

Ant Fauna (Insecta: Hymenoptera: Formicidae) of the Northern Mariana Islands, Micronesia

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Abstract Thirty-one species of ants belonging to 17 genera of 4 subfamilies were recorded from the northern Mariana Islands. The fauna of these Islands was characterized by a rather poor species diversity and a high ratio of tramp species. Cluster analyses using similarity indices showed that the fauna was similar to that of the Samoa Islands of Polynesia rather than that of the Ogasawara Islands.

Key words: Ant fauna, cluster analysis, northern Mariana Islands, tramp species.

The northern Mariana Islands consist of young volcanic islands, most of which are small, lying in the Pacific Ocean between 16°N to 20°N. The climate of the islands is tropical, with an annual mean temperature of more than 20°C. All of the islands are oceanic, having never been connected to continents. It is important to study such oceanic islands, since they provide important data on the evolution of fauna, the nature of dispersal, and interspecific relationships in an insular environment.

The distribution records of ants from the Mariana Islands are scarce, being known only for Guam (Wheeler, 1912, 1935; Swezey, 1939, 1942), Saipan (Weber, 1950) and Pagan (Yasumatsu, 1940). However, about 900 individuals of ants were collected by members of the expedition to the northern Mariana Islands in 1992. These are identified as 31 species. This paper attempts to analyze the biogeographic characteristics of the northern Mariana Islands of Micronesia.

Study Area

The islands surveyed were 9 of the northern Mariana Islands (Fig. 1). Among them, Pagan has the largest size (47.7 km²), followed by Agrihan (46.8 km²). Seven islands are small, being less than 10 km². Faunal comparisons with the Izu, the Ogasawara, and the Samoa Islands were also made using quantitative analysis.

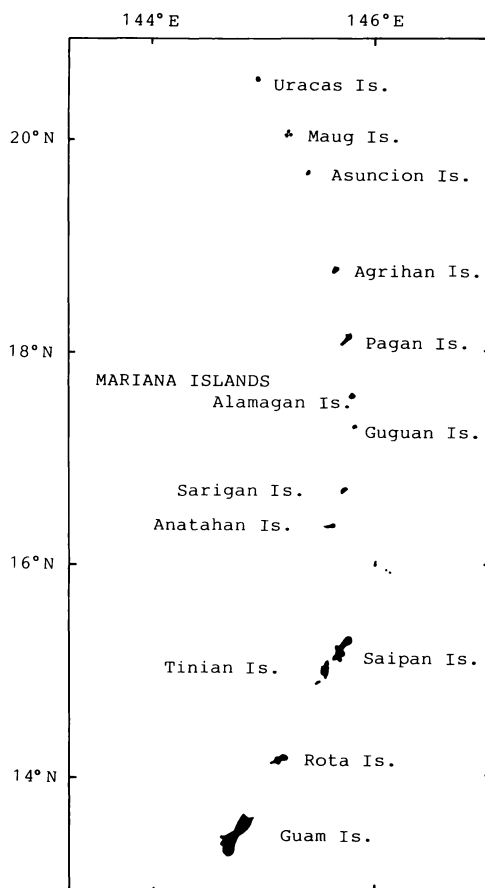


Fig. 1. Map of study area.

Table 1. Geographical positions of four groups of islands and the number of species.

Islands	Latitude	No. of species	Source
Izu	32°5'N–34°8'N	69	Terayama (1992)
Ogasawara	26°5'N–27°8'N	44	Terayama and Hasegawa (1992)
northern Mariana	16°N–20°N	31	Present study
Samoa	23°5'S–14°S	59	Wilson and Taylor (1967b)

Table 2. Distribution data for ants on each study island.

Subfamilies and species	Locality	Uracas	Maug			Asuncion	Agrihan	Pagan	Alamagan	Guguan	Sariguan	Antahan	
			West Is.	East Is.	North Is.								
PONERINAE													
1. <i>Ponera</i> sp. A							○						
2. <i>Ponera</i> sp. B							○						
3. <i>Hypoponera punctatissima</i>						○							W
4. <i>Anochetus graeffei</i>												○	W
5. <i>Odontomachus simillimus</i>		○		○	○		○	○	○	○	○	○	W
CERAPACHYINAE													
1. <i>Plathyletia parallela</i>								○					W
MYRMICINAE													
1. <i>Tetramorium tonganum</i>							○						W
2. <i>Tetramorium lanuginosum</i>		○		○			○	○		○	○	○	T
3. <i>Tetramorium simillimum</i>				○			○						T
4. <i>Tetramorium bicarinatum</i>		○	○	○	○		○		○	○	○	○	T
5. <i>Cardiocondyla wroughtonii</i>							○			○	○		T
6. <i>Cardiocondyla emeryi</i>		○										○	T
7. <i>Monomorium destructor</i>								○					T
8. <i>Monomorium floricola</i>				○	○		○		○	○			T
9. <i>Monomorium fossulatum</i>		○					○	○			○		T
10. <i>Monomorium chinense</i>								○					T
11. <i>Pheidole fervens</i>						○							W
12. <i>Pheidole</i> sp. A							○		○		○	○	
13. <i>Pheidole</i> sp. B								○	○	○		○	
14. <i>Vollenhovia</i> sp.							○						
15. <i>Strumigenys rogeri</i>												○	T
16. <i>Quadristruma emmae</i>								○					T
DOLICHODERINAE													
1. <i>Tapinoma melanocephalum</i>		○					○	○	○	○			T
2. <i>Tapinoma</i> sp.				○			○	○					
3. <i>Iridomyrmex</i> sp.		○								○			
FORMICINAE													
1. <i>Paratrechina bourbonica</i>				○			○	○	○		○	○	T
2. <i>Paratrechina longicornis</i>							○						T
3. <i>Paratrechina</i> sp.												○	
4. <i>Anoplolepis longipes</i>								○					T
5. <i>Camponotus chloroticus</i>				○		○	○	○	○	○	○	○	W
6. <i>Camponotus</i> sp.							○		○	○	○	○	
No. of genera		6	1	6	3	4	9	10	7	8	7	8	
No. of species		7	1	8	3	4	18	13	9	10	9	12	

T: Tramp species (According to Wilson and Taylor, 1967a, b).

W: Widely distributed species from the Indo-Australian to Pacific islands.

The geographical positions and the numbers of species recorded on each group of islands are shown in Table 1.

Methods of Zoogeographic Analysis

To examine faunal similarity, the Nomura-Simpson's Coefficient (NSC) and Jaccard's index (CC) were used. The NSC and CC are defined by the following equations:

$$NSC = c/b, a > b \ (0 \leq NSC \leq 1)$$

$$CC = c/(a + b - c) \ (0 \leq CC \leq 1),$$

where a and b are the total number of species found in areas 1 and 2, respectively, and c is the number of species found in both areas. Furthermore, the obtained NSC and CC value matrices were examined by cluster analysis using the UPGMA method.

Results and Discussion

1. Number of species recorded

Thirty-one species of ants belonging to 17 genera of 4 subfamilies were recorded from the studied islands. Table 2 shows the distribution records of each species on the islands. Among the islands, Agrihan has the highest species number (18 species of 10 genera), followed by Pagan (13 species of 9 genera). The fauna is much poorer than that of land bridge islands (e.g. Izu Is. and Nansei Is., Terayama, 1992).

The ants collected and the corresponding collection data were as follows. The following abbreviations are used in the collection data: w, worker; f, dealate female; af, alate female; m, male; [M], S. Miyano leg.; [K], T. Kurozumi leg.; [A], A. Asakura leg.

Subfamily PONERINAE

1. *Ponera* sp. A

Agrihan Is.: 1w, 29.V.1992, [K].

Remarks. This species belongs to the *taipingensis* group of Taylor (1967).

2. *Ponera* sp. B

Agrihan Is.: 1w, 31.V.1992, [K].

Remarks. The present species belongs to Taylor's *tenuis* group (1967).

3. *Hypoponera punctatissima* (Roger)

Asuncion Is.: 2w, 7.VI.1992, [K].

4. *Anochetus graeffei* Mayr

Anatahan Is.: 2w, 12.V.1992, [K]; 2w, 13. V.

1992, [K].

5. *Odontomachus simillimus* Fr. Smith

Agrihan Is.: 1w, 29.V.1992, [M]; 2w, 28. V. 1992, [M]; 1m, 31.V.1992, [M]; 1w, 28.V.1992, [K]. Alamagan Is.: 1f2w, 9.VI.1992, [M]; 1w, 19. V.1992, [M]. Anatahan Is.: 1f, 13.V.1992, [K]; 1 af, 13.V.1992, [K]; 2w, 12.V.1992, [M]; 1af3w, 12.V.1992, [M]; 1w, 12.V.1992, [K]. East Is. of Maug Is.: 1w, 2.VI.1992, [K]. Guguan Is.: 1w, 17. V.1992, [K]; 11w, 18.V.1992, [M]. North Is. of Maug Is.: 1w, 3.VI.1992, [M]. Pagan Is.: 1w, 25.V. 1992, [K]; 1f, 25.V.1992, [K]. Sarigan Is.: 1w, 15. V.1992, [K]; 1w, 16.V.1992, [K]; 1w, 15.V.1992, [K]. Uracas Is.: 1w, 6.VI.1992, [K]; 28w, 6.VI. 1992, [M].

Subfamily ERAPACHYINAE

6. *Plathyletia parallela* (Fr. Smith)

Pagan Is.: 1w, 25.V.1992, [K].

Subfamily MYRMICINAE

7. *Tetramorium tonganum* Mayr

Agrihan Is.: 1w, 28.V.1992, [K].

8. *Tetramorium lanuginosum* Mayr

Agrihan Is.: 1w, 31.V.1992, [K]. Anatahan Is.: 1w, 12.V.1992, [M]. Guguan Is.: 1w, 18.V.1992, [M]; 1w, 17.V.1992, [K]; 1f, 17.V.1992, [K]; 4w, 17.V.1992, [K]. East Is. of Maug Is.: 1w, 2.VI. 1992, [K]. Pagan Is.: 5w, 24.V.1992, [K]; 1w, 25. V.1992, [K]. Sarigan Is.: 1w, 15.V.1992, [K]. Uracas Is.: 2w, 6.VI.1992, [K]; 1w, 6.VI.1992, [K].

9. *Tetramorium simillimum* (Fr. Smith)

Agrihan Is.: 1w, 28.V.1992, [K]. Asuncion Is.: 2 w, 7.VI.1992, [K]. East Is. of Maug Is.: 2w, 2.VI. 1992, [M]; 2w, 2.VI.1992, [K].

10. *Tetramorium bicarinatum* (Nylander)

Agrihan Is.: 1w, 31.V.1992, [K]; 3w, 29.V. 1992, [K]; 1w, 30.V.1992, [M]. Alamagan Is.: 11 w, 19.V.1992, [M]; 2w, 19.V.1992, [K]. Anatahan Is.: 1w, 11.V.1992, [M]. East Is. of Maug Is.: 2w, 4. VI.1992, [M]; 8w, 2. VI.1992, [M]; 2w, 2. VI. 1992, [K]. Guguan Is.: 1w, 17.V.1992, [K]. North Is. of Maug Is.: 1w, 3.VI.1992, [M]. Sarigan Is.: 3 w, 15.V.1992, [M]. Uracas Is.: 3w, 6.VI.1992, [K]; 1w, 6.VI.1992, [K]. West Is. of Maug Is.: 4w, 5.VI. 1992, [M]; 13w, 5.VI.1992, [K]; 2w, 5.VI.1992, [K]; 3w, 2.VI.1992, [K]; 2f, 5.VI.1992, [K].

11. *Cardiocondyla wroughtonii* (Forel)

Agrihan Is.: 1af, 28.V.1992, [M]. Guguan Is.: 3w, 17.V.1992, [M]. Sarigan Is.: 1w, 15.V.1992,

[M]; 1w, 15.V.1992, [M].

12. *Cardiocondyla emeryi* Forel

Anatahan Is.: 4w, 11.V.1992, [M]; 3w, 13.V. 1992, [M]. Uracas Is.: 1w, 6.VI.1992, [K].

13. *Monomorium destructor* (Jerdon)

Pagan Is.: 8w, 24.V.1992, [A].

14. *Monomorium floricola* (Jerdon)

Agrihan Is.: 2w, 31.V.1992, [K]. Alamagan Is.: 1w, 19.V.1992, [M]; 2w, 19.V.1992, [M]. East Is. of Maug Is.: 5w, 4.VI.1992, [M]. Guguan Is.: 1w, 18.V.1992, [M]; 2w, 18.V.1992, [M]. North Is. of Maug Is.: 2f, 3.VI.1992, [M]; 12f2w, 3.VI.1992, [M].

15. *Monomorium fossulatum* Emery

Agrihan Is.: 1w, 29.V.1992, [K]. Asuncion Is.: 1w, 1.VI.1992, [K]. Pagan Is.: 3fca.100w 24.V. 1992, [K]. Sarigan Is.: 1w, 15.V.1992, [K]. Uracas Is.: 1w, 6.VI.1992, [M]; 1w, 6.VI.1992, [K]; 1w, 6.VI.1992, [K].

16. *Monomorium chinense* Santschi

Pagan Is.: 1w, 24.V.1992, [K].

17. *Pheidole fervens* Fr. Smith

Asuncion Is.: 3w, 1.VI.1992, [K].

18. *Pheidole* sp. A

Agrihan Is.: 17w, 29.V.1992, [K]. Alamagan Is.: 1f6w, 19.V.1992, [K]. Anatahan Is.: 1w, 13.V. 1992, [K]; 14w, 12.V.1992, [M]. Sarigan Is.: 2w, 15.V.1992, [K]; 3w, 15.V.1992, [K].

19. *Pheidole* sp. B

Agrihan Is.: 1w, 28.V.1992, [K]; 2w, 31.V. 1992, [K]; 18w, 28.V.1992, [K]. Alamagan Is.: 5w, 19.V.1992, [K]; 50w, 9.VI.1992, [K]; 3w, 19.V. 1992, [K]. Anatahan Is.: 17w, 13.V.1992, [M]; 1w, 13.V.1992, [K]; 6w, 12.V.1992, [M]; 2w, 13.V. 1992, [M]; 2w, 13.V.1992, [M]; 4w, 12.V.1992, [K]. Guguan Is.: 2w, 17.V.1992, [K]. Pagan Is.: 1w, 25.V.1992, [K]; 6w, 24.V.1992, [K]; 3w, 24.V. 1992, [K]; 3w, 25.V.1992, [K]; 1w, 24.V.1992, [K]; 2w, 24.V.1992, [K].

20. *Vollenhovia* sp.

Agrihan Is.: 3w, 29.V.1992, [K]

Remarks. This species resembles *V. oblonga* from tropical Asia to the New Hebrides and New Caledonia or *V. pacifica* from Samoa.

21. *Strumigenys rogeri* Emery

Anatahan Is.: 1w, 12.V.1992, [K].

22. *Quadristruma emmae* (Emery)

Pagan Is.: 2w, 24.V.1992, [K].

Subfamily DOLICHODERINAE

23. *Tapinoma melanocephalum* (Fabricius)

Agrihan Is.: 15w, 30.V.1992, [K]. Alamagan Is.: 3w, 9.VI.1992, [M]; 64w, 19.V.1992, [K]. Guguan Is.: 3w, 17.V.1992, [M]. Pagan Is.: 1f2w, 24.V.1992, [K]; 30w 24.V.1992, [M]. Uracas Is.: 3m3w, 6.VI.1992, [K].

24. *Tapinoma* sp.

Agrihan Is.: 2w, 31.V.1992, [K]. East Is. of Maug Is.: 11w, 2.VI.1992, [M]. Pagan Is.: 1w, 24.V.1992, [K].

25. *Iridomyrmex* sp.

Guguan Is.: 6w, 17.V.1992, [M]. Uracas Is.: 2w, 6.VI.1992, [K]; 1w, 6.VI.1992, [M]; 3w, 6.VI. 1992, [M].

Subfamily FORMICINAE

26. *Paratrechina bourbonica* (Forel)

Agrihan Is.: 1w, 31.V.1992, [K]; 1w, 29.V. 1992, [K]; 3w, 28.V.1992, [M]. Alamagan Is.: 1w, 9.VI.1992, [K]; 1w, 9.VI.1992, [K]; 1w, 19.V. 1992, [M]. Anatahan Is.: 9w, 12.V.1992, [M]; 1w, 13.V.1992, [K]; 2w, 12.V.1992, [K]. East Is. of Maug Is.: 6w, 2.VI.1992, [M]; 2w, 2.VI.1992, [M]; 8w, 2.VI.1992, [K]; 3w, 2.VI.1992, [K]. Pagan Is.: 1w, 25.V.1992, [K]; 1w, 25.V.1992, [K]; 1w, 24.V. 1992, [K]. Sarigan Is.: 5w, 15.V.1992, [K].

27. *Paratrechina longicornis* (Latreille)

Agrihan Is.: 1w, 29.V.1992, [K].

28. *Paratrechina* sp.

Anatahan Is.: 3w, 13.V.1992, [K].

29. *Anoplolepis longipes* (Jerdon)

Pagan Is.: 3w, 24.V.1992, [K].

30. *Camponotus chloroticus* Emery

Agrihan Is.: 2w, 31.V.1992, [K]; 1m, 29.V. 1992, [K]; 1m, 31.V.1992, [K]; 1w, 31.V.1992, [K]; 1f, 29.V.1992, [M]; 1w, 29.V.1992, [K]. Alamagan Is.: 1w, 9.VI.1992, [K]; 2w, 9.VI.1992, [M]; 1w, 19.V.1992, [M]; 1w, 19.V.1992, [K]. Anatahan Is.: 4w, 11.V.1992, [M]; 3w, 12.V.1992, [M]; 1w, 13.V.1992, [M]. Asuncion Is.: 1w, 1.VI.1992, [K]. East Is. of Maug Is.: 3w, 2.VI.1992, [K]. Guguan Is.: 4m13w, 18.V.1992, [M]; 1w, 17.V.1992, [K]. Pagan Is.: 1w, 25.V.1992, [K]. Sarigan Is.: 2w, 15.V.1992, [K]; 4w, 15.V.1992, [M].

31. *Camponotus* sp.

Agrihan Is.: 2w, 31.V.1992, [K]; 3w, 31.V. 1992, [K]; 5w, 28.V.1992, [M]. Alamagan Is.: 4w, 9.VI.1992, [K]; 1w, 19.V.1992, [K]. Anatahan Is.:

1w, 13.V.1992, [K]; 3w, 12.V.1992, [M]; 1af9w, 13.V.1992, [M]; 23w, 12.V.1992, [M]; 1w, 12.V.1992, [K]; 1m, 13.V.1992, [M]. Guguan Is.: 13w, 7.V.1992, [M]; 1w, 17.V.1992, [K]. Sarigan Is.: 3w, 15.V.1992, [M]; 8w, 15.V.1992, [M].

2. Faunal characteristics

Among the 31 species recorded, at least 15 species (48%) are tramp species (see Wilson and Taylor, 1967a, b, for definition) which were almost certainly introduced from other countries by human commerce. The ratio of tramp species is 50% on Agrihan, 62% on Pagan and 42% on Anatahan. It is well known that Pacific ant faunas show a high proportion of tramp species (Wilson, 1959; Wilson and Taylor, 1967 a, b; Wilson and Hunt, 1967). Seven species (23%) are widely distributed from Indo-Australian to Pacific areas. Thus, the ant fauna of the northern Mariana Islands is composed mostly of tramp species and widely distributed species. All of the widely distributed species on these islands, i.e. *Odontomachus simillimus*, *Tetramorium bicarinatum*, *Paratrechina bourbonica* and *Camponotus chloroticus*, are tramp species or species widely distributed in the Pacific islands.

3. Faunal similarities

Fig. 2 shows the numbers of species recorded and the numbers of common species among the northern Mariana, Izu, Ogasawara (Bonin), and

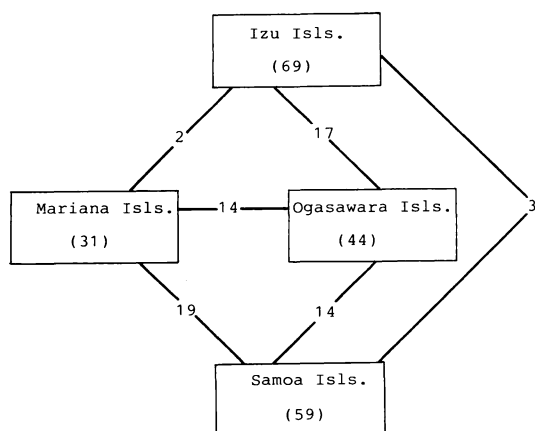


Fig. 2. Number of species recorded on each group of islands (parentheses) and the number of common species.

Samoa Islands. The NSC and the CC values are presented in Table 3. These values range from 0.051 (Izu–Samoa) to 0.613 (northern Mariana–Samoa) in NSC, and from 0.020 (Izu–northern Mariana) to 0.268 (northern Mariana–Samoa) in CC. The matrices obtained using NSC and CC values were reduced to dendrograms by the UPGMA method (Fig. 3). In the dendrogram obtained using by NSC values, we classified two faunal groups; the Izu–Ogasawara group, and the northern Mariana–Samoa group. The latter cluster has a high similarity level, 0.61. In terms of CC values, the Izu Islands have the lowest similarity, whereas the northern Mariana and Samoa Islands form a very compact cluster at a similarity level of 0.26. Thus, the ant fauna of the northern Mariana Islands is

Table 3. Nomura-Simpson's Coefficient (upper triangular matrix) and Jaccard's index (lower triangular matrix).

	A	B	C	D
A	—	0.386	0.065	0.051
B	0.168	—	0.452	0.318
C	0.020	0.230	—	0.613
D	0.024	0.157	0.268	—

A, Izu Is.; B, Ogasawara Is.; C, northern Mariana Is.; D, Samoa Is.

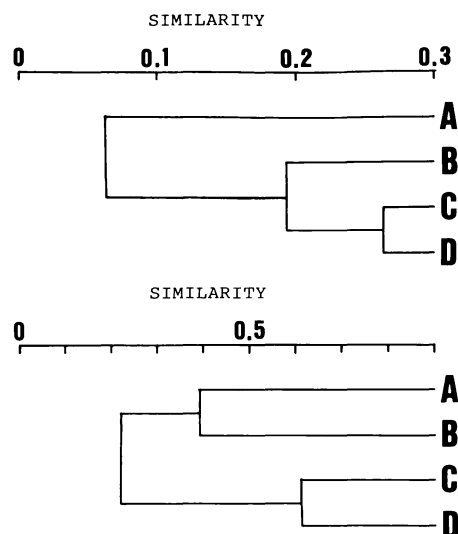


Fig. 3. Dendrogram showing the similarity of ant faunas based on the NSC (below) and CC (above). A, Izu Is.; B, Ogasawara Is.; C, northern Mariana Is.; D, Samoa Is.

more similar to that of the Samoa Islands of Polynesia than that of the Ogasawara Islands. The Ogasawara Islands also have a high ratio of tramp species (53–57%; Terayama and Hasegawa, 1992). Thus, the higher faunal similarity between the northern Mariana and Samoa Islands would be due to the common presence of widely distributed species, many of which are not distributed in the Ogasawara Islands.

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Appendix

We examined the following ant species from Saipan and Rota Islands, the southern Mariana Islands.

Saipan Is.

Paratrechina bourbonica (Forel)

1w, 9.V.1992, [M].

Anoplolepis longipes (Jerdon)

15w, 9.V.1992, [M].

Iridomyrmex sp.

7w, 7.V.1992, [M].

Rota Is.

Paratrechina longicornis (Latreille)

1w, 13.VI.1992, [M].

Odontomachus simillimus Fr. Smith

1af, 13.VI.1992, [M].