RIODINIDAE OF RONDÔNIA, BRAZIL: *CALEPHELIS*, WITH DESCRIPTIONS OF NEW SPECIES

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Abstract - Six species of *Calephelis* are known from central Rondônia, Brazil, including *Calephelis aymaran* and five species, distinguished largely by their genital morphology, named and described as new herein. These fly mostly during the wet season.

Key words: disturbance, genitalia, Lepidoptera, neotropical, Perú, South America, variation.

The genus *Calephelis* Grote & Robinson, 1869 (Riodinidae: Riodininae), distributed from the northern United States to Argentina, contains about 45 species that are difficult to identify (McAlpine 1971; Austin 1993a, 1993b, 1997; Lamas 2001; Hall and Harvey 2002; Callaghan and Lamas 2004; but see Scott 1986). The included species are very similar in their superficial appearance and genitalia. Taxa were poorly distinguished in their latest revision (McAlpine 1971) and determining *Calephelis* to species requires the need to resolve seasonal variation and recognize subtle character differences; dissections of genitalia and long series and comparative material are often necessities. Careful study of relatively extensive collections from Costa Rica (Austin 1997), the Tikal area of Guatemala (Austin *et al.* 1996), Belize, and southeastern Mexico (Campeche, Quintana Roo) indicated that genital characters are very constant, at least within these local faunas, and, for many taxa, superficial characters are not readily apparent until phenotypes are sorted using genital morphology. This sorting is best accomplished by the use of a camera lucida to superimpose images of genitalia over drawings of those of the local species. This allows identification of similar phenotypes by subtle differences in curvature, length, and breadth of the pedicel (see Hall and Harvey 2002) and in the shape and relative length of the transtilla of males and in the size and shape of the genital plate of females. Such differences between certain species are frequently difficult to judge without this direct comparison.

Species richness of *Calephelis* appears to be greatest in Guatemala, but at least ten species were reported to occur in South America with one species reaching Chile and Argentina (McAlpine 1971, Hall and Harvey 2002). A study area near Cacaulândia in central Rondônia, Brazil (Emmel and Austin 1990) contains several species of *Calephelis* as part of the fauna. This area has a distinctly seasonal climate with a pronounced dry season from May through September. One species of *Calephelis* here is a widespread western South American species and the others are undescribed. These are discussed herein and the new species are named and described. Forewing length was measured from base to apex. Characters useful in distinguishing species were outlined by Austin (1997). Names for structures of genitalia follow those used by McAlpine (1971) except his "valvae" actually represent caudal projections of a "highly modified bifurcate pedicel" (Hall and Harvey 2002). Further study, however, may reveal that those structures may require reevaluation (Penz and DeVries 2006). "GTA" numbers refer to genital vial numbers. Females were tentatively associated with males based upon overall similarities in markings. Because of the uncertainty involved in conclusively matching the sexes, however, females are not included as paratypes. Voucher specimens are deposited at the Universidade Federal do Paraná, Curitiba, Brazil and the McGuire Center for Lepidoptera and Biodiversity.

SPECIES ACCOUNTS

Calephelis aymaran McAlpine, 1971
(Fig. 24-28, 52-56, 57, 63, 68)

Description. Male. Forewing length = 10.8mm (10.0-11.6, n = 10), wings broad and rounded, forewing not produced, termen slightly concave before apex; dorsum dark red-brown, basal 2/3 of wing with five indistinct, concentric black lines, more or less continuous from costa to anal margin, outer shaded slightly proximad with darker brown; marginal and submarginal lines indistinct, iridescent blue-gray, outer thin and more or less parallel to termen, narrowly broken at veins, inner broader, broken and often disjunct at veins, produced distad between veins M_2 and CuA_1 on both wings; row of large black dots between iridescent lines; area distad to inner iridescent line vaguely redder brown; forewing fringe gray, prominently checkered with white in R_5-M_1 and M_3-CuA_1, vaguely checkered in M_1-M_2 and M_2-M_3; hindwing fringe entirely gray.

Venter pale red-brown to ochreous-red with markings of dorsum repeated, but more distinct on paler ground color; basal black lines prominent, 4th line (from base) most distinct, outer black line close to inner iridescent line, posterior part on both wings often as black macules, outer black line usually single (occasionally a trace of doubling on forewing towards costa); iridescent lines much broader than on dorsum, prominent and continuous, inner less irregular and in form of broad bars on both wings. No apparent seasonal variation; individual variation in color from dark brown to paler red-brown to still paler flat brown occurring apparently throughout year.

Head, thorax, and abdomen concolorous with wings on dorsum, paler than ground color on venter; antennae black with distinct white annular rings, tip blackish.

Genitalia (Fig. 57): in lateral view, pedicel projections short, narrow, and curved slightly ventrad towards caudal ends; in ventral view, pedicel projections narrow, nearly parallel, caudal ends slightly curved inward; cephalic end of genital capsule narrow; transtilla exceeding pedicel length, curved dorsad at caudal end.

Female. Forewing length = 11.2mm (n = 1); similar to male, wings of similar shape; dorsum with markings more distinct including medial band; more distinctly red-brown on distal 1/3; venter more ochreous with all lines more prominent.

Genitalia (Fig. 63): genital plate relatively narrow and long, nearly square, shallowly V-shaped on caudal edge; ductus bursae long, thin; gradually broadening to globular corpus bursae with signa near caudal end shaped as robust spines, broadened caudad.

Material examined. BRAZIL: Rondônia; Linha C-10, 5km S of Cacaulândia, 5 Jan 1997 (1 male), 18 Jan 1997 (1 male), 16 Feb 1997 (1 male), 18 Feb 1996 (1 male), 23 Mar 1997 (1 male), 25 Mar 1997 (1 male), 30 Mar 1997 (1 male), 7 Apr 1996 (1 male), 10 May 1995 (1 male), 14 May 1995 (1 male), 15 Jun 1992 (1 male), 22 Jul 1995 (1 male), 27 Jul 1997 (1 male), 8 Oct 1993 (2 females), 12 Oct 1997 (1 male), 10 Nov 1996 (1 male), 17 Nov 1996 (2 males), 30 Nov 1996 (1 male), 2 Dec 1995 (1 male), 6 Dec 1995 (1 male), Linha C-20, 7km E of B-65, Fazenda Rancho Grande, 18 Jan 1990 (1 male), 18 Mar 1991 (1 female), 11 Jul 1992 (1 male), 17 Jul 1992 (1 male), 18 Jul 1992 (1 male), 15 Aug 1992 (1 male), 30 Aug 1992 (1 male), 27 Sep 1992 (1 male), 30 Oct 1989 (1 male), 30 Oct 1990 (1 male), 8 Nov 1989 (1 male), 9 Nov 1989 (1 male), Linha C-5, 10km S of Cacaulândia, 29 Apr 1990 (1 male), 8 Nov 1989 (1 male), 11 Dec 1990 (1 male), Linha 15, lot 36, W of Cacaulândia, 9 Oct 1993 (1 male).

Discussion. The seven species of *Calephelis* that McAlpine (1971) recorded in South America are *Calephelis laverna* (Godman & Salvin, 1880) (Panama, northern South America); *Calephelis inca* McAlpine, 1971 (Panama, northern South America); *Calephelis tapuyo* McAlpine, 1971 (Orosi, Brazil); *Calephelis aymaran* McAlpine, 1971 (widespread in western South America); *Calephelis braziliensis* McAlpine, 1971 (northeastern Brazil); *Calephelis burgeri* McAlpine, 1971 (Colombia); and *Calephelis nilus* (C. & R. Felder, 1861) (Venezuela). These, except for *C. burgeri* for which the male is unknown, are readily distinguished by their male genitalia (see figures in McAlpine 1971). Males of *Calephelis laverna* have a very short and stout pedicel with its projections close together and a long and thin transtilla, *C. inca* have short and straight pedicel projections that approach each other caudad giving a triangular appearance and a transtilla that extends well caudad of the pedicel, *C. tapuyo* have long and curved pedicel projections and a transtilla distinctly shorter than the pedicel, *C. aymaran* (Fig. 57) have short and nearly straight pedicel projections with the transtilla extending barely caudad of the pedicel, and *C. brazilensis* have thin and straight pedicel projections with the transtilla extending caudad beyond the pedicel similar to that of *C. inca*. Three additional species that have been subsequently added or reinstated into the genus, *Calephelis candiope* (H. Druce, 1904), *Calephelis iris* (Staudinger, 1876), and *Calephelis velutina* (Godman & Salvin, 1878), by Hall and Harvey (2002), occur in northern South America, are dark brownish or blackish rather than red-brown, and have genitalia rather different from any taxon in Rondônia (McAlpine 1971, Hall and Harvey 2002).

The status of *C. nilus*, described from Venezuela, is unknown. McAlpine (1961) included *Calephelis perditalis* Barnes & McDunnough, 1918, as a subspecies of *C. nilus*. The genitalia of the holotype male subsequently became damaged beyond comparison and, although they were originally thought to resemble those of *C. perditalis*, McAlpine (1971) concluded that these were distinct species and that the identification of *C. nilus* was in doubt. Miller and Brown (1981), de la Maza *et al.* (1989), Ferris (1989), and Callaghan and Lamas (2004) retained *C. perditalis* as a species-level taxon. Scott (1986) again considered *C. perditalis* as a subspecies of *C. nilus* and suggested that *Calephelis wellingi* McAlpine, 1971; *Calephelis clenchi* McAlpine, 1971; and *Calephelis browni* McAlpine, 1971 may also be subspecies of *C. nilus* based, apparently, upon the short transtilla of the male genitalia, the similarities of the female genital plate, and apparent allopatry. The latter three taxa, however, have subsequently been encountered together in northern Guatemala (Austin *et al.* 1996) where they maintain their distinctness. Only with in-depth studies of the *Calephelis* of Venezuela and adjacent areas can the identity of *C. nilus* potentially be resolved.

Males of *Calephelis* from near Cacaulândia exhibit six genital types that are consilient with subtle superficial differences. These latter are seen best after sorting by genital morphology. There are also several female genital types which are provisionally matched with five of the male phenotypes. One of the phenotypes at Cacaulândia is like *C. aymaran* as discussed and illustrated by McAlpine (1971). That species was described from a holotype and allotype (at Carnegie Museum) taken in eastern Bolivia (Río Surutu, 350m). McAlpine (1971) further examined a series of "about 135 specimens" from Perú, Brazil, Chile, Bolivia, Paraguay, and Argentina and thought that *C. aymaran* probably occurred in other areas as well. He illustrated the wings of the primary types and two topoparatypes; the wing venation of an apparent paratype; the male genitalia of two topoparatypes (both labeled as "like holotype") and a "variant"; and the female genitalia of the allotype (genital plate and corpus bursae), an apparent topoparatype (corpus bursae), and one "possible" and two "probable" variants (genital plates). The male variant, at least, appears to be an undescribed species (see below); the genitalia of "variant" females also appear to resemble certain undescribed species as noted below. The material McAlpine (1971) included in *C. aymaran*, therefore, needs to be reevaluated and may include more than one species. If so, the distribution he outlined for that species requires reevaluation. Likewise, identities of *Calephelis* reported from studies of local faunas in South America (*e.g.*, Brown 1992; Mielke 1994; Mielke and Casagrande 1997, 1998; Lamas *et al.* 1999; Brown and Freitas 2000; Emery *et al.* 2006; Pinheiro and Emery 2006) should be treated as provisional until specimens are critically examined.

In Rondônia, males of *C. aymaran* have broad wings and initially appear like females. They have a vaguely shaded area in the middle of the dorsal wings and relatively indistinct dorsal lines. The markings are somewhat more prominent on paler individuals. Adults are present near Cacaulândia throughout the year and appear in peak numbers during the wet season (Fig. 68).

None of the remaining species of *Calephelis* from the Cacaulândia area represent described species. Their genitalia are different from any of the other species known to occur in South America. Similarities, as they exist, are with *C. aymaran* and Central American taxa.

Calephelis distinctus Austin, **new sp.**
(Fig. 1-5, 29-33, 58, 64, 68)

Description. Male. Forewing length = 11.5mm (11.0-12.0, n = 10), wings broad and rounded, forewing not produced, slightly excavate just before apex; dorsum medium brown, basal 2/3 of wing with five indistinct, concentric black lines, more or less continuous from costa to anal margin, outer on forewing produced between M_2 and CuA_1 where shaded proximad and often distad by poorly defined area of darker brown; marginal and submarginal lines prominent, iridescent blue-gray, outer more or less parallel to termen, entire or narrowly broken at veins, obviously angled on forewing at vein CuA_2, inner sinuous, produced prominently distad between M_2 and CuA_1 (especially on forewing), broken and often disjunct at veins; row of large black dots between iridescent lines; area distad to inner iridescent line red-brown; forewing fringe gray, prominently checkered with white in R_5-M_1 and M_3-CuA_1, vaguely checkered in M_1-M_2 and M_2-M_3; hindwing fringe entirely gray.

Venter bright pale red-brown, slightly paler basad on both wings; markings of dorsum repeated but more distinct on paler ground color; black lines relatively thin and as separated elements in each cell, but elements of outer line often exaggerated and prominent, outer black line very close to inner iridescent line and doubled on some individuals; iridescent lines broader than on dorsum, outer parallel to termen and narrowly broken at veins, inner less irregular and in form of well-separated bars, especially on forewing. Paler individuals are present during dry season.

Head, thorax, and abdomen concolorous with wings on dorsum, paler than ground color on venter; antennae black with distinct white annular rings, tip of club narrowly orange.

Genitalia (Fig. 58): in lateral view, pedicel projections relatively long and broad, caudal ends prominently curved ventrad; in ventral view, pedicel projections moderately broad, curved, caudal ends strongly curved inward; cephalic end of genital capsule narrow; transtilla slightly exceeding pedicel length, curved slightly dorsad at caudal end.

Female. Forewing length = 11.8mm (11.0-12.3, n = 10); similar to male, wings broader and more rounded; dorsum slightly less dark; medial dark band more prominent; venter more ochreous with all lines more prominent. As for males, paler individuals are present during dry season.

Genitalia (Fig. 64): genital plate relatively broad and long, rectangular, shallowly V-shaped on caudal edge; ductus bursae long, thin; corpus bursae oval with signa very close to caudal end, shaped as robust spines.

Types. *Holotype male*: with the following labels: white, printed - / BRASIL: Rondonia / 62 km S Ariquemes / linea C-20, 7 km E / B-65, Fazenda / Rancho Grande / 7 Nov. 1990 / leg G.T. Austin /; white, printed and handprinted - / Genitalic Vial / GTA - 1194 /; white, printed - / G.T. Austin colln. / MGCL Acc. / 2004-5 /, red, printed - / HOLOTYPE / *Calephelis distinctus* / Austin /. Deposited at the Departamento de Zoologia, Universidade Federal do Paraná, Curitiba, Brazil. *Paratypes* (all BRAZIL: Rondônia): Linha C-10, 5km S of Cacaulândia, 29 Mar 1997 (2 males), 12 Apr 1997 (1 male), 13 Apr 1997 (1 male), 18 Apr 1995 (1 male), 18 Apr 1997 (1 male), 20 Apr 1996 (1 male), 24 Apr 1995 (1 male), 4 May 1997 (1 male), 22 Jul 1995 (1 male), 4 Sep 1993 (1 male), 15 Nov 1995 (1 male), Linha C-20, 7km E of B-65, Fazenda Rancho Grande, 15 Mar 1991 (1 male), 21 Apr 1992 (1 male), 7 Nov 1990 (1 male), 8 Nov 1989 (1 male). *Additional material examined*: BRAZIL: Rondônia; Linha C-10, 5km S of Cacaulândia, 4 Feb 1995 (1 female), 5 Mar 1995 (1 female), 10 Mar 1996 (1 female), 5 Apr 1997 (1 female), 7 Apr 1996 (1 female), 14 Apr 1996 (1 female), 4 May 1997 (1 female), 14 May 1995 (1 female), 24 Jun 1995 (1 female), 1 Jul 1995 (1 male), 1 Sep 1993 (1 female), 6 Nov 1993 (1 female), 26 Nov 1996 (1 female), 30 Nov 1996 (1 female), Linha C-20, 7km E of B-65, Fazenda Rancho Grande, 21 Apr 1992 (1 female), 7 Nov 1989 (1 female), 10 Nov 1989 (1 female), B-65, 3km N of C-20, 8km N of Cacaulândia, 1 Nov 1990 (1 female).

Type locality. BRAZIL: Rondônia; 62km south of Ariquemes, Linha C-20, 7km (by road) east of route B-65, Fazenda Rancho Grande, elevation 180m. This is approximately 5km northeast of Cacaulândia in a disturbed area adjacent to typical lowland tropical rainforest.

Distribution and phenology. This species is known to date only from the vicinity of Cacaulândia with a flight period principally during the early and late wet season (Fig. 68).

Etymology. The name means "distinct" and refers to the prominent iridescent lines on the dorsum.

Diagnosis and discussion. *Calephelis distinctus* is larger on average than *C. aymaran* and the wings are more prominently rounded, especially the hindwing. The species is generally darker than *C. aymaran* and with a similar vague dark shade across both wings, but the iridescent lines are prominently visible. The red-brown venter averages the darkest among the *Calephelis* seen from Rondônia. Unlike on the dorsum, the ventral iridescent lines are less prominent than on *C. aymaran* and not produced as much in the middle of the wings. The basal black

Fig. 1-5. *Calephelis distinctus* from Rondônia, Brazil, dorsal surface. 1. holotype male; 2. paratype male, Fazenda Rancho Grande, 21 Apr 1992; 3. paratype male, Fazenda Rancho Grande, 7 Nov 1990; 4. female, Fazenda Rancho Grande, 7 Nov 1989; 5. female, B-65, 3 mi. N of C-20, 8 mi. N of Cacaulândia, 1 Nov 1980.

Fig. 6-10. *Calephelis canus* from Rondônia, Brazil, dorsal surface. 6. holotype male; 7. paratype male, Fazenda Rancho Grande, 14 Dec 1991; 8. paratype male, C-10, 5 km N of Cacaulândia, 21 Nov 1996; 9. paratype male, C-10, 5 km N of Cacaulândia, 17 Nov 1996; 10. female, C-10, 5 km N of Cacaulândia, 26 Jul 1993.

Fig. 11-15. *Calephelis brevis* from Rondônia, Brazil, dorsal surface. 11. holotype male; 12. paratype male, C-10, 5 km N of Cacaulândia, 4 Feb 1997; 13. paratype male, C-10, 5 km N of Cacaulândia, 1 Jul 1995; 14. female, Fazenda Rancho Grande, 10 Nov 1989; 15. female, C-10, 5 km N of Cacaulândia, 6 Sep 1993.

Fig. 16-20. *Calephelis rotundum* from Rondônia, Brazil, dorsal surface. 1. holotype male; 17. paratype male, Fazenda Rancho Grande, 3 Nov 1989; 18. paratype male, C-10, 5 km N of Cacaulândia, 22 Jul 1997; 19. female, C-10, 5 km N of Cacaulândia, 11 Feb 1995; 20. female, C-10, 5 km N of Cacaulândia, 1 Apr 1995.

Fig. 21-28. *Calephelis* from Rondônia, Brazil, dorsal surface. 21. *C. indistinctus* holotype male; 22. *C. indistinctus* paratype male, C-10, 5 km N of Cacaulândia, 17 Nov 1996; 23. *C. indistinctus* paratype male, C-10, 5 km N of Cacaulândia, 18 Sep 1997; 24. *C. aymaran* male, C-10, 5 km N of Cacaulândia, 18 Jan 1997; 25. *C. aymaran* male, C-10, 5 km N of Cacaulândia, 2 Dec 1995; 26. *C. aymaran* male, C-5, 10 km S of Cacaulândia, 8 Nov 1989; 27. *C. aymaran* female, Fazenda Rancho Grande, 18 Mar 1991; 28. *C. aymaran* female, C-10, 5 km N of Cacaulândia, 8 Oct 1993.

Fig. 29-33. *Calephelis distinctus* from Rondônia, Brazil, ventral surface; same specimens as Fig. 1-6.

Fig. 34-38. *Calephelis canus* from Rondônia, Brazil, ventral surface; same specimens as Fig. 7-10.

Fig. 39-43. *Calephelis brevis* from Rondônia, Brazil, ventral surface; same specimens as Fig. 11-15.

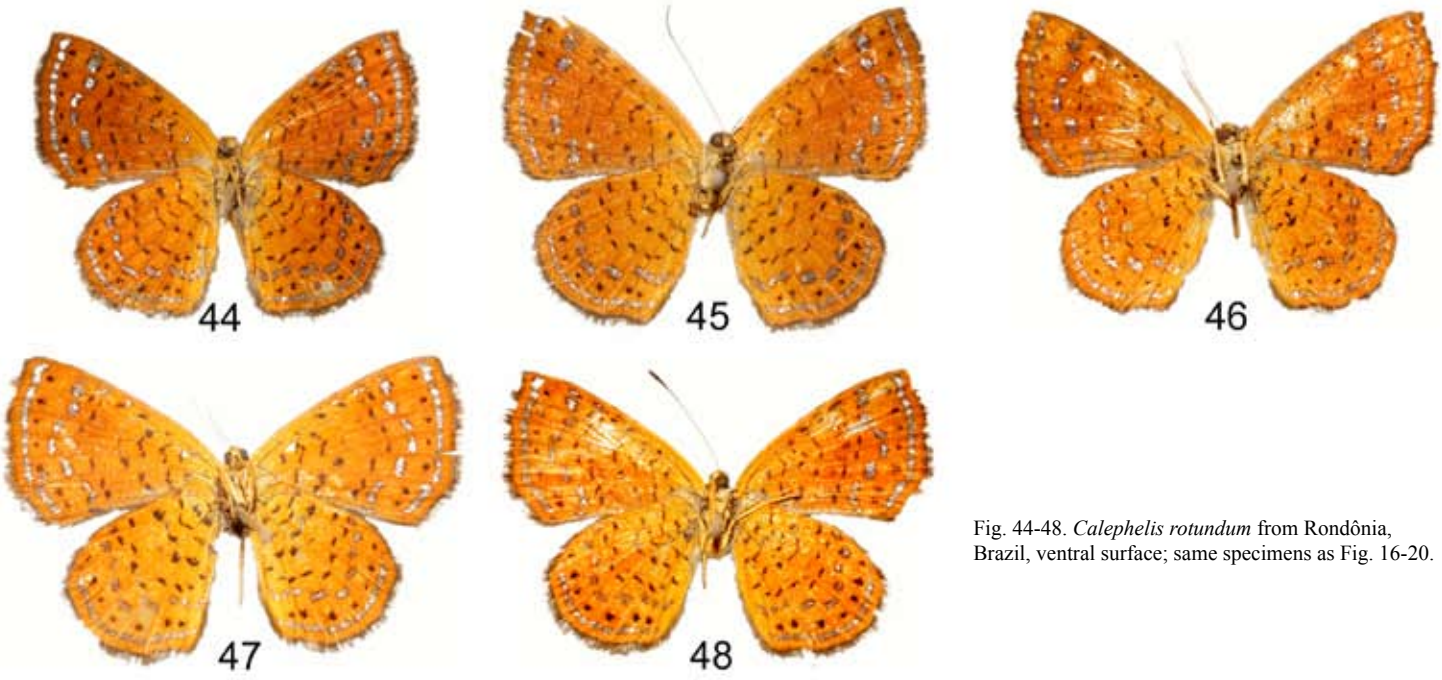

Fig. 44-48. *Calephelis rotundum* from Rondônia, Brazil, ventral surface; same specimens as Fig. 16-20.

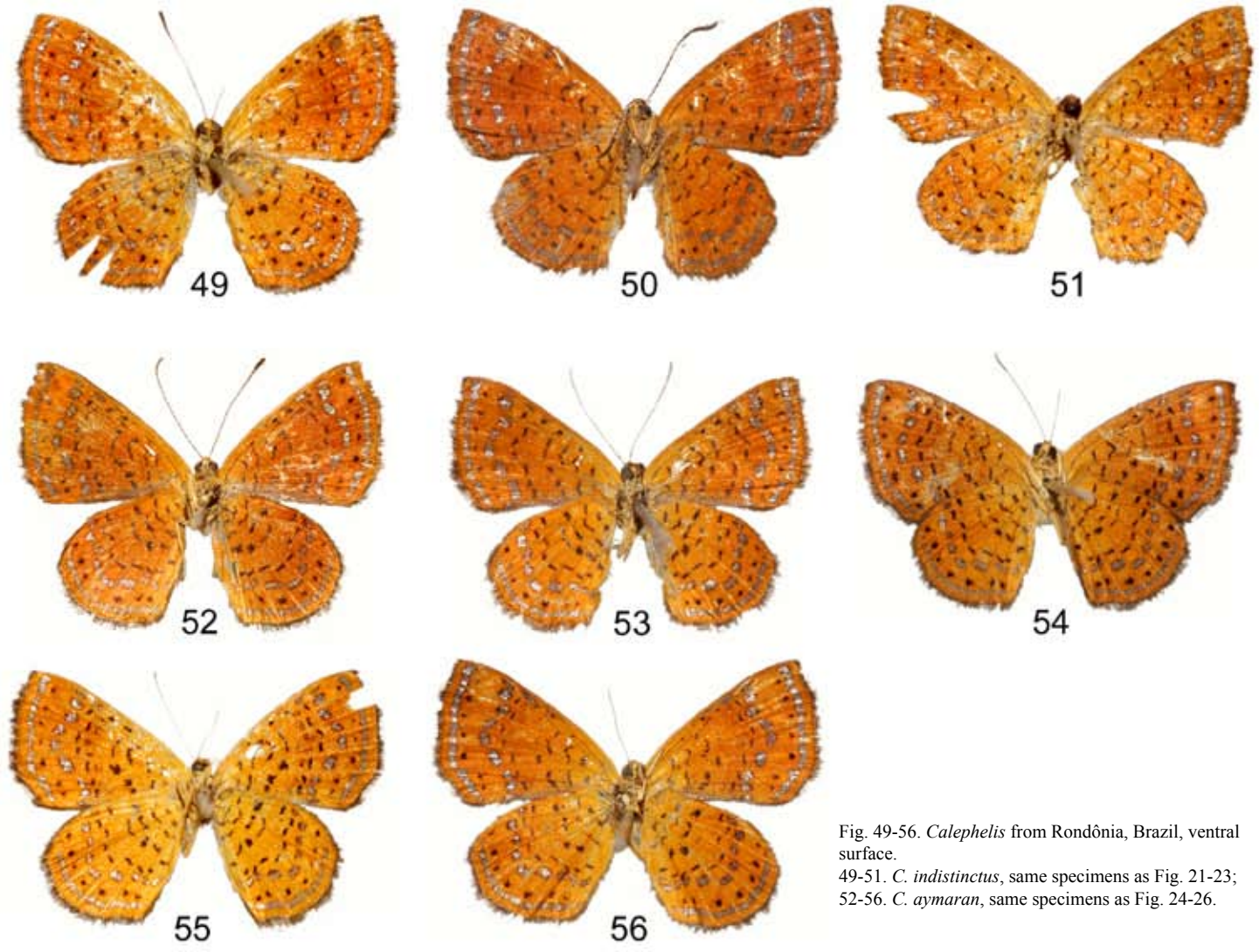

Fig. 49-56. *Calephelis* from Rondônia, Brazil, ventral surface.
49-51. *C. indistinctus*, same specimens as Fig. 21-23;
52-56. *C. aymaran*, same specimens as Fig. 24-26.

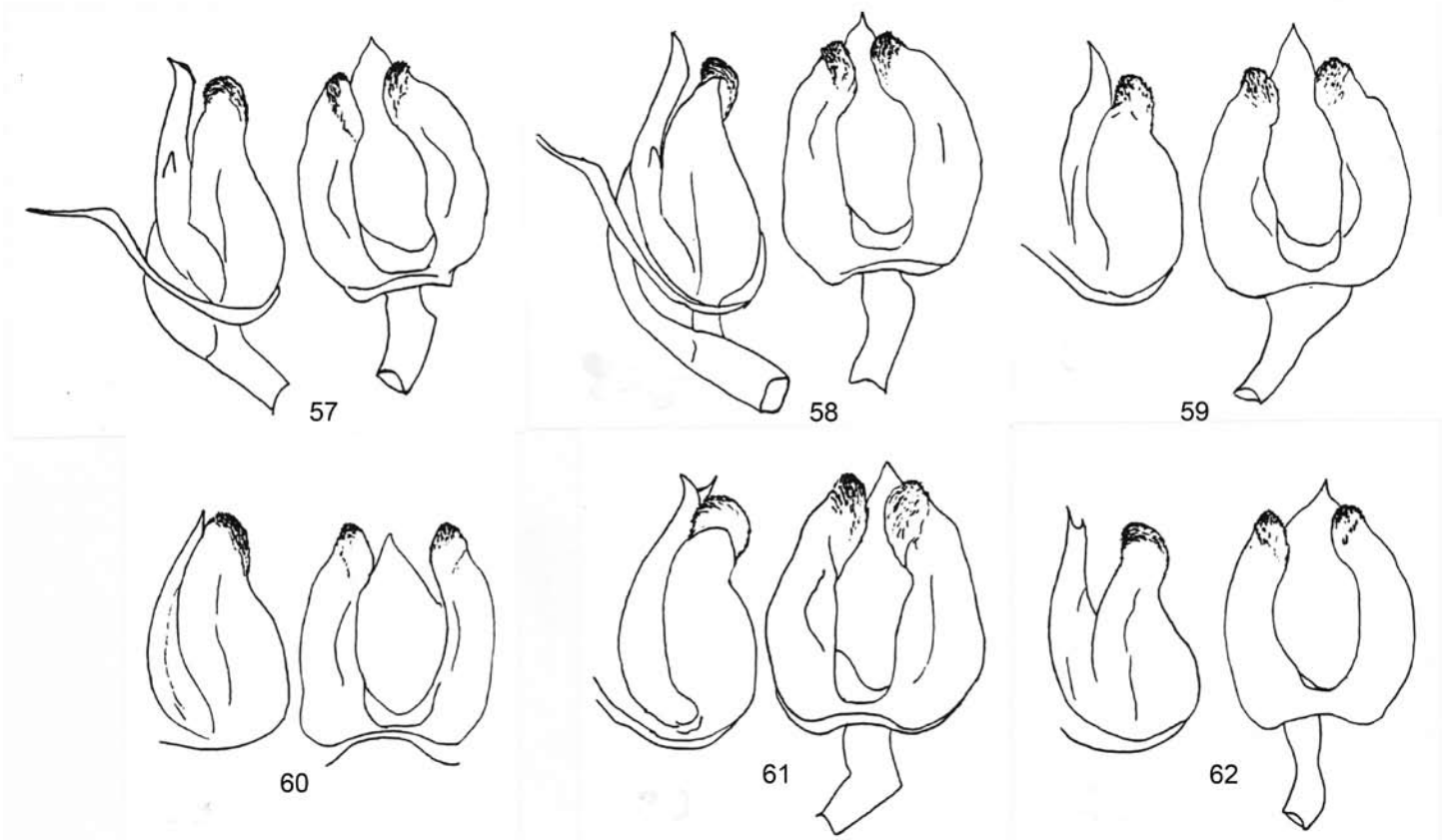

Fig. 57-62. Male genitalia of *Calephelis* from Rondônia, Brazil, lateral and ventral views of genital capsule. 57. *C. aymaran* (GTA #7850); 58. *C. distinctus* (GTA #7546); 59. *C. canus* (GTA #7908); 60. *C. brevis* (GTA #7923); 61. *C. rotundum* (GTA #1198); 62. *C. indistinctus* (GTA #7952).

lines are similarly thinner, less prominent, and less continuous with the outer very close to the inner iridescent line. The outer two of these lines often have broadened elements that stand out as the most prominent wing macules. Male genitalia of *C. distinctus* are more robust and angular (appearing quadrate between the pedicel projections in ventral view) than those of *C. aymaran* and the transtilla is a little shorter. Only the genitalia of *Calephelis acapulcoensis* McAlpine, 1971 (described from Guerrero, Mexico), approach the shape of those of *C. distinctus*, but even these have less angular pedicel projections. The genital plate of the female of that species is broader and more angular.

McAlpine's (1971) illustrated variant female of "*C. aymaran*" from Tujuco, Brazil (slide No. 55) has genitalia resembling those of *C. distinctus*.

Calephelis canus Austin, **new sp.**
(Fig. 6-10, 34-38, 59, 65, 68)

Description. Male. Forewing length = 11.0mm (10.5-11.8, n = 10), wings broad and rounded, forewing not produced; basal 2/3 of dorsum dark brown to red-brown with five indistinct, concentric black lines, more or less continuous from costa to anal margin, outer shaded proximad with darker brown; distal 1/3 of wings distinctly grayer; marginal and submarginal lines indistinct, iridescent blue-gray, outer more or less parallel to termen, narrowly broken at veins, inner sinuous, broken and often disjunct at veins, produced distad between veins M_2 and CuA_1 on both wings; row of large black dots between iridescent lines encircled with red-brown; area distad to outer iridescent line red-brown; forewing fringe gray, prominently checkered with white in R_5-M_1 and M_3-CuA_1, vaguely checkered in M_1-M_2 and M_2-M_3; hindwing fringe entirely gray.

Venter pale red-brown with markings of dorsum repeated but more distinct on paler ground color, black lines prominent, fine and not continuous, may be exaggerated elements in all lines, 4th line (from base) most prominent, outer black line close to inner iridescent line as on *C. aymaran*, usually single (occasionally trace of doubling as a few black scales); iridescent lines broader than on dorsum, inner less irregular and macular. No apparent seasonal variation, paler individuals occur throughout year.

Head, thorax, and abdomen concolorous with wings on dorsum, paler than ground color on venter; antennae black with distinct white annular rings, tip of club dull orange.

Genitalia (Fig. 59): in lateral view, pedicel projections short and relatively narrow, caudal ends not curved ventrad; in ventral view, pedicel projections evenly and broadly curved, caudal ends not curved inward; cephalic end of genital capsule broad; transtilla exceeding pedicel length (more than on preceding species), narrow and curved dorsad at caudal end.

Female. Forewing length = 11.5mm (n = 1); similar to male, wings broader and more rounded; dorsum less dark especially basad; medial dark band equally vague; venter more ochreous with all lines more prominent.

Genitalia (Fig. 65): genital plate narrow and short, trapezoidal, corners not prominently rounded, deeply V-shaped on caudal edge; ductus bursae long, thin; corpus bursae large, globular with signa near caudal end, shaped as robust spines.

Types. *Holotype male*: with the following labels: white, printed - / BRASIL: Rondonia / 62 km S Ariquemes / linea C-20, 7 km E / B-65, Fazenda / Rancho Grande / 4 December 1991 / leg G. T. Austin /; yellow, printed / photographed / G.T. Austin / J. P. Brock / July 1992 /; white, printed and handprinted - / Genitalic Vial / GTA - 9224 /; white, printed - / G.T. Austin colln. / MGCL Acc. / 2004-5 /, red, printed - / HOLOTYPE / *Calephelis canus* / Austin /. Deposited at the Departamento de Zoologia, Universidade Federal do Paraná, Curitiba, Brazil. *Paratypes* (all BRAZIL: Rondônia): Linha 10, 5km S of Cacaulândia, 20 Jan 1994 (1 male), 4 Feb 1997 (1 male), 5 Mar 1995 (1 male), 29 Mar 1997 (1 male), 13 Apr 1997 (1 male), 27 Jun 1993 (1 male), 22 Jul 1995 (1 male), 5 Aug 1995 (1 male), 17 Nov 1996 (1 male), 21 Nov 1996 (1 male), 29 Nov 1996 (1 male), Linha C-20, 7km E of B-65, Fazenda Rancho Grande, 18 Jan 1990 (2 males), 18 Jul 1992 (1 male), 17 Oct 1992 (1 male), 29 Oct 1989 (1 male), 9 Nov 1991 (1 male), Linha C-5, 10km S of Cacaulândia, 29 Apr 1990 (1 male), road B-80, between linhas C-20 and C-15, ca. 15km E of Cacaulândia, 17 Nov 1991 (2 males), Linha C-15, lot 36, W of Cacaulândia, 9 Oct 1993 (1 male). *Additional material examined*: BRAZIL: Rondônia; Linha C-10, 5km S of Cacaulândia, 26 Jul 1993 (1 female).

Type locality. BRAZIL: Rondônia; 62km south of Ariquemes, Linha C-20, 7km (by road) east of route B-65, Fazenda Rancho Grande, elevation 180m. This is approximately 5km northeast of Cacaulândia in a disturbed area adjacent to typical lowland tropical rainforest.

Distribution and phenology. This species is known at present only from the vicinity of Cacaulândia, with a flight period principally during the wet season (Fig. 68).

Etymology. The name means "gray" and refers to the gray distal portions of the dorsal wings.

Diagnosis and discussion. *Calephelis canus* is a relatively small species, slightly larger on average than *C. aymaran*, but smaller than *C. distinctus*. It is similar to those two species in overall color and pattern, but often has a grayish

aspect distad and a broader and more prominent medial dark shade. The macular aspect of the ventral iridescent lines resembles that of the larger *C. distinctus*, but the ground color averages less intense. Male genitalia are shaped much like those of *C. aymaran*, but the pedicel projections are broader and the transtilla is longer. The pedicel projections do not have the angular aspect of *C. distinctus*. The cephalic end of the genital capsule is broader than on both of those species. The genitalia also resemble those of *Calephelis dreisbachi* McAlpine, 1971 (described from Sinaloa, Mexico), but the transtilla is broader and the pedicel projections are less evenly curved. Female genitalia of *C. canus* have a shorter and more angular genital plate than either *C. aymaran* or *C. distinctus*.

Calephelis brevis Austin, **new sp.**
(Fig. 11-15. 39-43, 60, 66, 68)

Description. Male. Forewing length = 10.8mm (10.7-11.0, n = 4), wings relatively broad and rounded, forewing not produced; dorsum red-brown, basal 2/3 of wing with five indistinct, concentric black lines, more or less continuous from costa to anal margin, outer shaded proximad with darker brown; marginal and submarginal lines indistinct, iridescent blue-gray, outer thin and more or less parallel to termen, narrowly broken at veins, inner broader, composed of irregular scrawls and crescents, broken and often disjunct at veins, produced distad between veins M_3 and CuA_1 on both wings; row of large black dots between iridescent lines; area distad to black dots slightly redder brown than basad; forewing fringe worn but with gray and white; hindwing fringe gray.

Venter ochreous-orange with markings of dorsum repeated but more distinct on paler ground color, finer, and not continuous, little broadening of elements, outer black line single; iridescent lines broader than on dorsum but not prominent, lightly scaled on 3 of 4 individuals, inner less irregular and in form of bars, especially on forewing. No seasonal variation seen among material at hand.

Head, thorax, and abdomen concolorous with wings on dorsum, paler than ground color on venter; antennae black with distinct white annular rings, tip of club dull orange.

Genitalia (Fig. 60): in lateral view, pedicel projections short and relatively broad, caudal ends not curved ventrad; in ventral view, pedicel projections nearly straight and widely separated, caudal ends not curved inward; cephalad end of genital capsule broad and prominently concave; transtilla slightly shorter than pedicel length, broad, not curved dorsad at caudal end.

Female. Forewing length = 10.8, 10.9mm; similar to male, wings slightly broader and more rounded; dorsum of about same color, markings similar; venter more ochreous, markings similar to male.

Genitalia (Fig. 66): genital plate relatively broad and short, trapezoidal, corners distinctly rounded, deeply V-shaped on caudal edge; ductus bursae long, thin; corpus bursae globular with signa near caudal end, shaped as spines, expanded caudad.

Types. *Holotype male*: with the following labels: white, printed - / BRASIL: Rondonia / 62 km S Ariquemes / linea C-20, 7 km E / B-65, Fazenda / Rancho Grande / 25 March 1990 / leg Schmitz family /; white, printed and handprinted - / Genitalic Vial / GTA - 7923 /; white, printed - / G.T. Austin colln. / MGCL Acc. / 2004-5 /, red, printed - / HOLOTYPE / *Calephelis brevis* / Austin /. Deposited at the Departamento de Zoologia, Universidade Federal do Paraná, Curitiba, Brazil. *Paratypes* (all BRAZIL: Rondônia): Linha 10, 5km S of Cacaulândia, 4 Feb 1997 (1 male), 1 Jul 1995 (1 male), Linha C-20, 7km E of B-65, Fazenda Rancho Grande, 21 Oct 1989 (1 male). *Additional material examined*: BRAZIL: Rondônia; Linha C-20, 7km E of B-65, 15 Mar 1991 (1 female), 10 Nov 1989 (1 female), Linha 10, 5km S of Cacaulândia, 6 Sep 1993 (1 female).

Type locality. BRAZIL: Rondônia; 62km south of Ariquemes, Linha C-20, 7km (by road) east of route B-65, Fazenda Rancho Grande, elevation 180m. This is approximately 5km northeast of Cacaulândia in a disturbed area adjacent to typical lowland tropical rainforest.

Distribution and phenology. This species is known to date only from the few individuals from the vicinity of Cacaulândia. The flight period appears to be similar to other species of the genus, principally associated with the wet season (Fig. 68).

Etymology. The name means "short" and refers to the transtilla being shorter than the pedicel.

Diagnosis and discussion. *Calephelis brevis* is a small species, about the size of *C. aymaran* and is superficially distinguished as the reddest dorsally and yellowest ventrally of the *Calephelis* in Rondônia. Male genitalia differ from the foregoing species by the broad cephalic end of the genital capsule (more so than on even *C. canus*), relatively slender (like those of *C. aymaran*) and straight pedicel projections, and a transtilla which does not extend beyond the end of the pedicel (the shortest of the known species in Rondônia). Female genitalia have a short genital plate resembling that of *C. canus*, but it is more rounded without the angular aspect on that species.

Calephelis brevis has female genitalia similar to those illustrated by McAlpine (1971) as a variant female of *C. aymaran* (slide No. 20) from Itaparica, Brazil.

Calephelis rotundum Austin, **new sp.**
(Fig. 16-20, 44-48, 61, 67, 68)

Description. Male. Forewing length = 11.7mm (11.3-12.1, n = 10), wings very broad and rounded, forewing not produced, excavate before apex; dorsum brown, interspersed with patches of red-brown on some individuals, basal 2/3 of wing with five indistinct, concentric black lines, more or less continuous from costa to anal margin, outer shaded slightly proximad with darker brown (especially on early wet season individuals); marginal and submarginal lines distinct, iridescent blue-gray, outer thin and more or less parallel to termen, narrowly broken at veins, inner

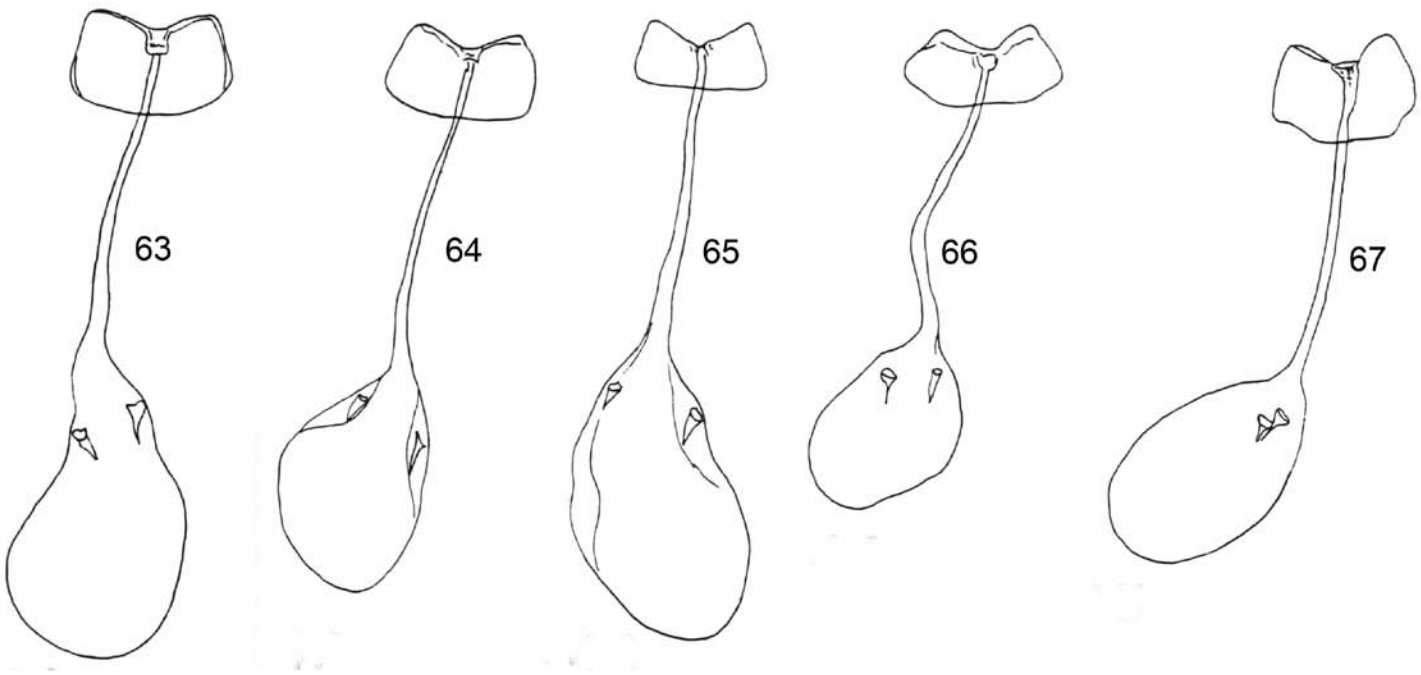

Fig. 63-67. Female genitalia of *Calephelis* from Rondônia, Brazil (ventral view), showing genital plate, ductus bursae and corpus bursae. 63. *C. aymaran* (GTA #7910); 64. *C. distinctus* (GTA #7919); 65. *C. canus* (GTA #7942); 66. *C. brevis* (GTA #7926); 67. *C. rotundum* (GTA #7959).

broader, composed of irregular scrawls and crescents, broken and often disjunct at veins, produced slightly distad between veins M_2 and CuA_1 on both wings; row of large black dots between iridescent lines encircled with red-brown; area distad to outer iridescent line red-brown; forewing fringe gray, prominently checkered with white in R_5-M_1 and M_3-CuA_1, vaguely checkered in M_1-M_2 and M_2-M_3; hindwing fringe entirely gray.

Venter pale red-brown to ochreous-orange with markings of dorsum repeated but more distinct on paler ground color, much finer, widely interrupted, 4th line (from base) most prominent, outer black line single; iridescent lines broader than on dorsum and prominent, inner less irregular and in form of widely separated macules, especially on forewing. Considerable individual variation in color with palest individuals seen from mid-dry season.

Head, thorax, and abdomen concolorous with wings on dorsum, paler than ground color on venter; antennae black with distinct white annular rings, tip of club black.

Genitalia (Fig. 61): in lateral view, pedicel projections relatively long and broad, caudal ends prominently curved ventrad; in ventral view, pedicel projections very broad and curved, caudal ends curved inward; cephalad end of genital capsule broad and slightly concave; transtilla barely exceeding pedicel length, curved dorsad at caudal end.

Female. Forewing length = 11.9mm (11.2-12.3, n = 5); similar to male, wings of similar shape; dorsum about of same color, markings similar; venter more ochreous with markings more prominent.

Genitalia (Fig. 67): genital plate relatively narrow and long, irregular in shape, deeply V-shaped on caudal edge; ductus bursae long, thin; corpus bursae oval with signa very close to caudal end, in shape of "golf tees".

Types. *Holotype male*: with the following labels: white, printed - / BRASIL: Rondonia / 62 km S Ariquemes / linha C-10, 5 km S / of Cacaulândia / 26 March 1994 / *leg.* O. Gomes /; white, printed - / STATION #3 / 2nd growth /; white, printed and handprinted - / Genitalic Vial / GTA - 8631 /; red, printed - / HOLOTYPE / *Calephelis rotundum* /Austin /. Deposited at the Departamento de Zoologia, Universidade Federal do Paraná, Curitiba, Brazil. *Paratypes* (all BRAZIL: Rondônia): Linha C-10, 5km S of Cacaulândia, 21 Jan 1995 (1 male), 9 Feb 1997 (2 males), 15 Jul 1995 (1 male), 16 Jul 1995 (1 male), 22 Jul 1997 (1 male), Linha C-20, 7km E of B-65, Fazenda Rancho Grande, 20 Oct 1989 (1 male), 3 Nov 1989 (3 males), road B-80, between linhas C-15 and C-20, ca. 15km E of Cacaulândia, 22 Apr 1992 (1 male). *Additional material examined*: BRAZIL: Rondônia; Linha C-10, 5km S of Cacaulândia, 11 Feb 1995 (1 female), 1 Apr 1995 (2 females), 24 Jun 1995 (1 female), 15 Jul 1995 (1 female).

Type locality. BRAZIL: Rondônia; 62km south of Ariquemes, Linha C-10, 5km south of Cacaulândia, elevation ca. 180m. This is approximately 5km south of Cacaulândia in a disturbed area adjacent to the Rio Pardo in typical lowland tropical rainforest.

Distribution and phenology. This species is known to date only from the vicinity of Cacaulândia with a flight period principally during the wet season, although it has been recorded more than any other *Calephelis*, except *C. aymaran*, in the middle of the dry season (Fig. 68).

Etymology. The name means "rotund" and refers to the prominently rounded wings and robust male genitalia of this species.

Diagnosis and discussion. *Calephelis rotundum* is the largest of the genus in central Rondônia and is relatively easily distinguished by the broadly rounded wings of both sexes. *Calephelis aymaran* is the only other species seen from near Cacaulândia on which the wing shapes of males and females are nearly identical. This species has the most robust genitalia of the known *Calephelis* in Rondônia. The caudal end of the genital capsule is broad as on *C. canus*, the pedicel projections are broader throughout than even those of *C. distinctus* (or any other *Calephelis*), but are less angular especially caudad, and the transtilla barely extends beyond the end of the pedicel. Female genitalia have a narrow genital plate (about as broad as long) that is prominently excavate in the middle of the caudal edge.

Male genitalia of *C. rotundum* appear very similar to McAlpine's (1971) variant male of *C. aymaran* from "Minas Geraes", Brazil; female genitalia resemble those of a female variant (slide No. 131) from Chanchamayo, Perú.

Calephelis indistinctus Austin, **new sp.**
(Fig. 21-23, 49-51, 62, 68)

Description. Male. Forewing length = 10.6mm (10.2-11.3, n = 8), wings elongate, forewing not produced, termen slightly concave before apex; basal 2/3 of wings medium brown with five nearly indiscernible, concentric black lines, more or less continuous from costa to anal margin, outer often vaguely shaded narrowly with darker brown; outer 1/3 of wings paler, red-brown; marginal and submarginal lines indistinct, iridescent blue-gray, outer more or less parallel to termen, narrowly broken at veins, inner sinuous, broken and often disjunct at veins, produced distad between veins M_2 and CuA_1 on both wings; row of small black dots between iridescent lines, most distinct on hindwing; forewing fringe gray, prominently checkered with white in R_5-M_1 and M_3-CuA_1; hindwing fringe entirely gray.

Venter pale red-brown with markings of dorsum repeated, but much more distinct on paler ground color; third or fourth line (from base) most distinct; outer black line single; iridescent lines broader and more distinct than on dorsum but not prominent, inner less irregular, macular but nearly continuous. No obvious seasonal variation.

Head, thorax, and abdomen concolorous with wings on dorsum, paler than ground color on venter; antennae black with distinct white annular rings, club black, paler at tip.

Genitalia (Fig. 62): in lateral view, pedicel projections short, narrow, and curved prominently ventrad towards caudal ends; in ventral view, pedicel projections narrow, evenly curved including caudal ends; cephalic end of genital capsule of moderate width; transtilla exceeding pedicel length, curved slightly dorsad at caudal end.

Female. Unknown.

Types. *Holotype male*: with the following labels: white, printed and handprinted - / BRASIL: Rondonia / linea C-2.5, off / B-65, 12.5 km S / Cacaulandia / 12 December 1990 / leg G.T. Austin /; white, printed and handprinted - / Genitalic Vial / GTA – 7945 /; red, printed - / HOLOTYPE / *Calephelis indistinctus* / Austin /. Deposited at the Departamento de Zoologia, Universidade Federal do Paraná, Curitiba, Brazil. *Paratypes* (all BRAZIL: Rondônia): Linha C-10, 5km S Cacaulândia, 5 Jan 1997 (1 male), 19 Apr 1995 (1 male), 22 Jul 1995 (1 male), 18 Sep 1997 (1 male), 25 Oct 1993 (1 male), 17 Nov 1996 (1 male), 30 Nov 1996 (1 male), Linha C-20, 7km E of B-65, Fazenda Rancho Grande, 27 Oct 1989 (1 male), 24 Nov 1991 (1 male).

Type locality. BRAZIL: Rondônia; Linha C-2.5, 12.5km south of Cacaulândia, elevation ca. 180m. This is south of Cacaulândia and just west of B-65 in lightly disturbed, but otherwise typical, lowland tropical rainforest; the site has subsequently been completely deforested.

Distribution and phenology. This species is presently known only from the vicinity of Cacaulândia, with records scattered throughout the year (Fig. 68).

Etymology. The name means "indistinct" and refers to the indistinct markings on the dorsum of this species.

Diagnosis and discussion. *Calephelis indistinctus* is the smallest of the genus in central Rondônia and relatively plain in its overall aspect. The forewing of the male is more elongate than among other sympatric species, this strongly contrasting with the female-like wing shape of especially male *C. aymaran* and *C. rotundum*.

Male genitalia of *C. indistinctus* are the least robust of the *Calephelis* known from Rondônia. The genital capsule is moderately broad cephalad, more so than on *C. aymaran*, but not as broad as on *C. canus*, *C. brevis*, or *C. rotundum*. The pedicel projections are slender like those of *C. brevis*, but evenly curved instead of straight. The transtilla extends beyond the end of the pedicel similar to that of *C. distinctus*. Several other species of *Calephelis* have pedicel projections curved similarly to those of *C. indistinctus*, but differ in the length or breadth of the transtilla and/or the breadth of the pedicel projections (see figures in McAlpine 1971).

DISCUSSION

The *Calephelis* of Rondônia were all initially determined by Emmel and Austin (1990) as variations of *C. aymaran* based largely on the distribution given by McAlpine (1971). Dissection of the material indicated six discrete types of male genitalia and five of female genitalia, with no apparent overlap of genital morphology. When sorted by genital morphology, the series showed subtle superficial differences in size, wing shape, color, and markings, but these were generally insufficient to separate all individuals (because of intraspecific, including wear and seasonal, variation) without knowledge of their genitalia. A review of McAlpine's (1971) genital drawings showed a variety of phenotypes included in his concept of *C. aymaran* and some of these appear to refer to new species described herein as noted above. *Calephelis* joins *Charis* among riodinids as a genus that encompasses more cryptic species than realized (see Hall and Harvey 2001, Harvey and Hall 2001). Careful examination of material from other South American locales is needed to elaborate local richness and determine distributions of the species described herein.

The details of the flight season for *Calephelis* near Cacaulândia

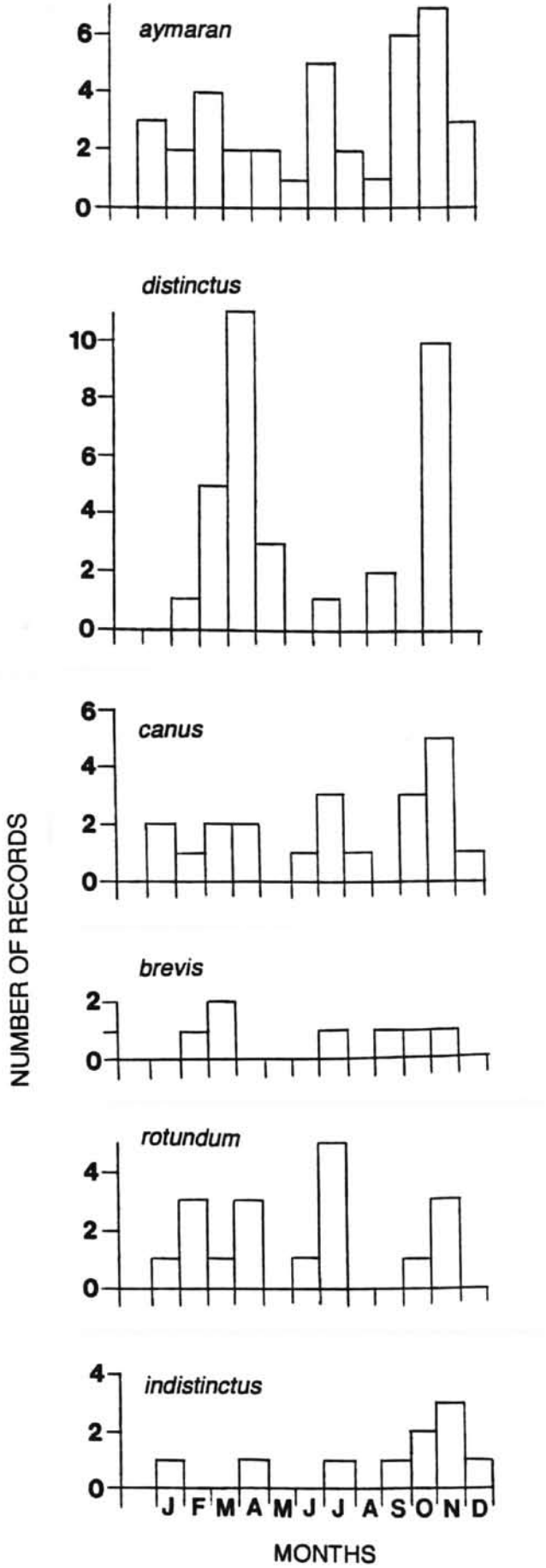

Fig. 68. Phenology of *Calephelis* near Cacaulândia, Rondônia, Brazil.

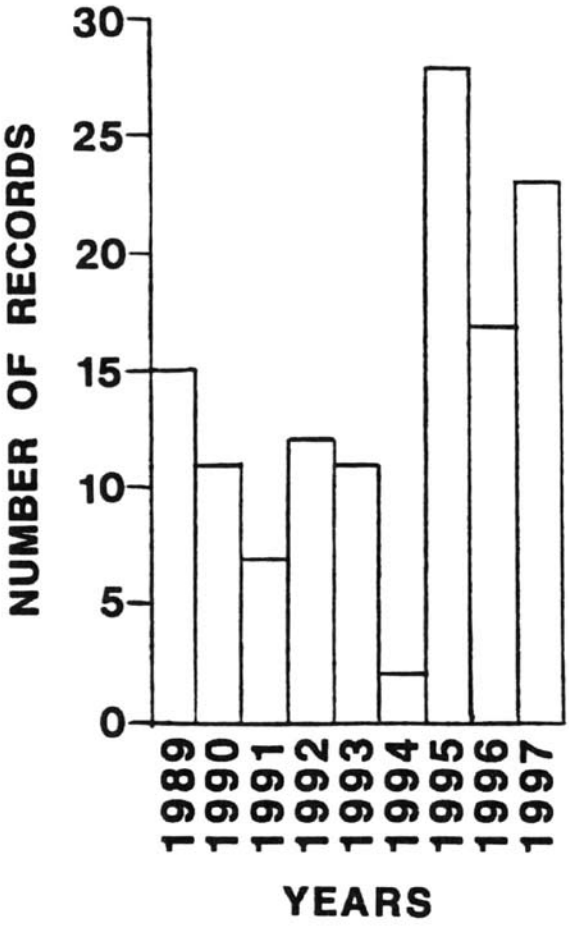

Fig. 69. Number of annual records (pooled abundance of all species) of *Calephelis* from near Cacaulândia, Rondônia, Brazil.

are not clear, hampered by small sample sizes and the inability to determine species in the field. They fly through the wet season and are poorly represented during most of the dry season, with an indication of peaks in the early and late portions of the wet season (Fig. 68). For all species combined, there is a definite paucity of records for the early (May-June) and late (August-September) dry season and well-defined peaks in March and April (late wet season) and October and November (early wet season). Another peak appears in the mid-dry season. *Calephelis* from Rondônia generally show little of the seasonal variation seen among certain species from Central America northward into the southern United States (*e.g.*, see McAlpine, 1971). The material at hand, however, exhibits some individual variation in most species apparently regardless of season. Series systematically collected from a succession of years are needed to determine whether these have a seasonal basis (*e.g.*, wet vs. dry, hot vs. cool) that temporally varies due to annual divergences from average climate.

It is curious that *Calephelis* are relatively prominent in the fauna near Cacaulândia, but have not been recorded at two well-studied and species-rich sites in Perú (Lamas 1994, Robbins *et al.* 1996), nor at a site in Ecuador (Murray 1996). Since *Calephelis* inhabit sunny places, avoid shaded habitats, and largely visit flowers in scrubby second growth and other disturbed areas, they are not forest species (*e.g.*, Austin 1997) and it must be assumed that they have become widespread in central Rondônia only in the last few

decades with the paving of BR-364 and the clearing of large tracts of forest (Frohn *et al.* 1990). In fact, based upon collections, the genus has become more abundant at the study area in recent years (Fig. 69).

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REFERENCES CITED

Austin, G. T.
1993a ("1991"). Three new taxa of *Calephelis* from Costa Rica (Lycaenidae: Riodininae). *Journal of Research on the Lepidoptera,* 30:237-244.

Austin, G. T.
1993b ("1991"). A new species of *Calephelis* from Guatemala (Lycaenidae: Riodininae). *Journal of Research on the Lepidoptera,* 30:245-247.

Austin, G. T.
1997. Genus *Calephelis* Grote and Robinson, 1869, pp. 174-179. In: P. J. DeVries, *The Butterflies of Costa Rica and their Natural History. Volume II: Riodinidae.* Princeton, Princeton University Press.

Austin, G. T., N. M. Haddad, C. Mendez, T. D. Sisk, D. D. Murphy, A. E. Launer & P. R. Ehrlich
1996. Preliminary annotated checklist of the butterflies of Tikal National Park and vicinity, Guatemala (Lepidoptera). *Tropical Lepidoptera,* 7:21-37.

Brown, K. S., Jr.
1992. Borboletas da Serra do Japi: diversidade, hábitats, recursos alimentares e variação temporal, pp. 142-187. In: L. P. Morellato (org.), *História Natural da Serra do Japi, Ecologia e Preservação de uma Área Florestal no Sudeste do Brasil.* Campinas São Paulo, Brazil: Editora UNICAMP/ FAPESP.

Brown, K. S., Jr. & A. V. L. Freitas.
2000. Diversidade de Lepidoptera em Santa Teresa, Espírito Santo. *Boletim do Museu de Biologia Mello Leitão (n.ser.)* 11/12:71-118.

Callaghan, C. J. & G. Lamas
2004. Riodinidae, pp. 141-170. In: G. Lamas (ed.), *Atlas of Neotropical Lepidoptera, Checklist: Part 4A. Hesperioidea-Papilionoidea.* Gainesville, FL: Scientific Publishers.

Emery, E. de O., K. S. Brown, Jr. & C. E. G. Pinheiro
2006. As borboletas (Lepidoptera, Papilionoidea) do Distrito Federal, Brasil. *Revista Brasileira de Entomologia,* 50:85-92.

Emmel, T. C. & G. T. Austin
1990. The tropical rainforest butterfly fauna of Rondonia, Brazil: species diversity and conservation. *Tropical Lepidoptera,* 1:1-12.

Ferris, C. D. (ed.)
1989. Supplement to: A catalogue/checklist of the butterflies of America north of Mexico. *Lepidopterists' Society Memoir,* 3:1-103.

Frohn, R. C., V. H. Dale & B. D. Jimenez
1990. *Colonization, Road Development and Deforestation in the Brazilian Amazon Basin of Rondônia.* ORNL/TM-11470. Oak Ridge, Tennessee: Oak Ridge National Laboratory.

Hall, J. P. W. & D. J. Harvey
2001. A phylogenetic revision of the *Charis gynaea* group (Lepidoptera: Riodinidae) with comments on historical relationships among Neotropical areas of endemism. *Annals of the Entomological Society of America,* 94:631-647.

Hall, J. P. W. & D. J. Harvey
2002. A phylogenetic review of *Charis* and *Calephelis* (Lepidoptera: Riodinidae). *Annals of the Entomological Society of America,* 95:407-421.

Harvey, D. J. & J. P. W. Hall
2001. Phylogenetic revision of the *Charis cleonus* complex (Lepidoptera: Riodinidae). *Systematic Entomology,* 27:265-301.

Lamas, G.
1994. List of butterflies from Tambopata (Explorer's Inn Reserve), pp. 162-177. In: R. B. Foster, J. L. Carr, and A. B. Forsyth (eds.), *The Tambopata-Candamo Reserved Zone of Southeastern Perú: a Biological Assessment.* Rapid Assessment Program, RAP Working Papers 6. Washington, D.C.: Conservation International.

Lamas, G.
2001. Rediscovery of the holotype of *Calephelis costaricicola* Strand, 1916 (Lepidoptera: Riodinidae). *Revista Peruana de Entomología,* 42:20.

Lamas, G., J. Grades & G. Valencia
1999. Las mariposas de Machu Picchu, Cuzco, Perú: un inventario preliminary (Lepidoptera: Rhopalocera). *Revista Peruana de Entomología,* 41:1-8.

Maza E. de la, R. G., J. de la Maza E. & A. White Lopez
1989. La fauna de mariposas de México. Parte I. Papilionoidea (Lepidoptera: Rhopalocera). *Revista de la Sociedad Mexicana de Lepidopterología*, 12:37-98.

McAlpine, W. S.
1961. Genus CALEPHELIS Grote and Robinson, pp. 247-251. In: P. R. Ehrlich and A. H. Ehrlich, *How to Know the Butterflies.* Dubuque: W. C. Brown Co.

McAlpine, W. S.
1971. A revision of the butterfly genus *Calephelis* (Riodinidae). *Journal of Research on the Lepidoptera,* 10:1-125.

Miller, L. D. and F. M. Brown.
1981. A catalogue/checklist of the butterflies of America north of Mexico. *Lepidopterists' Society Memoir,* 2:1-280.

Mielke, C. G. C.
1994. Papilionoidea e Hesperioidea (Lepidoptera) de Curitiba e seus arredores, Paraná, Brasil, com notas taxonômicas sobre Hesperiidae. *Revista Brasileira de Zoologia,* 11:759-776.

Mielke, O. H. H. & M. M. Casagrande
1997. Papilionoidea e Hesperioidea (Lepidoptera) do Parque do Morro do Diabo, Teodoro Sampaio, São Paulo, Brasil. *Revista Brasileira de Zoologia,* 14:967-1001.

Mielke, O. H. H. & M. M. Casagrande
1998. Butterflies of the Ilha de Maracá, pp. 355-359, 467-478. In: W. Milliken and J. A. Ratter (eds.), *Maracá. The Biodiversity and Environment of an Amazonian Rain Forest.* New York: Wiley.

Murray, D. L.
1996. A survey of the butterfly fauna of Jatun Sacha, Ecuador (Lepidoptera: Hesperioidea and Papilionoidea). *Journal of Research on the Lepidoptera,* 35:42-60.

Penz, C. M. & P. J. DeVries
2006. Systematic position of *Apodemia paucipuncta* (Riodinidae), and a critical evaluation of the nymphidiine transtilla. *Zootaxa* 1190:1-50.

Pinheiro, C. E. G., & E. O. Emery
2006. As borboletas (Lepidoptera: Papilionoidea e Hesperioidea) da Área de Proteção Ambiental do Gama e Cabeça de Veado (Distrito Federal, Brasil). *Biota Neotropica* 6(no. 3). http://www.biotaneotropica.org.br/v6n3/pt/abstract?inventory+bn1506032006

Robbins, R. K., G. Lamas, O. H. H. Mielke, D. J. Harvey & M. M. Casagrande
1996. Taxonomic composition and ecological structure of the species-rich butterfly community at Pakitza, Parque Nacional del Manu, Perú, pp. 217-252. In: D. E. Wilson and A. Sandoval (eds.), *Manu, The Biodiversity of Southeastern Peru.* Washington, DC: Smithsonian Institution.

Scott, J. A.
1986. *The Butterflies of North America, a Natural History and Field Guide.* Stanford, CA, Stanford University Press.