

***Temnothorax saxonicus* (SEIFERT, 1995) stat.n., comb.n. – a parapatric, closely-related species of *T. sordidulus* (MÜLLER, 1923) comb.n. and description of two new closely-related species, *T. schoedli* sp.n. and *T. artvinense* sp.n., from Turkey (Hymenoptera: Formicidae)**

Bernhard SEIFERT

Abstract

Morphological and chorological evidence is presented that *Temnothorax saxonicus* (SEIFERT, 1995) stat.n., comb.n. should be considered as parapatric closely-related species of *T. sordidulus* (MÜLLER, 1923), comb.n. Two new species, *T. schoedli* sp.n. and *T. artvinense* sp.n., are described from southeastern and northeastern Turkey. Including *T. melas* (ESPADALER, PLATEAUX & CASEVITZ-WEULERSSE, 1984), the *T. sordidulus* group comprises now a minimum of five species in Europe and Asia Minor. The morphological investigation system included 18 standardized numeric characters which were subject to a discriminant analysis. *Leptothorax sordidulus* var. *tergestina* FINZI, 1928 and *Leptothorax carinthiacus* BERNARD, 1957 are shown to represent younger synonyms of *Temnothorax sordidulus*.

Key words: *Temnothorax sordidulus* group, morphometry, discriminant analysis, parapatric species, taxonomy, new species.

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Introduction

Temnothorax MAYR, 1861 is undoubtedly the most diverse ant genus of the Palaearctic region. In contrast to other genera such as *Formica* LINNAEUS, 1758 or *Lasius* FABRICIUS, 1804, *Temnothorax* ants have a low capacity for long-range flight dispersal and need rather special microhabitats for nesting. Nuptial flights or mating usually occur near to nesting and foraging habitats (BUSCHINGER 1968, PLATEAUX 1978, SEIFERT 1996). In combination with isolation in separate glacial refuges (SEIFERT 1995) and geographical barriers, these features lead to a strong microgeographic differentiation and rather small geographic ranges of the species. My preliminary investigations, basically using the same methodology as presented here, suggest an unexpected number of closely-related species within rather small geographic areas: there should be two closely-related species of *T. lichtensteini* (BONDROIT, 1918) in the southern Alps, Italy and the northern Balkans (unpubl.); there should be 3 - 5 species of the *T. nylanderi* (FÖRSTER, 1850) group in Europe and Asia Minor (unpubl.); and the same region should have a minimum of five species of the *T. sordidulus* (MÜLLER, 1923) group (argumentation presented below). It seems that this unexpected biodiversity finds its equivalent also in other species groups of *Temnothorax*: according to my estimation, the whole genus should have more than 150 species in Europe alone, while only 81 species were listed up for this territory 27 years ago (AGOSTI 1989). An independent recent estimate of 600 species for the whole Palaearctic (Andreas Schulz, pers. comm. 11 January 2006) would correlate with my estimate for Europe. There is no doubt that current taxonomic systems are far from reflecting real biodiversity of this genus in Eurasia. Serious attempts of the

next generations of myrmecologists to get sufficiently-sized and testable data sets, both morphological and genetic, are needed to bring more clarity into the complicated taxonomy of this genus. A little mosaic stone to construct this final picture is added here by considering the species of the *Temnothorax sordidulus* group.

Relatedness of the *T. sordidulus* group to the *T. nylanderi* and *T. parvulus* (SCHENCK, 1852) / *lichtensteini* group and separation from all other species groups is indicated by the presence of a distinct mesonotal depression and by lateral petiolar shape, showing a high node with a small dorsal plane. The *T. sordidulus* group is separable from any group by the following character combination: Head, scape and mesosoma more elongated than in the *T. nylanderi* group, CL / CW 1.08 - 1.22, SL 0.75 - 0.81, ML / CS 1.180 - 1.27 (see Material and methods for definition of morphometric characters). Sculpture on vertex without the densely arranged, regular and linear carinulae of the *T. nylanderi* group; if stronger longitudinal sculpture is present on central vertex, it is more rugulose-linear. Compared to the *T. nylanderi* and the *T. parvulus* / *lichtensteini* group, spines usually shorter and more erect, spine axis in lateral view deviating by 40 - 55 ° from longitudinal axis of mesosoma. Coloration of head and gaster always rather dark, varying from medium orange brown to blackish brown, never light yellowish as frequently found in the *T. parvulus* / *lichtensteini* group. Mesosoma varying between distinctly lighter or as dark as head and mesosoma.

Temnothorax saxonicus (SEIFERT, 1995) was originally described in the rank of an eastern subspecies of *T. sordidulus*. This interpretation would demand a significant gene flow or, in phenetic terms, a broader morphological

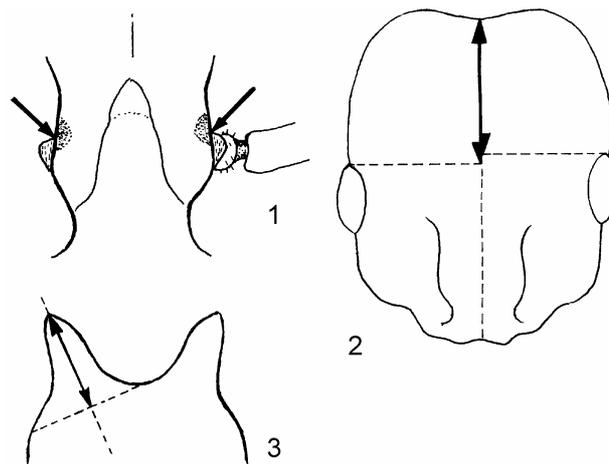
transition zone in contact areas of the two taxa. New samples obtained since then as well as extension and refinement of morphological investigation methods largely confirmed parapatric distribution and have shown intermediate specimens between *T. sordidulus* and *T. saxonicus* to be rare or absent. As a consequence, *T. saxonicus* is elevated here to species rank. A third good species of the *T. sordidulus* group, *T. melas* (ESPADALER, PLATEAUX & CASEVITZ-WEULERSSE, 1984) from Corsica, which was not differentiated by the primary authors (ESPADALER & al. 1984) against the next similar species *T. sordidulus*, was already confirmed in its separate species status by SEIFERT (1995). In the following I introduce two new species, *T. schoedli* sp.n. and *T. artvinense* sp.n. from Asia Minor, which increases the known species number of the *T. sordidulus* group to five.

In this paper I accepted the elevation of *Temnothorax* to genus level previously established by BOLTON (2003). This new system induces so many name changes that the reasons for this decision must be shortly explained. In his synoptic classification of ants, Bolton assumed two monophyletic species groups in the ant tribe Formicoxenini – a "*Leptothorax* genus group" combining *Leptothorax* MAYR, 1855 (= *Mychothorax* RUZSKY, 1904), *Harpagoxenus* FOREL, 1893, *Formicoxenus* MAYR, 1855, *Cardiocondyla* EMERY, 1869; and a "*Temnothorax* genus group" combining *Temnothorax* MAYR, 1861, *Myrafant* SMITH, 1950, *Protomognathus* WHEELER, 1905, *Chalepoxenus* MENOZZI, 1923, *Myrmoxenus* RUZSKY, 1902, and *Ochetomyrmex* MAYR, 1878. Apart from my investigation result (a) that *Cardiocondyla* cannot be reasonably placed within the *Leptothorax* genus group by any of the three criteria proposed by Bolton (10 species checked) and (b) that two of the proposed differential characters, the "clypeal carina presence" criterion and the "male antennae slenderness" criterion are very vague if not useless in the context of all considered genera, there is also much agreement. In any of the checked 19 species of *Temnothorax*, *Myrafant*, *Myrmoxenus*, *Chalepoxenus*, *Leptothorax*, *Formicoxenus*, and *Harpagoxenus*, the criterion "transverse crest on the stipes of the maxillae present or not" behaved as Bolton stated. The division of these genera in two monophyletic groups is also supported by investigation of 6 genes of mitochondrial and nuclear DNA (Mikko Kolkkala, pers. comm., 8 October 2004). Hence, it seems sufficiently supported that *Temnothorax* should be separated from *Leptothorax* in the rank of a genus.

Material and methods

Morphological investigation methods and evaluated characters

Each worker specimen was evaluated for 18 numeric characters, meaning 22 different measurements at magnifications of 200 - 320 × and an average measuring time of 45 minutes. All measurements were made on mounted and dried specimens using a pin-holding stage, permitting endless rotations around X, Y, and Z axes. A Wild M10 high-performance stereomicroscope equipped with a 1.6 × plan-apochromatic objective was used. A Schott KL 1500 cold-light source equipped with two flexible, focally mounted light-cables, providing 30° inclined light from variable directions, allowed sufficient illumination over the full magni-



Figs. 1 - 3: Mode of measuring FRS (1), SP (2), and PoOC (3).

fication range and a clear visualization of silhouette lines. A Schott KL 2500 LCD cold-light source in combination with a Leica coaxial polarized-light illuminator provided optimum resolution of tiny structures and microsculpture at highest magnifications. Simultaneous or alternative use of the two cold-light sources depending upon the required illumination regime was quickly provided by regulating voltage up and down. A Leica cross-scaled ocular micrometer with 120 graduation marks ranging over 65 % of the visual field was used. To avoid the parallax error, its measuring line was constantly kept vertical within the visual field. A mean measuring error of $\pm 0.6 \mu\text{m}$ was calculated for small and well-defined structures such as petiole width, but one of $\pm 1.5 \mu\text{m}$ for larger structures with difficult positioning such as gyne mesosoma length. To avoid rounding errors, all measurements were recorded in μm even for characters for which a precision of $\pm 1 \mu\text{m}$ is impossible.

- CL Maximum cephalic length in median line; the head must be carefully tilted to the position with the true maximum. Excavations of hind vertex and / or clypeus reduce CL.
- CS Cephalic size; arithmetic mean of CL and CW, used as a less variable indicator of body size.
- CW Maximum cephalic width; the maximum is found in *Temnothorax* always across the eyes.
- EYE Eye-size index: the arithmetic mean of the large (EL) and small diameter (EW) of the elliptic compound eye is divided by CS, i.e., $\text{EYE} = (\text{EL} + \text{EW}) / (\text{CL} + \text{CW})$. All structurally visible ommatidia are considered. EW is always taken perpendicular to EL – i.e., it must not necessarily be the smallest eye diameter.
- FRS Distance of the frontal carinae immediately caudal of the posterior intersection points between frontal carinae and the lamellae dorsal of the torulus. If these dorsal lamellae do not laterally surpass the frontal carinae, the deepest point of scape corner pits may be taken as reference line. These pits take up the inner corner of scape base when the scape is fully switched caudad and produce a dark triangular shadow in the lateral frontal lobes immediately posterior of the dorsal lamellae of scape joint capsule (Fig. 1).

MGr Depth of metanotal groove or depression, measured from and orthogonal to the tangent connecting the dorsalmost points of promesonotum and propodeum; here given as per cent ratio of CS.

MH In workers: maximum mesosoma height at mesopleural level measured perpendicular to the longer axis of mesosoma. The longer axis is defined in lateral view as straight line from the centre of propodeal lobe to the border point between anterior pronotal shield and propleuron.

ML In worker: mesosoma length from caudalmost point of propodeal lobe to transition point between anterior pronotal slope and anterior propodeal shield (preferentially measured in lateral view; if the transition point is not well defined, use dorsal view and take the centre of the dark borderline between pronotal slope and pronotal shield as anterior reference point).

MW Maximum mesosoma width.

PeH Maximum petiole height measured perpendicular to a reference line, which is, in *Leptothorax* and *Temnothorax*, the chord spanning between caudal corner of ventral petiole profile and the caudal end of the subpetiolar process.

PeHL Length of longest hair on petiole (accessory descriptive character, not used in DA).

PeL Diagonal petiolar length in lateral view; measured from anterior corner of subpetiolar process to dorso-caudal corner of caudal cylinder. Do not erroneously take as reference point the dorsocaudal corner of the helcium which is sometimes visible.

PeW Maximum width of petiole.

PnHL Length of longest hair on pronotum (accessory descriptive character, not used in DA).

PoOc Postocular distance. Use a cross-scaled ocular micrometer and adjust the head to the measuring position of CL. Caudal measuring point: median occipital margin; frontal measuring point: median head at the level of the posterior eye margin. Note that many heads are asymmetric and average the left and right postocular distance (Fig. 3).

PPW Maximum width of postpetiole.

SL Maximum straight line scape length excluding the articular condyle as arithmetic mean of both scapes.

SP Maximum length of propodeal spines; measured in dorsofrontal view along the long axis of the spine, from spine tip to a line, orthogonal to the long axis, that touches the bottom of the interspinal meniscus (Fig. 2). Left and right SP are averaged. This mode of measuring is less ambiguous than other methods but results in some spine length in species with spines reduced to blunt corners.

SPBA The smallest distance of the lateral margins of the spines at their base. This should be measured in dorsofrontal view, since the wider parts of the ventral propodeum do not interfere the measurement in this position. If the lateral margins of spines diverge continuously from the tip to the base, a smallest distance at base is not defined. In this case SPBA is measured at the level of the bottom of the interspinal meniscus.

SPST Distance between the centre of propodeal stigma and spine tip. The stigma centre refers to the midpoint

defined by the outer cuticular ring but not to the centre of stigma opening which may be positioned eccentrically.

SPTI The distance of spine tips in dorsal view; if spine tips are rounded or thick take the centres of spine tips as reference points.

A canonical discriminant analysis was performed on the basis of nest sample means and worker individuals under use of a SPSS 10.0 package.

Automontage pictures were taken with a Leica Z6 Apo photomicroscope, a digital camera JVC KY-70B, a Synoptics AutoMontage Pro 5.02.0096 software, under simultaneous use of 4 goose-neck light-cables mounted to a KL 1500 and a KL 2500 cold-light source. The goose-necks were directed at very low inclination to the upper rim of a bottomless Styrofoam cup set over the pin-holding stage – so that they provided a diffuse light both by reflection from the inner wall of the cylinder and by transmitting its wall but so that they did not directly shine at the specimen. Automontages were generated in the "speed mode" and with a patch size of 10, mounting 30 pictures (dorsal aspect of head) or 50 pictures (lateral and dorsal aspects of the whole ant).

Source collections of the investigated material have the following acronyms:

coll.Douwes – collection of Per Douwes, Lund, Sweden
 coll.Schulz – collection of Andreas Schulz, Leverkusen, Germany
 LMK Klagenfurt – Landesmuseum Kärnten, Klagenfurt, Austria
 MCZ Cambridge – Museum of Comparative Zoology of the Harvard University, Cambridge, Massachusetts, USA
 MNHN Paris – Museum National d'Histoire Naturelle Paris, France
 NHM Wien – Naturhistorisches Museum Wien, Vienna, Austria
 SMN Goerlitz – Staatliches Museum für Naturkunde Goerlitz, Germany
 SMN Karlsruhe – Staatliches Museum für Naturkunde Karlsruhe, Germany

Material investigated

The original locality labels of examined specimens almost always did not give information on geographical coordinates. Hence, latitude and longitude were estimated secondarily by the author and are given in decimal degrees.

Temnothorax sordidulus (MÜLLER, 1923)

Types of *Leptothorax carinthiacus* BERNARD, 1957: Lectotype worker by present designation "Carinthia Viktring Hölzel leg. [upside of label] V /55 [underside of label]" and "Lectotype *Leptothorax carinthiacus* Bernard 1957 des. B.Seifert 2006", PPW / CW 0.353, LMK Klagenfurt.

The following material from LMK Klagenfurt was labelled as "Paralectotype *Leptothorax carinthiacus* Bernard 1957 des. B.Seifert 2006": 1 worker "Carinthia Viktring Hölzel leg. [upside of label] V /55 [underside of label]", differing from lectotype by PPW / CW 0.371; 1 worker "Carinthia Viktring Hölzel leg. [upside of Label] 20.4.56 Mur [underside of label]"; 1 gyne "Carinthia Viktring Hölzel leg. [upside of label] 20.8.52 Licht [underside of

label]"; 5 males 1 gyne "Carinthia Viktring Hölzel leg. [upside of label] 27.8.56 [underside of label]".

The following material in MNHN Paris has the status of paralectotypes: 1 worker labelled "Carinthia Viktring Hölzel leg. [upside of label] 15.5.55 [underside of label]" and "type"; 1 worker "Carinthia Viktring Hölzel leg. [upside of label] V /55 [underside of label]" and "type"; 1 worker labelled "Carinthia Viktring Hölzel leg. [upside of label] VI /56 [underside of label]"; 1 gyne labelled "Carinthia Viktring Hölzel leg. [upside of label] 27.8.56 [underside of label]".

Types of *Leptothorax sordidulus* var. *tergestina* FINZI, 1928: 4 Syntype workers labelled ".S.Croze. Ven. Giulia B.Finzi 6.27", "BFinziColl. purch.1950", "MCZ CoType 28840", "Syntypes *Leptothorax sordidulus* var. *tergestinus* Finzi" [upside of label], "SP Cover 98" [underside of label]; MCZ Cambridge.

A total of 49 nest samples of *T. sordidulus* with 106 worker individuals from the following 28 sites was morphometrically investigated:

Austria: Kärnten, Loibl-Pass (46.23° N, 14.25° E), 13.IX.1989; Kirchentheur-1.6 km N, Hollenburg (46.53° N, 14.25° E); Mannsberg-E / Waldkogel (46.80° N, 14.48° E), 12.VIII.1965; Roppen (47.22° N, 10.82° E), 16.VI.1990; Roppen-1 km E (47.22° N, 10.83° E), 4.VII.1994 (No 0, 083, 218, VI, g8); Viktring (46.58° N, 14.25° E), VII.1964; Viktring (46.58° N, 14.25° E), IX.1964; Viktring (46.58° N, 14.25° E), VI.1962; Viktring (46.58° N, 14.25° E), VIII.1962; Villach-8 km SW (46.55° N, 13.77° E), 22.V.1994; Villacher Alpe (46.59° N, 13.75° E), 13.IX.2002 (No 5554). **Bosnia:** Orvar Dvar-1 km N, 15.IX.1989 (No 22), 44.37° N, 16.38° E. **Bulgaria:** Cherven Brjag (43.27° N, 24.12° E), 20.VIII.1988 (No 12, 20, 32, 34); Lakatnik (43.03° N, 23.38° E), 31.VIII.1988 (No 07); Dragoman, Tri Ushi (42.92° N, 22.93° E), 1.IX.1988 (No 16, 18, 19, 21, 22); Tompsan (42.93° N, 23.37° E), 3.IX.1988 (No 29, 30). Croatia: Jurjevo-10 km SE (44.87° N, 15.02° E), 3.VI.1997 (No 510, 514); Oltari: Krasna-7 km NW (44.85° N, 15.00° E), 2.VI.1997 (No 478, 484, 485b); Krk: Baska (44.97° N, 14.73° E), pre 1970 (coll. W. Faber, No 3171); Meja Hreljin (45.27° N, 14.58° E), 28.IX.1987 (No 1879); Oltari-2 km NW (44.89° N, 14.96° E), 2.VI.1997 (No 491); Oltari-2 km W (44.88° N, 14.96° E), 2.VI.1997 (No 489a, 496); Oltari-2 km S (44.86° N, 14.98° E), 2.VI.1997 (No 487); Sibenj: Senj-9 km S (44.90° N, 14.90° E), 3.VI.1997 (No 501, 504, 507); Urgini-10 km N, 4.VI.1997 (No 555); Urgini-16 km N, 4.VI.1997 (No 525); Urgini-8 km N, 4.VI.1997 (No 570). **Italy:** Irme / NE Italy, 18.IX.1989 (No 22); Triest: Santa Croce (45.73° N, 13.68° E), VI.1927. **Serbia & Montenegro:** Petrovac (42.20° N, 18.92° E), 21.V.1984; Zabljah (43.17° N, 19.15° E), 28.VIII.1984 (No 633). **Slovenia:** Knezac (45.62° N, 14.23° E), 17.IX.1989 (No 06, 07).

***Temnothorax saxonicus* (SEIFERT, 1995)**

Types of *Leptothorax sordidulus saxonicus* SEIFERT, 1995: Holotype gyne labelled "Sachsen: Kr. Löbau Löbauer Berg 1983.07.28-473", "*Leptothorax saxonicus* Seifert Holotype" and "GBIF-D/FoCol 0741 specimen + label data documented"; 4 gyne and 8 worker paratypes on three pins labelled "Sachsen: Kr. Löbau Löbauer Berg 1983.07.28-473" and "*Leptothorax saxonicus* Seifert Paratype"; all material in SMN Goerlitz.

A total of 45 nest samples of *T. saxonicus* with 100 worker individuals from the following 31 sites was morphometrically investigated:

Austria: Bad Gleichenberg-3 km NW (46.88° N, 15.85° E), 10.VII.1994 (No g6, g15, g24, g26); Laxenburg (48.07° N, 16.35° E), 13.IX.2002 (No 11646); Paudorf-0.5 km N (48.35° N, 15.60° E), 12.V.1994 (No 012, 38, 49, 76). **Bulgaria:** Varna: Aladza Monastir (43.27° N, 28.00° E), 18.VII.1970; Vitoscha: Tsuipetiovo (42.50° N, 23.23° E), 18.VIII.1988 (No 18, 19); Petrich: Bellasitza (41.38° N, 23.20° E), 24.VIII.1988 (No 05); Kresna-W (41.77° N, 23.18° E), 29.VIII.1988, No 03; Tompsan (42.93° N, 23.37° E), 3.IX.1988 (No 26). **Czechia:** Dobrichovice-Karlik (49.93° N, 14.27° E), 5.VII.1990; Homole u Vraneho (48.93° N, 14.42° E), 2.VIII.1980; Krivoklat (50.03° N, 13.87° E), 24.VIII.1980; Vanov (49.18° N, 15.42° E), 7.IX.1991; Vidim (50.47° N, 14.48° E), VIII.1984; Zbraslav Hradiste (49.97° N, 14.37° E), 4.IX.1982; Znoimo: NP Podyji "Sobes" (48.85° N, 15.93° E), 16.IV.1993. **France:** Gr.Canyon du Verdon (43.75° N, 6.34° E), V.1992 (No 745, 746, 749). **Germany:** Meissen: Bosel (51.13° N, 13.50° E) 19.VIII.1992 (No g30); Pillnitz (51.00° N, 13.88° E), pre 1925 (coll. Viehmeyer); Großhennersdorf-1.9 km SSE (50.97° N, 14.80° E), III.2001; Hohenburg-0.9 km SW (49.28° N, 11.80° E), 2002; Hohenburg-4 km WNW (49.32° N, 11.76° E), 2002; Kürmreuth-6 km WNW (49.64° N, 11.62° E), 2002; Georgewitzer Skala (51.13° N, 14.68° E), 31.III.1990; Löbauer Berg (51.08° N, 14.67° E), 16.V.1983; Löbauer Berg (51.08° N, 14.67° E), 6.VII.1983 (No 468); Löbauer Berg (51.08° N, 14.67° E), 13.VII.1983; Löbauer Berg, Löbauer Berg (51.08° N, 14.67° E), 21.VII.1983; Löbauer Berg (51.08° N, 14.67° E), 28.VII.1983 (No 473); Reicholzheim (49.72° N, 9.53° E), 1994; Rotstein / Sohland (51.10° N, 14.77° E), 10.VII.1991; Tharandt-1.2 km E (50.59° N, 13.35° E), 19.VI.1998; Weischlitz-1.5 km SW (50.43° N, 12.05° E), 17.V.1986; Wolkenstein (50.65° N, 13.07° E), 23.VII.1987 (No 1302, 1332). **Greece:** Agia Paraskevi-3 km N (40.17° N, 20.90° E), 22.V.1996 (No 320, 323, 324); Ioannia 50 km NE: Katara-Pass (39.78° N, 21.17° E), 18.VIII.1997; Olympos: Kalipefke (39.98° N, 22.45° E), 20.V.1988 (No 2076); Olympos: Litohoro 5-7 km W (40.08° N, 22.45° E), 13.V.1996 (No 187, 188, 190, 201, 203, 204). **Slovakia:** Kercovo (okr.Roznava) (48.50° N, 20.47° E), 10.VII.1993.

***Temnothorax artvinense* sp.n.**

A total of 7 nest samples with 18 worker individuals and 3 gynes from 4 sites in NE Turkey was morphometrically investigated (which series have been selected as type material is declared in the section containing the original description): Turkey: Artvin-5 km SSW (41.17° N, 41.77° E), 27.VI.1993 (No 1162, 1164, 1165); Artvin: Hopa-5 km E (41.41° N, 41.48° E), 4.VI.1986; Borcka-Civan (41.34° N, 41.65° E), 29.VI.1993 (No 1183, 1184); Artvin-60 km SW, Sarigöl-20 km NW (approximately 40.8° N and 41.4° E), 28.VI.1993 (No 1182).

***Temnothorax schoedli* sp.n.**

A total of 8 nest samples with 18 worker individuals and 4 gynes from one site in the Nur Daglari / SE Turkey was morphometrically investigated (which series have been selected as type material is declared in the section containing the original description):

Turkey: Hassa-14 km W (36.82° N, 36.42° E), 11.V.1997 (No 287, 289, 290, 292, 293, 295, 296, 299).

***Temnothorax melas* (ESPADALER, PLATEAUX & CASEVITZ-WEULERSSE, 1984)**

A total of 5 nest samples with 11 worker individuals from Corsica was morphometrically investigated:

Corsica: Asco (42.46° N, 9.03° E), 3.IX.1973; Asco, 30.IX.1973; Asco, 16.VI.1986 (No 363, 367); Route du Col Bavella (41.78° N, 9.20° E), 27.V.1973.

Results

The separation of *T. melas*

The separation of the Corsian endemic *T. melas* from any species of the *T. sordidulus* group is clearly given by a unique character combination of large CL / CW and SL / CS and small FRS / CS (Tab. 1). Because of this clear situation the material was not re-examined.

The separation of *T. sordidulus* and *T. saxonicus*

Based upon worker nest sample means, a discriminant function

$$D(18) = 2.78 * CS + 73.52 PoOc / CL + 3.03 * CL / CW + 12.77 * SL / CS - 44.73 * FRS / CS + 45.53 MW / CS - 73.73 * SPBA / CS + 53.44 * SPTI / CS + 38.32 * PeW / CS + 5.42 * PPW / CS + 28.47 * SP / CS + 10.78 * SPST$$

$$/ CS + 11.80 * MH / CS - 22.8 * MGr / CS - 57.88 * PeL / CS - 18.97 * PeH / CS - 66.86 * EYE / CS + 15.99 * ML / CS - 46.38$$

offered a sufficient separation of *T. sordidulus* and *T. saxonicus* within their European range:

$$T. saxonicus \quad D(18) \quad 2.476 \pm 0.988 \quad [0.53, 5.32] \quad (n = 45)$$

$$T. sordidulus \quad D(18) \quad -2.552 \pm 1.011 \quad [-5.18, -0.53] \quad (n = 49)$$

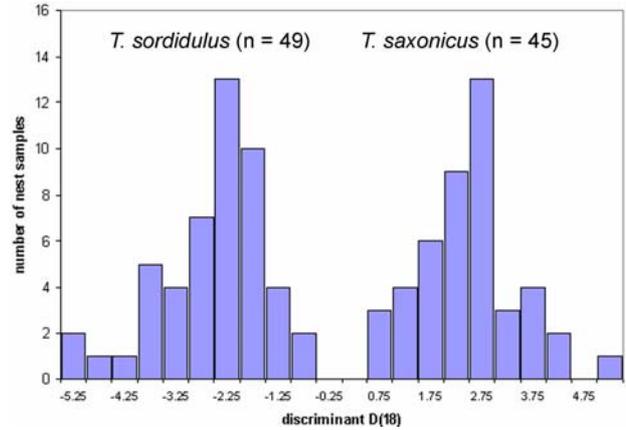


Fig. 4: Canonical discriminant values of 45 and 49 worker nest samples of *Temnothorax saxonicus* and *T. sordidulus* based upon 18 morphometric characters.

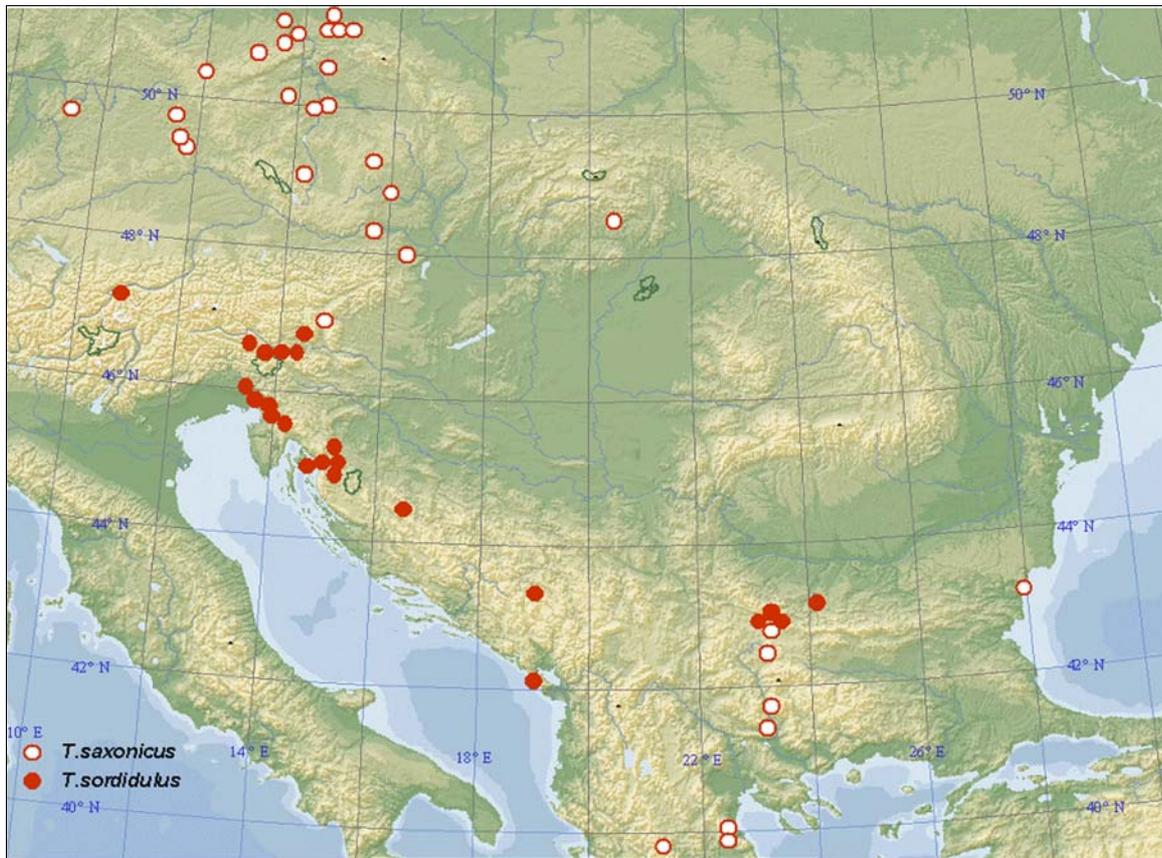


Fig. 5: Sampling sites of *Temnothorax saxonicus* and *T. sordidulus* in Europe. One known *T. saxonicus* site in France is outside the mapped area. The distributional gap between "northern" and "southern" *T. saxonicus* is most probably explained by a lack of samples from both Hungary and Romania.

Tab. 1: Nest sample means of worker morphometric data in the *Temnothorax sordidulus* group. Arrangement of data: arithmetic mean \pm standard deviation [upper extreme, lower extreme]. n = number of nest samples i = sum of evaluated individuals within these samples.

	<i>T. schoedli</i> sp.n. (n = 8; i = 18)	<i>T. artvinense</i> sp.n. (n = 7; i = 18)	<i>T. saxonicus</i> (n = 45; i = 100)	<i>T. sordidulus</i> (n = 49; i = 106)	<i>T. melas</i> (n = 5; i = 11)
CS	677 \pm 14 [656, 694]	614 \pm 14 [561, 631]	624 \pm 27 [568, 671]	608 \pm 35 [506, 670]	654 \pm 21 [628, 673]
CL / CW	1.086 \pm 0.010 [1.074, 1.102]	1.150 \pm 0.014 [1.124, 1.170]	1.125 \pm 0.015 [1.100, 1.156]	1.131 \pm 0.024 [1.079, 1.203]	1.206 \pm 0.015 [1.184, 1.220]
SL / CS	0.765 \pm 0.010 [0.754, 0.782]	0.781 \pm 0.008 [0.772, 0.793]	0.776 \pm 0.012 [0.748, 0.809]	0.765 \pm 0.011 [0.746, 0.788]	0.783 \pm 0.009 [0.766, 0.790]
PoOc	0.366 \pm 0.007 [0.358, 0.375]	0.389 \pm 0.004 [0.383, 0.394]	0.388 \pm 0.006 [0.377, 0.406]	0.380 \pm 0.006 [0.366, 0.394]	no data
FRS / CS	0.362 \pm 0.005 [0.355, 0.372]	0.353 \pm 0.006 [0.346, 0.362]	0.347 \pm 0.009 [0.328, 0.374]	0.353 \pm 0.008 [0.339, 0.378]	0.329 \pm 0.005 [0.322, 0.335]
EYE	0.229 \pm 0.006 [0.220, 0.238]	0.209 \pm 0.007 [0.195, 0.215]	0.220 \pm 0.007 [0.208, 0.236]	0.225 \pm 0.005 [0.215, 0.242]	no data
MW / CS	0.618 \pm 0.008 [0.607, 0.628]	0.594 \pm 0.009 [0.581, 0.608]	0.606 \pm 0.011 [0.580, 0.638]	0.595 \pm 0.014 [0.569, 0.627]	no data
SPBA / CS	0.283 \pm 0.008 [0.272, 0.294]	0.269 \pm 0.012 [0.253, 0.286]	0.265 \pm 0.012 [0.242, 0.291]	0.263 \pm 0.013 [0.240, 0.286]	0.279 \pm 0.018 [0.260, 0.303]
SPTI / CS	0.309 \pm 0.005 [0.300, 0.316]	0.305 \pm 0.007 [0.297, 0.316]	0.309 \pm 0.017 [0.265, 0.344]	0.281 \pm 0.016 [0.244, 0.318]	0.307 \pm 0.008 [0.299, 0.318]
SPST / CS	0.252 \pm 0.009 [0.234, 0.262]	0.261 \pm 0.016 [0.236, 0.279]	0.274 \pm 0.019 [0.241, 0.331]	0.251 \pm 0.013 [0.226, 0.289]	no data
SP / CS	0.176 \pm 0.007 [0.168, 0.186]	0.177 \pm 0.009 [0.165, 0.191]	0.196 \pm 0.017 [0.150, 0.240]	0.163 \pm 0.013 [0.132, 0.193]	no data
PEW / CS	0.255 \pm 0.006 [0.246, 0.265]	0.275 \pm 0.006 [0.265, 0.284]	0.259 \pm 0.009 [0.245, 0.291]	0.257 \pm 0.010 [0.239, 0.280]	0.258 \pm 0.011 [0.247, 0.274]
PPW / CS	0.350 \pm 0.007 [0.343, 0.360]	0.368 \pm 0.007 [0.360, 0.378]	0.357 \pm 0.011 [0.330, 0.386]	0.354 \pm 0.015 [0.328, 0.386]	0.364 \pm 0.021 [0.338, 0.385]
PEH / CS	0.371 \pm 0.006 [0.361, 0.380]	0.374 \pm 0.007 [0.360, 0.382]	0.370 \pm 0.010 [0.344, 0.396]	0.370 \pm 0.011 [0.351, 0.396]	no data
PEL / CS	0.502 \pm 0.005 [0.495, 0.511]	0.496 \pm 0.005 [0.487, 0.501]	0.475 \pm 0.012 [0.439, 0.506]	0.485 \pm 0.016 [0.458, 0.522]	no data
ML / CS	1.220 \pm 0.014 [1.201, 1.236]	1.231 \pm 0.017 [1.207, 1.256]	1.226 \pm 0.019 [1.180, 1.272]	1.228 \pm 0.024 [1.161, 1.272]	no data
MH / CS	0.511 \pm 0.010 [0.498, 0.526]	0.499 \pm 0.013 [0.479, 0.511]	0.507 \pm 0.010 [0.483, 0.532]	0.506 \pm 0.014 [0.484, 0.545]	no data
MGr / CS [%]	1.79 \pm 0.23 [1.54, 2.11]	2.89 \pm 0.66 [1.71, 3.52]	2.08 \pm 0.45 [1.29, 2.89]	2.10 \pm 0.50 [1.22, 3.32]	no data

The lectotype series of *L. carinthiacus* and the holotype nest sample of *L. sordidulus saxonicus* were safely allocated to either cluster with probabilities of $p > 0.9995$, having $D(18)$ values of -1.71 and 4.30 respectively. 97.9 % of all 94 classifications had probabilities > 0.959 . The morphological distinctness of both taxa is thus well-documented (Fig. 4). Considering the adequate geographic distribution of samples and their sufficient number in each class, which is more than 2.5 fold larger than the number of characters used, the analysis is not in danger to confirm compliantly an unrealistic prejudice. When performing a discriminant analysis on the individual level with the same 18 characters, 96.6 % of 206 specimens are determined in agreement with the nest sample analysis and 93.2 % are determined with $p > 0.95$. The error rate of 3.4 % can be considered a good result in determination of individuals of most similar species.

There are only two samples with lower determination probabilities: the syntype series of *L. sordidulus* var. *tergestina*, having $D(18) = -0.53$ is allocated to *T. sordidulus* with $p = 0.921$ and the nest sample from Germany: Reicholzheim 1994, with $D(18) = +0.53$ is allocated to *T. saxonicus* with $p = 0.944$. The sample from Reicholzheim (49.72° N, 9.53° E) marks the most western outpost within the known Central European range of *T. saxonicus* (Fig. 5) and is possibly rather isolated from the main population which may explain its deviating characters. The type locality of *L. s. tergestina*, Santa Croce, is situated clearly within the range of *T. sordidulus*, only 27 km away from the type locality of *T. sordidulus* and outside the known range of *T. saxonicus*. All four syntype worker are classified as *T. sordidulus* when a discriminant analysis on the individual level is run (probabilities: 0.964, 0.956, 0.740, 0.740). As a consequence, the syntypes of *L. s. tergestina* are not suspected of belonging to *T. saxonicus* but should most probably represent a deviating sample of *T. sordidulus* rather than being a third species.

Of particular interest is the *T. saxonicus* population in the Grand Canyon du Verdon at 43.75° N and 6.34° E. This population is apparently strongly isolated from the main range – the next known site of *T. saxonicus* is situated 707 km NE. Overall morphology of this and of the Central European population are in good agreement with exception of clearly subaverage FRS / CS in the French samples.

There is a character change between northern and southern populations in both *T. sordidulus* and *T. saxonicus*. Spine length reduction as well as elongation of head and mesosoma are less expressed in *T. sordidulus* from S Serbia and Bulgaria while southern *T. saxonicus* show a trend for longer spines and higher petioles compared to their northern conspecifics. The clear discrimination of *T. sordidulus* and *T. saxonicus* by discriminant functions based on worker nest sample means would not generally exclude that each entity could contain further species when additional characters and more samples will be available – Bulgarian material in particular is suspicious of containing unrecognized taxa.

Is it possible to avoid the very time-consuming determination by numeric taxonomy and discriminant functions? This question must be denied for Europe south of 44° N, but in the northern ranges, the vast majority of samples can be determined by subjective assessment: *T. sordidulus* is usually well characterized in this region by stronger, more

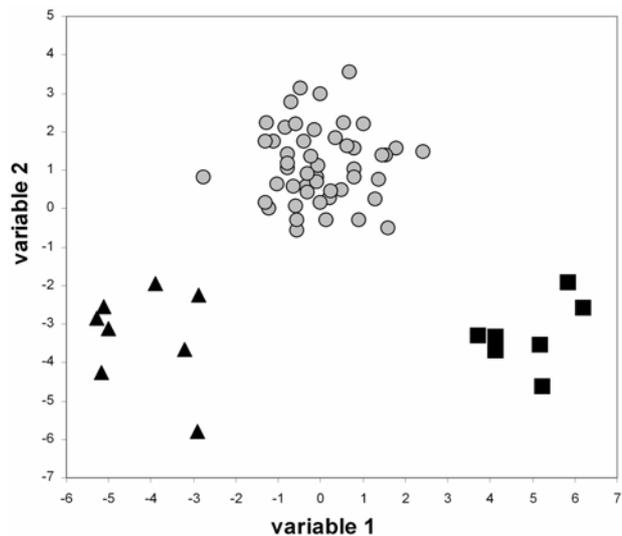


Fig. 6: Canonical discriminant values of 49, 8 and 7 worker nest samples of *Temnothorax sordidulus* (grey circles), *T. schoedli* sp.n. (black triangles), and *T. artvinense* sp.n. (black squares) based upon 18 morphometric characters.

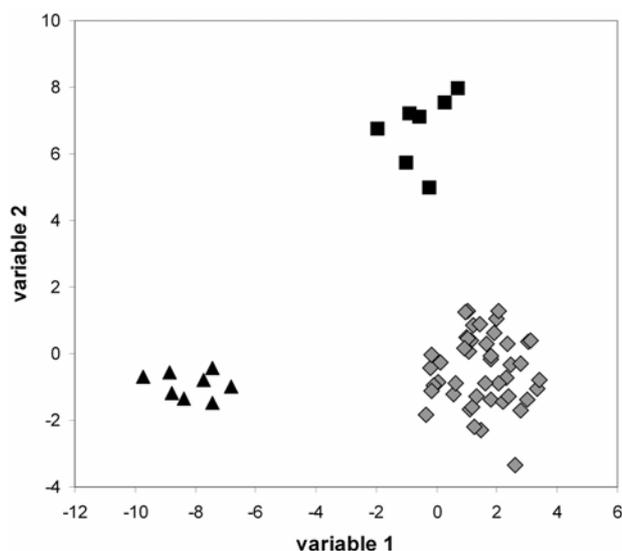


Fig. 7: Canonical discriminant values of 45, 8 and 7 worker nest samples of *Temnothorax saxonicus* (grey rhombs), *T. schoedli* sp.n. (black triangles), and *T. artvinense* sp.n. (black squares) based upon 18 morphometric characters.

reticulate sculpture on mesosoma and waist, shorter, often even triangular spines, more elongated head and rather homogeneous, blackish brown body colour. *Temnothorax saxonicus* shows less short spines and a less elongated head, a weaker, less reticulate waist sculpture and is usually distinctly bicoloured, with medium or light brown mesosoma and dark brown head and gaster. The colour photographs in SEIFERT (1996, p. 259) give a good impression on typical specimens of both species. Nevertheless, at least in contact zones of the parapatric species, it remains dangerous to rely on subjective assessment.

Identification of two new species from Asia Minor by discriminant functions

The populations from district Artvin in NE Turkey, described below as *T. artvinense* sp.n., and from the Nur Dag-

lari mountains / district Antakya in SE Turkey, described below as *T. schoedli* sp.n., are situated about 1200 and 1000 km distant from the next known *T. saxonicus* or *T. sordidulus* sites. The area in between is poorly investigated and we can not be sure that these Turkish species are nowhere in contact with the European species. A discriminant analysis (Figs. 6, 7) using 18 characters and performed on the level of nest sample means suggests that both new species are well-separated from *T. saxonicus* and *T. sordidulus*. However, these analyses calculating determination probabilities of > 0.995 for each considered case, are not necessarily conclusive because the number of samples available in the new species is much lower than twice the number of evaluated characters. *Temnothorax schoedli* sp.n. should not represent a problem in this context – as stated in the original description below, it shows several outstanding structural characters separating it from any related species of the genus.

The case of *T. artvinense* sp.n., which has no really outstanding character, needs further consideration. A reduction of characters in the nest sample analysis from 18 to down to 4 still offers a sufficient separation from *T. saxonicus* with

$$D(4) = 82.7 * FRS / CS - 80.26 * MW / CS - 60.6 * SP / CS + 126.33 * PeL / CS - 31.3$$

T. saxonicus $D(4) -3.107 \pm 1.038 [-5.26, -1.07]$ (n = 45)

T. artvinense $D(4) 2.119 \pm 0.660 [1.07, 2.90]$ (n = 7)

All 52 samples are determined with $p > 0.953$.

A DA on individual level with reduction to 10 characters determined 98.3 % of 118 cases in agreement with the nest sample analysis and 96.6 % of them with $p > 0.95$.

When separating *T. artvinense* sp.n. from *T. sordidulus*, a nest sample analysis with character reduction down to 5 offers a sufficient separation with

$$D(5) = 46.68 * SL / CS + 40.04 * SPTI / CS + 91.38 * PeW / CS - 179.8 * EYE / CS - 47.6 * PPW - 16.36$$

T. sordidulus $D(5) -3.203 \pm 1.034 [-5.16, -1.08]$ (n = 49)

T. artvinense $D(5) 2.322 \pm 0.671 [1.08, 3.24]$ (n = 7)

All 56 considered samples are determined with $p > 0.972$.

A discriminant analysis on individual level with reduction to 7 characters determined 99.2 % of 124 cases in agreement with the nest sample analysis and 96.8 % of them with $p > 0.95$.

These calculations make credible that the possibly geographically isolated *T. artvinense* sp.n. is morphologically distinct and well-separable both from *T. sordidulus* and *T. saxonicus* and should be introduced as a new species.

Synonymic lists

Temnothorax sordidulus (MÜLLER, 1923) comb.n.

Leptothorax sordidulus MÜLLER, 1923 [original description, zoogeography]

Leptothorax mulleri SANTSCHI, 1926 [objective synonym, unjustified replacement name for *L. sordidulus* MÜLLER]

Leptothorax sordidulus var. *tergestina* FINZI, 1928 [types investigated]

Leptothorax carinthiacus BERNARD, 1957 [types investigated]

Leptothorax sordidulus sordidulus MÜLLER, 1923 sensu SEIFERT (1995, 1996)

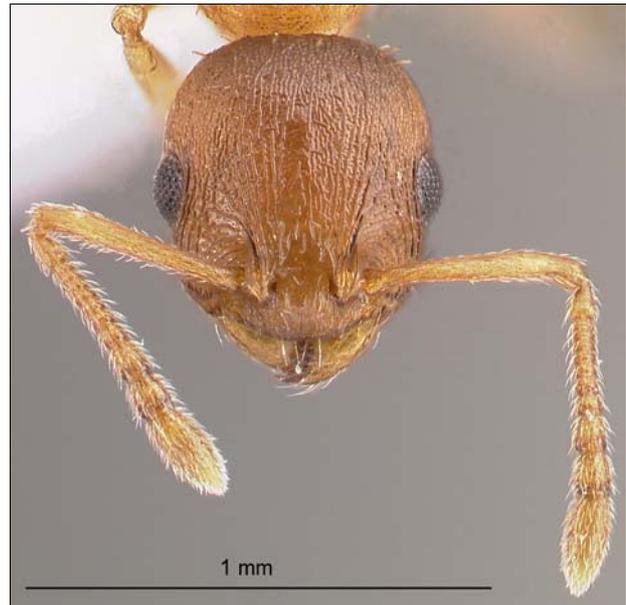


Fig. 8: Holotype of *Temnothorax schoedli* sp.n.: dorsal aspect of head.

Comments: *Temnothorax sordidulus* was described from "Roditti / Carso Triestino" (now in Slovenia and named Rodik: 45.618° N, 13.983° E). A type has apparently never been found by any later taxonomist. Fortunately this taxon represents a rare case in which a sufficiently safe species identification is possible in the absence of type material. Müller's descriptive statements are: short triangular spines (similar to *T. corticalis*), entirely dark body, a notable metanotal depression, a densely chagreened vertex with only very weak longitudinal rugulae (not clearly longitudinally carinate as in *T. nylanderi*) and short gastral setae. According to present knowledge, no other *Temnothorax* species in this region shows this very special character combination. Samples with scapes "perfettamente gialle", as stated by Müller, do occur in *T. sordidulus* together with such having an infuscated antennal club.

The synonymies of *T. sordidulus* with *L. s. tergestina* and *L. carinthiacus* were already derived in the section "Separation of *T. sordidulus* and *T. saxonicus*". The synonymy with *L. carinthiacus* was already stated by SCHULZ (1991).

Temnothorax saxonicus (SEIFERT, 1995) comb.n., stat.n.

Leptothorax sordidulus saxonicus SEIFERT, 1995 [types investigated]

Leptothorax sordidulus MÜLLER, 1923, sensu NOVAK (1944)

Leptothorax sordidulus MÜLLER, 1923, sensu HAUCK (1991)

Leptothorax sordidulus MÜLLER, 1923, sensu SEIFERT (1993a, b, 1994a, b)

Leptothorax sordidulus saxonicus SEIFERT, sensu SEIFERT (1996)

Leptothorax sordidulus MÜLLER, 1923, sensu SEIFERT (1998)

Leptothorax sordidulus MÜLLER, 1923, sensu SCHLICK-STEINER, STEINER & SCHÖDL (2003)

Description of new species

Temnothorax schoedli sp.n.

Type locality: In the Nur Daglari, about 14 road kilometres W of Hassa, 1600 m a.s.l, approximate estimate of position 36.82° N, 36.42° E.



Figs. 9 - 10: Holotype of *Temnothorax schoedli* sp.n.: (9) lateral aspect, (10) dorsal aspect.

Type material: Holotype worker labelled "Türkei_32, Prov. Antakya 296 [sample number handwritten in red] Nur Daglari, 14 rkm W. Hassa 1600mH, 11.05.1997, leg. A. Schulz, K. Vock, M. Sanetra", "GBIF-D/FoCol 1360 specimen + label data documented"; 2 worker paratypes with same locality label; 18 worker paratypes plus 3 gyne paratypes with same locality labels but with red, handwritten sample numbers 287, 289, 290, 292, 293, 295, 299; all above mentioned material in SMN Goerlitz; 30 worker and 2 gyne paratypes of the same samples in coll. Schulz; 12 worker paratypes of samples No. 287, 289, 292, and 295 in SMN Karlsruhe.

Derivatio nominis: The species name is given in honour and memory of Stefan Schödl.

Description of worker (Figs. 8 - 10): on average larger than all the closely-related species (CS 0.677 mm). Head significantly broader than in other members of the *T. sordidulus* group and with rounded sides, CL / CW 1.086. Scape with variable pubescence: varying in the same specimen from appressed to erect. Clypeus between sagittal level of frontal carinae rather smooth but with 5 - 9 longitudinal carinulae. Eyes rather large (EYE / CS 0.229) and more approached to hind margin of vertex (PoOc / CL

0.366). Vertex with fine microreticulum, on paramedian vertex superimposed on each side by 5 - 7 longitudinal rugulae. Frontal carinae widely distant (FRS / CS 0.362). A transversal line between the frontal carinae, set posterior of the frontal triangle, crosses 12 - 16 carinulae. Frontal triangle in posterior part with 2 - 4 carinulae. Mesosoma more thickset than in related species and with more distant spines bases (MW / CS 0.618, SPBA / CS 0.283). Propodeal spines rather short but acute (SP / CS 0.176), in lateral view deviating from longitudinal axis of mesosoma by 45°. Sculpture on mesosoma stronger than usually seen in the closely-related species: a strong longitudinal rugosity (height of rugae in many specimens up to 12 µm) is present at least on lateral pronotum but frequently stretches over whole mesosomal surface. Metanotal depression notable but not deep. Petiole and postpetiole covered by a reticulate microsculpture that is superimposed, in particular on dorsal parts, by a number of strong longitudinal rugulae. Petiole in profile with a rather straight face that forms with petiolar peduncle an angle of about 150°; top of node rather small and convex, posterior slope slightly convex. All appendages, mesosoma, waist and basis of first gaster tergite light yellowish to dirty yellowish brown. Dorsum of

head medium brown, at least the posterior surfaces of gaster tergites dirty brown. For morphometric data of 8 nest sample means see Tab. 1.

Description of gyne: on average larger than all the closely-related species, with smaller PoOC, very large mesosoma, more distant spine bases and more elongated petiole. Morphometric data of 4 paratype gynes: CS 805 ± 13 [794, 823], CL / CW 1.030 ± 0.020 [1.003, 1.047], SL / CS 0.719 ± 0.010 [0.707, 0.732], PoOc / CL 0.338 ± 0.004 [0.333, 0.342], FRS / CS 0.364 ± 0.008 [0.356, 0.374], MW / CS 1.057 ± 0.011 [1.043, 1.068], MH / CS 0.987 ± 0.019 [0.968, 1.014], ML/CS 1.800 ± 0.020 [1.772, 1.816], SPBA / CS 0.444 ± 0.012 [0.437, 0.462], SPTI / CS 0.376 ± 0.013 [0.361, 0.391], SPST / CS 0.311 ± 0.021 [0.290, 0.333], SP / CS 0.138 ± 0.034 [0.106, 0.177], PEW / CS 0.312 ± 0.027 [0.281, 0.336], PPW / CS 0.427 ± 0.034 [0.407, 0.478], PEH / CS 0.407 ± 0.018 [0.382, 0.424], PEL / CS 0.585 ± 0.017 [0.564, 0.605].

Comments: Differential characters to related species are given in the verbal description and Tab. 1. An argumentation making credible a consistent separation from *T. sordidulus*, *T. saxonicus*, and *T. artvinense* sp.n. was given in the section "Identification of two new species from Asia Minor by discriminant functions". Two of the nest samples were collected under the bark of trees.

Temnothorax artvinense sp.n.

Type locality: 5 km S of Artvin NE Turkey, about 41.17° N, 41.77° E, 1000 m a.s.l., in a light Pine forest of 50 % canopy closure.

Type material: Holotype worker labelled "ARTVIN – 5 km S Artvin 1000 mH 1164 [sample number handwritten] Kiefernwald 50 % Leg. Schulz 27.06.93 TÜRKEI", "GBIF-D/FoCol 1361 specimen + label data documented"; 2 worker paratypes with same locality label; 11 worker paratypes plus 2 gyne paratypes with same locality labels but handwritten sample numbers 1162 and 1165; all above mentioned material in SMN Goerlitz; 15 worker paratypes of samples No 1162, 1164 and 1165 in coll.Schulz.

Derivatio nominis: From the Turkish district Artvin.

Description of worker (Figs. 11 - 13): as large as *T. sordidulus* (CS 0.614 mm). Head significantly more elongated than in *T. schoedli* sp.n. and with only weakly convex sides, CL / CW 1.150. Scape with variable pubescence: varying in the same specimen from appressed to erect. Clypeus between sagittal level of frontal carinae with 8 - 11 longitudinal carinulae, the lateral ones often incurved. Eyes smaller (EYE / CS 0.209) and less approached to hind margin of vertex (PoOc / CL 0.389) than in *T. schoedli* sp.n. Sculpture on dorsal head similar to situation in *T. sordidulus* and *T. saxonicus*: Dorsal vertex with fine longitudinal rugulae which are on paramedian vertex stronger and on median vertex weaker or sometimes missing; interspaces between rugulae or rugae with microrugulae or microanastomosae. Dorsolateral head more strongly reticulate than longitudinally rugose. A transversal line between the frontal carinae, set posterior of the frontal triangle, crosses 14 - 17 carinulae. Frontal triangle with 2 - 3 carinulae. Mesosoma shape comparable to *T. sordidulus*, slender than in *T. schoedli* sp.n. and with more approached spine bases (MW / CS 0.594, SPBA / CS 0.269), metanotal depression deep and wide. Setae on dorsal mesosoma and petiole on average longer than in related species (PnHL /



Fig. 11: Holotype of *Temnothorax artvinense* sp.n.: dorsal aspect of head.

CS 0.139 ± 0.004 , PeHL / CS 0.167 ± 0.007). Propodeal spines rather short but acute (SP / CS 0.177), in lateral view deviating from longitudinal axis of mesosoma by 40°. Lateral mesosoma with rather strong longitudinal rugosity; dorsal mesosoma with weaker and finer sculpture which reticular component is always more developed than the longitudinally rugulose component, sometimes only fine reticulate sculpture present. Petiole with reticulate microsculpture, which is superimposed, in particular on dorsal and dorsolateral parts, by a number of rugae. Postpetiole with reticulate microsculpture, laterally a few longitudinal rugulae. Petiole in profile with a concave frontal face, top of node broader than in *T. schoedli* and convex, posterior node slope very steep, with a convex upper and a concave lower curvature. Head and gaster, with exception of its very base, dark to blackish brown. Mesosoma variably coloured: light yellowish brown to dirty brown, sometimes patchily coloured with lighter propodeum. Appendages light yellowish brown, femora sometimes infuscated. For morphometric data of 7 nest sample means see Tab. 1.

Description of gyne: representing a combination of significantly elongated head and scape, small PoOC, large FRS and more distant spine tips; much smaller than *T. schoedli* sp.n. Morphometric data of 3 paratype gynes: CS 727 ± 9 [719, 736], CL / CW 1.075 ± 0.009 [1.066, 1.084], SL / CS 0.740 ± 0.024 [0.725, 0.768], PoOc / CL 0.348 ± 0.004 [0.345, 0.353], FRS / CS 0.363 ± 0.004 [0.359, 0.366], MW / CS 0.990 ± 0.024 [0.964, 1.010], MH / CS 0.958 ± 0.036 [0.932, 0.999], ML / CS 1.753 ± 0.033 [1.732, 1.791], SPBA / CS 0.426 ± 0.013 [0.414, 0.440], SPTI / CS 0.388 ± 0.003 [0.386, 0.392], SPST / CS 0.310 ± 0.009 [0.301, 0.318], SP / CS 0.167 ± 0.013 [0.153, 0.177], PEW / CS 0.327 ± 0.009 [0.318, 0.335], PPW / CS 0.426 ± 0.020 [0.403, 0.438], PEH / CS 0.427 ± 0.014 [0.417, 0.443], PEL / CS 0.569 ± 0.025 [0.546, 0.596].

Comments: Differential characters to related species are given in the verbal description and Tab. 1. An argumentation making credible a consistent separation from *T. sordidulus*, *T. saxonicus*, and *T. schoedli* sp.n. was given in section "Identification of two new species from Asia Minor by discriminant functions".



Figs. 12 - 13: Holotype of *Temnothorax artvinense* sp.n.: (12) lateral aspect, (13) dorsal aspect.

Acknowledgements

To Christiana Klingenberg (Staatliches Museum für Naturkunde Karlsruhe) for making the fine automontage photos of the holotypes, to Andreas Schulz (Leverkusen) for giving full access to his private collection, donation of specimens and discussion of the issue, to J. Casevitz-Weulersse (MNHN Paris), Per Douwes (Lund University), Stefan Cover (MCZ Cambridge), Stefan Schödl (†, NHM Wien) and Christian Wieser (LMK Klagenfurt) for loan of valuable specimens.

Zusammenfassung

Es werden morphologische und chorologische Argumente präsentiert, dass *Temnothorax saxonicus* (SEIFERT, 1995) stat.n., comb.n. als parapatrische Schwesternart von *T. sor-*

didulus (MÜLLER, 1923) comb.n. betrachtet werden sollte. Zwei neue Arten, *T. schoedli* sp.n. und *T. artvinense* sp.n., werden aus der östlichen Türkei beschrieben. Unter Einschluss von *T. melas* (ESPADALER & al., 1984) umfasst die *T. sordidulus*-Gruppe in Europa und Kleinasien jetzt mindestens fünf Arten. Das morphologische Untersuchungssystem berücksichtigte 18 Merkmale, die in einer kanonischen Diskriminanzanalyse ausgewertet wurden. *Leptothorax sordidulus* var. *tergestina* FINZI, 1928 und *Leptothorax carinthiacus* BERNARD, 1957 werden als jüngere Synonyme von *Temnothorax sordidulus* dargestellt.

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