



**A Re-Description of *Balaustium leanderi* Comb. Nov.  
(Actinotrichida, Erythraeidae) with First First Report on  
Characteristics of All Active Instars and Taxonomic  
Notes on the Genus**

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A RE-DESCRIPTION OF *BALAUSTIUM LEANDERI* **COMB. NOV.**  
(ACTINOTRICHIDA, ERYTHRAEIDAE) WITH FIRST FIRST REPORT ON  
CHARACTERISTICS OF ALL ACTIVE INSTARS AND TAXONOMIC NOTES ON  
THE GENUS

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ABSTRACT

*Balaustium leanderi* (Haitlinger, 2000) **comb. nov.** (Actinotrichida: Erythraeidae), previously known only from the larval stage is re-described based on material originating from a laboratory culture of specimens collected in Colombia. This is also the first report of *Balaustium leanderi* (Haitlinger, 2000) in this country. The taxonomic characters of adult (female), deutonymph and larva are provided. The species re-described in this paper, is one of 37 nominal species presently assigned to the genus. With *Balaustium leanderi* (Haitlinger, 2000) there are just 6 species known both from larvae and active postlarval forms. *Palenquistium* Haitlinger (2000) is considered a junior synonym of *Balaustium*, which is one of 12 genera recognized within the Balaustiinae. A modified diagnosis of *Balaustium* von Heyden, 1826 is provided.

Key Words: Parasitengona, new generic synonym, taxonomy, *Balaustium*, Colombia

RESUMEN

*Balaustium leanderi* (Haitlinger, 2000) **comb. nov.** (Actinotrichida: Erythraeidae), conocido previamente en estado de larva fue re-descrito con base en material procedente de una cría en laboratorio de especímenes colectados en Colombia. Este también es el primer reporte de *Balaustium leanderi* (Haitlinger, 2000) en este país. Se describieron los caracteres taxonómicos de los adultos (hembras), deutoninfas y larvas. Esta es una de las 37 especies nominales actualmente asignadas al género. Junto con *Balaustium leanderi* (Haitlinger, 2000) solo hay seis especies cuyas formas larvales y postlarvales activas son conocidas. *Palenquistium* Haitlinger (2000) se considera un sinónimo menor de *Balaustium*, lo que resulta en un número verificado de 12 géneros que en la actualidad se distinguen en Balaustiinae. Se proporciona un diagnóstico modificado de *Balaustium* von Heyden, 1826.

Palabras Clave: Parasitengona, nuevo sinónimo genérico, taxonomía, *Balaustium*, Colombia

Mites in the genus *Balaustium* von Heyden, 1826 belong to the family Erythraeidae and are one of 19 families recognized within the terrestrial Parasitengona (Małkol & Wohltmann 2012). They are relatively large (ca. 1–2.5 mm long as adults), reddish in color, sometimes whitish to greenish in color. These mites can be found on the soil surface, on

trees and plants or climbing the walls of buildings. All active instars of *Balaustium* and most likely other Balaustiinae, are predatory or pollen feeders (Newell 1963; Childers & Rock 1981; Hayes 1985; Halliday 2001; Małkol et al. 2012; Muñoz-Cárdenas et al. in press), contrary to other members of Erythraeidae whose larvae parasitize arthropods.



Fig. 1. *Balaustium leanderi* **comb. nov.** Larva: Habitus, dorsal view, in vivo.

Of the 13 genera assigned to Balaustiinae (Małkol & Wohltmann 2012, 2013), only the larvae and postlarval forms of *Balaustium* have been described. The mosaic distribution of instars known for other genera makes the critical reappraisal of the generic identity difficult and blurs conclusions on within-family relationships. At present, the

genus *Balaustium* includes 36 species with only 5 known from both larvae and active postlarval forms (Małkol & Wohltmann 2012, 2013).

The identity of most species of *Balaustium*, especially from the Southern Hemisphere, as already stated by Halliday (2001), is unresolved due to the unknown level of synonymy and the likelihood of misidentifications. Our knowledge of circumtropical Balaustiinae of the Western Hemisphere is based mostly on taxa known from larvae (Haitlinger 2000, 2005; Małkol & Wohltmann 2012). The present paper contains a re-description of *Balaustium leanderi* (Haitlinger, 2000) **comb. nov.** based on material originating from Colombia and combined with first characteristics of all the stages. Some species of *Balaustium* are naturally associated with flower crops in Colombia (Torrado et al. 2001; Getiva & Acosta 2004) and may have potential for use in biological pest control.

#### MATERIALS AND METHODS

Specimens taken from a laboratory colony (Jan 2012) were used for the studies presented in this article. The individuals used to start the

SUPPLEMENTARY TABLE 1. ABBREVIATIONS AND EXPLANATION OF MEASUREMENTS TAKEN.

| Abbreviation | Meaning  |
|--------------|--|
| PaTr (L)     | Length of palp trochanter  |
| PaFe (L)     | Length of palp femur   |
| PaFe (W)     | Width of palp femur  |
| PaGe (L)     | Length of palp genu  |
| PaGe (W)     | Width of palp genu   |
| PaTi (L)     | Length of palp tibia   |
| PaTi (W)     | Width of palp tibia  |
| PaTa (L)     | Length of palp tarsus  |
| PaTa (W)     | Width of palp tarsus   |
| Odo          | Length of odontus  |
| IL           | Length of idiosoma (without gnathosoma)  |
| IW           | Width of idiosoma (the widest point)   |
| GL           | Length of gnathosoma   |
| AL(n)        | Number of setae AL (normal setae on anterior sensillary area of crista metopica) |
| ASE=Asens    | Length of sensillary setae on anterior sensillary area of crista metopica        |
| PSE=Psens    | Length of sensillary setae on posterior sensillary area of crista metopica       |
| Sba          | Distance between ASens bases   |
| SBp          | Distance between PSens bases   |
| L            | Length of scutum   |
| W            | Width of scutum  |
| ISD          | Distance between the level of ASens and PSens                                    |
| AL           | Length of non-sensillary setae of first pair on scutum                           |
| ML           | Length of non-sensillary setae of second pair on scutum                          |
| PL           | Length of posterior non-sensillary setae (third pair) on scutum                  |
| AW           | Distance between AL bases  |
| MW           | Distance between ML bases  |
| PW           | Distance between PL bases  |



Fig. 25. *Balaustium leanderi* **comb. nov.** Deutonymph: Habitus, dorsal view, in vivo.

colony were collected in Chía, Sabana de Bogotá, Colombia (N 04° 55' 00" – W 74° 03' 00") and transferred to the Center of Biosystems of the Jorge Tadeo Lozano University (CBIOS-UJTL). The colony of mites was kept in plastic containers in environmentally controlled rooms (temperature of  $22.1 \pm 2.0$  °C, 75% RH and 12:12 h L:D photoperiod). A total of 15 adult specimens were introduced in a plastic container (18 cm diam, 20 cm height) with an opening (10 cm diam) covered by a mite-proof steel mesh for ventilation. Representatives of *Balaustium* were provided with plant material infested with all stages of spider mites (*Tetranychus urticae* Koch; Tetranychidae), western flower thrips (*Frankliniella occidentalis* (Pergande) Thysanoptera:Thripidae) and whiteflies (*Trialeurodes vaporariorum* Westwood; Hemiptera: Aleyrodidae), which served as food (Muñoz et al. 2009; Muñoz-Cárdenas et al. 2014).

For the purpose of light microscopy the material was cleared in 85% lactic acid or in Nesbitt fluid and mounted in Hoyer's solution to create permanent slides. Measurements were taken under Leica DNL and Nikon Eclipse E600 microscopes equipped with differential interference contrast; drawings were made with Leica DNL equipped with camera lucida and processed with Adobe illustrator CS5 (Supplementary Table 1). We calculated averages and standard errors of all

TABLE 1. MORPHOMETRIC DATA OF *BALAUSTIUM LEANDERI* LARVAE. X = MEASUREMENTS (μM). SE = STANDARD ERROR.

| Character   | X (n = 12) | SE     |
|-------------|------------|--------|
| PaTr (L)    | 29.299     | 0.751  |
| PaFe (L)    | 73.848     | 2.257  |
| PaFe (W)    | 31.190     | 1.192  |
| PaGe (L)    | 62.232     | 2.096  |
| PaGe (W)    | 24.652     | 0.446  |
| PaGe L/W    | 2.077      | 0.291  |
| PaTi (L)    | 16.047     | 0.428  |
| PaTi (W)    | 17.045     | 0.273  |
| PaTa (L)    | 25.379     | 1.019  |
| PaTa (W)    | 5.052      | 0.112  |
| Odo         | 24.434     | 0.788  |
| GL          | 138.463    | 4.817  |
| LB          | 575.129    | 17.794 |
| WB          | 381.271    | 31.857 |
| LB/WB       | 1.574      | 0.078  |
| ASE = Asens | 57.639     | 1.860  |
| PSE = Psens | 79.639     | 1.695  |
| AL          | 35.387     | 2.360  |
| ML          | 36.611     | 1.290  |
| PL          | 37.426     | 0.867  |
| AW          | 41.649     | 0.961  |
| MW          | 39.214     | 0.630  |
| PW          | 47.735     | 0.824  |
| Sba         | 13.193     | 0.344  |
| SBp         | 15.648     | 0.280  |
| L           | 111.646    | 2.477  |
| W           | 51.426     | 1.302  |
| ISD         | 76.123     | 1.581  |
| MDS         | 39.918     | 1.032  |
| PDS         | 34.844     | 1.098  |
| MVS         | 33.795     | 1.036  |
| OCM         | 61.834     | 8.801  |
| OAS         | 84.726     | 4.238  |
| OPS         | 50.279     | 4.300  |
| O           | 17.760     | 0.495  |
| O – O       | 136.398    | 6.686  |
| Cx I        | 71.433     | 2.564  |
| Tr I        | 52.487     | 1.434  |
| bFe I       | 70.563     | 2.790  |
| tFe I       | 62.734     | 1.582  |
| Ge I        | 127.627    | 2.291  |
| Ti I        | 129.855    | 3.926  |
| Ta I        | 107.912    | 1.016  |
| Ta I (H)    | 35.668     | 1.687  |
| Leg I       | 627.094    | 12.139 |
| Cx II       | 81.518     | 3.184  |
| Tr II       | 46.620     | 1.228  |
| Bf II       | 55.976     | 1.829  |
| tFe II      | 51.133     | 1.087  |
| Ge II       | 96.745     | 1.632  |
| Ti II       | 113.115    | 1.946  |
| Ta II       | 92.012     | 1.577  |

TABLE 1. (CONTINUED) MORPHOMETRIC DATA OF *BALAUSTIUM LEANDERI* LARVAE. X = MEASUREMENTS ( $\mu\text{m}$ ). SE = STANDARD ERROR.

| Character  | X (n = 12) | SE     |
|------------|------------|--------|
| Ta II (H)  | 28.850     | 1.186  |
| Leg II     | 541.403    | 8.020  |
| Cx III     | 85.276     | 2.259  |
| Tr III     | 51.255     | 1.274  |
| Bf III     | 65.908     | 1.652  |
| tFe III    | 65.721     | 0.995  |
| Ge III     | 113.547    | 1.375  |
| Ti III     | 145.193    | 2.106  |
| Ta III     | 105.673    | 1.397  |
| Ta III (H) | 27.662     | 1.164  |
| Leg III    | 632.572    | 7.913  |
| IP         | 1703.693   | 78.652 |

measurements using Excel 2007. The terminology follows Małkol (2010), with updates contained in Małkol et al. (2012). All measurements are given in micrometers ( $\mu\text{m}$ ). In NDV formula setae on idiosoma dorsum (fD), arising behind the level of the scutum, setae placed between coxae II and III as well as ventral setae located behind the level of coxae III (fV) were considered. Also the holotype of *Palenquistium leanderi* Haitlinger, 2000 (deposited in the place: Museum of Natural History, University of Wrocław) was examined.

## RESULTS

### *BALAUSTIUM* VON HEYDEN, 1826

*Guatustum* Haitlinger, 2000

*Palenquistium* Haitlinger, 2000, **syn. nov.**

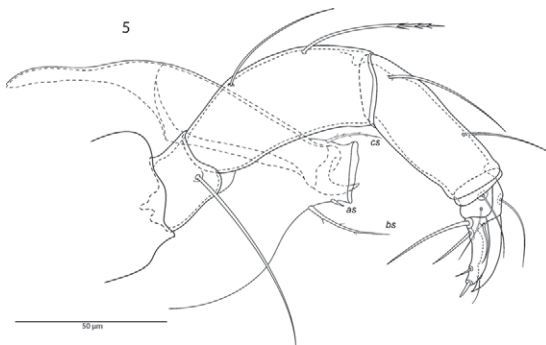


Fig. 5. *Balaustium leanderi* **comb. nov.** Larva: Gnathosoma, lateral view.

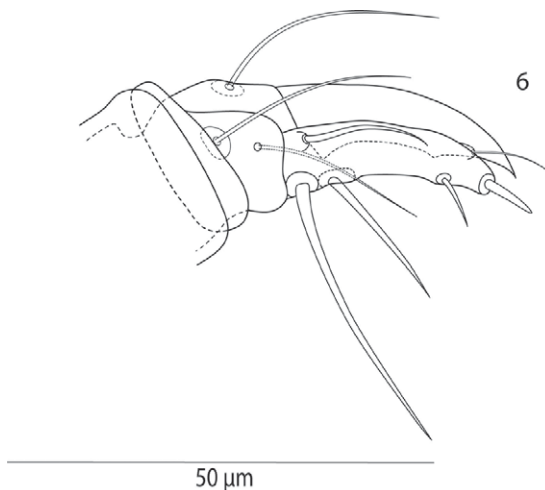


Fig. 6. *Balaustium leanderi* **comb. nov.** Larva: Palp tibia and palp tarsus, lateral view.

*Balaustium leanderi* (Haitlinger, 2000) Fuentes, 2013

Diagnosis (after Southcott 1961, but modified)

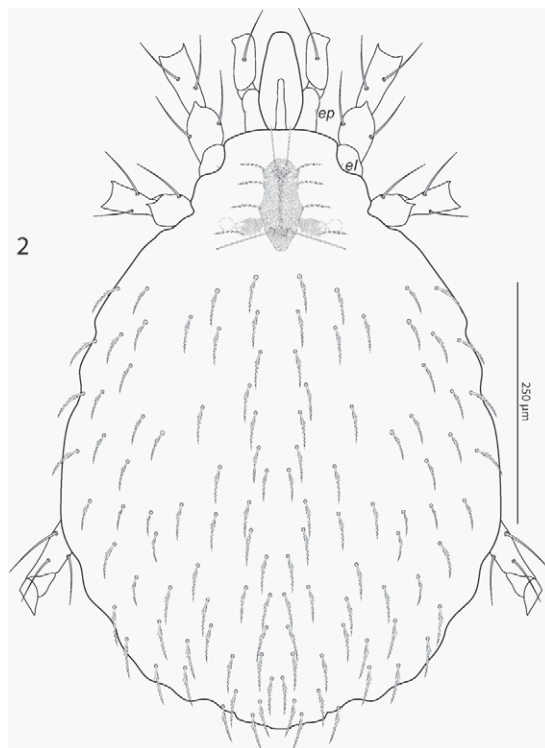
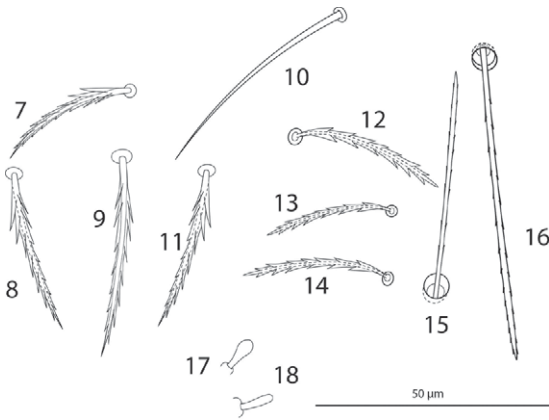


Fig. 2. *Balaustium leanderi* **comb. nov.** Larva: Idiosoma, dorsal view. Structure of integument partly shown (between scutum and eyes).



Figs. 7-18. *Balaustium leanderi* **comb. nov.** Larva: 7. Dorso-lateral seta; 8. Postero-dorsal seta; 9. Mid-dorsal seta; 10. Mid-ventral seta; 11. Postero-ventral seta; 12. Seta AL; 13. Seta ML; 14. Seta PL; 15. Anterior sensilla (ASens); 16. Posterior sensilla (PSens); 17. Seta eI; 18. Seta ep.

Adult and Deutonymph. Crista metopica inserted in the scutum. One eye on each side of the prodorsum. A pair of urnulae located posteriorly to the eyes. Odontus with ventral protrusion.

Larva. Crista metopica inserted in the scutum. One eye on each side of the prodorsum. Urnulae absent. Odontus with ventral protrusion. One seta on the palp trochanter, 1-2 setae on the palp femur. f<sub>Cx</sub> 1-1-1, f<sub>Tr</sub> 3-3-[2-3], f<sub>bFe</sub> 4-4-[2-4]. Posterior claw on tarsi I-III bifurcate, composed of a simple and of pulvilliform branch.

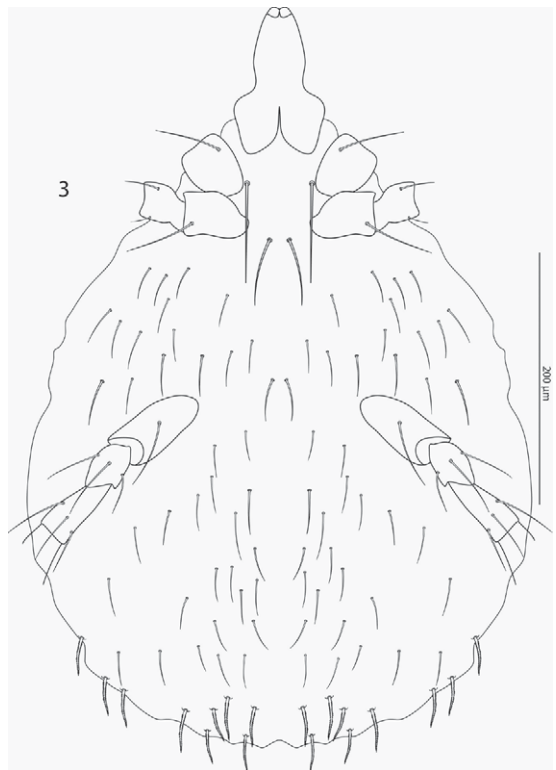


Fig. 3. *Balaustium leanderi* **comb. nov.** Larva: Idiosoma, ventral view.

*BALAUSTIUM LEANDERI* (HAITLINGER, 2000)  
FUENTES, 2013

*Balaustium leanderi* (Haitlinger, 2000), **comb. nov.**

*Palenquistium leanderi* Haitlinger, 2000

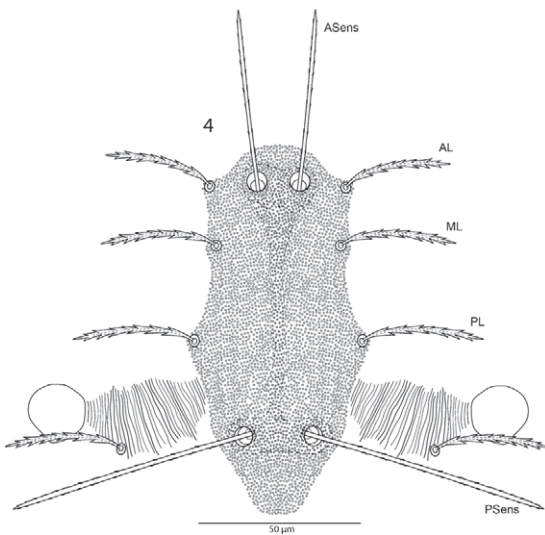
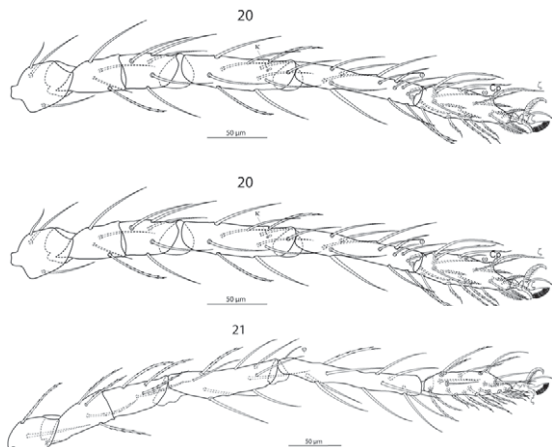
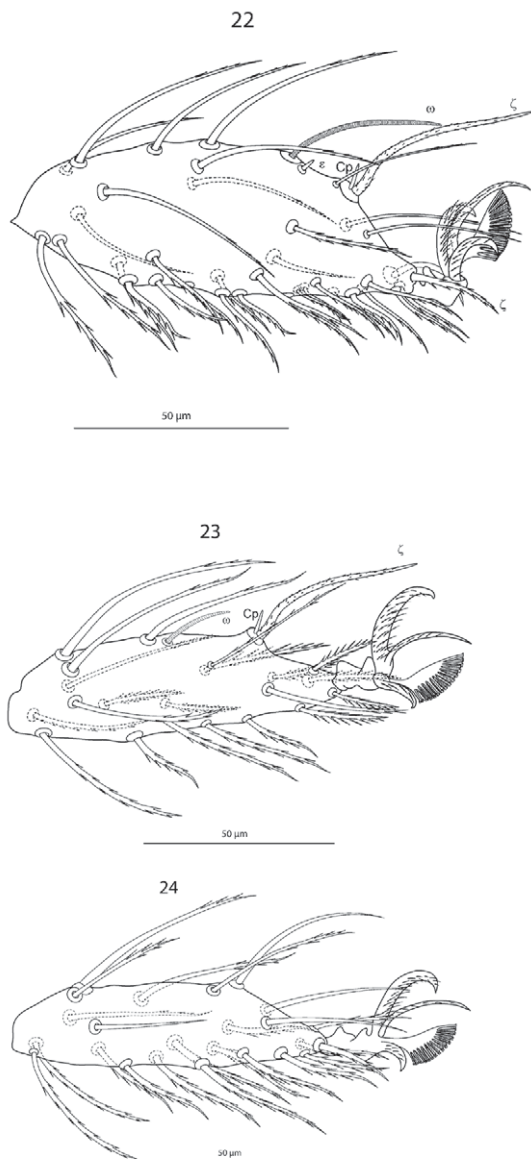


Fig. 4. *Balaustium leanderi* **comb. nov.** Larva: Dorsal scutum and eyes. Structure of cuticle partly shown (between scutum and eyes).



Figs. 19-21. *Balaustium leanderi* **comb. nov.** Larva, legs (coxae omitted): 19. Leg I; 20. Leg II; 21. Leg III.



Figs. 22-24. *Balaustium leanderi* **comb. nov.** Larva: 22. Tarsus leg I; 23. Tarsus leg II (subterminal eupathidium not shown); 24. Tarsus leg III (subterminal eupathidium not shown).

#### Diagnosis

Larva. Palp femur with 2 setae. PaGe L/W 1.84–2.80. fd 102–120, NDV 188–219. ISD 66–83.  $f_n bFe$  4–4–4.  $f_n Tr$  3–3–3. IP 1662–1893. Setae on palp tarsus smooth.

Deutonymph and Adult (Female). Semipeccinalae on palp genu absent. pDS 23–46. PaGe L/W 2.45–3.15 (deutonymph), 3.06–3.63 (adult).

Male. Not known.

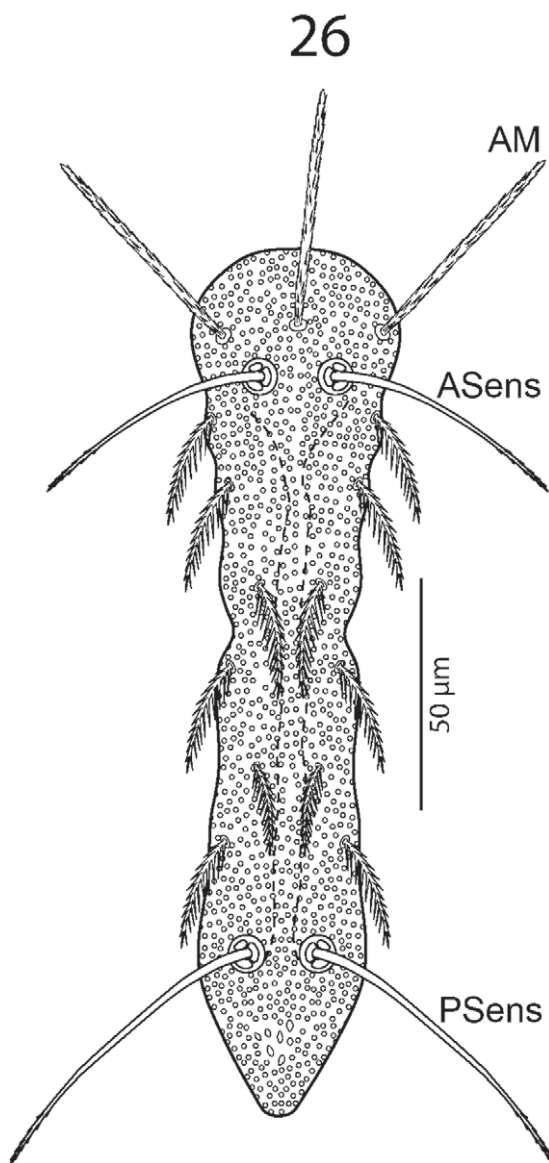
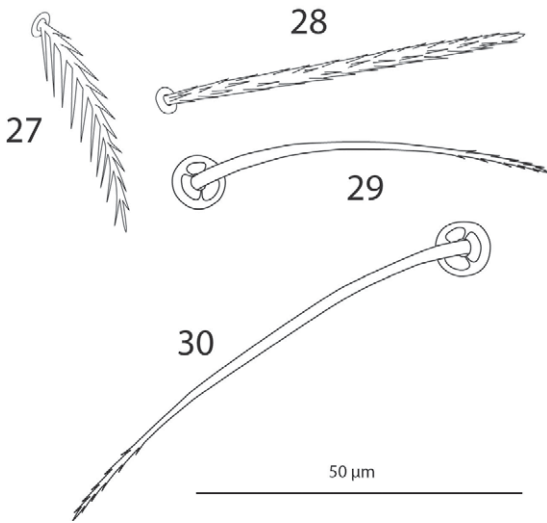


Fig. 26. *Balaustium leanderi* **comb. nov.** Deutonymph: Dorsal scutum.

For comparison with other taxa see Remarks on taxonomy.

#### Description

Body oval in shape. Color in life red, with longitudinal rows of whitish setae on opisthosomal dorsum; the pattern weakly marked in larvae (Fig. 1), more distinct in deutonymphs (Fig. 25) and the most contrasting in adults (Fig. 33).



Figs. 27-30. *Balaustium leanderi* **comb. nov.** Deutonymph: 27. Seta arising on scutum between the level of ASens and PSens; 28. Seta AM; 29. Anterior sensilla (ASens); 30. Posterior sensilla (PSens).

Larva (Figs. 1–24). Metric data are provided in Table 1. Meristic data are based on fifteen specimens.

Gnathosoma. Chelicerae composed of basal segment and movable claw (Fig. 5). Adoral setae (*cs*) and subcapitular setae (*bs*) of similar length (c. 23), with few tiny barbs. Setae *as* (c. 2  $\mu$ m) short, acicular. Palps slender, PaGe L/W 1.84–2.80. Pedipalp setal formula (fPp) N-NB-NN-NNN-NNN $\zeta\omega$  (Figs. 5 and 6). Odontus with tooth-like protrusion located ventrally at c. 3/5 of the claw length. Palpal supracoxalae (*ep*, c. 4  $\mu$ m) thumb-like (Fig. 18).

Idiosoma, Dorsal Side (Fig. 2). Behind the level of crista metopica 102–118 barbed, similar in shape, setae (Figs. 7–9). Scutum (Fig. 4) indistinct, with weakly marked margins. Crista well sclerotized, extending between bases of ASens and PSens. Setae AL, PL and ML (Figs. 12–14) of similar length, all barbed; PL located within or off scutum. AL leveled with ASens or slightly posterior of ASens. ASens shorter than PSens, both barbed distally (Figs. 15–16).

Idiosoma, Ventral Side (Fig. 3). Sternalae 1a and 2a present between coxae I and II, respectively, 30–35 setae between coxae II-III and 56–66 setae behind coxae III, all nude (Fig. 10). Setae located along the posterior margin of opisthosoma (Fig. 11) barbed, similar to those covering the idiosoma dorsum.

Legs (Figs. 17, 19–24). Leg segmentation formula 7–7–7; leg chaetotaxy: leg I: Cx 1B, Tr 3B, bFe 4B, tFe 5B, Ge 9B + 1 $\sigma$  + 1 $\kappa$ , Ti 11B + 2 $\phi$  + 1 $\kappa$ , Ta 33–35B + 2 $\zeta$  + 1Cp + 1 $\omega$  + 1 $\epsilon$ ; leg II: Cx

TABLE 2. MORPHOMETRIC DATA OF THE *BALAUSTIUM LEANDERI* DEUTONYMPH. X = MEASUREMENTS ( $\mu$ m). SE = STANDARD ERROR.

| Character   | X (n = 9) | SE     |
|-------------|-----------|--------|
| PaTr (L)    | 40.854    | 3.065  |
| PaFe (L)    | 121.124   | 6.146  |
| PaFe (W)    | 48.464    | 3.399  |
| PaGe (L)    | 97.075    | 3.390  |
| PaGe (W)    | 34.114    | 1.940  |
| PaTi (L)    | 27.284    | 1.073  |
| PaTi (W)    | 24.416    | 0.824  |
| PaTa (L)    | 32.027    | 1.635  |
| PaTa (W)    | 10.466    | 0.447  |
| Odo         | 29.983    | 0.606  |
| IL          | 946.833   | 59.194 |
| IW          | 712.373   | 56.149 |
| IL/IW       | 1.351     | 0.052  |
| AL (n)      | 4.000     | 0.000  |
| ASE = Asens | 62.119    | 1.270  |
| PSE = Psens | 86.023    | 1.682  |
| SBa         | 16.953    | 0.431  |
| SBp         | 16.217    | 0.600  |
| L           | 215.836   | 6.414  |
| W           | 39.736    | 1.158  |
| ISD         | 149.783   | 4.144  |
| mDS         | 32.245    | 0.824  |
| pDS         | 28.106    | 1.003  |
| pVS         | 43.387    | 0.941  |
| O           | 21.992    | 0.479  |
| Ur          | 29.063    | 1.596  |
| AOP         | 39.964    | 2.549  |
| Cx I        | 200.860   | 9.738  |
| Tr I        | 87.202    | 3.438  |
| bFe I       | 116.573   | 4.443  |
| tFe I       | 206.408   | 6.512  |
| Ge I        | 240.784   | 10.788 |
| Ti I        | 238.952   | 10.296 |
| Ta I        | 160.169   | 4.330  |
| Ta I (H)    | 63.681    | 3.070  |
| Leg I       | 1250.948  | 38.214 |
| Cx II       | 162.104   | 6.419  |
| Tr II       | 77.442    | 1.357  |
| bFe II      | 89.178    | 4.273  |
| tFe II      | 129.924   | 5.150  |
| Ge II       | 146.980   | 6.558  |
| Ti II       | 178.028   | 5.966  |
| Ta II       | 109.079   | 2.996  |
| Ta II (H)   | 47.644    | 2.483  |
| Leg II      | 892.736   | 29.479 |
| Cx III      | 144.167   | 4.946  |
| Tr III      | 77.932    | 2.605  |
| bFe III     | 91.296    | 5.414  |
| tFe III     | 148.671   | 7.099  |
| Ge III      | 181.532   | 6.697  |
| Ti III      | 216.811   | 9.572  |
| Ta III      | 109.549   | 2.962  |



TABLE 2. (CONTINUED) MORPHOMETRIC DATA OF THE *BALAUSTIUM LEANDERI* DEUTONYMPH. X = MEASUREMENTS ( $\mu\text{M}$ ). SE = STANDARD ERROR.

| Character  | X (n = 9) | SE      |
|------------|-----------|---------|
| Ta III (H) | 43.018    | 3.221   |
| Leg III    | 969.958   | 30.675  |
| Cx IV      | 186.919   | 4.868   |
| Tr IV      | 80.313    | 4.241   |
| bFe IV     | 116.305   | 7.536   |
| tFe IV     | 210.946   | 9.339   |
| Ge IV      | 231.647   | 11.234  |
| Ti IV      | 270.468   | 10.239  |
| Ta IV      | 110.436   | 3.619   |
| Ta IV (H)  | 44.160    | 2.943   |
| Leg IV     | 1207.033  | 45.119  |
| IP         | 4320.675  | 138.280 |

1B, Tr 3B, bFe 4B, tFe 5B, Ge 8–10B + 1 $\kappa$ , Ti 10–12B + 2 $\phi$ , Ta 23–25B + 2 $\zeta$  + 1Cp + 1 $\omega$ ; leg III: Cx 1B, Tr 3B, bFe 4B, tFe 5B, Ge 9B, Ti 10–11B + 1 $\phi$ , Ta 22–25B + 1 $\zeta$ . supracoxala of leg I (*eI*, *c.* 3  $\mu\text{m}$ ) thumb-like (Fig. 17). Normal setae on legs I–III slightly barbed along the entire stem or close to the tip. On legs II and III (Figs 20, 23) setae with adhering setules, making an impression of seta being nude, are also present. On tarsi I–III several setulated setae resembling the eupathidia, nude and bent apically, with blunt termination most often oriented towards the basal part of tarsus, arise along the ventro-lateral margin of the segment. Dorsal eupathidia on tarsi I–II ciliated along the entire stem, with adjacent companalae. Tarsi I–III terminated with 2 claws and claw-like empodium. Anterior claw sickle-like, ciliated, pos-

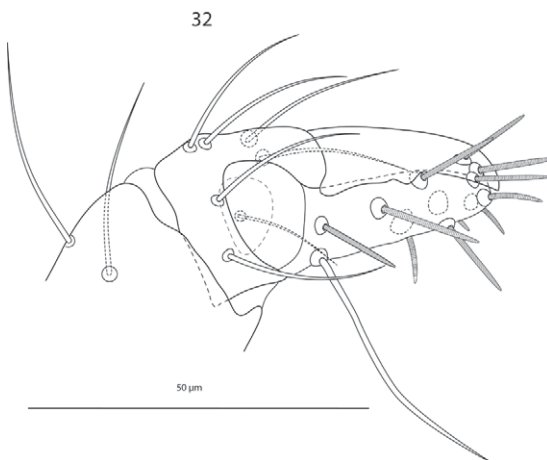


Fig. 32. *Balaustium leanderi* comb. nov. Deutonymph: Palp tibia and palp tarsus, medial aspect.

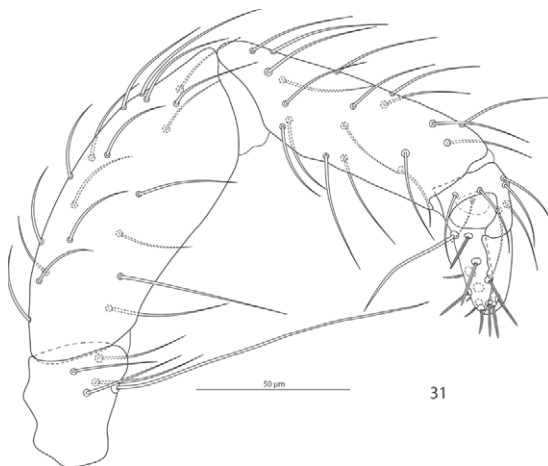


Fig. 31. *Balaustium leanderi* comb. nov. Deutonymph: Palp, medial aspect.

terior claw composed of 2 branches: one similar to anterior claw but shorter and another one terminated with discoid, pulvilliform structure.

Deutonymph (Figs. 25–32). Metric data provided in Table 2. Meristic data based on 9 specimens.

Gnathosoma. Palps (Fig. 31) slender. Palp trochanter with 5 setae, of which one (*c.* 140



Fig. 33. *Balaustium leanderi* comb. nov. Adult female: Habitus, dorsal view, in vivo.

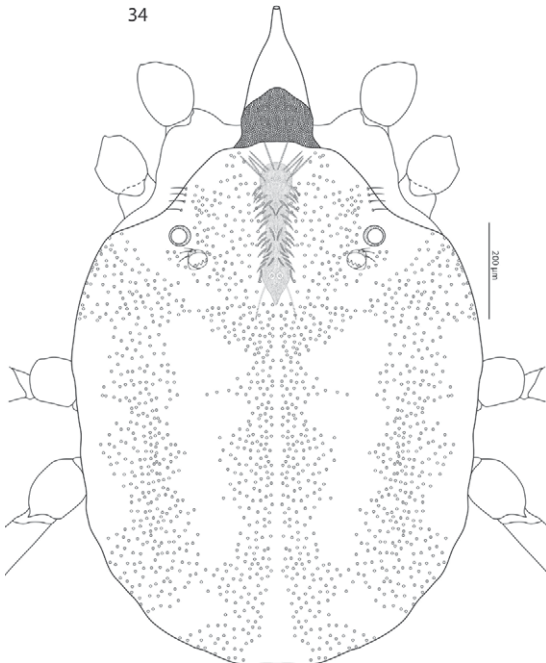


Fig. 34. *Balaustium leanderi* **comb. nov.** Adult female: Idiosoma, dorsal view.

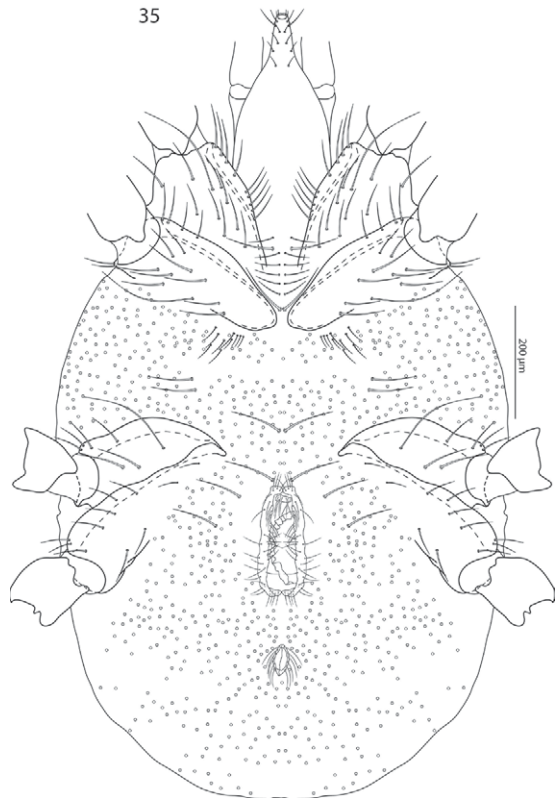


Fig. 35. *Balaustium leanderi* **comb. nov.** Adult female: Idiosoma, ventral view.

is much longer than the remaining ones, palp femur with 19–23 setae, palp genu with 19–21 setae, palp tibia with 7 setae. Setae on PaTr – PaTi either nude or weakly barbed. Palp tarsus (Figs. 31 and 32) with one long, nude seta located proximally and with *c.* 11 solenidia. Palpal supracoxalae *ep* (*c.* 4  $\mu$ m) thumb-like.

Idiosoma, Dorsal Side. Crista metopica well sclerotized and inserted in scutum (Fig. 26). ASens (Fig. 29) shorter than PSens (Fig. 30), both with tiny barbs in the distal part. A group to 3 to 5 AM setae (Fig. 28), covered with short, adhering setules and placed anterior of, or at the level of ASens. Eight to 12 setae (Figs. 26 and 27) located within scutum, between ASens and PSens. Single eyes at each side of symmetry axis, *c.* at the level of posterior sensillae. Urnulae placed postero-medially to eyes. Dorsal opisthosomal setae uniform in shape. Setal stem with 3 cuticular ridges, running from the base to the top of seta; along one ridge the relatively long, narrowing apically setules are distributed; 2 other ridges covered with relatively short, robust and not sharpened terminally setules (see Figs. 51 and 52, for adults).

Idiosoma, Ventral Side. Ventral setae acicular, longer than the dorsal setae, either smooth or with very tiny barbs. One seta on coxae I, II and III distinctly longer than the remaining coxal setae. At the level of coxae I and II, medially, 2 pairs of setae much longer than the remaining ventral setae. Another 2–3 pairs of

distinctly elongated setae present anterior of and at the level of coxae III–IV.

Legs. Supracoxal setae *eI* (*c.* 6  $\mu$ m) tiny and thumb-like. Two supracoxalae *eII* (*c.* 6  $\mu$ m) present on each of coxae II, dorsally, in antero-lateral position. All legs covered with very weakly barbed or nude setae; setulose setae arise along ventral and ventro-lateral surface of tarsi. Specialized setae of leg I: Ge 3 $\sigma$  + 1 $\kappa$ , Ti 4 $\phi$  + 1 $\kappa$ , Ta 1 $\omega$  (in dorsal position), 12–14 $\omega$  (placed laterally) + 2–3 $\zeta$  + 1 $\epsilon$ ; leg II: Ge 1–2 $\sigma$  + 1 $\kappa$ , Ti 3–4 $\phi$ , Ta 2–3 $\omega$  + 2 $\zeta$ ; leg III: Ge 1–2 $\sigma$ , Ti 2 $\phi$ , Ta 1 $\omega$  + 2 $\zeta$ ; leg IV: Ge 2 $\sigma$ , Ti 2 $\phi$ , Ta 2 $\zeta$ ; along the ventral surface of tarsi, several eupathidium-like setae, similar to other setulose setae but with blunt tip present; these setae are especially numerous on tarsus I. Tarsi terminated with paired, covered with fimbriae, claws.

Adult, Female (Figs. 33–52).

Metric data provided in Table 3. Meristic data based on 11 specimens. Body setation more dense than in deutonymphs.

Gnathosoma. Palps slender (Figs. 39 and 40). Palp trochanter with 6 nude setae, of which

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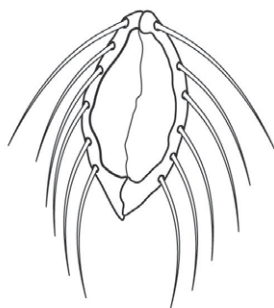
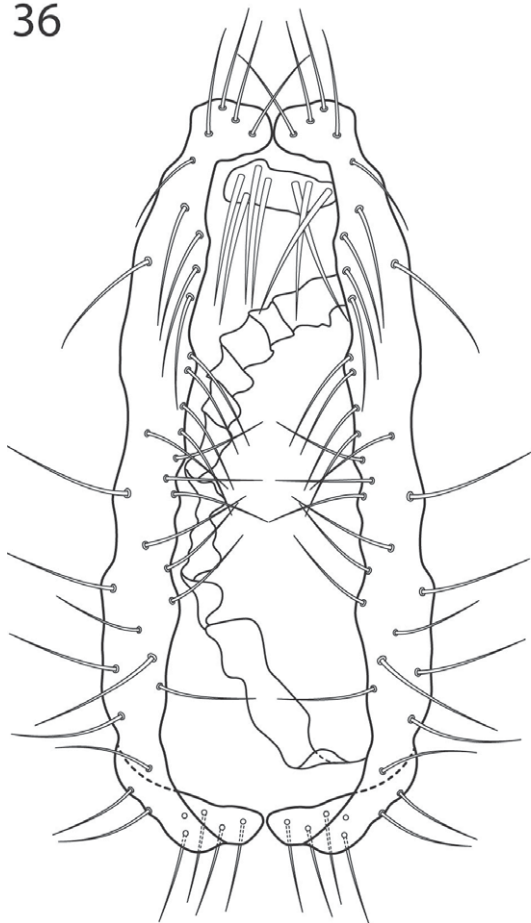


Fig. 36. *Balaustium leanderi* **comb. nov.** Adult female: Genital and anal region.

one (c. 178) is much longer than the remaining setae. Palp femur with 44–48 setae, palp genu with 34–38 setae, palp tibia (Figs. 41 and 42) with 10–12 setae, all setae nude or weakly barbed. Palp tarsus (Figs. 41 and 42) with one

37

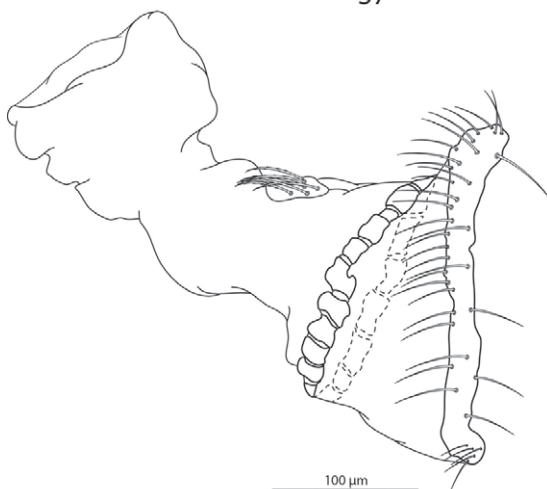


Fig. 37. *Balaustium leanderi* **comb. nov.** Adult female: Extruded ovipositor.

long, nude seta and with c. 20 solenidia. Supracoxalae *ep* thumb-like (c. 5  $\mu$ m).

Idiosoma, Dorsal Side. Dorsal view as in Fig. 34. Rod of crista metopica extended between bases of ASens and PSens and inserted in well sclerotized, narrowing posteriorly scutum (Fig. 38). ASens and PSens sparsely setulose in distal part (Figs. 38, 44 and 45), ASens always shorter than PSens. Five to 10 non-sensillary setae AM, with adhering setules (Figs. 38 and 43). *Circa* 32–40 setae, similar in shape to opisthosomal setae, arise on scutum, between the level of ASens and PSens (Figs. 38 and 46). Single eyes at each side of symmetry axis, placed before or at the level of posterior sensillae. Urnulae located postero-medially to eyes (Fig. 34). Dorsal opisthosomal setae (Figs. 47–49, 51 and 52) as in deutonymphs.

Ventral Side of Idiosoma. Dorsal view as in Fig. 35. Ventral setae and setae on coxae similar to those occurring in deutonymphs. At opisthosoma termination ventral setae display transitional form between mid-ventral and dorsal ones. Genital opening elongate, with extrusible ovipositor (Figs. 36 and 37), genital valves covered with setae similar in shape to ventral setae, but shorter (Fig. 50). Anus (Fig. 36) oval, surrounded by distinct sclerite with c. 12 setae.

Legs. One supracoxala *eI* (8  $\mu$ m) and 2 supracoxalae *eII* (8  $\mu$ m), all tiny, thumb-like, located in dorso-lateral part of coxal plates. Leg segments with weakly barbed or nude setae, setae covered with setules arise along ventral and ventro-lateral side of tarsi. Specialized setae of leg I: Ge 5 $\sigma$  + 1 $\kappa$ , Ti 14 $\phi$  + 1 $\kappa$ , Ta c. 15 $\omega$  + 4 $\zeta$  + 1 $\epsilon$ ; leg II: Ge 2–3 $\sigma$  + 1 $\kappa$ , Ti 6 $\phi$ , Ta c. 6 $\omega$  + 2–4 $\zeta$ ; leg III: Ge 2–3 $\sigma$ , Ti 3–4 $\phi$ , Ta 3–4 $\omega$  + 2–4 $\zeta$ ;

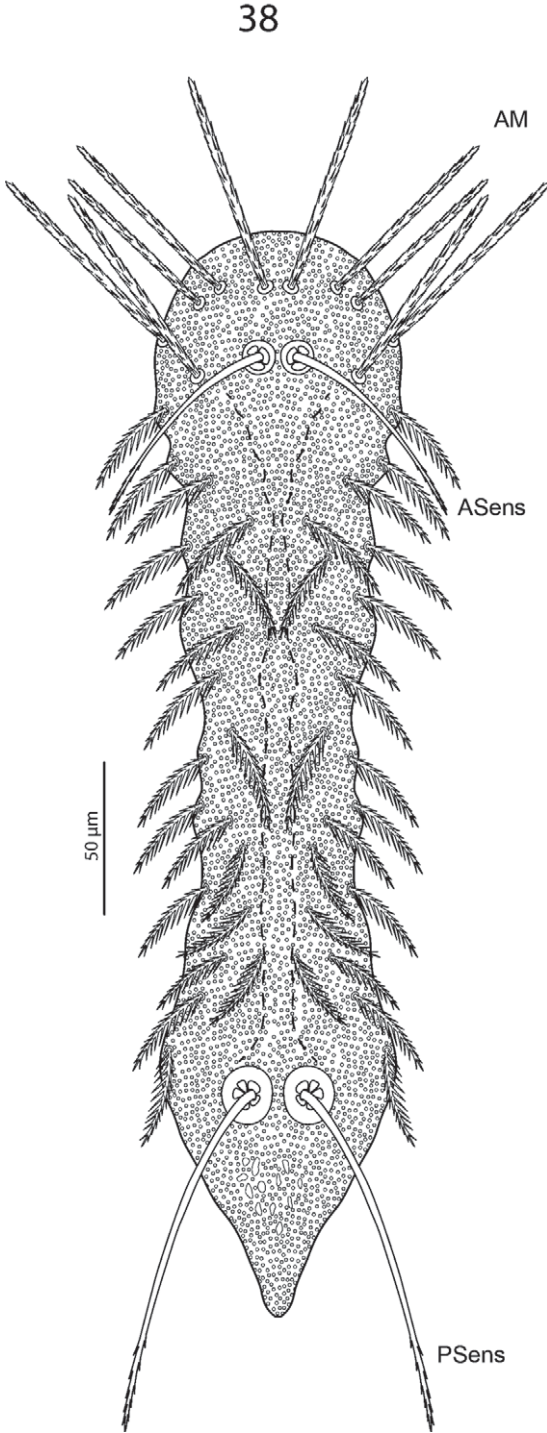


Fig. 38. *Balaustium leanderi* **comb. nov.** Adult female: Dorsal scutum.

leg IV: Ge 4 $\sigma$ , Ti 4 $\phi$ , Ta c. 2 $\omega$  + 2-4 $\zeta$ . Setae of eupathidium-type, not sharpened terminally and covered with setules, slightly bent towards

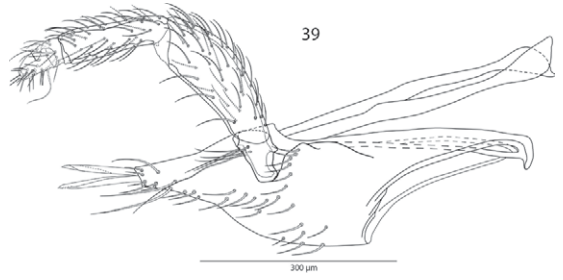


Fig. 39. *Balaustium leanderi* **comb. nov.** Adult female: Gnathosoma, lateral aspect.

proximal part of the segment, especially numerous on tarsus I, present among other setulose setae arising at ventral side of tarsi. Tarsi terminated with paired claws, each claw covered with fimbriae.

Material Deposition

A series of specimens, comprising 4 adult females (ICN-Ac-155–ICN-Ac-158), 4 deutonymphs (ICN-Ac-159–ICN-Ac-162) and 4 larvae (ICN-Ac-163–ICN-Ac-166) is deposited in the “Instituto de Ciencias Naturales ICN, Universidad Nacional de Colombia”. Three adults, 3 deutonymphs and 3 larvae are deposited in the collection of the Laboratory of Entomology, University of Bogotá Jorge Tadeo Lozano. Four slide-mounted adults (OSAL006617–006620) are deposited in the acarological collection of the Ohio State University. Two adults, 2

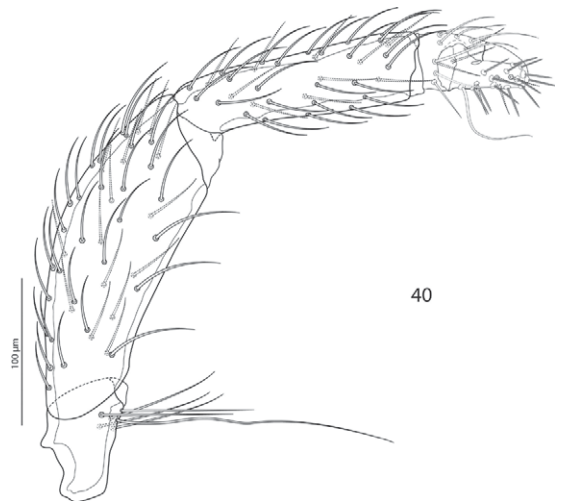
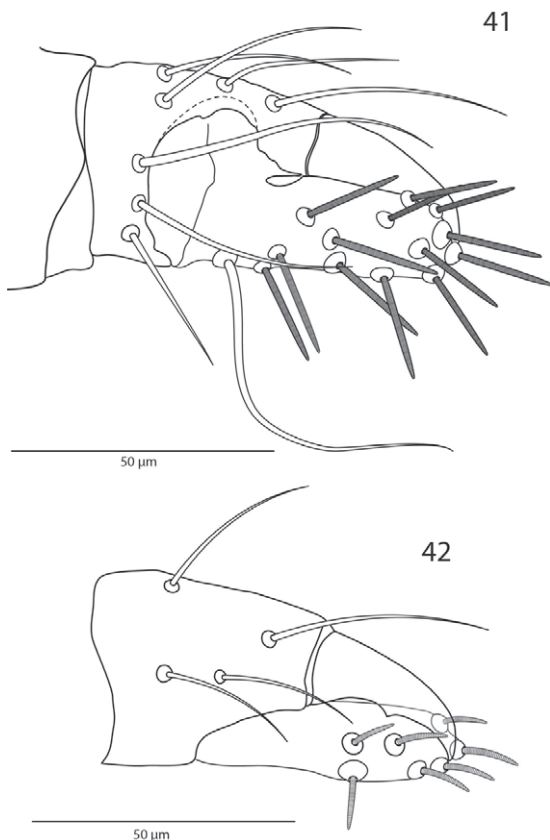


Fig. 40. *Balaustium leanderi* **comb. nov.** Adult female: Palp, lateral aspect.



Figs. 41 and 42. *Balaustium leanderi* **comb. nov.** Adult female: 41. Palp tibia and palp tarsus, lateral aspect; 42. Palp tibia and palp tarsus, medial aspect.

deutonymphs and 5 larvae - in the collection of the Department of Invertebrate Systematics and Ecology, Wrocław University of Environmental and Life Sciences.

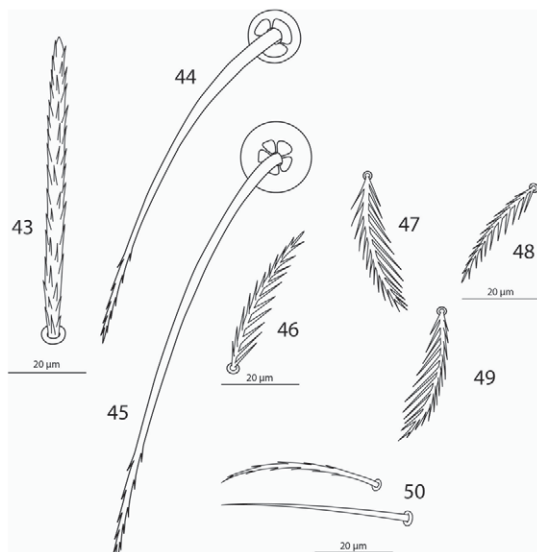
#### Distribution

Colombia, Mexico.

#### Remarks on Taxonomy

The following set of diagnostic characters allow to differentiate between larvae of *Balaustium* spp. and of other balaustiine genera: the palp tibial claw with a prominent tooth on ventral surface, one seta on palp trochanter, 1–2 setae on palp femur and 3 setae on trochanter I (see also Diagnosis). Some of these characters, however, can be recognized also in other balaustiine genera known from larvae.

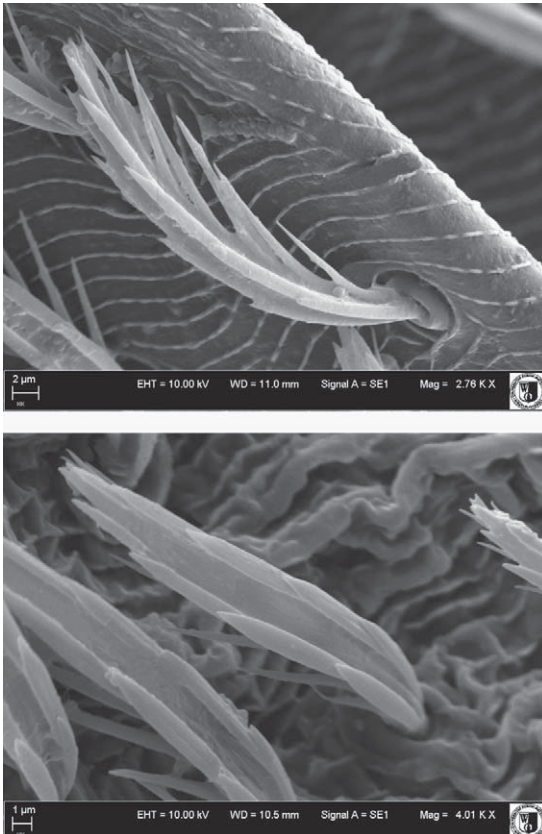
The presence of 2 setae on the palp femur, combined with the presence of one seta on the palp trochanter in larvae has been stated for



Figs. 43-50. *Balaustium leanderi* **comb. nov.** Adult female: 43. AM seta; 44. Anterior sensilla (ASens); 45. Posterior sensilla (PSens); 46. Seta arising on scutum between the level of ASens and PSens; 47. Mid-dorsal seta; 48. Latero-dorsal seta; 49. Postero-dorsal seta; 50. Genital setae.

monotypic *Palenquistium* Haitlinger, 2000 and also for *Pollux kovalamicus* Haitlinger, 2002. However, the members of *Pollux* Southcott, 1961 can be distinguished from *Balaustium* spp. by different termination of tarsus III. *Palenquistium*, with *Palenquistium leanderi* was described by Haitlinger (2000) based on 2 larvae collected from plants in Mexico. The simple odontus, without median tooth, 2 setae on the palp femur, bFe 4–4–4, Tr 3–3–3 and Ge 9–9–9, were listed as diagnostic characters for newly erected genus.

Examination of the holotype of *Palenquistium leanderi*, revealed that the distinct tooth is present at c. half length of the tibial claw, ventrally. Also, one barbed seta and one nude (instead of 2 nude setae) are present on palp femur, whereas the chaetotaxy of tibia II includes 10 normal setae and 2 solenidia. Thus the data contained in the original description should be corrected for fPp N-NB-NN-NNN-NNNNζω, fTi 11–10–11 and f<sub>sol</sub>Ti 2–2–1. Additionally, the AL setae are leveled with ASens (AL anterior of ASens stated in the original description might have been due to the shift of the left side of the idiosoma towards anterior position in relation to the right side of the body). The above verification of diagnostic characters, results in the presence of character states which are observed also in some members of *Balaustium*. Hence the separate identity of *Palenquistium* Haitlinger, 2000 is not justified anymore and the latter ge-



Figs. 51 and 52. *Balaustium leanderi* **comb. nov.** Adult female, SEM micrographs: 51. Dorsal seta, side view; 52. dorsal seta, view from above.

nus should be considered a junior synonym of *Balaustium* von Heyden, 1826. Moreover, the discrepancy in data contained in the original description, applying to the ISD value (50 – in the diagnosis, 68 and 78 – for the holotype and paratype, respectively – in the table), should be corrected in favor of the value provided in the table. PaGe L/W ratio in *Balaustium leanderi* **comb. nov.** equals 70 in the holotype.

*Balaustium leanderi* **comb. nov.** shares generic traits with other members of the genus, as evidenced by data on larvae and active postlarval forms. Difference between the larvae of *Balaustium leanderi* and of other *Balaustium* spp., besides the presence of 2 setae on the palp femur, pertains also to the number of normal setae on the basifemur ( $f_n$ bFe 4–4–4). The formula  $f_n$ bFe 4–4–4 has been known also for the monotypic *Moldoustium* Haitlinger, 2008, but the separate generic identity of the latter genus is supported by the absence of setae on the palp trochanter (vs one seta present in *Balaustium*).

Active postlarval forms of *Balaustium leanderi* belong to the group of *Balaustium* spp.

TABLE 3. MORPHOMETRIC DATA OF THE ADULT FEMALE *BALAUSTIUM LEANDERI*. X = MEASUREMENTS (μM). SE = STANDARD ERROR.

| Character | X (n = 9) | SE      |
|-----------|-----------|---------|
| PaTr (L)  | 70.627    | 1.019   |
| PaFe (L)  | 215.210   | 4.265   |
| PaFe (W)  | 73.203    | 1.895   |
| PaGe (L)  | 157.997   | 2.811   |
| PaGe (W)  | 48.313    | 0.741   |
| PaTi (L)  | 43.432    | 0.771   |
| PaTi (W)  | 36.906    | 0.593   |
| PaTa (L)  | 55.230    | 0.864   |
| PaTa (W)  | 17.118    | 0.363   |
| Odo       | 35.973    | 0.806   |
| IL        | 1496.460  | 101.228 |
| IW        | 1168.583  | 69.545  |
| IL/IW     | 1.281     | 0.035   |
| AL(n)     | 6.800     | 0.279   |
| ASE=Asens | 80.532    | 2.299   |
| PSE=Psens | 104.030   | 1.244   |
| Sba       | 19.147    | 0.323   |
| SBp       | 21.259    | 0.517   |
| L         | 346.369   | 6.416   |
| W         | 66.119    | 4.043   |
| ISD       | 241.859   | 3.829   |
| MDS       | 34.762    | 0.869   |
| PDS       | 35.478    | 0.499   |
| MVS       | 50.004    | 3.347   |
| OCM       | 212.414   | 10.106  |
| OAS       | 294.393   | 11.962  |
| OPS       | 247.114   | 12.008  |
| O-Ur      | 38.373    | 1.470   |
| O         | 32.186    | 0.617   |
| Ur        | 38.739    | 0.918   |
| O - O     | 490.971   | 22.874  |
| GOP       | 247.220   | 8.017   |
| AOP       | 65.032    | 1.223   |
| Cx I      | 323.492   | 9.693   |
| Tr I      | 163.541   | 5.865   |
| bFe I     | 198.466   | 6.669   |
| tFe I     | 368.613   | 8.173   |
| Ge I      | 432.324   | 8.363   |
| Ti I      | 419.004   | 7.005   |
| Ta I      | 273.453   | 4.701   |
| Ta I (H)  | 94.730    | 2.595   |
| Leg I     | 2188.191  | 39.276  |
| Cx II     | 277.133   | 4.796   |
| Tr II     | 136.110   | 6.033   |
| bFe II    | 145.000   | 2.837   |
| tFe II    | 233.097   | 4.359   |
| Ge II     | 266.953   | 5.368   |
| Ti II     | 295.582   | 5.833   |
| Ta II     | 178.142   | 3.392   |
| Ta II (H) | 73.139    | 2.750   |
| Leg II    | 1532.018  | 26.492  |
| Cx III    | 258.866   | 5.967   |

TABLE 3. (CONTINUED) MORPHOMETRIC DATA OF THE ADULT FEMALE *BALAUSTIUM LEANDERI*. X = MEASUREMENTS ( $\mu\text{M}$ ). SE = STANDARD ERROR.

| Character  | X (n = 9) | SE      |
|------------|-----------|---------|
| Tr III     | 139.838   | 5.265   |
| bFe III    | 154.393   | 3.367   |
| tFe III    | 274.544   | 5.903   |
| Ge III     | 316.480   | 6.290   |
| Ti III     | 343.344   | 7.653   |
| Ta III     | 180.254   | 3.635   |
| Ta III (H) | 70.482    | 1.871   |
| Leg III    | 1667.720  | 31.759  |
| Cx IV      | 331.493   | 9.423   |
| Tr IV      | 157.453   | 6.297   |
| bFe IV     | 203.116   | 4.570   |
| tFe IV     | 378.071   | 6.616   |
| Ge IV      | 417.560   | 9.277   |
| Ti IV      | 457.026   | 8.016   |
| Ta IV      | 187.513   | 4.423   |
| Ta IV (H)  | 68.337    | 1.867   |
| Leg IV     | 2138.836  | 44.742  |
| IP         | 7545.138  | 140.377 |

having long and slender palps (PaGe L/W > 2) and lacking semipectinalae on the palp genu. The latter group comprises also *Balaustium hernandezi* Małol et al., 2012. The most striking differences between these 2 species (except for characters which differentiate larvae) are expressed in the length of dorsal opisthosomal setae (23–46 in *B. leanderi* vs 45–75 in *B. hernandezi*) and in the PaGe L/W ratio (2.45–3.15 in DN and 3.06–3.63 in AD of *B. leanderi* vs 2.29 in DN and 2.7 in AD of *B. hernandezi*).

For several species known exclusively from active postlarval forms, the data on the PaGe L/W ratio and/or on the presence/absence of semipectinalae have not been described. The latter applies to the following species, from the circumtropical zone: *B. aonidiphagus* (Ebeling, 1934), *B. cristatum* Meyer & Ryke, 1959, *B. graminum* Meyer & Ryke, 1959, *B. medicagoense* Meyer & Ryke, 1959, *B. southcotti* Feider et Chioreanu, 1977. *Balaustium leanderi* differs from *B. aonidiphagus* in the body coloration, which in *B. aonidiphagus* is red but with greenish or bluish iridescence, from *B. cristatum* – in the number of AM setae in deutonymph (one seta in *B. cristatum*) and in PaGe L/W ratio (1.25 in *B. cristatum*, calculated from the drawing), from *B. graminum* – in the length of dorsal opisthosomal setae (22 in DN of *B. graminum*) and in PaGe L/W ratio (1.24 in *B. graminum*, calculated from the drawing), from *B. medicagoense* – in the lack of papillae-like structures on legs, from *B. southcotti* – in the length of the palp, excl. palp tarsus (203–261 in

females of *B. southcotti*, 496–556 in females of *B. leanderi*).

The relatively wide range of morphometric data (Tables 1 and 2) observed in *B. leanderi*, not known for other *Balaustium* spp. poses a question on separate identity of species for which the minor differences in metric data served as the only source to distinguish the new taxon.

#### ACKNOWLEDGMENTS

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