Three New Brazilian Species of Chrysopodes (Neuroptera: Chrysopidae)

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ABSTRACT We describe three new species of Chrysopodes (Chrysopodes) that were collected in agricultural or disturbed habitats in Brazil. Each species has a suite of distinguishing external characters, but to confirm identifications it is essential to examine the genital features (male or female). These three new species bring the total number of described Chrysopodes species to 47.

RESUMO São descritas três novas espécies de Chrysopodes (Chrysopodes) que foram coletadas em habitats agrícolas ou alterados no Brasil. Cada espécie apresenta um conjunto de características externas distintivas, mas para confirmar sua identificação é essencial examinar os caracteres genitais (macho ou fêmea). Com essas três novas espécies, o número total de espécies de Chrysopodes descritas é de 47.

KEY WORDS Chrysopodes, adult, Brazil, agricultural habitat, disturbed habitat

The green lacewing genus Chrysopodes Navás 1913 is a relatively large, taxonomically complicated group of neotropical chrysopines. Currently, it consists of two subgenera—C. (Chrysopodes) and C. (Neosuarius) (Adams and Penny 1985, Brooks and Barnard 1990). The smaller of the two, C. (Neosuarius) with 10 species, was recently revised (Tauber 2010); the other, C. (Chrysopodes), is currently under revision (C.A.T., unpublished data). Here, before the up-coming revision, we describe three new species of C. (Chrysopodes) from Brazil. All three of these species were collected in or very near agricultural settings. Thus, their descriptions add to the large number of lacewing species reported from Brazilian agroecosystems (see Freitas and Penny 2001). The number of described Chrysopodes species now totals 47.

The three species described here share the essential characteristic that has been used to distinguish the subgenus Chrysopodes from Neosuarius: mandibles that are sickle shaped, as opposed to the stouter, more molar-like mandibles of Neosuarius (Adams and Penny 1985, Brooks and Barnard 1990, Tauber 2010). Two of the species [C. (C.) fosteri and C. (C.) serrabonitensis] also express the C. (Chrysopodes)-like features of a pitted vertex, forewings with relatively tall costal cells (height >0.2× the maximum width of forewing), and fumate markings on the forewing membrane.

Materials and Methods

Procedures and Terminology. The procedures and terminology are identical to those used for the revision of Chrysopodes (Neosuarius) (Tauber 2010). Readers may refer to the explanatory material (pp. 3–11) and illustrations (Figs. 1–10) in that publication (freely available online http://www.pensoft.net/journals/zookeys/article/387/abstract).

Species Examined. The descriptions here are based on both field-collected and laboratory-reared specimens, as indicated for each species. All measurements are based on 3–4 specimens, except where stated otherwise. The holotypes and paratypes for all three species are in the Coleção Entomológica Pe. Jesus Santiago Moure, Universidade Federal do Paraná, Curitiba (DZUP). Additional paratypes and nontype material are deposited in the insect collection at the Universidade Estadual do Norte Fluminense (UENF), the Essig Museum of Entomology, University of California, Berkeley (UCB), and the United States National History Museum, Washington, DC (USNM). C.A. Tauber and G. S. Albuquerque are the authors of the species names.

Chrysopodes (Chrysopodes) serrabonitensis Tauber & Albuquerque, sp. nov. (Figs. 1–8)

Type Material. The holotype (♂) is in the Coleção Entomológica Pe. Jesus Santiago Moure, Universidade...
Fig. 1. Chrysopodes (C.) serrabonitensis (mature, field collected specimens). Top row: head, frontal; bottom row: head and prothorax, dorsal. (A, C: RJ, Madalena, Terras Frias; B, D: BA, Camacan.) (Online figure in color.)

Like the adults of numerous other Chrysopodes (Chrysopodes) species, C. (C.) serrabonitensis adults are characterized by their intermediate size, white face, red genal markings, pitted vertex, mostly green venation, and light fumose markings on the membrane surrounding the gradates, subcostal and radial crossveins, veins below PsM, and the bases of the posterior (but not distal) terminal veinlets. Their male and female genitalia are distinctive, and should be examined for accurate identification. In the male, the gonarcal apodemes are rounded; the gonarcal bridge is robust and curved; the mediuncus is almost as long as the gonarcal apodemes and is curved...
throughout. In the female, the spermatheca is distinctively shaped and has a broad invagination; the bursal duct is long and composed of two sections (a flat, ribbon-like basal section and a clear, tubular distal section) with an elongate, setose connection between them.

This species keys to couplet seven in the “Key to the species of Chrysopodes of Brazilian agro-ecosystems” (Freitas and Penny 2001, p. 270); it lacks dark mesonotal and metanotal spots and red semicircular marks below the antennae; its genae are entirely red, and the clypeus and labrum are pale mesally, amber to brown laterally. However, it differs from Chrysopodes (Neosuarius) karinae Freitas & Penny and Chrysopodes (C. crocinus Freitas & Penny in couplet 7; specifically, C. (C.) serrabonitensis adults have pale flagella, fumose markings around the gradate and other crossveins of the forewing, and distinctive male and female terminalia.

Description. Head. 1.3–1.4 mm wide (including eyes); ratio of head width to eye width = 2.5–2.6 : 1. Vertex raised, with very pitted surface, prominent, rounded posterior fold, surface without small setae. Antenna 10.0–11.8 mm long (0.75 times length of forewing); scape longer than broad (0.28–0.31 mm long, 0.22–0.24 mm wide); lateral margin of scape slightly concave, mesal margin convex; distance between scapes 0.14–0.17 mm; distance between tentorial pits 0.38–0.40 mm; length of frons (midway between scapes–midway between tentorial pits) 0.37–0.39 mm. Frons with smooth, shiny surface, slightly rounded below toruli, slightly rounded above clypeus, with anterior margin strongly concave. Clypeus smooth, narrow relative to frons, with small transverse fold distally, distal margin broadly acute mesally. Labrum slightly pinched mesally (i.e., with slight longitudinal ridge, flanked by depressions on either side); dorsal surface mostly smooth; distal margin with shallow indentation mesally, small setae distally.

Head Coloration (Fig. 1A–D). Antenna: scape yellow to cream; pedicel yellowish cream to amber or golden; flagellum cream to white. Vertex, torulus yellow to cream, with red patch next to eye, from mid-eye region to posterior margin, extending as red stripe to cervix and pronotum. Frons yellowish below toruli, white anteriorly, with dark red line on lateral margin, extending to eye, tentorial pit, and gena. Frontal torulus with dark red, lateral mark, extending to eye. Clypeus white mesally, dark red laterally. Tentorial pit, area anterior to tentorial pits, amber colored. Gena bright red throughout. Labrum mostly amber, with some white basomesally. Maxillary palp: distal palpomere black with white tip; second palpomere black; third palpomere cream, usually with black lateral
Fig. 3. *Chrysopodes* (C.) *serrabonitensis* (mature, field collected specimens). Upper: Forewing above, hindwing below, showing fumose shadowing on gradate and other crossveins. Lower: Forewing above, hindwing below, showing coloration of veins. Scale applies to all wings. (Upper: BA, Camacan; Lower: RJ, Madalena, Terras Frias.) (Online figure in color.)
stripe; basal two palpomeres cream colored. Labial palp: distal palpomere cream with black tip; basal two palpomeres white to cream, unmarked.

Thorax (Figs. 1C,D and 2A,C). Cervix mostly yellow, with light green sublaterally, red laterally. Prothorax (sclerotized region) 0.74–0.81 mm long; 1.1–1.2 mm wide; ratio of length to width = 0.67–0.68 : 1; setae thin, long, light golden; pronotum green, with broad, yellow mesal stripe, pair of diffuse to dark red lateral stripes, becoming slightly sublateral posteriorly. Mesonotum, metanotum green to brownish green, with yellow mesal stripe. Legs light green basally; tarsi cream-colored; claws brown.

Wings (Figs. 2B and 3). Forewing 12.6–15.1 mm long, 4.1–5.0 mm wide (at widest point); ratio of length: maximum width = 3.00–3.13:1. Height of costal area enlarged basally; tallest costal cell (#5–8) 1.0–1.1 mm tall, 1.9–2.43 times width, 0.25 times width of wing (midwing). First intramedian cell ovate, 0.5–0.6 times width of third median cell. First radial crossvein distal to origin of radial sector (Rs); radial area (between Radius and Rs) with single row of 10 to 11 closed cells; tallest cell (#3–4) 1.5–1.6 times taller than wide. Four b cells (=cells beneath Rs, not including an inner gradate vein). Two series of gradate veins; five inner gradates (posterior four in regular, parallel series, anterior one slightly more distal than others), six to seven outer gradates (in regular, parallel series). Four b’ cells (cells beneath pseudomedia after second intramedian cell). Three intracubital cells (two closed). Stigma opaque, with four to five subcostal crossveins included. Longitudinal veins green; costal veinlets brown throughout or at distal and basal ends, radial crossveins brown, gradates, veins below PsM, bases of posterior (but not distal) terminal veinlets brownish; gradates, many crossveins and terminal veinlets with fumose markings on surrounding membrane.

Hindwing. 11.3–13.2 mm long, 3.3–4.2 mm wide. Two series of gradate veins; five inner, six to seven outer (all in regular, parallel series); 10 to 11 radial cells (counted from origin of Radius, not false origin). Four b cells (including small “t” cell); four b’ cells beyond second intramedian cell; three intracubital cells (two closed). Stigma slightly opaque; veins green; membrane clear.

Abdomen (Figs. 4 and 6). Integument of pleural region with narrow, longitudinal folds. Male (lateral view): T6, length approximately same as length of T7 (× 0.9–1.1); S6, length =0.8–1.0 times height; S7 length =1.0–1.1 times height. Female: T6, =1.2 times longer than T7; S6, length approximately same as height (× 0.98–1.02); S7, length =1.4–1.8 times height. Tergites roughly rectangular, with rounded edges, ventral margins irregular, with shorter setae and longer microsetae than those on sternites. Spiracles oval externally; atria not enlarged. Dorsum green, with yellow mesal stripe; callus cerci cream-colored; integument often discolored after preservation.
Male (Figs. 4 and 5). Callus cerci ovate, 0.19–0.21 mm length, 0.14–0.15 mm width, with 31–32 trichobothria of various lengths. T9 + ectoproct truncate distally, ventral section extending broadly below ≈two-thirds length of T8, with slender apodeme along ventral margin; apodeme extending distally slightly beyond callus cerci, occasionally invaginating distally as a small internal hook, usually with small, sometimes robust, ventral tooth directly below callus cerci, no dorsal branches. S8 + 9 (lateral view) with ventral margin straight, broadly angled (≈170°) dorsal bend before mid-length, without knob; terminus with abrupt perpendicular bend, without upturn or knob; dorsal margin straight sloped. S8 + 9 (ventral view) with terminus broadly arcuate, without narrowing. Setae on terminal section of S9 slightly longer than those anteriorly. Subanal plate moderately large, with sparse patch of short setae; gonarcal complex connected to terminus of ectoproct by relatively short, clear, smooth membrane that attaches to top of gonarcus, membrane extending around sides of gonarcus, becoming confluent with distal base of gonosac-
cus, holding hypandrium internum. Gonarcus robust, broadly arcuate, with lateral apodemes extending perpendicularly from gonarcal bridge; gonarcal apodemes enlarged distally. Meduncius broad, dome-like; base extending almost to gonarcal arms, lightly sclerotized except for well sclerotized rods in inverted V-shape; base of inverted V occupying approximately one-half or slightly more of gonarcal bridge; tip of meduncius with relatively straight, sharp beak. Goniococcus below meduncius, smooth to folded, not large, without gonosetae. Gonapsis, gonocristae absent. Hypandrium internum V-shaped with slender, rounded arms, acute apex; comes short, lightly sclerotized.

**Female (Figs. 6–8).** Callus cerci slightly taller than broad, 0.17–0.18 mm maximum diameter, with 28–29 trichobothria of mixed length. Tergite eight same length or slightly shorter than T7, with rounded margins (lateral view), same height or slightly taller than T6 and T7. Tergite 9 + ectoproct elongate, broad, extending well below gonapophyses laterales; posterior margin: fairly straight, with slight indentation at gonapophyses laterales; ventral margin: slightly convex. Sternite seven with dorsal margin straight, not tapering distally, terminus with posteroventral setae slightly more dense, robust, and longer than other setae; ventral surface straight, without subapical knob. Gonapophysis lateralis rounded dorsally, ventrally, \( \approx 0.54–0.59 \) height of T9 + ectoproct; inner membranous surface not expandable, with double row of short setae on small, raised setal bases. Colleterial gland smooth, thin, elongate, extending approximately to midpoint of S7, with globate reservoir attached via a broad duct; no accessory gland observed. Transverse sclerification broad, platform-like, strongly convex dorsally, slightly convex ventrally, with numerous, dense, long setae. Bursa copulatrix relatively delicate membrane with small transverse folds, not covering entire spermatheca, shorter than three-fourths length of T9 + ectoproct; pair of large, robust, irregularly shaped bursal glands, connected to lateral edge of bursa (corner of S7). Spermatheca broad, tubular,
with U-shaped coil (mature: ≈0.13 mm diameter at mouth, ≈0.70 mm long; teneral: ≈0.18 mm diameter at mouth, ≈0.51 mm long); well sclerotized at base, tapering and becoming less sclerotized distally; transition to tubular bursal duct not distinct. Spermathecal invagination broad before U-shaped bend in spermatheca, then tapering abruptly to narrow, rounded terminus (mature: ≈0.60 mm deep, ≈0.10 mm diameter; teneral: ≈0.36 mm deep, ≈0.15 mm diameter). Bursal duct very long, divided into two sections with enlarged sclerotized connection between; basal section extending from ventrolateral surface of bursa, wide, flattened, with rough, ribbed surface, heavily coiled; distal section (near spermatheca) tubular, loosely coiled, with smooth surface, entering distal tip of spermatheca; connection between sections enlarged, sclerotized, with ribbed, roughly filamentous surface, both ends tapering distally at connection to remaining sections of duct. Teneral specimens: bursal duct with basal and distal sections approximately as above; section near spermatheca less sclerotized, becoming flattened, rough surfaced; section near bursa flat, folded, becoming undifferentiated distally; midsection connection not visible. Spermathecal duct extending from rim of spermatheca; long (≈2.5 mm), narrow, well sclerotized throughout, with three to five complete U-shaped curves, additional bends; distal section of basal curve connected to distal membrane of subgenitale via membrane; distal 75% of duct brushy, terminal section expanded, with deep split at tip. Subgenitale membraneous, rounded basally, basal surface relatively smooth, with shallow transverse folding, base extending from shallow membranous fold beneath S7; distal section with broad, short, protruding, bilobed knob; ventral margin of knob (lateral view) with small angular terminus.

Additional Specimens Examined. Laboratory-reared adults from the same localities as the types: Brazil, Bahia, Camacan (3 ♂, 4 ♀, UCB); Brazil, RJ, Terras Frias (2002: 3 ♂, 3 ♀; 2003: 3 ♂, UCB).
Variation. Specimens vary in the degree of head and thoracic coloration (see Fig. 1A–D). In some cases, the markings are very pale.

Known Distribution. Currently, this species is reported from two states in Brazil: Bahia and Rio de Janeiro.

Fig. 8. *Chrysopodes* (*C.*) *serrabonitensis*. Female genital structures (teneral, laboratory reared specimen). (A) Entire bursal system (lateral). (B) Spermatheca and section of bursal duct. (RJ, Madalena, Terras Frias.) b.c., bursa copulatrix; b.d., bursal duct; g.l., gonapophysis lateralis; inv, spermathecal invagination; sp, spermatheca; sp.d., spermathecal duct.

Fig. 9. *Chrysopodes* (*C.*) *fumosus*. Top row: head, frontal; bottom row: head and prothorax, dorsal. (All: RJ, Macabu, Santo Agostinho.) (A, C) Mature, field collected. (B, D) Slightly teneral, laboratory reared. (Online figure in color.)
Etymology. This species is named to honor of the conservation efforts of Vitor Osmar Becker and his wife, Clemira Ordoñez Souza. Vitor is an internationally recognized Brazilian systematist (Lepidoptera); Clemira is a dedicated educator; both are active environmentalists. Together with their family, they founded the Uiraci Institute, an NGO, and the Serra Bonita Reserve Complex in Camacan, BA. The name serrabonitensis (Latinized locality name, masculine) refers to the Reserve, the type locality of the new species.

Chrysopodes (Chrysopodes) fumosus Tauber & Albuquerque, sp. nov.

(Type. 9–18)

Type Material. The holotype (♂) is in the Coleção Entomológica Pe. Jesus Santiago Moure, Universidade Federal do Paraná, Curitiba (DZUP). Its labels read: 1) “BRASIL: RJ, Conceição de Macabu, Santo Agostinho, V-21-2002”; 2) “G. S. Albuquerque, M. J., C. A., A. J. & P. J. Tauber, E. S. Silva Collectors (1 ♀, 1 ♂, 1♀, with abdomen missing: UCB; 1 ♀, 1 ♂, UENF); V-2-2003, G. S. Albuquerque, M. J. Tauber, C. A. Tauber Expedition, Apr.–May 2003 (4 ♀, 1 ♂; UCB). Two additional paratypes, from Brazil, Rio de Janeiro, Campos dos Goytacazes, PESAGRO, VI-20-2006, G. S. Albuquerque & J. S. Multani Collectors (1 ♀, 1 ♂), are in the collection at UENF.

Diagnosis. Like numerous other C. (Chrysopodes) species, C. (C.) fumosus adults are characterized by their intermediate size, white face, red genal markings, and red semicircular markings below the antennae (sometimes very pale), pitted vertex, and mostly green venation. In addition, the males have a knob on the ventral margin of S8 + 9, which is also typical of a number of C. (Chrysopodes) species.

Chrysopodes (C.) fumosus is distinguished from other C. (Chrysopodes) species by their forewings, which have extensively crassate venation and heavily fumate markings surrounding many veins. Both the male and female genitalia are distinctive and should be

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Fig. 10. Chrysopodes (C.) fumosus. (A) Head, thorax, dorsal. (B) Habitus, lateral. (C) Scapes, dorsal. (D) Head, prothorax, lateral. (RJ, Macabu, Santo Agostinho.) (A, C) Mature, field collected specimens. (B, D) Slightly teneral, laboratory reared specimen. (Online figure in color.)
relied on for identification of the species. In the male, the gonarcal apodemes are broadly expanded frontally; the gonarcal bridge is relatively thin and curved smoothly; the mediuncus is short, fits within the gonarcal arms, and straight basally, curved distally. In the female, the spermatheca is tubular, with a long, relatively wide invagination; the spermathecal duct is short and has a very broad base; and the bursal duct has two discrete sections (a ribbon-like basal section and a very long, thread-like, tubular, distal section) connected by a heart-shaped, sclerotized structure that is visible in both mature and teneral specimens.

This species keys to couplet 10 in the “Key to the species of Chrysopodes of Brazilian agro-ecosystems” (Freitas and Penny 2001, p. 270); it lacks dark mesonotal and metanotal spots; it has red semicircular marks below the antennae; its vertex and frons lack dark marks between the antennal bases, and the male ectoproct has two ventral projections. Chrysopodes (C.) fumosus differs from C. (C.) spinellus and C. (C.) divisus in that the lateral arm of the gonarcus is higher than long, and S8 + 9 has a ventral knob. In addition, neither of these two species have forewings with cras- sate veins and fumate markings like those of C. (C.) fumosus.

**Description.** *Head.* 1.3–1.5 mm wide (including eyes); ratio of head width to eye width = 2.2–2.6 : 1. Vertex raised, with very pitted surface, small, rounded posterior fold, surface without small setae. Antenna 9.9–10.2 mm long (~0.8 times length of forewing); scape longer than broad, (0.33–0.45 mm long, 0.21–0.32 mm wide); lateral margin of scape almost straight, mesal margin convex; proximal flagellomeres shorter than more distal ones (segments 1, 2, 3: length = 1.8–2.5 times width), with irregularly placed setae; middle and distal segments becoming longer (segments 7–9: length = 3.1–4.0 times width; distal segments, midlength on antenna: length = 2.6–3.2 times width), with four concentric rings of setae. Distance between scapes 0.07–0.12 mm; distance between tentorial pits 0.39–0.43 mm; length of frons (midway between scapes–midway between tentorial pits) 0.37–0.38 mm. Frons with smooth, shiny surface, slightly rounded below toruli, raised above elypeus, with transverse depression between tentorial pits. Clypeus with small upward fold mesally, distal margin slightly concave, surface slightly textured. Labrum with distal margin indented mesally; dorsal surface smooth, slightly sculptured, with small setae distally.

*Head Coloration* (Figs. 9 and 10). Antenna: scape yellowish cream mesally, light green laterally, sometimes yellowish cream throughout; pedicel yellowish cream to amber or golden; flagellum cream to white. Vertex, torulus yellow to greenish yellow, with thin
red line next to eye, from mid-eye region to posterior margin. Frons white, with diffuse, red to reddish brown, crescent-shaped mark below torulus, with light red mark from edge of eye to tentorial pit. Frontal torulus yellow with small red patch laterally. Clypeus white, with lateral margin reddish brown. Labrum white to cream. Gena blackish red to brownish red, usually darker dorsally than ventrally. Maxillary palp: ultimate palpomere cream mesally, amber to light brown laterally; subultimate, third palpomeres cream, usually with light brown stripe or spot distolaterally; basal two palpomeres cream colored. Labial palp white to cream, unmarked. Thorax (Figs. 9B,D and 10A,D). Cervix small, largely withdrawn below prothorax, light green, with pair of reddish brown lateral marks. Prothorax (sclerotized region) 0.63–0.80 mm long; 0.98–1.20 mm wide; ratio of length to width = 0.64–0.67 : 1; setae numerous, long, light golden; pronotum light green, with broad, yellow, median stripe, with diffuse reddish brown, lateral stripe anteriorly, becoming submesal posteriorly, sometimes not reaching posterior margin of segment (some specimens with no stripe, but with a small reddish brown spot submesally). Mesonotum, metanotum light green, with broad, yellow, median stripe. Legs white to pale green, unmarked, with golden setae. Tarsal claws brown, with broad base, deep cleft. Wings (Fig. 11). Forewing 12.3–12.5 mm long, 4.2–4.4 mm wide (at widest point); ratio of length : maximum width = 2.83–2.93:1. Height of costal area moderately enlarged basally; tallest costal cell (#7) 1.1–1.2 mm tall, 2.2–2.6 times width, 0.27–0.28 times width of wing (midwing). First intramedian cell ovate, 0.5–0.6 times width of third median cell. First radial crossvein distal to origin of radial sector (Rs); radial area (between Radius and Rs) with single row of 10 closed cells; tallest cell (#5–4) 1.9–2.0 times taller than wide. Four b cells (= cells beneath Rs, not including an inner gradate vein). Two series of gradate veins; five inner gradates (posterior three in regular, parallel series, and anterior two more distal), 5–6 outer gradates (in regular, parallel series). Four b’ cells (cells beneath pseudomedia after second intramedian cell). Three intracubital cells (two closed). Stigma opaque. Longitudinal veins mostly green; costa golden to light green; costal veinlets golden, with dark distal and basal tips or dark throughout; three distal subcostal crossveins, basal one dark, others pale or dark; first crossvein below Rs dark distally; first intracubital crossvein dark; distal tips of terminal veinlets mostly dark (except posterior ≈S vein-
lets distal to anal veins. Membrane around most cross-
veinlets and at base and along proximal branches of distal
veinlets with dense smoky suffusion.

_Hindwing._ 10.8–11.1 mm long, 3.4–3.5 mm wide.
Two series of gradate veins; five inner, five to six outer;
nine to ten radial cells (counted from origin of Radius,
not false origin). Four b cells (including small “t” cell);
four b’ cells beyond second intramedian cell; three
intracubital cells (two closed). Stigma slightly opaque;
veins green; membrane clear.

_Abdomen (Figs. 12 and 14, 17, and 18)._ Integument
of pleural region with numerous, large, longitudinal,
and reticulate folds, especially in mature females. Male
(lateral view): Tergite six (T6), length approximately
same as length of T7 (× 1.0–1.2); Sternite six (S6),
length ≈0.7–0.9 times height; S7 length ≈0.6–0.8
times longer than tall. Female: T6 long, shallow, approx-
imately same length as T7 (× 1.1–1.2); S6, length
approximately same as height (× 0.99–1.01 height);
S7, ≈1.3–1.5 times longer than tall. Tergites roughly
rectangular, with rounded edges, ventral margins ir-
regular, with shorter setae and longer microsetae than
on sternites. Spiracles oval externally; atria not en-
larged. Dorsum green, with broad yellow mesal stripe;
callus cerci cream-colored. Integument often discol-
ored after preservation.

Fig. 13. _Chrysopodes_ (C.) _fumosus._ Male genital structures, mature field collected specimens. (A) Gonarcus, dorsal:
apodemes in normal position. (B) Gonarcus, frontal. (C, D) Gonarcus, lateral. C. mediuncus raised; D. mediuncus withdrawn
within gonarcal arms. The arrows indicate the tip of the mediuncal beak. (E) Hyandrium internum. (F) Setose subrectal
plate. (All images: RJ, Macabu, Santo Agostinho.) c. comes; c.m., cone-shaped mediuncal membrane; g.a., gonarcal apodeme;
g.b., gonarcal bridge; gsac, gonosaccus; mu, mediuncus; rod, sclerotized rod internal to the mediuncus; s.p., setose
subrectal plate.
Male (Figs. 12 and 13). Callus cerci oblong, 0.23–0.29 mm length, 0.17–0.20 mm width, with 29–32 trichobothria of various lengths. T9 + ectoproct truncate distally, with rounded margins, broadly fused mesally, setae more dense, robust distally than proximally; ventral section (ectoproct) well sclerotized especially behind and below callus cerci, extending broadly below full length of T8; dorsal apodeme robust, with convex curve from proximal end of segment well beyond callus cerci, with dorsal arm extending broadly into sclerotized area behind callus cerci, broad, flat, invaginating ventral arm with feathery appearance; terminus rounded, extending below ectoproct. Terminal sternite (S8 + 9) (lateral view) with proximal margin fairly straight, ventral margin with small, distinct knob at margin of “S8”; terminus abruptly upturned in rounded ~90° bend, with small platform extending distally; dorsal margin descending, rounded basally, abruptly descending, scalloped distally. Terminus of S8 + 9 (ventral view) with broad, rounded mesal projection; midline with thin, sclerotized, longitudinal invagination, extending through and beyond ventral knob. Setae on terminal section of S9 slightly more robust than those anteriorly. Subanal plate of moderate size, with patch of long setae; top of gonarcal bridge connected to terminus of ectoproct by short, smooth membrane extending from below anal plate, membrane reaching around sides of gonarcus, becoming confluent with distal base of gonosaccus. Gonarcus broadly arcuate; gonarcal bridge rounded throughout; gonarcal apodemes narrow basally, expanding, becoming rounded distally. Meduncus–dorsal view: membranous base encompassing full width of gonarcal bridge (almost to lateral apodemes), mesal, sclerotized section narrow, with paired rods mostly straight, slightly flared at articulation with gonarcal bridge, base of rods occupying <one-third width of gonarcal bridge; lateral view: overall shape cone-like, with dorsal margin curved, tip curved downward to sharp beak, dorsal rods extending ~three-fifths length.
Fig. 15. *Chrysopodes (C.) fumosus*. Female genital structures (mature, field collected specimens). (A) Entire genital system, ventral. (B) Subgenitale and bursa, ventral. (C) Basal section of bursal duct. Note connection to lateroventral surface of bursal terminus and sclerotized connection to tubular distal section of bursal duct. (D) Sclerotized heart-shaped connection between basal and distal sections of bursal duct. (E) Spermathecal complex, left side. Note elongate invagination, broad base of spermathecal duct, and broad, smooth distal section of bursal duct. (F) Spermathecal complex, right side. Note shape of brushy terminus. (All images: RJ, Macabu, Santo Agostinho.) b.b.d., basal bursal duct; b.c., bursa copulatrix; b.g., bursal gland; col.g., colleterial gland; d.b.d., distal bursal duct; inv, spermathecal invagination; sg, subgenitale; sp, spermatheca; sp.d., spermathecal duct.
of mediuncus, tapering in depth distally; dome with considerable depth basally; dorsal membrane covering mediuncus robust, with dorsal setae limited to distal membranous section of mediuncus, not above sclerotized section or laterally; membrane extending beyond tip of beak, recurving toward base of cone,

![Image](https://example.com/image16.png)

Fig. 16. *Chrysopodes* (C.) *fumosus*. Female colleterial complex (mature, field collected specimens). (A) Entire colleterial complex, lateral. (B) Transverse sclerification, posterior. (C) Colleterial reservoir and accessory gland (lateral). (All: RJ, Macabu, Santo Agostinho.) acc.g., accessory gland at base of colleterial duct; col.g., colleterial gland; col.res., colleterial reservoir; g.l., gonapophysis lateralis; t.sc., transverse sclerite.

![Image](https://example.com/image17.png)

Fig. 17. *Chrysopodes* (C.) *fumosus*. Exoskeleton of female abdominal segments, pleuron. (All images: RJ, Macabu, Santo Agostinho.) (A) Mature specimen, segment four (left), segment five (right). Note: the surface of P4 is smooth, with small longitudinal folds; that of P5 is leathery and reticulated. (B) Teneral specimen, segment 5. Note: The surface is mildly reticulate, with the longitudinal aspect of the folds prominent.
connecting to gonosaccus below, without gonosetae. Gonosaccus (below conical mediuncus) delicate, long, unstructured, without gonosetae. Tip of S8 + 9 with relatively long, robust, salebrose membrane, without setae; membrane attaching distally to base of gonosaccus, holding hypandrium internum. Gonapsis, gonocristae absent. Hypandrium internum (one specimen only) V-shaped with slightly flared arms; comes straight, short in dorsal view, unexpanded in lateral view.

Female (Figs. 14–16, 18). Callus cerci slightly taller than broad, 0.18–0.19 mm maximum diameter, with 31–33 trichobothria of mixed length. Tergite eight length slightly less than that of T7, with rounded margins (lateral view), slightly taller than T6 and T7. Tergite 9 + ectoproct elongate, extending well below gonapophyses laterales; posterior margin: dorsal half slightly concave, ventral half straight; ventral margin: slightly convex. Sternite seven with dorsal margin straight, not tapering distally, terminus with posteroventral setae slightly more dense, robust, and longer than other setae; ventral surface with distinct subapical knob (not visible when terminus of sternite folded inward). Gonapophysis lateralis rounded dorsally, ventrally, =0.52–0.56 height of T9 + ectoproct; inner membranous surface not expandable, with vertical strip of moderately dense, short setae. Colleterial gland smooth-walled, delicate, elongate, extending

Fig. 18. Chrysopodes (C.) fumosus. Abdominal and genital features of teneral female (field collected specimens). (A) Segments A6 to A9 + ectoproct, lateral. (B) Entire genital system (ventral). (C) Basal section of bursal duct. Note connection to distoventral surface of bursa and sclerotized connection to narrow distal section of bursal duct. (All images: RJ, Macabu, Santo Agostinho.) b.c., bursa copulatrix; b.d., bursal duct; b.g., bursal gland; c.c., callus cerci; co, sclerotized, heart-shaped connection between basal and distal sections of bursal duct; g.l., gonapophysis lateralis; sg, subgenitale; S7, seventh sternite; T8, eighth tergite; T9 + e, ninth tergite and ectoproct.
into S6, with globate reservoir attached via a broad duct; base of duct from colleterial reservoir to transverse sclerification with knob-shaped accessory gland bearing two digitiform processes. Transverse sclerification slender, flat, platform-like, with rows of elongate setae. Bursa copulatrix relatively robust, opaque membrane with wavy, transverse folds, extending over entire spermatheca, ≈three-fourths length of T9 + ectoproct; pair of large, robust, globose bursal glands, connected to lateral edge of bursa (corner of S7). Spermatheca elongate, tubular, with tight U-shaped coil (0.09 mm diameter at mouth, 0.64–0.68 mm long), well sclerotized at base, tapering and becoming less sclerotized distally; transition to bursal duct not distinct. Spermathecal invagination elongate, rounded, broad throughout (0.25–0.30 mm deep, 0.04 mm diameter). Bursal duct extremely long, divided into three sections; basal section extending from distoventral surface of bursa, wide, flat, fluted, with approximately five coils; midsection narrow, smooth, extremely long (mature specimens), connected to basal section via well sclerotized, heart-shaped swelling; distal section (near spermatheca) wider, smooth, loosely coiled, entering distal tip of spermatheca. Teneral specimens: bursal duct with basal and distal sections as above; sclerotized connection present; midsection unsclerotized, sometimes not visible. Spermathecal duct extending from distal margin of spermatheca, extending into tip of subgenitale; basal section thick, straight, very well sclerotized, remaining sections sclerotized, with two complete U-shaped curves; distal section of basal curve connected to distal membrane of subgenitale via membrane; distal 0.8 of duct brushy, terminal section expanded, split at tip. Subgenitale rounded basally, basal surface smooth, with shallow transverse folding, base extending from shallow membranous fold beneath S7; distal sec-

Fig. 19. *Chrysopodes* (C.) *hagenorum*. Top row: head, frontal; bottom row: head and prothorax, dorsal. (All images: PR, Foz do Iguacu). (A, C) Mature, field collected. (B, D) Teneral, laboratory reared. (Online figure in color.)
tion with broad, short, protruding, bilobed knob; ventral margin of knob (lateral view) with angular terminus.

Additional Specimens Examined. Specimens reared from females in the type series: 2 ♀ in 2002 (Tauber Lot 2002:21; UCB); 7 ♀, 9 ♂, 1? with abdomen missing in 2003 (Tauber Lot 2003:16, UCB); 1 ♀, 1 ♂ (reared by P. Silva; UCB).

Variation. Unknown.

Known Distribution. Apparently, this species has a large distribution in South America. We have seen specimens from the State of Rio de Janeiro, Brazil. Our colleague Francisco José Sosa Duque has identified specimens from Brazil: São Paulo, Jaboticabal (Feb., May, June, July); Pará, Capitão Poço (Apr.) and Venezuela: Yaracuy, San Felipe (Feb.); Portuguesa, La Estación, Ospino (Feb.).

Etymology. The species name *fumosus* (Latin adjective, masculine) refers to the distinctive smoky markings on the forewings.

**Chrysopodes** (*Chrysopodes*) *hagenorum* Tauber & Albuquerque, sp. nov.

(Figs. 19–26)

Type Material. The holotype (♂) is deposited in the Coleção Entomológica Pe. Jesus Santiago Moure, Universidade Federal do Paraná, Curitiba [DZUP]. Its labels read: 1) “BRAZIL: Paraná/Foz do Iguaçu”; 2) “Lab reared/M. J. & C. A. Tauber/Lot 96:06”; 3) “HOLOTYPE/Chrysopodes (C.) hagenorum Tauber/Albuquerque desig. 2012.” A female paratype with the same collection data as above is also in the DZUP.

Two field-collected paratypes (1 ♂, and the ♀ that produced the laboratory-reared offspring), as well as seven laboratory-reared paratypes (3 ♂, 4 ♀) are in the UCB collection. The labels on the field-collected specimens read: 1) “BRAZIL: Paraná/Foz do Iguaçu/VI-9–14-96”; 2) “M. J., C. A., P. J., & Mi. J. Tauber, Collectors”; 3) “PARATYPE/Chrysopodes (C.) hagenorum Tauber/& Albuquerque desig. 2012.” The la-

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**Fig. 20.** *Chrysopodes* (*Chrysopodes*) *hagenorum*. (A) Head, thorax, dorsal. (B) Habitus, lateral. (C, D) Head, prothorax, lateral. (All images: PR, Foz do Iguaçu.) (A, B, D) Mature, field collected; (C) slightly teneral, laboratory reared. (Online figure in color.)
bels on the laboratory-reared paratypes are identical to those on the holotype.

**Diagnosis.** Of the three species described here, this one is the least like other species in the subgenus. Although the height of the forewing costal area is enlarged basally, as is usual for the subgenus, it is enlarged only slightly (maximum costal height = 0.21–0.22 times the maximum width of the wing). Moreover, the vertex lacks pitting and the forewings completely lack fumate markings. However, the mandibles are clearly sickle-shaped, as is typical of the subgenus.

*Chrysopodes* (*C.*) *hagennorum* is small-bodied and light green, with a yellowish face, usually marked with red, crescent-shaped marks below the scapes. The male genitalia are distinctive as follows: quadrate-shaped gonarcus, highly setose mediuanal membrane with sclerotized internal flanges, gonosaccus with two pairs of relatively long gonosetae, gonarcal apodemes with heavily sclerotized internal braces, and tip of sternite 8 + 9 with a leathery, eversible membrane bearing a large patch of long, tuberculiform setae. The female genitalia are characterized by a very short, simple bursal duct, an antero-posteriorly compressed and highly membranous subgenitale, and a funnel-shaped spermathec with a short, setose duct.

This species keys to couplet nine in the “Key to the species of *Chrysopodes* of Brazilian agro-ecosystems” (Freitas & Penny 2001, p. 270); it lacks dark mesonotal and metanotal spots; the frons has red semicircular marks below the antennae (sometimes not apparent); and, the vertex and frons lack dark marks between the antennal bases. The dorsal apodeme is relatively weakly sclerotized, but it appears to have two ventral projections (one extending distally beyond the callus cerci and the second extending ventrally below the callus cerci). The male and female genitalia of *C.* (*C.*) *hagennorum* differ from those of all three of the species that key out after couplet nine—*Chrysopodes* (*C.*) *lineafrons* Adams & Penny, *spinellus* Adams & Penny and *divisus* (Walker). For example, its mediuncus is not narrow or elongate as in *C.* (*C.*) *lineafrons*, nor simple as in *C.* (*C.*) *divisus* or *spinellus*.

**Description.** *Head.* 1.3–1.4 mm wide (including eyes); ratio of head width to eye width = 2.0–2.3 : 1. Vertex raised, with smooth, shiny surface, small, rounded posterior fold, surface without small setae. Antenna 7.0–8.2 mm long (*≈*0.75 times length of forewing); scape almost as broad as long (0.24–0.29 mm long, 0.24–0.26 mm wide); lateral margin of scape straight, mesal margin convex; distance between scapes 0.07–0.08 mm; distance between tentorial pits 0.36–0.41 mm; length of frons (midway between scapes–midway between tentorial pits) 0.34–0.37 mm. Frons with smooth, shiny surface, slightly rounded below toruli, slightly rounded above clypeus, with midsection of anterior margin strongly concave. Clypeus smooth, with shallow transverse depression.

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Fig. 21. *Chrysopodes* (*C.*) *hagennorum*. Forewing above, hindwing below. Scale applies to both wings. (PR, Foz do Iguacu.) (Online figure in color.)
between tentorial pits, small, raised, transverse fold distally, distal margin straight. Labrum flat, quadrate, with dorsal surface mostly smooth, distal margin straight, with small setae distally.

**Head Coloration (Figs. 19 and 20).** Antenna: scape, pedicel, yellowish cream; flagellum cream. Vertex yellow to light green, with red longitudinal streak next to eye, from above mid-eye region almost to cervix. Dorso-torular cream, unmarked. Frons yellowish to amber, with light diffuse crescent-shaped marks below toruli. Frontal torular cream, with small, reddish brown, lateral mark, extending almost to eye. Clypeus amber, with reddish brown patch laterally; tentorial pit brown. Gena brown throughout. Labrum mostly amber, with some brownish areas. Maxillary palp: basal two palpomeres cream colored, third palpomere cream with black lateral stripe; distal two palpomeres black. Labial palp: basal palpomere cream, unmarked, distal two palpomeres cream with black lateral stripe.

**Thorax (Figs. 19B,D and 20A,C,D).** Cervix often withdrawn below prothorax, light green to cream, usually with pair of small reddish brown lateral marks. Prothorax (sclerotized region) small (0.57–0.67 mm long; 0.92–1.10 mm wide; ratio of length to width = 0.61–0.62 : 1; setae thin, pale, not exceptionally long; pronotum light green, with diffuse, yellow to yellowish green, mesal stripe, pair of broad, diffuse, light reddish brown stripes laterally along anterior half of segment, sublaterally along posterior half. Metanotum, metanotum yellow-green, with diffuse yellowish median stripe. Legs white to light green basally, cream to creamy amber distally; setae pale to amber. Tarsal claws brown, with broad base, deep cleft.

**Wings (Fig. 21).** Forewing 9.4–10.5 mm long, 3.1–3.4 mm wide (at widest point); ratio of length : maximum width = 3.0–3.1:1. Height of costal cells only slightly enlarged basally; tallest costal cell (#4–5) 0.65–0.72 mm tall, 1.1–1.3 times width, 0.21–0.22 times width of wing (midwing). First intramedian cell ovate, 0.49–0.52 times width of third median cell. First radial crossvein distal to origin of radial sector (Rs); radial area (between Radius and Rs) with single row of eight closed cells; tallest cell (#2–4) 0.9–1.2 times taller than wide. Three to four b cells (= cells beneath Rs, not including an inner gradate vein). Two series of gradate veins; two to three inner gradates, four to five outer gradates (all in regular, parallel series). Four b' cells (cells beneath pseudomedia after second intramedian cell). Three intracubital cells (two closed). Stigma slightly opaque, with three faint subcostal crossveins included. Longitudinal veins mostly green, occasional brown areas; costal veinlets, basal subcostal crossvein, radial crossveins, gradates, veins below pseudomedia, cubital crossveins, bases of posterior terminal veinlets brown; membrane clear, without suction.
Hindwing. 8.3–9.4 mm long, 2.6–2.9 mm wide. Two series of gradate veins; two inner, four to five outer (all in regular, parallel series); eight to nine radial cells (counted from origin of Radius, not false origin). Three to four b cells (including small “t” cell); four b’ cells beyond second intramedian cell; two to three intracubital cells (two closed). Stigma slightly opaque; veins green; membrane clear.

Abdomen (Figs. 22 and 24). Integument of pleural region with narrow, longitudinal folding. Male (lateral view): T6, 1.2–1.3 times longer than T7; S6, length \( \approx 1.0–1.2 \) times height; S7 length \( \approx 0.9–1.0 \) times height. Female: T6, \( \approx 1.4 \) times longer than T7; S6, length approximately same as height; S7, length \( \approx 1.5–1.6 \) times height. Tergites roughly rectangular, with rounded edges, ventral margins irregular, with shorter...
setae and longer microsetae than on sternites. Spiracles oval externally; atria not enlarged. Dorsum green, with yellow mesal stripe; callus cerci cream-colored; setae, trichobothria golden to amber. Integument often discolored after preservation.

**Male (Figs. 22 and 23).** Callus cerci round, 0.13–0.19 mm length, 0.10–0.14 mm width, with 27–33 trichobothria of various lengths. T9 + ectoproct truncate distally, ventral section (ectoproct) well sclerotized, extending broadly below full length of T8, with slender, lightly sclerotized apodeme; apodeme low on ectoproct, slightly convex, extending distally almost to level of callus cerci, without branches. S8 + 9 (lateral view) with proximal margin straight, with broad angled (~165°) dorsal bend before mid-length, without knob; terminus rounded throughout, without knob or platform. S8 + 9 (ventral view) with terminus broadly arcuate, without narrowing; dorsal margin slightly concave. Setae on terminal section of S9 slightly more robust than those anteriorly. Subanal plate of moderate size, with sparse patch of short setae; gonarcal complex connected to terminus of ectoproct by relatively short, clear, smooth membrane extending from top of gonarcus, membrane reaching around sides of gonosaccus, holding hypandrium internum. Gonarcus broadly arcuate, with lateral apodemes extending perpendicularly from gonarcal bridge; gonarcal apodemes broadly rounded basally, tapering, truncate distally. Mediuncus narrow, slightly dome-like in lat-
eral view; base extending almost to gonarcal arms, lightly sclerotized except for well sclerotized rods in narrow, inverted V-shape; base of inverted V occupying approximately one-third of gonarcal bridge; distal end of mediuncus (beyond tips of rods, dorsal view) rounded, slightly expanded laterally, tapering to broad, rounded terminus, with pair of short, stout, sclerotized arms extending ventrally below sclerotized rods; membranous covering of mediuncus densely setiferous over entire dorsum, well onto sides of mediuncus; membrane below mediuncus robust, tight, forming hollow enclosure beneath length of mediuncus, with two pairs of relatively large gonosetae. Gonosaccus (beyond tight membrane) delicate, large, unstructured. Tip of S8 + 9 with robust eversible membrane bearing large, dense covering of flexible, elongate, tuberculiform setae on one side, other side smooth, without setae; membrane attached distally to base of gonosaccus. Gonapsis, gonocristae absent. Hypandrium internum V-shaped with narrow arms, acute apex; comes curved in dorsal view, broadly expanded in lateral view.

Female (Figs. 24–26). Callus cerci slightly taller than broad, 0.13 mm maximum diameter, with 30–31
trichobothria of mixed length. Tergite 8 =0.8–0.9 times length of T7, approximately same height as T6 and T7. Tergite 9 + euptopt long, broad, extending well below gonapophyses laterales; posterior margin: fairly straight, with indentation at gonapophyses laterales; ventral margin: slightly convex. Sternite seven with dorsal margin straight, not tapering distally, terminus with posterior setae slightly more dense, robust, and longer than anterior setae; ventral surface straight, without subapical knob. Gonapophysis lateralis rounded dorsally, ventrally, ≈0.51–0.55 height of T9 + euptopt; inner membranous surface not expandable, without setae. Colleterial gland clear, wavy, extending into middle of A6, with large, globate reservoir attached via a broad duct, no accessory glands found. Transverse sclerification narrow, flat, with numerous, dense, long setae. Bursa copulatrix small, delicate membrane with small transverse folds, not covering spermatheca, shorter than three-fourths length of T9 + euptopt; no bursal glands found. Bursal duct extending from distal margin of bursa, short, delicate, flattened membrane, curved but not coiled, with mildly ribbed surface. Spermatheca very small (=0.10–0.13 mm diameter at mouth, ≈0.26–0.29 mm longer), round, funnel-shaped (when invagination not everted), with broad, tubular, distal extension bending in U-turn and away from head of spermatheca, extension sclerotized, with rough surface, tapering, with abrupt, narrow transition to membranous bursal duct. Spermathecal invagination V-shaped (everted on second specimen), with rounded terminus (≈0.56 mm deep, ≈0.50–0.60 mm diameter). Spermathecal duct extending from rim of spermatheca; moderate length (≈0.41–0.45 mm), well sclerotized throughout, with two complete U-shaped curves; distal section of basal curve connected to distal membrane of subgenitale via membrane; distal =80% of duct brushy, terminal section not expanded, without deep split at tip. Subgenitale very flat (lateral view), with sclerotized, inverted Y-shaped base, broad, mildly sclerotized neck, small, rounded, bilobed terminus; basal surface with shallow transverse folding, base extending from shallow membranous fold beneath S7; dorsum connecting directly to bursa copulatrix; terminus heart-shaped in posterior view, with ventral margin rounded, small internal invagination ventrally.

Additional Specimens Examined. None.

Variation. Unknown.

Known Distribution. This species is reported only from the type locality in the State of Paraná, Brazil.

Etymology. This species is named in memory of Kenneth S. Hagen and in honor of his devoted wife, Maxine Hagen (hagenorum: Latinized, masculine).

Ken was a professor at the University of California, Berkeley, our friend and colleague; a great supporter of Brazilian Entomology, he helped us collect this species during the V Siconbiol, Simpósio de Controle Biológico, in Foz do Iguacu (1996).

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Fig. 26. Chrysopodes (C.) hagenorum. Female colleterial complex (mature, field collected specimens). (A) Colleterial reservoir and base of colleterial gland (lateral). (B) Transverse sclerification and base of colleterial reservoir, dorsal. (All images: PR, Foz do Iguacu.) ca, canal at base of colleterial reservoir; col.g., colleterial gland; col.res., colleterial reservoir; t.sc., transverse sclerite.
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