Journal of the Lepidopterists' Society
60(3), 2006, 121–137

FIVE NEW SPECIES OF *PAUCIVENA* DAVIS, 1975 (LEPIDOPTERA: TINEOIDEA: PSYCHIDAE) FROM CUBA

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ABSTRACT. Five new species of *Paucivena* Davis (Lepidotera: Tineoidea: Psychidae), *P. ferruginea*, *P. pinarensis*, *P. fusca*, *P. cubana* and *P. orientalis* are described from Cuba and compared with relatives. The females of *P. ferruginea* and *P. orientalis* are described being the first females known within genus; their characteristics confirm the intermediate position of the genus among the American psychids. Notes on natural history of new species (e.g. hosts, habitat) are given as available. Keys for identification of known stages of all *Paucivena* species are provided.

Additional key words: Tineoidea, Psychidae, bagworm, natural history, West Indies.

The Neotropical region has the richest Lepidoptera diversity but one of the least studied psychid fauna with only 61 known species (Heppner, 1998; Davis, 2000). This species number is extremely low compared with that of other faunal regions. The Paleartic, for example, has more than 300 described species (Heppner, 1998). Members of this family were last reviewed by Davis (1975) who described two genera and five species from the West Indies. However, none of these taxa was known from Cuba. Recent collections from Cuba, chiefly on the three main mountain chains, have resulted in the discovery of new records including several new species. In this work, five new species belonging to *Paucivena* Davis, 1975 are described. Keys for identification of known stages of all species and information on natural history are also provided.

MATERIALS AND METHODS

Individuals of all species, except one whose representatives were taken flying at day, were collected as larvae and pupae in the field and reared in the laboratory. Lab-reared larvae were provided with field collected hosts until pupation. All type material is deposited at Instituto de Ecología y Sistemática (CZACC).

Diagnostic morphological characters employed follows Davis (1964, 1975) and Henderickx (1982). Setal maps of larvae follow Hinton (1946) and Stehr (1987). Measurements were taken with an ocular micrometer in a Carl Zeiss Stemi 2000 stereoscopic microscope. Interocular index of head was calculated as a ratio between the vertical diameter of the compound eye and interocular distance measured at a point across the frons midway between the base of antennal sockets and the anterior tentorial pits (Davis, 1975):

Interocular index= vertical eye diameter/ interocular distance

Characters of the two previously known species, *Paucivena reticulata* Davis, 1975 and *Paucivena hispaniolae* Davis, 1975, were taken from original descriptions and illustrations. Additionally, one *P. reticulata* specimen placed at CZACC, was examined.

Abbreviations: $\bar{x}$- mean, SD- standard deviation, CV- coefficient of variation.

RESULTS

Paucivena Davis, 1975

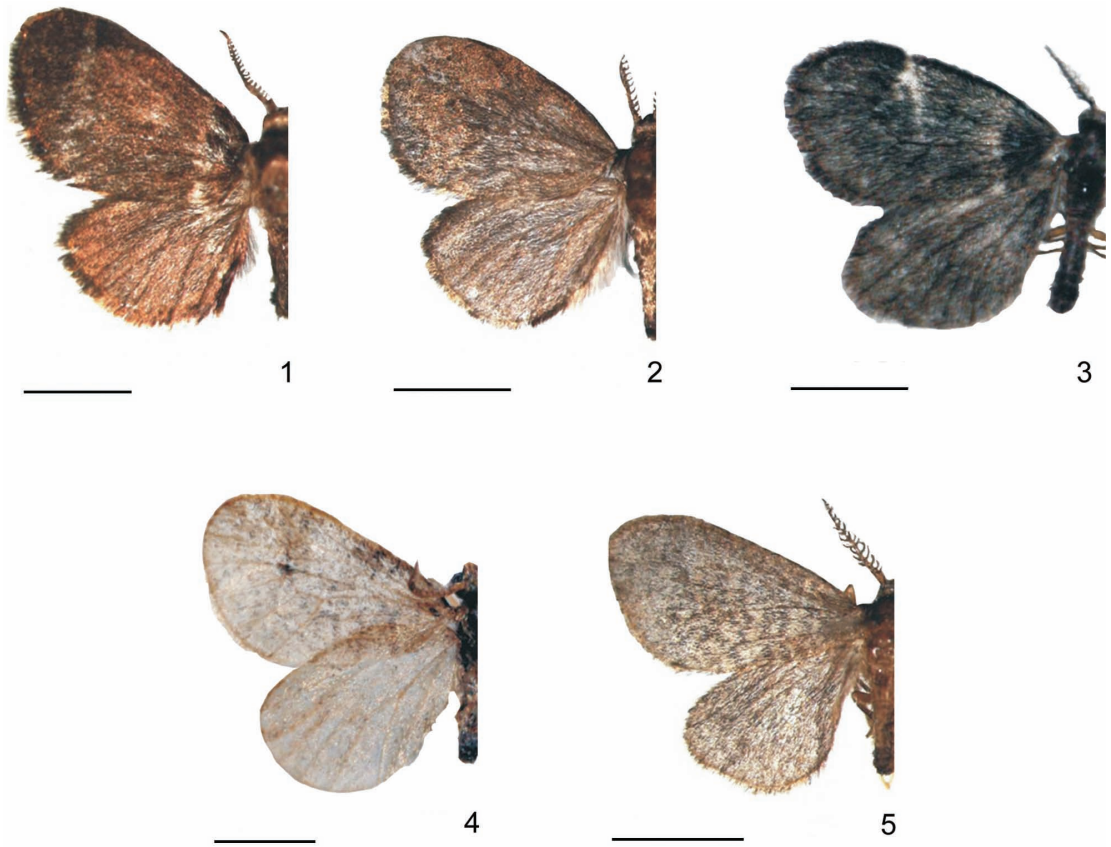
This genus is known only from the western part of the Antilles. Davis (1975) described *P. hispaniolae* from Dominican Republic, Hispaniola, and *P. reticulata* from Puerto Rico and Jamaica. In the same work, this author mentioned the possible presence of *Paucivena* on Cuba. This was confirmed recently by Núñez (2004) based on unknown species from Topes de Collantes, in the Cuban central mountains, which are described here.

Characters that best define *Paucivena* males are labial palpi with a single segment not fused, origin of antennal rami at base of each antennal segment, two pairs of tibial spurs on mid and hindlegs, reduced wing venation and the abbreviated genitalia. Females may be recognized by the possession of compound eyes and functional legs, and the lack of antennae and wings. Larvae feed on several hosts including mosses and lichens growing on rocks and bark, and detritus.

Paucivena ferruginea Núñez, new species
(Figs. 1, 6, 11, 16, 17, 22, 24, 26, 28–35, 41, 45–46, 52)

Diagnosis: *Paucivena ferruginea* male differs from all other *Paucivena* by its brown coloration with slight ferruginous iridescence. Other diagnostics characters are the acute and heavily sclerotized sacculus and the bifid saccus of its genitalia.

Male (Figs. 1, 6, 11, 16, 17). *Head*: brown. Antennae with 23 segments; lateral pectinations about 2–2.5 times length of supporting segment. Vertical diameter of eye 0.8 the interocular distance. *Thorax* (Figs. 6, 11): anterior half dark brown, posterior half brown with slight ferruginous iridescence; underside pale brown except inner surface of



FIGS. 1–5. *Paucivena* spp. adult males. **1** *P. ferruginea*, n. sp.; **2** *P. pinarensis*, n. sp.; **3** *P. fusca*, n. sp.; **4** *P. cubana*, n. sp.; **5** *P. orientalis*, n. sp. Scale= 3 mm.

coxa and femur of forelegs which are dark brown. Vestiture dense, scales hairlike. Wings brown with slight ferruginous iridescence; basal two thirds of costa on FW dark brown. Tibial spurs approximately 0.35 the length of basal tarsal segments (Fig. 6). Scales at discal cell variable in shape: oblanceolated, ovobated, with rounded or acute apices, or hairlike. FW with 9 veins, all veins separated (Fig. 11); accessory cell present; CuP not reaching inner margin; one anal vein. HW with 7 veins, all veins separated except M_{2+3} and CuA_1 which have a unique origin; cross vein between Sc and Rs absent; two anal veins. Wing expanse: 11 mm. *Abdomen*: brown with slight ferruginous iridescence; underside pale brown. Vestiture dense, scales hairlike. *Genitalia* (Figs. 16–17): tegumen broad, with a pair of sparsely setose apical lobes. Valvae with pulvilli setose; apex of sacculus acute and heavily sclerotized, armed with three spines; cucullus apically rounded and sparsely setose. Saccus bifid, apices blunt; approximately 0.1 the length of main body. Aedeagus simple, cylindrical, 0.7 times the length of valvae.

Female (Figs. 22, 24, 26). Length: 7.5 mm. Vermiform. Stramineous, with two longitudinal bands of brown spots on dorsum. *Head* (Fig. 22): stramineous, eyes black. Slightly sclerotized. Shape near ovoid (ventral view); eyes compound, well developed, subventral. Labial palpi 1-segmented, 100% fused; antennae absent. *Thorax* (Fig. 24): patterned as above; body wall slightly sclerotized. Legs functional, armed with numerous tiny spines; tarsi 1-segmented with a pair of claws at distal end (Fig. 24); wings absent. *Abdomen*: color pattern disappearing at A2–A3; membranous and naked except for a ring of dense brownish ochre hairlike scales around A7. External genitalia reduced (Fig. 26), largely membranous. Two pairs of apophyses present; anterior pair elongated, free except bifid base fused with tegument; posterior pair straight and free.

Larva (Figs. 28–34). Length of largest larva 11 mm, maximum width of head capsule 1.2 mm. Head and thorax whitish with dark fuscous longitudinal bands continued on thorax forming a striated pattern; spiracle on TI as large as spiracle on A8, both larger than spiracles on A1–A7. *Head* (Figs. 28–32): patterned as above, lateral area with five elongated bands; labrum ochre; an elongated band on adfrontal sclerite and frons extending from C1 to slightly beyond AF1; AF2 and P2 absent (Fig. 28). Six stemmata present; five arranged in an inverted semicircle, a sixth more distant and ventrad, immediately anterior to S3 (Fig. 29). Labrum (Figs. 30, 31) with LA3 isolated. Mandibles with four acute teeth and a fifth, blunt tooth (Fig. 32). *Thorax* (Fig. 33): patterned as above, three longitudinal bands between body axis and lateral margin of shield, interrupted on metathorax. TI with shield bearing D, SD, XD and L groups; XD-group and L2 in vertical line near anterior margin of shield, SD-group slightly posterior; XD1 about equal in length to SD1, about 2 times longer than XD2 and D2; D1 dorsoposterior to XD1, about 1/4 its length; SD2 above SD1, slightly posterior and about 1/4 its length; L-group trisetose, L1 about 3 times longer than L2 and L3, posteroventral to L2; L3 slightly longer than L2; spiracle dorsoposterior to L-group, diagonal; SV-group in horizontal line on elongated pinnaculum, SV2 about 3/5 length of SV1; MV2 on same pinnaculum, anterior to SV2; V1 about equal in length to SV2, posteroventral to SV1. TII-TIII: D and SD groups in a vertical line on same pinnaculum; D2 about 2–21/2 times longer than D1; SD1 about 3 times longer than SD2; L2 separated from pinnaculum bearing L1 and L3, about 1/2 length of L3; L1 3/5 length of L2, dorsoposterior to L3; SV group on same pinnaculum; SV1 about twice length of SV2; V1 slightly shorter than SV1. *Abdomen* (Figs. 33, 34): integument dark brown, pinnacula brownish ochre. A1: D-group on separated pinnacula, D1 dorsoposterior to D2 and about 3 1/2 times longer; SD1 above and slightly anterior to spiracle, slightly shorter than D2; SD2 minute, anterodorsal to spiracle; L-group trisetose, on separated pinnacula; L1 posterior to L2 and about twice its length; L3 below,

midway between L1 and L2, equal in length to L1; SV-group bisetose and on same pinnaculum, SV2 anterodorsal to SV1 and about 1/3 its length; V1 anteroventral to SV1 and about half its length (Fig. 33). A2 (not shown) equal to A1 except SV- group trisetose, SV3 on pinnaculum bearing V1, below SV2 and about equal its length. A3–A6 with four pairs of prolegs, crochets (22–24) uniordinal, uniserial, arranged in a lateral penellipse; setae as above except SV-group on pinnaculum containing proleg. A7 (not shown) as above except SV-group bisetose. A8 with setae as above except L-group arranged in a more or less vertical line, L1 on same pinnaculum bearing SD-group and spiracle; SV-group unisetose. A9 with all setae arranged in a more or less vertical line; SD1 and D2 on same pinnaculum, SD1 about 5 times longer than D2 and about equal in length to D1. A10 (Fig. 34): anal plate with SD1 slightly longer than D1, about 2–2 1/2 times longer than D2; prolegs bearing 24 uniordinal crochets, uniserial, arranged in a lateral penellipse; anterior margin of shield irregular.

Larval case (Fig. 41). Dimensions: length of main body: ♂ 12 mm ($\bar{x}$=12, SD=0, CV=0, n=2), total length of projecting fragments: 17–18 mm ($\bar{x}$=17.5, SD=0.71, CV=4%, n=2); ♀ 13 mm, total length of projecting fragments: 22 mm; maximum diameter: ♂ 2.6 mm ($\bar{x}$=2.6, SD=0, CV=0, n=2), ♀ 3.3 mm. Almost cylindrical in its entire length; soft. External cover formed by a basal layer of tiny vegetal fragments covered by large fragments of thin herbaceous stems, lengthwise arranged and parallel, various projecting backward from case.

Male pupa (Figs. 45–46). Length 5.8 mm. Uniform yellowish ochre. Frontal ridge absent, frons rounded. Antennal sclerites extending slightly beyond apex of prothoracic legs (Fig. 45). Wing sheaths extending midway along A3. Sclerites of metathoracic legs extending to anterior margin of A4. Cremaster reduced, consisting in a pair of small spines, ventrally curved, arising form a broad conical base; anal groove Y-shaped. Dorsum of A3–A7 with 2–3 irregular rows of spines directed caudad on anterior margin, both end of rows thickened (Fig. 46); A8 with spines grouped in an elliptical patch; areas surrounding rows covered by hundreds of tiny spines arranged in 2–5 series or solitaire. Dorsum of A5–A7 with single posterior row of slender spines oriented caudad. Tabulation of spines shown in Table 1.

Female pupa (Figs. 50–51). Length 7.5 mm. Uniform yellowish ochre. Head with eyes and labial palpi distinct (Fig. 50). Thorax with leg sclerites distinct; wings absent. Cremaster vestigial, reduced to a coarse and rough area around anal groove; anal groove Y-shaped. Dorsum of A6–A7 with 2–4 irregular rows of small spines directed caudad on anterior margin, A8 with spines grouped in an elliptical patch. A4–A6 with a single posterior row of slender spines cephalad oriented (Fig. 51). Tabulation of spines shown in Table 2.

Types. *Holotype* ♂ (with associated larval case and pupal exuvium), reared from larva (emerged 22 June 2003), CUBA: Sancti Spiritus province, Topes de Collantes, Pico Potrerillo, 973 m, 18 May 2003 (R. Núñez), slides RNA 014, 038, 046, 077, 078. *Paratypes*, ♀ (with associated larval case and pupal exuvium), reared from pupa (emerged 20 May 2003), CUBA: Sancti Spiritus province, Topes de Collantes, Parque Codina, 800 m, (R. Núñez), slide RNA 042; 2 larvae (with associated larval case), same data as holotype; 3 larval cases, same data as holotype; 1 larval case, same data as holotype except 17 June 2004.

FIGS. 6–10. *Paucivena* spp. male legs. **6** *P. ferruginea*, n. sp.; **7** *P. pinarensis*, n. sp.; **8** *P. fusca*, n. sp.; **9** *P. cubana*, n. sp.; **10** *P. orientalis*, n. sp. Top- prothoracic leg, middle- mesothoracic leg, bottom-metathoracic leg. Scale= 2 mm.

Natural history observations. Larvae were found feeding on mosses, *Orthostichidium guyanense* (Mont.) V.F. Brotherus (Pterobryaceae) and another unidentified species, on bark of an unidentified bush.

Two adults were reared from larvae: a male emerged from the pupa after a month; a female emerged and was observed hanging from distal end of the case.

The species was found in two localities with very different vegetation and climatic conditions. Parque Codina is characterized by a secondary and very humid evergreen forest with the lower strata protected by a dense canopy. A dry scrub, included in the mogote vegetational complex, grows on top of Pico Potrerillo, an enviroment very exposed to wind and solar radiation.

Distribution (Fig. 52). Known only from two localities at Topes de Collantes region, Trinidad Mountains, central Cuba.

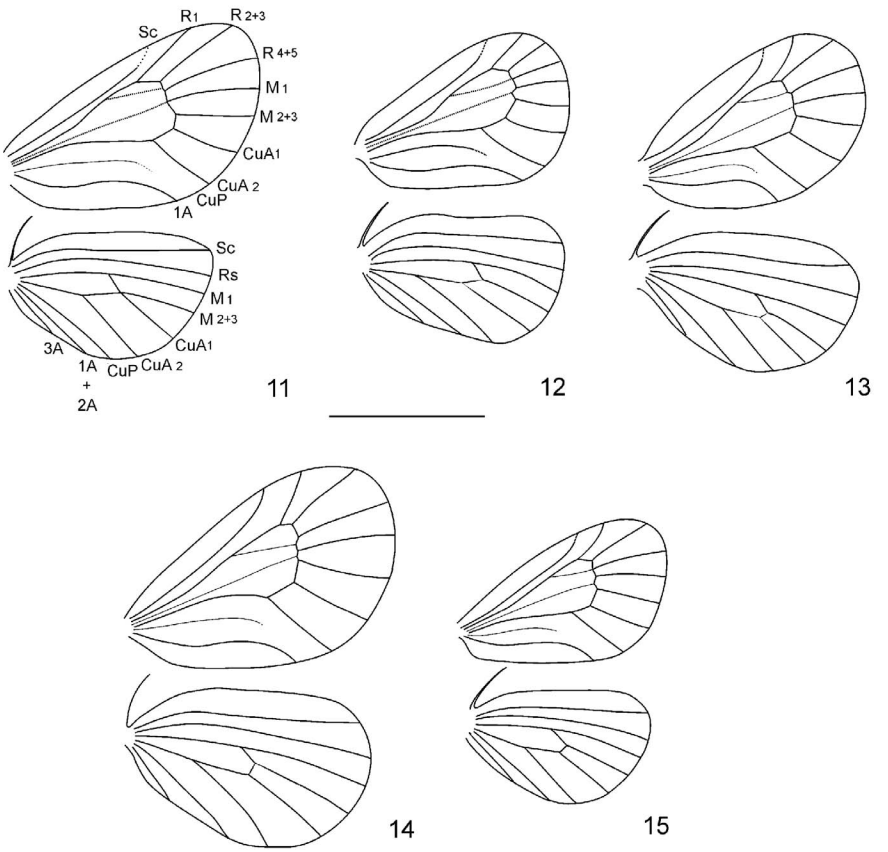
Etymology. The species name is derived from the slight ferruginous iridiscence of male wings.

Remarks. The female may be separated from that of *P. orientalis*, n. sp., by its greater size (length 7.5 versus 5 mm), its more elongated genitalia, the presence of only two longitudinal spot bands on tegument (six in the other species) and its unswollen tibiae. Larvae may be recognized by the loss of AF2 on head and the isolation of LA3 on labrum. The larval case is also diagnostic for this species within the genus. Davis (1964, 1975) reported similar cases from Haiti and Trinidad. Davis noted the similarity of these cases with those constructed by species of *Epichnopteryx* Hübner and *Psyche* Schrank, two Old World genera, considering them as a probable introduction from the Old World. Larval cases of *P. ferruginea* prove that this construction pattern is not exclusive to Old World species.

Paucivena pinarensis Núñez, new species

(Figs. 2, 7, 12, 18, 42, 47, 52)

Diagnosis: *Paucivena pinarensis* males possess a color pattern similar to that of *P. cubana*, sp. n., *P. orientalis*, sp. n., and *P. reticulata*. However, the reticulated pattern is weaker in *P. pinarensis* due to its more obscure background color. Compared to other *Paucivena* within this group, *P. pinarensis* males exhibit several diagnostic characters: absence of saccus in its



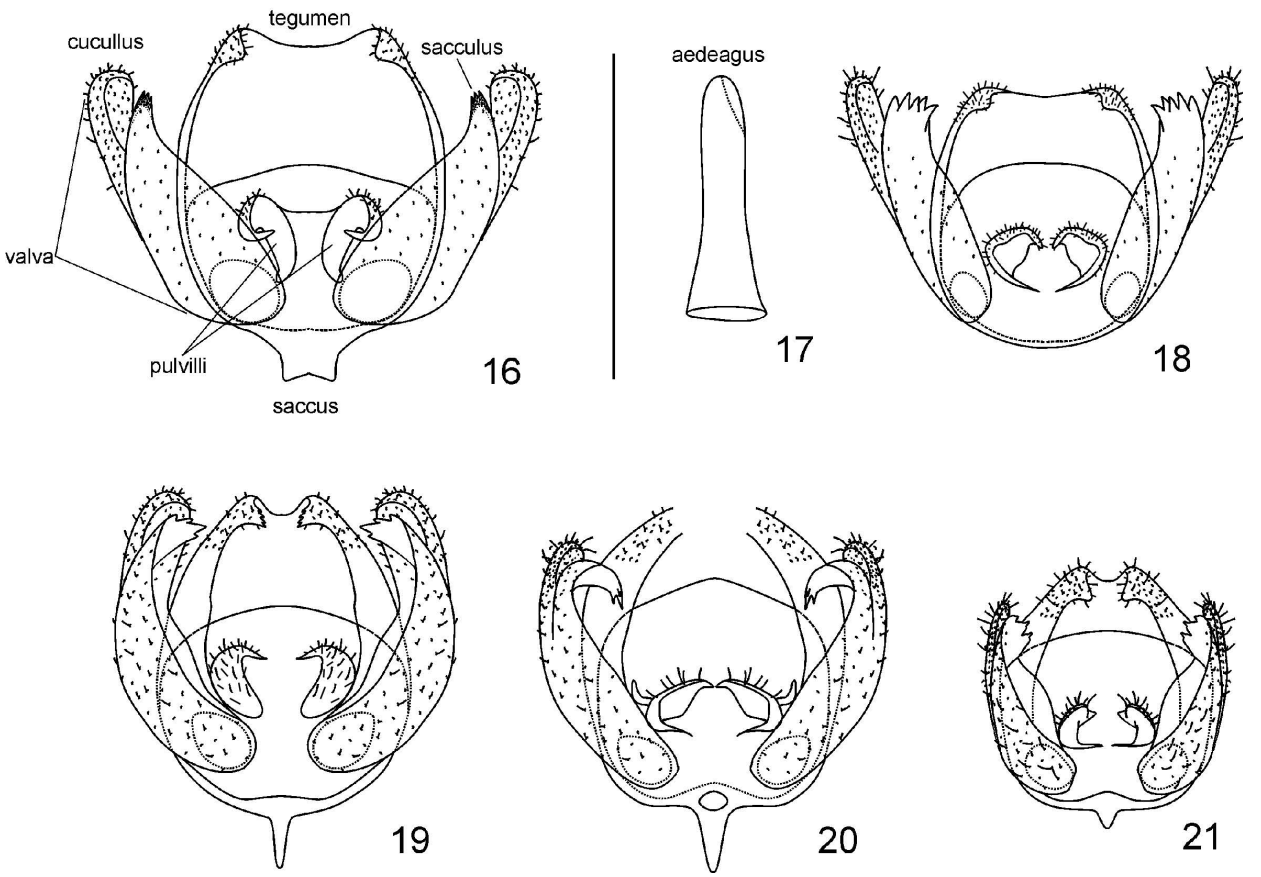
FIGS. 11–15. *Paucivena* spp. wing venation. **11** *P. ferruginea*, n. sp.; **12** *P. pinarensis*, n. sp.; **13** *P. fusca*, n. sp.; **14** *P. cubana*, n. sp.; **15** *P. orientalis*, n. sp. Scale= 3 mm.

TABLE 1. Rows and spines numbers per rows on dorsum of abdominal segments of Cuban *Paucivena* male pupae.

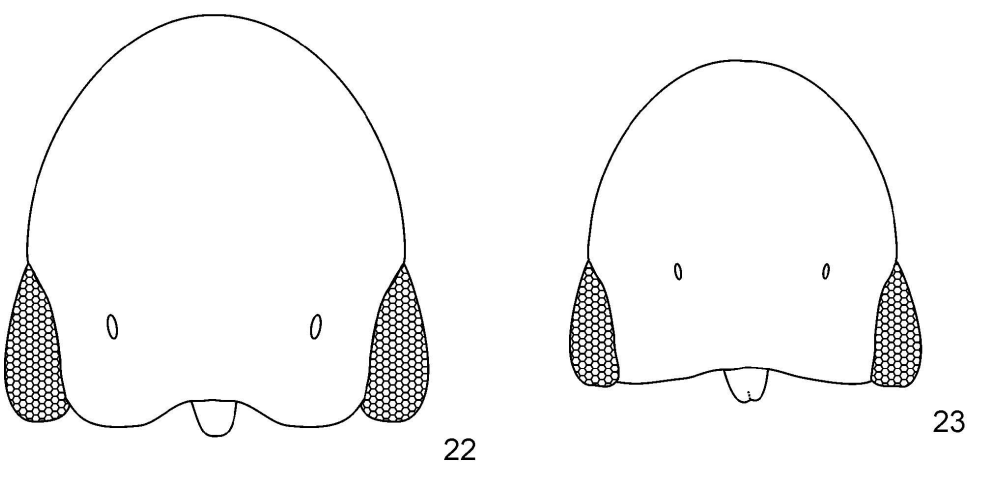
	Rows	Abdominal segments							
		I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**
Paucivena ferruginea n=1	anterior	0	0	269	135	140	176	122	48
	posterior	0	0	0	0	42	44	48	0
Paucivena pinarensis n=1	anterior	0	0	57	63	64	60	49	49
	posterior	0	0	1	7	38	38	14	0
Paucivena cubana n=3	anterior	0	0	0	52–70	47–58	42–55	29–45	22–24
	posterior	0	0	31	35–44	37–46	36–42	32–36	0
Paucivena orientalis n=3	anterior	0	0	0	102–136	96–125	95–111	90–96	25–32
	posterior	0	0	0	27–38	23–39	24–32	23–50	0

TABLE 2. Rows and spines numbers per rows on dorsum of abdominal segments of Cuban *Paucivena* female pupae.

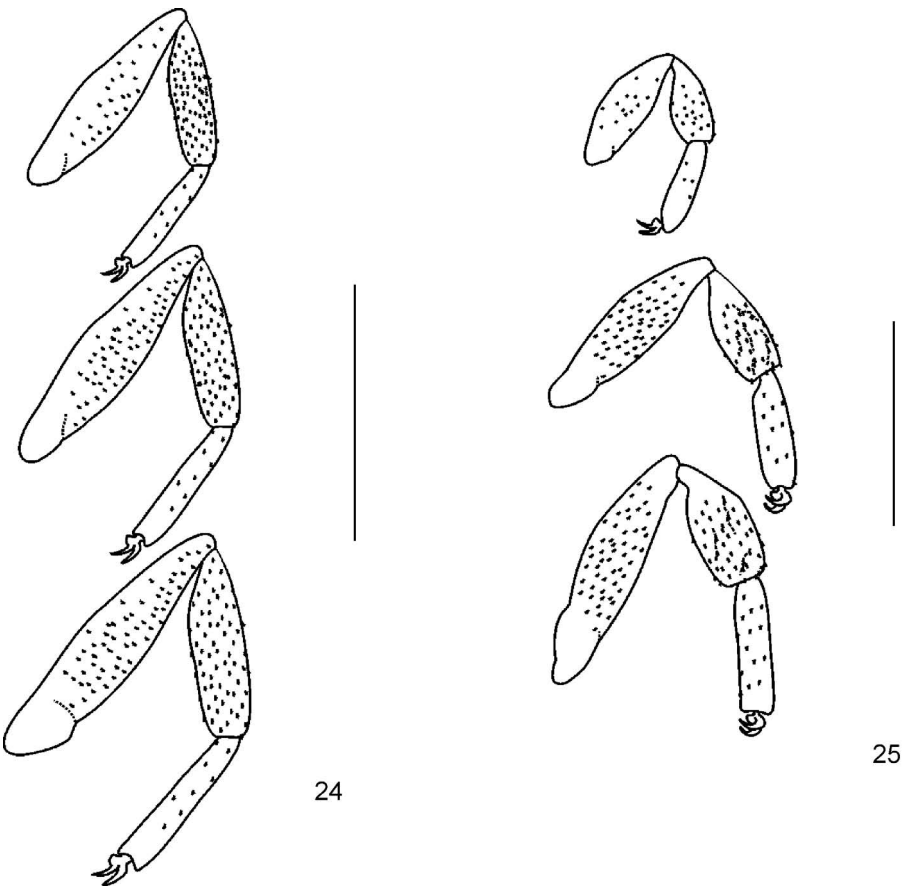
	Rows	Abdominal segments							
		I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**
Paucivena ferruginea n=1	anterior	0	0	0	0	0	61	90	21
	posterior	0	0	0	7	58	53	0	0
Paucivena cubana n=1	anterior	0	0	0	3	14	20	21	0
	posterior	0	0	6	56	78	71	0	0
Paucivena orientalis n=3	anterior	0	0	0	8–10	9–10	29–30	92–96	18-–22
	posterior	0	0	0	16–17	23–27	21–22	0	0



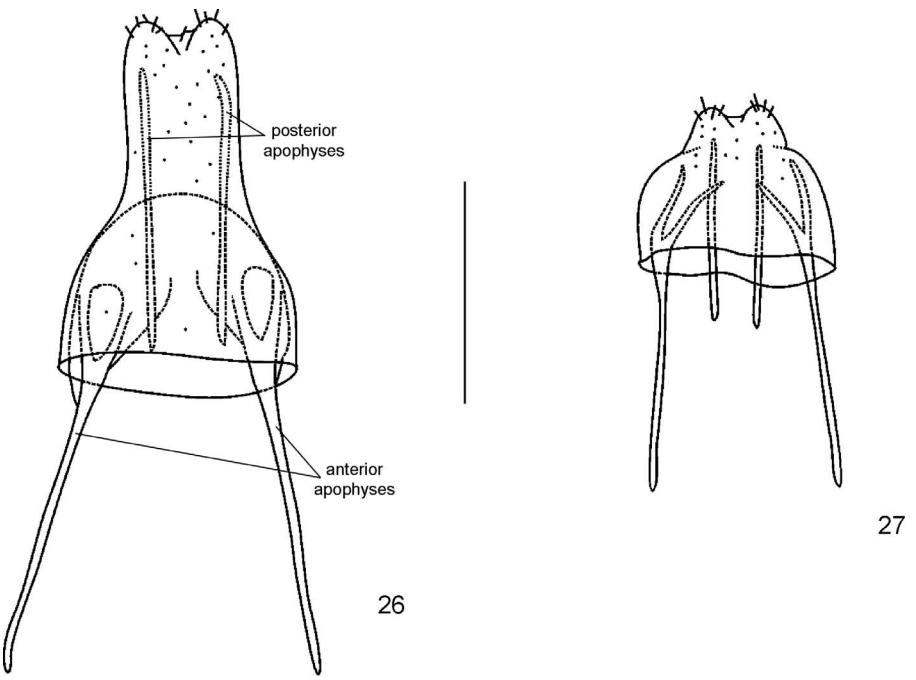
FIGS. 16–21. *Paucivena* spp. male genitalia, ventral view. **16** *P. ferruginea*, n. sp., main body; **17** *P. ferruginea*, n. sp., aedeagus; **18** *P. pinarensis*, n. sp.; **19** *P. fusca*, n. sp.; **20** *P. cubana*, n. sp.; **21** *P. orientalis*, n. sp. Scale= 0.5 mm.



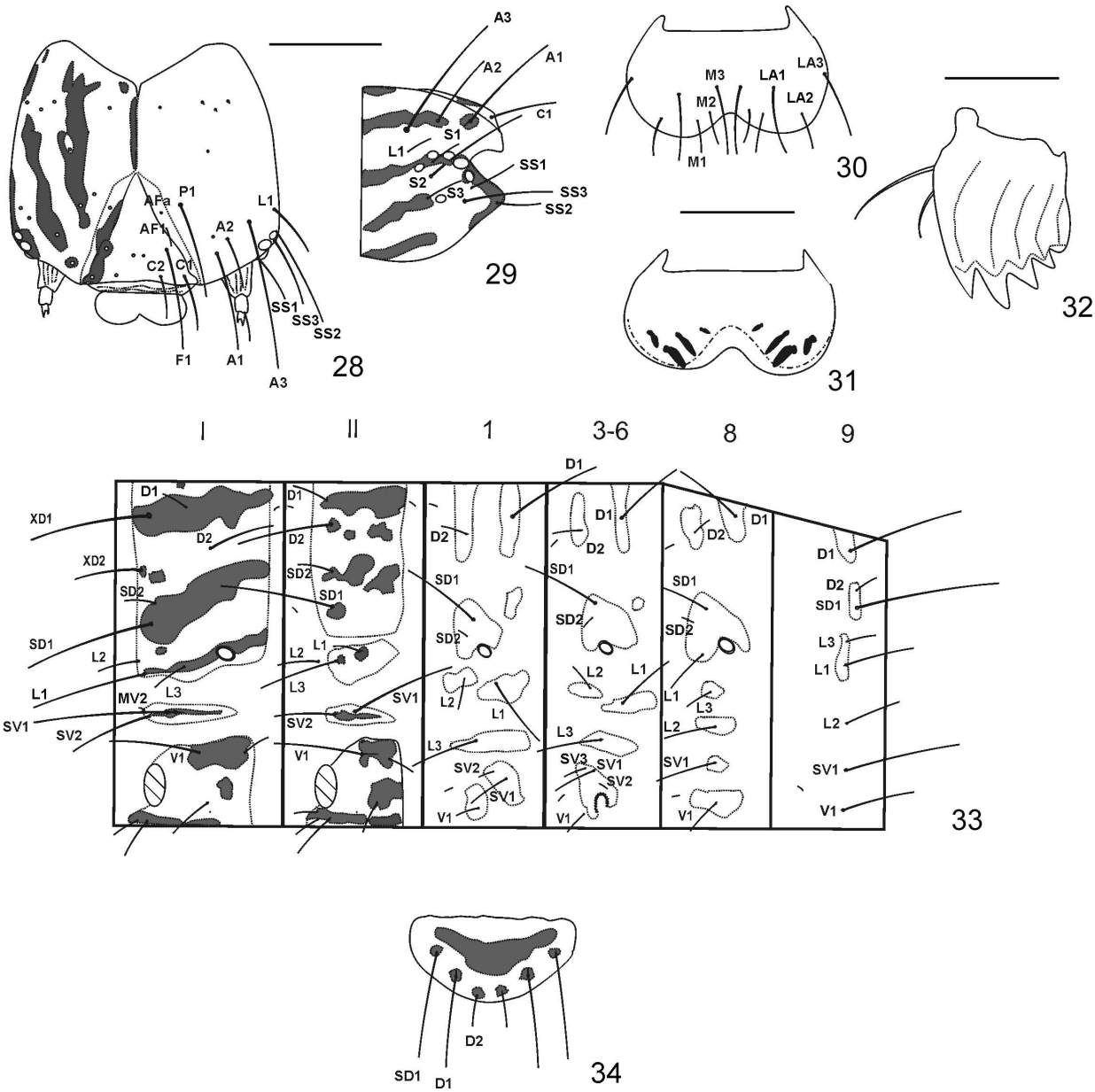
FIGS. 22-23. *Paucivena* spp. female head, ventral view. **22** *P. ferruginea*, n. sp.; **23** *P. orientalis*, n. sp. Scale= 1 mm.



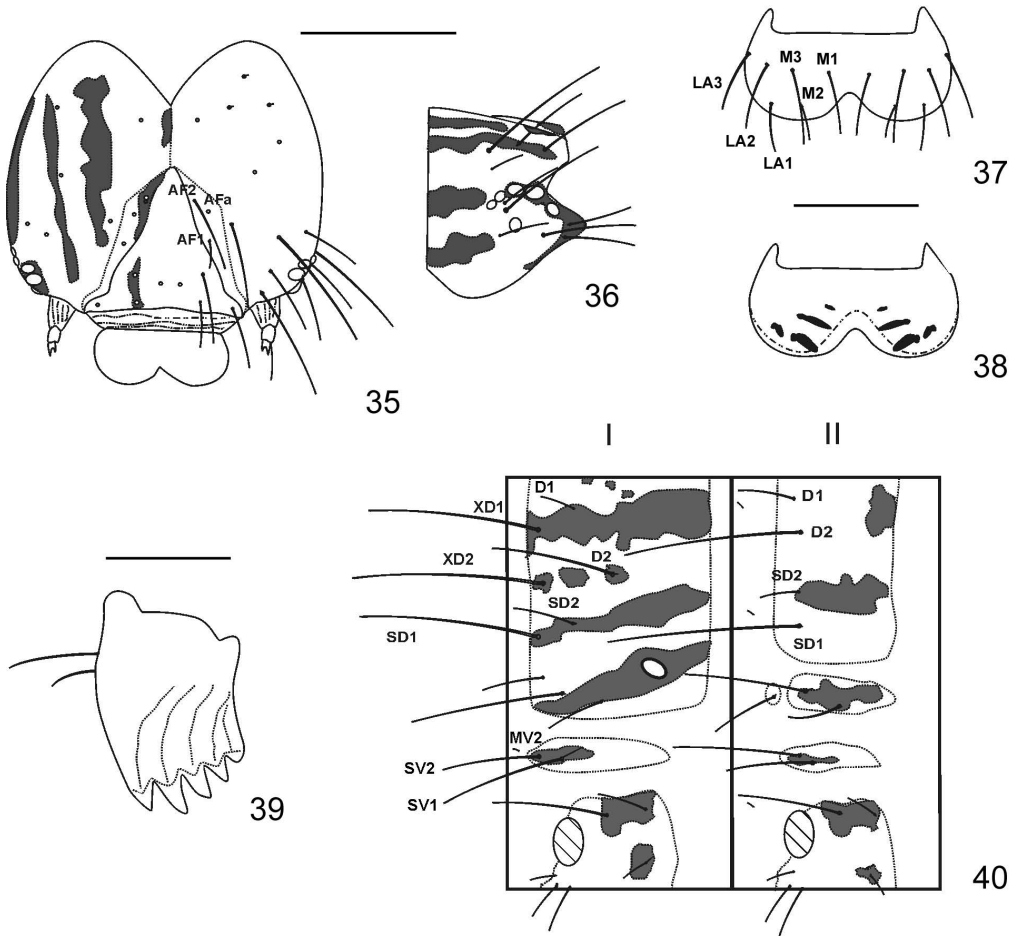
FIGS. 24–25. *Paucivena* spp. female legs. **24** *P. ferruginea*, n. sp., scale= 0.5mm; **25**- *P. orientalis*, n. sp., scale= 0.25 mm. Top-prothoracic leg, middle- mesothoracic leg, bottom-metathoracic leg.



FIGS. 26–27. *Paucivena* spp. female genitalia, ventral view. **26** *P. ferruginea*, n. sp.; **27** *P. orientalis*, n. sp. Scale= 0.5 mm.



FIGS. 28–34. Chaetotaxy of *Paucivena ferruginea*, n. sp., largest larva (last instar?). **28** Head, dorsal view; **29** Stemmata of left side, lateral view; **30** Labrum, dorsal view; **31** Labrum, ventral view; **32** Right mandible, ventral view; **33** Prothorax, mesothorax and abdominal segments 1, 3–6, 8 and 9, lateral view; **34** Anal shield, dorsal view. Scale, 28–29= 0.5 mm; 30–32= 0.2 mm.



FIGS. 35–40. Chaetotaxy of *Paucivena cubana*, n. sp., largest larva (last instar?). **35** Head, dorsal view; **36** Stemmata of left side, lateral view (scale= 0.5 mm); **37** Labrum, dorsal view; **38** Labrum, ventral view; **39** Right mandible, ventral view (scale= 0.2 mm); **40** Prothorax and mesothorax, lateral view (abdomen damaged). Scale, 35–36= 0.5 mm; 37–39= 0.2 mm.

genitalia; the relative length of its tibial spurs, 0.3 versus 0.15 (*P. cubana*, *P. orientalis*) and 0.5 (*P. reticulata*); and interocular index 0.7 versus 1.1 (*P. reticulata*) and 1.5 (*P. cubana*).

Male (Fig. 2, 7, 12, 18).: *Head*: pale brown, labial palpi dark brown. Antennal tips broken; lateral pectinations 3 about times length of supporting segment. Vertical diameter of eye 0.7 the interocular distance. *Thorax* (Figs. 7, 12): dark brown; underside pale brown, inner surface of fore and midlegs dark brown, joints pale brown. Vestiture dense, scales hairlike. Tibial spurs approximately 0.3 the length of basal tarsal segments (Fig. 7). FW with basal two thirds of costa dark brown; ground brown streaked with dark brown forming a faint reticulated pattern; fringe with various tones of brown. Scales at discal cell variable in shape: oblanceolated and ovobated, with rounded or acute apices, with scattered hairlike scales. Venation (Fig. 12) as in *P. ferruginea*. HW uniform brown; fringe with various tones of brown. Venation as in *P. ferruginea* except M_{2+3} and CuA_1 which arise separate from cell, M_{2+3} equidistant from CuA_1 and M_1, only one anal vein present. Wing expanse: 9.2 mm. *Abdomen*: pale brown. Vestiture dense, scales hairlike. *Genitalia* (Fig. 18): tegumen broad, with a pair of sparsely setose apical lobes. Valvae with pulvilli setose; apex of sacculus armed with five strong spines; cucullus apically rounded and sparsely setose. Saccus absent. Aedeagus simple, cylindrical, 0.6 times length of valvae.

Female. Unknown.

Larva. Unknown.

Larval case (Fig. 42). Dimensions: length: ♂ 9.8 mm; maximum diameter: ♂ 3.4 mm. Fusiform in outline; soft. Exterior heavily covered with vegetal fragments, leaves and short stems, and mosses various shaped and oriented lengthwise. Cases were found hanging from silk filaments (3.5 mm in length) attached to rocks and tree trunks.

Male pupa (Fig. 47). Length 5.1 mm. Ochre, wing sheaths reddish brown. Frontal ridge absent, frons rounded. Antennal sclerites extending slightly beyond apex of prothoracic legs. Wing sheaths extending to posterior margin of A3. Sclerites of metathoracic legs extending to posterior margin of A4. Cremaster consisting in a pair of strong spines ventrally curved; anal groove Y-shaped. Dorsum of A3–A8 with an irregular row of spines on anterior margin; areas surrounding rows covered by hundreds of tiny, solitaire spines. Dorsum of A3–A7 with single posterior row of slender spines. Tabulation of spines shown in Table 1.

Female pupa. Unknown.

Types. *Holotype*, ♂ (with associated larval case and pupal exuvium), reared from larvae (emerged 28 February 2004), CUBA: Pinar del Río province, Sierra del Rosario, Taco Taco River shore 1 km northeast from Jardín de Aspiro, 200 m, 28 November 2003 (R. Núñez), slides RNA 054, 079, 080. *Paratypes*: 4 larval cases, CUBA: Pinar del Río province, Sierra del Rosario, Jardín de Aspiro, 150 m,

28¬29 November 2003, (R. Núñez).

Natural history observations. The single larva was found on limestone rock near the Taco Taco River shore and its food source can not be accurately identified. In the lab, the larva was fed with several crustose lichens and mosses collected on its substrate. Other larval cases were found on rocks and tree trunks in an old abandoned Botanical Garden (Jardín de Aspiro). The unique adult emerged after a month; emergence took place between 0900 and 1130h.

At the Taco Taco River shore secondary remnants of gallery forest are present whereas at Jardín de Aspiro several introduced and native trees grow forming groves separated by cleared areas occupied by camping installations.

Distribution (Fig. 52). Known only from two close localities at Sierra del Rosario, Pinar del Río province.

Etymology. The species name is derived from the name of the Cuban province where the type locality, Pinar del Río, is located.

Remarks. The larval case is identical to that of *P. cubana*. The male pupa may be easily identified by the unique arrangement of spine rows on the dorsum of abdominal segments (Table 1).

Paucivena fusca Núñez, new species

Paucivena sp. n. 1: Núñez, 2004: 155

Figs. 3, 8, 13, 19, 52

Diagnosis. Males of *P. fusca* may be recognized by their uniform dark brown coloration. Within the genus only *P. hispaniolae* exhibits a similar coloration but it has

Key to the adult males of *Paucivena*

1. Wings dark brown with a ferruginous shine; genitalia with an acute and heavily sclerotized sacculus and a bifid saccus (Fig. 16) *P. ferruginea*
- Wings with a different color pattern; genitalia with sacculus not acute and weakly sclerotized, saccus not bifid 2
2. Dorsum of wings and body entirely dark brown, almost black 3
- Dorsum of wings and body with light color pattern 4
3. Body whitish grey ventrally; eyes of medium size (vertical diameter of eye 1.1 the interocular distance); genitalia with the margins of apex of sacculus and the apical lobes of tegumen smooth *P. hispaniolae*
- Body dark brown ventrally; eyes small (vertical diameter of eye 0.8 the interocular distance); genitalia with the margins of apex of sacculus and the apical lobes of tegumen serrulated (Fig. 19) *P. fusca*
4. Tibial spurs much reduced, approximately 0.15 the length of basal tarsal segment 5
- Tibial spurs less reduced, approximately 0.3 the length of basal tarsal segment or longer 6
5. Eyes very large (vertical diameter of eye 1.5 the interocular distance); wing expanse: 12 mm *P. cubana*
- Eyes very small (vertical diameter of eye 0.7 the interocular distance); wing expanse: 8.2-9.1 mm *P. orientalis*
6. Eyes of medium size (vertical diameter of eye 1.1 the interocular distance); tibial spurs large, approximately 0.5 the length of basal tarsal segment; FW reticulated pattern distinct *P. reticulata*
- Eyes very small (vetical diameter of eye 0.7 the interocular distance); tibial spurs reduced, approximately 0.3 the length of basal tarsal segment; FW reticulated pattern weak, indistinct *P. pinarensis*

Key to the known larvae of *Paucivena* (excludes *P. reticulata*, *P. pinarensis*, *P. fusca* and *P. orientalis*, which are unknown)

1. Head and thorax whitish to light tan with irregular patches of dark fuscous; meso and metathorax with an extra seta (SD1a?) *P. hispaniolae*
- Head and thorax whitish with longitudinal dark fuscous bands arranged in a striated pattern; meso and metathorax without an extra seta 2
2. Head with AF2 absent (Fig. 28); LA3 on labrum isolated from the rest (Fig. 30); abdominal integument dark brown *P. ferruginea*
- Head with AF2 present (Fig. 35); LA3 on labrum not isolated (Fig. 37); abdominal integument dirty white *P. cubana*

Key to the known male pupae of *Paucivena* (excludes *P. reticulata* and *P. fusca*, which are unknown)

1. Anterior margin of A3 without spines 2
- Anterior margin of A3 with at least one row of spines 3
2. Spines absent from posterior margin of A3; rows at anterior margin of A4-A7 with 90 or more spines (Table 1); length 3.8-4.8 mm *P. orientalis*
- Spines present on posterior margin of A3; rows at anterior margin of A4-A7 with 70 or fewer spines (Table 1); length 5.0-5.4 mm *P. cubana*
3. Rows on anterior margin of A3-A7 with more than 100 spines (Table 1); length 5.8 mm *P. ferruginea*
- Rows on anterior margin of A3-A7 with less than 100 spines (Table 1); length 5.0-5.1 mm 4
4. Spines present, although reduced, on posterior margin of A3-A4; cremaster consisting in a pair of strong spines ventrally curved *P. pinarensis*
- Spines completely absent from posterior margin of A3-A4; cremaster consisting in a pair of small spines ventrally curved *P. hispaniolae*

Key to the female pupae of *Paucivena* (excludes *P. reticulata*, *P. pinarensis* and *P. fusca*, which are unknown)

1. Anterior rows of spines absent from dorsum of A3-A4 2
- Anterior rows of spines present on dorsum of A3-A4 3
2. Posterior row of spines reduced but present on dorsum of A4; cremaster vestigial, reduced to a coarse and rough area around anal groove; length 7.5 mm *P. ferruginea*
- Posterior row of spines absent from dorsum of A4; cremaster relatively well developed, consisting in pair of short acute spines; length 10-11 mm *P. hispaniolae*
3. Anterior margin of A8 with a row of spines surrounded by hundreds of tiny spines; length 4.9-5.1 mm *P. orientalis*
- Anterior margin of A8 covered only by hundreds of tiny spines; length 8.0 mm *P. cubana*

the underside of body whitish grey. Other useful characters are FW shape (more rounded in the Cuban species), eye size (interocular index 0.8 in *P. fusca* and 1.1 in *P. hispaniolae*) and the serrated margins at apex of sacculus and apical lobes of tegumen in the genitalia of *P. fusca*, both smooth in *P. hispaniolae*.

Male (Figs. 3, 8, 13, 19). *Head*: dark brown. Antennae with 21–22 segments; lateral pectinations 2 times length of segment. Vertical diameter of eye 0.8 the interocular distance. *Thorax* (Figs. 8, 13): uniform dark brown. Vestiture dense, scales hairlike. Tibial spurs approximately 0.25 the length of basal tarsal segments (Fig. 8). Scales at discal cell of FW oblanceolated and ovobated with rounded or acute apices. Venation (Fig. 13) as in *P. ferruginea*. HW venation as in *P. pinarensis*, except the origin of M_{2+3} which is closer to CuA_1 than to M_1. Wing expanse: 10–11 mm ($\bar{x}$=10.2, SD=0.23, CV=4%, n=9). *Abdomen*: dark brown. Vestiture dense, scales hairlike. *Genitalia* (Fig. 19): tegumen broad with apical cleft, lobes minutely serrated and sparsely setose. Valvae with pulvilli setose; apex of sacculus strongly serrated; cucullus rounded, apex sparsely setose. Saccus reduced, approximately 0.2 the length of main body. Aedeagus simple, cylindrical, 0.6 times the length of valvae.

Female. Unknown.

Inmature stages. Unknown.

Larval case. Unknown.

Types. *Holotype*, ♂ CUBA: Sancti Spiritus province, Topes de Collantes, Pico Potrerillo, 973 m, 6 May 2002 (R. Núñez), slides RNA 011, 015, 039. *Paratypes*, 3 ♂, same data as holotype, slides RNA 010, 022. 5 ♂, same data as holotype except 17 June 2004, slides RNA 026, 029, 041.

Natural history observations. All individuals were found flying at noon on the top of Pico Potrerillo except a single specimen seen flying between rocky walls at peak access. This species shares its habitat, dry scrub on the top of Pico Potrerillo, with *P. ferruginea* and *P. cubana*.

Distribution (Fig. 52). Known only from Pico Potrerillo at Trinidad Mountains, central Cuba.

Etymology. The species name is derived from its uniform dark brown color.

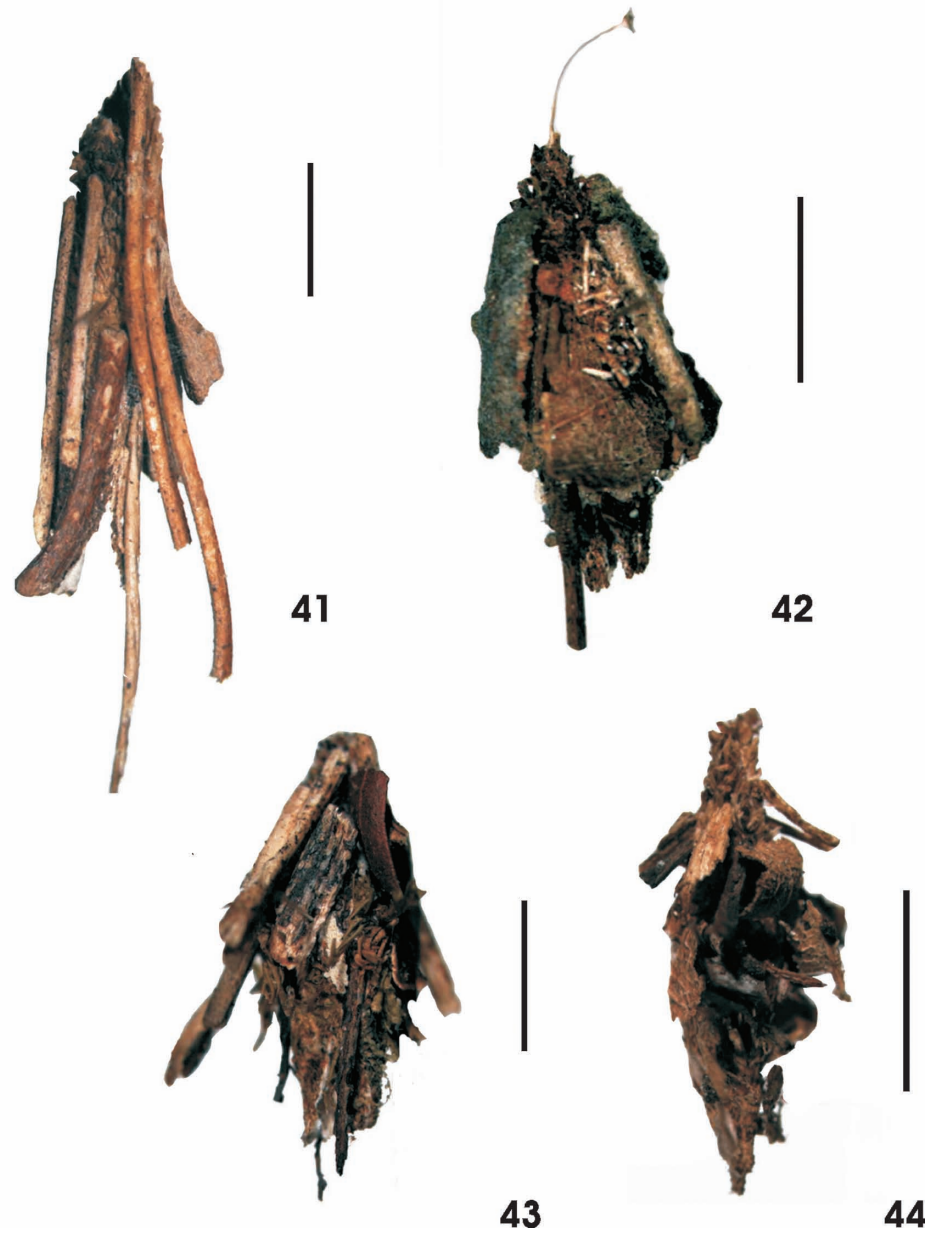
Paucivena cubana Núñez, new species

Paucivena sp. n. 2: Núñez, 2004: 155

Figs. 4, 9, 14, 20, 35–40, 43, 48, 52

Diagnosis. Males of *P. cubana* may be separated from other *Paucivena* with reticulated wing pattern by the following characters: 12 mm of wing expanse (the largest within the genus), elongated legs with tiny tibial spurs (approximately 0.15 the length of basal tarsal segment) and large eyes (interocular index 1.5, the largest within the genus).

Male (Figs. 4, 9, 14, 20). *Head*: pale yellowish ochre. Antennae with 18 segments; lateral pectinations 1.5–2 times the length of segment. Eyes large, vertical diameter of eye 1.5 the interocular distance. *Thorax* (Fig. 9, 14): pale yellowish ochre with scattered dark brown scales. Vestiture dense, scales hairlike. Tibial spurs approximately 0.15 the length of basal tarsal segments (Fig. 9). Wings thinly scaled. FW (faded) yellowish ochre with scattered dark brown



FIGS. 41–44. *Paucivena* spp. larval cases. **41** *P. ferruginea*, n. sp.; **42** *P. pinarensis*, n. sp.; **43** *P. cubana*, n. sp.; **44** *P. orientalis*, n. sp. Scale= 3 mm.

scales; dark brown scales concentrated at basal half of anterior and posterior margins, forming a faint reticulated pattern on basal two thirds; fringe ochre. Scales at discal cell variable in shape: oblanceolated and ovobated, with rounded or acute apices, or hairlike. Venation as in *P. ferruginea*, except accessory cell which is wider, closing below origin of R_{4+5} (Fig. 14). HW pale yellowish ochre with scattered dark brown scales, paler than FW; fringe pale yellowish ochre. Venation as in *P. fusca*. Wing expanse: 12 mm. *Abdomen*: pale yellowish ochre with scattered dark brown scales. Vestiture dense, scales hairlike. *Genitalia* (Fig. 20): tegumen broad, apex damaged. Valvae with pulvilli sparsely setose; apex of sacculus armed with three spines; cucullus rounded with apex sparsely setose. Saccus reduced, approximately 0.2 the length of main body. Aedeagus simple, cylindrical, 0.7 times the length of valvae.

Female. Unknown.

Larva (Figs. 35–40). Length of longest larva 6.9 mm, maximum width of head capsule 1.0 mm. Head and thorax whitish with dark fuscous longitudinal bands continued on thorax forming a striated pattern. *Head* (Figs. 35–39): as in *P. ferruginea* except, AF2 present; adfrontal sclerite with elongated spot on upper third covering origin of AF2; frons with spot covering origin of F1 and C2 (Fig. 35); AFa closer to AF2 than to AF1. Sixth stemma immediately anterior to S2 and S3, midway between them (Fig. 36). Labrum (Figs. 37, 38) with setae approximately mesad except, LA1 and M2 distinctly closer to border. Mandibles with four acute teeth and a fifth, blunt tooth (Fig. 39). *Thorax* (Fig. 40): as in *P. ferruginea* with the following exceptions. TI with XD1 about equal in length to XD2 and SD1, and about 1 1/2 times longer than D2; MV2 separated from pinnaculum bearing SV-

group. TII-TIII: D2 about 3 times longer than D1; SD1 about 4 times longer than SD2. *Abdomen* damaged, integument dirty white.

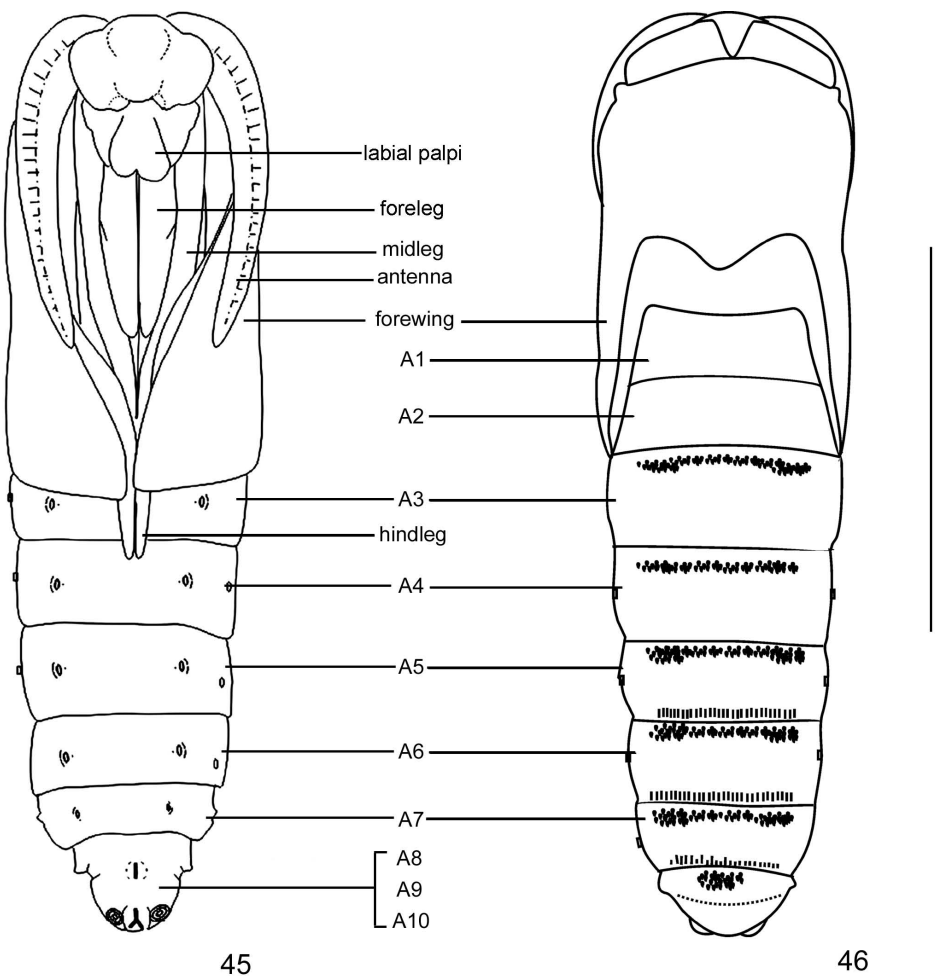
Larval case (Fig. 43). Dimensions, length: ♂ 10–11 mm ($\bar{x}$=10.5, SD=0.71, CV=7%, n=2), ♀ 18 mm; maximum diameter: ♂ 4.0 mm ($\bar{x}$=4.0, SD=0, CV=0, n=2), ♀ 6.5 mm. Fusiform in outline, soft. Exterior densely covered by fragments of leaves, small herbaceous stems and mosses of different shape and lengthwise oriented. Cases were found attached to rocky walls at Pico Potrerillo and banana trees, *Musa paradisiaca* L. (Musaceae), at Mogote Mi Retiro, hanging from silk threads (length: ♂ 3.5 mm, ♀ 5 mm).

Male pupa (Fig. 48). Length 5.0–5.4 mm ($\bar{x}$=5.2, SD=0.23, CV=4%, n=2). Uniform brownish ochre. Frontal ridge absent, frons rounded. Antennal sclerites extending slightly beyond apex of prothoracic legs. Wing sheaths extending to anterior margin of A4. Sclerites of metathoracic legs extending midway along A5 or its posterior margin. Cremaster consisting in a pair of strong and very close spines, ventrally curved and abruptly tapered at apex; anal groove Y-shaped. Dorsum of A4–A8 with 1–2 irregular rows of spines on anterior margin; anterior margin A3 and areas surrounding spine rows on A4–A8 covered by hundreds of tiny, solitaire spines. Dorsum of A3–A7 with single posterior row of slender spines. Tabulation of spines shown in Table 1.

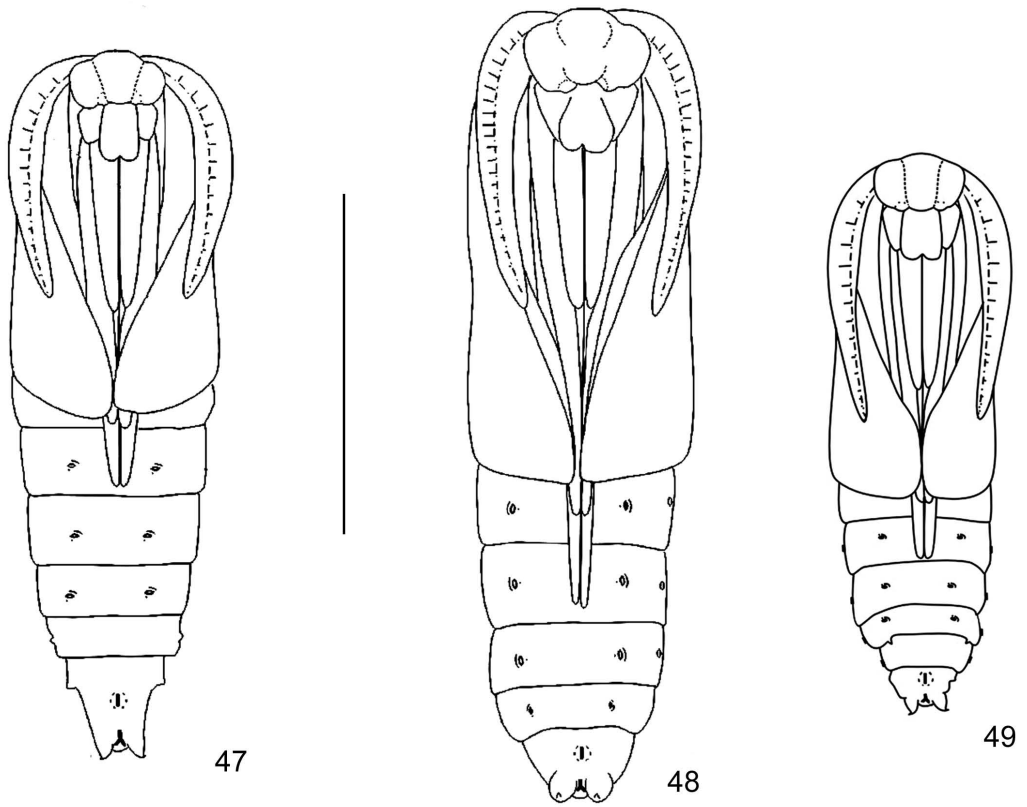
Female pupa. Length 8 mm. Uniform ochre. Head with eyes and labial palpi distinct. Thorax with leg sclerites distinct; wings absent. Cremaster vestigial, reduced to a small pair of blunt, widely separated spines; anal groove Y-shaped, with a pair of small rounded tubercles on either side. Dorsum of A4 with single anterior row of reduced, widely spaced spines; A5–A7 with 2–3 irregular rows of spines on anterior margin; anterior margin of A3, areas surrounding rows on A4–A8 and anterior margin of A8 covered by hundreds of tiny spines, solitaire or in 2–4 series. A3–A6 with single posterior row of slender spines. Tabulation of spines shown in Table 2.

Types. *Holotype*, ♂ (with associated larval case and pupal exuvium), reared from larva (emerged June 2002), CUBA: Sancti Spiritus province, Topes de Collantes, Caburní River depression, 500 m, 30 April 2002 (R. Núñez), slides RNA 013, 016, 023, 040, 045. *Paratypes*, 1 larva, same data as holotype, slides RNA 065, 066, 070; 6 larval cases (some with associated pupal exuvium), CUBA: Sancti Spiritus province, Topes de Collantes, mogote Mi Retiro northern base, 800 m, 17 May 2003 (R. Núñez); 4 larval cases (some with associated pupal exuvium), CUBA: Sancti Spiritus province, Topes de Collantes, southern side of rocky outcrop at Pico Potrerillo access, 850 m, 18 May 2003 (R. Núñez), slides RNA 075, 076; 3 larval cases (one with associated pupal exuvium), same data as preceding except 17 June 2004; 2 larval cases, CUBA: Sancti Spiritus province, Topes de Collantes, Parque Codina, 800 m, 20 May 2003 (R. Núñez).

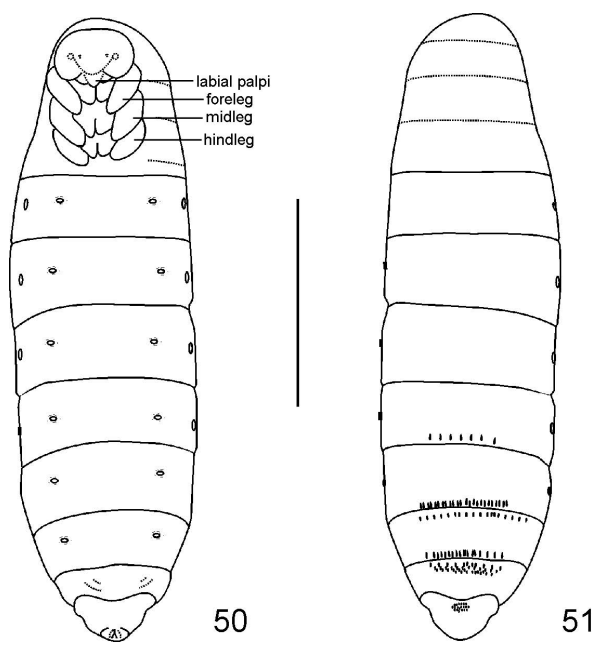
Natural history observations. Larvae fed on *Plagiochila* sp. (Plagiochilaceae), a hepatic growing on



FIGS. 45–46. *Paucivena* spp. male pupa. **45** *P. ferruginea*, n. sp., ventral view; **46** *P. ferruginea*, n. sp., dorsal view



FIGS. 47–49. *Paucivena* spp. male pupa. **47** *P. pinarensis*, n. sp., ventral view; **48** *P. cubana*, n. sp., ventral view; **49** *P. orientalis*, n. sp. Scale= 0.25 mm.



FIGS. 50–51. *Paucivena ferruginea*, n. sp., female pupa. **50** Ventral view; **51** Dorsal view. Scale= 0.25 mm.

rocks on the Caburní River shore. However, larvae probably use other hosts since cases were found on different substrates at other localities. At the Pico Potrerillo access cases were found attached to rocky walls covered by crustose lichens, at mogote Mi Retiro base they were located on banana plants whereas at Parque Codina they live on trunks of native trees. The single adult emerged after a month as pupa.

Paucivena cubana inhabits localities with very different vegetation and climatic conditions. At Parque Codina it was found in the lower strata of secondary evergreen forest, a very humid habitat, and at the mogote Mi Retiro base in cultivated land, banana and coffee (*Coffea arabica* L., Rubiaceae), close to the mogote rocky wall. On the other hand, Caburní River shores are covered by gallery forest remnants, today dominated by an introduced tree (*Syzigium jambos* L., Myrtaceae), whereas at the Pico Potrerillo access cases were attached to rocky walls surrounded by evergreen forest.

Distribution (Fig. 52). Known from four localities at Topes de Collantes, Trinidad Mountains, central Cuba.

Etymology. The species name is derived from the name of the Cuban island.

Remarks. The larval color pattern is identical to that of *P. ferruginea*; however, differences in chaetotaxy and abdominal coloration are present. Male and female pupae are easily distinguished by the arrangement of abdominal dorsal spines (Tables 1, 2).

Paucivena orientalis Núñez, new species

Figs. 5, 10, 15, 21, 23, 25, 27, 44, 49, 52

Diagnosis. Adult males of *P. orientalis* possess a color pattern similar to that of *P. pinarensis*, *P. cubana*, and *P. reticulata*. *P. orientalis* may be separated from *P. pinarensis* by its smaller tibial spurs (0.15 versus 0.3 the length of basal tarsal segment), the presence of a saccus in its genitalia and its more distinct FW reticulated pattern. From *P. reticulata,* it may be distinguish by its smaller eyes (interocular index 0.7 versus 1.1) and tibial spurs (0.15 versus 0.5 the length of basal tarsal segment). From *P. cubana* it differs by its smaller size (8.2–9.1 versus 12 mm of wing expanse) and eye size (interocular index 0.7 versus 1.5).

Male (Figs. 5, 10, 15, 21). *Head*: pale greyish brown. Antennae with 16 segments; lateral pectinations 2–2.5 times the length of segment. Eyes small, vertical diameter of eye 0.7 the interocular distance. *Thorax* (Figs. 10, 15): dorsum dark brown; underside pale greyish brown, inner surface of legs dark brown. Vestiture dense, scales hairlike. Tibial spurs approximately 0.15 the length of basal tarsal segments (Fig. 10). Wings thinly scaled. FW variously rounded; pale grayish brown streaked with dark brown scales to form a reticulated pattern; fringe with various tones of brown. Scales at discal cell mostly oblanceolated and ovobated, with rounded, or rarely acute apices. Venation (Fig. 15) as in *P. ferruginea*. HW uniform pale greyish brown; fringe with various tones of brown; venation as in *P. fusca*. Wing expanse: 8.2–9.1 mm ($\bar{x}$=8.8, SD=0.49 CV=6%, n=3). *Abdomen*: dorsum dark brown at both ends, remainder pale greyish brown. Vestiture dense, scales hairlike. *Genitalia* (Fig. 21): tegumen broad, with a pair of sparsely setose apical lobes. Valvae with pulvilli sparsely setose; apex of sacculus armed with three to four spines; cucullus with apex rounded and sparsely setose. Saccus reduced, approximately 0.1 the length of main body. Aedeagus simple, cylindrical, 0.6 times the length of valvae.

Female (Figs. 23, 25, 27). Length 5.0 mm. Vermiform. Stramineous with six longitudinal bands of brown spots on dorsum and sides of body. *Head* (Fig. 23): stramineous, eyes black. Slightly sclerotized. Shape near ovoid (ventral view); eyes compound, well developed, subventral. Labial palpi 1-segmented, almost 100% fused; antennae absent. *Thorax* (Fig. 25): patterned as above; body wall slightly sclerotized. Legs functional, armed with numerous tiny spines; tibiae swollen; tarsi 1-segmented with a pair of claws at distal end (Fig. 25); wings absent. *Abdomen*: color pattern disappearing at A2–A3; membranous and naked except for a ring of dense brownish ochre hairlike scales around A7. External genitalia reduced (Fig. 27), largely membranous. Two pairs of apophyses present; anterior pair elongated, free except, bifid base fused with tegument; posterior pair straight and free.

Larval case (Fig. 44). Dimensions, length: ♂ 6.5–7.1 mm ($\bar{x}$=6.7, SD=0.32, CV=5%, n=3), ♀ 9–12 mm ($\bar{x}$=10.8, SD=1.10, CV=10%, n=5); maximum diameter: ♂ 1.5–1.7 mm ($\bar{x}$=1.6, SD=0.12, CV=8%, n=3), ♀ 1.8–2.7 mm ($\bar{x}$=2.2, SD=0.34, CV=15%, n=5). Fusiform in outline, soft. Exterior densely covered by elongated and divergent fragments of leaves and stems of bryophytes and herbaceous plants, occasionally hair fragments are added; material is arranged lengthwise.

Male pupa. Length 3.8–4.8 mm ($\bar{x}$=4.3, SD=0.71, CV=17%, n=2). Uniform brownish ochre. Frontal ridge absent, frons rounded. Antennal sclerites usually extending beyond apex of prothoracic legs (Fig. 49). Wing sheaths extending midway along A3. Sclerites of metathoracic legs usually extending to A4 posterior. Cremaster consisting in a pair of strong and widely separated, ventrally curved spines; anal groove Y-shaped. Dorsum of A4–A8 with 2–3 irregular rows of spines on anterior margin; anterior margin of A3 and areas surrounding rows at A4–A5 covered by hundreds of tiny spines, solitaire or in 2–5 series. Dorsum of A4–A7 with single posterior row of slender spines. Tabulation of spines shown in Table 1.

Female pupa. Length 4.9–5.1 mm ($\bar{x}$=5.0, SD=0.1, CV=2%, n=3). Uniform ochre. Head with eyes and labial palpi distinct. Thorax with legs sclerites present; wings absent. Cremaster vestigial, reduced to a coarse and rough area around anal groove; anal groove Y-shaped. Dorsum of A4–A6 and A8 with single row of spines on anterior margin, A7 with two rows; areas surrounding rows at A4–A6 and anterior margin of A8 covered by hundreds of tiny spines, solitaire or in 2–5 series. A4–A6 with single posterior row of slender spines. Tabulation of spines shown in Table 2.

Types. *Holotype*, ♂ (with associated larval case and pupal exuvium), reared from pupa (emerged 28 April 2004), CUBA: Santiago de Cuba province, La Gran Piedra, Estación Meteorológica La Gran Piedra, 1100 m, 23 April 2004 (R. Núñez), slides RNA 024, 031, 035, 036. *Paratypes*, 3 larval cases (some with associated pupal exuvium), CUBA: Granma province, La Bayamesa, abandoned coffe plantation at Nuevo Mundo stream shore, 1600 m, 21 April 2004 (R. Núñez); ♂ (with associated larval case and pupal exuvium), reared from pupa (emerged 2 May 2004), same data as holotype; ♂ (with associated larval case and pupal exuvium), reared from pupa (emerged 9 May 2004), same data as holotype; ♀ (with associated larval case and pupal exuvium), reared from pupa (emerged 24 May 2004), same data as holotype, slides RNA 030, 034; 1 larva with its larval case, same data as holotype; 9 larval cases (some with associated pupal exuvium), same data as holotype.

Natural history observations. Larvae were collected on substrates covered by several lichens and mosses and on external walls of edifications; thus, this

species probably also feeds on detritus. The adult reared from a larva, a female, emerged after three weeks. One case was collected with an egg cluster and 53 larvae hatched 1 May 2004.

At Nuevo Mundo larval cases were found on trunks of old isolated *Mangifera indica* L. (Anacardiaceae) trees, in an abandoned coffee plantation. At Gran Piedra all individuals were located on edification walls.

Distribution. Known only from two widely separated localities at Sierra Maestra, southeastern Cuba (Fig. 52).

Etymology. The species name is referred to its distribution range, restricted to the oriental Cuban region.

Remarks. The larval case is diagnostic for this species. Although constructed with small dry vegetal fragments like those of *P. pinarensis* and *P. cubana*, material is always cut in slender pieces and arranged lengthwise but in a divergent way. Pupae of both sexes are easily distinguished by the arrangement of abdominal dorsal spines (Tables 1, 2).

DISCUSSION

All new species described here fit the genus description. However, interespecific variation in the interocular index was noted with values between 0.7 and 1.5. This is the only character that shows significant deviation. Measurement given by Davis (1975) was 1.1. Deviation in Cuban representatives may be due to differences in daily activity between species. Powell (1973) also used an "eye index" in his study on New World *Ethmia* Hübner (Oecophoridae: Ethmiinae). Index values were between 0.9 and 1.2 in moths known or presumed to be nocturnal whereas diurnal species exhibited ratios from 0.7 to 0.8. All adult males of *Paucivena* species described here were lab-reared, except those of *P. fusca* that always were collected flying during the day. Data on daily activity of species described by Davis (1975) are unavailable so this matter will only be clarified with future work.

The female, described here for the first time, shows characters that confirm *Paucivena* intermediate position among the American psychids proposed by Davis (1975) based on male characters. Female primitive features are the presence of well developed compound eyes, functional legs and the behaviour of leaving the larval case and climbing on it, as occurs in some primitive Old Word forms (Davis, 1964). Specialization evidences are

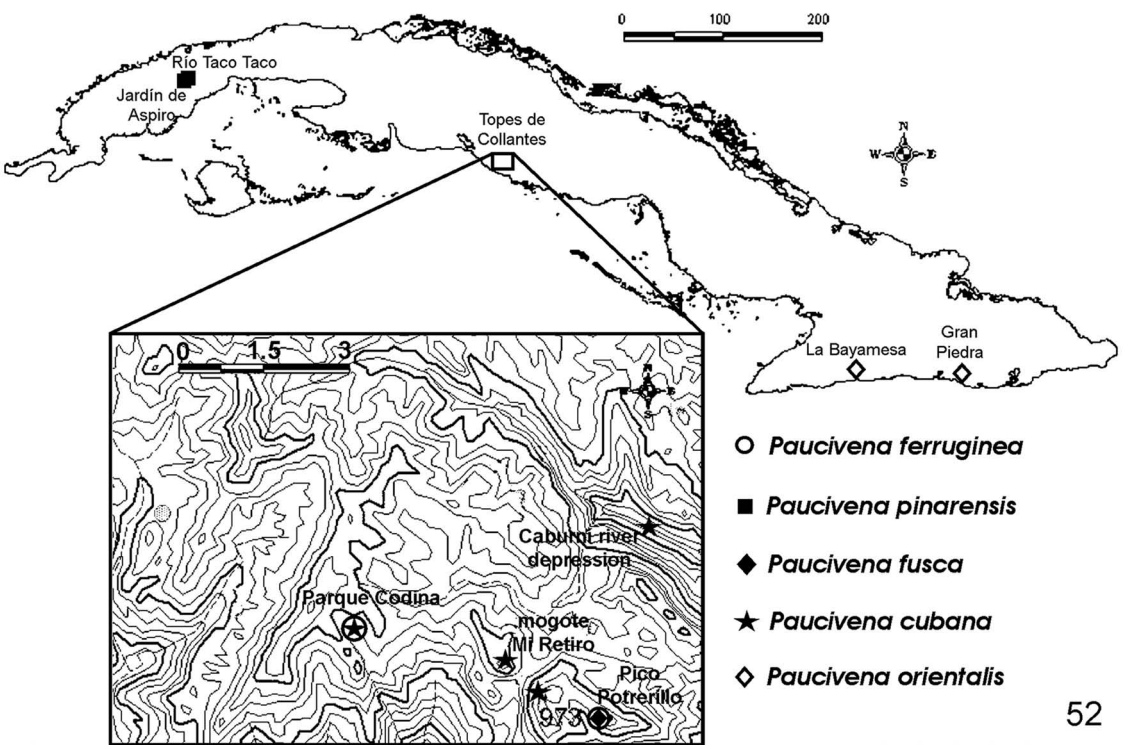


FIG. 52. Distribution of Cuban *Paucivena* spp. Scale bar in kilometers.

the reduced genitalia, the complete loss of antennae and wings and the slightly sclerotized body wall.

In the larvae, the color pattern of the head and thorax apparently lack diagnostic value, at least in Cuban species. In *P. ferruginea*, *P. cubana*, *P. pinarensis* and *P. orientalis* (the last two not described but observed during rearing), the pattern is white to greyish white with dark fuscous longitudinal bands. However, the abdominal integument is differently colored in *P. ferruginea* (dark brown) and *P. hispaniolae* and *P. cubana* (dirty white). Differences in chaetotaxy may be also used for species recognition.

Davis (1975) mentions that *P. hispaniolae* larvae feed on crustose lichens growing on the bark of an unidentified tree. Larvae of Cuban *Paucivena* feed on a wide variety of hosts including mosses, hepatics, lichens and detritus. All these food preferences have been observed before in the Psychidae (Davis, 1964; Hättenschwiler, 1985; Davis & Robinson, 1998) and perhaps explain in part genus diversification together with geographic isolation.

Paucivena appears to be well expanded on Cuba compared to other Antillean islands such as Hispaniola, Jamaica or Puerto Rico. However, this may due to lack of sampling on these islands. In Cuba, more collect effort on Psychidae is also needed. The Nipe-Sagua-Baracoa Mountains, in the northeast part of the island, and other habitats like coastal forests, ultramafic scrub, and white sand savannahs are yet unexplored.

ACKNOWLEDGEMENTS

I wish to thank Adriana Lozada, Arturo Ávila, Carlos Sánchez and Ledis Regalado for their collaboration in the expeditions and to executive and administrative personnel of Facultad Agropecuaria de Montaña del Escambray (FAME), at Topes de Collantes, for support during surveys. Also, I wish to thank Ricardo Herrera and Rigel Fernández for the photographs and Luis Manuel Díaz for his help with the Corel Draw computer program. Luis F. De Armas, Emily V. Saarinen and Alejandro Barro read the manuscript suggesting valuable changes and help with literature.

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Received for publication 3 May 2005; revised and accepted 30 May 2006