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First records of *Myrmica vandeli* BONDROIT and *M. tulinae* ELMES, RADCHENKO *et* AKTAÇ (*Hymenoptera*: *Formicidae*) for Poland, with a key for the *scabrinodis*- and *sabuleti*-complexes

Abstract: The first records from Poland of *Myrmica vandeli* and the recently described *M. tulinae*, both belonging to the *scabrinodis*-group, are reported. These species are poorly recorded and may be less rare than hitherto supposed. The current knowledge of their distributions and ecologies are summarised. The characteristic morphological features of the two species are illustrated and a key for separating them from their closest relatives in Poland is given.

Key words: ants, *Myrmica vandeli*, *Myrmica tulinae*, *scabrinodis*-complex, *sabuleti*-complex, morphology, key, fauna of Poland

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INTRODUCTION

The catalogue of the ants of Poland (part of Katalog Fauny Polski) compiled by PISARSKI (1975) contained 11 species of the genus *Myrmica* LATR. [including *Sifolinia* (=*Myrmica*) *karavajevi* (ARN.)]. RADCHENKO *et al.* (1997) provided a review of the Polish *Myrmica* species [including *M. lonae* FINZI, revived from synonymy by SEIFERT (1994), see also SEIFERT (2000)], with a key for their identification. More recently three more *Myrmica* species, *M. hirsuta* ELMES, *M. hellenica* FINZI and *M. microrubra* SEIFERT, were added to the list of Polish fauna (CZECHOWSKA and RADCHENKO 1997, CZECHOWSKI *et*

al. 1998, 1999). The most recent treatment of the 15 *Myrmica* species can be found in the monograph "The ants of Poland" (CZECHOWSKI *et al.* 2002).

However, in the same year that the monograph was published, ELMES *et al.* (2002) described four new species of *Myrmica* from Turkey, including *M. tulinae*, a member of the *scabrinodis*-group of *Myrmica* species. As part of an ongoing revision of the Palaearctic *Myrmica* species, two of us (A. RADCHENKO and G. W. ELMES) made detail investigation of ELMES' collection of *Myrmica* and found that *M. vandeli* BONDROIT (which also belongs to the *scabrinodis*-group) and *M. tulinae* are more widely distributed than supposed, with both being present in material taken from Poland. At the same time others of us (W. CZECHOWSKA, A. STANKIEWICZ and M. SIELEZNIEW), discovered both species in material taken as part of ongoing ecological studies. We report these new records here and outline the diagnostic features of the two species with some notes on their ecologies.

MORPHOMETRICS

A large number of morphometrics and indices can be used in studies of *Myrmica* species (for details see RADCHENKO and ELMES 1998, 1999), here we use only 6 measurements and 4 indices:

HW – maximum width of head in dorsal view behind the eyes
SL – maximum straight-line length of antennal scape seen in profile
FW – minimum width of frons between frontal lobes
PPW – maximum width of postpetiole seen from above
PPH – maximum height of postpetiole seen in profile
ESL – maximum length of propodeal spine seen in profile.
Frontal Index: FI = HW/FW[1]
Scape Index: SI = SL/HW
Postpetiole Index: PPI = PPW/HW
Propodeal spine-length Index: ESLI = ESL/HW.

DISTRIBUTION AND ECOLOGY

M. vandeli was described from France (BONDROIT 1920), based on queens and males, and remained known only from the type series until KUTTER (1977) described workers from Switzerland. Large populations were recorded from two regions of France (ELMES and THOMAS 1985) and since then, *M. vandeli* has been recorded from Germany and Czech Republic (SEIFERT 1988, 1996), parts of former Yugoslavia and Turkish Thrace (AGOSTI and COLLINGWOOD 1987), Romania (MARKÓ 1999), Austria (SCHLICK-STEINER and STEINER 2000), and England and Wales (ELMES *et al.*, in press).

[1] In the revisions of *Myrmica* (e.g. RADCHENKO and ELMES 1998, 1999) we used FI = FW/HW, but in the papers dealing with Polish ant fauna (e.g. RADCHENKO *et al.* 1997, CZECHOWSKI *et al.* 2002) we used FI = HW/FW. To transfer these different data one should only simply divide 1 to FI values.

M. vandeli inhabits wet and warm sites and builds its nests usually in moss pads, tussocks of grass and sedge, and rarely, in the soil under stones. It usually coexists with, but is much less abundant than *M. scabrinodis* NYL. (ELMES *et al.* 1998, WARDLAW *et al.* 1998) and the occurrence of mixed colonies in Britain led ELMES *et al.* (in press) to suggest that it might be a temporary social parasite of *M. scabrinodis*. Although workers of *M. vandeli* are quite easily discriminated from those of *M. scabrinodis* by body sculpture (see below) these two species are easily confused unless males are present, and we suspect that many *M. vandeli* series might have been misidentified in the past.

In Poland, *M. vandeli* colonies was found in Mt. Otrosz (Krakowsko-Wieluńska Upland, 50°49′N, 20°41′E, 350 m a.s.l.); currently, this site is the north-eastern extreme of its range. It is an isolated, partially and irregularly mown, wet meadow (the association *Molinietum medioeuropaeum*) surrounded by a mixed forest. A characteristic plant was *Gentiana pneumonanthe* L. The site was inhabited by myrmecophilous butterfly *Maculinea alcon* (DEN. *et* SHIFF.) (see STANKIEWICZ and SIELEZNIEW 2002). Although detailed population studies were not made at this site, the density of *Myrmica* spp. nests was quite high (we estimated one per 1–2 m²). Samples (leg. M. SIELEZNIEW) were taken from 15 colonies in August 2002 showed that 5 were *M. vandeli* and 10 were *M. scabrinodis*. The high proportion of *M. vandeli* colonies was similar to the French sites (ELMES and THOMAS 1985), which are believed to provide optimum conditions, and so differs from other records where *M. vandeli* was occurred in lower proportions relative to *M. scabrinodis* (see SEIFERT 1988, SCHLICK-STEINER and STEINER 2000).

M. tulinae was described from the extreme south-eastern edge of Europe, in Turkish Thrace, and in Asia Minor from the Artvin Region of Turkey. During a review of the *scabrinodis*-group species in the ELMES' collection, we found *M. tulinae* specimens, collected by various entomologists at different times, from France, Italy, Netherlands, Georgia, and Poland. A few series had been identified as *M. scabrinodis* but most were confused with *M. sabuleti* MEIN.; workers of *M. tulinae* differ only slightly from those of *M. sabuleti* although males are quite distinct (see below). We suppose that in many collections *M. tulinae* has most often been misidentified as *M. sabuleti* and, in fact, might prove to be a fairly widespread Euro-Caucasian species.

In Thrace, *M. tulinae* colonies nested mainly in damp, coarse-sandy soil in a small tree plantation (*Populus* sp.), where they built raised mounds (ca 20 cm in diameter and 10 cm high); several nest samples were also taken from an oak forest and from an elm-ash forest. In the Artvin Region, colonies lived under stones in an alpine meadow (ELMES *et al.* 2002). The Georgian habitats were rather similar to those at Artvin, being mountain meadows at altitudes between 1450 and 1800 m. *M. tulinae* nests were built usually under stones, in soil with different moisture conditions, ranging from moderately humid to wet or even boggy conditions. In France, *M. tulinae* was collected near Massignieu-de-Rives, Rhone Valley, Savoie in a boggy marsh dominated by reeds and sedge; *Phragmites* sp. also was common but not dominant. Whereas not so far away, near Turin in Italy, samples were taken, living in the soil and grass tussocks in damp meadows that are grazed periodically. Apart from Poland our most northern records

are from The Netherlands, where it was found in a small nature reserve, near Groenlo, with damp-heath (a mixture of *Calluna, Erica, Agrostis,* and *Molinia* species) which is quite hot and dry in summer but wet in winter.

The Polish records for *M. tulinae* come from two sites: at Kostrza near Kraków (Cracow)[2] (Krakowsko-Wieluńska Upland; 23 VII 1984, workers, gynes and male, leg. G. W. ELMES, coll. code no. PL-215) and in Sandomierska Forest (Puszcza Sandomierska) near Stalowa Wola (Sandomierska Lowland; 22 VII 1998, workers, 3 nest samples, leg. W. CZECHOWSKA; for other ant species from that site see CZECHOWSKA and CZECHOWSKI 1998). In both cases nests were found in soil. First site (Kostrza) was an old herb-rich meadow with much *Sanguisorba* sp. and the second one (Sandomierska Forest) was a marshy pine forest (the association *Vaccinio uliginosi-Pinetum*).

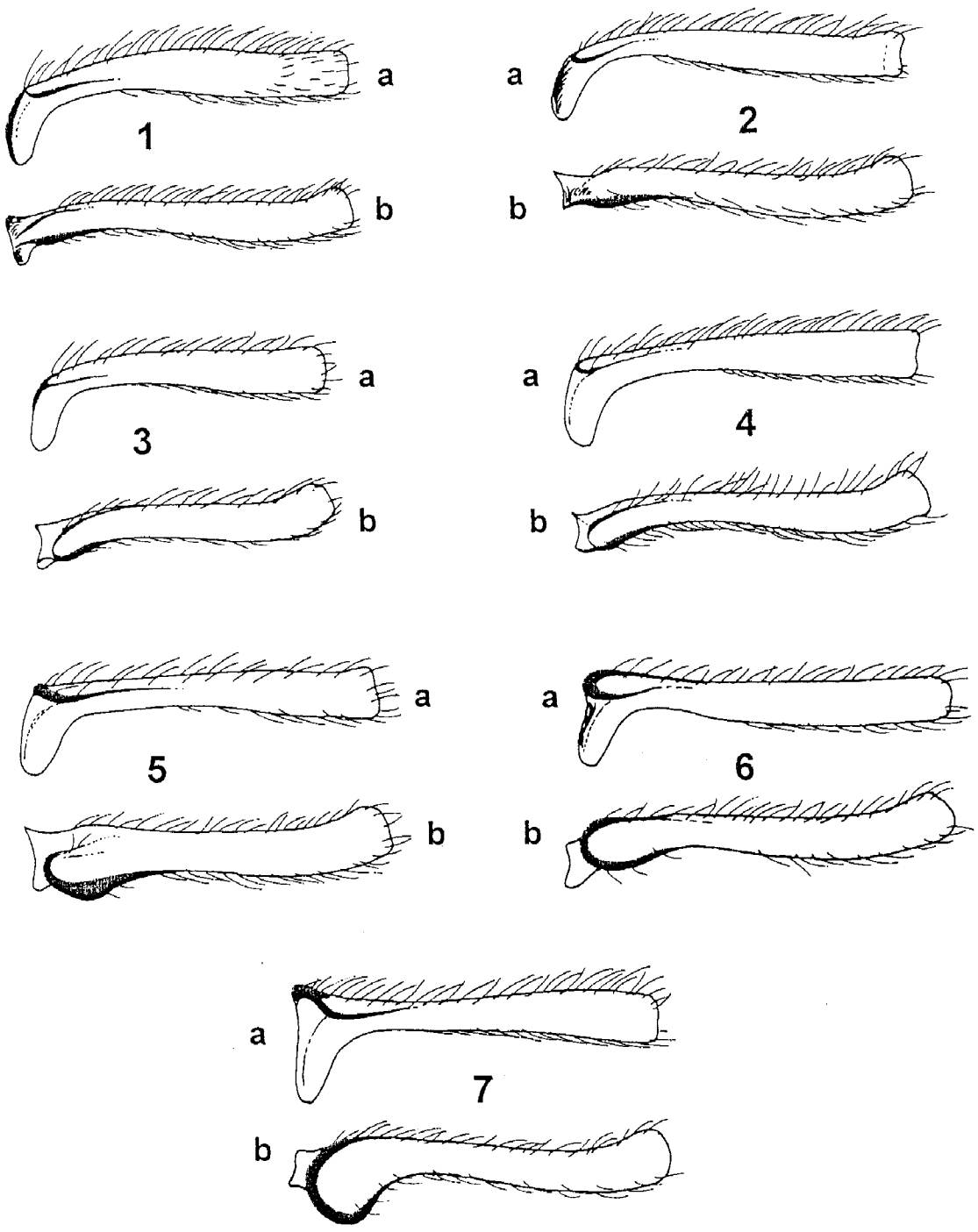
TAXONOMIC POSITIONS

M. vandeli clearly belongs to the *scabrinodis* species-group of the genus *Myrmica* (sensu RADCHENKO 1994) with the female castes being characterized by angulate scape with a moderately developed (though sometimes less so) longitudinal lobe or carina (see Figs 1–7). Workers appear most similar morphologically to those of *M. scabrinodis* and probably would be misidentified as such, using the common diagnostic features of the shape of frontal lobes and the size and shape of the lobe on the base of antennal scapes. It has an average FI (2.62) slightly smaller than that of *M. scabrinodis* (2.78), and its moderately developed (never large), longitudinal attenuated scape lobe (Fig. 1) overlaps the range of variation seen in *M. scabrinodis*. *M. vandeli* workers clearly differ from all other *Myrmica* species with longitudinally extended lobes on the base of their scapes, by a combination of the following features (see also Key and Figs 8, 13 and 14):

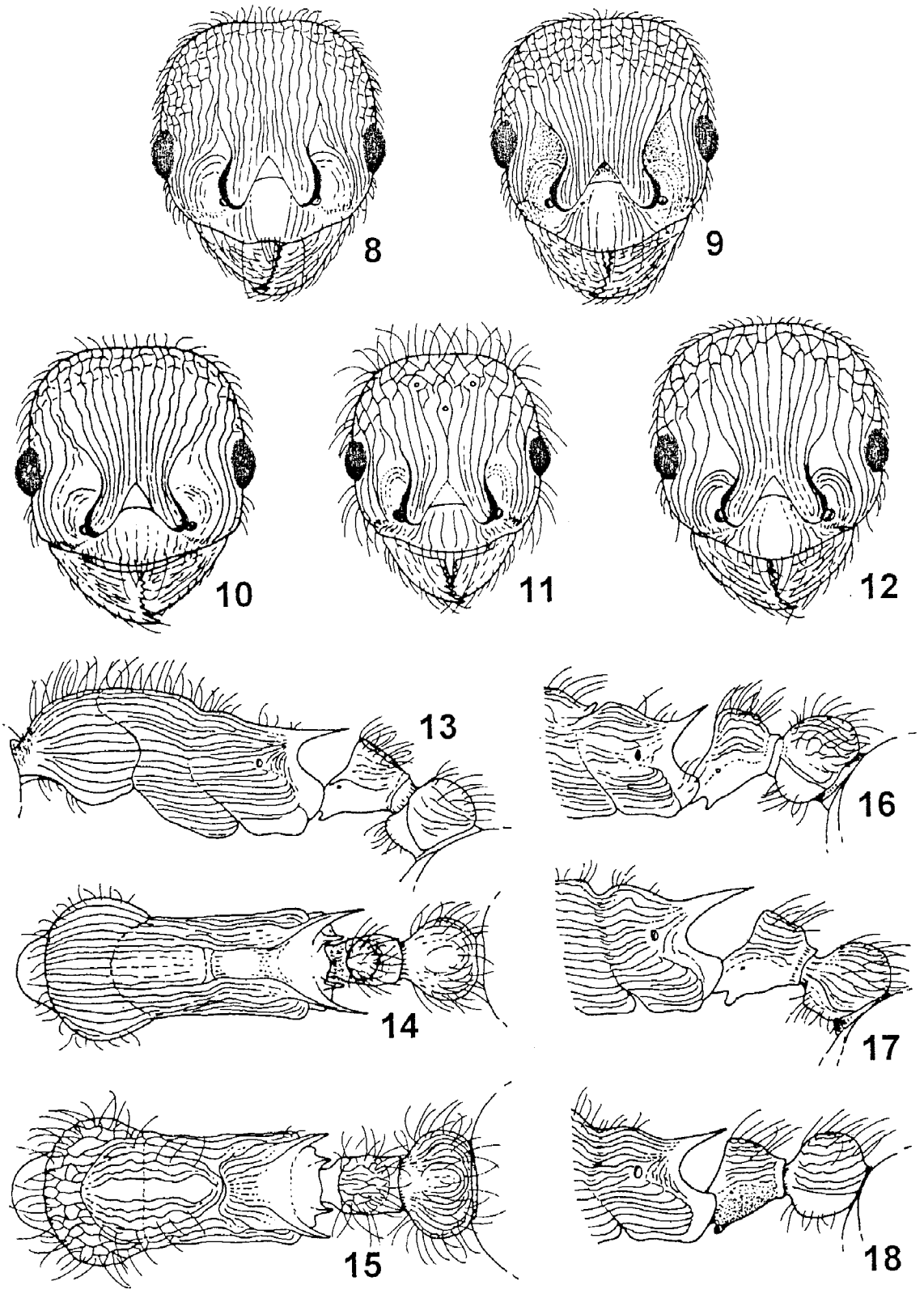
- more hairy body, petiole usually with 10–20, sometimes more, long, thin and often curved hairs;
- anterior clypeal margin with a distinct notch;
- dorsum of alitrunk with straight, or only slightly sinuous, longitudinal rugae;
- petiole, and especially postpetiole (seen from above), with a reduced sculpture;
- spurs on middle and hind tibiae always poorly developed and usually with no pectination.

Queens of *M. vandeli* are distinctly bigger than those of related species (HW > 1.20 mm, usually > 1.25 mm *vs.* HW < 1.20 mm, usually < 1.15 mm) and have quite conspicuous, longitudinally-concentric sculpture on the petiolar node, whereas the petiolar node of queens of related species have coarse reticulation (compare Figs 29 and 30). Usually *M. vandeli* queens are dark in colour, often appearing almost black, whereas queens of other species are the light brown colour that is more typical for European *Myrmica* (though specimens from acid moorland habitats can be quite dark).

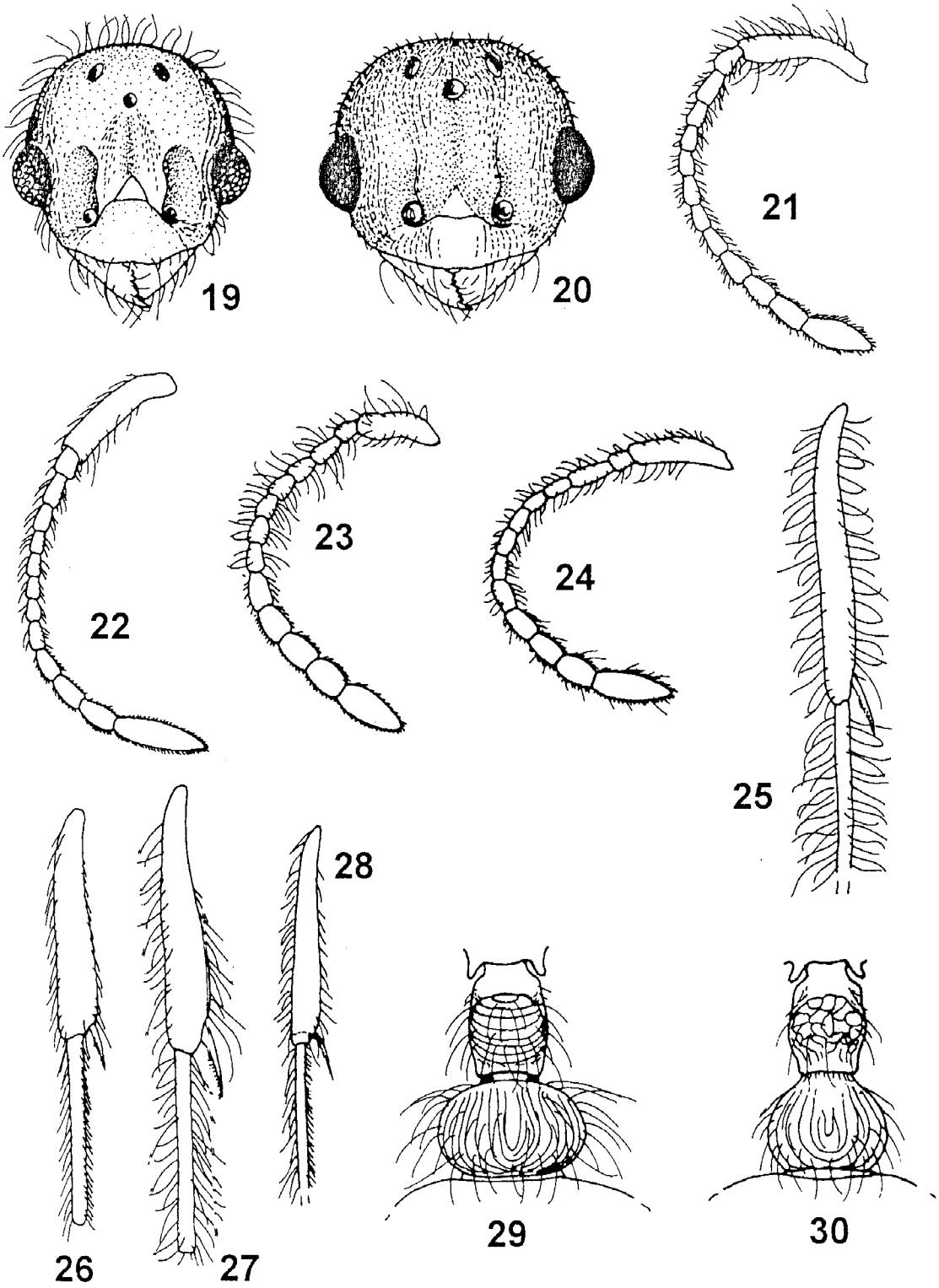
[2] At present, this area is included to the town of Kraków.



Figs 1–7. Antennal scapes of of *Myrmica* species (workers) (a – lateral view, b – dorsal view) (1 – *M. vandeli*, 2 – *M. specioides*, lectotype, 3 – *M. hirsuta*; 4 – *M. scabrinodis*, lectotype, 5 – *M. sabuleti*, lectotype, 6 – *M. tulinae*, holotype, 7 – *M. lonae*).



Figs 8–18. Details of structure of *Myrmica* species (workers) (8, 13, 14 – *M. vandeli*; 9, 17 – *M. scabrinodis*, lectotype, 10 – *M. tulinae*, holotype 11, 15, 16 – *M. hirsuta*, 12 – *M. sabuleti*, lectotype, 18 – *M. specioides*, lectotype; 8–12 – head, dorsal view, 13 – alitrunk and waist, lateral view, 14, 15 – alitrunk and waist, dorsal view, 16–18 – propodeum and waist, lateral view).



Figs 19–30. Details of structure of *Myrmica* species [19–28 males, 29, 30 – queens; 19, 21, 26, 29 – *M. vandeli* (29 – lectotype), 20, 22, 27 – *M. sabuleti*, paralectotype, 23, 25, 30 – *M. tulinae*, paratype, 24 – *M. specioides*, paralectotype; 19, 20 – head, dorsal view, 24 – antenna, 25–28 – tibia and first tarsal joint of hind leg, 29, 30 – petiole and postpetiole, dorsal view.

Males of *M. vandeli* are clearly separated from those of *M. scabrinodis*, *M. specioides* BONDR. and *M. tulinae* by their distinctly longer antennal scape: SL usually > 0.50 mm, average SI = 0.60 *vs.* SL < 0.45 mm, average SI = 0.40. Among the Polish fauna, only males of *M. sabuleti*, *M. lonae* FINZI and *M. hirsuta* ELMES have similar, relatively long antennal scapes. However, *M. vandeli* males can only be confused with *M. hirsuta*, differing from the other two species by a combination of much longer hairs on the head and scape (compare Figs 19 and 21 *vs.* 20 and 22). Compared to *M. hirsuta* males, *M. vandeli* have relatively narrower postpetiole: PPI = 0.45–0.60, mean = 0.56 *vs.* PPI = 0.64–0.70, mean = 0.66.

M. tulinae was also placed in the *scabrinodis*-group (ELMES *et al.* 2002). It has an unusual combination of features for an European *Myrmica* species: size, the antennal lobes of the female castes are generally rather large, distinctly larger than in typical *M. scabrinodis* (compare Figs 4 and 6) and somewhat resemble those of *M. sabuleti*. By shape the transverse margin of the lobe is less square than is typical for *M. sabuleti* and is somewhat intermediate with typical *M. scabrinodis*. The average FI in workers (2.94) is greater than that of *M. scabrinodis* (2.78) and, is perhaps, even slightly greater than that of "typical" *M. sabuleti* (compare Figs 9, 10 and 12). In contrast, males of *M. tulinae* clearly differ from those of *M. sabuleti* and related species by much shorter antennal scapes (SI < 0.45 *vs.* SI > 0.50) and by distinctly longer standing hairs on the antennal scapes (compare Figs 22 and 23). However, by these features, and by long hairs on the tibiae and tarsi, males of *M. tulinae* are extremely similar to those of *M. scabrinodis* and could be easily confused with them if found without female castes. The only feature that might separate males of *M. tulinae* from *M. scabrinodis* is antennal scapes that are even shorter than those of *M. scabrinodis* (SI = 0.37–0.40 *vs.* 0.39–0.42), but this feature needs confirmation based on a detailed comparison of the species over their ranges.

As a rule of thumb, any field entomologist, armed only with a hand lens, who finds a nest of "*M. scabrinodis*" containing "*M. sabuleti*" males should consider *M. vandeli* as a probable identification. On the other hand if they find living in damp soil, a "*M. sabuleti*" nest (based on a narrow FI), with large antennal lobes, intermediate in shape between *M. sabuleti* and *M. scabrinodis*, and with "*M. scabrinodis*" males, they should consider *M. tulinae* as a probable identification.

KEY FOR IDENTIFICATION OF POLISH *MYRMICA* SPECIES RELATED TO *M. SCABRINODIS* (I.E. OF THE *SCABRINODIS*- AND *SABULETI*- COMPLEXES)

Workers (also using some features of Queens if available)

1 More hairy species, petiole with more than 10 (usually with 12–20) long, thin and often curved hairs standing hairs (Figs 13–16) 2
– Less hairy species, petiole with less than 10 (usually not more than 8) long, straight, thick hairs (Figs 17 and 18) 3
2 (1) Postpetiole narrower (PPI < 0.45). Head and alitrunk with longitudinal, slightly sinuous rugae, without reticulation, only extreme upper and lateral parts of head

dorsum with reticulation (Figs 8, 13 and 14). Queens large (HW > 1.20 mm), usually black and less hairy ..... ***M. vandeli*** BONDR.

– Postpetiole wider (PPI > 0.45, usually > 0.50). Head and alitrunk at least partly with reticulation (Figs 11 and 15). Queens small (HW usually < 1.10 mm), usually reddish brown and very hairy ..... ***M. hirsuta*** ELMES

3 **(1)** Antennal scape at the base with large, often very massive lobe (Figs 5–7); frontal lobes more strongly curved, frons narrower: FI = 2.70–3.33, average for a nest series > 2.85. Queens large (HW usually > 1.15mm) **4**

– Antennal scape at the base with smaller lobe or even with carina (Figs 2 and 4); frontal lobes less strongly curved, frons wider: FI = 2.43–3.03, average for a nest series < 2.85. Queens smaller (HW usually < 1.15mm) **5**

4 **(3)** Antennal scape at the base with very large, massive lobe, which at the basal end is clearly raised or curled upwards, relative to the dorsal plane or surface of the scape when seen in profile (i.e. lateral to the dorsal plane – see Fig. 7) ..... ***M. lonae*** FINZI

– Antennal scape at the base with smaller and not massive lobe, which is not distinctly raised upwards at the basal end when seen in profile (Figs 5 and 6) ..... ***M. sabuleti*** MEIN. and ***M. tulinae*** ELMES, RADCHENKO *et* ACTAÇ

5 **(4)** Propodeal spines longer (ESLI = 0.36–0.44, average = 0.41); petiole with distinct horizontal or slightly declined dorsal plate, its posterior face abruptly falls to postpetiole (Fig. 17). Antennal scape usually with a wider, somewhat rounded lobe at its base (Fig. 4) ..... ***M. scabrinodis*** NYL.

– Propodeal spines shorter (ESLI = 0.29–0.40, average = 0.36); petiole without distinct horizontal dorsal plate; its posterior face smoothly falls to postpetiole (Fig. 18); antennal scape usually with a narrower lobe, or even carina, at its base (Fig. 2) ..... ***M. specioides*** BONDR.

Males

1 Antennal scape relatively long, as long as 4–4.5 basal funicular joints together, SI > 0.50 (Figs 21 and 22) **2**

– Antennal scape shorter, as long as 3–3.5 of basal funicular joints together, SI <0.45 (Figs 23 and 24) **4**

2 **(1)** Head margins (seen in full-face view) with sparse short hairs (Fig. 20). Tibiae and first tarsal joints of legs with long hairs (Fig. 27) ..... ***M. sabuleti*** MEIN. and ***M. lonae*** FINZI

– Head margins (seen in full face view) with abundant long hairs (Fig. 19). Tibiae and first tarsal joints of legs with short hairs (Fig. 26) **3**

3 **(2)** Postpetiole wider (PPI = 0.64–0.70, mean = 0.66) ..... ***M. hirsuta*** ELMES

– Postpetiole narrower (PPI = 0.45–0.60, mean = 0.56) ..... ***M. vandeli*** BONDR.

4 **(1)** Antennal scape and especially legs with very long standing hairs (Figs 23 and 25) ..... ***M. scabrinodis*** NYL. and ***M. tulinae*** ELMES, RADCHENKO *et* ACTAÇ

– Antennal scape and legs with much shorter standing hairs (Figs 24 and 28) ..... ***M. specioides*** BONDR.

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STRESZCZENIE

[Tytuł: Pierwsze informacje o występowaniu w Polsce *Myrmica vandeli* BONDROIT i *M. tulinae* ELMES, RADCHENKO *et* AKTAÇ (*Hymenoptera*: *Formicidae*) z kluczem do oznaczania gatunków z kompleksów *scabrinodis* i *sabuleti*]

Praca zawiera pierwsze doniesienia o występowaniu w Polsce dwóch nowych dla fauny krajowej, mało znanych gatunków mrówek, *Myrmica vandeli* i *M. tulinae* (przedstawicieli kompleksu *scabrinodis*), wraz z informacjami o ich pozycji taksonomicznej, cechach morfologicznych, rozmieszczeniu geograficznym i wymaganiach ekologicznych, a także kluczem do oznaczania całego kompleksu *scabrinodis* oraz pokrewnego kompleksu *sabuleti*. W Polsce *M. vandeli* została wykazana na podstawie pięciu kolonii znalezionych na górze Otrosz (Wyżyna Krakowsko-Wieluńska) na wilgotnej łące *Molinietum medioeuropaeum* w 2002 r. (leg. M. SIELEZNIEW). *M. tulinae* wykazano najpierw podczas przeglądu kolekcji G. W. ELMESA (Anglia), zawierającej okazy tego gatunku zebrane w 1984 r. w Kostrzy pod Krakowem (obecnie w granicach miasta) (Wyżyna Krakowsko-Wieluńska) na łące ziołoroślowej (leg. G. W. ELMES), a następnie na podstawie prób z trzech gniazd znalezionych w 1998 r. w Puszczy Sandomierskiej (Nizina Sandomierska) w borze bagiennym *Vaccinio uliginosi-Pinetum* (leg. W. CZECHOWSKA). Znaleziska te wydłużają listę krajowej myrmekofauny do 100 gatunków (zob. CZECHOWSKI *et al.* 2002).