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A new species of the genus *Paralycus* from Fujian, China

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Original research

ABSTRACT

A new oribatid mite species of the family Pediculochelidae, *Paralycus nortoni* sp. nov., is described and illustrated based on adult specimens collected from barks of dead *Pinus massoniana* Lamb. infested by *Monochamus alternatus* in Fuzhou city, China. This new species described here is the fourth species of the genus *Paralycus* in China. An updated key to the species of the genus *Paralycus* is provided.

Keywords taxonomy; oribatid mite; Pediculochelidae; Acari; morphology

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Introduction

The family Pediculochelidae has been associated with two mite suborders Prostigmata and Astigmata. It was erected by Lavoipierre (1946) and placed in the family Tarsonemidae (Prostigmata), and then proposed to be a member of Astigmata by Baker and Wharton (1952). Krantz (1978) suggested that it belonged to the primitive Pachygnathoidea but didn't provide supportive discussion. Norton *et al.* (1983) proposed based on a cladistic analysis that it represented a sister-group of the Haplochthoniidae and belonged to the superfamily Cosmochthonioidea (Oribatida). To date, one genus and seven species have been described (Schatz *et al.* 2011): *Paralycus chongqingensis* Fan, Li & Xuan, 1996 from *Auricularia* sp. in China, *P. lavoipierrei* (Price, 1973) from soil in California, *P. longior* Fan, Li & Xuan, 1996 from lily fruits in China, *P. parasiti* Zhang & Li, 2001 from *Coccinella septempunctata* in China, *P. parvulus* (Price, 1973) from soil in California, *P. pyrigerus* (Berlese, 1905) from soil in Italy, and *P. raulti* (Lavoipierre, 1946) from bees in South Africa (Norton *et al.* 1983). In this paper, we describe and illustrate a new species of this family, which is the fourth record in Chinese fauna. An updated key to the species of the genus *Paralycus* is also provided.

Materials and methods

Barks of *Pinus massoniana* Lamb. attacked by *Monochamus alternatus* were collected in Minhou country, Fuzhou city, Fujian province, China. The specimens were extracted from the barks using a Berlese funnel and separated under a stereomicroscope. All mites removed were cleared in lactic acid, and afterwards mounted in Hoyer's medium. Specimens were examined at 400x magnification by using differential interference contrast of a Leica DM5000B compound microscope. The studied materials were deposited in the National Zoological Museum of China, Institute of Zoology, Chinese Academy of Sciences, Beijing, China (NZMC) and the Department of Plant Protection, Fujian Agriculture and Forestry University (FAFU), Fuzhou, China (Zhang 2018). All measurements are given in micrometers (µm). The morphological terminology used in this paper is mostly based on that developed by Norton & Behan-Pelletier (2009).

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Family Pediculochelidae Lavoipierre, 1946

Genus *Paralycus* Womersley, 1944

Paralycus Womersley, 1944. Type species: *Alicus pyrigerus* (Berlese, 1905); Norton, O'Connor & Johnston, 1983.

Pediculocheilus Lavoipierre, 1946. Type species: *Pediculocheilus raulti* Lavoipierre, 1946; Price, 1973.

Paralycus nortoni sp. nov.

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(Figures 1–3)

Diagnosis — Adult female. Minute and elongate, weakly sclerotized. Idiosoma with a distinct humeral sulcus; propodosoma with 5 pairs of setae and a single pair of clavate bothridial organs; notogaster divided into 4 regions by 3 transverse dorsal sutures, covered with fine longitudinal striae. Venter each with one pair of setae between coxae I, coxae II, coxae III and without setae between coxae IV. Genital region with 2 pairs of discs and five pairs of genital setae. Setae g_1 , g_2 and g_3 minute and subequal in length, g_4 and g_5 subequal in length and about twice as long as g_1 . Claws absent on all tarsi, each tarsus with a minute empodial remnant and caruncle-like membrane.

Type material — Holotype Female, China, Minhou county, Fuzhou city, Fujian province, 17 Apr. 2019, by Yu-Zhen Zhu, Jie-Qin Wu and Yun Xu, ex. the barks of *Pinus massoniana* Lamb attacked by *Monochamus alternatus*. Paratypes: 1 female, same data as holotype.

Type deposition — The holotype and paratype were deposited in the National Zoological Museum of China, Institute of Zoology, Chinese Academy of Sciences, Beijing (NZMC) and the Department of Plant Protection, Fujian Agriculture and Forestry University (FAFU), respectively.

Female (n=2)

Gastronotic region (Fig. 1A): Body minute and elongate, colorless when alive. Length of gastronotic region 210–215, width 55–65. Prodorsum covered with shield-shaped plate in middorsal region, bearing 2 pairs of setae (*ro* and *le*); 3 pairs of setae (*exa*, *exp* and *in*) and one pair of clavate bothridial organs *ss* in the dorsolateral area of prodorsum. Setae *le* about twice as long as *ro*, *in* about twice as long as *exa*, and *exp* minute, lengths *ro* 13–14, *le* 30–31, *exa* 22–23, *exp* 5, *in* 42–44, *ss* 17. Notogaster divided into 4 regions by 3 transverse dorsal sutures. Notogaster covered with fine longitudinal striae, bearing 4 pairs of setae (c_1 , c_2 , c_3 and *cp*) in the region of segment C, 4 pairs of setae (d_1 , d_2 , e_1 and e_2) in the region of segment DE, 2 pairs of setae (f_1 and f_2) in the region of segment F, and 6 pairs of setae (h_1 , h_2 , h_3 , ps_1 , ps_2 and ps_3) in the region of segment H and PS. Lengths of notostral setae c_1 22–24, c_2 28–29, c_3 34–35, *cp* 29–34, d_1 17–18, d_2 24–26, e_1 22–23, e_2 24–27, f_1 32–34, f_2 32–39, h_1 32–39, h_2 37–39, h_3 32–35, ps_1 27, ps_2 53–56, ps_3 14–15.

Gnathosoma (Figs. 1B, 2A). Gnathobase with rutella and 4 pairs of setae along midventral line plus one seta proximal to trochanter on coxal base of palp. Palp simple, with 4 free segments, setal formula: 0, 2, 1, 7.

Ventral region (Figs. 1B, 2B). Venter each with one pair of setae between coxae I, coxae II, coxae III and without setae between coxae IV; setae between coxae II about twice as long as setae between coxae I, setae between coxae III minute. Venter of opisthosoma with 2 pairs of acetabula, 5 pairs of genital setae (g_1 , g_2 , g_3 , g_4 and g_5), 3 pairs of adanal setae (ad_1 , ad_2 and ad_3). Setae g_1 , g_2 , g_3 minute and subequal in length, g_4 and g_5 subequal and about twice as long as g_1 . Lengths: g_1 3, g_2 3–4, g_3 3–4, g_4 7–8, g_5 8, ad_1 14–15, ad_2 53–58, ad_3 11–13.

Legs (Fig. 3). Legs relatively short, measurements (total length from trochanter to tarsus, pretarsus excluded): I 50–55, II 45–48, III 45–48, and IV 50–52. Leg structure simple with highly visible segments, as shown in the Fig. 3. Claws absent on all tarsi, each tarsus with a minute empodial remnant and caruncle-like membrane. Setation of legs I–IV (from trochanter

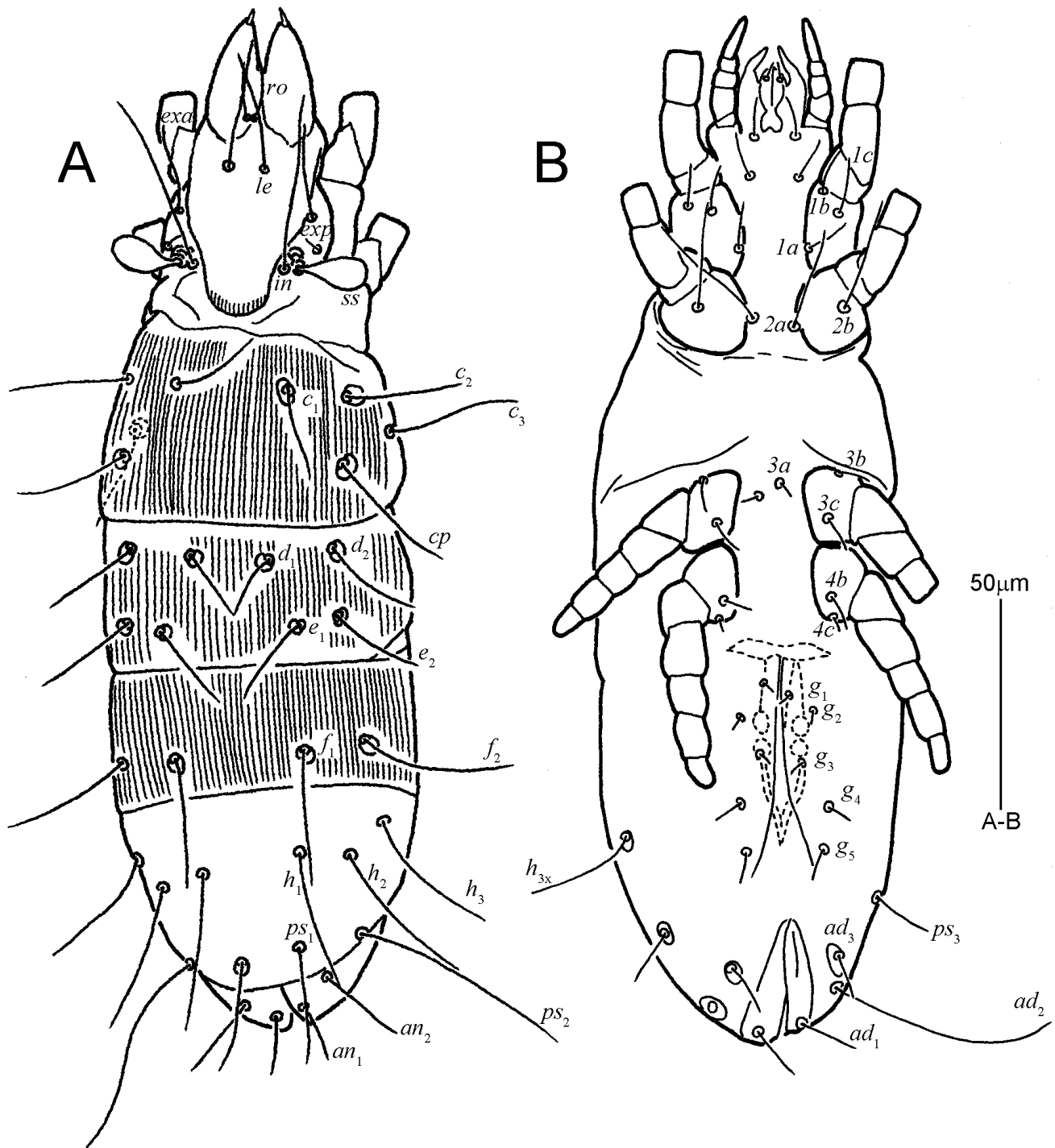


Figure 1 *Paralycus nortoni* sp. nov. (adult female). A – dorsal view; B – ventral view.

to tarsus, solenidia in brackets): leg I 0-2-4-3 (1)-8 (1); leg II 0-2-3-3 (1)-7 (1); leg III 1-2-0-3(1)-5 and leg IV 0-2-0-2-5. Dorsal, ventral and lateral setae on trochanter, femora, genua and tibiae I–IV simple and filiform. Solenidium ϕ on tibiae I–II elongate, attenuate, on tibia III baculiform. Unguinal setae *u* and proral setae *p* on tarsus I–IV simple. Only *p*' on tarsus I; seta *s* on tarsus I simple. Solenidium ω on tarsi I–II baculiform, ω on I about twice the length

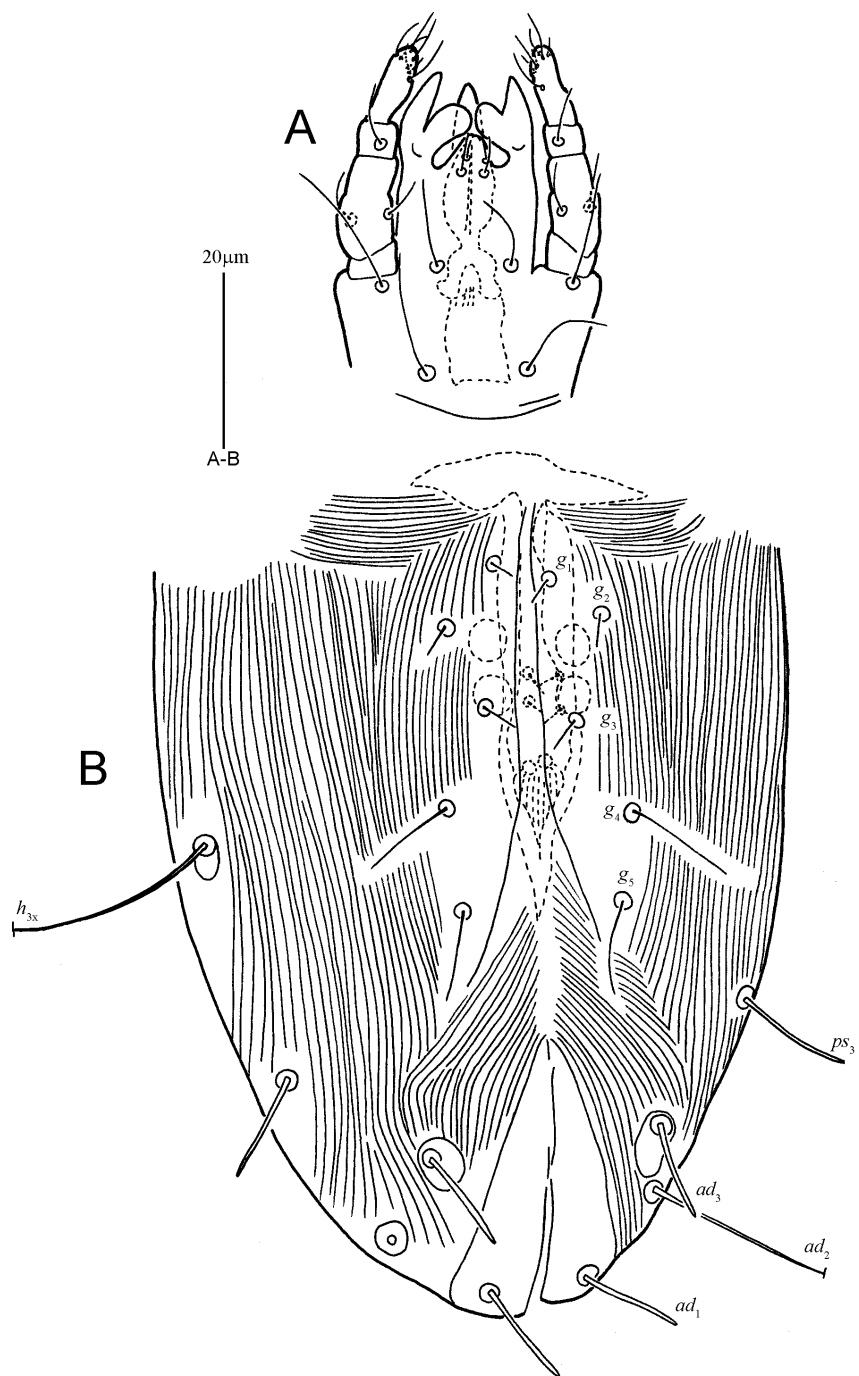


Figure 2 *Paralycus nortoni* sp. nov. (adult female). A – ventral view of gnathosoma; B – genital-anal region.

of that on II.

Male unknown.

Etymology — The species is named after Dr. Roy A. Norton, a distinguished acarologist who made significant contributions to the systematics of Oribatida.

Remarks — *Paralycus nortoni* sp. nov. is easily distinguishable from other species by the following features: Venter without setae between coxae IV (vs. with one pair of setae between

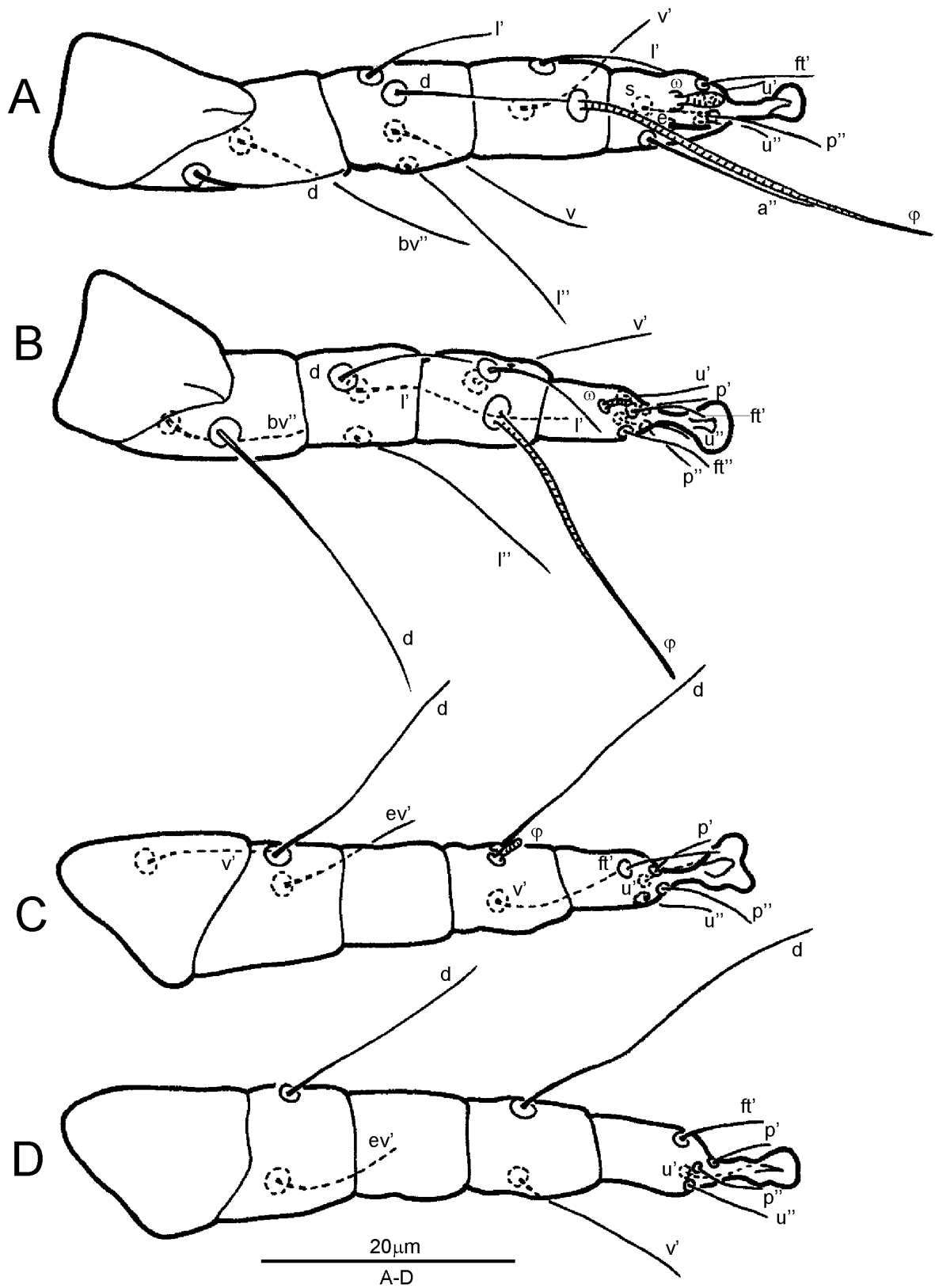


Figure 3 *Paralycus nortoni* sp. nov. (adult female, right side legs in dorsal view). A – leg I; B – leg II; C – leg III; D – leg IV.

coxae IV in *P. chongqingensis*, *P. lavoipierrei*, *P. longior*, *P. parasiti* and *P. raulti*); venter of opisthosoma with 5 pairs of genital setae (vs. with 3 pairs of genital setae in *P. chongqingensis*, *P. lavoipierrei* and 4 pairs of genital setae in *P. parasiti*, *P. parvulus* and *P. raulti*); trochanters 0-0-1-0 (vs. 0-0-0-0 in *P. parvulus*); genua 4-3-0-0 (vs. 4-2-0-0 in *P. lavoipierrei* and *P. parvulus*); tarsi 7+ ω -6+ ω -5-5 (vs. 9+ ω -6+ ω -5-5 in *P. chongqingensis* and *P. longior*). The identification characters of *P. pyrigerus* are not listed because the morphological details were not given by Berlese (1905), but the differences in size (213 μ m for *P. nortoni* **sp. nov.** vs. 170 μ m for *P. pyrigerus*), habitat (barks of pine for *P. nortoni* **sp. nov.** vs. soil for *P. pyrigerus*) and collection locality (China for *P. nortoni* **sp. nov.** vs. Italy for *P. pyrigerus*) suggest that *P. nortoni* **sp. nov.** and *P. pyrigerus* are distinct species.

The known species of *Paralycus* are described from soil, bees, *Auricularia* sp., lily fruits, and *Coccinella septempunctata*. Among them, two species are described as phoretic mites: *P. parasiti* and *P. raulti* (Berlese, 1905; Lavoipierre, 1946; Price, 1973; Fan *et al.* 1996; Zhang and Li, 2001). Despite of being collected from the barks of beetle-infested pines, the new mite species *P. nortoni* **sp. nov.** was not detected on the eggs, instars or mature beetles at the site, nor obvious interaction was noted between them. Up to date, there are five species of mesostigmatid mites, including *Dendrolaelaps fukikoeae*, *D. unispinatus*, *Proctolaelaps hystrix*, *Mucroseius nipponensis* and *M. squamosus*, which were found to coexist in the pupal chambers of the beetle *M. alternatus* (Tamura and Enda, 1980; Kinn, 1987; Lindquist and Wu, 1991); and one species of prostigmatid mite *Paracarophenax alternatus* distributed around the coxal cavity of the adult and feeding on the egg of *M. alternatus* (Xu *et al.* 2018). No significant morphological body adaptations to aid in phoresy, such as attachment devices (hook-like claws on legs), were found neither on this new species, nor on *P. parasiti* and *P. raulti*. With that said, it remains an interesting topic whether this new species is phoretic on beetles or share the same host preference with beetles.

Notes — In the holotype, one seta h_3 was duplicated (h_3 and h_{3x} in Fig. 1B and 2B)

Key to species of the genus *Paralycus*

The incompletely described species *P. pyrigerus* (Berlese, 1905) is not included.

1. Venter without setae between coxae IV 2
— venter with one pair of setae between coxae IV 3
2. Venter of opisthosoma with 5 pairs of genital setae; trochanters with 0-0-1-0 setae; genua with 4-3-0-0 setae *Paralycus nortoni* **sp. nov.**
— Venter of opisthosoma with 4 pairs of genital setae; trochanters with 0-0-0-0 setae; genua with 4-2-0-0 setae *P. parvulus* (Price, 1973)
3. Tarsi with 9+ ω -6+ ω -5-5 setae 4
— Tarsi with 7+ ω -6+ ω -5-5 setae 5
4. Venter of opisthosoma with 3 pairs of genital setae, without setae g_1 and g_3 ; setae g_2 about half of the length of g_4 and g_5 *P. chongqingensis* Fan, Li & Xuan, 1996
— Venter of opisthosoma with 5 pairs of genital setae; setae g_2 about half of the length of g_4 and two-thirds of g_5 *P. longior* Fan, Li & Xuan, 1996
5. Venter of opisthosoma with 3 pairs of genital setae, without setae g_1 and g_3 ; genua with 4-2-0-0 setae *P. lavoipierrei* (Price, 1973)
— Venter of opisthosoma with 4 pairs of genital setae, without setae g_3 ; genua with 4-3-0-0 setae 6
6. Setae $2a$ between coxae II elongate, reaching the base of setae $1a$ between coxae I; setae $2a$ about twice as long as $1a$ *P. parasiti* Zhang & Li, 2001

— Setae *2a* between coxae II short, not reaching the base of setae *1a* between coxae I; setae *2a* as long as *1a* *P. raulti* (Lavoipierre, 1946)

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