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Two new arboreal species of pseudophylline katydids from northern Peru (Orthoptera: Tettigoniidae: Pseudophyllinae)

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Abstract

Two new arboreal katydid species (Pseudophyllinae) were recently discovered from northern Peruvian rainforest canopies using pesticide-fogging methods. Although these two species are in different tribes, they share the distinction of being the smallest of the pseudophylline katydids. One species, belonging to the platyphylliine genus *Brachyauchenus* Brunner von Wattenwyl, 1895, is known only from the male sex and differs from both described species of that genus by its more elongate pronotum, the mother-of-pearl markings on the pronotal disc, and differences in the shape of the male cercus and subgenital plate. The other new species belongs to the pleminiine genus *Bufotettix* Caudell 1918, but is easily distinguished from *B. alpha* Caudell by its unusually expanded pronotum and by genitalic characters. Both sexes of this species are described. The occurrence of these species in rainforest canopies suggests that many species of katydids may yet be discovered as this poorly known habitat is studied in more detail.

Key words

Bufotettix, *Brachyauchenus*, Pleminiini, Platyphyllini, katydid, Peru, rainforest, arboreal

Introduction

Brunner von Wattenwyl (1895) erected the monotypic genus *Brachyauchenus*, with the species *B. castaneus*, based on a male from Colombia. Griffini (1896) added *B. festae*, again based on a single male, from Panama. These members of the tribe Platyphyllini are relatively small species and have been collected only rarely. Caudell (1918) described the monotypic genus *Bufotettix*, with a single species *B. alpha*, based on an individual male collected in central Peru. Perhaps the smallest member of the subfamily Pseudophyllinae, in the tribe Pleminiini (Beier 1962), this unusual pebble-shaped species also has not been collected since its discovery. The rarity of these species suggests they are probably arboreal in habitat, based on findings of Nickle and Castner (1995) regarding other species of katydids in northern Peru.

In a long-term study (funded to Nickle and Castner by Earthwatch Foundation, Cambridge, MA) on the biodiversity of orthopteroid and dictyopteroid insects of northern Peru (Nickle & Castner 1995), numerous new and unusual katydids were discovered using rainforest canopy sampling techniques, two of which are described herein and compared with the known fauna. One of them is an unusually small species of *Brachyauchenus*. The other is related to *Bufotettix*, and is described here as such; but it also has some features similar to another pleminiine genus, *Championica* Saussure & Pictet 1898. *Championica* was revised by Beier (1962) to include 19 species, which Beier divided into 3 subgenera: *Championica* (with 6 species), *Auchenacophora* (with 9 species), and *Lipachophora* (with 3 species) (see also Otte 1997). With a few exceptions [*e.g.*, *C. coronata* (Linnaeus 1758) and *C. montana* (Saussure & Pictet, 1898)], most species of this genus also are known only from single specimens.

The present study of the 2 species is based on 9 males, 7 females, and 3 nymphs collected at 2 sites in northern Peru in Loreto Province. These sites are part of an ecotourist facility, Exploraciones Amazonicas, also known as Explorama, owned and operated by Peter Jenson in Iquitos, Peru, and are abbreviated in the text as follows: Explorama Lodge [LODGE], 80 km. NE Iquitos on Rio Yanamono (1 km upriver from Rio Amazon, 3˚30′ S, 73˚05′ W); and the Amazon Center for Environmental Education and Research [ACEER] nr Explornapo Camp, 90 km NE Iquitos on Rio Sucusari (1 km upriver from Rio Napo, 3˚11′ S, 72˚53′ W). Specimens were collected from rainforest canopy samples obtained by fogging treetops with a mild pesticide (Resmethrin®, 0.5%). Nickle (2002) provides a more detailed description of procedures used in collecting with this technique. Although 20 teams of Earthwatch volunteers (each team comprising the collecting efforts of 11 to 17 persons, supervised by D. A. Nickle and J. L. Castner) had collected intensively along trails beneath the trees that were fogged, no specimens of these species were ever found at ground level. Only Teams 21-24 which utilized fogging procedures were successful in retrieving any specimens of these species. Collecting dates for these teams were: Team 21 (VIII.31-IX.14.1996); Team 22 (VII.26-VIII.9.1997); Team 23 (VIII.9-23.1997); Team 24 (VII.25-VIII.8.1998). Specimens were measured (in mm) with a device described by Grant (1965), and characters used to evaluate species were essentially those detailed by Emsley et al. (1967). Specimens are deposited in the National Museum of Natural History, Smithsonian Institution, Washington, DC [USNM].

Bufotettix auchenacophoroides Nickle, new species
(Figs 3, 4, 8, 9, 12, 14, 16, 17, 19-22)

Diagnosis.— Very small, brown, pebble-shaped katydid (Figs 3, 4) differing from *B. alpha* (Figs 1, 2) by its expanded, fan-like metazona of the pronotal disc (*cf* Figs 13, 14); males distinguishable by shape of cercus, with a pre-apical tooth in *B. auchenacophoroides* (Fig. 19), untoothed in *B. alpha* (Fig. 18).

Holotype.— Male. Peru: LODGE. Team 24, Fogging Site 3. Allotype. Female. Peru: LODGE. Team 23, Fogging Site 13. Paratypes. 6 males, 6 females, 3 nymphs: LODGE, Team 21, 1 female, 1 nymph; ACEER, Team 22, 1 female; LODGE, Team 22, 1 male, 1 female, 1 nymph; ACEER, Team 23, 3 males; LODGE, Team 23, 2 males, 3 females, 1 nymph.

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Description.— **Head**. Moderately broad for genus (Fig. 9), in dorsal view wider than long. Eyes prominent, globose, in lateral view rising slightly above occiput. Ratio of width of head (measured from lateral margins of compound eyes) in dorsal view to head length (occiput to ventral margin of labrum) in frontal view *ca* 0.9:1.0 (male) to 1.0:1.1 (female). Fastigium narrow, triangulate, apically rounded, rising above, but not touching, frons. Texture of face rugose, with numerous irregularly spaced shallow punctations (Fig. 12). Scape of antenna lacking a well-defined medial spine. Maxillary and labial palpi short.

Thorax. Pronotal disc greatly modified, rugulose with densely spaced punctations and with numerous irregularly spaced nodules of various sizes; L/W pronotal disc 1.7 to 1.9; metazonal suture deep with prozona subequal in length to metazona; lateral margins of metazona greatly expanded broad triangulate lobes with margins ornimented with small nodules (Fig. 14). Prosternum armed with two short widely-spaced spines; meso- and metasternum flat, lateral margins without lobiform expansions.

Legs. Genicular lobes of all legs unarmed but those on foreleg somewhat elongated. Forelegs. Coxa unmodified, with short, phallangiform coxal spine. Femur short, subquadrate in cross-section, sides parallel, with well-defined ventral margins; outer margin unarmed, inner margin with 3 to 4 broad, lobiform spines. Tibia short, robust, with broad, flattened leading edge, basally expanded at tympanum into a bulbous tympanal shield (Fig. 17); all tibial margins unarmed. Midlegs. Ventral margin of coxa inflated, in some specimens appearing to be collapsed (Fig. 16). Femur laterally somewhat compressed, tapering distally, with outer ventral margin expanded and armed with 3 lobiform spines; inner ventral margin unarmed. Tibia short, subquadrate in cross-section, with broad, flattened posterior surface, outer margin unarmed, inner margin with two undulations reminiscent of vestigial lobiform spines. Hindlegs. Coxa unmodified. Femur L/W *ca.* 2.3 to 2.5, short, barely extending to apex of tegmen, broad along most of its length and abruptly narrowing at distal quarter; outer ventral margin armed with 6 to 8 spines, basal 3 to 4 spines broad and lobiform, with distal spines becoming increasingly spiniform; inner ventral margin unarmed. Tibia with outer dorsal margin unarmed, inner dorsal margin with 6 to 8 spines, basal 4 spines large, lobiform, distal 2 to 4 spines small, spiniform.

Wings. Tegmina and hind wings well developed; tegmen short, compact, ovoid, L/W 1.9 to 2.1, extending only 4 to 5 mm beyond tip of abdomen; hind wings brown, completely concealed beneath tegmina in repose.

Abdomen. Male. Tenth tergite distally weakly produced, apically truncate (*cf* Figs 7, 8). Cercus very short, stout, barely extending beyond level of tenth tergite, basal half of cercus with a sharp, madially-directed elongated tooth, dorsal half of cercus produced posteriorly, apically rounded (Fig. 19). Subgenital spatulate basally, gradually narrowing distally with 2 short articulating true styles separating a shallow V-shaped emargination (Fig. 20).

Female. Terminal tergite truncate. Cercus short, cylindrical, subequal in length to subgenital plate. Subgenital plate spatulate, with margins weakly expanded, apically rounded with a shallow notched emargination (Fig. 22). Ovipositor *ca* 40 to 44 mm in length, glabrous, with margins smooth basal third expanded, distal 2/3 laterally flattened, gradually upcurved, apically pointed (Fig. 21).

Color. Variable within type series. Basal color deep chocolate brown with light cream patches variously located laterally on legs, tegmina, and body. Front of face beneath frons brown, genae usually cream or brown with cream patches. Dorsum of head and pronotum in all specimens dark brown or dark reddish brown but with no cream coloration. In some specimens tegmina entirely cream, in others only some major veins cream against dark brown background.

Measurements (mm). Total length: male (n=7) 10.6, 9.4 to 11.9; female (n=7) 13.7, 12.6 to 13.9; length pronotum: male 4.1, 3.9 to 4.7; female 5.3, 4.5 to .5.6; width pronotum: male 3.1, 3.6 to 3.7; female 4.3, 3.5 to 4.6; length forefemur: male 4.0, 3.9 to 4.1; female 4.0, 4.0 to 4.1; length midfemur: male 4.3, 4.2 to 4.4; female 4.6, 4.5 to 4.7; length hindfemur: male 8.1, 7.8 to 9.4; female 11.1, 10.8 to 11.4; width hindfemur: male 1.6, 1.4 to 2.0; female 2.1, 1.9 to 2.4; length tegmen: male 8.2, 7.0 to 8.3; female 10.7, 10.1 to 13.9; width tegmen: male 1.7, 1.6 to 1.8; female: 1.8, 1.7 to 2.3; length ovipositor: 6.3, 6.2 to 6.5.

Etymology.— (<Gr.) *-oides*, resembling, like, similar to; with *Auchenacophora* (the subgenus of *Championica*), to which it bears a superficial resemblance in pronotal shape.

Discussion.—This small katydid is found in low understorey canopy foliage, 4 to 10 m above ground level. Although similar in size to *Bufotettix alpha*, its posteriorly-expanded fan-shaped pronotal disc suggests a closer relationship to members of the subgenus *Auchenacophora* of the genus *Championica*. A comparison of key characters of all subgenera of *Championica*, *Bufotettix alpha*, and this new species has resulted in its placement in the genus *Bufotettix* (Table 1).

An unusual feature of *Bufotettix auchenacophoroides* is the expanded ventral margin of the midcoxa, which appears to be membranous or at least less sclerotized than surrounding areas. In many of the specimens, this inflation on one or both midcoxae appears to be collapsed, suggesting a glandular function. Since both sexes have this structure, it does not seem likely to have a sexual purpose, but it may have use as a means of holding on to its substrate reminiscent of the tarsal pads of tree frogs and geckos. Since the midcoxa of *Bufotettix alpha* lacks this modification (Fig. 15), the difference may be a reflection of features of the plants each species inhabits.

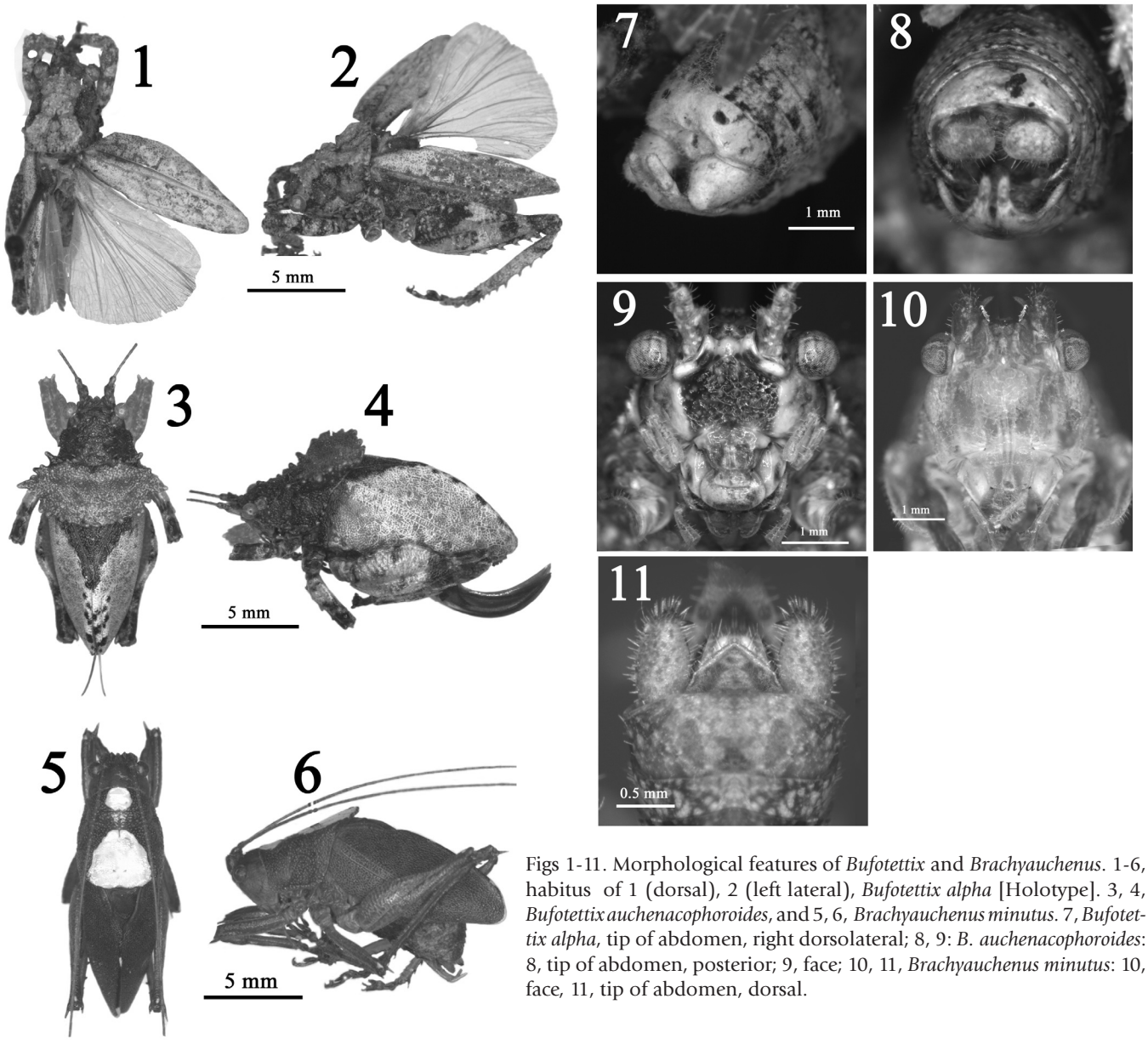
Brachyauchenus minutus Nickle, new species
(Figs 5, 6, 10, 11, 23-25)

Diagnosis.— Small mocha brown katydid (Figs 5, 6) with short legs and short, compressed tegmina completely concealing hindwings. Head and face matte, smooth; spine on scape of antenna well developed. Pronotum more elongated than in other species of *Brachyauchenus*, granulate, rugose; prosternum armed with two apically-pointed, pyramidal spines; lateral margins of mesosternum weakly inflated, margins of metasternum unmodified. Genicular lobes on all legs armed with a sharp spine.

Holotype.— Male. Peru: ACEER. Team 19. Fogging site 7. Paratype. 1 male. LODGE, Team 24, Fogging site 5. Same data as holotype.

Description.—Head. Moderately broad, from above wider than long; ratio of width of head at compound eyes as seen in dorsal view to width of head behind eyes *ca* 1.24:1.00; in frontal view, head longer than wide, 0.85:1.00 (Fig. 10); surface of head smooth, matte mocha brown, with very shallow or obsolete punctations on occiput and genae, face without punctations but with weakly undulate lines running parallel on surface. Eyes small, globose, about 0.5x length of subocular gena, in lateral view dorsum of eye below occiput; antennal scape cylindrical with well developed posteromedial spine (Fig. 23).

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Figs 1-11. Morphological features of *Bufotettix* and *Brachyauchenus*. 1-6, habitus of 1 (dorsal), 2 (left lateral), *Bufotettix alpha* [Holotype]. 3, 4, *Bufotettix auchenacophoroides*, and 5, 6, *Brachyauchenus minutus*. 7, *Bufotettix alpha*, tip of abdomen, right dorsolateral; 8, 9: *B. auchenacophoroides*: 8, tip of abdomen, posterior; 9, face; 10, 11, *Brachyauchenus minutus*: 10, face, 11, tip of abdomen, dorsal.

Thorax. Pronotum 2.2 to 2.9× longer than wide, densely granulate (Fig. 24) with lateral margins of pronotal disc obsolete and only weakly expressed near posterior half of metazona. Prozona divided by an intermediate suture into two equal areas, metazona somewhat longer than entire prozona. Pronotal disc with distinct shiny, yellowish-cream mother-of-pearl maculation as follows: anterior half of pronotal disc with a trapezoidal pattern arising at anterior margin of pronotum and diminishing at prozonal suture, joining up with a smaller cylindrical maculation in posterior half of prozona (only weakly expressed in paratype); metazona gradually weakly expanded posteriorly and filled entirely with mother-of-pearl. Prosternum armed with two apically-pointed, pyramidal spines. Lateral margins of mesosternum weakly inflated, margins of metasternum unmodified.

Legs. Genicular lobes of all legs each armed with a single elongated sharp spine, with spine of inner genicular lobe on fore- and midleg longer and sharper than that on outer lobe, and spine on outer lobe of hindleg longer and sharper than that on inner lobe.

Forelegs. Coxa with short, apically-rounded procoxal spine. Femur with ventral margins weakly convex, with 2 to 3 spines on inner ventral margin only. Dorsal surface of tibia broad, flattened, with bulbous tympanal shields symmetrical. Both ventral margins with spines on distal half of tibia. Midlegs. Femur somewhat flattened laterally, with outer ventral margin expanded, bearing 3 spines. Tibia uniformly expanded with spines on both ventral margins, dorsal margins unarmed. Hindlegs. Femur L/W ca 3.6 to 3.8, outer ventral margin with 6 to 7 spines, inner ventral margin unarmed. All margins of tibia armed.

Numbers of spines on legs. Ventral margins, forefemur: inner (anterior) 2; outer (posterior) 0; midfemur inner (posterior) 0; outer (anterior) 3; hindfemur inner (posterior) 0; outer (anterior) 5 to 7. Ventral margins, foretibia: inner (anterior) 6; outer (posterior) 2 to 4; midtibia inner (posterior) 2; outer (anterior) 4; hindtibia inner (posterior) 6; outer (anterior) 6 to 9. Dorsal margins, foretibia: inner (anterior) 0; outer (posterior) 0; midtibia inner (posterior) 0; outer

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(anterior) 0; hindtibia inner (posterior) 9; outer (anterior) 5 to 6.
Wings. Tegmina and hind wings well developed; tegmen short, compact, ovoid, L/W 2.2 to 2.3, extending only 4 to 5 mm beyond tip of abdomen; hind wings brown, completely concealed beneath tegmina in repose. Stridulatory file not examined.
Abdomen. Male. Apical margin of 10th tergite truncate. Cercus short, stout, conical, apically rounded with a small medially-directed, preapical tooth (Fig. 25). Subgenital plate spatulate basally, narrowing distally with two elongated articulating true styles separating a shallow U-shaped apical emargination (Fig. 26).
Female. Unknown.
Color. Light uniform mocha brown, with distinctive shiny, yellowish-green or yellowish-cream maculations as follows: (1) largest area on pronotal disc (already described in detail); (2) tiny round spots at dorsal apex of each femur; (3) larger round spots at dorsal apex of each tibia; and (4) on margins of tegmina from apex and proceeding dorsally, becoming interrupted along anal margin. Exposed stridulatory field, exclusive of brown veins, a distinct matte black.
Measurements.— (in mm) Total length: male (n=2) 13.2, 12.8 to 13.9; female (unknown); length pronotum: 4.3, 3.9 to 4.7; width pronotum: 2.0, 1.9 to 2.1; length hindfemur: 7.6, 6.8 to 8.4; width hindfemur: 1.8, 2.1; length tegmen: 10.1, 9.9 to 10.3; width tegmen: 4.4, 4.1 to 4.8.

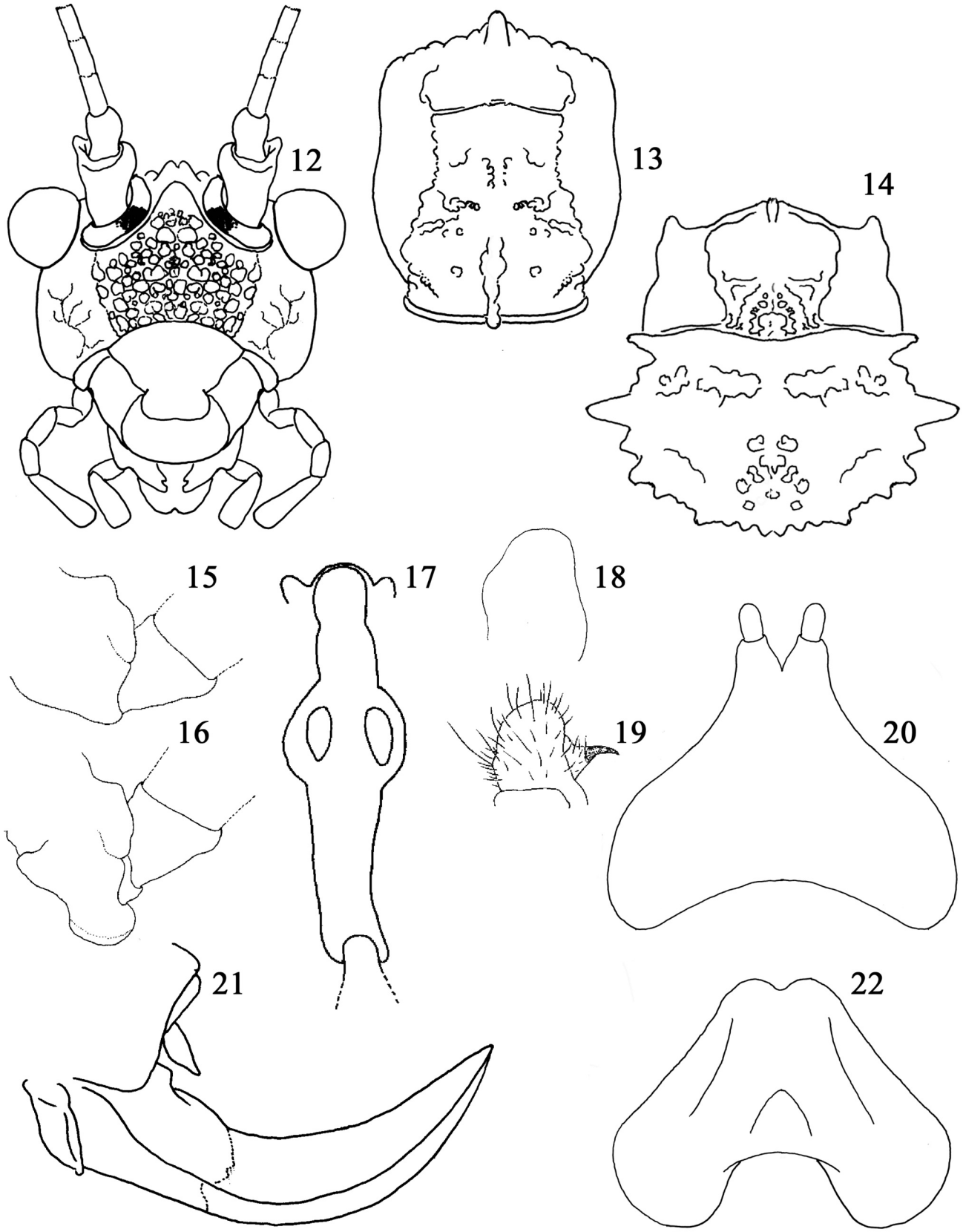
Etymology.— (L.) *-minutus*, small, referring to the small size of this species compared with other members of the genus.

Table 1. Comparison of spines on legs on representative pseudophylline genera (subgenera) and species of *Bufotettix*.

	Championica (Championica)	*Championica (Auchenacophora)*	*Championica (Lipacophora)*	*Bufotettix alpha*	*Bufotettix auchenacophora*
Ventral margins					
forefemur:					
inner (anterior)	4S	3S	3s	2-3S	3-4L
outer (posterior)	0	0	0	0	0
genae (nner)	1S	1S	1s	0	0
genae (outer)	1S	1S	1s	0	0
midfemur					
inner (posterior)	0	0	0	NA	0
outer (anterior)	4S	4S	4s	NA	3L
genae (nner)	1S	1S	1s	NA	0
genae (outer)	1S	1S	1s	NA	0
hindfemur					
inner (posterior)	0	0	0	0	0
outer (anterior)	8S	4s	4s	6S	6-8L
genae (nner)	1S	1S	1s	0	0
genae (outer)	1S	1S	1s	0	0
Ventral margins,					
foretibia					
inner (anterior)	6S	3s	3s	5s	0
outer (posterior)	6S	3s	3s	8s	0
midtibia					
inner (posterior)	6S	3s	2s	NA	0
outer (anterior)	6S	3s	2s	NA	0
hindtibia					
inner (posterior)	6S	8s	7s	4s	0
outer (anterior)	7S	8s	7s	8s	0
Dorsal margins,					
foretibia					
inner (anterior)	0	0	0	0	0
outer (posterior)	0	0	0	0	0
midtibia					
inner (posterior)	3S	4S	3s	NA	0
outer (posterior)	2S	2S	2s	NA	0+L
hindtibia					
inner (posterior)	10S	10S	10S	8S	0
outer (anterior)	9S	10S	10S	2s	7L

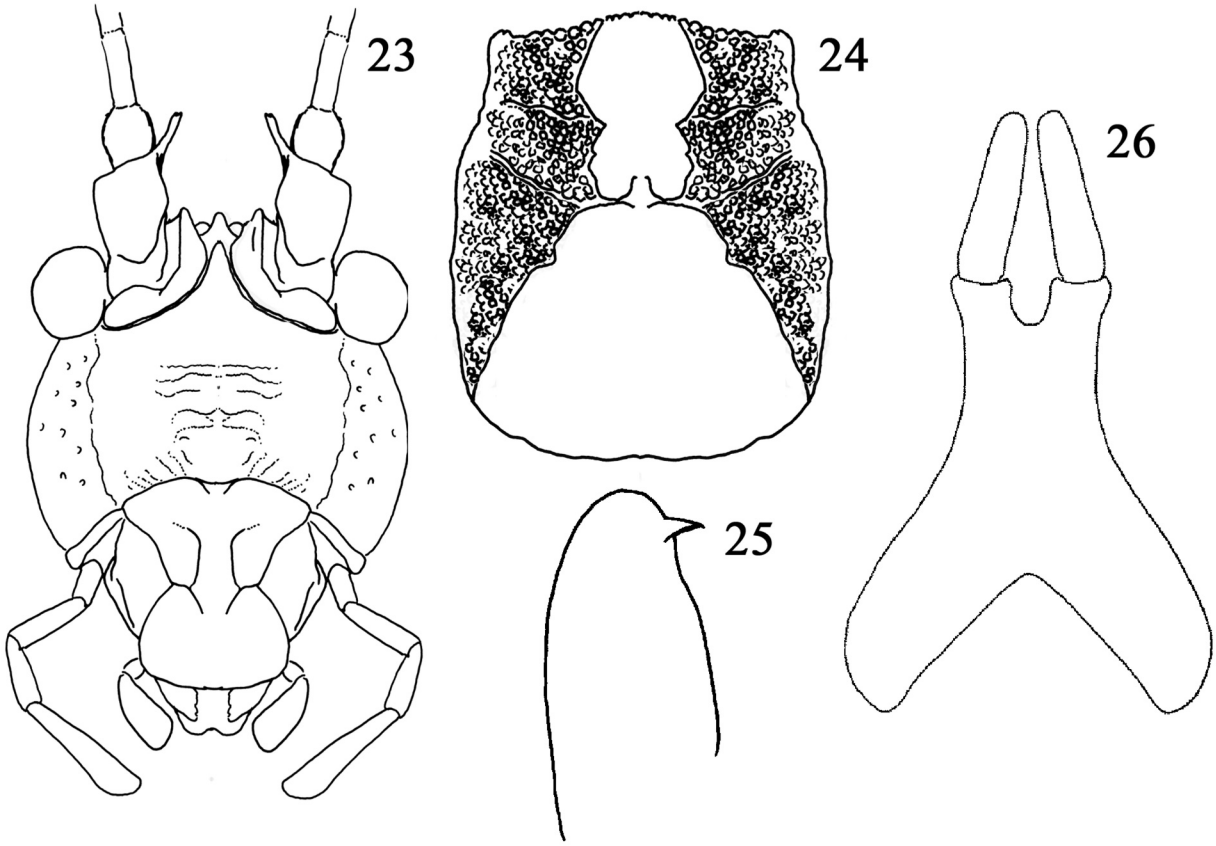
S = large, spiniform; s = small, spiniform; L = lobiform; NA = structure not available for study

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Figs 12-22, Morphological features of *Bufotettix* species: *B. alpha* (Figs 13, 15, 18), *B. auchenacophoroides* (Figs 12, 14, 16, 17, 19-22): 12, face; 13,14, pronotum; 15,16, left midcoxa and trochanter; 17, foretibia; 18-19, male cercus; 20, male subgenital plate; 21, ovipositor; 22, female subgenital plate.

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Figs 23-26, Morphological features of *Brachyauchenus minutus*: 23, face; 24, pronotum; 25, male cercus; 26, male subgenital plate.

Key to males of the species of *Brachyauchenus*
[females unknown]

1 Posterior margin of pronotum convex; pronotal disc elongated, L/W *ca* 2.0, with characteristic glossy, mother-of-pearl whitish-green pattern; small species, with body of male *ca* 12 mm in length . . . . . *B. minutus*
1′ Posterior margin of pronotum truncate; pronotal disc elongated, L/W *ca* 1.6, without mother-of-pearl pattern; larger species, with body of male 19 to 24 mm in length 2
2 Occiput uniform brown in color; ventral margins of fore- and midfemora with 4 spines; metazona of pronotum uniform light brown . . . . . *B. castaneus*
2′ Occiput with 2 dark brown longitudinal bands; ventral margins of fore- and midfemora with 3 spines; metazona of pronotum brown with 2 light brown callosities . . . . . *B. festae*

Discussion

Similar in size to *Bufotettix* species, this small katydid is also found in low understorey canopy foliage, 4 to 10 m above ground level.

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