Ecography

ECOG-04730

Plowman, N. S., Mottl, O., Novotny, V., Idigel, C., Philip, F. J., Rimandai, M. and Klimes, P. 2019. Nest microhabitats and tree size mediate shifts in ant community structure across elevation in tropical rainforest canopies. – Ecography doi: 10.1111/ecog.04730

Supplementary material

Appendix A1 - Supplementary Figures & Tables

Supplementary Figures

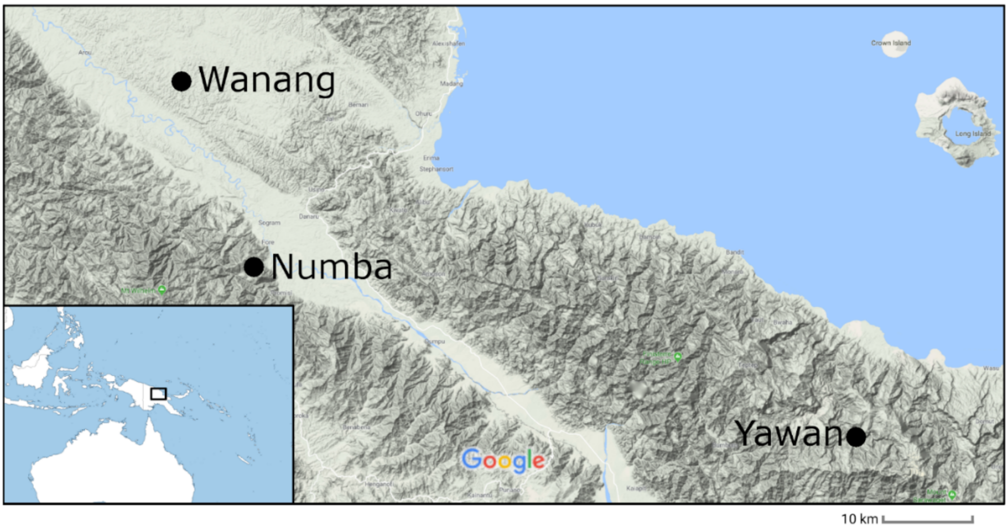

Figure A1. Map indicating location of study sites in north-eastern Papua New Guinea. We sampled two lowland forest plots near Wanang village (~200 m.a.s.l; 05°140S 145°110E), one mid-elevation forest plot near Numba village, Bismarck Range (~900 m.a.s.l; 5°43’18”S, 145°16’2”E), and two high elevation forest plots near Yawan village, Saruwaged Range (~1800 m a.s.l; 6°09’46’’S146°50’22’’ E). Image adapted from Map data © 2018 Google.

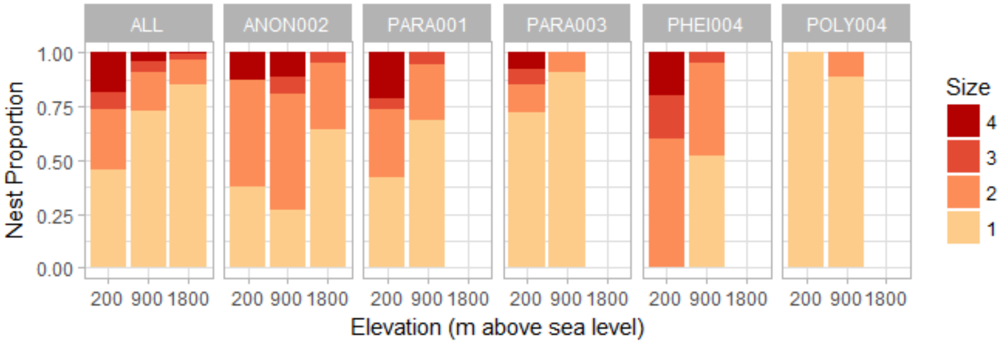

Figure A2. Change in nest size distribution of tree-nesting ants over elevation. Nest size categories are based on the estimated number of workers per nest (1: ≤100, 2: ~100-500, 3: ~500-1000, 4: >1000). Nest size significantly differed between three elevations ($\chi 2=297.64$, df= 6, $P < 0.001$, n=2143) with a decreasing proportion of large nests (cat. 2-4) and an increase in small nests (cat. 1). A similar pattern was found for the most common species present at more than one elevation: *Anonychomyrma scrutator* (ANON002, n=79), *Paraparatrechina pallida* (PARA001, n=57), *Paraparatrechina minutula* (PARA003, n=74), *Pheidole hospes* (PHEI004, n=31) and *Polyrhachis debilis* (POLY004, n=40).

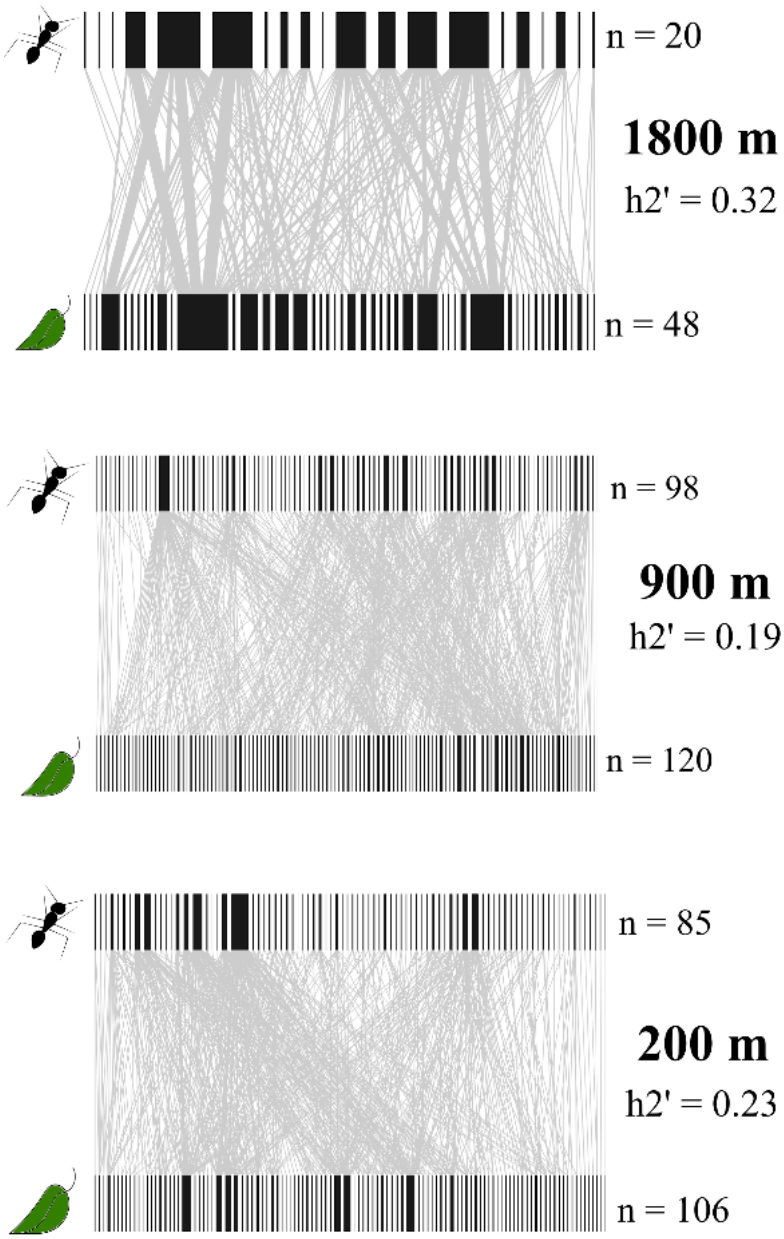

Figure A3. Bipartite networks with elevation between ants and trees hosting their nests, with h2’ network specialisation index. Upper bars represent ant species, lower bars represent the tree species they are found nesting in. All elevations have low network specialisation (0 being completely unspecialised, 1 being fully specialised), indicating that ant – tree species specificity was very low in all three sites.

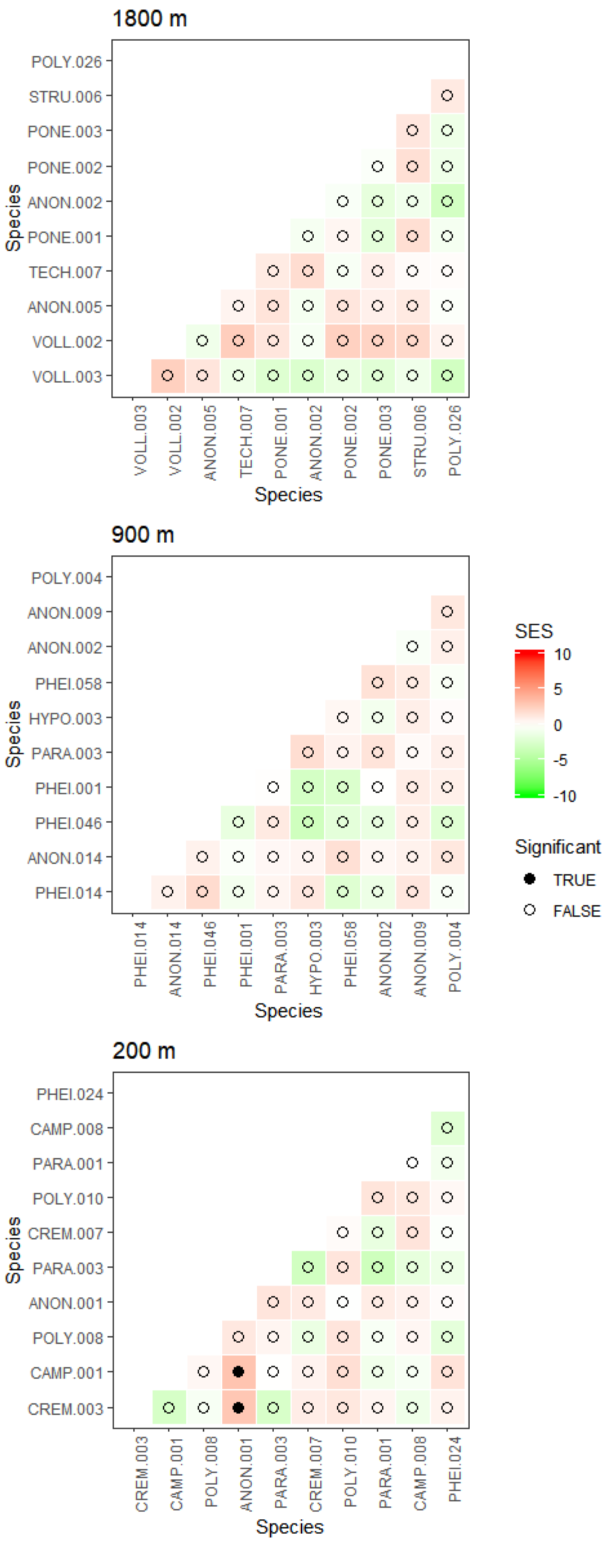

Figure A4. Results of co-occurrence model for pairs of the ten most common tree nesting ant species at low, mid and high elevation. Positive standardised effect size values in red (SES) indicate negative association (i.e. species co-occur in trees less often than expected by chance), and negative SES indicates positive associations (i.e. species co-occur more often than expected by chance). The only significantly non-random associations (P<0.001) occurred at low elevation and are outlined in black – *Anonychomyrma* cf. *scrutator* (ANON001) was negatively associated with *Crematogaster polita* (CREM003) and *Colobopsis vitrea* (CAMP001). ANON001 and CREM003 were the most common dominant ant species at low elevations. See Table A1 for species codes, taxonomic names, and abundance at each elevation.

Supplementary Tables

Table A1. Full list of arboreal nesting ant species (ordered alphabetically), and their nest abundance at each elevation. Mounted voucher specimens and additional material in ethanol are available for each Species code at the Institute of Entomology, Biology Centre of the Czech Academy of Sciences, Ceske Budejovice. Accession numbers for each site are as follows: Wanang – HP0001 to HP0732; Numba – NA0012 to NA0242; Yawan – YA0001 to YA0097.

Species	Subfamily	Genus	Species code	200 m	900 m	1800 m
Acropyga ambigua Emery, 1922	Formicinae	*Acropyga*	ACRO 001		1	
Aenictus nesiotis Wheeler & Chapman 1930	Dorylinae	*Aenictus*	AENI 003		1	
Anochetus cato Forel, 1901	Ponerinae	*Anochetus*	ANOC 001		8	
Anochetus sp. 3	Ponerinae	*Anochetus*	ANOC 003		1	
Anonychomyrma dimorpha (Viehmeyer, 1912)	Dolichoderinae	*Anonychomyrma*	ANON 003			16
Anonychomyrma minuta (Donisthorpe, 1943)	Dolichoderinae	*Anonychomyrma*	ANON 002	8	24	45
Anonychomyrma cf. scrutator (Smith F., 1859)	Dolichoderinae	*Anonychomyrma*	ANON 001	50	5	
Anonychomyrma sp. 5	Dolichoderinae	*Anonychomyrma*	ANON 005			66
Anonychomyrma sp. 9	Dolichoderinae	*Anonychomyrma*	ANON 009		26	
Anonychomyrma sp. 12	Dolichoderinae	*Anonychomyrma*	ANON 012		7	
Anonychomyrma sp. 14	Dolichoderinae	*Anonychomyrma*	ANON 014		51	
Anonychomyrma sp. 15 aff. dimorpha (Viehmeyer, 1912)	Dolichoderinae	*Anonychomyrma*	ANON 015		22	
Brachyponera croceicornis (Emery,1900)	Ponerinae	*Brachyponera*	PACH 006	1	3	
Calomyrmex laevissimus (Smith, 1859)	Formicinae	*Calomyrmex*	CALO 001		3	
Camponotus (*Forelophilus*) *sp. 1*	Formicinae	*Camponotus*	FORE 001		2	
Camponotus anezkae Klimes & McArthur, 2014	Formicinae	*Camponotus*	CAMP 022	1		
Camponotus dorycus confusus Emery, 1887	Formicinae	*Camponotus*	CAMP 016	7	1	

Camponotus cf. flavocassis Donisthorpe, 1941	Formicinae	*Camponotus*	CAMP 033		3	
Camponotus hastifer Emery, 1911	Formicinae	*Camponotus*	CAMP 038		4	
Camponotus mussolinii Donisthorpe, 1936	Formicinae	*Camponotus*	CAMP 028		4	
Camponotus cf. variegatus (Smith, F., 1858)	Formicinae	*Camponotus*	CAMP 018	2	12	
Camponotus triangulatus Klimes & McArthur, 2014	Formicinae	*Camponotus*	CAMP 019	1		
Camponotus wanangus Klimes & McArthur, 2014	Formicinae	*Camponotus*	CAMP 003	3	2	
Camponotus sp. 7 aff. trajanus Forel, 1912	Formicinae	*Camponotus*	CAMP 007	12		
Camponotus sp. 20 aff. janeti Forel, 1895	Formicinae	*Camponotus*	CAMP 020	1		
Camponotus sp. 32	Formicinae	*Camponotus*	CAMP 032		1	
Cardiocondyla sp. 2 aff. thoracina (Smith, 1859)	Myrmicinae	*Cardiocondyla*	CARD 002			1
Carebara atoma Emery, 1900	Myrmicinae	*Carebara*	CARE 002	1		
Carebara crassiuscula (Emery, 1900)	Myrmicinae	*Carebara*	CARE 006		1	
Carebara sp. 1	Myrmicinae	*Carebara*	CARE 001		3	
Carebara sp. 3	Myrmicinae	*Carebara*	CARE 003		1	
Cerapachys cf. flavaclavatus Donisthorpe, 1938	Dorylinae	*Cerapachys*	CERA 001	1	2	
Cerapachys opacus Emery, 1901	Dorylinae	*Cerapachys*	CERA 004		1	
Cerapachys sp. 5	Dorylinae	*Cerapachys*	CERA 005		1	
Colobopsis aruensis Karavaiev, 1933	Formicinae	*Colobopsis*	CAMP 004	3		
Colobopsis conithorax Emery, 1914	Formicinae	*Colobopsis*	CAMP 006	10		
Colobopsis cf. macrocephala (Erichson, 1842)	Formicinae	*Colobopsis*	CAMP 010	5	6	
Colobopsis aff. polynesica (Emery, 1896)	Formicinae	*Colobopsis*	CAMP 017	1		
Colobopsis quadriceps (Smith F., 1859)	Formicinae	*Colobopsis*	CAMP 013	1	3	
Colobopsis rotunda Klimes & McArthur, 2014	Formicinae	*Colobopsis*	CAMP 014	2		
Colobopsis vitrea (Smith F., 1860)	Formicinae	*Colobopsis*	CAMP 001	75	6	

Colobopsis sp. 5 aff. conithorax Emery, 1914	Formicinae	*Colobopsis*	CAMP 005	5		
Colobopsis sp. 8 aff. sanguinifrons Viehmeyer, 1925	Formicinae	*Colobopsis*	CAMP 008	27		
Colobopsis sp. 24 aff. aruensis	Formicinae	*Colobopsis*	CAMP 024			4
Colobopsis sp. 37 aff. sanguinifrons Viehmeyer, 1925	Formicinae	*Colobopsis*	CAMP 037		2	
Crematogaster elysii Mann, 1919	Myrmicinae	*Crematogaster*	CREM 002	18	3	
Crematogaster emeryi Forel, 1907	Myrmicinae	*Crematogaster*	CREM 010		1	
Crematogaster flavitarsis Emery, 1900	Myrmicinae	*Crematogaster*	CREM 005		1	
Crematogaster polita Smith F., 1865	Myrmicinae	*Crematogaster*	CREM 003	146		
Crematogaster cf. pythia Forel, 1915	Myrmicinae	*Crematogaster*	CREM 004	2		
Crematogaster tarsata Smith, F. 1865	Myrmicinae	*Crematogaster*	CREM 013		6	
Crematogaster sp. 6	Myrmicinae	*Crematogaster*	CREM 006	6		
Crematogaster sp. 7 aff. fritzi Emery, 1901	Myrmicinae	*Crematogaster*	CREM 007	39	2	
Crematogaster sp. 11 aff. fritzi Emery, 1901	Myrmicinae	*Crematogaster*	CREM 011	3		
Crematogaster sp. 15 aff. flavicornis Emery, 1897	Myrmicinae	*Crematogaster*	CREM 015		3	
Diacamma rugosum (Le Guillou, 1842)	Ponerinae	*Diacamma*	DIAC 001	13		
Echinopla sp. 2	Formicinae	*Echinopla*	ECHI 002	1		
Echinopla sp. 3	Formicinae	*Echinopla*	ECHI 003		2	
Hypoponera cf. confinis Roger, 1860	Ponerinae	*Hypoponera*	HYPO 002	2	15	
Hypoponera sabrone Donisthorpe, 1941	Ponerinae	*Hypoponera*	HYPO 003	1	31	
Hypoponera sp. 4	Ponerinae	*Hypoponera*	HYPO 004			9
Leptomyrmex flavitarsus (Smith, F., 1859)	Dolichoderinae	*Leptomyrmex*	LEPM 002		1	
Lordomyrma sp. 7	Myrmicinae	*Lordomyrma*	LORD 007			1
Lordomyrma sp. 10	Myrmicinae	*Lordomyrma*	LORD 010		29	
Monomorium intrudens Smith F., 1894	Myrmicinae	*Monomorium*	MONO 002		2	

Monomorium pharaonis (Linnaeus 1758)	Myrmicinae	*Monomorium*	MONO 004	1		
Monomorium sp. 3	Myrmicinae	*Monomorium*	MONO 003	3		
Myopias cf. delta Willey & Brown, 1983	Ponerinae	*Myopias*	MYOP 003		1	
Myrmecina mandibularis Viehmeyer, 1914	Myrmicinae	*Myrmecina*	MYRM 003		5	
Nylanderia aff. vaga (Forel, 1901)	Formicinae	*Nylanderia*	PARA 005	7		
Nylanderia nuggeti Donisthorpe, 1941	Formicinae	*Nylanderia*	PARA 007	2	13	
Odontomachus tyrannicus Smith, 1859	Ponerinae	*Odontomachus*	ODON 005		5	
Oecophylla smaragdina (Fabricius, 1775)	Formicinae	*Oecophylla*	OECO 001	2	12	
Paraparatrechina minutula (Forel, 1901)	Formicinae	*Paraparatechina*	PARA 003	40	34	
Paraparatrechina pallida Donisthorpe, 1947	Formicinae	*Paraparatechina*	PARA 001	38	19	
Paraparatrechina sp. 2	Formicinae	*Paraparatechina*	PARA 002	4		
Paraparatrechina sp. 6	Formicinae	*Paraparatechina*	PARA 006	1	4	
Paraparatrechina sp. 13	Formicinae	*Paraparatechina*	PARA 013		4	
Paraparatrechina sp. 14	Formicinae	*Paraparatechina*	PARA 014			1
Pheidole amber Donisthorpe, 1941	Myrmicinae	*Pheidole*	PHEI 046		45	
Pheidole fuscula Emery, 1900	Myrmicinae	*Pheidole*	PHEI 003		17	
Pheidole hospes Smith, F. 1865	Myrmicinae	*Pheidole*	PHEI 004	10	21	
Pheidole sexspinosa biroi Emery, 1900	Myrmicinae	*Pheidole*	PHEI 030		6	
Pheidole sp. 1	Myrmicinae	*Pheidole*	PHEI 001		35	
Pheidole sp. 2 aff. sexspinosa biroi Emery, 1900	Myrmicinae	*Pheidole*	PHEI 002	1		
Pheidole sp. 7 aff. gambogia Donisthorpe, 1948	Myrmicinae	*Pheidole*	PHEI 007	10	4	
Pheidole sp. 14 aff. gambogia Donisthorpe, 1948	Myrmicinae	*Pheidole*	PHEI 014	5	91	
Pheidole sp. 24 aff. amber Donisthorpe, 1941	Myrmicinae	*Pheidole*	PHEI 024	23		
Pheidole sp. 25 aff. sexspinosa biroi Emery, 1900	Myrmicinae	*Pheidole*	PHEI 025	2		

Pheidole sp. 26	Myrmicinae	*Pheidole*	PHEI 026	1		
Pheidole sp. 38	Myrmicinae	*Pheidole*	PHEI 038		2	
Pheidole sp. 48	Myrmicinae	*Pheidole*	PHEI 048			6
Pheidole sp. 49	Myrmicinae	*Pheidole*	PHEI 049			1
Philidris cf. cordata (Smith F., 1859)	Dolichoderinae	*Philidris*	PHIL 001	8	1	
Philidris sp. 2	Dolichoderinae	*Philidris*	PHIL 002	7		
Philidris sp. 3	Dolichoderinae	*Philidris*	PHIL 003	2		
Plagiolepis sp. 2	Formicinae	*Plagiolepis*	PLAG 002		8	
Platythyrea parallela (Smith, F., 1859)	Ponerinae	*Platythyrea*	PLAT 001		1	
Podomyrma basalis Smith F., 1859	Myrmicinae	*Podomyrma*	PODO 004		2	
Podomyrma keysseri Viehmeyer, 1914	Myrmicinae	*Podomyrma*	PODO 005			3
Podomyrma sp. 2 aff. basalis Smith F., 1859	Myrmicinae	*Podomyrma*	PODO 002	4		
Podomyrma sp. 3 aff. laevifrons Smith F., 1859	Myrmicinae	*Podomyrma*	PODO 003	8	7	
Polyrhachis alphea Smith F.,1863	Formicinae	*Polyrhachis*	POLY 008	56	3	
Polyrhachis aurita Emery, 1911	Formicinae	*Polyrhachis*	POLY 047		5	
Polyrhachis debilis Emery, 1887	Formicinae	*Polyrhachis*	POLY 004	14	26	
Polyrhachis dolomedes Smith F., 1863	Formicinae	*Polyrhachis*	POLY 020	5	3	
Polyrhachis esuriens Emery, 1897	Formicinae	*Polyrhachis*	POLY 001	13		
Polyrhachis hostilis Smith, F. 1859	Formicinae	*Polyrhachis*	POLY 028		1	
Polyrhachis limbata Emery, 1897	Formicinae	*Polyrhachis*	POLY 031		1	
Polyrhachis lombokensis Emery, 1898	Formicinae	*Polyrhachis*	POLY 019	8		
Polyrhachis luteogaster Kohout, 2012	Formicinae	*Polyrhachis*	POLY 010	39		
Polyrhachis mondoi Donisthorpe, 1938	Formicinae	*Polyrhachis*	POLY 026			18
Polyrhachis mucronata Smith F., 1859	Formicinae	*Polyrhachis*	POLY 016	3	5	

Polyrhachis nigripes Emery, 1897	Formicinae	*Polyrhachis*	POLY 039		1	
Polyrhachis pallipes Donisthorpe, 1948	Formicinae	*Polyrhachis*	POLY 021	2		
Polyrhachis queenslandica Emery, 1895	Formicinae	*Polyrhachis*	POLY 011	8	2	
Polyrhachis cf. rossi Donisthorpe, 1948	Formicinae	*Polyrhachis*	POLY 046		5	
Polyrhachis semitestacea Emery, 1900	Formicinae	*Polyrhachis*	POLY 012		3	
Polyrhachis sericata (Guérin-Méneville, 1838)	Formicinae	*Polyrhachis*	POLY 002	2	19	
Polyrhachis waigeuensis Donisthorpe, 1943	Formicinae	*Polyrhachis*	POLY 015	8	7	
Polyrhachis xiphias Smith, F. 1863	Formicinae	*Polyrhachis*	POLY 029	1	1	
Polyrhachis sp. 14 sp. nov. (Myrmatopa, flavicornis group)	Formicinae	*Polyrhachis*	POLY 014		2	
Polyrhachis sp. 23 sp. nov. aff. bubastes Smith F., 1863	Formicinae	*Polyrhachis*	POLY 023	1		
Polyrhachis sp. 42 cf. sericata (Guérin-Méneville, 1838)	Formicinae	*Polyrhachis*	POLY 042		4	
Polyrhachis sp. 45 (Aulacomyrma)	Formicinae	*Polyrhachis*	POLY 045		2	
Polyrhachis sp. 53 aff. menozzii Karavaiev, 1927	Formicinae	*Polyrhachis*	POLY 053		2	
Ponera sp. 1	Ponerinae	*Ponera*	PONE 001			52
Ponera sp. 2	Ponerinae	*Ponera*	PONE 002			37
Ponera sp. 3	Ponerinae	*Ponera*	PONE 003			26
Ponera sp. 4	Ponerinae	*Ponera*	PONE 004		26	
Ponera sp. 7	Ponerinae	*Ponera*	PONE 007		1	
Proceratium austronesicum Baroni Urbani & De Andrade, 2003	Proceratiinae	*Proceratium*	PROC 001		1	
Prolasius sp. 5	Dolichoderinae	*Prolasius*	PROL 005		4	
Pseudolasius breviceps Emery, 1887	Formicinae	*Pseudolasius*	PSEU 001	1	13	
Rhytidoponera strigosa (Emery, 1887)	Ectatomminae	*Rhytidoponera*	RHYT 001	1		
Rogeria stigmatica Emery, 1897	Myrmicinae	*Rogeria*	ROGE 001	4		
Solenopsis papuana Emery, 1900	Myrmicinae	*Solenopsis*	SOLE 004	17	5	

Strumigenys cf. racabura Bolton, 2000	Myrmicinae	*Strumigenys*	STRU 003	2	8	
Strumigenys szalayi Emery, 1897	Myrmicinae	*Strumigenys*	STRU 002	3	15	
Strumigenys tigris	Myrmicinae	*Strumigenys*	STRU 007			1
Strumigenys sp. 6 cf. szalayi Emery, 1897	Myrmicinae	*Strumigenys*	STRU 006			19
Strumigenys sp. 11	Myrmicinae	*Strumigenys*	STRU 011		1	
Tapinoma cf. indicum Forel, 1895	Dolichoderinae	*Tapinoma*	TAPI 002	3		
Tapinoma melanocephalum (Fabricius, 1793)	Dolichoderinae	*Tapinoma*	TAPI 001	2		
Tapinoma sp. 3 aff. williamsi (Wheeler 1935)	Dolichoderinae	*Tapinoma*	TAPI 003	6	7	
Technomyrmex albicoxis Donisthorpe, 1945	Dolichoderinae	*Technomyrmex*	TECH 004	1		
Technomyrmex albipes (Smith F., 1861)	Dolichoderinae	*Technomyrmex*	TECH 002	2		
Technomyrmex cf. cheesmanae Donisthorpe, 1945	Dolichoderinae	*Technomyrmex*	TECH 008		3	
Technomyrmex difficilis Forel 1892	Dolichoderinae	*Technomyrmex*	TECH 003	5		
Technomyrmex gilvus Donisthorpe, 1941	Dolichoderinae	*Technomyrmex*	TECH 005	3		
Technomyrmex mixtus Bolton, 2007	Dolichoderinae	*Technomyrmex*	TECH 007			55
Tetramorium kydelphon Bolton, 1979	Myrmicinae	*Tetramorium*	TETR 002	6		
Tetramorium pulchellum Emery, 1897	Myrmicinae	*Tetramorium*	TETR 012	1	11	
Tetramorium cf. validisculum Emery, 1897	Myrmicinae	*Tetramorium*	TETR 003		10	
Tetramorium sp. 6 aff. validisculum Emery, 1897	Myrmicinae	*Tetramorium*	TETR 006	7		
Tetramorium sp. 12 aff. pulchellum Emery, 1897	Myrmicinae	*Tetramorium*	TETR 016	2		
Tetramorium sp. 20 aff. bicolor Viehmeyer, 1914	Myrmicinae	*Tetramorium*	TETR 020		1	
Tetramorium sp. 21	Myrmicinae	*Tetramorium*	TETR 021			1
Tetraponera atra Donisthorpe, 1949	Pseudomyrmecinae	*Tetraponera*	TETP 003	1		
Tetraponera laeviceps (Smith F., 1859)	Pseudomyrmecinae	*Tetraponera*	TETP 001	14	1	
Vollenhovia brachycera Emery, 1897	Myrmicinae	*Vollenhovia*	VOLL 001	3	2	

Vollenhovia sp. 2	Myrmicinae	*Vollenhovia*	VOLL 002	4	72
Vollenhovia sp. 3	Myrmicinae	*Vollenhovia*	VOLL 003		85
Vollenhovia sp. 4	Myrmicinae	*Vollenhovia*	VOLL 004		4
Vollenhovia sp. 14	Myrmicinae	*Vollenhovia*	VOLL 014	1	
Vollenhovia sp. 15	Myrmicinae	*Vollenhovia*	VOLL 015	1	
Vombisidris australis (Wheeler, 1935)	Myrmicinae	*Vombisidris*	VOMB 004	2	
Vombisidris sp. 2	Myrmicinae	*Vombisidris*	VOMB 002	2	

Table A2. Results of full canonical correspondence analysis (CCA) on the significant explanatory variables (forward-selected at $p \leq 0.05$) of all forest plots combined. The explanatory variables elevation, nest height, tree size and nest types accounted for 7.9% of total variance (6.5% adj.) in ant communities (adjusted p-values used). The significant nest types are marked in italics.

Explanatory factor	% of all variation	% of explained variation	pseudo-F	P (adj.)
Elevation	2.2	26.9	17.2	0.001
Nest height	0.4	5.3	3.5	0.001
Tree size (DBH)	0.3	3.4	2.3	0.002
Carton/soil/silk nest on leaves	1.2	14.9	9.7	0.001
Carton/soil nest on bark	1.1	13.7	8.9	0.001
Under epiphytic roots	0.9	11.0	7.2	0.001
Cavity/gallery in live twig	0.4	4.3	2.9	0.001
Cavity/gallery in live branch	0.3	3.1	2.1	0.002
In dead/rotten twig	0.3	4.0	2.7	0.002
On trunk base	0.3	3.9	2.6	0.045
Under bark	0.3	3.7	2.4	0.001
Cavity/gallery in trunk	0.2	2.5	1.7	0.003

Table A3. Variation partitioning of full dataset across all forest plots to determine the respective contribution of elevation versus the other predictors (DBH, nest height and nest type) from the model in Table A6 to the overall variation in communities (adjusted variability presented).

Explanatory factor	% of all variation (adj.)	% of explained variation (adj.)	Degrees of freedom	Mean Square
Elevation	1.7	26.4	1	0.731
DBH, nest height, nest type	4.4	67.8	11	0.211
Shared variation	0.4	5.8	--	--
Total Explained	6.5	100	12	0.268

Table A4. Variation partitioning within each elevation to compare how much tree size (DBH), and nest microhabitats (nest type & nest height) contributed to all variation and explained variation in the different communities. Values were analysed by individual forest plots and mean variability (adjusted) for each elevation are presented.

	Mean % of all variation			Mean % of explained variation		
Elevation	200 m	900 m	1800 m	200 m	900 m	1800 m
DBH	0.3	0.7	2.6	2.2	17.0	16.4
Nest height & nest type	8.7	3.4	12.7	88.0	79.3	81.8
Shared variation	1.0	0.2	0.3	10.0	3.7	1.8
Total explained	9.9	4.3	15.6	100	100	100

Table A5. Results of C-Score analysis to examine nesting ant species co-occurrence within trees. Analysis was performed on all trees in a subplot (ALL), and trees of different size classes (small, medium, large). The DBH ranges for small, medium and large trees respectively were as follows: low elevation (5-8 cm, 9-13 cm, 13-100 cm), mid-elevation (5-8 cm, 8.1-14 cm, 14-68 cm), high elevation (5-11 cm, 12-19 cm, 19-96 cm). Two models were run: Fixed model = sim9, Relaxed model = sim2. The fixed model excludes trees with a single species of nesting ants, and the relaxed model includes them. NA marks datasets not tested for C-scores due to low sample size (see methods). Statistically significant at P ≤ 0.025 (two-tailed test).

Elevation	Subplot	Tree size	Simulation	Species count	N. trees	Observed C-score	Simulated C-score	SD	SES	Significant
200	**200a**	**Small**	**sim9**	**8**	**10**	**5.11**	**4.89**	**0.10**	**2.24**	**TRUE**
200	200a	Medium	sim9	13	22	11.97	11.84	0.14	0.97	FALSE
200	200a	Large	sim9	19	36	19.42	19.11	0.27	1.14	FALSE
200	200b	Small	sim9	10	15	6.73	6.79	0.11	-0.49	FALSE
200	200b	Medium	sim9	13	16	5.78	5.76	0.09	0.30	FALSE
200	**200b**	**Large**	**sim9**	**27**	**39**	**15.17**	**14.72**	**0.21**	**2.19**	**TRUE**
900	900a	Small	sim9	22	30	9.24	9.27	0.09	-0.42	FALSE
900	900a	Medium	sim9	26	44	17.70	17.67	0.10	0.27	FALSE
900	900a	Large	sim9	56	69	24.21	24.19	0.14	0.11	FALSE
1800	1800a	Small	sim9	3	3	NA	NA	NA	NA	NA
1800	1800a	Medium	sim9	7	13	11.00	10.98	0.23	0.11	FALSE
1800	1800a	Large	sim9	15	37	29.90	30.04	0.39	-0.37	FALSE
1800	1800c	Small	sim9	3	5	NA	NA	NA	NA	NA
1800	1800c	Medium	sim9	8	10	5.11	5.06	0.11	0.39	FALSE
1800	1800c	Large	sim9	9	17	13.17	13.19	0.17	-0.15	FALSE
200	200a	ALL	sim9	35	86	33.35	32.85	0.27	1.85	FALSE
200	200b	ALL	sim9	39	83	29.38	29.08	0.22	1.33	FALSE
900	**900a**	**ALL**	**sim9**	**70**	**157**	**53.24**	**52.46**	**0.27**	**2.95**	**TRUE**
1800	1800a	ALL	sim9	15	59	72.47	72.36	0.67	0.15	FALSE
1800	1800c	ALL	sim9	10	34	41.96	41.41	0.33	1.62	FALSE
200	**200a**	**Small**	**sim2**	**15**	**47**	**15.20**	**13.60**	**0.51**	**3.16**	**TRUE**
200	**200a**	**Medium**	**sim2**	**14**	**38**	**19.53**	**18.05**	**0.73**	**2.01**	**TRUE**
200	200a	Large	sim2	22	54	21.82	21.32	0.73	0.67	FALSE
200	**200b**	**Small**	**sim2**	**18**	**71**	**23.74**	**20.69**	**0.61**	**5.02**	**TRUE**
200	**200b**	**Medium**	**sim2**	**19**	**39**	**9.84**	**9.13**	**0.32**	**2.23**	**TRUE**
200	200b	Large	sim2	28	56	18.54	18.59	0.49	-0.10	FALSE
900	**900a**	**Small**	**sim2**	**26**	**67**	**16.55**	**15.52**	**0.39**	**2.62**	**TRUE**
900	900a	Medium	sim2	29	71	22.87	22.15	0.41	1.77	FALSE
900	**900a**	**Large**	**sim2**	**56**	**74**	**25.03**	**26.31**	**0.25**	**-5.20**	**TRUE**
1800	**1800a**	**Small**	**sim2**	**9**	**36**	**19.92**	**16.01**	**0.95**	**4.11**	**TRUE**
1800	1800a	Medium	sim2	9	26	18.31	17.37	1.26	0.74	FALSE
1800	1800a	Large	sim2	15	44	35.51	35.50	1.50	0.01	FALSE
1800	**1800c**	**Small**	**sim2**	**6**	**40**	**38.33**	**24.46**	**3.55**	**3.89**	**TRUE**
1800	**1800c**	**Medium**	**sim2**	**10**	**40**	**23.16**	**19.43**	**1.11**	**3.35**	**TRUE**
1800	**1800c**	**Large**	**sim2**	**9**	**29**	**24.39**	**21.79**	**1.44**	**1.80**	**TRUE**

Table A6. ANOVA to select best GLM model testing the effect of elevation on species dissimilarity between trees (Sørensen dissimilarity index). Model 1 was a significantly better fit than the null model. Model 0: dissimilarity ~ + 1, Model 1: dissimilarity ~ Elevation

Model	Residual df	Residual deviance	df	Deviance	P value
0	63406	25119			
1	63404	24415	2	704.05	<0.001

Table A7. Results of above GLM model 1 testing effect of elevation on species dissimilarity between trees. (Sørensen dissimilarity index).

	Estimate	Standard Error
200 m (intercept)	2.34	0.015
900 m	0.14	0.022
1800 m	-0.73	0.023

Table A8. General linear mixed models (glmmTMB) testing the effect of tree size and elevation on species richness per tree. Models compared with anova (mod_a, mod_b, test=chisq).

Model	Independent variable(s)	DF	AIC	Deviance	Test against	Chisq	Chi DF	p
Mod.0	+1	3	3868.8	3862.8	-	-	-	-
Mod.1	DBH	4	3531.7	3523.7	Mod.0	339.15	1	<0.01***
Mod.2	Elevation	5	3859.9	3849.9	Mod.0	12.927	2	<0.01**
Mod.3	A + B	6	3520.9	3508.9	Mod.1	14.836	2	<0.01***
Mod.4	A+B+A:B	8	3555.6	3498.6	Mod.3	10.307	2	<0.01***

Table A9. General linear mixed models (glmmTMB) testing the effect of tree size and elevation on nest abundance. Models compared with anova (mod_a, mod_b, test=chisq).

Model	Independent variable(s)	DF	AIC	Deviance	Test against	Chisq	Chi DF	p
Mod.0	+1	3	4366.5	4360.5	-	-	-	-
Mod.1	DBH	4	4000.2	3992.2	Mod.0	368.32	1	<0.01***
Mod.2	Elevation	5	4357.8	4347.8	Mod.0	12.716	2	<0.01***
Mod.3	A + B	6	3990.3	3978.3	Mod.1	13.867	2	<0.01***
Mod.4	A+B+A:B	8	3990.4	3974.4	Mod.3	3.8692	2	0.1445

Table A10. General linear mixed models (glmmTMB) testing the effect of tree size and elevation on nest diversity. Models compared with anova (mod_a, mod_b, test=chisq).

Model	Independent variable(s)	DF	AIC	Deviance	Test against	Chisq	Chi DF	p
Mod.0	+1	3	3315.5	3309.5	-	-	-	-
Mod.1	DBH	4	3100.8	3092.8	Mod.0	216.66	1	<0.01***
Mod.2	Elevation	5	3306.0	3296.0	Mod.0	13.44	2	<0.01**
Mod.3	A + B	6	3086.2	3074.2	Mod.1	18.583	2	<0.01***
Mod.4	A+B+A:B	8	3080.7	3064.7	Mod.3	9.5266	2	<0.01**