Taxonomic notes for some Caucasian *Temnothorax* Mayr, 1861 species (Hymenoptera: Formicidae), with descriptions of three new species

Таксономические замечания к некоторым видам рода *Temnothorax* Mayr, 1861 (Hymenoptera: Formicidae) с Кавказа, с описанием трех новых видов

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Abstract. Three new ant species are described form the North Caucasus (Russia): *Temnothorax dlusskyi* **sp. n.**, *T. arnoldii* Radchenko et Fedoseeva, **sp. n.**, and *T. tembotovi* Radchenko et Yusupov, **sp. n.** *Temnothorax dlusskyi* **sp. n.** is characterized by the long head, the low and long mesosoma without metanotal groove, by propodeum without teeth; the head dorsum is densely punctated and longitudinally rugulose, mesosoma is coarsely longitudinally rugose; body is reddish-brown, head is darker; 1st gastral tergite is completely brownish, without lighter spot at the base. *Temnothorax arnoldii* **sp. n.** is characterizes by the long head, the low and long mesosoma without metanotal groove, propodeum with very short but distinct, acute triangular teeth; the head dorsum with dense straight longitudinal rugulosity and punctation; mesosoma laterally and pronotal dorsum with coarse longitudinal sinuous rugae; mesosoma and waist are reddish-brown, head dorsum is dark brown; 1st gastral tergite is brownish, its base a little lighter. *Temnothorax tembotovi* **sp. n.** is characterized by the long head; mesosoma of moderate length, without metanotal groove, propodeum with teeth or spines of various length, they are almost straight and slightly widened at the base; head dorsum is densely punctated, appears dull, the fine longitudinal rugulosity or striation may be developed on frons; mesosoma and waist are densely punctated, appears dull; mesosoma and waist are dark-yellow to ochreous-yellow, the head dorsum somewhat darker, 1st gastral tergite is bright yellow, with brownish band posteriorly. Taxonomic position of *Temnothorax alpinus* and *T. korbi* are reassessed; the name *T. werneri* is considered as a junior synonym of *T. alpinus*; *T. korbi* is transferred to the *corticalis* species group.

Резюме. Три новых вида муравьев описано с Северного Кавказа (Россия): *Temnothorax dlusskyi* **sp. n.**, *T. arnoldii* Radchenko et Fedoseeva, **sp. n.**, and *T. tembotovi* Radchenko et Yusupov, **sp. n.** *Temnothorax dlusskyi* **sp. n.** характеризуется длинной головой, низкой и длинной грудью без метанотального вдавления, проподеум без зубчиков, угловатый; верх головы густо пунктирован и продольно морщинистый, грудь с грубыми продольными морщинками; тело красновато-коричневое, голова более темная; 1-й тергит брюшка полностью коричневый, без светлого пятна у основания. *Temnothorax arnoldii* **sp. n.** характеризуется длинной головой, низкой и длинной грудью без метанотального вдавления, проподеум с очень короткими, но явственными острыми зубчиками; верх головы с густой продольной морщинистостью и пунктировкой; грудь с боков и верх пронотума с грубыми волнистыми продольными морщинками; грудь и стебелек красновато-коричневые, верх головы темно-коричневый; 1-й тергит брюшка коричневый, его основание немного светлее. *Temnothorax tembotovi* **sp. n.** характеризуется длинной головой, грудь средней длины, без метанотального вдавления, проподеум с зубчиками различной длины, которые почти прямые и слабо расширенные у основания; верх головы густо пунктирован, матовый, нежные продольные морщинки могут быть на лбу; грудь и стебелек густо пунктированы, матовые; цвет груди и стебелька от темно-желтого до охристо-желтого, верх головы немного темнее, 1-й тергит брюшка светло-желтый, позади с коричневой перевязью. Пересмотрена таксономическая позиция *Temnothorax alpinus* и

T. korbi; название *T. werneri* предложено считать младшим синонимом *T. alpinus*; *T. korbi* перенесен в группу видов *corticalis*.

Introduction

Temnothorax Mayr, 1861 is the most specious ant genus not only in Europe (about 100 species), but in the whole Palaearctic Region (more than 200 species) [Radchenko, 1994a, b, c, 1995a, b, 1996, 2004; Terayama, Onoyama, 1999; Guénard, Dunn, 2012; Bharti et al., 2012; Borowiec, 2014].

Temnothorax korbi was the first new species of the genus *Temnothorax* described from the Caucasian region (Azerbaijan: Talysh) [Emery, 1898; unavailable name in this paper, the first available use of the name – Emery, 1922; this and following species were originally placed to the genus *Leptothorax* Mayr, 1855; for details of further separation of these genera see Bolton, 2003; Radchenko, 2004]. Two succeeding new species were described by Ruzsky [1902a, b] – *T. satunini* (Armenia) and *T. alpinus* (North Caucasus: Russia and Georgia). Somewhat later Ruzsky [1905] added to this fauna one more new species, *T. brauneri* (North Caucasus: Russia and Georgia), and later on Karawajew [1926] described *T. shelkovnikovi* from Armenia. Any more new species have not been described from the Caucasian region within the next 50 years, until Arnoldi [1977] described a set of new *Temnothorax* taxa, four of which are considered now as good species: *T. anodonta*, *T. sevanensis* (Armenia), *T. discoloratus* and *T. tesquorum* (North Caucasus: Russia). At last, Radchenko [1994a] added to this region two more new species: *T. tamarae*[1] and *T. werneri* (North Caucasus: Russia), and one more new species was described from Balcan-Caucasian Region very recently [Seifert, Csösz, 2015]. As a result, 20 *Temnothorax* species are known from the Caucasian region nowadays.

Below we revived the taxonomic position of *T. korbi* and *T. alpinus*, provided new synonymy, and described three new species form the North Caucasus.

Material and methods

We investigated the type and non-type material from the following institutions: Museo Civico di Storia Naturale "Giacomo Doria" (MCSNG, Genoa, Italy); Museum d'Histoire Naturelle (MHNG, Geneva, Switzerland); Zoological Museum of the Moscow State University (ZMMU, Moscow, Russia); I.I. Shmalhausen Institute of Zoology of the National Academy of Sciences of Ukraine (SIZK, Kiev, Ukraine); Tembotov Institute of Ecology of Mountain Territories of the Kabardino-Balkarian Scientific Centre, Russian Academy of Science (IEMT, Nalchik, Russia).

The photographs of the specimens have been made using the Leica MZ16 stereomicroscope, connected to the camera IC 3D. Fixed points for measurements were chosen based on scheme proposed for *Myrmica* Latreille, 1804 [Radchenko, Elmes, 2010].

Measurements of the specimens (accurate to 0.01 mm) were taken and these were used to calculate various indices: HL (head length) – maximum length of the head in dorsal view, measured in a straight line from the most anterior point of clypeus to the mid-point of occipital margin; HW (head width) – maximum width of the head in dorsal view behind (above) the eyes; SL (scape length) – maximum straight-line length of the scape from its apex to the articulation with condylar bulb; OL (ocular length) – maximum length of the eye; FW (frontal width) – minimal width of the frons between the frontal carinae; FLW (frontal lobes width) – maximum distance between the outer borders of the frontal lobes; AL (mesosomal [= alitrunk] length) – diagonal length of the mesosoma (seen in profile) from the anterior end of the neck shield to the posterior margin of the propodeal lobes; AH (mesosomal height) – measured in profile from the imaginary line connecting uppermost points of promesonotum and propodeum perpendicularly to the lowermost point of mesopleuron; PNW (pronotum width) – maximum width of the pronotum in dorsal view; HTL (hind tibia length) – maximum length of the hind tibia; PL (petiolar length) – maximum length of the petiole in dorsal view, measured from the posterodorsal margin of petiole to the articulation with propodeum (just below the posterior visible margin of propodeum); the petiole should be positioned so that measured points lay on the same plane; PW (petiolar width) – maximum width of the petiole in dorsal view; PH (petiolar height) – maximum height of petiole in profile, measured from the uppermost point of the petiolar node perpendicularly to the imaginary line between the anteroventral (just behind the subpetiolar process) and posteroventral points of petiole; PPL (postpetiolar length) – maximum length of postpetiole in dorsal view between its visible anterior and posterior margins; PPW (postpetiolar width) – maximum width of the postpetiole in dorsal view; PPH (postpetiolar height) – maximum height of the postpetiole in profile from the uppermost to the lowermost point, measured perpendicularly to the tergo-sternal suture; ESL (propodeal spine length) – length of propodeal spine, measured in lateral view from its tip to the base.

Indices: CI (cephalic index) – HL/HW; FLI (frontal lobe index) – FLW/FW; SI1 (scape index 1) – SL/HL; SI2 (scape index 2) – SL/HW; OI1 (ocular index 1) – OL/HL; OI2 (ocular index 2) – OL/HW; PI (petiolar index) – PL/PH; PPI (postpetiolar index) – PPL/PPH; ESLI (propodeal spine index) – ESL/HW; AI (mesosomal index) – AL/AH.

Results

Taxonomic position of *Temnothorax korbi*. Radchenko [1994c] has established 12 species groups for the Central and East Palaearctic *Temnothorax*, and the group *korbi* among them. The proposed diagnosis of this group was: mesosoma low, long, coarsely longitudinally rugose; petiole low, with the very massive node; propodeum with the very short denticles or only with the blunt tubercles. He placed 5 species to this group: *T. korbi*, *T. caucasicus* (Arnoldi, 1977), *T. anodonta*, *T. anodontoides* (Dlussky et Zabelin, 1985), and *T. iranicus* (Radchenko, 1994).

Nevertheless, the previous treatments of *T. korbi* by Arnoldi [1948, 1977] and by Radchenko [1994a, b,

[1] Here we ignored some of the synonymy proposed by Ward et al. [2015]. These authors proposed really "parallel to the classic" system of the subfamily Myrmicinae, which is based exclusively on the molecular-genetic data; in many cases these propositions seem quite idiosyncratic compare to any other previous systems founded on the ants' morphology and anatomy, and are not supported by the majority of ant taxonomists.

1995b] proved to be incorrect, and after investigation of the type specimens of this species from the Emery's collection (MCSNG) (worker and queen, the labels are: "*Lept. corticalis* var. *korbi* Emery", "Lenkoran Korb"), we have ascertained that *T. korbi* by the short propodeal spines resembles *T. corticalis* (Schenck, 1852), but by the presence of the shallow metanotal groove and by some other features it should be transferred to the *nylanderi* species group. As the name *T. caucasicus* is considered now a junior synonym of *T. nadigi* (Kutter, 1925) [see Czechowski et al., 2002, 2012], we establish here the *nadigi* species-group, placing to it *T. nadigi* itself, *T. anodonta*, *T. anodontoides*, *T. iranicus*, and *T. dlusskyi* **sp. n.** described below.

Reassessment of the taxonomic position of *Temnothorax alpinus*. As mentioned above, Ruzsky [1902b] described based on workers a new species, *Leptothorax alpinus* (now *Temnothorax*), from North Caucasus (now Russia: North Ossetia, and Georgia). For many years this taxon seemed to be quite enigmatic, until Radchenko [1994b, 1996] provided treatment of this species, placing it to the *serviculus* species-group.

Seeing that Ruzsky's [1902: 22–23] original description of *Leptothorax alpinus* was in Russian, we propose here its translation in English (using the modern taxonomic terminology): "Antennae 12-segmented. Mesosoma without metanotal groove. Propodeal spines very short, wide, dentiform, equal to 1/3 of length of dorsal surface of propodeum. Petiole with short peduncle, its node narrowly rounded, anterior face of petiolar node concave, posterior one convex.

Head long, its length almost equal to length of mesosoma. Clypeus slightly convex, with longitudinal rugae. Posterior part of head dorsum and frons densely striated, temples punctato-striated. Mesosoma coarsely rugose, petiole and postpetiole with finer and shorter rugulosity [striation?] and punctures. Body matt; gaster smooth and shiny.

Mandibles with 5 teeth, apical and preapical ones are the largest; surface of mandibles almost smooth, with short longitudinal rugulae [striation?] only.

Body with long ["big"] and blunt standing hairs; additionally, head, legs, antennae and ventral surface of body with dense, fine, quite long light-yellow subdecumbent pilosity.

Body colour rather dark, brownish-red, head and antennal club blackish-brown, gaster dark brown, occasionally with reddish tint near base. Tibiae and femora brown; antennae, mandibles and tarsi lighter (yellowish-brown). Body length 2–3 mm.

Caucasus: Mamisonski Pass and vil. [aul] Lisri (1899); Gudaur (Satunin, 1901).

Inhabits rocky mountain meadows at the altitudes 7.000–10.000′ in subalpine zone of the Great Caucasus. Nests build under stones".

When Radchenko revised the Palaearctic *Temnothorax* at the beginning of 1990th, he found in the ZMMU collection 8 specimens collected by Arnoldi in the North-West Caucasus, which fit quite well (or at least does not contradict) to the description of *Leptothorax alpinus*, particularly, by the long and narrow head, short propodeal teeth, by the coarsely rugose mesosoma, and by many other not so important diagnostically features (see above). As he thought that type specimens of *T. alpinus* have been lost, he designated the neotype of this species – worker from North-West Caucasus (ZMMU); the labels of this specimen are: "С-З Кавказ К. Арнольди" [N-W Caucasus, K. Arnoldi], "A 6141", "Neotypus *Leptothorax alpinus*" [Radchenko, 1995b].

Nevertheless, one worker from the original Ruzsky's type series of *T. alpinus* was found lately in the collection of Forel (MHNG) and labelled as the lectotype [http://www.antwiki.org/wiki/Category:Temnothorax_alpinus]. The labels of this lectotype specimen are: "Kaukasus, 7000-9000′ Höhe (Rücken des Grosses Kaukasus) 1899 M. Ruzsky", "*Leptoth. tuberum* var. *alpinus*, nov. var. m. [w] (Beschreib. in russisch. sprache)" (both written by Ruzsky's own hand), "*L. tuberum* var. *alpinus* [w] Ruzsky", "*L. alpinus* Ruzsky", "Coll. Forel.", "Cotypus", "Lectotype *Leptothorax alpinus* Ruzsky, 1902 det. A. Schulz & M. Verhaagh 1999", "ANTWEB CASENT 0909041". Since we could not find any publication with the formal designation of the lectotype of *T. alpinus*, we may agree with the proposed fixation of the lectotype and formally designate it here.

At the first sight, one may think that all taxonomic problems regarding *T. alpinus* are successfully resolved after finding the original material of Ruzsky, but the situation becomes more complicated: some features of the lectotype specimen do not fully correspond with the original description, particularly character of the sculpture of mesosoma.

Based on the modern *Temnothorax* taxonomy, the most important diagnostic features of *T. alpinus* may be the following: dark body colour (i.e. body not distinctly bicoloured); elongated head; mesosoma without metanotal groove; completely sculptured head, mesosoma and waist; coarsely rugose mesosoma; short, dentiform propodeal teeth.

Ruzsky stressed that mesosoma in *T. alpinus* is coarsely longitudinally rugose, while in the lectotype specimen it is mostly punctated and with the fine rugulosity or even striation only. Moreover, the lectotype specimen of *T. alpinus* is without any doubt the same species that was described by Radchenko [1994a] as *Leptothorax werneri* from Elbrus region!

To elucidate the existing discrepancy between the original description and the lectotype specimen of *T. alpinus* (particularly, the sculpture of mesosoma), we may only suppose that Ruzsky originally included in the type series two different species. This assumption is based also on our long-term experience with reading of Ruszky's original descriptions and examining the type material of many taxa described by him, when we have found the similar situation in other genera [e.g. see Radchenko, Elmes, 2010]. Anyway, now it is the most logic and taxonomically correct to consider the name *Temnothorax werneri* [Radchenko, 1994a] as a junior synonym of *Temnothorax alpinus* (Ruzsky, 1902). Accordingly, the neotype specimen of *T. alpinus*, designated by Radchenko (see above), is having lost its taxonomic value. Furthermore, we ascertained that the "neotype" of *T. alpinus* and 6 other specimens with the same collecting number belong to the new species, which we describe below as *T. arnoldii* **sp. n.**

Notes for *Temnothorax nadigi*. This species was described by Kutter [1925] (as *Leptothorax nadigi*) based on the workers and queens from Switzerland, and for more than 50 years after that it was known from the

type locality only. Later it was found in southern France and in Spain [Kutter, 1977; Espadaler, Franch, 1978; Espadaler, 1984], but the most comprehensive additions to the taxonomy, distribution and ecology of *T. nadigi* was provided by Czechowska et al. [1998]. At last, after comparison of the Mediterranean material of *T. nadigi* with that of *T. caucasicus* from Georgia and Armenia, and *T. hasardaghi* Dlussky et Zabelin, 1985 from Turkmenistan (Kopetdagh Mts.), including the type specimens, it was shown that they are conspecific, and the two latter names are synonyms of *T. nadigi* [Czechowski et al., 2002, 2012; Radchenko, 1995b]. Thus, the known range of this species embraces Mediterranean region from Spain to Bulgaria, Asia Minor, Transcaucasus, Iran and Kopetdagh Mts. in Turkmenistan.

Descriptions of new species

Temnothorax dlusskyi Radchenko, Yusupov et Fedoseeva, **sp. n.**
(Figs 1–3)

Material. Holotype: worker, Russia, Kabardino-Balkarian Republic, Elbrus region, upper flow of Malka River, Dzhilly-Su, alt. 2649 m a.s.l., 43°26′ / 42°33′E, 10.07.2010, leg. Z. Yusupov (ZMMU). Paratypes: 31 workers from the nest of holotype (ZMMU, IEMT, SIZK).

Description. Workers. Head distinctly elongate (to be more correct in terminology, head is rather narrowed than elongate, e.g. head length is commensurable with those of the related species, but head width in the describing species is distinctly less), with almost parallel sides, somewhat convex occipital margin and widely rounded occipital corners. Anterior clypeal margin convex but not prominent, gradually rounded, not-notched medially. Eyes of moderate size, distinctly shorter than length of genae, situated approximately at midlength of sides of head. Frontal lobes somewhat extended, so that distance between their outer margins distinctly larger than width of frons. Scape of moderate length, does not reach occipital margin approximately by its maximal width at the apex. Masticatory margin of mandibles with 5 teeth, apical and preapical ones are the largest.

Mesosoma long and low, without metanotal groove, its dorsum very feebly and gradually convex, promesonotal suture developed (seen from above), while not very sharp. Propodeum without spines or teeth, only angulated or at most with blunt tubercles. Petiole with distinct, but not very long peduncle and massive node, distinctly longer than height, its anterior surface concave, posterior one convex, petiolar node widely rounded dorsally, without dorsal plate. Postpetiole subglobular, slightly shorter than height.

Whole head dorsum usually with fine longitudinal, almost straight rugulosity and distinct punctation; rugulosity may be reduced in various extents, developed only on the central part of head dorsum, and surface laterally to this area may be predominately punctated. Seen in profile, genae with quite coarse longitudinal rugae, while temples with reduced sculpture, at most with fine striation and superficial punctation, appear shiny. Clypeus with central and several lateral longitudinal carinae, occasionally central carina may be very feebly developed, surface of clypeus smooth and shiny. Mandibles not coarsely longitudinally rugulose.

Mesosoma and waist coarsely sculptured. Mesosomal dorsum with quite coarse straight to slightly sinuous longitudinal rugae, sides of pronotum with very coarse straight rugae, mesopleura and sides of propodeum with coarse sinuous longitudinal rugae. Surface between rugae at most finely punctated, appears shiny. Whole petiolar node with quite coarse short sinuous rugosity and reticulation, postpetiole mainly with short longitudinal rugae; surface between rugae punctated at various extents, appearing shiny or somewhat dull. Gaster smooth and shiny.

Whole body with numerous straight, not long and blunt standing hairs, legs with not coarse decumbent pubescence, scape with abundant short subdecumbent pilosity. Whole body reddish-brown, head darker, dark brown to blackish-brown, appendages and mandibles somewhat lighter, reddish- to yellowish-brown. First gastral tergite completely brownish, without lighter spot at the base.

Measurements (in mm), ordered as: holotype (min-max) [mean±SD]: HL 0.69 (0.68–0.76) [0.71±0.021], HW 0.55 (0.53–0.59) [0.56±0.013], SL 0.51 (0.49–0.55) [0.51±0.015], FW 0.21 (0.2–0.23) [0.21±0.007], FLW 0.25 (0.23–0.26) [0.25±0.008], OL 0.12 (0.12–0.16) [0.14±0.012], AL 0.97 (0.95–1.05) [1.00±0.023], AH 0.35 (0.33–0.38) [0.36±0.016], PNW 0.43 (0.4–0.47) [0.44±0.018], HTL 0.46 (0.46–0.51) [0.49±0.02], PL 0.28 (0.28–0.31) [0.30±0.009], PH 0.21 (0.21–0.26) [0.23±0.013], PW 0.18 (0.17–0.22) [0.19±0.012], PPL 0.2 (0.18–0.22) [0.21±0.010], PPH 0.21 (0.2–0.25) [0.22±0.010], PPW 0.24 (0.22–0.26) [0.25±0.011].

Indices: CI 1.27 (1.23–1.34) [1.27±0.023], SI1 0.73 (0.7–0.77) [0.72±0.018], SI2 0.93 (0.89–0.98) [0.92±0.018], FLI 1.16 (1.12–1.22) [1.16±0.032], OI1 0.17 (0.16–0.23) [0.20±0.019], OI2 0.22 (0.21–0.29) [0.25±0.021], PI 1.32 (1.2–1.35) [1.29±0.042], PPI 0.92 (0.86–1) [0.91±0.04], AI 2.77 (2.61–3.08) [2.78±0.121].

Queens and males. Unknown.

Ecology. The species was found in the alpine meadow at the altitude about 2650 m a.s.l., nest was built in a rock crevice.

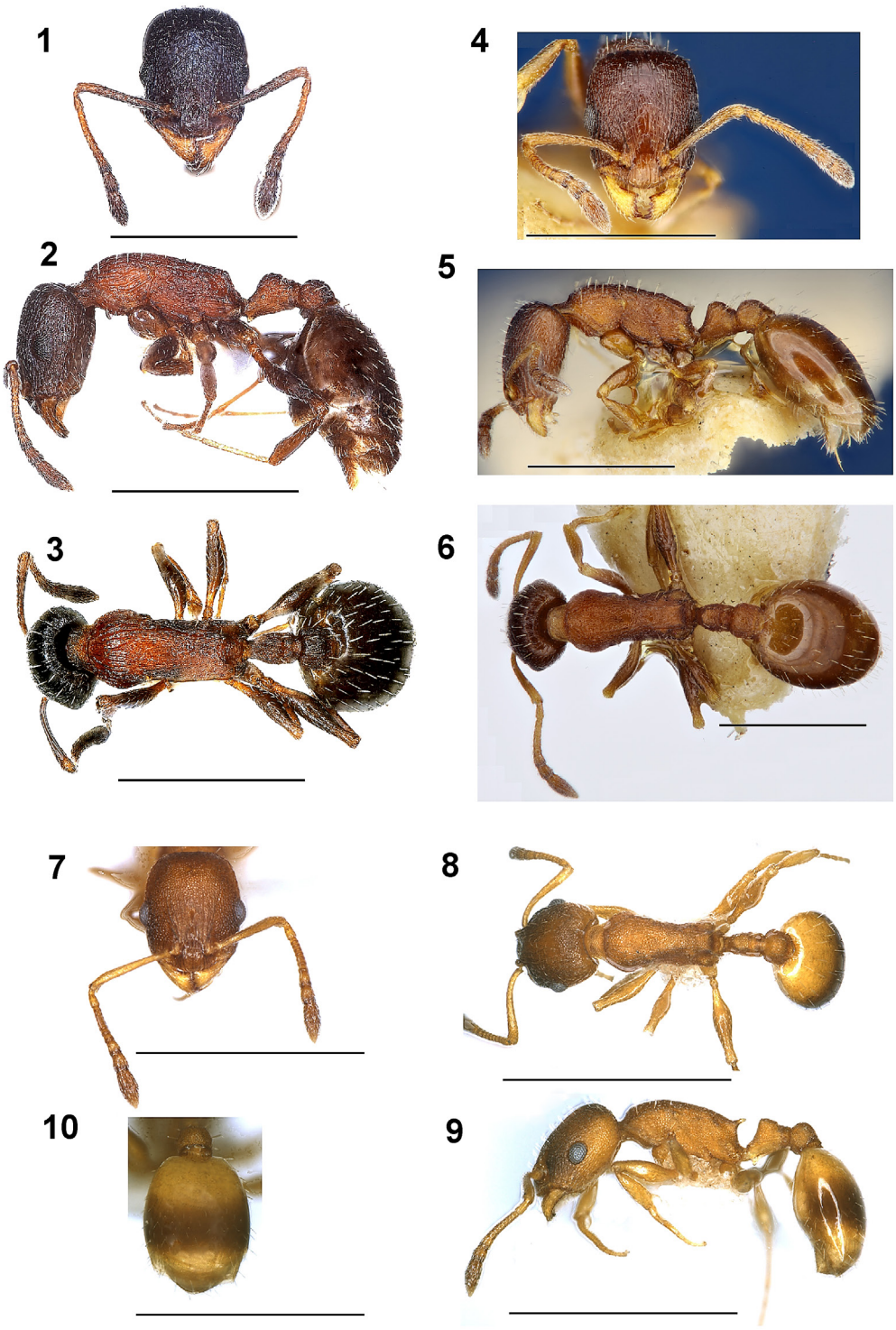
Distribution. North Caucasus, Russia: Kabardino-Balkarian Republic.

Comparative diagnosis. *Temnothorax dlusskyi* **sp. n.** by the general appearance is similar to *T. nadigi* and *T. anodontoides*, but well differs from both by the much narrower head (mean CI 1.27 vs. 1.14… 1.15; min 1.23 vs. max 1.2) and by the distinctly extended frontal lobes (mean FLI 1.16 vs. 1... 1.01; min 1.12 vs. max 1.02). Additionally, it differs from *T. nadigi* by the completely sculptured head dorsum (in the latter species at least the longitudinal central band on the head dorsum is smooth), by the not-notched medially anterior clypeal margin, etc., and differs also from *T. anodontoides* by the shorter petiole with the less developed peduncle (max PI 1.35 vs. min > 1.5).

By the long (narrow) head *T. dlusskyi* **sp. n.** resembles *T. anodonta* but differs from it by the distinctly extended frontal lobes (mean FLI 1.16 vs. 1.01; min 1.12 vs. max 1.01), by the somewhat smaller eyes (their maximum diameter is distinctly less than the length of genae, but two these values are subequal in the latter species), by the higher petiole (max PI ≤ 1.35 vs. > 1.45), by the rounded petiolar node, etc. *Temnothorax dlusskyi* **sp. n.** well differs from another Caucasian species with long head, *T. alpinus*, by the other character of the sculpture of mesosoma (it is coarsely rugose vs. predominately pucntated).

Temnothorax iranicus unquestionably differs from *T. dlusskyi* **sp. n.** by the much shorter head (mean CI 1.15 vs. 1.27), by the smooth head dorsum, presence of thin and acute propodeal teeth, by the not punctated head dorsum and mesosoma, etc.

Temnothorax dlusskyi **sp. n.** also well differs from other unicolour (brownish or brownish-red) Caucasian *Temnothorax*. Thus, mesosoma of *T. brauneri* is with the metanotal groove; mesosoma of *T. alpinus* is mostly densely punctated, without rugae; propodeum of *T. tamarae* is with



Figs 1–10. Species of the genus *Temnothorax* Mayr, 1861.

1–3 – *T. dlusskyi* Radchenko, Yusupov et Fedoseeva, **sp. n.**, worker, holotype: 1 – head, dorsal view; 2 – body, lateral view; 3 – body, dorsal view; 4–6 – *T. arnoldii* Radchenko et Fedoseeva, **sp. n.**, worker, holotype: 4 – head, dorsal view; 5 – body, lateral view; 6 – body, dorsal view; 7–10 – *T. tembotovi* Radchenko et Yusupov, **sp. n.**, worker, holotype: 7 – head, dorsal view; 8 – body, lateral view; 9 – body, dorsal view; 10 – gaster, dorsal view. Scale bars 1 mm. 4–6 – photos of V.G. Radchenko.

Рис. 1–10. Виды рода *Temnothorax* Mayr, 1861.

1–3 – *T. dlusskyi* Radchenko, Yusupov et Fedoseeva, **sp. n.**, рабочий, голотип: 1 – голова, вид сверху; 2 – тело, вид сбоку; 3 – тело, вид сверху; 4–6 – *T. arnoldii* Radchenko et Fedoseeva, **sp. n.**, рабочий, голотип: 4 – голова, вид сверху; 5 – тело, вид сбоку; 6 – тело, вид сверху; 7–10 – *T. tembotovi* Radchenko et Yusupov, **sp. n.**, рабочий, голотип: 7 – голова, вид сверху; 8 – тело, вид сбоку; 9 – тело, вид сверху; 10 – брюшко, вид сверху. Масштабные линейки – 1 мм. 4–6 – фотографии В.Г. Радченко.

thin and quite long teeth, its head is much wider than in *T. dlusskyi* **sp. n.**; propodeum of *T. tesquorum* is with quite long spines and petiole is much higher, with the narrowly rounded node dorsum [see also Arnoldi, 1977; Radchenko, 1994b].

Etymology. The species is dedicated to the memory of outstanding Russian myrmecologist, our teacher Prof. G.M. Dlussky (1937–2014).

Temnothorax arnoldii Radchenko et Fedoseeva, **sp. n.** (Figs 4–6)

Material. Holotype: worker, "С-3 Кавказ К. Арнольди" [N-W Caucasus, K. Arnoldi], "A 6141" (ZMMU). Paratypes: 6 workers, "A 6141" (ZMMU).

Description. Workers. Head distinctly elongate (narrowed), with almost parallel sides, very feebly concave occipital margin and quite narrowly rounded occipital corners. Anterior clypeal margin slightly convex, gradually rounded, not-notched medially. Eyes of moderate size, somewhat shorter than length of genae, situated approximately at midlength of sides of head. Frontal lobes not extended, so that distance between their outer margins subequal to width of frons. Scape of moderate length, does not reach occipital margin somewhat more than its maximal width at the apex. Masticatory margin of mandibles with 5 teeth, apical and preapical ones are the largest.

Mesosoma long and low, without metanotal groove, its dorsum somewhat flattened, promesonotal suture very feebly developed (seen from above), but visible. Propodeum with very short but distinct, acute triangular teeth. Petiole relatively short, with distinct, but not long peduncle, its anterior surface strongly concave, petiolar node distinctly truncated, with well-developed horizontal or somewhat inclined posteriorly dorsal plate. Postpetiole subglobular, slightly shorter than height.

Whole head dorsum with fine but dense straight longitudinal rugulosity and fine, but distinct punctation. Seen in profile, genae with quite coarse sinuous longitudinal rugae, while temples with fine longitudinal striation only. Clypeus with fine lateral longitudinal carinae, its surface smooth and shiny. Mandibles with very fine superficial striation appear shiny.

Mesosoma laterally and pronotal dorsum with coarse longitudinal sinuous rugae; rugosity on mesosomal and propodeal dorsum somewhat reduced and superficial reticulation well visible. Surface between rugae densely but not coarsely punctated, appears shiny. Petiolar node and postpetiole densely punctated only, but in some specimens short rugae and reticulation also present. Gaster smooth and shiny.

Whole body with numerous straight, not long and blunt standing hairs, legs with not coarse decumbent pubescence, scape with abundant short subdecumbent pilosity. Mesosoma and waist reddish-brown, head dorsum dark brown, appendages and mandibles somewhat lighter, yellowish-brown, antennal club somewhat darkened. First gastral tergite brownish, its base a little lighter.

Measurements (in mm), ordered as: holotype (min-max) [mean±SD]: HL 0.74 (0.67–0.74) [0.71±0.029], HW 0.59 (0.5–0.59) [0.56±0.025], SL 0.52 (0.45–0.53) [0.50±0.027], FW 0.24 (0.17–0.24) [0.20±0.025], FLW 0.24 (0.17–0.24) [0.21±0.026], OL 0.16 (0.14–0.16) [0.15±0.007], AL 1.01 (0.9–1.02) [0.97±0.042], AH 0.36 (0.34–0.36) [0.35±0.012], PNW 0.43 (0.4–0.43) [0.42±0.016], HTL 0.51 (0.41–0.51) [0.47±0.038], PL 0.3 (0.25–0.3) [0.28±0.018], PH 0.26 (0.21–0.26) [0.23±0.016], PW 0.2 (0.16–0.2) [0.18±0.013], PPL 0.21 (0.16–0.21) [0.19±0.021], PPH 0.22 (0.16–0.22) [0.2±0.021], PPW 0.23 (0.19–0.23) [0.22±0.015], ESL 0.08 (0.08–0.09) [0.09±0.006], ESD 0.21 (0.14–0.21) [0.18±0.026].

Indices: CI 1.27 (1.25–1.33) [1.28±0.032], SI1 0.71 (0.67–0.73) [0.71±0.02], SI2 0.89 (0.85–0.96) [0.91±0.033], FLI 1 (1–1.11) [1.03±0.039], OI1 0.21 (0.2–0.22) [0.21±0.008], OI2 0.3 (0.25–0.3) [0.27±0.020], PI 1.15 (1.09–1.22) [1.16±0.042], PPI 0.91 (0.896–1) [0.96±0.0480], ESLI 0.13 (0.13–0.16) [0.15±0.017], ESDI 0.36 (0.31–0.38) [0.33±0.027], AI 2.84 (2.84–2.92) [2.87±0.046].

Queens and males. Unknown.

Ecology. Unknown.

Distribution. North-West Caucasus, Russia.

Comparative diagnosis. By the long (narrow) head *T. arnoldii* **sp. n.** resembles *T. alpinus*, *T. anodonta* and T. *dlusskyi* **sp. n.**, but well differs from the first one by another character of sculpture of mesosoma. It differs from two latter species by the much shorter petiole (max PI 1.17 vs. min 1.2), by the presence of the short while distinct and acute propodeal teeth. Additionally, it differs from *T. dlusskyi* **sp. n.** by the distinctly truncated petiolar node with the dorsal plate. *Temnothorax arnoldii* **sp. n.** differs from *T. nadigi* and *T. anodontoides* by the much narrower head (mean CI 1.28 vs. 1.14... 1.15; min CI 1.25 vs. max 1.2).

Etymology. The species is dedicated to the memory of outstanding Russian myrmecologist, Prof. K.V. Arnoldi (1901–1982).

Temnothorax tembotovi Radchenko et Yusupov, **sp. n.** (Figs 7–10)

Material. Holotype: worker, Russia, Kabardino-Balkarian Republic, vicinity of vil. Verhniaja Balkaria, 1232 m a.s.l., 17.06.2007, leg. Z. Yusupov (ZMMU). Paratypes: 15 workers from the nest of holotype (ZMMU, IEMT, SIZK).

Description. Workers. Head distinctly elongate (narrowed), with very feebly convex sides, straight occipital margin and widely rounded occipital corners. Anterior clypeal margin slightly convex, gradually rounded, not-notched medially. Eyes rather big, subequal to length of genae, situated approximately at midlength of sides of head. Frontal lobes not extended, so that distance between their outer margins subequal to width of frons. Scape of moderate length, does not reach occipital margin approximately by its maximal width at the apex. Masticatory margin of mandibles with 5 teeth, apical and preapical ones are the largest.

Mesosoma of moderate length, without metanotal groove, its dorsum eventually convex, promesonotal suture absent (seen from above). Propodeum with teeth or spines of various lengths, but in any cases they are almost straight and slightly widened at base. Petiole quite high, with distinct, but not long peduncle, its anterior surface strongly concave, petiolar node truncated dorsally, with well-developed horizontal or somewhat inclined posteriorly plate. Postpetiole subglobular, slightly shorter than height.

Whole head dorsum densely punctated, appears dull, fine longitudinal rugulosity or striation may be developed on frons; seen in profile, temples with dense punctation, genae with coarser short longitudinal rugae. Clypeus longitudinally ruguloso-striated, its surface between rugulae smooth and shiny. Mandibles with very fine longitudinal striation, appears shiny.

Whole mesosoma and waist densely punctated, appears dull. Fine longitudinal rugulosity or striation may be developed on sides of pronotum, lower part of mesopleura, and on mesonotal dorsum.

Whole body with not abundant straight, not long and blunt standing hairs, legs with sparse decumbent pubescence, scape with abundant short subdecumbent pilosity. Mesosoma and waist dark-yellow to ochreous-yellow, head dorsum somewhat darker, appendages and mandibles bright yellow, antennal club somewhat darkened, concolour with head dorsum. First gastral tergite bright yellow, but with brownish band posteriorly, subsequent tergites bright yellow.

Measurements (in mm), ordered as: holotype (min-max) [mean±SD]: HL 0.59 (0.55–0.68) [0.61±0.032], HW 0.46 (0.43–0.55) [0.48±0.031], SL 0.45 (0.4–0.49) [0.46±0.024], OL 0.12 (0.12–0.16) [0.14±0.013], AL 0.73 (0.72–0.86) [0.78±0.044], AH 0.29

(0.27–0.33) [0.3±0.017], PNW 0.32 (0.31–0.39) [0.35±0.024], HTL 0.37 (0.31–0.44) [0.38±0.036], PL 0.22 (0.22–0.27) [0.25±0.018], PH 0.19 (0.18–0.23) [0.21±0.013], PW 0.13 (0.13–0.19) [0.15±0.015], PPL 0.17 (0.16–0.29) [0.18±0.011], PPH 0.18 (0.17–0.22) [0.19±0.015], PPW 0.18 (0.18–0.23) [0.2±0.013]; ESL 0.11 (0.08–0.12) [0.10±0.01].

Indices: CI 1.29 (1.21–1.29) [1.26±0.025], SI1 0.76 (0.72–0.82) [0.75±0.025], SI2 0.98 (0.9–1) [0.94±0.03], OI1 0.2 (0.2–0.25) [0.22±0.015], OI2 0.25 (0.26–0.32) [0.28±0.019], PI 1.14 (1.14–1.25) [1.20±0.034], PPI 0.94 (0.81–1) [0.93±0.05], ESLI 0.23 (0.16–0.24) [0.21±0.021], AI 2.52 (2.45–2.71) [2.62±0.077].

Queens and males. Unknown.

Ecology. It was found in the arid depression at the altitude somewhat over 1200 m a.s.l. Nest was found in a soil on the stony south-eastern mountain slope with xerophytic steppe-like vegetation.

Distribution. North Caucasus, Russia: Kabardino-Balkarian Republic.

Comparative diagnosis. *Temnothorax tembotovi* **sp. n.** belongs to the *tuberun* species-group, and by the colour of the first gastral tergite is similar to *T. unifasciatus* (Latreille, 1798). Nevertheless, it well differs from any *Temnothorax* species of this group from the Caucasus and adjacent regions by the much longer (narrower) head (mean CI 1.26 vs. < 1.2).

Etymology. The species is dedicated to the memory of Russian teriologist and ecologist, founder of the Institute of Ecology of Mountain Territories, Prof. A.K. Tembotov (1932–2006).

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References

AntWiki. Available at: http://www.antwiki.org/wiki/Category:Temnothorax_alpinus.

Arnoldi K.V. 1948. The ants of Talysh and Diabar basin. Their significance for the characteristic of cenosis of terrestrial invertebrates and the historical analysis of fauna. *In:* Trudy Zoologicheskogo instituta AN SSSR. Tom 7. Vypusk 3. Sbornik rabot po sistematike, zoogeografii i ekologii [Proceedings of the Zoological Institute of the USSR. Vol. 7. Iss. 3. Collection of papers on the systematics, zoogeography and ecology]. Moscow – Leningrad: Academy of Sciences of the USSR Publ.: 206–262 (in Russian).

Arnoldi K.V. 1977. New and little known ant species of the genus *Leptothorax* Mayr of the European part of the USSR and Caucasus. *Entomologicheskoe Obozrenie*. 56(1): 198–204 (in Russian).

Bharti H., Gul I., Schulz A. 2012. Three new species of genus *Temnothorax* (Hymenoptera: Formicidae) from Indian Himalayas with a revised key to the Indian species. *Acta Zoologica Academiae Scientiarum Hungaricae*. 58(4): 325–336.

Bolton B. 2003. Synopsis and Classification of Formicidae. *Memoirs of the American Entomological Institute*. 71: 1–370.

Borowiec L. 2014. Catalogue of ants of Europe, the Mediterranean basin and adjacent regions (Hymenoptera: Formicidae). *Genus*. 25(1–2): 1–340.

Czechowska W., Radchenko A., Czechowski W. 1998. Ecological and taxonomic notes on *Leptothorax nadigi* Kutter, 1925 (Hymenoptera, Formicidae) – an ant species new to Poland. *Annales Zoologici*. 48(1/2): 119–123.

Czechowski W., Radchenko A., Czechowska W. 2002. The ants of Poland. Warsaw: Museum and Institute of Zoology. 200 p.

Czechowski W., Radchenko A., Czechowska W., Vepsäläinen K. 2012. The ants of Poland with reference to the myrmecofauna of Europe. Fauna Poloniae. Vol. 4, NS. Warszawa: Natura Optima Dux Foundation. 496 p.

Emery C. 1898. Beiträge zur Kenntniss der palaearktischen Ameisen. *Öfversigt af Finska Vetenskaps-Societetens Förhandlingar*. 20: 124–151.

Emery C. 1922. Hymenoptera. Fam. Formicidae. Subfam. Myrmicinae. *In:* Genera Insectorum. (P. Wytsman ed.). Fasc. 174C. Bruxelles: L. Desmet-Verteneuil: 207–397.

Espadaler X. 1984. *Leptothorax nadigi* Kutter, 1925 y *Goniomma blanci* (André, 1881): descripción de los machos. *Boletín de la Asociation Española de Entomologia*. 8: 135–141.

Espadaler X., Franch J. 1978. *Leptothorax nadigi* Kutter, 1925 en España. *Boletín de la Asociation Española de Entomologia*. 1977. 1: 161–162.

Guénard E., Dunn R.R. 2012. A checklist of the ants of China. *Zootaxa*. 3558: 1–77.

Karawajew W. 1926. Beiträge zur Ameisenfauna des Kaukasus, nebst einigen Bemerkungen über andere palaearktische Formen. *Konowia*. 5(2): 161–169.

Kutter H. 1925. Eine neue Ameise der Schweiz. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft*. 13: 409–412.

Kutter H. 1977. Insecta Helvetica Fauna 6. Hymenoptera, Formicidae. Zürich: Fotorotar AG. 298 p.

Radchenko A.G. 1994a. New ant species of the genus *Leptothorax* (Hymenoptera, Formicidae) from Southern and Eastern Palaearctics. *Zhurnal Ukrainskogo entomologicheskogo obshchestva*. 1993. 1–2: 23–34 (in Russian).

Radchenko A.G. 1994b. A key to the species of the genus *Leptothorax* (Hymenoptera, Formicidae) of the Central and Eastern Palaearctic. *Zoolologicheskii zhurnal*. 73(7–8): 146–158 (in Russian).

Radchenko A.G. 1994c. A review of the ant genus *Leptothorax* (Hymenoptera, Formicidae) of Central and East Palaearctics. Communication 1. Subdivision into groups. Groups *acervorum* and *bulgaricus*. *Vestnik zoologii*. 6: 22–28 (in Russian).

Radchenko A.G. 1995a. A review of the ant genus *Leptothorax* (Hymenoptera, Formicidae) of Central and East Palaearctics. Communication 2. Groups *tuberum*, *corticalis*, *affinis*, *clypeatus*, *alinae* and *singularis*. *Vestnik zoologii*. 2: 14–21 (in Russian).

Radchenko A.G. 1995b. A review of the ant genus *Leptothorax* (Hymenoptera, Formicidae) of Central and East Palaearctics. Communication 3. Groups *nylanderi*, *korbi*, *nassonovi* and *susamyri*. *Vestnik zoologii*. 4: 3–11 (in Russian).

Radchenko A.G. 1996. A review of the ant genus *Leptothorax* (Hymenoptera, Formicidae) of Central and East Palaearctics. Communication 4. Group *congruus*.. Species of uncertain position. Zoogeographical characteristic. *Vestnik zoologii*. 1–2: 16–22 (in Russian).

Radchenko A. 2004. A review of the ant genera *Leptothorax* Mayr and *Temnothorax* Mayr (Hymenoptera, Formicidae) of the Eastern Palaearctic. *Acta Zoologica Academiae Scientiarum Hungaricae*. 50(2): 109–137.

Radchenko A., Elmes G.W. 2010. *Myrmica* ants (Hymenoptera, Formicidae) of the Old World. Warszawa: Natura Optima Dux Foundation. 789 p.

Ruzsky M. 1902a. Neue Ameisen aus Russland. Zoologische Jahrbücher. *Abtheilung für Systematik, Geographie und Biologie der Thiere*. 17: 469–484.

Ruzsky M.D. 1902b. Materials on the myrmecofauna of the Caucasus and Crimea. *Prilozhenie k Protokolam Obshchestva Estestvoispytatelei pri Imperatorskomy Kazanskomy Universitete*. 206: 1–33 (in Russian).

Ruzsky M.D. 1905. The ants of Russia (Formicariae Imperii Rossici). Part 1. *Trudy Obshchestva Estestvoispytatelei pri Imperatorskomy Kazanskomy Universitete*. 38(4–6): 1–798 (in Russian).

Seifert B., Csösz S. 2015. *Temnothorax crasecundus* sp. n. – a cryptic Eurocaucasian ant species (Hymenoptera: Formicidae) discovered by Near Centroid Clustering. *ZooKeys*. 479: 37–64.

Terayama M., Onoyama K. 1999. The ant genus *Leptothorax* Mayr (Hymenoptera, Formicidae) in Japan. *Memoirs of the Myrmecological Society of Japan*. 1: 71–97.

Ward Ph.S., Brady S.G., Fisher B.L., Schultz T. 2015. The evolution of myrmicine ants: phylogeny and biogeography of a hyperdiverse ant clade (Hymenoptera: Formicidae). *Systematic Entomology*. 40(1): 61–81.