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A taxonomic review of the Palaearctic *Tetramorium ferox* species-complex (Hymenoptera, Formicidae)

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Abstract

This revision treats the members of the Palaearctic *Tetramorium ferox* species-complex on the basis of external morphology and using high precision morphometrics. With this approach we recognize five taxa and six synonyms: *Tetramorium aegeum* Radchenko, 1992b; *Tetramorium densopilosum* Radchenko & Arakelian, 1990; *Tetramorium diomedeum* Emery, 1908; *Tetramorium ferox* Ruzsky, 1903; and *Tetramorium feroxoide* Dlussky & Zabelin, 1985. *Tetramorium laevior* Menozzi, 1936 is synonymized with *Tetramorium diomedeum*. *Tetramorium confinis* Radchenko & Arakelian, 1990, *Tetramorium perspicax* Radchenko, 1992b, and *Tetramorium ferox* subsp. *silhavyi* Kratochvil, 1941 are synonymized with *Tetramorium ferox*. *Tetramorium bursakovi* Radchenko, 1992a is synonymized with *Tetramorium feroxoide***.** A key and redescriptions for workers and gynes are given. SEM photos for workers and gynes of each species are provided. A morphology-based definition of the species complex for workers, gynes and males is also provided.

Key words: ants, taxonomy, morphometry, distribution, key, biogeography

Introduction

As a part of a larger revisionary work of the ant genus *Tetramorium* Mayr, 1855 we herein report our results concerning the *T. ferox* species-complex. *Tetramorium* is one of the most diverse ant genera, comprising more than 400 species worldwide (Bolton, 1995a). Modern taxonomic revisions of this genus were carried out by Bolton (1976, 1977, 1979, 1980) for all zoogeographical regions except for the Palaearctic. Biology, distribution and the life cycle of palaearctic *Tetramorium* species are poorly known. About 60 species and infraspecific forms of *Tetramorium* have been recorded from the Palaearctic up to now, mostly from the southern part of the region (Csősz *et al.* 2007).

In the last decade, the interest in research on the genus *Tetramorium* has grown and become part of the mainstream of European myrmecological research. An increasing number of new papers apply various approaches, such as morphology and morphometry (Schulz 1996, Sanetra *et al.* 1999, Csősz & Markó 2004, Csősz *et al.* 2007), or different molecular methods (*e.g.* Sanetra *et al.* 1994, Sanetra & Buschinger 2000, Schlick-Steiner *et al.* 2005, Schlick-Steiner *et al.* 2007) to identify smaller species groups or complexes. Due to the exceedingly high diversity and an expected number of cryptic species it is essential to split the genus into treatable, small complexes even within the Palaerctic Region. Moreover, these species-complexes have distinctive character combinations. The first part of our revisionary work was on the *T. chefketi* species complex (Csősz *et al.* 2007).

The *Tetramorium ferox* complex is distributed throughout Central Europe and the Central and Eastern Mediterranean basin up to central parts of the Palearctic region, and apparently is absent in North Africa, France and the Iberian Peninsula. Although unknown from the Near East, this area is poorly sampled and we expect to find members of the group in this area and also in the steppe formations of Central Russia. The species is adapted to dry and warm areas, with high nest densities in steppes and mediterranean grasslands with few trees.

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Material

The current revision is based on the investigation of both type and non-type material. Altogether 1487 workers of 273 nest samples were examined, of which 415 workers and 72 gynes of 75 samples belonged to the *T. ferox*-complex (the rest of them belonged to other complexes, see below). Material examined for individual species of the *T. ferox*-complex was as follows: *T. ferox*: 129 workers and 16 gynes of 22 nest samples, *T. feroxoide:* 48 workers and 15 gynes of 8 nest samples, *T. diomedeum*: 228 workers and 36 gynes of 42 nest samples, *T. densopilosum*: 8 workers and 3 gynes of 2 nest samples, and *T. aegeum*: type series with 3 workers and 2 gynes of one nest sample. In the lists of *Type material* and *Material examined* we used abbreviations "w" for workers, "q" for gynes (=queen), and "m" for males.

Tetramorium caespitum-complex:

Species names and code-names for species of this complex follow the terminology of Schlick-Steiner *et al.* (2006). Material examined for this complex consisted of 406 individuals from 63 nest samples belonging to 6 species as follows (individuals/nest samples): *Tetramorium hungaricum*: (118 individuals/19 nest samples): Hungary (51/8), Romania (35/6) and Russia (32/5); *Tetramorium*_A: (22/4): Germany (7/1), Hungary (6/1) and Poland (9/2); *Tetramorium*_B: (16/): Romania; *Tetramorium*_C: (122/17): Kyrgyzstan (23/5), Hungary (25/4), Romania (30/4) and Russia (44/7); *Tetramorium*_D: (42/7): Hungary (6/1) and Russia (36/6); *Tetramorium*_E: (46/8): Hungary (7/1), Romania (27/5) and Russia (12/2).

Tetramorium chefketi-complex:

Species names for this complex follow those used by Csősz *et al.* (2007). The combined sample of this complex consisted of 484 individuals of 95 nest samples belonging to 8 species as follows (individuals/nest samples): *Tetramorium alternans*: (33/7): Algeria (3/1), Morocco (6/1) and Tunisia (24/5); *Tetramorium anatolicum*: (45/8): Turkey; *Tetramorium chefketi*: (130/27): Kyrgyzstan (3/1), Turkey (110/22), Turkmenistan (1) and Ukraine (16/3); *Tetramorium exile*: (33/1): Afghanistan; *Tetramorium forte*: (81/16): France (35/6), Morocco (1) and Spain (45/9); *Tetramorium moravicum*: (101/25): Bulgaria (2/1), France (14/4), Germany (4/1), Greece (10/2), Hungary (7/1), Italy (22/7), Kosovo (4/1), Romania (14/2), Turkey (25/5) and Ukraine (3/1); *Tetramorium rhodium*: (21/4): Greece (4/1), Cyprus (3/1) and Turkey (14/2); *Tetramorium syriacum*: (40/7): Israel (2/1) and Turkey (38/6).

Tetramorium semilaeve-complex:

This problematic species-complex lacks a modern taxonomic revision. We cannot verify the validity of each taxon name. Corresponding type material was examined if a taxon name is indicated below. *Tetramorium semilaeve sens. str.* is not included because it is a difficult taxon whose limits are not properly understood. Samples from the eastern Mediterranean area are not clearly conspecific to those from Italy, France and the Iberian Peninsula. In order to avoid confusion we have excluded this species from our analysis. The combined sample of this complex consisted of 107 individuals of 13 nest samples belonging to 7 species and subspecies as follows (individuals/nest samples): *Tetramorium caespitum judas*: (9/1): Israel; *Tetramorium caespitum st. jugurtha*: (4/1): Tunisia; *Tetramorium caespitum st. maura*: (22/3): Morocco (4/1) and Tunisia (18/2); *Tetramorium davidi*: (8/2): Jordan; *Tetramorium schmidti*: (10/1): Israel; *Tetramorium* sp.1: (23/1): Cyprus; *Tetramorium* sp.2: (31/4): Cyprus (25/2) and Turkey (6/2).

The examined material is deposited in the following collections:

HNHM	Hungarian Natural History Museum, Budapest / Hungary
MSNG	Museo Civico di Storia Naturale "Giacomo Doria" di Genova / Italy
MHNG	Muséum d'Histoire Naturelle, Genève / Switzerland
ZMPA	Museum and Institute of Zoology, Warsaw / Poland
MSNM	Museo Civico di Storia Naturale, Milano / Italy

NHMB Naturhistorisches Museum Basel / Switzerland
PCAS private collection of Andreas Schulz, Leverkusen / Germany
SIZK Schmalhausen Institute of Zoology, Kiev / Ukraine

SEM photos were taken on un-coated samples by HITACHI S-2600 VP-SEM using low vacuum (15–25 Pa, 15–20kV) mode.

Methods

Character recording and terminology

All measurements were made in µm using a pin-holding stage, permitting rotations around X, Y, and Z axes. An Olympus SZX9 stereomicroscope was used at a magnification of x100 for most characters, allowing a precision of ± 5 µm. For larger (more than 1 mm) structures (e.g. ML, CL, CW) magnification x50 was used with a precision of ± 10 µm. All measurements were made by the first author. Due to some newly introduced metric characters it was necessary to test the repeatability of measurements. All characters were measured twice for 14 randomly chosen specimens, and the average measure of intraclass correlation coefficient (R) was calculated (see Csősz *et al.* 2007) with SPSS 11.0 for PC. Measurements for one variable, PEL, were slightly repeatable (R = 0.712, $F_{1, 13}$ = 3.4721, P = 0.0139), for two variables were moderately repeatable (PPL: R = 0.7382, $F_{1, 13}$ = 3.8191, P = 0.0092, EL: R = 0.7628, $F_{1, 13}$ = 4.2154, P = 0.0011), whereas each remaining character proved to be highly repeatable (R > 0.8299). Morphometric investigation is restricted to workers and gynes only, because of the lack of enough males. Explanation and abbreviations for measured characters are as follows:

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. (R= 0.9905; $F_{1, 13}$= 105.4821; P< 0.0001)
CW maximum width of head in full-face view, including compound eyes. (R= 0.9929; $F_{1, 13}$= 140.4945; P< 0.0001)
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. (R= 0.9921; $F_{1, 13}$= 127.3279; P< 0.0001)
EH the minimum diameter of the compound eye (Fig. 2). (R= 0.8960; $F_{1, 13}$= 9.6154; P= 0.0001)
EL the maximum diameter of the compound eye (Fig. 2). (R=0.7628; $F_{1, 13}$= 4.2154; P= 0.0058)
EYE eye size index, calculated from the arithmetic mean of EL and EH, divided by CS. (R= 0.8299; $F_{1, 13}$= 5.8785; P= 0.0011)
OMD oculo-malar space. The minimal distance between anterior (lower) margin of the compound eye and the mandibular junction in profile (Fig. 2). (R= 0.8924; $F_{1, 13}$= 9.2937; P= 0.0001)
FL the maximum distance between external borders of the frontal lobes (Fig. 1). (R= 0.9851; $F_{1, 13}$= 67.3077; P< 0.0001)
FR the minimum width of the frons between the frontal carinae (Fig. 1). (R= 0.9926; $F_{1, 13}$= 135.3846; P< 0.0001)
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. (R= 0.9845; $F_{1, 13}$= 64.5858; P< 0.0001)
MW the maximum width of the pronotum from above. (R= 0.9961; $F_{1, 13}$= 259.3077; P< 0.0001)
NOH the maximum height of the petiolar node (Fig. 4). (R=0. 9390; $F_{1, 13}$=16.3932; P< 0.0001)
NOL the length of the petiolar node, (Fig. 3). Though this character is fairly difficult to measure, the accuracy of that measurement is high. (R= 0.9742; $F_{1, 13}$= 12.5556; P< 0.0001)

PEH the maximum height of the petiole, (Fig. 4). (R= 0.9831; $F_{1, 13}$= 59.1538; P< 0.0001)

PEL the distance between the posteriormost point of the petiole and the petiolar spiracle (Fig. 3). (R= 0.7120; $F_{1, 13}$= 3.4721; P= 0.0139)

PEW the maximum width of the petiole in dorsal view. (R= 0.9904; $F_{1, 13}$= 103.7692; P< 0.0001)

POC postocular distance. Measured from the reference line fitted on the posterior margin of compound eyes to median posterior margin of the head (Fig. 1). (R= 0.9729; $F_{1, 13}$= 36.8462; P< 0.0001)

PPH the maximum height of the postpetiole in lateral view (Fig. 4). (R= 0.9764; $F_{1, 13}$= 42.3692; P< 0.0001)

PPL the maximum length of the postpetiole in lateral view (Fig. 3). (R= 0.7382; $F_{1, 13}$= 3.8191; P= 0.0092)

PPW the maximum width of the postpetiole in dorsal view. (R= 0.9794; $F_{1, 13}$= 48.4545; P< 0.0001)

SL the maximum length of the scape, measured from the proximal point of scape lobe to the distal end of scape (Fig. 1). (R = 0.9921; $F_{1, 13}$= 127.3385; P< 0.0001)

SPL the minimal distance between the center of propodeal spiracle and the propodeal declivity (Fig. 4). (R= 0.8960; $F_{1, 13}$= 26.3590; P< 0.0001)

SPSP the maximum length of propodeal teeth, measured in lateral view from the tip of spine to the propodeal spiracle (Fig. 4). (R= 0.9315; $F_{1, 13}$= 14.5962; P< 0.0001)

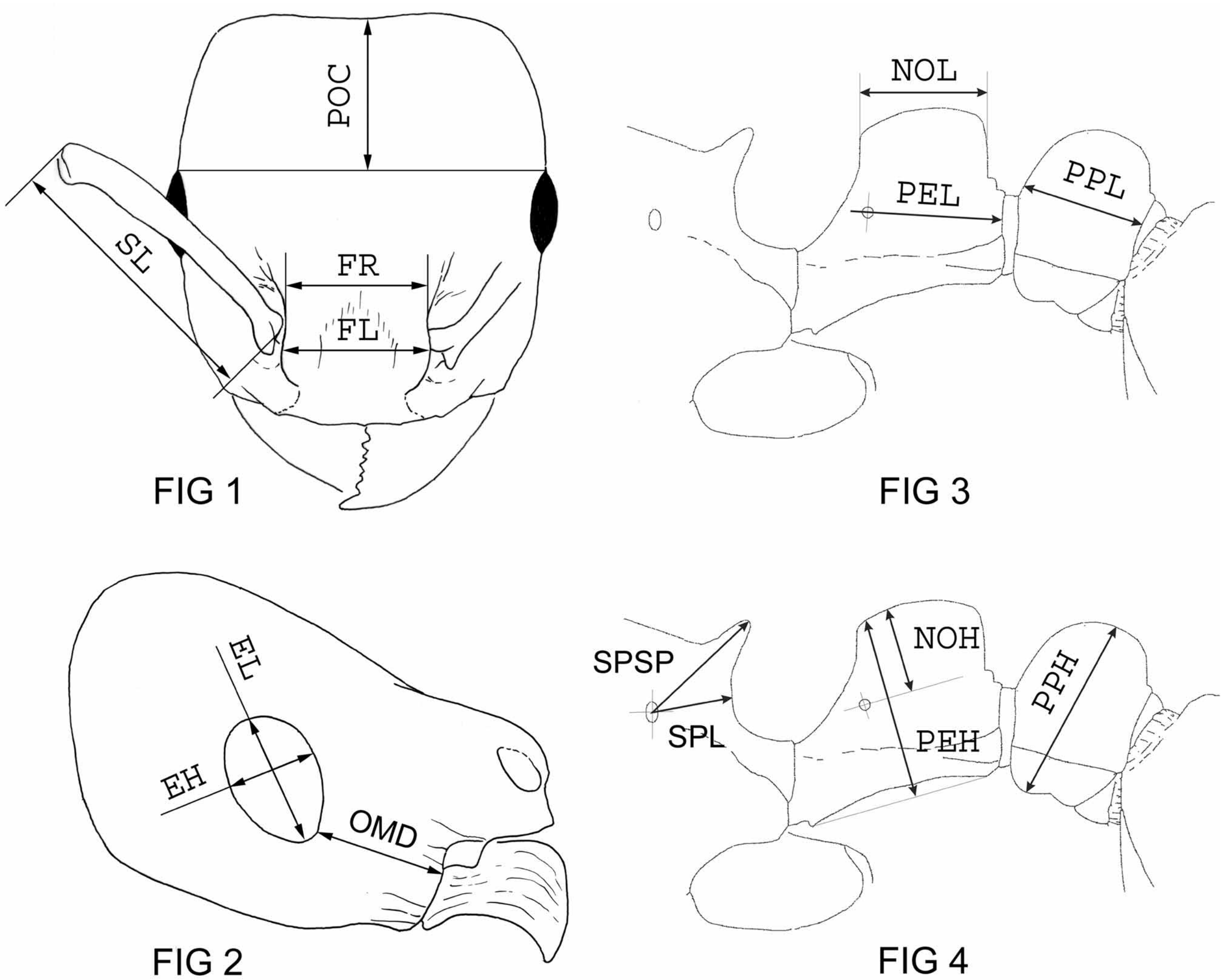
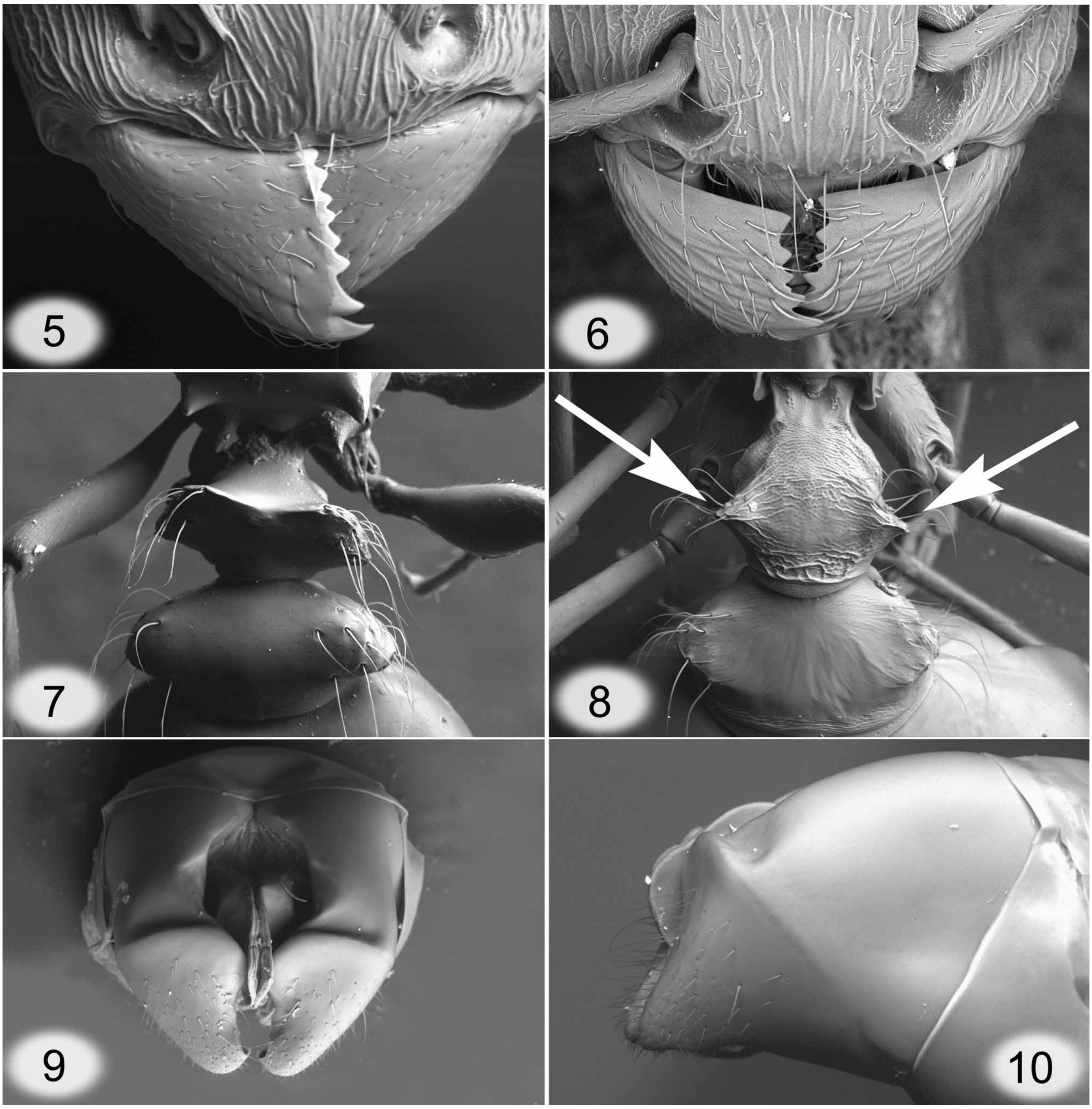


FIG 1 FIG 3

FIG 2 FIG 4

FIGURES 1–4. Measurement lines for metric characters. Fig. 1. Head in dorsal view. Measurement lines for POC, FL, FR and SL, Fig. 2. head in lateral view. Measurement lines for EL, EH, and OMD. Fig. 3. and 4. Propodeum, petiole and postpetiole in lateral view, measurement lines for NOL, PEL, PPL, NOH, PEH, PPH, SPSP, and SPL (for definition see text).



FIGURES 5–10. Characters of *Tetramorium ferox*-complex. Fig. 5. Mandibles of *Tetramorium ferox*, Fig. 6. mandibles of *Tetramorium chefketi*, Fig. 7. petiole and postpetiole of *Tetramorium feroxoide* gyne, Fig. 8. petiole and postpetiole of *Tetramorium feroxoide* male (white arrows mark the outstanding dorso-lateral lobes), male genitalia of *Tetramorium ferox*, Fig. 9. caudal view. Fig. 10. in profile.

Discriminant Analysis

Workers of palaearctic *Tetramorium* species are morphologically very similar and rarely differ by discrete, easily visible characters. Discriminant analysis (DA) is a multivariate approach that aids in recognizing species boundaries and provides identification tools (Seifert 2003, Csősz & Seifert 2003. Csősz & Markó 2004, Schlick-Steiner *et al.* 2006). Specimens are first identified to putative species by visual inspection and similarity of habitus. The full set of morphometric characters is then analyzed to yield the linear combination of variables that best recovers the *a priori* identifications. Cases with missing values were always omitted from the analyses. Unsatisfactory resolution into discrete clusters may result in a reevaluation of particular identifications or hypotheses of species boundaries. Once satisfactory resolution of species boundaries is achieved, the resultant formulas provide a reliable means of identification. We provide DA both to separate the *T. ferox*-complex from other *Tetramorium* complexes (D(12a), see Table 1, 2) and to separate species within the *T. ferox*-complex (D(11), see Table 3, 4; D(12b), see Table 5, 6). Canonical DA was performed using SPSS 11.0 for PC, based on workers and gynes. The backward stepwise method was used to decrease the character number, achieving the shortest formula that still allowed an identification success of at least 95%. Each character passed the tolerance test in a DA to the level of 0.01.

TABLE 1. Unstandardized row coefficients of Roots 1–3 achieved by discriminant D(12a) analysis run on *T. caespitum*-, *chefketi*-, *semilaeve*-, and *ferox* species-complexes.

variable	Root 1	Root 2	Root 3
CW	0.0151	0.0126	0.0231
FR	-0.0348	0.0238	-0.0916
FL	0.0181	-0.0330	0.0872
SL	-0.0095	0.0103	0.0140
ML	-0.0118	-0.0046	-0.0077
PEW	-0.0785	0.0119	-0.0076
PEH	0.0057	0.0315	-0.0074
NOL	0.0104	0.0338	-0.0361
PPW	0.0168	-0.0301	-0.0030
PPL	0.0252	-0.0340	-0.0258
PPH	0.0336	-0.0288	-0.0088
SPSP	0.0394	0.0184	-0.0049
Constant	2.9189	-5.0625	-0.3019
Eigenval	3.57	2.27	0.67
Cum.Prop	0.55	0.89	1.0

TABLE 2. Discriminant D(12a) scores for nest means of *T. caespitum*-, *chefketi*-, *semilaeve*-, and *ferox* species-complexes achieved by Roots 1–3. Upper row: mean ± SD, lower row [Min, Max].

Roots	*ferox*-complex (n=75)	*caespitum*-complex (n=61)	*chefketi*-complex (n=93)	*semilaeve*-complex (n=14)
Root 1	-1.813 0.80 [-3.813, -0.493]	2.789±0.50 [1.397, 3.824]	1.986 ±0.83 [0.200, 4.101]	1.864 ±0.78 [0.320, 3.111]
Root 2	-0.499 ±0.70 [-2.253, 1.025]	-1.827 ±0.51 [-3.056, -0.572]	1.883 ±1.16 [-0.868, 3.958]	0.018 ±1.01 [-1.229, 1.732]
Root 3	-0.035 0.75 [-1.836, 1.485]	-0.285 ±0.74 [-2.038, 1.773]	-0.295 ±0.94 [-2.900, 2.177]	2.604 ±1.43 [-0.315, 4.773]

Results

Separation of workers of *T. ferox*-complex from other *Tetramorium* complexes by cumulative discriminant analysis

The *T. ferox*-complex forms a morphologically uniform cluster that can be separated from other Palaearctic complexes (*T. chefketi*-, *T. caespitum*- and *T. semilaeve*-complexes). A discriminant D(12a) analysis revealed that the workers of the species-complexes separated from each other with high success and that 96.51% of the individuals were correctly identified, 98.83% of the originally grouped individuals of the *T. ferox* species-complex were correctly identified along Root 1 ($F_{12, 1344}$= 451.83; P< 0.0001), as was each *T. ferox*-complex nest sample ($F_{1, 269}$=1559.0 p<0.0001) (Fig. 11). Separation of *T. chefketi*- and *T. caespitum*-complexes was complete. 98.73% of the nest samples and 95.65% of individuals were correctly identified along Root 2 (Table 2). *Tetramorium semilaeve*-complex separated from each of the other complexes along Root 3 (Table 2), but this complex did not achieve a satisfactory level of identification. Only 82.42% of individuals were correctly identified. This result can be ascribed to the taxonomic uncertainties in the group.

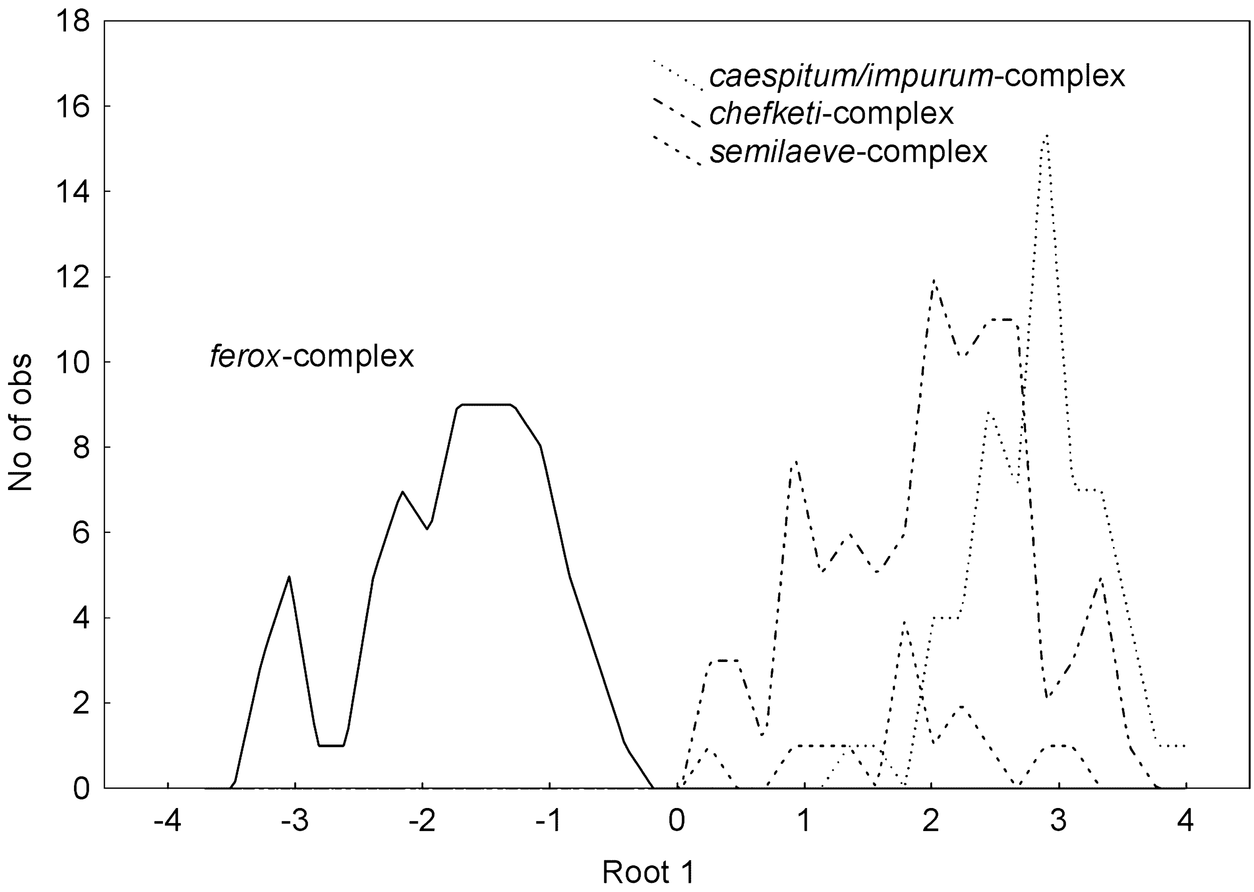


FIGURE 11. A cumulative discriminant analysis on twelve characters (D12a) separating species of the *T. ferox*-complex from those of *T. caespitum/impurum, T. chefketi* and *T. semilaeve*-complexes based on workers.

Separation of morphospecies of the *T. ferox*-complex by cumulative discriminant analysis

Separation of workers. The best results were achieved by using eleven characters. A cumulative discriminant D(11) analysis revealed that separation of species was nearly complete. 98.1% ($F_{44, 1562}$= 40.391; p<0.0001) of worker individuals were correctly identified (Table 3, 4). *Tetramorium aegeum* and *T. densopilosum* showed complete (100%) separation from each other. *Tetramorium diomedeum* (98.7%), *T. ferox* (97.8%) and *T. feroxoide* (95.6%) were also well separated with this character-set (Fig 12, Table 4).

Separation of gynes. The best result was achieved by using twelve characters (Table 5). A cumulative discriminant D(12b) analysis revealed that separation of each species was complete (Fig 13) and each gyne individual was correctly identified ($F_{48, 217}$= 28.741 p<0.0001, Table 5, 6).

Definition of ferox-complex

Species belonging to the *T. ferox*-complex within the *caespitum* group can be defined by the combination of the following characters.

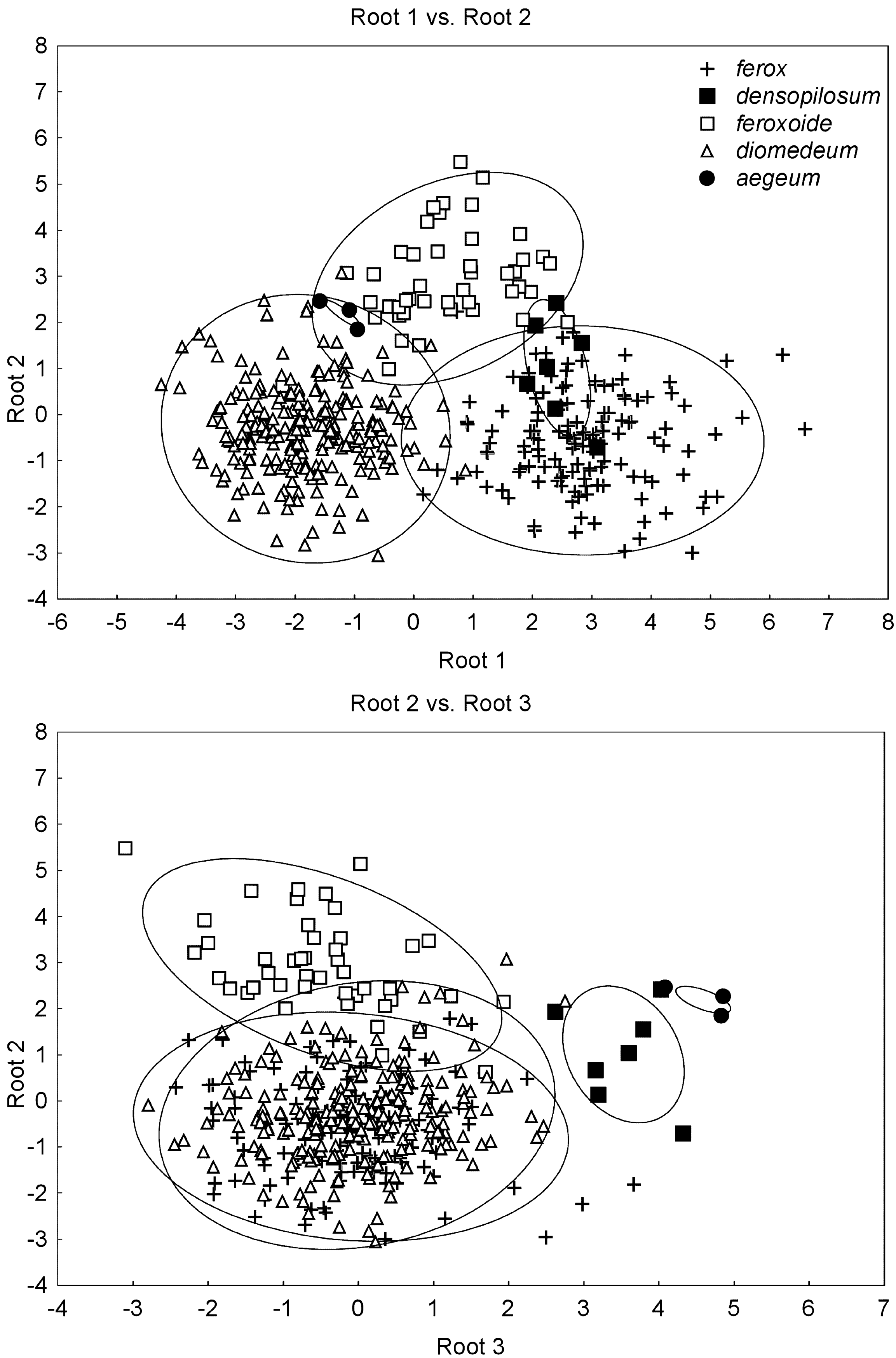


FIGURE 12. A cumulative discriminant analysis on eleven characters D(11) for separation of workers in the *T. ferox* complex.

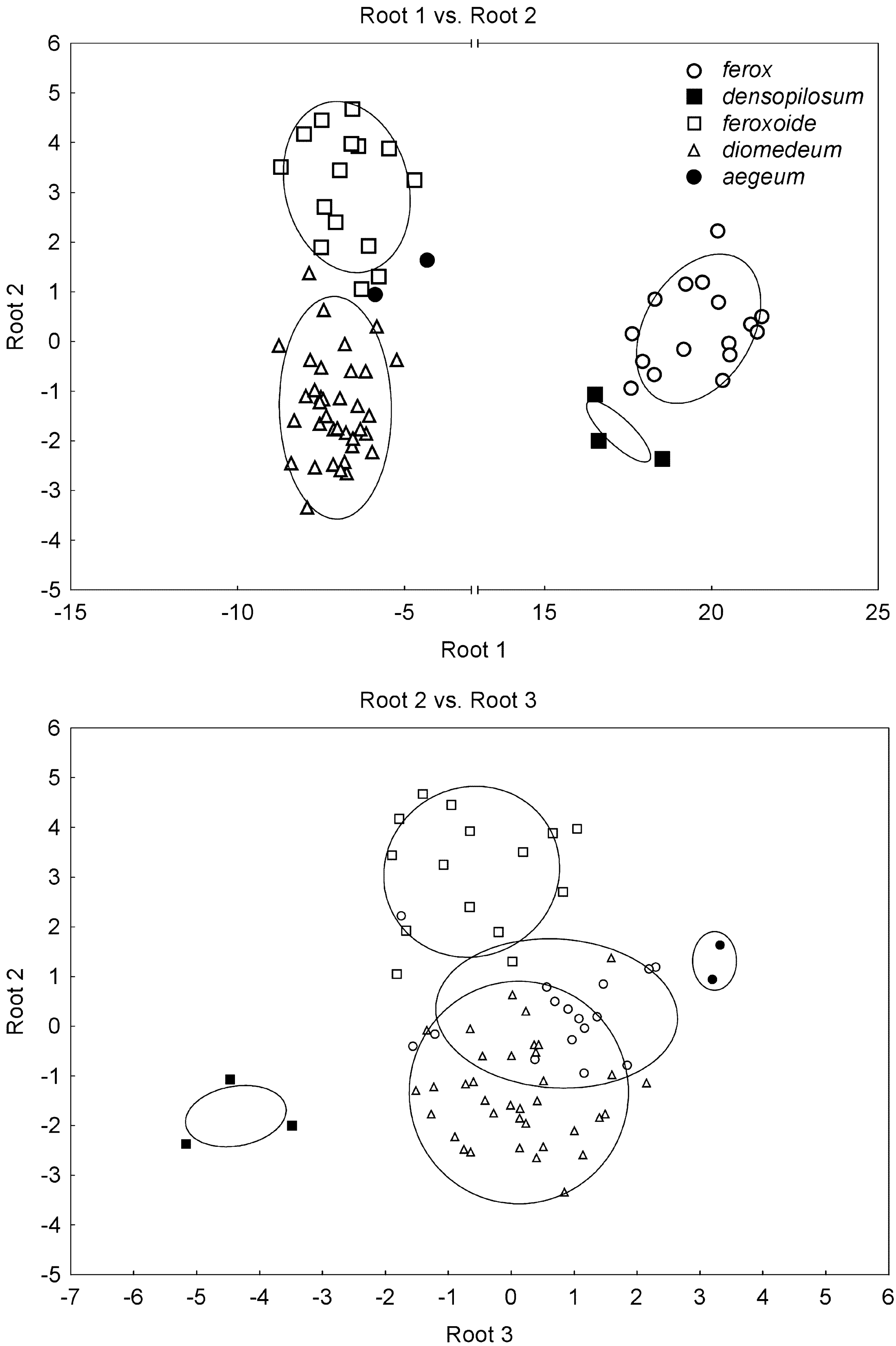


FIGURE 13. A cumulative discriminant analysis on twelve characters D(12b) for separation of gynes in the *T. ferox* complex.

TABLE 3. Unstandardized row coefficients of Roots 1–4 achieved by discriminant D(11) analysis run on workers of five species of *Tetramorium ferox*-complex (*T. aegeum*, *densopilosum*, *diomedum*, *ferox* and *feroxoide*).

variable	*Root 1*	*Root 2*	*Root 3*	*Root 4*
CW	-0.0186	-0.0159	-0.0214	0.0241
FR	0.0178	0.0326	0.0749	-0.0109
SL	0.0576	0.0024	-0.0078	0.0160
PEW	-0.0380	0.0172	0.0154	-0.0548
NOH	0.0292	0.0347	0.0314	0.0397
NOL	0.0526	-0.0234	-0.0168	-0.0881
PPW	0.0044	0.0213	-0.0607	0.0187
SPSP	-0.0090	-0.0312	0.0401	-0.0084
EL	-0.0110	0.0649	0.0232	-0.0020
OMD	-0.0023	-0.0515	0.0744	-0.0001
POC	-0.0461	-0.0545	-0.0492	0.0024
Constant	-10.4095	9.1935	3.2313	-9.0345
Eigenval	*4.61*	*1.14*	*0.39*	*0.10*
Cum.Prop	*0.74*	*0.92*	*0.98*	*1.00*

TABLE 4. Discriminant D(11) scores for worker individuals of five species of *Tetramorium ferox*-complex (*T. aegeum*, *densopilosum*, *diomedum*, *ferox* and *feroxoide*) by Roots 1-4. Upper row: mean ± SD, lower row [Min, Max].

Roots	*aegeum* (*n=3*)	*densoliposum* (*n=7*)	*diomedeum* (*n=233*)	*ferox* (*n=135*)	*feroxoide* (*n=48*)
Root 1	-1.202 ±0.34 [-1.581, -0.944]	2.419 ±0.42 [1.913, 3.094]	-1.819 ±0.93 [-4.250, 0.876]	2.849 ±1.13 [0.162, 6.596]	0.469 ±1.06 [-2.212, 2.595]
Root 2	2.194 ±0.32 [1.849, 2.465]	1.010 ±1.08 [-0.704, 2.419]	-0.306 ±0.96 [-3.051, 3.082]	-0.559 ±1.06 [-2.992, 2.239]	2.906 ±1.02 [0.635, 5.489]
Root 3	4.593 ±0.44 [4.088, 4.857]	3.531 ±0.58 [2.619, 4.322]	-0.016 ±0.98 [-2.793, 2.754]	-0.098 ±1.04 [-2.428, 3.666]	-0.383 ±1.06 [-3.103, 1.931]
Root 4	-2.761 ±0.52 [-3.349, -2.373]	1.531 ±0.78 [0.558, 2.977]	0.024 ±0.83 [-2.179, 2.446]	-0.069 ±1.16 [-2.859, 2.826]	0.032 ±1.26 [-3.235, 2.980]

Workers

- petiole and postpetiole relatively broad (CS/PEW > 2.31, CS/PPW > 1.93, see Table 7), in *T. aegeum* and *T. diomedeum* very broad.
- head, mesosoma and waist moderately sculptured; dorsum of both petiolar node and postpetiole medially shiny.
- first gastral tergite smooth (excluding *T. aegeum*, for which 1st gastral tergite is imbricate); several long, erect hairs always appear on first gastral tergite.
- propodeum in profile flat, sloping down at an angle of approximately 45° (Figs 19, 33, 40 and 46).
- propodeal teeth small, developed as triangular denticles, in contrast to a prominent propodeal lobe (Figs 19, 33, 40 and 46).

Gynes

- mandibles smooth and shiny (Fig. 5).
- petiole and postpetiole wide (Table 8, Fig. 7).

- mesosoma low, with flattened dorsum (seen in profile); scutum (seen from above) somewhat narrowed anteriorly and does not completely cover the pronotum, so that humeri (i. e. anterolateral pronotal angles) are easily visible.
- head, mesosoma and waist moderately sculptured or smooth.
- petiole and postpetiole with some very long thin hairs, in contrast to the first gastral tergite which is generally without long erect hairs (Fig. 7).

Males

- head and mesosoma moderately sculptured.
- sides of petiole and postpetiole angulate in dorsal view (Fig. 8).
- stipes of genitalia curved inwards at the tip, and with flattened apical plate (seen in caudal view) (Figs 9–10).

TABLE 5. Unstandardized row coefficients of Roots 1–4 achieved by discriminant D(12b) analysis run on gynes of five species of *Tetramorium ferox*-complex (*T. aegeum*, *densopilosum*, *diomedum*, *ferox* and *feroxoide*).

variable	*Root 1*	*Root 2*	*Root 3*	*Root 4*
CL	0.0549	0.0029	0.0252	0.0212
CW	0.0159	-0.0193	0.0029	0.0012
FR	-0.0294	-0.0307	0.0380	-0.0174
SL	-0.0145	0.0241	-0.0286	0.0101
MW	0.0059	0.0183	-0.0081	0.0057
PEH	-0.0039	-0.0036	-0.0228	-0.0653
NOH	0.0046	0.0281	0.0411	0.0274
PPH	-0.0204	0.0044	-0.0144	0.0430
SPL	0.0568	-0.0442	-0.0385	0.0285
SPSP	-0.0252	-0.0392	0.0672	-0.0311
EL	-0.1532	-0.0315	-0.0740	-0.0335
EYE	187.9079	32.8826	100.8781	51.8733
Constant	-56.5558	6.7494	-22.7637	-22.9731
Eigenval	*142.94*	*3.33*	*1.40*	*0.44*
Cum.Prop	*0.97*	*0.99*	*1.00*	*1.00*

TABLE 6. Discriminant D(12b) scores for gyne individuals of five species of *Tetramorium ferox*-complex (*T. aegeum*, *densopilosum*, *diomedum*, *ferox* and *feroxoide*) by Roots 1-4. Upper row: mean ± SD, lower row [Min, Max].

Roots	*aegeum* (*n=2)*	*densoliposum* (*n=3)*	*diomedeum* (*n=36)*	*ferox* (*n=16)*	*feroxoide* (*n=15)*
Root 1	-5.091 ±1.10 [-5.871, -4.310]	17.22 ±1.14 [16.51, 18.53]	-7.069 ±0.79 [-8.758, -5.226]	19.62 ±1.34 [17.60, 21.52]	-6.727 1.03 [-8.70, -4.697]
Root 2	1.291 ±0.49 [0.947, 1.634]	-1.807 ±0.67 [-2.364, -1.065]	-1.332 ±1.02 [-3.331, 1.383]	0.259 ±0.84 [-0.941, 2.222]	3.110 1.16 [1.058, 4.681]
Root 3	3.260 ±0.09 [3.20, 3.320]	-4.375 ±0.85 [-5.170, -3.487]	0.123 ±0.91 [-1.514, 2.153]	0.724 ±1.23 [-1.745, 2.299]	-0.627 1.01 [-1.896, 1.046]
Root 4	-3.283 ±0.84 [-3.874, -2.692]	-1.434 ±0.56 [-2.057, -0.988]	0.129 ±1.12 [-2.869, 1.840]	0.274 ±1.07 [-2.097, 1.927]	0.123 0.60 [-0.854, 1.384]

Synonymic synopsis of species

aegeum Radchenko, 1992b
densopilosum Radchenko & Arakelian, 1990
diomedeum Emery, 1908
= *bariensis* Forel, 1911
= *laevior* Menozzi, 1936 **syn. n.**
ferox Ruzsky, 1903
= *confine* Radchenko & Arakelian, 1990 **syn. n.**
= *perspicax* Radchenko, 1992b **syn. n.**
= subsp. *silhavyi* Kratochvil, 1941
feroxoide Dlussky & Zabelin, 1985
= *bursakovi* Radchenko, 1992a **syn. n.**

Key to species

Workers

1 First gastral tergite imbricate, (Figs 20, 21), appears dull; colour yellow. North Caucasus........................ *T. aegeum*
-. First gastral tergite smooth, appears shiny; colour variable, usually brown to black.. 2
2. Ventral surface of head with a row of short setae and long C-shape hairs arising just posteriorly to buccal cavity, forming a psammophore; dark brown to black. Turkey and Ponto-Caspian region. .... *T. feroxoide*
- Ventral surface of head with a row of short setae only, without long C-shape hairs; light brown to brown. 3
3(2) Head at least partly smooth and shiny; usually mesosoma, petiole and postpetiole very feebly sculptured; yellow to light brown. Italy to Easten Mediterranean...*T. diomedeum*
- Head, mesosoma, petiole and postpetiole moderately or coarsely sculptured, rugulose; interspaces between main sculpturation microreticulate, never smooth; light brown to brown.
4(3) Head rectangular, with feebly convex sides; anterordorsal angle of petiolar node rounded (Fig. 26); D(4b) scores < 0 [D(4b) = 0.0375 CL +0.0781 FR -0.0487 PPW -0.1302 POC +1.2872]. Widely distributed over the western Palaearctic, from Central Europe to the Caucasus and Turkey.. *T. ferox*
-. Head slightly trapezoidal; petiolar node slightly angulate anterordorsally (Fig. 26); D(4b) scores > 0. Armenia and Eastern Turkey. .... *T. densopilosum*

Gynes

1 First gastral tergite imbricate, (Fig. 20), appears dull; small species (CS 863±9 [857–870])........................*T. aegeum*
-. First gastral tergite smooth, appears shiny; size variable (CS 852–1095)... 2
2(1) Gastral tergites covered with very dense pubescence (Fig. 28); large species (CS 1055±36 [1025–1095]).................. .... *T. densopilosum*
-. First gastral tergite with pubescence very sparse (Fig. 41); size variable (CS 852–1095)... 3
3(2) Ventral part of katepisternum rugulose to finer ruguloso-reticulate, between main sculpturation microreticulate (Fig. 36); head, scutum and scutellum rugulose to rugose, between main sculpturation microreticulate (Figs 35, 37); medium to large species (CS 1000±44 [955–1095]) .... *T. ferox*
-. Ventral part of katepisternum smooth and shiny (Figs 29, 43); head, scutum and scutellum variable, but more feebly sculptured, never microreticulate between the main sculpturation; small to medium species (CS 852–1012)............ 4
4(3) Ventral surface of head with a row of short setae and long C-shape hairs arising just posteriorly to buccal cavity forming psammophore; small species (CS 893±32 [852–952]); dark brown to black .... *T. feroxoide*
. Ventral surface of head with a row of short setae only, without long C-shape hairs; medium sized species (CS 960±40 [860–1012]); yellow to light brown...*T. diomedeum*

Review of species

Tetramorium aegeum Radchenko, 1992

Tetramorium caespitum subsp. *ferox* var. *levigata* Karavaiev, 1926: 167. Unavailable name.

Tetramorium inerme subsp. *laevigatum* Arnol'di, 1948: 211. First available use of *Tetramorium caespitum* subsp. *ferox* var. *levigata* Karavaiev, 1926; junior primary homonym of *T. laevigatum* Mayr, 1901. Syntype worker, gyne, male (3w, 2q, 2m): Azerbaijan, valley of Pir-sagat, 18.V.1907 (Kaznakow and Schelkownikow) [label: 5865. Coll., Karawaiwi; Syntypus *Tetramorium*, *caespitum ferox* v., *levigata* Karaw. For label data see note] (examined) [SIZK].

Tetramorium caespitum ferox var. *aequa* Baroni Urbani, 1971: 361. Unavailable name, proposed replacement name for *T. caespitum* subsp. *ferox* var. *levigata* Karavaiev, 1926.

Tetramorium levigatus: Radchenko & Arakelian, 1990: 376.

Tetramorium aegea Radchenko, 1992b: 55. First available replacement name for *Tetramorium inerme* subsp. *laevigatum* Arnol'di 1948.

Description of workers (figs 17–19, 21). Small size, CS 683 [648, 710]. Whole body and appendages yellow. Head slightly longer than broad, CL/CW 1.04 [1.03, 1.06], with feebly convex sides, straight posterior margin of the head with widely rounded corners. Eyes large, EYE 0.18 [-]. Frons wide, FR/CS 0.40 [0.40, 0.41], frontal lobes as wide as the frons, FL/FR 1.00 [-]. Scape short, SL/CS 0.75 [-], without dorso-basal carina, surface smooth and shiny. Promesonotal dorsum slightly convex, metanotal groove shallow. Propodeal denticles very short. Dorsal surface of petiole rounded, petiolar node higher than long, seen in profile NOH/NOL 1.09 [1.04, 1.12].

Head dorsum, posterior head surface, mesosoma dorsum, petiolar node and postpetiole smooth and shiny, ground surface smooth and shiny, or finely microreticulate. First gastral tergite imbricate. Ventral surface of head with a row of short setae and long C-shape hairs arising just posteriorly to buccal cavity forming a psammophore.

Description of gynes (figs 14–16, 20). Small size, CS 864 [858, 870]. Head distinctly broader than long, CL/CW 0.90 [0.89, 0.91], with straight, sub-parallel sides, straight posterior margin with rounded corners. Frons wide, FR/CS 0.44 [-]. Scape short, SL/CS 0.70 [0.70, 0.71]. Head as wide as scutum, MW/CS 0.98 [0.97, 0.99]. Propodeal denticles short. Petiole and postpetiole wide, CS/PEW 1.62 [1.55, 1.68], CS/PPW 1.35 [-].

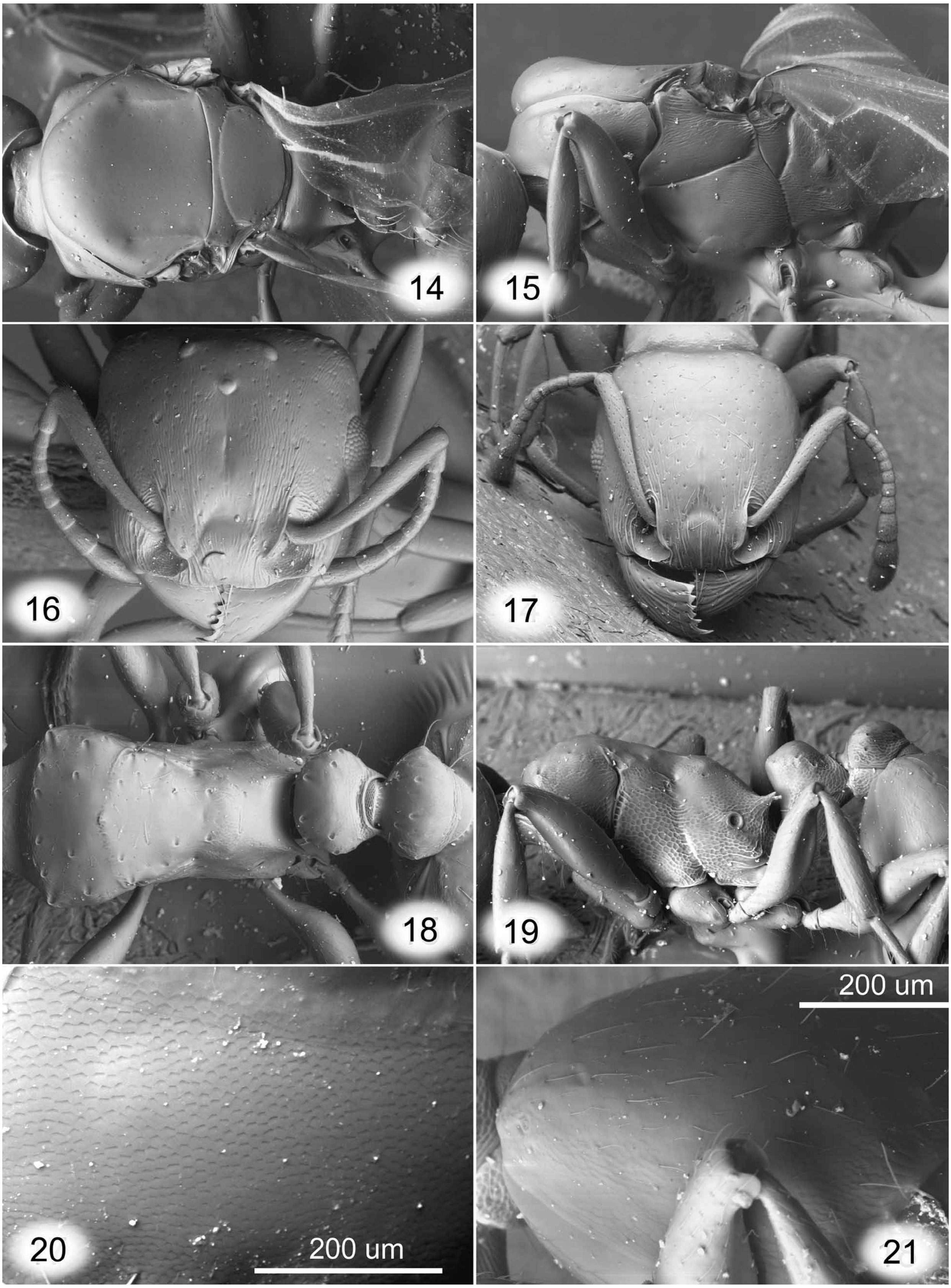
Whole body and appendages yellow. General appearance of head and mesosoma very feebly sculptured, surface smooth, appears shiny. Frons and genae with very fine longitudinal rugulae, or completely smooth, rest of head smooth. Scutum, scutellum, and anepisternum smooth and shiny, ventral part of katepisternum always smooth and shiny. Petiolar node and postpetiole feebly microreticulate, or smooth and shiny. First gastral tergite imbricate. Ventral surface of head with a row of short setae and long C-shape hairs arising just posteriorly to buccal cavity forming a psammophore.

Description of males. Head sides feebly convex, posterior margin widely rounded. Scutum broader than head. Propodeal denticles reduced, propodeum rounded in profile. Dorsum of petiolar node without a continuous transverse crest, dorsolaterally sharp and angulate. Whole body and appendages light brown. Head finely rugulo-reticulate, between main sulpturation microreticulate. Scutum, scutellum, anepi- and katepisternum finely rugulose, and smooth in part. Petiole and postpetiole finely rugulo-reticulate, between main sculpturation microreticulate.

Diagnosis. Workers and gynes of *T. aegeum* can be confused with those of *T. diomedeum*. Both species are less sculptured than relatives in the complex. The head and mesosoma are frequently smooth and shiny, but the imbricate first gastral tergite of *T. aegeum* is unique within this group. We had only a few samples of *T. aegeum*, so intraspecific variation is poorly known.

Discriminant function D(4a) = 0.0744 FR +0.0762 PEW -0.0616 PPW -0.1097 POC +8.0688 for *T. diomedeum* and *T. aegeum* workers resulted in 100% success, and each case (226 individuals) was correctly identified. The mean D(4a) scores for *T. diomedeum* workers (n=223) was -2.457 ±0.99 [-5.379, +0.294], for nest means (n=42) -2.462 ±0.72 [-4.047, -1.266]. The mean scores for *T. aegeum* workers (n=3) was 2.457 0.21 [+2.290, +2], for nest mean (n=1) +2.457642.

For the cumulative discriminant analysis for workers see Tables 3 & 4 and gynes see Tables 5 & 6. Morphometric characters and indices for workers and gynes are provided in Table 7 & 8.



FIGURES 14–21. *Tetramorium aegeum* Radchenko, 1992. Gyne mesosoma, petiole and postpetiole, dorsal view (Fig. 14), lateral view (Fig. 15); gyne head, dorsal view (Fig. 16); worker head, dorsal view (Fig. 17); worker mesosoma, petiole and postpetiole, dorsal view (Fig. 18), lateral view (Fig. 19); imbricate microsculpture on the 1st gastral tergite of gyne (Fig. 20); the most densely sculptured antero-lateral part on the 1st gastral tergite of worker (Fig. 21).

Note. In the original description (Karawajew, 1926: 169) the following designation was given for the type material: "Tal des Pir-sagat (Gouv. Baku) 18.V.1907., Kaznakow und Schelkownikow (w, q, m)" without indication of the series number. The syntype material examined by us had no indication for the locality. This makes the status of our syntype material doubtful, but the lack of other available material and the fact that this series is deposited in the original Karawajew collection led us to treat the above series as syntype material.

Material examined. Azerbaijan. Only the type material is known.

Tetramorium densopilosum Radchenko & Arakelian, 1990

Tetramorium densopilosus Radchenko & Arakelian, 1990: 372. Holotype queen and paratype worker, male (6w, 4m): Armenia, Nature Reserve, 14.VI.1986 (A. Radchenko) [label: Arm SSR Khosrovskij, z-k No 237.86, A.Radchenko 14.6.86] (examined) [SIZK].

Description of workers (figs 25–27). Medium to large size, CS 833 [763, 878]. Whole body and appendages light brown to brown. Head slightly longer than broad, CL/CW 1.04 [1.02, 1.05], with straight sides, straight posterior head margin and rounded corners. Eyes small, EYE 0.17 [0.17, 0.18]. Frons moderately wide, FR/CS 0.40 [0.38, 0.41], frontal lobes usually as wide as the frons, rarely slightly broader, FL/FR 1.00 [1.00, 1.02]. Scape long, SL/CS 0.78 [0.76, 0.80], with a feeble dorsal carina basally. Promesonotal dorsum slightly convex, metanotal groove moderately deep. Propodeal denticles moderately long. Petiolar node very high, NOH/NOL 1.23 [1.06, 1.44] trapezoid seen in profile, steeply rounded backward.

Head longitudinally rugulose and microreticulate, posterior surface ruguloso-reticulate, ground surface microreticulate, appears dull. Mesosoma dorsum and mesopleura ruguloso-reticulate, ground surface coarsely microreticulate. Dorsum of petiolar node ruguloso-reticulate, ground surface microreticulate, median part smooth. Dorsum of postpetiole rugulose and microreticulate. First gastral tergite smooth, appears shiny. Ventral surface of head with a row of short setae only (without long C-shape hairs).

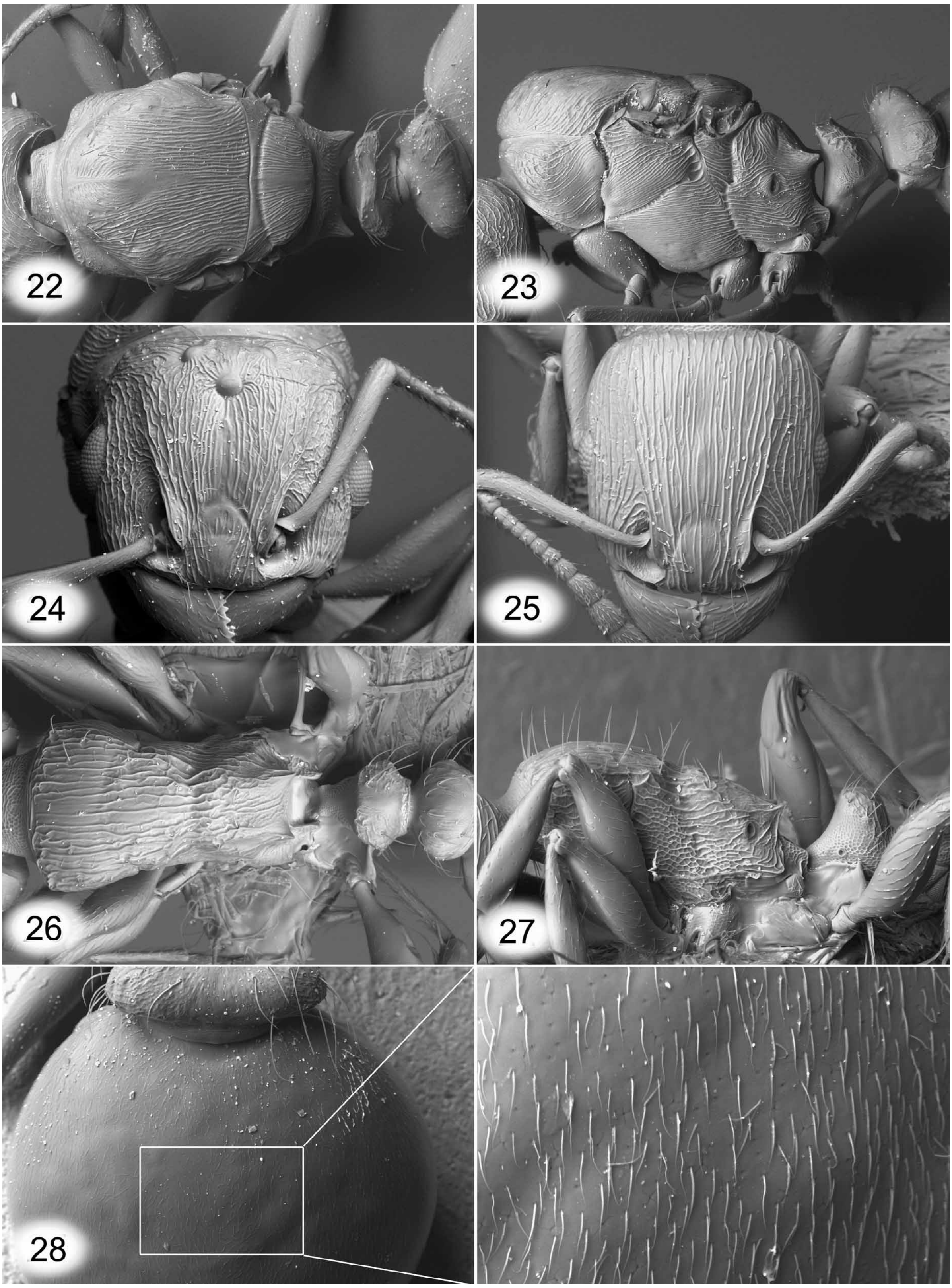
Description of gynes (figs 22–24, 28). Medium to large size, CS 980 [970, 990]. Head, mesosoma and appendages light brown, gaster dark brown. Head broader than long, CL/CW 0.87 [0.83, 0.90] with sides and posterior margin straight. Head trapezoid in full face view, narrower at genae. Frons moderately wide, FR/CS 0.40 [0.38, 0.41]. Scape long, SL/CS 0.76 [0.74, 0.78], without a dorsal carina basally, its surface is smooth and shiny. Head slightly narrower than scutum, MW/CS 1.06 [1.05, 1.07]. Propodeal teeth long and acute. Petiole and postpetiole wide, CS/PEW 1.71 [1.68, 1.75], CS/PPW 1.28 [1.24, 1.33].

Head dorsum, posterior surface and sides ruguloso-reticulate, ground surface microreticulate. Frons longitudinally rugulose and microreticulate. Scutum and scutellum longitudinally rugulose. Sides of mesosoma, rugoso-reticulate and microreticulate, ventral part of katepisternum always rugulose, or microreticulate. Dorsum of petiolar node and postpetiole coarsely reticulate and microreticulate, medially shiny. First gastral tergite smooth, appears shiny, 1^{st} gastral tergite very densely covered by pubescent hairs. Ventral surface of head with a row of short setae only (without long C-shape hairs).

Description of males. Head sides feebly convex, posterior margin and corners rounded. Scutum much broader than head. Propodeal denticles short but acute, propodeum angulate in profile. Dorsum of petiolar with a transverse crest, dorsolaterally sharp and angulate. Whole body and appendages brownish black. Head, scutum, scutellum, anepi- and katepisternum as well as petiole and postpetiole finely rugulo-reticulate, between main sculpturation microreticulate. First gastral tergite smooth, appears shiny, 1^{st} gastral tergite very densely covered by pubescent hairs.

Diagnosis. The very dense pubescence on the first gastral tergite (Fig. 28) makes the *T. densopilosum* gynes unique within this group.

Tetramorium densopilosum workers cannot be confused with those of *T. diomedeum* or *T. aegeum*. The general appearance of the head and mesosoma of *T. densopilosum* workers is always rugulose and microreticulate, but head and mesosoma of the two latter species are always shiny and usually at least partly smooth.



FIGURES 22–28. *Tetramorium densopilosum* Radchenko & Arakelian, 1990. Gyne mesosoma, petiole and postpetiole, dorsal view (Fig. 22), lateral view (Fig. 23); gyne head, dorsal view (Fig. 24); worker head, dorsal view (Fig. 25); worker mesosoma, petiole and postpetiole, dorsal view (Fig. 26), lateral view (Fig. 27); dense pubescence pilosity on 1st gastral tergite of a gyne (Fig. 28).

Tetramorium feroxoide workers usually bear feeble, often parallel rugulae on head and mesosoma. Discriminant function D(3a) = -0.1025 FL +0.0712 MW –0.0942 SPSP +8.1089 for *T. densopilosum* and *T. feroxoide* workers resulted in 100% success, and each case (56 individuals) was correctly identified. The mean D(3a) scores for *T. densopilosum* workers (n=8) was -2.191 ±0.89 [-3.512, -0.918], for nest means (n=2) -2.186 ±0.01 [-2.193, -2.180]. The mean scores for *T. feroxoide* workers (n=48) was 2.191 ±0.99 [+0.012, +3.911], for nest mean (n=2) -2.186 ±0.01 [-2.193, -2.180].

Separation of *T. densopilosum* and *T. ferox* workers is very difficult. With 8 observed workers we are not able to show variation in *T. densopilosum*. *Tetramorium densopilosum* workers have a slightly trapezoidal head and the petiolar node is slightly angulate anterordorsally (Fig. 26) in contrast to that of *T. ferox*, which is rounded. The frontal carinae are more developed in *T. densopilosum*, and also the erect hairs of mesosoma seem to be longer end denser than those of *T. ferox*. A discriminant D(4b) function proves the separation between *T. ferox* and *T. densopilosum*: see differential diagnosis of *T. ferox*.

For the results of cumulative discriminant analysis for worker caste see Tables 3 & 4 and for gynes see Tables 5 & 6. Morphometric characters and indices for workers and gynes are provided in Table 7 & 8.

Distribution. This species is known from Armenia, Georgia and Eastern Turkey.

Material examined. GEORGIA—USSR, Georgia, Dranda, Kodori stream, 20.05.1975. leg. Zombori (1w / HNHM, 1w / PCAS); Georgia, USSR, Novy Afon, 24.05.1975, leg. Zombori (1w / HNHM);

TURKEY—Agri, Cilli Gecidi 30km N Dogubayazit 1600mH Strassenrand Steppe leg. Schulz, 30.06.1989 (2q / PCAS).

Tetramorium diomedeum Emery, 1908

Tetramorium caespitum var. *diomedea* Emery, 1908: 24. Subspecies of *ferox*: Grandi, 1935: 102. Junior synonym of *ferox*: Bernard, 1967: 235. Raised to species: Schembri & Collingwood, 1981: 435. Revived status as species: Sanetra, Güsten & Schulz, 1999: 324. Syntype workers, gynes, males (9w, 6q, 1m): Italy, Tremiti, Caproni (J. Domino Cecioni) [labels: Tremiti, caproni; *T. caespitum*, *ferox*, var. *diomedea* n.] (examined) [MSNG].

Tetramorium caespitum subsp. *ferox* var. *laevior* Forel, 1911: 333. Unavailable name.

Tetramorium ferox var. *laevior* Menozzi, 1936: 292. First available use of *Tetramorium caespitum* subsp. *ferox* var. *laevior* Forel, 1911: 333**.** Syntype workers (6w): Turkey, Bosphorus (Forel) [labels: Typus; *T. caespitum* L., r. *ferox* Ruzsky, v. *laevior* Forel, type, Bou Youk Déré, Bosph. Eur. (Forel); coll. Forel] (examined) [MHNG]. **New synonymy.**

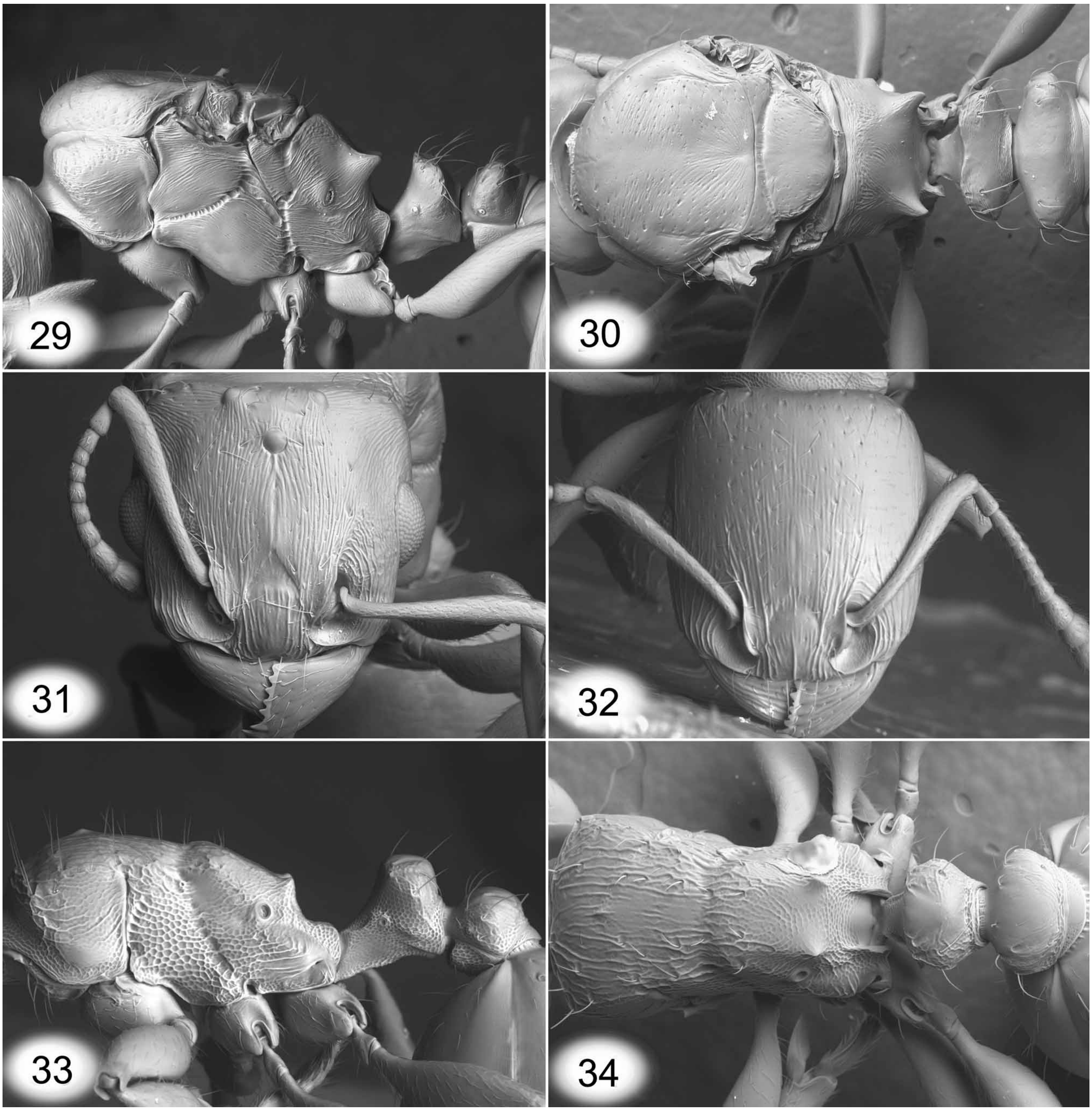
Tetramorium caespitum var. *bariensis* Forel, 1911: 331. Junior synonym of *diomedeum*: Emery, 1916: 194. [type locality: Italy, Bari, Apulie] (Not in MHNG, MSNG, not examined).

Description of workers (figs 32–34). Small to large size, CS 753 [647, 930]. Whole body and appendages yellow to brown. Head slightly longer than broad, CL/CW 1.02 [0.97, 1.08], with feebly convex sides, straight posterior margin with widely rounded corners. Eyes small, or medium sized, EYE 0.165 [0.144, 0.185]. Frons moderately wide, FR/CS 0.38 [0.35, 0.41], frontal lobes usually as wide as the frons, rarely slightly broader, FL/FR 1.0 [1.00, 1.04]. Scape moderately long, SL/CS 0.76 [0.73, 0.79], without a dorsal-basal carina, surface smooth and shiny. Promesonotal dorsum slightly convex, metanotal groove shallow. Propodeal denticles moderately long. Petiolar node trapezoid seen in profile, higher than long NOH/NOL 1.12 [0.96, 1.39].

Head longitudinally rugulose and feebly microreticulate, in eastern populations rarely the head can be shiny, posterior surface reticulate, ground surface very feebly microreticulate, appears shiny.Mesosoma dorsum and mesopleura finely ruguloso-reticulate, ground surface feebly microreticulate, or smooth. Dorso-lateral part of petiolar node ruguloso-reticulate, ground surface microreticulate, median part smooth. Dorsum of postpetiole rugulose and microreticulate. First gastral tergite smooth, appears shiny. Ventral surface of head with a row of short setae only (without long C-shape hairs).

Description of gynes (figs 29–31). Medium size, CS 955 [857, 1012]. Head distinctly broader than long, CL/CW 0.88 [0.85, 0.93], with straight, sub-parallel sides, straight posterior margin with widely rounded corners. Frons wide, FR/CS 0.42 [0.39, 0.46]. Scape short to moderately long, SL/CS 0.72 [0.67, 0.76]. Head as wide as scutum, MW/CS 1.01 [0.92, 1.12]. Propodeal denticles short. Petiole and postpetiole wide, CS/PEW 1.68 [1.53, 2.09], CS/PPW 1.33 [1.24, 1.42].

Whole body and appendages yellow to brown. Frons and genae with very fine longitudinal rugulae, or completely smooth, rest of head smooth. Scutum, scutellum, and anepisternum smooth and shiny, very fine rugulae can occure, ventral part of katepisternum always smooth and shiny. Petiolar node and postpetiole feebly microreticulate, or smooth and shiny. First gastral tergite smooth, appears shiny. Ventral surface of head with a row of short setae only, without long C-shape hairs.



FIGURES 29–34. *Tetramorium diomedeum* Emery, 1908, Gyne mesosoma petiole and postpetiole, lateral view (Fig. 29), dorsal view (Fig. 30); gyne head, dorsal view (Fig. 31); worker head (Fig. 32); worker mesosoma, petiole and postpetiole, lateral view (Fig. 33), dorsal view (Fig. 34).

Description of males. Head sides feebly convex, posterior margin widely rounded. Scutum much broader than head. Propodeal denticles reduced, propodeum rounded in profile. Dorsum of petiolar node without a transverse crest, dorsolaterally sharp and angulate. Whole body and appendages brownish black. Head finely rugulo-reticulate, between main sculpturation microreticulate. Scutum, scutellum, anepi- and katepisternum finely rugulose, and smooth in part. Petiole and postpetiole finely rugulo-reticulate, between main sculpturation microreticulate.

Diagnosis. In general the smooth and shiny sculpture separates *T. diomedeum* gynes from those of *T. ferox* and *T. densopilosum*. Ventral part of katepisternum is always smooth and shiny in *T. diomedeum* gynes. These characters can also help to distinguish them from the gynes of *T. ferox*, where the kataepisternum is always finely rugulose or microreticulate. Gynes of *T. diomedeum* can be confused with those of *T. feroxoide* by the feeble sculpture of head and mesosoma. However, gynes and workers of *T. feroxoide* have long C-haped setae on the ventral surface of head. Those of *T. diomedeum* have only short setae on the ventral surface of head. The colour can also be a good characteristic for the separation between the gynes of the latter two species: *T. diomedeum* is light brown or sometimes (though not frequently) yellow. The gynes of *T. feroxoide* are usually dark brown or black.

Tetramorium diomedeum workers cannot be confused with those of *T. ferox* or *T. densopilosum*. The general appearance of the head of *T. diomedeum* workers are always shiny, and usually smooth at least in part, these body parts of *T. ferox* or *T. densopilosum* are rugulose and microreticulate.

In a few cases larger *T. diomedeum* workers can be confused with those of *T. feroxoide* by sculpture. However, in the eastern populations (in Turkey where these two species co-occur) sculpture of *diomedeum* workers is usually very feeble. These characters and the lack of C-shaped setae of *T. diomedeum* workers (in contrast to those of *T. feroxoide*) result in clear separation without morphometry. In order to achieve the best separation for the doubtful cases of *T. diomedeum* and *T. feroxoide* workers we provide the discriminant function D(7) = 0.0604 CL –0.0398 FR -0.0578 SL -0.0697 NOH +0.0346 SPSP -0.0398 EL +0.0402 POC -1.0136. This analysis resulted in 98.6% success, with four erroneously identified cases of the 276 individuals, while 100% of the nest samples were correctly classified. The mean D(7) scores for *T. feroxoide* workers (n=48) was -1.980 1.11 [-4.021, -0.381], for nest means (n=8) -2.493 1.13 [-3.487, -0.739]. The mean scores for *T. diomedeum* workers (n=228) was +1.980 ±0.97 [-0.550, +4.975], for nest mean (n=42) +2,090±0.75 [+0.391, +4.161].

Workers of *T. diomedeum* can also be confused with those of *T. aegeum* on the basis of external characters. The sculpture of these species is similar to each other; head and mesosoma are frequently smooth and shiny. For best separation a discriminant D(4a) function has been provided (see differential diagnosis of *T. aegeum*).

For the results of cumulative discriminant analysis for worker caste see Tables 3 & 4 and for gynes see Tables 5 & 6. Morphometric characters and indices for workers and gynes are provided in Table 7 & 8.

Distribution. Eastern part of the Mediterranean basin: Italy, Croatia, Bulgaria, Turkey and Greece – including the islands of Rhodos and Crete.

Geographic variation. Along the wide, decisively east–west geographical range, including small islands, workers of *T. diomedeum* display a rather strong gradient of morphological variation in characters such as body size, colour and sculpture. Body size indicators (CS) of individuals show moderate correlation with longitude (Spearman r = -0.391, p<0.01), i.e. eastern populations are smaller. Average CS values of nest means do not correlate significantly (Spearman r = -0.304, p=0.06).

In the eastern populations workers are paler, body sculpture feebler, and the post-ocular surface of head in particular is smooth and shiny. Smaller workers often bear one pair of standing hairs on genae. This combination of characters is more frequent in the eastern populations and rare in the western ones. Some workers in nest series from Calabria and Syracusa (Italy) also bear this combination of characters, especially in the case of small workers.

Material examined. BULGARIA—Achtopol, 07.10.05.1958 leg Pisarski (5 w /HNHM);

CROATIA—Karlobag 01.10.2004 leg. Csősz, nr.CRO 062 (10w / HNHM);

GREECE—Crete, Prov. Herakleion 2km N Zaros 400–500mH. 25.04.1992. leg. Sanetra (5w / MSNM); I. Rodi 06.1997. „AT 1.1" (3w, 1q /NMSM); Kreta 1 km NW Melambes 600–700 m Nordostseite Wiese 24.–04.05.1992.leg.Schulz nr. 624. (3w / PCAS); Kreta 1 km S Anisraki nahe Kandanos Wiese 700 m, 24.–04.05.1992. leg. Schulz nr.696. (2w / PCAS); Kreta 3 km SWW Omalos 1400–1600 m Nordwesthang Eichenwald, 24. –04.05.1992. leg. Schulz nr. 684. (6w / PCAS); Kreta l km S Anisraki nahe Kandanos Eichenhecke 700 m, 24.–04.05.1992. leg. Schulz nr. 696. (2w / PCAS); Kreta, Zaros Bachschlucht 400 m

Kiefernwald, 24.–04.05.1992. leg.Schulz nr. 635. (3w / PCAS); Peloponnes, Prov Lakonia, Oros Taigetos, 20 km SW Sparti, 36°58'N, 22°21'E, 1800–2100 m, 29.04.2000. leg. A.Schulz nr.150. (5w / PCAS); Peloponnes, Prov. Arkadia, Parnon, 10 km SWS Kosmas, 37°04'N, 22°43'E, 800 m, 26.04.2000. leg. A.Schulz nr. 87. (5w / PCAS); Peloponnisos 28 km NW Tripolis, Pass zw Vitina u Karakaloú, 1140mH, 06.1994. leg. Schulz, Vock nr. 1391. (3w / PCAS); Rhodos 5 km E, Agios Isidoros, 36°12'N, 27°50'E, 600mH, 17.03.2002. leg. A.Schulz nr. 37. (6w / PCAS); Rhodos 5 km E, Kattavia, 35°57'N, 27°49'E, 50mH, 21.03.2002. leg. A.Schulz nr.116. (6w / PCAS); Rhodos 6 km N Kalathos 36°12'N, 28°07'E 50mH, 19.03.2002. leg. A.Schulz nr. 60. (5w / PCAS); Rhodos, 5 km E Kattavia, 35°57'N, 27°49'E, 50mH, 21.03.2002. leg. A.Schulz nr. 111. (6w / PCAS); Rhodos, vic. Lindos und Stadt, 36°06'N, 28°05'E, 20–50mH, 17.–23.03.2002. leg.A.Schulz nr. 98. (9w, 1 q / PCAS);

ITALY—Calabria, Prov. Catanzaro 3 km E Savelli, 700mH, 19.05.1994. leg. Schulz, Gusten, Sanetra nr. 1299. (3w / PCAS); Calabria, Prov.Catanzaro, 3 km E Savelli, 700mH, 19.05.1994. leg. Schulz, Gusten, Sanetra nr.1301. (1q / PCAS); Calabria, Prov. Catanzaro, 3 km NW Umbriatico, 350mH, 19.05.1994. leg. Schulz, Gusten, Sanetra nr.1305. (1m / PCAS); Calabria, Prov. Cosenza, 4 km N Morano Calabro, 800mH 21.05.1994. leg. Gusten, Sanetra nr.T. 351. (3w, 3 q, 5m / PCAS); Calabria, Prov. Cosenza, 4 km N Morano Calabro, 800mH, 21.05.1994. leg. Gusten, Sanetra nr. 381. (3w / PCAS); Calabria, Sambiase 04.1926 leg Minozzi (sic) (5w, 1q / ZMPA); Campana, Prov. Napoli Monte Faito, 5rkm NW Moiano, 800–1000mH, 24.09.1997. leg. M.Sanetra, A.Buschinger, R.Schumann nr. T.763-12. (6w / PCAS); Nicolosi, CT. 600mH, 10.10.1953 leg. Anonym (5w / MSNM); Puglie, Leuca 1975. leg. Springhetti (2w / MSNM); Sicilia, Edlie, Filicudi 06.04.1990. leg. Mei (8w / MSNM); Sicilia, Prov. Catania, Etna, 5 km N Ragalna 1000–1200mH, 12.05.1994. leg. M. Sanetra nr. Td.317. (3w / PCAS); Sicilia, Prov. Syrakus, 5 km NE Canicattini Bagni 300mH, 11.05.1994. leg. M. Sanetra nr. 379. (2q / PCAS); Sicilia, Prov. Syrakus, 5 km NE Floridia 100mH, 11.05.1994. leg. M. Sanetra nr. T.307. (3w / PCAS); Sicilia, Prov. Syrakus, 5 km NE Floridia, 100mH 11.05.1994. leg. M. Sanetra nr. T.308. (3w / PCAS); Sizilien, Prov. Syrakus, ca 5 km NE, Canicattini Bagni, 300mH, 29.05.1993. leg. M. Sanetra (3w / PCAS);

TURKEY—Antalya 25 km SW Elmali 90 km E Fethiye, bei Gömbe 1500mH Wiesengelände mit Bäumen, 23.05.1993. leg. Schulz nr. 907. (3w / PCAS); Antalya 5 km E Saklikent, 35 km W Antalya 1500–1700mH Kiefernwald und Wiese 28.05.1993. leg. Schulz nr. 936. (6w / PCAS); Prov. Mersin, Aydincik 7 km E, 50 km E Anamur, 200–400mH, 15.05.1997. leg. A. Schulz nr. 357-39 (3w / PCAS); Prov. Antalya, Demirtas 14 rkm NE, 400mH 04.05.1997. leg. A. Schulz, K. Vock, M. Sanetra nr. T.699-06. (3w / PCAS); Prov.Antalya, Demirtas 2 rkm N, 100mH, 04.05.1997. leg. A. Schulz, K. Vock, M. Sanetra nr. T.699-05. (3w, 6q / PCAS); Prov. Kayseri, Incesu 2 rkm NE, 30 km SW Kayseri, 1100mH, 10.05.1997. leg. A. Schulz, K. Vock, M. Sanetra nr. T.697. (3w / PCAS); Prov.Kayseri, Incesu 2 rkm NE, 30 km SW Kayseri, 1100mH, 10.05.1997. leg. A. Schulz, K. Vock, M. Sanetra nr. 267-27. (24w, 1q / PCAS); Mugla- 10 km NNE Kemer 30 km NEE Fethiye 1000mH Kiefernwald, 22.05.1993. leg.Schulz nr.904. (6w / PCAS); Mugla- Dirimli Gecidi, 100 km W Antalya, 30 km SSE Gölhiser 1600mH Kiefernwald, 22.05.1993. leg.Schulz nr.904. (3w / PCAS); NE Incesu 2rkm, 30 km SW Kayseri, Prov.Kayseri, 1100mH, 10.05.1997.leg.A.Schulz, K.Vock, M.Sanetra nr. T.696-27 (6w / PCAS); Nur Daglari 7-10rkm, Prov.Antalya W Hassa 1000–1200mH, 11.–12.05.1997. leg.A.Schulz, K.Vock, M.Sanetra nr. 312-33 (9w / PCAS); Nurdagi Gecidi, 20 km N Islahiye, Prov.Gaziantep, (ca.70 km W Gaziantep), 1200mH 12.05.1997. leg.A.Schulz, K.Vock, M.Sanetra nr.225-34, (12w / PCAS);

Tetramorium ferox Ruzsky, 1903

Tetramorium caespitum var. *ferox* Ruzsky, 1903: 309. Syntype workers, gynes, male (2w, 2q, 1m): Russia, Saratov (Ruzsky) [labels: *Tetr. caespitum* L., v. *ferox* Rusz, Ssaratov M.R.] (examined) [MSNG, MHNG]. Raised to species by Cori & Finzi, 1931: 239.

Tetramorium confinis Radchenko & Arakelian, 1990: 374. Holotype gyne and paratype workers, gynes, male: Armenian Republic, Talyn 14.VI.1989 (Kalashyan); Ukraine, Crimea, Krasnolesje 28.VI.1978 (E. Malij) [labels: ArmSSR, 1km severneje, g.Talyn, Kalashyan, 14.06.89. Krym Krasnolesje, kosh-kaya, No 83, E. Malij, 28.VI.1978; gn. V shcheli kamnja] (3w, 2q, 1m paratypes examined) [SIZK]. **New synonymy.**

Tetramorium caespitum st. *ferox* var. *perspicax* Santschi, 1921: 111. Unavailable name.

Tetramorium perspicax Radchenko, 1992b: 56. Syntype workers, gyne (10w, 1q): Turkey, Ankara (G.D. Kerville) [labels: Asie Min., Angora, (G.d. Kerville); 243; Tetramorium, ferox Ruzs., v. perspicax Sant., Santschi det. 1920; Sammlung, Dr. F. Santschi, Kairouan] (examined) [NHMB]. First available use of *Tetramorium caespitum* st. *ferox* var. *perspicax* Santschi, 1921: 111. Junior synonym of *feroxoide*: Radchenko, 1992b: 56. **New synonymy.**

Tetramorium (Lobomyrmex) ferox subsp. *silhavyi* Kratochvil, 1941: 84. Syntype worker, gyne: Czech Republic, Slovakia and Hungary (not examined). Also described as new by Kratochvil, 1944: 72. Junior synonym of *ferox*: Bernard, 1967: 235.

Description of workers (figs 38–40). Medium to large size, CS 825 [693, 918]. Whole body and appendages greyish brown to dark brown. Head slightly longer than broad, CL/CW 1.03 [0.99, 1.09], with feebly convex sides, straight posterior margin with widely rounded corners. Eyes small, EYE 0.16 [0.15, 0.18]. Frons moderately wide, FR/CS 0.39 [0.36, 0.41], frontal lobes usually as wide as the frons, rarely slightly broader, FL/FR 1.01 [1.00, 1.03]. Scape long, SL/CS 0.79 [0.74, 0.83], with a feeble dorsal carina basally, its surface very finely microreticulate. Promesonotal dorsum slightly convex, metanotal groove shallow. Propodeal denticles moderately long. Petiolar node moderately high, NOH/NOL 1.05 [0.88, 1.29] trapezoid to cubic seen in profile.

Head longitudinally rugulose and microreticulate, posterior surface ruguloso-reticulate, ground surface microreticulate, appears dull. Mesosoma dorsum and mesopleura ruguloso-reticulate, ground surface coarsely microreticulate. Dorsum of petiolar node ruguloso-reticulate, ground surface microreticulate, median part smooth. Dorsum of postpetiole rugulose and microreticulate. First gastral tergite smooth, appears shiny. Ventral surface of head with a row of short setae only (without long C-shape hairs).

Description of gynes (figs_35–37, 41). Medium to large size, CS 999 [955, 1095]. Whole body and appendages black. Head broader than long, CL/CW 0.92 [0.90, 0.94] with sides and posterior margin straight, with widely rounded corners. Head trapezoid in full face view, narrower at genae. Frons moderately wide, FR/CS 0.40 [0.39, 0.42]. Scape long, SL/CS 0.75 [0.70, 0.81], with a feeble dorsal carina basally, its surface smooth and shiny. Head slightly narrower than scutum, MW/CS 1.03 [0.99, 1.08]. Propodeal teeth long. Petiole and postpetiole wide, CS/PEW 1.65 [1.56, 1.78], CS/PPW 1.29 [1.11, 1.43].

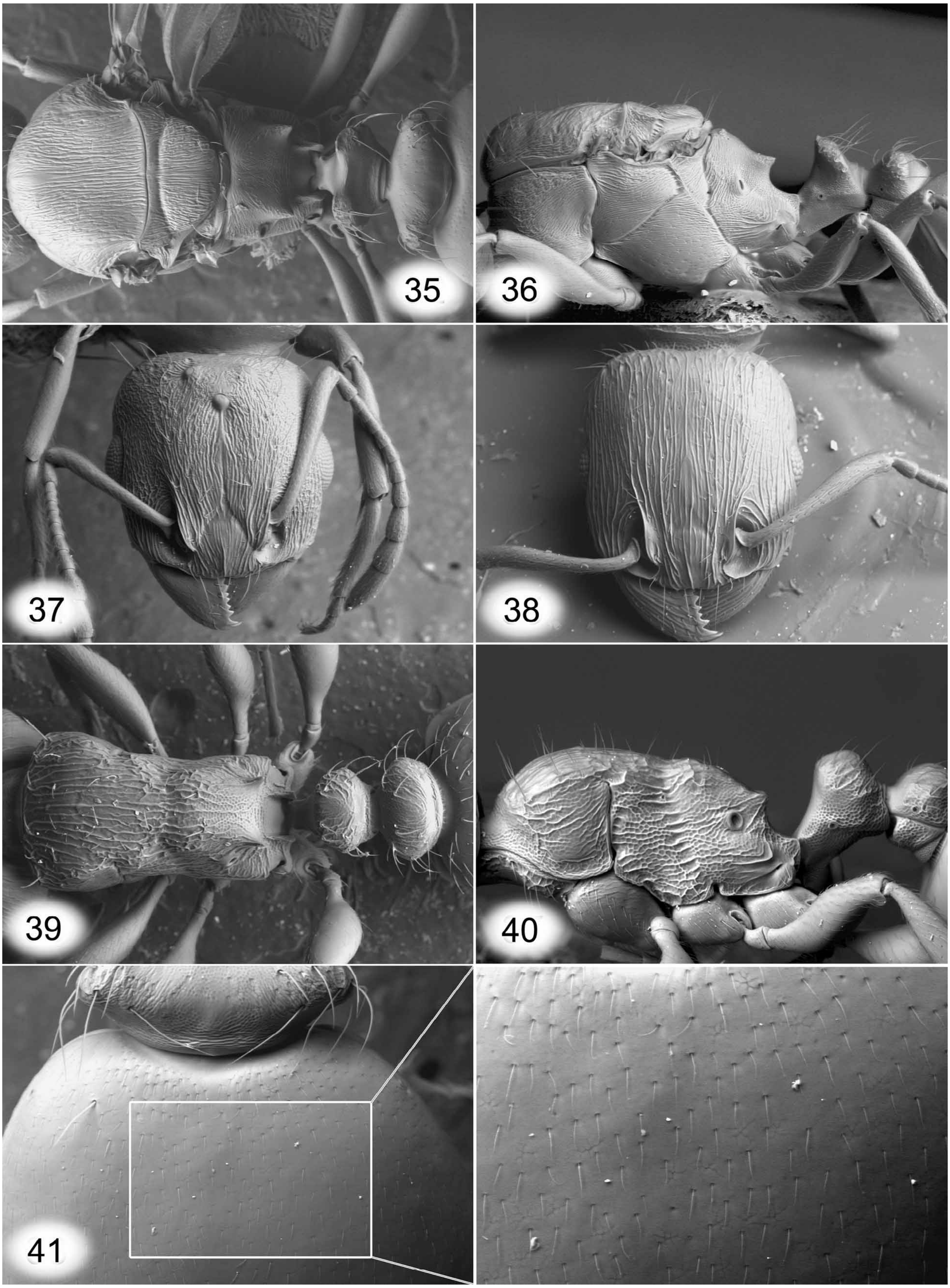
Head dorsum, posterior surface and sides ruguloso-reticulate, ground surface microreticulate. Frons longitudinally rugulose and microreticulate. Scutum and scutellum longitudinally rugulose. Sides of mesosoma, rugoso-reticulate and microreticulate, ventral part of katepisternum always rugulose, or microreticulate. Dorsum of petiolar node and postpetiole coarsely reticulate and microreticulate. First gastral tergite smooth, appears shiny. Ventral surface of head with a row of short setae only (without long C-shape hairs).

Description of males. Head sides feebly convex, posterior margin widely rounded. Scutum much broader than head. Propodeal denticles reduced, propodeum nearly rounded in profile. Dorsum of petiolar node blunt, dorsolaterally sharp and angulate. Whole body and appendages black. Head, scutum, scutellum, anepi- and katepisternum as well as petiole and postpetiole finely rugulo-reticulate, between main sculpturation microreticulate. First gastral tergite smooth, appears shiny.

Diagnosis. The feebly rugulose general sculpture, the microreticulate ground surface, and the relatively sparse pubescence on the first gastral tergite make the *T. ferox* gynes unique within this group.

Tetramorium ferox workers cannot be confused with those of *T. diomedeum* or *T. aegeum*. The general appearance of the head and mesosoma of *T. ferox* workers is always rugulose, microreticulate and dull, but head and mesosoma of the latter two species are always shiny and usually at least partly smooth.

Tetramorium feroxoide workers usually bear much feebler (and often parallel) rugulae on head and mesosoma than *T. ferox* workers, but in a few cases *T. feroxoide* workers can be confused with the smallest *T. ferox* workers. Discriminant function D(3b) = -0.0465 SL +0.0354 PPW +93.9076 EYE +1.5372 for workers of *T. ferox* and *T. feroxoide* resulted in 99.4% success, with only one erroneously identified case of the 177 individuals, while 100% of the nest samples were correctly identified. The mean D(3b) scores for *T. ferox* workers (n=129) was -1.748 ±1.02 [-4.799, +0.277], for nest means (n=22) -1.560 ±0.84 [-3.526, -0.254]. The mean scores for *T. feroxoide* workers (n=48) was + 1.748 ±0.95 [+0.070, +4.355], for nest mean (n=8) +2,421±0.54 [+3.073, +0.539].



FIGURES 35–41. *Tetramorium ferox* Ruzsky, 1903, Gyne mesosoma, petiole and postpetiole, dorsal view (Fig. 35), lateral view (Fig. 36); gyne head, dorsal view (Fig. 37); worker head, dorsal view (Fig. 38); worker mesosoma, petiole and postpetiole, dorsal view (Fig. 39), lateral view (Fig. 40); sparse pubescence pilosity on 1st gastral tergite of a gyne (Fig. 41).

Separation of *T. densopilosum* and *T. ferox* workers is very difficult on the basis of traditional characters only, though *T. densopilosum* workers have slightly trapezoidal heads and the petiolar node slightly angulates anterororsally. Discriminant function D(4b) = 0.0375 CL +0.0781 FR -0.0487 PPW -0.1302 POC +1.2872 for *T. ferox* and *T. densopilosum* workers resulted in 99.3% success, with only one erroneously identified case of the 137 individuals, while 100% of the nest the samples were correctly identified. The mean D(4b) scores for *T. ferox* workers (n=129) was -1.748 ±1.02 [-4.799, +0.277], for nest means (n=22) -1.560 ±0.84 [-3.526, -0.254]. The mean scores for *T. densopilosum* workers (n=8) was +1.656 ±0.75 [+0.983, +2.910], for nest mean (n=2) +1.632 ±0.04 [+1.60, +1.663].

For the results of cumulative discriminant analysis for worker caste see Tables 3 & 4 and for gynes see Tables 5 & 6. Morphometric characters and indices for workers and gynes are provided in Table 7 & 8.

Distribution. Widely distributed over the western Palaearctic, from Central Europe to the Caucasus and Turkey.

Material examined. AUSTRIA—Spitzerberg vic. Prellenkirchen, (16˚57'E/48˚05'N) nr. AUT002 23.06.2002. leg. B. C. Schlick-Steiner & F. M. Steiner (7w / HNHM);

BULGARIA—Dolno Ezerovo ad Burgas 20.07.1957. leg. W. nr. 70/57 (10w / HNHM); Kărdžali 29.05.1956. leg. Bielawski et Goljan (4w / HNHM);

HUNGARY—Pécs 1929.08.28. leg. Szabó-Patay (10w / HNHM); Kalocsa 1936.03.23. leg. Erdős (1w / HNHM); Budapest 1905.04.20. leg. Biró (1w / HNHM); Budapest 1918.05.12. S. h. leg. Szabó-Patay (10w / HNHM);

ROMANIA—Orşova, 27.06.1957. leg. B. Pisarski nr. 68/57 (1w / HNHM); Black Sea Region, S Euforie, 12km S Constanta, 20mh, 04.vii.2005, leg. A. Schulz (12w PCAS);

SLOVAKIA—Stiavnické vrchy Mts., Súdovce, 48°13.7'N, 18°49.5'E 230mH 23.05.2007 leg. Wiezik (5w / HNHM); Medovarce, u Krupiny, Slov.occ. nr. 7779-80, 24.6.1989. leg. P. Werner (1w, 1m, / Central Europe Czechoslovakia Ex. coll. P. Werner); Slov.occ. Medovarce, u Krupiny, Slov.occ. nr. 7779-80 24.6.1989. leg. P. Werner Mess 041 (1q / Central Europe Czechoslovakia Ex. coll. P. Werner); Ajnácskő [Hajnáčka] 1909.06.09. leg. Szabó (5w, 1m / HNHM);

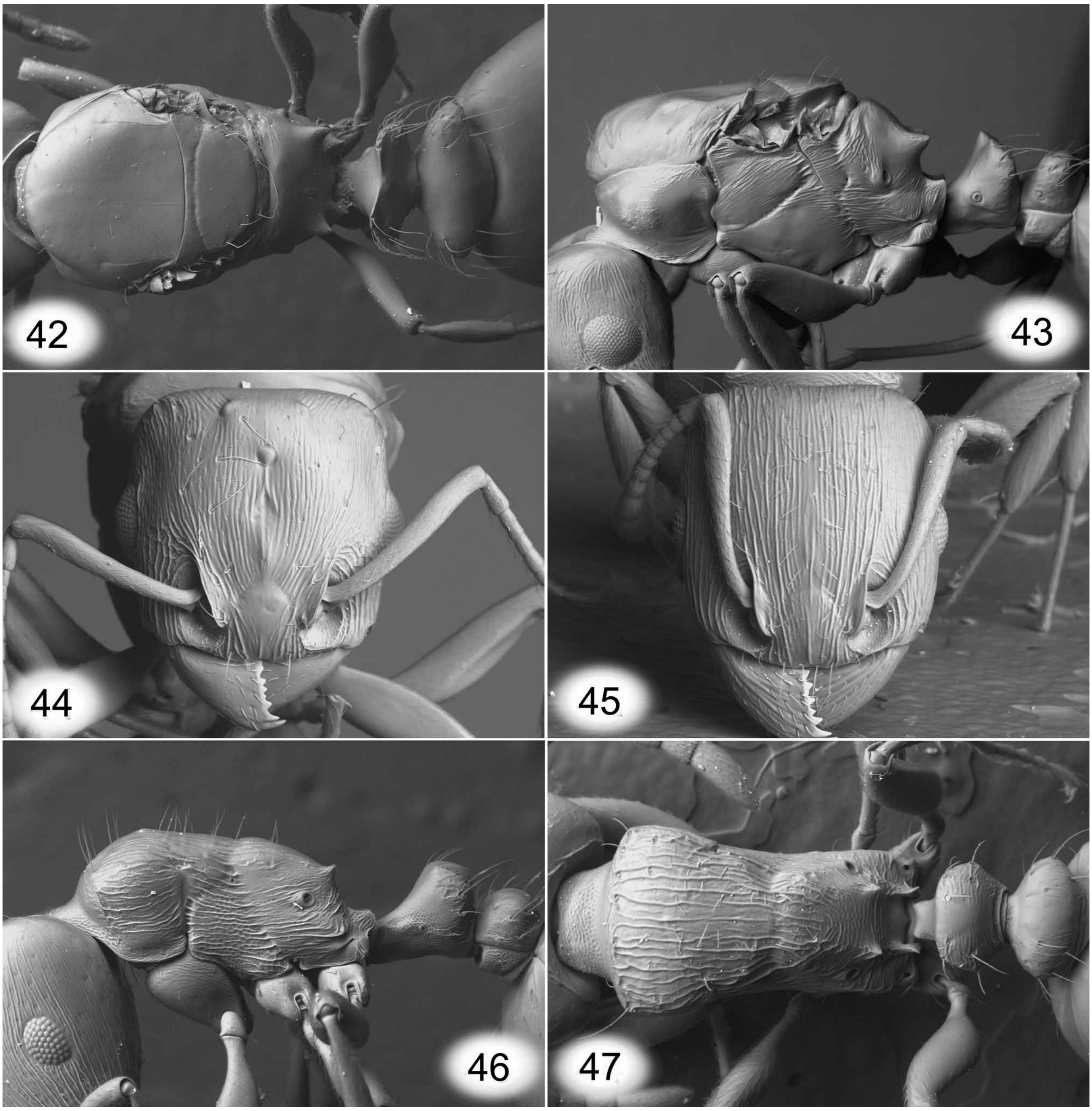
TURKEY—Adana-10km E Carmadi Ala Dag Gebirge 1800–2000mH Tannenwald 70% 31.05.1993. leg. Schulz nr. 958 (6w / HNHM); Aksaray-50km NW Aksaray 10km NW Acipinar 1000 mH Artemisia Steppe, Straßenrand 02.06.1993. leg. Schulz nr. 981 (5w / PCAS); Aydos Dagi, 32rkm SE. Halkapinar, Prov. Konya, 1600–1800mH, 08.05.1997. leg. A. Schulz, K. Vock, M. Sanetra nr. 229 (6w / PCAS, 3w / HNHM); Aykirikçi, Prov. Kütahya, (39,040N/30,120E) 1027mH 12.06.2004. leg. A Schulz nr. 196 (2w, 2q, 2m / PCAS, 3w, 6g, 6m / HNHM); Aykirikçi, Prov. Kütahya, (39,040N/30,120E) 1027mH 12.06.2004. leg. A Schulz nr. 206 (3w / PCAS, 5w, 2m / HNHM); Incesu 2rkm NE., Kayseri 30km SW., Prov. Kayseri, 1100mH 10.05.1997. leg. A. Schulz, K. Vock, M. Sanetra nr. 267 (6w / PCAS, 3w / HNHM); Kars s/Digor 1800m 15.06.1986. leg. Besuchet-Löbl Burckhardt (4w, 1q / PCAS, 1w / HNHM); Kastamonu-10km S Küre 50km N Kastamonu Straßenrand, 1000mH 21.05.1990. leg. Schulz (3w, / PCAS); Kastamonu-10km S Küre 50km N Kastamonu Straßenrand, 1000mH, 21.05.1990. leg. Schulz (6w / HNHM); Kastamonu-10km S Küre 50km N Kastamonu Straßenrand, 1000mH, 21.05.1990. leg. Schulz (6w / PCAS); K'radžali 29.05.1956. leg. R. Bielawski et A. Goljan Inst. Zool. PAN Warszawa nr. 49/56 (4w / HNHM); Kütahya, 30km SSE (39. 122N/ 30.080E) 1140mH 10.06.2004. leg. A. Schulz 147 (3w / PCAS, 3w / HNHM); Sarkisla 15rkm S., Prov. Sivas, (ca. 80km SW. Sivas), 1400mH, 19.05.1997. leg. A. Schulz, K. Vock, M. Sanetra nr. 247 (12w / HNHM); Sultandaglani Mountains, vic. Cankurtaran, (38. 155N/31. 239E) 1750mH 10.05.2003. leg. A. Schulz (3w, 2q / PCAS, 6w, 2g / HNHM); Tasacu, Silifke nr. TR037 14.05.1990. leg. Gallé (10w / HNHM).

Tetramorium feroxoide Dlussky & Zabelin, 1985

Tetramorium feroxoides Dlussky & Zabelin, 1985: 230. Holotype gyne and paratype workers, gynes, males: Turkmenistan, Kopet dag 29.V.1971 Ipaj-Kala (Dlussky) [label: Turkmenia Ipaj-, kala n. 71–117, Dlussky 29.v. 71] (1w, 1q paratype examined) [SIZK].

Tetramorium bursakovi Radchenko, 1992a: 41. Holotype gyne and paratype workers, gynes, males: Kazakhstan, eastern slopes of Karatau, steppe, 13.VI.1979 (S. Bursakov) [labels: N48 13.VI.1979, Juzhnyj Kazakhstan, Vostochnyj otrog Karatau, stepp, sobr. S.Bursakov] (2w, 2q, 2m paratypes examined) [SIZK]. **New synonymy.**

Description of workers (figs 45–47). Medium to large size, CS 755 [683, 855]. Whole body and appendages usually black. Head slightly longer than broad, CL/CW 1.01 [0.99, 1.06], with feebly convex sides, straight posterior margin with widely rounded corners. Eyes large, EYE 0.17 [0.16, 0.20]. Frons wide, FR/CS 0.40 [0.38, 0.42], frontal lobes usually as wide as the frons, FL/FR 1.00 [1.00, 1.04]. Scape long, SL/CS 0.78 [0.75, 0.80], with a feeble dorso-basal carina. Promesonotal dorsum slightly convex, metanotal groove shallow, or completely absent. Propodeal denticles very short. Petiolar node moderately high, NOH/NOL 1.09 [0.76, 1.40] trapezoid in profile.



FIGURES 42–47. *Tetramorium feroxoide* Dlussky & Zabelin, 1985. Gyne mesosoma petiole and postpetiole, dorsal view (Fig. 42), lateral view (Fig. 43); gyne head, dorsal view (Fig. 44); worker head (Fig. 45); worker mesosoma, petiole and postpetiole, lateral view (Fig. 46), dorsal view (Fig. 47).

TABLE 7. Morphometric comparison (µm) of *Tetramorium* workers. Abbreviations of morphometric characters in Material and Methods. Upper line: arithmetic mean ± standard deviation, lower line, in [ ]: minimum and maximum values, n = number of measured specimens.

	ferox (n=128)	*densopilosum* (n=8)	*feroxoide* (n=48)	*diomedeum* (n=227)	*aegeum* (n=3)
CS	825 43 [693, 918]	833 ±45 [763, 878]	755 ±49 [683, 855]	753 ±56 [648, 930]	683 ±31.92 [647.5, 710]
CL/CW	1.03 ±0.02 [0.99, 1.09]	1.04 ±0.01 [1.02, 1.05]	1.01 ±0.02 [0.99, 1.06]	1.02 ±0.02 [0.97, 1.08]	1.04 ±0.01 [1.03, 1.06]
EYE	0.16 ±0.01 [0.15, 0.18]	0.17 ±0.00 [0.17, 0.18]	0.17 ±0.01 [0.16, 0.20]	0.17 ±0.01 [0.14, 0.19]	0.18 ±0 [0.18, 0.18]
POC/CL	0.39 ±0.01 [0.37, 0.43]	0.37 ±0.00 [0.37, 0.38]	0.39 ±0.01 [0.36, 0.41]	0.40 ±0.01 [0.37, 0.42]	0.37 ±0 [0.37, 0.38]
FR/CS	0.39 ±0.01 [0.36, 0.41]	0.40 ±0.01 [0.38, 0.41]	0.40 ±0.01 [0.38, 0.42]	0.38 ±0.01 [0.35, 0.41]	0.4 ±0.01 [0.4, 0.41]
FL/FR	1.01 ±0.01 [1.00, 1.03]	1.00 ±0.01 [1.00, 1.02]	1.00 ±0.01 [1.00, 1.04]	1.00 ±0.01 [0.96, 1.04]	1 ±0 [1, 1]
SL/CS	0.79 ±0.02 [0.74, 0.83]	0.78 ±0.01 [0.76, 0.80]	0.78 ±0.01 [0.75, 0.80]	0.75 ±0.01 [0.73, 0.79]	0.75 ±0 [0.75, 0.75]
ML/MW	1.84 ±0.04 [1.75, 1.96]	1.87 ±0.03 [1.82, 1.90]	1.79 ±0.04 [1.69, 1.87]	1.80 ±0.04 [1.60, 1.95]	1.85 ±0.04 [1.82, 1.9]
CS/ML	0.84 ±0.02 [0.77, 0.87]	0.83 ±0.01 [0.82, 0.86]	0.85 ±0.02 [0.82, 0.90]	0.87 ±0.02 [0.81, 0.97]	0.86 ±0.01 [0.85, 0.88]
PEW/PPW	0.85 ±0.03 [0.79, 0.91]	0.85 ±0.03 [0.82, 0.91]	0.85 ±0.02 [0.78, 0.89]	0.88 ±0.03 [0.81, 0.97]	0.93 ±0.02 [0.91, 0.94]
PEH/NOH	1.80 ±0.08 [1.63, 2.13]	1.78 ±0.09 [1.64, 1.89]	1.81 ±0.06 [1.68, 1.93]	1.91 ±0.08 [1.72, 2.19]	1.81 ±0.02 [1.79, 1.83]
NOH/PEL	0.85 ±0.07 [0.68, 1.03]	0.95 ±0.09 [0.85, 1.09]	0.92 ±0.07 [0.81, 1.09]	0.84 ±0.05 [0.67, 0.97]	0.91 ±0.03 [0.88, 0.94]
NOH/NOL	1.05 ±0.08 [0.88, 1.29]	1.23 ±0.12 [1.06, 1.44]	1.09 ±0.17 [0.76, 1.40]	1.12 ±0.08 [0.96, 1.39]	1.09 ±0.04 [1.04, 1.12]
PEW/NOL	3.21 ±0.18 [2.76, 3.72]	3.09 ±0.21 [2.78, 3.38]	3.52 ±0.49 [2.94, 4.67]	3.51 ±0.19 [3.03, 4.05]	3.1 ±0.04 [3.07, 3.14]
PPW/PPL	1.73 ±0.09 [1.53, 2.05]	1.68 ±0.08 [1.57, 1.83]	1.81 ±0.13 [1.58, 2.21]	1.78 ±0.10 [1.47, 2.06]	1.72 ±0.08 [1.67, 1.81]
PEW/PEH	0.97 ±0.04 [0.85, 1.11]	0.94 ±0.04 [0.90, 1.00]	0.99 ±0.05 [0.88, 1.13]	1.00 ±0.04 [0.88, 1.10]	1 ±0.02 [0.98, 1.02]
CS/PEW	2.85 ±0.12 [2.58, 3.14]	2.87 ±0.07 [2.77, 2.96]	2.76 ±0.19 [2.31, 3.20]	2.85 ±0.14 [2.49, 3.41]	2.73 ±0.07 [2.68, 2.82]
CS/PPW	2.42 ±0.09 [2.21, 2.63]	2.45 ±0.07 [2.32, 2.54]	2.35 ±0.15 [1.93, 2.64]	2.49 ±0.12 [2.20, 2.94]	2.53 ±0.07 [2.45, 2.59]

Head dorsum and posterior surface longitudinally rugulose, microreticulate, and sides ruguloso-reticulate, ground surface feebly microreticulate. Mesosoma dorsum longitudinally rugulose ground surface smooth. Dorsum of petiolar node semi-circularly rugulose, ground surface smooth, dorsum of postpetiole longitudinally rugulose and finely microreticulate. First gastral tergite smooth, appears shiny. Ventral surface of head with a row of short setae and long C-shape hairs arising just posteriorly to buccal cavity forming a psammophore.

Description of gynes (figs 42–44). Medium size, CS 893 [852, 952]. Whole body and appendages black. Head broader than long, CL/CW 0.90 [0.85, 0.93] with sides and posterior margin straight, with widely rounded corners. Head trapezoid in full face view, narrower at genae. Frons wide, FR/CS 0.43 [0.41, 0.45]. Scape long, SL/CS 0.75 [0.72, 0.78], without dorsal carina basally, its surface smooth and shiny. Head slightly narrower than scutum, MW/CS 1.04 [0.97, 1.12]. Propodeal teeth long and blunt. Petiole and postpetiole wide, CS/PEW 1.66 [1.48, 2.16], CS/PPW 1.25 [1.18, 1.56].

TABLE 8. Morphometric comparison (µm) of *Tetramorium* gynes. Abbreviations of morphometric characters in Material and Methods. Upper line: arithmetic mean ± standard deviation, lower line, in [ ]: minimum and maximum values, n = number of measured specimens.

	ferox (n=16)	*densopilosum* (n=3)	*feroxoide* (n=15)	*diomedeum* (n=36)	*aegeum* (n=2)
CS	1000 ±43.55 [955, 1095]	1055 ±36.06 [1025, 1095]	893 ±31.76 [852.5, 952.5]	960 ±40.0 [860, 1012.5]	863 ±8.84 [857, 870]
CL/CW	0.92 ±0.01 [0.90, 0.94]	0.87 ±0.04 [0.83, 0.90]	0.90 ±0.02 [0.85, 0.93]	0.88 ±0.02 [0.85, 0.92]	0.90 ±0.01 [0.90, 0.91]
EYE	0.27 ±0.01 [0.26, 0.28]	0.26 ±0.0 [0.26, 0.27]	0.27 ±0.01 [0.26, 0.28]	0.27 ±0.01 [0.25, 0.28]	0.27 ±0.0 [-]
POC/CL	0.35 ±0.01 [0.34, 0.36]	0.33 ±0.0 [-]	0.35 ±0.01 [0.34, 0.36]	0.35 ±0.01 [0.33, 0.38]	0.33 ±0.01 [0.33, 0.34]
FR/CS	0.40 ±0.01 [0.39, 0.42]	0.40 ±0.01 [0.38, 0.41]	0.43 ±0.01 [0.41, 0.45]	0.42 ±0.02 [0.39, 0.46]	0.44 ±0.0 [-]
SL/CS	0.75 ±0.03 [0.70, 0.81]	0.76 ±0.02 [0.74, 0.78]	0.75 ±0.02 [0.72, 0.78]	0.72 ±0.02 [0.67, 0.76]	0.70 ±0.0 [0.70, 0.71]
ML/MW	1.68 ±0.04 [1.61, 1.74]	1.72 ±0.05 [1.67, 1.77]	1.62 ±0.05 [1.52, 1.68]	1.68 ±0.07 [1.50, 1.80]	1.64 ±0.05 [1.61, 1.67]
CS/ML	0.58 ±0.01 [0.55, 0.60]	0.55 ±0.02 [0.53, 0.56]	0.59 ±0.02 [0.54, 0.63]	0.59 ±0.01 [0.56, 0.63]	0.62 ±0.01 [0.62, 0.63]
PEW/PPW	0.78 ±0.05 [0.69, 0.87]	0.75 ±0.01 [0.74, 0.76]	0.77 ±0.02 [0.74, 0.80]	0.79 ±0.04 [0.63, 0.87]	0.87 ±0.0 [-]
PEH/NOH	1.93 ±0.07 [1.83, 2.02]	1.86 ±0.01 [1.85, 1.86]	1.90 ±0.06 [1.79, 2.02]	1.97 ±0.10 [1.72, 2.27]	1.94 ±0.02 [1.93, 1.95]
NOH/PEL	1.08 ±0.09 [0.96, 1.23]	1.29 ±0.02 [1.27, 1.32]	1.17 ±0.07 [1.05, 1.26]	1.11 ±0.08 [0.95, 1.38]	1.19 ±0.0 [-]
PEW/PEH	1.25 ±0.04 [1.19 ,1.31]	1.16 ±0.03 [1.13, 1.19]	1.25 ±0.10 [1.02 ,1.36]	1.28 ±0.08 [1.01, 1.44]	1.27 ±0.09 [1.20, 1.33]
PEW/PEL	2.60 ±0.19 [2.29, 2.80]	2.77 ±0.05 [2.72, 2.82]	4.74 ±0.36 [4.09, 5.46]	2.77 ±0.23 [2.30, 3.24]	2.93 ±0.25 [2.76, 3.11]
PPW/PPL	2.82 ±0.18 [2.53, 3.20]	2.64 ±0.22 [2.40, 2.84]	2.85 ±0.16 [2.52, 3.22]	2.80 ±0.14 [2.54, 3.13]	2.87 ±0.0 [-]
CS/PEW	1.65 ±0.07 [1.56, 1.78]	1.71 ±0.04 [1.68, 1.75]	1.66 ±0.20 [1.48, 2.16]	1.68 ±0.10 [1.53, 2.09]	1.62 ±0.09 [1.55, 1.68]
CS/PPW	1.29 ±0.09 [1.11, 1.43]	1.28 ±0.04 [1.24, 1.33]	1.25 ±0.10 [1.18, 1.56]	1.33 ±0.05 [1.24, 1.42]	1.35 ±0.0 [-]

Head dorsum, posterior surface and sides rugulose, ground surface feebly microreticulate, or smooth and shiny. Frons longitudinally rugulose, ground surface smooth and shiny. Scutum smooth and shiny (or finely rugulose), scutellum longitudinally rugulose, with the median part smooth and shinny. Sides of mesosoma rugoso-reticulate and microreticulate, ventral part of katepisternum always finely rugulose, or microreticulate. Petiolar node and postpetiole reticulate, or microreticulate. Ventral surface of head with a row of short setae and long C-shape hairs arising just posteriorly to buccal cavity forming a psammophore.

Description of males. Head sides feebly convex, posterior margin widely rounded. Scutum much broader than head. Propodeal denticles reduced, propodeum rounded in profile. Dorsum of petiolar node without a transverse crest, with a sharp angle dorsolaterally. Whole body and appendages brownish black. Head finely rugulo-reticulate, between main sculpturation microreticulate. Scutum and scutellum finely rugulose, in part smooth. Anepisternum rugulose, ventral part of katepisternum smooth and shiny. Petiole and postpetiole finely rugulo-reticulate, between main sculpturation microreticulate.

Diagnosis. The very smooth surface of mesosoma, the relatively sparse pubescence and the smooth and shiny first gastral tergite make the *T. feroxoide* gynes unique within this group.

The general appearance of the head and mesosoma of *T. feroxoide* workers is always finely rugulose, in comparison the head of *T. diomedeum* is at least partly smooth.

Tetramorium feroxoide workers bear usually much feebler and often parallel rugulae on head and mesosoma than *T. ferox* and *T. densopilosum* workers, but in a few cases *T. feroxoide* workers can be confused with the smallest *T. ferox* or *T. densopilosum* workers in this characteristic. Discriminant D(3a) function proves the separation between *T. feroxoide* and *T. densopilosum* (see differential diagnosis of *T. densopilosum*) and D(3b) function between *T. feroxoide* and *T. ferox* (see differential diagnosis of *T. ferox*).

For the results of cumulative discriminant analysis for worker caste see Tables 3 & 4 and for gynes see Tables 5 & 6. Morphometric characters and indices for workers and gynes are provided in Table 7 & 8.

Distribution. Middle East between- and south from the Caspian Sea and the Black Sea. This species is possibly a Turanian element.

Material examined. ARMENIA—Aragats okr. Gjurakana, 19.06.1988. leg. Radchenko nr. 197.88. (2w, 5q, 2m / ZISP);

IRAN—Guilán s/Ástárá 1200 m 38º24'N/48º36'E, A. Senglet 26. VI. 73. (1q);

KYRGIZIA—Alatskaia, Kyrgizia, 16.06.1963 leg. Tarbinskij (3w, 1q, 1m);

RUSSIA—Neftekumsk, Achikulak, Stavropolskij kraj 08.06.2006. leg Csősz nr. Rus_009 (12w / HNHM);

TURKEY—Prov. Gaziantep, 7 km N Islahiye, ca.70 km W Gaziantep, 500mH, 11.05.1997., leg. A. Schulz, K. Vock, M. Sanetra nr. T705-31. (3 w); Kars, Yerköy, 10 km E Tuzluca 30 km NW Igdir, 1000mH Steppe 23.06.1993. leg. Schulz nr. 1119. (3 w, 5 q, 3 m); Kayseri, Sultan Salz Sümpfe 10 km W Develi, 40 km S Kayseri Artemisia Steppe 1000mH 01.06.1993. leg. Schulz nr. 968. (6 w, 1 q); Kayseri, Sultan Salz Sümpfe 10 km W Develi, 40 km S Kayseri, Artemisia Steppe 1000mH 01.06.1993. leg. Schulz nr. 965. (6 w, 4 q, 3m); Kayseri, Sultan Salz Sümpfe 10 km W Develi, 40 km S Kayseri, Artemisia Steppe 1000mH 01.06.1993. leg. Schulz nr. 966. (12 w).

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