



***Acantholachesilla* gen. n. (Psocodea: Psocoptera): Lachesillidae: Eolachesillinae: Graphocaeciliini) from Valle del Cauca, Colombia**

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Abstract

Acantholachesilla saltoensis gen. et sp. n. is described from Valle del Cauca, Colombia, in the Lachesillidae, tribe Graphocaeciliini (Eolachesillinae). The genus is related to *Dagualachesilla* and *Dagualachesilloides* that occur in the same area, differing from them in the male clunial projection, phallosome, and female subgenital plate and gonapophyses.

Key words: Taxonomy, neotropics, Valle del Cauca

Introduction

The related graphocaeciliine genera *Dagualachesilla* and *Dagualachesilloides* (see García Aldrete *et al.*, 2013) are endemic to Valle del Cauca, Colombia. They have been found only in a small area in the Western Cordillera, relatively close to the Colombian Pacific (3°25'21.7"–3°33'56"N: 76°37'0.1"–76°52'22.6"W). Specimens of a new species representing another graphocaeciliine genus, related to the two above, were recently found in the same area. The purpose of this work is to describe and illustrate this genus and new species, and to establish the relationships of the three genera.

Material and methods

Six males and three females were available for study. Three males and two females were dissected in 80% ethanol, and their parts (head, right wings and legs, and genitals), were mounted on slides in Canada balsam. Color was recorded by placing whole specimens, before dissection, under a microscope illuminated with cold white light, at 50X. Parts on the slides were measured, following standard procedures, and the illustrations were made from digital photographs, taken with a Canon T3i camera and Helicon Focus program, processed in a vector graphics editor CorelDraw.

Abbreviations of parts measured are as follows: FW and HW: lengths of right fore- and hind- wings, F, T, t1 and t2: lengths of femur, tibia and tarsomeres 1 and 2 of right hind leg, respectively, ctt1: number of ctenidobothria on t1, Mx4: length of fourth palpomere of right maxillary palpus, fl...fn: lengths of flagellomeres 1..n of right antenna, IO, D and d: minimum distance between compound eyes, antero-posterior diameter and transverse diameter of right compound eye, respectively, on dorsal view of head, PO: d/D.

The specimens studied are deposited in the Entomological Museum, Universidad del Valle (MUSENUV), Santiago de Cali, Colombia.

To assess the relationship of the new genus with the two related genera, a phylogenetic analysis was conducted, utilizing TNT and Winclada. A matrix was built, utilizing 26 characters (Table 2). *Ectopsocus andinus*

Saenz, González & García Aldrete, and *Anomolachesilla palaciosi* García Aldrete, González & Carrejo, were utilized as outgroups; the character states were unweighted and treated as unordered, those considered ambiguous or absent were coded as (?). The option *implicit enumeration* in TNT (Goloboff *et al.*, 2008), was utilized. The nodes were supported on TNT by means of bootstrap (Felsenstein, 1985), with 1000 pseudoreplicas.

Results

Acantholachesilla gen. n.

Diagnosis. Belonging in the Graphocaeiliini. Ocelli absent. Forewing veins with a row of conspicuous setae, except on Cu2. Hypandrium with sides and posterior border distinctly thickened, surface setose, bearing two mesal macrosetae. Endophallus large, formed by a compact group of small sclerites. Aedeagal arch projected posteriorly in the middle, projection wide based. External parameres anteriorly wide, narrowing distally to blunt ends. Posterior border of clunium, over the area of the epiproct, with an almost quadrate, densely spinose projection, extending to about half the length of the epiproct; border of clunium, over the area of each paraproct, next the middle projection, with a row of 8–10 macrosetae. Male paraprocts with a distinct, elongate, sclerotized anterior projection, joined distally to clunium. Female subgenital plate broad, setose, slightly concave in the middle. Gonapophyses with V1 short, slender; V2+3 elongate, distally pointed, with a field of macrosetae.

Type species. *Acantholachesilla saltoensis* sp. n.

Comments. This genus differs from *Dagualachesilla* in the structure of the clunial projection, in having two mesal macrosetae on the hypandrium, and in the structure of the aedeagal arch and external parameres. It differs from *Dagualachesilloides* in having a clunial projection over the area of the epiproct, that is absent in the latter, in having two mesal macrosetae on the hypandrium, and in the structure of the aedeagal arch and external parameres.

Acantholachesilla saltoensis sp. n.

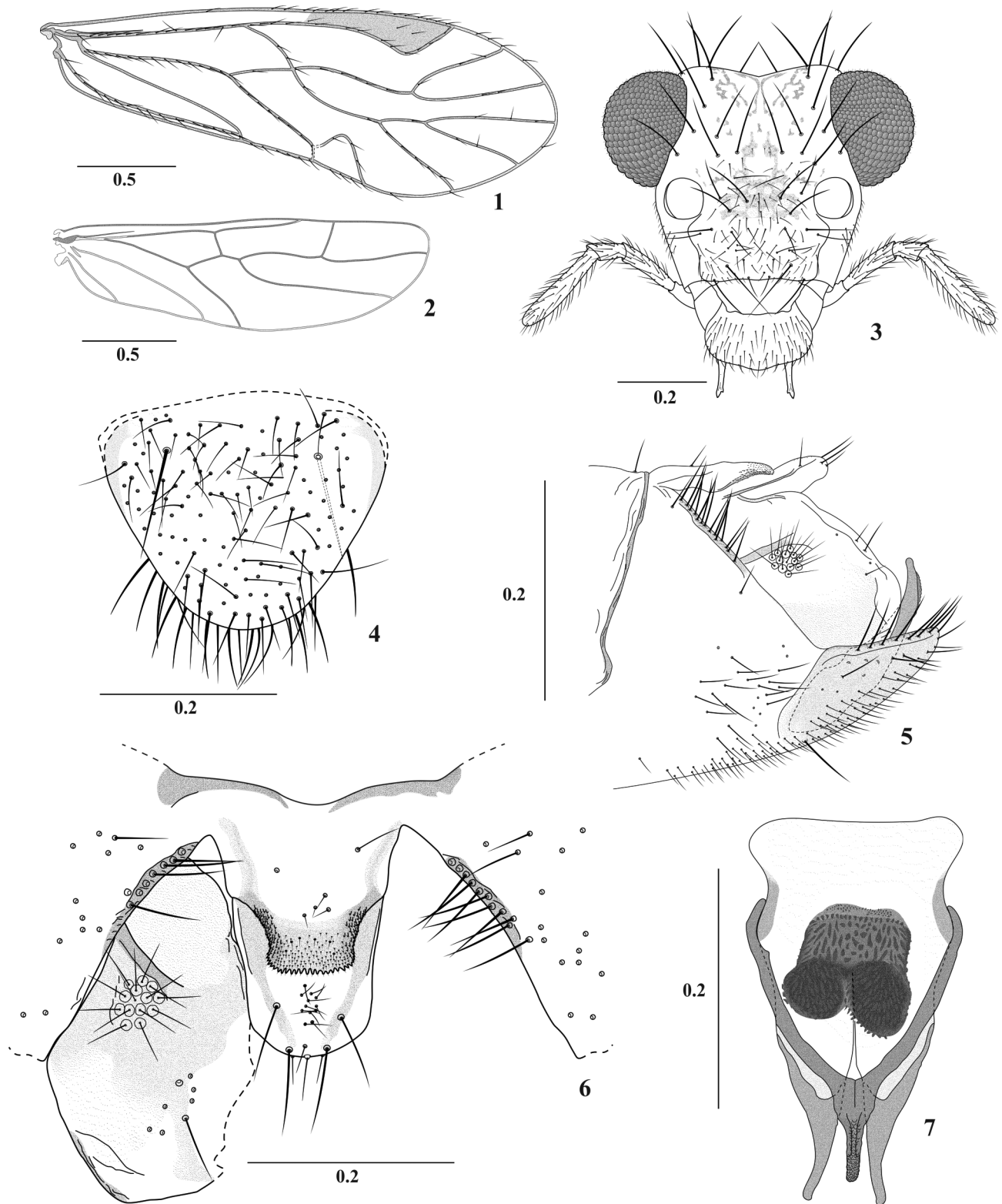
(Figs 1–13)

Diagnosis. As in generic diagnosis plus the following: male with distal end of abdomen broad, hypandrium well developed, this with sides and posterior border distinctly thickened, surface setose, with two basal macrosetae (Figs 4 and 5). Phallosome broadly triangular (Fig. 7). Clunial projection proximally wide, narrowing distally, with posterior border straight, sides and posterior border with a dense field of short spines (Fig. 6). External parameres with a slender posterior projection, extending beyond the level of the aedeagal arch (Fig. 7), this joined anteriorly to the broad based external parameres, aedeagal apex strongly curved dorsally, bearing minute blunt teeth. Female subgenital plate with a triangular prominence mesally near posterior border, bearing abundant setae and two macrosetae; IX sternum distinct, pigmented, almost rectangular (Fig. 13).

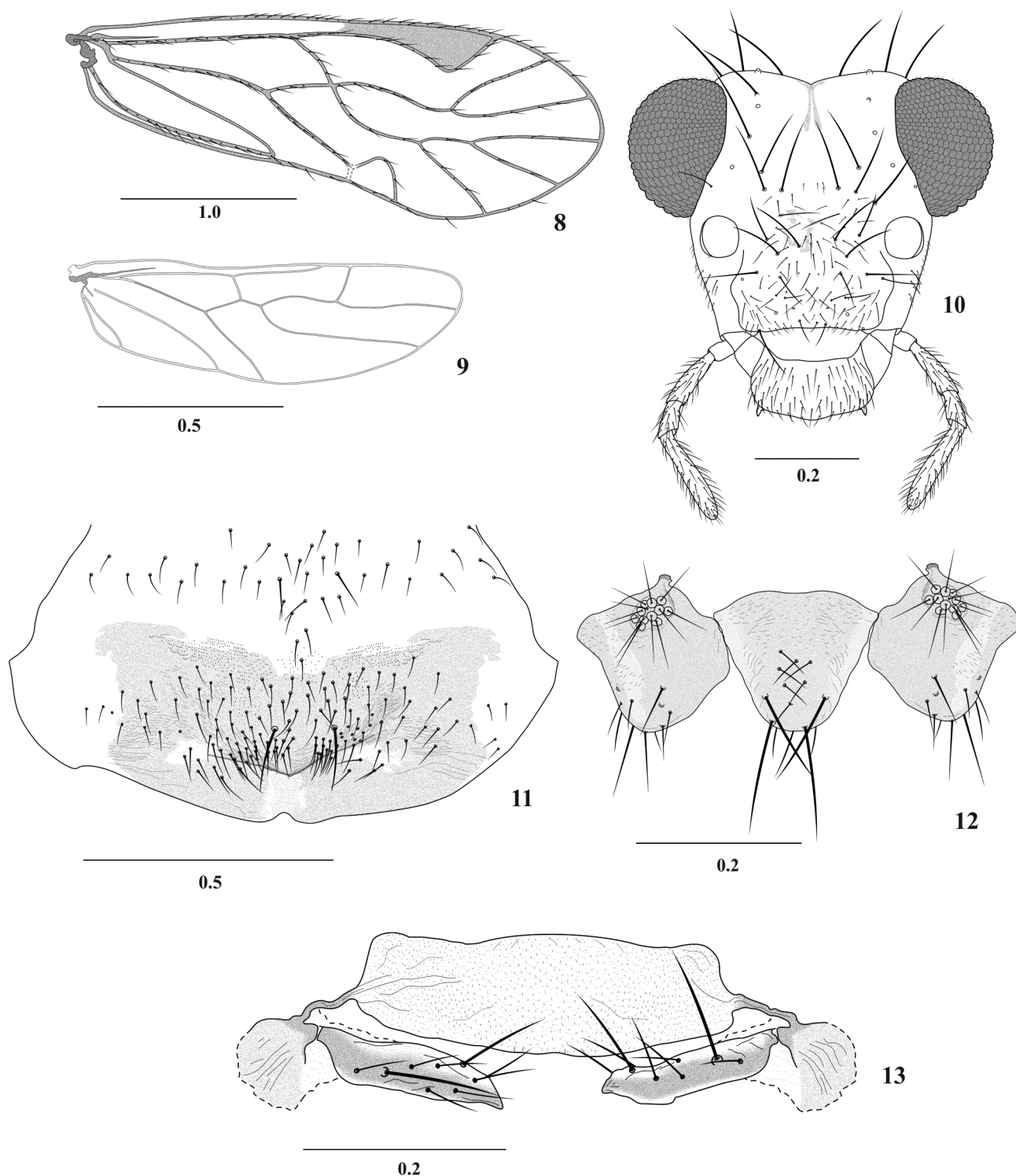
Male. Color (in 80% ethanol). Body pale brown, compound eyes black, legs pale brown, forewings pale brown, fumose; hindwings almost hyaline, abdominal sternites creamy, phallosome pale brown, apex of aedeagal arch reddish brown. Clunial projection pale brown, contrasting with the creamy paraprocts and epiproct.

Morphology. Head with vertex slightly concave (Fig. 3), setae as illustrated. Compound eyes prominent, with small interommatidial setae. Forewing L/W: 2.88. Forewing pterostigma elongate, narrow anteriorly, much wider posteriorly, lp/wp: 3.80, with abundant microspines in the membrane. Areola postica triangular (Fig. 1). Hindwing L/W: 3.33 (Fig. 2). Phallosome (Fig. 7): aedeagal arch with posterior projection wide based proximally, narrowing posteriorly, blunt ended; radula with distinct anterior area, almost quadrate, with medium sized sclerites, and two posterior rounded areas, with small sclerites. Paraprocts (Figs 5 and 6), broad, with anterior process long, sclerotized, joining the clunium; setal field of 5–7 macrosetae, plus a group of smaller setae latero-posteriorly; sensory fields with 13 trichobothria in basal rosettes and one trichobotrium without basal rosette. Epiproct long, posteriorly rounded, most of the proximal half of it covered by the clunial process, setal fields as illustrated (Fig. 6).

Measurements. (in μm). FW: 2625, HW: 2000, F: 910, T: 1310, t1: 500, t2: 170, ctt1: 25, Mx4: 218, f1: 500, f2: 493, f3: 355, f4: 290, f5: 170, f6: 170, f7: 160, f8: 140, f9: 140, f10: 130, f11: 120, IO: 310, D: 190, d: 253, IO/d: 1.23, PO: 1.33.



FIGURES 1–7. *Acantholachesilla saltoensis* sp. n. Male. 1. Forewing. 2. Hindwing. 3. Front view of head. 4. Hypandrium. 5. Abdominal terminalia, lateral view. 6. Paraproct, epiproct and clunial projection. 7. Phallosome, dorsal view. Scales in mm.



FIGURES 8–13. *Acantholachesilla saltoensis* sp. n. Female. 8. Forewing. 9. Hindwing. 10. Front view of head. 11. Subgenital plate. 12. Epiproct and paraprocts. 13. Gonapophyses and ninth sternum. Scales in mm.

Female. As in diagnosis, plus the following:

Color (in 80% ethanol). Same as male.

Morphology. Head and wings as in male. Forewing L/W: 2.88. Pterostigma, lp/wp: 3.7. Areola postica triangular (Fig. 8). Hindwing L/W: 3.24 (Fig. 9). Subgenital plate broad, posteriorly rounded, with a small, obtuse concavity in the middle (Fig. 11). Gonapophyses (Fig. 13), V1 slender, joining IX sternum, V2+3 directed mesally, with setae as illustrated, sides almost parallel, and apices slightly projected to form conical extensions. Paraprocts broad (Fig. 12), with 3–5 macrosetae, smaller setae posteriorly, as illustrated, sensory fields elliptic, with 11

trichobothria issuing from basal rosettes and one trichobothrium without basal rosette (Fig. 12). Epiproct broadly triangular, rounded posteriorly, mesally with a field of seven small setae, two macrosetae near posterior border, and 5 macrosetae along the border, two decidedly longer (Fig. 12).

Measurements. (in μm). FW: 3062, HW: 2350, F: 860, T: 1380, t1: 530, t2: 160, ctt1: 26, Mx4: 200, f1: 500, f2: 510, IO: 360, D: 190, d: 275, IO/d: 1.31, PO: 1.44.

Etymology. The generic name is a compound word formed with the root *Acantho*, referred to the field of short spines on the clunial process, and *Lachesilla*. The specific name refers to the locality of El Salto, Buenaventura, where this species was found, at the Pericos Natural Reserve.

Specimens studied. Holotype male. COLOMBIA. Valle del Cauca, Buenaventura, El Salto trail, Reserva Natural Pericos (03°50'55.7" N: 76°47'14.0" W, 478m), 5–6.I.2014, light trap, MUSENUV slide cod. 25711, O. Saenz.

Paratypes: 3 females, 5 males, same data as the holotype, MUSENUV, O. Saenz. 1 male, same locality as the holotype, III.2013. MUSENUV slide cod. 25712, N. Calderón and O. Saenz. All specimens taken in light traps, near the canopy of the forest (12–18 meters from ground level).

TABLE 1. Character and character states, utilized to assess the relationships of *Acantholachesilla*, *Dagualachesilla* and *Dagualachesilloides*.

| | |
|-----|--|
| 1. | Clunial process over the area of the epiproct (absent=0, slightly projected=1, strongly projected=2) |
| 2. | Spines on clunial process (absent=0, present = 1) |
| 3. | Clunial process distally (wider than base=1, as wide as base=0) |
| 4. | External parameres (with posterior process=1, without posterior process=0) |
| 5. | Processes of external parameres (absent=0, little developed= 1, well developed=2) |
| 6. | Macrosetae on hypandrium (present= 1, absent=0) |
| 7. | Ctenidobothria on t1 of hindleg (15–18= 1, 19–26=2) |
| 8. | Setae on membrane of pterostigma (absent= 0, present=1) |
| 9. | Subgenital plate (without a triangular protuberance= 0; with triangular protuberance=1) |
| 10. | Distal processes of subgenital plate (absent= 0, present=1) |
| 11. | Caudal slit on subgenital plate (without slit=0, small slit =1, large slit =2) |
| 12. | Macrosetae on subgenital plate (absent =0, present=1) |
| 13. | V ₁ (well developed=0, little developed =1, absent=2) |
| 14. | V ₂ and V ₃ (separated= 0, joined=1) |
| 15. | Ocelli (present=0, absent=1) |
| 16. | Forewing pterostigma (sides parallel =0, sides diverging=1) |
| 17. | Areola postica (present=0, absent=1) |
| 18. | Areola postica (free=0, joined to M=1) |
| 19. | Apex of aedeagus (straight=0, curved=1) |
| 20. | Apex of aedeagus (acute=0, rounded=1) |
| 21. | Endophallic sclerites (well developed=0, little developed =1) |
| 22. | Male paraproct (without basal process =0, with elongate basal process =1) |
| 23. | Male and female paraproct (rhomboid=0, elliptic=1, subtriangular=2) |
| 24. | Preapical shape of aedeagus (slender=0, little globose=1, globose=2) |
| 25. | Endophallus (rounded= 0, irregular, with lobes=1) |
| 26. | Color pattern of forewing (absent=0 present=1) |

Relationships of *Acantholachesilla*, *Dagualachesilla* and *Dagualachesilloides*. Table 1 shows the characters and character states utilized in the phylogenetic analysis of the three genera. Table 2 shows the matrix resulting from the coding of the above characters in the ingroup and in the outgroup, and Figure 14 shows the consensus tree

resulting from the analysis. The tree has a length of 35 steps, a CI of 0.91, and a RI of 0.78. *Anomolachesilla* was basal to the node of *Dagualachesilloides*- *Acantholachesilla*- *Dagualachesilla*. The analysis confirmed that *Acantholachesilla* and *Dagualachesilla* are closely related, with *Dagualachesilloides* apparently as ancestor (Fig. 15). The clade formed by *Acantholachesilla* and *Dagualachesilla* is highly supported by the following synapomorphies (bootstrap value of 93): a distinct clunial process over the area of the epiproct; similarity in shape (character 4) and development of the posterior processes of the external parameres (character 5), and by having a caudal slit on the posterior margin of the female subgenital plate (Table 2). This analysis shows the relationships of only four genera of Graphocaeciliini; it is necessary a cladistic analysis, including all the genera presently included in the tribe, to test the monophyly of it.

TABLE 2. Data matrix utilized for the phylogenetic analysis of four species in three genera of Lachesillidae. *Anomolachesilla palaciosi* and *Ectopsocus andinus* are outgroups.

| TAXA | Character | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------------|-----------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| <i>Ectopsocus andinus</i> | 0 | ? | ? | ? | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | ? | 0 | 0 | 0 | 0 | 0 | 0 | ? | 1 |
| <i>Anomolachesilla palaciosi</i> | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| <i>Dagualachesilla anchicayaensis</i> | 2 | 0 | 1 | 1 | 2 | 0 | 1 | 1 | 1 | 0 | 2 | 0 | 2 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 0 |
| <i>Dagualachesilla queremalensis</i> | 2 | 0 | 1 | 1 | 2 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 2 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 0 | 1 | 0 |
| <i>Dagualachesilloides caliensis</i> | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 2 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 2 | 1 | 0 |
| <i>Acantholachesilla saltoensis</i> | 2 | 1 | 0 | 1 | 2 | 1 | 2 | 1 | 1 | 0 | 2 | 1 | 2 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 |

Discussion

The sympatric presence, in a relatively small area of Western Valle del Cauca (Quebrada Pericos Natural Reserve, Fig. 14) of three related genera of Graphocaeciliini (*Dagualachesilla*, *Dagualachesilloides*, and *Acantholachesilla*), illustrates the Colombian megadiversity and endemism. The area is part of the Chocó biogeographic region, which comprises the border with eastern Panama to northern Ecuador (Langendoen & Gentry, 1991). This biogeographic region is one of the most diverse in the world, with a significant number of endemic species and high concentration of biodiversity per unit area (Myers *et al.*, 2000).

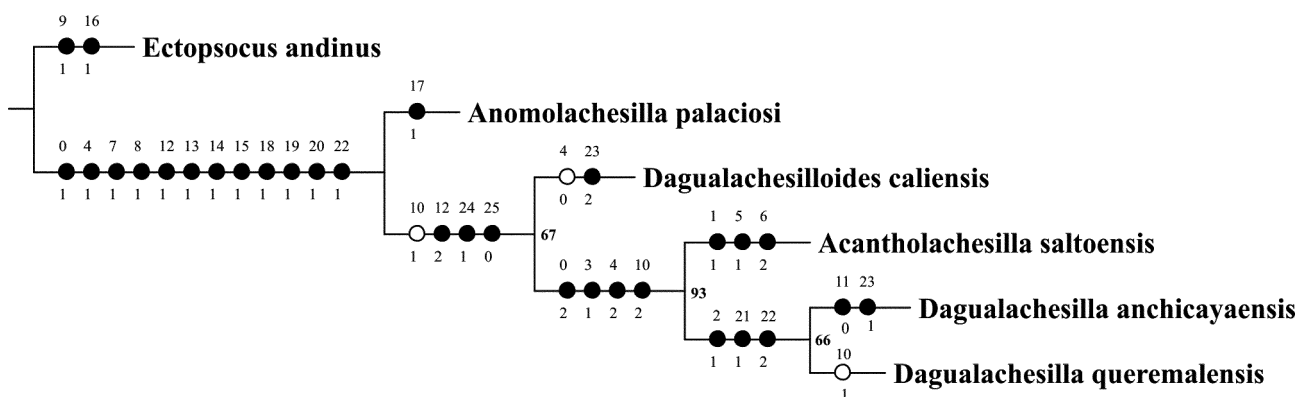


FIGURE 14. Relationships of three related genera of the tribu Graphocaeciliini: *Acantholachesilla*- *Dagualachesilla*- *Dagualachesilloides*. *Anomolachesilla palaciosi* and *Ectopsocus andinus* are outgroups. Parsimonious tree with 35 steps (CI = 0.91, RI = 0.78).

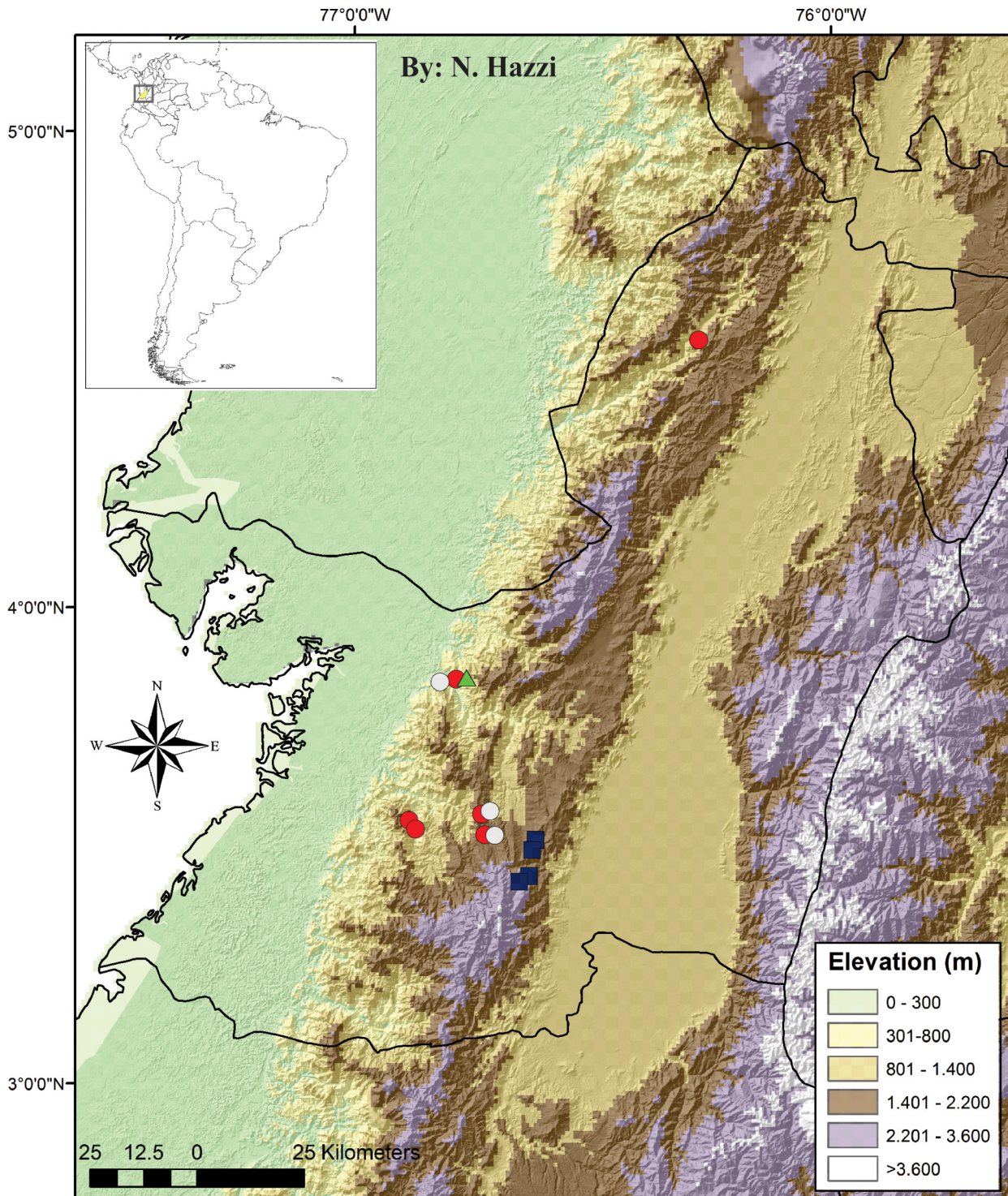


FIGURE 15. Distribution of four species of the genera *Dagualachesilla*, *Dagualachesilloides* and *Acantholachesilla* in Valle del Cauca, Colombia. Red circles: *Dagualachesilla anchicayaensis*, white circles: *D. queremalensis*, blue squares: *Dagualachesilloides caliensis*, green triangle: *Acantholachesilla saltoensis*.

The Quebrada Pericos Natural Reserve, included in the 90 km² Dagua river basin, has an area of 4.4 km², constituted mostly by tropical rain forest and sub-andean forest along an altitudinal gradient of 300–1200 meters; more than 365 plant species, 223 vertebrate species and 26 coprophagous beetle species have been recorded there, representing 64% of the flora and fauna species reported for the Dagua basin, with values of endemism estimated as high (CC-AMD, 2007).

Most of the species of ‘Psocoptera’ found in the area have been collected by light traps placed in the forest canopy; we have found 16 species in three families (Lachesillidae, Epipsocidae and Ptiloneuridae), of which 14 are new to science. Little field work has been conducted in the Pacific area, and the psocids found are mostly endemics; it is likely that the real species richness is much higher than has been documented.

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