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New data on the ants of the genus *Myrmica* Latreille (Hymenoptera: Formicidae) from the North Caucasus

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Новые данные о муравьях рода *Myrmica* Latreille (Hymenoptera: Formicidae) с Северного Кавказа

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Abstract. A new data on the North Caucasian *Myrmica* ants is presented, particularly: males of *M. elbrusi* Radchenko et Yusupov are described for the first time; based on the male morphology the taxonomic position of this species is revised and it is placed to the *M. dshungarica* species-group. *M. bakurianica* Arnoldi, which was previously known from Georgia, and European species *M. vandeli* Bondroit are recorded for the first time from the North Caucasus and Russia. Differences of both latter species from related *Myrmica* species are given.

Key words. *Myrmica elbrusi*, first description of male, *M. bakurianica*, *M. vandeli*, new records, fauna of Russia.

Резюме. Представлены новые данные о муравьях *Myrmica* Северного Кавказа, в частности: впервые описаны самцы *M. elbrusi* Radchenko et Yusupov; на основании морфологии самцов пересматривается таксономическое положение этого вида, и он перемещен в группу видов *M. dshungarica*. *M. bakurianica* Arnoldi, ранее известный из Грузии, и европейский вид *M. vandeli* Bondroit, впервые обнаружены на Северном Кавказе и в России. Приведены отличия обоих последних видов от близких видов рода *Myrmica*.

Ключевые слова. *Myrmica elbrusi*, первое описание самца, *M. bakurianica*, *M. vandeli*, новые находки, фауны России.

Introduction

The first data on the ants of the genus *Myrmica* Latreille from Caucasus were introduced by Mayr (1859) and later by Nassonov (1889), Ruzsky (1902, 1905), Karawajew (1926), Arnoldi (1934, 1970), Seifert (1988), Radchenko (1994a–1994e), Arakelyan (1994) and some others. These and other data were summarized in the monograph of Radchenko, Elmes (2010). Several *Myrmica* species were described from Transcaucasia, *M. caucasicola* Arnoldi and *M. bakurianica* Arnoldi (Arnoldi, 1934, 1970), and also from

the North Caucasus, *M. jennyae* Elmes, Radchenko et Aktaç (Elmes et al., 2002) (Asia Minor and Dagestan) and *M. elbrusi* Radchenko et Yusupov (Radchenko, Yusupov, 2012). As a result, 22 *Myrmica* species are known so far from the Caucasian region.

Some Transcaucasian *Myrmica* species were not known in the North Caucasus until now. Only *M. ravasinii* Finzi was found in North Ossetia-Alania and in South Ossetia (Radchenko et al., 2016), and recently second co-author of this paper found two more *Myrmica* species for the fauna of North Caucasus: *M. bakurianica* and *M. vandeli* Bondroit (both are recorded for Russia for the first times). Additionally, he found males of *M. elbrusi*, which we are first describing below.

Material and methods

We examined four males of *M. elbrusi,* 30 workers and nine males of *M. bakurianica* collected in Kabardino-Balkaria, Russia, as well as five workers, four males and two queens of the latter species from Borzhomi, Georgia (including the neotype), and one male of *M. vandeli* collected in Kabardino-Balkaria, Russia. Newly collected material is stored in the Institute of Ecology of Mountain territories, RAS (Nalchik, Russia) and in the Schmalhausen Institute of Zoology of the National Academy of Sciences of Ukraine (Kiev, Ukraine).

For the comparison we previously and recently examined many tens of workers, queens and males of *M. scabrinodis* Nylander*, M. sabuleti* Meinert*, M. specioides* Bondroit, *M. hellenica* Finzi*, M. bibikoffi* Kutter and *M. hirsuta* Elmes, including type specimens (for more details see Radchenko, Elmes, 2010).

In this paper the following measurements of specimens (accurate to 0.01 mm) were made to calculate various ratios:

HL – maximum length of head in dorsal view, measured in a straight line from the anteriormost point of clypeus (including any carina or ruga, if they protrude beyond the anterior margin) to the mid-point of occipital margin;

HW – maximum width of head in dorsal view behind (above) the eyes;

FW – minimum width of frons between the frontal carinae (workers);

FLW – maximum distance between the outer borders of the frontal lobes (workers);

SL – maximum straight-line length of scape from its apex to the articulation with condylar bulb;

OL – maximum diameter of eye;

ML – diagonal length of the mesosoma (seen in profile) from the most anterodorsal point of mesosoma to posterior margin of propodeal lobes (males);

MH – height of mesosoma, measured from upper level of mesonotum perpendicularly to the level of the lower margin of mesopleuron (males);

SCW –maximum width of scutum in dorsal view (males);

SCL – length of scutum + scutellum in dorsal view (males);

HTL – maximum length of hind tibia, measured from the junction with femur to the junction with the first tarsal joint;

PL – maximum length of petiole in dorsal view, measured from the posterodorsal margin of petiole to the articulation with propodeum; the petiole should be positioned so that measured points lay on the same plane;

PW – maximum width of petiole in dorsal view;

PH – maximum height of petiole in profile, measured from the uppermost point of the petiolar node perpendicularly to the virtual line between the anteroventral (just behind the subpetiolar process) and posteroventral points of petiole;

PPL – maximum length of postpetiole in dorsal view between its visible anterior and posterior margins;

PPW – maximum width of postpetiole in dorsal view;

PPH – maximum height of postpetiole in profile from the uppermost to the lowermost point, measured perpendicularly to the tergo-sternal suture;

ESL – maximum length of propodeal spine in profile, measured along the spine from its tip to the deepest point of the propodeal constriction at the base of the spine (workers).

For simplicity, we give ratios of various measurements (e.g. HL/HW or ML/MH, etc.) rather than name and abbreviate various indices (e.g. CI or MI).

Results

Myrmica elbrusi Radchenko et Yusupov, 2012

(Figs 1–4)

Material examined: four males, Russia, Kabardino-Balkaria, gorge Bashil-Auzusu River, 43°12'08.2" N, 42°58'38.5" E, two nest samples (Nos. 20a–15 and 22–15) 5.VIII.2015, with workers.

Male (first description). Head distinctly longer than broad, with moderately convex sides and occipital margin and widely rounded occipital corners. Eyes big, *ca*. 0.3 of head width, situated distinctly in front of head sides, more than twice longer than gena. Ocelli well developed but quite small. Anterior clypeal margin very narrowly rounded and somewhat prominent, not-notched medially. Antennae 13-segmented, with barely defined 4-segmented club; scape long, subequal to head width; second funicular segment *ca.* 1.5 times longer than third one. Mandibles with seven teeth.

Mesosoma relatively long, *ca*. 1.6 times longer than high, scutum moderately convex, scutellum does not project dorsally above scutum (seen in profile). Propodeum with blunt subtriangular tooth-like tubercles, its dorsal surface subequal to posterior one. Petiole with short peduncle and massive and quite long node, its dorsal surface very slightly convex; postpetiole massive, distinctly higher than long, with convex dorsum, *ca*. 1.3 times wider than petiole. Middle and hind tibiae with well developed, quite big pectinate spur. Forewing with typical for *Myrmica* venation (i.e. with closed cell *mcu*, an open cell *3r* and vein *2+3RS* reduced proximally so that cells *1+2r* and *rm* only partly separated).

In general, quite coarsely sculptured species. Frons, genae and area between ocelli with quite coarse longitudinal rugae, rest of head dorsum with coarse reticulation, surface between rugae finely punctated while looks more or less shiny; clypeus with transversal rugosity. Mandibles longitudinally rugulose.

Whole mesosoma, both dorsally and laterally, with quite coarse longitudinal rugae. Sides of petiolar node with fine and short longitudinal striation, its dorsum with superficial microsculpture developed in various extents, but quite shiny. Postpetiole laterally with fine longitudinal striation, dorsally smooth and shiny. Gaster smooth and shiny.

Head margins and mandibles with numerous, relatively long and curved suberect hairs. Mesosoma, petiole and gaster with abundant quite long suberect hairs (they much sparser and shorter on propodeum). Tibiae and tarsi with relatively short subdecumbent to suberect hairs, the longest hairs on tibiae shorter than the maximal tibial width, those on basitarsus subequal or only slightly longer than its maximal width. Scape with abundant but not long suberect to subdecumbent hairs, longest hairs shorter than maximal width of scape.

Colour. Body dark reddish-brown, appendages somewhat lighter.

Measurements in mm, ordered as mean (min-max): HL 0.92 (0.91–0.94); HW 0.825 (0.82–0.83); SL 0.82 (0.81–0.82); OL 0.27; ML 1.71 (1.66–1.76); MH 1.03 (0.99–1.07); SCW 0.78 (0.75–0.79); SCL 1.17 (1.13–1.20); PL 0.51 (0.48–0.52); PH 0.38 (0.35–0.40); PW 0.37 (0.34–0.38); PPL 0.43 (0.42–0.44); PPH 0.49 (0.47–0.51); PPW 0.48 (0.47–0.49); HTL 1.07 (1.05–1.08).

Ratios: HL/HW 1.11 (1.10–1.13); SL/HL 0.89 (0.88–0.90); SL/HW 0.99 (0.98–1.00); OL/HL 0.30 (0.29–0.30); ML/MH 1.67 (1.65–1.69); SCL/SCW 1.49 (1.46–1.51); PL/HL 0.56 (0.53–0.57); PL/PH 1.34 (1.29–1.38); PPL/HL 0.47 (0.48–0.46); PPL/PPH 0.88 (0.85–0.89); PPL/PPW 0.89; PPW/PW 1.31 (1.28–1.38).

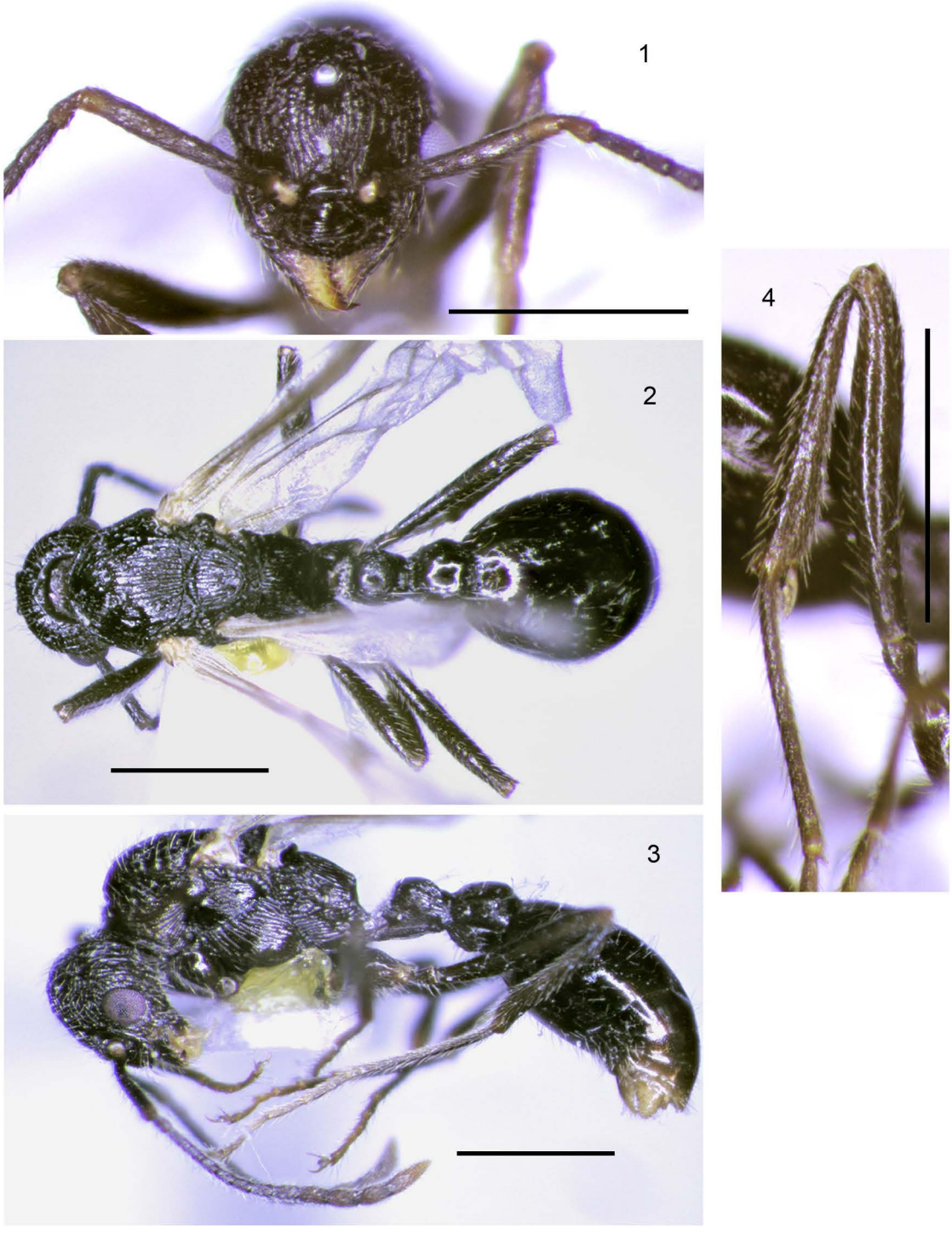
Remarks. This mountain species seems to be endemic of the North Caucasus, inhabiting subalpine meadows, floodplain terraces of rivers and edges of mixed forests (pine with birch) at altitudes 2070–2130 m, where build nests in the soil, often under stones.

As was stressed earlier (Radchenko, Yusupov, 2012), workers and queens of *M. elbrusi* are so well distinct from all known *Myrmica* species occurring in the Euro-Caucasian region, that cannot be placed to any species-group recognized there. On the other hand, they share diagnostic features with both the *M. rugosa* and *M. dshungarica* species groups. By the main diagnostic features of workers and queens, the species of these groups are hardly distinguishable, but workers of the *M. rugosa* group are larger and have more coarse body sculpture than those of *M. dshungarica* group (Radchenko, Elmes, 2010). Thus, as we described *M. elbrusi* based on workers and queens only, we tentatively placed it to the *M. rugosa* species group.

However, the mentioned groups well separated by the characters of the males, particularly by the length of their scape: males of the *M. dshungarica* group have long antennal scape (SL/HW $\geq$ 1.0) while scape of the *M. rugosa* group males are much shorter (SL/HW < 0.6). Now, after detection that males of *M. elbrusi* have long scape (SL/HW = 0.98–1.00), we have to alter our previous opinion and propose now tentatively place this species to the *M. dshungarica* group or even establish to this species one more, *M. elbrusi* species group. Possibly, this question may be resolved after carrying out comparative molecularly-genetic investigation of *M. elbrusi* and species from the *M. dshungarica* and *M. rugosa* groups.

Myrmica bakurianica Arnoldi

This somewhat enigmatic species has been briefly described based on all castes by Arnoldi (1970) from the vicinity of Bakuriani (Georgia) in a key as *M. pilosiscapus* subsp. *bakurianica*. Until now it was



Figs 1–4. Male of *Myrmica elbrusi*. 1– head, dorsal view; 2 – body, dorsal view; 3 – body, lateral view; 4 – hind leg. Scale bars: 1 mm.

known only from the type series (5 workers, 4 males and 2 queens), and from the 6 workers (including the neotype), 3 queens and 3 males, collected near Borzhomi, Georgia (for more details see Seifert, 1988; Radchenko, 1994c; Radchenko, Elmes, 2010). A nest series that includes 30 workers and nine males were collected recently by second co-author in Russia (Kabardino-Balkaria, vicinity of the village Verhnyi Kurp, Tersky Range, 43º49′61.2" N, 44º37′57.2" E, h = 307 m, 8.IX.2013). It is the first record of this species not only for the North Caucasus, but also for Russia.

M. bakurianica seems to be Caucasian endemic and supposedly very rare species. On the other hand, at least some of the older records of *M. scabrinodis* from Caucasus (e.g. Ruzsky, 1902, 1905; Karawajew, 1926) may belong to *M. bakurianica*.

This species was placed to the *M. specioides*-complex of the *M. scabrinodis* species group (Radchenko, Elmes, 2010), and in Caucasus it can be confused with several related species, especially with *M. scabrinodis* and *M. specioides*, or even with *M. hellenica*.

However, its workers well differ from the latter species by the much narrower frons and more extended frontal lobes (mean FW/HW = 0.39, mean FLW/HW = 1.34 in *M. bakurianica vs*. 0.43 and 1.15 in *M. hellenica*, respectively), and by the distinctly bigger lobe at the base of scape.

By the shape of the frontal carinae and frontal lobes its workers resemble *M. specioides* (means FW/HW = 0.39…0.38, means FLW/HW = 1.34…1.32, respectively), but differ those of *M. scabrinodis* that have narrower frons and more extended frontal lobes (mean FW/HW = 0.36 and mean FLW/HW > 1.40). The shape of petiolar node of *M. bakurianica* and *M. specioides* is also similar: it is without a distinct dorsal plate, while in *M. scabrinodis* petiole has a distinct horizontal or slightly declined posteriorly dorsal plate. *M. bakurianica* resembles *M. scabrinodis* by the length of propodeal spines, but differs from *M. specioides*: mean ESL/HW in first two species ≥ 1.40 *vs.* 1.36 in the latter (Figs. 5, 8, 11). Additionally, the lobe at the base of scape in *M. bakurianica* is generally bigger than in *M. specioides* and similar to that in *M. scabrinodis*.

Nevertheless, workers and queens of *M. bakurianica* well differ from all mentioned species by the much denser and coarser, whitish standing hairs on the antennal scape, head margins and body.

Similarly, males of *M. bakurianica* share features of three mentioned species: by the length and pilosity of the scape they are similar to *M. specioides* and *M. hellenica*, but have much longer standing hairs on the tibiae and tarsi: middle and hind tibiae and tarsi on both anterior and posterior surfaces have very long and erect, often curved hairs, the longest hairs on the tibiae are distinctly longer than the maximum width of tibia, those on the basitarsus more than twice as long as its maximal width, similar to but somewhat shorter than those of the males of *M. scabrinodis*. In contrary, in *M. specioides* and *M. hellenica* the middle and hind tibiae and tarsi have much shorter hairs, the longest hairs on the tibiae are not longer than the tibial width, same on the basitarsus less than twice as long as its width (Figs. 6, 7, 9, 10, 12, 13).

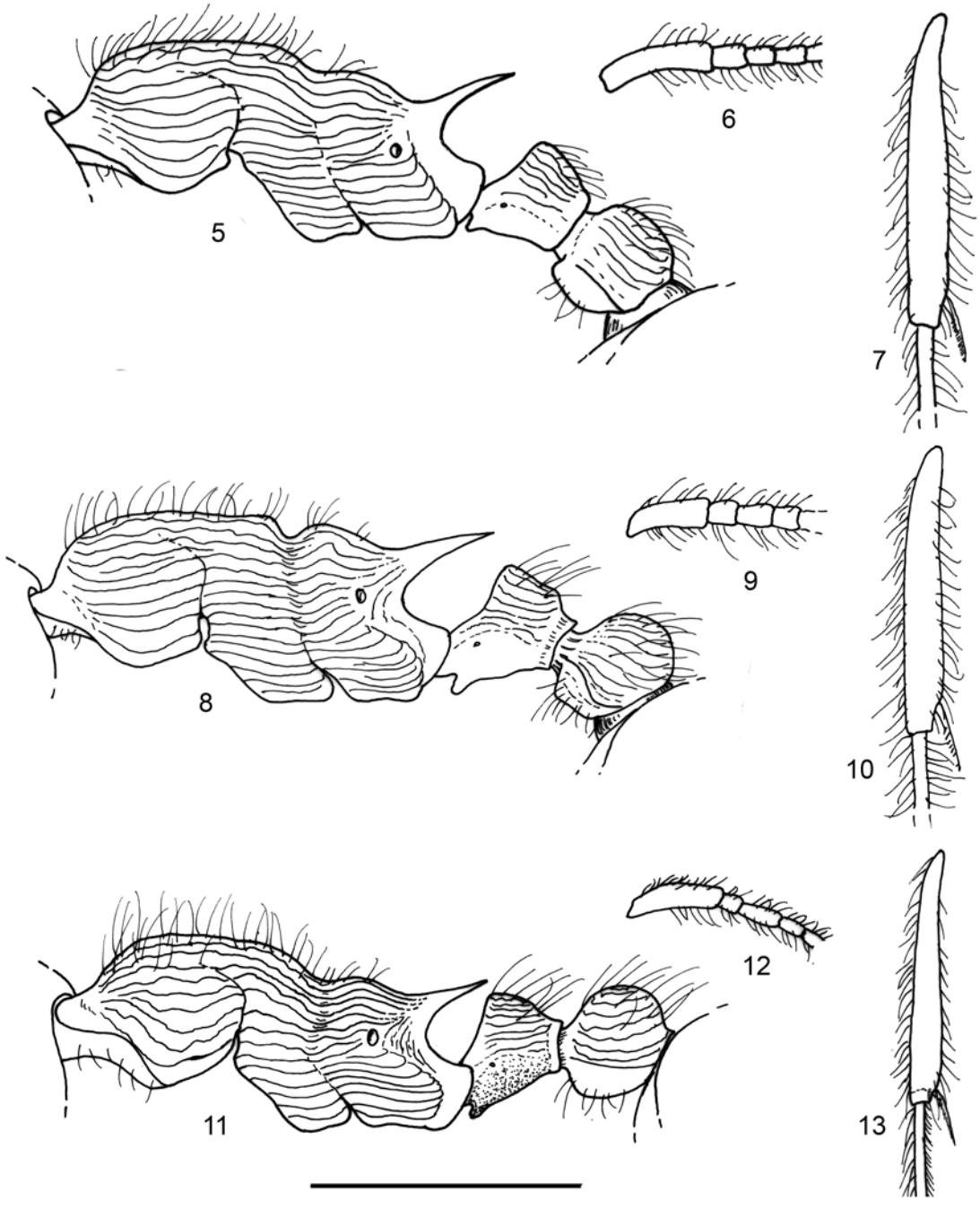
Ecology. One nest of this species has been found in a ground under tree, on steppe site with sparse trees.

***Myrmica vandeli* Bondroit**

M. vandeli Bondroit was described from queens and males from France (Bondroit, 1920) and was known only from the type series for more than 50 years, until Kutter (1977) described workers of this species from Switzerland. Later on this species has been recorded from the Central European countries, Pyrenees, southern Sweden, England and Wales, Balkans and western Ukraine (for details see Elmes et al., 2003; Radchenko, Elmes, 2003, 2010; Czechowski et al., 2012; Radchenko, 2016).

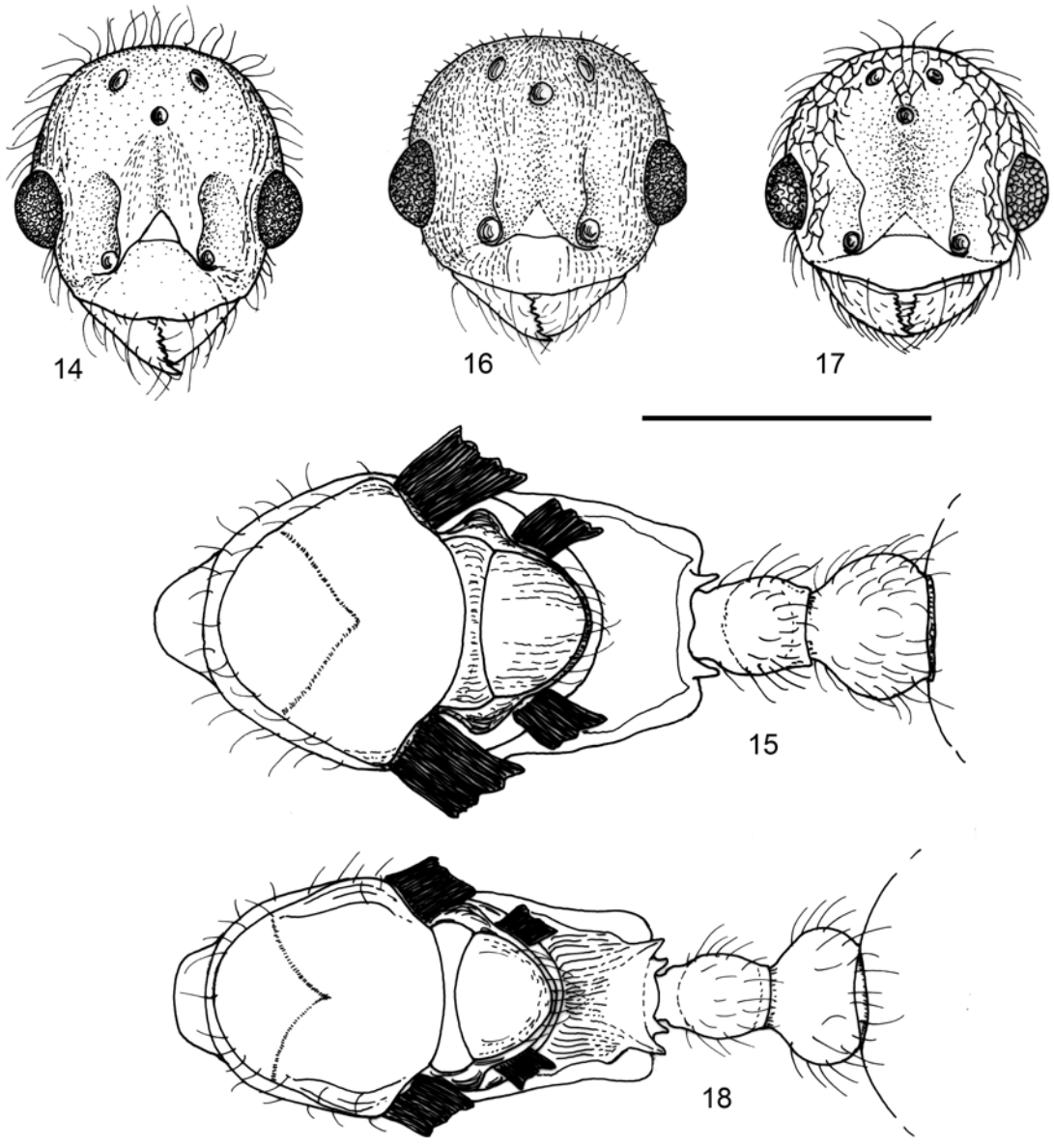
M. vandeli requires wet and warm conditions at the nest site and the most preferable its habitats are wet to very wet grasslands, but not true bogs or swamps. In some parts of its area there were found nest containing only workers (sometimes also gynes and males) of *M. vandeli*, but in other parts mixed colonies containing workers of *M. vandeli* and *M. scabrinodis* exist. Elmes et al. (2003) supposed that *M. vandeli* may be a temporary (perhaps even facultative?) social parasite of *M. scabrinodis*, and in the optimal ecological conditions it might successfully compete with *M. scabrinodis* and reproduce new colonies by queen foundation or by colony fission, but at the edge of its range queens might have to resort to temporary social parasitism of *M. scabrinodis* to establish a new colony. Such mixed colonies containing workers of both species, were found in England, France, Poland, Ukraine, etc.

We placed *M. vandeli* to the *M. sabuleti*-complex of the *M. scabrinodis* species group (Radchenko, Elmes, 2003, 2010). Workers of *M. vandeli* appear very similar to those of *M. scabrinodis* by the shape of



Figs 5–13. Details of structure of *Myrmica bakurianica* (5–7), *M. scabrinodis* (8–10) and *M. specioides* (11–13) (5, 8, 11 – workers; 6, 7, 9, 10, 12, 13 – males). 5, 8, 11 – mesosoma and waist in profile; 6, 9, 12 – antennal scape and three basal funicular segments; 7, 10, 13 – hind tibia and base of basitarsus. Scale bar: 1 mm.

mesosoma, propodeal spines and waist, by the size and shape of the lobe at the bent of the scape, by the shape of frontal carinae and frontal lobes, but differ from the latter by more abundant standing hairs on the body (e.g. petiole with > 10, often > 20 hairs *vs*. < 10, usually ≤ 8 hairs in *M. scabrinodis*), by the presence of at least shallow medial notch on the anterior clypeal margin, by the less coarse, almost straight longitudinal rugosity on the mesosomal dorsum (*vs*. strong reticulation in *M. scabrinodis*), by the reduced (to various extents) sculpture of the petiolar and postpetiolar dorsum, and finally, by its reduced tibial spurs.



Figs 14–18. Details of structure of males of *Myrmica vandeli* (14, 15), *M. sabuleti* (16), *M. bibikoffi* (17) and *M. hirsuta* (18). 14, 16, 17 – head, dorsal view; 15, 18 – mesosoma and waist, dorsal view. Scale bar: 1 mm.

Queens of *M. vandeli* differ from those of all species of the *M. scabrinodis* group by their large size, very dark, almost black body colour, and especially by the characteristic longitudinally-concentric rugosity on the petiolar node dorsum.

At the same time, males of *M. vandeli* have relatively long scape (mean SL/HW = 0.60) and may be confused only with three Palaearctic *Myrmica* species: *M. sabuleti*, *M. bibikoffi* and *M. hirsuta*. *M. sabuleti* is quite common free-living Euro-Caucasian species, but two latter species are social parasites. *M. bibikoffi* is known only from four nest samples collected in Switzerland, Germany and Spain, and *M. hirsuta* is rare but more widespread European species, distributed from England in the west to Nizhniy Novgorod (Russia) in the east.

Males of *M. vandeli* are easily separated from those of *M. sabuleti* by the presence of abundant long standing hairs on the head margins and scape, and by the much shorter hairs on the mid and hind tibiae (Figs 14, 16). On the other hand, by the presence of long standing hairs on the head margins they are similar to

M. bibikoffi and *M. hirsuta*, but differs from the first by the absence of the distinct reticulation on the lateral and posterior parts of head dorsum (Figs 14, 17), and from the latter – by the distinctly narrower postpetiole (PPW/HW = 0.45–0.60 *vs*. 0.64–0.70) (Figs 15, 18).

Until now the known range of *M. vandeli* was West Europe with easternmost point in Transcarpathian Province of Ukraine (Radchenko, 2009) (Fig. 19), but second co-author of this paper collected nest sample (57 workers) of *M. specioi*des in Kabardino-Balkaria (gorge of the Baksan River between village Verkhniy Baksan and town Tyrnyauz (43º35′71.9" N, 42º56′27.1" E) at an altitude 1371 m on the glade of sea buckthorn forest, where we surprisingly found the single male that we with any doubt identified as *M. vandeli*, but any worker of *M. vandeli* was not found it this sample.

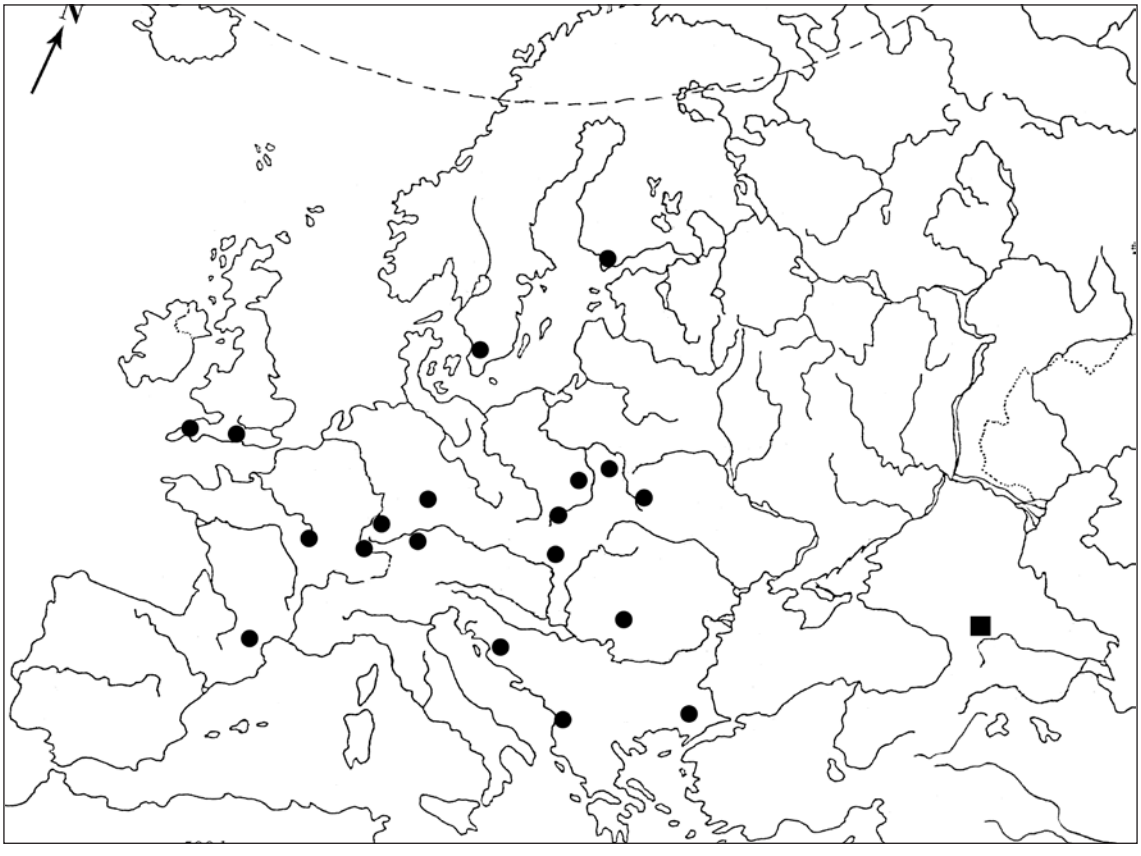


Fig. 19. Map of distribution of *Myrmica vandeli* (dots – previously known localities, square – new locality).

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