

Two new species of moths (Lepidoptera, Pyralidae, Chrysauginae) associated with the three-toed sloth (*Bradypus* spp.) in South America

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Abstract

Two species of chrysaugine moths, discovered as a result of an ecological study in Brazil of tree sloths and their ectoparasites, are described as new and named *Cryptoses waagei* sp. n. and *C. rufipictus* sp. n. They are differentiated from their single congener *C. choloepi* Dyar and near relatives *Bradypophila garbei* Ihering and *Bradypodicola hahneli* Spuler which are also found on tree sloths.

Several species of pyralid moths of the subfamily Chrysauginae have long been known to live habitually in the fur of tree sloths in South America. The moths were generally believed to be parasites and to inhabit the fur of the animal throughout their life-cycle. It is only comparatively recently, in a report by Waage & Montgomery (1976) based on an ecological study of the moth *Cryptoses choloepi* Dyar, which occurs in Costa Rica, Panama and Colombia, and the three-toed sloth *Bradypus variegatus* (=infuscatus), that factual evidence on the moth-sloth relationship has become available. The relationship proved to be phoretic, since only in the adult stage (imago) does the moth actually live in the animal's fur. The immature stages of the moth (ovum, larva, pupa) were found not to live on the animal but on its dung, the larva being coprophagous (see also Waage & Best, 1982, for review).

Subsequently, when ecological studies were extended to Brazil, it was observed that the moths living on the three-toed sloth (*Bradypus tridactylus* and *B. variegatus*) occurring there differed significantly from *C. choloepi* in certain characteristics. Taxonomic study of the Brazilian specimens, together with material in the collections of the British Museum (Natural History), has shown that two distinct species are involved which are closely related

and apparently congeneric with *C. choloepi* but hitherto undescribed.

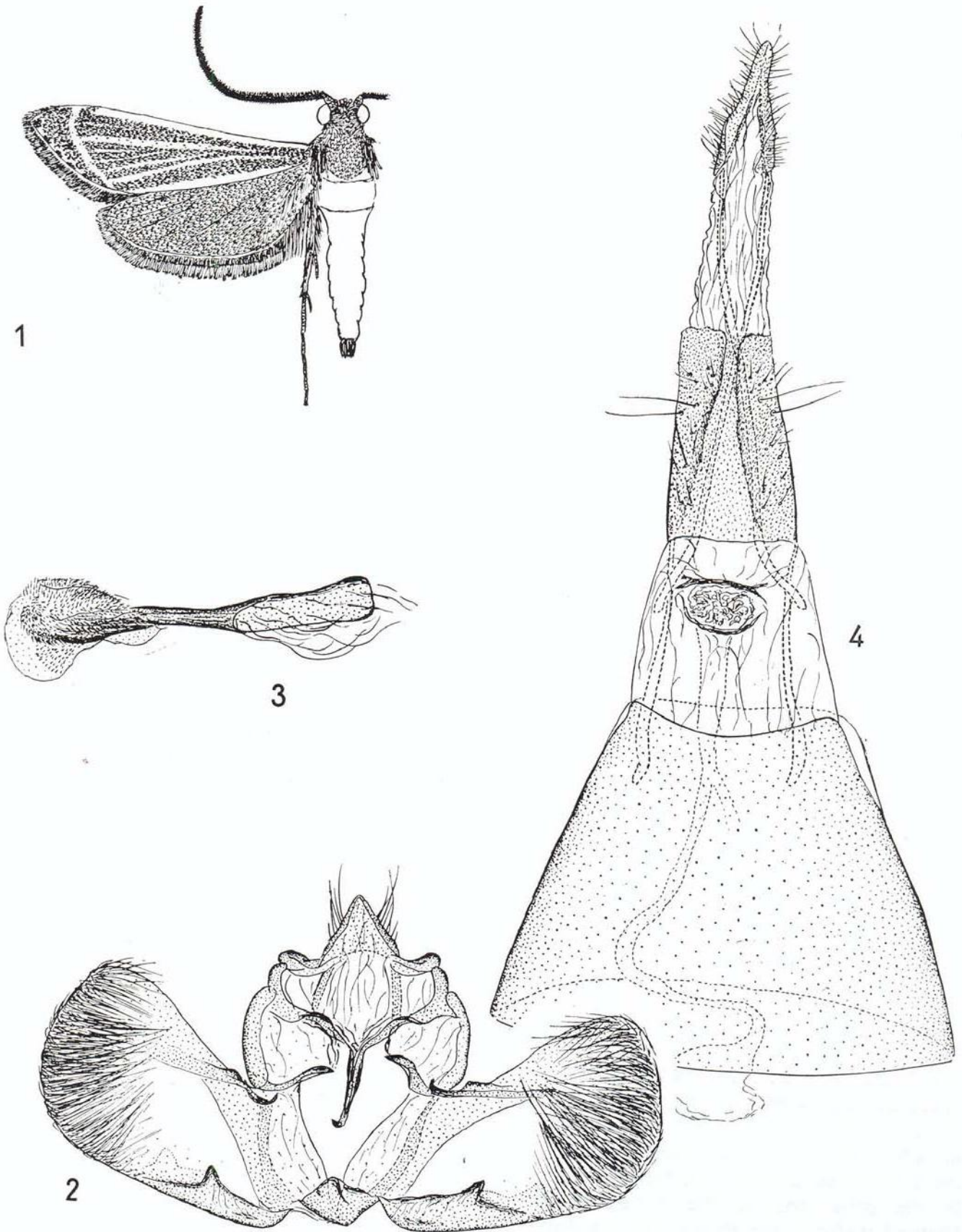
Cryptoses Dyar, 1908 *Cryptoses waagei* sp. n.

(Figs. 1-4)

WINGSPAN: ♂, ♀ 13-15 mm. Sexual dimorphism not pronounced, female usually larger, sexes similar in coloration and forewing pattern, with antennae shortly ciliate, flagellum of male somewhat stouter. Labial palpus, head, thorax, patagium and tegula ochreous-brown, variably suffused with grey-brown; antennal scape and flagellum ochreous-white, scaling of flagellum in male confined mainly to basal part. In both sexes forewing long and narrow, with apex produced and pointed and termen very oblique; ground colour ochreous-white, marked with somewhat diffuse longitudinal streaks or rays consisting of black and grey-black scales mixed with dull purplish red scales, comprising basically a subcostal, a medial and a subdorsal streak, these more or less confluent in basal area of wing, diverging distally and interrupted before termen by a narrow band of ground colour, the subcostal streak divided into two plumes and the medial streak into four plumes postmedially; a series of 5 or 6 blackish interneural dots dispersed along termen; cilia grey, with a diffuse, blackish brown subbasal line. Hindwing uniformly dark grey, the scaling rather thin-spread; cilia unicolorous, with a blackish brown subbasal line. Legs ochreous-white, irrorate or diffusely marked with blackish brown exteriorly. Abdomen ochreous-brown, darker ventrally; male with a light ochreous-brown anal tuft.

MALE GENITALIA: Uncus conical and sparsely setose, its apex reaching well beyond

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Figs. 1-4 — *Cryptoses waagei* sp. n.: 1, imago, ♂; 2, male genitalia, ventral aspect (aedeagus removed); 3, aedeagus, lateral aspect; 4, female genitalia, ventral aspect.

comparatively small lateral protuberances at base. Gnathos with medial process long and slender, hook-tipped. Valva comparatively short and broad, truncated distally; sacculus narrow, reaching to about middle of ventral margin of valva, its upper (dorsal) margin sharply produced at about middle. Aedeagus with membranous apical part (vesica) minutely spiculate, basal part without internal sclerotization.

FEMALE GENITALIA: Ovipositor extensile, pointed, with lobes (papillae anales) long and narrow. Eighth sternite long and comparatively slender; ostium situated anteriorly (on intersegmental membrane), ovate (wider than broad); sterigma forming a thin, weakly sclerotized rim; ductus bursae and bursa copulatrix very weakly developed, membranous.

MATERIAL EXAMINED

HOLOTYPE ♂: **Brazil**, Upper Amazon, Codajas, iv.1907 (S.M. Klages); abdomen *in situ*. **Paratypes:** **Brazil**, Manaus, xi.1919 (Parish), 1 ♀ (genitalia slide 13933); Manaus, 12.iv.1978, ex *Bradypus* sp. (J. K. Waage), 4 ♂ (genitalia slide 13887), 1 ♀ (genitalia slide 13891); Manaus, 19.iii.1978, ex *Bradypus* sp. (R. C. Best), 1 ♀; same locality data but dated 27.iii.1978, 1 ♂; ditto 28.iii.1978, 1 ♂, 1 ♀; ditto 8.vi.1979, 1 ♂; Parintins, 1.x.1919 (Parish), 1 ♀ (wing slide 13921, abdomen missing); Rio Japurá, lago Amanã, 2.ix.1979, at light (R. C. Best), 2 ♂; same locality data but dated 10.ix.1979, 3 ♂. Holotype and 9 paratypes deposited in the British Museum (Natural History); 8 paratypes in the Museum of Zoology of the University, São Paulo; Museu Paraense Emílio Goeldi, Belém, and Instituto Nacional de Pesquisas da Amazônia, Manaus.

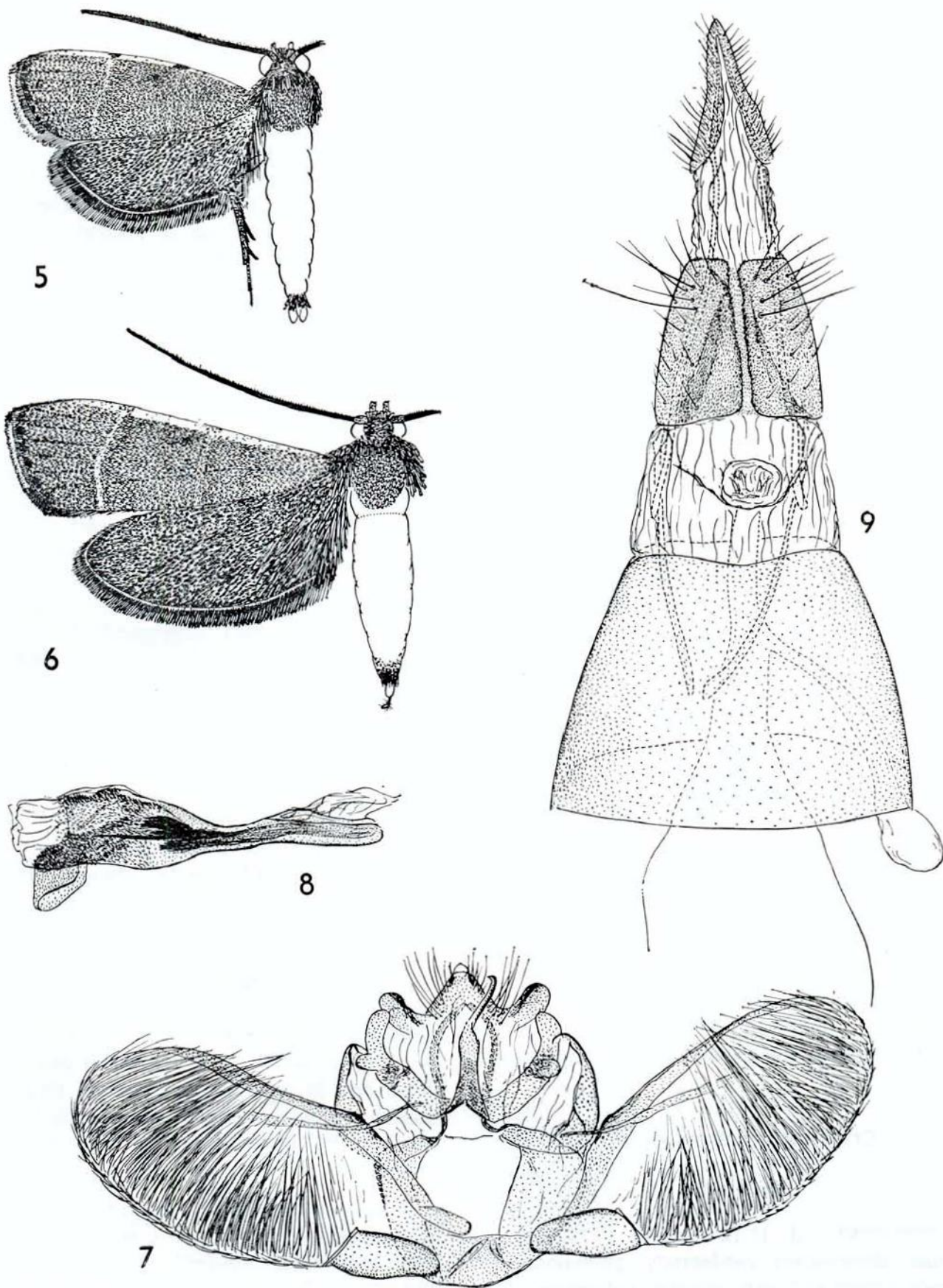
***Cryptoses rufipictus* sp. n.**

(Figs. 5-9)

WINGSPAN: ♂ 11-12 mm, ♀ 15-18 mm. Sexual dimorphism moderately pronounced, female larger and with general coloration of forewing darker; antennae shortly ciliate in both sexes. Labial palpus, head, thorax, pata-

gium and tegula greyish ochreous, palpus sprinkled with dark purplish red exteriorly, vertex and frons of head suffused with brownish red. In both sexes forewing moderately broad, with apex obtusely rounded and termen moderately oblique; ground colour cream, in male overlaid with greyish ochreous weakly tinged with olive, in female overlaid with brownish ochreous or reddish ochreous lacking olive tinge but often with an admixture of scattered blackish-tipped scales, except (in both sexes) for poorly defined, slightly convex and sinuate antemedian and postmedian transverse lines, each line arising from a black spot on costa, the spots being heaviest and most conspicuous in the male and the transverse lines often obscure and obliterate, while in the female the postmedian line is often comparatively clear and distinct; in both sexes a few raised blackish scales in upper part of cell a little beyond antemedian line, sometimes forming a stigma in male; costa narrowly edged with orange-yellow sparsely sprinkled with black; blackish interneural dots along termen; cilia cream-white, with a purplish red basal line reaching from apex to near tornus, the reddish coloration infusing the area around the interneural dots along terminal margin. Cilia around tornus wholly suffused with grey. Hindwing uniformly dark grey; cilia cream-white, with a dark grey subbasal line, sometimes faintly suffused with purplish red from apex to middle of termen, thence suffused with grey. Underside of hindwing grey, with costal margin broadly suffused with purplish red and sprinkled with black; a pair of closely approximated, almost parallel, blackish subterminal lines, the inner one heaviest. Legs pale ochreous, tibia extensively suffused with purplish red exteriorly except tarsal segments, these marked with blackish annuli. Abdomen greyish dorsally, pale ochreous mixed with purplish red ventrally, with a pale ochreous anal tuft.

MALE GENITALIA: Uncus conical and sparsely setose, rather low, its apex reaching only a little beyond comparatively large lateral protuberances. Gnathos with medial process long and slender, hook-tipped. Valva elongated, rounded distally; sacculus short, reaching a



Figs. 5-9 — *Cryptoses rufipictus* sp. n.: 5, imago, ♂; 6, imago, ♀; 7, male genitalia, ventral aspect (aedeagus removed); 8, aedeagus, lateral aspect; 9, female genitalia, ventral aspect.

quarter to one third along ventral margin, its inner edge smooth and even. Aedeagus with membranous apical part (vesica) minutely spiculate, basal part strongly sclerotized internally, terminating apically in a long acicular process (cornutus).

FEMALE GENITALIA: Ovipositor extensile slender, pointed, with lobes (papillae anales) long and narrow. Eighth sternite comparatively broad; ostium situated anteriorly (on intersegmental membrane), circular; sterigma membranous posteriorly, weakly sclerotized anteriorly and forming a thin rim. In some specimens examined the ostium bursae had become impregnated with an opaque spherical mass of black mould spores.

MATERIAL EXAMINED

HOLOTYPE ♂: French Guiana, St Jean de Maroni, ante 1939 (E. Le Mout); abdomen *in situ*. Paratypes: same data as holotype, 9 ♂ (genitalia slides 13911, 13915, 13916), 20 ♀ (genitalia slides 13909, 13914); **Brazil**, R. Maroni, — 1916 (Le M.), 1 ♀ (genitalia slide 13910); Manaus, xi.1919 (Parish), 1 ♂; Manaus, 18.i.1978, ex *Bradypus* sp. (R.C. Best), 1 ♂; same locality data but dated 23.i.1978, 1 ♀; ditto 28.i.1978, 2 ♀; ditto 19.iii.1978, 1 ♀; ditto 26.iii.1978, 1 ♀; ditto 27.iii.1978, 4 ♂, 2 ♀; ditto 28.iii.1978, 2 ♀; ditto 12.iv.1978, 3 ♂ (genitalia slide 13886), 3 ♀ (genitalia slide 13890); Belém, 21.vi.1978, ex *Bradypus* sp. (R.C. Best), 3 ♂ (genitalia slide 13888), 4 ♀ (genitalia slides 13892, 13934); Rio Japurá. Lago Amanã, 2.ix.1979, at light (R.C. Best), 2 ♂; same locality data but dated 10.ix.1979, 3 ♂. Holotype and 46 paratypes deposited in the British Museum (Natural History); 17 paratypes in the Museum of Zoology of the University, São Paulo, Museu Paraense Emílio Goeldi, and Instituto Nacional de Pesquisas da Amazônia, Manaus.

COMMENTS AND DIFFERENTIAL DIAGNOSES

The imago of *C. waagei* is superficially very similar but on average smaller than that of *C. choloepi* Dyar; the male of the latter can have a wingspan of as little as 13 mm but

is more often nearer 15-17 mm, while the female can reach 24 mm. Both species have a forewing pattern consisting of radiating longitudinal streaks, but *C. waagei* is distinguished by the well-defined subterminal band which in *C. choloepi* is poorly defined and hardly determinate in the male and obliterated in the female, and by the distinct light-coloured costal margin of the forewing which in *C. choloepi* is suffused with brown. *C. rufipictus* differs markedly from both species in having antemedian and postmedian transverse lines on the forewing in lieu of the longitudinal streaks and subterminal band of the other two species.

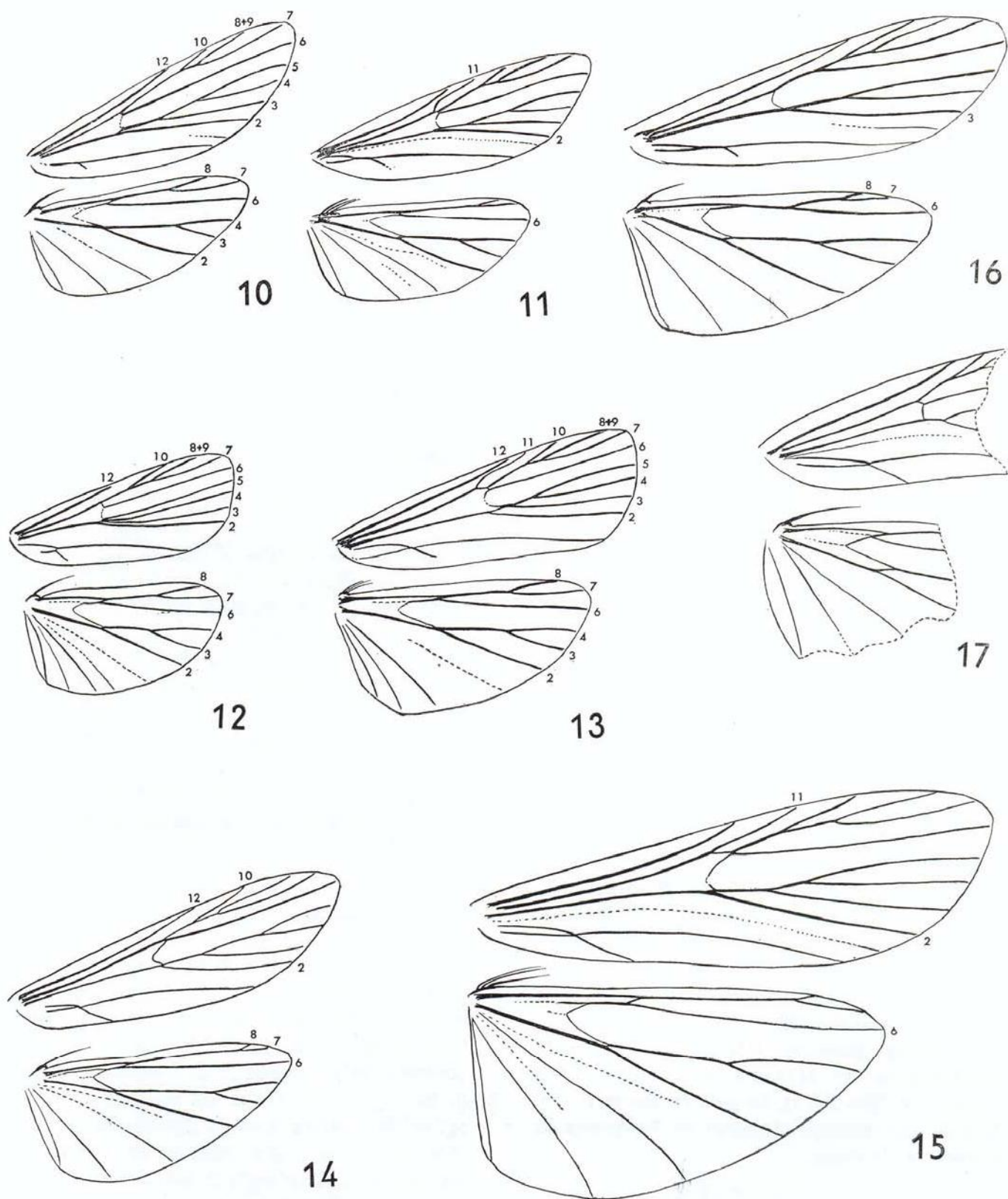
VENATION

(Figs. 10-15)

In both *C. waagei* (Figs. 10, 11) and *C. rufipictus* (Figs. 12, 13) vein 11 of the forewing is absent in the male but present in the female, similarly as in *C. choloepi* (Figs. 14, 15). In *C. waagei* and *C. choloepi* veins 3, 4 and 5 of the forewing are stalked in both sexes, but in *C. rufipictus* they are stalked in the female only and are either connate or closely approximate in the male. In the hindwing, the stalking of veins 7 and 8 varies in all three species but the stalk is usually longer in *C. choloepi*.

MALE GENITALIA

The comparatively short valva and prominent tooth-like projection from the inner margin of the sacculus distinguish *C. waagei* from *C. rufipictus*. In *C. choloepi* the valva is comparatively short as in *C. waagei* but differs in having the distal margin distinctly rounded rather than truncate, and although the sacculus reaches to near the middle of the ventral margin as in *C. waagei* it lacks the tooth-like projection. The short plate-like sacculus distinguishes *C. rufipictus* from the other two species. In both *C. waagei* and *C. rufipictus* the uncus is simple and sparsely setose, but in *C. choloepi* it is bifurcate and densely setose apically.



Figs. 10-17 — Wing venation: 10, *Cryptoses waagei* sp. n., ♂; 11, *C. waagei* sp. n., ♀; 12, *Cryptoses rufipictus* sp. n., ♂; 13, *C. rufipictus* sp. n., ♀; 14, *Cryptoses choloepi* Dyar, ♂; 15, *C. choloepi* Dyar, ♀; 15, *Bradypodiphila garbei* Ihering, ♂; 17, *Bradypodicola hahneli* Spuler, ♂.

FEMALE GENITALIA

The structure of the female genitalia in all three species is very similar and differences are mainly comparative. In *C. choloepi* the eighth sternite is relatively short and is less well sclerotized than in the other two species; the ostium is membranous and circular as in *C. rufipictus* but is relatively larger. *C. waagei* differs from both species by its broader, ovate ostium.

OTHER CHRYSAUGINAE ASSOCIATED WITH TREE SLOTHS

Two further chrysaugine species, *Bradyphila garbei* Ihering and *Bradypodicola hahneli* Spuler, are known to live in association with tree sloths in Brazil and adjacent countries in South America. The imagos of both species come within the size-range of the three *Cryptoses* species but can be distinguished by the following characters.

B. garbei is distinctive by its almost unicolorous dark ochreous forewings, which lack the markings found in *Cryptoses*. The wing venation (Fig. 16) is reduced and simplified, vein 2 being absent in the forewing and the stalk of veins 7 and 8 anastomosing with vein 6 in the hindwing. As in the genus *Cryptoses*, vein 11 of the forewing is absent in the male but present in the female.

B. hahneli differs from all the species mentioned above by its almost unicolorous dark fuscous forewings, the coloration being distinctly more blackish than in *B. garbei*. A distinctive feature of *B. hahneli* is the compressed form of the head, the frons of which is flattened and receding and the vertex prominent; in *Cryptoses* and *Bradyphila* the frons is convex and the vertex is not prominent.

In both *B. hahneli* and *B. garbei* the proboscis is shorter than in *Cryptoses* and is less extensively scaled at the base and the labial palpi are comparatively rough-scaled and droop more or less straight downwards. In *Cryptoses* the proboscis is very long and the basal portion

is extensively scaled, the labial palpi appear slender, the scales being appressed, and the palpi are held in a declivent, porrect or slightly recurved position.

As a result of examining extensive sloth-moth material it has become apparent that, in contrast to the virtually pristine condition of captured imagos of *Cryptoses* and *B. garbei*, specimens of *B. hahneli* are often worn and the extremities of the wings sometimes tattered. It seems that the outer margins and fringes of the wings of this species may be weak and thinly scaled and that they could be damaged by movement through the fur of the sloth.

The male genitalia and wing venations of *B. garbei* and *B. hahneli* are illustrated by Lima (1949).

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RESUMO

Duas espécies de mariposas da família Chrysauginae, descobertas pelos estudos ecológicos da preguiça e seus ectoparasitas no Brasil, são descritas como novas e são denominadas, *Cryptoses waagei* sp. n. e *C. rufipictus* sp. n. Estas são diferenciadas da única outra espécie deste gênero, *C. choloepi* Dyar e das espécies afins, *Bradyphila garbei* Ihering e *Bradypodicola hahneli* Spuler que também são encontrados nas preguiças.

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