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## ***Ununguitarsonemus rarus* (Acari: Tarsonemidae), a new species of mite associated with bark beetle from Crimea, Ukraine**

### ABSTRACT

*Ununguitarsonemus rarus* (Acari: Tarsonemidae), a new mite species phoretic on *Dryocoetes villosus* (Fabr.) (Coleoptera: Scolytidae) from Crimea, Ukraine is described and illustrated. Another species, *U. peacocki* Smiley et Moser, 1974, is briefly redescribed. Systematic position of the new taxon is briefly discussed and diagnosis of the genus *Ununguitarsonemus* is emended.

Key words: Heterostigmata, systematic, taxonomy, morphology.

### INTRODUCTION

The genus *Ununguitarsonemus* Beer and Nucifora, 1965 was proposed in order to recognize the uniqueness of the earlier described species *Tarsonemella beameri* Beer, 1958. This species is distinguished from *Tarsonemella africanus* (HIRST, 1923) by the presence of capitulate prodorsal sensilli (contrary to sensilli lacking), greater number of ventral metapodosomal setae and unilateral reduction of claws on apoteles of tarsi II and III. The morphology of this species was further augmented by SMILEY (1967), who gave also the first description of a male, still under generic name *Tarsonemella*. Later SMILEY and MOSER (1974) emended the diagnosis of *U. beameri* and described a new species, *U. peacocki*, based on both sexes. The generic concept of the genus was elaborated in the monograph by LINDQUIST (1986), who also set this genus in a phylogenetic framework of the family Tarsonemidae. The present paper is intended to give the morphological description of a third species, being a bark beetle associate found in Crimea, Ukraine. This is also the first European record of the genus.

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## MATERIAL AND METHODS

The female of this new tarsonemid was collected by removing it from between coxae I of the bark beetle, which was trapped while flying. It was subsequently mounted on a slide and studied with a phase contrast microscope Olympus BX 50. All measurements in the description are given in micrometers ( $\mu\text{m}$ ); lengths of legs are compared excluding pretarsi and trochanters.

The nomenclature applied for morphology of gnathosoma, idiosoma and legs follows mainly that of LINDQUIST (1986). In the diagnoses and descriptions abbreviation PrS stands for prodorsal shield, PrP propodosomal ventral plate, ap. 1-1, ap. 2-2, for distances between anterolateral ends of apodemes 1-1 and 2-2 respectively. Leg chaetotaxy counts express the number of non-sole-nidial setae; numbers of solenidia are given in parentheses; sign “+” marks a fusion of segments. Small setae flanking pretarsi: Ta I  $u'$ - $u$ ” and Ta II and III  $u$ ” are visible, but in accordance with the accepted standard of systematic description of Tarsonemidae, these small setae are excluded from the count.

### ***Ununguitarsonemus rarus* sp. n.**

*Diagnosis:* Females of the new species are distinguishable from those of the two other described species by the lack of strongly developed lateral musculature of pharynx (instead, the internal part has the shape of an elongated narrow horse-shoe sclerite); bothridial setae  $sc_1$  shaped as short, stubby spines; narrow triangular form of tegula (contrary to the broad subcircular form in the other two species) resembling that of the genus *Neotarsonemoides* Kaliszewski, 1984; setae  $ag$  short, tapering. The new species (together with *U. peacocki*) differs also from *U. beameri* by apodemes IV not reaching the edge of metapodosomal plate between trochanters III and IV.

Males and larvae: unknown.

#### DESCRIPTION:

FEMALE (figs.1-8): *Gnathosoma*: shape rounded subtriangular. Pharynx as wide as 0.3x of basal width, and as long as 0.6x ventral length of gnathosomal capsule; with glandular bodies small, hard to distinguish. External part of pharynx strongly sclerotized and elongate horse-shoe in shape. Postpalpal ( $pp$ ) setae not visible. Setae  $dgs$  subequal to  $vgs$ , the former pair reaching slightly beyond apices of palpi. Cheliceral stylets and levers small but apparent. Palpi small, about twice longer than wide at the base, inserted close to each other, and parallel to each other. Each palpus with two tiny setae subapically and one minute ventral process; palptibial claw undefined.

*Idiosoma - dorsal side* (length 1.6x width); relative lengths of dorsal setae ( $v_1$ :  $sc_2$ :  $c_2$ :  $c_1$ :  $d$ :  $e$ :  $f$ :  $b$ ): 1: 2: 1: 0.9: 1: 0.5: 0.6: 0.8.

Rostral shield semicircular in shape, ca. 2.5x wider than long. Setae  $v_1$  slender, hair-like, pointed, their bases separated by distance ca. 2.5x longer than their lengths. Prodorsal shield (PrS) with slightly concave posterior edge medially, 1.6x wider posteriorly than long medially; prodorsomedial apodeme diffused, in a shape of an anchor; prodorsolateral apodemes present, though diffused. Sensilli  $sc_1$  very short, spine-like. Tracheae with weakly expressed atrial segment and without postatrial sacs. Pits  $v_2$  located slightly laterally to level of insertions of  $sc_2$  and  $v_1$ . Setae  $sc_2$  located behind half of length of prodorsal shield, not reaching beyond posterior edge of PrS, located in distance of 1.6x their lengths. Setae  $c_2$  not reaching with their tips half of the distance between their bases and those of  $c_1$ . Setae  $c_1$  slender, sharp, not reaching to posterior edge of tergite C; separated by distance of 3.8x their lengths and slightly posteriad of level of  $c_2$ . Subsurface nodules visible mediad and little anteriad of  $c_1$  bases, at a distance from them smaller than lengths of setae. Setae  $d$  thin, attenuated, smooth, not reaching beyond posterior edge of tergite D, located in distance of 4.25x their lengths. Setae  $e$ ,  $f$  and  $b$  pointed, stiff,  $e$  little shorter than  $f$ . Setae  $f$  separated by distance of 3x their lengths. Transverse interval between setae  $b$  3.7x their lengths; longer than  $e$  and  $f$ . Surface of dorsal sclerites covered with uniform, sparse but conspicuous punctate ornamentation.

*Idiosoma - ventral side*: apodemes 1 diffused, anteromedial apodeme continuous, though tending to disappear between apodemes 1 and 2. Area between posterior end of anteromedial apodeme and medial segment of sejugal apodeme weakly defined, without delineated edges but with an evident different sclerotization. Sejugal apodeme continuous, weakened medially, arch-like with undulated fore-edge. Setae  $1a$  very short, tapering pointed, located on the area of apodemes 1, in distance of 2.6x larger than their length. Setae  $2a$  very short, tapering, pointed, located somewhat over mid-lengths of apodemes 2, in distance bigger than their 2x lengths. Propodosomal plate with anterior extremity weakly concave, but protruding under base of gnathosoma and without clear angularities of lateral edges between trochanters I and II. Setae  $3a$  very short, tapering and pointed, separated from  $3b$  by distance of 6x their length, and by transverse distance slightly smaller than that between  $3b$ . Setae  $3b$  short, tapering and pointed, subequal to  $3a$ , and separated by transverse distance 5x as long as their length. Setae  $3c$  very short, tapering and pointed, inserted in distance of over 11x their lengths, separated by transverse distance larger than that between  $3a$

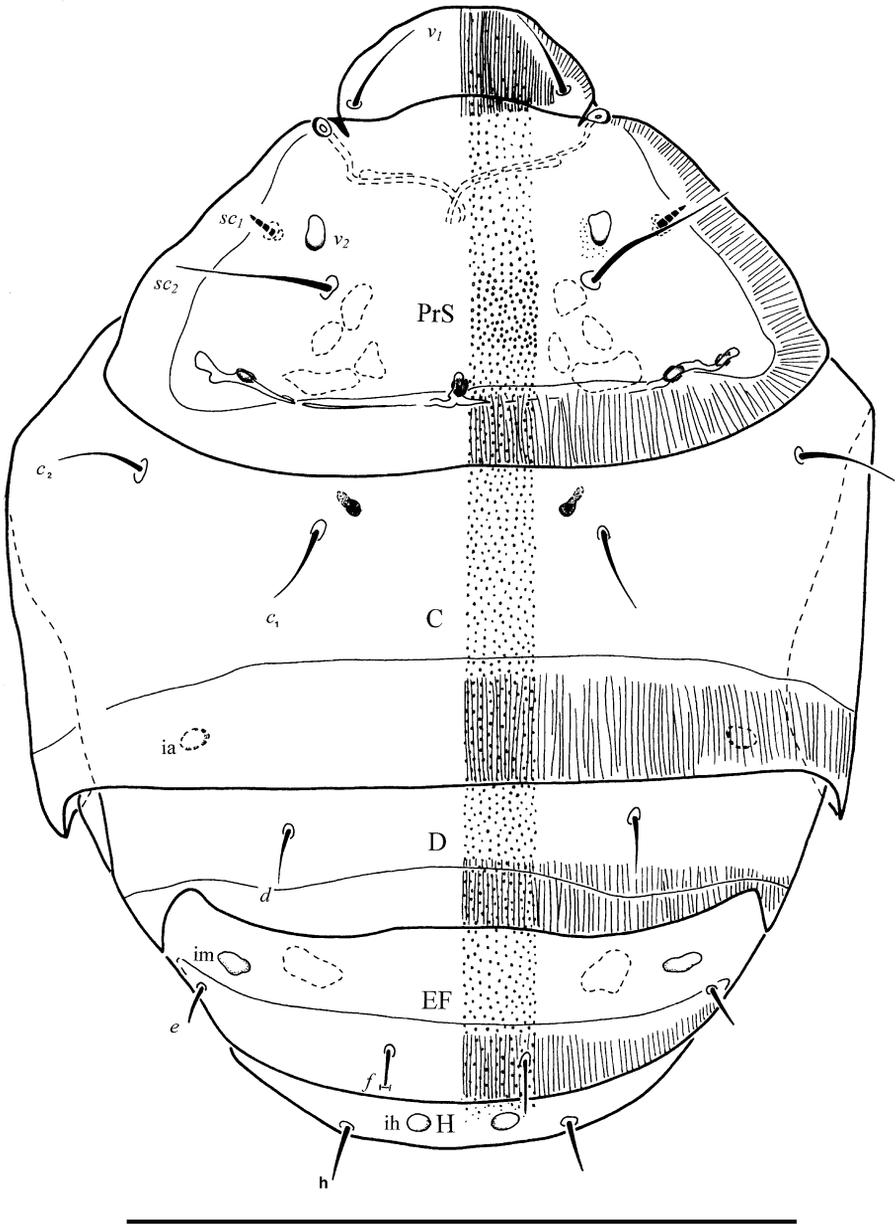


Fig. 1 - *Ununguitarsonemus rarus* sp. n. female idiosoma - dorsal side. Scale bar = 100  $\mu$ m.

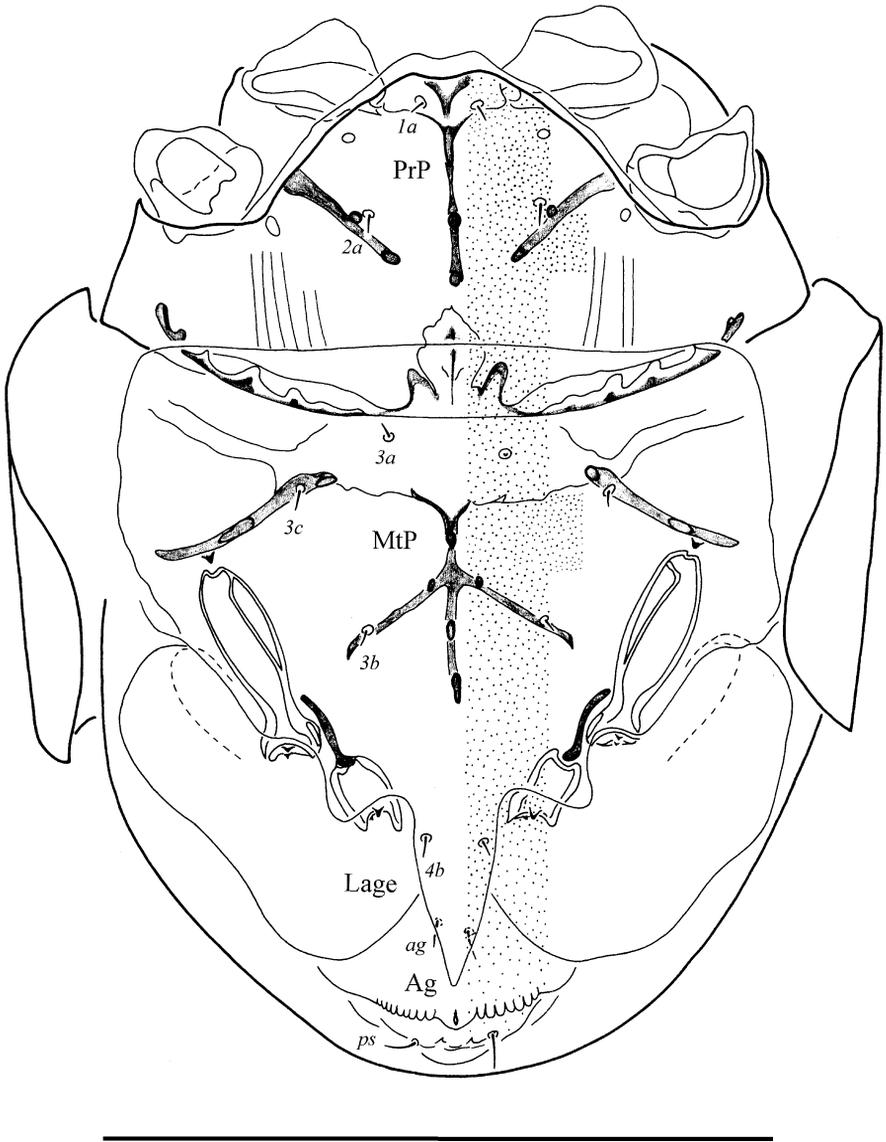


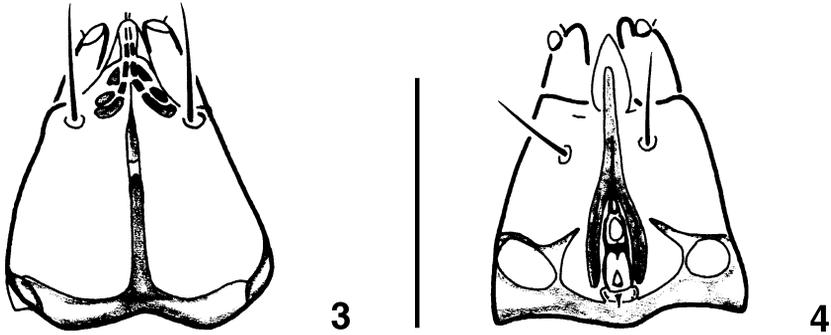
Fig. 2 - *Ununguitarsonemus rarus* sp. n. female idiosoma - ventral side. Scale bar = 100  $\mu$ m.

and *3b*, inserted on anteromedial parts of apodemes 3. Metapodosomal plate almost straight anteriorly, with lobate, rounded protrusions at level of trochanters IV. Apodemes IV not reaching edge of metapodosomal plate between trochanters III and IV, however extending slightly beyond bases of setae *3b*. Tegula relatively narrow, elongate triangular, with bluntly pointed tip, about 2x longer than wide. Posterolateral apodemes of metapodosoma strongly sclerotized, extending from anterolateral extremities of trochanters IV to medial concavities of trochanters III. Setae *4b* very short, tapering, separated by distance of 2.6x their lengths. The distance between posteromedial extremities of trochanters IV as long as approximately 1.5x their width. Aggenital setae short and pointed (though little longer than *4b*), separated by interval equal to their length, under tegula. Aggenital plate with posterior margin convex, weakly undulated. Setae *ps* sharp, slender, delicate, located in distance of 2x their lengths.

*Legs*: Proportions of free segments of legs: (I: II: III: IV): 1: 1: 1: 0.6.

Leg I: Chaetotaxy: 4-4-6(2 $\phi$ )+9(1 $\omega$ ). Tarsal claw sessile, strongly hooked perpendicularly to long axis of a segment, with tip protruding beyond wall of tibiotarsus (actually stronger than in *U. beameri*, resembling more the condition found in *Pseudotarsonemoides*). Seta *s* tapering, pointed, stronger than other non-eupathidial tarsals (but not as much as seta *u'* of tarsi II and III). Setae *u'* and *u''* strong, but not apparently pad-like (as in *U. beameri*), constituting a receptacle in opposition with tarsal claw. Tibiotarsus without ventral bend in area of tibia, ca. 2x longer than wide at base, with distal width approaching proximal. Eupathidion *p'* longer than *p''*, both located subapically; eupathidion *tc'* equal to *p''* but shorter than *tc''*, located subapically; *tc''* located above midlength of segment. No vestige of eupathid *ft'* visible. Solenidion  $\omega$  with spindle-like head slightly longer than pedicel, somewhat larger than Ta II  $\omega$ . Four slender and pointed tarsal setae present: *pl'*, *pl''*, *pv'* and *pv''*. Solenidion  $\phi_2$  smaller than  $\phi_1$  (whose head is without apparent striation), famulus *k* longer than solenidion  $\phi_1$ ; located at same level with solenidia. Genua seta *l'* rather thick, pointed. Femur I without clearly expressed ventral protrusion. Seta *l'* on femur strong, attenuated; *d* short, stiff, tapering.

Leg II: Chaetotaxy: 3-3-4-6(1 $\omega$ ). Claws medium sized, hooked, symmetrically well developed (contrary to *U. beameri*, but not to *U. peacocki*), empodium slightly smaller than basal stalk. Seta *u'* spine-like, *u''* rod-like, apparent. Seta *pl''* present, strongly spine-like, bigger than solenidion Ta  $\omega$ , located distally to *pl''*. Seta *tc''* about 1.5x times longer than other setae of segment, reaching slightly beyond the tip of empodium. Tibia without lateral spine-like protrusion; seta Ge *l'* tapering, pointed, with barbs. Femur with small, rounded ventral lobe; seta *d* short, pointed; seta *l'* slender, sharply pointed.



Figs. 3-4 - *Ununguitarsonemus rarus* sp. n. female gnathosoma: 3 - dorsal aspect, 4 - ventral aspect. Scale bar = 20  $\mu$ m.

Leg III: Chaetotaxy: 1+3-4-5. Claws slightly weaker than those of leg II. Empodium as large as the basal stalk. Setae *u'* and *u''* as in tarsus II. Seta *tc''* markedly (about 3x) longer than other setae of segment, seta *pv'* stiff, needle-like.

Leg IV: Free segments of leg IV equal in length to femurogenu and tibia III. Femurogenu ca. 1.5x longer than tibiotarsus. Femoral seta shorter and weaker (though rather stiff) than genual one. Genual seta *v'* almost as long as tibial *v''*. Seta *Tb v'* little longer than femurogenu, tapering, pointed; *v''* shorter than *v'* but longer than tibiotarsus, pointed, tapering, rather stiff, but not as much as same seta in *U. peacocki*. Seta *Ta tc''* about 1.8x as long as whole leg IV. Tibiotarsus constricted distally behind base of tibial setae.

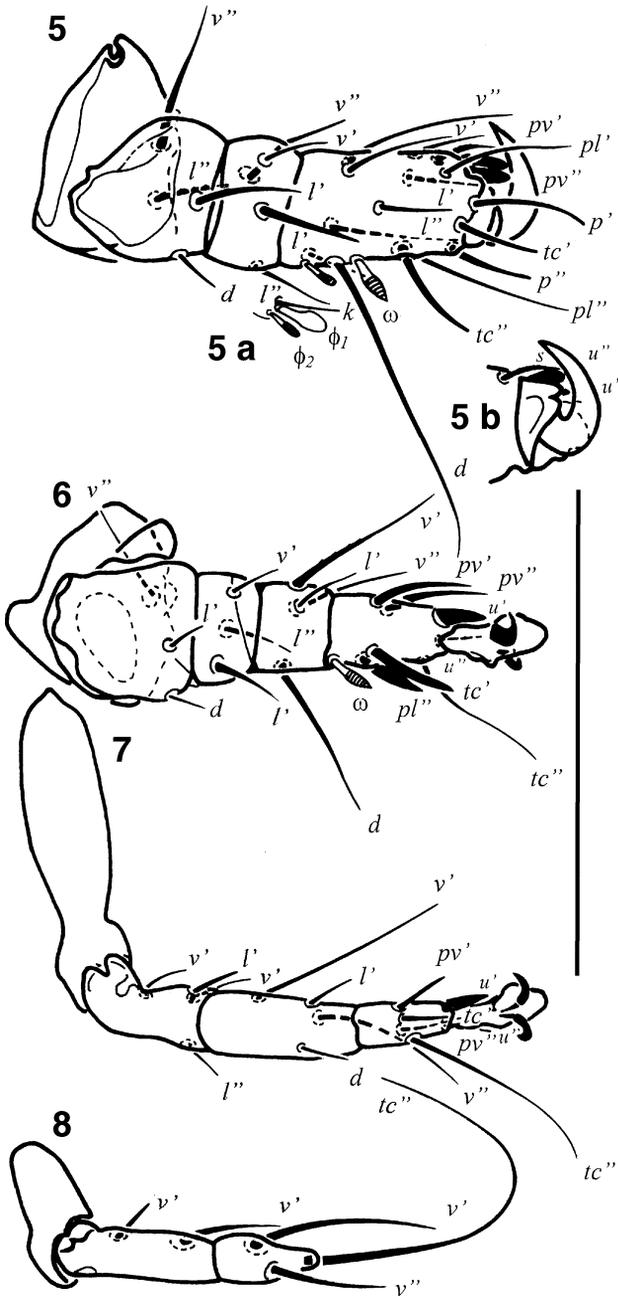
*Measurements* (holotype):

Body and tagmata: Length of body: 177; length of idiosoma: 164; width of idiosoma: 102; length of gnathosoma: 25; width of gnathosoma: 21; length of pharynx: 14; width of pharynx: 6. *dgs*: 9; *vgs*: 8.

Dorsal side: length of PrS: 65; width of PrS: 103. Lengths of setae: *v<sub>1</sub>*: 13; *sc<sub>1</sub>*: 5; *sc<sub>2</sub>*: 24; *c<sub>2</sub>*: 13; *c<sub>1</sub>*: 11; *d*: 12; *e*: 6; *f*: 7; *b*: 9. Distances between setae: *v<sub>1</sub>-v<sub>1</sub>*: 31; *sti-sti*: 40; *sc<sub>1</sub>-sc<sub>1</sub>*: 54; *sc<sub>2</sub>-sc<sub>2</sub>*: 38; *c<sub>2</sub>-c<sub>2</sub>*: 96; *c<sub>1</sub>-c<sub>2</sub>*: 30; *c<sub>1</sub>-c<sub>1</sub>*: 42; *d-d*: 51; *e-e*: 75; *e-f*: 29; *f-f*: 20; *b-b*: 33.

Ventral side: Lengths of setae: *1a*: 3; *2a*: 3; *3a*: 3; *3b*: 4; *3c*: 4; *4b*: 3; *ag*: 6; *ps*: 5. Distances between setae: *1a-1a*: 8; *2a-2a*: 25; *3a-3a*: 17; *3b-3b*: 26; *3c-3c*: 45; *4b-4b*: 8; *ag-ag*: 5; *ps-ps*: 11. Length of PrP: 51; width of PrP: 103; Ap. 1-1: 15; ap. 2-2: 47; length of tegula: 31; width of tegula: 17.

Leg segments and leg setae (lengths): *Tbt I*: 20; *Ta I*  $\omega$ : 7;  $\phi_2$ : 4;  $\phi_1$ : 6; *k*: 7;



Figs. 5-8 - *Ununguitarsonemus rarus* sp. n. female legs: 5 - leg I (5a - apex of tibiotarsus, ventral aspect; 5b - tibial sensory cluster), 6 - leg II, 7 - leg III, 8 - leg IV. Scale bar = 50  $\mu$ m.

Ta II  $\omega$ : 6; Ta II  $pl$ ": 7; Fege IV: 16; Tbt IV: 11; Fe  $v$ ': 6; Ge  $v$ ': 11; Tb  $v$ ': 14; Tb  $v$ ": 21; Ta  $tc$ ": 42.

*Locus typicus*: Ukraine, Yalta (Crimea), ex *Dryocoetes villosus* (Fabr.) (Coleoptera, Scolytidae) between coxae I; August 26, 1996, leg. A. Khaustov.

*Material*: One female collected at the locus typicus.

*Deposition of type*: Department of Animal Taxonomy and Ecology, A. Mickiewicz University, Poznan, Poland.

*Comparative material*: *U. peacocki* (two females slides nos.14.683 and 14.694) ex inner bark of American elm with *Scolytus multistriatus* Marsh, Marion Co., Ohio, USA, Feb. 1970. Though these data are congruent with the type series, slides are not marked as such.

## DISCUSSION

Females of the genus *Ununguitarsonemus* are (according to LINDQUIST, 1986) characterised by two synapomorphies:

\* ornamentation of idiosoma smooth (or uniformly finely granulated) but with a pair of small subsurface nodules between setae  $c_1$  (character 37, state A3), and

\* apodemes 4 fully developed arching or angled anteromedially from anterior condyli of trochanters IV and uniting with each other and with posteromedial apodeme at midline (as in adult males; character 69, state A2).

The former state seems to be a modification characteristic for all *Ununguitarsonemus*, while the latter is unique only to *U. beameri* in the Pseudotarsonemoidini stock. In contrast, the remaining two species have posterolateral ends of apodemes 4 extending somewhat beyond bases of setae  $3b$ , but not reaching the edge of metapodosomal plate. Examined female of the new species reveals certain interesting unique modifications. The most obvious is the shape of the tegular flap: elongated, subtriangular-narrow, correlated with the relatively narrow spread of trochanters IV. Additionally, apodemes underlying the posterolateral edges of the metapodosomal plate (in which the anterolateral extremities of trochanters IV are seated-named here posterolateral apodemes of metapodosoma) are long and well expressed. Although legs IV do not differ drastically in shape from those known in the other two species of *Ununguitarsonemus*, it is striking that they seem to be more sclerotized than legs III (as well as I and II), which is manifested by an apparent darker shade when seen in phase-contrast microscopy. This suite of modifications of the metapodosomal venter indicates a more active mechanical action of this region, and it is tempting to speculate that

females of the new species are performing an unusual behaviour, perhaps associated with oviposition.

Supplementary description of female *Ununguitarsonemus peacocki* Smiley et Moser, 1974:

Pharynx about twice as long as its maximum width, with well developed lateral musculature. Setae *dgs* slightly longer than *vgs*, both attenuated pointed. Chelicerae weakly visible, thin, with small but conspicuous levers; palpi over twice as long as wide at base, with small rounded process and two minute setae each. Postpalpal setae moderately long, slender. Relative lengths of dorsal setae (*v*<sub>1</sub>: *sc*<sub>2</sub>: *c*<sub>2</sub>: *c*<sub>1</sub>: *d*: *e*: *f*: *b*): 1: 1.1: 1.2: 0.4: 0.35: 0.5: 0.35: 1.1. Prodorsal setae *v*<sub>1</sub> separated by distance equal to their lengths, *sc*<sub>2</sub> by distance almost twice greater than their lengths, both pairs slender, delicate, pointed. Subsurface nodules on tergite C weakly developed, mediad and slightly anterior of *c*<sub>1</sub> bases (indiscernible in one of examined females). Dorsal opisthosomal setae *c*<sub>1</sub> and *d* relatively strong at base, tapering, smooth, pointed, needle-like. Setae *e*, *f* (the weakest) and *b* tapering, barbed, bluntly ended. Setae *c*<sub>1</sub> separated by distance of 5x their lengths, *d* by 8.5x their lengths, *e* from *f* by 2.6x their lengths on each side, *f* by less than 2x their lengths, and *b* (the longest) by 1.4x their lengths. Anteromedial apodeme interrupted behind level of setae *1a*, besides that continuous to junction with sejugal apodeme. Ventral podosomal setae mostly pointed, needle-like, except for *3b* which slightly more attenuated and slender. Setae *1a* separated by distance of ca. 2.6x their lengths and *2a* by 2.8x their lengths. Apodemes 3 clearly expanded laterad of anterior acetabuli of trochanters IV. Apodemes 4 reaching posterolaterally slightly beyond bases of setae *3b*, but not to edges of metapodosomal plate. Setae *3a* located in distance of ca. 3x their lengths, *3b* by over 3x their lengths, setae *3c* in distance of almost 2x their lengths from *3a* and 5.6x each to the other, *4b* by 2.6x their lengths. Setae *ag* inserted at distance slightly greater than their lengths while distance between *ps* is slightly less; both pairs attenuated, slender, pointed. Aggenital plate with convex, even posterior edge. Leg chaetotaxy and solenidiotaxy as described for genus. Tibiotarsus with weak ventral bend in area of tibia. Tarsal I seta *u*' (flanking tip of tarsal claw) spine-like, *u*" lobe-like, flattened. Solenidion Ta I ω larger than that on tarsus II, with head striated, spindle shaped. Seta *s* tapering but stronger than other non-modified tarsals. Among tarsal eupathids *p*' shortest and *tc*" longest (all reaching far beyond distal extremity of tarsal claw). Vestigial eupathid *ft*' present between bases of *tc*" and *tc*'. Tibial part of tibiotarsus with seta *k* stiff, barbed; *d* and *l*" elongated, barbed; of three remaining setae (located almost at the level of tarsal ω) *v*' longest; solenidion

$\phi_2$  smaller than  $\phi_1$ , both with their heads visibly striated. Genu with seta  $v'$  shortest, all four tapering, pointed, barbed. Femur I with seta  $d$  short, tapering, spine-like; seta  $l'$  stiff. On tarsus II all non modified setae attenuated, pointed,  $tc''$  longest. Tarsal spine  $pl''$  stout, inserted well distal of and larger than solenidion Ta II  $\omega$ . Claws large, hooked. Of four tibial setae only  $l'$  stout, strongly barbed, remaining three over twice longer, attenuated, slender. Genuals  $l'$  and  $v'$  stout, tapering, pointed and slightly barbed;  $l''$  more slender, smooth. On femur II seta  $d$  present, stiff, blunt. Four tarsal setae of leg III attenuated, pointed;  $tc'$  and  $pv''$  located more proximally than  $pv'$  and  $tc''$ . Claws on tarsus III as on tarsus II. Tibial setae all slender, pointed. Of four setae on femurogenu III only  $l'$  stiff, blunt; remaining ones slender, pointed. Entire leg IV approximately as long as femurogenu and tibia III. Tibial seta  $v'$  stiff, tapering and pointed, longer than femurogenu but shorter than entire leg IV; seta  $v''$  strong, flattened, narrow-elliptical pointed, as long as tibiotarsus. Femurogenu almost twice as long as tibiotarsus, with both setae (Fe  $v'$  and Ge  $v'$ ) attenuated, slender.

The generic description of *Ununguitarsonemus* should be emended as follows:

Pharynx with lateral musculature developed or reduced. Dorsal shielding ornamented from fine dense to more sparse, thicker punctate sculpture. Prodorsal sensilli may be capitate or shaped as short, strong spines. Pits  $v_2$  contiguous with, or located at short distance anterior of alveoli of  $sc_2$ . Antero-medial apodeme joining sejugal one clearly, or with diffused area of stronger sclerotization; apodemes 3 and posteromedial apodeme may join in wide area of diffused sclerotization; bases of legs IV widely to relatively narrowly spaced, ranging from 3 to 1.5x widths of trochanters IV. Tegula varying in shape and proportion from rounded "U"-shaped to narrow triangular bluntly pointed tip.

When this paper was at the final stage of preparation we were kindly informed by Dr. Ronald Ochoa from Systematic Entomology Laboratory, U.S. Department of Agriculture, Beltsville, Maryland about his work on a new genus and species of tarsonemid mites (in preparation). The new genus, though closely related to *Pseudotarsonemoides*, seems to share also some primitive features with *Ununguitarsonemus*, namely, stigmata located behind the bases of setae  $v_1$ , and moderately long and broad pharynx with muscular, thinly sclerotized walls. According to his unpublished phylogenetic reconstruction (Ochoa, in prep.) the new taxon clusters together with *Pseudotarsonemoides* as a sister group of *Ununguitarsonemus*. Another stock (sister group of the *Pseudotarsonemoides*-*Ununguitarsonemus* stock) consists of two

branches: one comprising *Polyphagotarsonemus*, *Nasutitarsonemus* and *Tarsononychus*, and another with the genera *Tarsonemella*, *Paratarsonemella*, *Ficotarsonemus* and *Alkithoenemus*. Further phylogenetic analyses are needed in future in order to elucidate the genealogy of the new taxon related to *Pseudotarsonemoides* and *Ununguitarsonemus* as the latter is revised herewith.

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The authors have contributed to the paper with the following activities:

W.L. Magowski with the comparative study, correction and description of inked illustrations, improving description and layout, writing the paper. A. Di Palma with the pencil drawings, measuring the specimen, preliminary description, early proof of the paper. A.A. Khaustov collecting the material, making microscopic preparation of the material, determination of host carrier, preliminary determination of mite material.

#### RIASSUNTO

*UNUNGUITARSONEMUS RARUS* (ACARI: TARSONEMIDAE) N. SP. FORETICA SU *DRYOCOETES VILLOSUM*  
(COLEOPTERA: SCOLYTIDAE) RINVENUTA IN CRIMEA, UCRAINA

*Ununguitarsonemus rarus* (Acari: Tarsonemidae) specie nuova associata a Coleotteri Scolitidi, rinvenuta in Crimea, Ucraina, viene descritta e illustrata. Si tratta della terza specie del genere e della prima segnalazione europea del genere stesso. Inoltre *U. peacocki* Smiley et Moser, 1974 viene brevemente ridescritta. Infine la posizione sistematica della nuova specie e la diagnostica del genere *Ununguitarsonemus* viene discussa.

Parole chiave: Heterostigmata, sistematica, tassonomia, morfologia.

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