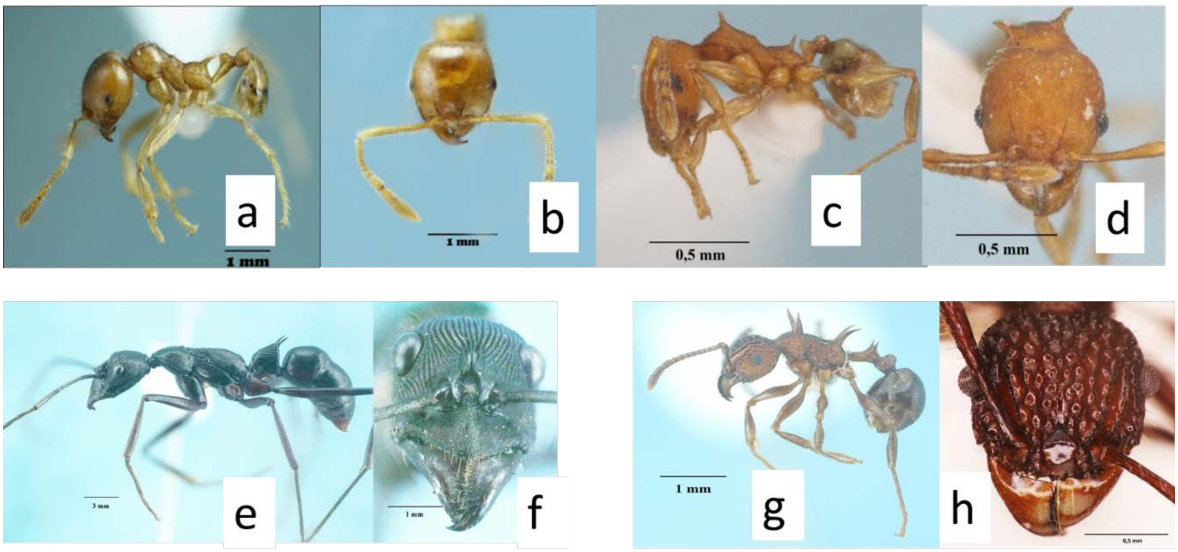

Figure 3. Abundant ant species in BERF (lateral and anterior-rostral aspect). A,b = *Lophomyrmex bedoti*. C,d = *Pheidole aristotelis*, e,f = *Diacamma holocericum*, g,h = *Acanthomyrmex ferox*.

Diacamma ants were observed to prefer the secondary portion of BERF, similarly with *A. ferox*. It is thought to be related with their feeding habit and in connection to the resource available in such secondary habitat. The first taxon mainly consists of predatory species, while the later more of seed harvester (Brown, 2000). Some species were infrequently observed at one or a few sites with a handful individuals collected. These included *Dolichoderus* spp., *Aenictus* spp., *Gnamptogenys coxalis*, *Camponatus* spp., *Odontomachus minangkabau*, *O. rixoxus*, *Carebara* cf. *affinis*, *Meranoplus mucronatus*, *Crematogaster medigmiani*, *Paratrechina* sp. 1 or *Anoplolepis gracilipes* (Appendix 1).

The current study also recognized the existence of alien, tramp and invasive ant species from sites in BERF, i.e. *Tapinoma melanocephalum*, *Anoplolepis gracilipes*, and *Paratrechina longicornis*. These categories are attached to species that extend their distribution outside their original range by adapting and invading new territory (Pfeiffer *et al*., 2008). The presence of alien, tramp and invasive ant species in BERF gave strong indication of interference incurred from high human activities, which in many cases, negatively impacts the habitat for wildlife. The movement and distribution of alien, tramp and invasive species have been thought to be mediated by human activities (Pfeffer et al., 2008; Wetterer 2009, 2010). Since these alien, tramp and invasive species have good adaptability to new or disturbed habitats, they can also negatively influence the native communities (Pfeffer et al., 2008). Hence, from the ecological standpoint of ants, this study can provide further recommendation to reduce human interference within the BERF area in order to maintain better habitats therein.

4. Conclusion

Combining some collection methods for sampling ant show significant species number can be recorded at Biological Education and Research Forest of Universitas Andalas. The total species number accumulated in this study was the highest among other studies reported from Sumatra. Quadra Protocol, a standardized method for rapid assessment of ants, collected prominent number of species among other methods listed in this study as well as effective to detect frequent and abundant ant species. The analysis on the procured data indicates the possibility to record more ant species given the field exploration continued. Alien, tramp and invasive ant species were also observed during the study, indicated existing interference incurred from human activities within BERF.

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Appendix 1. List of Subfamily, Tribe and Species of ants collected by using several methods in HPPB Universitas Andalas.

Sampling sites along with collection method as follows: site 1 = Permanent Plot inside BERF in 2014 (daytime Quadra Protocol), site 2 = Water Dam site point 1 in 2014 (daytime Quadra Protocol), site 3 = Camping ground, on 2014 (daytime Quadra Protocol), site 4 = Water Dam site point 2, in 2014 (Night Quadra Protocol), site 5 = bushy area, in 2016 (daytime Quadra Protocol), site 6 = Puncak Ixora, in 2017 (daytime Quadra Protocol), site 7 = bushy area and permanent plot, in 2017 (subterranean ant collection), site 8 = BERF area, purposive sampling, in 2018 (rotten log ant collection), site 9 = BERF area, purposive sampling, in 2018 (bird nest ant collection), site 10 = BERF area, purposive sampling, between 2010-2018 (hand collection), site 11 = BERF area (ants as pollinator); T = total, F = ant frequency at sampling sites. asterisk (*) indicate individual number for that species unavailable.

No.	Sp Code	Subfamily	Species	Total number of individuals at each Sites											T	F
				1	2	3	4	5	6	7	8	9	10*	11		
1	421	Amblyponinae	*Mystrium camillae* Emery, 1889										1		1	1
2	219	Dolichoderinae	*Dolichoderus* sp. 1 of HH					2							2	1
3	346		*Dolichoderus* sp. 2 of HH					1							1	1
4	81		*Dolichoderus thoracicus* (F. Smith, 1860)						17					1	18	2
5	42		*Tapinoma melanocephalum* (Fabricius, 1793)			3	6								9	2
6	36		*Technomyrmex horni* Forel, 1912		15	3	19								37	3
7	48		*Technomyrmex kraepelini* Forel, 1905			11	397		27					1	436	4
8	424	Dorylinae	*Aenictus gracilis* Emery, 1893										1		1	1
9	437		*Aenictus laeviceps* (F. Smith, 1857)										1		1	1
10	251		*Iridomyrmex anceps* (Roger, 1863)						1						1	1
11	425	Ectatomminae	*Gnamptogenys coxalis* (Roger, 1860)										1		1	1
12	28		*Gnamptogenys menadensis* (Mayr, 1887)	16		7		18					1		42	4
13	46	Formicinae	*Camponotus (Tanaemyrmex) arrogans* (F. Smith, 1858)			10	43	9						1	63	4
14	11		*Camponotus (Tanaemyrmex) odiosus* Forel, 1886	1	1	1									3	3
15	153		*Camponotus (Tanaemyrmex)* sp. 12 of SKY					2							2	1
16	426		*Camponatus* sp. 4 of HH								5				5	1
17	101		*Colobopsis leonardii* Emery, 1889						1				1		2	2
18	53		*Colobopsis* cf. *saundersi* Emery, 1889			6							1		7	2
19	39		*Dinomyrmex gigas* (Latreille, 1802)		1			1	1				1		4	4
20	6		*Polyrhachis (Myrma) hosei* Donisthorpe, 1942	2	2										4	2
21	196		*Polyrhachis (Myrma)* cf. *vindex* F. Smith, 1857		3										3	1
22	18		*Polyrhachis (Myrmatopa) phalerata* Menozzi, 1926	4	3										7	2
23	201		*Polyrhachis (Myrmhopla) armata* (Le Guillou, 1842)						1						1	1
24	158		*Polyrhachis (Polyrhachis) bihamata* (Drury, 1773)						5						5	1

No.	Sp Code	Subfamily	Species	Total number of individuals at each Sites											T	F
				1	2	3	4	5	6	7	8	9	10*	11		
25	19		*Polyrhachis (Polyrhachis) olybria* Forel, 1912	4	12			1							17	3
26	427		*Myrmoteras bakeri* Wheeler, 1919										1		1	1
27	55		*Myrmoteras* sp. 1 of HH			1									1	1
28	51		*Myrmoteras* sp. 2 of HH			1									1	1
29	57		*Oechophylla smaragdina* (Fabricius, 1775)						1					1	2	2
30	2		*Anoplolepis gracilipes* (F. Smith, 1857)	16	535		244	17	2				1		815	6
31	8		*Euprenolepis procera* (Emery, 1900)	4		6		240	3			1			254	5
32	410		*Nylanderia obscura* (Mayr, 1862)						16			`			16	1
33	43		*Nylanderia* sp. 1 of HH			10	13	2	20					1	46	5
34	13		*Nylanderia* sp. 2 of HH	4	132		43		2						181	4
35	44		*Nylanderia* sp. 3 of HH			8	40		5						53	3
36	421		*Paraparatrechina butteli* (Forel, 1913)						3						3	1
37	26		*Paraparatrechina* sp. 1 of HH	4	7	5		2	56		1				75	6
38	38		*Paraparatrechina* sp. 2 of HH		2	8									10	2
39	198		*Paratrechina longicornis* (Latreille, 1802)						4						4	1
40	10		*Pseudolasius* sp. 1 of HH		4										4	1
41	428	Myrmicinae	*Pheidole acantha* Eguchi, 2001								12				12	1
42	16		*Pheidole aristotelis* Forel, 1911	8	4	6	1		32	37	22		1		111	8
43	12		*Pheidole longipes* (Latreille, 1802)	52	24	15			434				1		526	5
44	103		*Pheidole plagiaria* Smith, 1860					3							3	1
45	307		*Pheidole quadrensis* Forel, 1900					59	2			2			63	3
46	429		*Pheidole* cf. *sauberi* Forel, 1905										1		1	1
47	7		*Pheidole* sp. 1 of HH	1		809			124	13 1			1		1066	5
48	14		*Pheidole* sp. 2 of HH		78	81	2	33							194	4
49	29		*Pheidole* sp. 3 of HH	22	74	38	5	5	20	1			1		166	8
50	4		*Pheidole* sp. 4 (major worker) of HH	6	8	2		6							22	4
51	197		*Pheidole* sp. 5 of HH			39			79						118	2
52	171		*Pheidole* sp. 8 of HH					264	421						685	2
53	174		*Pheidole* sp 11 of HH			4									4	1
54	192		*Pheidole* sp. 12 of HH							2			1		3	2
55	193		*Pheidole* sp. 13 of HH					1							1	1
56	240		*Pheidole* sp. 14 of HH					1							1	1
57	396		*Pheidole* sp. 17 of HH						1						1	1
58	430		*Strumigenys chimaera* Bolton, 2000										1		1	1
59	21		*Strumigenys koningsbergeri* Forel, 1905	1	2								1		4	3
60	275		*Srtumigenys* sp. 2 of HH						1						1	1
61	17		*Acanthomyrmex ferox* Emery, 1893	16	1	15	10	4	37				1		84	7

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				1	2	3	4	5	6	7	8	9	10*	11		
62	168		*Acanthomyrmex padanensis* Terayama, Ito & Gobin, 1998					3	16				1		20	3
63	23		*Carebara* cf. *affinis* (Jerdon, 1851)	26	56	78		6			8		1		175	6
64	314		*Carebara* cf. *pygmaea* (Emery, 1887)						11						11	1
65	291		*Cataulacus horridus* F. Smith, 1857										1		1	1
66	253		*Crematogaster (Crematogaster)* cf. *rogenhoferi* Mayr, 1879					13					1	1	15	3
67	22		*Crematogaster (Decacrema) borneensis* Andre, 1896	8	28		39								75	3
68	252		*Crematogaster (Orthocrema) longipilosa* Forel, 1907					34	412						446	2
69	409		*Crematogaster (Paracrema) coriaria* Mayr, 1872						7						7	1
70	24		*Crematogaster (Paracrema) modiglianii* Emery, 1990	33	99	29	142	29	24						356	6
71	431		*Crematogaster (Physocrema) inflata* F. Smith, 1857										1		1	1
72	228		*Crematogaster (Physocrema) sewardi* Forel, 1901						6				1	1	8	3
73	5		*Lophomyrmex bedoti* Emery, 1893	55	22	77	62	1	16	179	1		1		414	9
74	122		*Lordomyrma* sp. queen of HH		1										1	1
75	25		*Meranoplus mucronatus* F. Smith, 1857		30	4	27	2	21				1		85	6
76	**423**		*Pristomyrmex bicolor* Emery, 1900							1			1		2	2
77	175		*Recurvidris browni* Bolton, 1992					26	451						477	2
78	27		*Tetramorium kheperra* (Bolton, 1976)		6	57									63	2
79	177		*Tetramorium pacificum* Mayr, 1870						1						1	1
80	**420**		*Tetramorium smithi* Mayr, 1879						6						6	1
81	**432**		*Tetramorium* sp. 2 of HH								1				1	1
82	33		*Aphaenogaster (Deromyrma)* cf. *feae* Emery, 1889	2	1			95	6				1		105	5
83	195		*Monomorium* cf. *chinense* (Santchi, 1925)		17										17	1
84	37		*Monomorium floricola* (Jerdon, 1851)		23				1			16		1	41	4
85	45		*Monomorium* sp. of HH			99	23								122	2
86	54		*Solenopsis geminata* (Fabricius, 1804)			2				1			1		4	3
87	230	Ponerinae	*Anochetus rugosus* Donisthorpe, 1941										1		1	1
88	34		*Brachyponera* sp. 28 of SKY		46	12									58	2
89	3		*Diacamma holosericum* (Roger, 1860)	25	11	17	1	37	15				1		107	7
90	422		*Hypoponera truncata* (Smith, F. 1860)							8			1		9	2

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				1	2	3	4	5	6	7	8	9	10*	11		
91	434		*Hypoponera* sp. 5 of HH								12				12	1
92	231		*Leptogenys parvula* Emery, 1900										1		1	1
93	185		*Odontomachus minangkabau* Satria *et al*., 2015	1	1	3			7	8			1		21	6
94	20		*Odontomachus rixosus* F. Smith, 1857	4	12	21	4	13					1		55	6
95	191		*Odontoponera denticulata* (F. Smith, 1858)					1		1					2	2
96	1		*Odontoponera transversa* (F. Smith, 1857)	21	28	22							1		72	4
97	435		*Pseudoneoponera tridentata* F. Smith, 1858										1		1	1
98	113	Pseudomyrmecinae	*Tetraponera attenuata* F. Smith, 1887										1		1	1
99	436		*Tetraponera crassiuscula* (Emery, 1900)										1		1	1
100	437		*Tetraponera allaborans* (Walker, 1859)									1			1	1
Total number of individual				336	1289	1510	1121	931	2316	369	62	19	40	8		
Total number of species				25	34	35	19	32	42	10	8	4	40	8		