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Faunal Comparison of Ants among Cheongsando and Other Islands of South Sea in Korea

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ABSTRACT **This paper attempts to reveal the biogeographic characteristics of ant fauna of the islands among Korean South Sea, using quantitative analyses. The data treated in this paper are those from Cheongsando Is. and 10 other islands in South Sea which have been well investigated. The faunal similarity is examined using the Nomura-Simpson's Coefficient (NSC). Futhermore, the obtained *NSC* value matrix is examined by a cluster analysis using UPGMA method. The number of species which has been recorded in the 11 islands are 91 species belonging to 34 genera under 4 subfamilies. Among the above 11 islands, Jejudo Is., which is the largest, has the highest number of species, 67 spp., while Geogeumdo Is. has the lowest, 21 spp. Cheongsando Is. which has directly been investigated by authors has 30 species. The *NSC*-values between the 11 localities investigated range from 0.522 (Wando Is. to Saryangdo Is.) to 1.000 (Namhaedo Is. to Geojedo Is.). The comparative *NSC* value of Cheongsando Is. and 10 islands range from 0.522 (to Saryangdo Is.) to 0.833 (to Jejudo Is). The cluster analysis using a similarity index (NSC) showed that the islands of these areas could be grouped into 3, a level of 32%. The similarity of Soando Is. and Geomundo Is. were the closest, 63%, while Soando Is. and Namhaedo Is. were the remotest, 32%. The similarity of Jindo Is. and Cheongsando Is, was 63%, while that of Namhaedo Is. and Cheongsando Is. was 32%.**

Key words: Ant, Fauanl comparison, Nomura-Simpson's Coefficient, Korea

INTRODUCTION

The information of ants in Korea has been increasing with the progress of taxonomic and ecological researches (Choi et al., 1993; Choi & Lee, 1995; Kim & Park, 1996; Choi, 1996; Kim & Kim, 1997; Park & Kim, 2000). However, little has been studied the similarities of ant faunas in this country. The South Sea has a lot of islands, including Jeju, which is the largest in Korea. So, we are interested in the islands of South Sea.

Cheongsando Is. consists of 14 islands, which are located in the South Sea and belongs to Wando-gun, Jeollanam-do. It is 19.2 km from Wando in a east and south direction. The central island is covered with black pines, rocks, hills, and mountains (Maebongsan, Daebongsan, Bojeoksan, etc.). They are designated as the Dadohae National Park.

They are surrounded with Jejudo, Wando, and Sinjido islands, etc. The total square of all the Cheongsando Is. are 42.7 km^2 and the central island, which we intended to survey, is the largest one, 34 km^2. The population is about 5,000.

Since Cheongsando Is. is located in the South Sea between the peninsular mainland and Jeju-do, it was thought that they had quite a different ant fauna from those of mainland and Jeju-do. However, in spite of being just 19.2 km from Wando Is., the reports of this type research in Cheongsando Is. have apparently not been published to date. Therefore, the authors intended to survey the ant fauna of Cheongsando Is. expecting the different results from those of other islands.

This study attempts to reveal the biogeographic characteristics of ant fauna of the islands among Korean South Sea, using quantitative analyses. The data treated in this research are those from Cheongsando Is. and 10 other islands in South Sea which have been well investigated. The faunal similarity is examined using the *Nomura-Simpson's Coefficient* (*NSC*). Futhermore, the obtained *NSC* value matrix is examined by a cluster analysis using UPGMA method.

This research is one of comparison of the ant fauna on the Korea peninsula with that of the surrounding islands.

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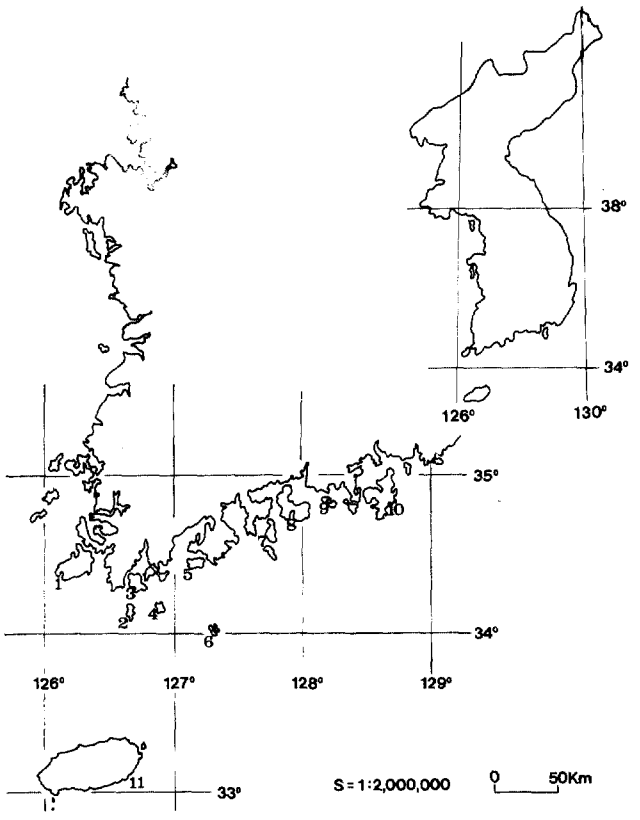

Fig. 1. Map of studied areas. 1: Jindo Is., 2: Soando Is., 3: Wando Is., 4: Chengsando Is., 5: Geogeumdo Is., 6: Geomundo Is., 7: Dolsando Is., 8: Namhaedo Is., 9: Saryangdo Is., 10: Geojedo Is., 11: Jejudo Is.

MATERIALS AND METHODS

The data treated in this paper are those from Cheongsando Is. and 10 other South Sea in Korea islands which have been well investigated. The geographical positions of each island are shown in Fig. 1. The faunal similarities are examined using the *Nomura-Simpson's Coefficient* (*NSC*) which is defined by the following equation:

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

Where a and b are the total number of species found in the 1st and 2nd areas respectively, and c is the number of species found in both areas. The *NSC* is favorable for this analysis because the index said to be less affected by the sample size (Komoto, 1967). Futhermore, the obtained *NSC* value matrix is examined by a cluster analysis using UPGMA method.

RESULT

The appendix shows the number and the distribution records of each species in the areas. The 91 species of ants belonging to 34 genera of 4 subfamilies were recorded from the 11 studied islands. Among the above 11 islands, Jejudo Is., which is the largest, has the highest number of species, 67 spp., while Geogeumdo Is. has the lowest, 21 spp. Cheongsando Is. which has directly been investigated by authors has 30 species.

The species composition of ants collected at six sites in Cheongsando Is. was 30 species of 19 genera under 4 families; 2 species of 1 genera under the subfamily of Ponerinae (6.7%), 2 species of 2 genera under the subfamily of Dolichoderinae (6.7%), 16 species of 11 genera under the subfamily of Myr-

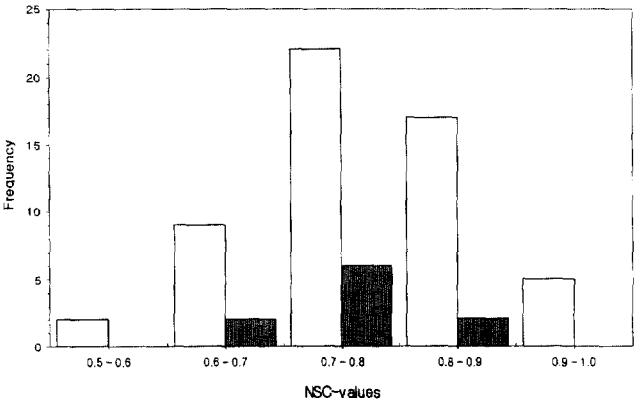

Fig. 2. Frequency distribution of *NSC*-value in different regional data sets.
(□ : *NSC*-value from whole data at Table 1, ■ : *NSC*-value from the data set of Cheongsabdo Is.-others)

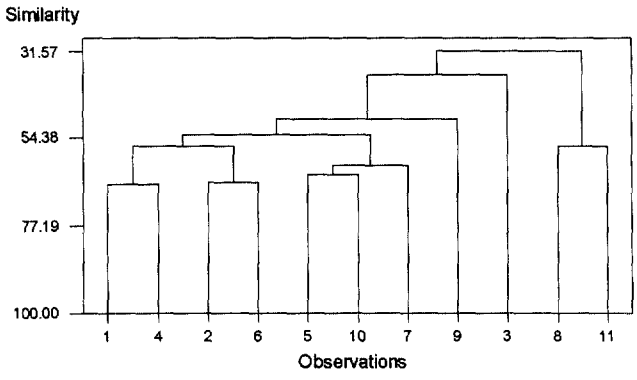

Fig. 3. Dendrogram showing the similarity among ant species in the studied areas. For a area codes see Fig. 1.

Table 1. Number of common species (upper triangular matrix) and Nomura-Simpson's Coefficient (lower triangular matrix). For a area codes see Fig. 1.

	1	2	3	4	5	6	7	8	9	10	11
1	–	22	17	23	19	17	20	24	17	20	26
2	0.759	–	18	22	20	18	19	25	16	22	25
3	0.654	0.692	–	16	16	13	18	21	12	18	23
4	0.767	0.759	0.615	–	20	17	20	23	17	19	35
5	0.731	0.769	0.692	0.769	–	16	19	24	17	19	23
6	0.810	0.857	0.619	0.810	0.762	–	15	19	12	17	19
7	0.741	0.704	0.692	0.704	0.692	0.714	–	25	17	19	24
8	0.800	0.862	0.808	0.767	0.923	0.905	0.926	–	20	28	35
9	0.739	0.739	0.522	0.739	0.739	0.571	0.739	0.870	–	17	19
10	0.714	0.786	0.692	0.679	0.731	0.810	0.704	1.000	0.739	–	25
11	0.867	0.862	0.885	0.833	0.885	0.905	0.889	0.833	0.826	0.893	–

micinae (53.3%), and 10 species 5 genera under the subfamily of Formicinae (33.3%).

The several differing points were found among the 6 sites in the islands; the dominant species were 4; *Tetramorium casepitum*, *Crematogaster vagula*, *Crematogaster osakensis*, and *Paratrechina flavipes*. The two rare ant species came to view; *Aphaenogaster tipuna*, and *Formica japonica*.

Table 1 shows the number of common species and the *NSC*-values between the 11 localities of the studies areas. The *NSC*-values range from 0.522 (Wando Is. to Sarayngdo Is.) to 1.000 (Namhaedo Is. to Geojedo Is.). The *NSC*-values between Cheongsando Is. and 10 localities range from 0.522 (to Saryangdo Is.) to 0.833 (to Jejudo Is.).

These aspects are clearly shown in a cluster analysis of *NSC* using the UPGMA method (Fig. 3).

CONCLUSION

The composition of ant species investigated in the 11 islands including Cheongsando Is. is as follow in appendix, 91 species of 34 genera under 4 families. Among all the investigated islands Jejudo Is showed the highest diversity, 67 species of 30 genera, while Geomundo Is. and Saryangdo Is showed the lowest diversity, 21 species of 16 genera and 23 species of 17 genera. These results coincided with that numbers of species increase with size of area, and probably also with evolutionary time that has been available for colonization, niche specialization, and speciation (Preston, 1960; Sanders, 1968).

The common species in the 11 islands were found 7 species as follow; *Pheidole fervida*, *Solenopsis jaonica*, *Pristomyrmex pungens*, *Tetramorium caespitum*, *Camponotus japonicus*, *Camponotus tokiensis*, and *Paratrechina flavipes*.

The dendrogram showing the similarity among 11 islands is showed in Table 1 and Fig. 3. It consists of 3 groups, and the similarity between first (1, 2, 4, and 6) and second group (5, 7, and 10) shows 0.740, and that between the first and the third group (3, 8, 9, and 11) shows 0.76, while that between the second and the third group shows 0.817. Accordingly the first and third group seemed to be continuos, not so high at the level of variation, while the first and second group, and the first and the third group does not reach the criteria of continuity, 0.800 (Choi, 1996). So, It was found that both the second and third group were on the way of seceding from the total groups.

ACKNOWLEDGEMENT

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REFERENCES

Choi, B.M., 1996. Distribution of ants (Formicidae) in Korea (16)-Ant fauna from Chollabukdo-Korea *J. Soil Zoology*, **1**(1): 5-23.

Choi, B.M. and Bang J.R., 1993. Studies on the distribution of ants (Formicidae) in Korea (12)-The analysis ant communities in 23 Islands-*Cheongju National University of Education*, **30**: 317-386.

Choi, B.M., K. Ogata, & M. Terayama. 1993. Comparative studies of ant fauna of Korea and Japan. I. Faunal comparison among islands of southern Korea and northern Kyushu, Japan. *Bull. Bio. Soci. Japan*, **48**(1): 37-49.

Choi, B.M., C.H. Kim, & J.R. Bang, 1993. Studies on the distribution of ants (Formicidae) in Korea (13). *Bulletin of Cheongju National Univ. of Education*, **30**: 331-380.

Kim, B.J. and K.G. Kim, 1997. Systematic study of Korean *Camponotus* ants based on electrophoretic and morphological data. *Korean J. Entomol.*, **27**(4): 281-296.

Kim, B.J., K.G. Kim, J.Y. Park & K.H. Lim, 1993, Systematic study of ants from Chejudo province. *Korean J. Entomol.*, **23**(3): 117-141.

Park, S.J. and B.J. Kim, 2000. Systematic study of Pheidolini (Hymenoptera: Formicidae: Myrmicinae) from Korea. *Korean J. Entomol.*, **30**(2): 107-114.

Preston, F.W., 1960. Time and space and the variation of species. *Ecology*, **41**: 611-627.

Sanders, H.L., 1968. Marine benthic diversity: A comparative study. *Am. Nat.*, **102**: 243-282.

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Appendix. Distribution data of ants in study area.
1: Jindo Is., 2: Soando Is., 3: wando Is., 4: Chengsando Is., 5: Geogeumdo Is., 6: Geomundo Is., 7: Dolsando Is., 8: Namhaedo Is., 9: Saryangdo Is., 10: Geojedo Is., 11: Jejudo Is.

Science Name	1	2	3	4	5	6	7	8	9	10	11
Ambliopone silvestrii							○	○			○
Pachycondyla chinensis	○			○			○	○	○	○	○
Pachycondyla javana	○	○	○	○	○	○	○	○			○
Pachycondyla pilosior											○
Cryptopone sauteri		○	○					○		○	○
Hypoponera sauteri	○	○				○		○		○	○
Ponera japonica	○				○			○			○
Ponera scabra		○					○		○	○	
Proceratium itoi	○		○				○				○
Proceratium watasei											○
Dolichoderus sibiricus											○
Iridomyrmex glaber											○
Ochetellus itoi	○	○	○	○	○	○	○	○	○	○	
Technomyrmex gibbosus		○		○							○
Crematogaster matsumurai	○	○		○	○	○	○	○	○		○
Crematogaster osakensis	○	○	○	○	○		○	○		○	○
Crematogaster teranishii	○	○	○	○	○		○	○	○		○
Crematogaster vagula				○							
Aphaenogaster famelica											○
Aphaenogaster japonica			○			○	○	○		○	○
Aphaenogaster tipuna	○	○	○	○		○					
Messor aciculatus				○	○		○	○	○		○
Pheidole fervida	○	○	○	○	○	○	○	○	○	○	○
Pheidole indica	○								○		○
Pheidole noda		○			○	○		○	○	○	○
Leptothorax acervorum											○
Leptothorax congruus	○	○		○		○		○		○	○
Leptothorax spinosior	○	○		○	○			○	○	○	○
Leptothorax sp. A			○[a]								○
Leptothorax sp. B	○[a]										
Leptothorax sp. 2								○[b]			
Monomorium chinense	○	○		○	○	○	○	○	○	○	○
Monomorium floricola											○
Monomorium intrudens	○			○	○	○		○		○	○
Monomorium pharaonis								○			○
Solenopsis fugax											○
Solenopsis japonica	○	○	○	○	○	○	○	○	○	○	○
Myrmecina graminicola nipponica	○		○								○
Pristomyrmex pungens	○	○	○	○	○	○	○	○	○	○	○
Myrmica jessensis											○
Myrmica kotokui											○
Myrmica sulcinodis											○
Myrmica sp. 7					○[a]						
Strumigenys lewisi	○	○	○	○	○	○	○	○		○	○
Dacatria (Proatta) templaris		○									
Tetramorium caespitum	○	○	○	○	○	○	○	○	○	○	○
Smithstruma japonica					○						○
Epitritus hexamerus		○									
Strongylognathus koreanus										○	○
Vollenhovia emeryi		○	○	○	○	○	○	○	○	○	○
Camponotus itoi								○			○
Camponotus japonicus	○	○	○	○	○	○	○	○	○	○	○
Camponotus jejuensis				○							○
Camponotus kiusuensis								○			
Camponotus nipponensis			○								○
Camponotus obscuripes											○
Camponotus quadrinotatus							○				○
Camponotus tokioensis	○	○	○	○	○	○	○	○	○	○	○
Camponotus sp. H							○[b]	○[b]			
Polyrhachis lamellidens											○
Formica fusca						○					○

Appendix. Continued.

Science Name	1	2	3	4	5	6	7	8	9	10	11
Formica japonica	○	○	○	○	○		○	○	○	○	○
Formica lemani											○
Formica rufa											○
Formica sanguinea											○
Formica sp.											○
Formica transkaucasica											○
Formica truncorum											○
Formica yessensis								○	○	○	
Lasius alienus		○	○		○			○		○	○
Lasius brunneus			○					○			○
Lasius crispus											
Lasius flavus								○			○
Lasius fuligionosus											
Lasius hayashi				○							
Lasius japonicus	○	○	○	○			○	○		○	○
Lasius merdionalis											○
Lasius morisitai											
Lasius rabaudi											
Lasius sonobei											
Lasius spathepus								○			
Lasius talpa	○			○					○		
Lasius teranishii											
Lasius umbratus											
Paratrechina flavipes	○	○	○	○	○	○	○	○	○	○	○
Paratrechina sakurae	○	○		○	○	○	○	○		○	○
Plagiolepis flavescens			○		○		○	○	○	○	
Plagiolepis manczshurica	○	○					○	○	○	○	○
Plagiolepis pigmae				○							○
No. of species	30	29	26	30	26	21	27	42	23	28	67

[a] : Choi B.M., Kim C.H. and Lee I.H., 1993

[b]: Choi B.M., Kazuo Ogata and Mamoru Terayama, 1993