Lasius austriacus sp.n., a Central European Ant Related to the Invasive Species *Lasius neglectus*

by

Birgit C. Schlick-Steiner[1], Florian M. Steiner[1], Stefan Schödl[2] & Bernhard Seifert[3]

ABSTRACT

Lasius austriacus sp.n., a xerothermophilic ant with mainly subterranean life habits, is described. The new species is related to the pest ant *L. neglectus* Van Loon, Boomsma & Andrasfalvy 1990 and *L. turcicus* Santschi 1921. *L. austriacus* was found to be associated with the grass mealybug *Euripersia europaea* Newstead 1897. The presently known distribution range is restricted to Austria (three populations) and the Czech Republic (one population), the Czech population so far had erroneously been referred to as the only known *L. neglectus* population in a natural habitat in Europe. *L. austriacus* offers an opportunity to elucidate the evolution of the notorious pest species *L. neglectus*.

Key words: Hymenoptera, Formicidae, *Lasius austriacus*, new species, taxonomic description, SEM, Austria, Czech Republic

INTRODUCTION

The Palaearctic *brunneus* group of the subgenus *Lasius* s.str. presently contains *L. brunneus* (Latreille 1798), *L. himalayanus* Forel 1917, *L. lasoides* (Emery 1869), *L. neglectus* Van Loon, Boomsma & Andrasfalvy 1990 and *L. turcicus* Santschi 1921. *L. neglectus* has gained a doubtful reputation. The species probably originates from Asia Minor and has every characteristic of a tramp species (Passera 1994); it is currently spreading all over Europe (Seifert 2000). Its potential impact on the native ant fauna is comparable to that of *Linepithema humile* (Mayr 1868) (Espadaler & Rey 2001, *cf.* Giraud *et al.* 2002). The need to remedy this situation has made *L. neglectus* the object of intense investigations with respect to phylogeny, ecology, biology and social organization. *L. austriacus* sp.n. is related to *L. neglectus* and offers an opportunity to elucidate the evolution of the notorious pest species.

[1]Institut für Zoologie, Universität für Bodenkultur, Gregor-Mendel-Str. 33, A-1180 Wien, AUSTRIA. E-mail: h9304696@edv1.boku.ac.at

[2]Naturhistorisches Museum, Internationales Forschungsinstitut für Insektenkunde der 2. Zoologischen Abteilung, Burgring 7, A-1014 Wien, AUSTRIA. E-mail: stefan.schoedl@nhm-wien.ac.at

[3]Staatliches Museum für Naturkunde Görlitz, PSF 300154, D-02826 Görlitz, GERMANY. E-mail: bernhard.seifert@smng.smwk.sachsen.de

MATERIAL AND METHODS

Lasius austriacus sp.n. was studied based on individuals from > 50 nests of three populations (Feldberg & Braunsberg in Austria, Hnanice in the Czech Republic): > 200 workers (32 specimens from 11 nests measured biometrically), > 50 gynes and > 100 males.

Dry-mounted specimens were fixed on a pin-holding goniometer that permitted rotations around three axes. A Wild M10 dissection microscope with a 1.6 x planapochromatic lens and a cross-scaled ocular micrometer was used at magnifications of 50 - 320 x. The highest magnification that kept a structure within the range of the ocular micrometer was used. To avoid rounding errors, all measurements were recorded in µm, even for characters for which a precision of ± 1 µm is impossible. In order to reduce reflections of the cuticular surfaces and to improve visualization of the microsculpture, a plastic diffuser was positioned as close as possible to the specimen. Setae were distinguished from pubescence hairs by their distinctly larger basal diameter. Seta counts (nSC, nHT, nOCC, nGU, nGEN, nST) apply to erect setae projecting > 20 µm from the silhouette of the cuticular surface as observed under transmitted light.

Morphometric characters:

a - Shortest distance between the junction anterior cubital vein/ cubito-anal crossvein and the proximal end of discoidal cell. On gyne forewing.

b - Shortest distance along anterior cubital vein from proximal to distal end of first discoidal cell. On gyne forewing.

CL - Maximum cephalic length along the median line (the head must be carefully tilted to the position with the true maximum). Excavations of occiput and/or clypeus reduce CL.

CS - Arithmetic mean of CL and CW as a less variable indicator of body size.

CW - Maximum cephalic width (across, behind, or in front of the eyes).

dCLAN - Shortest distance from posterior clypeal suture (PCS) to inner margin of antennal sockets. If no surface structure indicates the position of PCS, the centre of the dark line is taken as one measuring point.

EYE - Eye-size index EYE = (EL + EW) / (CL + CW). The arithmetic mean of the large (EL) and small diameter (EW) of the elliptic compound eye is divided by CS.

GUHL - Maximum length of setae on underside of head (gula).

MaDe - Number of dents on masticatory border of mandible. Mean value of the two mandibles.

nGEN - Number of setae projecting from genae in full face view. Mean value of the two genae.

nGU - Number of setae on gula as seen in full profile. Mean value of the two gulae.

nHT - Number of setae on extensor profile of hind tibia. Mean value of the two tibiae.

nOCC - Number of setae projecting between occipital margin of the head and caudal end of eye, counted in full face view and in measuring position for CL. The bilateral number is halved.

nSC - Number of setae on dorsal plane of scape, counted with view on the small scape diameter. Mean value of the two scapes.

nST - Number of setae on the area between lower margin of propodeal spiracle and upper margin of the bulla glandulae metapleuralis. The bilateral number is halved.

PLF - Mean length of pubescence hairs on head between the frontal carinae. Mean values of 6 measurements in each individual.

PNHL - Maximum length of pronotal setae.

PoOc - Postocular distance in measuring position of CL. Caudal measuring point: median occipital margin; frontal measuring point: median head at the level of the posterior eye margin. Mean value of the left and right postocular distance, as many heads are asymmetric.

SL - Maximum straight line scape length excluding the articular condyle.

sqPDCL - Square root of pubescence distance on clypeus (Seifert 1992).

In order to increase the power of discriminative functions, the values of some characters were allometrically corrected for a CS = 900 µm (indexed "(900)") according to the following functions:

CL / CW (900)	= CL / CW - 0.0002204 * (900 - CS)
SL / CS (900)	= SL / CS - 0.0002123 * (900 - CS)
GuHL (900)	= GuHL - 0.00001432 * (900 - CS)
PnHL (900)	= PnHL - 0.00001105 * (900 - CS)
SqPDCL (900)	= sqPDCL - 0.0008701 * (900 - CS)
PooC / CL (900)	= Pooc / CL - 0.00004724 * (900 - CS)
EYE (900)	= EYE - 0.00005170 * (900 - CS)
DCLAN / CS (900)	= dCLAN / CS + 0.001402495 * (900 - CS)
PLF (900)	= PLF + 0.016675 * (900 - CS)

Photographs of cuticular microsculptures were taken with a Phillips XL20 SEM.

Deposition of type material

CBFS - Collection of B.C. Schlick-Steiner & F.M. Steiner, Vienna, Austria

NM Wien - Naturhistorisches Museum Wien, Austria

SMN Goerlitz - Staatliches Museum für Naturkunde Görlitz, Germany

Lasius austriacus Schlick-Steiner new species

Type locality: Feldberg near Pulkau, Austria (15°51' E / 48°40' N), 360 m a.s.l., south exposed slope, inclination 0 - 5°, xerothermous grassland with interspersed vegetation-free silicate rocks that cover about 5 % of the total habitat area.

Holotype: worker labelled "Austria, Feldberg vic. Pulkau (15°51' E / 48°40' N), leg. B.C. Schlick-Steiner & F.M. Steiner (#10982), 6.8.2002". Deposition: NM Wien.

Paratypes: 31 workers, 25 gynes and 63 males from the holotype nest series (CBFS, NM Wien, SMN Goerlitz); 25 workers, 4 gynes and 47 males with same data but #11055, (CBFS); 24 workers, 6 gynes and 3 males, labelled "A. inf 10.vii.2002, Feldberg S Pulkau 48°41'N 15°51'E leg. Schödl; SS#1050" (NM Wien, SMN Goerlitz); 9 workers with same data but SS#1052 (NM Wien); 28 workers with same data but "5.vi.2002 Nest 2" (NM Wien); 37 workers with same data but "5.vi.2002 Nest 1" (NM Wien); 9 workers and 10 gynes labelled "Austria, Feldberg vic. Pulkau (15°51' E / 48°40' N), leg. B.C. Schlick-Steiner & F.M. Steiner (#10514), 10.7.2002" (CBFS); 45 workers and 7 gynes from a nest series labelled "Austria, Braunsberg vic. Hainburg (16°57' E / 48°09' N), leg. B.C. Schlick-Steiner & F.M. Steiner (#10445), 2.7.2002" (CBFS, SMN Goerlitz); 32 workers, 3 gynes and 7 males with same data but #10449 (CBFS, SMN Goerlitz); 6 workers from the same locality but labeled "AUSTRIA inf. 18.v.1999 Hainburg / Braunsberg c. 300m; 16°57'E 48°09'N leg. Schödl; S.S.: 582" (NM Wien); 8 workers and 4 males from a nest series collected near Znoimo/Czech Republic, labelled "CZE: S Moravia: Hnanice 1.5 NNE, armer Steppenrasen mit Calluna auf Fels, 1997.09.18-44" (SMN Goerlitz).

Etymology: The name is derived from Austria (lat.).

Worker (Figs. 1 & 2, Table 1): Very small overall body size, smallest known species of Palaearctic *Lasius* s.str. Head relatively long. Eye small, postocular distance relatively large. Clypeal keel very weak to nearly absent, in proximal and distal parts of clypeus completely absent. Lateral clypeal profile convex. Clypeal pubescence density very low. Distance from posterior clypeal suture to inner margin of antennal sockets very short. Scape very short, pubescence frequently 25 to 40°,

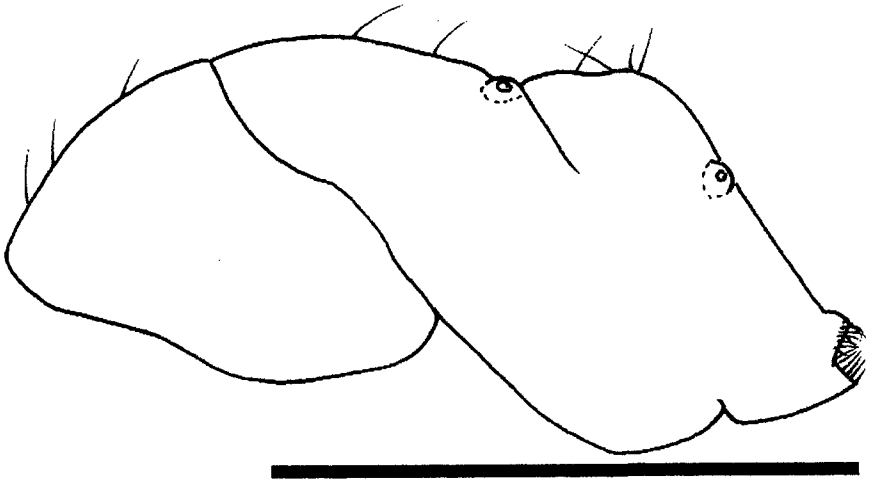

Fig. 1. Lateral view of mesosoma of the worker of *Lasius austriacus* sp.n. Scale bar: 600 µm.

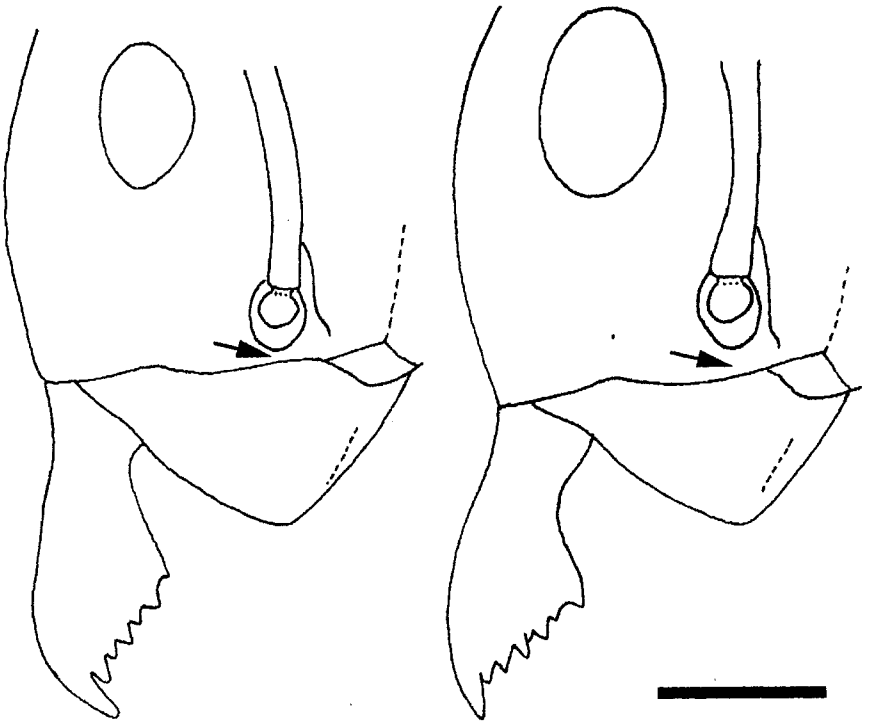

Fig. 2. Laterofrontal view of head of workers of *Lasius austriacus* sp.n. (left) and *L. neglectus* (right). Arrows indicating position of dCLAN. Scale bar: 200 µm.

Table 1. Morphometric comparison of the workers of *Lasius austriacus* sp.n., *L. neglectus* and *L. turcicus*. Allometrically corrected values have been calculated for the assumption of each individual having CS = 900 µm. Upper line, bold: arithmetic mean ± standard deviation, lower line, in []: minimum and maximum values, n = number of measured specimens. Abbreviations of morphometric characters as in Material and Methods, D = Discriminant function, as given in Phylogenetic Position, differential diagnosis and discussion.

	without allometric corrections			allometrically corrected for CS = 900 µm		
	austriacus (n = 32)	*neglectus* (n = 106)	*turcicus* (n = 105)	*austriacus* (n = 32)	*neglectus* (n = 106)	*turcicus* (n = 105)
CS	**707 ± 33**	**756 ± 42**	**853 ± 57**			
	[648,775]	[606,854]	[695,1010]			
CL/CW	**1.122 ± 0.020**	**1.121 ± 0.017**	**1.095 ± 0.021**	**1.079 ± 0.016**	**1.089 ± 0.014**	**1.084 ± 0.015**
	[1.080,1.162]	[1.072,1.167]	[1.043,1.145]	[1.048,1.112]	[1.049,1.126]	[1.056,1.123]
SL/CS	**0.926 ± 0.022**	**0.995 ± 0.021**	**0.973 ± 0.020**	**0.885 ± 0.020**	**0.965 ± 0.017**	**0.963 ± 0.014**
	[0.872,0.972]	[0.951,1.062]	[0.907,1.026]	[0.839,0.923]	[0.921,1.010]	[0.916,1.004]
PoOc/CL	**0.275 ± 0.006**	**0.232 ± 0.007**	**0.229 ± 0.007**	**0.266 ± 0.006**	**0.225 ± 0.007**	**0.226 ± 0.006**
	[0.263,0.285]	[0.218,0.253]	[0.216,0.244]	[0.255,0.276]	[0.212,0.245]	[0.214,0.241]
EYE	**0.207 ± 0.009**	**0.249 ± 0.008**	**0.239 ± 0.008**	**0.197 ± 0.009**	**0.242 ± 0.008**	**0.237 ± 0.006**
	[0.185,0.224]	[0.228,0.266]	[0.224,0.261]	[0.174,0.211]	[0.222,0.257]	[0.219,0.252]
dCLAN/CS	**2.53 ± 0.47**	**4.25 ± 0.39**	**4.01 ± 0.42**	**2.80 ± 0.47**	**4.45 ± 0.39**	**4.08 ± 0.42**
[%]	[1.6,3.5]	[3.2,5.1]	[2.8,4.8]	[1.9,3.8]	[3.4,5.3]	[2.8,5.0]
sqPDCL	**5.76 ± 0.55**	**5.62 ± 0.54**	**5.42 ± 0.55**	**5.59 ± 0.54**	**5.50 ± 0.54**	**5.38 ± 0.55**
	[4.61,6.88]	[4.51,7.03]	[3.89,7.44]	[4.50,6.70]	[4.40,6.92]	[3.86,7.37]
PLF	**25.9 ± 1.7**	**29.7 ± 2.2**	**33.6 ± 3.4**	**29.8 ± 1.6**	**33.0 ± 2.0**	**34.3 ± 3.0**
	[21.8,27.7]	[24.1,34.0]	[27.5,42.5]	[25.9,32.5]	[28.2,36.5]	[28.7,42.5]
GuHL/CS	**0.119 ± 0.015**	**0.116 ± 0.020**	**0.124 ± 0.016**	**0.116 ± 0.015**	**0.114 ± 0.020**	**0.124 ± 0.016**
	[0.094,0.144]	[0.000,0.148]	[0.000,0.149]	[0.092,0.142]	[0.000,0.146]	[0.000,0.147]
PnHL/CS	**0.124 ± 0.012**	**0.124 ± 0.009**	**0.132 ± 0.012**	**0.122 ± 0.012**	**0.122 ± 0.009**	**0.131 ± 0.012**
	[0.098,0.149]	[0.100,0.145]	[0.100,0.164]	[0.096,0.147]	[0.098,0.143]	[0.099,0.163]
MaDe	**7.33 ± 0.52**	**7.34 ± 0.44**	**7.49 ± 0.58**			
	[6.0,8.0]	[6.0,8.0]	[7.0,9.0]			
nOCC	**4.83 ± 1.07**	**9.11 ± 2.60**	**9.18 ± 2.73**			
	[3.0, 8.0]	[2.5,19.0]	[4.0,16.0]			
nGU	**2.09 ± 0.63**	**2.25 ± 0.87**	**3.31 ± 1.11**			
	[1.0, 3.5]	[0.5, 5.0]	[1.0, 6.0]			
nSC	**0.05 ± 0.20**	**0.20 ± 0.46**	**0.19 ± 0.52**			
	[0.0, 1.0]	[0.0, 2.5]	[0.0, 3.0]			
nHT	**0.16 ± 0.32**	**0.30 ± 0.43**	**0.94 ± 1.15**			
	[0.0, 1.5]	[0.0, 2.0]	[0.0, 4.5]			
nST	**2.41 ± 0.72**	**2.42 ± 1.06**	**4.16 ± 1.40**			
	[1.0, 4.0]	[0.0, 4.5]	[0.0, 7.0]			
D				**0.632 ± 0.267**	**3.035 ± 0.316**	**2.848 ± 0.287**
				[0.086,1.009]	[1.992,3.470]	[2.257,3.461]

single pubescence hairs nearly 90°. Number of dents on masticatory border of mandible 6 to 8, frequently 7. Pubescence on head between frontal carinae short and strongly depressed. 0 to 2 setae per gena. Mesosoma profile in lateral view with a straight posterior slope and a very flat dome equalling or nearly equalling mesonotum in height, mesopropodeal depression very shallow. Setae on whole body sparse,

particularly from occipital margin to caudal end of eye, underside of the head, scape, hind tibia and on the area between lower margin of propodeal spiracle and upper margin of the bulla glandulae metapleuralis. Setae on underside of head and on pronotum relatively short. For data of morphometric characters see Table 1.

Gyne (Figs. 3 to 6): Overall body size medium. Frontal groove fully developed from mid-ocellus to frontal triangle but weakly impressed. Mandibles with 8 to 9 dents, mandibular surface structure coarsely striate. Number of genal setae frequently 0, seldom 1, genal pubescence depressed. Pubescence of scape 30°, no setae projecting. Shortest distance from posterior clypeal suture to inner margin of antennal sockets very short. Mesosoma long, in lateral view high. Pubescence on scutellum dense. Petiolar scale broad, always emarginate with an angle of 100 to 140°. Upper corners rounded to angularly rounded, sides converging to the basis. Forewing with a big first discoidal cell, distance "a" always shorter than distance "b" by at least 10 %. Microsculpture of median epiproct reticulate, meshes of homogeneous size in frontal direction from caudal end of epiproct.

Male: Very small overall body size, relatively short head. Details of male morphology are not the objective of this study.

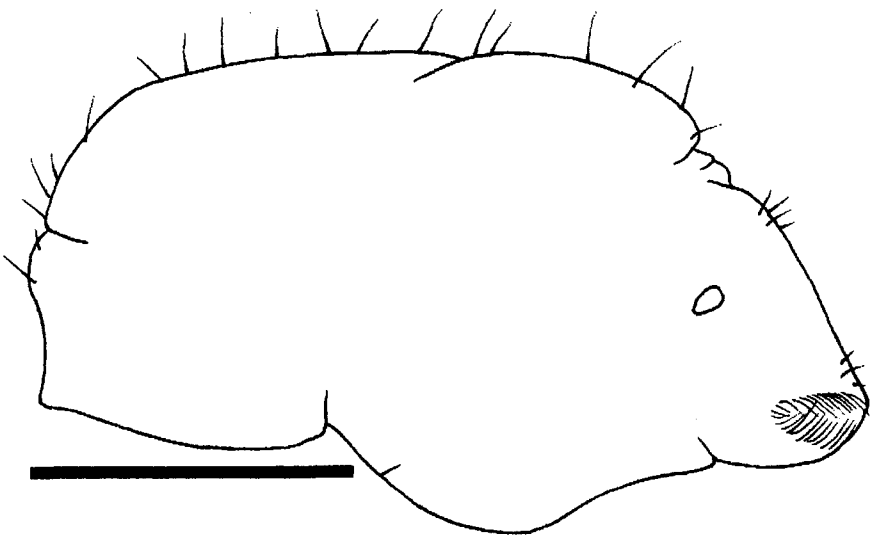

Fig. 3. Lateral view of mesosoma of the gyne of *Lasius austriacus* sp.n. Scale bar: 1000 µm.

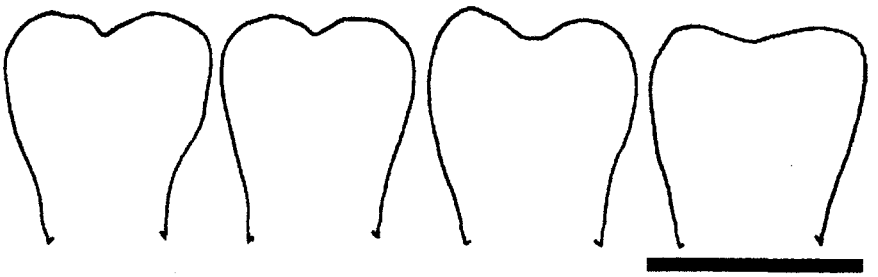

Fig. 4. Variability of petiolar scale in caudal view in gynes of *Lasius austriacus* sp.n. Scale bar: 600 µm.

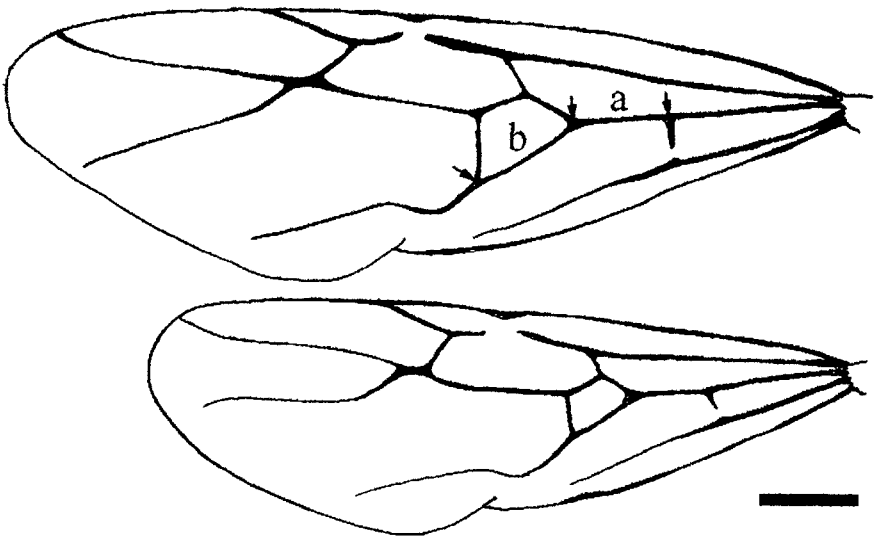

Fig. 5. Forewings of the gyne of *Lasius austriacus* sp.n. (above) and *L. neglectus* (below). Distances "a" and "b" as defined in Material and Methods, Morphometric characters. Scale bar: 1000 µm.

PHYLOGENETIC POSITION, DIFFERENTIAL DIAGNOSIS AND DISCUSSION

Lasius austriacus sp.n. is a species of the subgenus *Lasius* s.str. It is classified within the *L. brunneus* group based on the character combination of a reduced number of mandibular dents (mean value < 8) and small body size. The only other Palaearctic species with reduced mandibular dentition, the Himalayan *Lasius magnus* Seifert 1992 (not belonging to the *L. brunneus* group), has an extremely large body size and a distinctly different pubescence pattern. Within the *L. brunneus* group, the workers of *L. austriacus* sp.n., *L. neglectus* and *L. turcicus*

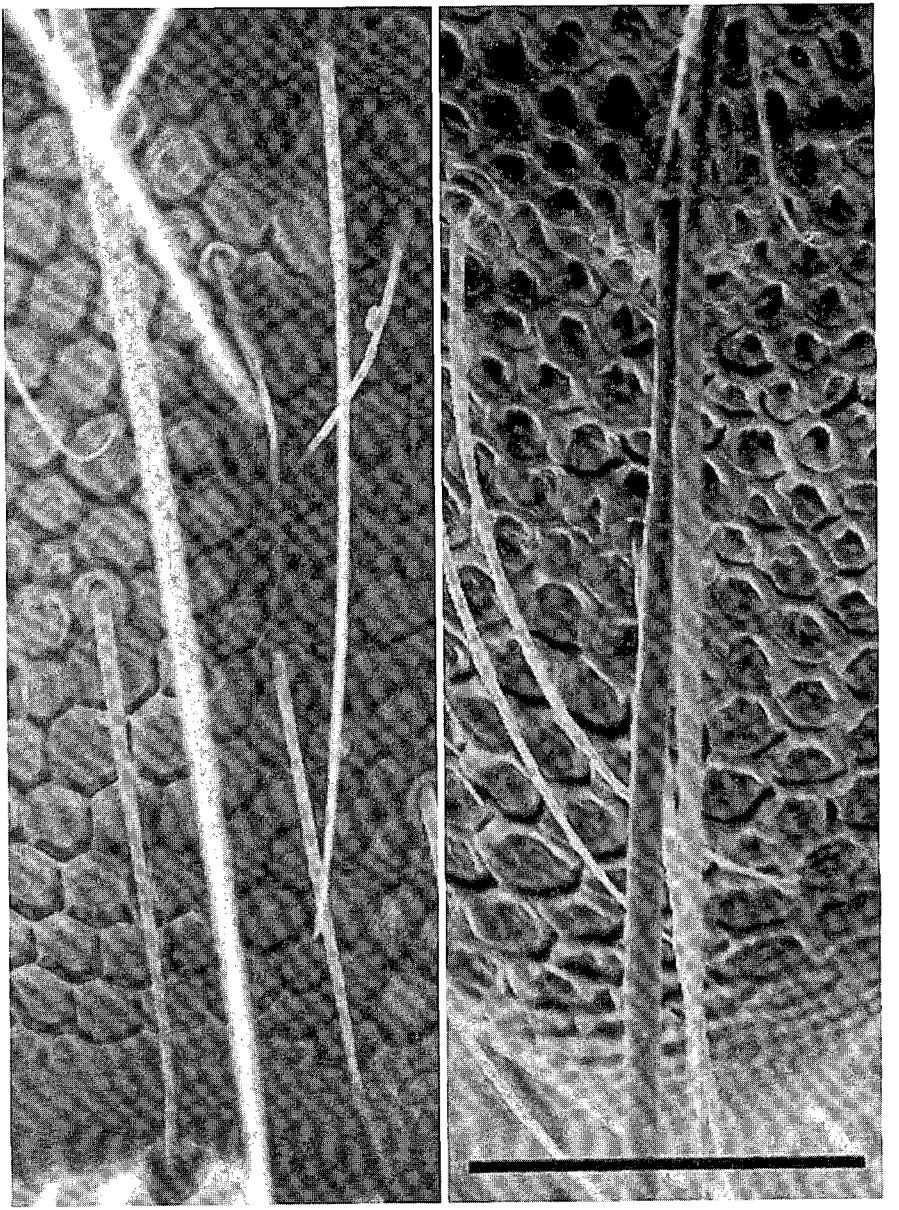

Fig. 6. Microsculpture on epiproct of the gyne of *Lasius austriacus* sp.n. (left) and *L. neglectus* (right). Scale bar: 50 µm.

resemble each other and are clearly distinct from the other members of the group (Seifert 1992, for *L. turcicus*, at that time including *L. neglectus*; Seifert 2000, for *L. neglectus* and *L. turcicus*). The differential diagnosis of workers of *L. neglectus* and *L. turcicus* is mainly based on absolute size differences (Seifert 2000). *Lasius austriacus* is distinguished from *L. neglectus* and *L. turcicus* by the smaller eye and the larger postocular distance (Table 1). An even clearer separation emerges from the discriminant function:

D = 6.2 * SL / CS (900) - 28 * Pooc / CL (900) + 6.1 * EYE (900) + 0.31 * dCLAN (900) + 0.5

For values of D see Table 1.

The differential diagnosis of gynes based on extensive morphometry is postponed to a revision of *Lasius* s.str. (Seifert in prep.). Here we describe differences without having tested their reliability over the whole range of distribution: The overall body size of the *L. austriacus* gyne is bigger and the mesosoma is longer and higher than that of the two other species (Seifert 2000). The shortest distance from the posterior clypeal suture to the inner margin of the antennal sockets is much shorter in *L. austriacus* (dCLAN / CS = 2.705 ± 0.105 [2.18, 3.02], n = 10) than in *L. neglectus* (dCLAN / CS = 4.252 ± 0.147 [3.75, 4.84], n = 10). Compared with *L. neglectus* (*partim* in Seifert 1992), the petiolar scale of *L. austriacus* is broader, the sides are converging instead of diverging to the basis, the mean number of mandibular dents is higher, the surface structure of the mandible is coarser, and the pubescence of the scutellum is denser. The microsculpture of the median epiproct is reticulate in both *L. austriacus* and *L. neglectus*. In *L. neglectus*, however, the diameter of the meshes decreases substantially in frontal direction from the caudal margin of the epiproct (Fig. 6), their maximum diameter being longer than in the uniformly reticulated *L. austriacus*. Fore- and hindwings of *L. neglectus* are smaller. In contrast to *L. austriacus*, the distance "a" is frequently the same size or longer than distance "b", only exceptionally about 3 % shorter (*L. austriacus*: a / b = 0.755 ± 0.105 [0.57, 0.89], n = 10); *L. neglectus*: a / b = 1.163 ± 0.147 [0.97, 1.39], n = 10; Fig. 5). The maximum width of the medium cell of the hindwing is smaller in *L. neglectus*.

As data on males of *Lasius* s.str. are scarce, their determination is frequently most difficult (Seifert 1992). A coherent differential diagnosis is not possible at present.

The populations of *L. austriacus* at Feldberg and Braunsberg were inspected at different times of the day from May to October 2002 (Feldberg: 13 occasions, Braunsberg: 5 occasions; the third Austrian population at Retz, about 10 km from Feldberg, was discovered in

October 2002, and detailed observations there were thus not possible). No *L. austriacus* workers were found on the soil surface, on herbaceous vegetation and on trees. We therefore consider the species to be mainly subterranean. This view is supported by an eye size reduction that is unusual in *Lasius* s.str.

On various occasions, specimens of the grass mealybug *Euripersia europaea* Newstead 1897 (Homoptera: Pseudococcidae; P.J. Gullan, pers. comm.) were found inside *L. austriacus* nests. This common root-feeding species is known to be associated with ants, especially *Lasius* spp. (Kosztarab & Kozár 1988). The association seems to contribute to the nutrition of *L. austriacus*. The extent and importance of this contribution, however, cannot be estimated at present.

Sexuals were found to be present in the nests from early July to mid September.

L. austriacus is a rare species in Central Europe, restricted to undisturbed xerothermous grassland: by the determination of > 60 000 ant specimens from the past 150 years from > 1 200 sites in Lower Austria (19 174 km^2, Schlick-Steiner *et al.*, 2003) no further *L. austriacus* populations could be detected. Whether there are populations in other Palaearctic regions cannot be judged at the moment. It seems unlikely, however, that the distribution range of *L. austriacus* extends much further to the north and west.

The *L. austriacus* population of Hnanice near Znoimo, Czech Republic, was referred to as *L. neglectus* by Seifert (2000). The identification as *L. austriacus* changes our picture of the distribution of the invasive *L. neglectus*, since no population of this pest species is known from a natural habitat in Central Europe so far.

ACKNOWLEDGMENTS

For determining *Euripersia europea* and helping with literature search to P.J. Gullan; for donating *L. neglectus* samples to X. Espadaler, L. Passera, A. Tartally; for helping with the SEM photographs to D. Gruber, W. Klepal, M. Pausch, S. Tschegg, I. Burgert; for stimulating discussions to E. Christian, C. Stauffer, X. Espadaler, M. Sanetra, A. Buschinger, H. Zettel, K. Ross, J.J. Boomsma, J.S. Pedersen, S. Cremer; for valuable informations to A. Beckenbach, C.A. Collingwood, R.H. Crozier, K. Moder, R. Schultz, A. Tartally, P. Werner (alphabetic order), for a linguistic revision to M. Stachowitsch.

REFERENCES

Espadaler, X. & S. Rey 2001. Biological constraints and colony founding in the polygynous invasive ant *Lasius neglectus* (Hymenoptera, Formicidae). Insectes sociaux, 48: 159-164.

Giraud, T., J.S. Pedersen & L. Keller 2002. Evolution of supercolonies: The argentine ants of southern Europe. Proceedings of the National Academy of Sciences, 99: 6075-6079.

Kosztarab, M. & F. Kozar 1988. Scale insects of central Europe. Dr. W. Junk Publisher, Dordrecht, The Netherlands and Akademiai Kiado, Budapest, Hungary.

Passera, L. 1994. Characteristics of tramp species. Exotic ants (ed. by D.F. Williams), pp. 23-43. Westview Press, Boulder, San Francisco, Oxford.

Schlick-Steiner, B.C., F.M. Steiner & S. Schödl 2003. A case study to quantify the value of voucher specimens for invertebrate conservation: Ant records in Lower Austria. Biodiversity and Conservation (In press).

Seifert, B. 1992. A taxonomic revision of the Palaearctic members of the ant subgenus *Lasius* s. str. (Hymenoptera: Formicidae). Abhandlungen und Berichte des Naturkundemuseums Görlitz, 66: 1-67.

Seifert, B. 2000. Rapid range expansion in *Lasius neglectus* (Hymenoptera, Formicidae) - an Asian invader swamps Europe. Mitteilungen des Museums für Naturkunde Berlin, Deutsche entomologische Zeitschrift, 47: 173-179.