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NEW SPECIES OF *CERATINOPTERA* COCKROACHES FROM PANAMA AND COSTA RICA (BLATTARIA: BLATTELLIDAE: PLECTOPTERINAE)

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Abstract.—Three new species of *Ceratinoptera* are described: *C.* ***gurneyi*** and *C.* ***estribii*** from Panama and *C.* ***bilunata*** from Costa Rica and Panama. A key to the known species of *Ceratinoptera* is included. These three new species form the *Bilunata* Group, distinct from the rest of the genus.

The genus *Ceratinoptera,* originally proposed by Brunner v. W. in 1865, includes some 13 species as catalogued by Princis (1969). However, Hebard (1916) proposed that the genus be restricted to three species, essentially those for which Saussure (1868) proposed the name *Paraceratinoptera.* Hebard considered *Paraceratinoptera* to be an absolute synonym of *Ceratinoptera.* In agreement with Hebard we would restrict the genus to those species which share the following characters: 1) corneous tegmina, which when overlapping have the concealed area of the right tegmen as colorless as the wings; 2) seventh abdominal tergum of the male with a specialization (gland); 3) limbs stout, ventro-anterior margin of fore-femur with a row of minute piliform setae (Type C) terminated by two large distal spines; 4) tarsi lack pulvilli; tarsal claws slender, symmetrical, simple; arolia lacking or very minute. Reviewing the 13 species listed by Princis we find four were transferred by him from the genus *Temnopteryx,* while five others have one or more characters in disagreement with the generic features listed above or whose brief descriptions do not address any of those key features.

Species of *Ceratinoptera* we include in the restricted definition are as follows (those known to occur in Panama are noted by an asterisk):

1. *C. picta* C. Brunner v. W. 1865*, genotype by original description and selection by Kirby (1904).
   binotata (L. Bruner) 1906, a synonym of *picta* (Princis, 1969: 761).
2. *C. castanea* C. Brunner v. W. 1865, redescribed by Albuquerque and Gurney (1963).
   aequalis (Walker) 1871, a synonym of *castanea* (Albuquerque and Gurney, 1963: 522).
3. *C. nahua* (Saussure) 1868.
   dohrniana (Saussure and Zehntner) 1893, a synonym of *nahua* (Hebard, 1916: 131).
4. *C. tropaia* Hebard 1916.

5. *C. bilunata* Fisk and Wolda, new species*.
6. *C. gurneyi* Fisk and Wolda, new species*.
7. *C. estribii* Fisk and Wolda, new species*.

The new species, *C. bilunata, gurneyi,* and *estribii,* are referred to here as the *Bilunata* Group and have, in the male, between the styles a median projection of the subgenital plate which is equal to or longer than the styles. Also the supra-anal plate is broadly emarginate at the apex, giving it a sinuate, bilobed appearance (Fig. 2). In other *Ceratinoptera,* e.g. *C. picta, nahua, castanea,* and (?)*tropaia,* referred to here as the *Picta* Group, males lack the median projection between the styles and the supra-anal plate is convex posteriorly, without an emargination in the material examined (although Albuquerque and Gurney (1963) describe the lectotype of *C. castanea* as having the supra-anal plate "weakly emarginate at apex"). In our key to the flying cockroaches of central Panama (Fisk and Wolda, 1979) the only *Ceratinoptera* listed was *C. picta.* Unfortunately, the new species *C. estribii* and unmarked *C. bilunata* were not recognized at that time and would key out as *C. picta.* However, the key which follows may be useful in separating all seven species of *Ceratinoptera,* at least the males. Difficulties will be encountered in those species typically having pale pronotal markings because such markings may be reduced or lacking in some populations of *C. picta, nahua,* and *bilunata.* Also reduction in the length of tegmina and wings frequently occurs in individuals of *C. castanea, nahua, picta,* and *bilunata* although these reductions are never so complete as in *tropaia.*

Key to Species of *Ceratinoptera* Cockroaches, Based Primarily on Males

1. Male supra-anal plate convex posteriorly; subgenital plate between styles moderately convex, without appendages; left phallomere (L2vm) sclerotized, curved, with needle-like tip (L2d) (Fig. 19) (*Picta* Group) 2
– Male supra-anal plate with apex broadly emarginate (Fig. 2); subgenital plate between styles produced as a slender median process (Fig. 4); L2vm less sclerotized, straight, tip not sharply pointed (Fig. 6) (*Bilunata* Group) 7
2. Pronotal disc with characteristic pale markings (both sexes) 3
– Pronotal disc lacks pale markings although lateral margins of pronotum may be pale or transparent 4
3. Overall length, i.e. distance from front of head (or pronotum if head is covered) to tip of abdomen (or to apex of tegmina if they extend beyond abdomen), 9–11 mm; shining blackish brown; pale spot on pronotal disc crescent-shaped, the points directed anteriorly (Guatemala, Panama, northern South America, including Brazil) ..... typical *picta* Brunner
– Overall length of male 11–14 mm, of female 12–14 mm; shining chestnut brown; pale spot circular and suffused with base color of pronotum, the marking may include almost entire disc, be reduced to a mesoposterior blotch or pair of tiny pale dots, or be lacking altogether (Mexico, Guatemala, Costa Rica) ..... *nahua* (Saussure)
4. Relatively large, overall length of male 11–14 mm (see previous couplet) ..... unmarked *nahua* (Saussure)
– Somewhat smaller, overall length 10–12 mm 5

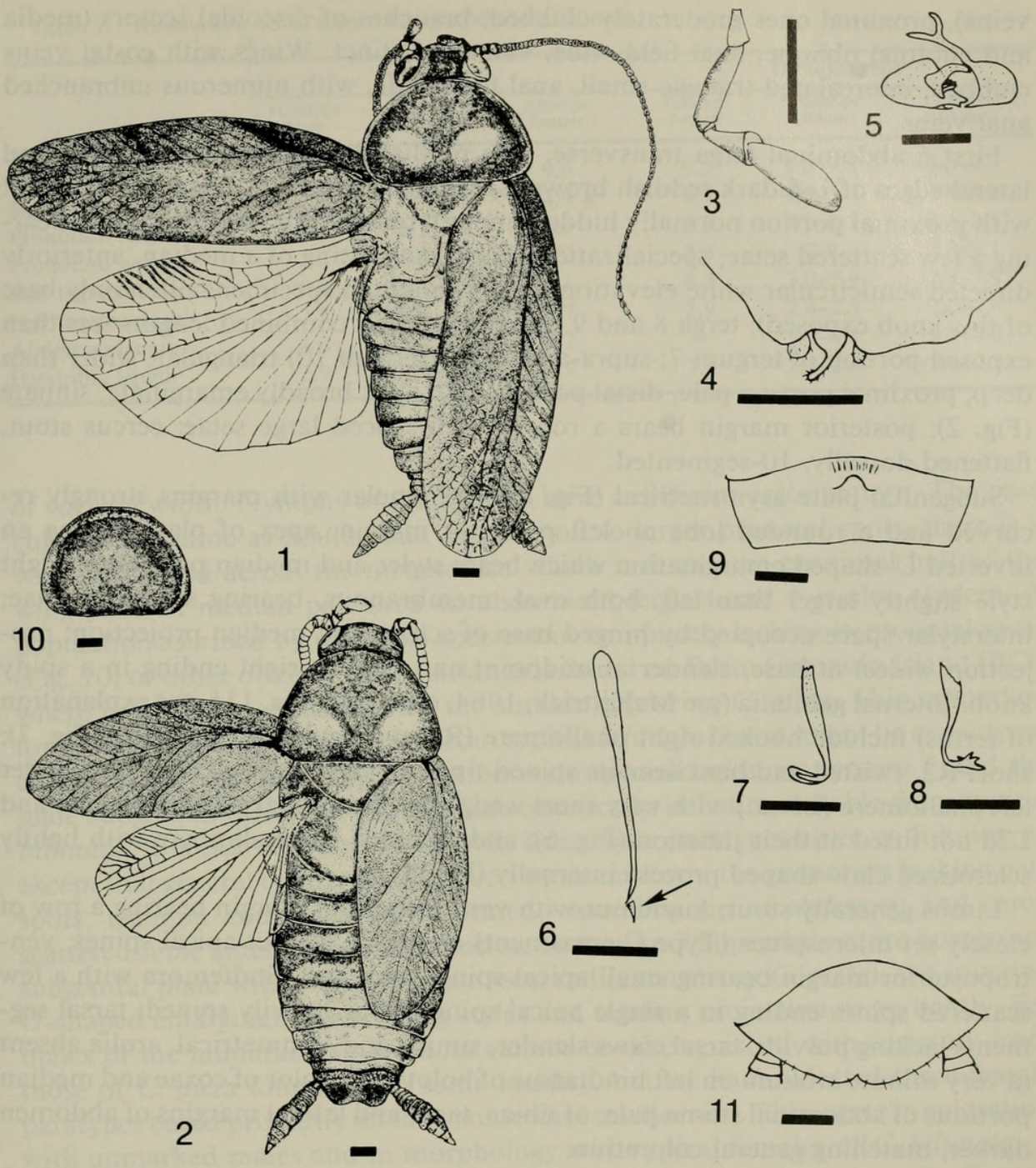
5. Length of male 10 mm; shining chestnut brown; tegmina short, truncate, very little longer than wide, exposing most of abdomen; wings minute; female unknown (Mexico) ..... *tropaia* Hebard
- Length 9–12 mm; color reddish or blackish brown; tegmina and wings fully formed (especially male) reaching to or beyond tip of abdomen or tegmina and wings reduced in length (especially female), though never so short as above 6
6. Length 9–11 mm; blackish brown above, lighter below; tegmina usually full length, but shortened tegmina may occur in both sexes (Panama) (see also couplet 3) ..... unmarked *picta* Brunner
- Length 10–12 mm; color blackish brown above, reddish below; shortened tegmina most often found in female (Brazil) ..... *castanea* Brunner
7. Posterior portion of pronotum with a pair of yellow or nearly white spots 8
- Pronotum unmarked, but may have very narrow pale lateral margin ... 9
8. Length 9–10.5 mm; uniformly reddish brown to mahogany with a pair of well-defined yellow spots on disc of pronotum, narrow lateral margins of pronotum pale; male specialization on tergum 7 with a few scattered setae anteriorly (Fig. 9), median projection between styles wide at base, narrowing to midpoint with its knobbed tip bent to the right (Costa Rica and Panama) (Fig. 1) ..... typical *bilunata,* new species
- Length 12–14.5 mm; uniformly reddish brown to nearly black with a pair of diffuse, nearly white spots on pronotal disc (Fig. 12), narrow latero-anterior margins pale; male specialization on tergum 7 with 2 tufts of slender setae anteriorly (Fig. 13); median projection between styles as noted above, but larger and more heavily sclerotized (Fig. 14) (Panama) ..... *gurneyi,* new species
9. Length 7.5–9 mm; reddish brown to nearly black except that distal ⅗ of tegmina nearly transparent like the wings; male with median projection between styles slender and straight with knoblike tip (Fig. 17) (Panama) ..... *estribii,* new species
- Length 9–10 mm; uniformly reddish brown to nearly black, including tegmina; median projection between styles as noted in couplet 8 (Fig. 4) (Panama) ..... unmarked *bilunata,* new species

Holotypes and allotypes of the following species are in the Ohio State University Entomology Museum. Except as noted otherwise, paratypes are divided between the collections of the authors (FWF and HW).

Ceratinoptera bilunata Fisk and Wolda, New Species

Figs. 1–11

Male holotype.—Measurements in Table 1. Head evenly convex, eyes well separated, interocular space nearly 1.5× interantennal space; ocelli present; ultimate (5th) segment of maxillary palpus subequal to 3rd segment and 1.5× 4th segment in length (Fig. 3); head dark reddish brown to a line just below fronto-clypeal junction, pale yellow below this line; length of antenna subequal to overall length. Pronotum broadly rounded anteriorly and laterally, posterior margin truncate; base color of pronotum shining reddish brown with lateral margins pale,



Figs. 1–11. 1–10 *Ceratinoptera bilunata,* male. 1, Habitus of holotype. 2, Habitus of short-winged paratype (specialization on tergum 7 completely hidden under overlapping tergum 6, costal veins on wing should be shown clubbed). 3, Maxillary palpus. 4, Subgenital plate, ventral view. 5, Male genitalia; L1, sclerite of left phallomere. 6, L2d (at arrow) and L2vm, dorsal and ventromedial sclerites of left phallomere. 7, R2 hooked sclerite of right phallomere. 8, R3, sclerite of right phallomere. 9, Tergum 7 specialization. 10, Pronotum of unmarked form. 11, *C. bilunata,* female, supra-anal plate, dorsal view. Scale bars equal to 0.5 mm.

straw colored; posterior ½ of disc with a pair of large semicircular pale yellow spots (Fig. 1). Tegmina and wings fully developed, exceeding abdomen in length but exposing cerci; tegmina shining reddish brown with iridescent reflections, that portion of right tegmen normally covered by overlapping left tegmen nearly transparent as are wings; tegminal venation indistinct, about 12 radial sectors (costal

veins), proximal ones moderately clubbed; branches of discoidal sectors (media and cubitus) oblique, anal field wide, veins indistinct. Wings with costal veins clubbed, intercalated triangle small, anal field wide, with numerous unbranched anal veins.

First 6 abdominal terga transverse, pale reddish brown, remaining terga and lateral edges of 1–6 dark reddish brown; specialized tergum 7 also transverse but with proximal portion normally hidden under tergum 6, its anterior margin bearing a few scattered setae; specialization (Fig. 9) consisting of a median, anteriorly directed semicircular white elevation (in dry mounted specimens often only base of this knob exposed); terga 8 and 9 transverse, their combined lengths less than exposed portion of tergum 7; supra-anal plate (tergum 10) triangular, wider than deep, proximal portion pale, distal portion with apex broadly emarginate, sinuate (Fig. 2); posterior margin bears a row of well-spaced large setae; cercus stout, flattened dorsally, 10-segmented.

Subgenital plate asymmetrical (Fig. 4) semicircular with margins strongly recurved and a rounded lobe on left posterior margin; apex of plate having an inverted U-shaped emargination which bears styles and median projection; right style slightly larger than left, both oval, membranous, bearing scattered setae; interstylar space occupied by hinged base of sclerotized median projection; projection widest at base, slender at midpoint and bent to right ending in a spiny knob. Internal genitalia (see McKittrick, 1964, especially Fig. 115, for explanation of terms) include hooked right phallomere (R2) with subapical incision (Fig. 7); short R3, twisted and bent near its spined tip (4 or more spines) (Fig. 8); slender left phallomere (L2vm) with very short wedge-shaped L2d at its apex, L2vm and L2d not fused at their junction (Fig. 6); and complex L1 phallomere with lightly sclerotized claw-shaped process internally (Fig. 5).

Limbs generally stout; forefemur with ventro-anterior margin bearing a row of closely set microspines (Type C armament) ending in 2 stout apical spines; ventroposterior margin bearing small apical spine; mid- and hindfemora with a few scattered spines ending in a single apical spine; tibiae heavily spined; tarsal segments lacking pulvilli, tarsal claws slender, simple and symmetrical, arolia absent (a very minute arolium on left hindtarsus of holotype). Color of coxae and median portions of abdominal sterna pale, of tibiae, tarsi, and lateral margins of abdomen darker, matching general coloration.

Female allotype.—Measurements in Table 1. Left foreleg, right hindleg and left hindtarsus missing, but morphology essentially same as holotype except as follows: ocelli well defined; tergum 7 of abdomen smooth, without specialization; supra-anal plate transverse, weakly bilobed at apex (Fig. 11), similar to that structure in male but color pattern obscure; subgenital plate convex, symmetrical, bilobed at apex; lateral dark margins of abdominal sterna wider than male and subgenital plate wholly dark.

Remarks.—As with other species of *Ceratinoptera, C. bilunata* exhibits variations in length of tegmina and wings as well as coloration. In holotype and allotype the tegmina exceed tip of abdomen, but not cerci, while the Quesada and Quepos male paratypes have shorter tegmina that barely cover the specialization on tergum 7. The distinctive semicircular pronotal spots vary somewhat in size and shape. In the typical form they are always obvious and separated by a dark median area

Table 1. Measurements of *Ceratinoptera bilunata*, in mm.

	Typical Form			Unmarked Form		
	Holotype Male	3 Paratype ♂ (Range)	Allotype Female	Paratype Female	3 Paratype ♂ (Range)	3 Paratype ♀ (Range)
Total length	10.2	9.1–9.3	9.6	9.3	9.0–9.8	9.6–9.7
Maximum width	4.6	4.0–4.5	4.9	4.7	4.9–5.0	4.6–4.8
Pronotum length	2.4	2.3–2.6	2.5	2.7	2.1–2.2	2.4–2.5
Pronotum width	3.2	3.0–3.3	3.2	3.3	2.9	3.0–3.1
Left tegmen length	8.2	5.1–6.0	8.1	8.3	7.0–7.9	7.8–7.9
Left tegmen width	2.8	2.3–2.5	2.7	2.9	2.4–2.5	2.5–2.6
Abdomen length	5.0	5.0–5.5	5.2	—	3.5–4.1	3.7–3.8
Hindtibia length	2.9	2.9–3.2	2.9	3.1	2.5–2.6	2.6–2.9

of varying width. Nymphs of this species have a different color pattern. The base color is the same as adults, but, in addition to larger pronotal spots, there is a wide pale band across the metanotum which includes the proximal half of the wing pads. A median pale area on abdominal terga 4 and 5 is also evident. A population ascribed by us to this species but completely lacking in pronotal spots (Fig. 10) or other obvious pale markings is found on Barro Colorado Island (BCI) where it has been confused with the similar appearing *C. picta*. This unmarked form differs so markedly in color from typical *bilunata* that it might be considered a distinct species were it not that the male specialization on tergum 7 and the male subgenital plate and genitalia are practically indistinguishable from typical *bilunata*. It is characterized as follows: three male paratypes agree with holotype except that general coloration is darker, more uniform, the pronotum lacking pale spots; tegmina and wings fully formed, exceeding tip of abdomen and cerci; scattered setae anterior to specialization on tergum 7 apparently more numerous; subgenital plate with edges strongly recurved (as in many *C. picta*), the inverted U-shaped emargination enclosing styles and median projection more tightly. Females of the unmarked *C. bilunata* cannot be distinguished with certainty from those of *C. picta* found in the same locality, but we have selected three female paratypes based primarily on their somewhat smaller size. They agree in coloration with unmarked males and in morphology with typical females of *C. bilunata*.

The name *bilunata* was suggested for this species by Dr. Ashley B. Gurney because of the two half-moon-shaped light spots on the pronotum.

Types.—Holotype ♂, PANAMA, Bocas del Toro Province, Rio Changuinola, Corriente Grande, coll. HW IV/2/80; allotype ♀, COSTA RICA, Heredia Prov., Puerto Viejo, "La Selva," coll. FWF I/30/74; 4 paratypes: 1 ♂ COSTA RICA, Cartago Prov., Turrialba, coll. S.S. & W.D. Duckworth II/22–28/65 (specimen at USNM); 1 ♂, COSTA RICA, Alajuela Prov., Quesada, coll. FWF VII/29/66; 1 ♂, COSTA RICA, San Jose Prov., 16 km north of Quepos, coll. FWF VIII/7/66; 1 ♀, Cartago Prov., Chitaria, coll. M. Valerio IV/12/30 (specimen at ANSP). Also 3 ♂ and 3 ♀ paratypes of unmarked form, all from PANAMA, BCI, coll. HW between May and Oct., 1977 and 1978 plus 1 ♀ paratype, BCI, coll. HW IV/79. All the above Costa Rican records were listed by Fisk (1971) as "*Ceratinoptera* n. sp."

Table 2. Measurements of *Ceratinoptera gurneyi*, in mm.

	Holotype Male	7 Paratype ♂ (Range)	Allotype Female	Paratype Female
Total length	13.0	12.0–14.4	12.4	12.3
Maximum width	6.1	5.8–6.5	5.2	5.8
Pronotum length	2.8	2.6–3.0	2.8	2.8
Pronotum width	3.7	3.4–4.0	3.5	3.3
Left tegmen length	10.5	10.3–13.8	9.9	9.8
Left tegmen width	3.2	3.5–3.7	3.0	3.1
Abdomen length	5.0	4.2–5.0	5.1	5.0
Hindtibia length	3.4	3.0–4.1	3.4	3.5

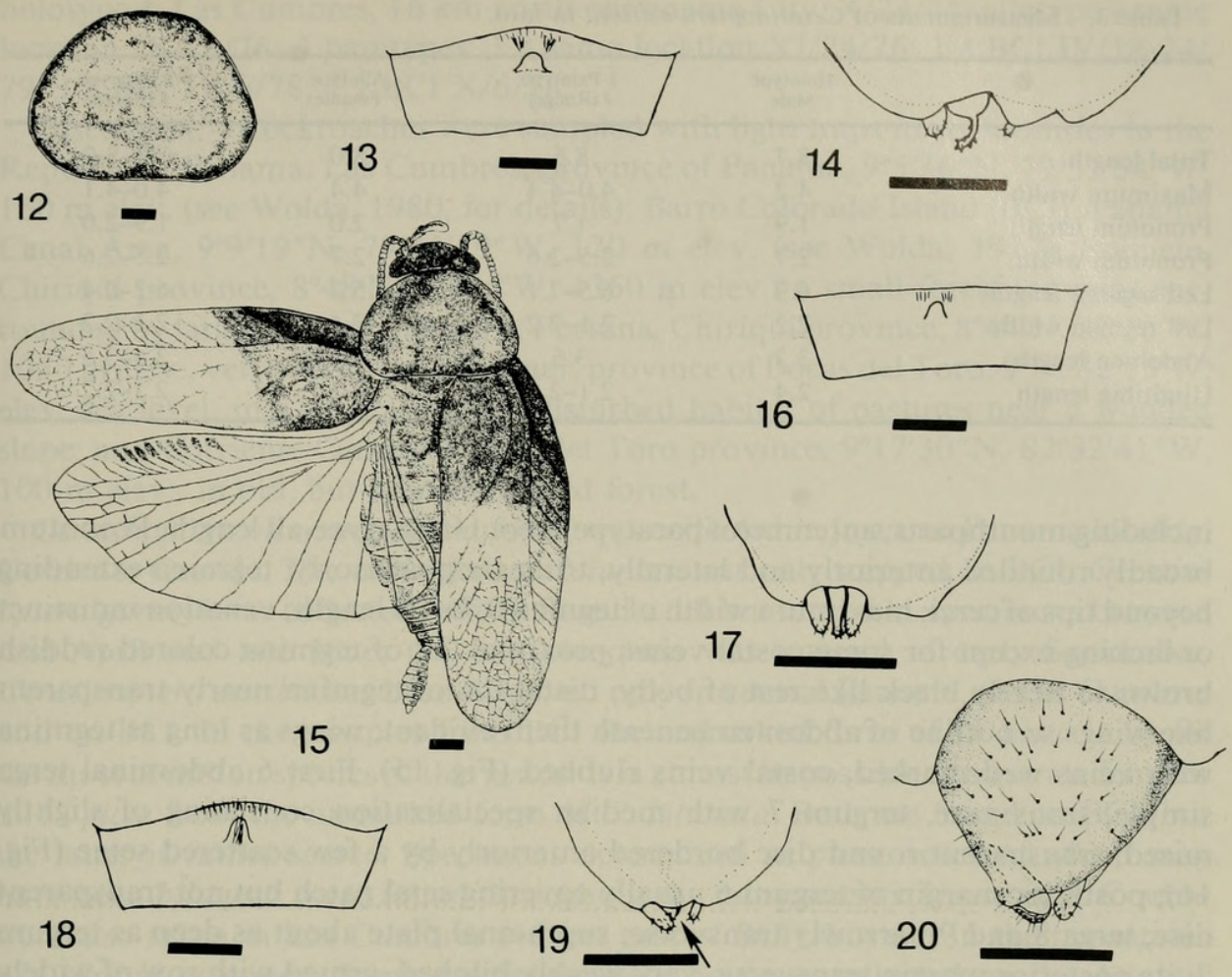
Ceratinoptera gurneyi Fisk and Wolda, New Species

Figs. 12–14

Male holotype.—Measurements in Table 2. Head evenly convex, eyes well separated, the interocular space nearly 1.5× interantennal space; ocelli present; ultimate segment of maxillary palpus subequal to 3rd segment and 1.5× 4th segment in length; antenna subequal to overall length; head coloration similar to *C. bilunata* but darker. Pronotum broadly rounded anteriorly, posterior margin truncate; base color of pronotum shining mahogany with narrow latero-anterior margins pale, posterior ½ of disc with a pair of irregularly shaped yellowish or off-white spots, spots suffused with ground color medially (Fig. 12). Tegmina and wings fully developed, exceeding tips of cerci in length; tegmina shining reddish brown with iridescent reflections except transparent portion of right tegmen normally covered by left tegmen; tegminal venation indistinct; wings transparent with costal veins clubbed, intercalated triangle small. First 6 abdominal terga transverse, tergum 7 less transverse with proximal portion normally hidden under tergum 6, but exposing specialization consisting of a median, anteriorly directed, semicircular white knob surrounded at its tip by a slightly depressed area; anterior to knob are a pair of setal tufts and other scattered setae (Fig. 13); terga 8 and 9 transverse, their combined length less than exposed portion of tergum 7; supra-anal plate triangular, wider than long, darker at its broadly bilobed apex, a row of widely spaced large setae bordering apical margin of plate; cercus stout, flattened dorsally, 10 (or 11) segmented.

Subgenital plate (Fig. 14) circular, asymmetrical, with sides strongly recurved and rounded lobe on left posterior margin; a shallow median emargination bearing greatly modified styles and median projection; styles subequal, right larger than left, oval, membranous, bearing scattered setae, seemingly attached to median emargination by their sides rather than their bases; sclerotized median projection hinged at its base and may extend posteriorly or, more often, be held in a dorsal or anterior position, therefore partly hidden from below; projection larger and darker than with *C. bilunata*, otherwise similar internal genitalia much as in *bilunata* but R3 bears just 3 spines at tip.

Morphology of limbs as for *bilunata* (very minute arolia noted on tarsi of some paratypes); color of limbs and abdominal sterna darker. Female allotype and paratype with coloration and external morphology as described for male except tergum 7 smooth, subgenital plate convex and bilobed at apex, bilobed appearance being enhanced due to apical portion being strongly recurved.



Figs. 12–20. 12–14 *Ceratinoptera gurneyi,* male. 12, Pronotum. 13, Tergum 7 specialization. 14, Subgenital plate, ventral view. 15–17 *C. estribii,* male. 15, Habitus of holotype. 16, Tergum 7 specialization. 17, Subgenital plate, ventral view. 18–20 *C. picta,* male. 18, Tergum 7 specialization. 19, Ventral view of subgenital plate in flattened relaxed position showing sharp tip of L2d exposed (at arrow). 20, Ventral view of subgenital plate in frequently occurring tightly curled position. Scale bars equal 0.5 mm.

Remarks.—This is the largest *Ceratinoptera* species known from Panama. The larger size, limited distribution and somewhat diffuse pronotal spots serve to separate specimens of *gurneyi* from other members of the genus. All but three of the specimens were trapped during mid to late Spring. We name this species for Dr. Ashley B. Gurney, retired specialist of orthopteroid insects, Systematic Entomology Laboratory, USDA, who co-authored a draft description of *C. bilunata.*

Types.—All material collected by HW in light traps at PANAMA, Chiriquí Prov., Fortuna (8°44′N, 82°16′W, elev. 1050 m). Holotype ♂ IV/30/78; allotype ♀ IV/23/79; 7 paratype ♂ IX/6/77, IV/18/78, VII/7/78, IV/18/79, V/7/79, VI/26/79, VII/9/79; 1 paratype ♀ VI/6/79.

Ceratinoptera estribii Fisk and Wolda, New Species

Figs. 15–17

Male holotype.—Measurements in Table 3. Head broad and flat, interocular distance 0.65× width of head and 1.5× wider than interantennal space; ocelli poorly defined; ultimate segment of maxillary palpus inflated with inner surface pale, subequal to 3rd and longer than 4th segment; color of head nearly uniform,

Table 3. Measurements of *Ceratinoptera estribii*, in mm.

	Holotype Male	2 Paratype ♂ (Range)	Allotype Female	2 Paratype ♀ (Range)
Total length	8.7	8.6	8.0	7.8–8.0
Maximum width	4.2	4.0–4.4	4.4	4.0–4.1
Pronotum length	1.9	1.7	2.0	1.9–2.0
Pronotum width	2.7	2.5–2.6	2.7	2.5–2.6
Left tegmen length	6.9	6.5–7.1	6.2	6.2–6.4
Left tegmen width	2.2	2.1–2.2	2.4	2.1–2.2
Abdomen length	3.3	3.6	3.8	3.4–3.5
Hindtibia length	2.4	2.1–2.2	2.1	2.1–2.2

including mouthparts; antenna (of paratype) about 0.8× over-all length. Pronotum broadly rounded anteriorly and laterally, truncate posteriorly; tegmina extending beyond tips of cerci; maximum width of tegmen 0.3× its length; venation indistinct or lacking except for some costal veins; proximal 0.4 of tegmina colored reddish brown to nearly black like rest of body, distal 0.6 of tegmina nearly transparent like wings so outline of abdomen beneath them evident; wings as long as tegmina with veins well marked, costal veins clubbed (Fig. 15). First 6 abdominal terga simple, transverse, tergum 7 with median specialization consisting of slightly raised, transparent round disc bordered anteriorly by a few scattered setae (Fig. 16); posterior margin of tergum 6 usually covering setal patch but not transparent disc; terga 8 and 9 narrowly transverse; supra-anal plate about as deep as tergum 7; its posterior margin transverse, very weakly bilobed, armed with row of widely spaced large setae; cercus stout, 3× longer than wide. Subgenital plate (Fig. 17) semicircular in outline with margins strongly recurved, left margin with lobe halfway between median line and left side; apex of plate strongly emarginate, enclosing bases of short symmetrical simple styles and a narrow straight median projection with slightly enlarged, rounded tip; tips of styles and median projection appear to extend beyond recurved posterior margin of plate for at least ½ their length; morphology of limbs as for *C. bilunata*; abdominal sterna pale centrally, darker laterally; mid- and hindcoxae and all tarsi not so dark as remainder of limbs; distinctive coloration in both sexes confined to tegmina, apical ⅗ being nearly transparent.

Female allotype.—Morphology and coloration as described for male except as follows: abdominal tergal specialization lacking, terga 1 through 7 similar; supra-anal plate transverse, its right and left margins meeting at an oblique (130°) angle, apex rounded; subgenital plate larger than for male, posterior margin rounded, recurved, with shallow median notch; styles and median projection lacking.

Remarks.—This species can be readily separated from other *Ceratinoptera* by the tegmina of both sexes being nearly transparent apically for over half their length, reminiscent of the condition in some *Holocompsa* cockroaches. The styles and median projection of the males are also distinctive. The species is named for Miguel Estribí whose help in the study of Panamanian cockroaches and other light trap collections is deeply appreciated and who prepared many of the drawings for this paper.

Types.—All material collected by HW at light traps in two PANAMA locations:

holotype ♂, Las Cumbres, 16 km north of Panama City, X/24/75; allotype ♀ same location IX/29/76; 4 paratypes: 1 ♂ same location XI/24/76; 1 ♂ BCI IV/18-24/79; 1 ♀ BCI IV/6/78; 1 ♀ BCI X/6/78.

Discussion.—Cockroaches were sampled with light traps in six localities in the Republic of Panama: Las Cumbres, province of Panama, 9°5′36″N, 79°31′54″W, 150 m elev. (see Wolda, 1980, for details); Barro Colorado Island (BCI), Panama Canal Area, 9°9′19″N, 79°45′19″W, 120 m elev. (see Wolda, 1977); Boquete, Chiriquí province, 8°48′N, 82°26′W, 1350 m elev., a small forest remnant surrounded by large coffee plantations; Fortuna, Chiriquí province, 8°44′N, 82°16′W, 1050 m elev., very wet forest; Miramar, province of Bocas del Toro, 9°N, 82°15′W, elev. sea level, in a coastal, rather disturbed habitat of pastures near a wooded slope; and Corriente Grande, Bocas del Toro province, 9°17′30″N, 82°32′41″W, 100 m elev., in old, but recently logged forest.

Ceratinoptera bilunata typical form, was collected in just one Panama locality, Corriente Grande. The unmarked *C. bilunata* was only trapped on BCI. *Ceratinoptera gurneyi* was collected only in Fortuna, all but one of 11 specimens between mid-April and late June; the one exception was trapped in early September. *Ceratinoptera estribii* has been observed only in central Panama, at Las Cumbres and on BCI. In the samples from BCI the unmarked form of *C. picta* is by far the most common species of this genus. It is almost impossible to separate females of *C. picta* from the unmarked form of *C. bilunata.* Both are found on BCI, but the latter is rather scarce. Specimens determined as *picta,* some of which may have been *bilunata,* were found throughout the rainy season. Unmarked *C. picta* were also taken in Las Cumbres (45 km east of BCI), but not in the mountains of Chiriquí province. Some specimens were however collected on the Atlantic side in Bocas del Toro Province, both at Miramar and Corriente Grande. All specimens of *picta* sampled in this study lacked markings on the pronotum, confirming Hebard's (1920) findings that all *C. picta* collected in Panama were of the unmarked form, but these included both long-winged and short-winged individuals.

Acknowledgments

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Literature Cited

Albuquerque, R. e S. and A. B. Gurney. 1963. Records and descriptions of cockroaches from southern Brazil (Orth. Blattoidea). Stud. Entomol. 6: 515–536.

Bruner, L. 1906. Report on the Orthoptera of Trinidad, West Indies. J. N.Y. Entomol. Soc. 14: 140.
Brunner v. Wattenwyl, C. 1865. Nouveau Système des Blattaires. Pp. 75–79, Plate I.
Fisk, F. W. 1971. An annotated check list of Costa Rican cockroaches (Dictyoptera: Blattaria). Proc. Entomol. Soc. Wash. 73: 431–444.
Fisk, F. W. and H. Wolda. 1979. Keys to the cockroaches of central Panama. Part I: Flying species. Stud. Neotrop. Fauna Environ. 14: 177–201.
Hebard, M. 1916. The genus *Ceratinoptera* (Orthoptera, Blattidae, Pseudomopinae). Trans. Am. Entomol. Soc. 42: 125–134.
———. (1919) 1920. The Blattidae of Panama. Mem. Am. Entomol. Soc. No. 4, 184 pp.
Kirby, W. F. 1904. A synonymic catalog of Orthoptera, Vol. I, p. 99.
McKittrick, F. A. 1964. Evolutionary studies of cockroaches. Cornell Univ. Agric. Exp. Stn. Mem. No. 389, 97 pp.
Princis, K. 1969. Blattariae: Epilamproidea: Blattellidae. In Beier's *Orthopterorum Catalogus,* Pars 13, pp. 760–763.
Saussure, H. de. 1868. Orthopterorum species novae aliquot No. II. Rev. et Mag. Zool. (2nd Ser.) 20: 357.
Saussure, H. de and L. Zehntner. 1893. Insecta, Orthoptera, Blattidae. *In* Biologia Centrali-Americana, Orthoptera Pt. I: 47–52.
Walker, F. 1871. Supplement to the catalogue of Blattidae. Pt. V: p. 21.
Wolda, H. 1977. Fluctuations in abundance of some Homoptera in a Neotropical Forest. Proc. III Int. Symp. Trop. Ecol. (Lubumbashi, Zaire) 1975. Geo-Eco-Trop. 3: 229–257.
———. 1980. Seasonality of Tropical Insects. I. Leafhoppers (Homoptera) in Las Cumbres, Panama. J. Anim. Ecol. 49: 277–290.