

Contribution to the knowledge of *Paratrechus* JEANNEL, 1920 (Coleoptera: Carabidae: Trechini) from Costa Rica

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Abstract

The species of *Paratrechus* JEANNEL, 1920 from Costa Rica are reviewed. Eleven species are reported, habitus and aedeagus are pictured, and detailed information on habitats and locations is provided for the first time. Four species are newly described: *Paratrechus irazuensis* sp.n. from Volcan Irazu, *P. quetzal* sp.n., *P. tapantiensis* sp.n. and *P. tobiasi* sp.n. from the northern Talamanca range.

Key words. Carabidae, Trechinae, Trechini, *Paratrechus*, taxonomy, new species, Costa Rica.

Zusammenfassung

Die Arten der Gattung *Paratrechus* JEANNEL, 1920 von Costa Rica werden besprochen. Elf Arten werden gemeldet, Habitus und Aedeagus werden abgebildet und detaillierte Angaben zu den Lebensräumen werden zum ersten Mal geliefert. Vier Arten werden neu beschrieben: *Paratrechus irazuensis* sp.n. vom Volcan Irazu, *P. quetzal* sp.n., *P. tapantiensis* sp.n. und *P. tobiasi* sp.n. vom nördlichen Talamanca Gebirge.

Introduction

Costa Rica is a country in the Central American region of North America. The climate is tropical, except for the high mountains in its centre. Mountains exceeding 2500 m in elevation are covered by evergreen cloud forests and subalpine shrubs, growing in a temperate and (super-)humid climate. The country's mountain ranges are divided into the northern Cordillera Central consisting of several young volcanoes and the southern non-volcanic Cordillera de Talamanca.

A comparatively small number of lineages of carabid beetles (Carabidae) inhabit these high altitudinal ecosystems, which are well separated from other mountain ranges in Nicaragua and southern Panama by tropical lowland forests. These montane beetles share a reduction of wings, eye size, and pigmentation and belong to a very limited number of (sub)genera: *Dyscolus* DEJEAN, 1831 (Platynini); *Pelmatellus* BATES, 1882 (Harpalini); *Bembidion* LATREILLE, 1802 subgenus *Ecuadion* MORET & TOLEDANO, 2002 (Bembidiini) and *Paratrechus* JEANNEL, 1920 (Trechini). All these lineages are present in the Paramo of Ecuador as well (MORET 2005).

Paratrechus is not well studied in Costa Rica. Seven species have been described so far, partly from single specimens, partly missing exact collection sites, or with rudimentary descriptions illustrated by figures without scale. Identification is difficult because the taxa are similar to each other in habitus and shape of aedeagi. The aim of this contribution

is to describe new species, provide standardized figures of habitus and aedeagus, and provide exact locations with coordinates and description of microhabitats for ten of the eleven known taxa.

Material and methods

This study is based on 481 specimens of *Paratrechus* from Costa Rica, collected by the author and stored in his private collection. The stacked habitus photographs were taken with a 5.0 Mpixel MicroQ digital Microscope Ocular camera attached to a Nikon SMZ 745T binocular microscope and processed with GIMP 2.10.24 software. The photographs of male genitalia were taken with the same camera attached to a BTC Student-12 Microscope.

Results

Paratrechus JEANNEL, 1920

Type species. *Trechus mexicanus* PUTZEYS, 1870

Diagnosis. *Paratrechus* is a well characterized genus of Trechini, defined by the following characters: (1) the position of the first discal puncture on elytra at stria 5 (instead of stria 3 as in the vast majority of other genera); (2) comparatively large body size (> 4 mm); (3) pronotum with strongly pronounced laterobasal angles and deep basal fovea; (4) slender median lobe of aedeagus with large sagittal aileron, reduced copulatory pieces in internal sack and apex ending in a characteristic “sensorial organ” (BARR 1982).

Species diversity. *Paratrechus* is distributed across the mountain ranges from Mexico to Ecuador with about 50 species described: In Costa Rica, all high altitudinal species of Trechini belong to *Paratrechus*. The only other species of Trechini is a tropical, ripicolous and fully winged species of *Cnides* MOTSCHULSKY, 1862 (DONABAUER 2013: fig. 4). In contrast, species of *Paratrechus* are restricted to areas above 2000 m elevation and frequently occur together with several species of the subgenus *Ecuadion* MORET & TOLEDANO, 2002 of *Bembidion* LATREILLE, 1802, which are superficially similar by convergence and difficult to separate in the field. *Ecuadion* was revised by ERWIN (1982).

Phylogenetic position. Most recently, the relationship of *Paratrechus* to other Trechini was illuminated by a molecular phylogenetic analysis (FAILLE et al. 2023): *Paratrechus* is most closely related to *Duvaliomimus* JEANNEL, 1928 from New Zealand and *Baehria* SCHMIDT & FAILLE, 2023 from Ethiopia.

Species groups in Costa Rica (preliminary). The six species *P. alexandri*, *P. obrieni*, *P. halffteri*, *P. irazuensis* sp.n., *P. quetzal* sp.n., and *P. chiriquirensis* BARR, 1982 from Panama share the position of the posterior discal puncture in stria 5 of elytron, and a piceous body. These taxa likely form a natural group and show gradual adaptation from the generalist *P. alexandri* at lower elevation to the high elevational *P. irazuensis* sp.n. (Figs 1, 3, 5, 7, 9, 11, 13).

The three sibling species *P. tapantiensis* sp.n., *P. tobiasi* sp.n. and *P. reyesi* can be separated by aedeagus differences alone and share with *P. costaricensis* and *P. gouleti* the position of the posterior discal puncture shifted mesally, and a partly depigmented body with yellowish or reddish paler parts. These taxa likely form a second natural group.

Determination key for species of *Paratrechus* from Costa Rica

- 1 Elytra without posterior discal puncture (Fig. 21). Colour pale. Male unknown. Northern Talamanca range. *P. pecki*
- Elytra with posterior discal puncture present between striae 4 and 5. 2
- 2 Posterior discal puncture on stria 5. Body piceous black. 3
- Posterior discal puncture shifted inside, on or around stria 4. Body more reddish piceous. 7
- 3 Legs yellowish pale, especially femora strongly contrasting to colour of elytra. Habitus more convex, especially elytra, shoulders more pronounced (Figs 1, 3). Pronotum broader, less constricted to base. Median lobe of aedeagus with ventral side (in lateral view) slightly swollen near internal sack, thus slightly thickened in apical third (Figs 2, 4). 4
- Legs reddish brown, darker, less contrasting to colour of elytra. 5
- 4 Median lobe of aedeagus equally curved, shorter (ca. 30% of length of elytra, Fig. 2). Tibia not darkened. Northern Talamanca range. *P. obrieni*
- Median lobe of aedeagus straight, slightly longer (ca. 36% of length of elytra, Fig. 4). Tibia frequently darker. Widespread. *P. alexandri*
- 5 Head enlarged, elytra subparallel with shoulders more pronounced (Fig. 22). Northern Talamanca range. *P. quetzal* sp.n.
- Pronotum and head smaller; elytra strongly ovate, flattened on disc, shoulders strongly rounded (Figs 5, 7). 6
- 6 Median lobe of aedeagus slender and equally curved in lateral view, without swelling near internal sack (Fig. 6). Northern Talamanca range. *P. halffteri*
- Median lobe of aedeagus in lateral view with slight ventral swelling near internal sack (Fig. 8). Volcan Irazu. *P. irazuensis* sp.n.
- 7 Body larger, around 5 mm. Elytra broadly ovate and strongly convex; discal punctures large, deeply impressed, foveate, frequently disturbing or connecting striae 4 and 5; striae deeply impressed on disc. 8
- Body smaller than 4.5 mm. Elytra with striae moderately impressed on disc. 10
- 8 Median lobe of aedeagus with apical sensorial organ reduced in size, apex straight, neither turned up nor turned down (Fig. 16). Around Villa Mills south of Cerro Buena Vista. *P. reyesi*
- Median lobe of aedeagus apical sensorial organ of normal size, apex not straight 9
- 9 Median lobe of aedeagus elongated, ca. 1 mm in length, of characteristic shape by apex slightly turned up in lateral view (Figs 10, 12). North of Talamanca range and Cordillera Central. *P. tobiassi* sp.n.
- Median lobe of aedeagus significantly shorter, ca. 0.7 mm in length, evenly curved, with apex turned down in lateral view (Fig. 14). Northern Talamanca range. *P. tapantiensis* sp.n.
- 10 Median lobe of aedeagus more elongated, before apex slender (Fig. 18). Pronotum with basal angles more pronounced; elytra more elongated oval. Volcan Poas, type locality “Rosario de Desempario” at 1550 m a.s.l. likely erroneous. *P. cf. costaricensis*
- Median lobe of aedeagus shorter, before apex slightly thicker (Fig. 20). Body smaller, broader, hardly larger than 4 mm, entirely reddish-brown, elytra with shallow striae (Fig. 19). Northern Talamanca range. *P. gouleti*

Notes. *Paratrechus chiriquensis* BARR, 1982 and *P. panamensis* MATEAU, 1998 have been described from Cerro Punta in Panama, close to the border of Costa Rica, and may be expected to occur in southernmost Costa Rica on hardly accessible mountains.

***Paratrechus obrieni* MATEAU, 1981 (Figs 1, 2)**

Type locality. Costa Rica, 26 miles north of San Isidro General.

Material examined. Costa Rica, Talamanca range: 22 ex., near entrance of Los Quetzales National Park, N 9.6137°, W 83.8175°, 3000 m a.s.l., 14.IX.2023; 48 ex., Cerro Buena Vista, 3400 m a.s.l., N 9.5548°, W 83.7552°, 15.IX.2023.

Description. Body length 4.2–4.7 mm. Body short and broad, with ample prothorax and broadly ovate elytra; dorsum well convex, especially in hind body; inner wings absent. Colour piceous, shiny; lateral border of elytra in apical half lighter; neck of head, clypeus, mouthparts, and antenna reddish piceous; basal segment of antennae and legs yellowish, strongly contrasting to body; ventral surface piceous brown.

Head moderately depressed above; frontal furrows deep throughout, equally curved at middle and slightly divergent in front; frons and supraorbital areas moderately convex, two supraorbital setae present, insertion normal; microsculpture distinct; eyes slightly reduced in size but still prominent; length of gena about two thirds of eye diameter, moderately convex; labrum transverse, its apical margin strongly emarginate, with six setae; mandibles normal and sharp at the apical parts; antennae thin, filiform, reaching half of body length (ca. 53%).

Pronotum large, transverse, much wider than head, widest before middle, strongly convex, strongly contracted to base; on average 1.44 times as wide as midlength; sides well rounded in front, feebly in basal third, basal sinuation brief but deep; hind angles strongly developed, sharp and projecting; front angles rounded and moderately produced; base more or less straight; median line distinct, reaching base, not reaching apex; apical transverse impression hardly visible; basal transverse impression strongly curved, almost interrupted at middle, and laterally extended to the bottoms of basal foveae, which are very large, deep and smooth; microsculpture fine on disc, more developed in basal fifth; two lateral setae are present as normal in Trechini, but frequently broken off.

Elytra ovate, ample, moderately convex, slightly flattened on disc; on average one third longer than wide; shoulders distinct but rounded, with nearly straight prehumeral borders; sides narrowly bordered throughout; dorsum convex, with rather steep lateral parts and apical declivity; elytra shiny, microsculpture not sharply impressed; inner striae 1 to 5 complete, deep on disc and slightly punctate, outer striae reduced and hardly visible, stria 8 deepened in apical half; scutellar striole deep though not long; apical striole deeply impressed, moderately curved though nearly straight at the anterior part, and connected to stria 5; intervals flat; stria 5 with two setiferous dorsal pores, small and weakly impressed, at ca. 15% and 50% of length from base, respectively; preapical pore usually inserted at the apical end of stria 2, equally distant from apex and suture, more distant to apical striole.

Legs not strongly elongated; protibiae with longitudinal groove on external face; in males two proximal segments of each protarsus moderately dilated and sharply denticulate inwards at apices.

Aedeagus (Fig. 2) simple and typical for the genus *Paratrechus*. Median lobe length ca. 30% of elytron length; slender and equally curved in lateral view, nearly parallel-sided,

but slightly swollen on ventral side in vicinity of internal sack just before apex; apex short, apical sensorial organ of average size and rounded.

Diagnosis. This species is similar to *P. halffteri* in size, colour and the position of the posterior seta on the elytron. Both occur together in the Talamanca range around Cerro de la Muerte. *Paratrechus obrieni* can be separated best by the yellowish legs, the (slightly) more pronounced shoulders and minor differences in median lobe of aedeagus, especially the presence of swelling near internal sack (compare Figs 1 and 5). *Paratrechus obrieni* is even more similar to *P. alexandri* and likely the most closely related species. *Paratrechus obrieni* can be separated by its smaller size and by the different median lobe of aedeagus, which is significantly smaller, more slender and more curved. These two species seem to differ in their preferred height ranges, *P. obrieni* occurs at higher elevations than *P. alexandri*.

Observations. This species lives at high elevations along the crest of the Talamanca range in wet leaf litter of cloud forests, under wood branches and stones, in bamboo shrubs, outside of forests in the subparamo and even in disturbed areas like roadsides and footpaths. It prefers very humid, clayish soils, near at least temporarily running water. Humus-rich soils are avoided. It occurs together with *P. halffteri* and species of *Bembidion* (*Ecuador*). It is locally common.

***Paratrechus alexandri* TREZZI, 1995 (Figs 3, 4)**

Type locality. Costa Rica, Volcan Barva.

Material examined. Costa Rica, Cordillera Central: 90 ex., Volcan Poas, Lagunillas env., 2350 m a.s.l., 8.IX.2023; 3 ♂♂, Volcan Barva, ca. 2700 m a.s.l., 9.IX.2023. Costa Rica, Talamanca range: 1 ♂, 1 ♀, near Paraiso Quetzal lodge, N 9.6449°, W 83.8490°, 2700 m a.s.l., 12.IX.2023; 1 ♂, near entrance of Los Quetzales National Park, N 9.6137°, W 83.8175°, 3000 m a.s.l., 14.IX.2023.

Description. Body length 4.5–4.9 mm. This species is almost identical to the previous one and thus a complete description is omitted. It is distinguished by its slightly larger average size, and a darkened tibia in most individuals (Fig. 3). Median lobe of aedeagus (Fig. 4) significantly larger than in *P. obrieni*, length ca. 35% of elytron length; less slender, straight and not curved in lateral view, more swollen on ventral side in vicinity of internal sack just before apex.

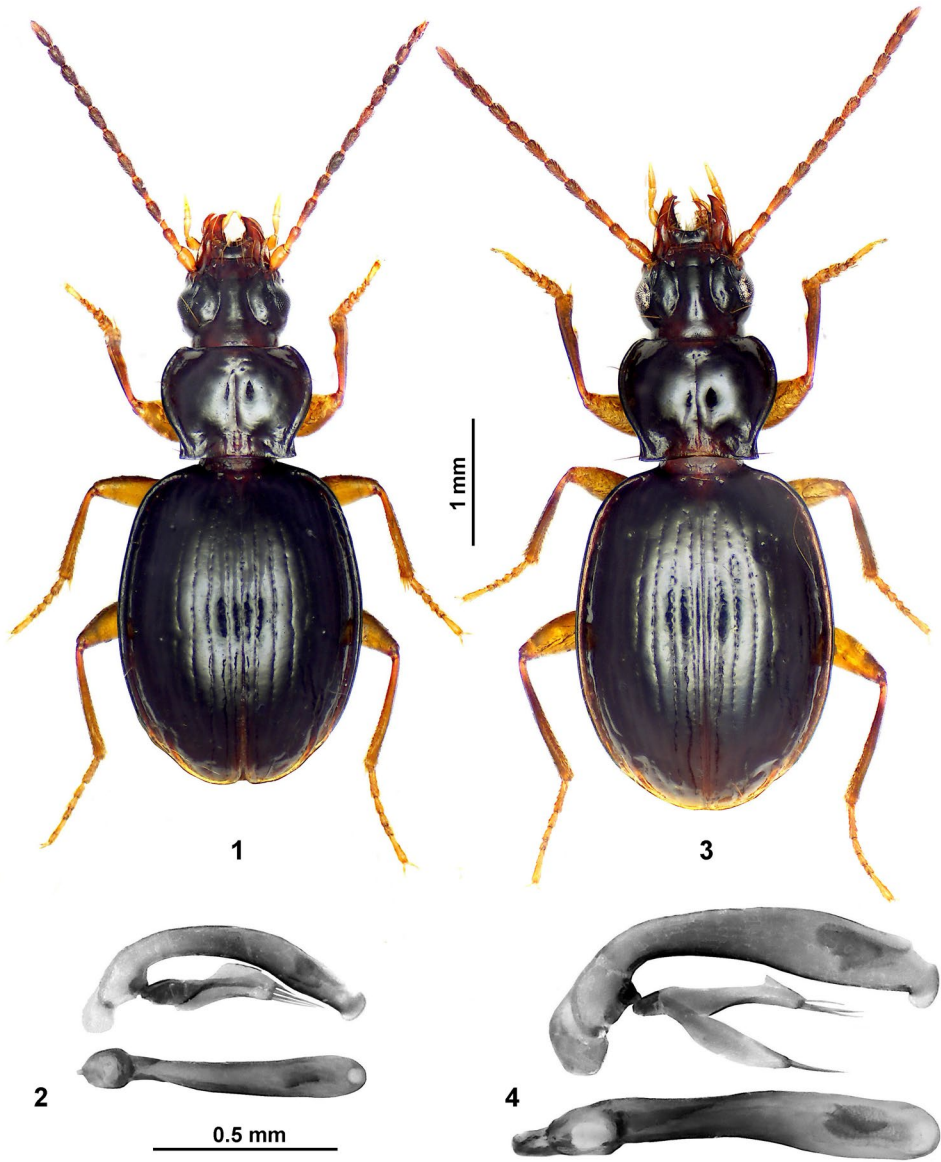
Observations. *Paratrechus alexandri* was found on cultivated meadows, shaded by solitary trees and sometimes trampled by cows, in muddy places at the border of forests or along forest roads. Data indicate a rather unspecialized, hygrophilous mode of life at comparatively lower elevations. *Paratrechus alexandri* is locally common and widespread.

***Paratrechus halffteri* MATEAU, 1974 (Figs 5, 6)**

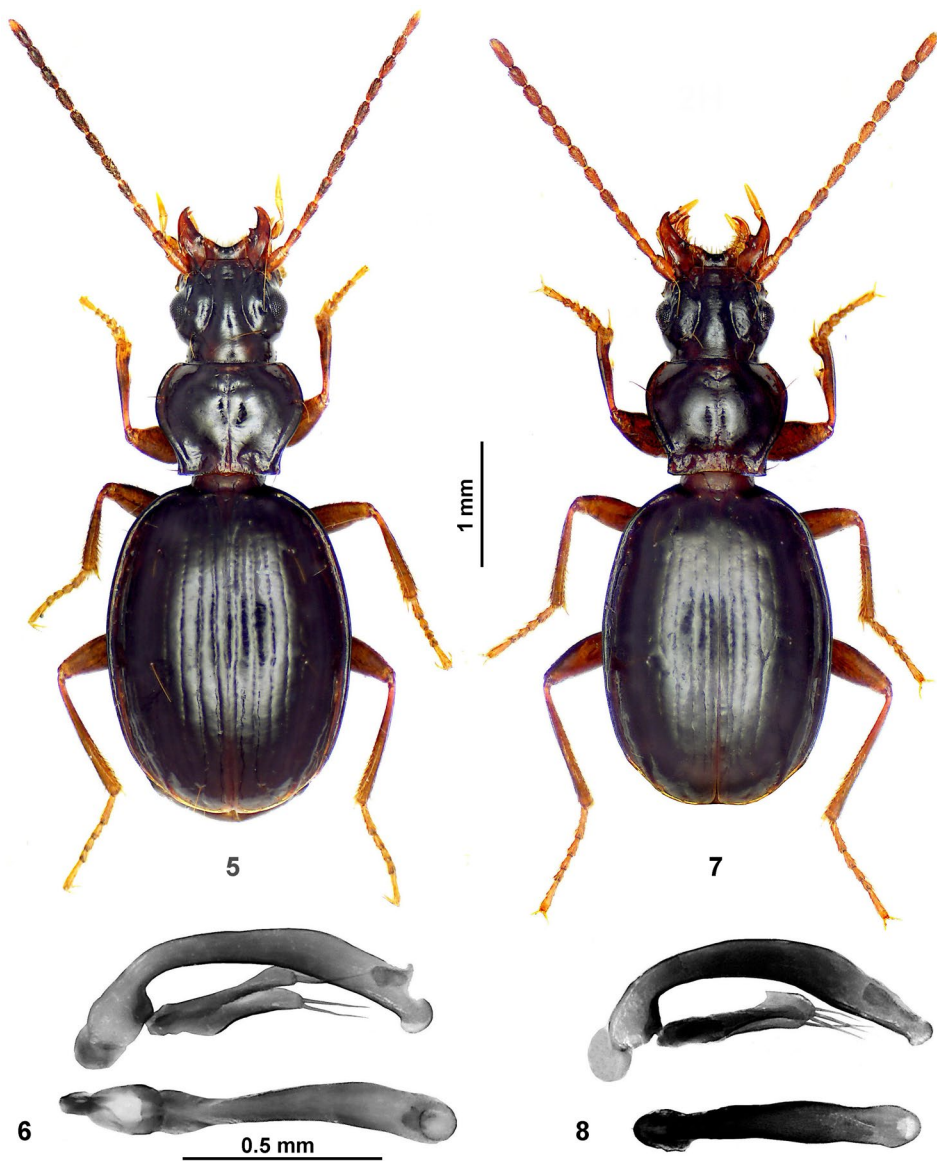
Type locality. Costa Rica, Arroyo de la Muerte.

Material examined. Costa Rica, Talamanca range: 143 ex., near entrance of Los Quetzales National Park, 3000 m a.s.l., N 9.6137°, W 83.8175°, 14.IX.2023; 5 ex., Villa Mills env., 2700 m a.s.l., N 9.5312°, W 83.709°, 16.IX.2023. 25 ex.: Cerro Buena Vista, 3400 m a.s.l., N 9.5548°, W 83.7552°, 15.IX.2023.

Description. Body length 4.5–5.0 mm, in exceptional cases as small as 4.0 mm. Body slightly larger than in *P. obrieni*, slightly narrower prothorax and more ovate elytra; dorsum slightly more flattened, especially in hind body. Colour piceous, shiny; lateral border of



Figs 1–4. Habitus and aedeagus of *Paratrechus* from Costa Rica. (1, 2) *P. obrieni*, Cerro Buena Vista; (3, 4) *P. alexandri*, Volcan Barva.



Figs 5–8. Habitus and aedeagus of *Paratrechus* from Costa Rica. (5, 6) *P. halffteri*, Cerro Buena Vista; (7, 8) *P. irazuensis* sp.n., Volcan Irazu.

elytra in apical half hardly lighter; neck of head, clypeus, mouthparts and antenna reddish piceous; basal segment of antennae and legs reddish brown, less contrasting to body; ventral surface piceous brown.

This species is almost identical to *P. irazuensis* sp.n. and thus a complete description is omitted. Head with gena ca. two thirds as long as eye diameter; antennae thin, filiform, reaching more than half of body length (ca. 58%); pronotum slightly transverse, on average 1.1 times as wide as midlength; elytra ovate, ca. 1.3–1.4 times as long as maximum width.

Aedeagus (Fig. 6). Median lobe length ca. 33% of elytron length; slender and equally curved in lateral view, nearly parallel-sided, not at all swollen on ventral side in vicinity of internal sack just before apex as in the previous species; partly darkened.

Comparative notes. This species is difficult to separate from *P. obrieni* (see key), both syntopically occur around Cerro de la Muerte. *Paratrechus halffteri* is even more similar to *P. irazuensis* sp.n., probably the most closely related species (see next).

Observations. This species was collected in a variety of microhabitats at muddy sites in forests, especially common in bamboo shrubs (Fig. 24) and on Cerro Buena Vista even outside of forests in unshaded drainage ditches along streets in the subparamo. Specimens were taken in syntopy with *P. obrieni*, *P. reyesi* and *P. gouleti* at different elevations ranging from 2700 to 3400 m a.s.l.

***Paratrechus irazuensis* sp.n. (Figs 7, 8)**

Type material. Holotype (♂) and paratypes (41 ♂♂, 23 ♀♀) from Costa Rica, Cartago Province, Volcan Irazu, near summit, 3300 m a.s.l., N 9.9754°, W 83.8501°, 11.IX.2023.

Derivatio nominis. This species is named after the highest volcano of Costa Rica (3432 m).

Description. Body length 4.5–4.9 mm. Body slightly smaller than in *P. halffteri*, more slender, elytra more elongated ovate; dorsum slightly flatter, especially in hind body; inner wings absent. Colour piceous, shiny; lateral border of elytra in apical half hardly lighter; neck of head, clypeus, mouthparts and antenna reddish piceous; basal segment of antennae and legs reddish brown, less contrasting to body; ventral surface piceous brown.

Head elongated, depressed above; frontal furrows deep throughout, rather straight at middle and hardly divergent in front; frons and supraorbital areas weakly convex, two supraorbital setae present, insertion normal; microsculpture distinct; eyes reduced in size and weakly prominent; length of gena ca. two thirds of eye diameter, rather convex; labrum transverse, its apical margin strongly emarginate, with six setae; mandibles slightly elongated and sharp at the apical parts; antennae thin, filiform, reaching half of body length (ca. 50%).

Pronotum small, slightly transverse, slightly wider than head, widest before middle, convex, contracted to base; width ca. 1.25 times midlength; sides well rounded in front, feebly in basal third, basal sinuation less deep than in previous species; hind angles strongly developed, right angled and hardly projecting; front angles rounded and not protruded; base more or less straight; median line fine, reaching base, not reaching apex; apical transverse impression hardly visible; basal transverse impression slightly curved, not interrupted at middle, and laterally extended to the bottoms of basal foveae, which are very large, deep and smooth; microsculpture fine but clearly distinct on disc; two lateral setae are present as normal in Trechini.

Elytra elongate ovate, flattened on disc; length ca. 1.4 times their maximum width; shoulders indistinct, with regularly rounded prehumeral borders; sides narrowly bordered throughout; flattened on disc; elytra shiny, microsculpture not sharply impressed; inner striae 1 to 6 complete, weakly impressed on disc and not punctate, outer striae and in apical area reduced and hardly visible, stria 8 deepened in apical half; scutellar striole deep though not long; apical striole short and deeply impressed, moderately curved and connected to stria 5; intervals flat; stria 5 with two small setiferous dorsal pores, at ca. 13% and ca. 50% of length from base, respectively; preapical pore usually inserted at the apical end of stria 2, equally distant from apex and suture, more distant to apical striole.

Legs not elongated; protibiae with longitudinal groove on external face; in males two proximal segments of each protarsus moderately dilated and sharply denticulate mesally at apices.

Aedeagus (Fig. 8) simple and typical for the genus *Paratrechus*. Median lobe length ca. 33% of elytron length; slender and equally curved in lateral view, nearly parallel-sided, slightly swollen on ventral side in vicinity of internal sack just before apex as in the previous species except *P. halffteri*; partly infuscated; sagittal aileron fully developed; apex short, apical sensorial organ of average size and rounded; internal sack covered by weakly developed scales; parameres unmodified.

Comparative notes. This new species is most similar to *P. halffteri* and can be separated by the slightly swollen median lobe of aedeagus on the ventral side in the vicinity of the internal sack just before the apex.

Observations. Known from the type locality only. This new species was taken from wet accumulations of leaf litter under shrubs and thickets at 3300 m (Fig. 26). No other *Paratrechus* has yet been reported from Volcan Irazu.

***Paratrechus tobiasi* sp.n. (Figs 9–12)**

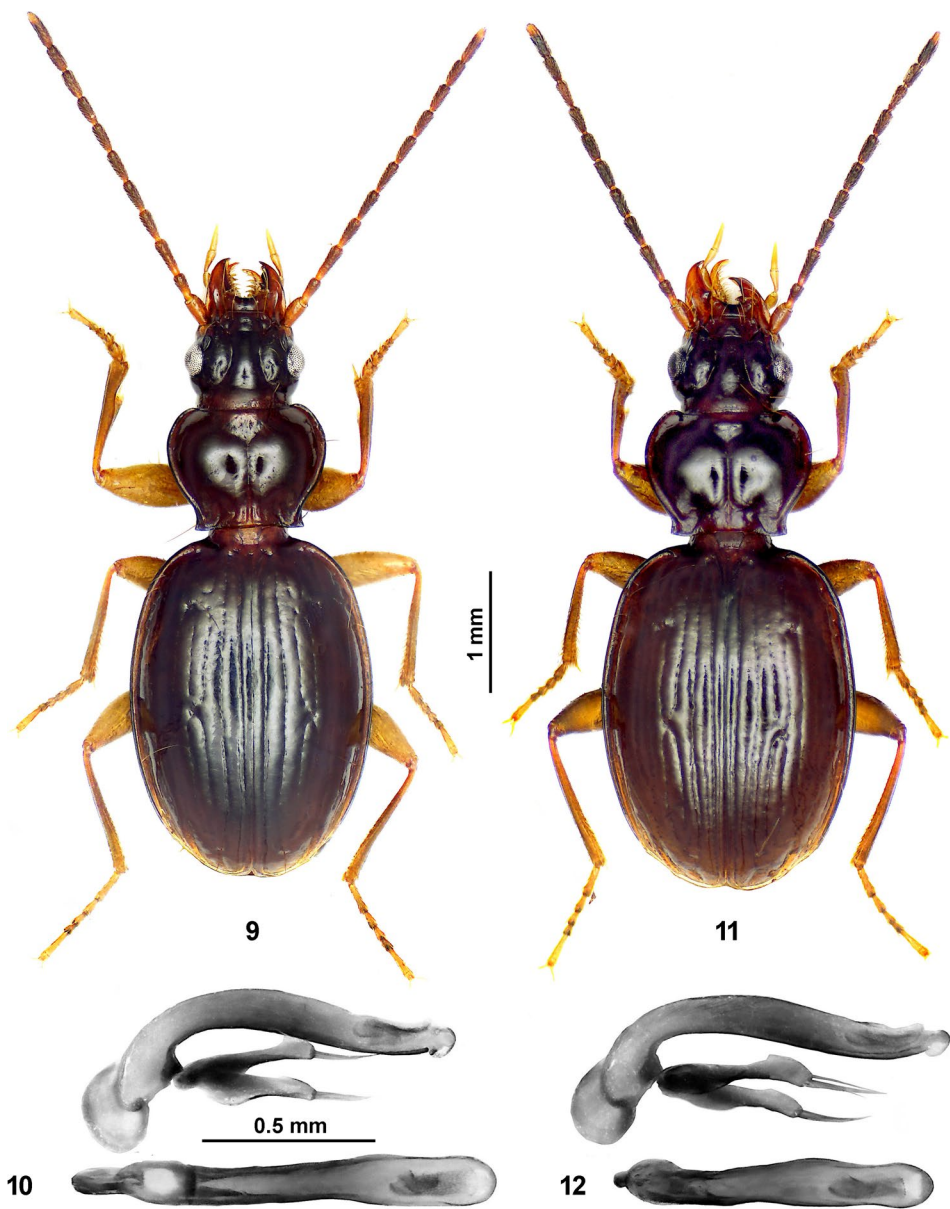
Type material. Holotype (♂) and paratypes (13 ♂♂, 11 ♀♀) from Costa Rica, Talamanca range, near Paraiso Quetzalodge, N 9.6449°, W 83.8490°, 2700 m a.s.l., 12.IX.2023.

Additional material examined. 4 ex., Costa Rica, Volcan Barva, ca. 2700 m a.s.l, 9.IX.2023.

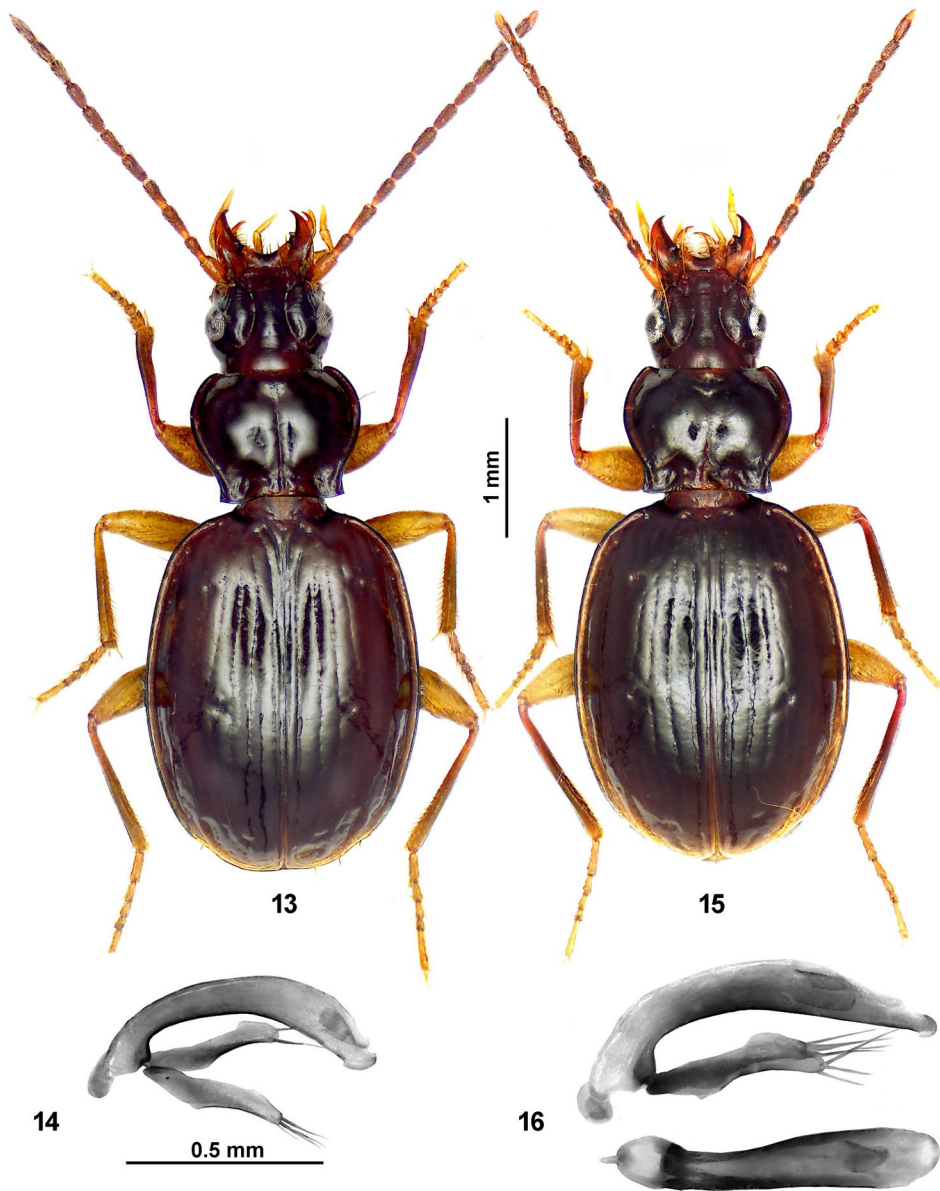
Derivatio nominis. This species is dedicated to my son Tobias, who accompanied me to Costa Rica.

Description. Body length 4.7–5.0 mm. Broad and strongly convex, ample prothorax and broadly ovate elytra; dorsum well convex, especially in hind body; hind wings absent. Colour reddish piceous; basal segment of antennae and legs yellowish contrasting to body, outer segments of antennae starting with segment 2 and tibia slightly darker; ventral surface colourful for a species of Trechini, yellowish brown, but each sternite apically with a contrasting darker band; epipleura of pronotum yellowish, contrasting to much darker proepisterna, the latter again contrasting to reddish prosternum.

Head of normal size; frontal furrows deep throughout, equally curved at middle and slightly divergent in front; frons and supraorbital areas moderately convex, two supraorbital setae present, insertion normal; microsculpture distinct; eyes slightly reduced in size but still prominent; genae half as long as eyes, moderately convex; labrum transverse, its apical margin strongly emarginate, with six setae; mandibles normal and sharp at the apical parts; antennae thin, filiform, slightly longer than half of body length (ca. 55%).



Figs 9–12. Habitus and aedeagus of *Paratrechus* from Costa Rica. (9, 10) *P. tobiasi* sp.n., Volcan Barva; (11, 12) *P. tobiasi* sp.n., Paraiso Quetzal Lodge.



Figs 13–16. Habitus and aedeagus of *Paratrechus* from Costa Rica. (13, 14) *P. tapantiensis* sp.n., Tres de Junio env., near entrance of Tapantí National Park; (15, 16) *P. reyesi*, Villa Mills.

Pronotum large, transverse, much wider than head, widest before middle, strongly convex, strongly contracted to base; pronotum width about 1.3–1.4 times midlength; sides well rounded in front, feebly in basal third, basal sinuation brief but deep; hind angles strongly developed, slightly acutely angled and projecting; front angles rounded and moderately produced; base more or less straight; median line distinct and deep, reaching base, not reaching apex; apical transverse impression slightly impressed; basal transverse impression strongly curved, laterally extended to the bottoms of basal foveae, which are very large, deep and smooth; microsculpture fine on disc, more developed in basal fifth; two lateral setae are present as normal in Trechini, but frequently broken off.

Elytra ovate, ample, convex, slightly flattened on disc; length about 1.4 times their maximum width; shoulders rounded; sides narrowly bordered throughout; dorsum convex, with rather steep lateral parts and apical declivity; elytra shiny, microsculpture not sharply impressed; inner striae 1 to 5 complete, deep on disc and in some specimens slightly punctate, outer striae more reduced and hardly visible, stria 8 deepened in apical half; scutellar striole deep; apical striole deeply impressed, moderately curved though nearly straight at the anterior part, and connected to stria 5; intervals flat; one deep, basal setiferous dorsal pore in stria 5 at ca. 18% of length from base; a second dorsal pore in interval 4 or at stria 4, deep and foveate, disturbing stria, ca. 50% from base; preapical pore usually inserted at the apical end of stria 2, closer to suture than to apex and apical striole.

Legs not strongly elongated; protibiae with longitudinal groove on external face; in males two proximal segments of each protarsus moderately dilated and sharply denticulate inwards at apices.

Aedeagus (Figs 10, 12). Median lobe elongated, with a soft but highly characteristic S-shape. Median lobe length ca. 38% of elytron length; slender and equally curved in lateral view, nearly parallel-sided, apex slightly turned up, which is not seen in any other known species from Costa Rica, not at all swollen on ventral side in vicinity of internal sack; sagittal aileron strongly developed; apex short, apical sensorial organ of average size and rounded; internal sack covered by weakly developed scales; parameres unmodified.

Observations. All specimens were found in wet conditions beside small brooks under leaf litter and branches in muddy places. In the Talamanca range this species was observed together with *P. gouleti* and numerous *Bembidion*.

Comparative notes. *Paratrechus tobiasi* sp.n. is externally almost identical to the next two species *P. reyesi* and *P. tapantiensis* sp.n. These three likely form a group of vicariant taxa. In contrast to similarities in habitus, significant aedeagal differences (Figs 10–16) can be observed. All three taxa occur in the Talamanca range around Cerro de la Muerte in close vicinity in the same type of microhabitat and without separating barriers, but never together. Interestingly, I am not able to separate the population of *P. tobiasi* sp.n. from Volcan Barva and the Talamanca range (Figs 5–6), which are distant and geographically well separated by the central valley. The distribution of these taxa cannot be explained by the insufficient data at hand and is worth further investigations.

***Paratrechus tapantiensis* sp.n. (Figs 13, 14)**

Type material. Holotype (♂) and paratypes (2 ♂♂, 3 ♀♀): Costa Rica, Talamanca range, near Tres de Junio, Sinac Minae Esperanza, 2700 m a.s.l., N 9.6841°, W 83.8777°, 13.IX.2023.

Derivatio nominis. This new species is named after the Tapantí National Park, which is very close to the type locality.

Description. The habitus of this species (Fig. 13) is almost identical to *P. tobiasi* sp.n. (Fig. 9) and thus a complete description is omitted. Body length, 4.7–5.3 mm. Pronotum ca. 1.2–1.3 times wider than midlength; elytra ca. 1.35 times as long as their maximum width.

Median lobe of aedeagus (Fig. 14) short, length ca. 25% of elytron length; slender and equally curved in lateral view, nearly parallel-sided, apex turned down, stronger than in any other known species from Costa Rica, not at all swollen on ventral side in vicinity of internal sack; sagittal aileron developed, but smaller than in the previous; apex short, apical sensorial organ of average size and rounded; internal sack covered by weakly developed scales; parameres unmodified.

Observations. Known from a single location next to the street leading to one of the side entrances of Tapantí National Park east of Tres de Junio, in a water drainage system in newly grown forest. No other *Paratrechus* was found at this site.

***Paratrechus reyesi* MATEAU, 1974 (Figs 15, 16)**

Type locality. San Isidro, Talamanca, Costa Rica.

Material examined. 68 ex.: Costa Rica, Talamanca range, Villa Mills env., 2700 m a.s.l., N 9.5312°, W 83.709°, 16.IX.2023.

Diagnosis. This species is very similar to the previous two (compare Fig. 15 with Figs 9, 11, 13) but distinguished by the highly characteristic median lobe of aedeagus (Fig. 16), which has an apical sensorial organ reduced in size and a straight apex.

Observations. All specimens were taken from drainage ditches beside a small forest street, under stones and accumulated leaf litter.

Notes. This species was among the first *Paratrechus* described from Costa Rica, based on a single male and two females from 2300 m a.s.l. The type locality San Isidro is next to Villa Mills. The material examined perfectly corresponds to the figures and descriptions previously provided (see key).

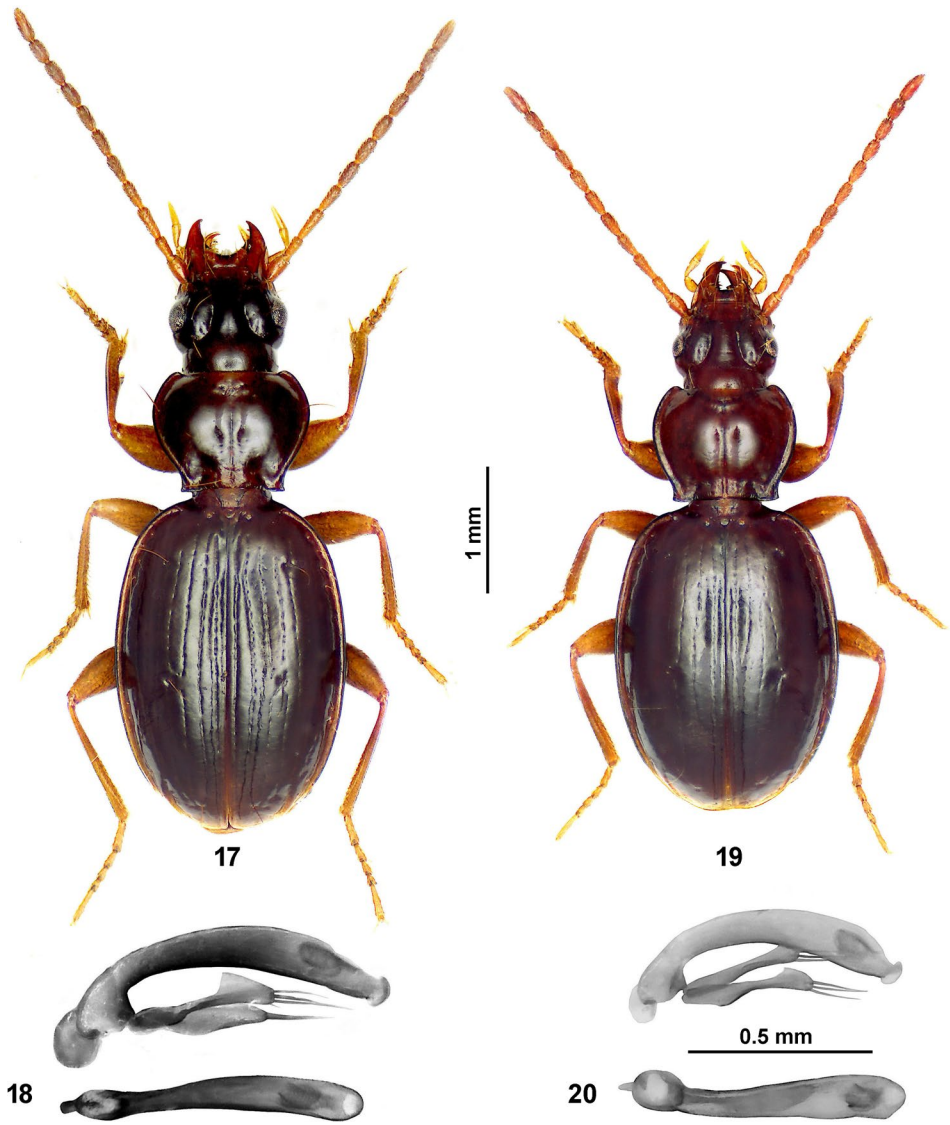
***Paratrechus cf. costaricensis* MATEAU, 1974 (Figs 17, 18)**

Type locality. Costa Rica, Rosario de Desempara (MATEAU 1974: p. 203), Rosario de Desemparos (MATEAU 1974: p. 198), 1500 m a.s.l. There is a village Rosario de Desemparados in the northern Talamanca range at 1200 m a.s.l. (N 9.7932°N, W 84.0855°) with mountains in the surrounding reaching up to 1500 m a.s.l.

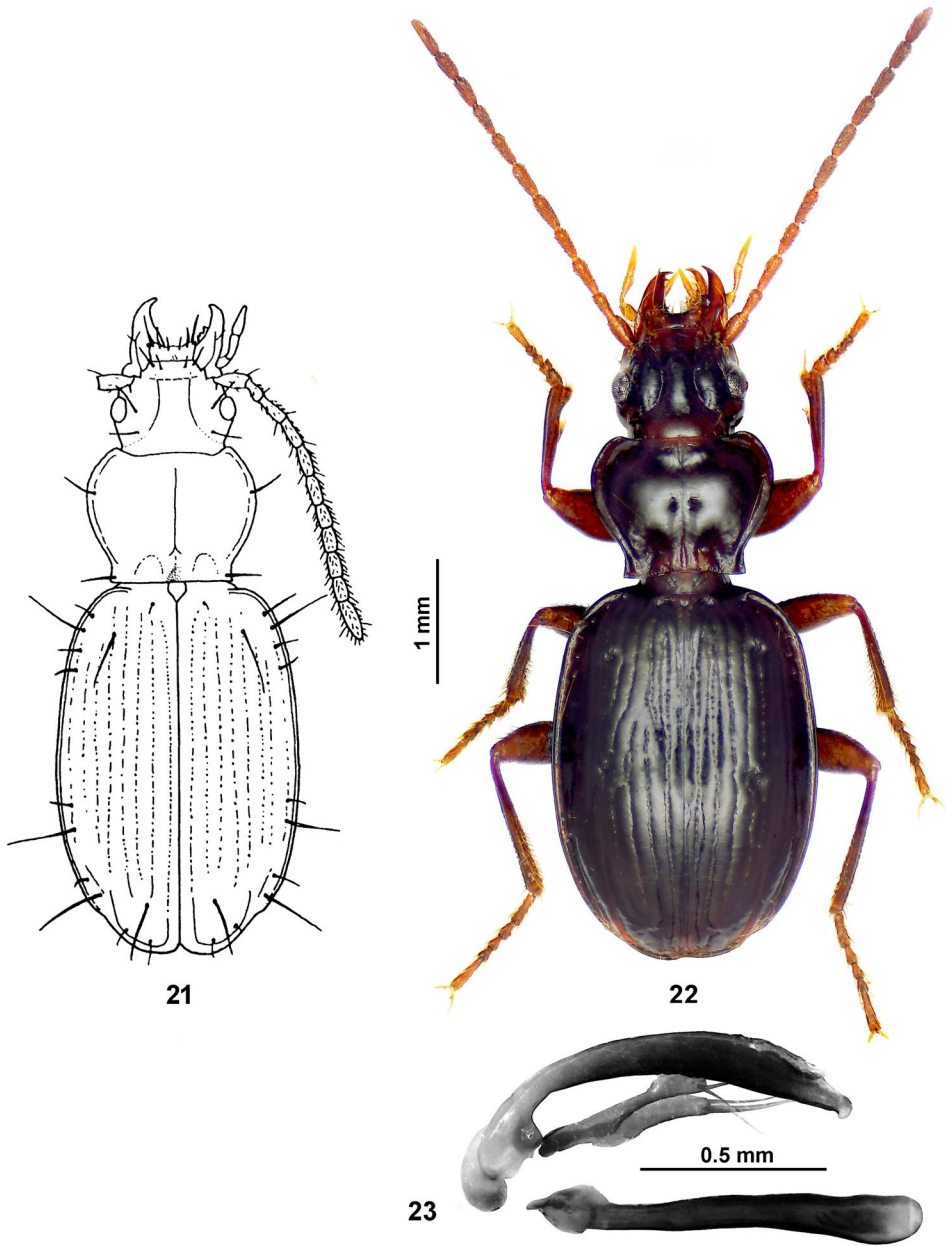
Material examined. 31 ♂♂, 11 ♀♀, Costa Rica, Prov. Alajuela, Volcan Poás, near summit, 2600 m a.s.l., N 10.1888°, W 84.2310°, 6.IX.2023.

Original description (MATEAU 1974, own translation). “Of the three species (*P. costaricensis*, *P. halffteri*, *P. reyesi*) of *Paratrechus* that we currently know from this country, it is the one that has a narrower shape and more elongated elytra. It is also the smallest, reddish brown in colour. Its slightly transverse pronotum with the narrow lateral canal and its genitalia are very different from that of the other two species, justifying the creation of a new taxon.”

Notes. This species was among the first *Paratrechus* described from Costa Rica; consequently, the original description is very short. Additionally, the type locality is likely erroneous or not precise. Based on my field experience, no *Paratrechus* exists at such



Figs 17–20. Habitus and aedeagus of *Paratrechus* from Costa Rica. (17, 18) *P. cf. costaricensis*, Volcan Poas; (19, 20) *P. gouleti*, near entrance of Quetzal National Park.



Figs 21–23. Habitus and aedeagus of *Paratrechus* from Costa Rica. (21) *P. pecki*, copied and resized from original description (BARR 1982). (22, 23) *P. quetzal* sp.n., near Cerro Vueltas Lodge.



Figs 24–25. Near the entrance to Quetzal National Park at 3000 m a.s.l. (24) A bamboo shrub with muddy floor is the habitat of *Paratrechus halfferi*. (25) In this superhumid forest with muddy floor several *Paratrechus* species were found: *P. halfferi*, *P. obrieni* and *P. gouleti*.



Fig. 26. Volcan Irazu at 3300 m a.s.l. The type locality of *Paratrechus irazuensis* sp.n. is a muddy place with deep layer of leaf litter in low grown forest at high elevation.

“low” elevation. However, the material examined from Volcan Poas fully matches the description of habitus and the figure of median lobe of aedeagus in the original description and likely belong to this species.

Observations. Specimens were found on the forest floor in wet places under sticks, decaying wood and accumulations of leaf litter. No other *Paratrechus* was found at this site.

***Paratrechus gouleti* MATEAU, 1998** (Figs 19, 20)

Type locality. Costa Rica, San Jose province, km 95 carretera 2, 3200 m alt. According to elevation this should be around Cerro Muerte/Cerro Buena Vista.

Material examined. Costa Rica, Talamanca range: 21 ex., near Paraiso Quetzal lodge, N 9.6449°, W 83.8490°, 2700 m a.s.l., 12.IX.2023; 4 ex., near entrance of Los Quetzales National Park, N 9.6137°, W 83.8175°, 3000 m a.s.l., 14.IX.2023.

Description (MATEAU 1998, own translation). “Short, reddish insect, wider and convex; body length barely exceeding 4 mm. Pronotum transverse, the posterior angles small and briefly acute. Elytra broad and convex with high and well-defined shoulders, 1.29 times longer than broad, the internal angles separately rounded. Median lobe of aedeagus moderately elongated, arched, the apex broadly rounded, the ventral constriction elongated but deep; sagittal lamella of the basal bulb large, subspherical. Styli with four setae. Distinguished from *P. costaricensis* by its broad and squat shape, the short

head with the temples also short but convex; pronotum transverse, less convex with small posterior angles; elytra wide, with well-rounded but high shoulders, the sides well arched with wide marginal groove, while in *P. costaricensis* the pronotum is more elongated, with large and prominent posterior angles and the base almost rectilinear, the elytra are elongated and subparallel, the gutter narrow, etc. The aedeagus is of the same type, although very distinct.”

Observations. This characteristic small, reddish species is solely known from the Northern Talamanca range, where it inhabits accumulations of leaf litter in shrubs and thickets at high elevations (Fig. 25).

***Paratrechus pecki* BARR, 1982 (Fig. 21)**

Type locality. Costa Rica, Villa Mills, Cerro de la Muerte, 3050 m a.s.l.

No material examined. A single female specimen known.

Diagnosis (BARR 1982). According to the description, a highly characteristic species recognizable by pale colour, elongate form, strongly punctured elytral striae, and absence of a posterior discal seta on elytra. Body length 4.8 mm. Aedeagus unknown. Habitus see Fig. 21, copied from BARR (1982: p. 218, fig. 34) and resized to scale for better comparison.

***Paratrechus quetzal* sp.n. (Figs 22, 23)**

Type material. Holotype (♂) and paratypes (2♂♂, 1♀): Costa Rica, Talamanca range, near Cerro Vueltas lodge, N 9.6360°, W 83.8523°, 2900 m a.s.l., 12.IX.2023.

Derivatio nominis. This new species is named after the resplendent quetzal (*Pharomachrus mocinno*), a famous and colourful bird. The area around the type locality is the best for its observation in Costa Rica.

Description. Body length 4.9–5.4 mm. The largest species so far from Costa Rica, habitus quite remarkable, body more elongated, with ample prothorax and larger head, elytra more parallel sided and less ovate than in other species; dorsum moderately convex; inner wings absent. Colour dark piceous; basal segment of antennae and legs reddish, moderately contrasting to body, outer segments of antennae starting with segment 3 and tibia slightly darker.

Head slightly larger than normal, frontal furrows deep throughout, equally curved at middle and slightly divergent in front; frons and supraorbital areas moderately convex, two supraorbital setae present, insertion normal; microsculpture distinct; eyes reduced in size but still slightly prominent; genae slightly shorter than eyes, convex; labrum transverse, its apical margin strongly emarginate, with six setae; mandibles normal and sharp at the apical parts; antennae thin, filiform, longer than half of body length (ca. 55%).

Pronotum large, transverse, on average one third wider than long, wider than head, widest before middle, convex, strongly contracted to base; sides well rounded in front, feebly in basal third, basal sinuation deep; hind angles strongly developed, acutely angled and projecting; front angles rounded and moderately produced; base more or less straight; median line distinct and complete; apical transverse impression slightly impressed; basal transverse impression strongly curved, laterally extended to the bottoms of basal foveae, which are very large, deep and smooth; microsculpture fine on disc, two lateral setae present as normal in Trechini, but frequently broken off.

Elytra elongated ovate, more parallel sided; moderately convex and flattened on disc; length ca. 1.4 times their maximum width; shoulders rounded but still prominent; sides narrowly bordered throughout; elytra shiny, microsculpture not sharply impressed; striae complete, deep on disc and slightly punctate, outer striae finer, stria 8 deepened in apical half; scutellar striae deep; apical striae deeply impressed, moderately curved though nearly straight at the anterior part, and connected to stria 5; intervals flat; one deep, basal setiferous dorsal pore in stria 5 at ca. 18% of elytron length from base; a second deep dorsal pore at stria 5 at ca. 52% from base, striae 3–5 sometimes disturbed at level of the pore; preapical pore usually inserted at the apical end of stria 2, closer to suture than to apex and apical striae.

Legs not strongly elongated; protibiae with longitudinal groove on external face; tarsi short and fairly thick; in males two proximal segments of each protarsus moderately dilated and sharply denticulate inwards at apices.

Aedeagus (Fig. 23). Median lobe strongly darkened, strongly elongated and very large; median lobe length ca. 35% of length of elytron; slender and slightly curved in lateral view, nearly parallel-sided, apex straight, not at all swollen on ventral side in vicinity of internal sack; sagittal aileron strongly developed; apical sensorial organ of small size and rounded; internal sack covered by weakly developed scales; parameres unmodified.

Diagnosis. Unmistakable by large size, habitus, dark colour and shape of median lobe of aedeagus.

Observations. All specimens of this impressive species were found in a single location in a drainage ditch, temporarily flooded, beneath an accumulation of leaf litter on muddy soil. No other *Paratrechus* was obtained at this site.

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