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TAXONOMICAL AND ECOLOGICAL STUDIES ON THE ANT GENUS *LASIUS* IN JAPAN (HYMENOPTERA: FORMICIDAE). I. TAXONOMY

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Synopsis

A taxonomical study was made on the Japanese species of the ant genus *Lasius*. Including those reported by previous writers, 16 species belonging to 4 subgenera were confirmed from the present study, among which *L. (Cautolasius) sonobei*, *L. (Chthonolasius) hikosanus* and *L. (Dendrolasius) morisitai* are new to science. Following the descriptions, a key to the Japanese species was prepared for each subgenus.

Introduction

Among numerous genera of ants, the genus *Lasius* is one of the most trouble groups to establish a reliable classification, mainly by an extreme intraspecific variability combined with the paucity of well defined characters. Nevertheless, the taxonomic revision of this genus is indispensable because it involves many common, wide-spread and ecologically important species.

The first effort to solve taxonomic confusions in the genus was attempted by Wilson (1955). In his comprehensive monograph, he recognized four subgenera and established 33 valid species out of 110 names so far published, in addition of six new species. His monograph is really monumental and is an immense sources for further studies, but inevitably contains some unsolved problems, mainly caused by poor information on some, mostly Old World forms. For instance, Collingwood (1957) did not accept to synonymize *L. mixtus* with *L. umbratus* as proposed by Wilson, mentioning the occurrence of some ecological and behavioral differences between these two forms. After detailed examination with many nest series, he (1963) mentioned "It appears to me sounder at the present time to assume that, in addition to *L. rabaudi* Bond., there are at least two other species in N. Europe which should continue to be named *L. umbratus* Nyl. and *L. mixtus* Nyl." In Japan, too, many forms not mentioned by Wilson's monograph have been recorded (Hayashida, 1960; Morisita and Onoyama, 1974; Sonobe, 1977, etc.). For the reliable classification of a group so difficult as *Lasius*, it is indispensable to carry out ecological comparisons, in addition to detailed morphological studies. On the basis of their ecological survey on the myrmecofauna in Hokkaido, Yamauchi and Hayashida (1968, 1970) discovered the worker and the male of *L. teranishii*, so far known only by a single queen, and all three castes of two so far unknown species, *L. hayashi* and *L. sakagamii*. But the revision of the genus covering all Japanese territories has not yet been made, making a serious obstacle for various myrmecological studies.

In the present paper, the taxonomical revision of all *Lasius* species inhabiting Japan is

given, and some eco- and ethological characters of each species will be dealt with in a separate paper.

Materials and morphological characters examined

1. Materials

During the course of the present study, numerous specimens were collected from various localities in Japan. Besides, the writer was given many valuable specimens by the following men: Mr. Masao Kubota (Odawara), Mr. Shuichi Kurino (Gifu), Dr. Kazuyoshi Kurosa (Tokyo), Mr. Shuichi Osawa (Yabuki, Fukushima Pref.), Mr. Rikio Sonobe (Sendai), Mr. Atsuo Takizawa (Tsumakoi, Gumma Pref.), Mr. Shoichi Yoshida (Gifu). These specimens are deposited in the writer's collections (YGU).

Further, the writer had an opportunity to examine valuable specimens deposited in the following institutions as well as private collections: Entomological Institute, Faculty of Agriculture, Kyushu University, Fukuoka (EKU), Entomological Institute, Faculty of Agriculture, Hokkaido University, Sapporo (EHU), Dr. Kazuo Hayashida, Koen-Gakuen Junior College, Sapporo (HKC), Dr. Masaaki Morisita, Kyoto University, Kyoto (MKU), Mr. Keiichi Onoyama, Obihiro University, Obihiro (OOU).

The provenance of the materials covers Hokkaido (including Rishiri Is. and Okushiri Is.), Honshu (including Izu-Oshima Is. and Sado Is.), Shikoku and Kyushu (including Tsushima Is. and Yaku Is.), excluding Ryukyu Is. and Bonin Is. Besides, some specimens from Saghalien, Kuriles, Manchuria, Korea and Formosa were comparatively studied. These locality names are given by those recorded on the labels.

2. Morphological and metric characters examined

Details of external anatomy of a worker and a male are shown in Fig. 1. Besides the observation of numerous morphological characters, individual variation of some characters were studied quantitatively, mainly by using the workers of each form. For each form, measurements were made as a rule with 100 workers, consisting of 20 workers taken from each of 5 mature colonies, except for rare forms.

Definition of the measurements, terms and symbols used are as follows:

Cephalic index (CI): $\text{Head width} \times 100 / \text{head length}$.

Eye index (EI): $\text{Eye length} \times 100 / \text{head width}$.

Eye length (EL): Maximum eye length.

Eye width (EW): Maximum eye width.

Head length (HL): Length of head, held in perfect full face, measured from midpoint of occipital border to midpoint of anterior border of clypeal lobe.

Head width (HW): Maximum width of head, held in perfect full face, excluding eyes in worker and queen, and including ones in male.

Pilosity: Longer, stouter hairs, or setae, outstanding above the shorter, usually finer hairs which constitute the pubescence. A special terminology, adopted from Wilson (1955) and illustrated in Fig. 1, has been employed to describe the angle of inclination from the cuticular surface.

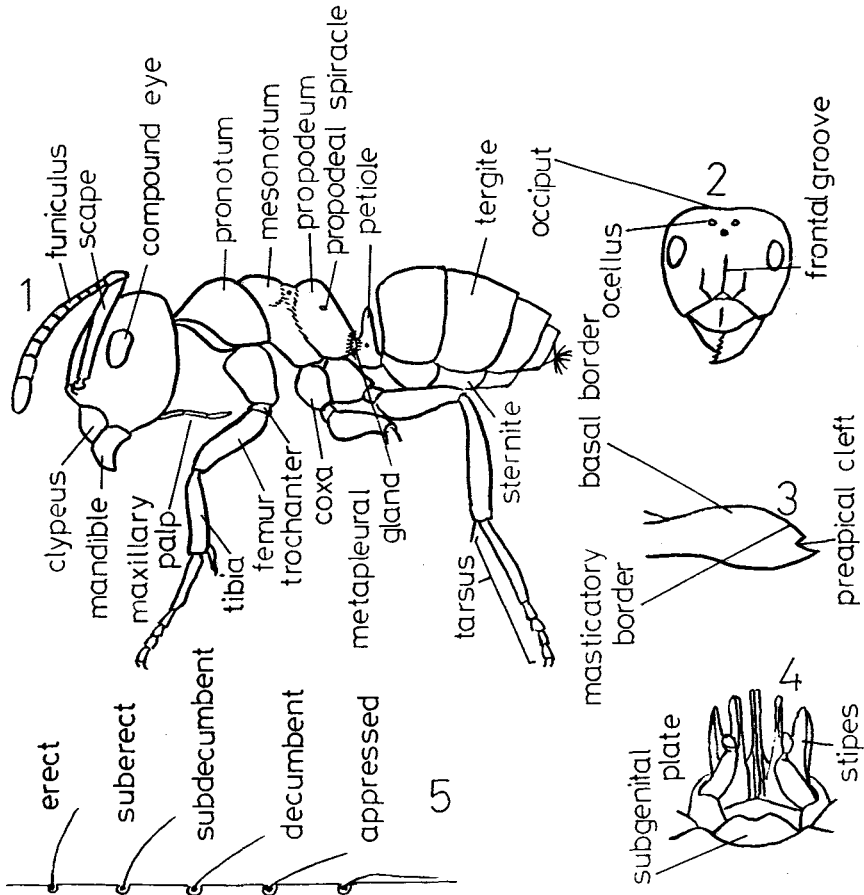


Fig. 1. External morphology of *Lasius* ant. 1, worker; 2, worker head; 3, male mandible; 4, male genitalia; 5, inclination of pilosity.

Pronotum width (PW): Maximum width of pronotum in dorsal view.

Pubescence: Shorter, usually finer hairs underlying the pilosity.

Regression area: Area expressed by the distribution of individual plots as to two characters concerned.

Scape index (SI): $\text{Scape length} \times 100 / \text{head width}$.

Scape length (SL): Maximum scape length exclusive of basalmost "neck".

Seta count (SC): Number of standing hairs (see definition below) seen extending beyond outline of following appendages surface: antennal scape surface viewed in line with plane of funicular flexion, and outer surface of fore tibia viewed in line with plane of tibial flexion.

Standing hair: A hair which is subdecumbent, suberect, or erect, i.e., forming an angle with the cuticular surface of 45° or more.

Stipes: The outermost pair of genital armature consisting of three pairs of complicated appendages.

Subgenital plate: In the male, the terminal sternite just underlying the genitalia.

All measurements were made with an ocular micrometer fitted in a binocular dissecting microscope. One unit 0.01 mm.

Key to the subgenera of Japanese *Lasius*

Wilson (1955) separated *Cautolasius* from *Chthonolasius* by metapleural gland and its opening, being reduced in *Chthonolasius* while developed in *Cautolasius*, in all castes and by head width, broader than thorax in *Chthonolasius* while narrower than thorax in *Cautolasius*, in queen and male. The writer could not find such differences as to metapleural gland openings between the Japanese species of *Chthonolasius* and *Cautolasius*. However, worker size seems to be another auxiliary character for the distinction of these two subgenera. According to Wilson, workers of *Cautolasius* hardly exceed 0.70 mm in PW, but those of most *Chthonolasius* species exceed 0.70 mm.

Consequently, *Cautolasius* and *Chthonolasius* are clearly distinguished only in reproductive castes, by relative width of head to thorax. Distinction in the worker caste remains for the future.

Worker:

1. Body color yellow to brownish yellow; maximum eye length less than $0.20 \times$ head width, mostly less than $0.17 \times$ head width; maxillary palp segments VI and V conspicuously reduced relative to IV. 2
 Body color brown to jet black; maximum eye length more than $0.20 \times$ head width; maxillary palp segments IV, V and VI subequal in length 3
2. Pronotum width between 0.60~0.95 mm, mostly ca. 80 mm in mature colony (Table 3) *Chthonolasius*
 Pronotum width smaller than 0.77 mm, mostly 0.60 mm (Table 2) *Cautolasius*
3. Body color brown to brownish black; terminal segment of maxillary palp about as long as maximum eye width *Lasius* s. str.
 Body color shining jet black; terminal segment of maxillary palp about half as long as or shorter than maximum eye width. *Dendrolasius*

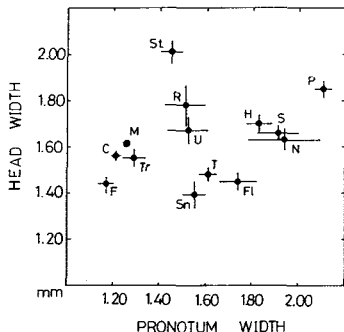


fig. 2. Head width-pronotum width relationships in queens of Japanese *Lasius* (Horizontal and vertical bars: standard deviation).

C, *D. crispus*; F, *D. fuliginosus*; Fl, *Ca. flavus*; H, *L. hayashi*; M, *D. morisitai*; N, *L. niger*; P, *L. productus*; R, *Ch. rabaudi*; S, *L. sakagami*; Sn, *Ca. sonobei*; St, *D. spathepus*; T, *Ca. talpa*; Tr, *D. teranishii*; U, *Ch. umbratus*.

Queen:

1. Head broader than thorax just anterior to tegulae (Fig. 2) ; wings hyaline but basal 1/3 brownish 2
- Head narrower than thorax just anterior to tegulae (Fig. 2) ; wings hyaline uniformly. . . 3
2. Metapleural gland opening larger than propodeal spiracle, provided with guard hairs *Chthonolasius*
- Metapleural gland opening reduced, lacking guard hairs *Dendrolasius*
3. Maxillary palp segments IV, V and VI subequal in length *Lasius* s. str.
- Maxillary palp segments VI and V conspicuously reduced relative to IV *Cautolasius*

Male:

1. Metapleural gland opening reduced, lacking guard hairs. *Dendrolasius*
- Metapleural gland opening larger than propodeal spiracle, provided with guard hairs 2
2. Mandible lacking preapical cleft, basal angle always broadly rounded, masticatory border curving gradually into basal border *Lasius* s. str.
- Mandible with distinct preapical cleft, basal angle often distinctly marked, clearly separating masticatory border from basal border. 3
3. Head including eyes broader than thorax just anterior to tegulae; wing hyaline but basal 1/3 brownish *Chthonolasius*
- Head including eyes narrower than thorax just anterior to tegulae; wing hyaline uniformly *Cautolasius*

Henceforth, each species is cited with abbreviated subgeneric names.

Japanese species of *Lasius* Fabricius (s. str.)

Although the species belonging to *Lasius* s. str. have frequently been cited in previous papers dealing with the Japanese myrmecofauna, they represent one of the most confused groups among Japanese ants. Wilson (1955) recorded three species from Japan: *L. niger*

(Linnaeus), *L. alienus* (Foerster) and *L. productus* Wilson, Thereafter, Yamauchi and Hayashida (1970) described two new species: *L. hayashi* and *L. sakagamii*, from Hokkaido, However, this group is still one of the most imperfectly revised groups.

Lasius (Lasius) niger (Linnaeus)

Formica nigra Linnaeus, 1758, Syst. Nat., Ed. 10. 1:580; worker. Type locality: Europe.

Lasius niger Fabricius, 1805, Systema Piezatorum, 415.

Lasius niger var. *alieno-niger* Forel, 1874, Les Fourmis de la Suisse (Nouv. Mem. Soc. Helv. Sci. Nat.), 44, 49; worker, queen. Type locality: Switzerland.

Lasius emarginatus var. *japonicus* Santchi, 1941, Mitt. Schweiz. Ent. Ges., 18: 277–278; worker, queen.
Type locality: Tokiwa, Hokkaido.

According to Wilson (1955), the unique character found to be of consistent diagnostic value between *L. niger* and *L. alienus* is the quantity of appendage pilosity in all three castes: numerous standing hairs on antennal scapes and legs in *L. niger*, while few or no standing hairs in *L. alienus*. But he writes that in Eastern Asia *L. niger* tends to reduce standing hairs on scapes and tibiae, resulting in the difficulty of its separation from sympatric populations of *L. alienus*. In the present study, too, this character of *L. niger* from Japan varied in workers considerably as shown by SC range covering 0–50 (Fig. 3), making the separation of *L. niger* and *L. alienus* impossible.

Consequently, the writer would like to regard most if not all populations of this complex in Japan as *L. niger*, though *L. alienus* is left in the key to the species given below. As already discussed by Yamauchi and Hayashida (1970), another reason to strengthen this assumption is given as follows:

1) The large sized workers with higher SC value (6~30) can be identified with certainty *L. niger*, because a) SC value of *L. alienus* is always less than 20 and usually less than 10 (Wilson, 1955), b) many workers of the population exceed 0.70 mm in PW, while most workers of *L. alienus* do not exceed 0.70 mm in PW.

2) Besides, it was concluded that small workers with low SC value were always recognized as those of incipient colonies of *L. niger* by the following items of evidence: a) all colonies of these small workers are very small, b) their queens have no characters definitely different from those of *L. niger*, c) their habitat and nest site preferences are not different from those of *L. niger*. d) EL-HW and SL-HW regression areas of these workers coincide with those of *L. niger*.

However, these small workers may hardly be distinguished from *L. alienus*.

In all queens examined, standing hairs on scapes tend to diminish, varying from 8 to 18 in SC value, though they are easily distinguished from European *L. alienus*. Other measurements are given in Table 1. Body color is blackish brown to black, darker than other Japanese consubgeneric species.

In examined males, standing hairs are very sparse on scape and tibia, SC mostly 0. Other

measurements are given in Table 1. Body color blackish brown to black, darker than other consubgeneric Japanese species.

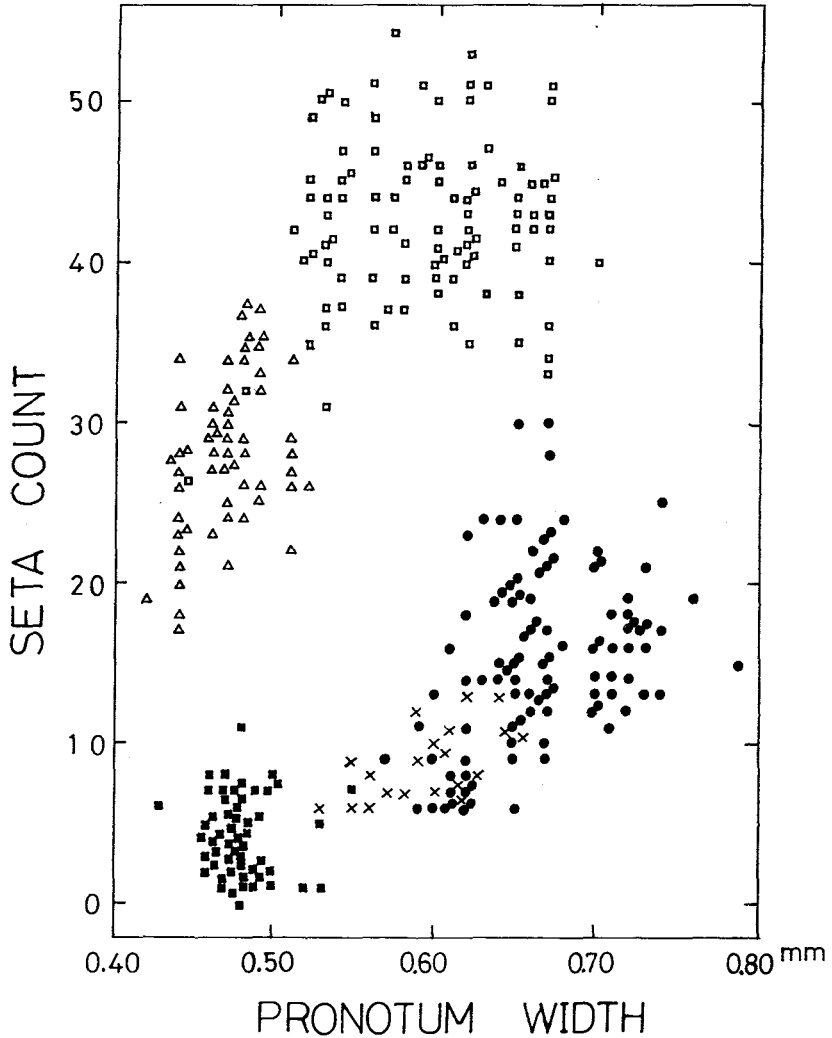


Fig. 3. Seta count-pronotum width relationships in workers of *L. sakagamii* and *L. niger*. □, *sakagamii* in mature colonies; △, *sakagamii* in incipient colonies; ●, *niger* in mature colonies; ×, *niger* in small colonies; ■, *niger* in incipient colonies.

Table 1. Some morphological characters measured in each species of *Lasius* s. str. Values are given as means and, in parentheses, minima and maxima.

Caste	Species	SL (mm.)	HL (mm.)	HW (mm.)	EL (mm.)	EW (mm.)
worker	<i>hayashi</i>	0.99 (0.91-1.13)	1.07 (0.96-1.21)	1.07 (0.94-1.22)	0.24 (0.22-0.28)	0.19 (0.17-0.22)
	<i>niger</i>	1.01 (0.89-1.15)	1.03 (0.90-1.20)	1.01 (0.84-1.20)	0.27 (0.23-0.31)	0.21 (0.15-0.24)
	<i>sakagamii</i>	0.94 (0.82-1.01)	0.94 (0.84-1.09)	0.86 (0.75-1.00)	0.24 (0.21-0.26)	0.19 (0.17-0.21)
	<i>productus</i>	1.18 (1.14-1.30)	1.13 (1.04-1.26)	1.01 (0.92-1.14)	0.26 (0.24-0.28)	0.21 (0.20-0.24)
queen	<i>hayashi</i>	1.24 (1.23-1.25)	1.55 (1.51-1.58)	1.70 (1.66-1.82)	0.44 (0.42-0.46)	0.29 (0.28-0.30)
	<i>niger</i>	1.26 (1.23-1.30)	1.58 (1.55-1.60)	1.71 (1.65-1.78)	0.45 (0.43-0.47)	0.32 (0.30-0.33)
	<i>sakagamii</i>	1.24 (1.20-1.27)	1.54 (1.49-1.58)	1.63 (1.55-1.75)	0.44 (0.44-0.46)	0.31 (0.30-0.33)
	<i>productus</i>	1.51 (1.46-1.54)	1.70 (1.68-1.74)	1.85 (1.80-1.90)	0.46 (0.44-0.48)	0.35 (0.34-0.38)
male	<i>hayashi</i>	0.74 (0.74-0.76)	0.89 (0.87-0.92)	1.05 (1.03-1.09)	0.31 (0.29-0.33)	0.25 (0.24-0.26)
	<i>niger</i>	0.65 (0.63-0.68)	0.82 (0.78-0.84)	0.95 (0.85-1.00)	0.32 (0.30-0.34)	0.25 (0.24-0.26)
	<i>sakagamii</i>	0.64 (0.63-0.66)	0.76 (0.70-0.81)	0.90 (0.85-0.93)	0.30 (0.29-0.32)	0.25 (0.24-0.26)
	<i>productus</i>	1.03 (1.02-1.06)	0.88 (0.84-0.92)	1.03 (0.95-1.06)	0.33 (0.32-0.34)	0.26 (0.25-0.26)

Caste	Species	ML (mm.)	PW (mm.)	CI	SI	SC
worker	<i>hayashi</i>	0.21 (0.18-0.23)	0.69 (0.60-0.80)	99 (95-109)	93 (86-100)	13 (4-25)
	<i>niger</i>	0.20 (0.18-0.23)	0.67 (0.56-0.80)	97 (93-105)	100 (90-108)	15 (6-30)
	<i>sakagamii</i>	0.19 (0.17-0.22)	0.61 (0.52-0.72)	93 (89-97)	106 (99-110)	40 (30-53)
	<i>productus</i>	0.31 (0.30-0.32)	0.69 (0.64-0.78)	90 (82-95)	116 (113-122)	2 (0-3)
queen	<i>hayashi</i>	0.24 (0.23-0.25)	1.83 (1.78-1.94)	113 (110-118)	71 (69-72)	5 (2-8)
	<i>niger</i>	0.24 (0.21-0.25)	1.91 (1.81-2.03)	108 (104-111)	76 (70-79)	11 (8-18)
	<i>sakagamii</i>	0.22 (0.21-0.23)	1.94 (1.68-2.26)	111 (110-112)	77 (73-80)	50 (45-56)
	<i>productus</i>	0.34 (0.34-0.36)	2.11 (2.02-2.14)	110 (106-112)	82 (79-84)	1 (0-2)
male	<i>hayashi</i>	0.15 (0.14-0.16)	1.08 (1.04-1.10)	118 (114-121)	71 (70-72)	0 (0-2)
	<i>niger</i>	0.15 (0.14-0.16)	0.96 (0.90-1.02)	116 (110-121)	72 (69-74)	1 (0-3)
	<i>sakagamii</i>	0.15 (0.14-0.16)	0.93 (0.90-0.96)	118 (115-121)	72 (69-74)	10 (4-15)
	<i>productus</i>	0.23 (0.20-0.25)	0.93 (0.90-0.94)	117 (115-121)	116 (113-121)	0

Specimens examined:

- Hokkaido: Hama-Koshimizu, VII 9'66. 100♂♀(K. Yamauchi leg., YGU); Okoppe, VI 24 '68.3 ♀♀(K. Yamauchi leg., YGU); Tesho-Ariake, VI 20 '68 30 ♀♀(K. Yamauchi leg., YGU); Furano, IX 19 '67 40 ♀♀(K. Yamauchi leg., YGU); Hidaka-Mombetsu, V9-11 '66 30 ♀♀(K. Yamauchi leg., YGU); Sapporo, IV 8 '66 20 ♀♀, IV 19 '66 40 ♀♀, IV 22 '66 3 ♀♀, 1 ♀, V 1 '66 10 ♀♀, V 9 '66 20 ♀♀, V17 '66 20 ♀♀, 1 ♀, VII 16 '66 20 ♀♀, VII 22 '66 20 ♀♀(K. Yamauchi leg., YGU); Hakodate, VII 30 '70 50♂♀(K. Yamauchi leg., YGU).
- Aomori Pref.: Mt. Osoresan, VIII 4 '72 2 ♀♀, 1 ♀ (K. Onoyama leg., OOU).
- Akita Pref.: Akita, IV 2 '76 20♀♀(K. Yamauchi leg., YGU).
- Iwate Pref.: Miyako, Jodohama, VIII 7 '72 2♀♀, 5 ♀♀, 5 ♂♂ (K. Onoyama leg., OOU); Kurosaki, VII 5 '72 4 ♀♀(K. Onoyama leg., OOU).
- Yamagata Pref.: Hondoji, VII 27 '70 10♀♀(K. Yamauchi leg., YGU).
- Gumma Pref.: Tsumakoi, VI 20 '71 3♀♀(A. Takizawa leg., YGU).
- Ibaraki Pref.: Tsuchiura, VII 13 '73 20♀♀(K. Yamauchi leg., YGU); Mt. Tsukuba, VIII 8 '74 36♀♀(K. Yamuchi leg., YGU).
- Chiba Pref.: Kanoyama, IV 7 '68 22♀♀(K. Kurosa leg., YGU).
- Tokyo: Kodaira, XII 23 '67 9 ♀♀(N. Kitamura leg., YGU); Mejiro, VI 4 '69 30♀♀(K. Kurosa leg., YGU).
- Kanagawa Pref.: Hakone, VIII 7 '66 5 ♀♀ (M. Kubota leg., YGU); Manazuru, I 6 '73 4 ♀♀(K. Yamauchi leg., YGU).
- Nagano Pref.: Takamori, VII 31 '67 14♀♀, 1 ♀ (K. Yamuchi leg., YGU); Kaida-Kogen; VIII 35 '72 20♀♀(K. Yamauchi leg., YGU).
- Toyama Pref.: Unazuki, VIII 2 '74 30♀♀, 10 ♀♀, 10 ♂♂ (K. Yamauchi leg., YGU).
- Fukui Pref.: Izumi, VII 29 '74 2♀♀(K. Yamauchi leg., YGU).
- Gifu Pref.: Hagiwara, XI 5 '72 5 ♀♀(K. Yamauchi leg., YGU); Shirakawa, IX 2 '72 20♀♀(K. Yamauchi leg., YGU).
- Aichi Pref.: Shinojima, V 25 '70♀♀(K. Yamauchi leg., YGU).
- Shizuoka Pref.: Kou, V 17 '76 5 ♀♀(K. Yamauchi leg., YGU); Dogashima, V 17 '76 8 ♀♀, 1 ♀ (K. Yamauchi leg., YGU); Matsuzaki, V 18 '76 14♀♀(K. Yamauchi leg., YGU).
- Kyoto Pref.: Kyoto, IV '73 4♀♀ IV 7 '73 6♀♀(K. Onoyama leg., OOU).
- Mie Pref.: Taiji, V 27 '66 6 ♀♀(M. Kubota leg., YGU).
- Wakayama Pref.: Shirahama, IV 9 '66 7♀♀(M. Kubota leg., YGU); X 30 '73 2 ♀♀(K. Onoyama Leg., OOU).
- Tottori Pref.: Yonago, I 2 '69 11 ♀♀(N. Okumura leg., YGU).
- Kochi Pref.: Ashizuri, IV 1 '67 5 ♀♀(M. Kubota leg., YGU).
- Fukuoka Pref.: Hikosan, X 5 '72 15♀♀, 1 ♀ (K. Yamauchi leg., YGU); Orio, VI 7 '67 3♀♀(M. Kubota leg., YGU).
- Nagasaki Pref.: Tsushima, Izuhara-Ariake, IX 25 '59 1 ♀ (Hidaka, Morimoto, Kamiya, Kawarabata leg., EKU); Kuneinaka, VII 26 '72 3♀♀, 3 ♀♀ (T. Maruyama leg., OOU).
- Oita Pref.: Sagazeki, I 6 '69 11 ♀♀(N. Okumura leg., YGU).
- Miyazaki Pref.: Miyazaki, VI 2 '67 5♀♀(M. Kubota leg., YGU).
- Saghalien: Ichinozawa, VIII 4 '24 3♀♀, 3 ♀♀, 2 ♂♂(Matsumura leg., EHU).
- Korea: Nanyo, Suigen-gun (Keikido), VIII 18 '39 2 ♀♀(R. S. Rin leg., EKU); Mt. Kongo, VIII 20 '40 1 ♀ (T. Shirozu leg., EKU); Kwang-Nung, VII 13 '73 9 ♀♀(R. Sonobe leg., YGU).
- Manchuria: Harbin, VIII 19 '41 2 ♀♀(Y. Mori leg., EKU).
- Formosa: Taiheizan (Taihoku-shu), X 25 '32 1 ♀ (K. Sato leg., EKU).

Lasius (Lasius) alienus (Foerster)

Formica aliena Foerster, 1850, Hymenopterologische Studien (Ernst Ter Meer Publ., Aachen), 1: 36-38; worker, male. Type locality: Lousberg: a suburb of Aachen, Germany.

Lasius niger alienus, Forel, 1874, Les Fourmis de la Suisse, 46.

All three castes of this species are extremely close to *L. niger*. According to Wilson (1955), the unique character separating both species is 'quantity of appendage pilosity as mentioned above. SC value of *L. alienus* is always less than 20 and usually less than 10 in worker within the PW range of 0.53~0.70 mm, never exceeding 10 and usually 0 in queen, and almost always 0 in male. Another difference between both species is found in worker size: According to Wilson (1955), in a sample of 165, mean with standard deviation of PW is 0.630 ± 0.069 mm in *L. niger*, while in a sample of 147, 0.56 ± 0.054 mm in *L. alienus*.

In the present study, the writer could not obtain any typical specimens of *L. alienus* from Japan, though he could examine some specimens of *L. alienus* collected from Korea and Manchuria (EKU), which were easily separated from *L. niger* by its appendages with few or no standing hairs.

However, the name "*alienus*" is often found in the papers dealing with Japanese myrmecofauna (Wheeler 1906, Teranishi 1915, 1930, Morisita 1945, Kogure 1955). Further studies required to clarify on the actual status of *L. alienus* in Japan.

Specimens examined:

Korea: Enjomen Monangen (Kankyohoku-do), VII 15, 20 '39 3 ♀♀ (T. Hirao leg., EKU); Toku-to, Koyo-gun. (Keikido), VII 30 '39 2♂♂ (G. T. Mei leg., EKU); keijo, VIII 16 '40 2 ♀♀ (T. Shirozu leg., EKU).
Manchuria: Harbin, VIII 19 '41 2 ♀♀ (Y. Mori leg., EKU).

Lasius (Lasius) productus Wilson

Lasius (Lasius) productus Wilson, 1955, Bull. Mus. Comp. Zool., 113: 95-96; worker, queen, male. Type locality: Mt. Imano, Shikoku, Japan.

Size average of this species is larger than in other consubgeneric Japanese species as shown in Table 1. Further, this species is characterized by the possession of extra-ordinarily long appendages as below, making easy to separate them from all congeneric Japanese species in all three castes.

Worker: Body length 3.5~4.5 mm. Within the HW range 0.92~1.14 mm, SI is between 113~122, and ML exceeds EW by about 1.3X. Other measurements given in Table 1. Body bicolorous, with contrasting reddish brown thorax and petiole, head and gaster dark brown; rarely concolorous dark brown.

Queen: Largest in consubgeneric Japanese species, body length about 10 mm. SI ranging 79~84. Other measurements in Table 1.

Male: Body length about 4.0 mm. Antennal scape extra-ordinarily long, SI ranging 113~121. Other measurements in Table 1.

Specimens examined:

Yamagata Pref.: Hondoji, VII 27 '70 5 ♀♀ (K. Yamauchi leg., YGU).

Ibaraki Pref.: Mt. Tsukuba, VII 13 '73 4 ♀♀, VIII 8 '74 35 ♀♀ (K. Yamauchi leg., YGU).

Kanagawa Pref.: Hakone, VIII 11 '65 7 ♀♀ (M. Kubota leg., YGU).

Gifu Pref.: Hagiwara, VII 28 '71 3 ♀♀, XI 4 '71 22 ♀♀, XI 5 '71 22 ♀♀ (K. Yamauchi leg., YGU);

Ijira, VII 26 '73 3 ♀♀, 3 ♂♂ (S. Kurino leg., YGU); Yoro, VIII 18 '73 3 ♀♀, 1 ♂ (S. Kurino leg., YGU).

Shizuoka Pref.: Amagi, V 18 '76 20 ♀♀ (K. Yamauchi leg., YGU).

Kyoto Pref.: Mt. Hiei, IX 23 '71 1 ♀ (K. Sawada leg., MKU); Hanase, VII 28 '72 1 ♀ (S. Namigai leg., MKU).

Shiga Pref.: Mt. Ryozen, IX 23 '71 1 ♀, 3 ♂♂ (K. Yamauchi leg., YGU).

Tottori Pref.: Mt. Daisen, X 1 '72 6 ♀♀, 2 ♀♀ (K. Yamauchi leg., YGU).

Fukuoka Pref.: Mt. Hikosan, VII 30 '39 3 ♀♀ (K. Yasumatsu leg., EKU), VIII 8 '40 1 ♂ (Esaki, Yasumatsu leg., EKU), VIII 4 '73 20 ♀♀ (K. Yamauchi leg., YGU).

Nagasaki Pref.: Unzen, VII 18 '46 1 ♀ (M. Morisita, Y. Kurosawa Leg., EKU).

Miyazaki Pref.: Okawachi-Kamishiiba, X 7 '50 1 ♀ (Y. Hirashima leg., EKU).

Lasius (*Lasius*) *sakagamii* Yamauchi et Hayashida

Lasius (*Lasius*) *sakagamii* Yamauchi et Hayashida, 1970, Jour. Fac. Sci., Hokkaido Univ., Ser. VI, Zool. 16: 504–508; worker, queen, male. Type locality: Sapporo, Japan.

This species can be separated from any other Japanese species of *Lasius* s. str. by numerous standing hairs on worker and queen scapes and tibiae, shape of male and worker petioles, and shape of male subgenital plate. Besides, the coloration of worker in mature colonies is a good character to separate it from the other species. However, as the proportions in some body parts of this species are almost same to those of *L. niger*, it is often difficult to separate workers of incipient colony of *L. sakagamii* from *L. niger* workers. The former closely similar to the latter both in coloration and in number of standing hairs as mentioned below. Although slight differences in shape of petiole and number of standing hairs exist, these are distinguishable only by comparing the same sized workers of both species (Fig. 3). Without knowledge of individual variations connected with colony growth, the classification of the subgenus is hardly realized, and this is one of serious factors causing confusion in this subgenus.

Worker: Body length 2.5 ~ 3.5 mm. Other measurements in Table 1. Body concolorous, light to medium brown in mature colonies, but dark brown nearly as in *L. niger* in incipient colonies. Head viewed in perfect full face with numerous standing hairs all over outline. SC more than 30 in mature colonies, but decrease in incipient ones as shown in Fig. 3. Petiole thicker in profile and narrower in frontal view as compared with those of other Japanese species of *Lasius* s. str.

Queen: Body length 7~8 mm. Other measurements in Table 1. Body concolorous, medium to dark brown. Antennal scape and tibia with numerous standing hairs; SC more than 45.

Male: Body length about 3.5 mm. Other measurements in Table 1. Body color medium

to dark brown. Head viewed in perfect full face with numerous standing hairs over outlien. Scape and tibia with numerous standing hairs, but remarkably less than those in worker and queen; SC mostly several. Head in perfect full face more rounded than in other consubgeneric Japanese species; occipital border rounded, occipital corner curving gradually into occipital border. Petiole thicker in profile than in other consubgeneric Japanese species, tapering roundly to tip.

Specimens examined:

Hokkaido: Nayoro, VI 23 '68 21 ♀♀ (K. Yamauchi leg., YGU); Sapporo, VII 29 '66 20 ♀♀, VII 30 '66 21 ♀♀, 8 ♀♀, 8 ♂♂, VIII 3 '66 20 ♀♀ (K. Yamauchi leg., YGU); Shiraoi, VII 1 '59 9 ♀♀ (K. Hayashida leg., HKC); Oshima-Gobanzaka, VII 30 '70 10 ♀♀, 8 ♀♀, 10 ♀♀ (K. Yamauchi leg., YGU).
 Akita Pref.: Akita, IV.2 '76 3 ♀♀ (K. Yamauchi leg., YGU).
 Yamagata Pref.: Hondoji, VII 25 '70 8 ♀♀, 4 ♀♀, 6 ♂♂ (K. Yamauchi leg., YGU).
 Ibaraki Pref.: Tsuchiura, VII 13 '73 3 ♀♀ (K. Yamauchi leg., YGU).
 Tokyo: Nishigigubo, VIII 30 '69 10 ♀♀ (T. Wada leg., YGU); VIII 31 '74 15 ♀♀ (M. Kawai leg., YGU).
 Niigata Pref.: Shibata, VIII 2 '74 4 ♀♀, 2 ♂♂ (K. Yamauchi leg., YGU).
 Nagano Pref.: Takamori, VIII 26 '70 12 ♀♀ (K. Yamauchi leg., YGU).
 Toyama Pref.: Toyama, VIII 1 '74 2 ♀♀, 3 ♂♂ (K. Yamauchi leg., YGU).
 Gifu Pref.: Gifu, VI 13 '70 39 ♀♀, 4 ♀♀, X 7 '72 11 ♀♀ (K. Yamauchi leg., YGU).
 Kyoto Pref.: Ashiu, VI 15 '72 3 ♀♀ (M. Morisita leg., MKU).

Lasius (Lasius) hayashi Yamauchi et Hayashida

Lasius (lasius) hayashi Yamauchi et Hayashida, 1970, Jour. Fac. Sci., Hokkaido Univ., Ser. Vi, Zool. 16: 510-511; worker, queen, male. Type locality: Sapporo, Japan.

This species closely similar to *L. niger*. Worker and queen coloration may be a good character for the separation of these two species, though the overlap is exceptionally seen. Besides, slight differences are seen in some proportions measured such as SL-HW and EW-HW between them (Yamauchi and Hayashida, 1970). In spite of morphological similarities, this species is different in habitat and nest site preferences from *L. niger*. The former prefers shaded woodlands while the latter prefers wood margins and herbaceous lands.

Worker: Body length 2.0~4.0 mm. Other measurements in Table 1. Body bicolorous, contrasting with dark brown gaster, head, thorax and petiole light to medium reddish brown. Head viewed in perfect full face with less standing hairs than *L. sakagamii*; the genal margins with few or several standing hairs. Antennal scape with a few or several standing hairs on SC — plane. Head relative to thorax more massive than other consubgeneric Japanese species; CI ranging 95 ~ 109, the mode at 100. Petiole thin in profile and broad in frontal view as in *L. niger*.

Queen: Body length 7 ~ 8 mm. Other measurements in Table 1. Body color varying from concolorous dark reddish brown to bicolorous with reddish brown thorax and petiole contrasting with dark reddish brown head and gaster. Head with a few standing hairs all over the outline. SC less than 10.

Male: Body length about 4 mm. Other measurements in Table 1. Body concolorously

medium to dark brown. Head viewed in perfect full face with few or no standing hairs all over the outline. Scape and tibia with sparse standing hairs; SC usually 0. Head viewed in perfect full face with broad occipital border. Petiole thin in profile, tapering to tip almost straight.

Specimens examined:

Hokkaido: Hama-Koshimizu, VII 9 '66 65 ♀♀ (K. Yamauchi leg., YGU); Rumoi, VI 19 '68 4 ♀♀ (K. Yamauchi leg., YGU); Hidaka-Mombetsu, V 9 '66 15 ♀♀ (K. Yamauchi leg., YGU); Sapporo, IV 8 '66 20 ♀♀, V 6 '66 40 ♀♀, VII 27 '66 21 ♀♀, 20 ♀♀, 3 ♂♂, VII 30 '66 20 ♀♀, VIII 7 '70 8 ♀♀ (K. Yamauchi leg., YGU); Sobetsu, IV 29 '69 38 ♀♀ (M. Shiokawa leg., YGU).

Aomori Pref.: Towada, VIII 2 '72 5 ♀♀ (K. Onoyama leg., OOU).

Yamagata Pref.: Hondoji, VII 25 '70 6 ♀♀ (K. Yamauchi leg., YGU).

Miyagi Pref.: Sakunami, VIII 3 '74 5 ♀♀ (K. Yamauchi leg., YGU).

Ibaraki Pref.: Mt. Tsukuba, VII 13 '73 27 ♀♀ (K. Yamauchi leg., YGU).

Niigata Pref.: Sado Is., VIII 3 '71 2 ♀♀ (M. Kubota leg., YGU).

Nagano Pref.: Tsumago, VII 29 '72 6 ♀♀, 15 ♂♂ (K. Yamauchi leg., YGU).

Toyama Pref.: Unazuki, VIII 2 '74 10 ♀♀ (K. Yamauchi leg., YGU).

Fukui Pref.: Izumi, VII 29 '74 3 ♀♀ (K. Yamauchi leg., YGU).

Gifu Pref.: Hagiwara, VII 25 '71 3 ♀♀, XI 4~5 '71 58 ♀♀, IV 17 '72 24 ♀♀ (K. Yamauchi leg., YGU).

Shizuoka Pref.: Amagi, V 18 '76 15 ♀♀ (K. Yamauchi leg., YGU).

Kochi Pref.: Kochi, IV 29 '67 7 ♀♀ (R. Sonobe leg., YGU).

Fukuoka Pref.: Mt. Hikosan, X 6 '72 9 ♀♀, VIII 4 '73 30 ♀♀ (K. Yamauchi leg., YGU).

Nagasaki Pref.: Unzen, VII 17 '46 3 ♀♀ (M. Morisita, Y. Kurosawa leg., EKV); Tsushima Is., I 19 '69 5 ♀♀ (K. Kurosa leg., YGU).

Kuriles: Kunashiri, VII 26 '35 1 ♀ (T. Uchida leg., EHU).

Korea: Kwang-Nung, VII 14 '73 4 ♀♀ (R. Sonobe leg., YGU).

Key to the Japanese species of *Lasius* s. str.

Worker:

1. Within HW 0.86~1.12 mm, SI ranging 112~124; if HW outside of the range, then SI dropped into an extension of SL-HW regression area *productus*
 — Within the same HW range, SI not exceeding 109 and usually much smaller 2
2. Antennal scape and fore tibiae with few or no standing hairs even in mature colonies *alienus*
 — Antennal scape and fore tibia with numerous standing hairs in mature colonies, but hairs decreasing incipient colonies as shown in Fig. 3 3
3. SC more than 30 in mature colonies (Fig. 3); scape with numerous standing hairs mostly erect of suberect, uniformly from base to tip on SC-plane; petiole thicker and lower than in other species, posterior surface flat and brilliant centrally whereas rounded at both sides *sakagamii*
 — SC less than 30 (Fig. 3); scape with standing hairs at distal third to half on SC-plane petiole thinner and higher than in *sakagamii*, posterior surface flat throughout or slightly concave, strongly brilliant 4
4. Body concolorous blackish brown, rarely thorax and petiole dark reddish brown . . . *niger*

- Body bicolorous, thorax and petiole light to medium reddish brown, contrasting with somewhat darker head and dark brown gaster, but rarely nearly concolorously dark brown *hayashi*

Queen:

1. Length of terminal segment of maxillary palp more than 0.30 mm; SI more than 81 *productus*
- Length of terminal segment of maxillary palp less than 0.28 mm; SI less than 80 2
2. Scape with numerous standing hairs, more than 20 on SC-plane, mostly erect or suberect, uniformly from base to tip as in worker; SC more than 40 *sakagami*
- Scape with standing hairs less than 10 on SC-plane, concentrated at distal third or half; SC less than 10 3
3. Body concolorous blackish brown *niger*
- Body concolorous medium brown, but rarely nearly blackish brown *hayashi*

Male:

1. SI exceeding 100 *productus*
- SI less than 80 2
2. Petiole in profile high and thin, tapering to tip almost straightly; subgenital plate with convex posterior border; head with broad occipital border *niger, hayashi*
- Petiole in profile lower and thicker, tapering to tip roundly; subgenital plate with almost straight posterior border; head with rounded occipital border *sakagami*

Japanese species of *Cautolasius* Wilson

Wilson (1955) recorded two species of *Cautolasius*, *Ca. flavus* (Fabricius) and *Ca. talpa* Wilson, from Japan. He regarded *Ca. flavus myopus* as synonymous with *Ca. flavus*. However, the name "*flavus myopus*" frequently cited in previous papers dealing with Japanese ants (Wheeler 1906, 1928, Teranishi 1929, 1930, Okamoto 1952) seems to refer to *Ca. talpa* (Okamoto, 1969). Recently, the writer received from Mr. Sonobe another species clearly distinguished from both *Ca. flavus* and *Ca. talpa* as below.

***Lasius* (*Cautolasius*) *flavus* (Fabricius)**

Formica flava Fabricius, 1781, Species Insectum, 1: 491; worker, Type locality: Northern Europe.

Lasius flavus myopus Forel, 1894, Bull. Soc. Vand. Sci. Nat., 30: 12; worker. Type locality: Terni, Oran, Algeria.

Lasius (*Cautolasius*) *flavus*, Wilson, 1955, Bull. Mus. Comp. Zool., 113: 112–130

This species can be separated with certainty from other consubgeneric Japanese species in worker caste: from *Ca. talpa* by its appendages without standing hairs, and from *Ca. sonobei* by its shorter antennal scapes.

Worker:

More polymorphic, i.e. shows greater intranidal size variation, differing from other consubgeneric Japanese species. Body length 2.0~3.5 mm. Coloration also varying from pale yellow to brownish yellow. Eye size largest in the subgenus: EL more than 0.11 mm and EW more than 0.07 mm. Other measurements given in Table 2.

Queen:

Body length about 7.0 mm. Other measurements in Table 2. Body color dark brown, with medium brown appendages. Wings hyaline. Scape and tibia with few or no standing hairs. Eye largest in the subgenus, EL and EW more than 0.36 mm and 0.29 mm respectively, in 10 specimens measured.

Male:

Body length about 3.0 mm. Other measurements in Table 2. Isolated individuals can not be separated with certainty from *Ca. talpa*

Specimens examined:

Hokkaido: Abashiri, VIII 6 '59 9♀♀ (K. Hayashida leg., HKC); Okoppe, VI 24 '68 5♀♀ (K. Yamauchi leg., YGU); Kushiro, VII 17 '60 21♀♀ (K. Hayashida leg., HKC); Shihoro, VII 19 '56 9♀♀ (K. Hayashida leg., HKC); Hidaka-Mombetsu, VII 24 '66 40♀♀ (K. Yamauchi leg., YGU); Sapporo, IV 8 '66 21♀♀, IV 15 '66 20♀♀, V 9 '66 20♀♀, VI 8 '66 20♀♀, IX 12 '66 3♀♀, 13♂♂, VI 27 '67 1♀, 8♂♂ (K. Yamauchi YGU); Oshima, Gobansaka, VIII 1 '70 8♀♀, 2♀♀, 1♂ (K. Yamauchi leg., YGU); Hakodate, VIII 9, 10 '60 15♀♀ (K. Hayashida leg., HKC).

Aomori Pref.: Mt. Bonju, IV 24 '60 1♀ (K. Yasumatsu leg., EKU).

Miyagi Pref.: Kinkazan Is., late VIII '72 12♀♀, 6♂♂ (R. Sonobe leg., YGU).

Yamagata Pref.: Hondoji, VIII 6 '74 9♀♀ (K. Yamauchi leg., YGU).

Kanagawa Pref.: Hakone, VIII 5 '63 6♀♀ (M. Kubota leg., YGU).

Nagano Pref.: Shigakogen, VII 29 '67 4♀♀ 2♀♀ (M. Kubota leg., YGU); Mt. Yatsugatake, VIII 10 '72 3♀♀, 3♀♀, 3♂♂ (R. Sonobe leg., YGU); Kaidakogen, VIII 25 '72 9♀♀, 2♀♀, 8♂♂ (K. Yamauchi leg., YGU).

Toyama Pref.: Unazuki, VIII 2 '74 42♀♀, 6♂♂ (K. Yamauchi leg., YGU).

Gifu Pref.: Takayama, VII 1 '73 10♀♀ (K. Yamauchi leg., YGU); Gifu, VI 28 '74 12♀♀ (K. Yamauchi leg., YGU).

Korea: Genzan, IX 29 '39 1♀ (S. Kumashiro leg., EKU).

Manchuria: Harbin, IX 11 '41 1♀ (Y. Mori leg., EKU).

Lasius (Cautolasius) talpa Wilson

Lasius (Cautolasius) talpa Wilson, 1955, Bull. Mus. Comp. Zool., 113: 136-138; worker, queen, male.

Type locality: Hirooka, Shikoku, Japan.

This species is easily distinguished from other consubgeneric Japanese species by its numerous standing hairs on scapes in worker and queen.

Table 2. Some morphological characters measured in each species of *Cautolaius*. Values are given as means and, in parentheses, minima and maxima.

Caste	Species	SL (mm.)	HL (mm.)	HW (mm.)	EL (mm.)
Worker	<i>flavus</i>	0.72 (0.61–0.86)	0.91 (0.72–1.13)	0.87 (0.62–1.13)	0.14 (0.11–0.19)
	<i>talpa</i>	0.66 (0.47–0.75)	0.82 (0.65–0.95)	0.75 (0.57–0.90)	0.08 (0.06–0.11)
	<i>sonobei</i>	0.84 (0.68–0.96)	0.93 (0.77–1.03)	0.89 (0.72–0.99)	0.10 (0.07–0.10)
Queen	<i>flavus</i>	1.08 (1.07–1.10)	1.32 (1.30–1.36)	1.43 (1.40–1.50)	0.38 (0.36–0.39)
	<i>talpa</i>	1.00 (0.98–1.02)	1.25 (1.22–1.30)	1.48 (1.44–1.54)	0.33 (0.32–0.36)
	<i>sonobei</i>	1.06 (1.00–1.10)	1.20 (1.16–1.28)	1.39 (1.28–1.46)	0.33 (0.30–0.34)
Male	<i>flavus</i>	0.45 (0.39–0.49)	0.65 (0.62–0.68)	0.80 (0.72–0.86)	0.26 (0.25–0.28)
	<i>talpa</i>	0.44 (0.42–0.46)	0.60 (0.57–0.63)	0.77 (0.73–0.81)	0.25 (0.25–0.26)
	<i>sonobei</i>	0.51 (0.51–0.52)	0.64 (0.63–0.66)	0.80 (0.76–0.84)	0.25 (0.24–0.26)

Caste	Species	EW (mm.)	PW (mm.)	CI	SI
Worker	<i>flavus</i>	0.10 (0.07–0.14)	0.60 (0.46–0.84)	95 (99–100)	84 (76–91)
	<i>talpa</i>	0.06 (0.04–0.08)	0.55 (0.48–0.60)	92 (87–98)	81 (72–87)
	<i>sonobei</i>	0.07 (0.05–0.08)	0.55 (0.48–0.60)	95 (91–98)	94 (91–100)
Queen	<i>flavus</i>	0.30 (0.29–0.32)	1.74 (1.68–1.90)	109 (106–112)	75 (72–77)
	<i>talpa</i>	0.24 (0.24–0.26)	1.61 (1.56–1.70)	119 (116–123)	67 (66–69)
	<i>sonobei</i>	0.26 (0.24–0.26)	1.55 (1.46–1.60)	116 (110–121)	76 (72–80)
Male	<i>flavus</i>	0.20 (0.19–0.21)	0.88 (0.83–0.96)	122 (116–128)	57 (53–61)
	<i>talpa</i>	0.20 (0.19–0.21)	0.80 (0.78–0.84)	129 (121–136)	57 (55–59)
	<i>sonobei</i>	0.19 (0.19–0.20)	0.83 (0.80–0.88)	124 (120–127)	64 (62–67)

Worker:

Body length 2.0~3.0 mm. Other measurements given in Table 2. Color nearly always clear yellow. Eye very small, with only 6~17 ommatidia. Appendages with numerous standing hairs, separating easily this species from other consubgeneric Japanese species.

Queen:

Body length about 6.5 mm. Other measurements in Table 2. Color lighter than in other member of the subgenus; body concolorous medium brown, with light brown appendages. Wings hyaline.

Male:

Body length about 3.0 mm. Other measurements given in Table 2.

Specimens examined:

Fukushima Pref.: Higashiyama, IX 15 '39 1 ♀ (M. Kohono leg., EKU).

Ibaraki Pref.: Toyosato, XI 5 '67 5 ♀♀ (H. Tamura leg., YGU).

Nagano Pref.: Takamori, VI 3 '68 27 ♂♂, VIII 26 '70 2 ♀♀ (K. Yamauchi leg., YGU).

Gifu Pref.: Hagiwara, VIII 22 '71 2 ♀♀ (K. Yamauchi leg., YGU); Ijira, VIII 26 '73 14 ♀♀, 5 ♂♂ (S. Kurino leg., YGU); Yoro, VIII 18 '73 1 ♀ (S. Kurino leg., YGU).

Wakayama Pref.: Shirahama, IX 9 '72 1 ♀ (M. Morisita leg., MKU).

Fukuoka Pref.: Mt. Hikosan XI 21 '39 3 ♂♂ (K. Yasumatsu leg., EGU), X 5 '72 18 ♂♂, VIII 4 '73 20 ♀♀, 10 ♂♂, 9 ♂♂ (K. Yamauchi leg., YGU).

Kumamoto Pref.: Amakusa, Tomoezaki, VI 18 '68 3 ♀♀ (M. Morisita leg., MKU).

Miyazaki Pref.: Mt. Kirishima, VIII 23 '67 8 ♀♀ (M. Kubota leg., YGU), VIII 9 '73 20 ♀♀ (K. Yamauchi leg., YGU).

Kagoshima Pref.: Sakurajima, V 16 '59 2 ♀♀ (M. Morisita leg., MKU).

Lasius (*Cautolasius*) *sonobei* sp. nov.

Worker:

Size: Body length 2.5~3.5 mm; other measurements in Table 2.

Color: Yellow to slightly brownish yellow; appedages yellow; hairs whitish yellow.

Hairs: Head viewed in perfect full face with a few standing hairs only at occipital borders (Fig. 4); antennal scapes and tibiae with few or no standing hairs, SC usually O.

Head: Narrower than other consubgeneric Japanese species, CI ranging 91~98, with mean at 95; occipital border viewed in full face feebly concave; frontal groove indistinct; clypeus feebly keeled or not, with broadly rounded anterior border; mandible with 7~9 denticules, mostly 7; maxillary palp 6 segmented, segments V and VI conspicuously reduced relative to IV; antennal scape longer than other consubgeneric Japanese species, SI ranging 91~100 within workers with PW 0.48~0.60 (Fig. 5); eye very small, intermediate between *Ca. flavus* and *Ca. talpa*.

Petiole: in frontal view, broader than long, with rounded outline, but straight or slightly emarginated at dorsal center.

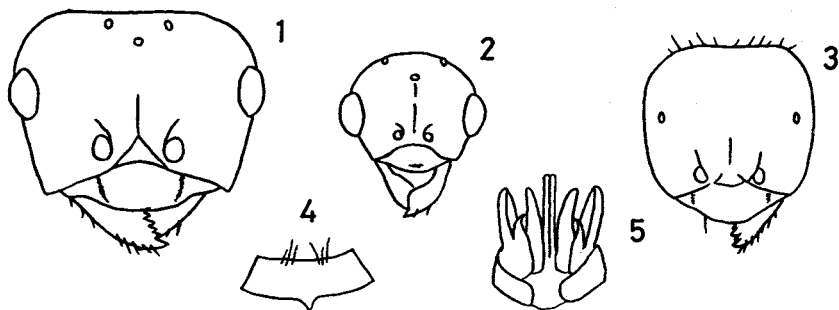


Fig. 4. *Ca. sonobei*.

1, queen; 2, male; 3, worker; 4, male subgenital plate; 5, male genitalia.

Queen:

Size: Body length about 6.5 mm; other measurements in Table 2.

Color: Concolorous dark brown; appendages light brown; wings slightly brownish hyaline.

Hairs: Head viewed in full face with few or no standing hairs all over the outline (Fig. 4); antennal scape and fore tibia without standing hairs.

Head: Broader than long, CI ranging 110~121, the mean at 116; occipital border almost straight or feebly concave; frontal groove distinct at least in the anterior 1/3; clypeus feebly keeled, with broadly rounded anterior border, with slightly concave at central part; mandible with 7~9 denticules, basal teeth often varying in size and shape; SI ranging 72~80.

Thorax: Metapleural gland opening well developed, with guard hairs.

Petiole: In frontal view with roundly convex side borders and slightly concave dorsal border; thin in profile, with sharp dorsal crest.

Male:

Size: Body length about 3.0 mm; other measurements in Table 2.

Color: Concolorous dark brown; appendages medium brown; hairs whitish to slightly yellowish brown; wings slightly brownish hyaline.

Hairs: Viewed in perfect full face with few or no standing hairs all over the outline; antennal scape and tibia with few or no standing hairs.

Head: Occipital border rounded, occipital corner curving gradually into occipital border (Fig. 4); CI ranging 120~127; frontal groove distinct; clypeus not keeled, with rounded anterior border; mandible with distinct preapical cleft, denticules lacking on masticatory border; antennal scape longer than in other consubgeneric species (Table 2)

Thorax: Slightly broader than head; scutum broader than long; parapsidal furrows almost straight; metapleural gland opening well developed, with guard hairs.

Petiole: In profile with sharp dorsal crest, broad in frontal view with flat or slightly concave dorsal border.

Subgenital plate and genitalia as illustrated in Fig. 4.

Type designation: Holotype: Worker: Kinkasan, Miyagi Pref.; late VIII '72, R. Sonobe leg. SL 0.85, HW 0.89, HL 0.96, EL 0.10, EW 0.06, PW 0.65 in mm. respectively. Paranidotype: 19 ♀♀, 2 ♀♀, 7 ♂♂. Paratypes: Oga, Miyagi Pref., V 28 '78 4 ♀♀ (R. Sonobe leg.); Mt. Hikosan, Fukuoka Pref., X 5 '72 20 ♀♀, VII 5 '73 3 ♀♀ (K. Yamauchi leg.). The holotype, paranidotypes and paratypes are provisionally deposited in YGU.

Remarks: This species can easily be separated from other consubgeneric Japanese species by its higher SI value in worker (Table 2 and Fig. 5).-In queen, this species is separated from *Ca. flavus* by its smaller eye size (Table 2), and from *Ca. talpa* by its possession of no standing hairs on the antennal scape and tibia. In male, long antennal scape and high SI value are good characters for the separation of this species from other consubgeneric Japanese species (Table 2). This species was dedicated to Mr. R. Sonobe.

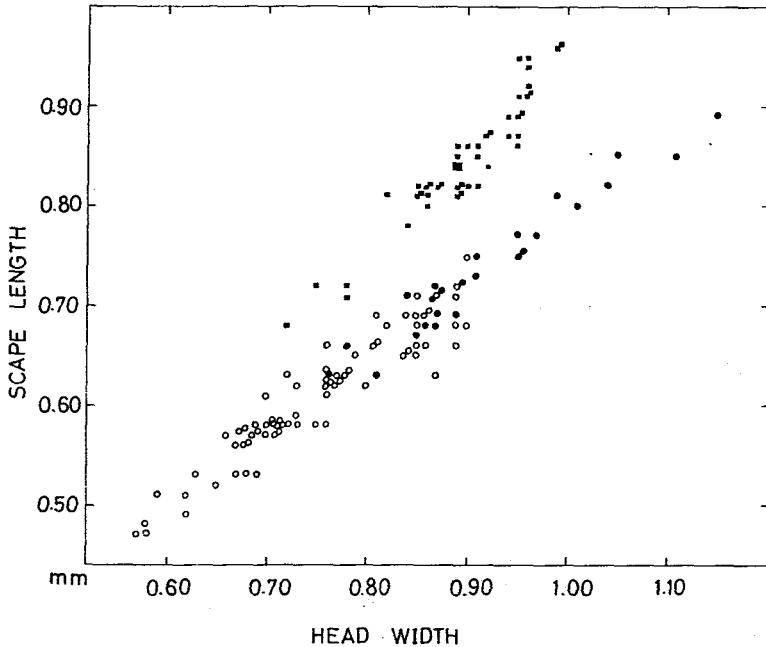


Fig. 5. Scape length-head width relationships in workers of *Cautolasius*.
 ■, *sonobei*; ●, *flavus*; ○, *talpa*.

Key to the Japanese species of *Cautolasius*

Worker:

1. Antennal scape and fore tibia with numerous standing hairs *talpa*
- Antennal scape and fore tibia with few or no standing hairs 2
2. SI more than 91 (Fig. 5); eye very small, EL usually less than 0.11 mm *sonobei*
- SI less than 91 (Fig. 5); eye larger than *sonobei* and *talpa* (Table 2) *flavus*

Queen:

1. Antennal scape with numerous standing hairs; body color light to medium brown; *talpa*
- Antennal scape with few or no standing hairs; body color dark brown 2
2. Eye smaller, EL and EW less than 0.34 and 0.26 respectively in mm *sonobei*
- Eye larger, EL and EW more than 0.36 and 0.29 respectively in mm *flavus*

Male:

1. Antennal scape longer than 0.51 mm; SI more than 62 *sonobei*
- Antennal scape shorter than 0.49 mm; SI less than 61 *flavus, talpa*

Japanese species of *Chthonolasius* Ruzsky

Wilson (1955) recorded two species of *Chthonolasius*, *Ch. umbratus* and *Ch. rabaudi*, from Japan. These are closely similar to each other, in worker and male castes, but are distinguished by the shape of antennal scapes in queen (Wilson, 1955). According to Okamoto (1969), a queen of *Ch. rabaudi* has long, flattened antennal scapes with numerous standing hairs while that of *Ch. umbratus* has short elliptical one without standing hairs. The name "*rabaudi*" are not found in previous papers dealing with Japanese myrmecofauna, probably confused with *Ch. umbratus*. However, after Wilson's monograph, *Ch. rabaudi* has been frequently reported (Okamoto, 1969; Sonobe, 1972, etc.)

Recently, Bourne (1973) regarded *Ch. rabaudi* as synonymous with *Ch. umbratus* after studying many nest series in both England and Europe. The reasons are as follows: 1) Although the character of flattened scapes in the females of *Ch. rabaudi* is perhaps the most universally accepted means of determination, males and workers from the same nests as females with flattened scapes are totally inseparable from males and workers of *Ch. umbratus*. 2) In queen, there was no noticeable characters separating these two forms except for scape width, 3) Two females, one with the distinctly flattened scapes and the other with those of *Ch. umbratus*, in the same mount bearing the label "Woking, 4-8-1915, Crawley Coll." and another similar specimen were found at the Hope Department of Entomology, Oxford.

However, the writer wishes to regard these as two distinct species by the following reasons: 1) It is probable that morphological differences in queen caste between distinct species tend to decrease in male and worker castes, as shown in *Dendrolasius*. 2) It may be dangerous to judge that they belonged to the same colony only from the attached label.

Table 3. Some morphological characters of worker measured in each species of *Chthonolasius*. Values are given as means and, in parentheses, minima and maxima.

	<i>umbratus-rabaudi</i>	<i>hikosanus</i>
SL (mm)	1.05 (0.84-1.15)	1.14 (1.04-1.20)
HL (mm)	1.18 (0.95-1.32)	1.28 (1.14-1.34)
HW (mm)	1.13 (0.91-1.30)	1.29 (1.16-1.38)
EL (mm)	0.18 (0.15-0.21)	0.22 (0.19-0.24)
EW (mm)	0.15 (0.12-0.17)	0.19 (0.16-0.22)
PW (mm)	0.80 (0.62-0.90)	0.89 (0.81-0.95)
CI	98 (93-102)	101 (98-103)
SI	89 (84-93)	83 (84-93)

For instance, these two queens might possibly be caught when they were wandering in the same place and were mounted together, especially in the time when these two forms had yet not distinguished from each other. 3) In Japan, some characters of female such as scape

length, scape width, standing hairs on scapes are obviously different between these forms. Moreover, some morphological differences were observed in male in the present study.

In the present study, the following morphological characters separating these two species were observed, in addition to those known in previous works (Wilson, 1955; Okamoto, 1969):

1) Veins of wings in queen and male: Section of cubital-vein between two points intersected by the marginal and first section of radius vein tends to be long in *Ch. umbratus*, while short in *Ch. rabaudi* (Fig. 6).

2) Mandible of male: Masticatory border with many denticles and separated clearly from basal border with distinctly marked basal angle in *Ch. umbratus*, while that of *Ch. rabaudi* with few denticles and forming broadly basal angle (Fig. 6)

3) Stipes of male: In side view, short in *Ch. umbratus* while long in *Ch. rabaudi* (Fig. 6).

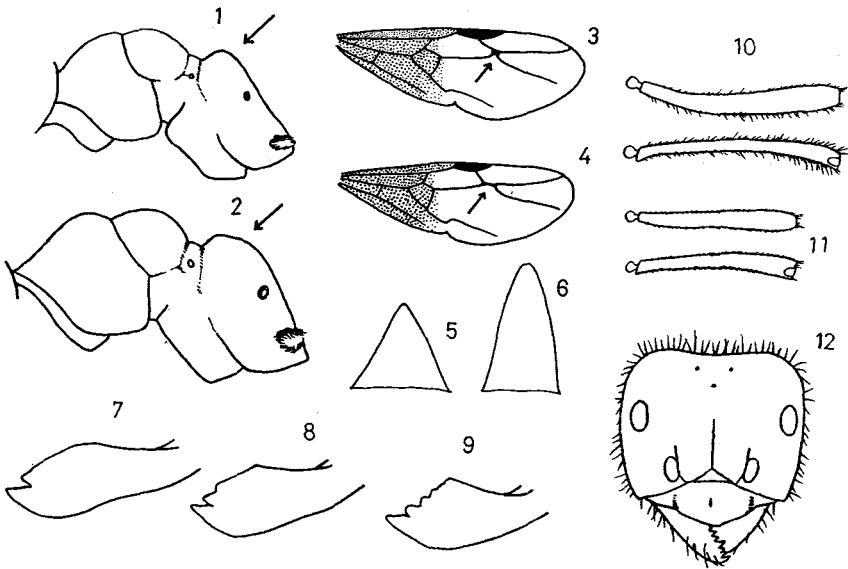


Fig. 6. *Chthonolasius*.

1, thorax of *umbratus* worker; 2, thorax of *hikosanus* worker; 3, fore wing of *rabaudi* queen; 4, fore wing of *umbratus* queen; 5, stipes of *umbratus* male; 6, stipes of *rabaudi* male; 7, 8, mandible of *rabaudi* male; 9, mandible of *umbratus* male; 10, antennal scape of *rabaudi* queen (Above showing maximum width at the midpoint; below showing minimum width at the midpoint); 11, antennal scape of *umbratus* queen; 12, head of *hikosanus* worker.

Lasius (Chthonolasius) umbratus (Nylander)

Formica umbrata Nylander, 1846, Acta, Soc. Sci. Fenn., 2: 1048–1050; queen, male. Type locality: Helsinki.

Lasius silvestrii Wheeler, 1928, Boll. Lab. Zool. Portici, 20: 120–121; queen. Type locality: Mt. Maya, nr. Kobe, Japan.

Lasius silvestrii var. *osakana* Santschi, 1941, Mitt. Schweiz. Ent. Ges., 1: 278; queen. Type locality: Ikeda, Osaka, Japan.

Worker:

Body length 4.0~4.5 mm. Other measurements given in Table 3. Petiole in frontal view tapering slightly from base to dorsal crest. Dorsal crest broad and very variable in outline, from flat to deeply concave.

Queen:

Body length about 8.0 mm. Body color medium to dark brown. Wings bicolorous, hyaline with brownish basal 1/3. Scape short-elliptical to circular in crosssection, with few or no standing hairs. Third funicular segment 1.0~1.5 × longer than broad.

Male:

Body length about 4.5 mm. Body color blackish brown. Stipes of genitalia shorter than in *Ch. rabaudi* as in Fig. 6. Mandible with more distinct denticles than in *Ch. rabaudi* as in Fig. 6.

Specimens examined:

Hokkaido: Rishiri Is., VII 31 '59 1 ♀ (K. Hayashida leg., HKC); Ashoro, VIII 1 '49 1 ♀ (R. Matsumura leg., EKU); Shiretoko, VI 21 '59 ♀ (K. Hayashida leg., HKC); Nokanan, VII 21 '67 5 ♀♀ (K. Yamauchi leg., YGU); Sapporo, VIII 4~5 '66 4 ♀♀, 1 ♀, 2♂♂, VIII 6, 7 '70 2 ♀♀ (K. Yamauchi leg., YGU).

Yamagata Pref.: Hondoji, VIII 4 '74 9 ♀♀ (K. Yamauchi leg., YGU).

Ibaraki Pref.: Tsuchiura, VII 12 '74 3 ♀♀ (K. Yamauchi leg., YGU).

Kanagawa Pref.: Odawara, VI 21 '67 10 ♀♀, 4 ♂♂ (M. Kubota leg., YGU).

Niigata Pref.: Shibata, VIII 2 '74 3 ♀♀ (K. Yamauchi leg., YGU).

Nagano Pref.: Shigakogen, VII 15'67 6 ♀♀, 5 ♂♂ (M. Kubota leg., YGU); N. Alps, Takase River, X 7~8 '72 2 ♀♀ (T. Maruyama leg., MKU).

Toyama Pref.: Kurobe, X 10 '72 2 ♀♀ (S. Yoshida leg., YGU). Toyama, VIII 1 '74 1 ♀ (K. Yamauchi leg., YGU)

Gifu Pref.: Hagiwara, VIII 23 '71 2 ♀♀ (K. Yamuchi leg., YGU).

Shizuoka Pref.: Mt. Fuji, VIII 7 '70 2 ♀♀ (M. Kubota leg., YGU).

Tottori Pref.: Mt. Daisen, VII 27 '72 1 ♀ (A. Endo leg., MKU).

Kagoshima Pref.: Mt. Kirishima, VIII 28 '72 12♂♂, 21 ♂♂ (R. Sonobe leg., YGU).

Miyazaki Pref.: Sobosan, VII 3 '32 1 ♀ (Hori, Fujino, Cho leg., EKU); Mt. Karakunidade VIII 9 '73 40 ♀♀, 14 ♂♂ (K. Yamuchi leg., YGU).

Saghalien: Teradomari, VII 25 '34 4 ♀♀ (C. Watanabe, Inoue leg., EHU).

Korea: Seorak-san, VII 17 '73 2 ♀♀ (R. Sonobe leg., YGU).

***Lasius (Chthonolasius) rabaudi* (Bondroit)**

Formica rabaudi Bondroit, 1917, Bull. Soc. Ent. Fr., 86: 177: queen, Type locality: Amélie-les-Bains, Pyrénées-Orientales, France.

This species closely related to *Ch. umbratus* as mentioned above.

Worker:

Body length about 4.0~4.5 mm. Other measurements given in Table 3. Petiole as in *Ch. umbratus*.

Queen:

Body length about 8 mm. Coloration as in *Ch. umbratus*. Scapes conspicuously flattened, with numerous standing hairs. Third funicular segment larger than 1.5 x width.

Male:

Body length about 4.5 mm. Coloration as in *Ch. umbratus*. Stipes of genitalia longer than in *Ch. umbratus* (Fig. 8). Mandible varying as in Fig. 8.

Specimens examined:

Hokkaido: Rishiri Is., VII 31 '59 1 ♀ (K. Hayashida leg., HKC); Nokanan, VII 21 '67 6 ♀♀, 1 ♂ (K. Yamauchi leg., YGU); Sapporo, VIII 6 '70 1 ♀ (K. Yamauchi leg., YGU); Sounkyo, VIII 27 '73 1 ♀ (M. Morisita leg., MKU).

Yamagata Pref.: Hondoji, VIII 4 '74 13 ♀♀, 5 ♂♂ (K. Yamauchi leg., YGU).

Ibaraki Pref.: Mt. Tsukuba, VII 13 '73 17 ♀♀, 12 ♂♂ (K. Yamauchi leg., YGU).

Niigata Pref.: Shibata, VIII 2 '74 1 ♀, 3 ♂♂ (K. Yamauchi leg., YGU).

Nagano Pref.: Tsumago, VII 29 '72 1 ♀, 26 ♂♂ (K. Yamauchi leg., YGU).

Toyama Pref.: Toyama, VIII 1 '74 4 ♀♀, 2 ♂♂ (K. Yamauchi leg., YGU); Unazuki, VIII 2 '74 2 ♀♀ (K. Yamauchi leg., YGU).

Fukui Pref.: Izumi, VII 29 '74 6 ♀♀, 3 ♂♂ (K. Yamauchi leg., YGU).

Gifu Pref.: Hagiwara, VII 21 '71 2 ♀♀, VII 25 '71 2 ♀♀, 2 ♂♂, VIII 22 '71 10 ♂♂, VIII 23 '71 1 ♀, VII 25 '72 6 ♂♂ (K. Yamauchi leg., YGU); Shirakawa, VII 18 '73 1 ♀, VII 19 '73 18 ♀♀, 9 ♂♂, VII 20 '73 1 ♀ (K. Yamauchi leg., YGU); Higashi-Shirakawa, VI '72 10 ♂♂ (Y. Ono leg., YGU); Takatomi, VII 22 '73 3 ♂♂ (K. Yamauchi leg., YGU).

Shizuoka Pref.: Mt. Fuji, VIII 5 '70 1 ♀ (M. Kubota leg., YGU).

Kyoto Pref.: Kyoto, VII 26 '72 1 ♀ (M. Morisita leg., MKU).

Fukuoka Pref.: Mt. Hikosan, VIII 6 '73 2 ♀♀, 6 ♂♂ (K. Yamauchi leg., YGU); Mt. Inukariyama, VI '34 1 ♀ (Nomura, Kawahara, Fujino, Yasumatsu leg., EKU).

Oita Pref.: Kuzuyusan, Sugiyu, VIII 4 '44 1 ♀ (T. Esaki leg., EKU).

Kagoshima Pref.: Mt. Kirishima, VIII 28 '72 2 ♀♀, 4 ♀♀, (R. Sonobe leg., YGU).

Saghalien: Hoya, VII 15 16 '33 1 ♀ (Uchida, Okada, Sawamoto leg., EHU).

Korea: Seorak-san, VII 17 '73 1 ♀ (R. Sonobe leg., YGU).

***Lasius (Chthonolasius) hikosanus* sp. nov.**

Recently, studying the myrmecofauna of Mt. Hikosan, Fukuoka Pref., the writer dis-

covered many workers in the root systems of large living trees. They are clearly distinguished from *Ch. umbratus* and *Ch. rabaudi*. Unfortunately, no queen and male, by which *Chthonolasius* is safely separated from *Cautolasius*, were discovered. But the writer regarded these workers as those of *Chthonolasius* because of their large size. According to Wilson (1955) the workers of *Cautolasius* are generally smaller than those of *Chthonolasius*, the former hardly exceeding 0.70 mm in pronotum width while the latter mostly exceeding 0.70 mm.

It would be likely that this species identical with some other species already published under different name, with incomplete descriptions. After a little hesitation, however, the writer decided to describe it as a new species. The identification with the previous species described incompletely often causes a serious confusion, especially in taxonomically difficult groups. In such case, the precise description as a new species is better to be checked in future for any possible errors.

Worker:

Size: Body length about 4.5 mm. Other measurements given in Table 3.

Color: Body concolorously yellow to brownish yellow; appendages yellow; hairs whitish or light yellowish brown.

Hairs: Head viewed in full face with numerous standing hairs all over the outline; antennal scape and fore tibia with many standing hairs.

Head: Mostly broader than long, CI ranging 98~103, the mean at 101; occipital border viewed in full face feebly concave; frontal groove feeble; clypeus feebly keeled or not, with broadly rounded anterior border; mandible with 7~9 denticles, basal teeth almost same for each other in size and shape. Maxillary palp 6 segments; segments V and VI conspicuously reduced relative to IV.

Thorax: More massive than other Japanese species of *Chthonolasius*, pronotum in profile with rounded outline of posterior slope (Fig. 6); metapleural gland opening well developed, with guard hairs.

Petiole: In profile high and thin, with sharp dorsal crest, broad in frontal view with flat or slightly concave dorsal border.

Type designation: Holotype: Worker: Mt. Hikosan, Fukuoka Pref., VIII 6, 1973, K. Yamauchi leg., HW 1.36, HL 1.34, SL 1.20 EL 0.24, EW 0.22, PW 0.95, CI 102, SI 88. Paranidotypes: 11 ♀♀. Paratypes: 98 ♀♀: Mt. Hikosan, VIII 6, 1973, 47 ♀♀: Mt. Kuraiyama, Gifu Pref., VIII 21 '71. The holotype, paranidotypes and paratypes are deposited in YGU.

Remarks: This species is one of the largest species, at least in worker caste, among so far known *Chthonolasius* species. The PW of this species is ranging 0.81~0.95 mm with the mean of 0.89 mm, being comparable with the large species, *Ch. crinitus* known from the Himalayas. However, *Ch. hikosanus* obviously differs from *Ch. crinitus* in the shape of petiole and in the number of standing hairs on the appendages. *Ch. hikosanus* can be separated from other Japanese consubgeneric species by the shape of propodeum, convex in profile contrasting straight in other species (Fig. 6).

Key to the Japanese species of *Chthonolasius*

Worker:

1. Propodeum in profile with rounded posterior border (Fig. 6) *hikosanus*
 – Propodeum in profile with straight posterior border (Fig. 6) *rabaudi, umbratus*

Queen:

1. Antennal scape flattened, with numerous standing hairs (Fig. 6) *rabaudi*
 – Antennal scape short-elliptical in cross-section, with few or no standing hairs (Fig. 6)
 *umbratus*

Male:

1. Stipes long (Fig. 6) *rabaudi*
 – Stipes short (Fig. 6) *umbratus*

Japanese species of *Dendrolasius* Ruzsky

Up to the present five species of the subgenus *Dendrolasius* have been recorded from the Palaearctic Region: *fuliginosus* (Latreille), *buccatus* Starcke, *crispus* Wilson, *spathepus* Wheeler and *teranishii* Wheeler. Except *D. buccatus* in Europe, the other four species are known from Far East, all of which recorded from Japan, while only two species, *D. fuliginosus* and *D. buccatus*, are known from Europe and none from North America. Although the life mode of four Japanese species is very similar, they can easily be separated from one another by certain distinctive characters, such as pilosity, pubescence, shapes of antennal scape, legs and petiole, etc. Besides these species, in the present study, a distinct species, *D. morisitai*, is described below.

Lasius (*Dendrolasius*) *fuliginosus* (Latreille)

Formica fuliginosa Latreille, 1789, Essai Fourmis France, 36: worker, queen, male. Type locality: France.

Lasius fuliginosus var. *nipponensis* Forel, 1912, Ann. Soc. Ent. Belg., 56: 339: worker. Type locality: Tokyo.

Lasius nipponensis Santsch, 1941, Mitt. Schweiz. Ent. Ges., 18: 278.

Lasius fuliginosus var. *orientalis* Karawajew, 1912, Rev. Russ. Ent., 12: 586–587; worker. Type locality: Korea.

Worker:

Body length 4.0~5.0 mm. Other measurements in Table 4. Antennal scape short-elliptical in cross-section, so that for most of their length the minimum width at any point is 0.8 × the maximum width at that point or greater. Petiole in frontal view broadest at base, gradually narrowing to tip, and in profile symmetrical, with U-shaped dorsal crest (Fig. 9). Standing hairs on pronotum as long as eye width, outstanding very fine appressed

pubescence.

Queen:

Body length about 5.0 mm. Antennal scape short-elliptical in cross-section as in worker, densely covered by decumbent or subdecumbent hairs (Fig. 8). Petiole in profile symmetrical, with U-shaped dorsal crest (Fig. 9). Standing hairs of body sparse, outstanding dense appressed pubescence (Fig. 8).

Male:

Body length about 4.0 mm. Petiole in profile symmetrical, with dull dorsal crest (Fig. 9).

Specimens examined:

Hokkaido: Hama-Koshimizu, VII 9 '66 20 ♀♀ (K. Yamauchi leg., YGU); Engaru, VI 24 '68 15 ♀♀ (K. Yamauchi leg., YGU); Owada, VI 19 '68 15 ♀♀ (K. Yamauchi leg., YGU); Hidaka-Mombetsu, VII 24 '66 22 ♀♀ (K. Yamauchi leg., YGU); Sapporo, IV 19 '66 29 ♀♀, V 6 '66 20 ♀♀, V 31 '66 25 ♀♀, VI 22 '66 20 ♀♀, 5 ♀♀, 18 ♂♂, VII 13 '66 51 ♀♀, 1 ♀, 27 ♂♂, VIII 22 '66 8 ♂♂ (K. Yamauchi leg., YGU).

Iwate Pref.: Iwate, no further record, 1 ♀ (Ogasawara leg., EHU).

Yamagata Pref.: Hondoji, VIII 3 '70 20 ♀♀ (K. Yamauchi leg., YGU).

Miyagi Pref.: Mt. Zao, Gaga, VIII 1 '35 1 ♀ (M. Morisita leg., MKU).

Fukushima Pref.: Higashiyama, VIII 29 '30 1 ♀ (M. Kohono leg., EKU).

Chiba Pref.: Chiba, V 3 '74 1 ♀ (M. Morisita leg., MKU).

Tokyo: Yoga, IV 28 '50 1 ♀ (Ogasawara leg., EHU).

Kanagawa Pref.: Odawara, VI 21 '67 10 ♀♀ (K. Yamauchi leg., YGU).

Niigata Pref.: Sado Is., VIII 3 '71 2 ♀♀ (M. Kubota leg., YGU).

Nagano Pref.: Takamori, VII 31 '67 15 ♀♀ (K. Yamauchi leg., YGU).

Ishikawa Pref.: Chugu-Onsen, VI 6 '68 1 ♀ (M. Morisita leg., YGU).

Fukui Pref.: Izumi, VII 29 '74 1 ♀ (K. Yamauchi leg., YGU).

Gifu Pref.: Hirugano, VI 16 '74 20 ♀♀, 20 ♀♀, 20 ♂♂ (K. Yamauchi leg., YGU).

Kyoto Pref.: Asukai-cho, VII 3 '71 1 ♀ (M. Morisita leg., MKU).

Wakayama Pref.: Shingu, V 2 '55 1 ♀ (M. Morisita leg., MKU).

Fukuoka Pref.: Mt. Hikosan, VIII 4 '73 10 ♀♀ (K. Yamauchi leg., YGU).

Korea: Seorak-san, VII 17 '73 3 ♀♀ (R. Sonobe leg., YGU).

Lasius (Dendrolasius) spathepus Wheeler

Lasius spathepus Wheeler, 1910, Biol. Bull., 19: 130-131; queen. Type locality: none specified.

Lasius fuliginosus var. *spathepus*, Teranishi, 1927, Zool. Mag., 39: 50.

Worker:

Body length 4.0~5.0 mm. Other measurements in Table 4. Antennal scape flattened to the extent that for most of their length the minimum width at any point is less than half the maximum width at the same point. Petiole in frontal view subquadrate with emerginate dorsal border, and in profile asymmetrical, with sharp dorsal crest (Fig. 9). Standing hairs on pronotum as long as in *D. fuliginosus*.

Table 4. Comparison of the measurement values of some morphological characters among five species of *Dendrolasius*. Values are given as means and, in parentheses, minima and maxima.

	<i>crispus</i>	<i>fuliginosus</i>	<i>spathepus</i>	<i>teranishii</i>	<i>morisitai</i>
SL (mm)	1.13 (0.95–1.25)	1.25 (0.96–1.37)	1.16 (0.98–1.32)	1.08 (0.92–1.22)	1.24 (1.22–1.32)
ML (mm)	1.27 (1.01–1.35)	1.42 (1.20–1.49)	1.31 (1.08–1.61)	1.22 (1.00–1.34)	1.35 (1.32–1.42)
HW (mm)	1.25 (1.01–1.35)	1.37 (1.08–1.49)	1.33 (1.08–1.66)	1.20 (1.00–1.34)	1.42 (1.37–1.51)
EL (mm)	0.26 (0.22–0.30)	0.29 (0.25–0.31)	0.29 (0.24–0.35)	0.26 (0.22–0.29)	0.29 (0.27–0.31)
EW (mm)	0.22 (0.17–0.24)	0.24 (0.17–0.26)	0.23 (0.19–0.29)	0.22 (0.18–0.25)	0.23 (0.21–0.25)
PW (mm)	0.73 (0.58–0.82)	0.78 (0.66–0.90)	0.77 (0.66–0.91)	0.74 (0.60–0.86)	0.80 (0.77–0.85)
CI	99 (95–106)	99 (94–104)	100 (96–108)	98 (94–101)	105 (104–110)
SI	93 (87–99)	92 (86–97)	88 (80–94)	90 (86–96)	87 (85–91)

Queen:

Body length about 6.0 mm. Head broader than long, with deeply emarginate occipital border and strongly convex sides. Antennal scape, femur, tibia and tarsus greatly flattened. Petiole in profile asymmetrical, with sharp dorsal crest (Fig. 9). Body hairs very sparse or absent, so that the entire cuticular surface is moderately to strongly shining (Fig. 8).

Male:

Body length about 4.0 mm. Petiole in profile asymmetrical, with sharp dorsal crest (Fig. 9).

Specimens examined:

Hokkaido: Hama-Koshimizu, VII 9 '66 20 ♀♀ (K. Yamauchi leg., YGU); Rumoi, VI 20 '68 5 ♀♀ (K. Yamauchi leg., YGU); Obihiro, VI 20 '69 10 ♀♀ (T. Wada leg., YGU); Sapporo, VIII 22 '66 13♂♂, 20 ♂♂, VIII 5 '67 22 ♀♀ (K. Yamauchi leg., YGU); Jozankei, IX 24 '57 8 ♀♀ (K. Hayashida leg., HKC); Ishikari, VIII 6 '57 7 ♀♀ (K. Hayashida leg., HKC)

Iwate Pref.: Iwate, no further record, 1 ♀ (Ogasawara leg., EHU).

Yamagata Pref.: Hondoji, VII 25 '70 2♂♂, 3 ♀♀ (K. Yamauchi leg., YGU).

Gumma Pref.: Tsumakoi, VII 1 '71 3 ♀♀ (A. Takizawa leg., YGU).

Tochigi Pref.: Nikko, V 23 '67 6 ♀♀ (S. Osawa leg., YGU).

Kanagawa Pref.: Odawara, VI 21 '67 5 ♀♀ (K. Yamauchi leg., YGU).

Nagano Pref.: Takamori, VII 31 '67 7 ♀♀ (K. Yamauchi leg., YGU); Kiso-Fukushima, VII 30 '66 1 ♀ (M. Morisita leg., MKU).

Ishikawa Pref.: Kanazawa, V 25 '72 1 ♀ (M. Morisita leg., MKU).

Fukui Pref.: Izumi, VII 29 '74 4 ♀♀ (K. Yamauchi leg., YGU).

Gifu Pref.: Hagiwara, VIII 23 '71 3 ♀♀ (K. Yamauchi leg., YGU); Gifu, VII 10 '74 20♂♂, 10 ♀♀, 10 ♂♂ (K. Yamauchi leg., YGU).

Kyoto Pref.: Kyoto, VIII 3 '72 1 ♀ (M. Morisita leg., MKU).

Wakayama Pref.: Shingu, V 2 '55 1 ♀ (M. Morisita leg., MKU).

Kochi Pref.: Usa, V 17 '72 1 ♀ (M. Morisita leg., MKU).

Miyazaki Pref.: Miyazaki, VI 2 '67 4 ♀♀ (M. Kubota leg., YGU), VIII 8 '73 1 ♀ (K. Yamauchi leg., YGU).

Kagoshima Pref.: Ebino Plateau, VIII 7 '66 1 ♀ (M. Morisita leg., MKU).

Lasius (*Dendrolasius*) *crispus* Wilson

Lasius (*Dendrolasius*) *crispus* Wilson, 1955, Bull. Mus. Comp. Zool., 113: 144–145: worker, queen, male.

Type locality: Katsurahama, Shikoku, Japan.

Worker:

Body length 4.0~4.5 mm. Other measurements given in Table 4. Antennal scape short-elliptical in cross-section as in *D. fuliginosus*. Standing hairs on pronotum shorter than in *D. fuliginosus*, about 1/3 to half of eye width. Petiole thin and high, in profile symmetrical, with sharp V-shaped dorsal crest (Fig. 9).

Queen:

Body length about 6.0 mm. Antennal scape slightly flattened than *D. fuliginosus*, never as in *D. spathepus* or *D. teranishii* (Fig. 8). Petiole in profile thin and high, symmetrical, with sharp dorsal crest (Fig. 9). Body and appendage pilosity finer and longer than in *D. fuliginosus*, many curved at the tip or even sinuate. Body pubescence very sparse or absent, so that the entire cuticular surface is moderately to strongly shining.

Male:

Body about 4.0 mm. Petiole in profile thin and high, symmetrical, with sharp dorsal crest (Fig. 9).

Specimens examined:

Hokkaido: Sapporo, IV 14 '66 20 ♀♀, IV 19 '66 20 ♀♀, V 6 '66 21 ♂♂, VI 22 '66 20 ♀♀, 8 ♀♀, 17 ♂♂, VII 7 '66 1 ♀, 4 ♂♂, VIII 9 '66 22 ♀♀, VIII 19 '66 20 ♀♀, 11 ♂♂ (K. Yamauchi leg., YGU); Hidaka Mombetsu, V 14 '66 20 ♀♀ (K. Yamauchi leg., YGU).

Fukushima Pref.: Higashiyama, VIII 29 '39 1 ♀, 1 ♂ (M. Kohono leg., EKU).

Niigata Pref.: Shibata, VIII 2 '74 1 ♀ '74 1 ♀ (K. Yamauchi leg., YGU).

Nagano Pref.: Tenryukyo, VIII 1 '67 5 ♀♀ (K. Yamauchi leg., YGU).

Formosa: Wushe, VII 31 '69 3 ♀♀ (M. Kubota leg., YGU).

Lasius (*Dendrolasius*) *teranishii* Wheeler

Lasius (*Chthonolasius*) *teranishii* Wheeler, 1928, Boll. Lab. Zool. Portici, 21; queen. Type locality: Nokkeushi, Hokkaido, Japan.

Lasius (*Dendrolasius*) *teranishii*, Wilson, 1955, Bull. Mus. Comp. Zool., 113: 146–147.

Worker:

Body length 3.0–3.7 mm. Other measurements given in Table. 4. Standing hairs on head and thorax sparse, mostly shorter than terminal segment of maxillary palp. Propodeum distinctly constricted just above propodeal spiracle. Petiole rather thick, in profile, with straight anterior and posterior margins and convex dorsal border; in frontal view, with flat border (Fig. 9).

Queen:

Body length about 7.0 mm. Antennal scape and leg conspicuously flattened as in *D. spathepus* queen, with dense, appressed hairs. Short and appressed hairs densely covering over the whole body (Fig. 8). Petiole thick with dull dorsal crest in profile, broader above than below in frontal view (Fig. 9).

Male:

Body length about 4.0 mm. Petiole rather thick, in profile, dorsal border generally rounded with a weak elevation medially (Fig. 9).

Specimens examined:

Hokkaido: Rishiri Is., VII 31 '59 1 ♀ (K. Hayashida leg. HKC); Hama-Koshimizu, VII 9 '66 5 ♀♀ (K. Yamauchi leg., YGU); Kawayu, 1 ♀ (K. Hayashida leg., HKC); Sapporo, VI 21 '66 80 ♀♀, 2 ♀♀, 10 ♂♂, VIII 1 '67 20 ♀♀, 3 ♀♀, 9 ♂♂, VIII 7 '70 1 ♀ (K. Yamauchi leg., YGU).

Tochigi Pref.: Nikko, V 23 '67 17 ♀♀ (S. Osawa leg., YGU).

Gumma Pref.: Tsumakoi, VII 1 '71 2 ♀♀ (A. Takizawa leg., YGU).

Gifu Pref.: Takayama, VII 1 '73 2 ♀♀ (K. Yamauchi leg., YGU).

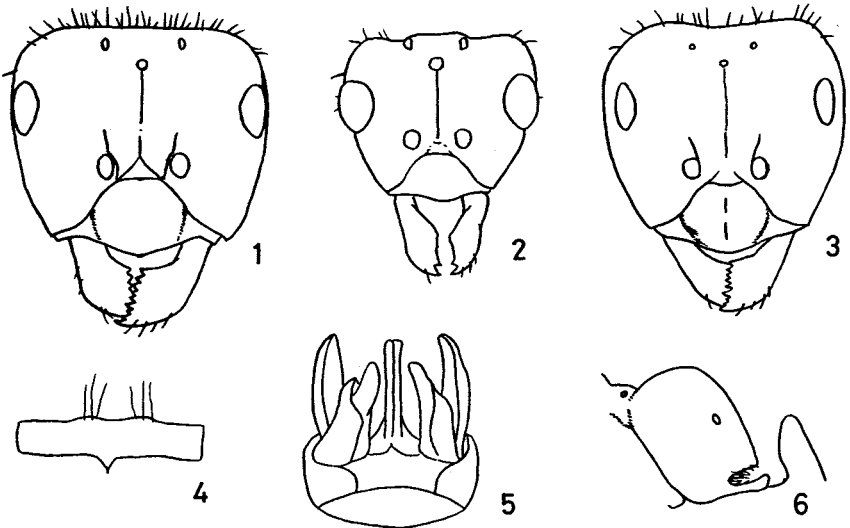


Fig. 7. *Dendrolasius morisitai*.

1, queen; 2, male; 3, worker; 4, male subgenital plate; 5, male genitalia; 6, worker propodeum.

Lasius (Dendrolasius) morisitai sp. nov.

Worker:

Size: Body length about 4.5 mm; other measurements given in Table 4.

Color: Body strongly shining jet black; antennae and legs gradually brownish black to light brown from base to tip; hairs white to golden.

Hairs: Pubescence very fine, very short, appressed and very sparse or absent on whole body; pilosity on antennae and legs relatively long and dense, mostly appressed or decumbent; standing hairs on head, thorax and petiole sparse, fine, mostly as same as terminal segment of maxillary palp in length; standing hairs on gaster as long as eye width.

Head: Broader than long, broadest at eye level, CI about 107, largest in the subgenus (Table 4), occipital border concave; ocelli distinct; frontal groove feeble; frontal keel developed; mandible with 9 denticules; maxillary palp 6 segmented; IV, V and VI subequal in length; labial palp 4 segmented; antennal scape short-elliptical in cross-section.

Thorax: Narrower than 2/3 of head width; mesonotum, seen from above, short-elliptical, longer than broad; propodeum rounded, never constricted just above propodeal spiracle; metapleural gland opening well developed, with guard hairs.

Petiole: Subquadrate in frontal view; dorsal border varying from slightly convex to almost straight, with feeble emargination or not; in profile, asymmetrical with dull dorsal crest (Fig. 9).

Queen:

Size: Body length about 5.0 mm; other measurements given as follows (means of 10 specimens): SL-1.46, HL-1.45, HW-1.61, PW-1.29, EL-0.36, EW-0.30, in mm. respectively.

Color: Body strongly shining jet black; appendages medium brown; wings bicolorous, contrasting with brownish basal 1/3 to half, the rest hyaline.

Hairs: Pubescence very fine, very short, appressed and very sparse or absent; pilosity on antennae and legs fine, relatively longer, appressed and dense (Fig. 8); standing hairs dense on occipital border and corner, but sparse or absent on genal margins; standing hairs on scutum sparse, mostly shorter than terminal segment of maxillary palp (Fig. 8); standing hairs on gaster longer than those on other body parts, but shorter than eye width.

Head: Broader than long, broadest at eye level, CI about 110; occipital border concave; frontal groove feeble; frontal keel feeble; clypeus broad, with broadly rounded anterior border; mandible with 9 denticules; maxillary pale 6 segmented, VI and V subequal in length, slightly shorter than IV; labial palp 4 segmented; antennal scape short-elliptical in cross-section.

Thorax: Narrower than head; scutum in side view overhanging pronotum, seen from above concealing pronotum, metapleural gland opening closed, without guard hairs.

Petiole: Subquadrate in frontal view; dorsal border slightly convex to almost straight; nearly symmetrical in side view (Fig. 9).

Male:

Size: Body length about 4.0 mm; other measurements given as follows (means of 8 specimens): SL-0.84, HL-1.03, HW-1.17, PW-1.09, EL-0.36, EW-0.29, in mm respectively.

Color: Body shining jet black; appendages medium brown; wings bicolorous, contrasting with brownish basal 1/3 to half, the rest hyaline; hairs white to golden.

Hairs: Pubescence very fine, short, appressed and sparse; antennal scape with dense decumbent or subdecumbent hairs, lacking standing hairs; fore tibia with a few standing hairs; Head with sparse standing hairs on occipital border and corner, but lacking genal margin; standing hairs on thorax very sparse.

Head: Broader than long, broadest at just posterior ends of eyes; in frontal view occipital border nearly straight; frontal groove distinct; clypeus broad with broadly rounded anterior border; clypeal keel developed at anterior part; mandible with distinct preapical cleft, sometimes with small denticles at masticatory border; antennal scape short-elliptical in cross-section.

Thorax: Narrower than head; scutum in profile convex, overhanging pronotum, seen from above, roundly projecting forward, concealing pronotum. Metapleural gland opening closed, without guard hairs.

Petiole: Nearly symmetrical in profile (Fig. 9). Subgenital plate and genitalia as illustrated in Fig. 7.

Type designation: Holotype: Worker: Kamigamo, Kyoto, VI 25, 1972, K. Onoyama leg., SL-1.30, HL-1.40, HW-1.50, PW-0.84, EL-0.30, EW-0.25. Paraniidotypes: 3 ♀♀, 2 ♂♂: VI 25, 1972; 1 ♀: VI 21, 1972; 1 ♀ 1 ♂: VII 18, 1972; 10 ♀♀: VI 30, 1973; 7 ♀♀, 6 ♂♂: VI 19, 1974, K. Onoyama leg. from the holotype nest. The holotype and paraniidotypes are deposited in YGU.

Remarks: *D. morisitai* can easily separated from other consubgeneric species by length and density of body hairs in queen. Besides, the shape of petiole is a good character to separate it from other consubgeneric species. This species was dedicated to Dr. Masaaki Morisita.

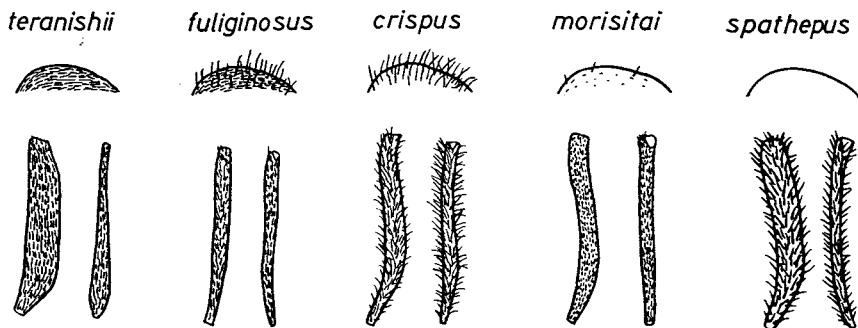


Fig. 8. Hairs and shape of antennal scape of *Dendrolasius* queens. Above, hairs on thorax; below, antennal scape (Left showing maximum width at the midpoint; right showing minimum width at the midpoint).

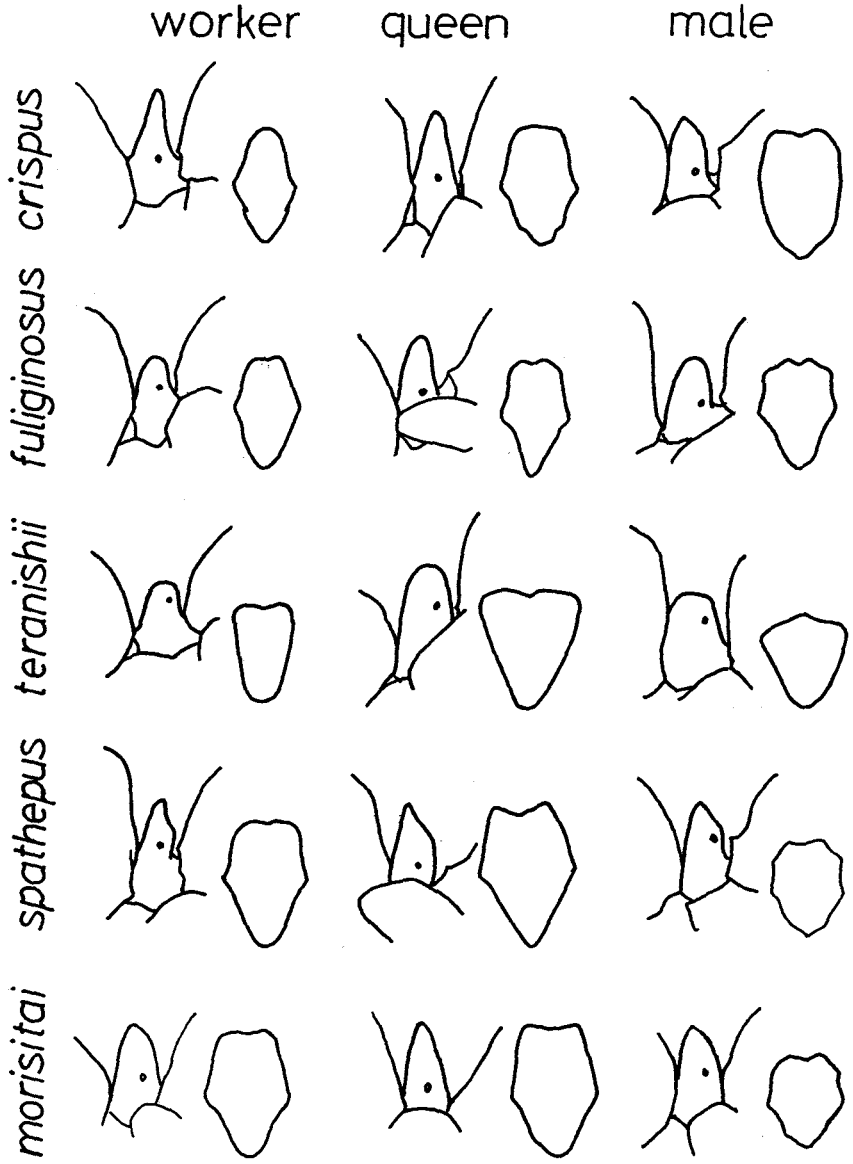


Fig. 9. Petiole of *Dendrolasius*. Left seen laterally, right seen frontally.

Key to the species of Japanese *Dendrolasius*

Worker:

1. Dorsal crest of petiole thin and sharp in profile (Fig. 9) 2
- Dorsal crest of petiole thick and dull in profile (Fig. 9) 3
2. Antennal scape flattened, for most parts minimum width about half of maximum width in cross-section; petiole asymmetrical in profile, subquadrate frontally (Fig. 9); standing hairs on pronotum mostly longer than terminal segment of maxillary palp *spathepus*
- Antennal scape short-elliptical in cross-section; petiole tapering symmetrically from base to tip in profile as like as frontally (Fig. 9); standing hairs on pronotum mostly shorter than terminal segment of maxillary palp *crispus*
3. Antennal scape short-elliptical in cross-section; petiole broadest at level of petiolar spiracle frontally (Fig. 9) 4
- Antennal scape flattened like *spathepus*; petiole broader above than below seen frontally (Fig. 9) *teranishii*
4. Petiole symmetrical in profile, with U-shaped dorsal crest (Fig. 9); head broad as long *fuliginosus*
- Petiole thinner than *fuliginosus* (Fig. 9); head broader than long, CI about 107 *morisitai*

Queen:

1. Dorsal crest of petiole thin and sharp in profile (Fig. 9) Body with few or no pubescence (Fig. 8) 2
- Dorsal crest of petiole thick and dull in profile (Fig. 9) Body covered with dense pubescence (Fig. 8) 4
2. Petiole asymmetrical in profile (Fig. 9); antennal scape strongly flattened (Fig. 8) *spathepus*
- Petiole symmetrical in profile (Fig. 9); antennal scape short-elliptical in cross-section to slightly flattened (Fig. 8) 3
3. Body except appendages with sparse, short standing hairs (Fig. 8) *morisitai*
- Body with numerous, fine, long hairs (Fig. 8) *crispus*
4. Body with long stout standing hairs exceeding dense appressed pubescence (Fig. 8); antennal scape short-elliptical in cross-section or slightly flattened (Fig. 8) *fuliginosus*
- Body without long standing hairs except apical abdominal segment; antennal scape strongly flattened (Fig. 9) *teranishii*

Male:

1. Dorsal crest of petiole thin and sharp in profile (Fig. 9) 2
- Dorsal crest of petiole thick and dull in profile (Fig. 9). 3
2. Petiole asymmetrical in profile (Fig. 9); antennal scape and tibia distinctly flattened *spathepus*
- Petiole symmetrical in profile (Fig. 9); antennal scape short-elliptical in cross-section *crispus, morisitai*
3. Antennal scape short-elliptical in cross-section; standing hairs on scutum long, relatively dense *fuliginosus*
- Antennal scape flattened; standing hairs on scutum very short, very few *teranishii*

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References

- Bourne, R.A. 1973. A taxonomic study of the ant genus *Lasius* Fabricius in the British Isles (Hymenoptera: Formicidae). *J. Ent. (B)*, 42: 17–27.
- Collingwood, C.A. 1957. The species of ants of the genus *Lasius* in Britain. *Jour. Soc. Brit. Ent.* 5: 204–214.
- 1963. The *Lasius (Chthonolasius) umbratus* (Hym., Formicidae) species complex in North Europe. *Entomologist* 96: 145–158.
- Hayashida, K. 1960. Studies on the ecological distribution of ants in Sapporo and its vicinity. *Insectes Sociaux* 7: 125–162.
- Kogure, T. 1955. Additional notes on ants of Central Hokkaido. *Saishu to Shiiku* 17: 9 (in Japanese).
- Morisita, M. 1945. Ants in the southernmost of Hokkaido. *Mushi* 16: 1–8 (in Japanese).
- and K. Onoyama 1974. Ants of Kyoto. *Wild life of Kyoto*: 31–40 (in Japanese)
- Okamoto, H. 1952. Ants from Shikoku, Japan (1). *Gensei* 1: 9–12 (in Japanese).
- 1969. Ants from Shikoku, Japan (6). *Ibid.* 19: 5~10 (in Japanese).

- Sonobe, R. 1972. Faunal survey of the Mt. Kirishima Area, JIBP main area-XI. Ant fauna of the Mt. Kirishima Area. Annual Rep. JIBP-CTS for 1971: 176-182 (in Japanese with English summary).
- 1977. Ant fauna of Miyagi Prefecture, Japan. Jap. J. Ecol. 27: 111-116.
- Teranishi, C. 1915. On ants of Osaka and its vicinity, Kontyu Sekai 19: 194-198 (in Japanese).
- 1929. Japanese ants, their behavior and distribution I. Zool. Mag., Tokyo 41: 239-251 (in Japanese).
- 1930. Winged ants gathered around the arclight of Nawa Entomological Laboratory. Trans. Kansai Ent. Soc. 1: 87-89 (in Japanese).
- Wheeler, W. M. 1906. Ants of Japan. Bull. Amer. Mus. Nat. Hist. 22: 301-328.
- 1928. Ants collected by Professor F. Silvestri in Japan and Korea. Boll. Lab. Zool. 21: 96-125.
- Wilson, E.O. 1955. A monographic revision of the ant genus *Lasius*. Bull. Mus. Comp. Zool. 113: 1-202.
- Yamauchi, K. and K. Hayashida 1968. Taxonomic studies on the genus *Lasius* in Hokkaido, with ethological and ecological notes (Formicidae, Hymenoptera). I. The subgenus *Dendrolasius* or jet black ants. Jour. Fac. Sci., Hokkaido Univ., Ser. VI, Zool. 16: 396-412.
- and ————— 1970. Taxonomic studies on the genus *Lasius* in Hokkaido, with ethological and ecological notes (Formicidae, Hymenoptera). II. The subgenus *Lasius*. Ibid. 17: 501-519.