

FOUR NEW *MYRMICA* SPECIES (HYMENOPTERA: FORMICIDAE) FROM TURKEY

GRAHAM W. ELMES¹, ALEXANDER RADCHENKO² and NIHAT AKTAÇ³

¹Centre for Ecology & Hydrobiology, Winfrith Technology Centre, Winfrith Newburg, Dorchester, Dorset DT2 8ZD, United Kingdom; e-mail: gwe@ceh.ac.uk

²Museum and Institute of Zoology, Polish Academy of Sciences, 64, Wilcza str., 00-679, Warsaw; e-mail: rad@usenc.kiev.ua, agradchenko@hotmail.com

³Trakya University, Faculty of Art and Sciences, Department of Biology, 22030, Edirne, Turkey; e-mail: nihata@trakya.edu.tr

Abstract.— Four new *Myrmica* species (*M. tulinae*, *M. jennyae*, *M. tamarae* and *M. anatolica*) are described from Turkey. Their taxonomic position is discussed and ecological data is provided. *M. tulinae* belongs to the *scabrinodis*-group of *Myrmica* species and the other three species belong to the *lobicornis*-group. All four species are probably endemic to the region but *M. jennyae* and *M. tamarae* appear to have certain unusual features which suggest they might be quite old species.



Key words.— Ants, Formicidae, *Myrmica*, taxonomy, Turkey, new species.

INTRODUCTION

Ants belonging to the genus *Myrmica* Latreille are widespread and abundant in the Holarctic region. The genus in Eurasia currently comprises 111 species and 14 subspecies – based on Bolton (1995) and adding to his list 23 new species from the Himalaya, Korea, Taiwan, Southern China and Northern Vietnam and taking account of recent synonymies (Radchenko 1994a,b,d–f; Radchenko and Elmes 1998, 1999, 2001a, 2001b; Elmes and Radchenko 1998; Radchenko et al. 2001; Elmes et al. 2001). The Eurasian *Myrmica* species have been ordered as species groups which to some extent reflects the relationship within and between the groups (see Radchenko 1994b; Radchenko and Elmes 2001b). The majority of *Myrmica* species are found in natural and semi-natural forest, meadow and wetland biotopes of the temperate zone and although the genus includes a few hemi-xerophilous and galophilous steppe species, it has no true desert and semi-desert dwellers. In mountains *Myrmica* ants have been recorded at altitudes up to 3600 m in the Pamirs and 4500–4800 m in the Himalaya and Tibet (see Radchenko and Elmes 2001b). All species of *Myrmica* are generalist scavengers and predators. Colonies usually contain from several hundred to several thousand workers and from one to tens or even hundreds, of queens (Wardlaw and Elmes 1996). Nests are most frequently constructed in soil, often under stones, with moss, rotting wood and occasionally leaf litter being

used, particularly in woodlands and wetter habitats (Elmes 1991).

Fifteen *Myrmica* species have been recorded from Turkey (Santschi 1921, 1931, Donisthorpe 1950, Aktaş 1976, 1988, Agosti and Collingwood 1987, Aktaş et al. 1994) some of which need confirmation being possible misidentifications. One of us (Aktaş) has collected ants, including *Myrmica*, extensively from Turkey for many years while another (Elmes) has recently collected *Myrmica* intensively from northeast Turkey. This material forms the basis of a revision of Turkish *Myrmica* fauna (in preparation); four species new to science are described below.

MATERIALS AND METHODS

The *Myrmica* examined comprised several hundred workers and some tens of gynes/queens of four new species, and males from three of these. Collection details are given with the descriptions. A holotype of each species is deposited in the Collection of Biological Department of the Trakya University, Edirne, Turkey (TU). The paratypes are in the collections of TU, Institute of Zoology of the Ukrainian National Academy of Sciences, Kiev (IZK), Museum and Institute of Zoology of the Polish Academy of Sciences, Warsaw (MIIZ) and G. W. Elmes, UK (ELMES).

Following previous publications (e.g. Radchenko and Elmes 1998), various morphometrics of a sample of spec-

imens from each caste, were measured (accurate 0.01mm). Indices calculated from these are compared with related species (see Tables and Discussion). The following abbreviations are used:

Morphometrics

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

Indices

- Cephalic CI = HL / HW
 Frontal FI = FW / HW
 Frontal lobe FLI = FLW / FW
 Scape (1) $SI_1 = SL / HL$
 Scape (2) $SI_2 = SL / HW$
 Petiole (1) $PI_1 = PL / PH$
 Petiole (2) $PI_2 = PL / HW$
 Postpetiole (1) $PPI_1 = PPL / PPH$
 Postpetiole (2) $PPI_2 = PPH / PPW$
 Postpetiole (3) $PPI_3 = PPW / PW$
 Postpetiole (4) $PPI_4 = PPW / HW$
 Spine-length ESLI = ESL / HW
 Spine-width ESDI = ESD / ESL
 Hind-tibia HTI = HTL / HW

$$\text{Alitrunk AI} = AL / AH$$

$$\text{Scutum SCI} = SCL / SCW$$

TAXONOMY

Myrmica tulinae sp. nov.

(Figs 1–18)

Workers (Figs 1–7; measurements and indices in Tables 1a and 2a). Head slightly longer than broad, with weakly convex sides and occipital margin, and rounded occipital corners. Anterior clypeal margin broadly rounded, not prominent and without notch medially. Frontal carinae strongly curved, frons quite narrow (similar to that of *M. sabuleti* Meinert). Antennal scape relatively short, strongly angulate at its base, with quite large horizontal lobe (similar to that of *M. sabuleti*). Mandibles with 7–9 teeth.

Alitrunk with slightly flattened promesonotal dorsum; promesonotal suture indistinct from above; metanotal groove distinct, wide and deep. Propodeal spines relatively long, acute and straight, not curving downwards, wide at base, not divergent (seen from above), projecting backwards at an angle less than 45°. In profile, anterior surface of petiole concave, meets with dorsal surface at an angle about 90°; dorsal surface flattened, inclined posteriorly, forming distinct plate. Postpetiole somewhat shorter than high, with convex dorsum. Spurs on middle and hind tibiae (at least in part of type series) partly reduced and with reduced pectination.

Head dorsum with longitudinal, divergent rugae, only occiput with reticulation. Antennal sockets usually not surrounded by rugae, or at most only fine concentric striation. Clypeus with fine longitudinal rugulae. Alitrunk with longitudinal, more or less straight rugae but pronotal dorsum with more sinuous rugae. Rugae on petiole longitudinal, those of postpetiole longitudinally-concentric. Surfaces between rugae on the body smooth and shiny.

Hairs of the head margins and alitrunk dorsum abundant, erect to suberect, quite long and slightly curved; antennal scape with suberect and tibiae with short sub-decumbent hairs.

The overall colour reddish, appendages somewhat lighter.

Queens (Figs 8–13; measurements and indices in Tables 1b and 2b). Generally like workers in shape of head, character of sculpture, colour and pilosity of the body except they have a relatively slightly wider head (compare indices in Tables 2a and 2b), slightly coarser sculpture, a more or less straight anterior surface of the petiole, and propodeal spines that are wider at their base.

Males (Figs 14–18; measurements and indices in Tables 1b and 2b). Head usually (but not always) slightly longer than broad, with convex occipital margin and sides, and gradually rounded occipital corners; anterior clypeal margin widely rounded, not prominent medially. Frontal

	<i>Myrmica tulinae</i> (30)			<i>Myrmica jennyae</i> (30)			<i>Myrmica tamarae</i> (16)			<i>Myrmica anatolica</i> (32)		
	Holotype	mean	range	Holotype	mean	range	Holotype	mean	range	Holotype	mean	range
HL	1.10	1.08	1.00 – 1.20	1.06	1.01	0.94 – 1.08	1.06	1.01	0.98 – 1.13	1.12	1.06	0.90 – 1.16
HW	1.02	0.98	0.88 – 1.08	0.88	0.83	0.76 – 0.90	0.94	0.92	0.86 – 0.98	0.98	0.94	0.78 – 1.06
FW	0.34	0.33	0.29 – 0.36	0.47	0.44	0.41 – 0.48	0.38	0.37	0.34 – 0.41	0.38	0.37	0.31 – 0.42
FLW	0.51	0.50	0.46 – 0.54	0.53	0.50	0.45 – 0.55	0.42	0.41	0.37 – 0.45	0.46	0.45	0.37 – 0.49
SL	0.88	0.85	0.80 – 0.92	0.80	0.77	0.72 – 0.82	0.88	0.89	0.84 – 0.94	0.88	0.81	0.70 – 0.90
AL	1.60	1.53	1.38 – 1.74	1.42	1.37	1.26 – 1.46	1.54	1.54	1.44 – 1.62	1.56	1.50	1.28 – 1.64
HTL	0.82	0.79	0.72 – 0.88	0.72	0.68	0.62 – 0.74	0.76	0.78	0.70 – 0.84	0.84	0.79	0.66 – 0.86
PNW	0.72	0.69	0.62 – 0.74	0.64	0.61	0.56 – 0.66	0.70	0.68	0.63 – 0.74	0.74	0.70	0.58 – 0.76
PL	0.50	0.48	0.43 – 0.53	0.43	0.41	0.37 – 0.44	0.44	0.43	0.41 – 0.52	0.46	0.43	0.34 – 0.47
PW	0.32	0.30	0.26 – 0.33	0.28	0.27	0.23 – 0.28	0.28	0.27	0.25 – 0.29	0.30	0.28	0.24 – 0.32
PH	0.40	0.38	0.33 – 0.42	0.34	0.32	0.30 – 0.35	0.37	0.36	0.34 – 0.39	0.38	0.37	0.31 – 0.42
PPL	0.35	0.33	0.30 – 0.38	0.33	0.32	0.30 – 0.35	0.34	0.33	0.29 – 0.36	0.34	0.32	0.26 – 0.35
PPW	0.47	0.44	0.39 – 0.49	0.40	0.39	0.36 – 0.40	0.43	0.42	0.39 – 0.46	0.43	0.42	0.35 – 0.48
PPH	0.48	0.45	0.38 – 0.50	0.41	0.40	0.38 – 0.43	0.44	0.43	0.39 – 0.46	0.46	0.44	0.36 – 0.49
ESL	0.95	0.41	0.35 – 0.46	0.38	0.35	0.30 – 0.38	0.26	0.27	0.24 – 0.29	0.34	0.34	0.25 – 0.38
ESD	0.57	0.46	0.38 – 0.54	0.44	0.43	0.36 – 0.47	0.40	0.40	0.37 – 0.43	0.48	0.44	0.34 – 0.51

Table 1a. The mean and range of morphometrics (mm) of the holotype and a sample of paratype workers (number in parenthesis) of four new *Myrmica* species from Turkey.

	<i>Myrmica tulinae</i>				<i>Myrmica jennyae</i>				<i>Myrmica tamarae</i>	<i>Myrmica anatolica</i>			
	Queens (8)		Males (12)		Queens (19)		Males (4)		Queen (1)	Queens (8)		Males (23)	
	mean	range	mean	range	mean	range	mean	range		mean	range	mean	range
HL	1.25	1.22 – 1.30	0.94	0.82 – 0.98	1.12	1.08 – 1.15	0.84	0.80 – 0.87	1.20	1.15	1.10 – 1.20	0.89	0.80 – 0.93
HW	1.15	1.12 – 1.20	0.90	0.78 – 0.95	0.95	0.92 – 0.99	0.77	0.74 – 0.79	1.08	1.06	1.00 – 1.12	0.86	0.80 – 0.90
FW	0.41	0.39 – 0.43			0.49	0.48 – 0.50			0.44	0.41	0.40 – 0.43		
FLW	0.59	0.56 – 0.63			0.56	0.55 – 0.58			0.47	0.49	0.47 – 0.52		
SL	0.92	0.88 – 0.94	0.35	0.30 – 0.36	0.82	0.80 – 0.84	0.66	0.63 – 0.68	0.92	0.88	0.86 – 0.90	0.70	0.63 – 0.77
AL	1.96	1.90 – 2.08	2.15	1.74 – 2.30	1.64	1.58 – 1.71	1.54	1.48 – 1.58	1.65	1.77	1.70 – 1.88	1.65	1.54 – 1.76
HTL	0.93	0.88 – 0.96	1.18	0.94 – 1.26	0.77	0.74 – 0.80	0.89	0.84 – 0.92	0.90	0.87	0.84 – 0.92	0.88	0.82 – 0.92
PL	0.63	0.60 – 0.65	0.58	0.47 – 0.65	0.49	0.47 – 0.52	0.42	0.41 – 0.43	0.55	0.54	0.49 – 0.57	0.46	0.43 – 0.50
PW	0.41	0.39 – 0.42	0.40	0.32 – 0.43	0.31	0.29 – 0.33	0.29	0.27 – 0.31	0.37	0.34	0.32 – 0.36	0.32	0.28 – 0.34
PH	0.51	0.50 – 0.53	0.49	0.38 – 0.55	0.41	0.39 – 0.42	0.38	0.36 – 0.39	0.48	0.47	0.45 – 0.50	0.40	0.35 – 0.42
PPL	0.42	0.40 – 0.45	0.41	0.31 – 0.45	0.37	0.35 – 0.38	0.33	0.31 – 0.35	0.41	0.39	0.38 – 0.40	0.35	0.31 – 0.40
PPW	0.63	0.61 – 0.65	0.56	0.44 – 0.59	0.46	0.44 – 0.48	0.42	0.39 – 0.43	0.55	0.52	0.50 – 0.55	0.45	0.41 – 0.50
PPH	0.61	0.59 – 0.63	0.57	0.46 – 0.61	0.48	0.45 – 0.50	0.43	0.41 – 0.45	0.57	0.53	0.51 – 0.56	0.47	0.42 – 0.53
ESL	0.41	0.39 – 0.42			0.35	0.32 – 0.41			0.30	0.36	0.32 – 0.39		
ESD	0.58	0.51 – 0.60			0.49	0.43 – 0.53			0.52	0.53	0.47 – 0.59		
AH	1.18	1.12 – 1.26	1.26	0.96 – 1.33	0.96	0.92 – 0.99	0.97	0.94 – 1.00	1.18	1.13	1.06 – 1.18	1.09	1.00 – 1.18
SCW	1.02	0.98 – 1.04	1.11	0.90 – 1.22	0.82	0.78 – 0.87	0.80	0.78 – 0.82	0.96	0.93	0.90 – 0.96	0.87	0.80 – 0.94
SCL	1.40	1.36 – 1.46	1.51	1.38 – 1.58	1.14	1.10 – 1.18	1.10	1.02 – 1.14	1.40	1.26	1.20 – 1.36	1.19	1.10 – 1.24

Table 1b. The mean and range of morphometrics (mm) from samples of paratype queens and males (number in parenthesis) of four new *Myrmica* species from Turkey.

carinae not strongly curved. Antennal scape very short (even shorter than in *M. scabrinodis* Nylander), antennae 13-jointed, antennal club distinctly 5-jointed. Masticatory margin of mandibles distinct, with 5–7 acute teeth.

Alitrunk relatively long, scutum convex, and scutellum does not project dorsally above scutum when seen in profile. Propodeum with blunt rounded denticles. In profile, petiole relatively high, with narrowly rounded dor-

	<i>Myrmica tulinae</i> (30)			<i>Myrmica jennyaee</i> (30)			<i>Myrmica tamarae</i> (16)			<i>Myrmica anatolica</i> (32)		
	Holotype	mean	range	Holotype	mean	range	Holotype	mean	range	Holotype	mean	range
CI	1.08	1.11	1.06 – 1.16	1.20	1.22	1.19 – 1.25	1.13	1.15	1.10 – 1.20	1.14	1.13	1.08 – 1.17
FI	0.33	0.34	0.30 – 0.37	0.53	0.53	0.51 – 0.55	0.40	0.41	0.39 – 0.44	0.39	0.39	0.36 – 0.41
FLI	1.50	1.53	1.37 – 1.77	1.13	1.14	1.09 – 1.19	1.11	1.11	1.08 – 1.18	1.21	1.23	1.14 – 1.31
SI1	0.80	0.79	0.74 – 0.82	0.75	0.77	0.73 – 0.80	0.83	0.84	0.80 – 0.88	0.79	0.76	0.72 – 0.80
SI2	0.86	0.87	0.82 – 0.93	0.91	0.93	0.88 – 0.98	0.94	0.97	0.92 – 1.01	0.90	0.86	0.81 – 0.90
PI1	1.25	1.25	1.13 – 1.33	1.26	1.25	1.14 – 1.33	1.19	1.20	1.10 – 1.49	1.21	1.56	1.07 – 1.23
PI2	0.49	0.49	0.47 – 0.51	0.49	0.49	0.45 – 0.52	0.47	0.48	0.44 – 0.59	0.47	0.45	0.42 – 0.47
PPI1	0.73	0.74	0.69 – 0.84	0.80	0.80	0.75 – 0.89	0.77	0.78	0.74 – 0.81	0.74	0.74	0.69 – 0.83
PPI2	1.02	1.01	0.95 – 1.07	1.03	1.04	0.95 – 1.11	1.02	1.01	1.00 – 1.07	1.07	1.03	0.97 – 1.10
PPI3	1.47	1.46	1.33 – 1.54	1.43	1.46	1.39 – 1.57	1.54	1.55	1.46 – 1.61	1.43	1.49	1.38 – 1.59
PPI4	0.46	0.45	0.43 – 0.48	0.45	0.47	0.43 – 0.50	0.46	0.46	0.43 – 0.51	0.44	0.45	0.41 – 0.48
ESLI	0.44	0.42	0.40 – 0.45	0.43	0.42	0.37 – 0.45	0.28	0.29	0.26 – 0.32	0.35	0.36	0.29 – 0.40
ESDI	1.13	1.11	0.91 – 1.24	1.16	1.23	1.06 – 1.39	1.54	1.52	1.36 – 1.79	1.41	1.32	1.08 – 1.79
HTI	0.80	0.81	0.76 – 0.87	0.82	0.82	0.76 – 0.87	0.77	0.86	0.77 – 0.91	0.86	0.84	0.78 – 0.89

Table 2a. The indices for the holotype and the range of indices for a sample of paratype workers (number in parenthesis) of four new *Myrmica* species from Turkey.

	<i>Myrmica tulinae</i>				<i>Myrmica jennyaee</i>				<i>Myrmica tamarae</i>	<i>Myrmica anatolica</i>			
	Queens (8)		Males (12)		Queens (19)		Males (4)		Queen (1)	Queens (8)		Males (23)	
	mean	Range	mean	range	mean	range	mean	range		mean	range	mean	range
CI	1.08	1.07 – 1.11	1.04	1.00 – 1.06	1.17	1.15 – 1.24	1.09	1.08 – 1.10	1.11	1.09	1.05 – 1.12	1.04	0.97 – 1.08
FI	0.36	0.33 – 0.38			0.52	0.51 – 0.53			0.41	0.39	0.36 – 0.40		
FLI	1.42	1.33 – 1.58			1.14	1.12 – 1.16			1.07	1.18	1.14 – 1.22		
SI1	0.73	0.72 – 0.75	0.37	0.36 – 0.38	0.73	0.70 – 0.75	0.80	0.78 – 0.81	0.77	0.77	0.73 – 0.80	0.78	0.72 – 0.84
SI2	0.79	0.78 – 0.81	0.38	0.37 – 0.40	0.86	0.83 – 0.87	0.86	0.85 – 0.87	0.85	0.83	0.80 – 0.86	0.81	0.74 – 0.89
PI1	1.22	1.20 – 1.24	1.19	1.08 – 1.27	1.22	1.15 – 1.28	1.12	1.10 – 1.17	1.15	1.15	1.09 – 1.27	1.16	1.07 – 1.26
PI2	0.54	0.53 – 0.56	0.65	0.58 – 0.73	0.52	0.50 – 0.54	0.55	0.53 – 0.57	0.51	1.51	0.48 – 0.54	0.54	0.50 – 0.58
PPI1	0.69	0.65 – 0.75	0.73	0.67 – 0.78	0.78	0.73 – 0.83	0.77	0.73 – 0.81	0.72	0.73	0.69 – 0.77	0.75	0.68 – 0.85
PPI2	0.97	0.92 – 1.00	1.02	0.98 – 1.05	1.03	1.00 – 1.09	1.03	1.00 – 1.05	1.04	1.03	1.00 – 1.08	1.05	0.94 – 1.14
PPI3	1.55	1.48 – 1.59	1.41	1.33 – 1.53	1.48	1.39 – 1.55	1.43	1.39 – 1.48	1.49	1.52	1.47 – 1.58	1.42	1.33 – 1.54
PPI4	0.55	0.52 – 0.58	0.62	0.56 – 0.67	0.48	0.46 – 0.50	0.55	0.53 – 0.56	0.51	0.49	0.45 – 0.52	0.52	0.49 – 0.56
ESLI	0.36	0.35 – 0.37			0.37	0.34 – 0.41			0.28	0.34	0.31 – 0.35		
ESDI	1.41	1.27 – 1.49			1.38	1.20 – 1.52			1.73	1.50	1.21 – 1.76		
HTI	0.80	0.78 – 0.82	1.31	1.21 – 1.37	0.81	0.79 – 0.84	1.15	1.14 – 1.17	0.83	0.82	0.78 – 0.84	1.02	0.93 – 1.08
AI	1.67	1.61 – 1.73	1.71	1.63 – 1.85	1.71	1.63 – 1.79	1.59	1.54 – 1.63	1.68	1.58	1.49 – 1.66	1.52	1.44 – 1.64
SCI	1.37	1.33 – 1.40	1.36	1.24 – 1.53	1.39	1.35 – 1.42	1.37	1.31 – 1.43	1.46	1.37	1.28 – 1.43	1.36	1.28 – 1.45

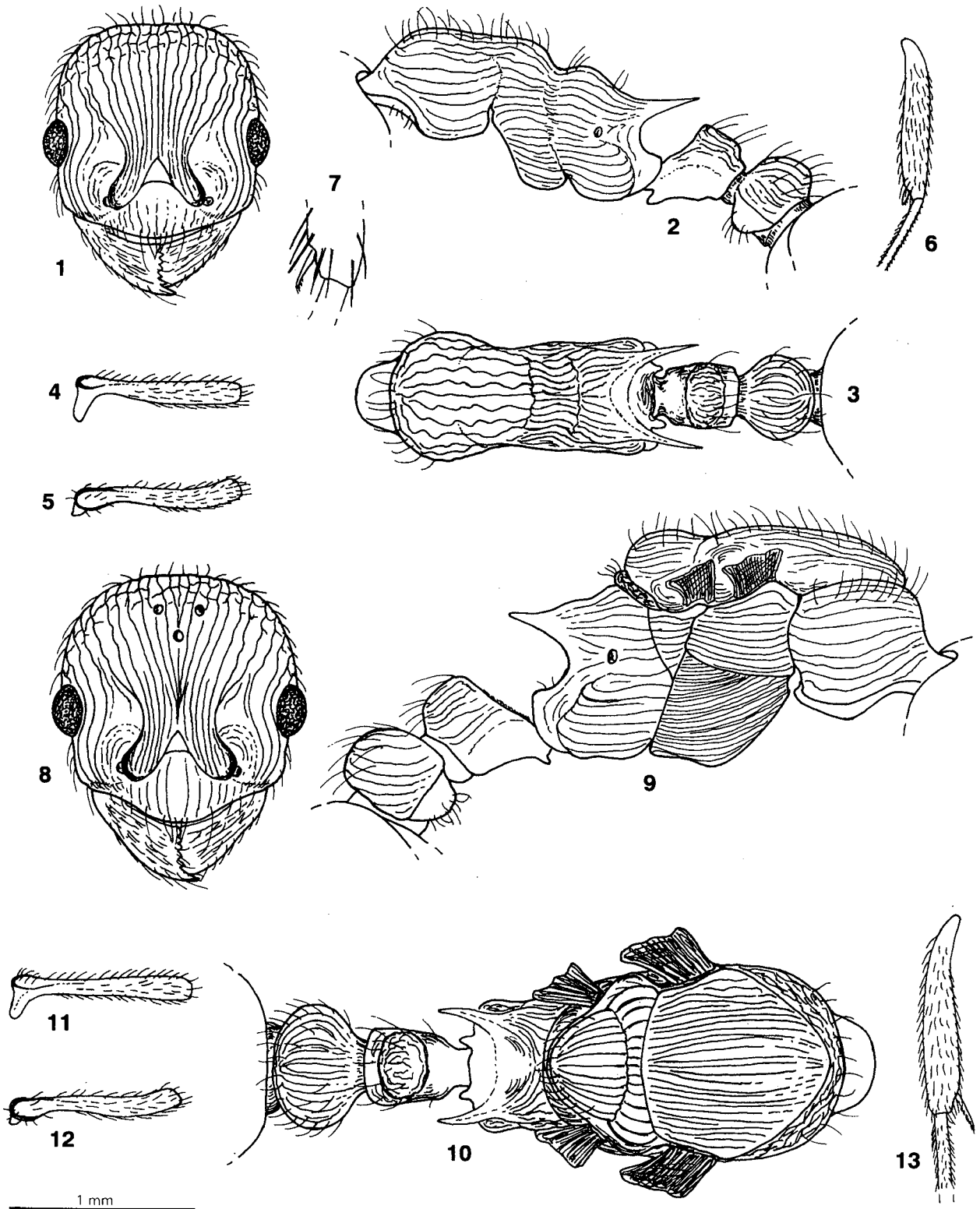
Table 2b. The indices for queen and male paratypes (number in parenthesis) of four new *Myrmica* species from Turkey.

sum of node, its anterior surface straight; postpetiole higher than long, with convex dorsum.

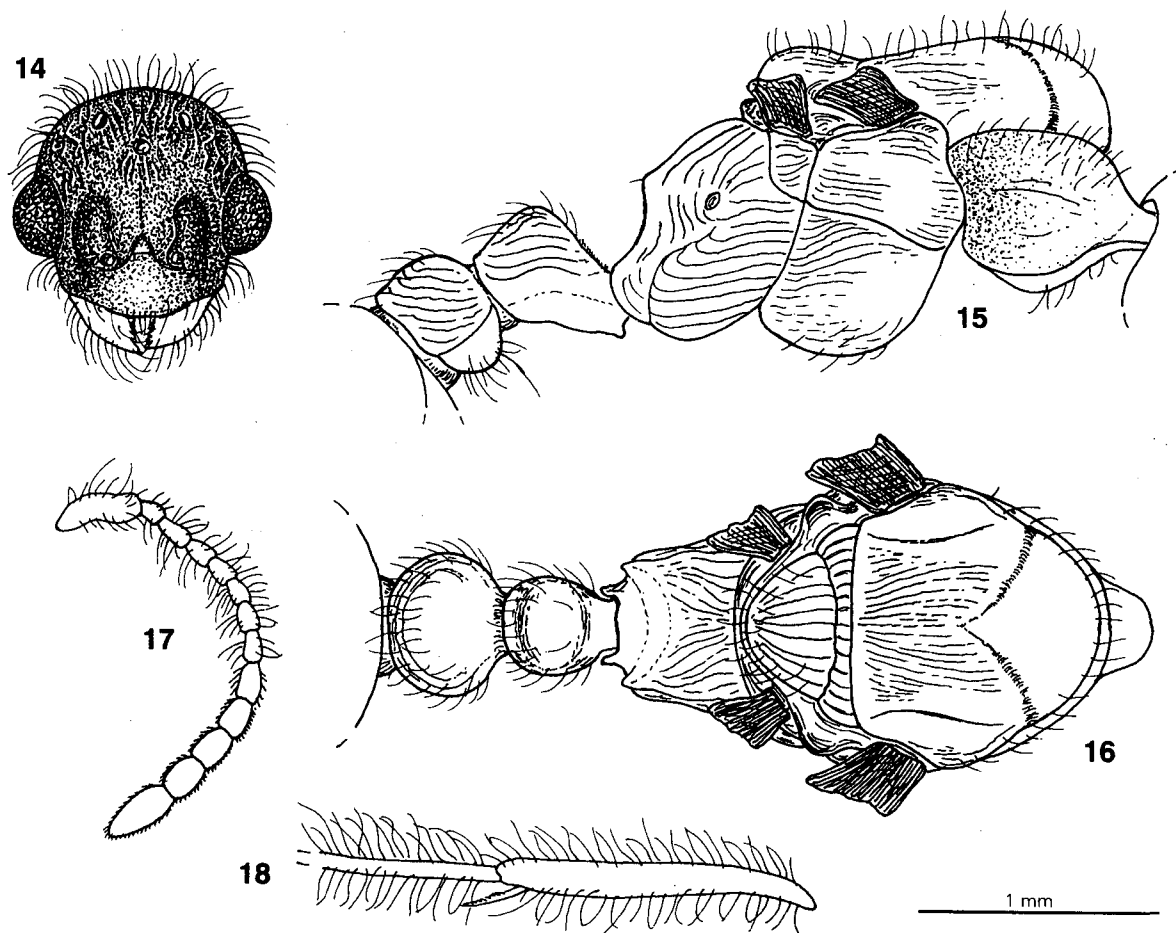
Frons and lateral parts of head dorsum with fine longitudinal rugulae; surface of head densely punctured, appearing dull; clypeus with finer punctation; short sinuous rugae and reticulation only on rear (upper) part of head dorsum. Central part of scutum behind Mayr's furrows with fine longitudinal striation; scutellum longitudinally rugulose. Pro- and mesopleurae with fine striation, propodeum more densely rugulose. Sides of petiole

and postpetiole with longitudinal rugae, their dorsal surfaces with only fine striation. Surface of alitrunk and waist between striation and rugae smooth and shiny, only propleurae with fine punctation.

Head margins and mandibles with very long, abundant, curved erect hairs. Alitrunk, petiole, postpetiole and gaster with less abundant and shorter erect to suberect hairs. Legs with very long, curved erect hairs (like *M. scabrinodis*); antennal scape and first 7 funicular joints with long, curved erect hairs, joints of antennal



Figures 1-13. Details of structure of *M. tulinae* (1-7 holotype, worker). (1) Head, frontal view; (2) alitrunk and waist in profile; (3) alitrunk and waist from above; (4) antennal scape in profile; (5) antennal scape from above; (6) hind tibia; (7) spoor of hind tibia. (8-13 paratype, queen). (8) Head, frontal view; (9) alitrunk and waist in profile; (10) alitrunk and waist from above; (11) antennal scape in profile; (12) antennal scape from above; (13) hind tibia.



Figures 14–18. Details of structure of *M. tulinae* (paratype, male). (14) Head, frontal view; (15) alitrunk and waist in profile; (16) alitrunk and waist from above; (17) antenna; (18) hind tibia and tarsus.

club with very short subdecumbent hairs. Colour of body blackish-brown to black, appendages somewhat lighter.

Types. Holotype worker, Turkey, Thrace, Kırklareli District, near Bulgarian border, alt. 380 m, 24.viii.1999, TR-59 (leg. J. E. & G. W. Elmes) (TU); paratypes: 49 workers, 3 gynes, 18 males from the nest of holotype; 10 workers, same locality, date and collectors, TR-60; 24 workers, 3 males, same locality and date, No 99/1721 (leg. K. Kiran); 17 workers, same locality and date, No. 99/1722 (leg. K. Kiran); 30 workers, 1 gyne, 1 male, same locality and date, No. 99/1723 (leg. K. Kiran); 20 workers, 3 males, Turkey, Thrace, 53 km east Kırklareli, Vize - Sergen Koyu, 06.ix.1988 (leg. N. Aktaş); 9 workers, Turkey, Thrace, Kırklareli, Dereköy, 18.iv.1989, No. 89/16 (leg. N. Aktaş); 1 worker, 1 gyne, Turkey, Thrace, Kırklareli, Pehlivan köy-Kuştepe köyü, 01.x.1996, No. 96/124 (leg. N. Aktaş); 60 workers, 15 gynes, 2 males, NE Turkey, south edge of Artvin Region, high pass ca. 10 km N of Ardesen, alt. 2150 m, 15.viii.2000, TR-123 (leg. G. W. Elmes) (TU, MIZ, IZK, ELMES).

Taxonomic position. The workers and gynes/queens of *M. tulinae* most resemble those of *M. sabuleti* using the

discriminatory characteristics of the *scabrinodis*-group (Radchenko, 1994c). The shape of antennal scape, including the lobe, resembles that of *M. sabuleti* (Figs 4, 5, 11, 12) and is distinctly larger than in typical *M. scabrinodis*. The relative distance between the frontal lobes (both FI and FLI) are smaller than in *M. scabrinodis* and perhaps, smaller than "typical" *M. sabuleti* (Figs 1, 8). The shape of the propodeal spines and petiole, body sculpture, etc. is typical for *M. scabrinodis* (Figs 2, 3, 9, 10), one exception observed in most of the worker series studies is the reduction in development of the spurs, especially the pectination, of the middle and hind tibiae (Fig. 7).

In contrast, males of *M. tulinae* clearly differ from those of *M. sabuleti* by having much shorter antennal scapes (Fig. 17; $SI_1 < 0.39$ and $SI_2 < 0.40$ compared to > 0.50 and > 0.51 respectively for *M. sabuleti*) and by much longer standing hairs on the antennal scape and especially on the tibiae and tarsi (Figs 17, 18). However, by these features males of *M. tulinae* are very similar to those of *M. scabrinodis* and could easily be confused with them if found without female castes. We found only one feature that more or less separates *M. tulinae* males

from *M. scabrinodis*: their antennal scape is even shorter than that of *M. scabrinodis* ($SI_1=0.36-0.38$, $SI_2=0.37-0.40$ versus $0.38-0.40$ and $0.39-0.42$ in Turkish populations of *M. scabrinodis*). Thus, one needs both workers and males to be absolutely sure of correct identification of *M. tulinae*. Unfortunately, this situation is quite common for *scabrinodis*-group, for example, *M. vandeli* Bondroit for which the situation is completely reversed with males that can be confused with those of *M. sabuleti* and workers that are similar to *M. scabrinodis*.

Ecology. The four colonies from Thrace (which provided the holotype) collected in 1999, were nesting in damp, coarse-sandy soil in a small plantation (*Populus* sp.), where they made raised mounds (ca. 20 cm diameter and 10 cm high). The earlier Thracian samples were taken from Oak forest and *Ulmus-Fraxinus* forest. Those from NE Turkey were living under stones in alpine meadow. The general impression of *M. tulinae* nests is similar to those of *M. sabuleti*, a species that the females resemble morphologically. However, *M. tulinae* appears to prefer slightly damper conditions than *M. sabuleti*.

Etymology. This species is dedicated to Tülin, wife of Nihat Aktaş.

Myrmica jennyae sp. nov.
(Figs 19–33)

Workers (Figs 19–23; measurements and indices in Tables 1a and 2a). Head longer than broad, with weakly convex sides, straight occipital margin, and rounded occipital corners. Anterior clypeal margin prominent, narrowly rounded medially. Frontal carinae very feebly curved, frons extremely wide (the widest among all known *Myrmica* species, $FI > 0.50$). Antennal scape relatively short, quite strongly curved at its base, but not angular and with no trace of a carina or lobe. Mandibles with 7–9 teeth.

Alitrunk with weakly convex promesonotal dorsum; promesonotal suture indistinct from above; metanotal groove distinct and quite deep. Propodeal spines wide at base, relatively long, acute and straight, not curving downwards and not divergent (seen from above), projecting backwards at an angle less than 45° . Anterior surface of petiole slightly concave, its node with feebly convex dorsum. Postpetiole somewhat higher than long, subglobular. Spurs on middle and hind tibiae well developed and distinctly pectinate.

Head dorsum longitudinally rugulose, only occiput with reticulation, clypeus with coarse longitudinal rugae. Antennal sockets surrounded by fine rugae. Alitrunk mainly longitudinally rugose, only pro- and mesonotal dorsum with coarse reticulation. Petiolar node with reticulation, postpetiole with longitudinally-concentric rugae. Latero-ventral surfaces of petiole and postpetiole finely punctured. Surfaces between rugae on the body smooth and shiny.

Alitrunk dorsum with abundant, slightly curved, erect to suberect hairs; head margins with relatively shorter suberect hairs; antennal scape with suberect and tibiae with short subdecumbent hairs. The overall colour brownish-red to yellowish-brown, appendages somewhat lighter.

Queens (Figs 24–28; measurements and indices in Tables 1b and 2b). Generally like workers in shape of head, character of sculpture, colour and pilosity of the body, except the head is relatively slightly wider (compare indices, Tables 2a and 2b), rear (upper) part of head dorsum has more developed reticulation, petiole is relatively shorter and higher (compare indices, Tables 2a and 2b) and sides of the node has fine longitudinal rugulosity; no reticulation on alitrunk, only longitudinal rugosity.

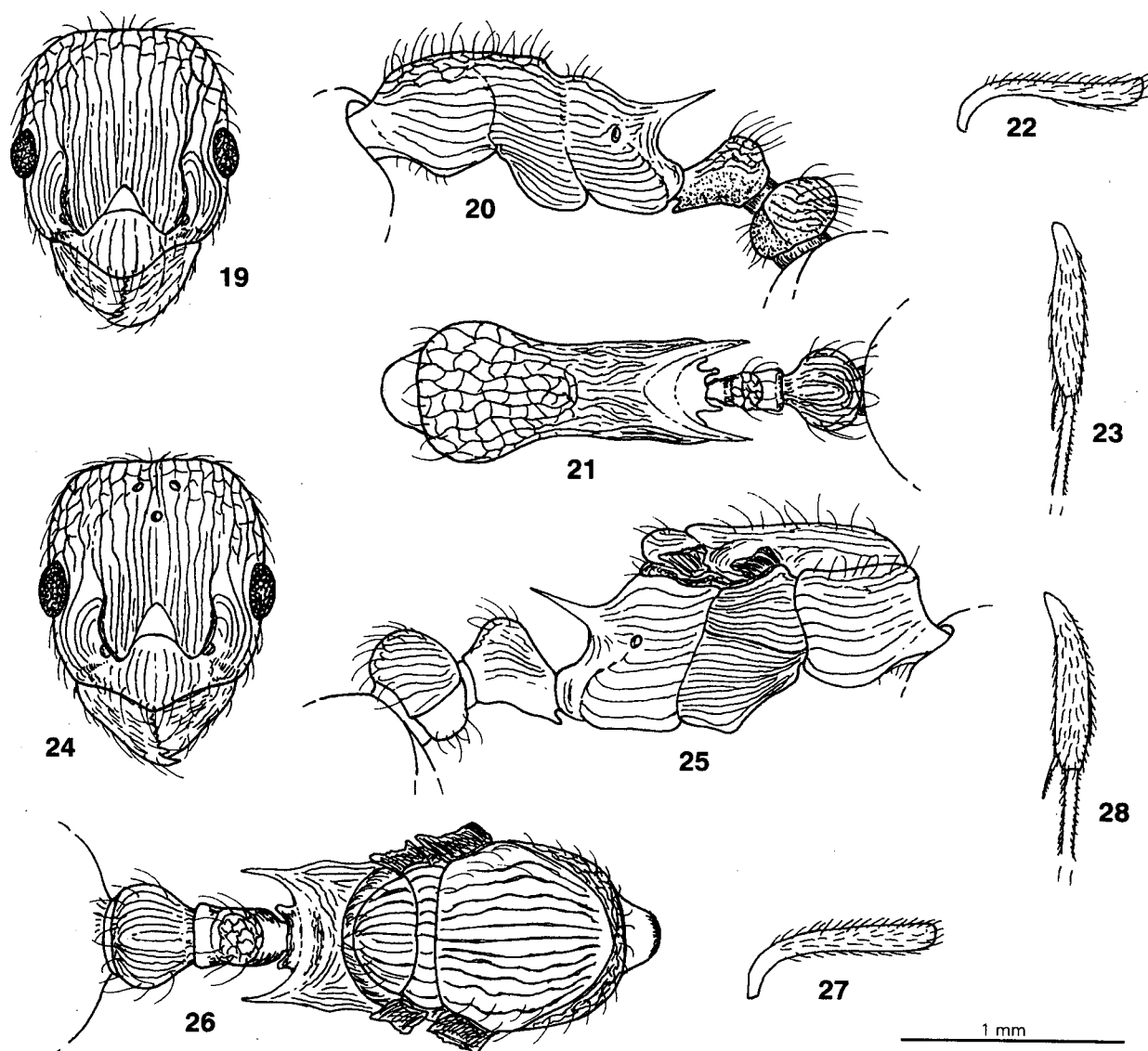
Males (Figs 29–33; measurements and indices in Tables 1b and 2b). Head longer than broad, with convex sides and occipital margin, and widely rounded occipital corners; anterior clypeal margin slightly prominent and narrowly rounded medially. Frontal carinae very feebly curved. Antennal scape relatively long (similar to species of *lobicornis*-group, see Radchenko 1994b,c), feebly curved at the base; antennae 13-jointed, antennal club 5-jointed, but not very distinct. Masticatory margin of mandibles distinct, with 6–7 acute teeth.

Alitrunk relatively short and wide, scutum feebly convex, and scutellum does not project dorsally above scutum when seen in profile. Propodeum with blunt rounded denticles. In profile, petiole relatively long and low, with its anterior surface appearing straight, sloping forwards gradually, dorsum of node rounded; postpetiole higher than long, with somewhat flattened dorsum (seen in profile).

Frons and lateral parts of head dorsum with fine longitudinal rugulae; surface of head densely punctured, appearing dull, clypeus with finer punctation. Central part of scutum with longitudinal striation and very finely punctured; scutellum with longitudinally-concentric rugulosity and fine punctures. Lateral parts of scutum and propleurae densely punctured; mesopleurae and propodeum with longitudinal rugulosity and fine punctures. Petiole densely and postpetiole finely punctured.

Head margins with short subdecumbent hairs. Alitrunk, petiole, postpetiole and gaster with sparse suberect hairs. Legs and antennae with very short subdecumbent hairs. Colour of body blackish-brown to black, appendages somewhat lighter.

Types. Holotype worker, NE Turkey, Trabzon Region, nr. Uzungöl, $40^\circ 35' 05''$ N, $40^\circ 17' 47''$ E, alt. 2257 m, 16.viii.1999, TR-43 (leg J. E. & G. W. Elmes); paratypes: 20 workers, 13 gynes, 4 males from same nest as the holotype; 4 workers, same locality, date and collectors, TR-45; 12 workers, 1 queen, NE Turkey, Trabzon Region, Sumela Yayla, $40^\circ 38' 44''$ N, $39^\circ 40' 40''$ E, alt. 1570 m, 19.viii.1999, TR-55 (leg J. E. & G. W. Elmes); 11 workers, NE Turkey, Trabzon region, Hamsiköy – Balahor deresi, 46 km. SE Trabzon, alt. 1600m, 08.vi.1975, T-94 (leg. N. Aktaş); 5

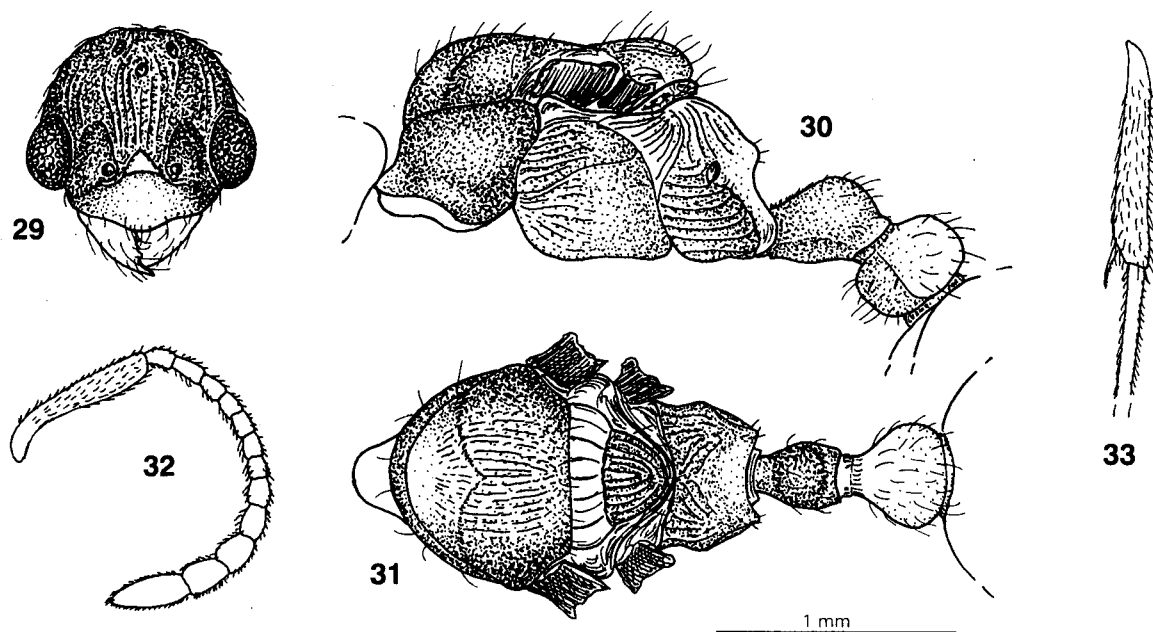


Figures 19–28. Details of structure of *M. jennyae* (19–23 holotype, worker). (19) Head, frontal view; (20) alitrunk and waist in profile; (21) alitrunk and waist from above; (22) antennal scape in profile; (23) hind tibia. (24–28 paratype, queen). (24) Head, frontal view; (25) alitrunk and waist in profile; (26) alitrunk and waist from above; (27) antennal scape in profile; (28) hind tibia.

workers, NE Turkey, Artvin Region, Kaskasor mt., above and just west of Artvin town, alt. 1750 m, 14.viii.2000, TR-113 (leg. G. W. Elmes); 6 workers, NE Turkey, Artvin region, Kafkasor yaylasi, alt. 1730m, 14.viii.2000, No. 00/107 (leg. K. Kiran); 3 workers, NE Turkey, Rize Region, Ovitdagi Gecidi, 50 km SE Rize, alt. 2600 m, 30.vi.1993, No. 1190 (leg. A. Schulz); 9 workers, [Russia], Daghestan, high mountains regions, 1972 (leg. Exp. of Daghestan State University) (TU, MIIZ, IZK, ELMES).

Taxonomic position. Workers and queens of *M. jennyae* clearly differ from any other known *Myrmica* species by their extremely wide frons (Figs 19, 24, FI > 0.50 and in all other species FI < 0.50). By the combination of a wide frons, a feebly curved frontal carinae and a

sharply curved antennal scape (Figs 22, 27) the female castes of *M. jennyae* superficially resemble *scabrinodis*-group species, such as *M. rugulosa* Nylander, *M. gallienii* Bondroit, *M. hellenica* Forel and *M. rugulososcabrinodis* Karavaiev. However, *M. jennyae* is closer to the *lobicornis*-group of species. Its male has a relatively long scape that is similar to members of *lobicornis*-group (Fig. 32), and is much longer than in any of the *scabrinodis*-group species. When compared to the *lobicornis*-group, the strongly curved antennal scape female castes of *M. jennyae*, that is never angular and with no trace of a carina, denticle or lobe (Figs 22, 27), also resembles some members of that group (e.g. *M. sulcinodis* Nylander, *M. incurvata* Collingwood, *M. kaszenkoi*



Figures 29-33. Details of structure of *M. jennyae* (paratype, male). (29) Head, frontal view; (30) alitrunk and waist in profile; (31) alitrunk and waist from above; (32) antenna; (33) hind tibia and tarsus.

Ruzsky, *M. displicentia* Bolton). However, even apart from its extremely wide frons, *M. jennyae* also well differs from each of these on at least one other character (e.g. size, colour, body sculpture, shape of petiole, etc.). Furthermore, the anterior clypeal margin of *M. jennyae* is prominent and narrowly rounded medially, while in other members of *lobicornis*-group it is slightly convex and with at least shallow notch medially (compare Figs 19, 24 and 44, 50).

Ecology. This species lives in high mountains meadows, cleared fir forests and forest edges where it sometimes nests under stones. The nest containing the holotype, was in soil at a forest edge, with no visible above ground structure, just a 3-4 mm hole in the soil. The workers forage cryptically, moving relatively slowly and close to the ground.

Etymology. This species is dedicated to Jenny, wife of Graham Elmes. She found the colony containing the holotype.

Myrmica tamarae sp. nov.
(Figs 34-43)

Workers (Figs 34-38; measurements and indices in Tables 1a and 2a). Head slightly longer than broad, with convex sides, straight occipital margin, and rounded occipital corners. Anterior clypeal margin prominent, rounded medially. Frontal carinae feebly curved, frons quite wide. Lateral portion of clypeus raised into sharp ridge in front of antennal insertions (like in *Tetramori-*

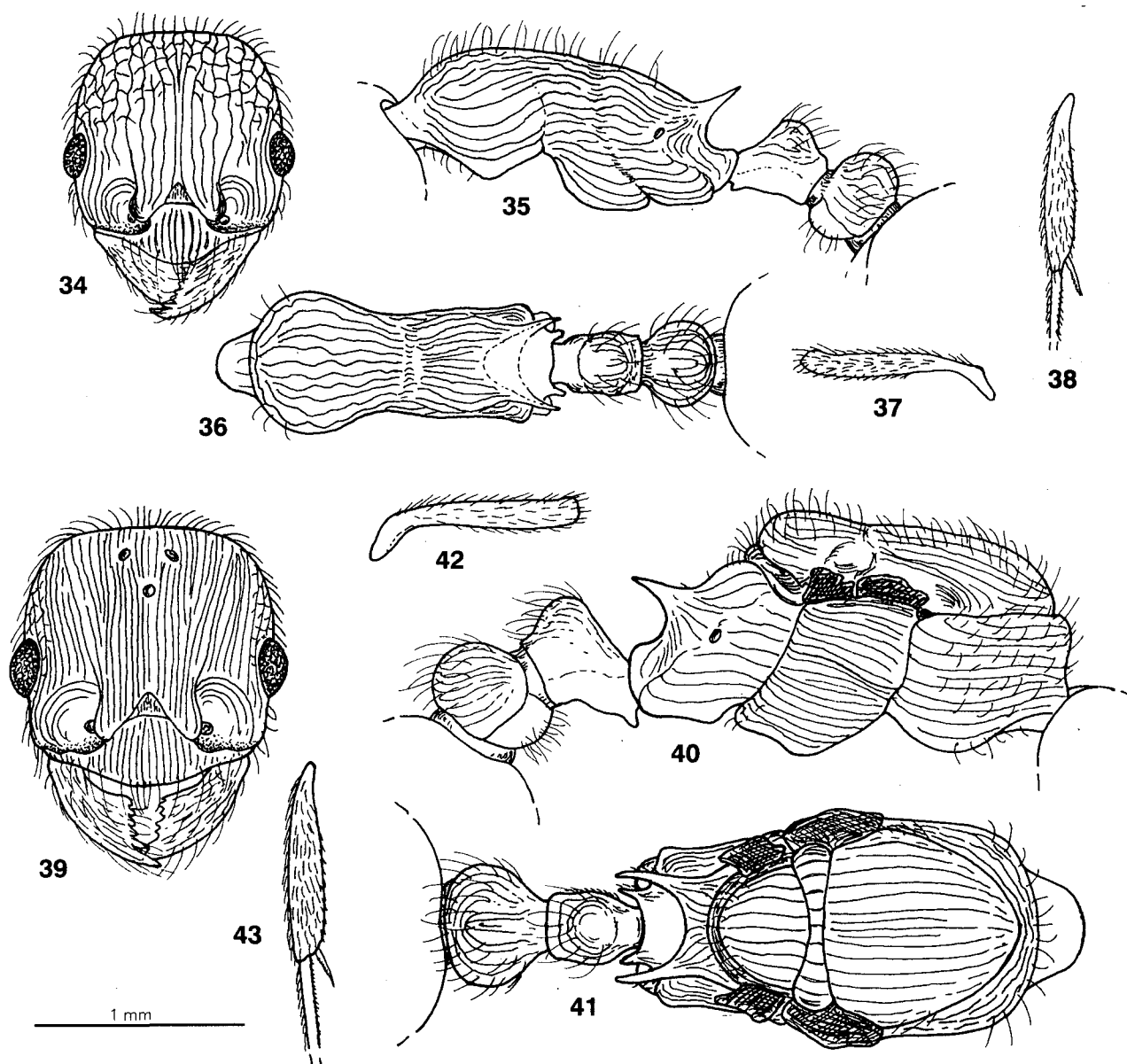
um Mayr – this very uncommon feature for genus *Myrmica* was previously recorded only from two Far Eastern species). Antennal scape relatively long, sharply curved at its base, upper surface of bend usually angulate, but sometimes only sharply rounded, with no vertical lobe or dent. Mandibles with 7-9 teeth.

Alitrunk with weakly convex promesonotal dorsum; promesonotal suture indistinct from above; metanotal groove very shallow or totally absent. Propodeal spines relatively short, acute, straight, not curving downwards, wide at base, projecting backwards at an angle not less than 45°, divergent (seen from above). In profile, petiole short and high, its anterior surface concave, node with short, very feebly convex dorsum. Postpetiole somewhat higher than long, with convex dorsum. Spurs on middle and hind tibiae well developed and distinctly pectinate.

Head dorsum with quite coarse sculpture; frons between the frontal carinae level with the eyes with not more than 10 sinuouse rugae; rear (upper) half of head dorsum with reticulation; frontal triangle longitudinally rugose; clypeus with coarse longitudinal rugae. Antennal sockets surrounded by distinct rugae. Alitrunk with longitudinal, partly sinuous rugae. Petiolar and postpetiolar nodes with longitudinally-concentric rugae. Surfaces between rugae on the body smooth and shiny.

Hair margins and alitrunk dorsum with abundant, slightly curved, erect to suberect hairs; antennal scape and tibiae with short suberect hairs. The overall colour dark brownish-red, appendages somewhat lighter.

Queen (Figs 39-43; measurements and indices in Tables 1b and 2b). Generally like workers in shape of



Figures 34-43. Details of structure of *M. tamarae* (34-38 holotype, worker). (34) Head, frontal view; (35) alitrunk and waist in profile; (36) alitrunk and waist from above; (37) antennal scape in profile; (38) hind tibia. (39-43 paratype, queen). (39) Head, frontal view; (40) alitrunk and waist in profile; (41) alitrunk and waist from above; (42) antennal scape in profile; (43) hind tibia.

head, character of sculpture, colour and pilosity of the body except the head dorsum has finer rugae (frons between the frontal carinae level with the eyes with not less than 15 rugae) and reticulation is developed only on lateral parts of head dorsum; anterior surface of petiole less concave, more or less straight.

Males. Unknown.

Types. Holotype worker, Turkey, Erzurum Region, Palandöken dag, alt. 2250 m, No. 2140, 25.ix.1979 (leg. N. Aktaş) (TU); paratypes: 15 workers, 1 queen from the nest of holotype; 16 workers, same locality, date and collector, alt. 2800 m, No. 2142 (TU, MIIZ, IZK, ELMES).

Taxonomic position. *M. tamarae* has a very rare feature for *Myrmica* species: the lateral portion of clypeus is raised into sharp ridge in front of antennal insertions (like in *Tetramorium*: e.g. compare Figs 34, 39 and 44, 50). It shares this feature only with *M. taediosa* Bolton (replacement name for *M. carinata* Kupyanskaya) and *M. excelsa* Kupyanskaya. They live in the Russian Far East, Korea, Japan and, most probably, in northeastern China, a biogeographic region that is a long distance and well isolated from Asia Minor. *M. tamarae* very similar to *M. taediosa* by the shape of head, frontal lobes and antennal scape, but differs from it by its frons,

between the frontal carinae level with the eyes, having not more than 10 sinuous rugae (Fig. 34) *versus* more than 13 in *M. taediosa*. Also, the reticulation on the head dorsum is more developed than in *M. taediosa*, but the metanotal groove is less distinct (Fig. 35). Both *M. tamarae* and *M. taediosa* well differ from *M. excelsa* by the shape of antennal scape (see also Kupyanskaya 1990).

Unfortunately, males of *M. tamarae* are unknown, but we expect them to have a relatively long scape, as in *M. taediosa* and *M. excelsa*; if not, the taxonomic position of this species will be problematic.

Ecology. Little is known about the ecology of *M. tamarae*. It is probably quite localised in its distribution being found only on high mountain meadows (2250 and 2800 m) in east Anatolia.

Etymology. This species is dedicated to Tamara, wife of Alexander Radchenko.

Myrmica anatolica sp. nov.
(Figs 44–60)

Workers (Figs 44–49; measurements and indices in Tables 1a and 2a).

Head longer than broad, with weakly convex sides, slightly concave medially occipital margin and broadly rounded occipital corners. Anterior clypeal margin rounded and shallowly notched medially. Frontal carinae not strongly curved, frons relatively wide (much wider than in *M. lobicornis* Nylander). Antennal scape relatively short, angulate at its base and with small vertical dentiform lobe (this lobe is very variable in size though never large, it can be reduced to a very small dentiform ridge). Mandibles with 6–8 teeth.

Alitrunk with more or less flattened promesonotal dorsum; promesonotal suture indistinct from above; metanotal groove distinct but not very deep. Propodeal spines wide at base, relatively long and acute, straight, not curving downwards, projecting backwards at an angle less than 45° and slightly divergent (seen from above). In profile, petiole with distinct peduncle, its anterior surface concave, petiolar node with slightly flattened or convex dorsum. Postpetiole higher than long, with convex dorsum. Spurs on middle and hind tibiae well developed and distinctly pectinate.

Frons rugose, rear (upper) half of head dorsum with reticulation; clypeus with longitudinal rugae. Antennal sockets surrounded by rugae. Alitrunk mainly longitudinally rugose, only pro- and mesonotal dorsum with sinuous rugae and reticulation. Petiolar node with lateral sinuous longitudinal rugosity and with irregular short rugae on its dorsum; postpetiole with longitudinally-concentric rugae. Surfaces between rugae on the body smooth and shiny.

Head margins and alitrunk dorsum with abundant, slightly curved, erect to suberect hairs; antennal scape

and tibiae with short suberect hairs. The overall colour dark brownish-red, appendages somewhat lighter.

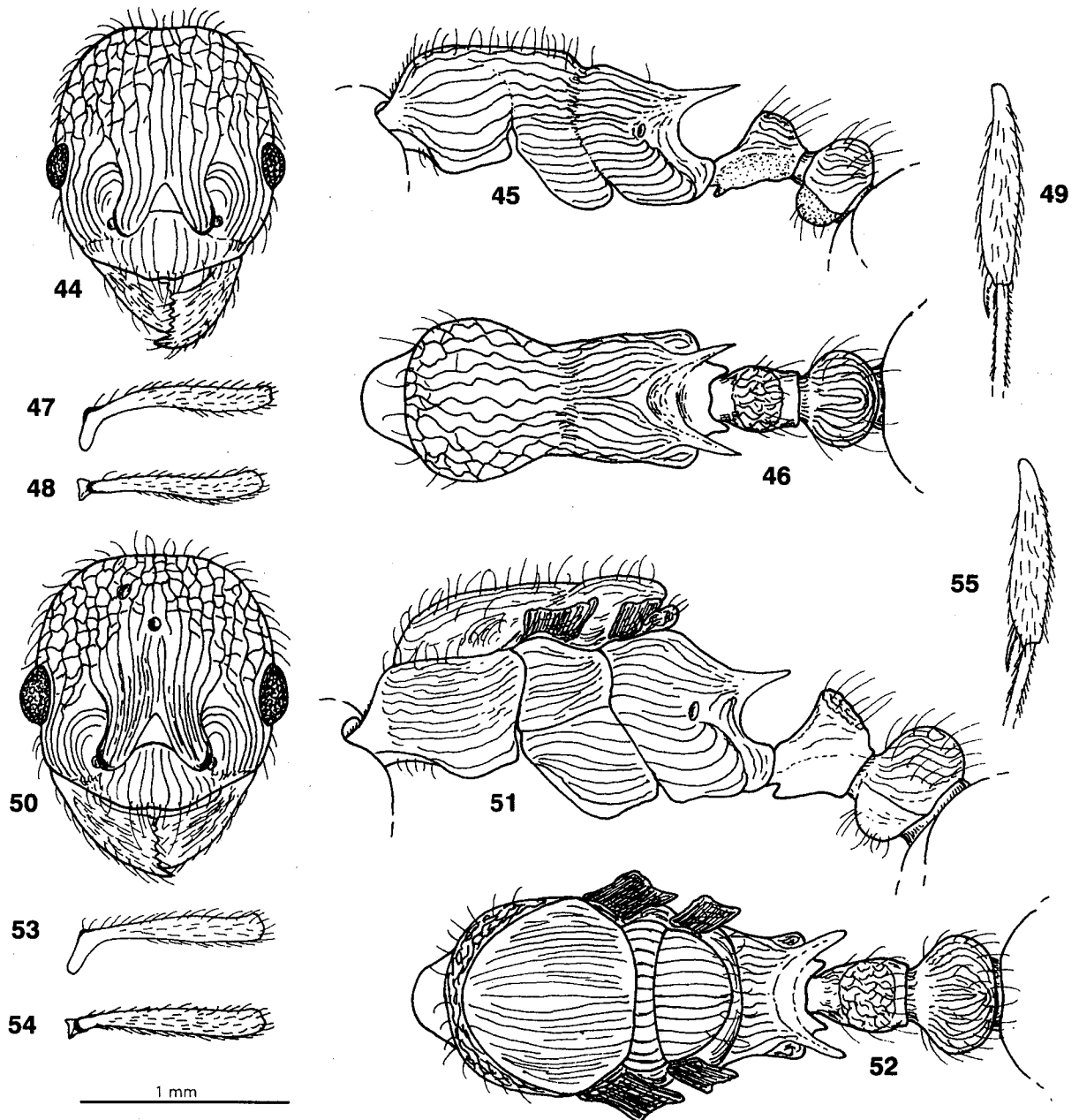
Queens (Figs 50–55; measurements and indices in Tables 1b and 2b). Generally like workers in shape of the head and body sculpture, colour and pilosity of the body except for a relatively wider head (compare indices, Tables 2a and 2b), coarser sculpture of head dorsum, petiole with relatively shorter peduncle, dorsal surface more declined backwards, and alitrunk with no reticulation, only longitudinal rugosity.

Males (Figs 56–60; measurements and indices in Tables 1b and 2b). Although head is usually slightly longer than broad, in some specimens it can be shorter, with a slightly convex anterior clypeal margin, convex sides and occipital margin, and widely and gradually rounded occipital corners. Frontal carinae very feebly curved. Antennal scape relatively long (similar to species of *lobicornis*-group, see Radchenko 1994b,c), curved at the base, but not distinctly angulate; antennae 13-jointed, antennal club 4-jointed. Masticatory margin of mandibles distinct, with 7–8 acute teeth.

Alitrunk relatively short and wide, scutum convex, and scutellum does not project dorsally above scutum when seen in profile. Propodeum with blunt rounded denticles, which sometimes reduced to simple rounded angles. In profile, petiole somewhat longer than high, with very short peduncle; its anterior surface very slightly concave, dorsum of node rounded; postpetiole subglobular.

Sculpture quite variable, especially on alitrunk. Only central part of head dorsum with short longitudinal rugae, surface of head densely punctured, appears dull; clypeus with finer punctures, especially on the central part, which appears shiny. Usually fine longitudinal striation on part or all of scutum; that can be coarser, or more sinuous, or sometimes concentric (more unusually scutum can appear smooth and shiny, with only very fine and short striae on its central part); surface between striae usually smooth and shiny, but can be finely, or more densely punctured. Scutellum usually with longitudinal rugulae or with longitudinally-concentric rugae, but sometimes reticulated; surface between sculpture smooth, or finely punctured, but appears more or less shiny. Pro- and mesopleurae usually smooth and shiny, with fine longitudinal striation, sometimes more coarsely striate with surfaces punctured, appearing somewhat dull. Propodeum with longitudinal rugosity developed to a variable degree, surface smooth and shiny. Petiole usually with very finely punctured dorsum node (or sometimes totally smooth and shiny), with more dense punctures and short fine rugulae surrounding the node. Postpetiole usually smooth and shiny, or very finely punctured (even so appears more or less shiny).

Head margins, alitrunk, waist and gaster with subdecumbent to suberect hairs. Antennal scape and first 8 funicular joints with short suberect hairs, antennal club with very short hairs. Legs with short subdecumbent

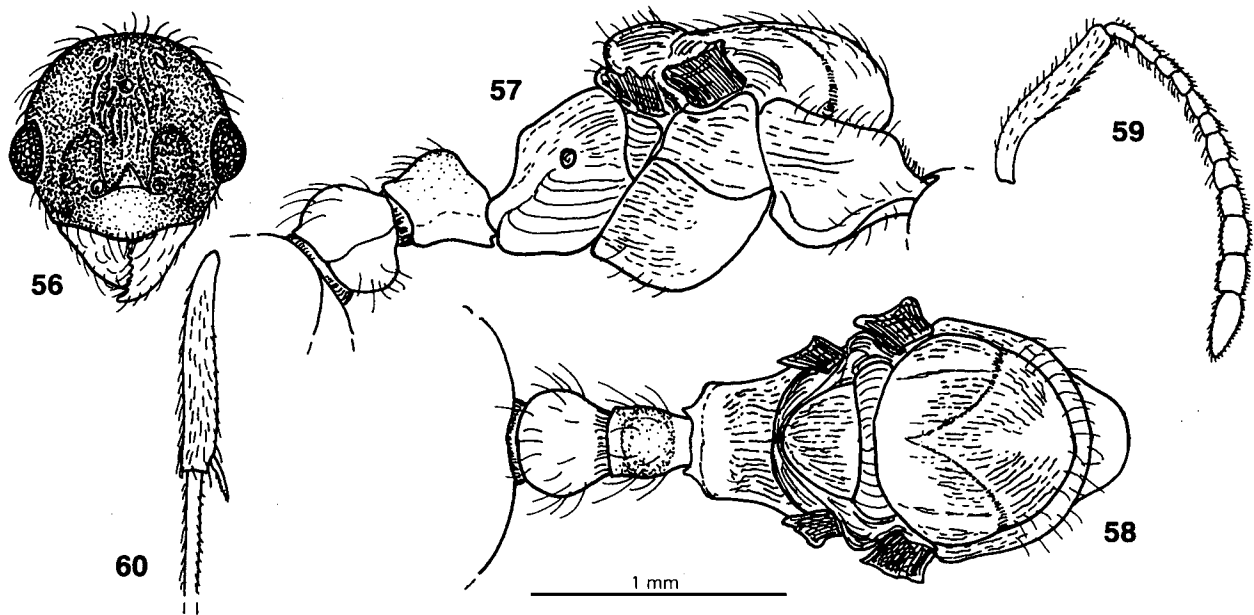


Figures 44–55. Details of structure of *M. anatolica* (44–49 holotype, worker). (44) Head, frontal view; (45) alitrunk and waist in profile; (46) alitrunk and waist from above; (47) antennal scape in profile; (48) antennal scape from above; (49) hind tibia. (50–55 paratype, queen). (50) Head, frontal view; (51) alitrunk and waist in profile; (52) alitrunk and waist from above; (53) antennal scape in profile; (54) antennal scape from above; (55) hind tibia.

hairs. Colour of body blackish-brown to black, appendages somewhat lighter.

Types. Holotype worker, NE Turkey, Trabzon Region, nr. Uzungöl, 40°34'29" N, 40°17'47" E, alt. 2372 m, 15.viii.1999, TR-27 (leg. J. E. & G. W. Elmes) (TU); paratypes: 12 workers, 4 gynes, 3 males from the nest of holotype; 30 workers, same locality, site, date and collectors, TR-26; 320 workers, 1 queen, 3 gynes, 36 males (12 colonies), same locality, date and collectors, but co-ordinate 40°38'33" N, 40°16'21" E, alt. 2397 m, TR-10, 11, 12,

13, 14, 15, 16, 17, 18, 19, 22, 23; 72 workers (4 colonies), NE Turkey, Trabzon Region, ca 5 km S Uzungöl, up mountain, alt. 1800 m, 17.viii.2000, TR-154, 155, 157 (leg. G. W. Elmes); 13 workers, NE Turkey, Trabzon Region, ca 5 km S Uzungöl, up mountain, alt. 1800 m, 17.viii.2000, No. 00/171a (leg. K. Kiran); 4 workers, NE Turkey, Trabzon Region, Hamsiköy, 41 km S Trabzon, alt. 1400 m, 25.v.1974, No. 42, 61 (leg. N. Aktaş); 8 workers, same locality and collector, 8.vi.1975, No. 117; 2 workers, N Turkey, Erzurum Region, 113 km NE Erzurum, Oltu-



Figures 56–60. Details of structure of *M. anatolica* (paratype, male). (56) Head, frontal view; (57) alitrunk and waist in profile; (58) alitrunk and waist from above; (59) antenna; (60) hind tibia and tarsus.

Uzunoluk, alt. 1900 m, 23.ix.1979, No. 2122 (leg. N. Aktaş); 10 workers, NE Turkey, Rize Region, S of Madenli (S of Cayeli), S of Kaptanpasa, between Cataldere and Incesu, alt. 1800 m, 12.viii.2000, TR-86 (leg. G. W. Elmes); 53 workers, 4 males (3 colonies), NE Turkey, Rize Region, S of Madenli (S of Cayeli) ca. between Incesu and Baltas/Balikli Gölü mts., alt. 2400 m, 12.viii.2000, TR-88, 89, 90 (leg. G. W. Elmes); 83 workers (5 colonies), NE Turkey, Rize Region, S of Madenli (S of Cayeli), ca. east of Baltas/Balikli Gölü mts., nr. Baskoy, alt. 2300 m, 12.viii.2000, TR-91, 93, 94, 95, 96 (leg. G. W. Elmes); 18 workers, NE Turkey, Rize region, Çaşiran yaylasi, alt. 1850m, 11.viii.2000, No. 00/4, (leg. K. Kiran); 1 worker, NE Turkey, Rize region, Yenisu, alt. 1850m, 12.viii.2000, No. 00/39 (leg. K. Kiran); 2 queens, NE Turkey, Rize region, Basköy, alt. 2300m, 12.viii.2000, No. 00/41 (leg. K. Kiran); 79 workers, 1 gyne (9 colonies), NE Turkey, Rize region, Incesu, alt. 2300m, 12.viii.2000, No. 00/42, 44, 46, 47, 48, 50, 54, 55, 56 (leg. K. Kiran); 2 workers, NE Turkey, Rize region, Rüzgarlı Köyü, alt. 2300m, 13.viii.2000, No. 00/88 (leg. K. Kiran); 44 workers, N Turkey, Erzincan – Refahiye, 50 km W Erzincan Gülendag, alt. 1800 m, 14.vi.1982, No. 2225 (leg. N. Aktaş); 14 workers, Central Turkey, 130 km N Ankara, Çankir, 18.vi.1985, No. 103 (leg. N. Aktaş) (TU, MIZ, IZK, ELMES).

Taxonomic position. *M. anatolica* well differs from the sympatric population of *M. lobicornis* by having a much less developed lobe at the base of antennal scape (Figs 47, 48, 53, 54), by a wider frons (in workers $FI > 0.36$ versus < 0.34) and a more rounded petiolar node of the workers (Fig. 45). *M. anatolica* is closer to the South

European mountain *lobicornis*-group species, *M. wesmaeli* Bondroit, from which the female castes differ by a relatively wider frons (mean FI 0.39 versus 0.36) and generally less developed lobe at the base of antennal scape. Clear differences exist between the males of these two species: *M. wesmaeli* have a much longer antennal scape, which is more similar to that of *rubra*-group species ($SI_1 > 0.90$, $SI_2 > 1.00$ versus < 0.85 and < 0.90 in *M. anatolica*). It should be noted that *M. wesmaeli* males described by Finzi (1926) are not *M. wesmaeli* (they belong to a species from *scabrinodis*-group); males of *M. wesmaeli* should be formally redescribed.

More generally, *M. anatolica* has similarities to several Central Asian and Siberian species (*M. kirgisorum* Arnoldi, *M. saposhnikovii* Ruzsky, *M. jessensis* Forel). Its workers well differ from those of *M. kirgisorum* and *M. saposhnikovii* by the shape of petiole: in both latter species it is more conical, subtriangular in profile, while in *M. anatolica* the petiolar node is slightly flattened or has a convex dorsum (Fig. 45). Although workers of *M. anatolica* are superficially very similar to those of *M. jessensis*, males of *M. jessensis* have distinctly shorter antennal scape (SI_1 0.65–0.70 versus 0.72–0.84).

Ecology. This species has been found only on mountains in NE Turkey at altitudes between 1800 and 2400 m, where it is fairly common under stones on grazed and more natural alpine meadows. It is also found in damper shaded hay meadows at slightly lower altitudes and on steep slopes at the edge of mixed and pine forests, where it nests in the soil, usually under stones. It frequently lives sympatrically with *M. lobicornis*, and in the field

(using a hand lens) it could be mistaken for a species from the *scabrinodis*-group.

Etymology. The species is named after the historical name Anatolia, given to the Asian part of modern Turkey, because it seems to be endemic to the northern part of Anatolia.

DISCUSSION

Based on morphology of female castes and males, *M. tulinae* clearly belongs to the *scabrinodis*-group of *Myrmica* species. Without males and / or a large reference material it is very hard to discriminate between several of the *scabrinodis*-group species; we are making a morphometric comparison within the *scabrinodis*-group which might assist in discriminating only on workers. We suspect that *M. tulinae* is a Balkano-Anatolian endemic and we are not surprised to find a new endemic *scabrinodis*-group species in Asia Minor or Balkans, because we suppose that the region of origin and active speciation of this group is the Euro-Caucasian region (Radchenko 1994b; Radchenko and Elmes 2001b).

The other three new species (*M. jennyae*, *M. tamarae* and *M. anatolica*) belong to *lobicornis*-group which generally has a clearer separation of female castes than in the *scabrinodis*-group. All are probably Anatolian-Caucasian endemics and it is no surprise that we should find three new species from the insufficiently studied myrmecofauna of this region. *M. anatolica* is a typical *lobicornis*-group species and is probably a southern mountain derivative of western "branch" of the *lobicornis*-group, which more probably has its centre of origin in Central Asia and Southern Siberia (Radchenko 1994b).

If the unusual feature of raised clypeus possessed by *M. tamarae* makes it a closer relative of several Oriental species, as we suggest, rather than Euro-Caucasian species, then it would provide a good example of amphipalaearctic distribution. We would consider *M. tamarae* to be a very old species (probably Eocene relict) isolated as an endemic of Anatolian mountains. Similarly we suggest that *M. jennyae* is probably quite an old species (Miocene or even Eocene) that has become isolated from populations of related species, to become endemic to the high mountain of Asia Minor and Caucasus. It has a combination of "mixed" features from several species groups: although the males have relatively long scape (a *lobicornis*-group feature) the female castes differ from those of *lobicornis*-group by their prominent and not-notched-medially anterior clypeal margin (an important feature), and are much more similar to *scabrinodis*-group species. A similar situation, where many species have "mixed" features from several groups, is very common in Himalayan *Myrmica* fauna which we believe contains a high proportion of "archaic" species (see Radchenko and Elmes 1999, 2001b).

ACKNOWLEDGEMENTS

This study was supported by a NATO Collaborative Linkage Grant (LST.CLG.976626). We thank Kadri Kiran (PhD student TU) and Jenny Elmes for assistance in collecting and preparing some of the material studied.

REFERENCES

- Agosti, D. and C. A. Collingwood. 1987. A provisional list of the Balkan ants (Hymenoptera, Formicidae) and a key to the worker caste. I. Synonymic list. Mitteilungen der Schweizerischen Entomologischen Gesellschaft, 60 (1-2): 51-62.
- Aktaş, N. 1976. Studies on the myrmecofauna of Turkey I. Ants of Siirt, Bodrum and Trabzon. İstanbul Üniversitesi Fen Fakültesi Mekmuası, Seri B, 41(1-4): 115-135.
- Aktaş, N. 1988. Doğu Anadolu Bölgesi karıncaalarının vertikal dağılımları. IX Usual Biyoloji Kongresi; Hidrobiyoloji seksiyonu. Poster ve Bildirileri, Cilt, 2: 201-211.
- Aktaş, N., Aras, A. and Y. Çamlitepe. 1994. Ants of Thracian Part of Turkey. Bios, 2: 203-209.
- Bolton B. 1995. A new general catalogue of the ants of the world. Harvard University Press, Cambridge, MA, 504 pp.
- Donisthorpe, H. 1950. A first instalment of the ants of Turkey. Annals and Magazine of Natural History, 3: 1057-1067.
- Elmes, G. W. 1991. The social biology of *Myrmica* ants. Actes Colloques Insectes Sociaux, 7: 17-34.
- Elmes, G. W. and A. G. Radchenko. 1998. Ants of the genus *Myrmica* from Taiwan (Hymenoptera, Formicidae). Chinese Journal of Entomology, 18: 217-224.
- Elmes, G. W., Radchenko, A. G. and B. -J. Kim. 2001. New species of *Myrmica* from Korea (Hymenoptera, Formicidae). Korean Journal of Biological Science 5: 107-112.
- Finzi, B. 1926. Le forme europee del genere *Myrmica* Latr. Primo contributo. Bollettino della Società Adriatica di Scienze Naturali, 29: 71-119.
- Kupianskaya, A. N. 1990. The ants of the Far East of the USSR. Vladivostok, DVO AN SSSR, 258 pp. (In Russian).
- Radchenko A. G. 1994a. New *Myrmica* species (Hymenoptera, Formicidae) in the Palaearctic. Memorabilia Zoologica, 48(1): 1-9.
- Radchenko, A. G. 1994b. Taksonomicheskaya struktura roda *Myrmica* Latreille (Hymenoptera, Formicidae) Evrazii. Soobschenie 1. Zoologicheskii Zhurnal, 73 (6): 39-51 [English translation: Taxonomic structure of the genus *Myrmica* (Hymenoptera, Formicidae) of Eurasia. Communication 1. Entomological Review (Washington), 1995, 74 (3): 91-106].
- Radchenko, A. G. 1994c. Opredeletel'naia tablica murav'ev roda *Myrmica* Latreille (Hymenoptera, Formicidae) centralnoi i vostochnoi Palearktiki. Zoologicheskii Zhurnal, 73 (7-8): 130-145 [English translation: A Key to species of the genus *Myrmica* (Hymenoptera, Formicidae) of the Central and Eastern Palaearctic. Entomological Review (Washington), 1995, 74 (3): 154-169].
- Radchenko, A. G. 1994d. Obzor gruppy *scabrinodis* roda *Myrmica* Latreille (Hymenoptera, Formicidae) centralnoi i vostochnoi Palearktiki. Zoologicheskii Zhurnal, 73 (9): 75-82 [English translation: A review of species of *Myrmica* belonging to the group of *scabrinodis* (Hymenoptera, Formicidae) from the Central and Eastern Palaearctic. Entomological Review (Washington), 1995b, 74 (5): 116-124].
- Radchenko, A. G. 1994e. Obzor grupp *rubra*, *rugosa*, *arnoldii*, *luteola* i *schrencki* roda *Myrmica* Latreille (Hymenoptera, Formicidae) centralnoi i vostochnoi Palearktiki. Zoologicheskii Zhurnal, 73 (11): 122-132 [English translation: A survey of species of *Myrmica* of groups of *rubra*, *rugosa*, *arnoldii*, *luteola* and *schrencki* (Hymenoptera, Formicidae) from Central and Eastern Palaearctic. Entomological Review (Washington), 1995c, 74 (8): 122-132].
- Radchenko, A. G. 1994f. Obzor vidov gruppy *lobicornis* roda *Myrmica* (Hymenoptera, Formicidae) centralnoi i vostochnoi Palearktiki.

- ki. Zoologicheskii Zhurnal, 73 (11): 81–92 [English translation: A survey of species of *Myrmica* of *lobicornis*-groups (Hymenoptera, Formicidae) from Central and Eastern Palaearctic. Entomological Review (Washington), 1995d, 74 (9): 133–146].
- Radchenko, A. G. and G. W. Elmes. 1998. Taxonomic revision of the *ritae* species-group of the genus *Myrmica* (Hymenoptera, Formicidae). Vestnik Zoologii, 32 (4): 3–27.
- Radchenko, A. G. and G. W. Elmes. 1999. Ten new species of *Myrmica* (Hymenoptera, Formicidae) from the Himalaya. Vestnik Zoologii, 33 (1): 27–46.
- Radchenko, A. G. and G. W. Elmes. 2001a. First record of the genus *Myrmica* (Hymenoptera, Formicidae) from Northern Vietnam, with a description of two new species. Annales Zoologici, 51 (2): 221–225.
- Radchenko, A. G. and G. W. Elmes. 2001b. A taxonomic revision of the ant genus *Myrmica* Latreille (Hymenoptera, Formicidae) from the Himalaya. Entomologica Basiliensia, 23: 237–276.
- Radchenko, A. G. , Zhou, S. and G. W. Elmes. 2001. New and rare *Myrmica* species (Hymenoptera, Formicidae) from Southern China. Annales Zoologici, 51 (2): 211–219.
- Santschi, F. , 1921. Notes sur les fourmis paléarctiques (1) II. Fourmis d'Asie Mineure récoltées par M. H. Gadeau de Kerville. Bolétin de la Real Sociedad Española de Historia Natural, 21: 110–116.
- Santschi, F. , 1931. Notes sur le genre *Myrmica* (Latreille). Revue Suisse de Zoologie, 38: 335–355.
- Wardlaw J. C. and G. W. Elmes. 1996. Exceptional colony size in *Myrmica* species (Hymenoptera: Formicidae). The Entomologist, 115: 191–196.

Received: December 6, 2002

Accepted: February 22, 2002