Studies on the Ecological Distribution of Ants in Akkeshi[1)2)]

By

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(*With 8 Text figures*)

The present paper constitutes the second report of the senior writer's studies on the ecological distribution of ants in Hokkaido, of which the aim is given in the first report. The present paper deals with the analysis of the ecological distribution in Akkeshi, Eastern Hokkaido based upon surveys made in 1958 and 1959.

Before going further, the writers wish to express their sincere gratitude of Prof. Tohru Uchida and Shôichi F. Sakagami under whose helpful guidance the present study has been carried out. Their thanks are also due to Dr. F. Iwata, Dr. C. Oguro, Mr. Z. Nagao and other members of the staff of the Akkeshi Marine Biological Station, whose kindness was indispensable in obtainment of the data at the area studied.

1. Description of the area studies and methods

Topographically, Akkeshi is located on the Nemuro Plateau Zone, which exists between the Volcanic Zone of Eastern Hokkaido and the Pacific Ocean (cf. Fig. 1 A). Phytogeographically, Akkeshi belongs to the Kuriles Range, with certain relics of continental elements of Eastern Asia such as willow (*Chosenia bracteosa* Nakai), birch (*Betura davurica* Pall.) and rose bay (*Rhododendron parifolium* Adams) (Tatewaki 1958). Such original flora remains only in a few limited areas because of extensive cultivation and urbanization.

The main climatic features of the area are seen from Fig. 1. This area is famous for the heavy sea-fog in spring and early summer. Further, a long and severe winter, a relatively cold summer, and strong sea-breezes, characterize the local climate, which restricts the outer activity of ants from middle May to early September.

As in the previous study, quantitative sampling which consisted of counting the number of colonies discovered in a given habitat per 0.5 hour was undertaken. This unit-interval sampling was repeated ten times for each habitat type as distinguished in the subsequent section. Further, qualitative sampling was made

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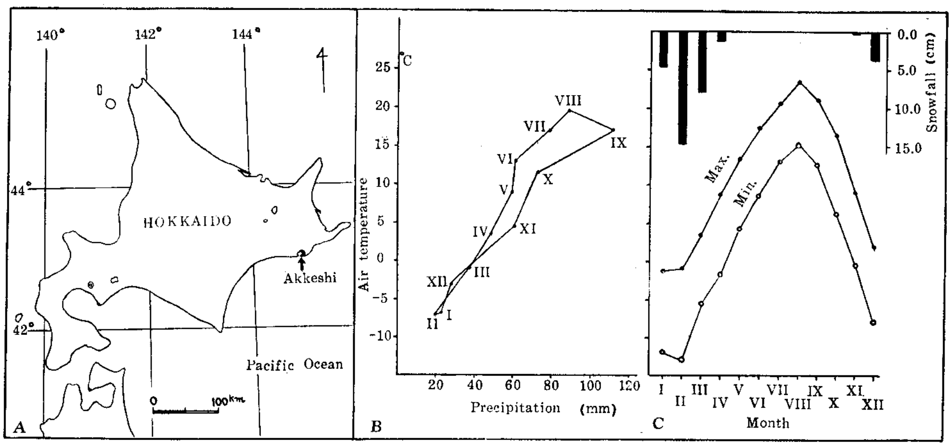

Fig. 1. Maps of the area studied and climatic conditions. (A) Location of the area in Hokkaido, (B) Climograph of Akkeshi, (C) Annual changes of monthly air temperature and snowfall (From "Climate of Hokkaido", published by Sapporo Region Meteor. Observatory (1952))

occasionally in order to obtain the precise faunal make-up in the area.

2. Distribution in various habitats

As listed in Table 1, 16 forms, including subspecies and varieties, were collected from the area, all being typical palaearctic elements, namely, about a quarter of the ant species hitherto recorded from Hokkaido (about 50, Hayashida 1960). As in the previous paper (Hayashida 1960), the area studied was divided into five habitats, namely, BS (mainly bare sand dune or sea shore), BA (bare or sparsely vegetated area such as crop fields, road sides, etc.), HG (herby or grassy land as meadow and pasture), WM (wood margins and scrub) and WL (woods).

The number of colonies obtained by quantitative sampling in each habitat may suggest the general tendency in the distribution of various species. As seen in Table 1, *Myrmica ruginodis* and *Lasius niger* are obviously the most dominant species in the area studied, providing about 73% of the total number of colonies discovered. On the other hand, other species are so remarkably less abundant that the faunal make-up is relatively simple. However, some interesting facts were noticed concerning rare species as follows: 1) *Leptothorax acervorum* is found in a damp area (Adlerz 1886, Dampf 1924, Skwarra 1927) or in an arid stony area (Gösswald 1932) in Europe. In Akkeshi, only one colony of this species was found in a piece of fallen wood on the hilly part of Daikokujima Island. 2) One colony of *Paratrechina flavipes* was found in the area, but it is listed as a very rare species in Eastern Hokkaido in a study of the regional distribution of ants by the senior writer (Hayashida unpubl.). It has never been discovered from Nemuro, Kushiro,

Table 1. Species collected in Akkeshi, together with their relative abundance in various habitats.

Order of abundance	Specific name	(Abbrev.)	Relative abundance in various habitats* BS	BA	HG	WM	WL	Total (Ratio, %)
1	*Myrmica ruginodis* Nylander	(*M*)	19 (7)	11 (5)	46 (9)	39 (9)	59 (9)	174 (39.82)
6	*M. lobicornis* var. *jessensis* Forel	(*Ml*)		6 (5)	6 (2)			12 (2.74)
7	*Myrmica* sp.	(*Lo*)				9 (6)	2 (1)	11 (2.51)
11 a	*Aphaenogaster* sp.	(*As*)	2 (2)					2 (0.34)
15 a	*Leptothorax acervorum* Fabricium	(*Lr*)		1 (1)				1 (0.17)
15 b	*Paratrechina flavipes* (F. Smith)	(*Pa*)		1 (1)				1 (0.17)
2	*Lasius niger* Linné	(*L*)	31 (9)	31 (8)	52 (7)	26 (10)	4 (3)	144 (32.95)
8	*L. alienus* (Foerster)	(*La*)		5 (3)		4 (4)	1 (1)	10 (2.29)
5	*L. fuliginosus* (Latreille)	(*Lg*)		1 (1)		8 (5)	4 (1)	13 (3.66)
3	*L. flavus* (Fabricius)	(*Lf*)	13 (1)	7 (3)	9 (2)	2 (1)	5 (1)	36 (8.23)
11 b	*L. umbratus* (Nylander)	(*Lu*)				1 (1)	1 (1)	2 (0.34)
9	*L. brunneus* (Latreille)	(*Lb*)					8 (4)	8 (1.83)
11 c	*Camponotus obscripes* Mayr	(*C*)				2 (2)		2 (0,34)
4	*Formica fusca* Linné	(*Ff*)	3 (3)	3 (3)		9 (5)	1 (1)	16 (3.66)
10	*F. fusca japonica* Motschulsky	(*F*)	3 (3)					3 (0.61)
11 d	*F. picea* Nylander	(*Fp*)	2 (1)					2 (0.34)
Number of species (16 spp. in total)			7	9	4	9	9	
Number of colonies			73	66	113	100	85	437

* Number of colonies discovered by the unit-interval sampling and (in parenthesis) number of samples in which the species was discovered.

Abashiri, Kitami which surround Akkeshi, the area studied, suggesting an isolated distribution of the species. 3) *Formica fusca japonica* was discovered from the area far beyond its hitherto known range. However, this species was found only in the urban district near wharf of the town of Akkeshi and is assumed to be an artificially introduced species as is known frequently to occur in other ants (Donisthorpe 1927, Wheeler 1934).

3. Habitat preference

The distribution of colonies in various habitats is illustrated in Fig. 2, together with the relative preference of nest sites discussed later. Further analyses were made to clarify the habitat preference, distribution pattern and characterization of each habitat.

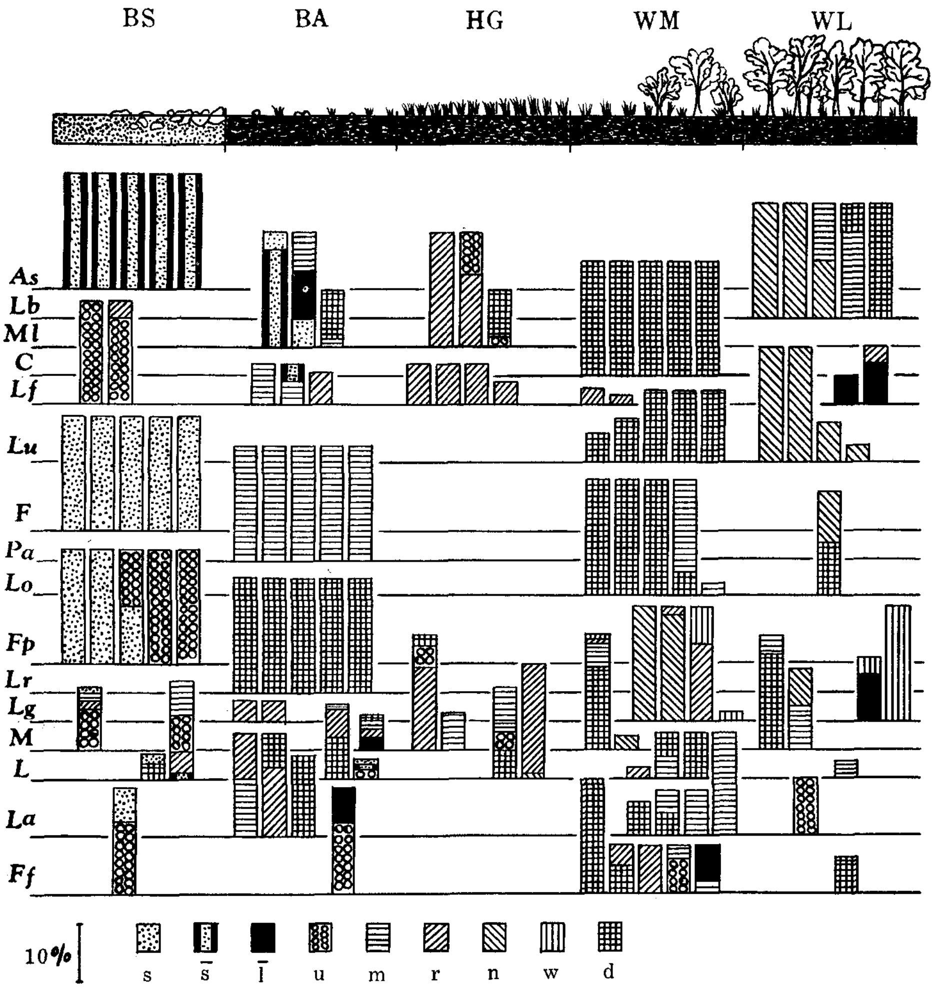

Fig. 2. The distribution of various species in each habitat, together with preference of nest sites.

1) Habitat preference and distribution pattern of each species : Habitat preference is measured by the number of colonies and frequency of discovery in each habitat. The correlation index between species and habitat, Nf/nFH, the colony ratio, c/C, and the patched degree of population in each habitat, c/f were used as in the previous paper. The values of these indices in relatively abundant species are presented in Table 2.

From the values of the correlation index, various species except rare ones can be classified into the following three categories :

Table 2. Correlation indices between relatively abundant species and habitat. Explanation of each index is given in text.

	Nf/nFH					*c/f*					*c/C*					C/F The whole area
	BS	BA	HG	WM	WL	BS	BA	HG	WM	WL	BS	BA	HG	WM	WL	
M	0.18	0.13	0.23	0.23	0.23	2.70	2.20	5.10	4.32	6.55	0.11	0.06	0.26	0.22	0.35	4.44
L	0.24	0.22	0.19	0.27	0.08	3.44	3.87	7.41	2.60	1.33	0.22	0.22	0.36	0.18	0.02	3.88
Lf	0.12	0.37	0.27	0.12	0.12	13.0	2.33	4.50	2.00	5.00	0.36	0.19	0.25	0.05	0.15	4.50
Ff	0.25	0.25	0.00	0.42	0.08	1.00	1.00	—	1.80	1.00	0.21	0.21	0.00	0.56	0.02	1.33
Lg	0.00	0.14	0.00	0.72	0.14	—	1.00	—	1.60	4.00	0.00	0.08	0.00	0.61	0.31	1.86
Ml	0.00	0.71	0.29	0.00	0.00	—	1.20	3.00	—	—	0.00	0.50	0.50	0.00	0.00	1.72
Lo	0.00	0.00	0.00	0.85	0.15	—	—	—	1.50	2.00	0.00	0.00	0.00	0.82	0.18	1.57
La	0.00	0.37	0.00	0.50	0.13	—	1.66	—	1.00	1.00	0.00	0.50	0.00	0.40	0.10	1.25
Lb	0.00	0.00	0.00	0.00	1.00	—	—	—	—	2.00	0.00	0.00	0.00	0.00	1.00	2.00

(1) Species found mainly in one habitat alone—*Lasius brunneus* (WL),

(2) Species found mainly from two habitats—*Myrmica lobicornis* var. *jessensis* (BA, HG), *Myrmica* sp. (WM, WL),

(3) Species found from more than two habitats—*M. ruginodis* (BS, BA, WM, HG, WL), *L. niger* (BS, BA, HG, WM, WL), *L. flavus* (BS, BA, HG, WM, WL), *L. fuliginous* (BA, WM, WL), *L. alienus* (BA, WM, WL), *F. fusca* (BS, BA, HG, WM, WL).

The distribution pattern of each species is characterized also by the values of correlation indices, *Nf/nFH* and *c/C*, in Fig. 3; the following three main categories of distribution pattern are recognized : 1. Patched distribution pattern.

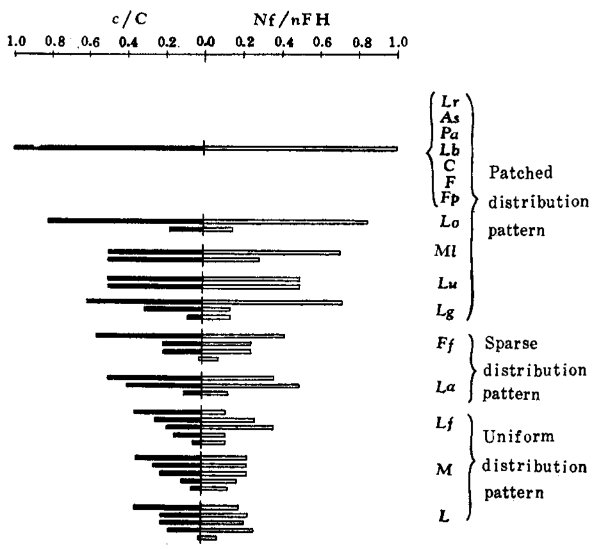

Fig. 3. The values of indices, *c/C* and *Nf/nFH* in various species. Each histogram corresponds to the value of two indices in the habitats.

(1) Species of typically patched distribution pattern — *Leptothorax acervorum*, *Aphaenogaster* sp., *Paratrechina flavipes*, *Camponotus obscripes*, *Formica fusca japonica*, *F. picea*. (2) Species of modified patched distribution pattern — *Myrmica* sp., *Myrmica lobicornis* var. *jessensis*, *L. umbratus*, *L. fuliginosus*; 2. Sparse distribution pattern — *F. fusca*, *L. alienus*; 3. Uniform distribution pattern—*L. flavus*, *L. niger*, *M. ruginodis*.

About two-thirds of all the species discovered in the area belong to the patched distribution pattern, suggesting poverty of myrmecofauna. In Sapporo, the sparse distribution pattern was found in relatively scarce species, while *F. fusca* and *L. alienus* are less abundant in Akkeshi than in Sapporo and its vicinity. The dominant species, *M. ruginodis L. niger* and *L. flavus* belong to the uniform distribution pattern, indicating a wide tolerance range of habitat preference and a large number of colonies in various habitats.

2) *The characterization of habitats*: The characterization of habitats differently utilized by various species constitutes another aspect of habitat preference. According to the occurrence probability method of Katô, Matsuda and Yamasita (1952) (originally referring to Ogawara 1945, Ogawara, Ozawa and Tomatsu 1951), the ratio of number of colonies occupied by each of various species was calculated in each habitat, together with its confidence interval within 95% reliability. In Fig. 4, the results of employment of that method are shown with the confidence

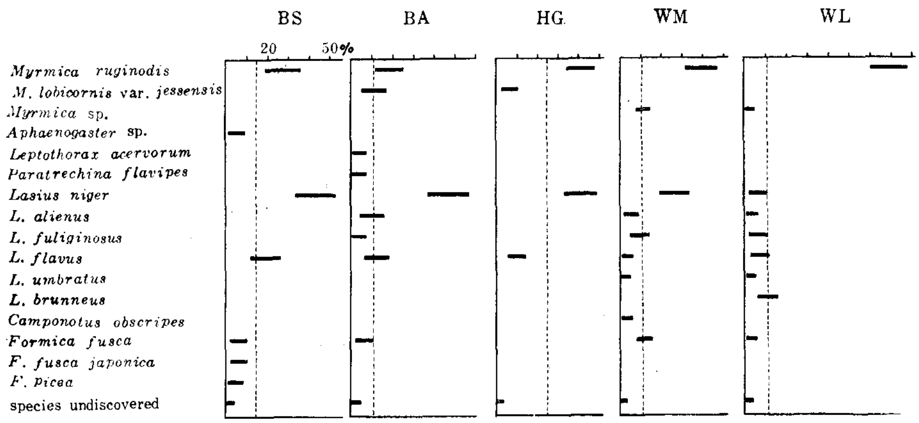

Fig. 4. The colony ratio of each species in various habitats, shown by bar with the confidence range in 95% reliability (Vertical brocken line: the upper confidence limit of mean colony number).

interval in each species. When the low confidence limit of the colony ratio of one species exceeds the upper confidence limit of the mean colony number, such species was regarded as dominant species in each habitat; for example, *Myrmica ruginodis* and *Lasius niger* are dominant in habitats, BS, BA, HG WM, and the former also in WL.

Further characterization of habitats was made by using Motomura's law of geometric series given by a formula, $\log y + ax = b$ (Motomura 1932) (Abbreviations as in the previous paper, Hayashida 1960). From the values given in Fig. 5, the following degree of complexity series was obtained: WM>BA>WL>BS>HG,

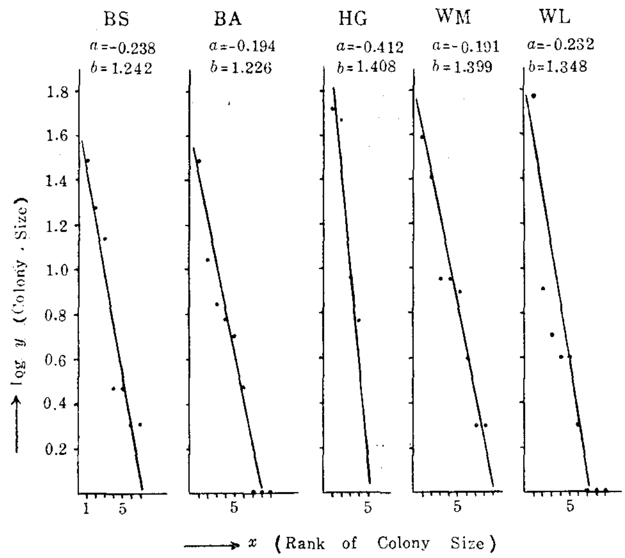

Fig. 5. Comparison of assemblage complexity in various habitats. Each regression line was derived from the low of goemetric series.

which is similar to that of Sapporo (WM>WL>BA>BS>SH>HG). Hence, to generalize, numerous species are attracted to the habitats of either diverse environmental structure or of the sparsely vegetated surface condition (BA). Contrarily, habitat HG is avoided by most species as in Sapporo, explained by the general environmental severity which hinders the development of colonies in most species. The values of b in Akkeshi as index of the population density of the assemblage, show the following series: HG>WM>WL>BS>BA. This seems to correlate to the abundance of vegetation, that is, the density is higher in densely vegetated habitats and *vice versa*, showing a marked contrast to the results in Sapporo and its vicinity.

4. Nest site preference

The nest site preference often deals with more confined microhabitats and occasionally shows a different tendency from that in the habitat preference. As in the previous paper, the nest sites were distinguished and abbreviated as follows:

s : in exposed sandy surface occasionally with stones or rocks; $\bar{s}$: in shaded sandy surface; l̄ : in shaded loam or clay soil ; u : under stones ; m : under accumulations of humus and other debris ; r : around the roots of grasses and herbs; n : around the roots of living trees ; w : in trunks of living trees ; d : in decayed stumps or fallen logs.

Many of these nest sites naturally have definite relations to each habitat respectively as presented in Table 3.

Table 3. Availability and preference of nest sites in each habitat (⧺: inexhaustible; +: abundant; ±: less abundant; −: scarce or absent).

	Availability of nest sites					Number of samples which nest sites occurred					Number of species					Number of colonies				
	BS	BA	HG	WM	WL	BS	BA	HG	MW	WL	BS	BA	HG	WM	WL	BS	BA	HG	WM	WL
s	±	±	−	−	−	2	2				3	2				7	4			
s̄	+	±	−	−	−	4	1				4	3				6	6			
l̄	−	±	−	±	±		3		1	1		3		1	2		6		1	5
u	⧺	+	+	±	±	6	5	4	2	1	5	2	3	2	1	36	7	13	2	1
m	+	+	+	+	⧺	5	6	6	8	8	2	6	2	5	3	11	12	22	19	23
r	+	+	⧺	+	±	5	6	10	4	1	3	5	4	5	1	9	15	66	10	1
n	−	−	±	+	⧺			1	4	7			1	2	5			1	9	20
w	−	−	−	±	±				1	1				1	1				1	3
d	±	+	+	⧺	⧺	1	5	6	10	9	1	5	3	7	5	4	16	11	58	32

1) Degree of utilization : The availavility of various nest sites differs within and among the various habitats. As presented in Table 3, s, s̄ and u are practically inexhaustible and are used rather indiscriminably by more than three species in habitat BS, while m and r sites are rather limited in number and preferred by two or three species. In BA, rather less abundant nest sites, m, r and d are well utilized by several species instead of the ordinary nest sites, l̄ and u. In HG, nest site r is naturally preferred by dominant species, resulting in the maximum number of colonies discovered among various nest sites. On the other hand, u and d are rather infrequent in this habitat but highly preferred if they occur. In general, woodland habitats, WM and WL provide a similar availability in the nest site preference among various species, although there are some differences in the sort of nest sites inexhaustibly utilized between them. In WM, decayed stumps or fallen logs among various nest sites are overwhelmingly preferred by about a half of the species found in the area studied. On the other hand, nest sites, d, m and n are predominantly utilized mainly by the most dominant species, *M. ruginodis* in WL, but other nest sites are rather avoided by wood dwellers.

From the facts mentioned above, it is suggested that the number of species in a given habitat is distinctly affected by the availability of diverse nest sites within the area.

2) Nest site preference of each species : The nest site preference of each species is difficult of quantitative comparison because of the technical difficulty in measuring the frequency of nest sites within a given habitat. As seen in Table 4, however, most species tend to prefer certain specific nest sites. Species possessing

Table 4. Number of colonies of each species found at various nest sites in the area studied.

Species	Types of nest site preference								
	(ls)			(mu)		(nr)		(dw)	
	s	$\bar{s}$	$\bar{l}$	u	m	r	n	w	d
M. ruginodis		2	4	20	43	32	17		56
L. niger	6	4		19	29	43	2		41
F. fusca		1	2	5	1	2			5
L. alienus				1	4	2			3
L. flavus		1	4	12	4	15			
M. lobicornis var. *jessensis*	1	2	1	1	1	4			2
Myrmica sp.					2		1		8
L. fuliginosus			1			3	5	4	
L. brunneus					2		4		2
Aphaenogaster sp.		2							
L. umbratus							1		1
Camp. obscripes									2
Lept. acervorum									1
Para. flavipes					1				
F. fusca japonica	3								
F. picea	1				1				
Number of colonies (c)	11	12	12	59	86	101	30	4	121
Number of species (s)	4	6	5	7	8	7	6	1	10
Ratio c/s in each type	35/9			145/10		131/10		125/11	
Order of preference	mu>nr>dw≫ls								

strong preference are *M. ruginodis* (d or m), *L. niger* (r or d), *L. flavus* (r or u), *F. fusca* (u or d), *Myrmica* sp. (mostly d) and *F. fusca japonica* (s only), especially, nest sites, d, r and m are highly preferred by many species and by their large number of colonies, suggesting the favorable nature of these shady and moist nest sites. Contrary to these optimum sites, w seems to be an unsuitable site judging from its scarce utilization, as seen in the table. Moreover, exposed sites, s, $\bar{s}$ and $\bar{l}$ are also supposedly unsuitable sites in the area studied.

From the nest site preference of all species, the various sites are classified into four major types as follows : Type ls (including s, $\bar{s}$ & $\bar{l}$) : characterized by excessive light intensity, low moisture, scarcity of food sources nearby; Type mu (m & u) : remarkably weak light intensity, rather high moisture and probably adequate food sources nearby; Types nr (n & r) : by weak light intensity, moderate moisture and sufficient food sources nearby; Type dw (d & w) : by moderate or weak light intensity, moderate moisture and relatively much food in w but indistinct in d.

The relative preference of these types by various species is shown in Fig. 6, from which eight subtypes of nest site preference are distinguishable.

A few words will be given with respect to the relationship between habitat preference and nest site preference. As seen in Table 5, the relative preference of nest sites in each of the habitat types depends on the difference of habitat nature

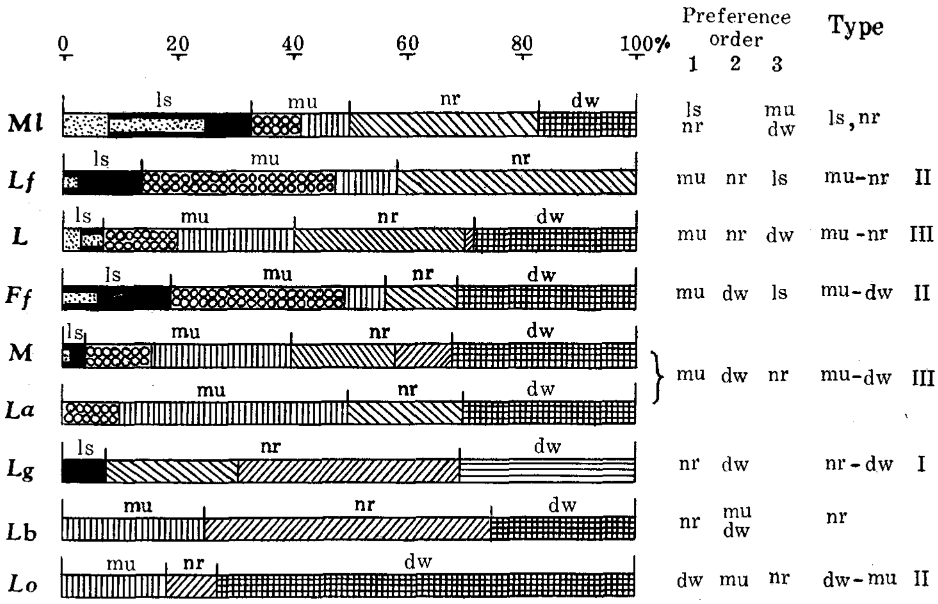

Fig. 6. The relative occupation of preferred nest site in relative abundant species and eight types of relative preference distinguished from the order of nest site preference.

Table 5. Relative preference of nest site shown by a ratio, c/s, where c and s are the number of colonies and species respectively in each habitat type.

Habitat	Type of nest site preference				Relative preference
	ls	mu	nr	dw	
BA, BA	28/8	65/7	21/5	20/5	mu>nr>dw>ls
HG	—	35/3	58/4	11/3	nr>mu≫dw
WM, WL	6/3	45/6	40/8	103/9	dw≫mu>nr>ls

and the relative abundance of nest sites. This tendency is clearly seen in each habitat type, for instance, types nr and dw are distinctly dominant in habitat type H(meaning HG alone in this case) and W(WM & WL) respectively, while mu in B (BS & BA) instead of the original type ls in this habitat type.

5. Degree of co-existence among species

The degree of co-existence among various species was analysed as in the previous paper both in the whole area and in each habitat by using co-existence index $Ed=100\cdot h/a$, where h and a are resepctively the number of samples in which both species, A and B or A was discovered.

1) *Co-existence over the whole area*: The degree of co-existence of the abundant species in proportion to all species is illustrated in Fig. 7. The highest degree of co-existence of *L. niger* with the other 7 species agrees with the wide tolerance range of habitat preference and the relatively large number of colonies of this

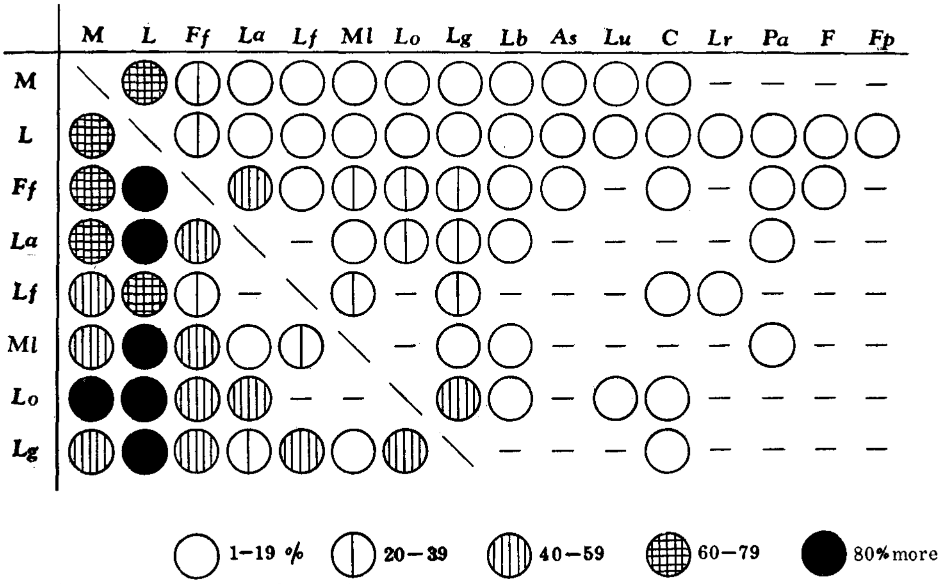

Fig. 7. The degree of co-existenee of relatively abundant eight species (vertically arranged) over the whole area to all species discovered.

species. The same tendency is, though less remarkable, seen also in *M. ruginodis.* The values of *Ed* in the other species are less than 60%, indicating the markedly sparse distribution of ant population in Akkeshi. A high moderate value of *Ed* occurs between *M. ruginodis* and *L. niger* alone, and a moderate value was found only in two pairs, namely, *F. fusca* and *L. alienus*, and *L. fuliginosus* and *Myrmica* sp., probably because of the differences of adaptability to various environments. Further analysis of the problem must be separately in each habitat.

2) *Co-existence in each habitat*: The degree of co-existence among various species discovered in more than 30% out of 10 samples in each habitat, is illustrated in Fig. 8 by using the either Ed_1 or Ed_2 which ever is smaller (cf. Hayashida 1960). Based upon these results, the interspecific relation in each habitat is briefly described.

In habitat BS, the dominant species, *L. niger* and *M. ruginodis* have a high degree of co-existence with one another, nevertheless one of them is not always abundantly found (cf. Table 1). It is clear that the suitable places are effectively utilized by these species. On the other hand, another species, *F. fusca* has a low

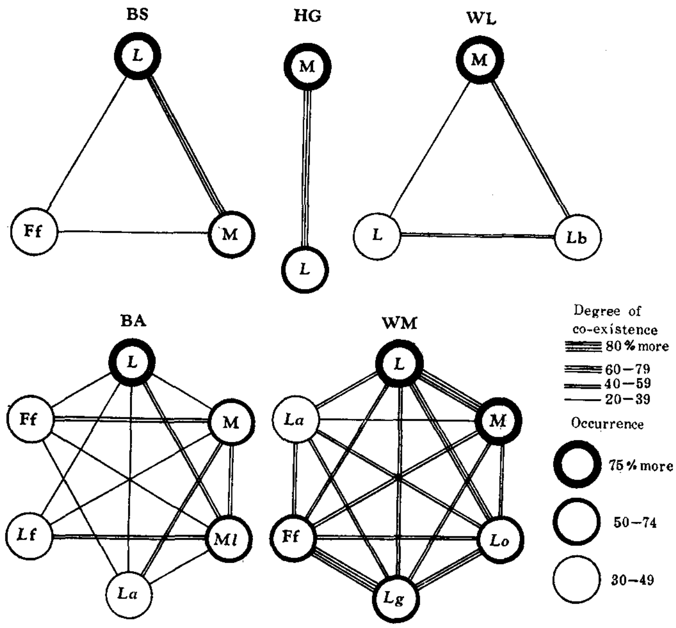

Fig. 8. The degree of co-existence among various species occurred more than 30% of total samplings in each habitat, while the descending order of occurrence of the species was represented from the top, the most one, in clockwise.

degree of co-existence with the two dominant species, apparently because of a less abundance. In habitat BA, the degree of co-existence between dominant or abundant species is markedly low, although the species observed are relatively abundant in this habitat. Hence, it may be said that many species tend to prefer independency in such poorly vegetated habitat in Akkeshi. As seen in Figs. 4 and 5, there are few in the habitat HG, where only the dominant species, *M. ruginodis* and *L. niger* are distributed with a relatively high degree of co-existence, probably due to unsuitable environmental conditions such as always most and shady surface, insufficient food supply, etc. Contrary to the case of habitat HG, in habitat WM, six species show high degree of co-existence, namely, the highest between *L. niger* and *M. ruginodis*, dominant species, and *L. fuliginosus* and *F. fusca*, comparatively high between *L. niger* and *Myrmica* sp., and *Myrmica* sp. and *L. fuliginosus*; moreover, even in other cases except *M. ruginodis* and *L. alienus*, the values show 40 to 59%. Consequently, the highest degree of co-existence in WM may offer the best habitation for ants judging from the fact that it is the most flourishing and complicated habitat both in the number of species and of colonies as well. On the other hand, the degree of co-existence is characterized by remarkably low values among a dominant species and two abundant ones in the habitat WL related to their infrequent occurrence.

6. Discussion

In the previous paper, some general considerations were offered regarding the ecological distribution of ants in Sapporo and its vicinity. Therefore, here will be mentioned only certain aspects peculiar to the myrmecofauna of Akkeshi in comparison with that of Sapporo.

The total number of species discovered from the two areas are 16 and 28 respectively, in which the species found from Akkeshi but not from Sapporo, 5; from Sapporo and its vicinity but not in Akkeshi, 17; from both area, 11. The marked difference of total number of species discovered is partly affected by the less extensive survey in Akkeshi, of course mainly due to lack of necessary time. But it reflects also the poor myrmecofauna in this area. Two dominant species in Akkeshi, *Myrmica ruginodis* and *Lasius niger* are also abundantly found in Sapporo, while five species from the former area alone are characteristic either in Northern and Eastern districts or in the alpine or subalpine zones of Hokkaido. Discussion concerning such patterns will be given in a later paper dealing with the overall distribution of ants in Hokkaido.

As to the utilization of diverse habitats, the rôle of woodland habitats seems to differ between Sapporo and Akkeshi. The inside of woods, WL, is scarcely attractive to ants in Sapporo. This is true in Akkeshi, too, but such a habitat is relatively better utilized. Although the wood margin, WM, is well utilized in Akkeshi, while it comes to the next of poorly vegetated area, BA, in Sapporo. This difference is also confirmed from the analysis of habitat characterization and leads to the following conclusion : the variety of nest sites is generally more abundant in WM and WL than in BA and BS in both areas. The first and the third dominant species, *F. fusca japonica* and *M. lobicornis* var. *jessensis* were frequently found from BA and BS in Sapporo, which are remarkably less populous in Akkeshi.

The distribution patterns classified from two indices are apparently diverse in the two areas. The uniform distribution pattern is shown by only three species out of the Akkeshi total 16, while it was shown by nine of twenty-three species in Sapporo. The patched distribution pattern is represented by two-thirds of the species in Akkeshi but by less than half of the species in Sapporo. Among the species belonging to the uniform distribution pattern in Sapporo, *F. fusca japonica*, *M. lobicornis* var. *jessensis* and *P. flavipes* show the patched one in Akkeshi, although *M. ruginodis* and *L. niger* commonly belong to this pattern in both of the two areas. An opposite example is given by *L. flavus*, which belongs to the patched distribution pattern, in Sapporo but the uniform one in Akkeshi. From the ditribution pattern, it is said that in Akkeshi, the tolerance range of two dominant species is very wide, but most other species narrow. Moreover, the degree of co-existence over the whole area is characterized as very low among the various species excepting with *L. niger*, because many species are sporadically found in Akkeshi. The occurrence of the same tendency is also to be deduced from the degree of co-existence in each habitat. Relatively high values of co-existence are obtained only among six species all in the most favorable habitat, WM.

Concerning the nest site preference, many species are usually found in nests, mu and nr in Akkeshi as well as in Sapporo, but the type ls is exclusively avoided in Akkeshi in contrast to Sapporo. In addition, the series of the population density is opposite between the two areas, manely, H>W>B in Akkeshi against B>H>W in Sapporo. It is clear that among various nest sites, m, u, n and r are relatively abundant in HG, WM and WL in Akkeshi. Furthermore, the environmental factors may be relatively invariable in these herby or woodland habitats in contrast to the poorly vegetated ones which are subjected to sever climatic pressure characteristic to the area more rigorously than in similar habitats in Sapporo. Therefore, the poor myrmecofauna in Akkeshi may be partly caused by the unsuitable conditions of the bare areas in turn due to the severe climate in such area and to the narrow tolerance range of some species. Besides the differences of species distribution between Akkeshi and Sapporo are resulted from the long-termed geological influence, as regarded in the regional zoogeography.

Summary

Using the method of unit-interval sampling, 16 forms of ants belong to 2 subfamilies and 8 genera discovered in Akkeshi, Eastern Hokkaido. The results were quantitatively analysed in comparison to those in Sapporo and its vicinity previously reported.

The order or relative abundance of colonies as well as species in various habitats was graded as woodland, poorly vegetated and herby or grassy habitats. Most species showed patched distribution pattern judging from both their specific habitat preference and distribution pattern in Akkeshi; species of uniform distribution pattern were fewer than in Sapporo. This tendency was also recognized from the analysis of the population density.

Then nest site preference and degree of co-existence were surveyed among various habitats and the species. In four types of nest site preference, types mu (under stones or accumulation of humus and other debris) and nr (around the roots of living trees or grassy plants or herbs) are extensively utilized but unlike in Sapporo ls (in exposed sandy or soil surface) is rather avoided. Co-existence is especially low among various species except in habitat WM (woodmargin), suggesting a simple eco-structure. Corresponding to the results described above, the poor myrmecofauna might be partly due to the severe climatic conditions peculiar to Akkeshi.

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