

## ***Anochetus bytinskii*, a new ant species from Israel (Hymenoptera: Formicidae)**

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### **ABSTRACT**

*Anochetus bytinskii* is newly described from Israel based on workers, a gyne and males. *A. bytinskii* is closely related and compared to *A. ghilianii* (Spinola) and *A. traegaordhi* Mayr. The distribution of *A. bytinskii* in the Mediterranean zone of Israel is briefly discussed, and notes about its nests are provided. A key to the workers of *Anochetus* species occurring in the Mediterranean region and the Middle East is given.

KEY WORDS: *Anochetus bytinskii* n. sp., Israel, key

### **INTRODUCTION**

The genus *Anochetus* Mayr includes 96 species (Bolton, 1995; <http://antbase.org/>) and has a mostly tropical and sub-tropical distribution. Only few species have been recorded from Mediterranean and Middle East localities to date: *A. evansi* Crawley, endemic to Iranian Kurdistan (Brown, 1978); *A. ghilianii* (Spinola), restricted to Morocco and southern Spain (Emery, 1909; Brown, 1964; Tinaut, 1989); *A. sedilloti* Emery, a species with a wide range of distribution from Tunisia and sub-Saharan Africa through Saudi Arabia to western India (Forel, 1900; Brown, 1978; Collingwood and Agosti, 1996); and *A. traegaordhi* Mayr, described by Mayr (1904) from Sudan and recorded from many places throughout Africa (Santschi, 1910; Weber, 1942; Arnold, 1946; Bernard, 1953; Brown, 1978), and also from Saudi Arabia (Collingwood and Agosti, 1996).

Little is known about the biology of *Anochetus*, probably due to widespread cryptobiosis in this genus (Brown, 1978). In the *ghilianii* group, *A. ghilianii* has well-documented subterranean habits and, as argued by Tinaut (1989), this species may have survived the glacial period due to cryptobiosis. The habits of *A. traegaordhi* are less known and mostly comprise anecdotic data: a nest was discovered in Zimbabwe in sand soil (Arnold, 1946); another nest was discovered in Sudan under a tree trunk (Viehmeyer, 1923); and Collingwood (1985) noted that 2 Saudi specimens were collected on the surface foraging under bushy scrub. More information exists on populations of *A.*

*traegaordhi* from Cameroon and Congo that specialize in feeding upon termites of the genus *Nasutitermes* and nest in logs occupied by their prey (Schatz et al., 1999).

A species of *Anochetus* from Israel was first mentioned in 1975, as *Anochetus israelis* n. sp., by the late Prof. Bytinski-Salz in an unpublished "List of Formicidae of Eretz Israel from Mount Hermon to Sinai". However, because the list was never published and the ant was not described, this name remained invalid. Subsequently, Kugler (1988) listed *Anochetus* n. sp. as supposedly an endemic ant for Israel, "close to" the Afrotropical species, *A. traegaordhi*, and the west-Mediterranean species, *A. ghilianii*. In this paper we describe this new species as *A. bytinskii* and compare it to several related species.

### Measurements and indices

Measurements (in millimeters) were made with a stereoscopic microscope (LEICA MZ 8), fitted with an ocular micrometer, at 50x magnification; and indices are reported as percentages. We essentially follow the abbreviations of Brown (1978) and the measurements and ratios used by Arnold (1946), Brown (1976, 1978), Forel (1915) and Viehmeyer (1923).

TL – Total Length, including mandibles

HL – Head Length, including occipital lobes

HW – Head Width

CI – Cephalic Index (=  $100 \times HW/HL$ )

ML – Mandible Length

MW – Mandible Width, measured as maximum width when head in full-face view, dentition excluded

MI – Mandibles Index (=  $100 \times ML/HL$ )

EL – Eye Length

EI – Eye Index (=  $100 \times EL/HL$ )

SL – Scape Length

SI – Scape Index (=  $100 \times SL/HW$ )

AL – Mesosoma Length

pNW – Pronotum Width

mNL – Mesonotum Length

mNW – Mesonotum Width, measured by excluding the striae or costae of the bordering sutures

PL – Petiole Length

PW – Petiole Width, measured in dorsal view and excluding anterior and posterior peduncles

PI – Petiole Index (=  $100 \times PW/PL$ )

PNL – Petiolar Node Length, measured as maximum thickness in lateral view

PNH – Petiolar Node Height

PNI – Petiolar Node Index (=  $100 \times PNH/PNL$ )

GL – Gaster Length

G1W and G2W – First Two Gastric Segments Width, measured in dorsal view

GI – First Two Gastric Segments Index (=  $100 \times G1W/G2W$ )

pTbL – Pro-Tibia Length

**TAXONOMY*****Anochetus bytinskii* Kugler and Ionescu, n. sp.**

(Figs. 1–11)

**Description**

**Worker. Measurements.** TL 5.83–6.98, HL 1.42–1.61, HW 1.21–1.38, SL 1.22–1.41, EL 0.18–0.22, ML 0.75–0.87, AL 2.00–2.23, pNW 0.65–0.74, mNW 0.36–0.47, PL 0.34–0.42, PNH 0.26–0.36, GL 1.41–2.00, G2W 0.76–0.92, pTbL 0.96–1.13, CI 84.2–87.7, SI 97.5–105.7, EI 11.8–14.8, MI 50.3–56.8, PI 72.0–84.7, PNI 84.4–106.3, GI 93.9–100.0 (N = 46).

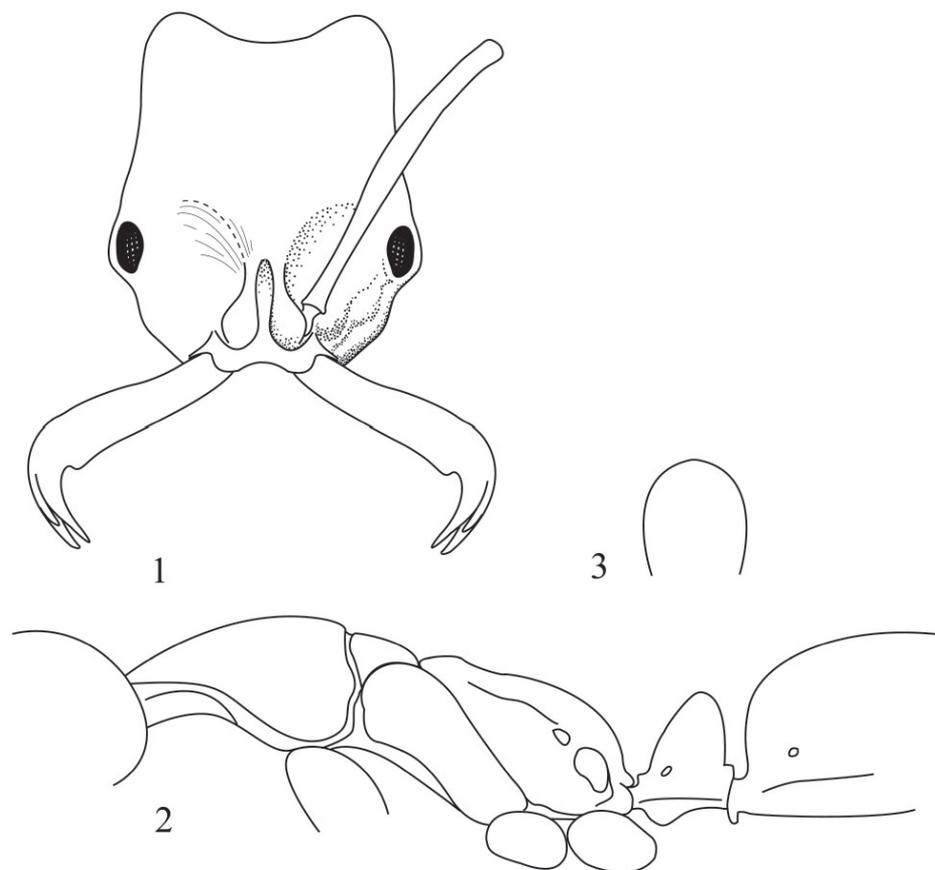
**Head** (Fig. 1). Vertex deeply concave; shallow depression in front of rounded nuchal carina; median furrow absent, except smooth and shiny strip that enlarges in shallow depression at level of posterior margin of orbital fossa. Eye with 8–11 ommatidia across greatest diameter; ocelli absent. Scape slightly curved, barely reaching or slightly surpassing occipital lobe; funiculus 11-jointed, second segment L/W (length-width ratio) 1.9–2.3, about equal to third and fourth segments. Mandible slender, W/L 0.23–0.27, broadened at distal half; medial edge with 2 nearly straight margins extending to semicircular preapical excision; ventral margin with series of 6–11 distinct, rounded denticles followed distally by 3–4 denticles fused into crenulated laminar process; denticles hidden from view by dorsal margin of mandible when head in “full-face” view and mandibles closed.

**Mesosoma** (Fig. 2). Slender, pNW/AL 0.31–0.35, with well-marked pro-mesonotal and meso-metanotal sutures; pronotum sub-pyriform; mesonotal disk convex, wider than long, W/L 2.00–2.79; propodeal dorsum straight to slightly depressed transversely behind metanotal spiracle, narrow, smoothly rounded into declivity; no traces of propodeal angles or teeth; declivity slightly convex in transversal plane.

**Petiole:** distinctly longer than wide. Petiolar node triangular in lateral view (Fig. 2), about as high as long, with rounded apex. In dorsal view, contour of base anteriorly ogival, posteriorly straight, with median concavity (posterior face flat, with feeble vertical sulcus); dorsal margin more or less compressed transversely – apex with distinctly transverse summit only in four of the largest specimens. In anterior view laterally arcuate with bluntly rounded apex (Fig. 3).

**Gaster.** Sub-cylindrical, weakly constricted between first 2 segments; first gastric segment narrower than second in 39 out of 41 examined specimens, and about as broad as long.

**Sculpture.** Head punctulate, smooth and shiny except frontal striation; striae fine but distinct, medially 0.20–0.28 mm long; striae fan out posterolaterally, extending just posterior to frontal carina, and to level of posterior margin of compound eye, laterally entering antennal hollow but not exceeding posterior and lateral margins. Pronotum mostly smooth and shiny; cervix distinctly transversely striate with curved ruga, and posterior to ruga few fine, superficial striae arched parallel to margin; laterally smooth and shiny, finely punctuate; disc with scattered and coarse punctuation in 34 of 46 specimens, superficially and patchily rugo-striate toward margins in concentric pattern



Figs. 1–3. *A. bytinskii* n. sp., worker. 1. Head, full-face view (striation omitted from left side of head). 2. Mesosoma and petiole, lateral view. 3. Petiolar node, anterior view. Pilosity omitted.

in other 12 specimens. Mesonotal disc crossed by up to 13 fine striae, although in 27 specimens anterior half more or less shagreened or striolate and strongly shiny. Dorsum of propodeum patchily rugo-striate and/or vermiculate on anterior third, posteriorly superficially cross-striate (11–16 striae per 0.2 mm); 2–11 striae present toward base of declivity; striae usually visible only in certain illumination, but in six specimens striation distinctly visible on propodeal dorsum and declivity, whereas in eight specimens striae too superficial to be counted; propodeum laterally with oblique striae. Mesopleuron and metapleuron smooth and shiny; ventral extremity of metapleuron with few oblique, strong rugae. Gaster and coxae smooth and shiny, sparsely punctulate. Antenna and mandible fine and densely punctulate.

**Pilosity.** Fine. Longest hairs (L 0.1 – 0.2 mm) abundant and decumbent on gaster, sparse and erect to suberect in bucal region and on coxae, absent on mesosoma, except one suberect hair on pronotal disk. Shorter hairs (L 0.04 – 0.10 mm) fairly abundant on head and thorax, sparse on propodeum and first gastric segment, obsolescent caudad; these hairs appressed to subappressed on most of head, pronotum and propodeum, erect on frontal carina, decumbent to erect on mesonotum, decumbent on gaster. Appendages covered by even shorter, appressed to decumbent pubescence. Propodeum nearly glabrous in few specimens.

**Color.** Living individuals yellow with orange tint. Dry specimens brownish yellow, lighter on mesosoma and coxae; gaster with brownish shading; epistoma, tip of mandible and leg brown.

**Gyne. Measurements.** TL 6.63, HL 1.37, HW 1.27, SL 1.22, EL 0.23, ML 0.71, AL 2.13, pNW 0.69, mNW 0.49, PL 0.41, PNH 0.35, GL 2.27, G2W 1.28, pTbL 0.97, CI 93.1, SI 96.1, EI 16.6, MI 52.2, PI 96.5, PNI 109.1, GI 96.9 (N = 1).

Dealate specimen, size (TL) of average workers, although with protibia length similar to that of smallest workers.

**Head** (Fig. 4). Slightly shorter and markedly broader than in worker with similar tibia length. Eye with 13 ommatidia across greatest diameter; ocelli absent. Mandible as in worker, W/L 0.25.

**Mesosoma** (Fig. 5). More robust than in worker, but with similar proportions; scutum W/L 1.32; scutellum hexagonal, with rounded edges, convex, L 0.19, W 0.27 mm; dorsellum elliptical, L 0.08, W 0.20 mm. Remnants of wings visible as dark brown stumps.

**Petiole.** Oval, broad, W 0.37 mm, only slightly longer than wide, node scale-like, more compressed fronto-caudally and higher relative to length than in workers (Fig. 6).

**Gaster.** Longer and wider than in largest worker, sub-cylindrical, weakly constricted between first two segments, first tergite distinctly broader than long.

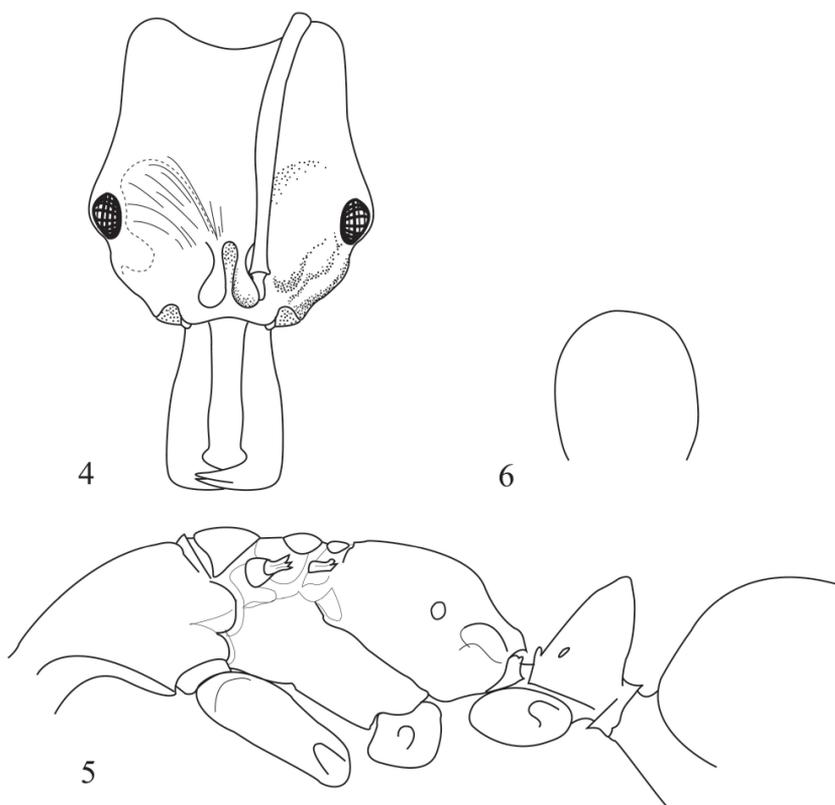
**Sculpture.** Head as in worker; pronotal and mesonotal disc and scutellum smooth and shiny. Propodeum laterally with oblique striae and coarse punctuation, declivity with 15 fine, transverse striae. Mesopleuron and metapleuron smooth and shiny. Gaster, coxae and head laterally shiny and sparsely punctulate.

**Pilosity.** More abundant on mesosoma, as compared to workers, most hairs decumbent to suberect; on gaster predominantly suberect pilosity in contrast to mainly decumbent pilosity of workers.

**Color.** Similar to workers.

**Male. Measurements.** TL 4.17–5.02, HL 0.85–0.87, HW 0.98–1.00, ML 0.12, AL 2.05–2.09, EL 0.50–0.53, PNL 0.340.39, GL 1.97–2.35, fore wing L 4.11–4.19 (N=10).

**Head.** With large compound eyes; three ocelli, raised (Fig. 7), shortest distance to compound eyes equal to four ocelli diameters, shortest distance to antennal sockets equal to three ocelli diameters; mandibles reduced, cuneiform. Scape about twice as long as wide, first funicular segment as long as wide.



Figs. 4–6. *A. bytinskii* n. sp., gyne. 4. Head, full-face view (striation omitted from left side of head). 5. Mesosoma and petiole, lateral view. 6. Petiolar node, anterior view. Pilosity omitted.

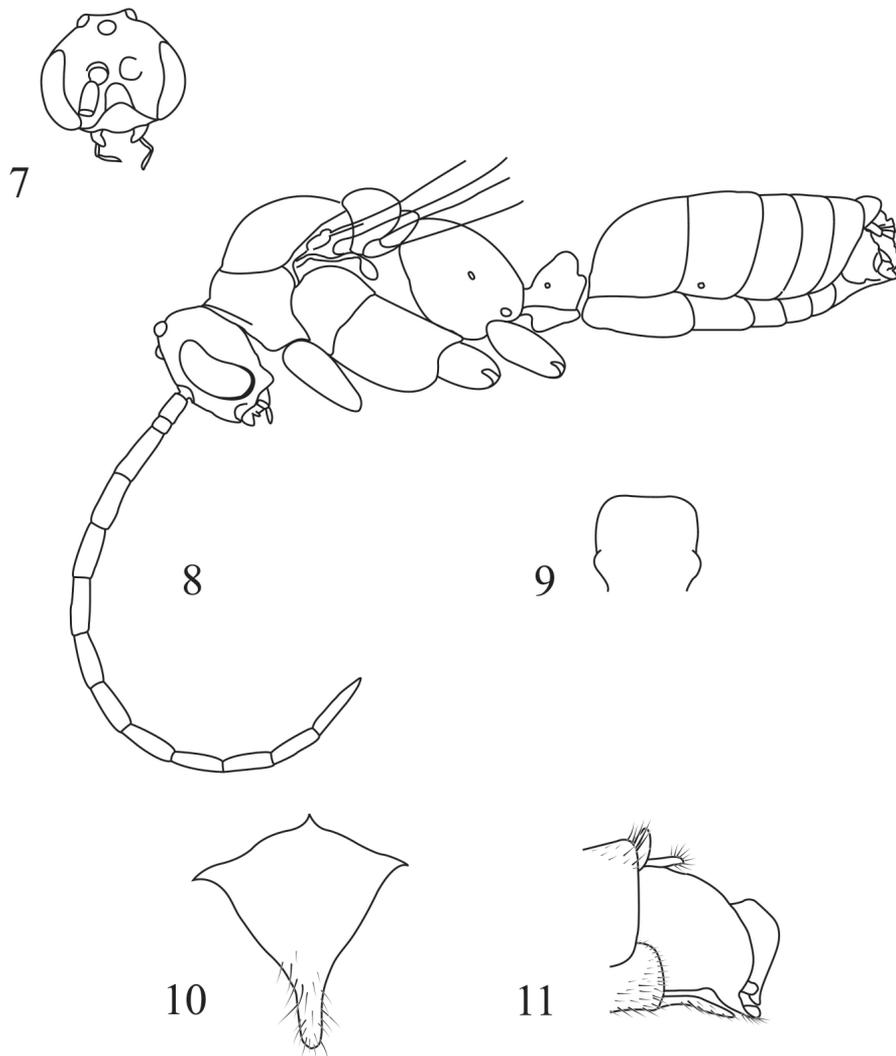
**Mesosoma.** Robust, with convex dorsum and nearly straight pleura; propodeum convex, dorsum rounded into declivity (Fig. 8).

**Petiole.** Node low, height about 0.5 of length, triangular in lateral view, apex bluntly rounded (Fig. 8); dorsal margin shallowly concave in anterior view; anterior face flat; lateral margins almost straight and slightly convergent (Fig. 9).

**Gaster.** Cylindrical, slightly constricted posterior to first segment. Terminalia partly retracted (Fig. 8); pygidium broadly rounded; subgenital plate narrowed caudally into median digitiform process (Fig. 10); cerci present; paramere broad, developed ventrally and apically into linguiform expansion (Fig. 11).

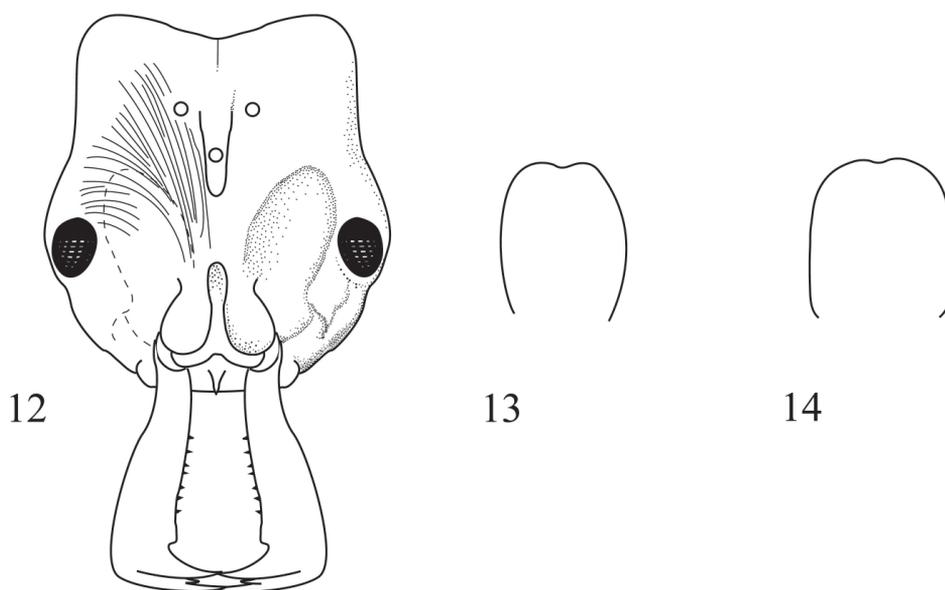
**Sculpture.** Large, coarse punctures on head, mesosoma and gaster. Frons and mesosoma dorsum rugged, propodeum transversely rugulo-striate.

**Pilosity.** Body covered by dense, short, decumbent, golden pubescence, somewhat longer on gaster; antennae and legs with shorter, more abundant appressed to decumbent hairs.



Figs. 7–11. *A. bytinskii* n. sp., male. 7. Head, full-face view. 8. Habitus, lateral view, wing omitted. 9. Petiolar node, anterior view. 10. Subgenital plate. 11. Genitalia, lateral view. Pilosity omitted except from subgenital plate and genitalia.

**Color.** Body predominantly black, antenna and coxae dark brown, terminalia, tibiae and tarsi lighter brown to yellowish brown. Wings transparent with brownish tint, venation and stigma light brown.



Figs. 12–14. *A. ghiliani* and *A. traegaordhi*, gyne. 12. *A. ghiliani* head, full-face view (striation omitted from left side of head). 13. *A. ghiliani*, petiolar node, anterior view. 14. *A. traegaordhi*, petiolar node, anterior view. Pilosity omitted.

### Material examined

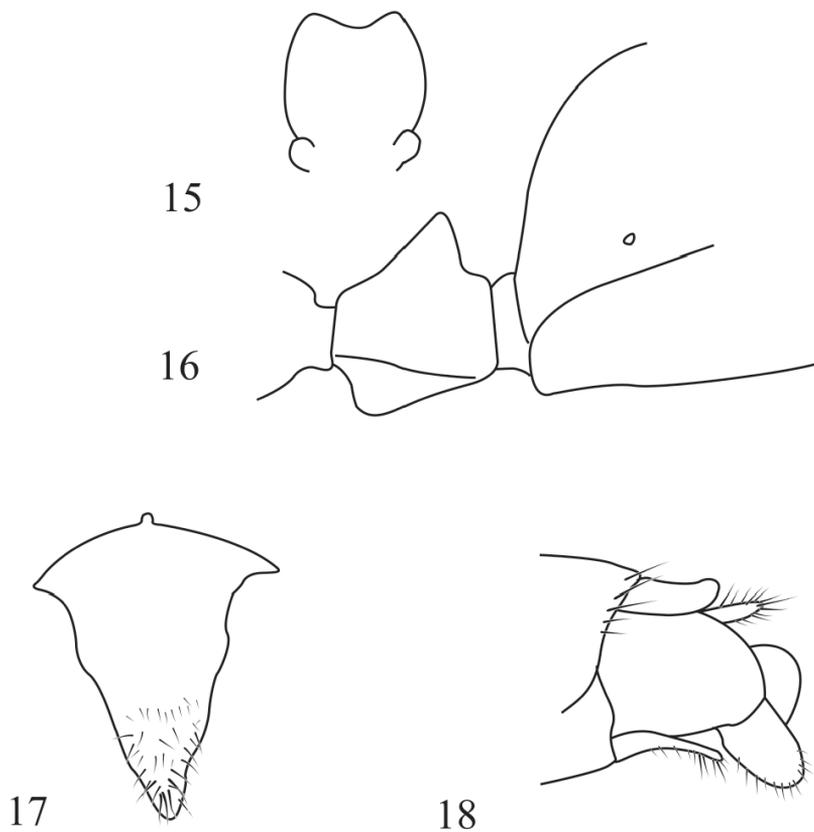
Holotype worker, ISRAEL: Migdal Aféq, 20.iv.1985, J. Kugler and D. Simon, No. 6484. Paratypes: same collection data as holotype (17♀, 10♂, emerged from cocoons in the laboratory, 4–31.v.1985); [Qiryat] Tiv'on, 11.vii.1989, J. Cnaani (2♀); Elyaqim, Karmel, 23.iii.1989, J. Kugler (11♀, 1♀); Karmi'él, 18.ii.2005, Th. Assmann (5♀); Oranim [near Qiryat Tiv'on], xi.1959, M. Costa (3♀); Oranim, 19.iv.1972, J. Ofer (1♀); H̄irbet Usha, 2.vii.1985, D. Simon (11♀). The holotype and paratypes are deposited in the entomological collection of Tel-Aviv University, Israel (TAUI).

### Etymology

The new species is named after the late Prof. Hanan Bytinski-Salz, whose work on the ants of Israel inspired us. Prof. Bytinski-Saltz was the first to note the presence of this species among the Israeli fauna.

### Biology and ecology

The nests of *A. bytinskii* are subterranean. Brood-containing cocoons (N=20) were found inside a chamber of such a nest together with workers, but without eggs and larvae. They were kept in the laboratory till the emergence of the last adults, all males, over a period of 27 days.



Figs. 15–18. *A. ghilianii*, male. 15. Petiolar node, anterior view. 16. Petiolar node, lateral view. 17. Subgenital plate. 18. Genitalia, lateral view. Pilosity omitted except from subgenital plate and genitalia.

The distribution of *A. bytinskii* is limited to the northern half of Israel, from the Karmel Ridge and the Lower Galilee to the Foothills of Judea. This species is apparently cryptobiotic as alluded by the subterranean nature of the nests that, together with their openings, were often found under large stones.

#### Affinities

We compared workers, a gyne and males of *A. bytinskii* n. sp. with the same casts of *A. ghilianii*, *A. sedilloti* and *A. traegaordhi*, whenever available (see Appendix 1 for collection data) and with *A. evansi* (based on the literature only: Crawley (1922) and Brown (1978)). The main differences among workers of these species are also presented in the following key. However, as *A. traegaordhi* is apparently a complex of several Afrotropical species (Bolton, personal communication), we based the key on the East-

African material only, including the holotype, and did not include the studied specimens from Congo, the latter not keying well to any of the species.

Workers: *A. bytinskii* is most similar to the East African *A. traegaordhi*, and the two species share similar head, antenna and mandible shape, and pattern of pilosity distribution. *A. bytinskii* has a distinctly weaker sculpture especially on the head and propodeum, much shorter frontal striation ( $L < 0.19$  as compared to  $L > 0.35$  of HL), and noticeably smaller eyes ( $L < 0.23$  mm as compared to  $L > 0.24$  mm).

Gyne: *A. bytinskii* differs from *A. ghilianii* and *A. traegaordhi* by the rounded, slightly convex declivity of propodeum as compared to a transversely concave declivity; weak and short frontal striation, as compared to a strong striation, extending to the posterior ocellus (Fig. 12); and the rounded petiolar node summit, as compared to an indented petiolar node summit in the other two species (Figs. 13, 14). *A. bytinskii* differs from *A. sedilloti* (based on the descriptions by Forel (1900) and Finzi (1939)) by the mostly smooth and shiny pronotum, mesopleuron and metapleuron as compared to a longitudinally striate pronotum and coarsely striated mesopleuron and metapleuron.

Male: *A. bytinskii* differs from *A. ghilianii* by the smaller ocelli, less bulky propodeum, cylindrical gaster (slightly conical in *A. ghilianii*), and distinctly fewer erect antennal hairs. The petiolar node is dorsally shallowly concave with rounded summit in lateral view in *A. bytinskii*, whereas bidentate with deeply incised dorsal margin, and with sharply pointed summit in lateral view in *A. ghilianii* (Figs. 15 and 16). The subgenital plate of *A. bytinskii* is posteriorly strongly narrowed, whereas that of *A. ghilianii* has elongated triangular shape without becoming caudally digitiform (Fig. 17). In dorsal view the concavity of the paramere is markedly narrower in *A. bytinskii* and in lateral view the caudally constricted part of the paramere is about twice as narrow as that of *A. ghilianii* (Fig. 18). *A. bytinskii* differs from *A. sedilloti* (Forel, 1907; Santschi, 1907) in the dorsal margin of the petiolar node concave as compared to convexly rounded; and subgenital plate apically digitiform as compared to rectangular, linguiform.

#### Key to workers of *Anochetus* species of the Mediterranean region and the Middle East

1. Eye length  $< 0.13$  mm; inner margins of mandible edentate (Iran)..... *evansi*
- Eye length  $> 0.15$  mm; inner margin of mandible denticulate ..... **2**
2. Scape short, not extending to occipital lobe, SI  $< 85$ ; length of second and third Funicular segments subequal; large eye, EI  $> 20$ ; mesopleuron and metapleuron striate (Tunisia, Eritrea, Saudi Arabia, western India) ..... *sedilloti*
- Scape longer, extending to or surpassing occipital lobe, SI  $> 90$ ; length of second and third funicular segments equal; eye smaller, EI  $< 20$ ; mesopleuron and metapleuron largely smooth ..... **3**
3. Mesonotal disc about twice as wide as long or wider; propodeal declivity smoothly rounded in vertical and horizontal plane; petiole distinctly longer than wide (PI  $< 86$ ), node about as high as long (PNI  $< 106$ ), summit more or less rounded; cross striation on propodeal dorsum finer than on pronotal cervix, or obsolete (Israel) ..... *bytinskii* n. sp.
- Mesonotal disk W/L  $< 2$ ; propodeal declivity bordered by elevated ridges (costae) and/or declivity transversely concave posterior to transition from dorsum; petiole about as broad as

- long or broader (PI > 86), node higher than long (PNI > 110), with transverse summit; cross striation on propodeal dorsum equally strong or stronger than on pronotal cervix..... 4
4. Eye length 0.16 – 0.22 mm in greatest diameter; mesonotal disk finely rugged, shagreened and dull; petiolar node scale-like, laterally strongly rounded; first gastric segment narrower than second or equally wide; antenna, mesosoma dorsum and tarsi with many strong suberect to erect hairs (Morocco, Southern Spain) ..... *ghilianii*
- Eye length > 0.24 mm in greatest diameter; sculpture of mesonotal disk variable, from striolate and strongly shiny to completely cross-striate; petiole width variable, node with parallel margins; first gastric segment broader than second; pilosity fine, antenna, mesosoma dorsum and tarsi with few suberect to erect hairs (Sudan, Eritrea, Saudi Arabia) ..... *traegaordhi*

### ACKNOWLEDGMENTS

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## APPENDIX 1

### Examined specimens of non-Israeli species used in this study

- A. ghilianii*: Spain: Algeciras, Vogt (3♀; MHNG), (1♀; TAUI), Algeciras, 20.ix.85, A. Tinaut (3♀, 1♂; A. Tinaut), Andalusia, Rosenhauer (1♀; MHNG), Cadiz, 5.xi.89, A. Tinaut (3♀, TAUI); Morocco: Casablanca (1♀; TAUI), Ito, 27.iii.1923, Ad. Nadig (6♀; TAUI), Tangier, 25–29.iv.1926, Lindberg (2♀, 1♂; TAUI), Volubilis, ii.1922, Alluaud (4♀; TAUI).
- A. traegaordhi*: Sudan: Khartoum, Sudan, 1901, Traegaordh (1♀, holotype; SMNH), Renk, 20.iv.1914, Ebner (1♀, described as type of *A. gracilicornis* Viehmeyer 1923; MNHU; 1♀; NHMV), Keilak, ii.1956, L. Sweeney (1♀; TAUI); D.R. Congo: “Congo Belge”, H. Kohl (5♀; MHNG), “Kongo”, H. Kohl (1♀; MNHU), Stanleyville, H. Kohl (3♀; MNHU); R. Congo, Brazzaville, Weiss (1♀, determined by Mayr as *A. traegaordhi* (Santschi 1910) and labeled by Forel “v. *plus pileuse*”; MHNG).
- A. sedilloti*: Tunisia (1♀, cotype; MHNG), Kairouan, vii.1906, Santschi (1♂; MHNG); Leghon, Ghana, 22.vi.1972, D. Leston (1♀; TAUI).