A myrmecofaunal survey at Hiyama Experiment Forest, Hokkaido University*

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水　谷　　章

Up to the present, many surveys on the ecological distribution of ants have been made in Hokkaido (HAYASHIDA, 1960; etc.), but none on the myrmecofauna of the woodland in Oshima Peninsula, the southernmost part of Hokkaido. The results given in the present paper are based on the observation made at Hiyama Experiment Forest, Hokkaido University, in 1976.

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Area surveyed and Method

As shown in Fig. 1, the area is located in south Hokkaido and belongs to the temperate zone from the biogeographical viewpoint. About twenty years ago, the area was covered with such hardwoods as *Fagus crenata*, *Betula ermani*, *Quercus mongolica*, etc. The greater part was deforested, and now, there is occupied by coniferous trees, especially by *Cryptomeria japonica*, except for restricted natural forest and secondary beech forest.

The brief explanation of the habitat types selected for this survey is given below.

Natural forest: *Fagus crenata* is the dominant species. Other hardwoods, e. g. *Betula ermani*, sparsely occur. The ground is sparsely covered with *Sasa*

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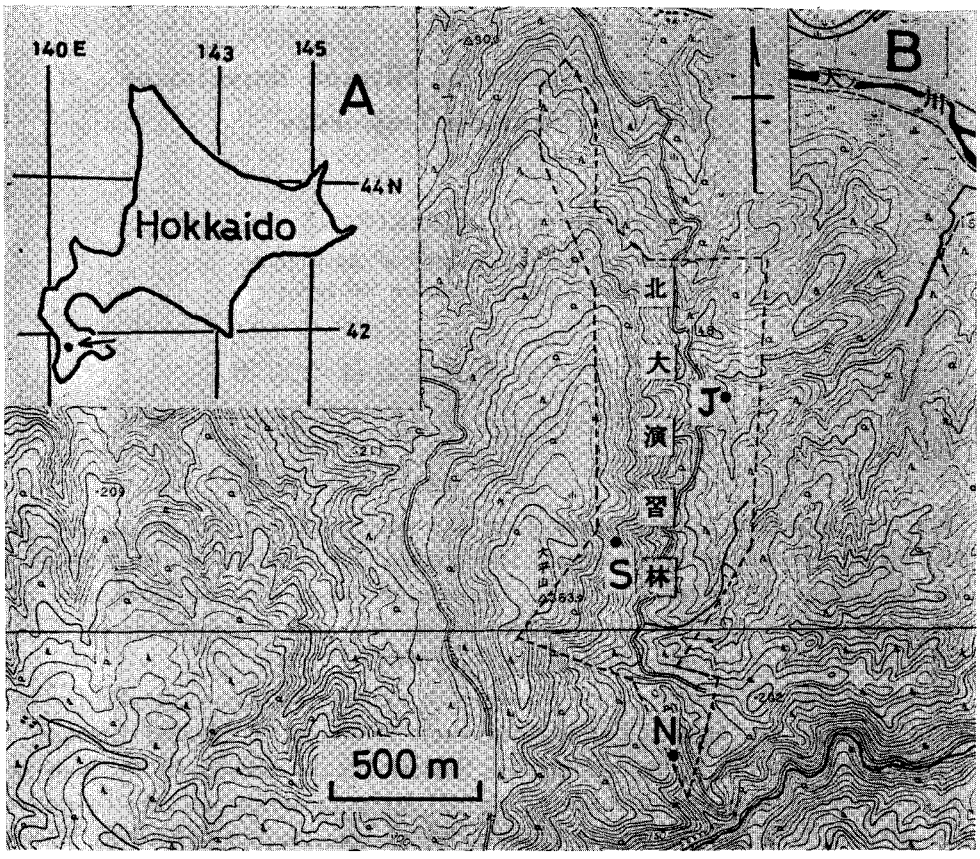

Fig. 1. Location (A) and topography B (of) the area surveyed. Abbreviations for habitat types are as follows: J: Japanese cedar plantation, N: natural forest, S: secondary beech forest. Solid circles indicate observation areas, each involving ten quadrates.

(ca. 2 m in hieght), relatively humid, and gets little sun light.

Secondary beech forest: The forest is mainly occupied by young beech trees of at most 30 years old. The ground is densely covered with *Sasa* (ca. 2 m), relatively humid, and rarely irradiated.

Japanese cedar plantation: The forest of Japanese cedar (*Cryptomeria japonica*) involving one- and eight-year-old trees. The younger trees are about 0.5 m high, and the older ones 4 m high, planted 5 m apart from each other. The undergrowth is mowed. The ground is relatively dry and sunny.

The survey was carried out during the summer of 1976 as follows:

1) Sampling individual ants: In each habitat a quadrate of 2 m×2 m was set, and the ants found within it were sampled for five minutes. When nests were found in a quadrate, only three individuals per nest were collected.

2) Counting colonies: Colonies found within a quadrate were examined by digging the ground down to the depth of ca. 5 cm. Three individuals were collected

Table 1. Relative abundance of the ant colony in various habitats at Hiyama Experiment Forest

Species	Natural forest	Secondary beech forest	Japanese cedar plantation	Total
Subfamily Formicinae				
Lasius niger			6 (*d*1, *n*5)	6
Lasius flavus			4 (*m*2, *n*1, *r*1)	4
Lasius umbratus	4 (*n*4)	2 (*n*2)		6
Paratrechina flavipes	1 (*m*1)	2 (*m*2)	31 (*m*22, *r*9)	34
Subfamily Myrmicinae				
Aphaenogaster japonica	4 (*d*4)	5 (*d*2, *m*2, *u*1)	19 (*d*8, *m*5, *n*1, *r*5)	28
Pheidole fervida			2 (*m*1, *r*1)	2
Myrmica ruginodis	4 (*m*4)	1 (*m*1)	12 (*d*2, *m*4, *n*1, *r*5)	17
Stenamma nipponense	1 (*m*1)			1
Stenamma owstoni	1 (*m*1)			1
Colony density (number of colonies/10 m^2)	3.75	2.5	18.5	

Numerals denote the number of colonies. *d*, *m*, *n*, *r* and *u* denote five types of nest site.
d: in fallen logs and decayed stumps. *m*: under accumulations of humus and other debris.
n: around the roots of living trees. *r*: around the roots of grasses and herbs.
u: under stones.

Table 2. Relative abundance of ants in various habitats at Hiyama Experiment Forest

Species	Natural forest	Secondary beech forest	Japanese cedar plantation	Total
Subfamily Formicinae				
Lasius niger	4	5	28	37
Lasius hayashi	3		2	5
Lasius umbratus		1		1
Lasius fuliginosus		3		3
Lasius spathepus			1	1
Formica japonica			2	2
Paratrechina flavipes	7	8	39	54
Camponotus obscuripes	4	1	4	9
Subfamily Myrmicinae				
Aphaenogaster japonica	14	25	49	88
Leptothorax sp.			1	1
Pheidole fervida	5	3	3	11
Myrmica ruginodis	19	4	22	45
Subfamily Dolichoderinae				
Dolichoderus sibiricus	2			2

Numerals denote the number of individuals obtained by five-minutes sampling.

from each colony. The combination of these two methods was repeated ten times for each habitat type. Occasional collections were also made for supplementary purpose.

Results and Discussion

1. Comparison among habitat types

In the survey area, 22 species of ants, corresponding to about a half of ant species so far recorded from Hokkaido, were collected. Sixteen species of them, belonging to ten genera of three subfamilies, were found by individual sampling and colony counting (Table 1 and 2). *Paratrechina flavipes* and *Aphaenogaster japonica* were obviously the most dominant species in the area. Although less abundant, *Myrmica ruginodis* was relatively common. The total number of the colonies of the above three species occupied 79.8% of all colonies discovered. The colony density in each habitat reduced to the value per ten square meters is given in Table 1. The remarkable high density in the Japanese cedar plantation was caused mainly by the abundance of *Paratrechina flavipes*, a tiny species forming a small colony. The colony density in the natural forest is higher than that in the secondary beech forest. In this connection, the ground of the secondary forest is more densely covered with *Sasa* than that of the natural forest, and with less insolation on the ground. Moreover, HAYASHIDA (1972) pointed out that accumulations and fallen logs available for nestsites are more frequently found in the natural forest. The total number of colonies found in the Japanese cedar plantation occupies 74.7% of all colonies found in the present survey. This high colony density seems to have occurred from various causes, among which abundance of nest sites such as decayed logs, accumulation of fallen leaves and other debris, and large amount of insolation due to mowed undergrowth may play an important role. Colonies of *Lasius umbratus* could not be found in the Japanese cedar plantation probably because this species prefers shady places.

The number of individuals obtained by the individual sampling is shown in Table 2. *Aphaenogaster japonica* was obviously the most dominant species in the area surveyed. Although less abundant, *Paratrechina flavipes*, *Myrmica ruginodis* and *Lasius niger* were relatively common. The other species were rather rare.

The orders of relative abundance about the above six species obtained by the two methods are as follows.

By colony counting: *Paratrechina flavipes* > *Aphaenogaster japonica* > *Myrmica ruginodis* > *Lasius niger* > *Lasius umbratus* > *Pheidole fervida*

By individual sampling: *Aphaenogaster japonica* > *Paratrechina flavipes* > *Myrmica ruginodis* > *Lasius niger* > *Pheidole fervida* > *Lasius umbratus*

The results by the two methods agree in general. They, however, disagree in the most dominant species. *Paratrechina flavipes* might have been overlooked in the individual sampling method, because the ant is inconspicuous for the small body-size of workers, or it may have a particular foraging activity that makes this method ineffective. Although six colonies of *Lasius umbratus* could be found by

the colony counting, only one individual of this species was collected by the individual sampling. Probably because, this species is strictly subterranean as *Lasius flavus* and *Solenopsis fugax* are.

The ratio of *Myrmica ruginodis* colonies to all ant colonies obtained in each habitat was 26.7% in the natural forest, 10.0% in the secondary beech forest and 16.2% in the Japanese cedar plantation, respectively. Similar results were obtained in Soranuma (YAMAUCHI 1970). In Hokkaido, there is a tendency of the colony density of *Myrmica ruginodis* to increase in the natural forest in comparison with secondary forest or plantation. Further, *Myrmica ruginodis* ranked the third in abundance in the area surveyed. But, according to previous authors, this species is the most dominant one in Sapporo, Mt. Daisetsu, Nakagawa and Hidaka Mountains, all in the central and northern part of Hokkaido. According to SONOBE (1975), at Mt. ZAÔ, north Honshû, *Aphaenogaster japonica* occurs at a height of 600～800 m and *Myrmica ruginodis* at 900～1800 m. In the central and northern part of Hokkaido, both species occur from the lowland to a hight of ca. 1000 m, and *Myrmica ruginodis* is, as mentioned above, the most dominant species. In the area surveyed (ca. 200 m), *Aphaenogaster japonica* was more abundant than *Myrmica ruginodis*, as shown by both methods. This suggests that the ant fauna of the area surveyed has a characteristic transitional between those of Mt. Zaô and the central and northern part of Hokkaido so far as the two species are concerned. Finally, in order to show the nest site preference, the nest sites are classified into five major types as explained in Table 1. As seen in Table 1, most of the species tend to prefer particular nest sites. The species possessing a strong preference tendency is *Lasius umbratus*, whereas the nest site *m* was preferred by many species. The order of relative preference among the five types is as follows: $m > r, d, n > u$.

2. Myrmecofauna in Hiyama Experiment Forest

In Table 3, the total number of individuals obtained by the two methods in the three habitats and by occasional collections carried out along the woodland paths is compared with other results in Sapporo (YAMAUCHI 1968) and Nakagawa Experiment Forest (HAYASHIDA 1972). In the woodland of Sapporo and the vicinity, 17 species were reported by YAMAUCHI. In the present survey, 22 species, belonging to ten genera, were collected. Although some of them are lacking, most of the other species are relatively abundant in Sapporo. Therefore, faunal composition of the area surveyed is deemed to be fundamentally similar to that of Sapporo. From Nakagawa, however, only 15 species belonging to ten genera were collected. Compared with those of Hiyama and Sapporo, the faunal composition in Nakagawa is simple. This would be because Nakagawa is located in the northern part of Hokkaido. It is generally true that the ant fauna becomes simpler in colder climates. MORISITA (1945) collected 24 species from Fukushima city, etc. in southernmost Hokkaido. Six of them, *Tetramorium caespitum*, *Vollenhovia emeryi*, *Solenopsis fugax*, *Formica exsecta*, *Camponotus caryae* and *Polyergus samurai*, could not be collected in the present survey. *Polyergus samurai* is a species very difficult to

Table 3. Comparison of ant faunae among Hiyama Experiment Forest, Nakagawa Experiment Forest, (quoted from HAYASHIDA 1972) and Sapporo (calculated from YAMAUCHI 1968)

Species	Sapporo	Nakagawa Experiment Forest*	Hiyama Experiment Forest
Ponerinae			
Ponera japonica	1		
Formicinae			
Lasius niger	164	###	67
Lasius hayashi	73	+	7
Lasius sakagamii			8
Lasius fuliginosus	21	+	3
Lasius spathepus			1
Lasius teranishii		+	1
Lasius crispus	4		
Lasius flavus		+	13
Lasius umbratus		+	19
Formica japonica	60	+	18
Formica lemani		##	
Formica yessensis			3
Formica sanguinea	8		
Formica exsecta	11	+	
Paratrechina flavipes	178		154
Camponotus obscuripes	18	##	9
Camponotus japonicus	14		1
Myrmicinae			
Aphaenogaster japonica	45	+	166
Aphaenogaster famelica		+	3
Leptothorax sp. A			1
Leptothorax sp. B	6		
Leptothorax spinosior	5		
Pheidole fervida	52		17
Myrmica ruginodis	155	###	88
Myrmica lobicornis	7	+	7
Myrmica sp.		+	
Stenamma nipponense			2
Stenamma owstoni			1
Dolichoderinae			
Dolichoderus sibiricus			2

Numerals donote the number of individuals.
*: Data obtained only by quantitative sampling.
###: dominant, ##: relatively abundant, +: less abundant.

be discovered except for a particular season, because of its obligatory dulotic mode of life. Further, *Vollenhovia emeryi*, *Tetramorium caespitum* and *Camponotus caryae* are rare species in Hokkaido. Although *Solenopsis fugax* is relatively common, this species was not collected because of the particular life mode as mentioned earlier.

Summary

The distribution of ants at Hiyama Experiment Forest, in natural forest, secondary beech forest and Japanese cedar plantation, was surveyed by sampling individuals during five minutes and counting colonies in 2 m × 2 m quadrates. Twenty two species of ants belonging to ten genera were collected in the area surveyed. Among them *Paratrechina flavipes*, *Aphaenogaster japonica* and *Myrmica ruginodis* were relatively abundant, occupying 79.8% in the number of colonies. The colony density in the Japanese cedar plantation was higher than those of the natural forest and of the secondary beech forest. The high density was caused by the abundance of *Paratrechina flavipes*. Further, it is possible to say that the high colony density in the plantation is caused by larger amount of insolation. The results by the different methods agree in general, though with some discrepancies. This was probably due to the different life modes of the species.

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摘　　要

1976年8月，異なったサンプリング方法（コロニー計数法と5分間採集法）を用いて北海道大学桧山地方演習林の蟻相の調査を行い，10属22種の生息を確認した。これらのうち，コロニー数では *Paratrechina flavipes*（アメイロアリ），*Aphaenogaster japonica*（スミスアシナガアリ）および *Myrmica ruginodis*（シワクシケアリ）の3種が優占で（多い順に配列），これら3種のコロニー数の合計は全コロニー数の約8割を占めた。

スギ植林地におけるコロニー密度は，天然林やブナ二次林のそれより高い傾向があった。植林地における高いコロニー密度は主としてアメイロアリが多産することに負っており，環境的要因としては日当たりの良さが挙げられる。

5分間採集法によってもほぼ同様の結果が得られたが，アリの習性に起因すると思われる若干の相違も生じた。