

What is *Tetramorium semilaeve* André, 1883? (Hymenoptera, Formicidae)

Lech Borowiec¹, Christophe Galkowski², Sebastian Salata¹

1 Department of Biodiversity and Evolutionary Taxonomy, University of Wrocław, Przybyszewskiego, 63/77, 51-148 Wrocław, Poland **2** Route de Mounic, 33160 Saint-Aubin-de-Médoc, France

Corresponding author: Lech Borowiec (lech.borowiec@uwr.edu.pl)

Academic editor: Brian Fisher | Received 18 May 2015 | Accepted 20 June 2015 | Published 6 July 2015

<http://zoobank.org/307FD052-53D2-4472-90E0-A03F8F03A310>

Citation: Borowiec L, Galkowski C, Salata S (2015) What is *Tetramorium semilaeve* André, 1883? (Hymenoptera, Formicidae). ZooKeys 512: 39–62. doi: 10.3897/zookeys.512.10006

Abstract

Tetramorium semilaeve André, 1883 is redescribed based on the type series and new material from terra typica (Pyrénées-Orientales). Lectotype worker is designated. Detailed descriptions of gyne and male are given. A review of material from the Mediterranean area suggests that in the past the name *Tetramorium semilaeve* has been applied to more than one species and the true *T. semilaeve* is common only in the western part of the Mediterranean basin. The structure of the male genitalia is the most reliable set of characters allowing a proper distinction of species in *Tetramorium semilaeve* species group. All names attributed to the former name “*semilaeve*” are discussed.

Keywords

Mediterranean Subregion, Crematogastrini, taxonomy, *Tetramorium semilaeve*

Introduction

The genus *Tetramorium* Mayr, 1855 with 560 valid species and 21 valid subspecies is one of the most speciose ant genera of the subfamily Myrmicinae (Bolton in AntCat 2015). It is a genus with worldwide distribution in which the highest number of species has been recorded in the Afrotropical Region. 55 species (including 5 tramp, subcosmopolitan species) have been recorded so far from Europe and the Mediterranean basin (Borowiec 2014). Several of the names are poorly known, have not been revised

since the original description, and are considered to be incertae sedis. Only *Tetramorium cheffeki* and *T. ferox* groups have been recently revised and six other species have been lately redescribed in detail (Csösz and Markó 2004, Güsten et al. 2006, Csösz et al. 2007, 2014, Csösz and Schulz 2010, Steiner et al. 2010, Borowiec and Salata 2014, Espadaler and Goméz 2014) and molecular data suggests that some widely distributed species represent groups of cryptic taxa (Schlick-Steiner et al. 2006).

Tetramorium semilaeve André, 1883 was originally described as a variety of *Tetramorium caespitum*. No types were designated in the original description and André (1883) only noted that “Cette variété qui paraît méridionale est répandue dans toute la région méditerranéenne de l’Europe, de l’Afrique et d’Asie” [This apparently southern variety is distributed throughout the entire region of the Mediterranean Europe, Africa, and Asia]. Emery (1891) was the first who noted that André described this species based on material from Banyuls in Pyrénées Orientales (ex coll. Saulcy). Dalla Torre (1893), in his catalogue of Formicidae, treated this taxon as a good species and noted its distribution in southern Europe and northern Africa. Subsequently Forel (1902), based on material from Algeria, again reduced *semilaeve* to a race of *T. caespitum*. However, it is uncertain whether the specimens he mentions in this work were conspecific with *T. semilaeve* sensu André. Emery (1909) also considered *semilaeve* as a variety of *Tetramorium caespitum* and noted that its range covers an area of the whole Mediterranean basin and Central Asia. Eventually, Bondroit (1918) restored *Tetramorium semilaeve* a species rank and on the basis of material from André collection confirmed that type material came from Pyrénées-Orientales. The majority of subsequent authors accepted Bondroit’s proposition and the species has begun to be seen as a one of the most common members of the genus *Tetramorium* in the Mediterranean basin. Most of the populations of *Tetramorium* characterized by pale colour and incomplete head sculpture were treated as different variants of this species with the result that more than twenty names are attributed to the taxon “*semilaeve*” sensu lato (see discussion).

Sanetra et al. (1999) based on electrophoretic studies were the first to suggest that the western and eastern populations of “*semilaeve*” complex represent two distinct taxa. Our morphological studies, especially the examination of male genitalia in samples from throughout the Mediterranean region, show that more than two species with characters so far attributed to *T. semilaeve* occur in this area. The access to the type specimens from André collection and the results of our study on the fresh material enabled us to answer questions regarding the real distribution of this species and determine characters distinguishing it from other taxa. In this work we designate the lectotype for *T. semilaeve* and prepare detailed redescription of all castes based on types and recently collected material from the terra typica (Pyrénées-Orientales).

Material and methods

Specimens were compared using standard methods of comparative morphology. Photos were taken using a Nikon SMZ 1500 stereomicroscope, Nikon D5200 photo camera and Helicon Focus software.

All given label data are in their original spelling; a vertical bar (|) separates data on different rows and double vertical bar (||) separates labels.

Our scheme of description corresponds with the revisions of *Tetramorium chefketi* and *T. ferox* groups (Csösz et al. 2007, Csösz and Schulz 2010: see Figs 1–4 on p. 4).

Abbreviation of the depositories:

CG	coll. Christophe Galkowski, Saint-Aubin-de-Médoc, France;
DBET	Department of Biodiversity and Evolutionary Taxonomy, University of Wrocław, Poland;
MNHN	Muséum National d'Histoire Naturelle, Paris, France.

Measurements and indices:

CL	length of head in full-face view, measured in a straight line from the anteriormost point of median clypeal margin to the mid-point of the posterior margin of the head. Concavity of posterior margin reduces CL;
CW	maximum width of head in full-face view, including compound eyes;
CS	cephalic size; calculated from the arithmetic mean of CL and CW. It is used as a less variable indicator of body size. For simplicity CS is used to describe body size;
EH	the minimum diameter of the compound eye;
EL	the maximum diameter of the compound eye;
EYE	eye size index, calculated from the arithmetic mean of EL and EH, divided by CS;
OMD	oculo-malar space. The minimal distance between anterior (lower) margin of the compound eye and the mandibular junction in profile;
FL	the maximum distance between external borders of the frontal lobes;
FR	the minimum width of the frons between the frontal carinae;
ML	the diagonal length of mesosoma measured in lateral view from the anteriormost point of the pronotal slope to the posterior (or postero-ventral) margin of the propodeal lobes;
MW	the maximum width of the pronotum from above;
NOH	the maximum height of the petiolar node;
NOL	the length of the petiolar node;
PEH	the maximum height of the petiole in lateral view;
PEL	the distance between the posteriormost point of the petiole and the petiolar spiracle;
PEW	the maximum width of the petiole in dorsal view;
POC	postocular distance. Measured from the reference line fitted on the posterior margin of compound eyes to median posterior margin of the head;

- PPH** the maximum height of the postpetiole in lateral view;
PPL the maximum length of the postpetiole in lateral view;
PPW the maximum width of the postpetiole in dorsal view;
SL the maximum length of the scape, measured from the proximal point of scape lobe to the distal end of scape;
SPL the minimum distance between the center of propodeal spiracle and the propodeal declivity;
SPSP the maximum length of propodeal teeth, measured in lateral view from the tip of spine to the propodeal spiracle;
WAIST (gyne only), waist index, calculated as $(PEW+PPW)/CS$.

Descriptions

Tetramorium semilaeve André, 1883

Tetramorium caespitum var. *semilaeve* André, 1883: 286 (terra typica: “toute la region méditerranéenne de l’Europe, de l’Afrique et d’Asie”).

Tetramorium semilaeve: Dalla Torre 1893: 134; Bondroit 1918: 109; Müller 1923: 104; Santschi 1927: 54.

Tetramorium caespitum r. *semilaeve*: Forel 1902: 148.

Tetramorium caespitum ssp. *semilaeve*: Emery 1909: 700, 703; Menozzi 1926: 182.

Type material examined. Lectotype worker (here designated, no. ANTWEB1008880): Pyrénées | Orientales || Type || TYPE || MUSEUM PARIS | COLLECTION | ERNEST ANDRÉ | 1914 (MNHN); two paralectotype workers: Pyrénées-Orientales | (de Saulcy || TYPE || *Tetr. caespitum* | race *semilaeve* || MUSEUM PARIS | COLLECTION | ERNEST ANDRÉ | 1914 (MNHN); three paralectotype workers: Pyr. | orient. | (d. Saulcy) || TYPE II T. | *semilaeve* || MUSEUM PARIS | COLLECTION | ERNEST ANDRÉ | 1914 (MNHN).

Other material examined. *Pinned material.* 4 gynes, 6 workers: FRANCE, Pyrénées Orientales | Banyuls, Route du col, 196 m | 42.467 N / 3.141 E | 12 VI 2010, C. Galkowski || Collection L. Borowiec | Formicidae | LBC-FR00043 (DBET); 3 workers, 4 males: FRANCE, Pyrénées Orientales | Banyuls, Col de Sérís, 290 m | 42.452 N / 3.141 E | 12 VI 2010, C. Galkowski || Collection L. Borowiec | Formicidae | LBC-FR00040 (DBET); 2 gynes, 3 workers, 3 males: FRANCE, Pyrénées Orientales | Banyuls, Col de Sérís, 290 m | 42.452 N / 3.141 E | 12 VI 2010, C. Galkowski || Collection L. Borowiec | Formicidae | LBC-FR00041 (DBET); 4 gynes, 2 workers: FRANCE, Pyrénées Orientales | Banyuls, Col de Sérís, 290 m | 42.452 N / 3.141 E | 12 VI 2010, C. Galkowski || Collection L. Borowiec | Formicidae | LBC-FR00042 (DBET); 1 worker: [FRANCE, Pyrénées Orientales] Banyuls | Berland || MUSEUM PARIS | BANYULS-S-MER | PYRÉNÉES-ORIENTALES | L. BERLAND 1925 (MNHN); 3 gynes, 9 workers, 1 male: [FRANCE, Provence-Alpes-Côte d’Azur]

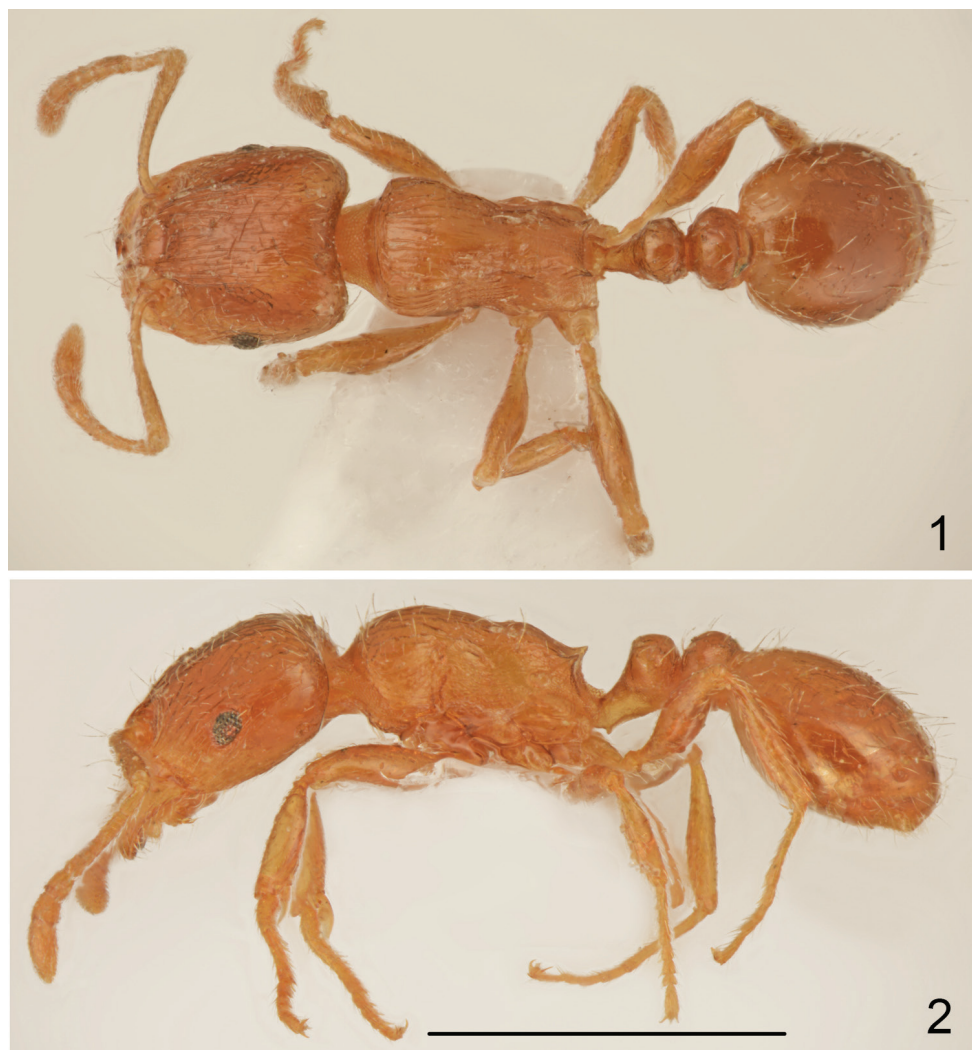
Plan de Tour | 25.6.83 || F. BERNARD || MUSEUM PARIS (MNHN); 1 gyne: [FRANCE] CORSE – près Corte | Vallee moyenne du | Tavignano 11.VI.1976 I Rec. CASEVITZ-WEULERSSE II pris s/pierre I ecles au labo. | 17.VI.1976 || Museum Paris (MNHN).

Alcohol material. 10 workers: FRANCE, Pyrénées Orientales, Banyuls, Col de Sérís, 42.452 N / 3.141 E, 12 VI 2010, leg. C. Galkowski (CG); 8 gynes, 6 workers: FRANCE, Pyrénées Orientales, Banyuls, Col de Sérís no. 2, 42.452 N / 3.141 E, 12 VI 2010, leg. C. Galkowski (CG); 18 workers: FRANCE, Pyrénées Orientales, Banyuls, Col de Sérís no. 3, 42.452 N / 3.141 E, 12 VI 2010, leg. C. Galkowski (CG); 19 workers: FRANCE, Pyrénées Orientales, Banyuls, Cap Béar, 42.515 N / 3.132 E, 12 VI 2010, leg. C. Galkowski (CG); 27 workers: FRANCE, Pyrénées Orientales, Banyuls, Route du col, 42.467 N / 3.142 E, 12 VI 2010, leg. C. Galkowski (CG); 20 workers: FRANCE, Pyrénées Orientales, Banyuls, Paulilles, 42.501 N / 3.126 E, 12 VI 2010, leg. C. Galkowski (CG); 17 workers: FRANCE, Pyrénées Orientales, Banyuls, Bartissol, 42.481 N / 3.124 E, 12 VI 2010, leg. C. Galkowski (CG); 7 workers: FRANCE, Corsica, Bastia, 42.655 N / 9.449 E, IV 2011 (CG); 7 workers: FRANCE, Corsica, Pianà, 42.231 N / 8.552 E, 23 VII 2011 (CG); 2 workers: SPAIN, Balears, Mallorca, Cala D'Or, 14 m, 39,36666 N / 3,21666 E, 7 V 2009, leg. L. Borowiec (DBET); 2 workers: SPAIN, Balears, Mallorca, Cala Egos, 11 m, 39,35 N / 3,21666 E, 7 V 2009, leg. L. Borowiec (DBET); 21 workers: SPAIN, Balears, Mallorca, Cap de ses Salines from Punta de Mila to Punta Galera, 5 m, 39,26666 N / 3,03333 E, 9 V 2009, leg. L. Borowiec (DBET); 5 workers: SPAIN, Balears, Mallorca, Parc Natural Mondrago n. Cala Egos, 12 m, 39,35 N / 3,18333 E, 11 V 2009, leg. L. Borowiec (DBET); 1 gyne, 7 workers, 4 males: SPAIN, Balears, Mallorca, Cap de ses Salines from Punta de Mila to Punta de sa Cresta, 8 m, 39,26666 N / 3,06666 E, 12 V 2009, leg. L. Borowiec (DBET); 6 workers: SPAIN, Balears, Mallorca, Ermita de Betlem n. Arta, 378 m, 39,71666 N / 3,31666 E, 12 V 2009, leg. L. Borowiec (DBET); 4 workers: SPAIN, Balears, Mallorca, Colonia Sant Jordi, 4 m, 39,31666 N / 2,98333 E, 15 V 2009, leg. L. Borowiec (DBET); 4 workers: Spain, Andalucia, Malaga Pr., road Ojén-Refugio de Juanar, 544 m, 36,59358 N / 4,85621 W, 6 V 2014, leg. L. Borowiec (DBET); 5 workers: SPAIN, Andalucia, Malaga Pr., Igualeja, 720 m, 36,63259 N / 5,1179 W, 7 V 2014, leg. L. Borowiec (DBET); 4 workers: SPAIN, Andalucia, Malaga Pr., road Marbella-Istán, 145 m, 36,53324 N / 4,94905 W, 11 V 2014, leg. L. Borowiec; 50 workers: SPAIN, Andalucia, Cádiz Pr., nr. Getares, 36,06698 N / 5,44166 W, 8 V 2014, 21 m, leg. L. Borowiec (DBET); 5 workers: SPAIN, Andalucia, Cádiz Pr., road Tarifa-El Bujeo, 262 m, 36,05206 N / 5,55 W, 9 V 2014, leg. L. Borowiec (DBET); 10 workers: SPAIN, Andalucia, Cádiz Pr., Venta de Ojén, 248 m, 36,15910 N / 5,58684 W, 9 V 2014, leg. L. Borowiec (DBET); 20 workers: SPAIN, Catalonia, Alt Empordà, Cap de Creus n. Cadaques, 203 m 42°18'N/3°13'W, 2 IX 2011, leg. L. Borowiec (DBET); SPAIN, Catalonia, Alt Empordà, n. Llançà, 79 m, 42°21'N/3°06'W, 2 IX 2011, leg. L. Borowiec (DBET); 10 workers: ITALY, N Calabria, Scalea city-castle hill, 49 m, 39,81859 N/15,78963 E, 25 VIII 2014, leg. L. Borowiec (DBET); 5 workers: ITALY, N Calabria, n. Grisolia

loc. 2, 484 m, 39,71887 N/15,88376 E, 2 IX 2014, leg. L. Borowiec (DBET); 4 workers: ITALY, N Calabria, n. Papisidero loc. 1, 162 m, 39,87390 N/15,90534 E, 5 IX 2014, leg. L. Borowiec; (DBET) 5 workers: ITALY, N Calabria, n. Tortora, 388 m, 39,94668 N/15,80452 E, 6 IX 2014, leg. L. Borowiec (DBET).

Redescription. *Worker* (Figs 1–3, 5–9). Measurements and indices (n=15): CL: 0.723 ± 0.034 (0.637-0.771); POC: 0.293 ± 0.021 (0.246-.324); CW: 0.693 ± 0.037 (0.606-0.749); FR: 0.253 ± 0.015 (0.234-0.279); FL: 0.262 ± 0.017 (0.235-0.291); SL: 0.534 ± 0.03 (0.503-0.626); OMD: 0.18 ± 0.021 (0.145-0.223); EL: 0.13 ± 0.01 (0.106-0.145); EH: 0.091 ± 0.006 (0.078-0.101); ML: 0.781 ± 0.043 (0.737-0.894); SPSP: 0.133 ± 0.015 (0.112-0.179); SPL: 0.099 ± 0.007 (0.089-0.112); PEL: 0.184 ± 0.01 (0.167-0.201); NOL: 0.144 ± 0.013 (0.128-0.168); PPL: 0.176 ± 0.009 (0.156-0.19); PEH: 0.239 ± 0.018 (0.212-0.291); NOH: 0.158 ± 0.017 (0.14-0.218); PPH: 0.228 ± 0.02 (0.201-0.291); MW: 0.45 ± 0.027 (0.413-0.508); PEW: 0.22 ± 0.014 (0.201-0.246); PPW: 0.256 ± 0.018 (0.223-0.307); CS: 0.707 ± 0.036 (0.622-0.76); EYE: 0.155 ± 0.007 (0.143-0.166); CL/CW: 1.042 ± 0.013 (1.015-1.075); FR/CS: 0.358 ± 0.01 (0.345-0.378); FL/FR: 1.025 ± 0.02 (0.996-1.066); SL/CS: 0.756 ± 0.03 (0.732-0.841); MW/CS: 0.636 ± 0.018 (0.612-0.682); PEW/PPW: 0.861 ± 0.033 (0.801-0.918); NOH/NOL: 1.1 ± 0.113 (0.929-1.298); NOH/PEL: 0.86 ± 0.085 (0.819-1.085); NOL/PEL: 0.784 ± 0.045 (0.705-0.871); PEH/NOL: 1.66 ± 0.152 (1.399-1.922); PEW/PEH: 0.926 ± 0.049 (0.805-1.0); CS/PEW: 3.215 ± 0.089 (3.026-3.336); CS/PPW: 2.769 ± 0.154 (2.425-3.024); CW/MW: 1.541 ± 0.046 (1.435-1.602);

Small to medium size, CS: 0.707 [0.622-0.76]. In most specimens whole body pale yellowish-brown and appendages yellow, the palest specimens completely yellow, the darkest specimens yellowish-brown but never dark brown or black. Head nearly square CL/CW: 1.042 [1.015-1.075], with almost parallel sides, straight or slightly concave occipital margin and narrowly rounded occipital corners. Eyes small, EYE 0.155 [0.143-0.166]. Frons moderately wide, FR/CS 0.358 [0.345-0.378], frontal lobes as wide as frons, FL/FR: 1.025 [0.996-1.066]. Scape short, SL/CS 0.756 [0.732-0.841], without dorsal carina basally, surface smooth and shiny. Promesonotal dorsum slightly convex, metanotal groove shallow, but distinct. Propodeal teeth short, spiniform, apex of spine located approximately at 2/3 height of mesosoma. Dorsal surface of petiole flat to slightly convex, NOH/NOL 1.1 [0.929-1.298], petiole relatively high, PEH/NOL 1.66 [1.399-1.922], postpetiole distinctly transverse (Figs 1, 5). General appearance finely rugose, ground surface shiny. Head dorsum partly longitudinally rugose and shiny between rugae, rugae extend occipital margin of head, occiput mostly smooth and shiny, sides in anterior half longitudinally rugose and shiny between rugae. In most specimens between frontal rugose area and rugosities along ocular area on each side runs longitudinal band without rugosities (Fig. 8) but smooth area never exceeds 1/5 of the anterior surface of head; in extremely sculptured specimens almost whole frontal surface of head with long rugae with very small smooth patch between interrupted rugae and occiput with fine rugosities (Fig. 9), dark coloured specimens usually have more distinct sculpture than pale coloured specimens but strongly sculptured and completely



Figures 1–2. *Tetramorium semilaeve* André, lectotype **1** dorsal **2** lateral. Scale bar = 1 mm.

yellow specimens were also observed. Alitrunk dorsum rugose and microreticulate but never reticulate, only occasionally rugae on pronotum partly interrupted with indistinct microreticulation but pronotum never with smooth and shiny areas (Figs 1, 5). Sides of pronotum and meso- and metapleuron usually coarsely microreticulate, sometimes reticulation tends to form transverse lines but surface never appears striate or rugose (Figs 2, 6). Dorsum of petiolar node smooth and shiny with sides carinate, lateral surface microreticulate. Dorsum of postpetiole smooth and shiny, sides microreticulate. First gastral tergite smooth and shiny. Whole dorsum, including head, covered with sparse setae, the longest on pronotum and the shortest on frons. Ventral surface of head with sparse short and 2-3 moderately long setae not forming a psammophore.



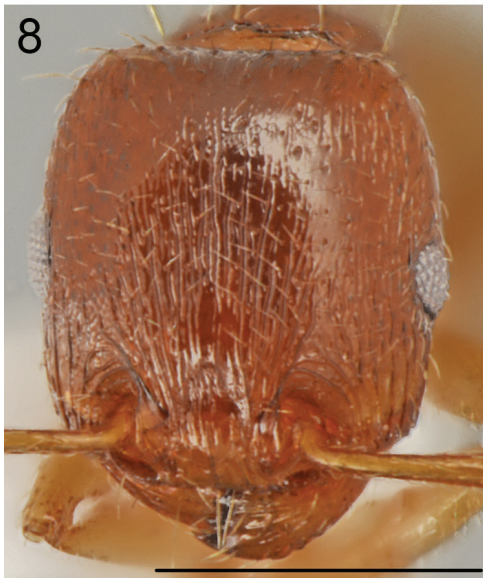
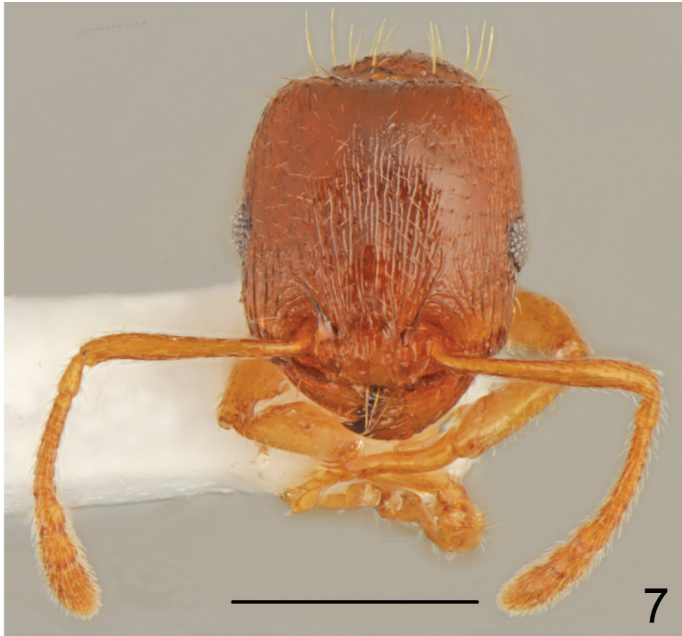
Figures 3–4. *Tetramorium semilaeve* André, lectotype **3** head **4** labels. Scale bar = 1 mm (**3**).

Gyne (Figs 10–13). Measurements and indices (n=11): CL: 0.999 ± 0.015 (0.983–1.027); POC: 0.378 ± 0.019 (0.34–.413); CW: 1.09 ± 0.05 (0.978–1.161); FR: 0.397 ± 0.009 (0.38–0.412); FL: 0.385 ± 0.018 (0.357–0.413); SL: 0.715 ± 0.015 (0.693–0.737); OMD: 0.223 ± 0.016 (0.212–0.257); EL: 0.274 ± 0.01 (0.257–0.291); EH:



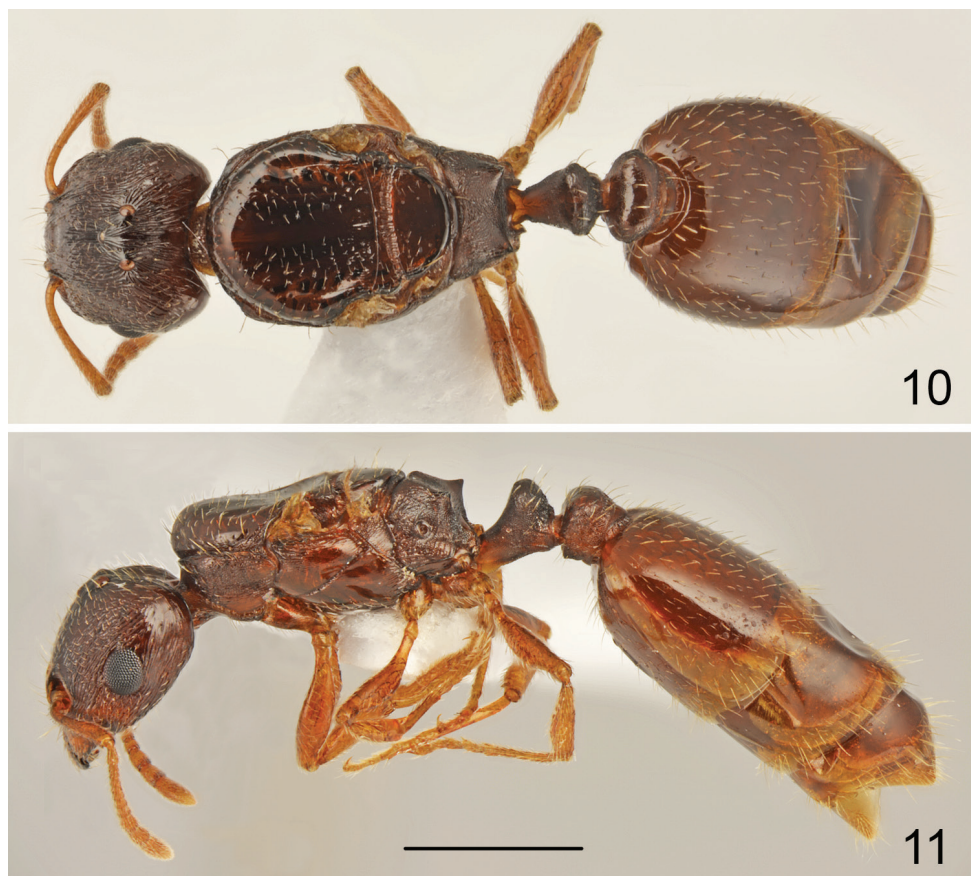
Figures 5–6. *Tetramorium semilaeve* André, worker **5** dorsal **6** lateral. Scale bar = 1 mm.

0.218 ± 0.012 (0.193-0.235); ML: 1.699 ± 0.217 (1.053-1.813); SPSP: 0.267 ± 0.015 (0.24-0.291); SPL: 0.193 ± 0.01 (0.173-0.201); PEL: 0.298 ± 0.014 (0.279-0.324); NOL: 0.225 ± 0.022 (0.179-0.256); PPL: 0.301 ± 0.01 (0.285-0.313); PEH: 0.424



Figures 7–9. *Tetramorium semilaeve* André, worker **7** head and antennae **8** sculpture of head of the most common morphotype **9** sculpture of head of the most sculptured morphotype. Scale bar = 1 mm.

± 0.011 (0.408–0.447); NOH: 0.283 ± 0.019 (0.257–0.313); PPH: 0.423 ± 0.017 (0.391–0.447); MW: 1.069 ± 0.04 (1.0–1.141); PEW: 0.393 ± 0.022 (0.348–0.419); PPW: 0.509 ± 0.019 (0.48–0.547); CS: 1.046 ± 0.032 (0.986–1.094); EYE: 0.235 ± 0.012 (0.219–0.251); CL/CW: 0.917 ± 0.038 (0.882–0.985); FR/CS: 0.377 ± 0.011



Figures 10–11. *Tetramorium semilaeve* André, gyne **10** dorsal **11** lateral. Scale bar = 1 mm.

(0.36–0.393); FL/FR: 0.978 ± 0.035 (0.913–1.027); SL/CS: 0.686 ± 0.019 (0.654–0.717); MW/CS: 1.024 ± 0.043 (0.94–1.088); PEW/PPW: 0.773 ± 0.035 (0.692–0.821); NOH/NOL: 1.266 ± 0.136 (1.094–1.587); NOH/PEL: 0.949 ± 0.053 (0.883–1.036); NOL/PEL: 0.755 ± 0.059 (0.63–0.847); PEH/NOL: 1.9 ± 0.175 (1.746–2.374); PEW/PEH: 0.931 ± 0.048 (0.818–0.971); CS/PEW: 2.62 ± 0.123 (2.475–2.879); CS/PPW: 2.052 ± 0.085 (1.947–2.185); CW/MW: 1.02 ± 0.057 (0.911–1.129); WAIST: 0.871 ± 0.035 (0.817–0.918).

Moderate size, CS 1.046 [0.986–1.094]. Whole body brown, appendages yellowish. Head wider than long, CL/CW 0.917 [0.882–0.985], with straight subparallel sides, shallowly emarginate occipital margin and narrowly rounded occipital corners. Frons moderately wide, FR/CS 0.377 [0.36–0.393], frontal lobes as wide as frons, FL/FR 0.978 [0.913–1.027]. Scape short, SL/CS 0.686 [0.654–0.717], without dorsal carina basally, smooth and shiny. Head as wide as scutum, MW/CS 1.024 [0.94–1.088]. Propodeal teeth very short. Dorsal crest of petiolar node in frontal view straight. Petiolar node dorsum steeply rounded backward. Petiole and postpetiole relatively nar-



Figure 12–13. *Tetramorium semilaeve* André, gyne **12** head **13** mesosoma dorsal. Scale bar = 1 mm.

row, WAIST 0.871 [0.817-0.918]. General appearance smooth and shiny. Head dorsum, occiput and sides rugulose, ground surface shiny or indistinctly microreticulate. Frons longitudinally rugulose (Fig. 12). Mesosoma flat, pronotum visible from above.

Scutum and scutellum punctate along sides, in most specimens smooth and shiny (Fig. 13), only occasionally scutellum in corners with very short rugae and scutum in basal part with thin longitudinal rugae never extending to half length of scutum. Sides of pronotum ruguloso-reticulate and feebly microreticulate, anepisternum mostly smooth and shiny only in dorsal part with fine longitudinal rugae, katepisternum smooth and shiny. Dorsum of petiolar node distinctly reticulate and smooth, posterior surface granulate and more or less transversely rugose. Postpetiole distinctly transverse, sides narrowly rounded to subangulate (Fig. 10), dorsum of postpetiole smooth, sides granulate. First gastral tergite smooth and shiny. Whole dorsum, including head, covered with short, sparse setae. Ventral surface of head with several short setae, as long as to 1.5 times longer than frontal setae, arising posteriorly to buccal cavity.

Male (Figs 14–19). Measurements and indices (n=10): CL: 0.667 ± 0.018 (0.637-0.693); POC: 0.279 ± 0.019 (0.263-.313); CW: 0.807 ± 0.024 (0.771-0.827); FR: 0.238 ± 0.012 (0.221-0.257); FL: 0.292 ± 0.013 (0.277-0.307); SL: 0.333 ± 0.016 (0.307-0.358); OMD: 0.068 ± 0.016 (0.056-0.089); EL: 0.312 ± 0.01 (0.302-0.324); EH: 0.251 ± 0.011 (0.235-0.263); ML: 1.716 ± 0.069 (1.626-1.785); SPSP: 0.226 ± 0.014 (0.212-0.246); SPL: 0.205 ± 0.013 (0.184-0.223); PEL: 0.275 ± 0.017 (0.257-0.302); NOL: 0.176 ± 0.018 (0.156-0.201); PPL: 0.287 ± 0.017 (0.263-0.302); PEH: 0.286 ± 0.022 (0.257-0.313); NOH: 0.163 ± 0.01 (0.156-0.179); PPH: 0.418 ± 0.015 (0.391-0.425); MW: 1.125 ± 0.056 (1.056-1.223); PEW: 0.337 ± 0.023 (0.307-0.368); PPW: 0.478 ± 0.022 (0.453-0.503); CS: 0.737 ± 0.019 (0.704-0.755); EYE: 0.382 ± 0.009 (0.37-0.395); CL/CW: 0.826 ± 0.023 (0.797-0.857); FR/CS: 0.323 ± 0.012 (0.314-0.345); FL/FR: 1.228 ± 0.06 (1.132-1.306); SL/CS: 0.452 ± 0.015 (0.436-0.478); MW/CS: 1.528 ± 0.093 (1.411-1.684); PEW/PPW: 0.705 ± 0.04 (0.668-0.767); NOH/NOL: 0.928 ± 0.076 (0.812-1.0); NOH/PEL: 0.595 ± 0.059 (0.517-0.668); NOL/PEL: 0.643 ± 0.069 (0.559-0.75); PEH/NOL: 1.625 ± 0.114 (1.502-1.788); PEW/PEH: 1.182 ± 0.061 (1.1-1.284); CS/PEW: 2.216 ± 0.165 (2.019-2.438); CS/PPW: 1.558 ± 0.085 (1.443-1.652); CW/MW: 0.719 ± 0.045 (0.639-0.783)

Whole body dark brown, appendages yellowish. Head with feebly convex sides, slightly rounded occipital margin and widely rounded occipital corners. Scutum distinctly wider than head. Propodeum rounded in profile or with only indistinct angulation in position of propodeal teeth. Dorsal crest of petiolar node with obtuse transversal edge, slightly emarginated in frontal view. Head distinctly granulate, dull, scutum in anterior part and laterally smooth and shiny, rest microreticulate. Scutellum ostly smooth and shiny, at corners microreticulate and in anterior part with thin transverse rugosities. Sides of alitrunk smooth and shiny. Dorsum of petiolar node microgranulate and microreticulate, dull, postpetiole mostly microreticulate only top partly smooth and shiny. First gastral tergite smooth and shiny. Male genitalia stout (Figs 16–18), in lateral view only slightly constricted before apex with obtuse inner angle, top shortly and sparsely pubescent, ventral and dorsal margins of parameres shallowly incised, top of inner margin of paramere before apical denticle straight with dentiform plate distinctly clearly extending beyond the sharp edge of paramere (Fig. 19, arrow indices this plate).



Figure 14–15. *Tetramorium semilaeve* André, male **14** lateral **15** dorsal. Scale bar = 1 mm.

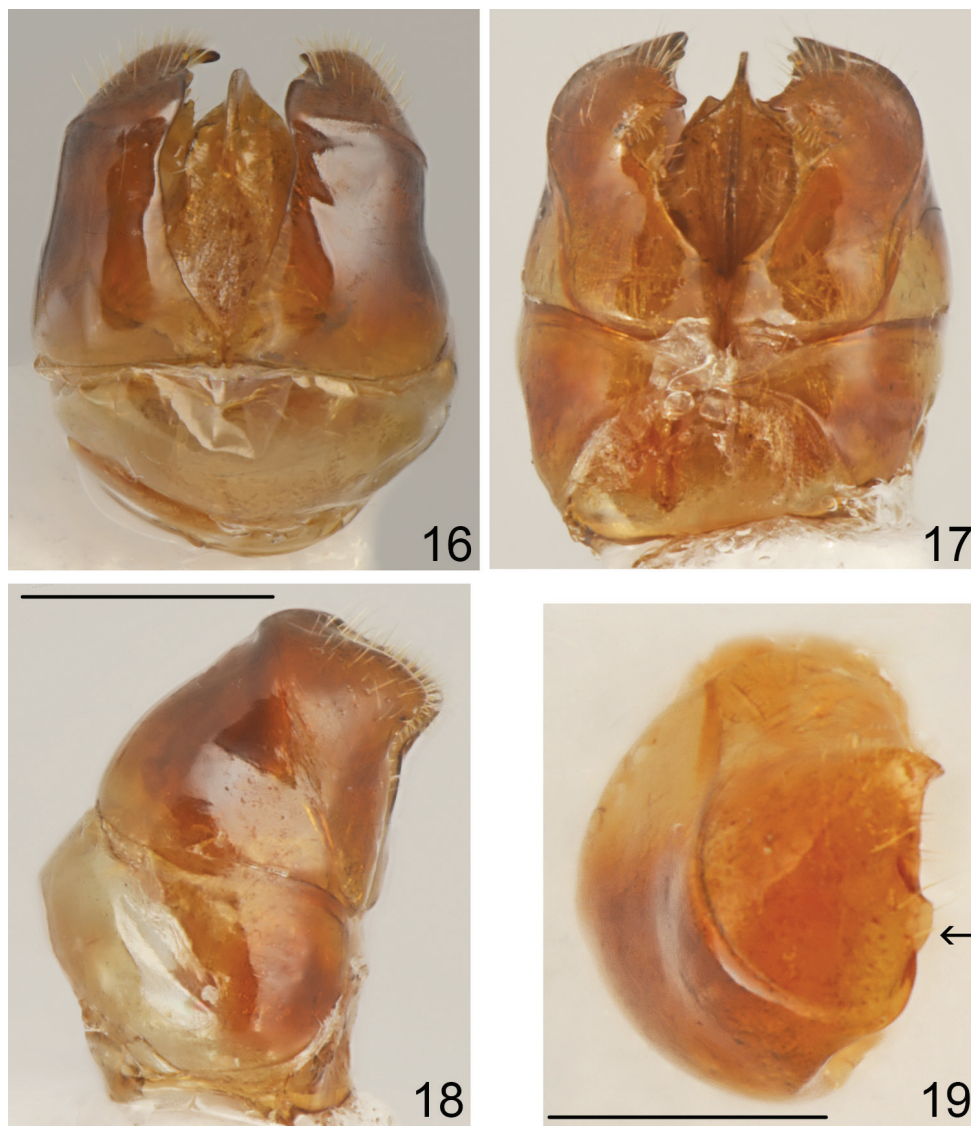


Figure 16–19. *Tetramorium semilaeve* André, male genitalia **16** dorsal **17** ventral **18** lateral **19** apex of paramere in dorsal view. Scale bar = 0.5 mm (**16–18**); 0.3 mm (**19**).

Diagnosis. *Tetramorium semilaeve* belongs to the group of Mediterranean species with workers pale-coloured, from yellow to yellowish-brown but never dark brown or black, head sculpture partly reduced, at least with postocular area and sides of frons without distinct striation but with at least half of the surface of the anterior part of head striate, striae on top of head not diverging laterally, pronotum mostly striate, sides of mesosoma only microreticulate and microgranulate without carinae, short propodeal spines, petiole and postpetiole dorsally with polished area, and first ab-



Figure 20. *Tetramorium semilaeve* André, revised localities.

dominal tergite smooth and shiny, without microreticulation or striation; gyne with flat mesonotal plate, without a distinct striation or the striation is indistinct, short not extending behind half length of the plate, scutellum without striation or only on sides with short, indistinct striae, postpetiole not enlarged; male genitalia stout, in lateral view only slightly constricted before apex, ventral and dorsal margins of parameres shallowly incised, top of inner margin of paramere before apical denticle straight with dentiform plate distinctly clearly extending beyond the sharp edge of paramere (Fig. 19, arrow indices this plate). The presence of dentiform plate on top of the inner margin of paramere is the best character distinguishing *T. semilaeve* from all other species related to this taxon.

Biological data. *Tetramorium semilaeve* prefers very warm and dry places. Most observed nests were located in the littoral zone on the flat, sandy areas covered with sparse vegetation or on stony pastures. The locality with the highest altitude in the examined material here is from Andalucia, Igualeja placed 720 m a.s.l. Sanetra et al. (1999) noted that in Italy most samples were collected below 1000 m a.s.l. and only occasionally above this altitude. All nests were located under stones, from small to very large size, and consisted of from several to several hundred workers. Because gynes were rarely collected, Sanetra et al. (1999) suggested that this species is monogynous but we observed more than one gyne in one nest in five cases. The following ant species were recorded in the same areas as *T. semilaeve*:

- France, Banyuls, Col de Sérís: *Camponotus aethiops* (Latreille), *Lasius myops* Forel, *Pheidole pallidula* (Nylander), *Plagiolepis pygmaea* (Latreille), *Temnothorax recedens* (Nylander), *Tetramorium* sp.;
- France, Banyuls, Cap Béar: *Aphaenogaster senilis* Mayr, *Pheidole pallidula* (Nylander), *Plagiolepis pygmaea* (Latreille), *Tapinoma nigerrimum* (Nylander), *Temnothorax niger* (Forel), *Tetramorium* sp.;
- France, Banyuls, Route du col: *Cataglyphis piliscapa* (Forel), *Lasius lasioides* (Emery), *Pheidole pallidula* (Nylander), *Plagiolepis pygmaea* (Latreille), *Solenopsis fugax* (Latreille), *Tetramorium* sp.;
- France, Banyuls, Paulilles: *Aphaenogaster senilis* Mayr, *Iberoformica subrufa* (Roger), *Pheidole pallidula* (Nylander), *Plagiolepis pygmaea* (Latreille), *Tapinoma nigerrimum* (Nylander), *Temnothorax kutteri* (Cagniant), *Temnothorax niger* (Forel), *Tetramorium* sp.;
- France, Corsica, Bastia: *Aphaenogaster spinosa* Emery, *Crematogaster scutellaris* (Olivier), *Formica cunicularia* Latreille, *Pheidole pallidula* (Nylander), *Plagiolepis pygmaea* (Latreille), *Temnothorax exilis* (Emery), *Tetramorium* sp.;
- France, Corsica, Piana: *Aphaenogaster spinosa* Emery, *Formica cunicularia* Latreille, *Messor minor* (André), *Messor wasmanni* Krausse, *Plagiolepis pygmaea* (Latreille), *Solenopsis fugax* (Latreille), *Tapinoma nigerrimum* (Nylander), *Tetramorium* sp., *Tetramorium meridionale* Emery;
- Mallorca, Cap de ses Salines from Punta de Mila to Punta de sa Cresta: *Crematogaster laestrygon* Emery, *Plagiolepis pygmaea* (Latreille), *Plagiolepis schmitzii* Forel, *Temnothorax* sp.;
- Mallorca, Cap de ses Salines from Punta de Mila to Punta Galera: *Camponotus ruber* Emery, *Crematogaster auberti* Emery, *Lasius lasioides* (Emery), *Plagiolepis pygmaea* (Latreille), *Plagiolepis schmitzii* Forel;
- Mallorca, Cala D'Or: *Messor* cf. *structor*;
- Mallorca, Parc Natural Mondrago: *Camponotus ruber* Emery, *Crematogaster laestrygon* Emery, *Linepithema humile* (Mayr), *Messor bouvieri* Bondroit, *Messor* cf. *structor*, *Plagiolepis pygmaea* (Latreille);
- Mallorca, Ermita de Betlem n. Arta: *Crematogaster auberti* Emery, *Crematogaster laestrygon* Emery, *Crematogaster scutellaris* (Olivier), *Lasius grandis* Forel, *Lasius lasioides* (Emery), *Messor bouvieri* Bondroit, *Pheidole pallidula* (Nylander), *Plagiolepis pygmaea* (Latreille), *Plagiolepis xene* Stårcke, *Tapinoma madeirense* Forel, *Temnothorax algiricus* Forel, *Temnothorax recedens* (Nylander);
- Mallorca, Colonia Sant Jordi: *Linepithema humile* (Mayr), *Messor bouvieri* Bondroit, *Messor* cf. *structor*, *Monomorium salomonis* (Linnaeus), *Temnothorax* sp.;
- Andalucía, road Ojén-Refugio de Juanar: *Aphaenogaster gibbosa* (Latreille), *Camponotus foreli* Emery, *Camponotus pilicornis* (Roger), *Iberoformica subrufa* (Roger), *Plagiolepis schmitzii* Forel, *Tapinoma nigerrimum* (Nylander);
- Andalucía, road Marbella-Istán: *Camponotus foreli* Emery, *Crematogaster auberti* Emery, *Crematogaster sordidula* (Nylander), *Iberoformica subrufa* (Roger), *Monomorium salomonis* (Linnaeus), *Plagiolepis schmitzii* Forel;

- Andalucia, nr. Getares: *Anochetus ghilianii* (Spinola), *Camponotus barbaricus* Emery, *Crematogaster auberti* Emery, *Goniomma hispanicum* (André), *Messor barbarus* (Linnaeus), *Tapinoma nigerrimum* (Nylander), *Temnothorax* cf. *flavispinus*;
- Andalucia, road Tarifa-El Bujeo: *Anochetus ghilianii* (Spinola), *Aphaenogaster senilis* Mayr, *Camponotus barbaricus* Emery, *Camponotus gestroi*, *Messor barbarus* (Linnaeus), *Pheidole pallidula* (Nylander), *Tapinoma nigerrimum* (Nylander), *Temnothorax* cf. *flavispinus*;
- Andalucia, Venta de Ojén: *Camponotus cruentatus* (Latreille), *Cataglyphis iberica* (Emery), *Temnothorax* cf. *luteus*;
- Calabria, Scalea city-castle hill: *Aphaenogaster campana* Emery, *Camponotus piceus* (Leach), *Hypoconerina eduardi* (Forel), *Lasius emarginatus* (Olivier), *Lepisiota frauenfeldi* (Mayr), *Linepithema humile* (Mayr), *Messor capitatus* (Latreille), *Messor wasmanni* Krausse, *Pheidole pallidula* (Nylander), *Plagiolepis taurica* Santschi, *Tapinoma nigerrimum* (Nylander);
- Calabria, n. Grisolia loc. 2: *Aphaenogaster campana* Emery, *Bothriomyrmex communistus* Santschi, *Camponotus aethiops* (Latreille), *Camponotus lateralis* (Olivier), *Camponotus piceus* (Leach), *Crematogaster scutellaris* (Olivier), *Lasius emarginatus* (Olivier), *Lasius myops* Forel, *Messor capitatus* (Latreille), *Pheidole pallidula* (Nylander), *Plagiolepis pygmaea* (Latreille), *Plagiolepis xene* Stärccke, *Solenopsis fugax* Latreille, *Temnothorax exilis* (Emery), *Temnothorax flavicornis* (Emery), *Temnothorax leviceps* (Emery);
- Calabria, n. Papasidero loc. 1: *Aphaenogaster campana* Emery, *Camponotus aethiops* (Latreille), *Camponotus dalmaticus* (Nylander), *Camponotus lateralis* (Olivier), *Camponotus nylanderii* Emery, *Crematogaster scutellaris* (Olivier), *Crematogaster sordidula* (Nylander), *Lasius emarginatus* (Olivier), *Messor capitatus* (Latreille), *Messor wasmanni* Krausse, *Pheidole pallidula* (Nylander), *Plagiolepis pygmaea* (Latreille), *Temnothorax flavicornis* (Emery), *Temnothorax leviceps* (Emery), *Temnothorax recedens* (Nylander);
- Calabria, n. Tortora: *Aphaenogaster campana* Emery, *Camponotus lateralis* (Olivier), *Camponotus nylanderii* Emery, *Crematogaster scutellaris* (Olivier), *Lasius emarginatus* (Olivier), *Lasius myops* Forel, *Messor wasmanni* Krausse, *Pheidole pallidula* (Nylander), *Plagiolepis pygmaea* (Latreille), *Temnothorax leviceps* (Emery), *Temnothorax lichtensteini* (Bondroit), *Temnothorax recedens* (Nylander).

Discussion

Numerous names of various taxonomic rank have been attributed to the taxon “*semi-laeve*”. Below we listed all these names with comments (tt = terra typica):

Tetramorium caespitum r. *depressum* Forel, 1892: 455; as a form of *Tetramorium semi-laeve*: Santschi, 1936: 202 (tt: Canary Islands) – this taxon is common in the Canary Islands and was also recorded from north-western Africa usually as subspecies

of *T. semilaeve* (Cagniant 1997). Espadaler (2007) raised this name to a species rank and noted that *T. semilaeve* and *T. depressum* differ in head sculpture and male genitalia. We have examined several workers from Tenerife and agree with that but we are not sure whether the reports from north-western Africa relate to the same species. Our material from the Mediterranean suggests that more than one species with reduced head sculpture occurs in this area;

Tetramorium caespitum subsp. *judas* Wheeler & Mann, 1916: 172; as subsp. of *Tetramorium semilaeve*: Menozzi, 1933: 12 (tt: Palestine) – our materials showed that none of the populations from the Near East are conspecific with the true *T. semilaeve* but we are not sure how many species occur in this region due to absence of a sufficient number of samples with males and gynes;

Tetramorium hippocratis Agosti & Collingwood, 1987: 56 (= *Tetramorium caespitum semilaeve* var. *hippocratis* Emery, 1921: 217) (tt: Turkey, unavailable name) – we examined syntype images available on AntWeb (Available from: <https://www.antweb.org/specimen/CASENT0904822>) of this taxon and in our opinion it represents a distinct species more similar to *Tetramorium sahlbergi* Forel than to *T. semilaeve* André;

Tetramorium caespitum st. *semilaeve* var. *ernesti* Santschi, 1921a: 431 (tt: France and Algeria) – unavailable name;

Tetramorium caespitum st. *semilaeve* var. *romana* Santschi, 1921a: 431 (tt: ?) – unavailable name;

Tetramorium caespitum subsp. *semilaeve* var. *fortunatarum* Emery, 1925: 190 (tt: Canary Islands) – although Hohmann et al. (1993) treated this name as a subspecies of *T. semilaeve*, in accordance with the Code of Zoological Nomenclature it remains an unavailable name, likely conspecific with *T. depressum*;

Tetramorium caespitum subsp. *semilaeve* var. *palmense* Wheeler, 1927: 113 (tt: Canary Islands) – unavailable name, likely conspecific with *T. depressum*;

Tetramorium semilaeve var. *lipareum* Santschi, 1927: 55 (tt: Lipari and Sicily Islands) – Sanetra et al. (1999) studied syntypes of this name and synonymized it with *T. punctatum* (see comments below);

Tetramorium semilaeve var. *punctatum* Santschi, 1927: 55 (tt: Sicily) – Sanetra et al. (1999) studied syntypes of this name, designated lectotype and raised this taxon to species rank based on the morphology of workers, gynes and electrophoretic study. We agree with them, both taxa differ also in structure of male genitalia;

Tetramorium semilaeve var. *siciliense* Santschi, 1927: 56 (tt: Sicily) – Sanetra et al. (1999) based on syntypes synonymized this name with *T. semilaeve*. We agree with them, in Sicily occur two species from *T. semilaeve* complex (the second one is *T. punctatum* Santschi) and authors clearly explain the differences between the two species;

Tetramorium semilaeve var. *kutteri* Santschi, 1927: 57 (tt: Switzerland) – we had no opportunity to study the syntypes of this name but according to the original description this taxon is characterized by dark brown colour, a character never observed in populations of *T. semilaeve*, and in our opinion it is probably related to (or conspecific with) *T. diomedaeum* Emery or *T. hungaricum* Rösler, which are the

only taxa from this region with dark-brown colour combined with partly reduced head sculpture;

Tetramorium semilaeve var. *hoggarensis* Santschi, 1929b: 103 (tt: Algeria) – we have examined the syntype images available on AntWeb (Available from: <https://www.antweb.org/specimen/CASENT0915049>) and a sample of workers collected in NE Morocco that well agrees with the syntype morphology. In our opinion it is a distinct species more similar to *T. sablbergi* than to *T. semilaeve*. Its status needs revision based on sexual forms;

Tetramorium semilaeve st. *guanacha* Santschi, 1929a: 150 (tt: Tenerife, = *Tetramorium caespitum* st. *semilaeve* var. *guanacha* Santschi, 1921a: 431, unavailable name) – Hohmann et al. (1993) treated this name as a synonym of *T. semilaeve* ssp. *depressum* Forel and we agree with them;

Tetramorium semilaeve subsp. *italica* Menozzi, 1932: 11 (tt: Italy) – we had no opportunity to study syntypes of this name but according to the original description this taxon is characterized by black colour, a character never observed in populations of *T. semilaeve*. In our opinion it is probably related to *T. diomedaeum* Emery or *T. hungaricum* Rösler, the only taxa from this region with dark colour combined with partly reduced head sculpture;

Tetramorium semilaeve subsp. *depressiceps* Menozzi, 1933: 71 (tt: Palestina) – Collingwood (1985) raised this taxon to the species rank based on material from Saudi Arabia but we are not sure if his interpretation was based on correct identification. Our materials showed than in the Near East there is more than one species from the *T. semilaeve* complex that is characterized by dark body and the problem needs further study based on all castes;

Tetramorium semilaeve var. *jugurtha* Menozzi, 1934: 162 (tt: Tunisia, Morocco, Sicily, Dalmatia, = *Tetramorium caespitum* st. *semilaeve* var. *jugurtha* Santschi, 1921a: 430, unavailable name) – Finzi (1940) treated this name as a subspecies of *T. semilaeve* but undoubtedly this taxon was described from specimens belonging to more than one species. We have examined two syntypes from Tunisia available on AntWeb (Available from: <https://www.antweb.org/specimen/CASENT0904819> and <https://www.antweb.org/specimen/CASENT0915050>) and their characters agree more with *T. punctatum* than with *T. semilaeve*. At this moment, we do not have any samples of *T. semilaeve* from North Africa and Dalmatia. Both *T. semilaeve* and *T. punctatum* occur in Sicily and thus the conspecificity of “*jugurtha*” with the true *T. semilaeve* is not certain;

Tetramorium semilaeve st. *syriacum* var. *cypricum* Santschi, 1934: 279 (tt: Cyprus) – this is an unavailable name. Our material of the *T. semilaeve* complex from Cyprus showed that the Cyprian taxon belongs to species more close to “*galatica*” form rather than the true *T. semilaeve* (see comment below);

Tetramorium semilaeve var. *galatica* Menozzi, 1936: 292 (tt: Turkey, = *Tetramorium caespitum* st. *biskrensis* var. *galatica* Santschi, 1921b: 112, unavailable name) – we have examined two syntypes available on AntWeb (Available from: <https://www.antweb.org/specimen/CASENT0904820> and <https://www.antweb.org/specimen/CASENT0915047>) from Turkey and several samples from western

Turkey well agree with these syntypes. In our opinion it is a distinct species close to *T. semilaeve*. Its redescription is under preparation. Probably most records of *T. semilaeve* from northeastern part of Mediterranean basin refer to the taxon “*galatica*”;

Tetramorium semilaeve subsp. *transbaicalense* Ruzsky, 1936: 93 (tt: Russia) – Radchenko (1992) synonymized this name with *Tetramorium caespitum*;

Tetramorium semilaeve var. *gaetulum* Santschi, 1936: 203 (tt: Morocco, = *Tetramorium semilaeve* st. *guanacha* var. *gaetulum* Santschi, 1929a: 150 unavailable name) - we have examined syntype available on AntWeb (Available from: <https://www.antweb.org/specimen/CASENT0915046>) and in our opinion this taxon is more close to *T. depressum-punctatum* complex than to the true *T. semilaeve*. Its status needs revision based on sexual forms;

Tetramorium semilaeve subsp. *atlante* Cagniant, 1970: 430 (tt:Tunisia, = *Tetramorium caespitum* st. *punicum* var. *atlantis* Santschi, 1918: 155, unavailable name) – we have examined syntype from Tunisia available on AntWeb (Available from: <https://www.antweb.org/specimen/CASENT0915045>) and a nest sample with all castes collected in NE Morocco well agrees with the syntype. In our opinion it is a distinct species close to *T. semilaeve* but distinguished by the morphology of gynes and male genitalia. Its redescription is now under preparation;

Tetramorium banyulense Bernard, 1983: 98 (tt: France, Pyrénées-Orientales) – this name was synonymized with *T. semilaeve* by Casevitz-Weulersse and Galkowski 2009: 497.

From the 22 names listed above, 2 are unavailable for nomenclature, 9 have revised valid status (species or synonym), 2 are under redescription as valid species, and 9 are still difficult to interpret due to lack of the nest samples with all castes. Our material from Greece and Turkey suggests that some undescribed species of *T. semilaeve* complex occur in this area and when nest samples with alates become available, they will be described in detail.

Acknowledgements

Thanks to Jolanta Świątojańska (University of Wrocław, Poland) for her assistance during field trips of the senior author and Marek L. Borowiec (University of California, Davis, USA) for language verification and other comments. The junior author would like to thank the University of Wrocław for supporting grant no. 1161/M/ KBTE/15.

References

Agosti D, Collingwood CA (1987) A provisional list of the Balkan ants (Hym. Formicidae) and a key to the worker caste. I. Synonymic list. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft* 60: 51–62.

- André E (1883) Les fourmis. [part]. In: André Edm. 1881–1886. Species des Hyménoptères d'Europe et d'Algérie. Tome Deuxième. Edmond André, Beaune, 281–344.
- Bernard F (1983) Encyclopédie entomologique - XLV. Les fourmis et leur milieu en France méditerranéenne. Éditions Lechevalier, Paris, 149 pp.
- Bolton B (2015) AntCat. <http://www.antcat.org> [accessed 18 February 2015]
- Bondroit J (1918) Les fourmis de France & de Belgique. Annales de la Société Entomologique de France 87: 1–174.
- Borowiec L (2014) Catalogue of ants of Europe, the Mediterranean Basin and adjacent regions (Hymenoptera: Formicidae). Genus 25: 1–340. [Special issue – Monograph]
- Borowiec L, Salata S (2014) *Tetramorium exasperatum* Emery, 1891 in Iberian Peninsula (Hymenoptera: Formicidae). Genus 25: 519–525.
- Cagniant H (1970) Deuxième liste de fourmis d'Algérie récoltées principalement en forêt. (1re partie). Bulletin de la Société d'Histoire Naturelle de Toulouse 105: 405–430.
- Cagniant H (1997) Le genre *Tetramorium* au Maroc (Hymenoptera: Formicidae): clé et catalogue des espèces. Annales de la Société Entomologique de France NS 33: 89–100.
- Casevitz-Weulersse J, Galkowski C (2009) Liste actualisée des fourmis de France (Hymenoptera, Formicidae). Bulletin de la Société Entomologique de France 114: 475–510.
- Collingwood CA (1985) Hymenoptera: Fam. Formicidae of Saudi Arabia. Fauna of Saudi Arabia 7: 230–302.
- Csösz S, Markó B (2004) Redescription of *Tetramorium hungaricum* Roeszler, 1935, a related species of *T. caespitum* (Linnaeus, 1758) (Hymenoptera: Formicidae). Myrmecologische Nachrichten 6: 49–59.
- Csösz S, Schulz A (2010) A taxonomic review of the Palaearctic *Tetramorium ferox* species-complex (Hymenoptera, Formicidae). Zootaxa 2401: 1–29.
- Csösz S, Radchenko A, Schulz A (2007) Taxonomic revision of the Palaearctic *Tetramorium chefketi* species complex (Hymenoptera: Formicidae). Zootaxa 1405: 1–38.
- Csösz S, Wagner CH, Bozsóc M, Seifert B, Arthoferb W, Schlick-Steiner BC, Steiner FM, Péntes Z (2014) *Tetramorium indocile* Santschi, 1927 stat. rev. is the proposed scientific name for *Tetramorium* sp. C sensu Schlick-Steiner et al. (2006) based on combined molecular and morphological evidence (Hymenoptera: Formicidae). Zoologischer Anzeiger 253: 469–481. doi: 10.1016/j.jcz.2014.06.002
- Dalla Torre KW (1893) Catalogus Hymenopterorum hucusque descriptorum systematicus et synonymicus. Vol. 7. Formicidae (Heterogyna). W. Engelmann, Leipzig, 289 pp.
- Emery C (1891) Exploration scientifique de la Tunisie. Zoologie. - Hyménoptères. Révision critique des fourmis de la Tunisie. Imprimerie Nationale, Paris, iii + 21 pp.
- Emery C (1909) Beiträge zur Monographie der Formiciden des paläarktischen Faunengebietes. (Hym.) Teil IX. Deutsche Entomologische Zeitschrift 1909: 695–712.
- Emery C (1921) Formiche raccolte a Budrum (Anatolia) da Raffaele Varriale, Cap. medico nella R. Marina. Annali del Museo Civico di Storia Naturale „Giacomo Doria” 49[(3) (9)]: 208–218.
- Emery C (1925) Notes critiques de myrmécologie. Annales de la Société Entomologique de Belgique 64: 177–191.

- Espadaler X (2007) The ants of El Hierro (Canary Islands). In: Snelling RR, Fisher BL, Ward PS (Eds) *Advances in ant systematics (Hymenoptera: Formicidae): homage to E. O. Wilson – 50 years of contributions*. *Memoirs of the American Entomological Institute* 80: 113–127.
- Espadaler X, Gómez K (2014) *Tetramorium biskrense* Forel, 1904 en España y Portugal peninsulares (Hymenoptera, Formicidae). *Boletín de la Sociedad Entomológica Aragonesa (SEA)* 55: 303–305.
- Finzi B (1940) Formiche della Libia. *Memorie della Società Entomologica Italiana* 18: 155–166.
- Forel A (1892) Quelques fourmis de la faune méditerranéenne. *Annales de la Société Entomologique de Belgique* 36: 452–457.
- Forel A (1902) Les fourmis du Sahara algérien récoltées par M. le Professeur A. Lameere & le Dr. A. Diehl. *Annales de la Société Entomologique de Belgique* 46: 147–158.
- Güsten R, Schulz A, Sanetra M (2006) Redescription of *Tetramorium forte* Forel, 1904 (Insecta: Hymenoptera: Formicidae), a western Mediterranean ant species. *Zootaxa* 1310: 1–35.
- Hohmann H, La Roche F, Ortega G, Barquín J (1993) Bienen, Wespen und Ameisen der Kanarischen Inseln. *Veröffentlichungen Überseemusum Bremen Naturwissenschaften* 12: 14–712.
- Mayr G (1855) Formicina austriaca. Beschreibung der bisher im österreichischen Kaiserstaate aufgefundenen Ameisen, nebst Hinzufügung jener in Deutschland, in der Schweiz und in Italien vorkommenden Arten. *Verhandlungen der Zoologisch-Botanischen Vereins in Wien* 5: 273–478.
- Menozzi C (1926) Zur Kenntnis der Ameisenfauna der Balearen. *Zoologischer Anzeiger* 66: 180–182.
- Menozzi C (1932) Contributo alla conoscenza della fauna mirmecologica d'Italia. *Bollettino del Laboratorio di Entomologia del Reale Istituto Superiore Agrario di Bologna* 5: 8–12.
- Menozzi C (1933) Le formiche della Palestina. *Memorie della Società Entomologica Italiana* 12: 49–113.
- Menozzi C (1934) Reperti mirmecofaunistici raccolti dal Prof. L. di Caporiacco nelle oasi di Cufra e in altre località del deserto Libico. *Atti della Società dei Naturalisti e Matematici di Modena* 65[(6)1 13]: 153–166.
- Menozzi C (1936) Nuovi contributi alla conoscenza della fauna delle Isole italiane dell'Egeo. VI. Hymenoptera - Formicidae. *Bollettino del Laboratorio di Zoologia Generale e Agraria della Reale Scuola Superiore d'Agricoltura. Portici* 29: 262–311.
- Müller G (1923) Le formiche della Venezia Giulia e della Dalmazia. *Bollettino della Società Adriatica di Scienze Naturali in Trieste* 28: 11–180.
- Radchenko AG (1992) Ants of the genus *Tetramorium* (Hymenoptera, Formicidae) of the USSR fauna. Report 2. *Zoologicheskii Zhurnal* 71(8): 50–58.
- Ruzsky M (1936) Ants of the Transbaikal region. *Trudy Biologicheskogo Nauchno-Issledovatel'skogo Instituta Tomskogo Gosudarstvennogo Universiteta* 2: 89–97.
- Sanetra M, Güsten R, Schulz A (1999) On the taxonomy and distribution of Italian *Tetramorium* species and their social parasites (Hymenoptera Formicidae). *Memorie della Società Entomologica Italiana* 77: 317–357.

- Santschi F (1918) Nouveaux *Tetramorium* africains (Suite et fin). Bulletin de la Société d'Histoire Naturelle de l'Afrique du Nord 9: 153–156.
- Santschi F (1921a) Notes sur les fourmis paléarctiques. I. Quelques fourmis du nord de l'Afrique & des Canaries. Memorias de la Real Sociedad Española de Historia Natural Tomo del Cincuentenario, 424–436.
- Santschi F (1921b) Notes sur les fourmis paléarctiques. II. Fourmis d'Asie Mineure récoltées par M. H. Gadeau de Kerville. Boletín de la Real Sociedad Española de Historia Natural 21: 110–116.
- Santschi F (1927) A propos du *Tetramorium caespitum* L. Folia Myrmecologica et Termitologica 1: 52–58.
- Santschi F (1929a) Fourmis du Maroc, d'Algérie et de Tunisie. Bulletin et Annales de la Société Entomologique de Belgique 69: 138–165.
- Santschi F (1929b) Fourmis du Sahara central récoltées par la Mission du Hoggar (février-mars 1928). Bulletin de la Société d'Histoire Naturelle de l'Afrique du Nord 20: 97–108.
- Santschi F (1934) Fourmis d'une croisière. Bulletin et Annales de la Société Entomologique de Belgique 74: 273–282.
- Santschi F (1936) Liste et descriptions de fourmis du Maroc. Bulletin de la Société des Sciences Naturelles du Maroc 16: 198–210.
- Schlick-Steiner BC, Steiner FM, Moder K, Seifert B, Sanetra M, Dyreson E, Stauffer C, Christian E (2006) A multidisciplinary approach reveals cryptic diversity in Western Palearctic *Tetramorium* ants (Hymenoptera: Formicidae). Molecular Phylogenetics and Evolution 40: 259–273. doi: 10.1016/j.ympev.2006.03.005
- Steiner FM, Seifert B, Moder K, Schlick-Steiner BC (2014) A multisource solution for a complex problem in biodiversity research: Description of the cryptic ant species *Tetramorium alpestre* sp.n. (Hymenoptera: Formicidae). Zoologischer Anzeiger 249: 223–254. doi: 10.1016/j.jcz.2010.09.003
- Wheeler WM (1927) The ants of the Canary Islands. Proceedings of the American Academy of Arts and Sciences 62: 93–120. doi: 10.2307/25130107
- Wheeler WM, Mann WM (1916) The ants of the Phillips Expedition to Palestine during 1914. Bulletin of the Museum of Comparative Zoology 60: 167–174.