



Description of two new *Temnothorax* species (Hymenoptera: Formicidae) from Italy

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Abstract

We describe two species of the ant genus *Temnothorax*: *T. alienus* **nov. spec.** and *T. saxatilis* **nov. spec.** Both new species are endemic to middle and southern Italy. We characterize the two species and compare them to similar *Temnothorax* from Italy and the Western Palearctic.

Key words: Formicoxenini, species diversity, taxonomy of ants, radiation, European fauna

Introduction

In his recent reclassification of the Formicidae, Bolton (2003) divided the myrmicine genus *Leptothorax* (*sensu lato*) into three genera: *Leptothorax* (*sensu stricto*), *Nesomyrmex* and *Temnothorax*. The great majority of former species of *Leptothorax* (*s.l.*) were transferred to the genus *Temnothorax*, established by Mayr in 1861 for a number of small Palearctic Formicidae. During the last decades, a wealth of biological information has been accumulated about species of this and other genera in the tribe Formicoxenini. As colonies are generally small, with often less than 200–300 individuals, they can be collected completely and reared under controlled conditions in the laboratory (Buschinger 1968, 1974). The large interest in the Formicoxenini stems from the fact that its species serve as model systems for the investigation of population and colony structures of ants with small societies and pronounced kin conflict (Heinze 2004), and also because numerous species are social parasites – guest ants, slave-makers, and workerlessinquilines (Buschinger 1981, 1986, Hölldobler & Wilson 1990).

In contrast to the attention species of *Temnothorax* and other formicoxenine genera have received with respect to behavior and social biology, their taxonomy is still unclear. There are nearly 600 described taxa in the genus *Temnothorax*, of which approximately 300 are recognized as valid species (Bolton 1995a, 1995b). *Temnothorax* inhabits nearly all terrestrial environments in the Palearctic and is found in almost all habitats from sea level to altitudes of 2700 m. Mediterranean habitats are especially rich in species. A high proportion of endemic *Temnothorax* species occurs at high altitudes, especially on isolated mountains (Schulz unpubl.).

In Italy, the number of described species of *Temnothorax* is high and the diversity of species seems to be similar from north to south (Baroni Urbani 1971). However, southern Italy is less well studied than the northern part of the country and additional species can be expected. Here, we report on two new species of *Temnothorax* from southern Italy, with interesting or geographically far distant relatives. We hope that our study inspires more interest in the remarkable diversity of *Temnothorax* in the Palearctic, which matches that of the most diverse ant genera in the tropics.

Material and methods

Material studied

The samples of the described species were collected in 1994 (M. Sanetra) and 2004 (J. Beibl, P. D'Ettorre, K. Pusch, C. Wanke). In addition, we examined material from the private collection of A. Schulz and type material of *T. korbi* (Emery, 1922), *T. lichtensteini* (Bondroit, 1918), *T. parvulus* (Schenck, 1852), and *T. luteus* (Forel, 1874). Collections are referred to by the following acronyms:

EMAU	Ernst-Moritz-Arndt-Universität - Zoologisches Institut und Museum, Greifswald, Germany
MCSN	Museo Civico di Storia Naturale 'Giacomo Doria', Genova, Italy
MHNG	Muséum d'Histoire Naturelle, Genève, Switzerland
MNHN	Muséum National d'Histoire Naturelle. Paris, France
PCAS	Private Collection Andreas Schulz
SMFM	Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt a. M., Germany
SMNG	Staatliches Museum für Naturkunde, Görlitz, Germany
SMNK	Staatliches Museum für Naturkunde Karlsruhe, Karlsruhe, Germany

Measurements

All measurements were taken using a Zeiss Stemi SR stereomicroscope equipped with an ocular graticule, at a maximum magnification of 250x. The data are presented in mm, as mean \pm standard deviation, with minimum and maximum value in parentheses, holotype in brackets.

The following measurements were taken:

HL	Head length: maximum distance from anteriormost to posteriormost margin along median axis. Both anterior and posterior margin of head must be in focus.
HW	Head width: maximum head width posterior to eyes.
HS	Head size: the arithmetic mean of HL and HW.
SL	Maximum chord length of scape: maximum distance from most distal point of the dorsal lamella of the scape apex to the most proximal point of the scape shaft near the neck of the articular condyle. To obtain the maximum a frontal to dorsal view is necessary.
FCD	Frontal carinae distance: Distance between the frontal carinae, measured in full face dorsal view, taken at the level of a transverse line where the articulatory bulb of scapes inserts in the antenna socket.
ED	Eye diameter: The largest measurable line across the compound eye including all structurally visible ommatidia irrespective of the pigmentation status, measured in lateral view.
ML	Mesosoma length: measured in lateral view from the frontalmost point of the anterior pronotal slope to the caudalmost portion of the propodeum.
MW	Maximum mesosoma width: measured in dorsal view at the widest part of mesosoma
PSL	Propodeal spine length: measured in workers and gynes. In dorsal to anterodorsal view, the tip of the measured spine, its base, and the center of the concavity between the spines must all be in focus (Fig. 1: points 1, 2 and 3). Using a cross-shaped ocular graticule, point 1 is placed at the median point of the concavity between the spines, point 3 at the tip of a spine. The spine length is measured as the distance from point 2 to point 3. We measured always the right spine (see also Güsten <i>et al.</i> 2006).
PEL	Petiole length: the maximum length of the petiolar node is measured in dorsal view from the anterior notch close to the propodeum to the articulation with the postpetiole. Both points must be in focus.

PEW	Petiole width: maximal measured width of petiole in dorsal view.
PEH	Petiole height: maximum height of the petiolar node, measured in lateral view from the highest (median) point of node to the ventral margin. The ventral margin always has a short concave portion, which is the ventral measuring point.
PPW	Postpetiole width: maximal measured width of postpetiole in dorsal view.
PHD	Petiole hair length: distance between the bases of the uppermost erect hairs on petiolar node, measured in dorsal view.

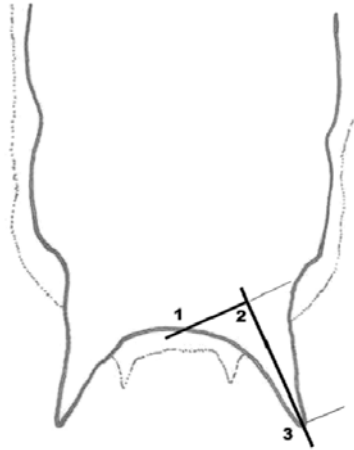


FIGURE 1. Dorsal view of mesosoma, showing measurement of propodeal spine length (distance between points 2 and 3).

Photography

The photographic images (Figs. 2–37) were taken using a digital camera (JVC KY-70B) attached to a Leica Z6 APO stereomicroscope. The microscope was equipped with a Z-stepper (Syncroscopy, Synoptics Ltd.) to enable the generation of usually 100 images in different focus layers from which a montage image was computed using AutoMontage Pro 5.02.0096 (Synoptics Ltd.). Montage images were enhanced (Photoshop 7.0, Adobe Systems Inc.) by removing out of focus structures and artifacts caused by the montage process (see also Güsten *et al.* 2006).

Temnothorax alienus nov. spec.

(Figs. 2, 3, 22, 26, 28, 29)

Holotype worker. ITALY, Campania, near Tortora, N. Sapri, Parco Nazionale del Cilento, 39°57.879'N 15°48.809'E, 633 m.a.s.l., 28.iv.2004 (Leg. K. Pusch, C. Wanke, J. Beibl, P. D'Ettorre) [SMNK].

Paratypes. 12 workers and 4 gynes, same data as holotype [MHNG, MCSN, PCAS, SMNG]; 10 workers, ITALY, Campania, near Carpaccio, N. of Agropoli & Paestum, Mte. Vesole, Parco Nazionale del Cilento, 730 m.a.s.l., 27.iv.2004 (Leg. K. Pusch, C. Wanke, J. Beibl, P. D'Ettorre) [MHNG, MCSN, PCAS, SMNG].

Etymology. From the Latin word “alienus”, meaning “foreigner” or “alien”, referring to the unique combination of characters, which is found only in a small number of other western Palaearctic *Temnothorax* species.

Description of worker. Measurements and indices (n=16): HL [0.684] 0.67 ± 0.03 (0.58–0.71), HW [0.580] 0.58 ± 0.03 (0.50–0.63), SL [0.475] 0.48 ± 0.03 (0.43–0.53), FCD [0.220] 0.22 ± 0.02 (0.18–0.24), ML [0.791] 0.77 ± 0.05 (0.67–0.85), MW [0.390] 0.39 ± 0.03 (0.32–0.46), PSL [0.095] 0.09 ± 0.01 (0.07–0.11), PEL

[0.238] 0.24 ± 0.02 (0.21–0.27), PEW [0.171] 0.18 ± 0.02 (0.15–0.21), PEH [0.238] 0.23 ± 0.02 (0.21–0.27), PHD [0.090] 0.09 ± 0.01 (0.07–0.11), PPL [0.162] 0.16 ± 0.02 (0.13–0.18), PPW [0.238] 0.23 ± 0.02 (0.20–0.26), HS 0.63 ± 0.03 (0.54–0.67), HW/HL 0.86 ± 0.03 (0.83–0.97), SL/HS 0.77 ± 0.03 (0.70–0.82), FCD/HS 0.34 ± 0.02 (0.31–0.36), MW/ML 0.50 ± 0.03 (0.48–0.63), PSL/ML 0.11 ± 0.01 (0.09–0.13), PEH/PEL 0.98 ± 0.05 (0.91–1.08), PEW/PEL 0.74 ± 0.07 (0.68–0.90), PHD/PEW 0.48 ± 0.07 (0.35–0.56), PPL/PPW 0.72 ± 0.06 (0.64–0.79), PEW/PPW 0.76 ± 0.08 (0.71–0.97).



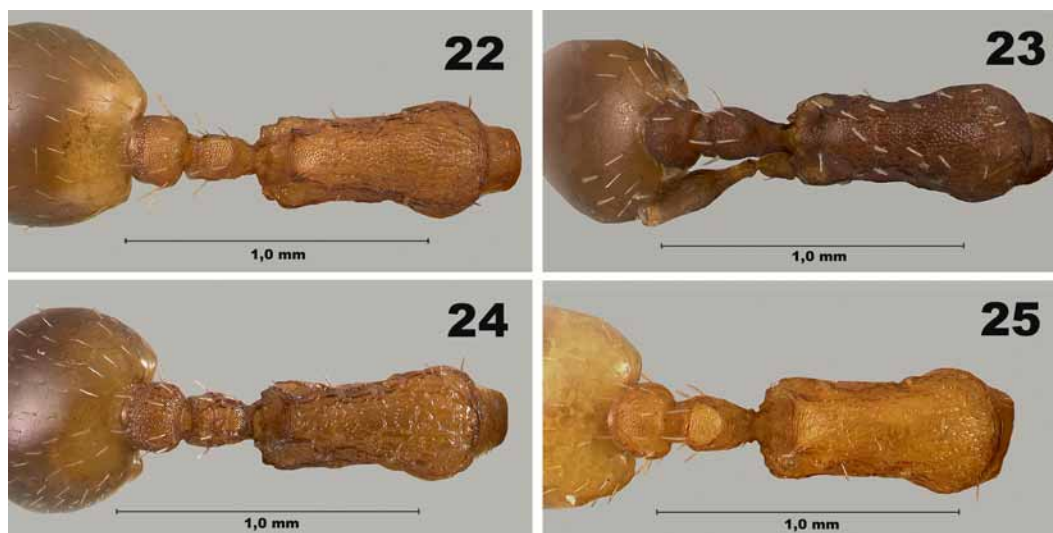
FIGURES 2–11. *Temnothorax* workers, left: lateral view of body, right: full-face view of head. 2 & 3, *T. alienus* Holotype; 4 & 5, *T. satunini*, Prov. Artvin, East Turkey; 6 & 7, *T. nylander*, Beira Alta, Sierra de Montemuro, Portugal; 8 & 9, *T. lichtensteini*, Südtirol, Italy; 10 & 11, *T. italicus*, Island Krk, Croatia.



FIGURES 12–21. *Temnothorax* workers, left: lateral view of body, right: full-face view of head. 12 & 13, *T. saxatilis* Holotype; 14 & 15, *T. nigriceps*, Arcadia, Peloponnesos, Greece; 16 & 17, *T. tuborum*, Südtirol, Italy; 18 & 19, *T. anodontoides*, Arkadia, Peloponnesos, Greece. 20 & 21, *T. affinis*, near Spitz, Wachau, Austria.

Head narrower anterior to eyes than posteriorly. Margins of head posterior to eyes weakly convex, vertexal corners evenly rounded, posterior margin of vertex linear. Frontal triangle somewhat impressed but not clearly demarcated. Frontal carinae narrow and short, strongly divergent posteriorly. Mesosoma with dorsal profile evenly and weakly convex, without metanotal groove. Propodeal spines broadly attached, nearly triangular, acute, slightly pointed upward and slightly divergent. Petiole subsessile, its anterior face straight or only

slightly concave, node triangular with rounded apex. Posterior face weakly convex or straight, sloping downwards nearly at the same angle as the anterior face. Anterior subpetiolar process large, slightly longer than broad at the base. In dorsal view, petiole with weakly convex to straight sides at midlength, strongly converging anteriorly. In dorsocaudal view the node apex is relatively narrow with a straight dorsal margin. Postpetiole in lateral profile more or less evenly rounded. In dorsal view the postpetiole is subrectangular with weakly rounded corners, slightly broader anteriorly, sides are straight and nearly parallel.



FIGURES 22–25. *Temnothorax* workers, dorsal views showing first gaster tergite, postpetiole, petiole and mesosoma. 22 *T. alienus*, Holotype; 23, *T. saxatilis*, Holotype; 24, *T. nigriceps*, Arcadia, Peloponnesos, Greece; 25, *T. tuberum*, Val di Fossa, Alto Edige, Italy.

Mandibles very finely irregularly longitudinally striate, sublucid. Frontal triangle smooth with 1–2 shallow micro-rugulae. Clypeus medially lucid, without a coarse median carina, but with some paramedian striae running half way from anterior to posterior clypeal border. Scapes faintly striate to very finely granulate. Frons with a narrow medial unsculptured and lucid part, other surfaces irregularly and divergently rugose with anastomoses. Interspaces between rugae densely reticulate. Posterior frons reticulate with isolated superficial rugae. Genae, surface around the eyes and vertex irregularly rugose to striate, with densely reticulate interstices. Surface posterior to eyes with semicircular rugulae. Ventral surface of head laterally striate, medially smooth. Entire mesosoma irregularly and densely rugose to rugoreticulate, dorsal median surface of mesonotum alveolate. Space between the propodeal spines and entire petiole and postpetiole reticulate. Petiolar node with some fine rugae superimposed on the reticulum. Gaster lucid. Colour entirely yellowish-orange, appendages with same colour, without darker antennal club. Up to 2/3 of posterior portion of first gastral tergite dull orange-brown. Standing pilosity of head, mesosoma and gaster of medium size, transparent, with blunt tips.

Some specimens have stronger medial carinae on the clypeus, the head may be slightly darker than the mesosoma, the distal antennal club may be slightly darker than the rest of the funiculus, the femur may be darker, the gaster may be mainly brownish, with a more or less extended yellow orange spot on the anterior-most portion of the first gastral tergite. The sculpture may be coarser in general, the frons may be entirely reticulate.

Description of gyne. Measurements and indices (n=4): HL 0.74 ± 0.03 (0.73–0.79), HW 0.69 ± 0.03 (0.66–0.73), SL 0.52 ± 0.02 (0.50–0.54), ED 0.21 ± 0.01 (0.19–0.22), MW 0.77 ± 0.02 (0.75–0.80), PSL 0.10 ± 0.01 (0.09–0.11), PEL 0.30 ± 0.01 (0.29–0.32), PEW 0.23 ± 0.01 (0.22–0.25), PHD 0.11 ± 0.01 (0.10–0.11), PPL 0.23 ± 0.01 (0.22–0.24), PPW 0.31 ± 0.01 (0.30–0.31), ML 1.19 ± 0.04 (1.15–1.24), PEH 0.30 ± 0.01 (0.28–0.31), HS 0.72 ± 0.03 (0.69–0.76), SL/HS $0.72.0 \pm 0.01$ (0.71–0.73), ED/HS 0.29 ± 0.01 (0.26–0.30), HW/HL 0.93 ± 0.01 (0.92–0.94), MW/ML 0.65 ± 0.01 (0.63–0.66), PSL/ML 0.08 ± 0.01 (0.07–0.09), PEH/PEL

0.97±0.06 (0.87–1.03), PEW/PEL 0.77±0.04 (0.72–0.82), PHD/PEW 0.34±0.02 (0.32–0.36), PPL/PPW 0.74±0.03 (0.70–0.76), PEW/PPW 0.76±0.02 (0.75–0.79), PEL/ML 0.28±0.04 (0.25–0.34).



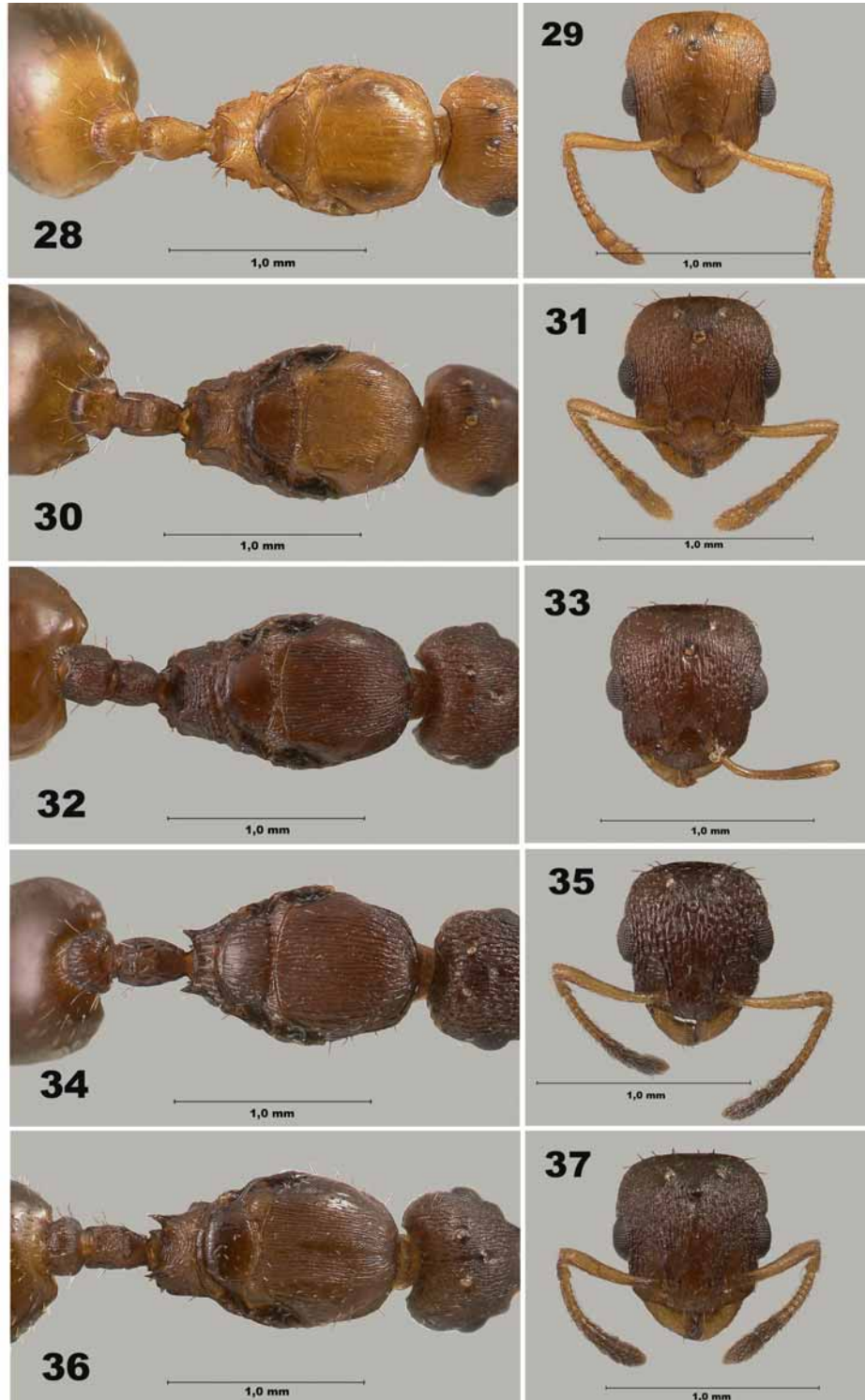
FIGURES 26–27. *Temnothorax* gynes, lateral view of body. 26, *T. alienus* Holotype; 27, *T. saxatilis* Holotype.

Head relatively large with weakly convex and convergent genae, rounded vertexal corners and slightly convex anterior clypeus margin. Compound eyes relatively small. Mesosoma short, relatively high and robust, with straight dorsal margin, and distinct pronotal corners. Scutellum broader than long, posterior margin of it semicircular. Propodeal spines short, broadly attached and triangular, with pointed tips, posteriorly oriented. In dorsal view the spines are linear and parallel-sided. Petiole subsessile, with general shape as described for workers. Postpetiole shaped as in workers.

Mandibles faintly longitudinally striate, sublucid. Frontal triangle unsculptured and lucid. Clypeus medially lucid, without a coarse median carina, but with some paramedian carinae, with lucid interstices. Scapes faintly striate, or granulate. Frons striate to carinate, with unsculptured and lucid interstices. Other parts of head dorsum more strongly longitudinally carinate to irregularly rugose, with lucid interstices. Anterior surface of pronotum reticulate, other parts broad-meshed rugose with shining interstices. Mesonotal dorsum with a few longitudinal, nearly invisible carinae, mainly shining. Scutellum lucid, laterad with 2–3 very fine striae on each side. Dorsum of propodeum transversely and diffusely carinate, between and below the spines trans-

versely reticulo-striate. Anepisternum and other lateral parts of mesosoma irregularly and shallowly rugo-striate, with shining interstices. Petiole and postpetiole dorsally rugoreticulate, ventrally reticulate, subopaque. Bicoloured, mainly orange with equally coloured or paler appendages, without darker antennal clubs. Genae, dorsum of head, two lateral small spots of mesonotum, 50% of scutellum, and 2/3 of first gastral tergite darker coloured, testaceous to brownish. Standing pilosity as described in workers.

The male is unknown.



FIGURES 28–37. *Temnothorax* gynes, left: dorsal view of body. right: full-face view of head. 28 & 29, *T. alienus* Holotype; 30 & 31, *T. nylanderi*, Beira Alta, Sierra de Montemuro, Portugal; 32 & 33, *T. saxatilis* Holotyp; 34 & 35, *T. nigriceps*, Arcadia, Peloponnesos, Greece; 36 & 37, *T. affinis*, near Spitz, Wachau, Austria.

Differential diagnosis. Workers of *Temnothorax alienus* show the typical *nylanderi*/*parvulus*-like petiolar shape (Fig. 6 & 7), but differ from the latter in lacking a metanotal impression or groove. The colour of *T. alienus* is uniformly light yellow-orange, with only a slightly darker broad band on the first gastral tergite. Other Italian *Temnothorax* are dark brown to black, or have distinctly darker antennal clubs, or if yellow, they have a shining surface.

Other species that are similar to *Temnothorax alienus* and lack a metanotal groove are *T. tianshanicus* (Tarbinsky 1976), *T. satunini* (Ruzsky, 1902), an unidentified species from Morocco, *T. luteus* (Forel 1874), *T. rabaudi* (Bondroit, 1918), and *T. italicus* (Consani & Zangheri, 1952). The central Asian *T. tianshanicus* has longer scapes, broader head, and shorter propodeal spines than *T. alienus*. The head dorsum of *T. tianshanicus* is more shining. In addition, *T. tianshanicus* sometimes has a faint metanotal depression. Other characters are similar, thus *T. tianshanicus* is morphologically the closest to *T. alienus*.

Temnothorax satunini (Fig. 4 & 5), a species from southern to eastern Turkey and Caucasus, is also morphologically similar, but differs in the following characters: narrower and shining, nearly unsculptured head; yellow colour without darker gaster, and often distinctly shorter propodeal spines (PSL/ML <0.07).

An unidentified *Temnothorax* species from Morocco (PCAS sp. 27 “Morocco”) has distinctly longer scapes, a lower, narrower petiole, and a faint metanotal depression. Additionally, the petiole is truncated and pedunculate. Sculpture and colour are similar to *T. alienus*.

Another lighter coloured species with slightly convex or straight mesosomal dorsum is *Temnothorax luteus* s.l., which is distinguishable from *T. alienus* by longer propodeal spines, broader head, longer scapes, and the distinctly lower, pedunculate and narrower petiole. Sculpture characters are similar to *T. alienus*, but in *T. luteus* the whole gaster is yellowish coloured. The taxonomic situation of *T. luteus* is not clear yet; one can split the taxon into two or more species.

The two arboreal species *Temnothorax rabaudi* and *T. italicus* (Fig. 10 & 11) are similar in the shape of petiole and mesosoma, and might be confused with *T. alienus*. However, *T. rabaudi* and *T. italicus* differ morphometrically in the length of propodeal spines, and the petioles of both species are distinctly lower and more triangular. The petiolar node apex is more rounded in lateral view, with a straight anterior face. The sculpture of head is more heavily reticulate in both species.

Species that have a metanotal groove but otherwise resemble *Temnothorax alienus* are *T. lichtensteini* (Bondroit, 1918), *T. nylanderi* (Foerster, 1850), *T. crassispinus* (Karawajev, 1926), *T. parvulus*, (Schenck 1850) and *T. flavicornis* (Emery 1870).

Temnothorax lichtensteini (Fig. 8 & 9) workers can easily be distinguished from *T. alienus* by their very long and curved propodeal spines, the pedunculate petiole with a more rounded or truncated node, the distinct metanotal groove, and the denser sculpture of the head and other parts of the body. Also *T. lichtensteini* is smaller. Sometimes the colour is identical to *T. alienus*, but it is usually darker.

Temnothorax nylanderi can be distinguished from *T. alienus* by its longer propodeal spines and more widely separated frontal carinae. *T. nylanderi* (Fig. 6 & 7) and *T. crassispinus* workers are darker, with brownish head and mainly dark brown gaster. They can be distinguished from *T. alienus* by their distinct metanotal groove, more truncated petiolar node, and evident fine and dense parallel striae on the frons. Sometimes the metanotal groove is less visible or rarely absent in *T. lichtensteini*, *T. nylanderi*, and *T. crassispinus*.

Temnothorax parvulus has distinctly longer propodeal spines, a deep metanotal groove, a smaller head, and gradually narrower frontal carinae. In addition, *T. parvulus* has a less coarse, mainly reticulate sculpture, and a uniform pale yellow colour. *T. parvulus* is rarely found in south Italy.

Temnothorax flavicornis is more common, but is easily differentiated by its 11-jointed antenna, coarser head sculpture, longer propodeal spines, and lower petiole.

The gynes of *Temnothorax alienus* are morphologically similar to *T. parvulus* or a pale *T. nylanderi* (Fig. 30 & 31). To distinguish gynes of *T. alienus* from other *Temnothorax* species is more difficult than in workers.

TABLE 1. Morphometric characters of *T. alienus*, *T. saxatilis*, and related species, workers.

Species	HS	SL/HS	HW/HL	PSL/ML	PEH/PEL	PEW/PEL	FCD/HS	N=
<i>T. alienus</i> nov. spec.	0.63±0.03 (0.54–0.67)	0.77±0.03 (0.70–0.82)	0.86±0.03 (0.83–0.97)	0.11±0.01 (0.09–0.13)	0.98±0.05 (0.91–1.08)	0.74±0.07 (0.68–0.90)	0.34±0.02 (0.30–0.36)	18
<i>T. italicus</i> (Consani & Zangheri, 1952)				0.13±0.02 (0.09–0.18)	0.83±0.03 (0.78–0.92)			24
<i>T. lichtensteini</i> (Bondroit, 1918)	0.55±0.02 (0.48–0.58)		0.82±0.02 (0.78–0.85)	0.21±0.01 (0.18–0.24)				39
<i>T. luteus</i> (Forel, 1874)		0.86±0.02 (0.80–0.85)	0.82±0.01 (0.80–0.84)	0.15±0.01 (0.12–0.17)	0.84±0.03 (0.80–0.90)	0.61±0.03 (0.57–0.67)		8
<i>T. nylanderi</i> (Foerster, 1850)				0.15±0.01 (0.12–0.18)			0.37±0.01 (0.37–0.41)	18
<i>T. parvulus</i> (Schenck, 1852)	0.54±0.03 (0.48–0.60)			0.20±0.02 (0.17–0.24)			0.38±0.02 (0.34–0.41)	30
<i>T. satunini</i> (Ruzsky, 1902)			0.81±0.02 (0.77–0.87)					41
<i>T. crassispinus</i> (Karawajev, 1926)				0.19±0.02 (0.13–0.24)				70
<i>T. sp</i> 27 "Morocco"	0.65±0.01 (0.64–0.66)	0.84±0.01 (0.84–0.84)			0.86±0.03 (0.83–0.86)	0.64±0.05 (0.59–0.69)		3
<i>T. tianshanicus</i> (Tarbinsky, 1976)		0.85±0.02 (0.82–0.88)	0.82±0.02 (0.80–0.85)	0.08±0.02 (0.06–0.10)				9
<i>T. saxatilis</i> nov. spec.	0.56±0.02 (0.53–0.59)	0.74±0.02 (0.70–0.77)						9
<i>T. anodontoides</i> (Dlussky & Zabe- lin, 1985)	0.63±0.03 (0.57–0.70)	0.79±0.02 (0.76–0.82)						35
<i>T. nigriceps</i> (Mayr, 1855)		0.77±0.02 (0.72–0.81)						20

Compared to *Temnothorax alienus*, gynes of *T. tianshanicus* are distinctly smaller, have longer scapes, a narrower head and petiole, a different petiole shape, and a darker colour. *T. satunini* differs in the shorter propodeal spines, in shorter and narrower head, and narrower mesosoma, but sculpture and colour are equal. In *T. luteus* the scapes and propodeal spines are longer, and the petiole is pedunculate and distinctly lower. Nearly the whole mesonotum and scutellum is strongly longitudinally rugose, whereas in *T. alienus* the surface is mainly unsculptured and shiny. In southern Italy, *T. luteus s.l.* is brownish and strongly sculptured. Gynes of *T. rabaudi* and *T. italicus* have tooth-like propodeal spines and a distinctly lower petiole. In both species the head is densely reticulate. Gynes of *T. lichtensteini* are dark ferrugineous to brown, distinctly smaller, with larger eyes, and longer propodeal spines. *T. nylanderi* has a narrower petiole in comparison with the postpetiole, darker head, and the same striation of frons as described in workers. *T. crassispinus* has distinctly longer propodeal spines. Sculpture and colour are similar to *T. nylanderi*, but *T. crassispinus* is generally darker than *T. alienus* and *T. nylanderi*. The gyne of *T. parvulus* has a smaller head, larger eyes, longer propodeal spines, and a narrower petiole in comparison with the postpetiole. The colour of *T. parvulus* is sometimes uniformly yellowish-testaceous including the gaster, in contrast to the more ferrugineous gynes of *T. alienus*, but usually *T. parvulus* has brownish coloured gynes. *T. parvulus* also has a more pedunculate petiole than *T. alienus*, yet they are very similar and most safely distinguished by morphometric characters.

TABLE 2. Morphometric characters of *T. alienus*, *T. saxatilis*, and related species, gynes.

Species	HS	SL/HS	ED/HS	HW/HL	PSL
<i>T. alienus</i> nov. spec.	0.72±0.03 (0.69–0.76)	0.72±0.01 (0.7–0.73)	0.27±0.01 (0.26–0.30)	0.93±0.01 (0.92–0.94)	0.10±0.01 (0.09–0.11)
<i>T. italicus</i> (Consani & Zangheri, 1952)		0.67±0.02 (0.67–0.71)			0.03±0.01 (0.01–0.05)
<i>T. lichtensteini</i> (Bondroit, 1918)	0.65±0.01 (0.63–0.67)	0.75±0.02 (0.73–0.80)	0.32±0.01 (0.31–0.34)		0.14±0.01 (0.13–0.16)
<i>T. luteus</i> (Forel, 1874)		>0.73			>0.11
<i>T. nylanderi</i> (Foerster, 1850)					
<i>T. parvulus</i> (Schenck, 1852)	0.66±0.01 (0.63–0.68)		0.32±0.01 (0.31–0.35)		0.14±0.02 (0.12–0.17)
<i>T. satunini</i> (Ruzsky, 1902)	0.67±0.02 (0.65–0.69)	0.76±0.02 (0.74–0.78)		0.89±0.01 (0.88–0.90)	0.08±0.01 (0.07–0.08)
<i>T. crassispinus</i> (Karawajev, 1926)					0.15±0.02 (0.11–0.18)
<i>T. tianshanicus</i> (Tarbinsky, 1976)	0.63±0.01 (0.62–0.64)	0.81±0.02 (0.78–0.84)		0.85±0.02 (0.82–0.87)	0.08±0.01 (0.08–0.08)
<i>T. saxatilis</i> nov. spec.	0.72				
<i>T. affinis</i> (Mayr, 1855)					
<i>T. nigriceps</i> (Mayr, 1855)					
<i>T. anodontoides</i> (Dlussky & Zabelin, 1985)					
<i>T. tuberum</i> (Fabricius, 1775)	0.69±0.02 (0.63–0.72)				

continued.

Species	PSL/ML	MW/ML	PEH/PEL	PEW/PEL	PEW/PPW	N=
<i>T. alienus</i> nov. spec.	0.08±0.01 (0.07–0.09)	0.65±0.01 (0.63–0.66)	0.97±0.06 (0.90–1.03)	0.77±0.04 (0.72–0.82)	0.76±0.02 (0.75–0.79)	4
<i>T. italicus</i> (Consani & Zangheri, 1952)	0.02±0.01 (0.01–0.04)		0.77±0.06 (0.69–0.88)			6
<i>T. lichtensteini</i> (Bondroit, 1918)	0.12±0.01 (0.10–0.13)	0.58±0.01 (0.56–0.60)		0.66±0.04 (0.57–0.70)		14
<i>T. luteus</i> (Forel, 1874)	>0.09		<0.90	<0.72		1
<i>T. nylanderi</i> (Foerster, 1850)					0.70±0.02 (0.67–0.73)	12
<i>T. parvulus</i> (Schenck, 1852)	0.12±0.012 (0.10–0.15)	0.60±0.01 (0.58–0.63)			0.67±0.03 (0.61–0.72)	13
<i>T. satunini</i> (Ruzsky, 1902)		0.59±0.01 (0.59–0.60)				4
<i>T. crassispinus</i> (Karawajev, 1926)	0.12±0.02 (0.09–0.15)					33
<i>T. tianshanicus</i> (Tarbinsky, 1976)				0.69±0.03 (0.65–0.72)	0.68±0.01 (0.66–0.70)	7
<i>T. saxatilis</i> nov. spec.	0.04		0.89	0.73		1
<i>T. affinis</i> (Mayr, 1855)			0.77±0.03 (0.70–0.82)			17

<i>T. nigriceps</i> (Mayr, 1855)	0.08±0.02 (0.05–0.10)			10
<i>T. anodontoides</i> (Dlussky & Zabelin, 1985)	0.09±0.02 (0.07–0.12)	0.75±0.04 (0.68–0.84)	0.64±0.05 (0.56–0.71)	1
<i>T. tuberum</i> (Fabricius, 1775)	0.07±0.01 (0.04–0.09)			36

Comments. Some of the *Temnothorax alienus* nests were collected in a forest with *Quercus* and *Laurus* trees, at the base of a hill. The ground was covered with rocks and ivy. Nests were located in dead sticks on the ground. A second locality where specimens were collected had sparse vegetation with scattered *Castanea* and *Corylus* trees.

An unpublished cytochrome oxidase (CO 1) analysis (Pusch *et al.*) supports the hypothesis that *T. alienus* is not related to the *T. nylanderi/parvulus* complex, but is phylogenetically closer to *T. unifaciatus* or *T. luteus*.

***Temnothorax saxatilis* nov. spec.**

(Figs 12, 13, 23, 27, 32, 33)

Holotype worker. ITALY, Abruzzi, Prov. L'Aquila, Gran Sasso, 6 km NE. Castel del Monte, 1600m.a.s.l. 12.iv.1994, Leg. M. Sanetra [SMNK].

Paratypes. 8 workers and 1 gyne, same data as holotype [SMNG, MHNG, MCSN, PCAS].

Etymology. The Latin word means “between the rocks,” a tribute to the name of the type locality, Gran Sasso.

Description of worker. Measurements and indices [holotype] (n=10): HL [0.637] 0.62±0.02 (0.59–0.66), HW [0.532] 0.51±0.02 (0.48–0.54), SL [0.428] 0.42±0.02 (0.38–0.43), FCD [0.214] 0.21±0.01 (0.20–0.22), ML [0.822] 0.77±0.03 (0.72–0.82), MW [0.399] 0.37±0.02 (0.35–0.40), PSL [0.081] 0.08±0.01 (0.07–0.10), PEL [0.261] 0.25±0.02 (0.23–0.28), PEW [0.176] 0.16±0.01 (0.14–0.18), PEH [0.228] 0.21±0.01 (0.19–0.23), PPW [0.228] 0.21±0.01 (0.20–0.23), HS 0.56±0.02 (0.53–0.59), HW/HL 0.82±0.02 (0.78–0.84), SL/HS 0.74±0.02 (0.67–0.77), FCD/HS 0.37±0.01 (0.35–0.39), MW/ML 0.46±0.01 (0.48–0.50), PSL/ML 0.11±0.01 (0.09–0.12), PEH/PEL 0.84±0.05 (0.76–0.90), PEW/PEL 0.64±0.04 (0.59–0.68), PEW/PPW 0.75±0.03 (0.71–0.79).

Head slender, narrower anterior to eyes than posteriorly, vertexal corners evenly rounded, posterior vertexal margin medially slightly concave. Anterior margin of clypeus slightly convex, medially with a shallow depression or straight. Frontal carinae short, nearly parallel-sided. Scapes short. Mesosoma relatively narrow, in lateral view moderately high, with the dorsal margin mainly straight, or slightly convex. Propodeal spines short, broadly attached, nearly triangular, in dorsal view nearly linear and only slightly divergent distally, with rounded tips. Petiole pedunculate, average high and broad, in lateral view with a broadly rounded node. Anterodorsal petiolar node weakly angulate, anterior petiolar face concave. In dorsal view the node is evenly rounded, without angles or a crest. In dorsal view the postpetiole is subrectangular, slightly broader anteriorly than posteriorly.

Mandibles partially rugoreticulate, lucid. Frontal triangle faintly granulate, lateral parts of clypeus irregularly striate to rugoreticulate, medially faintly granulate, with one superimposed shallow carina, surface subopaque. Frons reticulate with some striae, sublucid. Genae rugoreticulate, around the eyes, and whole vertex mainly reticulate. Larger specimens more rugoreticulate. Ventral surface of head faintly reticulate, medially lucid. Entire mesosoma densely reticulate, with a few superimposed rugulae on dorsum and pronotum. Propodeum between the propodeal spines and postpetiole reticulate, petiolar dorsum rugoreticulate, dorsal face of propodeum reticulate. Gaster lucid. Colour dark ferrugineous to brown; head darker than gaster and append-

ages. Antennal clubs dark brown. Standing pilosity of head, mesosoma and gaster sparse, transparent, with blunt tips.

Description of gyne. Measurements and indices (n=1): HL 0.74, HW 0.67, SL 0.50, FCD 0.26, ED 0.20, ML 1.33, MW 0.76, PSL 0.05, PEL 0.31, PEW 0.23, PEH 0.28, PPL 0.20, PPW 0.30, HS 0.72, HW/HL 0.94, SL/HS 0.70, FCD/HS 0.36, ED/HS 0.28, MW/ML 0.57, PSL/ML 0.04, PEH/PEL 0.89, PEW/PEL 0.73, PPL/PPW 0.68, PEW/PPW 0.76.

Head in relation to the mesosoma large and broad, especially behind the eyes. Genae weakly convex and convergent. Behind the eyes the margins are convex, vertexal margin broadly rounded, medially nearly linear. Anterior margin of clypeus slightly convex, medially with a shallow depression. Frontal triangle negligibly impressed. Eyes very small. Frontal carinae short and widely separated. Scapes short. Mesosoma in lateral view flat. Scutellum distinctly broader than long, posterior margin straight. Propodeal spines very short, dentiform.

Petiole pedunculate, average high, but broad, node with a truncated and rounded apex. Anterior-dorsal margin is slightly concave in profile. Subpetiolar process inconspicuous, nearly triangular. In dorsal view with narrow peduncle, strongly divergent, from midlength the sides are nearly parallel. The node apex has rounded, weak lateral corners, in dorsocaudal view. Postpetiole of same shape as in workers.

Mandibles longitudinally striate, lucid. Frontal triangle lucid, clypeus carinate. A small strip of frons nearly unsculptured, lucid, bordered by longitudinal carinae, which are connected by shallow transverse strigae. Each frontal carina fades to less stronger carinae posteriorly. Posterior part of frons reticulo-striate. Genae, surface around the eyes and vertex more strongly rugose, with reticulate interstices. Ventral surface of head reticulo-striate. Lateral parts of mesosoma rugose to carinate with scattered reticulate interstices. Pronotum rugose, mesonotum irregularly and densely carinate with some anastomoses, anterior surface unsculptured medially. Scutellum lucid medially, lateral surface striate. Dorsum of propodeum and surface between the spines transversely carinate. Petiole rugoreticulate, with transverse strigae on dorsum, dorsal petiolar surface and entire postpetiole irregularly reticulate. Dark brown, unicoloured, with the gaster somewhat lighter testaceous to brown. Appendages orange-brown, darker scapes, antennal clubs, and femora.

Differential diagnosis. The workers of *T. saxatilis* are distinguishable from most Italian *Temnothorax* by the brown colour in combination with a conspicuously truncated and robust petiole. In comparison to *T. saxatilis*, *T. nigriceps* (Mayr, 1855) (Fig. 14, 15, 24) has longer scapes and is usually bicoloured with ferruginous mesosoma and waist and contrastingly darker head and gaster. Additionally, the sculpture is much rougher and more visible especially on the head and mesosoma. Workers of *T. tuberum* (Fabricius, 1775) (Fig. 16, 17, 25) always have a distinctly lighter mesosoma and head, and also stronger sculpture on dorsal head surface, than in *T. saxatilis*. Other Mediterranean dark coloured *Temnothorax* species are *T. laestrygon* (Santschi, 1931), *T. niger* (Forel, 1894) and the usually lighter, but sometimes equally dark coloured *T. exilis* (Emery, 1869). The petiole of all three species is lower, triangular, and with a more or less distinct apical crest in lateral view. Furthermore, these species occur only at lower elevations with Mediterranean climate. The arboreal species *T. affinis* (Mayr, 1855) (Fig. 20 & 21) is similar, when specimens are darker than usual, but they differ by distinctly longer propodeal spines. Very rarely specimens of *T. affinis* may have shorter spines in combination with darker reddish brown colour. In such cases, these specimens have a more triangular petiolar node and a more evenly reticulate head, without superimposed rugae. A morphologically similar species outside Italy is the tentatively determined *T. anodontoides* (Dlussky & Zabelin, 1985) (Fig. 18 & 19) from Transcaucasia and a probably isolated population on high mountains of southern Greece. *Temnothorax anodontoides* from Greece can be distinguished from *T. saxatilis* by longer scapes, shorter propodeal spines, lower waist (Table 3) dark brown to nearly black colour, coarser rugose sculpture, and truncated, weakly rounded dorsum/apex of petiolar node.

For comparison only one gyne of *T. saxatilis* is available. The gyne of *T. nigriceps* has longer propodeal spines, more triangular petiolar node in lateral view, and more coarsely sculptured head and mesosoma. *Tem-*

nothorax tuberculatum is a morphologically variable species, but has a smaller head and somewhat shorter propodeal spines. Furthermore, in *T. tuberculatum*, the mesosoma and especially the scutellum is more densely rugose, and the legs are evenly yellowish, whereas the legs of *T. saxatilis* are somewhat bicoloured, mostly brown with ferruginous patches. The gyne of *T. affinis* (Fig. 36 & 37) is normally lighter coloured than in *T. saxatilis*, but darker specimens occur. The propodeal spines are usually longer and the petiole is lower in profile. Head sculpture of *T. affinis* (Fig. 37) is more reticulate and less rugulose, than in *T. saxatilis*. The brownish to black gynes of *T. exilis*, *T. laestrygon* and *T. niger* are distinctive in their low petiole with a triangular and acute petiolar node in profile. The morphometric differentiation of gynes of *T. saxatilis* and *T. anodontoides* from Greece is difficult; only one gyne each is available for comparison. *Temnothorax anodontoides* has a distinctly lower and truncated petiolar node in profile. In addition, in this species the sculpture is mainly rugose and coarser.

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