

RESEARCH PAPER

Discovery of mysterious *Pakistatyrus* in Tibet (Coleoptera: Staphylinidae: Pselaphinae)

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Abstract. The monotypic genus *Pakistatyrus* Hlaváč, 2006 of the tribe Tyrini (Staphylinidae: Pselaphinae) previously contained a single species described based on two museum specimens found in northern Pakistan. Here I describe *P. inconspicuus* sp. nov. from a high-altitude area of Tibet. This species differs from *P. ater* Hlaváč, 2006 in reddish-brown coloration of the body, simple male antennae and metatibiae, and a much broader median lobe of the aedeagus. Both known species are probably locally endemic and have limited dispersal abilities, suggested by their greatly reduced elytra and lack of functional wings. A record of a second species from Tibet, which is represented by a female, is given.

Key words. Coleoptera, Staphylinoidea, Tyrini, endemism, Qinghai-Tibet Plateau, China

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Introduction

The genus *Pakistatyrus* Hlaváč, 2006 (Pselaphitae: Tyrini: Tyrina) was proposed (HLAVÁČ 2006) shortly after the publication of a series of works revising the Oriental genera (HLAVÁČ & NOMURA 2001, 2003; HLAVÁČ 2003a, b) and a catalog (HLAVÁČ & CHANDLER 2005) summarizing the world fauna of the tribe Tyrini. At present only a single species of this genus is known, i.e., *P. ater* Hlaváč, 2006 described from two museum specimens taken at Malam Jabba in the Swat valley of northern Pakistan. One notable feature of *Pakistatyrus*, albeit not specifically discussed in the original description, appears to be greatly reduced eyes and elytra, which suggest that the beetles may have very limited dispersal capabilities. Otherwise, information on the bionomics, potential distributional range, and taxonomic diversity of this seemingly enigmatic genus remains unknown.

During the past ten years the tyrine fauna of the Himalaya has been reported in several papers, which included two new species of *Labomimus* Sharp, 1883 (YIN 2019; ZHANG et al. 2019), eight new species of *Pselaphodes* Westwood, 1870 (YIN et al. 2011, 2013a; YIN & LI 2015; HUANG et al. 2018; YIN 2019), a new genus *Tibetyrus* Yin & Lin, 2020 (YIN & LIN 2020), a new record of *Tyrus sinensis* Raffray, 1912 (YIN et al. 2013b) from Tibet, and the descriptions and reviews of 17 *Pselaphodes* species,

plus a new *Labomimus* species from Nepal (BEKCHIEV & HLAVÁČ 2013; HUANG & YIN 2019, 2020; ZHANG & YIN 2019). In June and July 2021, my colleagues Zhong Peng, MA student Wen-Xuan Zhang, and I spent one month surveying the Staphylinidae in five major canyons of the Qomolangma National Nature Preserve and in the Nyingchi area of the Qinghai-Tibet Plateau, resulting in the collection of an unexpectedly diverse pselaphine fauna (YIN 2022). One of the most exhilarating finds was that of two undescribed species of *Pakistatyrus* collected from rather high-altitude areas where the other groups of Pselaphinae are poorly represented. One of the new species is formally described here, and the other, pending a formal description, is represented by a single female.

Material and methods

The type series of *P. inconspicuus* and the material of *Pakistatyrus* sp. are deposited in the Insect Collection of the Shanghai Normal University, Shanghai, China (SNUC); the holotype of *P. ater* is housed in the Muséum d'histoire Naturelle, Geneva (MHNG).

The text of the specimen labels is quoted verbatim in quotation marks.

Dissected parts were preserved in Euparal on a plastic slide that was pinned under the specimen. The habitus images (Figs 1A; 2A, B) of the beetles were taken using



a Canon 5D Mark III camera in conjunction with a Canon MP-E 65mm f/2.8 1-5x Macro Lens, and a Canon MT-24EX Macro Twin Lite Flash was used as the light source. Images of the morphological details (Figs 2B–H) were produced using a Canon G9 camera mounted to an Olympus CX31 microscope under reflected or transmitted light. Zerene Stacker (version 1.04) was used for image stacking. The distribution map was created using QGIS 3.10.8-A Coruña, with the base map acquired from the online mapping service provided by Google Maps (<https://www.google.com/maps>). All images were modified and arranged into plates using Adobe Photoshop CC 2018.

The abdominal tergites and sternites are numbered following CHANDLER (2001) in Arabic (starting from the first visible segment) and Roman (reflecting true morphological position) numerals, e.g., tergite 1 (IV), and sternite 1 (III).

Taxonomy

Genus *Pakistatyrus* Hlaváč, 2006

Chinese common name: 高山苔蚁甲属

Pakistatyrus Hlaváč, 2006: 171.

Type species. *Pakistatyrus ater* Hlaváč, 2006 (Figs 2B, C) (by original designation).

Diagnosis. In the original description (HLAVÁČ 2006), *Pakistatyrus* was suggested to be most closely related to the Australian *Hamotulus* Schaufuss, 1887, and was compared with and separated from the latter genus. However, a list of characters that are diagnostic for *Pakistatyrus* was not given. The diagnosis is provided here based on the examination of the holotype of *P. ater* and two Tibetan species:

Tyrine of medium to large size, body length ranging from 3.0–3.8 mm. Head elongate-trapezoidal, with apex truncate; with small aetose vertexal (dorsal tentorial pits) and large setose frontal foveae; area between antennal tubercles longitudinally sulcate; frontal rostrum broad and prominent; antennal insertions on ventral side of rostrum; with setose postantennal foveae and large ocular canthi; gula with foveae (posterior tentorial pits) widely separated, lacking median carina; eyes in both sexes small; maxillary palpi with palpomere 1 small, 2 elongate and curved, 3 and 4 pedunculate at base and broadening apically, 4 with distinct apical cone. Pronotum with well-marked median and lateral antebasal foveae connected by shallow transverse antebasal impression/sulcus, areas anterior to foveae impressed, medial impression may extend anteriorly to form shallow longitudinal sulcus. Prosternum with widely separated lateral procoxal foveae. Elytra strongly shortened and fused, trapezoidal, truncate at bases, each elytron with two large, setose basal foveae; discal stria represented by broad, shallow impression. Metathoracic (hind) wings lacking. Mesoventrite with moderately separated median foveae in transverse setose impression, large, setose lateral foveae forked internally. Metaventrite with large, setose lateral mesocoxal foveae and single setose median metaventral fovea, with postero-admedial areas conspicuously projecting/ridged. Legs elongate; pro- and mesofemur broadened, profemur with two large, widely separated ventral spines

strongly divergent from shared base, protibia with two rows of spinose setae along mesal margin; mesotrochanter with distinct spine on ventral margin; tarsi with short tarsomere 1 and elongate tarsomeres 2 and 3, 2 slightly longer than 3, each tarsus with two subequal pretarsal claws. Abdomen with tergites 1–3 (IV–VI) subequal in length in middle and broadly sulcate at bases; corresponding paratergites of tergites 1–3 complete, protruding laterally, paratergite of tergite 4 (VII) triangular. Male sexual characters present on antennae and legs, or inconspicuous; aedeagus elongate, dorso-ventrally slightly asymmetric, with elongate parameres and weakly developed endophallus.

Comparative notes. Members of *Pakistatyrus* are usually large in size (3.0–3.8 mm) and possess characters that may be related to their high-altitude lifestyles, e.g., shining surface of the body, small eyes, greatly reduced elytra, and well-developed spines of the legs. Using HLAVÁČ & CHANDLER (2005) *Pakistatyrus* is keyed out at couplet 13 with *Palimboldus* Raffray, 1890, a fairly large group comprising 23 described species and some 50 undescribed ones in Australia (CHANDLER 2001). *Pakistatyrus* shares with *Palimboldus* the presence of frontal and vertexal foveae of the head, distinct median and lateral antebasal foveae of the pronotum, ovoidal fourth segments of the maxillary palpi, and relatively short first visible tergites. Aside from the aforementioned characters, *Pakistatyrus* clearly differs from *Palimboldus* in more elongate antennomeres, lack of anterosternal foveae (foveae present and large in *Palimboldus*), tergite 1 (IV) approximately as long as 2 (V) (tergite 1 distinctly shorter than 2 in *Palimboldus*), and the presence of well-developed parameres of the aedeagus (parameres lacking in *Palimboldus*).

Among the Asian genera of Tyrina *Pakistatyrus* appears to be most similar to the genus *Tyrinasius* Kurbatov, 1993 with seven species found in Central Asia (Kyrgyzstan, Uzbekistan) and China (Ningxia, Yunnan, Sichuan). *Tyrinasius* likewise has all members with small eyes and reduced elytra, and the male sternite 7 (IX) is composed of three plates (NOMURA 1999). *Tyrinasius* can be readily separated from *Pakistatyrus* by small body size (1.6–2.5 mm), suboval head, sub-globose pronotum that lacks foveae, the absence of spines on the profemora, and by short parameres of the aedeagus. *Pakistatyrus* is also similar to *Tibetyrus* from Tibet in general appearance, but the latter genus has tufted setae on temporal angles, the apical cone of the maxillary palpomere 4 and the femoral spines are lacking, parameres of the aedeagus are short, and ecologically, the adults were found in association with *Formica* ants.

Ecology. According to HLAVÁČ (2006) the two males of *P. ater* were collected from Malam Jabba (Fig. 2C) in May at an altitude between 2300 to 2600 m, where the area is dominated by temperate coniferous forests and with temperature varying from –4.7°C in January to 21.9°C in June (ATTA-UR-RAHMAN & DAWOOD 2017). Similarly, the two Tibetan species were collected from rather high-altitude areas, where the other pselaphine groups, except for a few *Brachyglutina*, are poorly represented. Three males of *P. inconspicuus* sp. nov. were found, one was collected by sifting a mixed litter sample of fern leaf

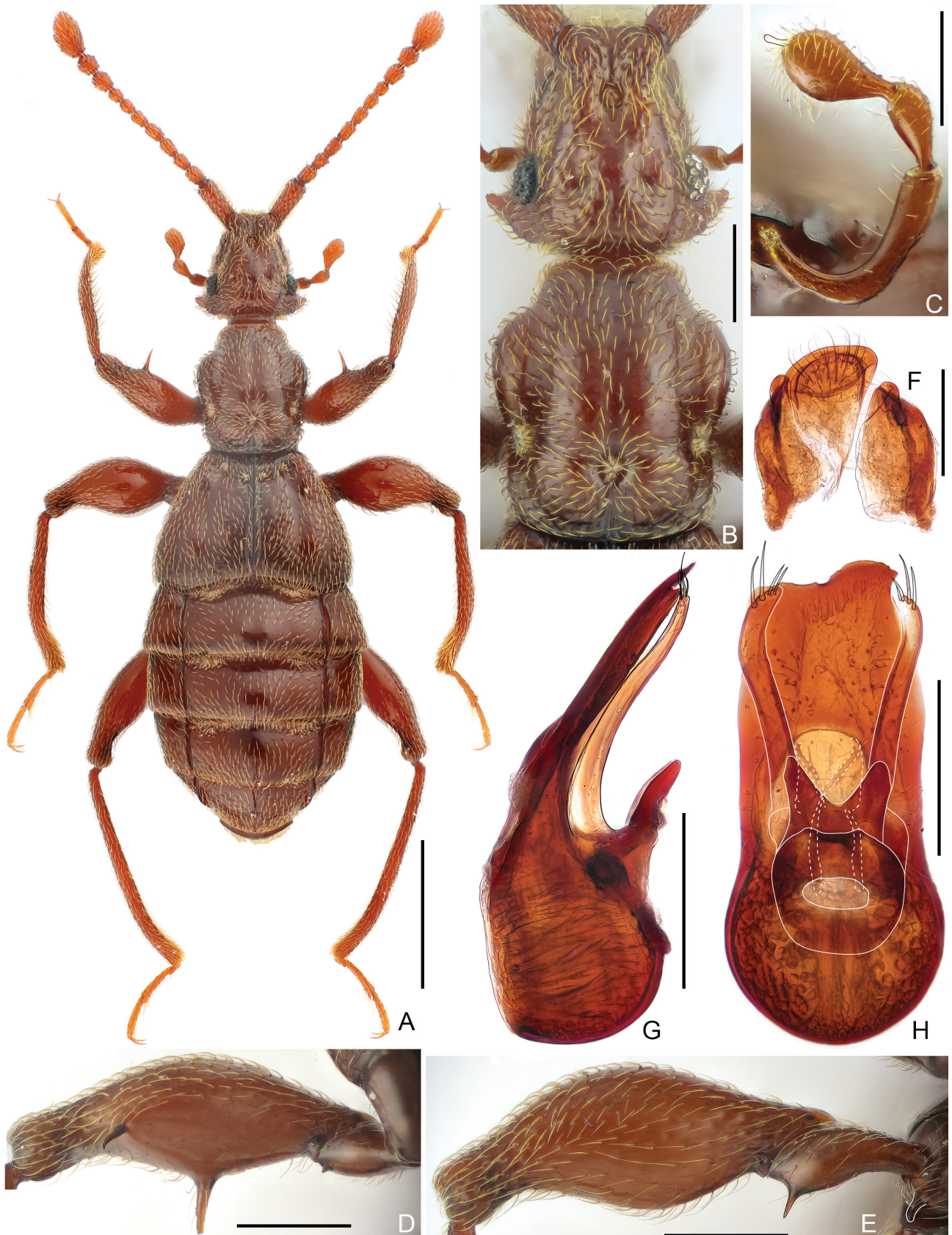


Fig. 1. Morphology of *Pakistatyrus inconspicuus* sp. nov., male. A – dorsal habitus; B – head and pronotum; C – right maxillary palpus; D – prothorax and profemur; E – mesocoxa, mesotrochanter and mesofemur; F – sternite 7 (IX); G, H – aedeagus, lateral (G) and ventral (H), with endophallus and parameres outlined. Scale bars: 1.0 mm in A; 0.3 mm in B, D, E; 0.2 mm in C, F–H.

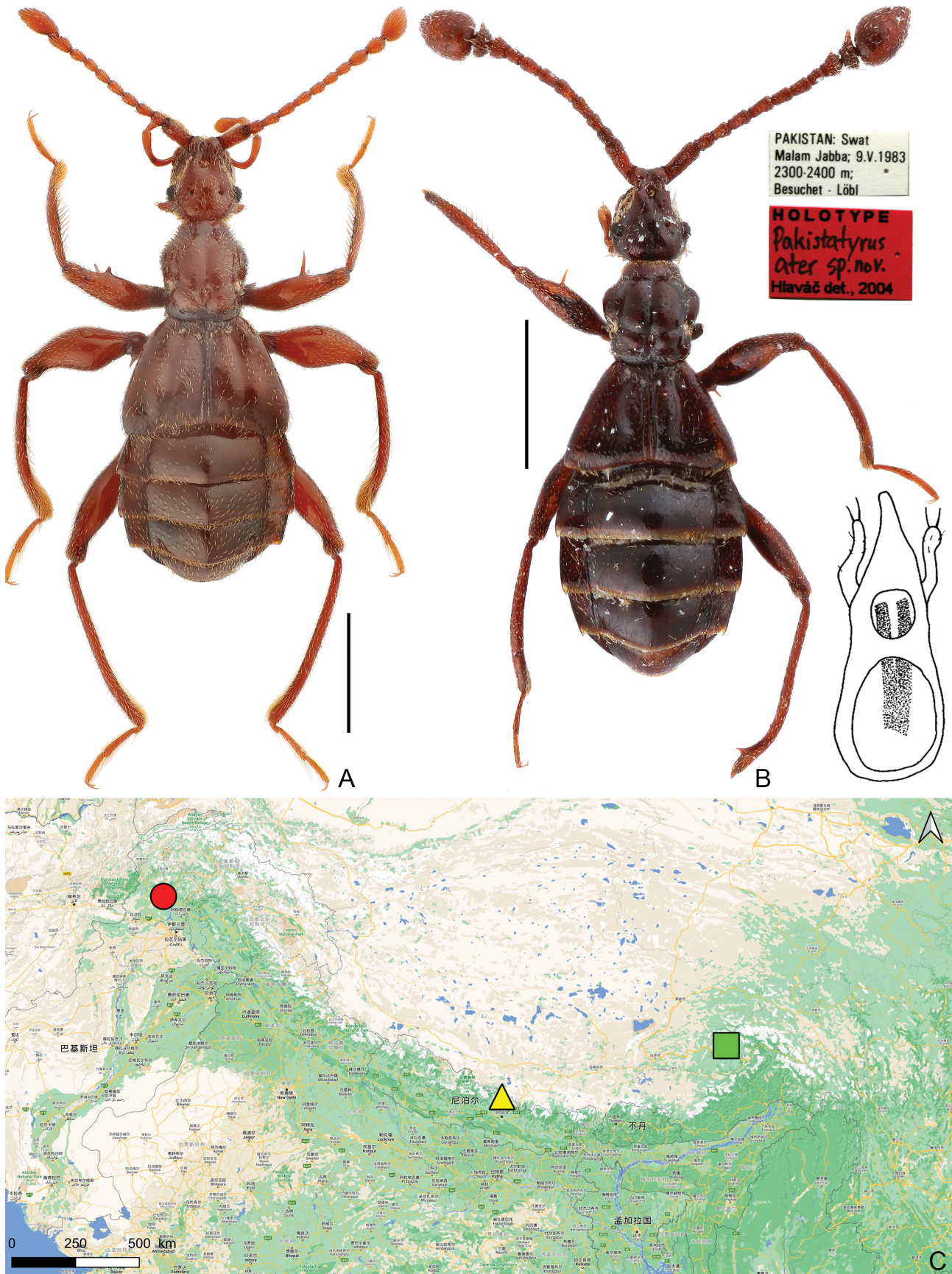


Fig. 2. Dorsal habitus (A, B) and distribution (C) of *Pakistatyrus*. A – *Pakistatyrus* sp.; B – holotype of *P. ater*, with type labels (upper) and sketch of aedeagus (lower, from Hlaváč 2006); C – circle: *P. ater*, triangle: *Pakistatyrus* sp., square: *P. inconspicuus* sp. nov. Scale bars: 1.0 mm.

and wood debris at an altitude of 3750 m (Figs 3A, B), and the other two males were taken by sifting fern leaves lying on the ground on a steep, rocky slope at a slightly lower area of approximately 3600 m. The single female of *Pakistatyrus* sp. (Fig. 3E) was collected by sifting leaf litter and debris on the ground in a *Rhododendron* dominant forest (Figs 3C, D), at an altitude of 4100 m with rather low temperature (< 15°C). An examination of the Tibetan species revealed that the elytra of all four individuals are fused (cannot be open separately), and the hind wings in both sexes are lacking, which suggests that these species are probably locally endemic and have limited abilities of dispersal. This was further reinforced by the small, reduced eyes of the male, which is often correlated to wing development, indicating trade-offs related to flight capability, reproductive output, and longevity of life span (GUERRA 2011) may exist for the male sex. The presence of two rows of spinose setae along the inner margin of the protibia of *Pakistatyrus* appears to be a highly distinctive character that is rarely found among the other tyrine genera. These spinal structures and the projecting ocular canthi may be involved in a specialized, previously unknown prey mechanism in pselaphine beetles, and future behavioral observation is desired to confirm such a hypothesis.

It is interesting to note that all three specimens of *P. inconspicuus* sp. nov. were thought to be female during initial checks using a magnifier in the field, because it was assumed that the male antennae of these beetles may present modifications as in *P. ater*. The members of *Pakistatyrus* are difficult to collect due to their high-altitude habitats which are hard to access, as well as the minimum dispersal capabilities of the beetles. It is clear that additional collecting efforts are needed to further determine the diversity of the genus along the Himalayan range.

***Pakistatyrus inconspicuus* sp. nov.**

(Figs 1; 2C; 3A, B)

Chinese common name: 隐征高山苔蚁甲

Type material. HOLOTYPE: CHINA: ♂, 'China: Xizang, Nyingchi City, valley nr. Jiare Vill., Chongge, 30°03'19"N, 93°46'46"E, 3600-3750 m, 08.vii.2021, Peng, Yin, Zhang, 西藏林芝加热村冲戈' (SNUC). PARATYPE: CHINA: 2 ♂♂, same collection data as holotype (SNUC).

Diagnosis. Male. Body length 3.6–3.8 mm, color reddish-brown. Maxillary palpomere 3 2.1 times as long as broad. Antenna approximately 1.8 mm; antennomere 1 2.7 times as long as wide, 2–7 each slightly elongate, 8 smallest, as long as wide, 9–11 moderately enlarged to form indistinct club, lacking modifications. Protrochanter with tiny spine on ventral margin; mesocoxa with short, blunt ventral tubercle; hind leg simple. Aedeagus with broad median lobe shortly protruding on right side of apex; parameres elongate, ventrally curved before apices, each paramere with four apical setae; endophallus composed of two triangular and two elongate weakly sclerotized structures. **Female.** Unknown.

Description. Male. Body (Fig. 1A) length 3.66–3.79 mm; color reddish-brown, tarsi and mouthparts lighter. Dorsal surface of body shining, covered with short pubescence.

Head (Fig. 1B) elongate-trapezoidal, truncate at apex, slightly broader than long, length from anterior margin of clypeus to posterior margin (excluding 'neck' region) 0.73–0.75 mm, width across ocular canthi 0.69–0.76 mm; vertex finely punctate, small asetose vertexal foveae (dorsal tentorial pits) at level of middle of eyes; frons strongly impressed around frontal fovea, antennal tubercle weakly convex, area between tubercles broadly sulcate; ocular canthus greatly developed, broadly triangular, with 7–8 short apical spines. Gula deeply impressed in middle to form transversely oval depression, where widely separated foveae (posterior tentorial pits) are located. Compound eyes small, each composed of approximately 16 facets. Antenna moderately elongate, length 1.77–1.79 mm, indistinct club formed by three apical moderately enlarged antennomeres, lacking modifications; antennomere 1 longer than 2 and 3 combined, 2.7 times as long as wide, 2 slightly wider than 3–8, 5 slightly longer than 4 and 6, 11 suboval, truncate at base, slightly longer than 9 and 10 combined. Maxillary palpus (Fig. 1C) with small palpomere 1, long and strongly curved palpomere 2, and basally pedunculate and apically broadened palpomeres 3 and 4, 4 with short, translucent palpal cone at apex.

Pronotum (Fig. 1B) longer than wide, length along middle 0.81–0.89 mm, maximum width 0.71–0.75 mm, widest in anterior 1/3; lateral margins rounded at widest point, convergent anteriorly and posteriorly, moderately incised at level of lateral antebasal foveae; disc slightly convex, finely punctate, with shallow median and lateral longitudinal impressions; shallow transverse antebasal impression connecting large, setose median and lateral antebasal foveae, with short mediobasal carina posterior to median fovea. Prosternum with anterior part much shorter than coxal part, with distinct lateral procoxal foveae; margin of coxal cavity weakly carinate.

Elytra markedly shortened, trapezoidal, truncate at bases, much wider than long, length along suture 0.79–0.84 mm, maximum width 1.26–1.34 mm, broadest shortly before posterior margin; each elytron with two large, setose basal foveae and broad, shallow discal stria; lacking humeral angle; subhumeral fovea and marginal stria absent.

Mesoventrite short, fused with metaventrite, with relatively long and carinate mesoventral process. Metaventrite distinctly ridged admesally, broadly impressed in middle, anterior metaventral process short, with truncate anterior margin, posterior process with short slit in middle.

Legs elongate; protibia with two rows of spinose setae along mesal margin, protrochanter (Fig. 1D) with tiny ventral spine, profemur (Fig. 1D) swollen, with two large spines on ventral surface; mesocoxa (Fig. 1E) with short, blunt ventral tubercle, mesotrochanter (Fig. 1E) with acute long ventral spine, mesofemur swollen; hind leg lacking spines or projections.

Abdomen much broader than elytra, as long as wide, widest at lateral margins of tergite 1 (IV), length 1.42–1.51 mm, width 1.42–1.50 mm. Tergites 1–3 (IV–VI) subequal in length along middle, each with broad paratergites protruding laterally, setose basal sulcus and two basolateral foveae, 4 (VII) slightly longer than 3 (VI) along middle, with triangu-



Fig. 3. Environment and habitat of *P. inconspicuus* sp. nov. (A, B) and *Pakistatyrus* sp. (C, D), and a living individual of *Pakistatyrus* sp. *in situ* (E).

lar paratergites and pair of basolateral foveae in setose lateral impressions, 5 (VIII) transverse, posterior margin broadly truncate, two small basolateral foveae. Sternite 2–5 (IV–VII) subequal in length along middle, each with setose basal sulcus and two basolateral foveae on lateral margins of sulcus, 6 (VIII) transverse, posterior margin roundly emarginate in middle, 7 (IX) (Fig. 1F) moderately sclerotized, composed of one middle and two lateral plates, middle sclerite with many setae along apical margin.

Aedeagus (Figs 1G, H) 0.57 mm long, dorso-ventrally slightly asymmetric; median lobe broad, with bulbous

basal capsule and small foramen, dorsal diaphragm distinct, apical margin protruding on right side (position as in figure); parameres evenly curved in lateral view, moderately curved near apex in ventral view, apical margin of each paramere with four thick setae; endophallus weakly developed and sclerotized, composed of two subtriangular and two elongate sclerites.

Female. Unknown.

Comparative notes. This species differs from its only congener *P. ater* (Fig. 2B) from northern Pakistan in reddish-brown coloration of the body, simple male antennomeres

10 and 11 and metatibiae, as well as in dorsoventrally much broader median lobe of the aedeagus.

Etymology. The specific epithet '*inconspicuus*' (inconspicuous, unremarkable) is a Latin adjective indicating lack of obvious male sexual characters of this species.

Distribution and habitat. SW China: Tibet (Fig. 2C). All three individuals were collected by sifting fern leaf or fern leaf/shrub debris samples in a coniferous forest at an altitude of 3600–3750 m (Figs 3A, B).

Pakistatyrus sp.

(Figs 2A, C; 3C–E)

Material examined. 1 ♀, 'China: Xizang, Gyirong County, Gyirong Valley, Langjicuo, 28°24'10" N, 85°23'58" E, 4100 m, 21.vi.2021, Z. Peng, Z. Yin & W. Zhang leg., 西藏日喀则吉隆镇朗吉措神湖' (SNUC).

Comments. This female (Figs 2A, 3E) is morphologically similar to *P. inconspicuus* but doubtlessly represents a different species judging from its much longer maxillary palpomeres 3 and antennomeres, and its well-isolated distribution.

Distribution and habitat. SW China: Tibet (Fig. 2C). The single female was collected by sifting leaf litter sample in a *Rhododendron* dominant forest at an altitude of 4100 m (Figs 3C, D).

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