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Scientific note

REGISTER OF NESTS OF THREE FORMICID SPECIES (HYMENOPTERA) IN RÍO CLARILLO NATIONAL RESERVE, METROPOLITAN REGION, CHILE

Joaquín Ipinza-Regla[1], Pamela Jara[1], y Jaime E. Araya[2*]

[1] Laboratorio de Zoología y Etología, Facultad de Ciencias, Universidad Mayor, Camino La Pirámide , Huechuraba, Santiago, Chile. joaquin.ipinza@umayor.cl
[2] Facultad de Ciencias Agronómicas, Universidad de Chile, Casilla 1004, Santiago, Chile,
* Corresponding author E-mail: jaimearaya@yahoo.com

RESUMEN

Se registró la distribución de los formícidos *Brachymyrmex giardii* (Emery), *Camponotus chilensis* (Spinola) y *Nothidris bicolor* (Snelling) con el método de área mínima en dos sectores en la Reserva Nacional Río Clarillo (33º41-51′ S; 70º24-29′ O), Comuna de Pirque, Región Metropolitana, Chile, uno con tránsito de personas y el otro menos intervenido. Los nidos presentaron una distribución en grupos, y la presencia de personas afectó su densidad, frecuencia y abundancia.

Palabras clave: nidos de hormigas, *Brachymyrmex giardii*, *Camponotus chilensis*, *Nothidris bicolor*.

ABSTRACT

The distribution of formicids *Brachymyrmex giardii* (Emery), *Camponotus chilensis* (Spinola), and *Nothidris bicolor* (Snelling) was registered with the minimum area method in two sectors of Río Clarillo National Reserve (33º 41-51′ S and 70º 24-29′ W), Pirque Commune, Metropolitan Region, Chile. One sector corresponded to an area with human presence, while the other corresponded to an area with less human intervention. The nests presented a group distribution, and the presence of people affected their density, frequency, and abundance.

Key words: Ant nests, *Brachymyrmex giardii*, *Camponotus chilensis*, *Nothidris bicolor*.

INTRODUCTION

Formicids play an important role in the environment not only as plant and sap feeders, but also because they are zoophagous and detritivorous, necrophagous and coprophagous (Ipinza-Regla, 1971). The 62 species of Formicidae in Chile represent a poor myrmecological fauna compared to that of South America (Snelling and Hunt, 1975). The flora in Río Clarillo Reserve has been studied by Espinoza (1981), Gajardo (1994), and Niemeyer et al. (2002). In general, the insect fauna in the reserve is better known than that of other protected areas in the central zone of Chile, particularly the soil micro arthropods (Covarrubias, 1991), epigeous insects (Solervicens et al., 1991), coleopterans associated to the foliage of shrubs (Solervicens and Estrada, 1996), tabanid and tachinid flies (González, 1992), plant feeding hemipterans (Niemeyer et al., 2002), and wasps *Vespula germanica* (F.) and *Polistes buyssonii* (Brèthes) (CONAF, 1996).

In Chile, there are ten introduced and 34 endemic ant species (Snelling and Hunt, 1975). Some studies conducted in Río Clarillo Reserve (e.g., Covarrubias, 1991; Solervicens et al., 1991; González, 1992; Niemeyer et al., 2002; Solervicens and Estrada, 2002; Estrada and Solervicens, 2004;

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Jara, 2008) have determined a total of 18 species.

The spatial distribution of the nests of formicids is related to availability of food, nest areas, and the intra- and inter-specific competition between different species of formicids with the same diet (Bernstein and Goebel, 1979; Levings and Franks, 1982; Hölldobler and Wilson, 1990; Ipinza-Regla et al., 2010; 2013). The availability of substrates for building nests and the physicochemical characteristics of the soil are also important factors (Petal, 1978; Torres, 1984, Johnson, 1992).

It is evident that the distribution of ants is affected by the presence of people. Therefore, this work aimed at studying the distribution of different species of ants coexisting in an area with endemic and introduced flora in Río Clarillo National Reserve in the Andean foothills southeast of Santiago, Metropolitan Region, Chile. The characteristics, frequency, and spatial distribution of the species were determined in two different areas that differed in human presence.

MATERIALS AND METHODS

As formicids use their nests as working centers around which all members of the colony conduct their activities. Herein the minimum area method was used to determine the area where a large amount of species was found. The minimum area method is used in plant studies to determine the area where all species that represent a community are present (Ipinza-Regla et al., 1983). This method may also be used to analyze the nests of ants, which are fixed structures that can be counted. The selected area is divided in quadrants of a certain size, and species of ants are identified. The search finishes when no more new species appear during sampling so that the minimum area is then established (Ipinza-Regla et al., 1983; 1987). In this study, no new ant species appeared when revising 3 quadrant lines (Table 1).

The area with human presence in the study was a picnic site near a trail in El Maitén – La Roca (33º43'34,3'' S, 70º28'47,8'' W), at 901 m altitude, with a 1.71 ± 0.75 plant cover index (1 = scarce; 2 = medium; 3 = high; 4 = soil fully covered), including quillay (*Quillaja saponaria* Molina) and espino [*Acacia caven* (Molina)], a 1.27 ± 0.60 stone cover index, and 2.27 ± 1.03 plant remains. The area with less human intervention was located at 33º43'50,8'' S; 70º28'78'' W, at 930 m altitude, and had a 1.32 ± 0.56 plant cover index, including quillay, litre [*Lithraea caustica* (Molina) Hook et Arn.], peumo [*Cryptocarya alba* (Molina) Looser], and espino, a 2.06 ± 0.79 stone cover index, and 3.29 ± 0.94 plant remains (Jara, 2008).

Each quadrant in Table 1 was examined to record the total number of ant nests from November 2006 through February 2007. Ants were searched for by looking under each stone or on branches, and vegetation in general. Once a nest was found, 15 ants were collected at the entrance of each nest using twigs or a brush and were kept in hermetic glass vials, together with material from where they were obtained (soil, dead plant material, trunks, etc.). Species were then identified by comparison with specimens stored in the Zoology and Ethology Laboratory, College of Agroforestry Sciences, Universidad Mayor, Santiago, and by using the taxonomic keys for Chilean formicids by Snelling and Hunt (1975). The nests in the vials were fed with honey, apple puree, ham pieces, and water in humid cotton.

The ants and nests identified in the quadrants

Table 1. Diagram of the minimum area method. Each quadrant represents a 1 m^2 area. The light grey area are the quadrants where the study began (36 m^2), while the dark gray quadrants are the three lines where no new ant species were found, at which point the study ended.

196	195	194	193	192	191	190	189	188	187	186	185	184	183
169	168	167	166	165	164	163	162	161	160	159	158	157	182
144	143	142	141	140	139	138	137	136	135	134	133	156	181
121	120	119	118	117	116	115	114	113	112	111	132	155	180
100	99	98	97	96	95	94	93	92	91	110	131	154	179
81	80	79	78	77	76	75	74	73	90	109	130	153	178
64	63	62	61	60	59	58	57	72	89	108	129	152	177
49	48	47	46	45	44	43	56	71	88	107	128	151	176
6	12	18	24	30	36	42	55	70	87	106	127	150	175
5	11	17	23	29	35	41	54	69	86	105	126	149	174
4	10	16	21	28	34	40	53	68	85	104	125	148	173
3	9	15	21	27	33	39	52	67	84	103	124	147	172
2	8	14	20	26	32	38	51	66	83	102	123	146	171
1	7	13	19	25	31	37	50	65	82	101	122	145	170

were analyzed considering plants, stones, and plant remains indexes using a Fisher test. The following determinations were made: total nests per quadrant, percentage of quadrants with nest entrances of each species, *i.e.* percentage of nests in the total quadrants, and the number of nests in relation with the total number of entrances of each species, which indicates the number of nest entrances for the area occupied.

RESULTS AND DISCUSSION

The formicids *Brachymyrmex giardii* (Emery), *Nothidris bicolor* (Snelling), and *Camponotus chilensis* (Spinola) were found in the study. The results of nests found in the area with human presence (picnic site) and in that with less human intervention are presented in Table 2.

The area with human presence had a total of 34 nest entrances: 32 of them with *B. giardii* (94%), 1 with *N. bicolor*, and 1 with *C. chilensis* (3% each).

A number of 39 nests were found in the area with less human intervention: 37 with *B. giardii* (95%), 2 with *N. bicolor* (5%), and none with *C. chilensis*.

The nest totals, frequency, density, and abundance of the three formicid species in the areas with human presence (a) and less human intervention (b) are presented in Table 3.

In both areas, the predominant species was *B. giardii*, which was found in 16.32 and 18.00% of the quadrants in the areas with human presence and

Table 2. Distribution of nests of three formicid species in the areas with human presence (a) and less human intervention (b) in the study.

a. Area with human presence

196	195	194	193	192	191	190	189	188	187	186	185	184	183
169	168	167	166	165	164	163	162	161	160	159	158	157	182
144	143	142	141	140	139	138	137	136	135	134	133	156	181
121	120	119	118	117	116	115	114	113	112	111	132	155	180
100	99	98	97	96	95	94	93	92	91	110	131	154	179
81	80	79	78	77	76	***75**	74	73	90	109	130	153	178
64	63	62	61	60	59	58	57	72	89	108	129	152	177
49	48	47	46	45	44	43	56	71	88	107	128	151	176
6	12	18	24	30	36	42	55	70	87	106	127	150	175
5	11	17	23	29	35	41	54	69	86	105	***126**	149	174
4	10	16	22	28	34	40	53	68	85	104	125	148	173
3	9	15	21	27	33	39	52	67	84	103	124	147	172
2	8	14	20	26	32	38	51	66	83	102	123	146	171
1	7	13	19	25	31	37	50	65	82	101	122	145	170

B. giardii
N. bicolor
C. chilensis
* *B. giardii* 2 nest entrances

b. Area with less human intervention

183	184	185	186	***187**	188	189	190	191	192	193	194	195	196
182	157	158	159	160	161	162	163	164	165	166	167	168	169
181	156	133	134	135	136	137	138	139	140	141	142	143	144
180	155	132	111	112	113	114	115	116	117	118	119	120	121
179	154	131	110	91	92	93	94	95	96	97	98	99	100
178	153	130	109	90	73	74	75	76	77	78	79	80	81
177	152	129	108	89	72	57	58	59	60	61	62	63	64
176	151	128	107	88	71	56	43	44	45	46	47	48	49
175	150	127	106	87	70	55	42	36	30	24	****18**	12	6
174	149	126	105	86	69	54	41	35	29	23	17	11	5
173	148	125	***104**	***85**	68	53	40	34	28	22	16	10	4
172	147	124	103	84	67	52	39	33	27	21	15	9	3
171	146	123	102	83	66	51	38	32	26	20	14	8	2
*170	145	122	101	82	65	****50**	***37**	31	25	19	13	7	1

B. giardii
N. bicolor
* *B. giardii* 2 nest entrances
** *B. giardii* 3 nest entrances

Table 3. Nest entrances, frequency, density, and abundance of *B. giardii*, *N. bicolor*, and *C. chilensis* in the areas with human presence (a) and less human intervention (b) in the study.

Species	Nest entrances	Density (%)	Frequency (%)	Abundance (%)
a) Area with human presence				
B. giardii	32	16.32	15.30	94.0
N. bicolor	1	0.51	0.51	3.0
C. chilensis	1	0.51	0.51	3.0
b) Area with less human intervention				
B. giardii	37	18.00	14.28	94.0
N. bicolor	2	1.00	1.02	5.0
C. chilensis	0	0.00	0.00	0.0

less human intervention, respectively, occupying > 90% of the study area (Table 3). The nests of this species are large and may have several entrances (polycaly) (Ipinza-Regla et al., 2005); some entrances may belong to the same nest. To verify this hypothesis, chromatograph studies of the epicuticle of the ants can be conducted. According to a Fisher test ($p = 0.027$) a significant effect was found between species abundance in both areas, with a confidence interval of 0.6714 to 236.23.

The results of this study are similar to those reported by Vidal (2000) in El Ingenio, Cajón del Maipo, Región Metropolitana, Chile, who found three species, *B. giardii*, *C. morosus* (Smith), and *Solenopsis gayi* Spinola, with dominance of *B. giardii* since nests were found in 83% of the quadrants. Solervicens et al. (1991) also found three ant species: *C. morosus*, *Pogonomyrmex odoratus* Kusnezov, and *Pseudomyrmex lynceus* (Spinola).

Estrada and Solervicens (2004) found 18 formicid species in the Río Clarillo Reserve using Barber traps for nests on the surface of the soil and collecting by shaking branches over an umbrella. These 18 formicid species correspond to 29% of the 62 species described in Chile. The greater number of species obtained in that study is explained by the sampling of individuals foraging rather than by the number of nests. In our work, the three species found are equivalent to 4.8% of the formicid species described in Chile.

Ribeiro de Castro et al. (2016) have indicated that quantifying and understanding the main drivers of biodiversity responses to human disturbances are key issues to foster effective conservation plans and management systems. In their study, irrespective of forest disturbance ant species richness was almost twice as high in forests when compared to areas in production. In contrast, ant species composition presented continuous variations from primary forest to intensive agriculture, following a gradient of aboveground biomass.

The management objectives of Río Clarillo Reserve to preserve and protect the soil and wild fauna and flora have not been fully accomplished. In fact, as some areas are used for recreation, only a few areas are not affected by anthropomorphic pressure. This affected the study because it was difficult to find an area which was totally free of human intervention in order to differentiate the distribution of formicids from an area with people activity. In fact, the presence of people was frequent in trails and buildings as well as the presence of introduced animals. However, the anthropomorphic effect in the environment did not affect the distribution of the formicid species found in this study; nests of three species were found in the area with human presence, while only two were found in the area with less human intervention. This result was not expected, because it was thought that fewer species would occur in the intervened area. However, this result may be explained by the feeding of formicids, which use the food left in the garbage by visitors to the reserve. Further study is required to determine if there are different nests or several entrances to the same nest of an ant species (policaly). This was not included in this study because we tried to manipulate the area as little as possible.

CONCLUSIONS

Three formicid species were found in Río Clarillo National Reserve in central Chile: *Brachymyrmex giardii*, *Camponotus chilensis*, and *Nothidris bicolor*. Their distribution was aggregated and was not affected by human presence. The minimum area method used in this study may not be the most adequate to determine the diversity of formicid species, but it proved useful herein in determining nest distribution.

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