

On the identities of Neotropical *Stegana* species (Diptera, Drosophilidae). III. Four Costa Rican species described by J. R. Malloch

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ABSTRACT

The identities of the following four New World species of *Stegana* from Costa Rica, *Stegana atrimana* Malloch, 1924, *Stegana nigrita* Malloch, 1924, *Stegana schildi* Malloch, 1924, and *Stegana tempifera* Malloch, 1924, are clarified, and their redescrptions are provided. According to the original descriptions, the holotypes of the four species, deposited in the National Museum of Natural History (USNM), were males. However, upon dissection of their terminalia, we realized that all but one (*S. tempifera*) are females. Therefore, redescrptions of their external morphology (and/or terminalia) are mainly based on male paratypes, except for *S. schildi*, which is based on a male non-type specimen from Panama bearing Malloch's handwritten identification label. Photomicrographs of the habitus and terminalia, in addition to china ink drawings of the aedeagi and associated sclerites, are included.

Introduction

Almost 30 species of *Stegana* Meigen, 1830, from the New World were described in the first half of the 20th century. With few exceptions, they are only known from their original, relatively short descriptions. The systematic knowledge of New World *Stegana* species and their distribution is scanty because *Stegana* species are rarely sampled using commonly employed *Drosophila* baiting methods.

In this third paper on the identities of Neotropical *Stegana* we clarify the status of four species collected in Costa Rica by Pablo Schild, described by Malloch in 1924, and located in the USNM collection by revising their type material using accurate methods. Unfortunately, many of these specimens were covered with mold, making it challenging to identify their sex. Malloch was probably confronted with the same problem since only one out of his four selected holotypes was correctly sexed.

Material and methods

The redescrptions of four Costa Rican species of *Stegana* described by Malloch are based on 26 type and 15 non-type specimens on loan from the Smithsonian's National Museum of Natural History (USNM)

in Washington, D.C., USA. The holotypes of the four species described by Malloch share the following third label from above (the largest one): white, black line bordered, that reads "Stegana ... Type [handwritten]" "Det. / J R Malloch [printed]" (see Figs. 1, 9, 17, 26), followed by a red U.S.N.M. label printed as "Type No. ...[handwritten]", differing from the remaining type series specimens that lack the large label but have a red U.S.N.M. label printed "Paratype No. ... [handwritten with the same species number as the "Type"] ". A total of 9 out of the 26 analyzed type specimens were dissected. The sex identities of the 17 remaining non-dissected type specimens are mostly tentative, as are the remaining 14 non-type and non-dissected specimens. Additionally, one male non-type specimen from Panama [ALMelander collection] also housed in the USNM collection and identified by Malloch as belonging to *Drosophila schildi* was analyzed and dissected.

Label data attached to each holotype are cited in full with a slash [/] indicating a line change and a double slash [/], a label change. Our notes or interpretations are included in brackets (also in other items throughout the text). Our internal numbering is given as #11–18, #21–24, #29–32, #34–43 for the type specimens and as #10, #19, #20, #33, #44, #48–57 for the non-type specimens. Five of the non-type specimens included in the loan numbered #45–47, #58 and #59 were analyzed but excluded from the redescrptions because they were

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considered outside the range of species variation some unidentified person previously ascribed to one of the species described herein.

The specimens' habitus were photomicrographed with a Samsung Galaxy S8 smartphone's rear camera. As previously described, the smartphone was attached to the right eyepiece of a Wild M3 stereomicroscope through a magnetic plate of a clothespin-shaped plastic adapter (Vilela and Bächli 2019, 2020a). Objective lenses of 1.6× and 4× were used. The camera was set to default or optically zoomed to 2× or 3× with the autofocus mode disabled. A series of pictures was taken at different depths of focus for every selected view. Later the pictures were stacked to create an all-in-focus composite using the "All Methods" algorithm of the open-source software CombineZP (Hadley, 2010, Vilela and Bächli, 2019, 2020b, Vilela and Prieto, 2018).

Preparations of microscope slides were made following Wheeler and Kambysellis (1966) and Kaneshiro (1969). The abdominal sclerites, including the disarticulated male terminalia, were preserved in glass microvials filled with glycerin and attached by the stopper to the pin of the respective specimen. Refer to Vilela and Bächli (2000) and Bächli et al. (2004) for further details.

Male terminalia were photomicrographed with the Smartphone (as described above) attached to a Zeiss compound microscope. Objective lenses of 16×, 20×, and 25× were used. These anatomical structures were also partially drawn using a camera lucida (1.8×) attached to the same microscope under a 16× [*Stegana schildi*] or 25× objective.

Finally, the images of line drawings and the composite photomicrographs taken either with a stereo or a compound microscope were edited with Adobe Photoshop Elements 2.0 and/or 6.0. Unless otherwise indicated, all photomicrographs in the same plate were taken and enlarged to the same magnification.

For measurements and indices see Vilela and Bächli (1990); for morphological terminology see Grimaldi (1990), Vilela and Bächli (2000) and Bächli et al. (2004).

Results and discussion

Stegana Meigen, 1830

Meigen, 1830: 79 (description). Type species: *Stegana nigra* Meigen, 1830: 79 (= *Musca furta* Linnaeus, 1767: 991) (des. Zetterstedt, 1847: 2577).

Subgenus *Stegana* (*Steganina*) Wheeler, 1960

Wheeler, 1960: 110 (description, taxa included). Type species: *Musca coleoprata* Scopoli, 1763 (original designation).

Diagnosis. See Bächli et al. (2004: 83).

Comments: All species described by Malloch have hitherto been placed in the subgenus *Steganina* (Brake and Bächli, 2008). One of the main diagnostic characters of the *Steganina* species is that the main eye axis is oblique or almost horizontal (up to about 80 degrees) (Bächli et al. 2004), with distinct, broad gena. Malloch and many other investigators of *Stegana* species did not always specify the main eye axis direction. If this character is not clearly stated as oblique, we suppose that the main eye axis is more or less vertical because, for drosophilists, this is a standard condition and, therefore, not usually mentioned. Such species may belong to the subgenus *Stegana*. The Malloch species analyzed here, except for *Stegana schildi*, do not present this feature but have almost roundish eyes with the main eye axis indistinct or relatively vertical (differing by about 10 degrees) and with very narrow gena, suggesting that they would belong to the subgenus *Stegana*. For now, however, we have decided to keep the four species within the subgenus *Steganina*.

Stegana (*Steganina*) *atrimana* Malloch, 1924

(Figs. 1-8)

Stegana atrimana Malloch, 1924a: 97 (key, description); Malloch, 1924b: 2 (description); Wheeler, 1970: 79.6 (affiliation).

Stegana (*Steganina*) *atrimana* Malloch: Wheeler, 1981: 31 (affiliation); Brake and Bächli, 2008: 296 (affiliation).

Type locality: Costa Rica, Province of Alajuela, Canton of San Mateo, Higuito.

Diagnosis. Generally brownish, shining flies. Eyes roundish, main axis almost vertical. Front pale with dark orbital plates. Gena narrow. Pleura pale with two distinct black longitudinal bands. Male fore tarsi somewhat laterally compressed, tarsomeres 1–4 black, apical joint yellow. Surstylus finger-shaped, double-walled, with many setae adjacent to the inner margin of both the outer and inner wall, bearing just one short, sharp, subterminal prensiseta on the lower margin, not microtrichose, and anteriorly fused in a right angle to decasternum. Decasternum transverse, circumflex-shaped, curved posterad, densely covered with ca. 40 strong, curved, sharply tipped setae, laterally fused in a right angle to the anterior region of the surstylus. Gonopods sclerotized, distally fused to outer paraphyses, proximally somewhat concave, curved strip-shaped, fused to each other and articulated to the posterior hypandrial process by membranous tissue, devoid of seta. Aedeagus ca. 1/2 length of aedeagal apodeme, and not coalescent to it, distally covered with blunt, seta-like scales, anterior ones short, the posteromarginal ones conspicuously long, distally 3- or 4-branched (longest ones), conspicuously fringe-shaped. Outer paraphysis folded over itself, knee-shaped in the lateral view, medianly bearing 6 tiny setulae.

Material examined (n = 4).

Holotype ♀ [#22], dissected, labeled (Fig. 1): "Higuito / SanMateoCR [Costa Rica] // PabloSchild / Coll // *Stegana* / atrimana / Type [handwritten] / Det. / J R Malloch [printed] // Type No. / 26683 [handwritten] / U.S.N.M. [red label] // USNMMENT / [QR Code] / 01383629 [back side] // *Stegana* / atrimana Malloch / Bächli & Vilela det. 2017 / HOLOTYPE [red label] // ♀". Paratypes ♂♂ [#11, #12; latter dissected] and non-type ♂ [#10]: same data as holotype, except for type status, sex and QR code.

Comments. Malloch (1924b) listed one male holotype and two female paratypes. However, the type series we received contains one female holotype [labeled Type] and two male paratypes.



Figure 1 *Stegana atrimana* Malloch, 1924, labels of female holotype #22.



Figure 2 *Stegana atrimana* Malloch, 1924, female holotype #22, Higuito, San Mateo, Alajuela, Costa Rica [Type Number 26683, USNM], habitus, four views: a, oblique dorsal, b, left lateral, c, head and thorax dorsal, d, abdomen dorsal. Scale bar = 1 mm.

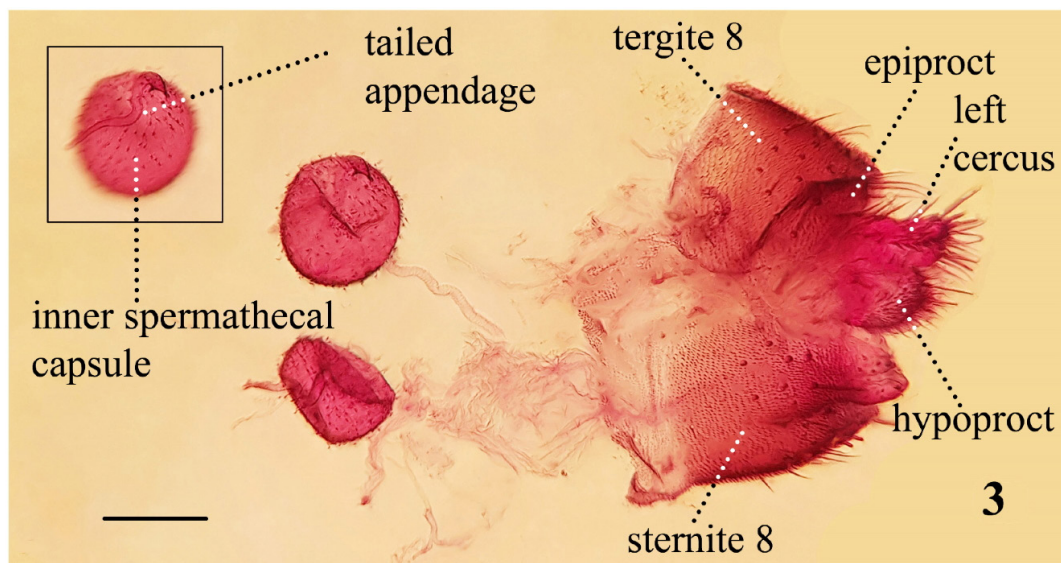


Figure 3 *Stegana atrimana* Malloch, 1924, female holotype #22, Higuito, San Mateo, Alajuela, Costa Rica [Type Number 26683, USNM], terminalia [inset = inner spermathecal capsule in focus], left oblique lateral view. Scale bar = 0.1 mm.



Figure 4 *Stegana atrimana* Malloch, 1924, male paratype #12, Higuito, San Mateo, Alajuela, Costa Rica [Paratype Number 26683, USNM], habitus, four views: a, oblique dorsal, b, left lateral, c, thorax dorsal, d, abdomen dorsal. Scale bar = 1 mm.

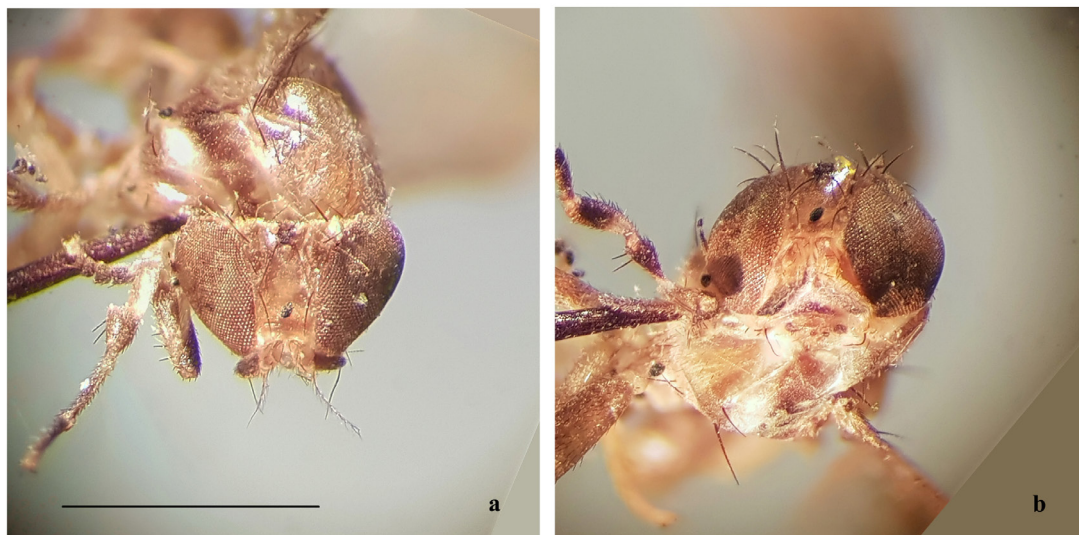


Figure 5 *Stegana atrimana* Malloch, 1924, male paratype #12, Higuito, San Mateo, Alajuela, Costa Rica [Paratype Number 26683, USNM], habitus, two close-up views: a, head dorsal, b, head frontodorsal. Scale bar = 1 mm.

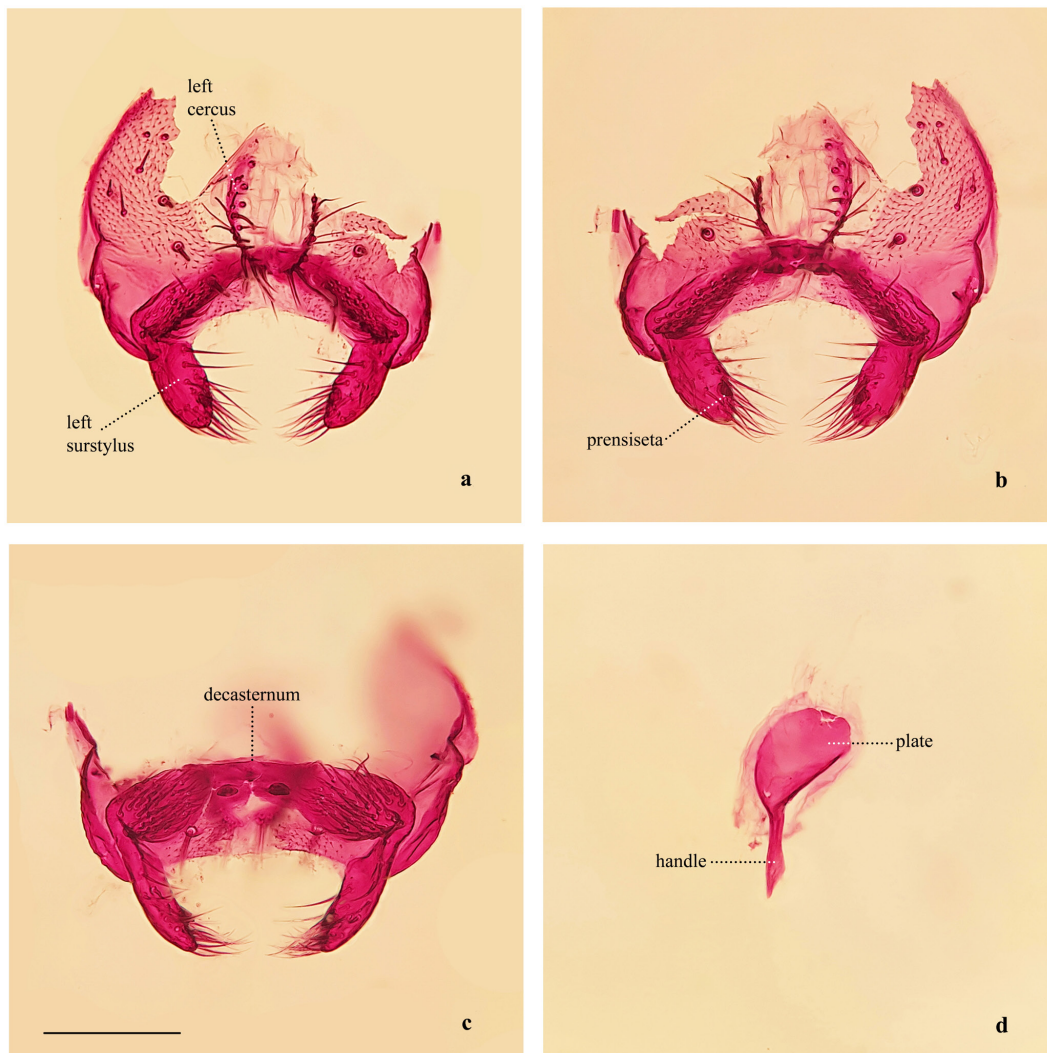


Figure 6 *Stegana atrimana* Malloch, 1924, male paratype #12, Higuito, San Mateo, Alajuela, Costa Rica [Paratype Number 26683, USNM], external terminalia and ejaculatory apodeme: a, epandrium [dorsally damaged], surstylus, and cerci, posterior view, b, idem, anterior view, c, decasternum and surstyli, ventral view, d, ejaculatory apodeme, oblique posterior view. Scale bar = 0.1 mm.

Redescription

♂. (n = 3). Head (Fig. 5) is generally yellowish. Frons glossy brownish, paler medially and above antennae. Frontal length 0.48 (0.44–0.51) mm; frontal index about 1.83 (1.76–1.87), top to bottom width ratio = 1.57 (1.53–1.60); frontal triangle hardly visible, about 33–44% of frontal length; ocellar triangle black, slightly prominent, about 26–35% of frontal length. Orbital plates apically slightly diverging from the eye margin, about 64–73% of frontal length. Orbital setae arranged in a row, distance of or3 to or2 about 55% of or3 to or1, distance of or2 to or1 about 45% of or3 to or1, distance of or3 to or1 about 220% of or3 to vtm, or1 / or3 ratio = 1.09 (1.00–1.21), or2 / or1 ratio = 0.67 (0.63–0.71), vt index = 0.96 (0.93–1.00), postocellar setae crossed, about 22 (17–27) % of frontal length, ocellar setae = 56 (50–65) % of frontal length; vibrissal index = 0.24. Face pale yellowish, with a brown spot above mouth margin. Carina narrow, prominent in the upper half of the face. Cheek whitish, broadened backwards, index about 8 (6–9). Eye oblong, main axis slightly oblique, index about 1.11 (1.06–1.14). Occiput black at about upper half, white below. Pedicel yellowish. Flagellomere 1 black, length to width ratio about 1.74 (1.50–2.00). Arista has 7 dorsal, 6 ventral and about 6 rather long inner branches, plus a short terminal fork. Proboscis and palpus yellowish.

Thorax (Fig. 4a–c) length about 1.36 (1.19–1.40) mm. Scutum slightly micropubescent, brownish, paler in anterior area and on postpronotum, with diffuse pale stripes outside dc lines, 8 rows of acrostichal setae. Transverse distance of dorsocentral setae about six times the longitudinal distance; dc index about 0.30. Scutellum almost roundish, brownish, with paler margin, scutellar setae almost equidistant; basal setae divergent, apical ones crossed: scut index about 1.65 (1.56–1.75). Pleura whitish, with a broad, black, horizontal stripe (Fig. 4b) in the upper half and a lower, narrower, brown, horizontal stripe above the middle of the katepisternum joining the upper stripe around the haltere, sterno index about 0.82 (0.79–0.84). Haltere with a black knob. Legs generally yellowish, fe1 in basal half blackish, apically with 2–3 strong setae below, ti1 black with short pale base and tip, fe2 and ti2 black with a pale knee, fore tarsi slightly laterally compressed, tarsomeres 1–4 black, tarsomere 5 pale.

Wing (Fig. 4) slightly pointed, generally brownish but becoming paler towards hind margin, c_3 with about 7 warts below, r_{2+3} apically bent towards costa, m_3 straight, ending close to r_{2+3} , wing length about 2.09 (1.92–2.31) mm, length to width ratio about 1.81 (1.77–1.83). Indices: $C = 1.70$ (1.62–1.76), $ac = 8$ (7–9), $hb = 0.73$ (0.71–0.76), $4C = 1.44$ (1.38–1.55), $4v = 1.96$ (1.80–2.18), $5x = 1.10$ (1.00–1.17), $M = 0.60$ (0.53–0.64), $prox. x = 0.98$ (0.77–1.18).

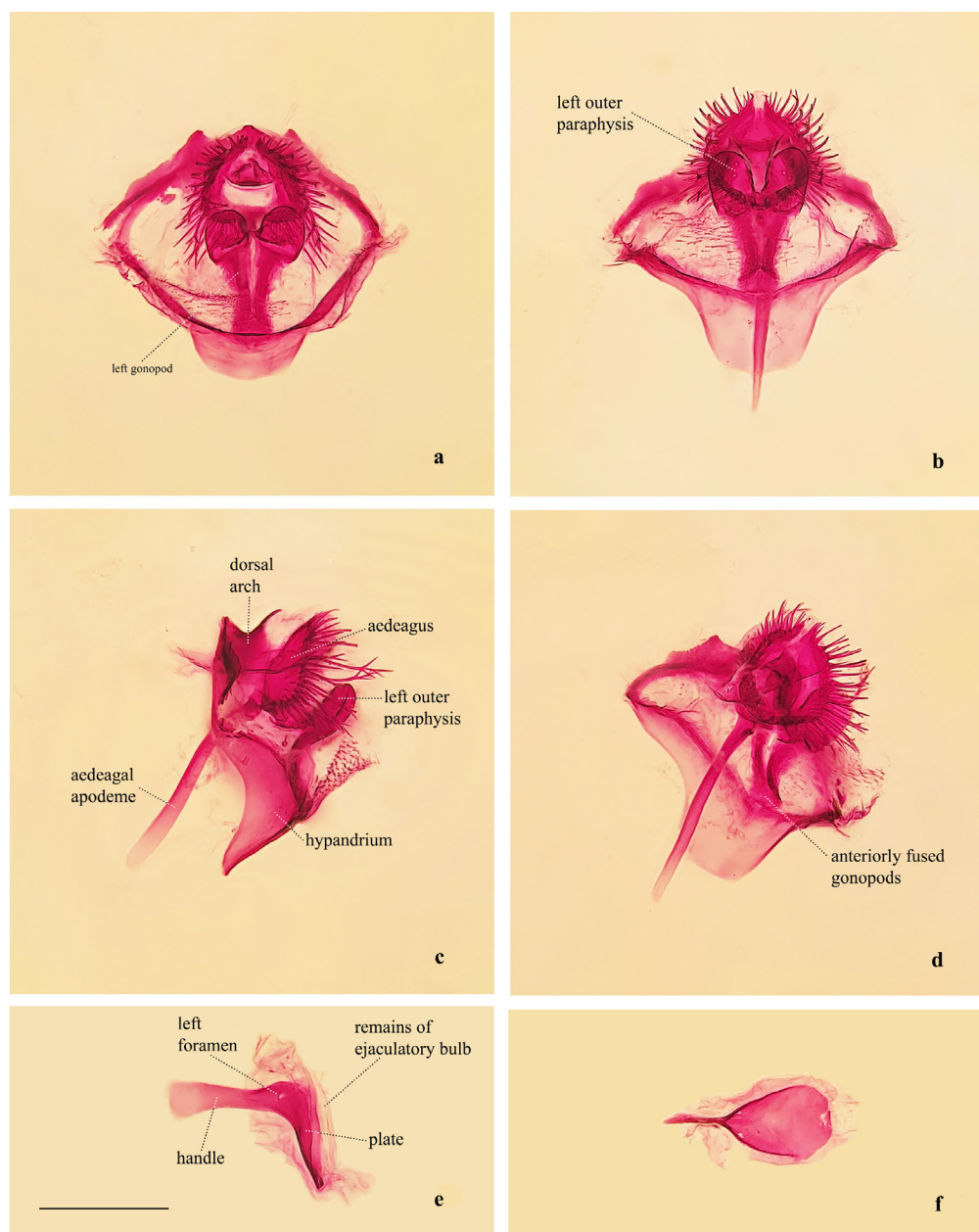


Figure 7 *Stegana atrimana* Malloch, 1924, male paratype #12, Higuito, San Mateo, Alajuela, Costa Rica [Paratype Number 26683, USNM], internal terminalia, several views: a, hypandrium, aedeagus, and outer paraphyses+gonopods, dorsoposterior, b, idem plus the aedeagal apodeme, posterior, c, idem, left lateral, d, idem, antero-oblique, e, ejaculatory apodeme, left lateral view of the handle and plate, f, idem, posterior view of the handle and plate. Scale bar = 0.1 mm.

Abdomen (Fig. 4d) shining brownish, hind margins of tergites blackish.

Terminalia (Figs. 6–8). Epandrium setose and macrotrichose, except for the vestigial lobe, dorsally destroyed [probably eaten by psocopterans as their feces were stuck to the specimen body], setae adjacent to distal margin longer; ventral lobe vestigial, partially covering the surstylus' proximal area. Surstylus (Fig. 6a–c), finger-shaped, double-walled, with many setae adjacent to the inner margin of both the outer and inner wall, bearing just one short, sharp, subterminal preniseta on the lower margin inner wall, not microtrichose, anteriorly fused in a right angle to the decasternum; weakly linked to the epandrium by membranous tissue. Decasternum circumflex-shaped in the anterior (Fig. 6b) and posterior (Fig. 6a) views, curved posterad, laterally fused in a right angle to the anterior region of the surstylus (Fig. 6c), densely covered with ca. 40 strong, curved, sharply-tipped setae, probably functioning as a prenisetae which

are scarce (just one) on the inner margin of the surstylus. Cercus reduced to a narrow vertical stripe, dorsally destroyed, setose, not microtrichose, without ventral lobe, anteriorly linked to the epandrium by membranous tissue. Hypandrium sinuate in the lateral view (Fig. 7c), lozenge-shaped in the dorsal and ventral views (Fig. 7a, b), as long as wide, anterior margin strongly convex, posterior margin concave; posterior hypandrial process short; dorsal arch sclerotized, mediolaterally projected dorsad, dorsodistally slightly projected backwards as a half cylinder, medially strongly narrow sheath-shaped (probably originated from fused inner paraphyses) dorsally embracing the aedeagus (Fig. 7c); gonopods sclerotized, proximally curved strip-shaped (Fig. 7d), anteriorly fused to each other (Fig. 7b), articulated by membranous tissue to posterior hypandrial process; distally fused to outer paraphysis (Fig. 7c), devoid of seta. Aedeagus (Figs. 7a–d, 8) relatively small (ca. 1/2 length of aedeagal apodeme),

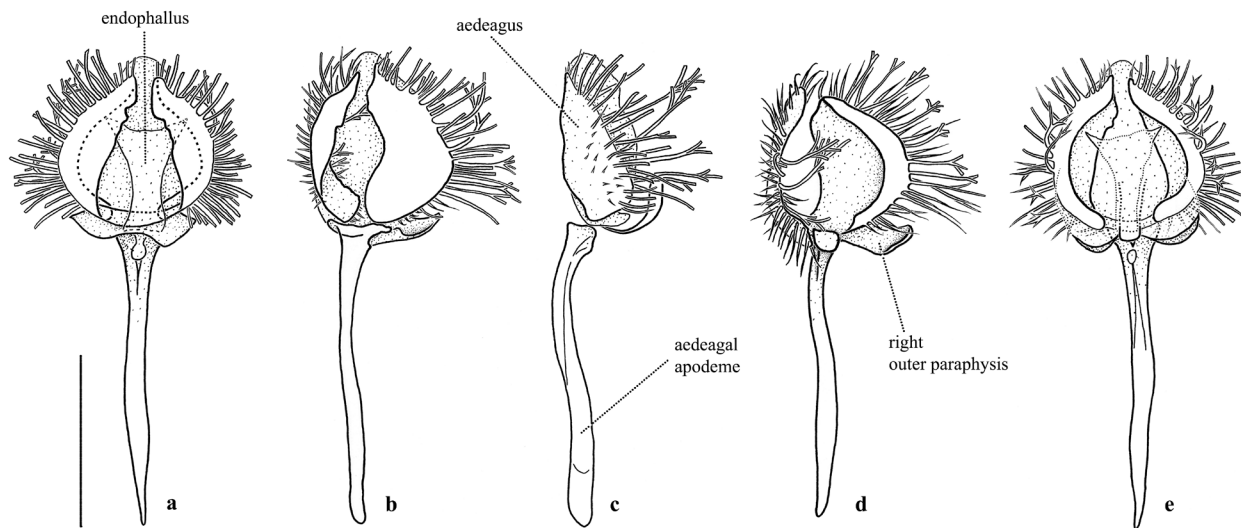


Figure 8 *Stegana atrimana* Malloch, 1924, male paratype #12, Higuito, San Mateo, Alajuela, Costa Rica [Paratype Number 26683, USNM], five views of the aedeagus, aedeagal apodeme, and ventral rod, from dorsal through ventral. Scale bar = 0.1 mm.

somewhat similar to that of *S. tempifera* (Fig. 31), triangular in lateral view [as in *S. tempifera*], circular in dorsal and ventral views (Fig. 8a,e) [elliptical in *S. tempifera*; Fig. 31a,e)], distally covered with blunt, seta like scales, anterior ones short, posteromarginal ones conspicuously long, distally 3- or 4-branched (longest ones; Fig. 8), conspicuously fringe-shaped; aedeagus linked to aedeagal apodeme by membranous tissue. Aedeagal apodeme rod-shaped, distally slightly curved and expanded laterad, twice as long as aedeagus. Ventral rod not recognizable (clearly recognizable in *S. tempifera*) between outer paraphyses. Outer paraphysis proximally divergent, perpendicular to aedeagus, concave (Fig. 8c-e) and mostly membranous, distally double-walled (Fig. 7a), folded over itself (knee-shaped in lateral view; Fig. 7c), ear-shaped in posterior view, strongly sclerotized (Fig. 7a, b) and widely fused to curved strip-shaped gonopod, medianly bearing 6 tiny setulae (Fig. 7b); inner paraphysis not recognizable, probably fused to form a dorsal arch (as interpreted by Laštovka and Máca, 1982) or just its distal part, sheltering the aedeagus. Ejaculatory apodeme (Figs. 6d, 7e, f) strongly sclerotized, somewhat similar in profile to the generalized *tripunctata* type of genus *Drosophila* as proposed by Throckmorton (1962: 242, fig. 19.34); in the lateral view (Fig. 7e), plate ca.77% handle length, and handle ca. 70% of the aedeagal apodeme length (Fig. 7c), inner angle (Fig. 7e) between the handle and plate > 90°; plate spatulate, longer than wide, in the posterior view (Fig. 7f).

♀. Differences compared to males: No obvious differences in external morphology (Fig. 2). Measurements: Frontal length about 0.46 mm. Frontal index about 1.80, top to bottom width ratio about 1.47. Frontal triangle about 30% of frontal length; ocellar triangle about 45% of frontal length. Orbital plates about 65% of the frontal length. Distance of or3 to or2 about 64% of or3 to or1, distance of or2 to or1 about 36% of or3 to or1, distance of or3 to or1 about 135% of or3 to vtm, or1 / or3 ratio about 1.17, or2 / or1 ratio about 0.86, postocellar setae about 25% of frontal length, ocellar setae about 52% of frontal length; vt index about 0.80, vibrissal index about 0.30. Cheek index about 8. Eye index about 1.14. Flagellomere 1 ratio about 2.00.

Thorax length about 1.50 mm. Transverse distance of dorsocentral setae about 480% of their longitudinal distance; dc index about 0.36, scut index about 1.96, sterno index about 0.73. Wing length about 2 mm. Indices: C = 1.79, ac = 9.5, hb = 0.53, 4C = 1.46, 4v = 2.00, 5x = 1.14, M = 0.62, prox. X = 1.08.

Terminalia (Fig. 3). One pair of finger-shaped cerci inserted beyond and between the epiproct and hypoproct (subanal plate of Laštovka and Máca, 1982). Oviscapt valves absent, sternite 8 (egg guide of Okada, 1971 and Laštovka and Máca, 1982) horizontally positioned, somewhat rectangle-shaped, posterior margin with a shallow median notch, and not protruding. It is devoid of a peg-shaped ovisensilla, and its trichoid ovisensilla seem to be similar to those of the preceding sternites, except for the distal notch. Inner spermathecal capsule (Fig. 3, and inset) somewhat spherical, mostly papillate, distally bearing a long-tailed appendage (Laštovka and Máca, 1982), devoid of basal and apical introverts; height slightly shorter than sternite 8.

Distribution. Costa Rica (Province of Alajuela).

Biology. Unknown.

Stegana (Steganina) nigrita Malloch, 1924

(Figs. 9-16)

Stegana nigrita Malloch, 1924a: 97 (key, description). Malloch, 1924b: 1 (description); Heed, 1956: 61 (distribution); Heed, 1957: 76 (distribution); Wheeler, 1970: 79.6 (affiliation).

Stegana (Steganina) nigrita Malloch: Wheeler, 1981: 31 (affiliation); Brake and Bächli, 2008: 298 (affiliation).

Type locality: Costa Rica, Province of Alajuela, Canton of San Mateo, Higuito.

Diagnosis. Generally blackish flies without distinct pleural bands. Surstylus trapezoid, double-walled, outer wall devoid of a row of prenisetae, innerly covered with tiny wart-shaped scales, scarcely setose in the lower region; inner wall brush-like, as it is densely covered in the anteromedial area with ca. 40 strong, curved, sharp-tipped setae. Aedeagus spherical, ca. 1/3 length of aedeagal apodeme, membranous except for two strongly sclerotized anterodorsal curved plates, covered dorsodistally and ventrodorsally with seta-like scales giving a serrate aspect to the margins; not coalescent to the aedeagal apodeme. Aedeagal apodeme long, curved, rod-shaped, anteriorly expanded dorsoventrally, almost three times as long as the aedeagus. Ventral rod submedianly (not distally) positioned, strongly sclerotized, conspicuously fan-shaped, distally very wide and linked to the pouched gonopods by membranous tissue. Outer and inner paraphyses unrecognizable.

Material examined (n = 22).



Figure 9 *Stegana nigrita* Malloch, 1924, labels of female holotype #24.

Holotype ♀ [#24], dissected, labeled: "Higuito / SanMateoCR [Costa Rica] // PabloSchild / coll // *Stegana / nigrita* / Type [handwritten] / Det. / J R Malloch [printed] // Type No. / 26684 [handwritten] / U.S.N.M. [red label] // USNMMENT / [QR code] / 01096615 [back side] // *Stegana / nigrita* Malloch / Bächli & Vilela det. 2017 // HOLOTYPE [red label] // ♀". (Figs. 9–12). Paratypes ♂♂ [#34–43; #37, dissected]: same data as holotype, except sex and QR code; collector label missing in some such as in #37. Non-type specimens ♂♂ [#48, #51, #52], ♀♀ [#44, #49, #50, #53–57]: labeled: "La Suiza de / Turrialba Jul / COSTA RICA / Pablo Schild // ALMelander / Collection / 1961 // USNMMENT / [QR Code] / 013... [back side] // #.."

Comments. Malloch (1924b) listed one male holotype and ten paratypes. Indeed, the type specimen series we received contains 11 specimens; one female labeled "type" and ten males labeled "paratype".

Redescription

♂. (n = 13). Head (Fig. 13) generally blackish. Frontal length 0.475 (0.39–0.51) mm; frontal index about 1.69 (1.35–1.92), top to bottom width ratio about 1.41 (1.24–1.54). Frontal triangle hardly visible, about 40% of frontal length; ocellar triangle prominent, about 35% of the frontal length. Orbital plates paler grayish, about 60% of frontal length, orbital setae arranged in a row, distance of or3 to or2 about 64% of or3 to or1, distance of or2 to or1 about 36% of or3 to or1, distance of or3 to or1 about 220% of or3 to vtm, or1 / or3 ratio about 1.03 (0.90–1.17), or2 / or1 ratio about 0.76 (0.63–0.86), vt index about 0.89 (0.79–0.95), postocellar setae about 24 (20–29) % of frontal length, ocellar setae about 69 (58–79) % of frontal length; vibrissal index about 0.41 (0.31–0.47). Face blackish. Carina indistinct, short, flat. Cheek linear, narrow, brownish, index about 17 (12–23). Eye roundish, with main axis almost vertical, index about 1.24 (1.14–1.35). Pedicel yellowish, dorsally blackish, flagellomere 1 blackish, length to width ratio about 1.76 (1.38–2.00). Arista has 5–7 dorsal, 5–7 ventral and about 6 small inner branches, plus a short terminal fork. Proboscis brownish. Palpus black, somewhat broader medially.

Thorax (Fig. 13) generally blackish, length about 1.35 (1.10–1.67) mm. Scutum with about 8 rows of acrostichal setae, one postpronotal seta; dc index about 0.44 (0.33–0.50). Scutellum slightly pointed, distance between apical scutellars about 75% of the apical to the basal one; basal ones divergent, apical ones crossed; scut index about 1.42 (1.25–1.65). Pleura (Fig. 13b) generally blackish but paler towards the lower margin, no distinct horizontal dark stripes visible, sterno index about 0.92 (0.85–1.00). Halter with black knob. Legs (Fig. 13a,b,d) generally blackish, knees and tips of tibiae paler, all tarsi yellowish.

Wing (Fig. 13) generally dark brown, somewhat paler towards the hind margin, m₃ apically slightly bent upwards, length 2.14 (1.82–2.45) mm, length to width ratio about 1.86 (1.54–2.07). Indices: C = 1.85 (1.70–2.00), ac = 9 (7–10), hb = 0.71 (0.64–0.80), 4C = 1.32 (1.17–1.46), 4v = 1.86 (1.59–2.08), 5x = 1.07 (0.89–1.29), M = 0.59 (0.50–0.69), prox. x = 0.99 (0.83–1.25).

Abdomen (Fig. 13d) shining blackish.

Terminalia (Figs. 14–16). Epandrium microtrichose (Fig. 14), with 17 (left) or 13 (right) upper and 12 (left) or 18 (right) lower setae; upper setae in two parallel curved rows adjacent to the posterior margin, setae of posterior row longer, lower setae scattered over the ventral region that is neither in a ventral lobe form nor covering the surstylus. Cercus (Fig. 14b,c) reduced to a narrow vertical stripe, setose, not microtrichose, without ventral lobe and anteriorly linked to epandrium by membranous tissue. Surstylus trapezoid-shaped in the lateral view (Fig. 14a), double-walled, outer wall covered with tiny wart-shaped scales and scarcely setose in the lower region, inner wall brush-like, densely covered in the anteromedial area with ca. 40 strong, curved, sharply-tipped setae (Fig. 14b,d), probably functioning as prenisetae which are absent on the inner margin; base of surstylus weakly linked to epandrium by membranous tissue. Decasternum (Fig. 14c) slightly sclerotized, strip shaped. Hypandrium sinuate in lateral view (Fig. 15a), triangular in anterior and posterior views, slightly wider than long, as long as the epandrium, anterior margin convex, posterior margin medially concave (Fig. 15b); posterior hypandrial process absent; dorsal arch sclerotized, distally sinuate in the anterior and posterior views, laterally perpendicular and widely fused to the posterior hypandrium arms, bearing a deep concavity (Fig. 15b), where well-developed surstyli rest, dorsodistally projected forwards as a half pear-shaped tube dorsally sheltering the aedeagus (Fig. 15a); gonopods fused to each other and the posterior margin of the hypandrium, perpendicular to the hypandrium, bare and concave as a shallow pouch (Fig. 15b) where the aedeagus rests. Aedeagus (Figs. 15, 16) relatively small, somewhat spherical, membranous except for two strongly sclerotized anterodorsal curved plates (probably inner paraphyses fused to the aedeagus), covered dorsodistally (Fig. 16a) and ventrodistally (Fig. 16e) with seta-like scales, which are dorsally shorter and ventrally longer giving a serrate aspect to the margins in the lateral view (Fig. 16c); base of aedeagus linked to the aedeagal apodeme by membranous tissue. Aedeagal apodeme (Figs. 15, 16) long, curved (Fig. 16c), rod-shaped, anteriorly expanded dorsoventrally (Fig. 16c), almost three times as long as the aedeagus. Ventral rod submedially (not distally) positioned, strongly sclerotized, crosswise flattened, conspicuously fan-shaped (Figs. 15b, 16), distally very wide and linked to the pouched-like gonopods by membranous tissue (Fig. 15b). Outer and inner paraphyses not recognizable, probably either lost or fused to the ventral rod and aedeagus, respectively.

♀. (n = 9). Differences compared to males: No obvious differences in external morphology (Figs. 10, 11). Measurements: Frontal length about 0.42 (0.32–0.46) mm, frontal index about 1.46 (1.19–1.63), top to bottom width ratio about 1.32 (1.21–1.50), or1 / or3 ratio about 1.08 (0.93–1.67), or2 / or1 ratio about 0.81 (0.60–0.93), postocellar setae about 30 (22–35) % of the frontal length, ocellar setae about 79 (70–85) % of the frontal length; vt index about 0.89 (0.79–1.00), vibrissal index



Figure 10 *Stegana nigrita* Malloch, 1924, female holotype #24, Higuito, San Mateo, Alajuela, Costa Rica [Type Number 26684, USNM], habitus, four views: a, oblique dorsal, b, left lateral, c, thorax and wings dorsal, d, abdomen dorsal. Scale bar = 1 mm.



Figure 11 *Stegana nigrita* Malloch, 1924, female holotype #24, Higuito, San Mateo, Alajuela, Costa Rica [Type Number 26684, USNM], habitus, three close-up views: a, head left lateral, b, head frontodorsal, c, left wing ventral. Scale bars = 1 mm; a and b, to the same scale.

about 0.37 (0.32–0.47), Cheek index about 17 (9–24). Eye index about 1.25 (1.18–1.38). Flagellomere 1 ratio about 1.74 (1.63–1.86).

Thorax length about 1.28 (0.79–1.60) mm; dc index about 0.44 (0.33–0.50), scut index about 1.42 (1.25–1.65), sterno index about 0.92 (0.85–1.00).

Wing length = 2.11 (1.64–2.45) mm. Indices: C index = 1.90 (1.78–2.19), ac = 8 (7–9), hb = 0.69 (0.61–0.77), 4C = 1.27 (1.17–1.42), 4v = 1.86 (1.67–2.00), 5x = 1.08 (0.89–1.20), M = 0.56 (0.47–0.67), prox. X = 1.01 (0.86–1.25).

Terminalia (n = 1) (Fig. 12). One pair of short cerci inserted beyond and between the epiproct and hypoproct. Oviscap valves absent, sternite

8 (egg guide of Laštovka and Máca, 1982) horizontally positioned, not protruding beyond the hypoproct, and somewhat rectangle-shaped; posterior margin with a deep V-shaped notch conspicuously bordered with 14 short, strongly sclerotized, sharply pointed, peg-shaped ovisensilla in addition to 16 similar ones, arranged somewhat in adjacent line. Spermathecal capsule bulbous, with a long-tailed appendage (Laštovka and Máca, 1982); height slightly shorter than sternite 8.

Distribution. Costa Rica (Provinces of Alajuela and Cartago)

Biology. Unknown.

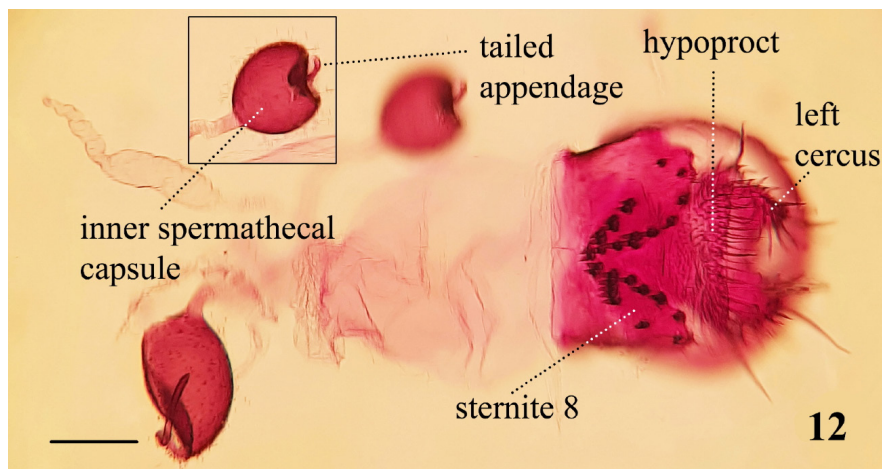


Figure 12 *Stegana nigrita* Malloch, 1924, female holotype #24, Higuito, San Mateo, Alajuela, Costa Rica [Type Number 26684, USNM], terminalia [inset = inner spermathecal capsule in focus], ventral view. Scale bar = 0.1 mm.



Figure 13 *Stegana nigrita* Malloch, 1924, male paratype #37, Higuito, San Mateo, Alajuela, Costa Rica [Type Number 26684, USNM], habitus, four views: a, oblique dorsal, b, left lateral, c, thorax and wings dorsal, d, abdomen dorsal. Scale bar = 1 mm.

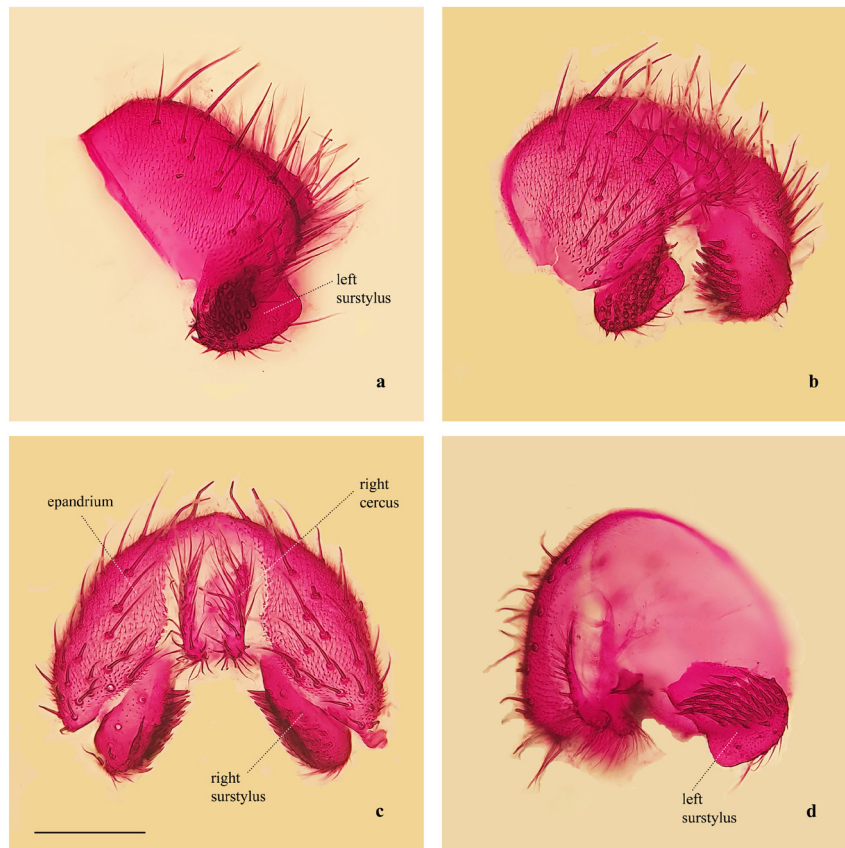


Figure 14 *Stegana nigrita* Malloch, 1924, male paratype #37, Higuito, San Mateo, Alajuela, Costa Rica [Type Number 26684, USNM], external terminalia, four views: a, epandrium, surstylus, and cercus, left lateral, b, epandrium, surstyli, and cerci, oblique posterior, c, idem, posterior, d, idem, anterior [left surstylus inner wall in focus]. Scale bar = 0.1 mm.



Figure 15 *Stegana nigrita* Malloch, 1924, male paratype #37, Higuito, San Mateo, Alajuela, Costa Rica [Type Number 26684, USNM], internal terminalia, four views: a, hypandrium, aedeagus, gonopod, and aedeagal apodeme, left lateral, b, hypandrium, aedeagus, fused gonopods [perpendicular to the hypandrium], and aedeagal apodeme, oblique posterior, c, idem, oblique ventral, d, idem, ventral. Scale bar = 0.1 mm.

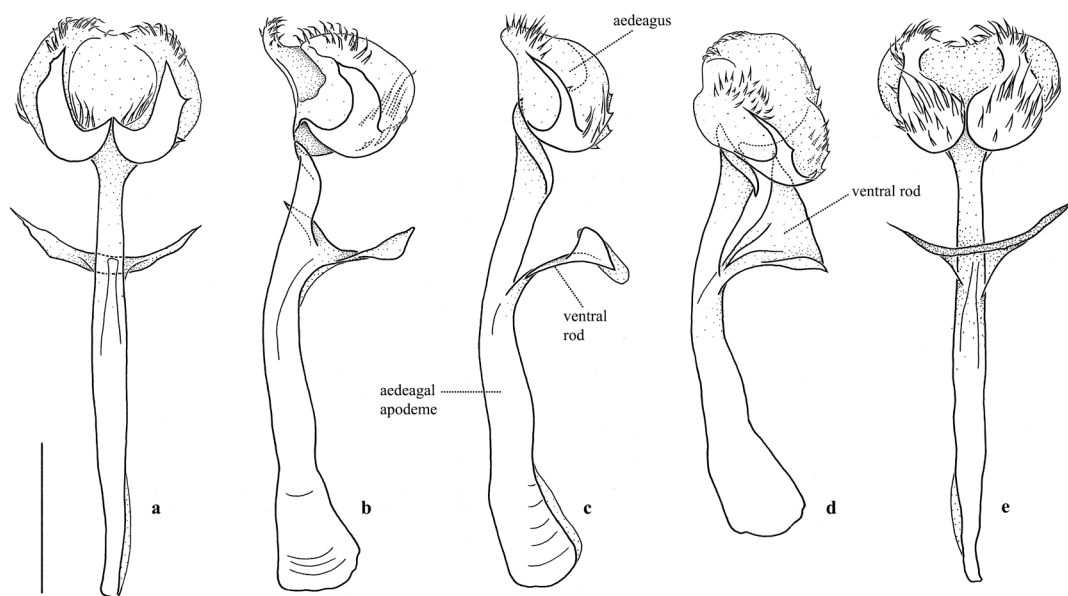


Figure 16 *Stegana nigrita* Malloch, 1924, male paratype #37, Higuito, San Mateo, Alajuela, Costa Rica [Type Number 26684, USNM], five views of the aedeagus, aedeagal apodeme, and ventral rod, from dorsal through ventral. Scale bar = 0.1 mm.

Stegana (Steganina) schildi Malloch, 1924

(Figs. 17–25)

Stegana schildi Malloch, 1924a: 99 (key, description); Malloch, 1924b: 5 (description); Heed, 1956: 3 (distribution); Heed, 1957: 76 (distribution); Wheeler, 1970: 79.7 (affiliation).

Stegana (Steganina) schildi Malloch: Wheeler, 1960: 110 (affiliation); Wheeler, 1981: 31 (affiliation); Brake and Bächli, 2008: 299 (affiliation).

Type locality: Costa Rica, Province of Alajuela, Canton of San Mateo, Higuito.

Diagnosis. Generally blackish flies. Front yellowish, with a conspicuous shining black, slightly prominent transverse stripe in the lower third. Pleura pale with an upper, distinct black band and a lower brownish band. Surstylus linked to the epandrium by membranous tissue, double-walled, outer wall not microtrichose, scarcely setose in the lower region, inner wall brush-like, with ca. 40 strong, curved, sharp-tipped setae; prenisetae reduced to two, blunt and widely spaced apart pegs. Hypandrium strongly sclerotized, anterior margin deeply concave, laterally projected anterad by narrow sclerotized lamellae, posterior margin slightly concave; posterior hypandrial process absent; dorsal arch strongly sclerotized; gonopods fused to each other and posterior margin of hypandrium, devoid of seta. Aedeagus spatulate, 1/2 length of aedeagal apodeme with which it is fused. Aedeagal apodeme rod-shaped, laterally sinuate in the dorsal and ventral views. Ventral rod tongue-shaped, strongly sclerotized, linked to the posterior margin of the hypandrium and outer paraphysis by membranous tissue. Outer paraphysis reduced, bearing one large and two tiny setulae, linked to the supposedly fused gonopods (posterior hypandrial margin) and the apicolateral margin of the ventral rod.

Material examined (n = 9)

Holotype ♀ [#21, dissected] labeled (Fig. 17): “Higuito / SanMateoCR [Costa Rica] / PabloSchild / coll // *Stegana / schildi* / Type [handwritten] / Det. / J R Malloch [printed] // Type No. / 26674 [handwritten] / U.S.N.M. [red label] // USNMMENT / [QR Code] / 01097758 [back side] // *Stegana / schildi* Malloch / Bächli & Vilela det. 2017 // HOLOTYPE [red label] // ♀”. Paratypes ♀♀ [#13–18; dissected: #13, #16, #17]: same data as holotype, except Type and QR code labels. Non-type specimen ♂ [#20, dissected] labeled: “Cano Saddle [apparently a dike] / Gatun L. [Lake (artificial, huge), part of Panama Canal Zone formed by the Gatun Dam in Chagres river], Pan [Panama] / RCS Shannon / V.13.1923 [handwritten]



Figure 17 *Stegana schildi* Malloch, 1924, labels of female holotype #21.

// *Stegana / schildi* Mall. [handwritten] / Det / J R Malloch // USNMMENT [QR Code] / 01372797 [back side] // *Stegana / schildi* Malloch / Bächli & Vilela det. 2017 // ♂; ♀ [#19] labeled: “COSTA RICA / La Suiza [de Turrialba] / April 1922 / Pab. [Pablo] Schild coll. // ALMelander / Collection / 1961 [green right half] // *Stegana / schildi* / Mall [handwritten] // USNMMENT [QR code] 01372796 [back side] // ♀”.

Comments. Malloch (1924b) listed one male type [holotype], one allotype [female] and five paratypes. However, the type specimen series we have received contains seven female specimens (1 ♀ labeled type [holotype] plus 6 ♀♀ labeled paratype).

Redescription

♂. (n = 1). Head. Frons (Fig. 22) glossy, yellowish with a more or less darkened spot around the ocellar triangle, with a conspicuous



Figure 18 *Stegana schildi* Malloch, 1924, female holotype #21, Higuito, San Mateo, Alajuela, Costa Rica [Type Number 26674, USNM], habitus, four views: a, oblique dorsal, b, left lateral, c, head, thorax and wings dorsal, d, abdomen dorsal. Scale bar = 1 mm.



Figure 19 *Stegana schildi* Malloch, 1924, female holotype #21, Higuito, San Mateo, Alajuela, Costa Rica [Type Number 26674, USNM], habitus, two close-up views: a, head dorsal, b, tip of left wing ventral [optically cut anteroventrally]. Scale bar = 1 mm.

shining black, slightly prominent transverse stripe in the lower third, the upper margin medially narrowed. Frontal length 0.61 mm; frontal index about 1.33, top to bottom width ratio about 1.22, frontal triangle

hardly visible, about 40% of the frontal length; ocellar triangle black, prominent, about 25% of the frontal length. Orbital plates about 60–65% of the frontal length. Orbital setae almost arranged in a line, distance

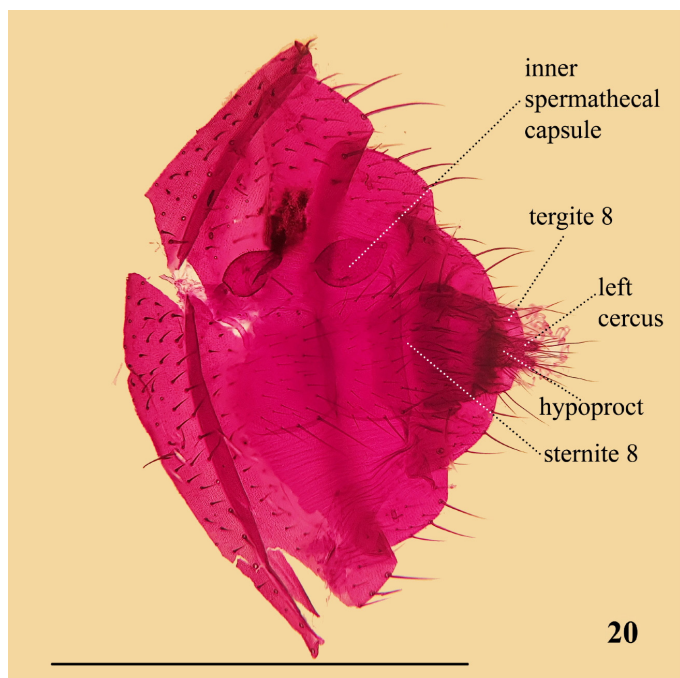


Figure 20 *Stegana schildi* Malloch, 1924, female holotype #21, Higuito, San Mateo, Alajuela, Costa Rica [Type Number 26674, USNM], distal abdomen, ventral [ventral receptacle partially extruded]. Scale bar = 1 mm.

of or3 to or2 about 57% of or3 to or1, distance of or2 to or1 about 43% of or3 to or1, distance of or3 to or1 about 200% of or3 to vtm, vt index about 0.83, ocellar setae about 50% of frontal length; vibrissal index about 0.32. Face black in about upper half, white below. Carina narrow, prominent in the upper half of the face. Cheek white, broad, index about 6. Eye oblong, main axis distinctly oblique, index about 1.38. Occiput black in upper 5/6, white below. Pedicel yellowish. Flagellomere 1 slightly narrowed apically, black, with a narrow yellowish base and a length-to-width ratio of about 2.22. Arista with 10 dorsal, 7 ventral and about 7 rather long inner branches, plus a short terminal fork. Proboscis and palpus yellowish.

Thorax length about 2.28 mm. Scutum (Fig. 21) predominantly slightly microtrichose, brownish, paler on the frontal margin, with a paler median and a lateral stripe outside the dc lines, each preceded by a small somewhat circular pale spot; about 8 rows of acrostichal setae. One postpronotal seta: dc index about 0.39. Scutellum somewhat longish, apically slightly pointed, with a pale median stripe, scutellar setae nearly equidistant, lateral ones diverging, apical ones crossed, scut index about 1.85. Pleura (Fig. 21a, b) yellowish, with a broad, black stripe in upper third and a diffuse dark stripe or spot in the upper half of the katepisternum, sterno index about 0.86. Haltere with a yellow knob. Legs (Fig. 21a,b,d) generally yellowish; fe1 with a dorso-apical dark spot, midleg brownish, with fe2 basally and apically yellowish and ti2 yellowish in the apical fourth, hindleg as midleg, but paler; preapical and ventral apical setae on ti2.



Figure 21 *Stegana schildi* Malloch, 1924, non-type male #20, Cano Saddle, Gatun L., Panama, [13.V.1923, R.C. Shannon coll., J.R. Malloch det., USNM], habitus, four views: a, oblique dorsal, b, right lateral, c, thorax dorsal, d, abdomen dorsal. Scale bar = 1 mm.



Figure 22 *Stegana schildi* Malloch, 1924, non-type male #20, Cano Saddle, Gatun L., Panama, [13.V.1923, R.C. Shannon coll., J.R. Malloch det., USNM], habitus, two close-up views: a, head left lateral, b, head dorsal. Scale bar = 1 mm.

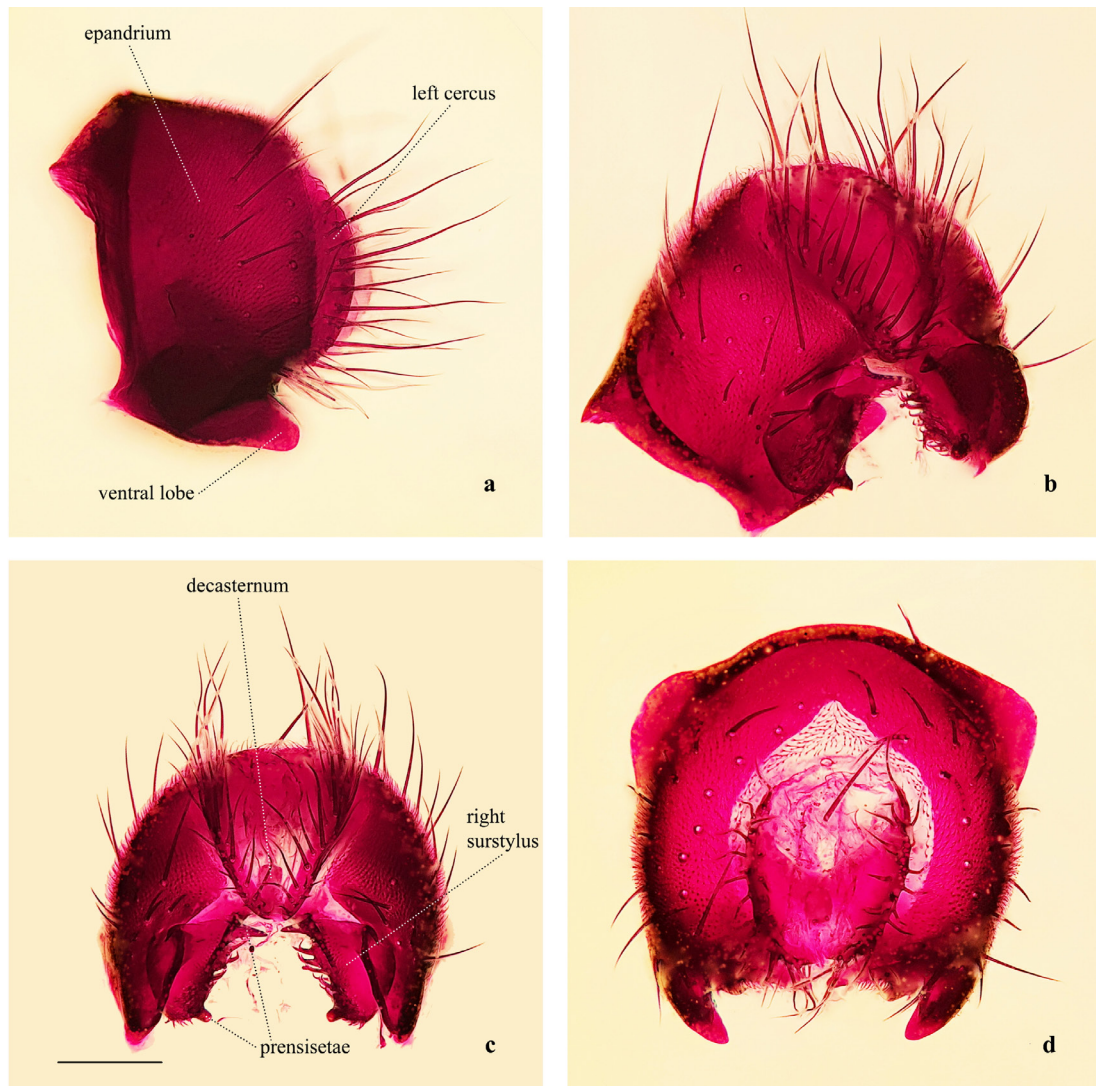


Figure 23 *Stegana schildi* Malloch, 1924, non-type male #20, Cano Saddle, Gatun L., Panama, [13.V.1923, R.C. Shannon coll., J.R. Malloch det., USNM], external terminalia, four views: a, epandrium, surstylus, and cercus, left lateral, b, epandrium, surstyli, and cerci, oblique posterior, c, idem, ventroposterior, d, idem, posterior. Scale bar = 0.1 mm.

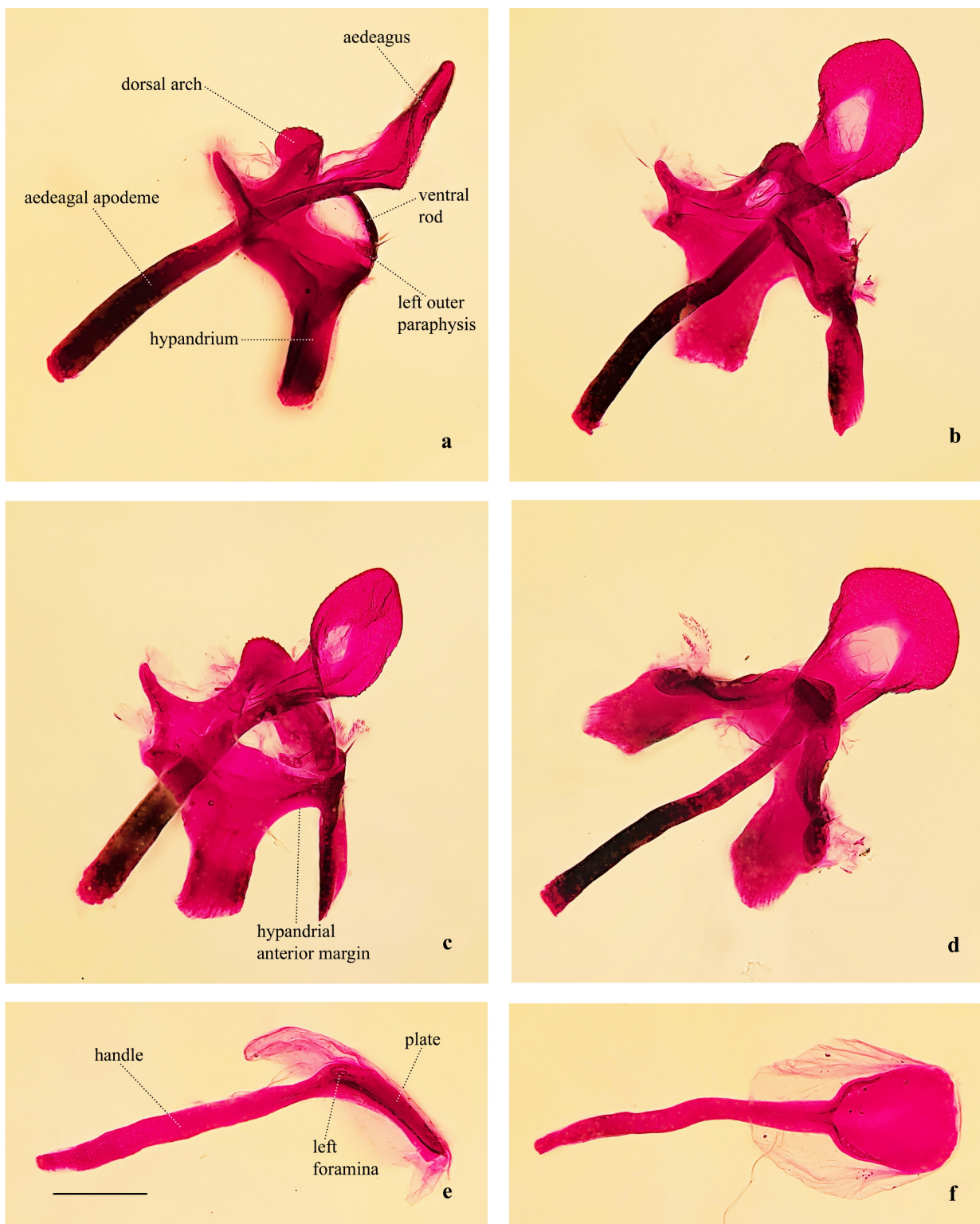


Figure 24 *Stegana schildi* Malloch, 1924, non-type male #20, Cano Saddle, Gatun L., Panama, [13.V.1923, R.C. Shannon coll., J.R. Malloch det., USNM], inner terminalia, several views: a, hypandrium+gonopod, aedeagus+aedeagal apodeme, ventral rod, and left outer paraphysis, left lateral, b, idem, oblique anterior, c, idem, plus right paraphysis, oblique posterior, d, hypandrium+gonopods, and aedeagus+aedeagal apodeme, dorsal, e, ejaculatory apodeme left lateral, f, idem, posterior. Scale bar = 0.1 mm.

Wing (Fig. 21c,d) apically pointed, generally dark brown, paler along the hind margin, costa apically with 9–11 warts below, r_{2+3} apically bent towards the costa, both crossveins with a small shadow, m_3 somewhat sigmoid, length 3.29 mm, length to width ratio about 2.09. Indices: C = 1.93, hb = 0.85, 4C = 1.29, 4v = 1.81, 5x = 1.00, M = 0.48, prox. x = 1.05.

Abdomen (Fig. 21d) glossy, dark brown, tergites with a diffuse blackish hind margin.

Terminalia (Figs. 23–25). Epandrium microtrichose and setose, except for the anterior region and ventral lobe, with ca. 20 upper and no lower setae; ventral lobe (Fig. 23a) bare, projected inwards, mostly

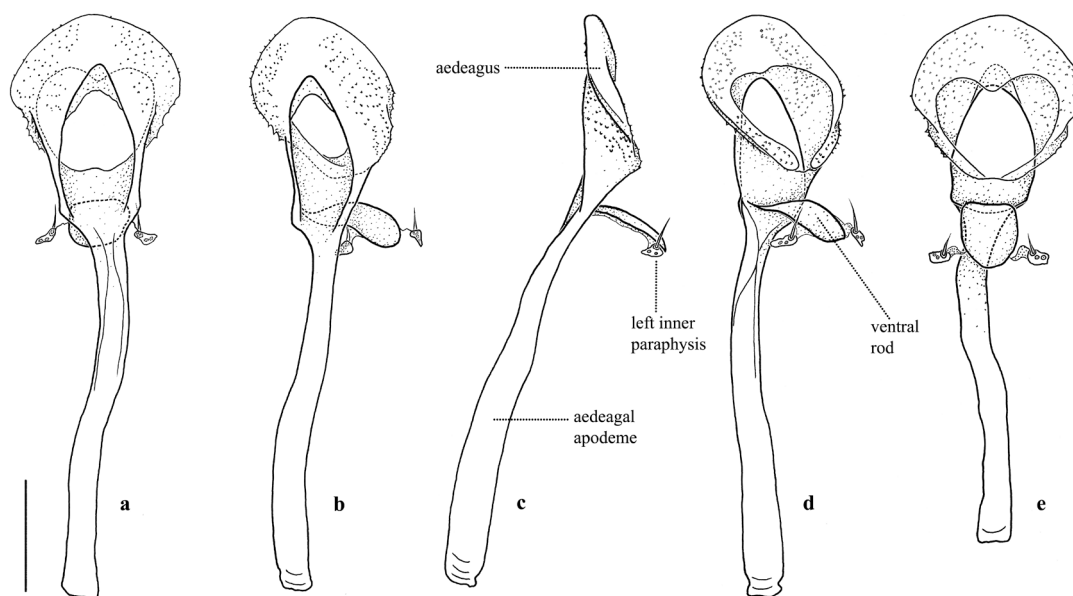


Figure 25 *Stegana schildi* Malloch, 1924, non-type male #20, Cano Saddle, Gatun L., Panama, [13.V.1923, R.C. Shannon coll., J.R. Malloch det., USNM], five views of the aedeagus+aedeagal apodeme, ventral rod, and outer paraphyses, from dorsal through ventral. Scale bar = 0.1 mm.

covering the surstylus. Cercus reduced to a narrow vertical stripe, setose, not microtrichose, without a ventral lobe and anteriorly linked to the epandrium by membranous tissue. Surstylus basally narrow, distally wide, curved inwards, ventromarginally bearing a row of small curved setae, double-walled, outer wall not microtrichose, scarcely setose in the lower region, inner wall like a brush, densely covered in the posteromedial area with ca. 40 strong, curved, sharply-tipped setae, probably supporting the function of prensisetae, which are scarce (just two, widely separated, upper one sharp, lower one blunt; Fig. 23c) on the inner margin of the surstylus, base of surstylus linked to the epandrium by membranous tissue. Decasternum medianly projected posterad, distolaterally bifid, distoventrally fused to the surstylus' inner wall. Hypandrium strongly sclerotized, slightly wider than long and shorter than the epandrium, anterior margin deeply concave, laterally projected anterad like two somewhat squared table legs, lateral margin sinuate in the lateral view, bench-shaped in the anterior and posterior views, posterior margin slightly concave; posterior hypandrial process absent; dorsal arch strongly sclerotized, V-shaped and sinuate in the dorsal view, perpendicular and laterally fused to the hypandrium arms, dorsodistally slightly projected forwards and marginally serrate in the lateral view; gonopods fused to each other and to posterior margin of the hypandrium, devoid of seta. Aedeagus (Figs. 24, 25) dorsoventrally flattened, spatulate, bare, ca. 1/2 length of the aedeagal apodeme, and fused to each other. Aedeagal apodeme, curved, rod-shaped, anteriorly expanded dorsoventrally, twice as long as the aedeagus. Ventral rod strongly sclerotized, tongue-shaped, anteroposteriorly flattened, curved in the lateral view, linked to the posterior margin of the hypandrium and outer paraphysis by membranous tissue. Outer paraphysis reduced, bearing one large and two tiny setulae, linked to the supposedly fused gonopods (posterior hypandrial margin) and apicolateral margin of the ventral rod. Ejaculatory apodeme (Fig. 24e,f) strongly sclerotized and somewhat similar to the aedeagus in the lateral view (Fig. 24e), plate ca. 43% of the handle length, and handle ca. 67% of the aedeagus+aedeagal apodeme length (Fig. 24a), the inner angle between the handle and plate > 90°; plate trapezoid-shaped in the posterior view (Fig. 24f).

♀. (n = 8). Differences compared to males: No obvious differences in external morphology (Figs. 18, 19). Measurements: Frontal length about 0.54 (0.47–0.65) mm. Frontal index about 1.27 (1.19–1.46), top

to bottom width ratio about 1.20 (1.16–1.27), or1 / or3 ratio about 0.98 (0.85–1.14), or2 / or1 ratio about 0.71 (0.61–0.76), postocellar setae about 28 (21–34) % of the frontal length, ocellar setae about 44 (41–53) % of the frontal length, vt index about 0.92 (0.78–1.00), vibrissal index about 0.32 (0.28–0.35). Cheek index about 5 (4–7). Eye index about 1.32 (1.24–1.41). Flagellomere 1 ratio about 1.91 (1.60–2.14).

Thorax length about 1.86 (1.56–2.04) mm, dc index about 0.42 (0.39–0.46), scut index about 1.66 (1.08–2.06), sterno index about 0.86 (0.71–0.95).

Wing length 2.80 (2.38–3.22) mm, length to width ratio about 1.95 (1.79–2.09). Indices: C = 1.91 (1.78–2.04), hb = 0.81 (0.74–0.88), 4C = 1.23 (1.10–1.33), 4v = 1.74 (1.62–1.89), 5x = 0.94 (0.89–1.00), M = 0.46 (0.42–0.50), prox. X = 0.98 (0.88–1.17).

Terminalia (n = 1) (Fig. 20). One pair of finger-shaped cerci inserted beyond and between the epiproct and hypoproct. Oviscapt valves absent, sternite 8 (egg guide of Laštovka and Máca, 1982) horizontally positioned, somewhat trapezoid-shaped, with a straight posterior margin not protruding beyond the hypoproct. It does not bear peg-shaped ovisensilla, and its size and trichoid ovisensilla are similar to the setae of the preceding rectangle-shaped sternites. Inner spermathecal capsule bulbous, with a tailed appendage (Laštovka and Máca, 1982) as long as sternite 8.

Distribution. Costa Rica (Provinces of Alajuela and Cartago), Panama (Canal Zone) [new record].

Biology. Unknown.

Stegana (Steganina) tempifera Malloch, 1924

(Figs. 26–31)

Stegana tempifera Malloch, 1924a: 98 (key, description), Malloch, 1924b: 3 (description); Heed, 1956: 61 (distribution); Heed, 1957: 76 (distribution); Wheeler, 1970: 79.7 (affiliation).

Stegana (Steganina) tempifera Malloch: Wheeler, 1981: 31 (affiliation); Brake and Bächli, 2008: 300 (affiliation).

Type locality: Costa Rica, Province of Alajuela, Canton of San Mateo, Higuito.

Diagnosis. Generally brownish flies. Front pale with one large upper and one smaller lower black, medially joining triangles that form an



Figure 26 *Stegana tempifera* Malloch, 1924, labels of male holotype #23.

hourglass-shaped design. Pleura pale with two distinct black bands. Surstylus trapezoid, bearing two blunt prensisetae (one dorsal and one ventral), double-walled, inner wall densely covered in the anteromedial area with ca. 40 strong, curved, and sharp-tipped setae. Dorsal arch sclerotized, laterally perpendicular and widely fused to the posterior hypandrium arms, dorsodistally strongly projected forward as a half pear-shaped tube dorsally sheltering the aedeagus. Gonopods proximally fused to each other, with each side apparently bearing one tiny setula on a conspicuous conical-shaped tip. Aedeagus ca. 1/2 length of the aedeagal apodeme, distally covered with seta-like scales, anterior ones short and posteromarginal ones conspicuously long, sharply pointed, distally 3- or 4-branched (longest ones), and fringe-shaped; base of aedeagus linked to the aedeagal apodeme by membranous tissue.

Material examined (n = 6).

Holotype ♂ [#23], dissected, labeled (Fig. 26): "Higuito / SanMateoCR [Costa Rica] // PabloSchild / coll // *Stegana / tempifera* / Type [handwritten] / Det. / J R Malloch [printed] // Type No. / 26680 [handwritten] / U.S.N.M. [red label] // USNMENT / [QR code] / 01384614 [back side] // *Stegana / tempifera* Malloch / Bächli & Vilela det. 2017 // HOLOTYPE [red label] // ♂". Paratypes: ♂♂ [#31, #32], ♀♀ [#29, #30]: same data as holotype, except Type status and QR code labels. Non-type specimen ♀ [#33]: labeled: "... // *Stegana / tempifera* / Mall // ALMelander / collection / 1961 [green right half] // USNMENT [QR code] / [back side] // [#33].



Figure 27 *Stegana tempifera* Malloch, 1924, male holotype #23, Higuito, San Mateo, Alajuela, Costa Rica [Type Number 26680, USNM], habitus, two views: a, oblique dorsal, b, left lateral, c, thorax and wings dorsal, d, abdomen dorsal. Scale bar = 1 mm.



Figure 28 *Stegana tempifera* Malloch, 1924, male holotype #23, Higuito, San Mateo, Alajuela, Costa Rica [Type Number 26680, USNM], habitus, three close-up views: a, head dorsal, b, terminalia posterior, c, right wing dorsal. Scale bars = 1 mm.

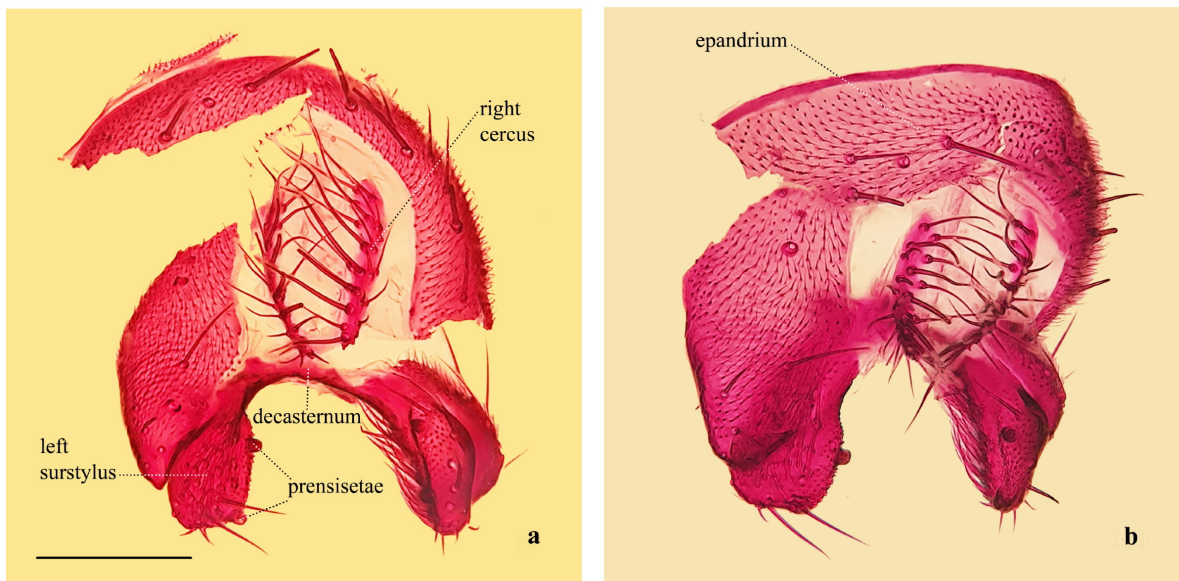


Figure 29 *Stegana tempifera* Malloch, 1924, male holotype #23, Higuito, San Mateo, Alajuela, Costa Rica [Type Number 26680, USNM], external terminalia, two views: a, epandrium [accidentally broken during dissection], surstyli, and cerci, posterior, b, idem, oblique posterior. Scale bar = 0.1 mm.

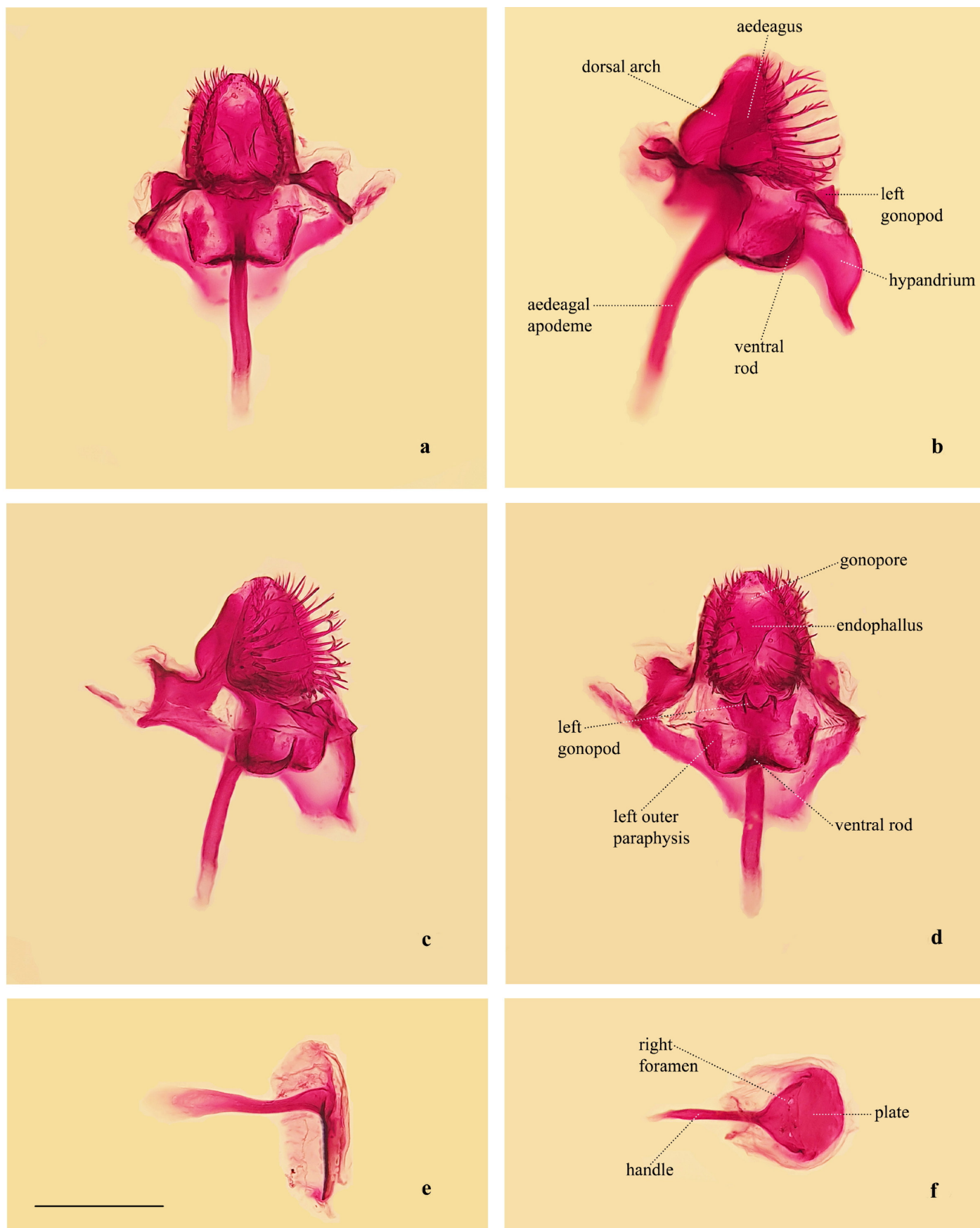


Figure 30 *Stegana tempifera* Malloch, 1924, male holotype #23, Higuito, San Mateo, Alajuela, Costa Rica [Type Number 26680, USNM], inner terminalia, several views: a, hypandrium+gonopod, aedeagus, aedeagal apodeme, ventral rod, and outer paraphyses, anterior (dorsal), b, idem, left lateral, c, idem, oblique posterior, d, idem, posterior (ventral), e, ejaculatory apodeme left lateral, f, idem, posterior. Scale bar = 0.1 mm.

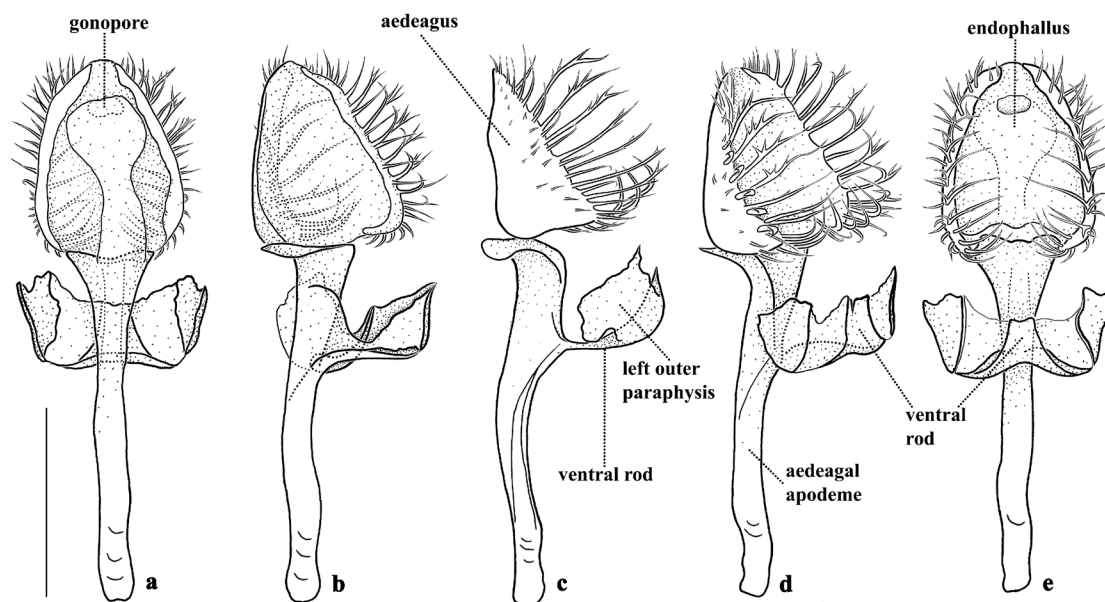


Figure 31 *Stegana tempifera* Malloch, 1924, male holotype #23, Higuito, San Mateo, Alajuela, Costa Rica [Type Number 26680, USNM], five views of the aedeagus, aedeagal apodeme, ventral rod, and outer paraphyses, from dorsal through ventral. Scale bar = 0.1 mm.

Comments. Malloch (1924b) listed one male holotype and four paratypes. Indeed, the type specimen series we have received contains five specimens (3 ♂♂ [holotype and 2 paratypes] plus 2 ♀♀ paratypes).

The external description is based on the five type specimens and one non-type specimen (#33).

Redescription

♂. (n = 3). Head generally yellowish. Frons (Figs. 27a,c, 28a) glossy, with a large brownish spot just above the antenna, medially connected with the brownish frontal triangle, somewhat looking like an hourglass (Fig. 28a). Frontal length 0.41 (0.39–0.43) mm. Frontal index about 1.68 (1.61–1.75), top to bottom width ratio about 1.44 (1.39–1.50). Frontal triangle apically pointed, about 50% of the frontal length; ocellar triangle prominent, black, about 45% of the frontal length. Orbital plates slightly paler, about 60% of the frontal length. Orbital setae arranged in a row, distance of or3 to or2 about 55% of or3 to or1, distance of or2 to or1 about 45% of or3 to or1, distance of or3 to or1 about 220% of or3 to vtm, or1 / or3 ratio about 1.27 (1.25–1.29), or2 / or1 ratio about 0.67 (0.61–0.73), vt index about 0.92 (0.78–1.07), postocellar setae about 35 (32–37) % of frontal length, ocellar setae about 61 (57–63) % of the frontal length; vibrissal index about 0.25. Face brownish, with a yellowish median cross-band. Carina narrow, about 1/4 the face length. Cheek pale yellowish, narrow, index about 13 (12–13). Eye roundish, main axis almost vertical, index about 1.08 (1.06–1.11). Pedicel yellow, with a dark spot above. Flagellomere 1 yellow, with brownish margin, length to width ratio about 1.92 (1.75–2.14). Arista has 7 dorsal, 5–6 ventral and about 6 small inner branches, plus a terminal fork. Proboscis yellowish, palpus blackish.

Thorax (Fig. 27) length about 1.45 (1.42–1.50) mm. Scutum brownish, frontal margin paler, about 8 rows of acrostichal setae. Transverse distance of the dorsocentral setae six times the longitudinal distance; dc index about 0.47 (0.45–0.48). Scutellum slightly pointed apically, scut index about 1.52 (1.48–1.57), distance between the apical scutellars about 80% of the apical to the basal one; basal ones divergent. Pleura (Fig. 27b) pale yellowish, with a black stripe in the upper 1/3 and a dark brown stripe in the upper 1/3 of the katepisternum, the stripe reaching the base of the abdomen, sterno index about 0.86 (0.82–0.90). Haltere yellow, legs generally yellowish, fe1 basally and apically brownish,

ti1 with a median brownish ring, mid and hind legs with fe2 and fe3 predominantly brownish, ti2 and ti3 with dark median bands.

Wing (Fig. 28c) apically pointed, generally brownish, with paler hind margin, m₃ almost straight but slightly bent upwards towards the tip, both crossveins shadowed, length = 2.38 (2.17–2.52) mm, length to width ratio about 2.05 (1.97–2.18). Indices: C = 1.96 (1.81–2.18), ac about 9 (8–10), hb = 0.73 (0.71–0.76), 4C = 1.23 (1.06–1.38), 4v = 1.78 (1.63–2.00), 5x = 0.97 (0.78–1.13), M = 0.50 (0.44–0.54), prox. x = 0.92 (0.81–1.08).

Abdomen (Fig. 27b,d) predominantly dark brown.

Terminalia (n = 1) (Figs. 29–31). Epandrium uniformly microtrichose, longer than the hypandrium, with 5 (left) or 8 (right) upper and 6 (left) or 5 (right) lower setae; upper setae in two parallel curved rows adjacent to the posterior margin, setae of the posterior row longer, lower setae scattered over the ventral region that is neither in a ventral lobe form nor covering the surstylus. Cercus (Fig. 29) reduced to a narrow vertical stripe, setose (setae mostly waved and remarkably long), not microtrichose, without a ventral lobe and anteriorly linked to the epandrium by membranous tissue. Surstylus trapezoid in lateral view (Fig. 29b), double-walled, outer wall covered with tiny wart-shaped scales (seen in the left surstyli of Fig. 29a,b), bearing a row of setae adjacent to the inner margin; inner wall like a brush, densely covered in the anteromedial area with ca. 40 strong, curved, sharply-tipped setae (seen in the right surstyli of Fig. 29a,b), and only two blunt prensisetae (one dorsal and one ventral, Fig. 29a,b); base of surstylus weakly linked to the epandrium by membranous tissue. Decasternum as in Fig. 29a,b. Hypandrium sinuate in the lateral view, triangular in the anterior and posterior views, slightly longer than wide, shorter than the epandrium, anterior margin convex, posterior margin concave; posterior hypandrial process absent; dorsal arch sclerotized, distally sinuate in the anterior and posterior views, laterally perpendicular and widely fused to the posterior hypandrium arms and slightly concave, dorsodistally strongly projected forwards as a half pear-shaped tube (lateral view) dorsally sheltering the aedeagus; gonopods proximally fused to each other, anterolaterally linked to the outer paraphysis by membranous tissue, perpendicular to and membranously linked to the medioposterior margin of the hypandrium, each gonopod bearing one tiny setula on a conspicuous conical-shaped tip. Aedeagus (Figs. 30a–d, 31) relatively small (ca. 1/2 length of the aedeagal apodeme), triangular in the lateral view, elliptical in the dorsal and ventral views, distally covered with seta-

like scales, anterior ones short and posteromarginal ones conspicuously long, sharply pointed, distally 3- or 4-branched (longest ones), and fringe-shaped; linked to the aedeagal apodeme by membranous tissue. Aedeagal apodeme curved, rod-shaped, distally expanded laterally. Ventral rod sclerotized, anteroposteriorly flattened, bowl-shaped, laterally flanked by the outer paraphyses, linked to the sclerite composed of fused gonopods by membranous tissue. Outer paraphyses proximally membranous, slightly sclerotized distally, devoid of setae, and linked to the ventral rod by membranous tissue; inner paraphyses not recognizable (probably absent or fused to each other as a shelter, dorsally embracing the aedeagus). Ejaculatory apodeme (Fig. 30e,f) strongly sclerotized, somewhat similar in profile to the generalized *tripunctata* type of genus *Drosophila* of Throckmorton (1962: 242, fig. 19.34); in the lateral view (Fig. 30e), plate 54% of the handle length, and the handle 74% of the aedeagal apodeme length (Fig. 30b), inner angle (Fig. 30e) between the handle and plate ca. 90°; plate spatulate, as long as wide, in the posterior view (Fig. 30f).

♀. (n = 3). Differences compared to males: No obvious differences in external morphology. Measurements: Frontal length about 0.44 (0.40–0.46) mm, frontal index about 1.45 (1.42–1.50), top to bottom width ratio about 1.36 (1.32–1.44), or1 / or3 ratio about 1.30 (1.06–1.50), or2 / or1 ratio about 0.59 (0.50–0.65), postocellar setae about 38 (35–42) % of the frontal length, ocellar setae about 65 (59–69) % of the frontal length; vt index about 0.83 (0.78–0.88); vibrissal index about 0.34 (0.27–0.42). Cheek index about 10 (9–11). Eye index about 1.07 (1.06–1.09).

Thorax length about 1.43 (1.36–1.48) mm, dc index about 0.44 (0.42–0.46), scut index about 1.40 (1.38–1.42), sterno index about 0.89 (0.77–1.00).

Wing length 2.30 (2.24–2.41) mm, length to width ratio about 1.90 (1.83–2.00). Indices: C = 1.81 (1.76–1.85), hb = 0.76 (0.71–0.81), 4C = 1.32 (1.24–1.40), 4v = 1.84 (1.65–2.00) 5x = 1.14 (1.00–1.29), M = 0.58 (0.53–0.60), prox. X = 0.90 (0.82–0.93).

Terminalia. Not analyzed.

Distribution. Costa Rica (Province of Cartago).

Biology. Unknown.

Comments. All specimens are partially covered with mold, and many setae are missing or broken. It seems that the epithet *tempifera* stands for the large hourglass-shaped dark spot of the frons. According to Malloch (1924b), this character also occurs in *Stegana interrupta* Malloch 1924a collected from the same locality and in *Stegana horae* Williston, 1896, from Saint Vincent Island (Caribbean Sea).

Final comments

Almost all *Stegana* species are arranged in subgenera. The four species studied certainly do not belong to the subgenus *Stegana*. They are traditionally held in the subgenus *Steganina*, and we follow this arrangement unless we have got arguments for another decision.

Concerning wing shape, in dried specimens, the natural, roof-like wing position is usually not retained. Instead, the wings are creased across their basal fifth. However, in all such cases, we assumed that the natural position was roof-like. It is plausible that the typical roof-like position of the wings is related to behavioral aspects since these flies can fly but are usually fast jumping whenever disturbed, as previously mentioned by Okada (1956).

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Conflicts of interest

The authors declare no conflicts of interest.

Author's contributions

GB, CRV conceived and designed the study; GB intermediated the facilities offered by the Universität Zürich-Irchel, requested the specimens, and made the external morphology descriptions; CRV took the photomicrographs, stacked the images, dissected the flies, prepared the microscope slides, and made the internal morphology descriptions. Both authors wrote the manuscript and approved the final version.

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