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Taxonomic notes on the *scabrinodis*-group of *Myrmica* species (Hymenoptera: Formicidae) living in eastern Europe and western Asia, with a description of a new species from Tien Shan

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Таксономические заметки о видах группы *M. scabrinodis* рода *Myrmica* (Hymenoptera: Formicidae) из Восточной Европы и Западной Азии с описанием нового вида из Тянь-Шаня

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Abstract. The examination of the type specimens and a large amount of material of *Myrmica scabrinodis* and related species (*scabrinodis*-group) from Europe, Asia Minor, Caucasus and Central Asia was made. A new species from the Tien Shan, *M. tobiasi* sp. n., is described and placed in context with related species. Several taxonomic problems in the *scabrinodis*-group are discussed and resolved: synonymy of *M. slovaca* Sadil with *M. salina* Ruzsky and *M. sancta* Karavaiev with *M. specioides* Bondroit confirmed; name *M. rugulososcabrinodis* Karavaiev considered as valid, and name *M. caucasica* Arnoldi is not necessary proposed replacement name; *M. georgica* Seifert revived from synonymy for the Kazakhstan's populations, Georgian populations are conspecific with *M. tulini* Elmes et al. The species of *scabrinodis*-group are placed in 5 complexes according to female and male characteristics.

Key words. Hymenoptera, Formicidae, *Myrmica*, *scabrinodis*-group, taxonomy, new species, Palaearctic.

Резюме. Изучены типовые экземпляры и обширный дополнительный материал по видам рода *Myrmica* из группы *M. scabrinodis* из Европы, Малой Азии, Кавказа и Средней Азии. Описан новый вид из Тянь-Шаня *M. tobiasi* sp. n. и обсуждается его положение в системе видов группы. Подтверждена синонимия *M. slovaca* Sadil с *M. salina* Ruzsky и *M. sancta* Karavaiev с *M. specioides* Bondroit. Название *M. rugulososcabrinodis* Karavaiev признано валидным, а название *M. caucasica* Arnoldi — неоправданным замещающим названием. *M. georgica* Seifert восстановлен из синонимов для казахстанских популяций, его грузинские популяции оказались конспецифичны с *M. tulini* Elmes et al. Виды группы *M. scabrinodis* отнесены к 5 комплексам на основе признаков самцов и каст самок.

Ключевые слова. Hymenoptera, Formicidae, *Myrmica*, группа *scabrinodis*, таксономия, новый вид, Палеарктика.

Introduction

Taxonomists had long grouped *Myrmica* species together in a way that echoed Nylander's original descriptions of the 6 most distinct and widespread European species (Nylander, 1846, 1849). This concept of species groups within genus *Myrmica* was formalised and extended to the Asian species by Radchenko (1994a). Many of the specific and infraspecific forms, described from Europe, the Caucasus and Asia Minor, are morphologically centred on the widespread species *M. scabrinodis* Nylander. The *scabrinodis*-group was defined by Radchenko (1994a, 1994c) (with some minor, later additions and changes) as being characterized by the combination of the following features: males with short antennal scape ($SI_1 < 0.55$, abbreviations see below); antennal scape of the workers and queens sharply curved or angulate at the base, in some species there is no sign of any thickening or other ornamentation at the curve, but most species have a lateral (i.e. horizontal with respect to the dorsal surface of the scape when seen from above or laterally) ridge or lobe (but never with a vertical dent or lobe) that can vary in size from more or less absent to very large; the anterior clypeal margin is convexly curved with no median notch (with the exception of *M. vandeli* Bondroit); the antennal sockets are, at most, surrounded by fine concentric striations and never by concentric rugae.

Seifert (1988) made a major contribution to introducing order into the taxonomic understanding of European *Myrmica.* Ignoring the fully socially parasitic species (discussed in detail in: Radchenko, Elmes, 2003), Seifert recognised 15 species that can be placed in the *scabrinodis*-group using the criteria outlined above. However, the taxonomy of the free-living species of the *scabrinodis*-group was not fully resolved by Seifert (1988) and since then *M. lonae* Finzi (Seifert, 2000) and *M. divergens* Karavaiev (Radchenko et al., 2002) were revived as a species, and a new species *M. tulinae* Elmes, Radchenko et Aktaç (Elmes et al., 2002) was described from Turkey and is now known to be fairly widespread in southern Europe (Radchenko et al., 2003); one more new species, *M. cagnianti*, was described from Morocco (Espadaler, 1996).

Three of the 16 free-living *scabrinodis*-group species, recognised in an revision made by Radchenko (1994a, 1994c), *M. tenuispina* Forel, *M. aimonissabaudiae* Menozzi and *M. orthostyla* Arnoldi, can now be placed in different species groups (Radchenko, Elmes, 2001). Otherwise Radchenko's treatment was largely in agreement with Seifert's. The major difference was Radchenko's (1994c) acceptance of Dlussky's (Dlussky et al., 1990) opinion that *M. bessarabica* Nassonov [and consequently its junior synonyms, *M. sancta* Karavaiev, *M. caucasica* Arnoldi and *M. bakurianica* Arnoldi, made by Radchenko (1995b)] is a senior synonym of *M. specioides* Bondroit and its various junior synonyms. This treatment was not fully accepted by many West European taxonomists and ecologists who continued to use the name *M. specioides*, causing considerable confusion in the ecological literature. We discuss this situation below.

The *scabrinodis*-group is widespread throughout the West Palaearctic [Europe, North-west Africa (Atlas Mts), the Caucasus, Asia Minor, Iran, Turkmenistan (Kopet-Dagh Mts), West Siberia, Kazakhstan, Kyrghyzstan] with the region of maximum diversity apparently centred on the Black Sea. The most eastern record of *M. scabrinodis* is in the vicinity of Irkutsk (about 104°E). To date, only *M. divergens*, which is distributed from the Altai through North Mongolia, North-western China and Yakutia (about 130° E), has been found east of Baikal. Over this range (Atlantic Europe to Baikal) *scabrinodis*-group species use a very wide variety of habitats ranging from fairly benign conditions in forests and meadows to the harsh conditions of northern moorlands and southern steppes and semi-deserts. They are often found in bogs, marshes, lake and river margins but even in the driest habitats they always are associated with more humid soil.

Many of the species are highly variable morphologically and it is necessary to examine a large amount of material before clear patterns emerge. We considered that a detailed study of the previously poorly studied Turkish fauna might help clarify the relationship between some of the less well-known species of the *scabrinodis*-group. We examined therefore, a large collection of Turkish *Myrmica* and much of the available material from Ukraine, Russia and the Caucasus. In the course of this work we refined our concept of species complexes (Radchenko, Elmes, 2001), applying it to the *scabrinodis*-group, and discovered a previously unknown species from the Tien Shan. Here, we describe the new species and place it in context other species of the *scabrinodis*-group, then we make some minor revisions of the existing nomenclature and finally we describe the species complexes.

Material and methods

This comprised the types of the new species (33 workers, 2 queens and 4 males), and also types and non-type material (in total many hundreds of workers together with males and queens where available) from *M. scabrinodis* (and its synonyms; here and below for details see: Seifert, 1988; Radchenko, 1994a, 1994c), *M. sabuleti* Meinert, *M. bessarabica*, *M. specioides* (and its synonyms), *M. turcica* Santschi, *M. georgica* Seifert, *M. sancta* (and its synonyms), *M. rugulososcabrinodis* Karavaiev, *M. slovaca* Sadil, *M. tulinae*. The type material are preserved in many Museums and Institutions: Zoological Museum of Moscow State University, Russia (ZMMU), Institute of Zoology of the Ukrainian National Academy of Sciences, Kiev (IZANU), Zoological Institute of Russian Academy of Sciences, St. Petersburg (ZISP), Trakya University, Edirne, Turkey (TU), collection of G.W. Elmes (ELMES), Museum and Institute of Zoology of the Polish Academy of Sciences, Warsaw (MIZ), Finnish Museum of Natural History, Helsinki (FMNH), Institute Royal des Sciences naturelles de Belgique, Bruxelles (IRSNB), National Museum of Natural History, Praha, Czech Republic (MNHP), Zoological Museum, University of Copenhagen, Denmark (ZMUC), Naturhistoriches Museum Basel, Switzerland (NHMB), Staatliches Museum für Naturkunde, Görlitz, Germany (SMNG). The non-type material examined mainly came from the ZMMU, IZANU and ELMES collections.

Following our previous publications (e.g. Radchenko, Elmes, 1998, 1999; Elmes et al., 2002), morphometrics of a sample of specimens from each caste were measured (accurate to 0.01 mm) and these were used to calculate various indices.

*Morphometrics***.** HL — length of head in dorsal view, measured in a straight line from the anterior point of median clypeal margin to mid-point of the occipital margin; HW — maximum width of head in dorsal view behind the eyes; FW — minimum width of frons between the frontal lobes; FLW — maximum width between external borders of the frontal lobes; SL — maximum straight-line length of antennal scape seen in profile; AL — diagonal length of the alitrunk seen in profile, from the neck shield to the posterior margin of metapleural lobes (workers) and from the anterio-dorsal point of alitrunk to posterior margin of metapleural lobes (queens and males); HTL — length of tibia of hind leg; PNW — maximum width of pronotum from above in dorsal view (workers); PL — maximum length of petiole from above; PPL — maximum length of postpetiole from above; PW — maximum width of petiole from above; PPW — maximum width of postpetiole from above; PH — maximum height of petiole in profile; PPH — maximum height of postpetiole in profile; ESL — maximum length of propodeal spine in profile; ESD — distance between tips of propodeal spine from above; SCW — maximum width of scutum from above (queens and males); SCL — length of scutum and scutellum combined from above (queens and males); AH — height of alitrunk, measured from upper level of mesonotum perpendicularly to the level of lower margin of mesopleura (queens and males).

Indices: CI = HL/HW; FI = FW/HW; FLI = FLW/FW; SI_1 = SL/HL; SI_2 = SL/HW; PI = PL/PH; PPI = PPL/PPH; ESLI = ESL/HW; ESDI = ESD/ESL; AI = AL/AH; SCI = SCL/SCW.

Systematic part

Myrmica tobiasi **Radchenko et Elmes, sp. n.**

Diagnosis. The workers and queens of *M. tobiasi* share most features with *M. specioides* but resemble *M. scabrinodis* in other respects. They most resemble *M. scabrinodis* by the size and shape of the lobe at the base of antennal scape, and by extended frontal lobes, but they clearly differ by a much wider frons (mean FI = 0.40 vs. 0.36 for *M. scabrinodis*), shorter propodeal spines (mean ESLI = 0.35 vs. 0.41) and by a differently shaped petiole (*M. scabrinodis* has a horizontal or slightly declined dorsal plate that makes a sharp edge with the anterior surface).

The wider frons, more rounded petiole and shorter spines are all characters that more resemble *M. specioides*. However, the frons of *M. tobiasi* is even wider than in *M. specioides* (mean FI = 0.40 vs. 0.38) and they well differ by the more developed and extended frontal lobes of *M. tobiasi* that is obvious after measuring the FW and FLW (mean FLI = 1.40 vs. 1.32). Males of *M. tobiasi* clearly differ from those of *M. scabrinodis* by much shorter sub-erect hairs on the tibiae and tarsi (in the latter species tibiae and tarsi with very long, curved erect hairs), which are very similar to males of *M. specioides*.

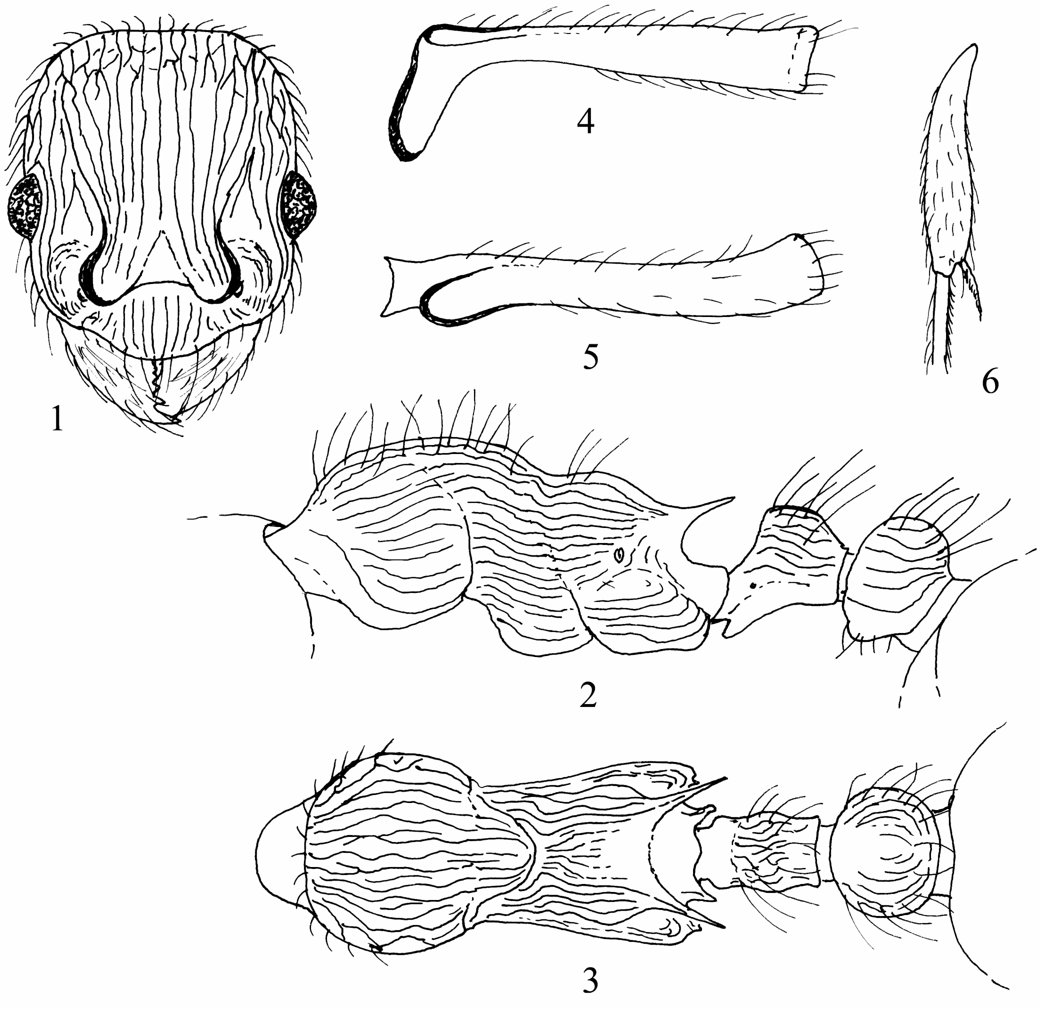
One other species, with which it could be confused, is *M. georgica* Seifert which we revive from synonymy (see the following section of this paper). Without females, males of *M. tobiasi* are almost impossible to separate them from those of *M. specioides* and *M. georgica*, but the females of *M. tobiasi* have much wider frons than *M. georgica* which has a mean FI = 0.355 and FLI = 1.51.

Description.

W o r k e r s (Figs 1–6).

Head longer than broad, with subparallel sides, very weakly convex occipital margin, and rounded occipital corners. Anterior clypeal margin broadly rounded, not prominent and without notch medially. Frontal carinae not strongly curved, frons relatively wide (similar to that of *M. specioides*), but frontal lobes well developed and extended, so that FLI bigger, similar to that of *M. scabrinodis*. Antennal scape strongly angulate at its base, with moderatory developed horizontal lobe (similar to that of *M. scabrinodis*).

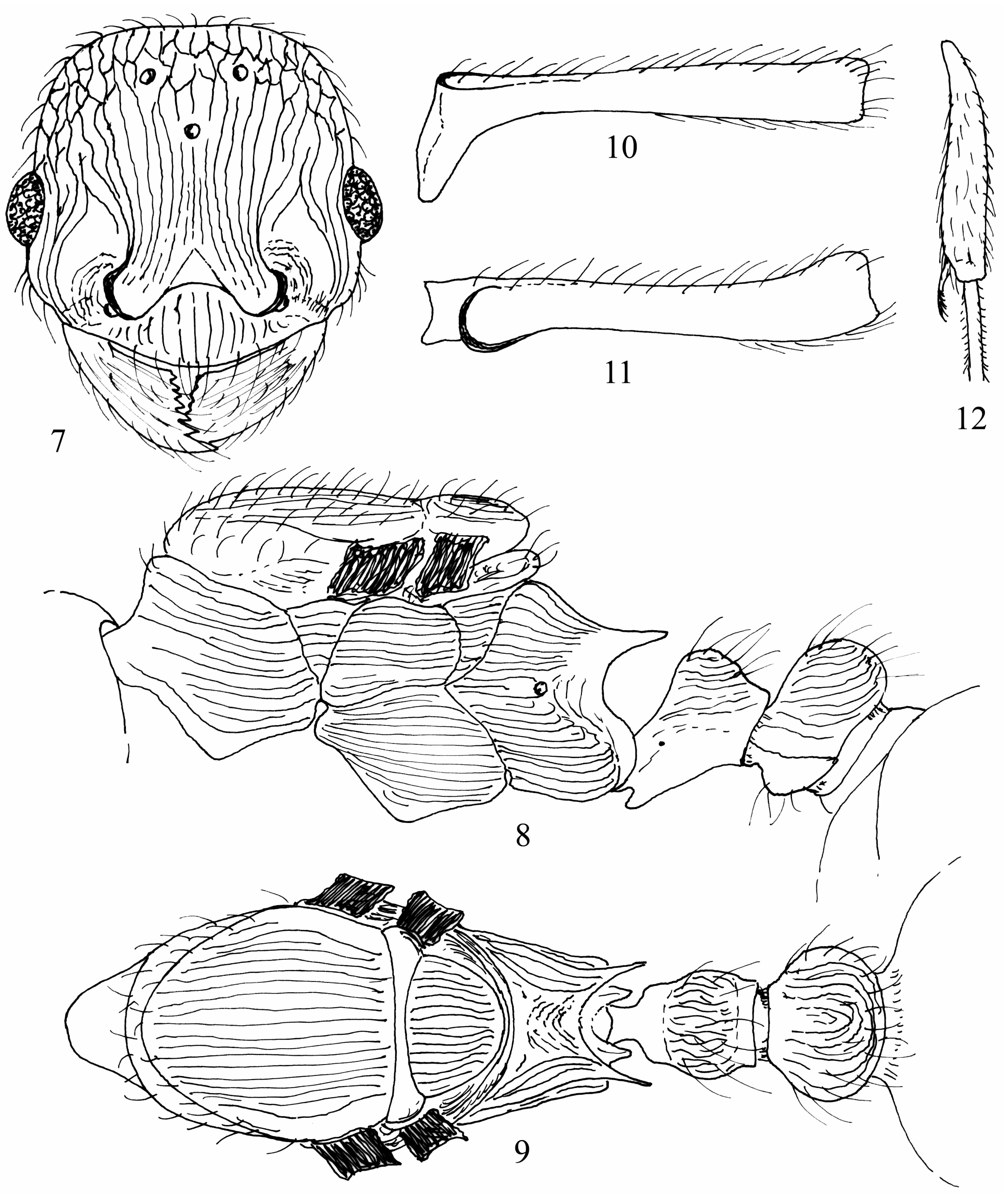
Alitrunk with convex promesonotal dorsum; promesonotal suture indistinct from above; metanotal groove distinct, wide and quite deep. Propodeal spines relatively short, acute and straight, not curving downwards, wide at base, divergent



Figs 1–6. *Myrmica tobiasi* sp. n. (holotype, worker). 1 — head, frontal view; 2 — alitrunk and waist in profile; 3 — alitrunk and waist from above; 4 — antennal scape in profile; 5 — antennal scape from above; 6 — hind tibia.

(seen from above), projecting backwards at an angle less than 45°. In profile, anterior surface of petiole concave, meets with dorsal surface at an angle about 90°; dorsal surface flattened, but not forming sharp plate, inclined posteriorly. Postpetiole shorter than high, with convex dorsum. Spurs on middle and hind tibiae well developed and pectinate.

Head dorsum with longitudinal, divergent rugae, only occiput with reticulation. Antennal sockets surrounded by fine concentric striation. Clypeus with longitudinal rugae. Alitrunk with longitudinal, more or less straight rugae but pronotal



Figs 7–12. *Myrmica tobiasi* sp. n. (paratype, queen). 7 — head, frontal view; 8 — alitrunk and waist in profile; 9 — alitrunk and waist from above; 10 — antennal scape in profile; 11 — antennal scape from above; 12 — hind tibia.

dorsum with more sinuous rugae. Rugae on petiole longitudinal, those of postpetiole longitudinally-concentric. Surfaces between rugae on the body smooth and shiny.

Hairs on the head margins and alitrunk dorsum abundant, erect to suberect, quite long and slightly curved; antennal scape with suberect, and tibiae with short subdecumbent hairs. The overall colour dark brownish red, appendages somewhat lighter.

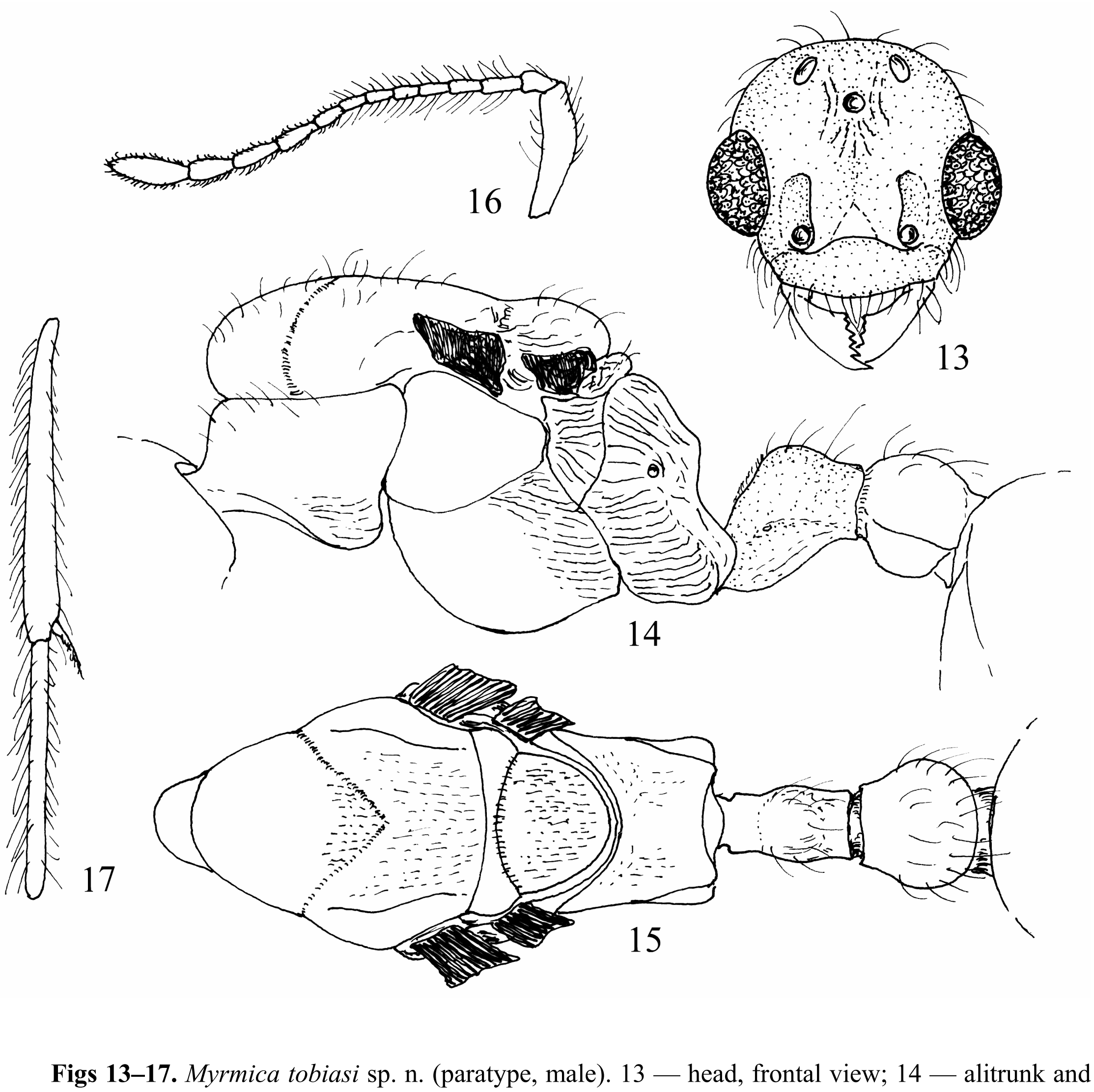
Measurements (mm) and indices in order minimum — maximum, for mean in ( ), for holotype in [ ]:

HW = 0.91–1.12 (1.02) [0.94], FW = 0.36–0.46 (0.40) [0.36], FLW = 0.50–0.62 (0.57) [0.52], SL = 0.81–0.98 (0.89) [0.81], AL = 1.46–1.69 (1.60) [1.50], HTL = 0.77–0.88 (0.83) [0.77], PNW = 0.64–0.76 (0.72) [0.67], PL = 0.43–0.49 (0.47) [0.48], PPL = 0.36–0.42 (0.38) [0.39], PW = 0.27–0.31 (0.29) [0.28], PPW = 0.42–0.48 (0.45) [0.42], PH = 0.34–0.39 (0.37) [0.36], PPH = 0.42–0.48 (0.45) [0.43], ESL = 0.31–0.39 (0.35) [0.32], ESD = 0.39–0.49 (0.43) [0.45].

CI = 1.11–1.22 (1.15) [1.16], FI = 0.38–0.42 (0.40) [0.39], FLI = 1.31–1.46 (1.40) [1.42], SI_1 = 0.72–0.49 (0.76) [0.74], SI_2 = 0.83–0.93 (0.86) [0.87], PI = 1.19–1.35 (1.28) [1.31], PPI = 0.79–0.93 (0.86) [0.92], ESLI = 0.31–0.39 (0.35) [0.34], ESDI = 1.07–1.45 (1.22) [1.39].

Queens (Figs 7–12).

Generally like workers in shape of head, character of sculpture, colour and pilosity of the body except they have a relatively wider head, slightly coarser sculpture with more developed reticulation on the occiput, and propodeal spines that are wider at their base.



Figs 13–17. *Myrmica tobiasi* sp. n. (paratype, male). 13 — head, frontal view; 14 — alitrunk and waist in profile; 15 — alitrunk and waist from above; 16 — antenna; 17 — hind tibia and first tarsal joint.

Measurements (mm) and indices of the two paratype queens in order minimum — maximum, for mean in ( ):

HL = 1.19–1.27 (1.22), HW = 1.08–1.12 (1.10), FW = 0.42–0.45 (0.43), FLW = 0.59–0.62 (0.60), SL = 0.90–0.91 (0.905), AL = 1.89–1.98 (1.93), AH = 1.11–1.19 (1.15), SCW = 0.94–0.97 (0.95), SCL = 1.33–1.36 (1.34), HTL = 0.88–0.92 (0.90), PL = 0.56–0.56 (0.56), PPL = 0.43–0.46 (0.45), PW = 0.34–0.35 (0.345), PPW = 0.53–0.58 (0.55), PH = 0.43–0.45 (0.44), PPH = 0.50–0.59 (0.55), ESL = 0.35–0.36 (0.355), ESD = 0.47–0.47 (0.47);

CI = 1.10–1.11 (1.105), FI = 0.39–0.40 (0.395), FLI = 1.38–1.40 (1.39), SI_1 = 0.73–0.75 (0.74), SI_2 = 0.81–0.83 (0.82), PI = 1.25–1.29 (1.27), PPI = 0.79–0.86 (0.825), ESLI = 0.31–0.34 (0.325), ESDI = 1.31–1.36 (1.34), AI = 1.66–1.71 (1.69), SCI = 1.14–1.20 (1.17).

M a l e s (Figs 13–17).

Head slightly longer than broad, with convex sides and occipital margin, and gradually rounded occipital corners; anterior clypeal margin widely rounded, not prominent medially. Antennal scape short (similar to that of *M. specioides*), antennae 13-jointed, antennal club distinctly 5-jointed.

Alitrunk relatively long, scutum slightly convex, scutellum does not project dorsally above scutum when seen in profile. Propodeum with blunt rounded tubercles. In profile, petiole relatively long, with widely rounded dorsum of node, its anterior surface very slightly concave, not steep; postpetiole slightly higher than long, with weakly convex dorsum.

Head dorsum very finely punctured, fine striation presents only near ocelli. Central part of scutum behind Mayr's furrows and scutellum with fine longitudinal striation. Pro- and mesopleura smooth and shiny, at most partly with fine striation, sides of propodeum densely rugulose. Sides of petiole finely punctured, petiolar dorsum and postpetiole smooth and shiny. Surface of alitrunk and waist between striation and rugae smooth and shiny, only propleura with fine punctation.

Head margins and mandibles with very long, curved erect hairs. Alitrunk, petiole, postpetiole and gaster with somewhat shorter erect to suberect hairs. Tibiae and tarsi with relatively short subdecumbent to suberect hairs (like in *M. specioides*); antennal scape and first 7 funicular joints with relatively long, straight suberect hairs, joints of antennal club with very short subdecumbent hairs. Colour of body dark brown, appendages somewhat lighter.

Measurements (mm) and indices in order minimum — maximum, for mean in ( ):

HL = 0.84–0.87 (0.86), HW = 0.78–0.85 (0.81), SL = 0.36–0.43 (0.38), AL = 1.74–1.99 (1.94), HTL = 1.01–1.05 (1.02), PL = 0.49–0.57 (0.53), PPL = 0.36–0.42 (0.39), PW = 0.24–0.29 (0.28), PPW = 0.38–0.48 (0.43), PH = 0.36–0.42 (0.39), PPH = 0.41–0.49 (0.44), SCW = 0.87–0.97 (0.92), SCL = 1.32–1.43 (1.36), AH = 1.12–1.26 (1.24).

CI = 1.03–1.09 (1.05), SI_1 = 0.42–0.50 (0.44), SI_2 = 0.43–0.54 (0.47), PI = 1.25–1.41 (1.35), PPI = 0.82–0.93 (0.87), AI = 1.52–1.63 (1.56), SCI = 1.07–1.15 (1.10).

Material. H o l o t y p e : worker, Kazakhstan, Alma-Ata Nature Reserve, Talgar, No. 749, VIII 1968 (V. Antsyferov) (ZMMU). P a r a t y p e s . 2 workers, 1 male from the nest of holotype; 12 workers, Kazakhstan, Alma-Ata Region, Range Zailiysky Alatau, 17 VIII 1972 (V. Antsyferov); 6 workers, Kazakhstan, Alma-Ata Nature Reserve (V. Antsyferov); 7 workers, 2 males, Kyrghyzstan, Chon-Kemin, Novorossiyka, 6 VIII 1966 (Yu. Tarbinsky); 1 queen, 2 males, Kyrghyzstan, Chon-Kemin, Kalmak-aksu, 7 VIII 1966 (Yu. Tarbinsky); 2 workers, Kyrghyzstan, Sary-Chelek Nature Reserve, Arkit, Khodzha-Ata, No. 63–215, 25 V 1963 (G. Dlussky, Yu. Tarbinsky); 1 queen, Kyrghyzstan, Issyk-Kul' Region, Khadzhi-sau, 20 VIII 1997 (collector unknown) (ZMMU, IZANU, ZISP).

Ecology. Dlussky (pers. com.) reports about the ants collected by him the followings. "The ants was collected in the valley of river Khodzha-Ata at an altitude of 1400–1500 m. Nests were under stones on meadows and sandy banks with tall grass and shrubs among open forest, comprising willow and apple trees. Other species collected included *Tetramorium* spp., *Tapinoma* (cf. *erraticum*), *Messor structor* (Latr.), *Lasius* (*alienus*-group), *Cataglyphis aenescens* (Nyl.) and *Crematogaster sordidula* (Nyl.)". Based on this combination of species, the habitat resembles many of the drier steppe-like meadows of southern Europe and Turkey but the presence of apple and willow also indicates that the soil probably remains moist.

Etymology. This species is dedicated to Prof. V.I. Tobias, the well-known Russian hymenopterist from the Zoological Institute of the Russian Academy of Sciences, St. Petersburg, who specialises mainly on parasitic wasps, and for his 75th birthday anniversary celebration.

Taxonomic notes on some species of the *M. scabrinodis*-group

M. salina Ruzsky, 1905 and *M. slovaca* Sadil, 1952.

Myrmica salina was described by Ruzsky (1905) from workers, queens and males from the southern part of West Siberia and Northern Kazakhstan as variety of *M. scabrinodis*. Arnoldi (1970) raised this form to the species rank, regarding it as distinct from *M. slovaca* Sadil, while Seifert (1988) considered it to be a junior synonym of *M. salina*. However, Radchenko (1994c, 1994d) took a very different view. He proposed that *M. salina* (as described by Ruzsky) was a junior synonym of *M. lacustris* Ruzsky

(= *M. deplanata* Ruzsky) and consequently considered *M. salina* (*sensu* Arnoldi and Seifert) was a synonym of *M. slovaca*. These very different opinions resulted from the absence of the original Ruzsky types of *M. salina* and on Ruzsky's rather unclear original description of the species.

Recently Seifert (2002) reaffirmed his original opinion and revived *M. salina* from synonymy considering it the senior synonym of *M. slovaca*. He designated as a neotype of *M. salina* the worker from Novosibirsk Region, which was (erroneously under the Code of Nomenclature) designated by Arnoldi as the lectotype of this species (ZMMU). We have studied this neotype, syntype workers, queens and males of *M. slovaca* (MNHP, MIZ, ZMMU), and non-type material of both from many different parts of Europe, the Caucasus, Asia Minor, West Siberia and Northern Kazakhstan. With no doubt we agree with Seifert that the neotype of *M. salina* is identical with the syntypes of *M. slovaca*, and while we do not totally agree on all details, especially on the interpretation of the original description, there is nothing to be gained by further discussion of this problem in the absence of original type material. Thus we accept Seifert's (2002) treatment of *M. salina* as definitive.

M. bessarabica **Nassonov, 1889,** ***M. specioides*** **Bondroit, 1918 and** ***M. sancta*** **Karavaiev, 1926.**

As outlined in the introduction, this is one of the more contentious issues in *Myrmica* taxonomy in Europe. Nassonov (1889) described *M. scabrinodis* var. *bessarabica* from Bessarabia (now part of Moldova) based on several workers. At first this form was considered as a variety of *M. scabrinodis* (Ruzsky, 1905; Emery, 1908, 1921) and later as a junior synonym of *M. sabuleti* (Weber, 1948; Sadil, 1952). However, Dlussky et al. (1990) considered it to be the same as *M. specioides* and *M. sancta* and being a much older name it should be their senior synonym, including earlier established synonyms for both junior species (see also: Seifert, 1988; Radchenko, 1994c; Bolton, 1995). At this stage it should be noted that Dlussky et al.'s opinion was based on a single worker from Bessarabia that they discovered in Nassonov's collection (ZMMU); they erroneously labelled it as holotype but under the Code of Nomenclature it is at best the lectotype and more probably a neotype. Seifert (2002) noted that the label "Бессарабія" on the "holotype" specimen is not original Nassonov's one and this label was added later with the red holotype label. In fact, while the holotype label was written by Dlussky (pers. comm.), the other label is probably Nassonov's original one, based on changing of Russian spelling since 1918. Although this specimen is in rather poor condition, we agree with Dlussky et al. (1990) that it is *M. specioides* or *M. sancta.*

The problem is that Nassonov's original description of *M. bessarabica* cannot refer to the "holotype" specimen. Seifert (2002) paid especial attention to the ambiguous phrase in Nassonov's (1889) original description of this form: "… antennal scape rather weakly bent at the base, forming a very blunt angle, above which raises a blunt denticle…" (Nassonov, 1889: 36; translation from Russian). Seifert, who reads Russian well, believed this inferred a vertical dent (*lobicornis*-group or perhaps *schencki*-group) rather than horizontal lobe (*scabrinodis*-group) and one of us (Radchenko, a native Russian speaker) agrees that Nassonov's description could be interpreted in this way. Given these uncertainties, we support Seifert's (2002) proposition that *M. bessarabica* is best considered *incertae sedis* in the genus *Myrmica* and the name *M. specioides* should be revived from synonymy.

Regardless of which name is used the numerous synonymies stand, making *M. specioides* a very widespread and morphologically variable species, even for genus *Myrmica*. We hypothesised that *M. specioides* might in fact combine two (or more) species. For example *M. specioides* might have a northern and western range in Europe while *M. sancta* might have a more southern and eastern range in Europe, Asia Minor, Iran and Turkmenistan with perhaps overlapping species distributions in Ukraine and the Balkans. We tested this by studying the lectotype and paralectotypes (workers, queens, males) of *M. specioides* (several tens of specimens, IRSNB), the syntypes (workers) of *M. sancta* (IZANU) (and types of the earlier established synonyms of these species, see: Seifert, 1988; Radchenko, 1994a, 1994c), and several hundred non-type specimens of these forms from a wide range of sites in Europe, the Caucasus, Asia Minor, Turkmenistan and Iran. We concluded that workers and queens of *M. specioides* are indistinguishable from *M. sancta* by all the main features, including morphometrics. Males of these two species are less similar; the European populations differing from the Caucasian and Turkish populations by somewhat shorter standing hairs on the tibiae and tarsi, but this feature is quite variable and is not sufficient to warrant a formal separation of these populations. Thus, we confirm the synonymy of *M. sancta* with *M. specioides* but will not be surprised if modern genetically based studies eventually show that *M. specioides* comprises two (or perhaps more) species.

Although workers of *M. specioides* are quite similar to those of *M. scabrinodis*, they differ on a suite of characters (see discussion of *M. tobiasi* above), notably by a wider frons, usually (but not always!) smaller lobe at the bend of the antennal scape, a more rounded petiole node and especially by distinctly shorter propodeal spines (mean ESLI = 0.36 vs. 0.41). Males are easily discriminated, those of *M. specioides* have tibiae and tarsi with the quite short sub-erect hairs whereas those of *M. scabrinodis* are much longer, curved and more erect.

***M. turcica* Santschi, 1931 and *M. georgica* Seifert, 1987.**

Seifert (1987) described *M. georgica* based on several tens of workers, collected in Georgia, and on 3 workers and 2 males, collected in Northern Kazakhstan. One year later Seifert (1988) synonymised his species with *M. turcica* (which Santschi described from workers and a queen collected near Ankara in Turkey). We studied 20 paratypes of *M. georgica*, including the paratypes workers and males from Kazakhstan (ZMMU) and workers from the holotype nest series from Georgia (kindly gifted to G.W. Elmes by B. Seifert). We noted that workers of *M. georgica* resemble *M. sabuleti* by the shape of the rather large lobe at the base of antennal scape, a quite narrow frons and extended frontal lobes (mean FI = 0.34 [Georgian populations] — 0.355 [Kazakhstan's-South Ukrainian populations] of *M. georgica* vs. 0.33 for *M. sabuleti*; mean FLI respectively 1.57 and 1.51 vs. 1.52), but the shape of the petiolar node is more similar to that of *M. specioides*. On the other hand, males of *M. georgica* have much shorter antennal scape than those of *M. sabuleti* and are practically indistinguishable from males of *M. specioides*, including characters such as the pilosity of the tibiae and tarsi.

We compared these *M. georgica* specimens with the type specimens of *M. turcica* (NHMB) and the abundant samples of *M. turcica*, recently collected in Turkey (several hundred workers and several tens of males and queens), and additional non-type material from Kazakhstan and Ukraine; also, we compared them with the type specimens and other material of *M. tulinae*. We concluded that Seifert's type series of *M. georgica* really comprises two species; the Georgian part is most similar to *M. tulinae* whereas the Kazakhstan paratypes seem to differ from other known *scabrinodis*-group species. Our evidence for this statement is outlined below.

Firstly, *M. georgica* most resembles *M. sabuleti* and not *M. turcica*. When Seifert (1988) established this synonymy he had only 5 syntypes workers and 1 queen of *M. turcica* on which to base his opinion of variability in that species. Furthermore, Santschi's (1931) original description was misleading because he said "… the higher edge [of the scape bend] almost as lobate as that of *sabuleti*". There is no doubt that the types of *M. turcica* are those specimens described by Santschi, but our examination of them and other non-type material showed that in general the antennal lobe of workers of *M. turcica* is relatively small and is more similar to that of *M. scabrinodis*. Moreover, the frons is distinctly wider than that of *M. sabuleti* [FI = 0.34–0.38, mean 0.36 (vs. 0.33), FLI = 1.32–1.54, mean 1.44 (vs. 1.55)] more like the frons of *M. scabrinodis* (Santschi made no comment on the frons width).

We conclude that *M. turcica* is somewhat intermediate between *M. specioides* and *M. scabrinodis.* Its workers resemble those of *M. specioides* by a similarly shaped petiolar node, relatively short propodeal spines (mean ESLI = 0.36 in both species) but differ by the more extended frontal lobes of *M. turcica* (mean FLI = 1.43 vs. 1.32). On the other hand, workers of *M. turcica* have very similar structure of the frontal carinae and lobes to *M. scabrinodis* (mean FI = 0.36 in both species) but well differ from *M. scabrinodis* by their much shorter propodeal spines (mean ESLI = 0.36 vs. 1.41). Males of *M. turcica* and *M speciodes* are very similar and easily distinguished from *M. scabrinodis* by shorter, more decumbent hairs on the tibiae and tarsi. If *M. turcica* overlapped more geographically with *M. speciodes* and *M. scabrinodis*, the taxonomy of all three species would become very difficult.

Thus the question was — if *M. georgica* is not *M. turcica*, what is it? The paratype workers are very similar to the recently described *M. tulinae* (Elmes et al., 2002), female castes of which most resemble *M. sabuleti* while the males most resemble *M. scabrinodis* (for details see: Elmes et al., 2002; Radchenko et al., 2003). Furthermore, among the rich material (more than 20 nest samples, including males, collected personally by Seifert in Georgia and kindly given to G.W. Elmes), there are 13 samples of *M. tulinae*, 8 of *M. scabrinodis*, 1 of *M. sabuleti*, 1 of *M. specioides* but no *M. georgica* (other than the paratypes). Thus while the taxonomic position of the Georgian part of *M. georgica* types remains somewhat uncertain (without the benefit of males they could be slightly unusual *M. sabuleti* or *M. tulinae*) we provisionally synonymise them with *M. tulinae*.

In contrast the workers of the Kazakhstan part of *M. georgica* type series more closely resemble *M. sabuleti*, as was discussed by Seifert and mentioned above in connection with *M. turcica*. However, while the males of *M. georgica* (from Kazakhstan) and *M. turcica* are very similar they clearly differ from those of *M. tulinae* and *M. sabuleti* (see above). Hence, we believe that the Kazakhstan part of *M. georgica* is a good species and revive this name from synonymy. Furthermore, on the steppe region of southern Ukraine we found numerous nest series (IZANU and ELMES) with very similar males and workers to the Kazakhstan material of *M. georgica*, living under wood and in the soil in small oak and pine-woods on wet halophytous steppe. Also, in ELMES collection there is a single series of similar ants collected from Czechia (Bohemia). We provisionally call this southeastern European material *M. georgica*, cannot exclude the slight possibility that when more material of *M. georgica* is available from Kazakhstan that it might be shown to differ.

M. rugulososcabrinodis Karavaiev, 1929 and *M. caucasica* Arnoldi, 1934.

Karavaiev (1929) described *Myrmica rugulosa* var. *rugulososcabrinodis* based on workers and males from the Caucasus. However, the same name (*Myrmica rubra* var. *rugulososcabrinodis*) had already used by Forel (1874), therefore Arnoldi (1934) proposed the replacement name *M. rugulosa* subsp. *caucasica* for Karavaiev's species and later he considered this form to be a subspecies of *M. sancta* (Arnoldi, 1970). *M. caucasica* was raised to species rank by Seifert (1988) but shortly afterwards Dlussky et al. (1990) synonymised it with *M. bessarabica* Nassonov (see discussion above).

Based on the rich new material from Turkey, the Caucasus and Crimea, and a detailed study of the syntypes of *Myrmica rugulosa* var. *rugulososcabrinodis* (IZANU) we believe it to be a good species and revive it from synonymy. Rather unfortunately, Forel's *Myrmica rubra* var. *rugulososcabrinodis* is a *nomen nudum* and the suitable replacement name *caucasica* was not necessary. Consequently Karavaiev's cumbersome old-fashioned name "*rugulososcabrinodis*" has priority.

The name *M. rugulososcabrinodis* is reasonably appropriate because morphologically the species is somewhat intermediate between the two eponymous species. Workers well differ from those of *M. scabrinodis* and *M. specioides* by less curved frontal carinae, thus the frons is much wider than that of *M. specioides* (mean FI = 0.38, FLI = 1.32). The Caucasian and Turkish populations of *M. rugulososcabrinodis* have mean FI = 0.43 and FLI = 1.15 and the Crimean populations have mean FI = 0.41 and FLI = 1.20. Generally, the scape of *M. rugulososcabrinodis* is clearly angulate at the base but has a much reduced lobe compared to *M. specioides* (see above), at most it appears as a narrow longitudinal ridge on the bend.

Species complexes within the *scabrinodis*-group.

We suggest *scabrinodis*-group species fall naturally into three clusters, based on male characteristics, one of which further separates into three, based on female characteristics, creating a total of five species complexes (Table). First, a distinct complex is typified by *M. sabuleti*, which well differs from all the other species by males with relatively long antennal scape ($SI_1 > 0.50$). Secondly, there is a cluster of species with males having shorter scape which divides into species with males that have very long hairs on the tibiae and those with much shorter hairs (although somewhat subjective the difference is usually very clear). Species having males with short scape and long tibial hairs are defined by *M. scabrinodis*; based on female characteristics there are considerable overlaps between the *scabrinodis*- and *sabuleti*-complexes (see below). Species having males with short scape and short tibial hairs divide into two clusters based on whether FI of workers is greater or less than 0.40. Those with the narrower frons are typified by *M. specioides.* In general the workers of the *specioides*-complex have affinities with those of the *scabrinodis*-complex and to a lesser extent the *sabuleti*-complex and without males correct identification of some species can be problematic (see below). However, species with worker FI > 0.40 are relatively easily separated into two complexes based on whether the scape is slightly angulate, often with a fine ridge or carina, the *rugulosa*-complex, or whether the scape is smoothly curved with no trace of any lobe, the *bergi*-complex.

As indicated above, identification of workers (even between complexes) can be difficult without males; for example *M. vandeli* are best described to field biologists as “*M. scabrinodis* workers with *M. sabuleti* males”, while *M. tulinae* is “*M. sabuleti* workers with *M. scabrinodis* males”. Correspondingly, while males are easily separated into 3 clusters on the characters given here, identification to species is often impossible without females from the same nest. Within complexes identification based on single specimens can be quite difficult and sometimes the choice between 2 species can only be probabilistic. The probability of correct determination increases when one has a nest-series of workers but a series with all castes is always preferable. Field biologists reporting on the distribution of species from *scabrinodis*-group should always state whether their determination is based upon single specimens, a worker series or a series including males.

Table. Main features of the species complexes of the *scabrinodis*-group.

<table>
<tr><td>males:
scape longer
(SI_1 > 0.50)</td><td colspan="4">sabuleti-complex
M. sabuleti, M. lonae, M. vandeli, M. bibikoffi Kutter, M. hirsuta Elmes</td></tr>
<tr><td rowspan="4">males:
scape shorter
(SI_1 < 0.45)</td><td>males:
legs with very long hairs</td><td colspan="3">scabrinodis-complex
M. scabrinodis, M. aloba Forel, M. tulinae,
M. cagnianti Espadaler</td></tr>
<tr><td rowspan="3">males:
legs with much shorter hairs</td><td colspan="2">workers:
frons narrower, mean FI ≤ 0.40;
scape sharply angulate, with small to large lobe</td><td>specioides-complex
M. specioides,
M. stangeana Ruzsky,
M. turcica,
M. salina,
M. georgica,
M. tobiasi sp. n.</td></tr>
<tr><td rowspan="2">workers:
frons wider, mean
FI ≥ 0.40</td><td>workers:
scape slightly angulate, with
fine ridge or carina</td><td>rugulosa-complex
M. rugulosa,
M. hellenica Finzi,
M. rugulososcabrinodis</td></tr>
<tr><td>workers:
scape smoothly curved, with no trace of a lobe</td><td>bergi-complex
M. bergi Ruzsky,
M. divergens,
M. gallienii Bondroit</td></tr>
</table>

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