A NEW GENUS AND SPECIES OF PSYCHID FROM PERU WITH ATYPICAL LARVAL BIOLOGY
(LEPIDOPTERA: PSYCHIDAE)

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ABSTRACT.—Brachygyna incae, a new genus and species of Psychidae, is described from Machu Picchu, Peru, where the larva feeds on lichens growing on the walls of the ancient Inca fortress. The female is brachypterous, with wings approximately half the size of the males. Proposed synapomorphies for the genus include the unusual degree of wing reduction in the female, the loss of the basal pair of tibial spurs in the hindlegs, the narrowly V-shaped form of the saccus and the short, stout, ventral lobe of the valva in the male genitalia. Prepupal larval behavior is atypical of the family, with the last instar larva not inverting its body prior to pupation. The larva instead maintains an upright vertical position inside the larval case prior to pupation, with the adult later emerging from a subapical slit near the point of attachment of the case and not from the caudal end of the case in the manner typical of other Psychidae.

KEY WORDS: bagworm moth, Brachygyna n. gen., Brachygyna incae n. sp., chaetotaxy, hostplants, larva, larval biology, larval case, lichenivorous, Neotropical, Pterogyne, South America, taxonomy, Typhoninae.

All members of the bagworm family Psychidae construct portable larval cases which they carry and enlarge throughout their larval life and in which they eventually pupate. One of the behavioral anomalies characteristic of all Psychidae prior to this report involves the last instar larva. Immediately prior to pupation, the larva attaches the upper, anterior end of the case to some support, and then inverts its body inside the case, so that the head is directed downward toward the lower or free end of the case (Kozhanchikov, 1956; Davis, 1964, 1987, 1999). Consequently, the adult (at least for all males and nonvermiform females) emerges from the lower, caudal end of the case. The species described herein is interesting in that it represents the first reported instance of a member of this family in which prepupal larval inversion does not occur, with the adult instead emerging from a subapical slit in the upper, anterior end of the case (Fig. 2).

The first specimens of Brachygyna incae, new species, were collected by Emmanuel de Bros (deceased 25 March 1997), formerly of Basel, Switzerland in July 1979 and were sent to the author for identification. It was not until I visited the type locality of Machu Picchu (Fig. 3) in 1981 to secure immatures that I realized the adult of this species emerges from the attached upper end of the larval case. Eugene Munroe and James Early later visited the site in June 1982 and, at my request, collected larvae that I was able to rear in my lab. All material collected thus far was found on the walls of the ruins of Machu Picchu (Fig. 4), where the larvae feed on lichens, Usnea rubicunda Stirt. in particular. The species is univoltine, with the optimal time to collect larvae for rearing being June to mid July.

Brachygyna is one of the more primitive genera of Psychidae and is tentatively placed in the subfamily Typhoninae (Sauter and Hättenschwiler, 1991). This is indicated by: 1) female with all appendages developed (although with wings reduced), 2) female exiting and mating outside case, 3) pupa with abdominal tergal spines in multiple rows, and 4) larva lichenivorous. At least one other undescribed member of this genus, represented by a unique male (USNM) in rather poor condition from an unspecified site in Colombia, has been examined. Possible synapomorphies for the genus are the partially reduced wings of the female, the loss of the basal tibial spurs on the hindleg, the narrowly V-shaped saccus, and short, stout ventral lobe at distal third of valva in the male genitalia.

This is the first report of a long term study by the author on the primitive, largely lichenivorous Psychidae of the Neotropical region. Fifty-eight species, over 80% of which represent new taxa and none of which were treated previously in either my 1964 or 1975 papers, have been examined and illustrated to date. These statistics are increasing steadily as our fieldwork in the neotropics continues. Acronyms used in this paper to show deposition of specimens include the following: MUSM (Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru; PH (Peter Hättenschwiler of Uster, Switzerland); USNM (collections of the former United States National Museum, now deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C.)

Brachygyna Davis, new genus

MALE.—Head (Fig. 5): Eye small, interocular index approximately 0.55. Ocellus absent. Antenna 1/3 the length of forewing, bipectinate with rami up to 4X the length of supporting flagellomere and arising from base of segment (Fig. 17); scape rough, covered with piliform scales and without specialized pecten; dorsum of flagellum densely covered with slender, bidentate scales irregularly arranged in multiple rows (Fig. 18); venter naked. Mandible reduced to a minute, stout spine. Maxillary palpus reduced to a single, short, acute lobe about 1/3 the length of basal labial palpal segment. Haustellum even more reduced to a minute lobe arising immediately anterior to vestigial maxillary palpus and 0.5-0.65 the length of the latter (Fig. 5). Labial palpus short, 2-segmented, apical segment 1.8 the length of basal segment. Thorax: Forewing moderately broad, L/W index 2.2, 11-veined (Fig. 8); R with 4 branches, all branches arising separate; R1 arising from basal third of discal cell; R2+3 completely fused and connate with R4; accessory cell present; M 3-branched; M1 & 2 connate or nearly so; base of M divided over half the length of cell; base of A1+2 with short fork; retinaculum a moderately long subcostal fold extending under base of Sc. Hindwing 8-veined; Rs arising near distal third of discal cell, the latter short, less than half the length of hindwing; M with all 3 branches arising separate. Foretibia without epiphysis; tibial spurs 0-2-2 (Fig. 6). Abdomen: Eighth segment unmodified, coremata absent; SS broadly quadrate, similar to ST in size and outline.

MALE GENITALIA.—Tegumen shallowly bilobed. Vinculum tapering
Fig. 1-4. *Brachygyna incae*. 1) Male (left), wingspan 18mm. Female (right), wingspan 11mm. 2) Larval cases, with pupal shell protruding from anterior end of case. 3) Type locality: Machu Picchu, Peru. 4) The author, with daughter Marisa, collecting larval cases from stone walls of Machu Picchu, October 1981.

**FEMALE** (Fig. 1).—Similar to male, except **Head**: Antenna irregularly unibipctinate; pectinations much shorter (Fig. 19), with longest rami about equal to length of supporting segment. Labial palpi slightly shorter than in male. **Thorax**: Wings reduced, approximately half the size of male; venation similar to male except discal cell proportionately longer in both fore- and hindwings of female (Fig. 7); frenulum consisting of 3 slender bristles. **Abdomen**: Seventh segment with corythrogyne consisting of a dense ring of piliform scales.


**ETYMOLOGY**.—The generic name is derived from the Greek brachys (short) and gyné (female), in reference to the shortened wings in the adult female.
DAVIS: *Brachygyna incae*, A New Species from Peru

53

(Fig. 5-8. *Brachygyna incae*. 5) Head. 6) Legs (a: foreleg; b: midleg; c: hindleg). 7) Wing venation, female. 8) Wing venation, male. (All scales = 0.5mm).

(Davis, 1975) except head with AF2 arising lower on adfrontal sclerite near dorsal third, and D2 arising directly anterior (same level as) to D1 on abdominal segments 1-7; SV1 absent on A9. **Head**: Dark brown, nearly black. AF2 elongate, more than 5X length of AF1. Six stemmata present; cornea of 1 and 6 more flattened (Fig. 21). Antenna and maxilla with sensilla as shown (Fig. 22-23). Venter of labrum with 4 pairs of epiphyrngeal setae (Fig. 35), with lateral pair short, less than 0.5 the length of mesal pair. Mandible broad, with 3-4 short cusps. Labial palpus with segment II elongate, ca. 8X length of III (Fig. 24). **Thorax**: Pronotum dark brown, nearly black anteriorly. SV bisetose on T1, trisetose on T2-3. **Abdomen**: D1 and D2 arising from separate, transversely narrow plates on A1-7, together on A8, and with SD1 on A9. Pinnacula below level of spiracles indistinct. SV bisetose on A1, 2 and 7, trisetose on A3-6, unisetose on A8, and absent on A9. Anal plate with D2 absent, represented instead by prominent pore. Cuticle immediately dorsal to anus densely spinose (Fig. 28). Prolegs 3-6 with 14-19 crochets; anal crochets 15-18.

**PUPA** (Fig. 15-16, 37-44).—**Male**: Length 6-7mm, light to medium brown in color. Vertex broadly rounded, smooth. Antennal sheaths extending to middle of A4 (Fig. 16); wing sheaths to A5. Dorsal spines present along anterior margin of A3-7, arranged in 4-5 scattered rows of short, stout spines (Fig. 15, 38-41). A pair of large, nearly contiguous, low tubercules on ninth sternum (Fig. 42). Cremaster consisting of 2 pairs of short, dorsal spines (Fig. 42, 43).

**PUPA** (Fig. 13-14, 45-48).—**Female**: Length 7-8mm, medium to dark brown. Vertex smoothly rounded. Antennal sheaths extending to middle of A3, almost to apex of wings (Fig. 14). Dorsal spines similar to male, consisting of 4-5 scattered rows of short, stout spines near anterior margin of A3-7 (Fig. 13). Ninth sternum smooth, without large tubercles (Fig. 48). Cremaster.
Fig. 9-16. *Brachygyna incae*. 9) Male genitalia, ventral view (0.5mm). 10) Valva, mesal view. 11) Aedeagus, lateral view. 12) Female genitalia, ventral view (1 mm). 13) Female pupa, dorsal view (2mm). 14) Ventral view of Fig. 13. 15) Male pupa, dorsal view (2mm). 16) Ventral view of Fig. 15. (Scale lengths in parentheses).
Fig. 29-36. Brachygyna incae, larval chaetotaxy. 29) Lateral schematic. 30) Head, dorsal view (0.5mm). 31) Head, ventral view. 32) Abdominal terga 8-10. 33) Head, lateral view. 34) Labrum, dorsal view (0.2mm). 35) Labrum, ventral view. 36) Mandible (0.2mm). (Scale lengths in parentheses).
Brachygyna incae, male pupa: Fig. 37-44. 37) Head (0.58mm). 38) Dorsal spines of A4 (200 µm). 39) Detail view of Fig. 38 (72 µm). 40) Lateral view of A7-10 (0.38mm, D = dorsal). 41) Lateral view of dorsal spines of A7 (136 µm). 42) Caudal view of A10 (0.3mm). 43) Dorsal view of A8-10 (250 µm). 44) Ventral view of A9-10 (250 µm). Female pupa: Fig. 45-48. 45) Caudal view of A10 (231 µm). 46) Lateral view of A9-10 (250 µm). 47) Dorsal view of A10 (0.27mm). 48) Ventral view of A9-10 (0.27mm). (Scale lengths in parentheses; bar scale for all photographs shown in Fig. 37).
consisting of 2-3 pairs of short dorsal spines (Fig. 46, 47); third pair variable, possibly an anomaly.


**DISTRIBUTION.** - Known only from the Inca ruins of Machu Picchu, Peru.

**FLIGHT PERIOD.** - Late June to early August; univoltine.

**REMARKS.** - The reduction in wing size in the female of this species is most evident in that part of the wings distal to the discal cell. The basal half of the female fore- and hindwings appears similar in proportion to the male, compared to the more shortened distal half.

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**LITERATURE CITED**

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