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## A Taxonomic Revision of the Palearctic Members of the Ant Subgenus *Lasius s. str.* (Hymenoptera: Formicidae)

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With 9 tables and 41 figures

### Abstract

33 species and one distinct subspecies of the ant subgenus *Lasius s.str.* are described for the Palearctic region, including 17 species described as new and 8 taxa raised to species level. 11 taxa are synonymized and 12 taxa cannot be interpreted because of insufficient descriptions and unavailability of types. A total of 5050 specimens was studied and 3660 specimens were evaluated numerically giving 27 000 primary data on morphology. In the numeric analysis, the body-size-dependent variability was removed by consideration of allometric functions. The species' descriptions are supplemented by comments on differential characters and taxonomic status, by information on distribution and biology and by figures of each species. A key to the workers and comparative tables on numeric characters are provided.

### Zusammenfassung

Eine taxonomische Revision der paläarktischen Vertreter des Ameisensubgenus *Lasius s.str.* (Hymenoptera: Formicidae).

33 Spezies und eine distinkte Subspezies, darunter 17 neubeschriebene Spezies und 8 zum Art-niveau erhobene Taxa, werden für den Subgenus *Lasius s. str.* für die Paläarktische Region beschrieben. 11 Taxa werden synonymisiert und 12 Namen können wegen unzureichender Beschreibungen und des Fehlens von Typen nicht interpretiert werden. Ein Gesamtmaterial von 5050 Exemplaren wurde untersucht, davon 3660 Exemplare mittels numerischer Merkmalsbeschreibung, was 27 000 morphologische Primärdaten ergab. Durch Anwendung allometrischer Korrekturfunktionen wurde der körpergrößenabhängige Anteil der Variabilität eliminiert. Die Beschreibungen der Spezies werden durch Kommentare über Differentialmerkmale und den taxonomischen Status, durch Informationen über Verbreitung und Biologie und durch Abbildungen jeder Spezies ergänzt.

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## 1. Introduction

In his often-cited revision of 1955, E. O. WILSON recognized only 5 good species of the subgenus *Lasius* s. str. for the Palaearctic region (*brunneus*, *alienus*, *niger*, *emarginatus* and *productus*) and only 4 species were added since then: *hayashi* and *sakagamii* both described by Yamauchi and Hayashida in 1970, *neglectus* Van Loon, Boomsma & Andasfalvy, 1990 and *platythorax* Seifert, 1991. As a result of field studies on *Lasius* species in the confined territory of Germany, I was forced to describe 5 clear biospecies of dark brown *Lasius* which had been regarded so far as two species only. The morphological criteria used to separate the species *alienus*, *paralienus* n. sp., *psammophilus* n. sp., *niger* and *platythorax* and the strong ecological and

chorological segregation of each of these species changed my view of the whole group in a drastic manner. How many species, one may ask, might exist in the vast territories of Asia with its extreme climatic differences, extreme altitudinal structuring and its effective geographic barriers if such a negligible geographic patch as Germany is inhabited by 7 good species of the group alone? There is no reason why the Asian species richness per unit area should be lower than in Europe and there is further no reason why the delicacy of morphological differences between European biospecies should not be valid in Asia too. The total of 33 species plus 1 distinct subspecies described here for the whole Palaearctic region is certainly lower than the number of really existing species; the conceptions of *Lasius turcicus*, *alienus*, *grandis*, *japonicus* and *emarginatus* presented here are possibly lumping conceptions and there is no doubt that several species have not even been collected. Furthermore I refrained from making a description of a new species based on single individuals. One *alienus*-like specimen from Taiwan and one from Bulgaria deviate clearly enough to believe that they could represent two additional species.

In order to produce no synonyms, I had to check the status of all related Palaearctic taxa which de facto meant doing a taxonomic revision. This, however, was not my original intention which can be derived from the strong asymmetries in the intensity of investigation: 1500 workers and 320 queens I regarded as necessary in a numeric description of morphology to get a convincing demonstration of 5 Central European sibling species of *niger* and *alienus*. In contrast, the numeric description of 28 other species was done on the basis of 1500 workers and 340 queens, which means a much lower intensity of investigation per species, and few species were described on the basis of 1 local series only.

The comparative consideration and descriptive work inevitably had to be concentrated on worker morphology. In only 1 species described here workers are unknown. In contrast queens were lacking in 38 % and males in 65 % of all presented taxa. Since *Lasius* males are frequently most difficult indetermination and very poorly supplied, any taxonomic consideration of this caste is avoided in this paper and must wait until a bold colleague is willing to do this job.

## 2. Material studied and Acknowledgements

Among 5050 *Lasius* specimens seen, a total of 3000 worker specimens and 660 queens was studied numerically giving 27 000 primary data on morphology. About 60 % of the material is of W Palaearctic origin. The least studied areas from which only very few samples were available are Siberia, Tibet, Middle Asia and Afghanistan. The institutions or collections where types are deposited have the following acronyms

Basel MUS	- Naturhistorisches Museum Basel
Berlin MUS	- Zoologisches Museum der Humboldt Universität Berlin
Genève MUS	- Muséum d'Histoire Naturelle Genève
Genova MUS	- Museo Civico di Storia Naturale Genova
Görlitz MUS	- Staatliches Museum für Naturkunde Görlitz
Harvard MUS	- Museum of Comparative Zoology Cambridge / Mass.
London MUS	- British Museum (Natural History) London
Lund MUS	- Zoologiska Museet, Lunds Universitet
Werner coll.	- private collection of P.Werner/Praha
Wien MUS	- Naturhistorisches Museum Wien
Yamauchi coll.	- private collection of K.Yamauchi/Gifu

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### 3. Investigation methods and terminology

All measurements have been taken using a Carl Zeiss Jena stereomicroscope TECHNIVAL 2 at magnifications of 50x-250x (the maximum possible magnification to keep a structure within the range of the ocularmicrometer was used). Measuring accuracies of  $\pm 1 \mu\text{m}$  are given for small structures like the hair length, such of  $\pm 2 \mu\text{m}$  for medium-sized measures like worker head width, such of  $\pm 4 \mu\text{m}$  for large measures like the queen head width and such of  $\pm 8 \mu\text{m}$  for very large measures like the queen mesosoma length. To have a uniform presentation and to avoid rounding errors, all measurements have been recorded in  $\mu\text{m}$  even for characters where a precision of  $\pm 1 \mu\text{m}$  is impossible. If not otherwise stated, all statistic tests are tests on equality of mean values: a **t** test was applied if an **F** test proved equality of the variances; if not, a modified **t** test with corrected degrees of freedom according to WELCH (1947) or a nonparametric U test (MANN-WHITNEY) was applied.

- CLCA - a number describing the perceptible length of the median clypeal carina as a ratio of the total distance from anterior to posterior clypeal margin. This measurement is affected by illumination effects and subjective errors but is generally a good means to express the development of this structure.
- EL - eye length; the largest diameter of eye across all structurally visible ommatidia irrespective of the pigmentation status
- EW - eye width; the small diameter of eye measured perpendicularly to transect in EL and across all structurally defined ommatidia.
- HL - maximum head length in median line; the head has to be carefully tilted to the position with the real maximum.
- HW - maximum measurable head width; this is either across eyes or the head capsule width behind the eyes seen in transmitted-light to measure the real cuticular surface and not the pubescence surface.
- MaDe - number of dents on masticatory border of mandible
- MH - mesosoma height measured perpendicularly to tangent of dorsal mesosoma profile from scutellum down to lower margin of mesopleura (Fig. 1)
- ML - maximum mesosoma length from hind median extension of propodeum to frontal profile of pronotum (Fig. 1)
- M6 - the length of the maxillary palp segment 6 (= the apical one)
- nHS - number of standing hairs projecting  $> 20 \mu\text{m}$  from dorsal profile of scapus; i. e. the number of hairs visible when looking at the small diameter of scapus under transmitted-light condition. The always present hairs on distal apex are not counted and the number refers to one scapus.
- nHHT - number of standing hairs projecting  $> 20 \mu\text{m}$  from extensor profile of one hind tibia seen in transmitted-light. The always present hairs on distal apex are not counted and the number refers to one tibia.
- nUH - number of standing hairs on underside of head projecting  $> 20 \mu\text{m}$  from gular profile seen in lateral view. The number refers to only one half of head.
- nBH - number of standing hairs projecting  $> 20 \mu\text{m}$  from occipital profile of head frontad to hind margin of eye. The number refers to only one half of head and counting is performed in the position in which HL is measured.
- PDCL - average pubescence distance on clypeus; the number **n** of pubescence hairs crossing or touching a measuring line of length **l** (arrow in Fig. 2) is counted. PDCL is then  $l/n$  and given in  $\mu\text{m}$ .
- PLF - length of pubescence hairs on frontal head (normally expressed as mean of 4 to 5 measurements per specimen). PNHL - length of longest standing hair on pronotum
- SL - maximum straight line scapus length excluding articular bulb
- UHL - length of longest standing hair on underside of head

HL/HW (900) and SL/HL (900) are values of HL/HW and SL/HL calculated for a worker with HL = 900 using the overall allometric functions given in Tab. 1. These values indicate the relative head and scape length of a species independent of its average body size. To have a short but comparable characterization of the pilosity (= setae or bigger hairs) and pubescence (= microchaetae or fine, small hairs), descriptions as in the following example are applied: "Hind tibia: setae on whole profile,  $15.3 \pm 5.3$ ,  $30-55^\circ$ , max.  $55 \mu\text{m}$ ". This describes the distribution, mean hair number  $\pm$  standard deviation, frequent angles of erection, and the perpendicular projection of the longest hair from cuticular surface. Sometimes, particularly in the species of the *alienus*

complex, it is difficult to differentiate clearly between pilosity and pubescence and what has been called "setae" will then also refer to bigger, more projecting pubescence hairs.

The colour pattern is always referred to the average condition but is a very fallible character in the distinction of most species because it varies considerably. Furthermore, the subjective perception changes with type of illumination and the microscopic magnification. For colour assessment, I used a magnification of 50x and a halogen lamp with a simple white plastic film mounted near to the object. This plastic filter reduces surface reflections and allows a better visualisation of cuticular microstructures.

#### 4. Consideration of allometries

Several morphological characters change their relative values with growing body size. This must be considered when reading verbal descriptions and numeric data. For example, the relative height of the propodeal dome (and depth of mesopropodeal impression) grows with increasing body size. Propodeal domes which are conic in medium-sized workers may be more spheric in the largest and flatter in minute individuals. The petiole becomes relatively wider and thicker in larger workers. In 27 Palaearctic populations of 20 species of *Lasius* with sufficiently large worker samples regression functions were calculated to estimate the influence of body size on morphometric characters. The overall means in Tab. 1 may be accepted as rule of thumb for all species but, when higher accuracy is desired, population-specific parameters were used.

Tab. 1 Allometric relations as arithmetic mean of the data of 27 populations of 20 Palaearctic *Lasius* species.  $D_{100}$  gives the change of a character with a head length increase of 100  $\mu\text{m}$ , SD is the mean of standard deviation and  $SD_{\text{cor}}$  is the corrected standard deviation after removal of size-dependent variability by the factor  $D_{100}$ .

Charakter	$D_{100}$	SD	$SD_{\text{cor}}$	$(SD - SD_{\text{cor}}) / SD$ (%)
HL/HW	-0.0187	0.02085	0.01667	20.0
SL/HL	-0.0124	0.01965	0.01830	6.9
PDCL	-0.5540	4.876	4.858	0.4
PNHL/HL	0.0001	0.01012	0.01013	0.0
UHL/HL	-0.0027	0.01683	0.01620	3.7

Tab. 1 shows that allometric corrections may be neglected in case of hair length data and clypeal pubescence distance but should be done for SL/HL and particularly HL/HW where as much as 20 % of the overall variation is caused by body-size-dependent variation. The common habit in myrmecology to describe the scape length as simple, uncorrected ratio of head width must be criticized here. In most ant genera, at least in *Lasius*, *Formica* and *Camponotus* for which I have a large body of data, it can be shown that the ratio SL/HW has a much larger coefficient of variation than the ratio SL/HL due to the much stronger negative allometry (unpublished results). In the *Lasius* species of the present study, this coefficient is for SL/HW 130.0 % of the value for SL/HL.

The hair numbers nBH, nUH, nHS and nHHT increase with growing body size. In linear regressions of hair numbers  $y$  against HL as measure of body size according to the function

$$y = a * HL + b \quad (i)$$

the slope  $a$  strongly depends on the mean hair number  $M_y$  of a population. In absolute terms, the hair numbers do not substantially increase with growing body size in characters with low hair numbers but do so in characters with higher means. As simplification valid for nBH, nUH, nHS and nHHT the following rule of thumb may be applied

$$a = 0.0023 * M_y \quad (ii)$$

This gives a  $D_{100}$  (= difference for 100  $\mu\text{m}$  HL increase) of + 1.1 for  $M_y = 5$  e. g. (nBH in *Lasius alienus*) but a  $D_{100}$  of + 4.6 for  $M_y = 20$  (e. g. nHS in *L. platythorax*).

In queens, the head length index and the scapus length indices show negative allometries as derived from 8 Palaearctic species with sufficiently large samples. If the queen "body size" is calculated as geometric mean of HL, HW and ML, the decline of indices with 100 µm body size increase is as follows: HL/HW -0.005, SL/HL -0.0121 and SL/HW -0.0150.

Numeric character descriptions of queens and workers are highly correlated which enables approximate predictions on morphological data if either caste is unknown.

## 5. Diagnosis of the Subgenus *Lasius* Fabricius

At least if the the Palaearctic species of the genus are concerned, a subdivision into 5 subgenera is reasonable and not questioned by the occurrence of species with intermediate morphology or biology. While the morphologic differentiation of the subgenus *Lasius* Fabricius, 1805 from the subgenera *Dendrolasius* Ruzsky, 1913, *Chthonolasius* Ruzsky, 1913 and *Austrolasius* Faber, 1967 is no matter of question and confirmed by a lot of deviating biological traits (particularly the social parasitic colony foundation), the separation of the subgenus *Cautolasius* Wilson, 1955 is less clear. The subgenus *Lasius* differs in the worker from *Cautolasius* in having much bigger eyes and a longer terminal segment of maxillary palps. In all *Lasius* s. str. species tested the ratio  $(EL+EW)/(HW+HL)$  is larger than 0.168 and the ratio  $M6/HL$  larger than 0.130 while all *Cautolasius* species, including *Lasius alienoflavus* Bingham, 1903, do not surpass this limit even in the most extreme nest series. In the Nearctic range, the palp length criterion is invalidated in the case of *Lasius sitiens* Wilson, 1955, but the eye size argument will hold.

## 6. Treatment by species

In the heading synonymic lists, the types studied or other sources from which the identity of a taxon was concluded with a certain probability are given in square brackets. Taxa whose types were not available and which original descriptions do not allow a taxonomic statement without a high risk of error were completely excluded from the listing. These names are mentioned in chapter 7.

The origin of studied material is given separately for countries or geographic areas and the number of morphometrically studied individuals and of sites is given in brackets separated by a comma (the number of individuals seen is normally higher than the number of individuals studied morphometrically). In the majority of species no literature statements on distribution and biology were accepted if the determination of elder authors was possibly wrong and a post hoc interpretation impossible.

### 6.1. *LASIUS BRUNNEUS* (Latreille 1798)

*Formica brunnea* Latreille, 1798; [description]

*Formica timida* Förster, 1850; [description]

*Lasius niger* var. *alieno-brunneus* Forel, 1874; [5 type workers, Genève MUS]

*Acanthomyops brunneus* v. *nigro-brunneus* Donisthorpe, 1926; [Baroni Urbani, 1971]

#### Material studied:

England (4,1), Germany (200,50), Romania (1,1), Bulgaria (3,1), Switzerland (10,2), Italy (6,2), Spain (6,1), Turkey (7,4)

#### Description:

Worker (Fig. 7): Head: HL/HW (900) 1.044, SL/HL (900) 0.858; broad and with rounded sides; occipital margin ± straight; mandibles frequently 7-toothed, appearing relatively shorter and more incurved than in other species of the group; lateral clypeal profile strongly convex, carina weak. Genal setae completely absent. Mesosoma: propodeum in lateral view with a very straight posterior slope and a small conic dome equal in height to mesonotum, mesopropodeal depression not very deep. Scale: in lateral view with sharp dorsal tip, convex anterior and straight posterior profile; in anterior view with notably emarginate dorsal crest and convex to nearly straight sides. Scape: setae on dorsal plane completely lacking and

pubescence fully appressed, both characters giving a very smooth surface appearance. Hind tibia: setae on extensor profile completely lacking, exceptionally a weak hair may be present; pubescence as on scape. Surface characters: all surfaces on dorsal head with very appressed pubescence, 0-5°, PLF  $\pm 20 \mu\text{m}$ ; cuticular surface moderately shining, with weak micropunctures and weak microreticulum. Promesonotum moderately shining and with fine microreticulum, pubescence similar to head condition. Colour: bicoloured; head medium (sometimes dark) reddish-yellowish brown; mesosoma, petiole and appendages light yellowish brown, gaster dark brown with reddish tinge.

HL  $947.3 \pm 111.0$  (34), HL/HW  $1.0353 \pm 0.0292$  (34), SL/HL  $0.8524 \pm 0.0146$ (34), CLCA  $0.29 \pm 0.10$  (13), PDCL  $27.62 \pm 5.62$  (32), nHS  $0.0 \pm 0.0$ , nHHT  $0.16 \pm 0.41$  (32), nBH  $2.33 \pm 0.92$  (20), nUH  $1.50 \pm 0.55$  (24), UHL/HL  $0.0838 \pm 0.0471$  (31), PNHL/HL  $0.0935 \pm 0.0096$  (32)

Queen: Head: frontal groove fully developed from frontal triangle to midocellus and set in the middle of a broad, shallow trough; mandible frequently 7-toothed; very short scape. Genal setae completely absent. Mesosoma: strongly flattened, much wider than high. Scale: obtusely-angled emarginate, with sharp corners and straight dorsad converging sides. Scape: seta and pubescence condition similar to worker. Hind tibia: seta and pubescence condition similar to worker, but few 30-45° setae may be present on extensor profile. Surface characters of frontal head: surface moderately shining, but with well-defined micropunctures of 5-7  $\mu\text{m}$  diameter and  $\pm 13 \mu\text{m}$  central distance; pubescence  $\pm 30^\circ$  but surface appearance smooth, PLF 30-35  $\mu\text{m}$ . Colour: head, mesosoma and gaster dark brown with reddish tinge; scape and tibiae yellowish to pale yellowish brown.

HL  $1384.7 \pm 28.1$  (9), HW  $1541.4 \pm 42.1$  (9), ML  $2647.8 \pm 108.9$  (8), HL/HW  $0.8983 \pm 0.0102$  (9), SL/HL  $0.7892 \pm 0.0073$  (9), SL/HW  $0.7091 \pm 0.0079$  (9), MH/ML  $0.4602 \pm 0.0090$  (6), PDCL  $21.44 \pm 2.10$  (9), nHS  $0.22 \pm 0.67$  (9), nHHT  $1.06 \pm 1.21$  (9), nBH  $1.00 \pm 1.56$  (9), nUH  $2.06 \pm 1.33$  (9), PNHL  $131.8 \pm 12.1$ (8), MW/MH  $1.2709 \pm 0.0958$  (6)

### Comments:

The species is not to confuse. The worker is a combination of extremely low SL/HL and HL/HW, extremely smooth pubescence and surface appearance, lacking appendage pilosity and short pronotal setae. The queen is a combination of extremely short scape, flat mesosoma, very smooth surface appearance and short pronotal setae. For differences to *lasioides* see chapter 6.3.

### Biology and distribution:

The northern border of distributional range is reported by COLLINGWOOD (1979) as 61° N in Sweden and my own material includes records south to 37° N in Anatolia. In the Mediterranean region, *brunneus* may be expected in mountain areas above 1000 m as indicated by own samples from the Sierra de Gredos / Spain (40°N). *Brunneus* is probably widely distributed throughout Anatolia. Literature records from N Africa (Atlas) seem plausible but a confusion with *lasioides* can not be excluded.

*Brunneus* is found in all habitats where deciduous trees are present - from dense woodland to open land with scattered trees or hedgerows. Pure, shaded coniferous forests are avoided but light *Pinus* forests or mixed conifer-deciduous forests are inhabited at lower densities (0.1-2 nests/100 m<sup>2</sup>). Top densities of 10-23 nests / 100 m<sup>2</sup> were found in *Quercus-Carpinus-Tilia-Acer* forests in the Harz mountains in Germany (SEIFERT 1986). In such sites, big trees are sometimes occupied by two colonies as indicated by intraspecific fightings.

The nests are preferentially constructed in wood and under bark of living or dead deciduous trees, from subterranean parts up to the main branches. Dead parts of a tree are preferred but occasionally galleries may penetrate living wood. Nests containing brood and situated several meters away from the next tree are frequently found under stones or in litter. Possibly such nests are mainly of a temporal nature and represent a seasonal phenomenon. The occurrence of polycaelic

colonies is very likely but not definitely proved. COLLINGWOOD (1979) reports acceptance of dealate queens after swarming. *Brunneus* is known to occur inside the timbers or stone walls of houses (in Germany, however, much less frequently than *emarginatus*).

Trophobiosis with tree aphids, including the big *Stomaphis quercus*, is obviously the major food source but transport of insects to the nest is frequently observed. *Brunneus* is very fugitive and quickly escapes after the opening of nests. Workers avoid running over free open surfaces and move as long as possible in the shelter of crevices or grooves. The swarming period begins earlier than in most species of the group and lasts in Central Europe, according to my own records, from 10 June to 19 July (25 June  $\pm$  12 d, n = 14). There seems to be no special time of day for flying but the period near noon (11-14 h) was most frequently noted (own observations; Donisthorpe, Forsslund both cited by WILSON 1955). Early morning flight (5-6 h) is reported by Schenck (STITZ 1939) and even nocturnal flight seems possible. However, the observed light trap catches could be the result of artificial provocation by the light and no result of natural activity.

## 6.2. *LASIUS BRUNNEUS HIMALAYANUS* Forel, 1917

*Lasius niger brunneus* var. *himalayana* Forel, 1894; [5 type workers, Genève Mus]

*Lasius niger* var. *himalayanus* Forel, 1917

### Material studied:

Pakistan (16,6), India (8,3)

### Description:

Worker: HL/HW (900) 1.074, SL/HL (900) 0.893

HL 1020.3  $\pm$  87.6 (22), HL/HW 1.0513  $\pm$  0.0190 (22), SL/HL 0.8787  $\pm$  0.0211 (24), PDCL 22.08  $\pm$  6.30 (22), nHS 0.0, nHHT 0.14  $\pm$  0.35 (22), nBH 1.39  $\pm$  1.24 (22), nUH 0.25  $\pm$  0.69 (22), UHL/HL 0.0130  $\pm$  0.0298 (22), PNHL/HL 0.1060  $\pm$  0.0100 (22)

### Comments:

The Himalayan population differs from the W Palaearctic one by more elongated head, longer scape, larger size, smaller PDCL and darker colour. The means of size-corrected data of HL/HW and SL/HL are different for highest significance levels ( $p < 0.0001$ ); the means of square-root-transformed PDCL data differ for  $p < 0.001$  and the means of HL differ for  $p < 0.01$ . Since other characters of the Himalayan specimens are very similar to the W Palaearctic *brunneus*, *himalayanus* is treated here as distinct subspecies only but taxonomists rigidly rejecting ternary names are recommended to treat it as species.

### Distribution:

So far only recorded from W Himalayas: Chitral, Hazara, Lahore, Kashmir, Himachal Pradesh. All available altitudinal records (n = 7) fall in a narrow zone of 2000-2700 m. Absent in the E Himalayas?

## 6.3. *LASIUS LASIOIDES* (Emery, 1869)

*Prenolepis lasioides* Emery, 1869; [type queen, Wien MUS]

*Lasius fumatus* Emery, 1870; nomen pro *Prenolepis lasioides*

*Lasius niger lasioides* var. *barbara* Santschi, 1921 [description and terra typica]

### Material studied:

France (6,1), Spain (19,5), Mallorca (8,3), Malta (6,2), Italy (6,3), Greece (8,3), Turkey (3,1), Morocco (6,3), Algeria (7,2), Tunisia (4,1)

### Description:

**Worker** (Fig. 8): **Head**: HL/HW (900) 1.059, SL/HL (900) 0.942. Mandibles normally 7-toothed ( $7.02 \pm 0.53$ , 6-8,  $n=27$ ). Frontal line clearly visible. Carina well developed in center of clypeus, in anterior and posterior part frequently absent, lateral clypeal profile very convex. Genal setae completely absent. **Mesosoma**: reminiscent of *brunneus*; propodeum in lateral view with very straight posterior slope and conic dome, which is frequently slightly higher than promesonotum, mesopropodeal depression on average deeper than in *brunneus*. **Scale**: in anterior view wider than in *brunneus* and with moderately convex sides, always at least slightly emarginated; scale in lateral view thin and with convex anterior and straight posterior profile. **Scape and hind tibia**: seta and pubescence condition as in *brunneus*. **Surface characters**: very similar to *brunneus*; dorsal head with rather dilute, very appressed (0-10°) pubescence, PLF 20-26  $\mu\text{m}$ ; cuticular surface mildly shining, with weak micropunctures and weak microreticulum. Frontal pronotum with fine microreticulum and less dilute pubescence compared to head. Clypeal pubescence very sparse. **Colour**: head, mesosoma, gaster, femora and tibiae dark to medium brown; tibio-femoral joint region, scape and (frequently) anterior margin of clypeus pale yellowish brown.

HL  $848.1 \pm 42.6$  (64), HL/HW  $1.0688 \pm 0.0147$  (64), SL/HL  $0.9482 \pm 0.0269$  (64), CLCA 0.38  $\pm 0.14$  (63), PDCL  $31.41 \pm 7.79$  (63), nHS 0.0, nHHT 0.0, nBH  $3.23 \pm 1.27$  (64), nUH 0.20  $\pm 0.34$  (64), UHL/HL  $0.0227 \pm 0.0361$  (64), PNHL/HL  $0.1130 \pm 0.0108$  (63).

**Queens**: **Head**: short, occipital margin straight; frontal groove fully developed from frontal triangle to midocellus, set in the middle of a shallow trough; mandibles in the 4 specimens with fully visible masticatory border 7-toothed. Genal setae completely absent. **Mesosoma**: strongly flattened, much wider than high. **Scale**: wide, clearly emarginate and with more rounded dorsal corners compared to *brunneus*. **Scape and hind tibia**: seta and pubescence condition as in worker. **Surface characters**: frontal head in overall appearance very smooth and moderately shining, micropunctures slightly weaker than in *brunneus*, weak microreticulum; pubescence 10-20°, PLF 30-45  $\mu\text{m}$ . **Colour**: head, mesosoma and gaster dark reddish brown; scape and tibiae yellowish. Data of 7 queens:

HL  $1234.9 \pm 26.8$ , HW  $1396.3 \pm 50.4$ , ML  $2470.9 \pm 64.7$ , HL/HW  $0.885 \pm 0.0243$ , SL/HL  $0.887 \pm 0.0137$ , SL/HW  $0.785 \pm 0.0191$ , MH/ML  $0.462 \pm 0.0172$ , PDCL  $20.86 \pm 4.71$ , nHS 0.0, nHHT 0.0, nBH  $1.14 \pm 0.80$ , nUH  $0.71 \pm 1.07$ , PNHL  $139.1 \pm 12.4$ .

### Comments:

The lectotype queen in the Wien MUS is in good condition and is labelled "L. fumatus m., lasioides m., det. Emery, Neapel, Emery, Collect. G. Mayr" and "Lectotype, des. E. O. Wilson". The lectotype is probably the only original material of Emery that is still available (a search in the Emery collection in Genova MUS was negative). The specimen compares well with the worker-attributed queens from Malta, Mallorca and Algeria and has the data:

HL 1225, HW 1401, ML 2535, HL/HW 0.874, SL/HL 0.883, SL/HW 0.772, MH/ML 0.471, PDCL 18.6, nHS 0, nHHT 0, nBH 0.5, nUH 0, PNHL 118, MW/ML 0.632.

In workers and queens, *L. lasioides* shares some of the rare and diagnostic characters of *brunneus* and is most probably a close relative. *Lasioides* has the smooth head surface, the completely smooth reference surfaces of scape, the short pronotal hairs and the mandibular dentition of *brunneus* and is very similar in mesosomal shape. However, a safe distinction of workers and queens is given by the extremely different SL/HL alone (worker: *lasioides* lowest 0.895, *brunneus* largest 0.885; queen: *lasioides* lowest 0.864, *brunneus* largest 0.801). The scale shape in both castes and the colour of the worker offer additional means for separation.

A series of much bigger and more hairy queens from Iran, Goran region, 54.29 E and 36.44 N, leg. A. Senglet 20 vii 1973 has not been considered in the above description and data. These 4 dealate queens are similar to the 7 *lasioides* queens from the Mediterraneans but differ

in having bigger HW, much bigger mesosoma dimensions, bigger ML/HL and bigger nUH (in each case difference significant for  $p < 0.0001$ ). PNHL and nBH are larger for  $p < 0.01$ . Their scapes and hind tibiae are not perfectly smooth, covered by a 10-40° pubescence and a small number of fine 30-60°, 36-40 µm seta is present. With the poor knowledge of *lasioides* queens, it is impossible to decide whether the Iranian queens represent geographic variation or a different species. The data of the 4 Iranian queens:

HL 1298.0 ± 7.3, HW 1480.5 ± 4.4, ML 2772.0 ± 21.6, HL/HW 0.877 ± 0.008, SL/HL 0.878 ± 0.023, SL/HW 0.770 ± 0.022, MH/ML 0.480 ± 0.0144, PDCL 23.4 ± 3.1, nHS 3.50 ± 4.5, nHHT 1.75 ± 1.3, nBH 6.75 ± 3.9, nUH 4.50 ± 1.7, PNHL 163.5 ± 10.5, mandibular dents 7,7 and 8.

#### **Biology and distribution:**

Certainly widely distributed throughout the Mediterranean region from Spain to Turkey. The known northern border is at 44° N (Provence/S France). In N Africa it obviously abundant along the Atlas mountains from Morocco to Tunisia. Altitudinal records vary from sea level to 1750 m.

*Lasioides* is found in all habitats where at least few trees were present. Recorded were: a sand dune with trees (Malta), pastures with scattered trees which are often *Quercus* species (4 observations), open *Quercus* forests (2 observ.), dense *Quercus* forests (4 observ.), a dense *Pinus nigra* forest and a dense *Abies pinsapo* forest (Spain). Despite of similarities in habitat, there is only one observation of syntopic occurrence with *brunneus* in Spain.

According to my own findings in Spain, the nests are constructed in dead wood and under stones as well. The behaviour is very similar to *brunneus*: it is fugitive, does not attack after opening of the nest and presses into crevices to avoid being caught. Records of alates in the early period of 12 May - 7 July (3 June ± 22 d, n = 5) indicate further similarities to *brunneus*.

#### **6.4. LASIUS TURCICUS Santschi, 1921**

*Lasius niger turcicus* Santschi, 1921; [7 type workers, Basel MUS]

*Lasius neglectus* Van Loon, Boomsma & Andrasfalvy, 1990; [ 8 paratypes: 7 workers, 1 queen; London MUS, Görlitz MUS]

#### **Material studied:**

France (4,1), Hungary (8,1), Bulgaria (2,1), Greece (10,3), Turkey (46,15), Georgia (19,4), Iran (1,1).

#### **Description:**

**Worker:** (Figs. 3, 9): **Head:** relatively long, HL/HW (900) 1.097; SL/HL (900) 0.935. Number of mandibular dents 7.35 ± 0.46 (n = 23, 7.0-8.0). Clypeal carina weak and only developed in centre of clypeus; lateral clypeal profile convex. 2 (1-4) setae per gena. **Mesosoma:** propodeum a little lower than promesonotum and with small dome, mesopropodeal depression relatively shallow. In small workers (e. g. those from polygynous colonies !) propodeal dome and mesopropodeal depression very shallow. **Scale:** in lateral view thin and sharp, anterior profile almost straight, posterior profile straight; in frontal view relatively wide, with rather straight almost parallel sides and always weakly emarginate. **Scapae:** ± smooth, setae almost completely absent; a single hair may project 25 µm, pubescence 0-30°. **Hind tibiae:** ± smooth, setae absent or only 1-3 (30-50°, 30 µm); pubescence 0-25°. **Surface characters:** pubescence of frontal head 20-30° and dense which contrasts the very sparse clypeal pubescence, PLF 30-35 µm; cuticular surface of dorsal head shining, with fine microreticulum and weak micropunctures. Dorsal pronotal surface weakly transversally microrugulose, reticular microstructure not clearly detectable. **Colour:** a typical but not generally valid pattern for medium-sized and larger workers is: head and gaster yellowish reddish brown, mesosoma somewhat paler yellowish-reddish brown; mandibles yellow; antennae and legs light yellowish-brownish, anterior clypeal margin yellowish-reddish. Small individuals often lack the yellowish-reddish tinge and are more pale, dirty brown.

HL  $831.3 \pm 72.9$  (81), HL/HW  $1.1094 \pm 0.0248$  (81), SL/HL  $0.9430 \pm 0.0171$  (81), CLCA  $0.34 \pm 0.17$  (57), PDCL  $31.77 \pm 6.41$  (80), nHS  $0.22 \pm 0.51$  (80), nHHT  $0.39 \pm 0.54$  (79), nBH  $9.06 \pm 2.45$  (80), nUH  $2.42 \pm 1.25$  (77), UHL/HL  $0.1151 \pm 0.0118$  (77), PNHL/HL  $0.1192 \pm 0.0103$  (80).

**Queen:** Head: frontal groove fully developed from midocellus to frontal triangle but weakly impressed; mandibles with 7 to 8 dents ( $7.33 \pm 0.50$ ,  $n=9$ ), number of genal setae  $2.89 \pm 1.39$  ( $n=9$ ). **Mesosoma:** in lateral view flat. **Scale:** Always emarginate with an angle of  $110-160^\circ$ , upper corners rounded to angularly rounded. Sides slightly converging dorsally. **Scape:** pubescence  $30^\circ$ , relatively smooth, single setae  $30-60^\circ$  and  $25-60 \mu\text{m}$ . **Hind tibia:** pubescence  $30^\circ$ , few setae of  $30-60^\circ$  and  $30-52 \mu\text{m}$  may be present. **Surface characters:** overall impression of dorsal head weakly shining, pubescence dense,  $25-35^\circ$  and PLF  $35-52 \mu\text{m}$ . In one queen from Turkey (probably from a monogynous nest) dorsal head with well-developed micropunctures of  $7-9 \mu\text{m}$  diameter and  $\pm 13 \mu\text{m}$  central distance; these punctures are more weakly developed in queens from big polygynous colonies. **Colour:** head, mesosoma and gaster dark brown; scape, mandibles and tibiae yellowish; femora yellowish brown.

HL  $1230.0 \pm 36.1$  (9), HW  $1380.8 \pm 28.8$  (9), AL  $2533.4 \pm 67.1$  (9), HL/HW  $0.8909 \pm 0.0104$  (9), SL/HL  $0.8612 \pm 0.0222$  (9), SL/HW  $0.7672 \pm 0.0204$  (9), MH/ML  $0.4984 \pm 0.0264$  (9), PDCL  $22.33 \pm 7.09$  (9), nHS  $1.39 \pm 1.88$  (9), nHHT  $2.39 \pm 2.85$  (9), nBH  $13.61 \pm 2.37$  (9), nUH  $6.17 \pm 1.32$  (9), PNHL  $164.2 \pm 14.4$  (9), UHL  $171.7 \pm 12.8$  (9)

### Comments on types and the *Lasius neglectus* problem:

The 7 type workers from Basel MUS are labelled "Asie min., Angora, G. de Kerville" (one worker designated by E. O. Wilson as lectotype). As can be concluded from their above-average size (mean HL 925) and stronger coloration, they probably originate from a monogynous colony. The *turcicus* worker can be safely separated from other species with similarly reduced pilosity on scape and tibiae, by its character combination of short pronotal and long gular hairs, very sparse clypeal pubescence, elongated head, relatively high number of occipital setae, its petiolar and mesosomal shape and reduced mandibular dentition.

The frequency distribution of HL data suggests a bimodality (Fig. 3) and the nest samples can be divided into two fractions: one with nest means of HL below 835 (putatively polygynous) and the other with such above 855 (putatively monogynous). 42 workers of the first fraction have HL data of  $793.9 \pm 37.8$  (708-856) and 33 workers of the second such of  $896.5 \pm 29.7$  (751-1005). 4 colonies whose polygyny is proved by direct observations (Tiflis, Orange/ France, Budapest) had nest means of 794, 802, 805 and 792. If the interpretation of the 2 fractions is true, 11 colonies from the Asiatic part of the *turcicus* range would be monogynous and 12 colonies polygynous. A colony, probably being in initial state, having a mean HL of 661 was excluded from consideration. Of course, truly monogynous colonies in initial stage would be misinterpreted using the body size criterion and the monogyny ratio is probably higher. In contrast to the Asiatic situation, the nest means are below 810 in all European samples.

The late discovery in Europe and the occurrence of polygynous, intranidally mating colonies inside a big city has raised the hypothesis that the species could have been introduced artificially from SE European or W Asian origin (VAN LOON; BOOMSMA & ANDRASFALVY 1990). This view is obviously true: The distributional centre of *Lasius turcicus* is probably Asia Minor and Transcaucasia where it is the most frequently collected, most euryptent species of the group in regions below 1000 m. The successful colonisation of local, isolated spots within large European regions that are free of the species seems only possible by the artificial introduction of the polygynous, intranidally mating type while the monogynous type with long-range mating flight will have a very low fitness under such conditions. This could explain the predominance of polygynous colonies in Europe.

The reason why *Lasius neglectus* is synonymised here with *turcicus* is the high morphological similarity. No objective criteria are detectable offering a means for separation except for mean worker size. The hypothesis "all samples with mean HL < 835 (= 'polygynous') are 'Neglectus' and those with mean HL > 855 (= 'monogynous') are 'Turcicus'" was tested by removing the

body-size-depending variation of 9 characters through correction with regression functions and transforming these data for the assumption of an equal HL = 850. As a result, morphological identity or only weak differences could be demonstrated between the 'Neglectus' and 'Turcicus' samples (Tab. 2). The fact that 'polygynous' nests have significantly lower nUH and UHL/HL is not sufficient to hypothesize on different morphospecies, particularly since all diagnostic characters separating them from other species are shared. This proves true for clypeal pubescence, pronotal hairs, head length index, petiolar and mesosomal shape and mandibular dentition. In 10 'Neglectus' workers where the masticatory border was fully visible the number of mandibular dents was  $7.50 \pm 0.47$  and in 13 'Turcicus' workers  $7.23 \pm 0.44$ .

Tab. 2 Comparison of morphometric data of workers of *Lasius turcicus* from 'monogynous' and 'polygynous' colonies. Data marked with '(850)' are calculated for the assumption of equal body size (HL = 850  $\mu$ m) and their standard deviations are cleared from body-size-depending variability. These corrections were done with linear regression functions whose slopes were the arithmetic mean of the 'monogynous' and 'polygynous' samples.

		'monogynous' n = [31 ... 33]	'polygynous' n = [40 ... 42]	sign. level
HL		896.5 $\pm$ 49.7	793.6 $\pm$ 37.3	0.0001
HL/HW	(850)	1.1012 $\pm$ 0.0131	1.1196 $\pm$ 0.0163	n. s.
SL/HL	(850)	0.9437 $\pm$ 0.0129	0.9374 $\pm$ 0.0161	n. s.
PDCL	(850)	32.15 $\pm$ 6.21	31.24 $\pm$ 6.38	n. s.
nBH	(850)	8.55 $\pm$ 2.39	10.02 $\pm$ 2.21	0.01
nUH	(850)	3.10 $\pm$ 1.17	2.12 $\pm$ 0.83	0.001
nHS	(850)	0.06 $\pm$ 0.26	0.32 $\pm$ 0.59	n. s.
nHHT	(850)	0.53 $\pm$ 0.64	0.29 $\pm$ 0.44	n. s.
UHL/HL	(850)	0.1233 $\pm$ 0.0090	0.1077 $\pm$ 0.0113	0.0001
PNHL/HL	(850)	0.1223 $\pm$ 0.0093	0.1181 $\pm$ 0.0098	n. s.

However, this argumentation based on morphology must not necessarily be the ultimate ratio. The huge polygynous colonies, having a strong tendency to intranidal mating and reduction of nuptial flight (VAN LOON et al. 1990), could be in a state of reproductive isolation from the monogynous colonies and could develop to a separate species. The relations of the polygynous and monogynous form should be tested in regions where both forms are sympatric.

### Biology and distribution:

Known from S France (4° E) eastwards to the Iran (49° E), in latitudes between 36°N and 44° N. Budapest, the type locality of *neglectus* (47.30 N), seems to be rather isolated. Further known European sites are Orange /S France (leg. A. Schulz), Albena / Bulgaria (leg. P. Douwes) and Kifisia /Greece (leg. P. Douwes). The sites on the Greek islands Kos and Rhodos are very near to Asia Minor.

Altitudinal records concentrate near sea level but in Anatolia xerothermous steppe and karst habitats above 1000 m are inhabited. Vertical distribution in whole range: 0-150 m (n = 15), 200-500 m (n = 4), 500-1000 m (n = 3), 1000-1500 m (n = 4) and 1900 m (n = 1). Coastal areas along the Caspian, Black and Mediterranean Seas are obviously very frequently inhabited. At low altitudes *turcicus* is often found in more shaded habitats (e. g. city parks and gardens with tree canopy); in regions with cooler macroclimate direct solar insolation of the ground surface is needed.

The recorded habitats indicate an euryptent species which occurs in steppes, karst areas, sand dunes, pastures, tree rows, road sides, forest margins and very frequently in urban areas. Polygynous colonies may develop into huge supercolonies, displacing or exterminating most of the other ant species and getting increasing importance as pest species as reported for the city of Budapest (VAN LOON et al. 1990). There it is described as "very opportunistic species occupying all available nest space and monopolizing virtually all trees for tending and harvesting aphids". A similar, but less extreme situation was observed by the author in the Tiflis Botanical Garden.

On another site, a N-exposed steppe slope in a suburb of Tiflis, under nearly every stone moved, nest parts of a big polygynous colony were found. In polygynous colonies the nuptial flight is (perfectly?) reduced and intranidal mating takes place (VAN LOON et al.). The same authors reported alate queens inside a polygynous colony not later than 10 July. An alate queen from a (probably monogynous) nest near Kastamonu / Turkey was taken by A. Schulz on 5 July 1989.

#### 6.5. *LASIUS ALIENUS* Förster, 1850

*Formica aliena* Förster, 1850; [description, neotype Görlitz MUS]

##### Material studied:

Bulgaria (13,3), Czechoslovakia (88,19), England (11,1), France (5,1), Germany (457,31), Greece (24,5), Spain (27,5), Sweden (3,1), Caucasus (14,2), Turkey (12,5)

##### Fixation of a neotype

A thorough search in the ant collection of the Berlin MUS in 1988 revealed that the original specimens of Förster are no longer available and the content of the ant box of Förster was found almost completely consumed by pest insects. Försters morphological description of *Formica aliena* is referable to 3 German species: *psammophilus* n. sp., *paralienus* n. sp. and *alienus*. However, the regional abundance and the habitat of the type locality Lousberg suggest in which species the neotype should be fixed. In Försters time, the south slope of the Lousberg had been an open grassland (probably sheep pasture) on chalk soil. *L. psammophilus* n. sp. can be excluded by habitat and by low regional abundance and *paralienus* n. sp. is unlikely by its low abundance (or absence?) in the N Eifel region. Thus a neotype series was fixed in the most abundant species which additionally has the highest affinity to chalk / limestone soils (for the big differences of the 3 species concerning their occurrence on different soil types see below).

The habitat conditions on the Lousberg have drastically changed during the last 140 years (today fully incorporated in the built-up area of the city of Aachen) and ants of the *alienus* morphology could not be found during a search in 1991. Therefore a neotype series was fixed in material from a locality near Aachen. The neotypes, a nest sample of 11 workers, are labelled "GER: Eifel, 7.9.1991, 37 km SE Aachen, Schleiden, leg Seifert" and "Formica aliena Förster 1850 NEOTYPES, des. B. Seifert 1992". Depositories: Görlitz MUS, London Mus,

##### Description:

Worker: (Figs. 4, 5,10): Head: Genal setae absent or occasionally one 30° hair may be present. Occipital setae frequently not reaching to posterior eye margin. Clypeal carina normally well-developed, lateral clypeal profile strongly convex. Mandibles with 8, rarely 9 teeth (8.11 ± 0.31, n 19). HL/HW (900) 1.078, SL/HL (900) 0.915. Mesosoma: propodeal dome in medium-sized workers more conic than hemispheric and as high as mesonotum. Area between propodeal spiracle and metapleural gland with 0-1 setae. Petiole: in frontal view with convex sides, notably converging towards a rather narrow, slightly emarginate or straight dorsal crest; in lateral view with convex frontal and straight posterior profile, rather low, appr. reaching up to level of dorsal margin of propodeal spiracle. Scape: with smooth 0-30° pubescence and normally without setae, a small occasional hair (25-40°, max. 28 µm) may be present. Hind tibia: pubescence surface smooth, 0-30°; normally without setae; if 1-4 setae present, then 45-60°, max 42 µm and restricted to proximal tip. Surface characters: dorsal head with smooth overall surface appearance and rather shining, with weak microreticulum and fine shallow micropunctures of 3-4 µm diameter and 10-14 µm central distance; dorsal head with rather dense, appressed 0-10° pubescence, PLF 22-31 µm. Frontal pronotum mildly shining, with fine transversal micro-roughness, reticular structures not clearly detectable. Colour: head, mesosoma, petiole and gaster dirty brown, scape and tibiae yellowish brown, mandibles reddish brown.

HL 848.2 ± 47.3 (586), HL/HW 1.0848 ± 0.0192 (208), SL/HL 0.9211 ± 0.0186 (586), CLCA 0.73 ± 0.17 (42), PDCL 17.28 ± 2.93 (586), nHS 0.126 ± 0.396 (118), nHHT 0.942 ± 0.847 (118), nBH 4.73 ± 1.59 (586), nUH 0.79 ± 0.75 (575), UHL/HL 0.0597 ± 0.0377 (132), PNHL/HL 0.1442 ± 0.0122 (131)

47 specimens from Bulgaria, Greece and Turkey have significantly larger SL/HL ( $0.933 \pm 0.0181$ ,  $p < 0.0001$ ) and 27 workers from Spain have significantly larger HL/HW ( $1.0966 \pm 0.0161$ ,  $p < 0.01$ ), nBH ( $5.87 \pm 1.58$ ,  $p < 0.001$ ) and PNHL/HL ( $0.1561 \pm 0.0091$ ,  $p < 0.0001$ ) compared to those from other origins. In Caucasian workers the scale tends to be wider and the propodeum to be more hemispheric.

**Queen:** Head: Mandibles with 8 to 9 teeth ( $8.67 \pm 0.50$ ,  $n=9$ ), frontal groove fully developed but not set in the middle of a trough. Genal setae normally absent. Mesosoma: high. Scale: always emarginate, sides converging dorsally. Scape: pubescence surface frequently not as smooth as in worker, pubescence  $10-35^\circ$ ; few weak setae ( $30-50^\circ$ , max.  $45 \mu\text{m}$ ) are normally present. Hind tibia: pubescence surface not as smooth as in worker, pubescence  $25-30^\circ$ ; few setae ( $30-70^\circ$ , max.  $62 \mu\text{m}$ ) are present on whole extensor profile, the longest normally on proximal part. Surface characters: dorsal head with well-marked micropunctures of  $6-7 \mu\text{m}$  diameter and  $14-17 \mu\text{m}$  central distance; microreticulum absent; pubescence profuse,  $25-35$ , PLF  $\pm 53 \mu\text{m}$ . Colour: Head, mesosoma, petiole and gaster blackish brown; scape and tibiae yellowish brown; mandibles reddish brown.

HL  $1383.2 \pm 40.2$  (50), HW  $1542.0 \pm 47.2$  (50), AL  $2914.9 \pm 103.7$  (50), HL/HW  $0.8969 \pm 0.0145$  (50), SL/HL  $0.8393 \pm 0.0181$  (50), SL/HW  $0.7529 \pm 0.0191$  (50), AH/AL  $0.5810 \pm 0.0180$  (50), PDCL  $14.05 \pm 2.49$  (50), nHS  $2.42 \pm 1.61$  (38), nHHT  $5.21 \pm 2.61$  (47), nBH  $0.92 \pm 1.22$  (50), nUH  $0.49 \pm 0.61$  (50), PNHL  $178.7 \pm 14.2$  (11).

The Caucasian queens are bigger and longer-scaped.

### Comments

The *alienus* conception presented here possibly still includes more than one biospecies. This refers to the situation in the Mediterraneans where the longer-scaped specimens from the S Balkans and Turkey are suspected to represent a morphologically almost identical sibling. V. Assing (pers. Comm.) emphasized to have smelled an intensive aromatic colony odour in a series from Chalkidiki / Cholomon in Greece. Further, the conspecificity of the Iberian and Caucasian populations is not perfectly sure.

*Lasius alienus* is well separated from *brunneus*, *lasioides* and *turcicus* by a higher number of mandibular dents, well-developed clypeal keel, much lower PDCL, longer pronotal hairs and bigger queens with much higher mesosoma. For separation from *paralienus* and *psammophilus* see section 6.8.

### Biology and distribution (see also section 6.9.)

It is the most abundant and most widely distributed species of the W Palaearctic *Lasius alienus* complex. The northernmost site of the material seen is Revinge in S Sweden ( $55.30^\circ\text{N}$ ) and the southernmost Seydisheir in Anatolia ( $37^\circ\text{N}$ ). The vertical distribution in N Spain, Italy, S Bulgaria, Greece, Turkey and Caucasus (latitudes  $36-43^\circ\text{N}$ ) ranges between 500 and 2050 m (mainly 800-1700 m). In Germany (Schwäbische Alb) it goes up to 980 m. *Alienus* is found in all sufficiently xerothermous, non-urban habitats of differing horizontal and vertical plant structure: bare rocky areas, dense grasslands, orchards, sunny forest margins or warm woodlands (e.g. *Quercus* woods) with dilute canopy. From urban areas in Central Europe it is absent, certainly because of competitive inferiority to *Lasius niger*. Frequent nest densities in limestone regions in Thüringen / Germany vary between 10...50 nests /  $100 \text{ m}^2$  but top densities of 90 nests /  $100 \text{ m}^2$  are found locally. In xerothermous *Quercus* stands on rock in Central Germany the densities varied between 19...95 nests /  $100 \text{ m}^2$ . The nests are most frequently soil or soil/stone nests but combinations of soil and dead wood (up to 50 cm height) or such of soil and litter are not rare. Mounds are normally absent in Germany; a small soil dome of 5 cm height and 8 cm diameter and a small soil construction as shelter for a aphid colony near the base of an *Artemisia* plant was observed.

*Alienus* intensively feeds on the excretions of aphids - from subterranean strata up to the field layer, bush and tree levels. It was seen to climb in large numbers on oak and cherry trees mainly for trophobiosis with aphids. Larvae of Lycaenidae butterflies, extrafloral nectaries of *Vicia* plants and the blossoms of many plant species are visited and small items of insect booty are retrieved to the nest. As all the species of the *alienus* complex, it does not attack the myrmecologist disintegrating the nests and runs over his hands biting only exceptionally. It is the main host of *Lasius jensi* Seifert as proved by 4 direct observations and concluded from the species composition at *jensi* sites.

#### 6.6. *LASIUS PSAMMOPHILUS* n. sp.

*Lasius alienus* (Förster) sensu NIELSEN (1972)

*Lasius alienus* (Förster) sensu PEARSON (1983)

#### Material studied:

Czechoslovakia (20,3), Danmark (16,1), England (13,1), France (3,1), Germany (319,21), Sweden (44,7)

**H o l o t y p e :** a worker labelled "GER: Kr. Weißwasser, 4 km N Steinbach: N 135, 30. 7. 1991, leg. Seifert". **P a r a t y p e s :** 44 workers and 5 queens with same data but with sample numbers N 005, N 023, N 027, N 029, N 048, N 082, N 135 (= holotype nest), N 206 and N 215. The habitat at type locality is a Corynephorum phytoassociation on an aeolian sand dune. Depository: Görlitz MUS

#### Description:

**W o r k e r** (Figs. 4, 6, 11): **H e a d :** Gena frequently with single setae ( $0.80 \pm 0.71, 0-3, n = 37$ ),  $40^\circ$ . Occipital setae often reaching to hind margin of eye. Clypeal carina normally well-developed, lateral clypeal profile convex. Mandibles with 8, more rarely with 9 teeth ( $8.21 \pm 0.43, n = 14$ ). HL/HW (900) 1.065, SL/HL (900) 0.937. **M e s o s o m a :** Propodeal dome normally more hemispheric than conic, as high as mesonotum. Area between propodeal spiracle and metapleural gland with 2-5 setae. **S c a l e :** with convex sides and a weakly emarginate, straight or convex dorsal crest; tends to be a little wider and a little higher than in *alienus*. **S c a p e :** with rather smooth  $5-10^\circ$  pubescence; often without setae; occasionally 1-4 setae ( $45-70^\circ$ , max.  $32 \mu\text{m}$ ) may be present, particularly at distal third. **H i n d t i b i a :** pubescence smooth  $0-5^\circ$ ; 1-4 setae ( $30-60^\circ$ , max.  $49 \mu\text{m}$ ) are normally present at the proximal end. Surface characters: dorsal head more shining than in *alienus*, with weak microreticulum and shallow micropunctures of  $2-4 \mu\text{m}$  diameter and  $11-14 \mu\text{m}$  central distance; pubescence smooth,  $0-10^\circ$ , less dense compared to *alienus*, PLF  $28.8 \pm 2.6$  ( $n = 10$ ). Frontal pronotum shining, with fine transverse microrugosity. **C o l o u r :** as a rule not as concolorous as in *alienus*; head brown, mesosoma a little lighter brown with yellowish tinge, gaster blackish brown; petiole, coxae and femora pale yellowish brown; mandibles and anterior clypeal border yellowish with weak reddish tinge; scape yellowish.

HL  $843.7 \pm 59.5$  (378), HL/HW  $1.0737 \pm 0.0190$  (105), SL/HL  $0.9444 \pm 0.0234$  (378), CLCA  $0.60 \pm 0.23$  (21), PDCL  $22.49 \pm 4.71$  (378), nHS  $0.57 \pm 1.01$  (44), nHHT  $2.28 \pm 1.57$  (43), nBH  $8.49 \pm 2.31$  (378), nUH  $2.42 \pm 0.99$  (378), UHL/HL  $0.0938 \pm 0.0113$  (41), PNHL/HL  $0.1367 \pm 0.0112$  (36).

**Q u e e n :** Head wider than in *alienus*. Mandibles with 8 to 10 teeth ( $8.79 \pm 0.66, n = 12$ ). Frontal furrow fully developed but not set in the middle of a trough. Gena normally with 1-3 setae ( $1.92 \pm 1.38, n = 13$ ),  $30-45^\circ$ . **M e s o s o m a :** high. **S c a l e :** always clearly emarginate, sides slightly converging dorsally. **S c a p e :** pubescence surface not as smooth as in worker,  $25-35^\circ$ ; a small number of fine setae ( $40-60^\circ$ , max.  $48 \mu\text{m}$ ) almost always present. **H i n d t i b i a :** pubescence surface not smooth,  $30^\circ$ ; always with a number of setae ( $30-75^\circ$ , max.  $85 \mu\text{m}$ ), the majority proximally, the setae are on average much finer and shorter as in *L. niger*. Surface characters: dorsal head with well-marked micropunctures of  $5-9 \mu\text{m}$  diameter and  $14-17 \mu\text{m}$  central distance; pubescence profuse,  $30-35^\circ$ , PLF  $44-55 \mu\text{m}$ . **C o l o u r :** body brown to blackish brown; mandibles yellowish-reddish brown, scape yellowish brown or yellowish.

HL  $1417.2 \pm 31.8$  (47), HW  $1612.9 \pm 39.0$  (47), AL  $3041.2 \pm 101.3$  (47), HL/HW  $0.8781 \pm 0.0142$ (47), SL/HL  $0.8586 \pm 0.0244$  (47), SL/HW  $0.7538 \pm 0.0224$  (47), AH/AL  $0.5812 \pm 0.0178$  (47), PDCL  $16.42 \pm 3.08$  (47), nHS  $8.00 \pm 5.84$  (30), nHHT  $13.48 \pm 6.03$  (30), nBH  $7.77 \pm 3.36$  (47), nUH  $3.74 \pm 1.82$  (47), PNHL  $173.0 \pm 6.1$  (12).

### Comments:

The most notable biological trait of *psammophilus* in Central Europe is its very strong affinity to sandy dune areas, particularly *Corynephorus* stands, where it is the absolutely dominating ant species. The numerous ecological studies of Nielsen (e.g. NIELSEN 1972,1975,1978) were undoubtedly made on *psammophilus* as concluded from his descriptions of habitat, nests and biology. The hybrids described by PEARSON (1983) as *alienus* x *niger* refer to *psammophilus* x *niger* according to the species composition 1 found on PEARSONs test plots in Hartland Moor / Dorset in 1990. Hybrids between *niger* and *psammophilus* should be demonstrable by investigation of external morphology but not hybrids between the 3 siblings of the *alienus* complex. For the separation from *L. alienus* and *paralienus* see section 6.8.

### Biology and distribution (see also section 6.9.)

The northern as well as the southern distributional borders of *psammophilus* are unknown. It might be expected to go farther north than *alienus* because it was, in the studied material, the most abundant species in S Sweden. The southernmost sites proved by nest samples are in the high Apennines at 42°N where it was found in altitudes of 1400 and 1700 m (leg. M. Mei). Single-specimens of an *alienus* complex species that possibly could belong to *psammophilus* were available from Turkey. However, without having seen nest series and without notes on habitat, it seems risky to state an occurrence of *psammophilus* in this region. The known upper altitudinal limit of 550 m in Central Europe is lower than in the 2 siblings but this seems to be a function of the distribution of eolian sands. Typical densities in sandy xerothermous grasslands or open sandy heath covered by *Corynephorus canescens*, *Calluna vulgaris*, *Carex arenaria* and *Festuca ovina* aggr. species are 11-32 nests/100 m<sup>2</sup> (SEIFERT 1986), but locally up to 1 nest/m<sup>2</sup> may be found. Undoubtedly being the most important insect in the ecological dynamics of the sparse faunas in *Corynephorus* stands, *psammophilus* was found to have an annual production of 3.4 g dry weight/m<sup>2</sup> (workers plus sexuals) and average nests produce 34000 workers/year (NIELSEN 1975). *Psammophilus* is to some extent zoophagous but the main consumption is probably done by trophobiosis with subterranean honeydew producers. Nielsen mentions Pseudococcidae at the roots of *Corynephorus*. I have seen workers to exploit nectaries of the blossoms of *Potentilla*, *Heliochrysum* and *Cynanchum*. The nests have normally simple entrances which may be marked by sand ejections. High mounds with inner structure are unknown. The nest itself is fully subterranean, devoid of a compact core zone, and is a system of widely distributed galleries and nest chambers undermining an area of up to 4 m<sup>2</sup>. The major part of the nest is located in a depth of 10-30 cm but the deepest chambers reach down to 120 cm. In summer this enables daily vertical movements to keep within the temperature preferendum of 28 °C (Nielsen). I have seen the workers to begin above-ground activity at 7 °C soil surface temperature and the activity nearly ceases above 38 °C. Like its two sibling species, it is not aggressive to myrmecologists dismembering the nests. *Psammophilus* is the main host of *Lasius meridionalis*.

### 6.7. *LASIUS PARALIENUS* n. sp.

#### Material studied:

Austria (21,6), Bulgaria (6,3), Czechoslovakia (17,3), Germany (139,15), Greece (18,6), Hungary (16,3), Italy (20,7), Sardinia (7,2), Sweden (11,2), Switzerland (3,1), Turkey (9,3)

H o l o t y p e : a worker labelled "Germania: Kr. Bautzen, 2 km S Weißenberg, N066, 11. 7. 1991, leg. Seifert". P a r a t y p e s : 19 workers with same data as Holotype but nest sample numbers N005,

N038, N066 (the holotype nest) and N221; 14 Workers labelled "Germania: Kr. Bautzen, 1 km S Niedergurig, 28. 7. 1991" with sample nest numbers N086, N223 and N240. Depository: Görlitz MUS.

### Description:

**Worker** (Figs. 5, 6, 12): **Head**: Genal setae  $0.96 \pm 1.02$  ( $n=27$ , 0-4); occipital hairs distributed to hind margin of eye. Clypeal carina variable but on average less clearly developed than in *alienus*, often very blunt or nearly absent. Mandibles normally 8-toothed ( $8.00 \pm 0.43$ ,  $n=23$ , 7-9). HL/HW (900) 1.080, SL/HL (900) 0.953. **Mesosoma**: propodeal dome more hemispheric, flatter than in *psammophilus*. Area between propodeal spiracle and metapleural gland with 2-5 setae. **Scale**: in lateral view rather thick, with blunt apex and convex frontal and straight posterior profile; in frontal view with convex sides, dorsal crest convex (23%), straight with rounded corners (37%) or weakly emarginate (40%). **Scape**: pubescence surface rather smooth, 0-15°; single setae (30-50°, max. 34  $\mu\text{m}$ ) are frequently present. **Hind tibia**: pubescence surface rather smooth (0-10°); 1-6 setae (30-60°, max. 46  $\mu\text{m}$ ) are normally present at proximal end. **Surface characters**: Head, mesosoma and gaster with a profuse, appressed and white pubescence often giving a strong contrast to blackish cuticula and producing a silky surface appearance. Dorsal head with very weak and shallow micropunctures of 2-3  $\mu\text{m}$  diameter and 9-13  $\mu\text{m}$  central distance; microreticulum of dorsal head fine but better developed than in *alienus* and *psammophilus*. Pubescence on dorsal head smooth, 0-10°, PLF 27-39  $\mu\text{m}$ . Frontal pronotum with fine transversal microrugosity. **Colour**: normally notably darker than in *alienus*. Head, mesosoma, petiole, gaster and femora blackish or dark brown; tibia dark brown; scape, mandibles, distal femoral and proximal tibial end yellowish brown.

HL  $897.7 \pm 68.5$  (241), HL/HW  $1.0767 \pm 0.0201$  (74), SL/HL  $0.9536 \pm 0.0173$  (241) CLCA  $0.53 \pm 0.22$  (28), PDCL  $12.41 \pm 1.55$  (241), nHS  $0.76 \pm 0.75$  (27), nHHT  $3.57 \pm 2.13$  (27), nBH  $9.45 \pm 3.22$  (241), nUH  $2.52 \pm 0.98$  (241), UHL/HL  $0.1098 \pm 0.0109$  (29), PNHL/HL  $0.1454 \pm 0.0193$  (28).

Workers from the Hungarian plane, the Balkans and Turkey have nest means of HL of  $936.3 \pm 51.8$  ( $n=25$ ) and those from Germany and Sweden such of  $872.2 \pm 45.4$  ( $n=44$ ) which is a significant difference. The German and Swedish workers have, on average, shorter setae, often a more developed clypeal carina and often a slightly emarginate petiole scale which is rarely seen in SE European populations.

**Queen**: **Head**: Mandibles with 8 to 9 teeth ( $8.10 \pm 0.32$ ,  $n=11$ ). Frontal furrow fully developed but not set in the middle of a trough. Gena frequently with 1-3 setae ( $1.28 \pm 1.20$ ,  $n=9$ ), 30-45°. **Mesosoma**: very high. **Petiolus**: always clearly emarginate, sides slightly converging dorsad. **Scape**: pubescence surface not as smooth as in worker, 5-30°; a small number of setae (30-70°, max. 75  $\mu\text{m}$ ) is frequently present. **Hind tibia**: pubescence surface not as smooth as in worker, 15°-30°; always with a number of setae (30-70°, max. 104  $\mu\text{m}$ ), the majority proximally. **Surface characters**: dorsal head with very dense pubescence (10-20°, PLF 42-65  $\mu\text{m}$ ), producing a silky surface appearance; well-marked micropunctures of 3-7  $\mu\text{m}$  diameter and 13-17  $\mu\text{m}$  central distance and a weakly developed microreticulum are present. **Colour**: body blackish brown, femora dark brown, mandibles brown or reddish brown, scape pale reddish brown.

HL  $1511.4 \pm 64.0$  (27), HW  $1689.4 \pm 82.1$  (27), AL  $3235.9 \pm 109.1$ , HL/HW  $0.8929 \pm 0.0158$  (27), SL/HL  $0.8679 \pm 0.0221$  (27), SL/HW  $0.7747 \pm 0.0202$  (27), AH/AL  $0.6148 \pm 0.0129$  (27), PDCL  $10.87 \pm 1.10$  (27), nHS  $6.97 \pm 3.56$  (18), nHHT  $11.08 \pm 6.10$  (20), nBH  $9.26 \pm 5.16$  (27), nUH  $4.22 \pm 2.66$  (27), PNHL  $193.1 \pm 15.5$  (11)

### Comments:

*L. paralienus* is morphologically well-marked, having the lowest PDCL and the biggest queens of all Palaearctic species with few or without scape setae (For discrimination from *alienus* and *psammophilus* see section 6.8.).

### Biology and distribution (see also section 6.9.):

The distributional center of *paralienus* is probably the Balkans. It is very abundant in the pontic habitats of the Hungarian plane. The northernmost samples in the studied material came from the Swedish island Öland (57°N) and the southernmost sample from the southern coastland of Anatolia (36°N). The vertical distribution in S Bulgaria, Greece, Turkey and Italy (latitudes between 36°N and 41°N) ranges within 700 and 1900 m (mainly 900-1400). In the limestone areas of Central and S Germany (Thüringen, Franken, Hessen, Baden-Württemberg), *paralienus* is found at altitudes between 400 and 950 m. There, *paralienus* has still not been recorded from limestone regions below 400 m - i. e. from the warm vineyard zones in valleys of the rivers Saale, Unstrut, Main, Tauber and Neckar where only *alienus* has been found so far.

*Paralienus* is distributed in all habitats with a pontic character - i. e. xerothermous grasslands and steppe-heath as well. In contrast to *alienus* which is preferentially found in Germany in habitats with mild winters, *paralienus* predominates on sites with a more continental climate. It is absent from urban areas in Central Europe where *L. niger* is a superior competitor. Estimated nest densities on pontic hillsides in the German Oberlausitz are 20-30 nests / 100 m<sup>2</sup>. In Germany, the nests are soil or soil/stone nests with simple entrances and without conspicuous mound constructions. The information on biology is very sparse. I have seen it frequently climbing in the field layer or on bushes. Trophobiosis with Aphidae and different Lycaenidae (*Plebejus sephirus* and *argus*, leg. and det. K. Fiedler) was observed and small arthropode booty was retrieved to the nest. The sexuals occur on average 1 month later than in the siblings *alienus* and *psammophilus*. It is suspected to be the main host of *Lasius balcanicus* Seifert and does not attack the myrmecologist dismembering the nest.

### 6.8. Morphological discrimination of *L. alienus*, *L. psammophilus* n. sp. and *L. paralienus* n. sp.

The separation of the 3 morphologically similar species of the *alienus* complex in Europe is surprisingly clear if nest samples of only 2-5 workers are evaluated and if discriminant functions using the characters PDCL, nBH, nUH, SL/HL are calculated. Excluding the deviating Spanish and Caucasian material, 166 nest samples of *alienus*, 103 of *psammophilus* n. sp. and 78 of *paralienus* n. sp. were incorporated in the computation (altogether 1160 individual workers). To save space, the computation procedure is not explained here in detail. The principal way was to use arithmetic nest means of size-corrected data and to compare the species pairs *alienus/psammophilus*, *alienus/paralienus* and *psammophilus/paralienus* using 3 separate discriminant functions. The following steps were done for the character SL/HL and square-root-transformed data of nBH, nUH and PDCL:

- (1) removal of size-dependent variation by division with a linear regression function of the type  $y = ax + b$ , where  $a$  and  $b$  are the arithmetic means of the parameters of the species-specific functions. Simultaneously, this division means a centering of all characters  $SL/HL_{cor}$ ,  $nBH_{cor}$ ,  $nUH_{cor}$  and  $PDCL_{cor}$  to the median value of 1.
- (2) estimation of the discriminating power of the corrected characters.
- (3) computation of these corrected data in a multiple linear discriminant function with character weightings proportional to the discriminating power.

The characters have different discriminating powers from pair to pair as it can be seen from the weighting of the discriminant functions: For the pair *alienus/psammophilus* the discriminant  $D_{AL,PS}$  is computed as

$$D_{AL,PS} = 2.7 SL/HL_{cor} + 2.6 PDCL_{cor} + 0.75 nUH_{cor} + 1.2 nBH_{cor}$$

and for the pair *alienus/paralienus* as

$$D_{AL,PA} = 3.0 SL/HL_{cor} - 3.0 PDCL_{cor} + 0.50 nUH_{cor} + 1.5 nBH_{cor}$$

In the discrimination between *paralienus* and *psammophilus*,  $SL/HL_{cor}$ ,  $nBH_{cor}$  and  $nUH_{cor}$  do not contribute substantially but  $PDCL_{cor}$  alone is very powerful and  $D_{PA,PS} = PDCL_{cor}$ .

The discriminants  $D_{AL,PS}$ ,  $D_{AL,PA}$  and  $D_{PA,PS}$  offered a complete separation in each pair (Figs. 4, 5, 6; Tab. 3).

Tab. 3 Values of multiple, linear discriminants to distinguish workers of the 3 most northern species of the *Lasius alienus* complex in Europe on the basis of nest sample means. Variables of the discriminant are the characters SL/HL, PDCL, nBH and nUH. In the case of queens the discriminants refer to individuals and the character variables are HL/HW, SL/HL, SL/HW, nBH, nUH, PDCL and ML.

	WORKERS			QUEENS		
	$D_{AL,PS}$			$D_{AL,PS}$		
	mean $\pm$ SD	[min-max]	n	mean $\pm$ SD	[min-max]	n
<i>alienus</i>	6.632 $\pm$ 0.346	[5.44-7.28]	166	2.171 $\pm$ 0.393	[1.52-2.94]	45
<i>psammophilus</i>	8.041 $\pm$ 0.299	[7.43-8.79]	103	3.957 $\pm$ 0.452	[3.05-4.98]	47
	$D_{AL,PA}$			$D_{AL,PA}$		
	mean $\pm$ SD	[min-max]	n	mean $\pm$ SD	[min-max]	n
<i>alienus</i>	1.150 $\pm$ 0.331	[0.35-1.90]	166	8.374 $\pm$ 0.285	[7.88-9.07]	45
<i>paralienus</i>	2.558 $\pm$ 0.267	[2.03-3.31]	78	9.617 $\pm$ 0.214	[9.24-10.2]	27
	$D_{PA,PS}$			$D_{PA,PS}$		
	mean $\pm$ SD	[min-max]	n	mean $\pm$ SD	[min-max]	n
<i>paralienus</i>	0.864 $\pm$ 0.034	[0.76-0.95]	78	3.829 $\pm$ 0.063	[3.71-3.98]	27
<i>psammophilus</i>	1.150 $\pm$ 0.080	[0.98-1.38]	103	3.476 $\pm$ 0.095	[3.17-3.66]	47

In the queen caste, the computation of discriminants was performed with the same procedure as in workers but on individual level. The characters computed were HL/HW<sub>cor</sub>, SL/HL<sub>cor</sub>, SL/HW<sub>cor</sub>, nBH<sub>cor</sub>, nUH<sub>cor</sub>, PDCL<sub>cor</sub> and absolute ML. Again, a perfect separation was possible in each pair but the non-overlap range is very small in case of  $D_{AL,PS}$  and  $D_{PA,PS}$ . In fact, individual queens are more difficult to determine than small samples of workers both numerically and subjectively.

### 6.9. The ecological segregation of *L. alienus*, *L. psammophilus* n. sp. and *L. paralienus* n. sp.

The safe morphological distinction of the 3 siblings enabled preliminary studies on habitat selection and ecological segregation. The data presented here refer to Europe in latitudes between 47°N and 57°N. The situation in the south is poorly known. All three species similarly occupy open xerothermous habitats but clear distributional differences regarding the mineralic component of soil conditions are detectable (Tab. 4). *L. psammophilus* has a very narrow spectrum being almost restricted to habitats with sandy soils. In the German lowlands, it completely dominates in the open xerothermous grasslands and heath characterized by *Corynephorus*, *Calluna* and *Festuca ovina* species. *Lasius alienus*, on the other hand, has a broader spectrum but has a very high affinity to habitats on limestone / chalk. No extreme preferences and the biggest width for geological conditions is found for *L. paralienus*.

Tab. 4 Geological material at the nest sites of *Lasius alienus*, *psammophilus* and *paralienus* given as per cent frequency distributions. The habitat width of the species is given by the Index of COLWELL & FUTUYMA (1971).

	<i>alienus</i> (n = 176)	<i>psammophilus</i> (n = 96)	<i>paralienus</i> (n = 66)
sand	2.8	95.8	15.2
loess	2.8	—	15.2
lava	3.4	—	1.5
limestone /chalk	74.4	2.1	43.9
loam	2.3	—	2.1
quarcitic porphyre	—	1.0	—

	<i>alienus</i> (n = 176)	<i>psammophilus</i> (n = 96)	<i>paralienus</i> (n = 66)
basalte	8.0	—	6.1
red sandstone	1.7	—	—
granite	0.6	—	6.1
schist	4.0	—	—
diabase	—	1.0	—
habitat width	1.77	1.09	3.83

The habitat overlap calculated with the data of Tab. 4 is only 4.9 % for the pair *alienus* / *psammophilus*, 17.3 % for *psammophilus* / *paralienus* but 60.0 % for *alienus* / *paralienus*. However, as it is the rule in closely related, sympatric ant species, the degree of syntopic occurrence (local overlap) is very low in each pair, even if there are similarities in habitat selection (SEIFERT 1986). For *alienus* / *psammophilus* the local overlap was only 2.4 %, for *psammophilus* / *paralienus* 0 % and for *alienus* / *paralienus* 5.8 % (all overlap values calculated according to SCHOENER 1974). Similarly low ratios of syntopic occurrence were found for the *Lasius* siblings *niger* / *platythorax* (3.5 %) and *myops* / *flavus* (1.4 %) or the *Tapinoma* siblings *erraticum* / *ambiguum* (1.5 %).

The highest competition and highest probability for hybridisation is expected in the case of *alienus* and *paralienus*. Both species are frequently found in similar limestone habitats (e. g. in the Schwäbische Alb) but have a clear tendency for mutual spatial exclusion. The later flight period of *paralienus* will further reduce the probability for hybridisation. Data for occurrence of alates inside and outside the nests are given in Tab. 5.

Tab. 5 Data of occurrence of alates inside and outside the nests in the 3 Central European species of the *Lasius alienus* complex.

	mean day	± SD	first	— last	
<i>psammophilus</i>	3 August	± 10 d	14 July	— 25 August	(n = 17)
<i>alienus</i>	3 August	± 15 d	9 July	— 20 September	(n = 19)
<i>paralienus</i>	5 September	± 17 d	11 August	— 10 October	(n = 17)

## 6.10. LASIUS PILIFERUS n. sp.

### Material studied:

Spain (52,6)

**Holotype:** a worker labelled "Sierra de Gredos, 1600 m, 13. 5. 91-8, 3 km S Hoyos de Espiña". **Paratypes:** 3 nest samples with 14 workers with same data; 3 nest samples with 15 workers labelled "Sierra de Gredos, 1200 m, 3 km E San Martin del Pimpollar, 13. 5. 91"; 1 nest sample with 5 workers "Sierra de Gredos, 1900 m, 13. 5. 91, Puerto de la Pena Negra".  
**Depository:** Görlitz MUS

### Description:

**Worker (Fig. 13):** **Head:** few genal setae present ( $2.30 \pm 1.36$ , n = 43, 0-5); occipital hairs rather numerous and distributed frontad to eye. Clypeal carina normally incomplete and restricted to clypeal center, lateral clypeal profile strongly convex. Mandibles with 8 teeth. HL/HW(900) 1.072, scape significantly shorter than in related species, SL/HL(900) 0.900. **Scale:** sides convex; dorsal crest rounded, either slightly emarginate or continuous; in lateral view with convex frontal and straight posterior profile. **Scape:** pubescence surface not perfectly smooth, 0-30°; setae absent or occasionally single setae (30-45°, max. 25 µm) present. **Hind tibia:** pubescence 0-15°; few setae (25-75°, max. 46 µm) are normally present, mainly at proximal half. **Surface characters:** frontal head shining, with a weak or absent microreticulum, well-marked micropunctures (diameter 3-4 µm, central distance 10-13 µm) and rather dilute, appressed pubescence (0-5°, 26-37 µm). **Colour:** head, mesosoma and petiole blackish brown, dark brown or dirty brown with yellowish tinge; gaster blackish brown; scape and mandibles yellowish brown; femora and tibiae dirty brown, tibio-femoral joint region yellowish brown.

HL  $841.2 \pm 51.6$  (52), HL/HW  $1.0828 \pm 0.0178$  (52), SL/HL  $0.9073 \pm 0.0197$  (52), CLCA  $0.43 \pm 0.20$  (17), PDCL  $22.49 \pm 2.65$  (52), nHS  $0.39 \pm 0.81$  (52), nHHT  $2.82 \pm 1.45$  (52), nBH  $10.53 \pm 2.07$  (52), nUH  $3.72 \pm 1.13$  (52), UHL/HL  $0.1115 \pm 0.0095$  (52), PNHL/HL  $0.1447 \pm 0.0103$  (52).

**Comments:**

*L. piliferus* differs from sympatric *alienus* in having a much more developed occipital, genal and gular pilosity, a higher number of tibial setae and a significantly larger PDCL. *L. psammophilus* is similar by morphology but *piliferus* has significantly larger nBH, nUH, genal seta numbers, and UHL/HL and has much lower SL/HL (all data different for  $p < 0.0001$ ). Highly significant differences need not necessarily indicate separate species but the very different habitat selection adds a further argument to interpret *piliferus* as a good species.

**Distribution:**

I collected the species in the Central Pyrenees (17 km W La Seu de Urgell, 1600 m), in 3 sites of the Sierra de Gredos (3 km S Hoyos de Espiña, 1600 m; 3 km E San Martin del Pimpollar, 1200 m; Puerto de la Pena Negra, 1900 m) and in 2 sites in the Sierra de Quadarrama (10 km N Puerto de Navacerrada, 1300 m; 22 km SE Segovia, 1800 m). The habitats were mostly semidry grasslands (pastures grazed by cow, horse or sheep). Syntopic ant species were *Lasius alienus*, *Formica sanguinea*, *F. cunicularia*, *F. rufibarbis*, *F. pratensis*, *F. rufa*, *Myrmica sabuleti* and *M. wesniaeli*. However, more mesophilic conditions were not avoided as indicated by the occurrence on fresh meadows, coexisting with *Lasius flavus* and *Myrmica aloba*.

**6.11. LASIUS OBSCURATUS Stitz, 1930**

*Lasius brunneus* var. *obscurata* Stitz, 1930; [1 type queen, 5 type workers, Berlin MUS]

**Material studied:**

Great Caucasus (50,8), W Pamirs (6,1)

**Description:**

Worker (Fig. 14): Head: few genal setae frequently present ( $1.76 \pm 1.40$ ,  $n = 39$ , 0-6); occipital hairs normally distributed frontad to eye. Clypeal carina often relatively blunt and incomplete, sometimes sharper, lateral profile convex. Mandibles with 8, rarely with 9 teeth. HL/HW (900) 1.072, SL/HL (900) 0.939. Mesosoma: posterior slope of propodeum rather straight, mesopropodeal depression rather deep, propodeum at least as high as mesonotum. Scape: wide, with convex sides; dorsal crest round (25%), straight with round corners (21%) or slightly emarginate with round corners (54%); in lateral view on average thicker than in *psammophilus*. Scape: pubescence surface in most Caucasian populations not perfectly smooth, 15-30°; normally without setae; occasional setae 25-65°, max. 38  $\mu\text{m}$ . Hindtibia: pubescence surface in most Caucasian samples not perfectly smooth, 5-10°; few seta (30-60°, max. 47  $\mu\text{m}$ ) are almost always present, concentrated to proximal part. Surface characters: frontal head weakly shining, with weak or sometimes absent microreticulum, with micropunctures (2-4  $\mu\text{m}$  diameter, 10 - 13  $\mu\text{m}$  central distance) and with a rather dense, smooth pubescence (0-15°, PLF 26-40  $\mu\text{m}$ ). Frontal pronotum with fine, transverse microrugosity. Colour: Head and gaster dark brown (with a warm tinge!), mesosoma often slightly lighter; mandibles, scape and tibiae yellowish; coxae and femorae pale yellowish brown.

HL  $883.9 \pm 54.7$  (45), HL/HW  $1.0746 \pm 0.0168$  (45), SL/HL  $0.9410 \pm 0.0236$  (45), CLCA  $0.59 \pm 0.23$  (40), PDCL  $19.44 \pm 3.09$  (45), nHS  $0.36 \pm 0.67$  (45), nHHT  $3.20 \pm 2.13$  (45), nBH  $9.62 \pm 1.99$  (45), nUH  $2.17 \pm 1.02$  (44), UHL/HL  $0.0853 \pm 0.0114$  (44), PNHL/HL  $0.1436 \pm 0.0127$  (44)

Queen: Head: mandibles with 8 or 9 teeth; frontal furrow distinct but not as deeply impressed as in *brunneus*. Genal setae frequently present ( $2.36 \pm 1.77$ ,  $n = 7$ , 0-5.5). Mesosoma: high. Scape: sides converging dorsad, dorsal crest always emarginate. Scape: pubescence surface in Caucasian specimens frequently rough, 15-35°; few seta (20-55°, max. 52  $\mu\text{m}$ ) always present. Hindtibia: pubescence surface not perfectly smooth; setae 30-80°, max. 80  $\mu\text{m}$ .

**Surface characters:** frontal head with micropunctures of 5-7  $\mu\text{m}$  diameter and 13-19  $\mu\text{m}$  central distance; microreticulum absent; pubescence dense, 5-35°, PLF 42-52  $\mu\text{m}$ . **Colour:** head and mesosoma very dark brown, gaster warm brown, mandibles and head lateral of the antennal fossae reddish brown, femora and tibiae yellowish-reddish brown.

HL 1384.3  $\pm$  26.2 (11), HW 1535.4  $\pm$  17.3 (11), AL 2832.9  $\pm$  148.7 (11), HL/HW 0.9007  $\pm$  0.0151 (11), SL/HL 0.8657  $\pm$  0.0116 (11), SL/HW 0.7798  $\pm$  0.0169 (11), AH/AL 0.5789  $\pm$  0.0258 (11), PDCL 16.69  $\pm$  2.40 (11), nHS 7.55  $\pm$  3.56 (11), nHHT 12.90  $\pm$  3.90 (10), nBH 8.59  $\pm$  3.54 (11), nUH 2.75  $\pm$  2.21 (10), PNHL 178.2  $\pm$  13.7 (9)

#### **Comments:**

The type series from Karateghin / Tadshikistan (71.31 E, 39.18 N), labelled "West-Pamir, VII-X 28, leg. Reimig, Dschailgan, 1800 m 7.X" is similar to the Caucasian material but differs in having much larger HL/HW, larger SL/HL and larger ML in the queen and a sharper clypeal carina and a smooth pubescence surface on dorsal plane of scape and extensor profile of hind tibia in the worker. However, since the majority of morphological characters coincide and because the distributional aspect (river valleys of W Asian mountains at 1400-2000 m) is well-comparable, it does not seem reasonable to regard the Caucasian members as different species. This interpretation is backed by the observation that the studied Caucasian population is highly polymorphic (because of isolation of closely neighboured valleys by high mountain barriers) and shows nest samples expressing characters of the Pamir type. *L. obscuratus* differs from *psammophilus* by colouration and scale shape only and is in other characters almost identical but a synonymy seems very unlikely because of the big differences in habitat selection.

#### **Distribution:**

*L. obscuratus* is the most abundant species of *Lasius* s. str. in pastures and meadows of the eastern Central Caucasus at altitudes of 1400-2000 m (upper valleys of the rivers Terek, Alazani, Aragvi, Assa, Argun, Andiyskoye Koysu). The range of sympatric *alienus* is on average lower (550-1700 m). *L. obscuratus* is obviously rather eurytopic and dominant in the named regions. As habitats I observed xerothermous south-exposed pastures with very intensive grazing and solidified top soil, more mesophilic cut-meadows with higher grasses, stony riverside grasslands and a light *Salix* wood by a river. Many of these places are snow-covered until April and the riverside habitats are certainly influenced by floodings during snow melt in spring. In contrast, the south-exposed pastures high above the river levels have a very xerothermous character during summer. Thus *obscuratus* copes with very different physical conditions in the Caucasus as it may be expected for the type locality in the W Pamirs (valley of Kyzylsu). Alates were observed in the nests from 29 July to 13 August 1985.

#### **6.12. LASIUS GEBAUERI n. sp.**

##### **Type material:**

The type specimens from NE Tibet are labelled as "Qinghai: Xining, 101.53 E 36.34 N, 18. 7. 1990, leg. Gebauer, Trocken-Cañon" (6 workers) and "Qinghai: Chaka, 99.16 E 36.49 N, 13. 6. 1990, Wermutsteppe" (3 workers), all collected by A. Gebauer. Depository: Görlitz MUS.

##### **Description:**

**Worker** (Fig. 15): **Head:** fine, 25-35° genal setae always present (4.72  $\pm$  1.30, n = 9, 2.5-6.5); occipital hairs distributed frontad to eye. Clypeal carina often very blunt or absent, sometimes better defined, lateral profile convex. Mandibles with 8, more rarely with 9 teeth. HL/HW (900) 1.079, SL/HL (900) 0.928. **Mesosoma:** distinctly flatter than in *obscuratus*, propodeal dome and mesopropodeal depression shallow, posterior slope of propodeum slightly convex. **Scale:** sides rather straight, converging dorsad; dorsal crest emarginate, rarely straight, the corners more angular (weakly rounded); in lateral view thinner than in *obscuratus*, with rather sharp apex, frontal profile convex, posterior profile slightly concave or straight. **Scape:** pubescence not perfectly

smooth, 5-40°; normally with single setae (20-60°, max. 35 µm). Hind tibia: pubescence surface not perfectly smooth, 5-15°; few setae or bigger pubescence hairs (30-55°, max. 33 µm) are normally present, the most erect at proximal part. Surface characters: frontal head weakly shining, with very weak or absent microreticulum, with micropunctures (3-5 µm diameter, 10-14 µm central distance) and with a rather dense, smooth pubescence (20-30°, PLF ± 31 µm). Frontal pronotum with well-marked transverse microrugosity. Colour: Head and gaster dark brown, mesosoma often slightly lighter; mandibles and scape yellowish; petiole, coxae and femora pale yellowish brown. Data of 8 workers:

HL 911.8 ± 43.8, HL/HW 1.0771 ± 0.0100, SL/HL 0.9265 ± 0.0119, CLCA 0.36 ± 0.24, PDCL 17.58 ± 1.77 (8), nHS 1.56 ± 1.50, nHHT 2.31 ± 0.84, nBH 9.19 ± 2.78, nUH 3.87 ± 1.64, UHL/HL 0.0895 ± 0.0115, PNHL/HL 0.1199 ± 0.0090

#### Comments:

*L. gebaueri* was taken in a xerothermous gorge near Xining at 2800 m and in an *Artemisia* steppe near Chaka at 3400 m. The main difference to *L. obscuratus* is the distinctly flatter propodeal dome, the less compact mesosoma, the differing petiole shape, the more numerous genal pilosity and significantly shorter pronotal hairs ( $p < 0.0001$ ). *L. gebaueri* differs from *psammophilus* mainly by lower PNHL/HL and PDCL, shallow propodeum and more numerous genal pilosity. The climatic conditions in the terra typica are characterized by low annual precipitation (200-400 mm), high daily and annual temperature amplitudes, cold winters and late spring.

### 6.13. *LASIUS KARPINISI* n. sp.

#### Type material

4 workers from Greece labelled "GR: Evritania, Mt. Timfristos, 4 km E Karpinisi, 11. VI. 1982, loc. 24, leg. R. Danielson (DAYS)". Depository: Görlitz MUS.

#### Description:

Worker (Fig. 16): Head: single 25-35° genal setae may be present; occipital hairs distributed frontad to eye. Clypeal carina clearly developed, lateral profile convex. Mandibles with 8, in one specimen with 9 teeth. Head broad, with slightly concave occiput; scape long, HL/HW (900) 1.045, SL/HL (900) 1.009. Mesosoma: rather compact, mesopropodeal depression deep, propodeal dome rather hemispheric, posterior slope of propodeum rather straight. Scale: sides weakly convex, only slightly converging dorsad (almost parallel); dorsal crest slightly emarginate; in lateral view with slightly convex frontal and straight posterior profile. Scape: pubescence smooth, 0-20°, setae on dorsal plane completely absent. Hind tibia: pubescence surface smooth, 5-10°; few setae (25-65°, max. 49 µm) present. Surface characters: frontal head weakly shining, with clearly visible microreticulum but shallow micropunctures (2-4 µm diameter, 11-14 µm central distance) at base of pubescence hairs and with a rather dense, smooth pubescence (10°, PLF 26-39 µm). Frontal pronotum with weak microreticulum. Colour: Head and gaster dark brown with reddish tinge; mesosoma, petiole, coxae and femora reddish brown; scape and tibiae reddish-yellowish; distal half of funiculus blackish brown. Data of 4 workers:

HL 926.0 ± 41.9, HL/HW 1.0398 ± 0.0229, SL/HL 1.0058 ± 0.0117, CLCA 0.80 ± 0.04, PDCL 16.12 ± 2.67, nHS 0.0, nHHT 3.75 ± 2.50, nBH 9.50 ± 2.04, nUH 2.50 ± 0.58, UHL/HL 0.0917 ± 0.0040, PNHL/HL 0.1005 ± 0.0210.

#### Comments

Even if the short pronotal hairs in 2 specimens are possibly an aberration, the whole character combination can hardly be explained as extreme variant or abnormal form of another species, and no signs of malformations are detectable.

#### 6.14. *LASIUS BREVISCAPUS* n. sp.

##### Type material

5 workers (Holotype + 4 Paratypes) from Himachal Pradesh, labelled "Chopal 2400-2750 m, 7. 5. 1977" and "Indien, Him. Prad., Wittmer, Brancucci". Depository: Basel MUS.

##### Description:

Worker (Fig. 17): Head: 2-3 genal setae (40-50°) are present; occipital hairs distributed frontad to eye. Clypeal carina in 3 specimens clearly developed in 2 cases more blunt, lateral profile weakly convex. Mandibles with 8, in one specimen with 9 teeth. Scape very short, HL/HW (900) 1.086, SL/HL (900) 0.871. Mesosoma: rather compact, mesopropodeal depression deep, mesonotum high and vaulted. Scale: variable in shape; sides more or less convex; dorsal crest convex, straight or very slightly emarginate; in lateral view with rather blunt apex. Scape: pubescence surface in 4 specimens rough (20-40°) and in 1 more smooth, few hairs (intermediate in strength between setae and microchaetae, 30-45°, max 33 µm) are present. Hind tibia: pubescence surface rather rough, 5-30°; few setae (40-60°, max. 45 µm) present. Surface characters: cuticular surface of frontal head very shining, with weakly visible microreticulum and micropunctures (3-5 µm diameter, 11-14 µm central distance); frontal head with a rather rough and dilute pubescence (10-30°, PLF 26-39 µm). Frontal pronotum with weak microreticulum and very shining cuticular surface. Colour: Head brown with yellowish tinge; remaining body and appendages pale yellowish brown, gaster in 1 specimen dark brown. Data of 5 workers:

HL 764.0 ± 41.4, HL/HW 1.1118 ± 0.0056, SL/HL 0.8880 ± 0.0207, CLCA 0.72 ± 0.26, PDCL 29.10 ± 7.79, nHS 3.10 ± 2.88, nHHT 2.80 ± 1.25, nBH 7.50 ± 2.50, nUH 2.50 ± 0.58, UHL/HL 0.0965 ± 0.0112, PNHL/HL 0.1418 ± 0.0140.

##### Comments:

*Lasius breviscapus* is well characterized by its short scape, the high and vaulted mesonotum, the pale colour, shining cuticular surface of mesosoma and frontal head and the dilute pubescence which is rather rough on appendages and head sides. A differentiation between setae and pubescence hairs is often difficult. If they do not belong to a colony in initial stage, the workers are the smallest known for the group. There are superficial similarities to *Cautolasius* but the ratios M6/HL and (EL+EW)/(HL+HW) of *breviscapus* (0.167 and 0.232) are fully outside the range of this subgenus.

#### 6.15. *LASIUS SCHULZI* n. sp.

##### Type material:

Holotype: 1 worker labelled "Turkey: Alanya, 36.32 N 32.02 E, 22. 4. 88, leg. Schulz, Machia in Bergland, No 2448". Paratypes: 7 workers labelled "TUR: Gündogmus, 1800 m, 23. 4. 1988, leg. A. Schulz, No 2475, 34 km N Alanya"; 3 workers, 1 queen labelled "TR- Alanya, Gehweg in Stadt, leg. Schulz, 12. 05. 90"; 4 workers "Alanya, Türkei, Hinteres Bergland, 05. 05. 1988, No 2646, Kulturland"; 2 workers "TR - 50 km nördl. Ankara, Straßenrand, leg. Schulz 23. 05. 90". Depository: Görlitz MUS. 6 paratype workers deposited in London MUS: "Turkey-Alanya, Turbelinaz, 7. ii. 1966, Dr. N. Ozban, B. M. 1966-356".

##### Description:

Worker (Fig. 18): Head: genal setae always present (4.03 ± 1.81); occipital hairs long, numerous and distributed frontad to eye and farther. Clypeal carina incomplete or fully absent, lateral profile weakly convex. Number of mandibular dents 8.2 ± 0.42 (8-9, n = 10). HL/HW (900) 1.098, SL/HL (900) 0.975. Mesosoma: rather flat, propodeal dome and mesopropodeal depression shallow. Scale: higher than in most species of the group (higher than upper margin of propodeal spiracle); sides weakly convex, only slightly converging towards a rather broad,

weakly emarginate dorsal crest; in lateral view rather thick but not appearing so because of its big height. Scape: pubescence surface often perfectly smooth, 0-25°, setae normally absent (single, occasional setae 40-50°, max. 25 µm). Hind tibia: pubescence surface normally perfectly smooth, 0-20°; single setae (40-60°, max. 45 µm) normally present at proximal end. Surface characters: cuticular surface of frontal head very shining, with very weak microreticulum which transversal component is more pronounced, micropunctures very weak (2-4 µm diameter, 13-19 µm central distance); frontal head with dilute pubescence, 5-20°, PLF  $29.4 \pm 2.2$  µm (n = 16); postocular region almost without pubescence and brilliantly shining. Frontal pronotum shining with very weak microrugosity. Colour: mesosoma, petiole, gaster and appendages bright yellow; head brownish yellow. Gaster in one sample yellowish brown.

HL  $895.3 \pm 28.3$  (22), HL/HW  $1.0993 \pm 0.0129$  (22), SL/HL  $0.9751 \pm 0.0175$  (22), CLCA  $0.28 \pm 0.17$  (15), PDCL  $43.08 \pm 11.43$  (19), nHS  $0.24 \pm 0.41$  (21), nHHT  $1.17 \pm 0.84$  (21), nBH  $15.00 \pm 2.78$  (22), nUH  $4.02 \pm 1.76$  (21), UHL/HL  $0.1137 \pm 0.0086$  (21), PNHL/HL  $0.1498 \pm 0.0090$  (21).

Queen: Head: mandibles with 8 teeth; occipital corners with numerous, long setae, 3 genal setae present. Mesosoma: very flat. Scale: with straight parallel sides, dorsal crest clearly emarginate. Scape: pubescence surface smooth, 30°, without setae. Hind tibia: pubescence surface not perfectly smooth, 15-35°; several fine setae (30-40°, max. 41 µm) present. Surface characters: frontal head: shining, with rather weak micropunctures of 4-5 µm diameter and 13-17 µm central distance; microreticulum very weak. pubescence 30°, rather dilute, in postocular region and on clypeus very sparse. Colour: head, gaster, petiole and appendages deeply yellow, dorsum of mesosoma brownish yellow. Data of paratype queen:

HL 1268, HW 1367, AL 2530, HL/HW 0.927, SL/HL 0.870, SL/HW 0.806, AH/AL 0.425, PDCL 55.2, nHS 0, nHHT 8, nBH 16.5, nUH 6, UHL 149, PNHL 185.

#### Comments:

*L. schulzi* is a combination of deeply yellow colour, extremely sparse clypeal pubescence, large HL/HW and SL/HL, absence of scape hairs, very flat mesosoma and high and broad scale. There is no *Lasius* in the Palaearctic with a similar character combination except for *uzbeki* n. sp. (for differential characters see 6.16.).

#### Distribution:

So far only known from Turkey, where it seems to be particularly abundant in the Taurus Region of Alanya from the coast up to 1800 m. According to A. Schulz (pers. comm.) the habitats in this region are very shaded, humid places in forests or shrub, but also urban areas and agricultural land. The alate queen was taken early in the year (12 May). The big eyes and long appendages suggest to epigeaic foraging.

#### 6.16. *LASIUS UZBEKI* n. sp.

##### Type material:

A series of workers (holotype and 10 paratypes) labelled 'USSR-Uzbekistan, Chimgan near Tashkent, 6. 5. 1978, 2400 m, J.Visa lgt.'; deposited in Görlitz MUS and in Werner coll. / Praha. The type locality is situated 66 km ENE Tashkent.

##### Description:

Worker (Fig. 41): Head: genal setae always present ( $4.83 \pm 1.51$ , n = 6); occipital hairs distributed frontad to eye. Clypeal carina short and not reaching to anterior half, sometimes restricted to a small flat dome in posterior third, lateral profile weakly convex. Number of mandibular dents  $8.14 \pm 0.48$  (7.5-9, n = 7). HL/HW (900) 1.080, SL/HL (900) 0.967. Eyes big, (EL+EW)/(HL+HW)  $0.262 \pm 0.005$  (n = 7). Genae on average more rounded than in *schulzi*. Mesosoma: propodeal dome and mesopropodeal depression in medium-sized specimens rather flat, posterior propodeal slope straight or very slightly convex. Scale: narrower and distinctly lower than in *schulzi*; in lateral view lower than upper margin of propodeal spiracle, with

a rather blunt apex, convex frontal and straight or very slightly convex posterior profile; sides convex, converging to a narrow dorsal crest which is slightly emarginate, straight or slightly convex; the setae fringing the dorsal crest are longer than in *schulzi*. Scape: pubescence surface not perfectly smooth, 10-25°; setae absent, occasionally a single hair (max. 32 µm, 70°) may be present at distal end. Hind tibia: pubescence surface normally very smooth, 0-15°; single setae (40-60°, max. 60 µm) normally present at proximal end. Surface characters: cuticular surface of frontal head in overall impression shining (but less than in *schulzi*), with well-developed microreticulum and well-detectable micropunctures of 4-5 µm diameter and 13-20 µm central distance: Frontal head, compared to *schulzi*, with shorter pubescence (5-25°, PLF 24.5 ± 1.8 µm), pubescence density in postocular region and on clypeus clearly higher than in *schulzi*. Frontal pronotum in overall impression less shining than in *schulzi* because of well-developed microreticulum and denser pubescence, interspaces between microrugae shining. Colour: head and gaster pale yellowish brown; mesosoma lighter yellowish with a slight brownish tinge; all appendages pale yellowish. Data of 8 workers:

HL 900.2 ± 30.5, HL/HW 1.0795 ± 0.0123, SL/HL 0.9674 ± 0.0174, CLCA 0.31 ± 0.10, PDCL 23.72 ± 3.76, nHS 0.12 ± 0.33, nHHT 0.75 ± 0.71, nBH 10.37 ± 2.18, nUH 5.00 ± 1.65, UHL/HL 0.1292 ± 0.0106, PNHL/HL 0.1568 ± 0.0117.

#### Comments:

*Lasius uzbeki* can be confused with *schulzi* which is similar in many morphometric characters. However, the data of HL/HW (900), square-root-transformed PDCL, nBH, UHL/HL and PLF are significantly different for  $p < 0.001$ . *L. uzbeki* can be distinguished from *schulzi* by its much larger pubescence density on clypeus and postocular head, its lower and narrower scale, its more developed microsculpture on frontal head and pronotum and its more dirty colour.

#### 6.17. LASIUS FLAVESCENS Forel, 1903

*Lasius niger flavescens* Forel, 1903; [3 Type workers Genève MUS]

*Lasius flavescens* Forel, 1903, sensu TARBINSKY (1976)

#### Material studied:

3 type workers from E Buchara region (66 E 39 N); 1 worker from Afganistan (71 E 37 N) and 4 workers from Uzbekistan (70.00 E 41.33 N).

#### Description:

Worker (Fig. 19): Head: whole occiput and genae with numerous, very erect setae. Clypeal carina in most of examples blunt, incomplete and restricted to posterior third (in 1 specimen longer and rather sharp); lateral clypeal profile weakly convex. Mandibles with 8, rarely 9 teeth. Scape rather short and subcylindric, ratio of maximum to minimum diameter at midpoint 1.25-1.30. HL/HW (900) 1.078, SL/HL (900) 0.918. Mesosoma: propodeal dome conic-hemispheric. Scale: rather narrow, sides weakly convex and more or less converging to a straight or faintly notched dorsal crest; in lateral view with rather sharp apex and convex anterior and straight posterior profile. Scape: pubescence 20-30°; numerous and very erect setae (60-85°, max. 51 µm). Hind tibia: pubescence 5-20°; numerous erect setae (45-80°, max. 55 µm); pilosity on flexor profile much weaker. Surface characters: cuticular surface of frontal head very shining, with very weak or absent microreticulum which transversal component is more pronounced, micropunctures well-marked (2-4 µm diameter, 11-16 µm central distance); frontal head with dilute, smooth pubescence (5-25°, PLF 28.4 ± 2.6 µm). Frontal pronotum with weak microrugosity the interspaces of which are brilliantly shining. Colour: overall impression always with a strong yellow component, varying from a bright clear yellow to a dark yellow with brownish tinge; head and gaster often darker than mesosoma.

HL 860.1 ± 58.8(8), HL/HW 1.0850 ± 0.0267 (8), SL/HL 0.9226 ± 0.0196(8), CLCA 0.41 ± 0.24(8), PDCL 27.51 ± 6.41 (8), nHS 23.00 ± 5.42 (8), nHHT 25.36 ± 4.11 (7), nBH > 10, nUH > 8, UHL/HL 0.1157 ± 0.0066 (6), PNHL/HL 0.1341 ± 0.0116 (7), (EL+EW)/(HL+HW) 0.243 ± 0.007 (8).

### Comments:

The very numerous and very erected setae on head, mesosoma, gaster and appendages, the dilute pubescence on all body parts, the shining surfaces and the yellow colour component make *flavescens* easy to distinguish from other species except *L. flavoniger* n. sp. (see 6.18.). As it can be concluded from geographic coincidence and his morphological description, TARBINSKY (1976) named his *flavescens* from Central Asia obviously correctly. He writes that *flavescens* is an endemic species of Middle Asian mountains which is rather abundant in Kirgisia and is found at elevations of 1600-3200 m. The habitats observed are *Ferula-Prangos* steppes, high-grassy meadows in the zone of fir forest and meadows of the subalpine zone. The nests are populous and found under stones or in soil. TARBINSKY calls the species as "typical geobiont". However, the big eyes of *flavescens* indicate certain epigeaic activity.

### 6.18. *LASIVS FLAVONIGER* n. sp.

#### Type material:

6 workers labelled "Turkey: S. Coastlands. Sogukoluk. C. Kosswig. B.M.1948-400". Depository: London MUS and Görlitz MUS

#### Description:

Worker (Fig. 20): Head: whole occiput and genae with numerous, very erect setae. Clypeal carina almost absent, lateral profile weakly convex. Mandibles with 7 to 9 teeth. Scape long and flattened, ratio of maximum to minimum diameter at midpoint 1.50-1.60. HL/HW (900) 1.094, SL/HL (900) 0.981. Mesosoma: propodeal dome rather low, conic-hemispheric, posterior propodeal slope in lateral view rather straight and without setae on upper half of profile. Mesopleurae with 2-4 setae. Scape: rather wide, with convex sides, a little converging dorsad, dorsal crest emarginate; in lateral view rather thin and with convex anterior and straight posterior profile. Scape: pubescence 10-35°; 4-10 setae present, (25-60°, max. 52 µm), majority of hairs sub-decumbent and projecting < 20 µm from cuticular surface. Hind tibia: pubescence 10-25°; numerous erect setae (45-85°, max. 74µm); pilosity on flexor profile much weaker. Surface characters: cuticular surface of frontal head shining, with very weak or absent microreticulum, micropunctures well-marked (3-5 µm diameter, 13-16 µm central distance); frontal head with rather dense, pubescence (20-35°, PLF ± 30 µm). Clypeus with extremely dilute pubescence. Frontal pronotum rather shining with weak transversal microrugosity. Colour: all body parts yellow. Data of 5 workers:

HL 913.0 ± 26.4, HL/HW 1.0918 ± 0.0085, SL/HL 0.9790 ± 0.0086, CLCA 0.14 ± 0.09, PDCL 41.18 ± 6.08, nHS 8.20 ± 2.49, nHHT 25.20 ± 3.11, nBH 28.20 ± 2.59, nUH 12.6 ± 1.34, UHL/HL 0.1242 ± 0.0057, PNHL/HL 0.1540 ± 0.0110, (EL+EW) / (HL+HW) 0.231 ± 0.005.

### Comments:

*L. flavoniger* differs from *flavescens* in having a rougher scape pubescence, much fewer and less erect scape setae, more dense pubescence on frons of head which contrasts the extremely sparse clypeal pubescence and by its much longer and flatter scape. The SL/HL (900) data are 0.9198 ± 0.0196 (n = 4, max. 0.939) for *flavescens* and 0.9806 ± 0.0069 (n = 5, min. 0.972) for *flavoniger* n. sp. The main differences to *schulzi* are the clearly longer and much more numerous standing pilosity on whole body and appendages and the denser, longer and rougher pubescence particularly on dorsum of head.

### 6.19. *LASIVS NIGER* (Linnaeus, 1758)

*Formica nigra* Linnaeus, 1758; [neotype Lund MUS]

*Lasius niger* (Linnaeus, 1758), sensu SEIFERT (1991)

#### Material studied:

England (10,4), Sweden (23,7), Germany (136,33), Czechoslovakia (136,20), Poland (6,1), France (15,4), Switzerland (3,1), Spain (10,3), Portugal (5,1), Algeria (4,1), Bulgaria (1,1), Caucasus (3,1), Mongolia (6,1), Baikal (2,1)

### Description:

**Worker** (Fig. 21): **Head**: whole surface of head with numerous but not very long setae. Clypeal carina weak and incomplete, in lateral profile convex. Mandibles with 8 to 9 teeth ( $8.22 \pm 0.40$ ,  $n = 16$ ). **HL/HW** (900)  $1.077$ , **SL/HL** (900)  $0.951$ . **Mesosoma**: propodeal dome high and hemispheric to conic-hemispheric, mesopropodeal depression deep, propodeum demarcated from metanotum by a distinct furrow. **Scale**: with slightly convex, dorsad weakly converging sides and weakly emarginate (78 %), straight (12 %) or convex (10 %) dorsal crest. **Scape**: pubescence not smooth,  $10-30^\circ$ ; erect setae always present,  $45-80^\circ$ , max.  $50 \mu\text{m}$ . **Hind tibia**: pubescence  $5-15^\circ$ ; erect setae always present,  $45-80^\circ$ , max.  $56 \mu\text{m}$ ; pilosity on flexor profile much weaker. **Surface characters**: frontal head in overall impression weakly shining, microreticulum or microrugosity better visible than in most species of the group, micropunctures well-marked ( $4-5 \mu\text{m}$  diameter,  $10-13 \mu\text{m}$  central distance); frontal head with dense pubescence ( $15-25^\circ$ ,  $\text{PLF } 30.5 \pm 3.0 \mu\text{m}$ ). Clypeus with dense pubescence. Frontal pronotum with well-marked transversal microrugosity. **Colour**: head and gaster blackish brown; mesosoma dark brown to medium brown with yellowish tinge; petiole coxae, femora and tibiae dark brown; mandibles, scape, trochanter and tibio-femoral joint region yellowish-reddish brown.

$\text{HL } 981.4 \pm 72.7$  (206),  $\text{HL/HW } 1.0594 \pm 0.0214$  (153),  $\text{SL/HL } 0.9376 \pm 0.0192$  (104),  $\text{CLCA } 0.42 \pm 0.15$  (26),  $\text{PDCL } 12.98 \pm 2.65$  (146),  $\text{nHS } 16.02 \pm 3.79$  (103),  $\text{nHHT } 17.69 \pm 3.90$  (103),  $\text{nBH} > 10$ ,  $\text{nUH} > 8$ ,  $\text{UHL/HL } 0.0840 \pm 0.0103$  (150),  $\text{PNHL/HL } 0.1188 \pm 0.0089$  (150).

**Queen**: **Head**: mandibles with 7-9 teeth ( $8.45 \pm 0.69$ ,  $n = 10$ ); frontal furrow distinct but not as deeply impressed as in *brunneus*. All surfaces of head with numerous setae. **Mesosoma**: very high. **Scale**: sides slightly convex and converging dorsad, dorsal crest always emarginate. **Scape**: pubescence surface not smooth,  $30-40^\circ$ ; erect setae ( $45-85^\circ$ , max.  $69 \mu\text{m}$ ) always present. **Hind tibia**: pubescence surface not smooth; setae  $45-80^\circ$ , max.  $85 \mu\text{m}$ . **Surface characters**: frontal head with big micropunctures of  $6-9 \mu\text{m}$  diameter and  $13-16 \mu\text{m}$  central distance; microreticulum weak or absent; pubescence very dense,  $15-45^\circ$ ,  $\text{PLF} \pm 48 \mu\text{m}$ . **Colour**: head and mesosoma blackish brown; gaster, petiole and femora dark brown; mandibles and scape reddish brown.

$\text{HL } 1430.1 \pm 40.9$  (37),  $\text{HW } 1617.3 \pm 50.0$  (37),  $\text{AL } 3011.3 \pm 116.4$  (122),  $\text{HL/HW } 0.8846 \pm 0.0131$  (37),  $\text{SL/HL } 0.8509 \pm 0.0173$  (37),  $\text{SL/HW } 0.7527 \pm 0.0150$  (37),  $\text{AH/AL } 0.5984 \pm 0.0170$  (122),  $\text{PDCL } 11.21 \pm 1.44$  (122),  $\text{nHS } 20.24 \pm 6.82$  (37),  $\text{nHHT } 23.86 \pm 5.23$  (36),  $\text{nBH} > 15$ ,  $\text{nUH} > 8$ ,  $\text{PNHL } 166.6 \pm 11.5$  (43).

### Comments:

The worker of *niger* is well separated from other dark and very hairy species by its shorter setae on head, mesosoma and appendages and its much lower PDCL. The best means of separation from *grandis* is a combined consideration of **HL/HW** (900) (*niger*:  $1.077 \pm 0.018$ , *grandis*:  $1.092 \pm 0.20$ ) and **SL/HL** (900) (*niger*:  $0.951 \pm 0.018$ , *grandis*:  $1.002 \pm 0.021$ ). The queen is characterized by its high mesosoma, the extremely low PDCL and relatively short setae on mesosoma compared to other hairy species. There seems to be no geographic variability within the huge W-E range of 8200 km: specimens from Mongolia and Lake Baikal ( $105^\circ \text{E}$ ) are identical with those from Iberia and Central Europe in all numeric data and other phenotypic characters.

### Biology and distribution:

The true geographical distribution of *L. niger* in the Palaearctic remains to be studied in future. Because of the lumping of 7 Palaearctic species into the *L. niger* conception of the myrmecologists since WILSON (1955), the real distribution and ecological potency of *L. niger* has been strongly overestimated. My own data indicate that it is obviously rare in the Iberian and N African regions where I have samples only from the Pyrenees (1200-1600 m) and from areas directly at the Atlantic and Mediterranean Sea coast (sites near Porto, in the delta of Ebro river and in Alger). In most mesophilic areas of Spain *niger* is completely displaced by *L. grandis*. No samples from the

Azores, Madeira, Teneriffe, the Balearic Islands, Asia Minor, the Central Asian mountains, Sachalin, Japan and East China, where *niger* is replaced by other species, were seen. *L. niger* is expected to be naturally distributed in the transition zone of steppe and woodland from E Europe to S Siberia and Mongolia. The occurrence in the southern Taiga zone (where *platythorax* should be the dominant species) may be a result of deforestation, cultivation and artificial introduction. The easternmost sites known are Bodonchiyn Gol in Mongolia (92.30 E 46.29 N) and the S Baikal region (105 E 51.30 N).

In Central Europe *L. niger* prefers moderately xerothermous to mesophilic cultural habitats and has a strong synanthropic trend being the most abundant *Lasius* in cities, parks, gardens and arable land (SEIFERT 1991). It avoids shaded woodland and undisturbed bogs and fens, where it is competed out by *platythorax*. A mean density of 22 nests / 100 m<sup>2</sup> was found on 24 test plots of very different habitat structure and a maximum of 108 nests / 100 m<sup>2</sup> was observed on a meadow stripe at the margin of ploughed land on black soil. Undoubtedly the studies of PONTIN (1960, 1961, 1963, 1969) refer to *L. niger*. Although it readily penetrates dead wood for nest construction, *L. niger* is preferentially a digger and above-ground constructor with mineralic soil particles. Large mounds, small shelters for aphid colonies and the eye-catching shelters or roofs above its above-ground runways are constructed mainly with soil particles. *L. niger* is aggressive and attacks the myrmecologist opening the nests. It typically swarms on hot or warm afternoons and evenings with high air humidity, and it has been caught in light traps after dusk. Alate queens, either observed inside the nests or swarming, were recorded in Central Europe 29 June - 3 Sept ( 26 July  $\pm$  16d, n = 39).

## 6.20. *LASIUS PLATYTHORAX* Seifert, 1991

*Lasius platythorax* Seifert, 1991; [types Görlitz MUS]

### Material studied:

England (14,1), Sweden (17,5), Germany (138,30), Czechoslovakia (60,7), Poland (2,1), France (7,1), Corsica (8,1), Italy (3,1), Romania (3,1), Greece (5,1), Russia (3,1)

### Description:

**Worker** (Fig. 22): **Head**: whole surface of head with numerous, long setae. Clypeal carina varying from long and clearly developed to weak and incomplete, in lateral profile weakly convex to straight. Mandibles with 7 to 9 teeth ( $8.25 \pm 0.55$ , n = 20). HL/HW (900) 1.050, SL/HL (900) 0.963. **Mesosoma**: outlines less curved than in *niger* and propodeal dome more conic than hemispheric. **Scale** with slightly convex, dorsad weakly converging sides and weakly emarginate (80 %) or straight (20 %). **Scape**: pubescence 5-40°; erect setae always present, (45-85°, max. 72  $\mu$ m). **Hind tibia**: pubescence 0-20°; numerous erect setae always present (30-80°, max. 78  $\mu$ m); pilosity on flexor profile much weaker. **Surface characters**: frontal head in overall impression weakly shining, microreticulum clearly visible, micropunctures well-marked (4-5  $\mu$ m diameter, 10-19  $\mu$ m central distance); frontal head with dense pubescence (10-15°, PLF  $32.5 \pm 3.3$   $\mu$ m), contrasting the very sparse clypeal pubescence. Frontal pronotum with well-marked transversal microrugosity. **Colour**: head, mesosoma, petiole, gaster, coxae and femora blackish brown; mandibles and scape reddish-yellowish; trochanter and tibio-femoral joint region yellowish.

HL  $985.2 \pm 75.5$  (168), HL/HW  $1.0342 \pm 0.0232$  (126), SL/HL  $0.9522 \pm 0.0197$  (81), CLCA  $0.56 \pm 0.21$  (39), PDCL  $25.93 \pm 6.06$  (126), nHS  $20.97 \pm 5.97$  (81), nHHT  $23.31 \pm 5.95$  (80), nBH > 10, nUH > 8, UHL/HL  $0.1293 \pm 0.0091$  (126), PNHL/HL  $0.1589 \pm 0.0100$  (125).

**Queen**: **Head**: mandibles with 7-9 teeth ( $8.00 \pm 0.59$ , n = 14); frontal furrow distinct but not as deeply impressed as in *brunneus*. All surfaces of head with numerous, long setae. **Mesosoma**: much lower than in *niger*. **Scale**: sides slightly convex and converging dorsad, dorsal crest clearly emarginate to deeply excised. **Scape**: pubescence surface not smooth, 15-45°; erect setae (40-85°, max. 91  $\mu$ m) always present. **Hind tibia**: pubescence 10-25°; setae 30-80°, max. 94  $\mu$ m. **Surface characters**: frontal head with well-defined micropunctures of

5-8  $\mu\text{m}$  diameter and 12-22  $\mu\text{m}$  central distance; microreticulum detectable; pubescence of frontal head very dense, 20-35°, PLF  $\pm$  50  $\mu\text{m}$ ; clypeal pubescence dilute. **C o l o u r** : head and mesosoma brownish black; petiole, gaster, coxae and femora blackish brown; mandibles reddish brown; scape yellowish; tibio-femoral and coxo-femoral joint region pale yellowish brown.

HL 1388.2  $\pm$  31.7 (37), HW 1568.9  $\pm$  42.3 (37), AL 2781.9  $\pm$  96.0 (69), HL/HW 0.8848  $\pm$  0.0189 (36), SL/HL 0.8558  $\pm$  0.0197(37), SL/HW 0.7576  $\pm$  0.0247 (37), AH/AL 0.5321  $\pm$  0.0213 (67), PDCL 24.57  $\pm$  7.98 (69), nHS 24.83  $\pm$  7.58 (37), nHHT 29.89  $\pm$  6.43 (37), nBH > 15, nUH > 8, PNHL 190.7  $\pm$  9.31 (45).

#### **Comments:**

*L. platythorax* can be safely separated from *niger* by its much higher PDCL, the much longer pilosity on all body parts and the much flatter mesosoma of the queen. *L. platythorax* differs from *grandis* and *japonicus* by significantly lower HL/HW and SL/HL and significantly larger PDCL, UHL/HL and PNHL/HL.

#### **Biology and distribution:**

The distribution of *platythorax* in the Palearctic remains to be studied. As it can be concluded from its habitat selection in Europe and its frequent association with species like *Leptothorax acervorum* and *Myrmica ruginodis*, it is very likely a species of the temperate deciduous woodland and the southern Taiga zones and its range should reach to W Siberia at least. The preferred habitats in Europe are all kinds of woodland as well as bogs and fens and *platythorax* shows a distinctly higher preference than *niger* to higher soil moisture (SEIFERT 1991). From open agricultural areas, the regions of cities and villages and other anthropogenic habitats it is almost absent, being competed out by *niger*. The habitat overlap between *niger* and *platythorax* in Germany is 5.8 % only and the degree of syntopic occurrence is still lower (3.5 %) as it is a rule for closely related species. The mean nest density of *platythorax* was 6.8 / 100 m<sup>2</sup> (maximum 23 / 100 m<sup>2</sup>) for 7 test plots in woodland and 4.0 / 100 m<sup>2</sup> (maximum 15 / 100 m<sup>2</sup>) for 10 test plots in bogs or fens. Above-ground constructions with mineralic soil or organic material are unknown for *platythorax* which is rather an excavator of preformed organic or mineralic spaces. The nests are frequently in dead wood, the turf layer of tussocks and bults, under stones, in vegetation pads with mosses and rarely litter or soil nests without stone cover are observed. *L. platythorax* is very aggressive and attacks the myrmecologist disturbing the nests. The conditions of swarming are unknown. Alate queens, either observed inside or outside the nests, were recorded in Central Europe 11 June - 8 Aug. ( 14 July  $\pm$  19 d, n = 14).

#### **6.21. LASIUS JAPONICUS Santschi, 1941**

*Lasius emarginatus* var. *japonicus* Santschi, 1941; [types: 1 queen, 5 workers, Basel MUS]

*Lasius niger* (L., 1758), sensu YAMAUCHI & HAYASHIDA (1970)

*Lasius niger* (L., 1758), sensu YAMAUCHI (1978, 1979)

#### **Material studied:**

Ussuri region (5,1), Sachalin (7,1), Japan (57,17), Prov. Shenyang / NE China (20,4), Korea (5,1)

#### **Description:**

**Worker** (Fig. 23): **Head** : occipital margin straight or weakly excavated; mandibles with 7 to 9 teeth (8.14  $\pm$  0.42, n = 25). Clypeal carina blunt or absent; if present, then hardly to define in length and sometimes interrupted in center by a very shallow depression. HL/HW (900) 1.079, SL/HL (900) 0.981. **Mesosoma** : in shape similar to *alienus*; propodeal dome more conic, in lateral view angulate and with rather straight posterior slope; promesonotum on average flatter than in *niger*. **Scale** : in anterior view wide, frequently almost rectangular, with rather straight sides which converge only little to the wide dorsal crest which is weakly notched or straight (sometimes, in smaller specimens, narrower, with more convex sides); in lateral view relatively thin and sharp, with straight posterior and weakly convex anterior profile. **Scape** : pubescence

0-30°; erect setae always present (40 - 85°, max. 66 µm). Hind tibia: pubescence 0-15°; erect setae always present (35-80°, max. 70 µm). Surface characters: frontal head in overall impression moderately shining, microreticulum clearly visible, micropunctures a little weaker than in *niger* (3-5 µm diameter, 10-14 µm central distance); frontal head with dense pubescence (5-25°, PLF 28.2 ± 2.6 µm). Frontal pronotum with well-marked microreticulum. Colour: variable: in pale form mesosoma pale yellowish-reddish brown, head and gaster with same tinge but darker; mandibles and anterior clypeal border (sometimes entire clypeus) yellowish to bright orange; in dark form mesosoma brown, head and gaster blackish brown, anterior clypeal border (sometimes whole clypeus) and scape yellowish, mandibles usually brightly orange, funiculus dark brown.

HL 982.3 ± 70.0 (87), HL/HW 1.0639 ± 0.0265 (87), SL/HL 0.9706 ± 0.0218 (87), CLCA 0.45 ± 0.22 (77), PDCL 18.67 ± 3.43 (87), nHS 15.66 ± 4.70 (87), nHHT 16.89 ± 4.37 (87), nBH 17.45 ± 3.76 (77), nUH 9.00 ± 3.37 (67), UHL/HL 0.1096 ± 0.0101 (85), PNHL/HL 0.1452 ± 0.0104 (87).

Queen: Head: mandibles with 7-9 teeth (8.00 ± 0.63, n = 6); All surfaces of head with numerous setae. Mesosoma: much lower than in *niger*. Scale: sides rather straight and weakly converging dorsad, dorsal crest clearly emarginate. Scape: pubescence 30-45°; erect setae (30-85°, max. 71 µm) always present. Hind tibia: pubescence 15-30°; setae 35-80°, max. 84 µm. Surface characters: frontal head with well-defined micropunctures of 5-7 µm diameter and 13-17 µm central distance; microreticulum always clearly detectable; pubescence of frontal head very dense, 30-40°, PLF ± 47 µm. Colour: head, mesosoma and gaster dark brown, medium brown with deep reddish tinge in the paler form. Scape, mandibles and region of mandibular corners and of anterior clypeus yellowish to reddish brown. Data of 7 queens: HL 1445.0 ± 58.1, HW 1609.0 ± 82.0, AL 2740.1 ± 158.0, HL/HW 0.8984 ± 0.0136, SL/HL 0.8517 ± 0.0145, SL/HW 0.7649 ± 0.0097, AH/AL 0.5370 ± 0.0097, PDCL 14.23 ± 1.39, nHS 24.57 ± 3.74, nHHT 28.57 ± 4.89, nBH > 10, nUH > 8 PNHL 195.1 ± 10.7.

#### Comments:

A clear separation between a dark and a pale colour type is not given. The darker forms tend to be slightly smaller, longer-headed and tend to have a narrower scale and are possibly an ecomorph adapted to cooler climates. However, the question whether there is a polymorphism of one species or the existence of highly similar siblings should be investigated thoroughly. A series of 3 workers from Tsingtao / E China (ex coll. Eidmann) shows above-average size, shorter pronotal hairs and larger SL/HL but is probably conspecific. The most similar species is *L. platythorax* but the data of UHL/HL, HL/HW (900), PDCL, SL/HL (900), PNHL/HL, nHS and nHHT are different for highest significance levels ( $p < 0.0001$ ) and the colour pattern and mesosomal and petiolar shape are distinct in most cases.

#### Biology and distribution:

*L. japonicus* seems to be the most abundant *Lasius* s. str. in Pacific Asia from 48° N to 32° N. It is found in the Ussuri region (Khabarovsk), Sachalin, Korea, NE China and throughout Japan from sea level to 2100 m. According to YAMAUCHI (1979), the upper altitudinal limit at 44° N is 1300 m (Hokkaido) and 2100 m at 36° N (Honshu). This corresponds well with the upper limit of 1500 m found in China at 42° N (Prov. Shenyang). *L. japonicus* is a very euryptent species which inhabits all kinds of open or semi-shaded habitats: urban areas, roadsides, sandy grasslands or heath, river banks, meadows, farmland and deciduous or coniferous woodlands with dilute canopy. It avoids very shaded, dense woodland and occurs there only at spots with sufficient sunlight i. e. in the marginal zones to open habitats. Thus *japonicus* occupies an ecological position similar to that of *niger* in Europe. The nests are constructed in very different substrates: simple soil nests in sandy or loamy ground, under stones, in pavement, in dead wood, in or under litter and humous horizons. YAMAUCHI (1979) noted a rather shallow, superficial construction of the nest cores and did not mention any mound construction. Alates are observed from early July to late September depending on climatic conditions. In sharp contrast to the late afternoon and

evening swarming in *niger*, the nuptial flight takes place in early morning. YAMUCHI, ITO & SUZUKI (1986) observed several flights in Honshu for 4:30 - 7:18 h.

## 6.22. *LASIUS GRANDIS* Forel, 1909

*Lasius niger* var. *grandis* Forel, 1909; [5 worker types Genève MUS]

### Material studied:

Andorra (6,1), Portugal (7,3), Spain (69,20), Balearic Isles (14,4), Azores (9,2), Madeira (17,9), Teneriffe (8,2), Morocco (26,8), Algeria (6,1)

### Description:

**Worker** (Fig. 24): **Head**: mandibles with 8 to 9 teeth ( $8.48 \pm 0.51$ ,  $n = 23$ ). Clypeal carina normally sharp and long; in specimens from Teneriffe and in some examples from the Atlas of Morocco incomplete and blunt. Size-corrected head and scape length big: HL/HW (900) 1.092, SL/HL (900) 1.002. **Mesosoma**: propodeal dome normally conspicuous and hemispheric. **Scale**: on average more massive than in other species of the subgenus; in anterior view normally wide, with convex sides and weakly emarginate or entire dorsal crest; in lateral view normally thicker than usual in the subgenus, with strongly convex anterior and straight posterior profile. Scale in the specimens from Teneriffe and some specimens from the Atlas of Morocco much less massive and much narrower. **Scape**: pubescence 10-30°; erect setae always present (45-85°, max. 69  $\mu$ m). A picture frequently seen is the contrast between the rather appressed pubescence and the very erect, long setae; however, numbers of setae highly variable and pubescence in the very irsute Balearic specimens similar to the condition in *niger*. **Hind tibia**: rather smooth pubescence of 0-15°; erect setae always present (45-85°, max. 84  $\mu$ m). **Surface characters**: pubescence of frontal head normally smooth (15-20°) and varying from rather dilute to dense, PLF  $28.8 \pm 4.3$   $\mu$ m; microreticulum variable but always clearly visible; micropunctures varying but always clearly visible (2-6  $\mu$ m diameter, 10-14  $\mu$ m central distance). Frontal pronotum with well-marked, transverse microrugosity. **Colour**: In most of the populations normally rather concolorous as in *niger* and varying from blackish brown to medium brown with reddish tinge. The specimens from Teneriffe and some from Morocco are paler and more bicoloured having yellowish brown mesosoma, appendages and clypeus. Data of 156 workers: HL  $1037.5 \pm 65.7$ , HL/HW  $1.0661 \pm 0.0246$ , SL/HL  $0.9847 \pm 0.0247$ , CLCA  $0.74 \pm 0.18$  ( $n = 80$ ), PDCL  $19.36 \pm 4.97$ , nHS  $22.84 \pm 7.31$ , nHHT  $25.66 \pm 6.77$ , nBH > 10, nUH > 8, UHL/HL  $0.1169 \pm 0.0126$ , PNHL/HL  $0.1372 \pm 0.0114$ .

**Queen**: **Head**: mandibles with 7-8 teeth ( $7.80 \pm 0.44$ ,  $n = 5$ ); All surfaces of head with numerous setae. **Mesosoma**: much flatter than in *niger*. **Scale**: sides rather convex and weakly converging dorsad, dorsal crest clearly emarginate to deeply incised; in lateral view rather thick; scale in 2 queens from Teneriffe clearly narrower, with straight sides and in lateral view narrower. **Scape**: pubescence 30-45°; erect setae always present, 30-80°, max. 90  $\mu$ m. **Hind tibia**: pubescence 5-20°; setae 30-75°, max. 85  $\mu$ m. **Surface characters**: frontal head with well-defined but variable micropunctures of 4-7  $\mu$ m diameter and 10-16  $\mu$ m central distance (in 2 queens from Teneriffe 7-9  $\mu$ m diameter and 16-20  $\mu$ m distance); microreticulum normally clearly detectable; pubescence of frontal head dense, 30-40°, PLF  $\pm 51$   $\mu$ m. **Colour**: body varying from blackish to medium brown with reddish tinge; gaster in 2 queens from Teneriffe pale brown with yellowish tinge. Data of 6 queens:

HL  $1529.8 \pm 49.0$ , HW  $1674.8 \pm 57.2$ , AL  $3078.8 \pm 113.7$ , HL/HW  $0.9137 \pm 0.0129$ , SL/HL  $0.8628 \pm 0.0146$ , SL/HW  $0.7885 \pm 0.0145$ , AH/AL  $0.5062 \pm 0.0185$ , PDCL  $23.10 \pm 6.88$ , nHS  $30.33 \pm 7.28$ , nHHT  $35.40 \pm 5.77$ , nBH > 10, nUH > 8, PNHL  $181.0 \pm 12.3$ .

### Comments:

The separation of the workers of *grandis* from those of *niger* and *platythorax* is no matter of question. Discriminant functions obtained by the same principal procedure as mentioned in section

6.8. offered a perfect distinction of nest samples with 2-4 workers. The discriminant  $D_{NL,GR}$  to separate *niger* and *grandis* was calculated as

$$1.1 \text{ HL/HW}_{\text{cor}} + 2.0 \text{ SL/HL}_{\text{cor}} + 1.5 \text{ PDCL}_{\text{cor}} + 0.9 \text{ UHL/HL}_{\text{cor}} + 0.2 \text{ PNHL/HL}_{\text{cor}}$$

and the discriminant  $D_{PL,GR}$  to separate *platythorax* and *grandis* was calculated as

$$3.6 \text{ HL/HW}_{\text{cor}} + 2.5 \text{ SL/HL}_{\text{cor}} - 0.4 \text{ PDCL}_{\text{cor}} - 0.3 \text{ UHL/HL}_{\text{cor}} - 0.6 \text{ PNHL/HL}_{\text{cor}}$$

$D_{NL,GR}$  was  $5.321 \pm 0.088$  (5.16-5.44) for 17 southern samples of *niger* and  $6.039 \pm 0.196$  (5.61-6.61) for 54 nest samples of *grandis*.  $D_{PL,GR}$  was  $4.592 \pm 0.074$  (4.47-4.68) for 19 samples of *platythorax* and  $5.011 \pm 0.092$  (4.81 -5.20) for 54 samples of *grandis*. However, it is really questionable whether all the ants pooled into the presented *grandis* concept belong to one polymorphic species or must be split up. At present, I see no possibility of finding an objective decision on the taxonomic status of the island populations of the Azores, Madeira, Tenerife and the Balearics and of some aberrant samples from Morocco by means of external morphology. This issue must be cleared up by a detailed study which also considers other aspects of biology.

The 5 type workers of *L. grandis* from Ronda / Andalusia (leg. Voigt) have low setae numbers on scape and hind tibia but these setae are long and erect, contrasting the smooth pubescence. Despite its low pilosity figures, the type series is morphometrically 'typical', having discriminant values near the median of the *grandis* distribution with  $D_{NL,GR}$  6.00 and  $D_{PL,GR}$  4.95 (see above).

### **Biology and distribution:**

*L. grandis* has so far not been recorded from the E Mediterranean region. The known extreme coordinates are 29° W, 6° E, 28° N and 42°30' N. It is the most abundant species of the subgenus on the Iberian peninsula where it is distributed from sea level up to 2300 m (Sierra Nevada). Open habitats as well as woodland habitats, deciduous and coniferous, are inhabited but all sites are mesophilic or humid. More sun-exposed, xerothermous places are avoided in altitudes below 2000 m. Most of the Spanish samples, except for those from high mountain pastures, were taken in sheltered, humid places (typically gorges or valleys with running waters). In the Atlas of Morocco *grandis* was taken by H. Cagniant in altitudes of 1400-1800 m in deciduous and coniferous woodland and, in altitudes of 2200-2800 m, in open habitats such as mountain pastures, *Juniperus* stands and more xerothermous grasslands. In Spain, the nests were found mainly under stones and in soil, and the construction of a big soil mound similar to those seen in *niger* was once noted. The time of nuptial flight and other aspects of biology are unknown. *L. grandis* is as aggressive as *niger* or *platythorax* after disturbance of the nest.

### **6.23. LASIUS CINEREUS n. sp.**

#### **Material studied:**

Specimens taken by myself in Spain were labelled as types: 2 nest samples with holotype and 7 paratypes from 5 km WSW Alcala de Chivert, 45 km N Castellon, 7. 5. 1991; 3 nest samples with 15 workers from 1 km W Chodos, 45 km NW Castellon, 7. 5. 91; 7 nest samples with 31 workers from the Sierra de Espuña, 15 km W Alhama de Murcia, 8. 5. 1991.

#### **Description:**

**Worker** (Fig. 25): **Head:** mandibles with 7 to 9 teeth ( $8.00 \pm 0.50$ ,  $n=9$ ). Clypeal carina rather blunt and often incomplete, head and scape relatively long, HL/HW (900) 1.106, SL/HL (900) 0.982. **Mesosoma:** the completely dull surface appearance is very diagnostic; propodeal dome normally more hemispheric than conic and rather high. **Scape:** in anterior view relatively narrow and high, with almost straight (sometimes slightly convex) and subparallel sides; dorsal crest entire (43 %), faintly notched (34 %) or convex to wedge-shaped (22 %); in lateral view rather thick and high, with a rather blunt apex and convex anterior and weakly concave posterior profile. **Scape:** pubescence very smooth 0-10°; numerous setae (30-80°, max. 55 µm).

**Hind tibia:** appressed pubescence of 0-5°; numerous setae (30-80°, max. 71 µm). **Surface characters:** pubescence of frontal head shorter than in *grandis* or *niger* (PLF  $24.3 \pm 2.5$  µm, n=34), appressed (0-5°) and rather dilute. Microreticulum always clearly visible, with more prominent microrugae than usual in the subgenus and the surfaces between the microrugae dull or weakly shining (using an EPIGNOST, a special microscope for recognition of surface structures, very fine punctures are detectable in these interspaces at magnifications  $\geq 320$  x). These "ultrastructures" produce a much less shining overall surface appearance. Micropunctures at base of pubescence hairs always visible (3-5 µm diameter, 9-14 µm central distance). Frontal pronotum and whole mesosoma with a transverse microrugosity more prominent than usual in the subgenus and with "ultrastructurally" punctate interspaces which produces the diagnostic dull surface. **Colour:** head and gaster blackish brown; mesosoma dark to medium brown with yellowish-reddish tinge, but even in the palest specimens darker than in Central European *emarginatus*. Mandibles, anterior clypeal margin and scape yellowish-reddish brown. Data of 34 workers: HL  $917.0 \pm 62.7$ , HL/HW  $1.1033 \pm 0.0200$ , SL/HL  $0.9801 \pm 0.0232$ , CLCA  $0.55 \pm 0.20$ , PDCL  $20.54 \pm 5.12$ , nHS  $22.24 \pm 3.57$ , nHHT  $21.74 \pm 2.49$ , nBH > 10, nUH > 8, UHL/HL  $0.1045 \pm 0.0140$ , PNHL/HL  $0.1341 \pm 0.0086$ .

#### **Comments:**

Except for the significantly smaller size, *L. cinereus* is similar to *grandis* in numeric characters. However, clearly separating characters of *cinereus* are the completely dull surface appearance of the mesosoma, the very weakly shining or almost dull surface of the frontal head, the shorter frontal head pubescence and (compared to Spanish *grandis*) the narrower, less massive and more straight-sided scale. The separation from *emarginatus*, which has a similarly short frontal pubescence and a similar morphometry, is possible by the surface and petiole characters and by colour.

#### **Biology and distribution:**

All 3 Spanish sites are limestone areas in altitudes of 430-1430 m. There seems to exist a spatial exclusion of *cinereus* and *grandis*, since I never noted syntopic occurrence. Compared to *grandis*, the habitats are distinctly more xerothermous. Recorded nest sites: a plateau with spiny shrubs and much bare rock, a plateau with *Juniperus* and *Artemisia*, a south slope with an open *Pinus* wood and two plateaus with xerothermous grassland. Frequently accompanying faunal elements were *Formica subrufa*, *Lasius myops* and termites which were obviously used as food source. *L. cinereus* is aggressive towards the myrmecologist disturbing the nests.

#### **6.24. LASIUS EMARGINATUS (Olivier, 1791)**

*Formica emarginata* Olivier, 1791; [description]

*Lasius alienus illyricus* Zimmermann, 1934; [4 type workers, Harvard MUS]

*Lasius niger brunneo-emarginatus* Forel, 1874; [6 type workers, Genève MUS]

*Lasius niger emarginatus* var. *brunneooides* Forel, 1874; [objective synonym of *brunneo-emarginatus* Forel]

*Lasius niger nigro-emarginatus* Forel, 1874; [5 worker and 4 queen types, Genève MUS; probably hybrids *emarginatus* x *platythorax*]

*Lasius alienus* var. *pontica* Stårcke, 1944; [description]

#### **Material studied:**

Germany (45,23), France (6,2), Switzerland (6,2), Czechoslovakia (9,4), Hungary (1,1), Corsica (19,4), Sardinia (4,1), Italy (12,5), Croatia (4,1), Malta (11,3), Bulgaria (7,3), Greece (1,1), Turkey (6,3), Crimea (6,1),Caucasus (10,3)

### Description:

**Worker** (Fig. 26): **Head**: mandibles with 8 to 10 teeth ( $8.67 \pm 0.48$ ,  $n = 24$ ), teeth often smaller and less heterodont than in *grandis* or *niger*. Clypeal carina normally blunt and often almost absent. Head capsule in dorsal aspect with more straight sides compared to *grandis*, having more trapezoid outlines. Head and scape long, HL/HW (900) 1.097, SL/HL (900) 1.014 [Corsica and Sardinia: HL/HW (900) 1.112, SL/HL (900) 0.982; Malta: HL/HW (900) 1.123, SL/HL (900) 1.017]. **Mesosoma**: propodeal dome normally conspicuous and definitely higher than the flat promesonotum, in lateral aspect angulate-rounded. **Scape**: in anterior view relatively wide and high, sides varying from almost straight to convex and weakly converging dorsad; dorsal crest straight to convex (52 %) or faintly notched (48 %), in lateral view rather thick and high, with a rather blunt apex and convex anterior and weakly concave posterior profile (in Caucasian specimens in lateral view less thick and with a more pointed apex). **Scape**: pubescence 5-30°; setae very few to many (30-80°, max. 58 µm); the most numerous and most erect setae in the Maltese population and the fewest and less erect in Balkanic, Pontic and Caucasian populations. **Hind tibia**: appressed pubescence of 0-5°; few to numerous setae (30-75°, max. 88 µm). **Surface characters**: pubescence of frontal head distinctly shorter than in *grandis* or *niger* (PLF  $20.3 \pm 2.0$  µm,  $n = 30$ ), appressed (0-5°) and rather dilute. Microreticulum always clearly visible, the surfaces between the microrugae shining. Micropunctures at base of pubescence hairs always visible (3-5 µm diameter, 9-16 µm central distance). Frontal pronotum with a transverse microrugosity and shining interspaces which produce a mildly shining overall surface appearance. **Colour**: Normally clearly bicoloured. Head, coxae, femorae and tibiae normally medium reddish brown to dark brown with reddish tinge. Mesosoma, petiole, scape and mandibles light yellowish red to light reddish brown; Mandibles, anterior clypeal margin and scape yellowish-reddish brown. Gaster dark reddish brown to blackish brown. Specimens from the Balkans frequently almost concolorous, having brown mesosomas. Data of 97 workers:

HL  $1001.9 \pm 73.5$ , HL/HW  $1.0779 \pm 0.0252$ , SL/HL  $1.0017 \pm 0.0243$ , CLCA  $0.43 \pm 0.25$ , PDCL  $27.26 \pm 7.34$ , nHS  $12.81 \pm 9.63$ , nHHT  $20.59 \pm 8.21$ , nBH > 10, nUH > 8, UHL/HL  $0.1164 \pm 0.0121$ , PNHL/HL  $0.1360 \pm 0.0119$ .

**Queen**: **Head**: mandibles with 7-9 teeth ( $8.14 \pm 0.54$ ,  $n = 23$ ); long scape. **Mesosoma**: much flatter than in *niger*. **Scape**: in the majority of specimens wide, with almost parallel, straight sides and clearly emarginate dorsal crest; in few cases sides convex and/or converging dorsad and in one queen with straight dorsal crest. **Scape**: pubescence rough, 30-40°; setae extremely variable in number, erection and length (often 30-60° and max. 46 µm, but also 40-80° and max. 67 µm or setae completely lacking). **Hind tibia**: pubescence 10-30°; setae variable, 25-80°, max. 104 µm. **Surface characters**: frontal head with well-defined micropunctures of 4-7 µm diameter and 12-20 µm central distance; microreticulum weak but clearly detectable; pubescence of frontal head relatively dense and shorter than in *grandis* or *platythorax*, 25-40°, PLF  $\pm 34$  µm. **Colour**: overall impression light orange brown; head medium brown with reddish tinge, sometimes dark brown except for the orange brown clypeus and genae; mesosoma normally light orange brown (in Balkanic queens sometimes medium brown); gaster orange brown. The wings are normally clear but are infuscated in the 2 Maltese queens. Data of 39 queens:

HL  $1454.6 \pm 36.8$ , HW  $1592.2 \pm 44.7$ , AL  $2924.8 \pm 118.5$ , HL/HW  $0.9139 \pm 0.0212$  (6 queens from Corsica and Sardinia:  $0.941 \pm 0.0211$ ), SL/HL  $0.8911 \pm 0.0247$ , SL/HW  $0.8144 \pm 0.0274$ , AH/AL  $0.4806 \pm 0.0131$ , PDCL  $27.53 \pm 8.53$ , nHS  $20.36 \pm 9.35$ , nHHT  $27.72 \pm 8.33$ , nBH > 10, nUH < 8, PNHL  $177.3 \pm 13.6$ .

### Comments:

Types of *Formica emarginata* were not seen. The original description by Olivier allows the interpretation that he could have meant the species which is described here as *L. emarginatus* i. e. his statements are not contradictory but could also refer to other species. A neotype fixation should be undertaken if the loss of Olivier's specimens should be proved.

*L. emarginatus* is morphometrically similar to *grandis* but can be most clearly distinguished by its distinctly shorter frontal pubescence. Furthermore, colour, mandibular dentition and mesosomal and head shape are frequently useful for separation of the workers.

There is no *Lasius* species known with such a high variability in scape pilosity. The occurrence of workers with very low and of such with high nHS numbers within the same nest as seen in Central European and Caucasian samples suggests a genetic determination of pilosity morphs. The geographic variability in this character is still much larger. The population from Malta shares all morphological characters typical of *emarginatus* except for the much higher nHS numbers and the more profuse overall pilosity. A detailed study considering both morphological and biological criteria is needed to clear up the taxonomic status of these Maltese *Lasius*.

*Lasius alienus illyricus* Zimmermann is interpreted here as synonym because of the high similarity with the members of the Balkanic, Pontic and Caucasian population of *emarginatus*. A synonymy with any species of the *alienus* complex is excluded by the data of the 4 type workers being completely outside the extremes known for this complex: SL/HL(900) 1.026, UHL/HL 0.121. The *illyricus* types share the head shape, frontal pubescence length and other morphometric characters of *emarginatus*. Their very pale colour is possibly caused by a longer storage in ethanol prior to mounting and the low and small petiole scale with very convex sides could be, in part, a result of allometry in these relatively small (mean HL = 903) specimens. The reduction of setae on the dorsal plane of the scape as seen in these types is a character frequently seen in *emarginatus* from this region. However, the synonymy assumed here is not free of doubt and the *illyricus* case should be considered in futural studies on Balkanic *Lasius* since it could possibly represent a rare sibling species.

Types of *alienus* var. *pontica* Stårcke were not seen, but the description (long scape, bicoloured, reddish tinge, type locality) make it very probable that this taxon belongs to the weakly haired *emarginatus* occurring along the Crimmean and Caucasian coast of the Black Sea.

A series of 5 type workers of *Lasius niger nigro-emarginatus* Forel, 1874 (collected under the bark of a tree near Mendrisio / Switzerland, 5 vii 1871) has character means which strongly suggest a hybridisation between *platythorax* and *emarginatus*: HL/HW (900) 1.075, SL/HL(900) 0.981, frontal pubescence length 24-28  $\mu\text{m}$ , PNHL/HL 0.157, nHS (900) 17.0, colour a little darker as usual in *emarginatus*. A similar situation is found in the respective 4 type queens which are, however, bigger than average queens of both putative parent species.

### **Biology and distribution**

*Lasius emarginatus* is a W Palaearctic species ranging eastwards to 46°E (Caucasus, Asia Minor). Being absent from the British Isles, Belgium, Danmark and S Skandinavia, the northern distributional limit in Central Europe is at 52.30 N. The upper limit in Switzerland (47°N) is 1200 m and in the Caucasus (42°N) it is distributed from sea level up to 1700 m.

In Central Europe, it is the most thermophilous species of the subgenus and its natural habitats are here most probably S-exposed rocky areas with sparse vegetation cover. In Central Europe S of 51° N it is a characteristic species of the 'stone deserts' of cities where it frequently dominates over *Lasius niger*, having a distinctly higher walking speed on the free surfaces, a quicker recruiting system and a more effective optical and tactile orientation (SEIFERT 1986). Among the autochthonic ants of Germany, *emarginatus* is the most frequently observed species inside houses where the nests are often constructed in masonry. Workers from a nest at the base of a tall concrete building were seen to forage in the kitchen of an apartment in the 7th floor. In sites or regions with a very warm local climate *emarginatus* may dominate even in shaded shrub or woodland habitats if there are enough free surfaces to make use of its advantage of highest walking speed.

A mean density of 11 nests / 100 m<sup>2</sup> (maximum of 29/100 m<sup>2</sup>) was found on 10 test plots in E Germany (SEIFERT 1986). The nests may contain a brown, carton-like construction made of wood and soil particles which are glued by regurgitated honey-dew (MASCHWITZ & HÖLLDOBLER 1970). The sugar is obviously an essential substrate for the growth of a fungus whose hyphae give the construction additional stability and a felt-like surface appearance. The

food sources used are highly diverse and include floral and extrafloral nectaries of plants and the zoophagous activity may be considerable. I observed *L. emarginatus* to forage in large files on trees exploiting the excretions of aphids the colonies of which can be dominated against other species of *Lasius*, *Serviformica* and *Myrmica*. The nest may be very populous and the workers are aggressive towards the myrmecologist. Very frequent catches in light traps indicate that it typically swarms at dusk or in the early night under conditions of high air temperature. Alate queens, either observed inside the nests or swarming, were recorded in Central Europe 22 vi - 30 viii (23 vii  $\pm$  17 d, n = 16).

### 6.25. *LASIUS TEBESSAE* n. sp.

#### Type material:

The holotype worker, 8 paratype workers and 4 paratype queens from E Algeria labelled "Algeria: Tebessa, 16. 5. 1967, 950 m, ex coll. Cagniant"; 8 paratype workers from the Atlas of Blida labelled "Algeria: 50 km S Alger, 17. 6. 1964, 1200 m, ex coll. Cagniant". Depository: Görlitz MUS.

#### Description:

Worker (Fig. 27): Head: mandibles with 8 to 9 teeth ( $8.28 \pm 0.44$ , n = 9). Clypeal carina on average better developed than in *emarginatus*. Sides of head in dorsal aspect with more rounded sides compared to *emarginatus* (the reservoir of mandibular gland seems to be bigger). Head and scape relatively long, HL/HW (900) 1.091, SL/HL (900) 0.996. Mesosoma: propodeal dome normally conspicuous, more or less hemispheric and slightly higher than promesonotum. Scape: in anterior view narrower and lower than in *emarginatus*, sides slightly to strongly convex and converging dorsad; dorsal crest mainly entire (straight or convex), more rarely feebly notched; in lateral view on average thinner, more pointed than in *emarginatus*, with a weakly convex anterior and straight posterior profile. Scape: pubescence 10-30°; setae relatively few (20-75°, max. 46  $\mu$ m). Hind tibia: appressed pubescence of 0-5°; relatively few setae (40-70°, max. 59  $\mu$ m). Surface characters: pubescence of frontal head distinctly shorter than in *grandis* or *niger* (PLF  $20.7 \pm 2.7$   $\mu$ m, n = 10), appressed (0-10°) and rather dense, in particular on clypeus much denser than in *emarginatus*. Microreticulum always clearly visible, the surfaces between the microrugae shining. Micropunctures at base of pubescence hairs always visible (3-5  $\mu$ m diameter, 10-18  $\mu$ m central distance). Frontal pronotum with a transverse microrugosity and shining interspaces which produces a mildly shining overall surface appearance. Colour: almost concolorous pale yellowish-reddish brown (but possibly strongly affected by long ethanol storage !). Data of 10 workers:

HL  $964.5 \pm 35.4$ , HL/HW  $1.0792 \pm 0.0134$ , SL/HL  $0.9883 \pm 0.0183$ , CLCA  $0.54 \pm 0.16$ , PDCL  $13.58 \pm 1.43$ , nHS  $7.75 \pm 3.47$ , nHHT  $11.80 \pm 1.96$ , nBH > 10, nUH > 5, UHL/HL  $0.1318 \pm 0.0134$ , PNHL/HL  $0.1475 \pm 0.0053$ .

Queen: Head: mandibles in 2 specimens with 8 teeth; long scape. Mesosoma: much flatter than in *niger*. Scape: with subparallel to notably converging, almost straight to slightly convex sides and clearly emarginate dorsal crest. Scape: pubescence relatively smooth, 25-40°; setae variable in number, 30-70° and max. 57  $\mu$ m. Hind tibia: pubescence 5-15°; setae 20-70°, max. 86  $\mu$ m. Surface characters: frontal head with well-defined micropunctures of 4-7  $\mu$ m diameter and 11-19  $\mu$ m central distance; microreticulum weak but clearly detectable; pubescence of frontal head relatively dense and shorter than in *grandis* or *platythorax*, 25-30°, PLF  $\pm 36$   $\mu$ m. Colour: concolorous yellowish brown; wings clear. Data of 4 queens:

HL  $1453.5 \pm 25.1$ , HW  $1568.2 \pm 24.6$ , AL  $2847.5 \pm 61.2$ , HL/HW  $0.9268 \pm 0.0160$ , SL/HL  $0.8652 \pm 0.0159$ , SL/HW  $0.8045 \pm 0.0119$ , AH/AL  $0.5100 \pm 0.0140$ , PDCL  $13.18 \pm 1.08$ , nHS  $17.50 \pm 11.90$ , nHHT  $19.25 \pm 3.77$ , nBH > 7, nUH > 4, PNHL  $167.2 \pm 22.2$ .

### Comments:

*L. tebossae* is certainly a close relative of *emarginatus* (if not an African subspecies of *emarginatus*). The worker of *tebossae* differs from *emarginatus* by its more rounded sides of head (namely genae), the lower and narrower scale, the much lower PDCL and the longer pronotal and gular hairs. The queens of both species are extremely similar. However, the 4 type queens of *tebossae* have PDCL data below the lower extreme known for *emarginatus* and, in lateral view of mesosoma, there is a distinct step between the scutellum and metanotum (in most queens of *emarginatus* scutellum, metanotum and propodeum form a continuous profile). H. Cagniant (pers. comm.) reported as habitats a pasture at 950 m (Tebessa) and a site with "Chènes verts et Pins d'Alep" in the Atlas of Blida at 1200 m.

### 6.26. *LASIUS NIGRESCENS* Stitz, 1930

*Lasius emarginatus* var. *nigrescens* Stitz, 1930; [types Berlin MUS]

### Material studied:

5 type queens labelled "West-Pamir, VII-IX 28, leg. Reinig, Maz, 3800 m, 15.-19. VIII" including the lectotype designated by E. O. Wilson in 1954.

### Description:

Worker: unknown. According to the correlations usually existing between the characters of queens and workers, the *nigrescens* worker is predicted to have the following data: HL/HW (900) 1.064, SL/HL (900) 1.025, PDCL 25.6, nHS 36, nHHT 35. It should be a very long-scaped ant with very numerous scape and tibial setae, dilute clypeal pubescence and long pronotal hairs.

Queen: head covered with a long 30-45° pubescence. Whole body covered with profuse and long but relatively fine pilosity. Surface of mesosoma rather shining because of reduced pubescence density. Mesosoma: much flatter than in *niger*. Scale: with straight, only slightly converging sides and clearly emarginate dorsal crest. Scape: with very numerous setae, max. 80 µm. Hind tibia: with very numerous setae, max. 95 µm. Colour: Head and mesosoma dark brown, gaster a little lighter. Mandibles light yellowish-reddish brown. Scape with pedicellus yellowish, remaining antenna dark brown. Data of 5 queens:

HL 1322.6 ± 17.8, HW 1494.0 ± 19.2, AL 3042.8 ± 51.0, HL/HW 0.8852 ± 0.0105, SL/HL 0.9248 ± 0.0092, SL/HW 0.8184 ± 0.0128, AH/AL 0.5216 ± 0.0054, PDCL 22.28 ± 1.17, nHS 44.20 ± 5.36, nHHT 48.40 ± 10.38, nBH 36.00 ± 8.28, nUH 32.00 ± 8.00, PNHL 200.6 ± 6.43.

### Comments:

The type queens have the largest SL/HL, nHS and nHHT of all known Palaearctic queens of the subgenus *L. nigrescens* is probably related to *emarginatus*. It has a darker colour, longer and more numerous setae and a much lower, non-overlapping ratio of HL/ML, being 0.435 ± 0.0074 [0.427-0.444, n = 5] but 0.498 ± 0.0154 [0.468-0.531, n=39] in *emarginatus*. The approximate coordinates of the type locality are 72.10 E and 38.42 N and the climatic conditions differ extremely from those found in the Westpalaearctic range of *emarginatus*.

### 6.27. *LASIUS LAWARAI* n. sp.

### Type material:

Altogether 20 paratype workers from N Pakistan, leg. Besuchet-Löbl, labelled "Pakistan: Dir, Lawarai-Pass 21e, 2700 m, 21. V. 1983" (nest sample with holotype); "Pakistan: Chitral, Madaglasht 2700 m, 26. V. 1983 26b"; "Pakistan: Hazara, Naran 2500 m, 31. V. 1983 32a"; "Pakistan: Swat, Kalam, 2300 m, 15. V. 1983 13b"; "Pakistan: Swat, Malam Jabba 4c, 9. V. 1983 2400 m"; "Pakistan: Swat, Miandam 15b, 17. V. 1983 2400 m"; "Pakistan: Swat, Utrot 2600 m, 13. V. 1983 11a". Depository: Genève MUS.

**Description:**

Worker (Fig. 28): Head: mandibles with 8 to 10 teeth ( $8.82 \pm 0.60$ ,  $n = 11$ ). Clypeal carina relatively blunt and incomplete, in lateral profile convex. Head long, scape relatively short: HL/HW (900) 1.104, SL/HL (900) 0.918. Mesosoma: propodeal dome normally conic, angulate in lateral view and lower than mesonotum; mesonotum higher and more vaulted than usual in the subgenus. Posteroventral sides of pronotum without pubescence and brilliantly shining. Surface between propodeal spiracle and opening of the metapleural gland with only 1-5 fine setae the longest of which measure  $56.8 \pm 10.5 \mu\text{m}$  (46-84  $\mu\text{m}$ ,  $n = 20$ ). Scale: with slightly convex, dorsad more or less converging sides and a straight dorsal crest which is never clearly emarginate; in lateral view with convex anterior and straight posterior profile. Scape: pubescence rough, 25-35°, difficult to separate from the smaller setae; setae 25-65°, max. 42  $\mu\text{m}$  (majority 25-45° and projecting  $\pm 20 \mu\text{m}$ ). Hind tibia: pubescence rough, 10-30°, difficult to separate from the smaller setae; setae relatively few, mainly at proximal profile, 20-75°, max. 56  $\mu\text{m}$ . Surface characters: pubescence of frontal head relatively short ( $26.9 \pm 2.0 \mu\text{m}$ ), 20-30° and rather dense. Microreticulum always clearly visible, the surfaces between the microrugae brilliantly shining. Micropunctures at base of pubescence hairs always visible (3-5  $\mu\text{m}$  diameter, 10-16  $\mu\text{m}$  central distance). Frontal pronotum with a transverse microrugosity and very shining interspaces. Colour: frons and occiput dark to blackish brown, genae and clypeus lighter with yellowish tinge, antennae and mandibles yellowish; mesosoma pale yellowish brown to dark brown, gaster blackish brown. Data of 19 workers:

HL  $863.1 \pm 48.4$ , HL/HW  $1.1104 \pm 0.0230$ , SL/HL  $0.9228 \pm 0.0176$ , CLCA  $0.53 \pm 0.22$ , PDCL  $19.25 \pm 5.06$ , nHS  $12.42 \pm 5.90$ , nHHT  $7.21 \pm 3.17$ , nBH  $9.29 \pm 2.85$ , nUH  $3.24 \pm 1.46$ , UHL/HL  $0.1049 \pm 0.0113$ , PNHL/HL  $0.1459 \pm 0.0127$ .

**Comments:**

*Lasius lawarai* differs from *wittmeri* n. sp. by its different mesosomal shape, its more converging sides of scale and its distinctly lower seta counts on all parts of body, in particular on gula and hind tibia. Furthermore, in *lawarai*, the number and length of setae on the propodeal surface between spiracle and the opening of metapleural gland is distinctly lower and the distal extensor profile of femora lacks the 20-30° setae which are present in *wittmeri*.

**6.28. LASIUS WITTMERI n. sp.****Type material:**

Only workers known: holotype and 6 paratypes labelled 'Kashmir, 1976, W. Wittmer; Pahalgam 7. 7., 2200-3100 m' and 6 paratypes labelled 'Pakistan 1974, Baroni Urbani; Naran 7900', Kagan Valley 25. V.'. Depository: Basel MUS.

**Description:**

Worker (Fig. 29): Head: mandibles with 8 to 9 teeth ( $8.75 \pm 0.50$ ,  $n = 4$ ). Clypeal carina blunt and incomplete, in lateral profile convex. Head long, HL/HW (900) 1.091, SL/HL (900) 0.940. Mesosoma: propodeal dome flatter and mesopropodeal depression shallower than in *lawarai*. Posteroventral sides of pronotum without pubescence and brilliantly shining. Surface between propodeal spiracle and opening of the metapleural gland with 4-10 setae, the longest of which measure  $93.4 \pm 7.9 \mu\text{m}$  (79-103  $\mu\text{m}$ ,  $n = 11$ ). Scale: on average a little wider than in *lawarai*, sides not or very weakly converging dorsad, dorsal crest straight, weakly emarginate or weakly convex; in lateral view with convex anterior and straight posterior profile. Scape: pubescence rough, 10-30°, difficult to separate from the smaller setae; setae 40-80°, max. 51  $\mu\text{m}$ . Hind tibia: pubescence 10-20°; setae 30-75°, max. 67  $\mu\text{m}$ . Surface characters: pubescence of frontal head a little longer than in *lawarai*:  $30.0 \pm 2.9 \mu\text{m}$ ), 15-30°. Microreticulum always clearly visible, the surfaces between the microrugae brilliantly shining. Micropunctures at base of pubescence hairs always visible (3-5  $\mu\text{m}$  diameter, 10-14  $\mu\text{m}$  central distance). Frontal

pronotum with a transverse microrugosity and shining interspaces. **C o l o u r**: in specimens from Naran whole body concolorous yellowish-reddish brown. Specimens from Pahalgam darker: head medium to dark brown, anterior portion of head capsule lighter with yellowish-reddish tinge; mesosoma medium brown with yellowish-reddish tinge, gaster brown, scape and mandibles yellowish. Data of 11 workers:

HL 868.4 ± 39.7, HL/HW 1.0974 ± 0.0163, SL/HL 0.9435 ± 0.0135, CLCA 0.31 ± 0.14, PDCL 22.76 ± 4.00, nHS 17.23 ± 5.34, nHHT 20.36 ± 7.15, nBH 13.05 ± 2.34, nUH 10.00 ± 3.19, UHL/HL 0.1169 × × ± 0.0121, PNHL/HL 0.1462 ± 0.0096.

#### **Comments:**

The differences of the 13 specimens of *wittmeri* to those of *lawarai* are clear enough to erect a new morphospecies but the possibility of them being only variants of the same species can not be fully excluded in view of the few samples seen.

#### **6.29. LASIUS SCHAEFERI n. sp.**

##### **Type material:**

A series of 1 alate queen, 1 male and 4 workers deposited in Basel MUS and labelled "II Dolan Expedition, Westchina / Tibet, leg. E. Schäfer, 1934/36 "and "131".

##### **Description:**

**Worker** (Fig. 30): **Head**: mandibles in 2 specimens with 8 teeth. Clypeal carina rather blunt, frequently clearly expressed in posterior center only, in lateral profile convex. Head long, HL/HW (900) 1.105, SL/HL (900) 0.927. **Mesosoma**: propodeal dome flatter and mesopropodeal depression much shallower than in *lawarai*. Surface between propodeal spiracle and opening of the metapleural gland with only 2-5 setae the longest of which measure 55 - 75 µm. **Scale**: in lateral view rather low and thick approximately reaching up to level of propodeal spiracle; with a strongly convex frontal and straight to feebly convex posterior profile; in frontal view with convex, dorsad converging sides and ± straight dorsal crest. **Scape**: pubescence relatively smooth, 0-20°; setae few and short 30-55°, max. 34 µm. **Hind tibia**: pubescence smooth and appressed, 0-15°; setae numerous and contrasting the pubescence condition, 30-70°, max. 57 µm. **Surface characters**: pubescence of frontal head relatively dilute, appressed (5-10°) and short (23.0 ± 2.5 µm); most of cuticular surface brilliantly shining; microreticulum detectable but very weak; micropunctures at base of pubescence hairs weak and shallow (2-3 µm diameter, 11-14 µm central distance). Frontal pronotum with a transverse microrugosity and shining interspaces. **C o l o u r**: head and mesosoma pale yellowish brown, gaster in 3 specimens yellow, in one pale yellowish brown. Data of 4 workers:

HL 858.2 ± 26.9, HL/HW 1.1125 ± 0.0026, SL/HL 0.9318 ± 0.0024, CLCA 0.41 ± 0.25, PDCL 20.92 ± 3.43, nHS 6.25 ± 2.63, nHHT 16.50 ± 3.32, nBH 15.88 ± 3.50, nUH 6.50 ± 2.08, UHL/HL 0.1150 ± 0.0154, PNHL/HL 0.1498 ± 0.0105.

**Queen**: **Mesosoma**: very high as in *niger*. **Scale**: not wide, with straight or slightly convex sides which notably converge towards a clearly emarginate dorsal crest. **Scape**: pubescence rough, 30-35°; setae numerous, 45-65° and max. 55 µm. **Hind tibia**: pubescence 20-25°; setae numerous, 45- 75°, max. 92 µm. **Surface characters**: frontal head with relatively small micropunctures of 4-6 µm diameter and 13-19 µm central distance; microreticulum very weak; cuticular surface very shining; pubescence of frontal head relatively dense, PLF ± 45 µm and 20-35°. **C o l o u r**: head and mesosoma medium yellowish brown, gaster pale yellowish brown. Data of the type queen:

HL 1457, HW 1560, AL 2828, HL/HW 0.934, SL/HL 0.859, SL/HW 0.802, AH/AL 0.609, PDCL 14.6, nHS 40, nHHT 36, nBH 18, nUH 5, PNHL 183, UHL 183

**Comments:**

The label "131" must be interpreted as station 131 of E. Schäfer's expedition route which is situated approximately at 96.33 E 33.42 N, 3800 m and was reached in the end of August 1935. The climatic conditions of the type locality are extreme: the vegetation period is restricted to 3½ months, night frosts are normal until May and the daily air temperature amplitude is bigger than 40° K during the summer season.

*Lasius schaeferi* differs from *lawarai* by its much more developed hind tibial pilosity, the flatter propodeum and mesonotum and the paler colour, particularly of the gaster. The best differential characters to *wittmeri* are the less numerous and shorter setae on the propodeal surface between spiracle and mesopleural gland which measure 55-75 µm in *schaeferi* and 79-103 µm in *wittmeri*. The pale colour of the *schaeferi* series seems to be no artefact and is possibly diagnostic. Despite of the stated differences, there is a high similarity of *lawarai*, *wittmeri* and *schaeferi* in many morphometric characters and it cannot be excluded fully that the 3 taxa are only variants of one highly polymorphic species with a large range in Central Asia. There is no doubt that each of the 3 taxa is not conspecific with any European species treated above.

**6.30. LASIUS HIRSUTUS n. sp.****Type material:**

6 workers deposited in Genève MUS, labelled "Pakistan: Chitral, Madaglasht, 2700 m, 27.V.1983 27b, Besuchet-Löbl"

**Description:**

**Worker** (Fig. 31): **Head:** occiput always weakly excavated, in smallest specimens nearly straight; mandibles in with 8-9 teeth. Clypeal carina defined only in posterior third, in anterior part blunt or absent, lateral profile angulate-convex. HL/HW (900) 1.084, SL/HL (900) 0.983. **Mesosoma:** propodeum with relatively flat dome and convex posterior slope. Posterior propodeal slope brilliantly shining because of completely absent pubescence and microsculpture. The final duct part leading caudad to propodeal spiracle is tube-like and optically pronounced by being less pigmented than the surrounding propodeal surface; spiracle opening elliptic and directed caudad. **Petiole:** in frontal view wide, relatively high and with rounded dorsal crest; in lateral view thicker than usual in the subgenus because of only weak convergence towards the very blunt dorsal crest; frontal profile weakly convex, posterior profile weakly concave or straight. **Scape:** pubescence 15-30°; setae very numerous 50-75°, max. 55 µm. **Hind tibia:** pubescence 15-20°, setae very numerous, 45-75°, max. 73 µm. **Surface characters:** pubescence of frontal head long (PLF  $33.6 \pm 1.9$  µm), 20-30°; microreticulum very weak; cuticular surface brilliantly shining; micropunctures small but well-marked, with 3-4 µm diameter and 10-16 µm central distance. Gaster tergites in median area with extremely dilute or nearly absent pubescence and brilliantly shining. **Colour:** dorsum of head blackish brown, genae and clypeus medium brown, mandibles and mandibular corners yellowish; mesosoma, femora and tibiae medium brown; tibio-femoral and tibio-metatarsal joints and antennae yellowish. Data of 6 workers:

HL  $951.0 \pm 59.5$ , HL/HW  $1.0748 \pm 0.0284$ , SL/HL  $0.9772 \pm 0.0109$ , CLCA  $0.36 \pm 0.04$ , PDCL  $29.07 \pm 4.05$ , nHS  $30.00 \pm 4.38$ , nHHT  $35.00 \pm 4.94$ , nBH  $27.33 \pm 3.61$ , nUH  $23.67 \pm 6.06$ , UHL/HL  $0.1467 \pm 0.0064$ , PNHL/HL  $0.1302 \pm 0.0073$ .

**Comments:**

*Lasius hirsutus* has the longest gular hairs of all Palaearctic members of the subgenus and has several extreme or rare characters such as petiolar shape, reduction of tergite pubescence and extremely numerous pilosity on all surfaces. It is probably related to *sakagamii*, being similar in mesosomal and petiolar shape and overall pilosity condition. *L. sakagamii* differs from *hirsutus*

by its pubescent and finely transversally striate posterior propodeal slope, the much denser pubescence particularly on clypeus and dorsum of tergites, the microsculpture of frons and tergites and much lower UHL/HL.

### 6.31. *LASIUS SAKAGAMII* Yamauchi & Hayashida, 1970

*Lasius sakagamii* Yamauchi & Hayashida, 1970; [types ex.coll. Yamauchi]

#### Material studied:

Japan (13,3)

#### Description:

**Worker** (Fig. 32): Head: mandibles in with 8-9 teeth ( $8.60 \pm 0.55$ ,  $n=5$ ). Clypeal carina blunt and indistinct. HL/HW (900) 1.090, SL/HL (900) 1.001. Mesosoma: very characteristic: with very flat propodeal dome and convex to angulate-convex posterior propodeal slope that is transversally striate which is a very diagnostic character. Scale: in lateral view very thick, blunt and relatively low, with strongly convex anterior and straight posterior profile; in anterior view rather narrow, with convex to nearly straight sides which slightly converge dorsad or are subparallel; dorsal crest frequently straight or feebly emarginate, sometimes convex. Scape: majority of pubescence hairs smooth ( $0-15^\circ$ ), a few longer microchaetae  $25^\circ$ ; setae very numerous and erect,  $55-80^\circ$ , max.  $56 \mu\text{m}$ . Hind tibia: pubescence smooth,  $0-15^\circ$ , contrasting the setae condition; setae very numerous,  $55-75^\circ$ , max.  $72 \mu\text{m}$ . Surface characters: Frontal head: pubescence dense and smooth,  $5-15^\circ$ , PLF  $27.7 \pm 2.5 \mu\text{m}$ ; microreticulum very clear, interspaces shining; micropunctures at base of pubescence hairs absent or very small, with  $1-3 \mu\text{m}$  diameter and  $10-15 \mu\text{m}$  central distance. Gaster tergites with very dense pubescence, well-marked transversal microrugosity and micropunctures at base of pubescence hairs. Colour: mesosoma medium brown with yellowish-reddish tinge, head a little and gaster distinctly darker; sometimes whole body concolorous paler brown with yellowish-reddish tinge. Data of 11 workers including 1 paratype:

HL  $914.2 \pm 52.7$ , HL/HW  $1.0873 \pm 0.0249$ , SL/HL  $0.9996 \pm 0.0234$ , CLCA  $0.47 \pm 0.20$ , PDCL  $14.62 \pm 2.69$ , nHS  $29.91 \pm 6.14$ , nHHT  $27.80 \pm 5.43$ , nBH  $23.64 \pm 3.72$ , nUH  $18.00 \pm 4.69$ , UHL/HL  $0.1039 \pm 0.0120$ , PNHL/HL  $0.1501 \pm 0.0087$ .

**Queen**: Head: mandibles with 8 and 9 teeth; ocelli distinctly bigger than usual in the subgenus, width of midocellus / head width  $0.092-0.094$ . Mesosoma: flatter than in *niger* but higher than in most other species. Scale: with straight sides which are in one queen parallel and in the other clearly converging dorsad; dorsal crest obtusely-angled emarginate; scale in lateral view thin (except of base) and tapering to a pointed apex. Scape: pubescence  $30-45^\circ$ ; setae very numerous,  $30-70^\circ$ , max.  $68 \mu\text{m}$ . Hind tibia: pubescence relatively smooth  $30^\circ$ ; setae very numerous,  $30-70^\circ$ , max.  $98 \mu\text{m}$ . Surface characters: frontal head with well-defined microreticulum and micropunctures of  $6 \mu\text{m}$  diameter and  $13-20 \mu\text{m}$  central distance; pubescence of frontal head very dense,  $20-25^\circ$ , PLF  $49.2 \pm 3.2 \mu\text{m}$ . Colour: head medium brown with yellowish-reddish tinge; mesosoma pale yellowish-reddish brown; gaster pale yellowish-reddish brown (in one queen darkening caudad). Data of 2 queens including 1 paratype:

HL  $1444.0 \pm 38.0$ , HW  $1591.5 \pm 33.5$ , AL  $3043.5 \pm 169.5$ , HL/HW  $0.907 \pm 0.0050$ , SL/HL  $0.8585 \pm 0.0085$ , SL/HW  $0.7795 \pm 0.0102$ , AH/AL  $0.5625 \pm 0.0125$ , PDCL  $14.95 \pm 1.95$ , nHS  $36.0 \pm 4.0$ , nHHT  $37.0 \pm 3.0$ , nBH  $30.0 \pm 3.0$ , nUH  $17.0 \pm 9.0$ , PNHL  $181.0 \pm 2.0$ .

#### Comments:

*Lasius sakagamii* is a species with outstanding morphology and cannot be confused with any Palaearctic species of the subgenus (for differences to *hirsutus* see 6.30.).

#### Biology and distribution [according to YAMAUCHI (1978, 1979) and YAMAUCHI, ITO & SUZUKI (1986)]:

*L. sakagamii* is widespread all over Japan from  $45^\circ\text{N}$  to  $33^\circ\text{N}$  and restricted to altitudes from sea level to  $500 \text{m}$  which is most probably a result of the vertical distribution of its natural habitat

which are deposition areas of alluvial and aeolian sands. *L. sakagamii* prefers sun-exposed places with sparse vegetation like river banks, dry river beds, sand dunes or road sides. The nests are mainly constructed at spots with bare sand or under stones and have numerous distinct chambers reaching usually down to 60 cm. Nuptial flights were observed 5 vii-25 ix (mainly mid July to mid August) and take place on warm ( $>22^{\circ}\text{C}$ ) evenings with high air humidity but no air movements or rain. The species is polygynous and in many nests only males fly. Females do only fly from nests without males otherwise they mate intranidally without subsequent flight. Big polycalic colony systems dominating an habitat may occur.

### 6.32. *LASIUS MAGNUS* n. sp.

#### Material studied:

All material from E Himalayan region: Bhutan (39,10), Darjeeling district (11,4), Meghalaya (6,2).

The type series includes 21 workers (holotype + 20 paratypes) and is labelled "Gogona, 3100 m, 10.-12. 6., Nat.-Hist. Museum Basel - Bhutan, Expedition 1972". Depositories: holotype and paratypes Basel MUS, paratypes Görlitz MUS.

#### Description:

**Worker** (Figs. 33-35, 40): **Head**: mandibles with only 6-8 teeth ( $7.21 \pm 0.47$ ,  $n = 26$ ). Clypeal carina blunt and incomplete, often restricted to posterior clypeus or fully absent. Occipital margin straight (even in extremely large specimens there is only a suggestion of a concavity in measuring position for HL). Head relatively long, HL/HW (900) 1.099, SL/HL (900) 0.980. **Mesosoma**: propodeal dome normally conspicuous, conic-hemispheric and at least as high as promesonotum; in smallest workers promesonotum very flat, only weakly curved and propodeum relatively flat but still higher than promesonotum. **Scale**: big and massive; in lateral view thick, with blunt apex and relatively high, with strongly convex anterior and straight posterior profile; in anterior view wide, with convex sides and a slightly emarginate (65 %) or straight (10 %) dorsal crest. **Scapae**: pubescence relatively smooth (20-30°); setae always present, 30-85°, max. 53  $\mu\text{m}$ . **Hind tibia**: pubescence smooth, 5-20°, contrasting the setae condition; setae 30-85°, max. 86  $\mu\text{m}$ . **Surface characters**: Frontal head: pubescence smooth, 15-20°, PLF  $30.6 \pm 4.0$   $\mu\text{m}$ ; microreticulum clearly developed, interspaces shining; micropunctures at base of pubescence hairs with 5-6  $\mu\text{m}$  diameter and 12-20  $\mu\text{m}$  central distance. Gaster tergites with a very diagnostic pubescence pattern deviating from the strictly longitudinal orientation common in *Lasius*: the appressed paramedian microchaetae in posterior dorsum of tergites are directed caudomedial or even mediad. This unique pattern may be affected in case of polluted surfaces. **Colour**: head, mesosoma and gaster relatively concolorous, varying from pale yellowish-reddish brown to medium brown with yellowish tinge or dark brown. Data of 54 workers:

HL  $1197.1 \pm 109.6$ , HL/HW  $1.0785 \pm 0.0229$ , SL/HL  $0.9435 \pm 0.0227$ , CLCA  $0.23 \pm 0.17$ , PDCL  $47.89 \pm 12.75$ , nHS  $19.83 \pm 5.52$ , nHHT  $25.09 \pm 4.70$ , nBH  $12.63 \pm 2.97$ , nUH  $4.82 \pm 2.87$ , UHL/HL  $0.0761 \pm 0.0173$ , PNHL/HL  $0.1147 \pm 0.0105$ .

**Queen**: **Head**: mandibles in both queens with 7 teeth. **Mesosoma**: relatively flat. **Scale**: wide, with slightly convex sides, moderately converging dorsad; dorsal crest emarginate. **Scapae**: pubescence 20-25°; setae 30-70°, max. 68  $\mu\text{m}$ . **Hind tibia**: pubescence relatively smooth 10-30°; setae 30-65°, max. 80  $\mu\text{m}$ . **Surface characters**: frontal head with well-defined microreticulum and micropunctures of 6-7  $\mu\text{m}$  diameter and 14-17  $\mu\text{m}$  central distance; pubescence of frontal head relatively dense, 20-30°, PLF  $\pm 42$   $\mu\text{m}$ . Clypeal pubescence very sparse. **Colour**: concolorous; head, mesosoma and gaster medium to dark brown. Data of 2 queens:

HL  $1774.5 \pm 37.7$ , HW  $2035.5 \pm 15.5$ , AL  $3570.5 \pm 171.5$ , HL/HW  $0.872 \pm 0.025$ , SL/HL  $0.8310 \pm 0.0140$ , SL/HW  $0.7245 \pm 0.0085$ , AH/AL  $0.5210 \pm 0.0040$ , PDCL  $32.95 \pm 3.85$ , nHS  $11.5 \pm 4.5$ , nHHT  $19.0 \pm 4.0$ , nBH  $4.25 \pm 0.75$ , nUH  $4.50 \pm 3.5$ , PNHL  $216.5 \pm 11.5$ .

**Comments:**

*Lasius magnus* cannot be confused with any Asiatic *Lasius* species. It is a combination of extremely dilute clypeal pubescence, unique pubescence pattern on tergites, reduced number of mandibular dents, reduced clypeal carina, very big scale and the worker body size is frequently above the upper extremes known for all other species. The worker HL ranges from 948 to 1447  $\mu\text{m}$  and the size of queen is exceptionally large.

There are 3 samples of workers and one queen which have no setae but only a fine pubescence on the dorsal crest and the sides of scale. In 13 other worker samples and the other queen the scale is fringed in frontal view with a number of setae. It remains to be studied whether these pilosity variants should be morphs as assumed here or whether they should have taxonomic significance.

The exceptionally large size of the queens and workers in *L. magnus*, the exceptionally large size of the queen in the putative social parasite *Lasius (Chthonolasius) crinitus* (Smith, 1858) and the syntopic occurrence make it most probable that *magnus* is the host of *crinitus*.

**Distribution:**

As it can be concluded from the numerous samples taken by the zoologists from Basel (C. Baroni-Urbani, O. Stemmler, W. Wittmer and M. Würmli), *L. magnus* is obviously very abundant in the E Himalayan region. The vertical distribution in Bhutan, Darjeeling and Meghalaya shows highest frequencies at 1600 - 3100 m. The main habitats are woodland biomes, mainly evergreen broad-leaved and evergreen coniferous mountain forests with mesophilic to very moist conditions - i. e. just below or within the zone of cloud forests. The highest *magnus* site in Bhutan at 3100 m was in the lower zone of *Rhododendron*-Coniferous woodland, but this record will probably not represent the real upper limit of vertical distribution in Bhutan. The records of the putative social parasite *L. crinitus* in E Nepal and Sikkim (WILSON 1955, COLLINGWOOD 1982) suggest a presence of *L. magnus* in the whole E Himalayan region. I have not seen material of *L. magnus* from the W Himalayas.

**6.33. LASIUS COLORATUS Santschi, 1937**

*Lasius niger coloratus* Santschi, 1937; [types Basel MUS]

**Material studied:**

The lectotype and a paratype worker from Musha/Taiwan, leg. K. Sato; 5 workers from Fenichihu/Taiwan, leg. J. & S. Klapperich 15. vi 1977; 5 workers from Nanwutao mountains near Sian/China, leg. P. Hammond ix 1980.

**Description:**

**Worker** (Fig. 36): **Head**: mandibles with 8-9 teeth ( $8.33 \pm 0.49$ ,  $n = 12$ ). Clypeal carina rather blunt but at least in posterior center well-defined. Head and scape relatively long, HL/HW (900) 1.093, SL/HL (900) 0.995. **Mesosoma**: propodeal dome conspicuous, more conic than hemispheric and higher than promesonotum; mesopropodeal depression very deep, the anterior propodeal slope and posterior mesonotal slope make an angle of 100-110°. **Scale**: in anterior view wide, with convex, dorsad converging sides and slightly convex or straight dorsal crest which sometimes shows in center a suggestion of a faint notch; in lateral view relatively thick and higher than propodeal spiracle, with blunt apex, convex frontal and straight posterior profile. **Scape**: pubescence relatively rough, 25-40°, difficult to separate from the shorter and less erect setae; setae always present, 30-80°, max. 56  $\mu\text{m}$ . **Hind tibia**: pubescence smooth, 5-20°, contrasting the setae condition; setae 30-80°, max. 65  $\mu\text{m}$ . **Surface characters**: Frontal head: pubescence smooth and relatively short, PLF  $24.1 \pm 3.5$   $\mu\text{m}$ , 20-30°; microreticulum very clearly developed, interspaces with rather dull or shining surface; micropunctures at base of pubescence hairs because of stronger microsculpture not very clearly visible (diameter 5-6  $\mu\text{m}$ , central distance 12-15  $\mu\text{m}$ ). Lateral pronotum with clearly developed striae. **Colour**: Taiwan: mesosoma

pale yellowish brown, head slightly and gaster notably darker. Sian: mesosoma pale yellowish brown, head medium brown with yellowish-reddish tinge, gaster blackish brown. Data of 12 workers: HL  $987.6 \pm 61.7$ , HL/HW  $1.0765 \pm 0.0217$ , SL/HL  $0.9846 \pm 0.0167$ , CLCA  $0.57 \pm 0.21$ , PDCL  $19.93 \pm 4.58$ , nHS  $24.83 \pm 5.65$ , nHHT  $26.09 \pm 3.83$ , nBH  $15.29 \pm 3.03$ , nUH  $7.17 \pm 1.75$ , UHL/HL  $0.0916 \pm 0.0144$ , PNHL/HL  $0.1494 \pm 0.0132$ .

**Comments:**

*L. coloratus* is probably related to *emarginatus*. The specimens from Taiwan have on average a distinctly more dull cuticular surface than those from Sian and could possibly represent an endemic island species different from the continental species. *Coloratus* differs from the similar Japanese species *hayashi* by its definitely longer head, the shorter scape and a steeper anterior propodeal slope. The ratio SL/HW (corrected for a head length of 1000  $\mu\text{m}$ ) provides a full separation: SL/HW (1000) is  $1.056 \pm 0.024$  [1.027 - 1.106] in *coloratus* and  $0.974 \pm 0.014$  [0.941-0.996] in *hayashi*.

**Distribution:**

*L. coloratus* is the most southern distributed species of the subgenus, reaching 22° N in Taiwan where it was collected at 1400 m. The continental sample (108.58 E 33.59 N) was taken at 1800 m.

**6.34. LASIUS HAYASHI Yamauchi & Hayashida, 1970**

*Lasius hayashi* Yamauchi & Hayashida, 1970; [type ex coll. Yamauchi]

**Material studied:**

Japan (24,7)

**Description:**

**Worker** (Fig. 37): **Head**: very broad, sides curved, occiput more or less excavated, rarely straight; mandibles with 7-9 teeth ( $8.00 \pm 0.50$ ,  $n = 9$ ). Clypeal carina varying from poorly defined to rather sharp but in the latter case normally incomplete in length. HL/HW (900) 1.051, SL/HL (900) 0.956. Relative eye-size (EL + EW)/(HL + HW)  $0.221 \pm 0.004$ . **Mesosoma**: propodeal dome not as high as in *coloratus*; mesopropodeal depression deep but less than in *coloratus*, the anterior propodeal slope and posterior mesonotal slope form an angle of 120-130°. **Scale**: in frontal view rather wide and with convex, dorsad converging sides and slightly convex to straight dorsal crest; in lateral view with convex anterior and straight posterior profile, thinner and with more pointed apex than *coloratus*. **Scape**: pubescence rough, 20-35°; very numerous hairs of 30-45° and projecting  $\pm 20 \mu\text{m}$  are intermediate between pubescence and setae; true setae less numerous 45-80°, max. 61  $\mu\text{m}$ . Hairs on scape underside at least as long, numerous and erect as on dorsal plane. **Hind tibia**: pubescence 5-20°, contrasting the setae condition; setae 30-80°, max. 69  $\mu\text{m}$ . **Surface characters**: Frontal head: overall impression shining; pubescence relatively short, PLF  $23.5 \pm 2.8 \mu\text{m}$ , 20-35°; microreticulum clearly to weakly developed, interspaces with very shining surface; micropunctures at base of pubescence hairs small, 2-4  $\mu\text{m}$  diameter and 9-19  $\mu\text{m}$  central distance. **Colour**: mesosoma, petiole, scape, femora and tibiae pale yellowish brown, head darker yellowish brown, gaster blackish brown. Data of 23 workers: HL  $1010.3 \pm 32.3$ , HL/HW  $1.0302 \pm 0.0139$ , SL/HL  $0.9421 \pm 0.0174$ , CLCA  $0.40 \pm 0.17$ , PDCL  $20.82 \pm 4.13$ , nHS  $21.26 \pm 7.30$ , nHHT  $22.35 \pm 6.08$ , nBH  $16.35 \pm 3.61$ , nUH  $6.54 \pm 3.44$ , UHL/HL  $0.1087 \pm 0.0100$ , PNHL/HL  $0.1516 \pm 0.0095$ .

**Queen**: Only 1 specimen seen. Scape short. **Mesosoma**: very flat. **Scale**: with slightly convex sides, moderately converging dorsad; dorsal crest emarginate. **Scape**: pubescence 30-45°, no clear separation between pubescence and setae; setae 30-70°, max. 63  $\mu\text{m}$ . **Hind tibia**: pubescence relatively smooth 15-25°; setae 30-85°, max. 99  $\mu\text{m}$ . **Surface characters**: frontal head with relatively weak microreticulum and micropunctures of 6  $\mu\text{m}$  diameter and 13-19  $\mu\text{m}$  central distance; pubescence of frontal head 30°, PLF  $\pm 43 \mu\text{m}$ . Clypeal pubescence sparse. **Colour**: concolorous pale yellowish brown, frons of head and occiput a little darker. Data of 1 queen (in brackets data of YAMAUCHI & HAYASHIDA 1970):

HL 1518 (1510-1580), HW 1693 (1660-1820), AL 2796, HL/HW 0.897 (0.888), SL/HL 0.808 (0.803), SL/HW 0.724 (0.713), AH/AL 0.475, PDCL 32.5, nHS 28, nHHT 20, nBH 11, nUH 2, PNHL 135.

#### Comments:

Compared to the Japanese main population, the specimens from the islands Tsushima and Iki are on average more hairy and have a more clearly excavated occiput. They differ further in being concolorous pale yellowish-reddish brown if no artefact of 12 years ethanol storage. *L. hayashi* can be separated from *japonicus* by its shorter scape, broader head, more convex and converging petiole sides, shorter frontal pubescence and different colour pattern of head.

#### Biology and distribution [according to YAMAUCHI (1978, 1979) and YAMAUCHI, ITO & SUZUKI (1986)]:

*L. hayashi* is distributed all over Japan from 32° N to 45° N and it is found on the Kuriles and in Korea. The upper altitudinal limit at 44° N is 600 m (Hokkaido) and 1600 m at 34° N (Shikoku). The main habitat is inside or at the margins of shaded deciduous woodland with large trees. The nests are mostly constructed within the rootsystems or in hollow tree trunks of large deciduous trees and sometimes in rotten logs. Carton nest structures were observed. Being active in Sapporo to mid November, *L. hayashi* has a longer foraging season than sympatric *japonicus* and *sakagami*. It covers its foraging paths almost completely with macerated plant and humus materials both on the tree trunks and on the ground near the tree where Homoptera are kept as important food suppliers. Flights were observed from early July to late August and start in the late evening at light intensities of only 10-0 lux and air temperatures of 22-24 °C. Air movements and rain stop the flight.

#### 6.35. *LASIUS PRODUCTUS* Wilson, 1955

*Lasius productus* Wilson, 1955; [description]

#### Material studied:

Japan (11,4)

#### Description:

**Worker** (Fig. 38): **Head**: longest head and longest scape of the subgenus. HL/HW (900) 1.142, SL/HL (900) 1.100. mandibles with 8-9 teeth ( $8.45 \pm 0.52$ ,  $n = 11$ ). Clypeal carina blunt, difficult to define in length, sometimes completely absent. **Mesosoma**: propodeal dome in lateral view rounded and clearly lower than in *coloratus*. **Scale**: in frontal view rather wide, widest above the point of half height; sides convex, slightly converging to a wide dorsal crest which is straight or weakly emarginate; in lateral view relatively thick and low, with a strongly convex anterior and straight posterior profile. **Scape**: pubescence 25°; setae short, difficult to separate from pubescence, majority just projecting 20 µm, max. 39 µm, 20-40°. **Hind tibia**: pubescence smooth, 0-5°; setae concentrated to proximal half, there 40-75° and max. 69 µm, at distal half often several almost appressed setae. **Surface characters**: Frontal head: overall impression shining; pubescence relatively short, PLF  $26.1 \pm 2.5$  µm, 20°; microreticulum very clearly developed, interspaces shining; micropunctures at base of pubescence hairs because of well-developed microreticulum barely visible, with 4-6 µm diameter and 12-21 µm central distance. **Colour**: mesosoma yellowish-reddish, head darker reddish brown, gaster varying between blackish brown and reddish brown. Data of 23 workers:

HL  $1114.7 \pm 60.0$ , HL/HW  $1.1019 \pm 0.0184$ , SL/HL  $1.0833 \pm 0.0178$ , CLCA  $0.41 \pm 0.25$ , PDCL  $18.10 \pm 2.35$ , nHS  $10.64 \pm 7.23$ , nHHT  $9.09 \pm 2.26$ , nBH  $12.09 \pm 2.52$ , nUH  $3.80 \pm 1.40$ , UHL/HL  $0.1060 \pm 0.0128$ , PNHL/HL  $0.1311 \pm 0.0068$ .

**Queen**: According to YAMAUCHI (1978) much bigger than any consubgeneric Japanese species with no size-overlap: SL > 1400, HL > 1600 and SL/HW 0.79-0.84.

### Comments:

The species is easily separated from other *Lasius* by its extreme head and scape length indices.

**Biology and distribution** [according to YAMAUCHI (1978, 1979) and YAMAUCHI, ITO & SUZUKI (1986)]:

*L. productus* seems to be endemic for Japan where it is distributed between 41°N and 32°N (found on all main islands except Hokkaido). The upper altitudinal limit at 41°N is 300 m and 1100 m at 34°N (Shikoku). It is predominantly found in lower mountain areas with woodland and still not confirmed for open lowlands. The nests are mostly constructed around the rootsystems of living trees or in hollow tree trunks. It has the latest flight period of the Japanese species of the subgenus (mid August to mid September).

### 6.36. *LASIUS KOREANUS* n. sp.

#### Material studied:

**Holotype:** worker labelled "Korea, Kaesong, Mts. Pakyon, 20 km NE from Kaesong, 30. Sept. 1971. No 254, leg. S. Horvatovich et J. Papp". **Paratypes:** 1 queen "Korea, Prov. Ryang-gang, Hyesan, Hotel garden, 23. Aug. 1971, No. 194, leg. S. Horvatovich et J. Papp". 1 worker "Korea, Prov. Pyong-sung, Bek-sung-li, Za-mo San, 60 km NE from Pyongyang. No. 304, 1. August 1975, leg. J. Papp et A. Vojnits"; 1 worker "Korea, Prov. Gang-von, district On-dzong, Kum-gang san, along Ok-ru dong, 300-600 m, No. 317. 5. August 1975, leg. J. Papp et A. Vojnits"; 1 worker "Korea, Prov. South Pyongyang, Mts. Guk-san-bong, 40 km NE from Nam-po, 5. Sept. 1971. No. 238, leg. S. Horvatovich et J. Papp"; 12 workers "North Korea, Paekdusan, 1.-18. 8. 1989, Kozanek lgt.". **Depositories:** Görlitz MUS (Holotype), Basel MUS and Werner coll.

#### Description:

**Worker** (Fig. 39): **Head:** scape shorter than in the 5 other species from Pacific Asia, HL/HW (900) 1.097, SL/HL (900) 0.919; mandibles with 8-9 teeth ( $8.19 \pm 0.37$ ,  $n = 8$ ). Clypeal carina sharp but normally limited in length. Relative eye size bigger than in *hayashi*,  $(EL+EW) / (HL+HW) 0.258 \pm 0.008$ . **Mesosoma:** propodeal dome relatively flat and in lateral view obtusely angulate; mesopropodeal depression flat, the anterior propodeal slope and the posterior mesonotal slope form an angle of 135-150°. **Scale:** sides convex, slightly converging towards the weakly emarginate, straight or convex dorsal crest; in lateral view relatively thick and low, with a convex anterior and straight posterior profile. **Scape:** pubescence 5-30°; setae absent or few short hairs present, 30-60°, max. 29  $\mu\text{m}$ . **Hind tibia:** pubescence smooth, 0-5°; setae always present, 40-75°, max. 47  $\mu\text{m}$ . **Surface characters:** Frontal head: the well-developed microsculpture produces a less shining, densely punctate overall surface impression at magnifications  $\leq 80\times$ ; pubescence smooth and very short, 20-25°, PLF  $20.3 \pm 2.2 \mu\text{m}$  ( $n = 9$ ); microreticulum strongly developed, the interspaces between the rugae are shining and are often like flat microfoveae with curved bottom and 9-12  $\mu\text{m}$  diameter. **Colour:** mesosoma medium brown to light reddish brown, head brown to darker reddish brown, gaster varying between blackish brown and dark reddish brown. Data of 9 type workers:

HL  $857.3 \pm 39.8$ , HL/HW  $1.1053 \pm 0.0153$ , SL/HL  $0.9246 \pm 0.0260$ , CLCA  $0.46 \pm 0.22$ , PDCL  $22.60 \pm 5.70$ , nHS  $2.00 \pm 2.14$ , nHHT  $11.00 \pm 4.67$ , nBH  $13.16 \pm 3.03$ , nUH  $4.17 \pm 0.75$ , UHL/HL  $0.0990 \pm 0.0097$ , PNHL/HL  $0.1302 \pm 0.0067$ .

**Queen:** **Head:** mandibles with 10 teeth. **Mesosoma:** very high as in *niger*. **Scale:** slightly convex sides, moderately converging dorsad; dorsal crest emarginate. **Scape:** pubescence rough, 35-40°; setae small and fine, often difficult to separate from pubescence, 30-65°, max. 65  $\mu\text{m}$  (but majority projecting less than 45  $\mu\text{m}$ ). **Hind tibia:** pubescence relatively smooth 0-20°; setae 25-55°, max. 75  $\mu\text{m}$ . **Surface characters:** dorsum of head with the strongest microsculpture known in the subgenus. Frontal head with very clear microrugosity which

is directed parallel to frontal carinae; these microrugae have a distance of 12  $\mu\text{m}$  and are cross-linked in a distance of 16  $\mu\text{m}$  thus forming microfoveae with curved bottom. At magnifications  $< 80\times$  these microfoveae give the frons a densely punctate appearance. Pubescence of frontal head dense,  $30\text{--}40^\circ$ , PLF  $\pm 49\ \mu\text{m}$ . Clypeal pubescence dense. **C o l o u r**: concolourous pale yellowish-reddish brown, dorsum of head a little darker, all appendages yellowish. Data of the type queen: HL 1502, HW 1715, AL 3280, HL/HW 0.876, SL/HL 0.849, SL/HW 0.744, AH/AL 0.613, PDCL 12.0, nHS 24, nHHT 27.5, nBH 23.5, nUH 6.5, PNHL 161.

#### Comments:

The *L. koreanus* worker is an unmistakable combination of diagnostic frontal microsculpture, big eyes and short scape with reduced pilosity. The queen is easily separated from *hayashi* by its much stronger frontal microsculpture, much bigger mesosoma, much larger MH/ML and much lower PDCL. *L. koreanus* seems to be common in Korea, which is indicated by the 6 samples taken by zoologists not specially aiming to collect ants.

#### 7. Names of uncertain taxonomic reference

The following names which probably refer to the subgenus *Lasius* s. str. cannot be interpreted because of insufficient descriptions and loss of type specimens (or inability to identify type specimens within a still existing collection).

*Formica pallida* Latreille, 1798

*Lasius niger* var. *alieno-niger* Forel, 1874

*Lasius niger* var. *alienoides* Forel, 1890; Nomen nudum

*Lasius niger* var. *alienoides* Emery, 1891; Nomen nudum

*Lasius niger emeryi* Ruzsky, 1905

*Acanthomyops niger nitidus* Kuznetsov-Ugamskij, 1927

*Acanthomyops niger alienus* var. *pilicornis* Kuznetsov-Ugamskij, 1927

*Acanthomyops niger alienus* var. *flavidus* Kuznetsov-Ugamskij, 1927

*Acanthomyops niger alienus* var. *turkmenus* Kuznetsov-Ugamskij, 1927

*Acanthomyops niger* var. *minimus* Kuznetsov-Ugamskij, 1928

*Lasius alienus* var. *pannonica* Rösler, 1942

*Lasius transsylvanica* Rösler, 1943

#### 8. Key to workers

The best way of determination for the beginner is in the first step a careful morphometric investigation of nest samples of  $\pm 3$  workers under full consideration of the investigation standards defined in section 3, in the second step to select the most probable species by comparing with data in Tabs. 6 and 7 and then to study descriptions, figures and distribution of the species in question.

The dichotomous key presented here is a simplification of a complicated situation and cannot consider fully the species-specific character combinations. It must be handled with much care and a certain amount of distrust. If the result of determination seems controversial, the procedure mentioned above must be executed. All data given in the keys refer to nest means, if not otherwise stated.

- |   |   |   |
|---|---|---|
| 1 | nHHT + nHS $< 8$ .....  | 2   |
| — | nHHT + nHS $> 8$ .....  | 15  |
| 2 | Dorsal plane of scape with perfectly appressed pubescence, number of mandibular dents $< 7.6$ , pubescence on all surfaces of body perfectly smooth .....   | 3   |
| — | Dorsal plane of scape with pubescence hairs projecting $\leq 5\ \mu\text{m}$ from cuticular surface, number of mandibular dents $> 7.6$ (except <i>turcicus</i> ), pubescence on surface of body not perfectly smooth ..... | 5   |
| 3 | Himalayan region only .....   | <b>brunneus</b> subsp. <b>himalayanus</b> |

- W Palaearctic region ..... 4
- 4 SL/HL <0.890 ..... *brunneus*
- SL/HL > 0.890 ..... *lasioides*
- 5 number of mandibular dents < 7.7, UHL/HL 0.102-0.127, PNHL/HL 0.109-0.129, PDCL < 25.0 which contrasts the rather dense pubescence on frontal head, propodeal dome flat (Fig. 9), clypeal carina weak and incomplete, colour never yellowish; monogynous and polygynous (= *neglectus*) colonies; Asia Minor, Caucasus, S Europe ..... *turcicus*
- number of mandibular dents > 7.7, character combination in at least 2 characters different from *turcicus* ..... 6
- 6 scape very short, SL/HL (900) < 0.890; mesopropodeal depression deep, mesonotum high and vaulted (Fig. 17); mesosoma and appendages pale yellowish brown; cuticular surface of head and mesosoma very shining; pubescence on frontal head very dilute and rather rough on appendages and head sides ; Himalayan region ..... *breviscapus*
- character combination different ..... 7
- 7 at least mesosoma distinctly yellowish, SL/HL (900) > 0.945, propodeal dome flat, mesopropodeal depression shallow (Figs. 18, 41), Asia Minor and mountains of Middle Asia 8
- character combination different ..... 9
- 8 postocular head surface almost without pubescence and brilliantly shining, clypeal pubescence extremely sparse, PDCL > 27; scale wide and higher than upper margin of propodeal spiracle, mesosoma slender (Fig. 18), frontal head and frontal pronotum very shining and with very weak microrugosity which transversal component is more pronounced, frontal head with very weak micropunctures of 2-4  $\mu\text{m}$  diameter, mesosoma and petiole bright yellow; Asia Minor ..... *schulzi*
- postocular head surface with less sparse pubescence and moderately shining, PDCL < 27; scale narrower and lower than upper margin of propodeal spiracle, mesosoma less slender (Fig. 41), frontal head and frontal pronotum moderately shining and with well-developed microreticulum, frontal head with well developed micropunctures of 4-5  $\mu\text{m}$  diameter, mesosoma and petiole yellow with brownish tinge; mountains of Middle Asia ..... *uzbeki*
- 9 scape very long, SL/HL (900) > 0.975; Head broad and with slightly concave occiput, HL/HW (900) 1.045; clypeal carina clearly developed; mesosoma, petiole, coxae and femora reddish brown. Only one series known from Greece. (compare with *emarginatus*) ..... *karpinisi*
- SL/HL (900) < 0.975; head often more elongated, clypeal carina often less developed, colour different ..... 10
- 10 known from Tibet only; 3-6 fine genal setae always present; propodeum distinctly flatter, mesopropodeal depression shallower, pronotal hairs shorter (PNHL/HL 0.120) than in similar Asiatic species, posterior propodeal slope slightly convex (compare with *obscuratus*) ..... *gebaueri*
- distribution different; propodeum higher, pronotal hairs longer ..... 11
- 11 head, mesosoma and gaster with a very dense whitish pubescence often giving a strong contrast to dark cuticula and producing a silky surface appearance; PDCL < 14.5; SL/HL (900) > 0.935; extensor profile of hind tibia normally with 1-5 setae at proximal end; head, mesosoma and gaster dark or blackish brown; Europe and Asia Minor ..... *paralienus*
- PDCL > 14.5 ..... 12
- 12 number of setae in area between propodeal spiracle and metapleural gland < 1.0; nBH < 6.4; nUH frequently < 1.6, PDCL frequently < 20.0, propodeal dome more conic; W Palaearctic species from Spain to Caucasus. .... *alienus*
- number of setae in area between propodeal spiracle and metapleural gland 2-6; nBH > 6.4; nUH frequently > 1.6 ..... 13
- 13 SL/HL (900) < 0.920; UHL/HL > 0.102; nUH 2.5-5, dorsal crest of scale entire or slightly emarginate but as a whole rounded; mountain grasslands of Spain at 1200-1900 m ..... *piliferus*

- SL/HL (900) > 0.910; UHL/HL < 0.104; nUH 1.2-3.4, distribution different ..... 14
- 14 river valleys of W Asian mountains at 1400-2600 m (Caucasus to Pamirs); head and gaster dark brown with a warm tinge. Dorsal crest of scale entire or slightly emarginate but as a whole more rounded and sides of scale more convex than in following species *obscuratus*
- sandy xerothermous grasslands and sandy heath of Europe, exceptionally in xerothermous grasslands on other soils. Head brown without warm tinge. Dorsal crest of scale weakly emarginate or entire, as a whole less rounded ..... *psammophilus*
- 15 number of mandibular dents < 7.8. Paramedian pubescence hairs in posterior dorsum of gaster tergites directed caudomedial or even medial (Fig. 40). Clypeal pubescence extremely sparse (PDCL > 30). Very big body size (HL 948-1448). Broad and massive scale. Clypeal carina very weak or completely reduced. Himalayas ..... *magnus*
- number of mandibular dents > 7.8. Pubescence hairs on whole surface of gaster tergites directed strictly longitudinal. Character combination very different ..... 16
- 16 scape and head very elongated SL/HL (900) > 1.07, HL/HW (900) > 1.12. Big species (HL frequently above 1030). Japan only ..... *productus*
- SL/HL (900) and HL/HW (900) shorter ..... 17
- 17 Iberian Peninsula only. Microreticulum on dorsal head always clearly visible, with more prominent microrugae than usual in the subgenus and the surfaces between the microrugae dull or weakly shining (this effect is produced by very fine micropunctures detectable in these interspaces at magnifications  $\geq 320 \times$ ). Frontal pronotum and whole mesosoma with a transverse microrugosity more prominent than usual in the subgenus and with "ultrastructurally" punctate interspaces producing a dull overall surface appearance as on head. Frontal pubescence short, PLF < 27. Scale in anterior view relatively narrow and high, with almost straight and sub-parallel sides (Fig. 25). Head and gaster blackish brown; mesosoma dark to medium brown with yellowish-reddish tinge ..... *cinereus*
- dorsum of head and pronotum in overall surface appearance not dull (except for E Asian species *coloratus* and *koreanus* but these have no micropunctures in the space between microrugae) ..... 18
- 18 PDCL < 15.5, SL/HL (900) < 0.970, UHL/HL < 0.095, PNHL/HL < 0.130. Portugal to Central Siberia, unknown from Himalayan region and Japan ..... *niger*
- character combination different ..... 19
- 19 PLF < 23 and distributed west of 66° E ..... 20
- PLF > 23; if not, then distributed east of 66° E ..... 21
- 20 PDCL > 17; SL/HL (900) 0.990-1.037. Bicoloured, mesosoma light yellowish red to light reddish brown (Balkan specimens often with brown mesosoma and more concolorous). Europe, Asia Minor, Caucasus ..... *emarginatus*
- PDCL < 17; differs from *emarginatus* further by more rounded head sides (namely genae) and the narrower, more converging scale (Figs. 26, 27). Atlas region of N Africa *tebessae*
- 21 Pamirs, Himalayan region and Tibet ..... 22
- different distribution ..... 25
- 22 UHL/HL 0.135-0.160; SL/HL (900) 0.97-1.00; very numerous and long setae on scape, tibiae and all parts of body (Fig. 31); gaster tergites in median area with extremely dilute or nearly absent pubescence and brilliantly shining; propodeum with relatively flat dome and convex posterior slope which is brilliantly shining because of completely absent pubescence and microsculpture. The final duct part leading caudad to propodeal spiracle is optically pronounced by being less pigmented than surrounding propodeal surface; scale in lateral view only weakly converging towards the very blunt dorsal crest ..... *hirsutus*  
[the worker of *nigrescens* from the Pamirs is unknown, but it can be concluded from the queen situation that it should have a longer scape, longer pronotal setae and a similarly numerous but finer pilosity than *hirsutus*]
- UHL/HL and SL/HL (900) lower, different character combination ..... 23

- 23 surface between propodeal spiracle and the opening of the metapleural gland with 4-10 setae, the longest of which measure 79-103  $\mu\text{m}$ . Sides of scale not or only weakly converging towards dorsal crest (Fig. 29). N Pakistan, Kashmir ..... **wittmeri**
- surface between propodeal spiracle and the opening of the metapleural gland with only 1-5 fine setae, the longest of which measure 46-84  $\mu\text{m}$ . Sides of scale slightly convex, dorsad more or less converging ..... **24**
- 24 nHHT > 10; mesonotum weakly vaulted, mesopropodeal depression shallow (Fig. 30); gaster pale yellowish brown. Tibet ..... **schaeferi**  
nHHT < 10; mesonotum notably vaulted, mesopropodeal depression deeper (Fig. 28); gaster blackish brown. N Pakistan ..... **lawarai**
- 25 mesosoma bright yellow to dark yellow ..... **26**  
— mesosoma dark brown, brown, or pale reddish brown ..... **27**
- 26 SL/HL (900) > 0.96; scape flattened, ratio of maximum to minimum diameter at midpoint > 1.40; pubescence on scape more rough, number of erect setae low (Fig. 20), nHS < 13; frontal head pubescence more dense, contrasting the extremely sparse clypeal pubescence. Asia Minor ..... **flavoniger**  
— SL/HL (900) < 0.95; scape subcylindric, ratio of maximum to minimum diameter at midpoint < 1.40; pubescence on scape not rough, erect setae very numerous (Fig. 19), nHS > 13; frontal head pubescence more dilute. Afghanistan and Turkmenia east to Kirgisia ..... **flavescens**
- 27 W Palaearctic distribution ..... **28**  
— E Asian distribution ..... **29**
- 28 SL/HL (900) < 0.982; HL/HW (900) < 1.070; PNHL/HL > 0.148 ..... **platythorax**  
— SL/HL (900) > 0.982; HL/HW (900) > 1.070; PNHL/HL < 0.148. Iberia, Balearic and Canaric Islands, Azores, Atlas region ..... **grandis**
- 29 whole body and appendages with very numerous and erect setae, nUH > 12.5. Propodeal dome very flat; posterior propodeal slope convex to angulate-convex, transversally striate and whole profile hirsute (Fig. 32). Scale in lateral view very thick, with blunt apex and relatively low; in anterior view rather narrow. SL/HL (900) > 0.975. Japan ..... **sakagamii**  
— nUH < 12.5. Propodeal dome higher and posterior propodeal slope without or only single setae on profile above spiracle. Scale in anterior view wider ..... **30**
- 30 scape short and without or few short setae on dorsal plane (Fig. 39), nHS < 7. SL/HL (900) < 0.945; HL/HW (900) > 1.080; PNHL/HL < 0.140; small size, HL often < 900. Frontal head with strongly developed microreticulum producing a less shining, densely punctate overall surface impression at magnifications  $\leq 80\times$ , the interspaces between the rugae shining and appearing at magnifications often like flat microfoveae with curved bottom at magnifications > 200x. Korea ..... **koreanus**  
— nHS > 7; different character combination ..... **31a, b, c**
- 31a HL/HW (900) > 1.080; SL/HL (900) > 0.960. Pubescence on dorsal scape not as rough as in 31b and 31c, the contrast between setae and pubescence is greater (Fig.23). Anterior clypeal border (sometimes whole clypeus) yellowish to bright orange giving a contrast to darker head which is yellowish brown to blackish brown. Propodeal dome more conic than hemispheric. Pacific Asia from 32°N to 48°N ..... **japonicus**
- 31b Head broad, HL/HW (900) < 1.065; scape rather short, SL/HL(900) < 0.972, SL/HW (1000) < 1.010. Dorsal scape pubescence relatively rough, difficult to separate from the shorter and less erect fraction of setae. Anterior propodeal slope and posterior mesonotum forming an angle of 120-130° (Fig. 37). Colour pattern of head more homogeneous. Japan, Kuriles and Korea ..... **hayashi**
- 31c HL/HW (900) > 1.073, SL/HL (900) > 0.982, SL/HW (1000) > 1.01. Dorsal plane of scape with rough pubescence, difficult to separate from the shorter and less erect fraction of setae. Propodeal dome conspicuous, its anterior slope forms an angle of 100-110° with posterior mesonotum (Fig. 36). Colour pattern of head more homogeneous. E China and Taiwan ..... **coloratus**

### 9. Comparative tables of morphological data

Tab. 6 Data of Palaearctic *Lasius* s. str. workers with no or few standing hairs on dorsal plane of scape and extensor profile of hind tibia ( NHS + NHHT < 10 ). Upper number: arithmetic mean, lower number: standard deviation. Data without standard deviation are only estimations based on few observations. The number below the species name gives the number of measured specimens. For possible deviations of sample size between characters see the species' descriptions.

	HL	HL/HW	HL/HW (900)	SL/HL	SL/HL (900)	PDCI	NHS	NHHT	NBH	NUH	UHL/HL	PNHL/HL	CLCA	PLF	MaDE
<i>brunneus</i> (n = 34)	947.3	1.035	1.044	0.852	0.858	27.6	0.0	0.2	2.3	1.5	0.084	0.093	0.29	20.0	7.0
<i>brunneus</i> ssp. <i>himalayanus</i> (n = 22)	1020.3	1.051	1.074	0.878	0.893	22.1	0.0	0.1	1.4	0.2	0.013	0.106	0.10		7.0
	87.6	0.019	0.013	0.022	0.026	6.3	0.0	0.4	1.2	0.7	0.030	0.010			
<i>lasioides</i> (n = 64)	848.1	1.069	1.059	0.948	0.942	31.4	0.0	0.0	3.2	0.2	0.023	0.113	0.38	23.0	7.02
	42.6	0.015	0.011	0.027	0.027	7.8	0.0	0.0	1.3	0.3	0.036	0.011	0.14		0.53
<i>turcicus</i> (n = 81)	831.3	1.109	1.097	0.943	0.935	31.8	0.2	0.4	9.1	2.4	0.115	0.119	0.34	30.0	7.35
	72.9	0.025	0.016	0.017	0.015	6.4	0.5	0.5	2.4	1.2	0.012	0.010	0.17		0.46
<i>alienus</i> (n = 586)	848.2	1.085	1.078	0.921	0.915	17.3	0.1	0.9	4.7	0.8	0.060	0.144	0.73	26.5	8.11
	47.3	0.019	0.016	0.019	0.019	2.9	0.4	0.8	1.6	0.8	0.038	0.012	0.17	2.2	0.31
<i>psammophilus</i> (n = 378)	843.7	1.074	1.065	0.944	0.937	22.5	0.6	2.3	8.5	2.4	0.094	0.137	0.60	28.8	8.21
	59.5	0.019	0.018	0.023	0.023	4.7	1.0	1.6	2.3	1.0	0.011	0.011	0.23	2.6	0.43
<i>paratienus</i> (n = 241)	897.7	1.077	1.080	0.954	0.953	12.4	0.8	3.6	9.5	2.5	0.110	0.145	0.53	30.0	8.00
	68.5	0.020	0.016	0.017	0.016	1.5	0.8	2.1	3.2	1.0	0.011	0.019	0.22		0.43
<i>piliferus</i> (n = 52)	841.1	1.083	1.072	0.907	0.900	22.5	0.4	2.8	10.5	3.7	0.112	0.145	0.43	29.0	8.0
	51.6	0.018	0.015	0.020	0.019	2.6	0.8	1.4	2.1	1.1	0.010	0.010	0.20		
<i>obscuratus</i> (n = 45)	883.9	1.075	1.072	0.941	0.939	19.4	0.4	3.2	9.6	2.2	0.085	0.144	0.59	30.0	8.1
	54.7	0.017	0.017	0.024	0.021	3.1	0.7	2.1	2.0	1.0	0.011	0.013	0.23		
<i>gebaueri</i> (n = 8)	911.8	1.077	1.079	0.926	0.928	17.6	1.6	2.3	9.2	3.9	0.090	0.120	0.36	30.0	8.2
	43.8	0.010	0.006	0.012	0.011	1.8	1.5	0.8	2.8	1.6	0.012	0.009	0.24		
<i>schulzi</i> (n = 22)	895.3	1.099	1.098	0.975	0.975	43.1	0.2	1.2	15.0	4.0	0.114	0.150	0.28	29.4	8.20
	28.3	0.013	0.011	0.017	0.017	11.4	0.4	0.8	2.8	1.8	0.009	0.009	0.17	2.2	0.42
<i>urbeki</i> (n = 8)	900.2	1.080	1.080	0.967	0.967	23.7	0.1	0.8	10.4	5.0	0.129	0.157	0.31	24.5	8.14
	30.5	0.012	0.010	0.017	0.016	3.8	0.3	0.7	2.2	1.6	0.011	0.012	0.10	1.8	0.48
<i>breviscapus</i> (n = 5)	764.0	1.112	1.086	0.888	0.871	29.1	3.1	2.8	7.5	2.5	0.096	0.142	0.72	30.0	8.2
	41.4	0.006	0.011	0.021	0.018	7.8	2.9	1.2	2.6	0.6	0.011	0.014	0.26		
<i>karpitisi</i> (n = 4)	926.0	1.040	1.045	1.006	1.009	16.1	0.0	3.8	9.5	2.5	0.092	0.100	0.80	30.0	8.25
	41.9	0.023	0.020	0.012	0.011	2.7	0.0	2.5	2.0	0.6	0.004	0.021	0.04		

Tab. 7 Morphological data of Palaearctic *Lasius* s.str. workers with higher numbers of standing hairs on dorsal plane of scape and extensor profile of hind tibia (NHS + NHHT > 10 ). Arrangement of data as in Tab. 6

	HL	HL/HW	HL/HW (900)	SL/HL	SL/HL (900)	PDCL	NHS	NHHT	NBH	NUH	UHL/HL	PNHL/HL	CLCA	PLF	MaDe
<i>niger</i> (n = 206)	981.4	1.059	1.077	0.938	0.951	13.0	16.0	17.7	> 10	> 8	0.084	0.119	0.42	30.5	8.22
<i>platythorax</i> (n = 168)	72.7	0.021	0.018	0.019	0.018	2.6	3.8	3.9	> 10	> 8	0.010	0.009	0.15	2.0	0.40
<i>japonicus</i> (n = 87)	75.5	0.023	0.017	0.020	0.019	6.1	6.0	6.0	> 10	> 8	0.129	0.159	0.56	32.5	8.25
<i>grandis</i> (n = 156)	982.3	1.064	1.079	0.971	0.981	18.7	15.7	16.9	17.4	9.0	0.110	0.145	0.45	28.2	8.14
<i>citineus</i> (n = 34)	70.0	0.026	0.019	0.022	0.020	3.4	4.7	4.4	3.8	3.4	0.010	0.010	0.22	2.6	0.42
<i>emarginatus</i> (n = 97)	1037.5	1.066	1.092	0.985	1.002	19.4	22.8	25.7	> 10	> 8	0.117	0.137	0.74	28.8	8.48
<i>tebessa</i> (n = 10)	65.7	0.025	0.020	0.025	0.021	5.0	7.3	6.8	> 10	> 8	0.013	0.011	0.18	4.3	0.51
<i>flavescens</i> (n = 8)	917.0	1.103	1.106	0.980	0.982	20.5	22.2	21.7	> 10	> 8	0.104	0.134	0.54	24.3	8.00
<i>flavoniger</i> (n = 5)	62.7	0.020	0.016	0.023	0.016	5.1	3.6	2.5	> 10	> 7	0.014	0.009	0.19	2.5	0.50
<i>nigrescens</i> (prediction)	1001.9	1.078	1.097	1.002	1.014	27.3	12.8	20.6	> 10	> 7	0.116	0.136	0.43	20.3	8.67
<i>lawarai</i> (n = 19)	73.5	0.025	0.020	0.024	0.023	7.3	9.6	8.2	> 10	> 7	0.012	0.012	0.25	2.0	0.48
<i>wittmeri</i> (n = 11)	964.5	1.079	1.091	0.988	0.996	13.6	7.8	11.8	> 8	> 4	0.132	0.148	0.54	20.7	8.28
<i>schaeferi</i> (n = 4)	35.4	0.013	0.014	0.018	0.016	1.4	3.5	2.0	> 10	> 8	0.013	0.005	0.16	2.0	0.48
<i>hirsutus</i> (n = 6)	860.1	1.085	1.078	0.923	0.918	27.5	23.0	25.4	> 10	> 8	0.116	0.134	0.41	28.4	8.2
<i>magnus</i> (n = 54)	58.8	0.027	0.018	0.020	0.015	6.4	5.4	4.1	> 10	> 8	0.007	0.012	0.24	2.6	0.48
	913.0	1.092	1.094	0.979	0.981	41.2	8.2	25.2	28.2	12.6	0.124	0.154	0.14	30.0	8.0
	26.4	0.008	0.006	0.009	0.007	6.1	2.5	3.1	2.6	1.3	0.006	0.011	0.09	30.0	8.0
			1.064		1.025	25.6	35	36							
<i>lararai</i> (n = 19)	863.1	1.110	1.104	0.923	0.918	19.2	12.4	7.2	9.3	3.2	0.105	0.146	0.53	26.9	8.82
<i>wittmeri</i> (n = 11)	48.4	0.023	0.022	0.018	0.020	5.1	5.9	3.2	2.8	1.5	0.011	0.013	0.22	2.0	0.60
<i>schaeferi</i> (n = 4)	868.4	1.097	1.091	0.944	0.940	22.8	17.2	20.4	13.0	10.0	0.117	0.146	0.31	30.0	8.75
<i>hirsutus</i> (n = 6)	39.7	0.016	0.019	0.014	0.013	4.0	5.3	7.2	2.3	3.2	0.012	0.010	0.14	2.9	0.48
<i>magnus</i> (n = 54)	858.2	1.112	1.105	0.932	0.927	20.9	16.2	16.5	15.9	6.5	0.115	0.150	0.41	23.0	8.0
	26.9	0.003	0.007	0.002	0.002	3.4	2.6	3.3	3.5	2.1	0.015	0.010	0.25	2.5	0.48
	951.0	1.075	1.084	0.977	0.984	29.1	30.0	35.0	27.3	23.7	0.147	0.130	0.36	33.6	8.5
	59.5	0.028	0.018	0.011	0.008	4.0	4.4	4.9	3.6	6.1	0.006	0.007	0.04	1.9	0.48
	1197.1	1.078	1.099	0.944	0.980	47.9	19.8	25.1	12.6	4.8	0.076	0.115	0.23	30.6	7.21
	109.6	0.023	0.022	0.023	0.017	12.8	5.5	4.7	3.0	2.9	0.017	0.010	0.17	3.5	0.47

	HL	HL/HW	HL/HW (900)	SL/HL	SL/HL (900)	SL/HL (900)	PDCI	NHS	NHHT	NBH	NUH	UHL/HL	PNHL/HL	CLCA	PLF	MaDe
<i>sakagami</i> (n = 11)	914.2	1.087	1.090	1.000	1.001	1.001	14.6	29.9	27.8	23.6	18.0	0.104	0.150	0.47	27.7	8.60
<i>coloratus</i> (n = 12)	52.6	0.025	0.018	0.023	0.023	0.023	2.7	6.1	5.4	3.7	4.7	0.012	0.009	0.20	2.5	0.55
<i>hayashi</i> (n = 23)	987.6	1.076	1.093	0.985	0.995	0.995	19.9	24.8	26.1	15.3	7.2	0.092	0.149	0.57	24.1	8.33
<i>koreanus</i> (n = 9)	61.7	0.022	0.020	0.017	0.013	0.013	4.6	5.6	3.8	3.0	1.8	0.014	0.013	0.21	3.5	0.49
<i>productus</i> (n = 11)	1010.3	1.030	1.051	0.942	0.956	0.956	20.8	21.3	22.4	16.4	6.5	0.109	0.152	0.40	23.5	8.00
	32.3	0.014	0.014	0.017	0.016	0.016	4.1	7.3	6.1	3.6	3.4	0.010	0.010	0.17	2.8	0.50
	857.3	1.105	1.097	0.925	0.919	0.919	22.6	2.0	11.0	13.2	4.2	0.099	0.130	0.46	20.2	8.19
	39.8	0.015	0.015	0.026	0.028	0.028	5.7	2.1	4.7	3.0	0.8	0.010	0.007	0.22	2.2	0.37
	1114.7	1.102	1.142	1.083	1.110	1.110	18.1	10.6	9.1	12.1	3.8	0.106	0.131	0.41	26.1	8.45
	60.0	0.018	0.019	0.018	0.014	0.014	2.4	7.2	2.3	2.5	1.4	0.013	0.007	0.25	2.5	0.52

Tab. 8 Morphological data of Palaearctic *Laxius* s. str. queens with no or few standing hairs on dorsal plane of scape. Upper number = arithmetic mean, lower number = standard deviation, number below the species name = number of measured specimens.

	HL	HW	ML	HL/HW	SL/HL	SL/HW	MH/MH	PDC/L	NHS	NHHT	NBH	NUH	PNHL
<i>brunneus</i> (n = 9)	1384.7 28.1	1541.4 42.1	2647.8 108.9	0.898 0.010	0.789 0.007	0.709 0.008	0.460 0.009	21.4 2.1	0.2 0.7	1.1 1.2	1.0 1.6	2.1 1.3	131.8 12.1
<i>lasioides</i> (n = 7)	1234.9 26.8	1396.3 50.4	2470.9 64.7	0.885 0.024	0.887 0.014	0.785 0.019	0.462 0.017	20.9 4.7	0.0 0.0	0.0 0.0	1.1 0.8	0.7 1.1	139.1 12.4
<i>lasioides</i> Iran (n = 4)	1298.0 7.3	1480.5 4.4	2772.0 21.6	0.877 0.008	0.878 0.023	0.770 0.022	0.480 0.014	23.4 3.1	3.5 4.5	1.8 1.3	6.8 3.9	4.5 1.7	163.5 10.5
<i>turcicus</i> (n = 9)	1230.0 36.1	1380.6 28.8	2533.4 67.1	0.891 0.010	0.861 0.022	0.767 0.020	0.498 0.026	22.3 7.1	1.4 1.9	2.4 2.8	13.6 2.4	6.2 1.3	164.2 14.4
<i>alienus</i> (n = 50)	1383.2 40.2	1542.0 47.2	2914.9 103.7	0.897 0.014	0.839 0.018	0.753 0.019	0.581 0.018	14.0 2.5	2.4 1.6	5.2 2.6	0.9 1.2	0.5 0.6	178.7 14.2
<i>psammophilus</i> (n = 47)	1417.2 31.8	1612.9 39.0	3041.2 101.3	0.878 0.014	0.859 0.024	0.754 0.022	0.581 0.018	16.4 3.1	8.0 5.8	13.5 6.0	7.8 3.4	3.7 1.8	173.0 6.1
<i>obscuratus</i> (n = 11)	1384.3 26.2	1535.4 17.3	2832.9 148.7	0.901 0.015	0.866 0.012	0.780 0.017	0.579 0.026	16.7 2.4	7.6 3.6	12.9 3.9	8.6 3.5	2.8 2.2	178.2 13.7
<i>paralienus</i> (n = 27)	1511.4 64.0	1689.4 82.1	3235.9 109.1	0.893 0.016	0.868 0.022	0.775 0.020	0.615 0.013	10.9 1.1	7.0 3.6	11.1 6.1	9.3 5.2	4.2 2.7	193.1 15.5
<i>schulzi</i> (n = 1)	1268	1367	2530	0.927	0.870	0.806	0.425	55.2	0	8	16.5	6	185

Tab. 9 Morphologic data of Palearctic *Lasius* s. str. queens with many standing hairs on dorsal plane of scape Upper number = arithmetic mean, lower number = standard deviation, number below the species name = number of measured specimens.

	HL	HW	ML	HL/HW	SL/HL	SL/HW	MH/MH	PDCL	NHS	NHHT	NBH	NUH	PNHL
<i>niger</i> (n = 122)	1430.1 40.9	1617.3 50.0	3011.3 116.4	0.884 0.013	0.851 0.017	0.753 0.015	0.598 0.017	11.2 1.4	20.2 6.8	23.9 5.2	>10	> 8	166.6 11.5
<i>platythorax</i> (n = 69)	1388.2 31.7	1568.9 42.3	2781.9 96.0	0.885 0.019	0.856 0.020	0.758 0.025	0.532 0.021	24.6 8.0	24.8 7.6	29.9 6.4	> 10	> 8	190.7 9.3
<i>granidis</i> (n = 6)	1529.8 49.0	1674.8 57.2	3078.8 113.7	0.914 0.013	0.863 0.015	0.788 0.014	0.506 0.018	23.1 6.9	30.3 7.3	35.4 5.8	> 10	> 8	181.0 12.3
<i>emarginatus</i> (n = 39)	1454.6 36.8	1592.2 44.7	2924.8 118.5	0.914 0.021	0.891 0.025	0.814 0.027	0.481 0.013	27.5 8.5	20.4 9.3	27.7 8.3	> 10	> 8	177.3 13.6
<i>tebessae</i> (n = 4)	1453.5 25.1	1568.2 24.6	2847.5 61.2	0.927 0.016	0.865 0.016	0.804 0.012	0.510 0.014	13.2 1.1	17.5 11.9	19.2 3.8	> 7	> 4	167.2 22.2
<i>nigrescens</i> (n = 5)	1322.6 17.8	1494.0 19.2	3042.8 51.0	0.885 0.010	0.925 0.009	0.818 0.013	0.522 0.005	22.3 1.1	44.2 5.4	48.4 10.4	36.0 8.3	32.0 8.0	200.6 6.4
<i>schaeferi</i> (n = 1)	1457	1560	2828	0.934	0.859	0.802	0.609	14.6	42	36	18	5	183
<i>magnus</i> (n = 2)	1774.5 37.7	2035.5 15.5	3570.5 171.5	0.872 0.025	0.831 0.014	0.724 0.008	0.521 0.004	33.0 3.8	11.5 4.5	19.0 4.0	4.2 0.8	4.5 3.5	216.5 11.5
<i>japonicus</i> (n = 7)	1445.0 58.1	1609.0 82.0	2740.1 158.0	0.898 0.014	0.852 0.014	0.765 0.010	0.537 0.010	14.2 1.4	24.6 3.7	28.6 4.9	> 10	> 8	195.1 10.7
<i>sakagamii</i> (n = 2)	1444.0 38.0	1591.5 33.5	3043.5 169.5	0.907 0.005	0.858 0.008	0.779 0.010	0.562 0.012	15.0 2.0	36.0 4.0	37.0 3.0	30.0 3.0	17.0 9.0	181.0 2.0
<i>hayashi</i> (n = 1)	1518	1693	2796	0.897	0.808	0.724	0.475	32.5	28	20	11	2	135
<i>koreanus</i> (n = 1)	1502	1715	3280	0.876	0.849	0.744	0.613	12.0	24	27.5	23.5	6.5	161
<i>productus</i> (data of Yamauchi)	1700	1850		0.919	0.888	0.816							

10. Figures

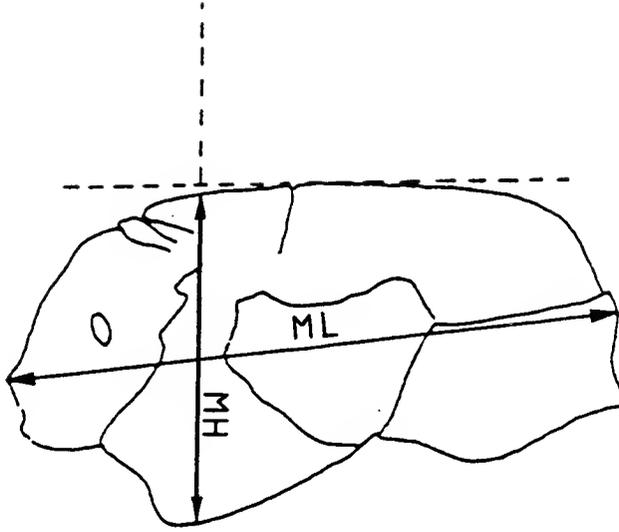


Fig. 1 Mode of measuring mesosoma length **ML** and mesosoma height **MH** in queens of *Lasius* ssp.

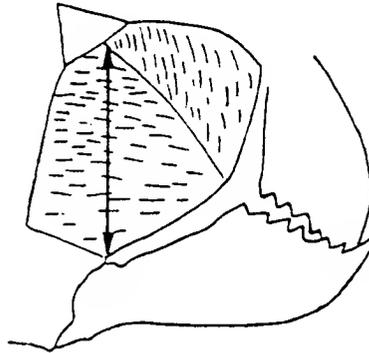


Fig. 2 Mode of measuring pubescence distance on clypeus (PDCL) in dorsolateral view. The double arrow indicates the counting/measuring line.

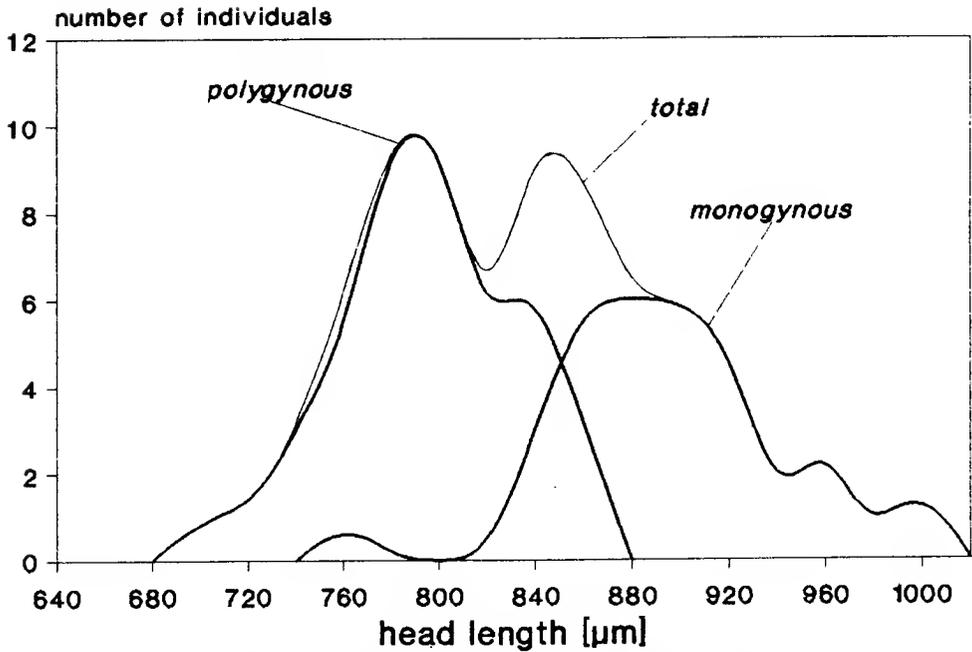


Fig. 3 Bimodal size distribution of 75 individual workers of *Lasius turcicus* Santschi. The specimens originate from 16 nest samples with mean head lengths < 835 (proved or interpreted as polygynous) and 11 nest samples with mean head lengths > 855 (interpreted as monogynous).

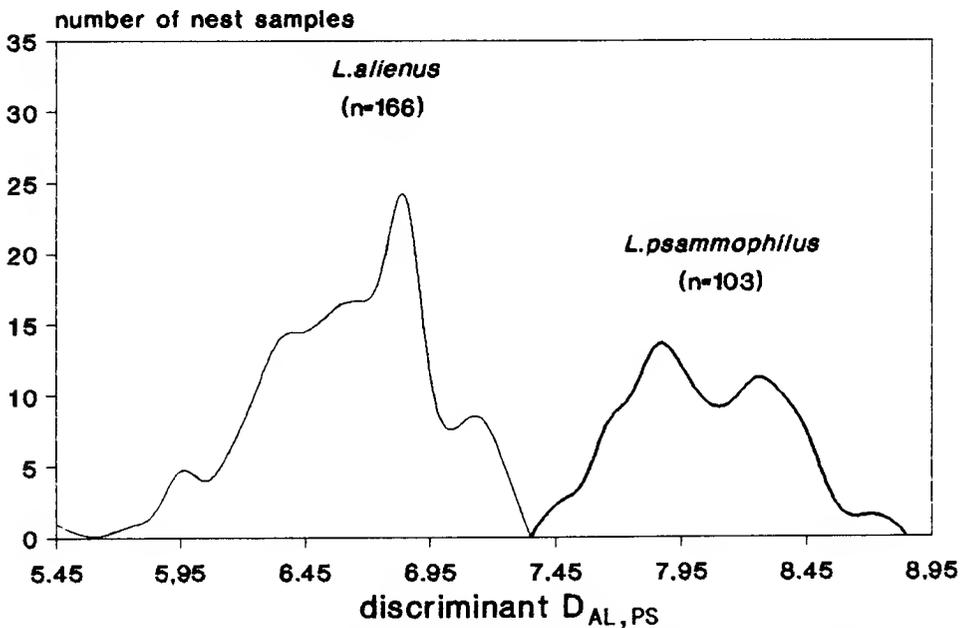


Fig. 4 Discriminant  $D_{AL,PS}$  to separate nest samples of *Lasius alienus* (Förster) and *Lasius psammophilus* n. sp. computed by a linear discriminant function with 4 morphometric characters

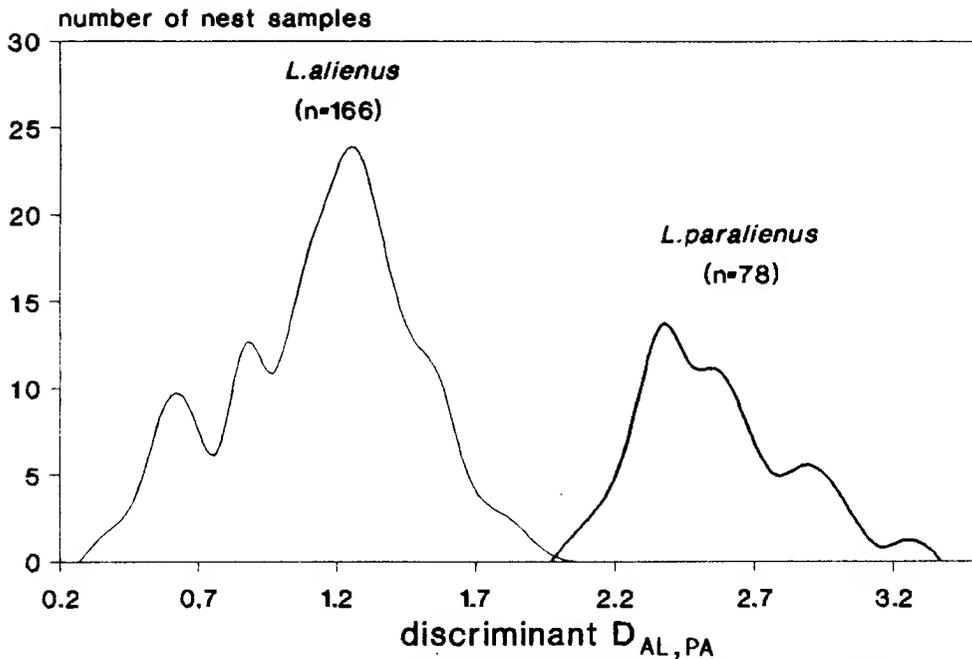


Fig. 5 Discriminant  $D_{AL,PA}$  to separate nest samples of *Lasius alienus* (Förster) and *Lasius paralienus* n. sp. computed by a linear discriminant function with 4 morphometric characters.

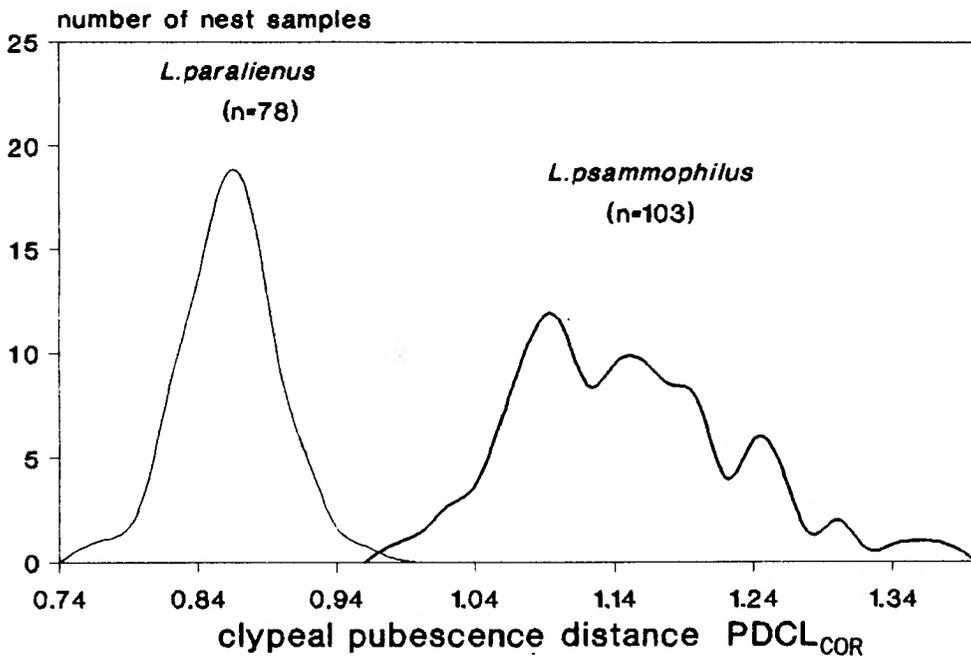


Fig. 6 Discriminant  $PDCL_{COR}$  to separate nest samples of *Lasius paralienus* n. sp. *Lasius psammophilus* n. sp. computed as square-root-transformed and size-corrected clypeal pubescence distance

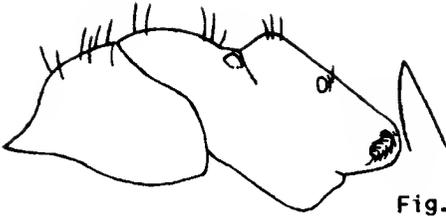


Fig. 7 *BRUNNEUS*

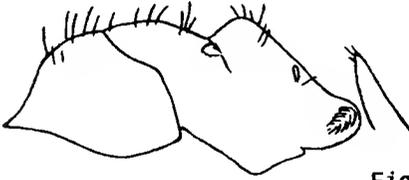
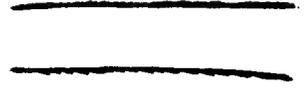


Fig. 8 *LASIOIDES*

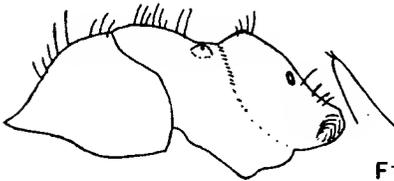
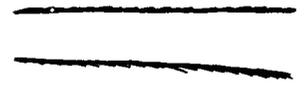


Fig. 9 *TURCICUS*

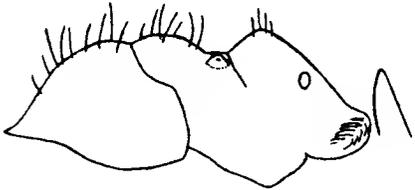
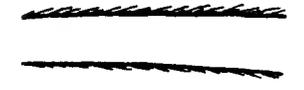


Fig. 10 *ALIENUS*

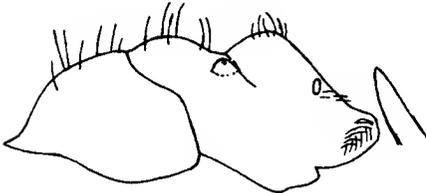
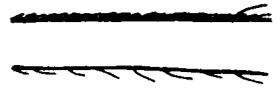


Fig. 11 *PSAMMOPHILUS*

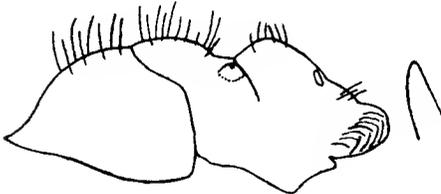
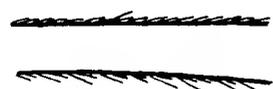


Fig. 12 *PARALIENUS*



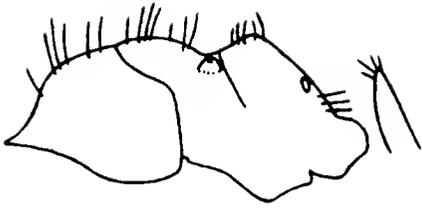


Fig. 13 *PILIFERUS*

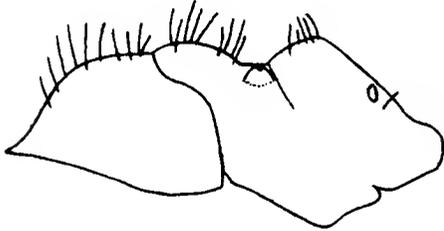
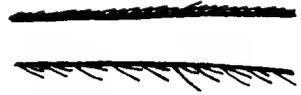


Fig. 14 *OBSCURATUS*

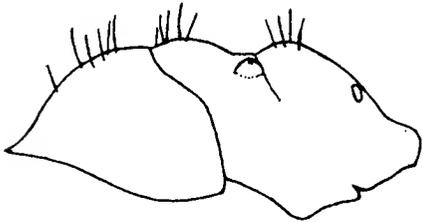


Fig. 15 *GEBAUERI*

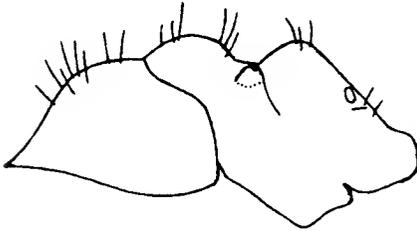


Fig. 16 *KARPINISI*

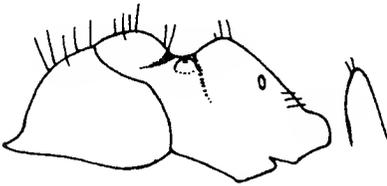
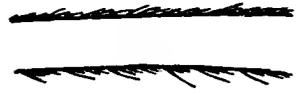


Fig. 17 *BREVISCAPUS*

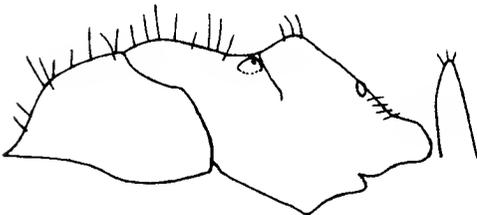


Fig. 18 *SCHULZI*



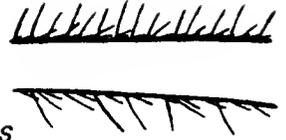
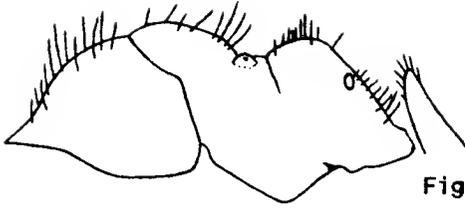


Fig. 19 *FLAVESCENS*

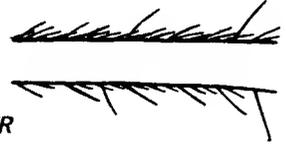
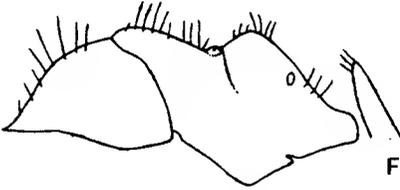


Fig. 20 *FLAVONIGER*

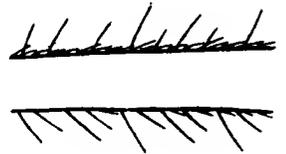
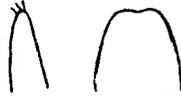
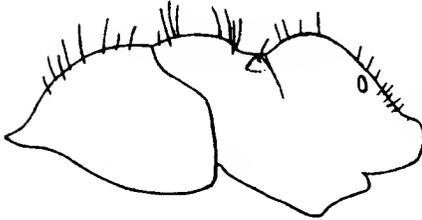


Fig. 21 *NIGER*

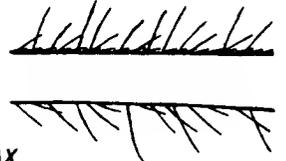
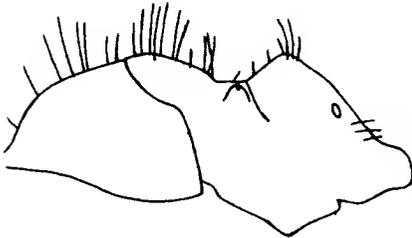


Fig. 22 *PLATYTHORAX*

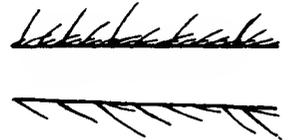
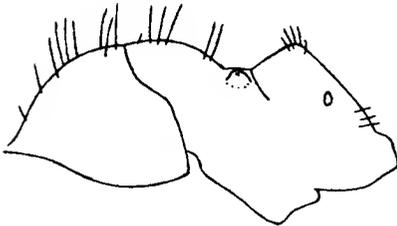


Fig. 23 *JAPONICUS*

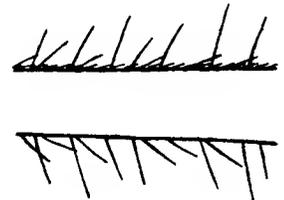
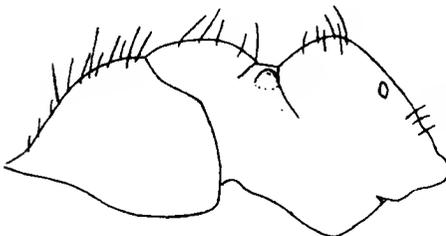


Fig. 24 *GRANDIS*

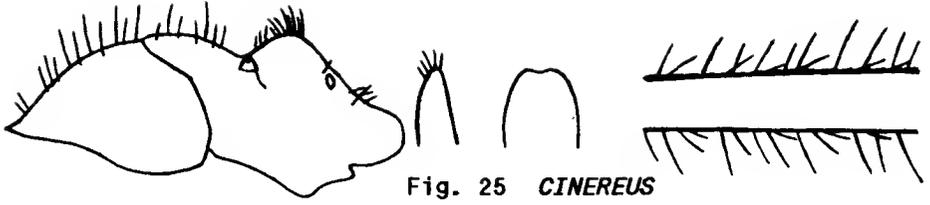


Fig. 25 *CINEREUS*

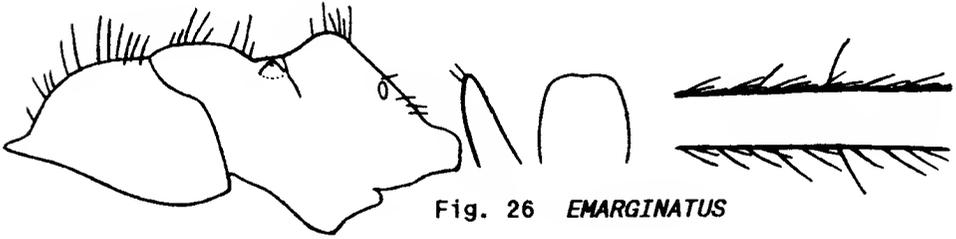


Fig. 26 *EMARGINATUS*

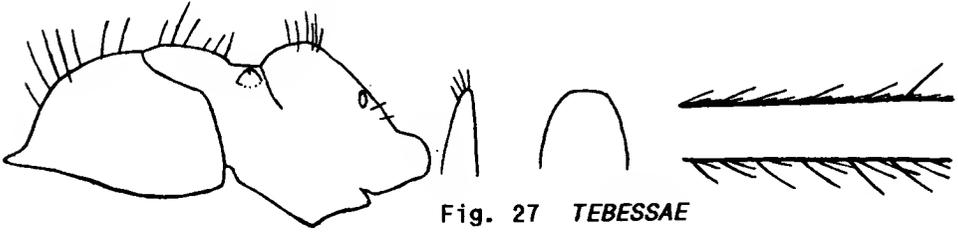


Fig. 27 *TEBESSAE*

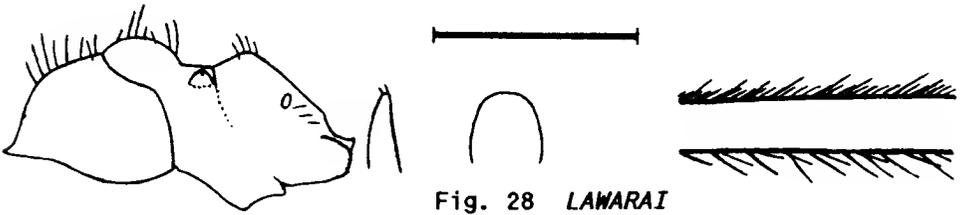


Fig. 28 *LAWARAI*

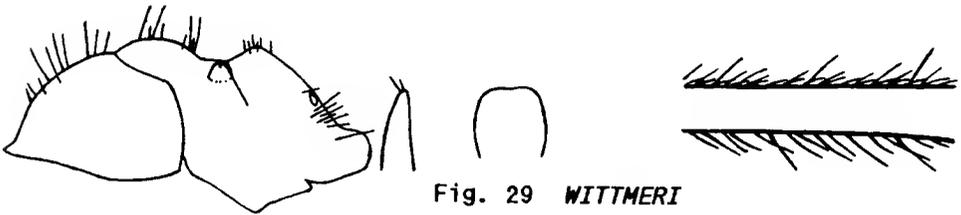


Fig. 29 *WITTMERI*

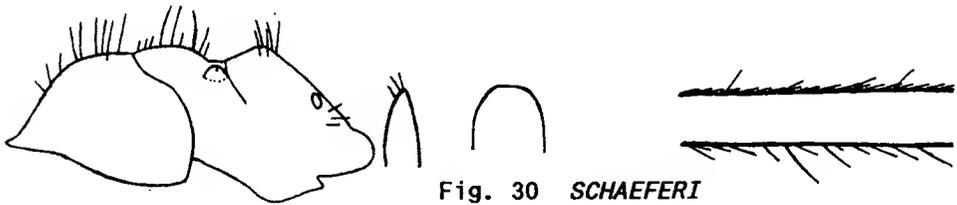


Fig. 30 *SCHAEFERI*



Fig. 31 *HIRSUTUS*

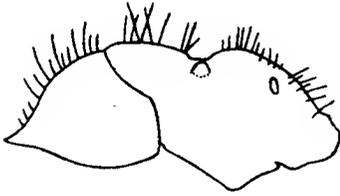


Fig. 32 *SAKAGAMII*

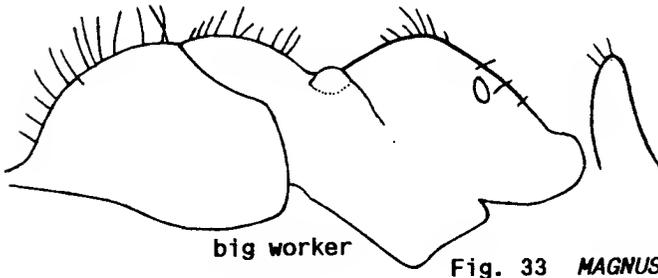


Fig. 33 *MAGNUS*

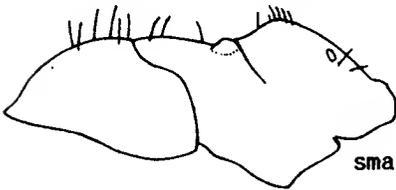


Fig. 34 *MAGNUS*



Fig. 35 *MAGNUS*  
big worker

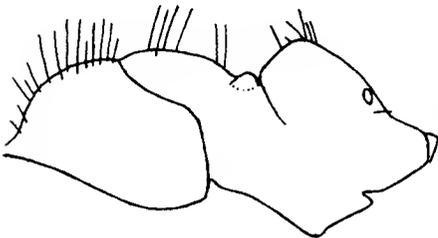


Fig. 36 *COLORATUS*

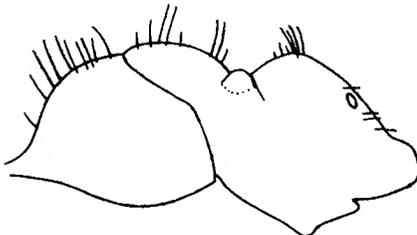
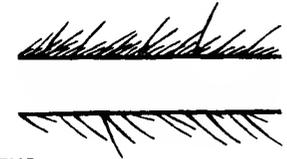
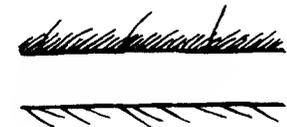


Fig. 37 *HAYASHI*



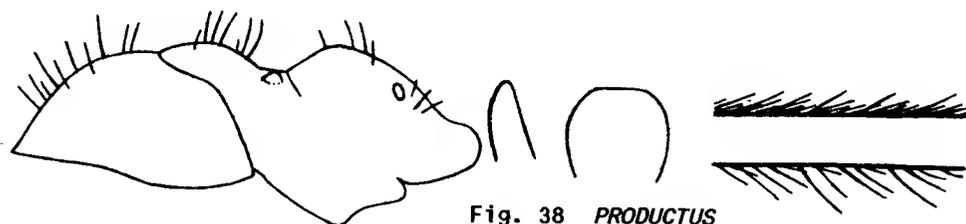


Fig. 38 *PRODUCTUS*

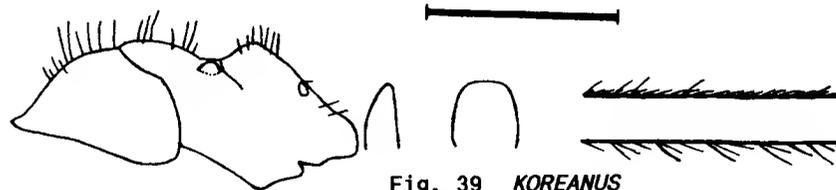


Fig. 39 *KOREANUS*

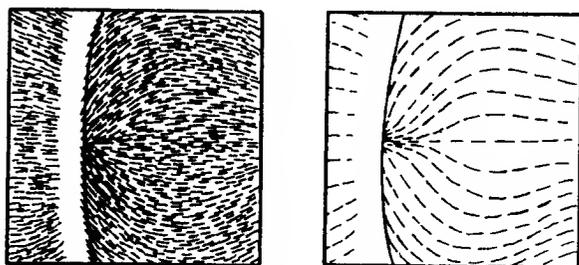


Fig. 40 *MAGNUS*



Fig. 41 *UZBEKI*

Figs. 7-39, 41 Body parts of workers of 32 species of *Lasius*. Lateral view of mesosoma and petiolar scale, caudal view of petiolar scale (pilosity omitted). Scape at midpoint as seen in transmitted-light and with small diameter in plane of paper; the dorsal/ventral margins of the drawing represent the dorsal/ventral plane of scape which have often differing pilosity and pubescence conditions. The scale bar equals 618  $\mu\text{m}$  in case of mesosoma and petiolar scale but 195  $\mu\text{m}$  in case of scape.

Fig. 40 Pubescence pattern in median portion of border region between 2nd and 3rd gaster tergite in *Lasius magnus* n. sp. The caudal direction is to the left. The sides of both squares measure 512  $\mu\text{m}$ . The left square depicts the natural situation and the right square gives a schematic view of the pubescence orientation.

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