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REDISCOVERY OF *LIBYTHEA COLLENETTEI* POULTON & RILEY (NYMPHALIDAE: LIBYTHEINAE) IN THE MARQUESAS, AND A DESCRIPTION OF THE MALE

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ABSTRACT. *Libythea collenettei* was rediscovered in the Marquesas Islands in 2001, for the first time since originally being found in 1925. The first known male, collected from Ua Pou, differs from the female in having weaker dorsal forewing markings and a more prominent pale submarginal line on the ventral hindwing. The male and the female holotype are presented in color, accompanied by wing venation diagrams and the first drawings of the male and female genitalia. The genitalia confirm the placement of *collenettei* in *Libythea*. The biology of the species remains mostly unknown, but adults have been recorded to frequent stream corridors near sea level, apparently have multiple annual generations, and their larvae are presumed to feed on *Celtis pacifica*.

Additional key words: morphology, natural history, systematics, snout butterfly, taxonomy.

Libythea collenettei Poulton & Riley 1928 (Figs. 1–4) is unique within the Libytheinae because it is restricted to the Marquesas, one of the most isolated archipelagos. Until recently, the only known specimens were three females from the type series that had been collected in 1925, and it was unknown whether *L. collenettei* was extinct. Poulton and Riley (1928), Viette (1950), and Shields (1987) described various morphological structures of the female, but in all cases, such crucial diagnostic structures as the genitalia were omitted.

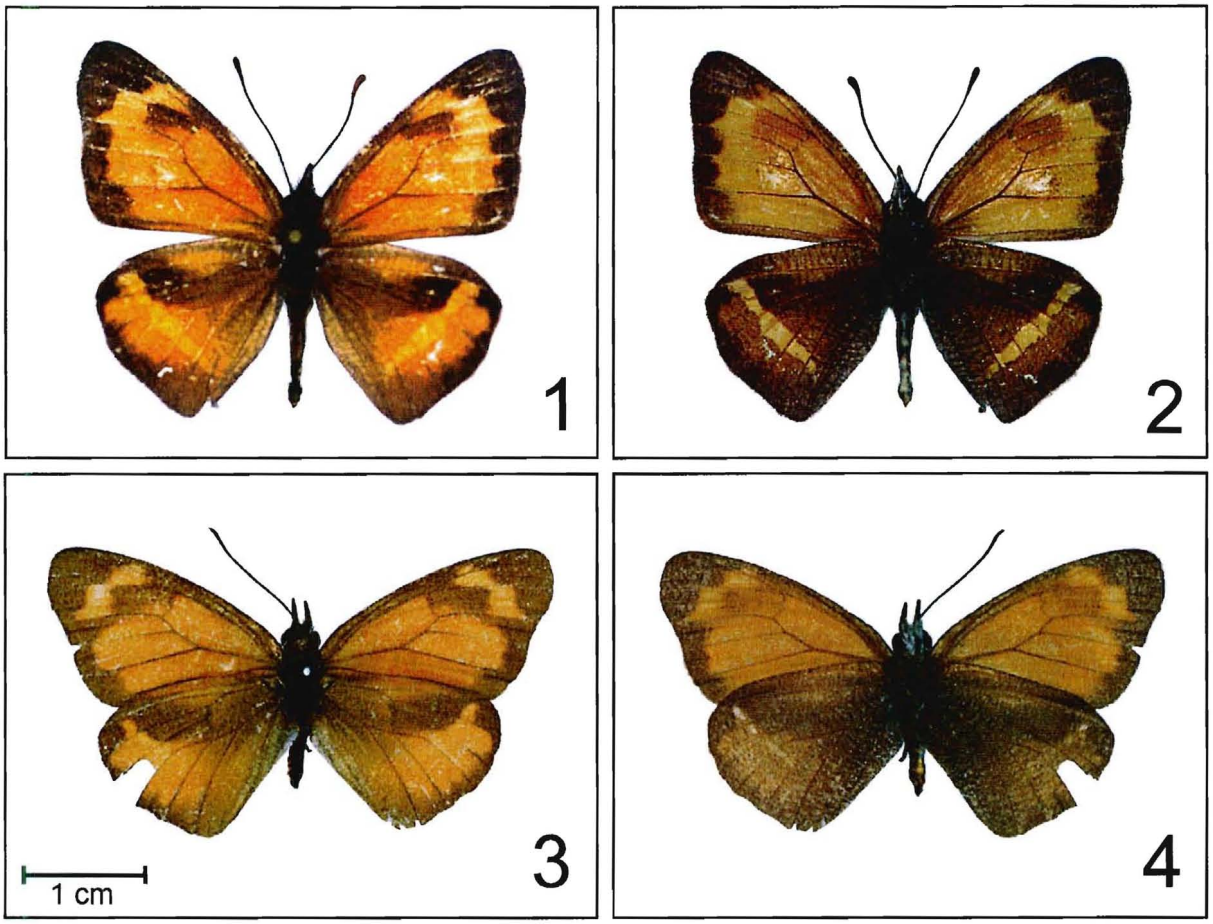
Fifteen years after *L. collenettei* was first described, Michener (1943) erected *Libytheana*, because the Libytheinae could be separated into two groups, primarily based on structures of the male genitalia. Taxonomic checklists of the snout butterflies (e.g., Shields 1984, Okano 1989) followed Poulton and Riley (1928) in placing *collenettei* in *Libythea*. However, the generic placement of *L. collenettei* has never been corroborated, because the male genitalia remained unknown. This paper presents and describes the genitalia and other characteristic features of both sexes, confirms the generic placement of *L. collenettei*, and provides comprehensive review of the biology of the species.

MATERIALS AND METHODS

I examined all five known specimens of *L. collenettei* and made dissections of one male and two females. Methods used for preparation of the genitalia followed Winter (2000:265–276): the abdomen of a dried specimen was removed and heated on a hot plate in 10% KOH until the abdomen was soft and the fats dissolved. Abdomen and genitalia were then placed in alcohol and hairs and scales were removed with a fine brush. Male genitalia were separated from the rest of the abdomen by cutting the membrane between the vinculum and eighth abdominal segment. In females, the membrane between the sixth and seventh segment was cut to remove the genitalia from the rest of the abdomen. Genitalia of the male and one female were preserved in glycerin jelly in genitalia capsules pinned below the labels on the respective specimens and deposited in the Bernice Pauahi Bishop Museum (BPBM). Genitalia of a paratype female were mounted on a slide (#29888) and archived at the Natural History Museum in London (BMNH). All illustrations were first sketched using a camera lucida attached to a WILD M5 stereomicroscope. Sketches were then scanned and refined using Adobe Illustrator 9.0®.

Libythea collenettei Poulton & Riley, 1928 (Figs. 1–13)

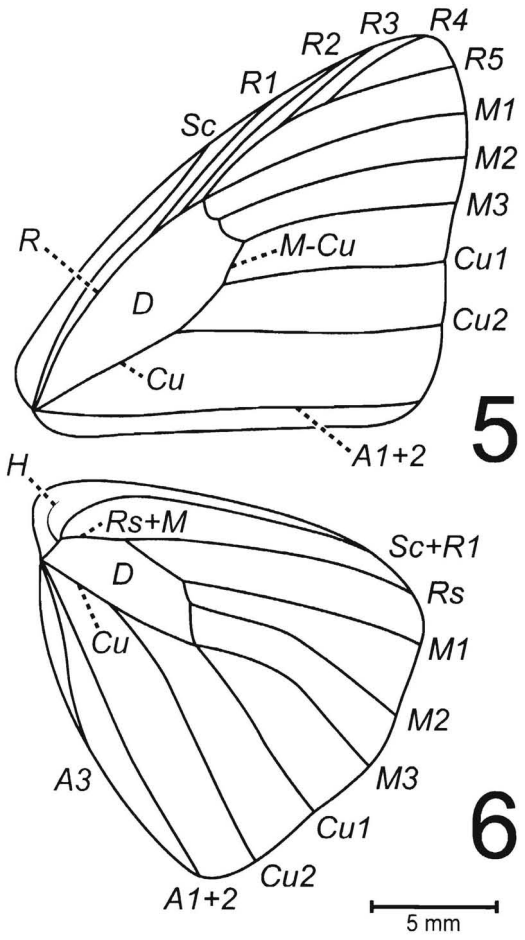
Diagnosis. Margin of forewing apex smooth and curved; wing markings orange; ventral surface of hindwing with pale orange band between Rs and A1+2; caudal margin of valva curved.



FIGS. 1–4. Adults of *Libythea collenettei*. **1,** Dorsal view of male; **2,** Ventral view of male; **3,** Dorsal view of Holotype female; **4,** Ventral view of Holotype female.

Description. Male: HEAD: All external surfaces covered in a mixture of gray, dark brown, and white hairs and scales, except eyes, which are bare and reddish-brown in dried specimens. **Antennae:** 10.1 mm in length, with 41 segments and three longitudinal carinae. Color of antenna changes from dark brown to light orange toward terminus, and white rings of scales define each segmental boundary. **Labial palpi:** 3.5 mm in length, with four segments, each segment covered in gray and white hairs and scales, white being prominent on ventral surfaces. **Proboscis:** dark brown, 5.2 mm long. THORAX: 4.7 mm in length, 2.6 mm at widest point, dorsal surface dark brown with a thin layer of short light-brown hairs; ventral surface covered in gray and white hairs and scales. Mesoscutellum overhanging mesoscutum when viewed from above. **Legs:** proleg tarsi reduced into a single club-like tarsus. Mesothoracic and metathoracic legs developed, both bearing 5 tarsal segments and pretarsus. On all legs, coxa, trochanter, femur, and tibia gray, tarsi brown. **Wings:** with characteristic libytheine venation (Figs. 5, 6). Light orange fringes define wing margins. Forewing length by width 19.5 × 8.5 mm (N = 1). **Dorsal surface:** forewing orange, dark brown band along distal margin, brown streak between costal margin of wing and R, small rectangular dark brown mark present from outer margin of discal cell between M1 and M3, tapering halfway between discal cell and wing margin. Hindwing also orange, a dark brown band defines distal margin. Discal cell golden-brown, forming a brown band stretching between M1 and M3 and curving anteriorly approximately halfway along M2. Pale narrow band of ventral surface faintly visible between Rs and A1+2. **Ventral surface:** forewing dull orange, mottled brown band defines margins and follows pattern on dorsal surface. Rectangular brown mark of M1–M3 weakly defined. Hindwing mottled brown, with short, fine white hairs close to thorax, pale orange band between Rs and A1+2. ABDOMEN: 0.8 mm in length, dorsally brown with short light brown hairs, ventrally covered in gray, white and brown scales. **Genital segments:** eighth abdominal tergum bifurcate, each projection bearing sharp teeth on ventrolateral margin (Fig. 7), and a row of long setae on dorsomedial surface (Fig. 8). Uncus sharp, bearing fine hairs on ventral surface of terminal third; aedeagus sigmoidal; ejaculatory bulb moderately large; saccus long, narrow at base but slightly enlarged anteriorly; caudal margin of juxta convex; valvae symmetrical, posterior quarter of valvae bearing setae and caudal margin curved (Fig. 9). When viewed dorsally, aedeagus enlarged anteriorly, caudally tapering to a sharp, very narrow tip (Fig. 10).

Female: Differs from male in following aspects: HEAD: **Antennae:** 40–44 segments. **Labial palpi:** 3.5–4.2 mm long, averaging 3.75 mm. THORAX: **Legs:** proleg tarsi developed, bearing 5 tarsal segments and pretarsus. **Wings:** more rounded, darker, and with wider brown bands than male. Forewing length by width varies from 19 × 7 mm to 21.5 × 9.2 mm, averaging 20.75 × 8.25 mm (N = 4). **Dorsal surface:** a faint brown band present along forewing M3. **Ventral surface:** a lighter background shade of brown than male, the pale narrow band of hindwing shortened and narrower, expressed between Rs and Cu2. ABDOMEN: curved ventrally, espe-



FIGS. 5, 6. Wing venation of *Libythea collenettei*. **5,** Forewing; **6,** Hindwing. Nomenclature for wing venation follows the Comstock-Needham system (Comstock 1918).

cially toward caudad end, more so than male. **Genital segments** (Figs. 11, 12): Eighth tergum with anterior apophyses projecting from anterolateral margins. Anal papillae setose, bearing two, long, posterior apophyses, which extend nearly as far as the anterior margin of the eighth abdominal tergum. Seventh sternum weakly fused with lightly sclerotized eighth sternum. Lamella antevaginalis and lamella postvaginalis fused to form a weakly sclerotized genital plate. Genital plate oval and slightly convex; ostium bursae semicircular; antrum heavily sclerotized and tongue-shaped. Ductus bursae elongate, width mainly uniform, but slightly narrower at caudad end. Bursa copulatrix oval, bearing two sharp signa (Fig. 13 shows enlarged signum).

Material examined. Holotype ♀ (Figs. 3, 4): FRENCH POLYNESIA: Marquesas Islands: Nuku Hiva, Oome, 18 January 1925, leg. C. L. Collenette. The specimen bears the following labels: a printed and hand-written white label: Oome, Nuka Hiva, Marquesas. Flying over stream near sea level, 18-I-25. St. George Expedn. C. L. Collenette; a printed white label: Joicey Bequest. Brit. Mus. 1934-120; printed round white label with red edge with the word "Type"; and a printed white label: BMNH(E) #145370. **Paratypes:** 2 ♀: same data as holotype, but both specimens differ in bearing the following labels: a printed round white label with yellow edge, with the word "Paratype"; and a printed white label: BMNH(E) #145371, or BMNH(E) #145372. 1 ♂ (Figs. 1, 2): Marquesas Islands: Ua Pou, Poohekaei summit. SW of Hohoi, 2100 ft, 20 August 2001, flying around *Miscanthus* R., leg. R. Englund. 1 ♀: Marquesas Islands: Nuku Hiva, Toovi Plat. near base of Takau Ridge, 2500 ft, 24 August 2001, leg. R. Englund & S. Jordan.

Etymology. Named for C. L. Collenette, who collected the first three specimens of this species in 1925.

Systematic position. Data from this study of the male genitalia of *L. collenettei* were included in a recent study of the phylogeny of Libytheinae (Kawahara 2001). Results confirm the placement of *collenettei* in *Libythea* (Fig. 14). Synapomorphies for *Libythea* include: sigmoidal aedeagus, strongly curved dorsal margin of valva, medial to ventral apical point of juxta, and sclerotized signa on inner membrane of bursa copulatrix.

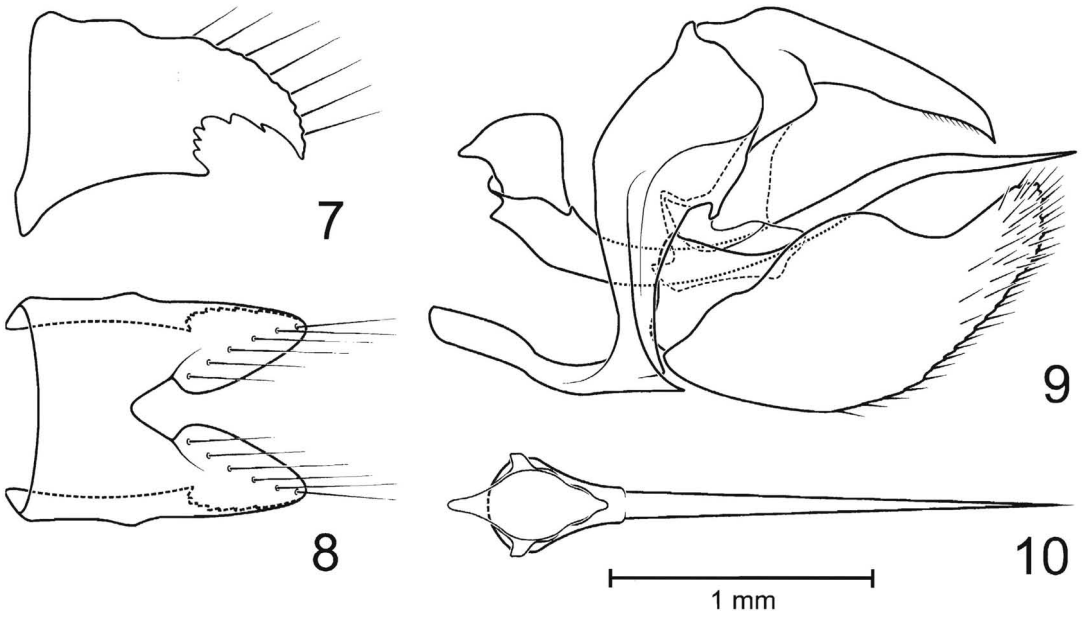
Distribution and abundance. Recorded from Nuku Hiva and Ua Pou, but may also be present on Hiva Oa, as noted by Poulton and Riley (1928). In addition to the three specimens collected at Oome, Collenette observed 7–9 individuals near sea level at Hooumi Valley and on a 366 m ridge above Typee Valley (Poulton & Riley 1928). In 2001, *L. collenettei* was observed to be relatively common on Ua Pou (R. Englund pers. com.).

Behavior. Collenette observed the species to have "frequented a stream-bed near sea level" (Poulton & Riley 1928:457), suggesting that this species puddles on damp ground near streams, much like other Libytheinae. They may fly high above the ground, because J. J. Walker stated, "14th March, 1883. At Taahu-ku, South side of Hiva Oa . . . Marquesas Is.—I saw another butterfly, a small fulvous fellow, I fancy the same as a *Phyciodes*?? which is common at Tahiti . . . this one was flying high in an awkward place, so I did not get near enough to catch it" (Poulton & Riley 1928:457). Although we can never know for certain, it is likely that Walker observed *L. collenettei,* since *Phyciodes* is unknown from the Marquesas (R. Englund pers. com.) and because some *Phyciodes* are fairly similar to *L. collenettei* in size and color.

Host plants. Shields (1987) suggested that *L. collenettei* most likely feeds on *Celtis pacifica* Planch (Ulmaceae), because this plant is found in the Marquesas Islands.

Nectar sources. None are known, but Collenette noted that "they were attracted by some flowering plants growing in the water" (Poulton & Riley 1928:457). It is possible that *L. collenettei* feeds on a variety of flowers like other Libytheinae (see Shields [1985] for flower visitation records of snout butterflies).

Generations. Unknown, but adult records from January, March, and August suggest multiple generations. Nothing is known about mating behavior, oviposition, or early stages.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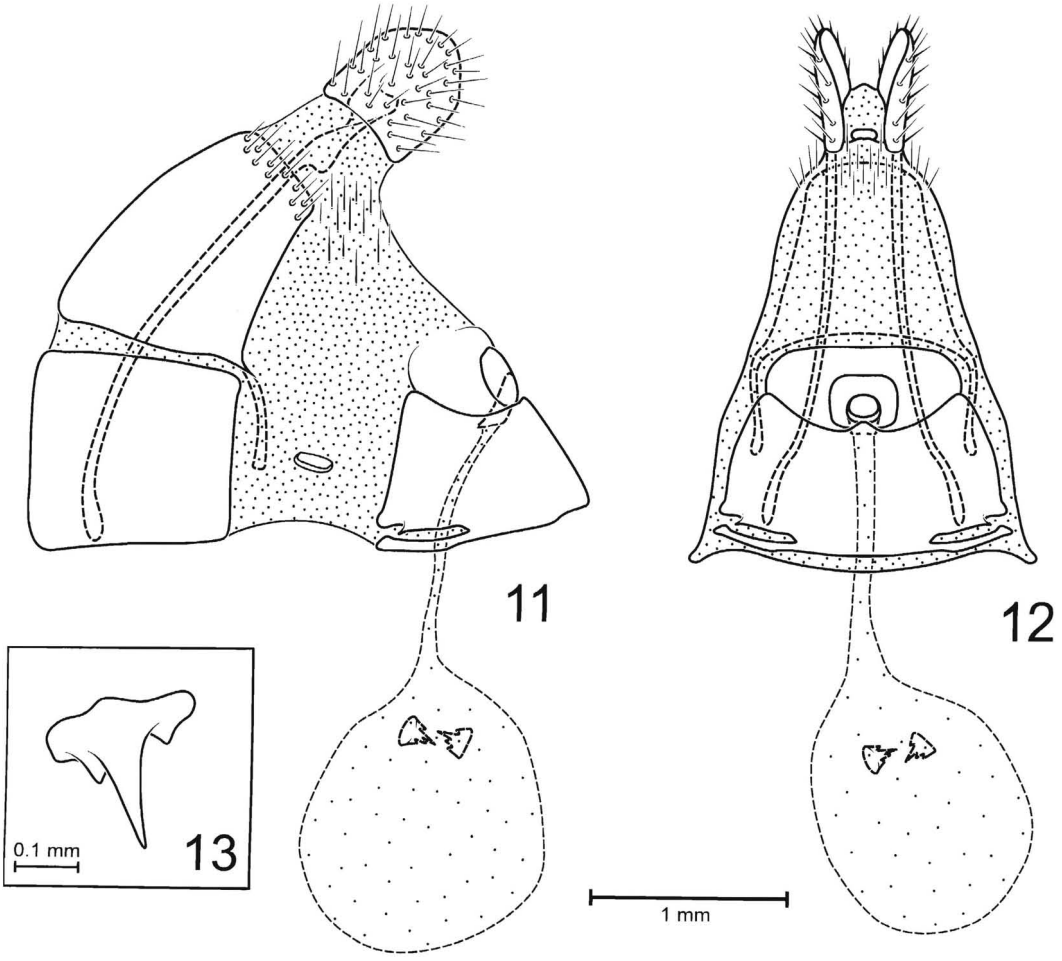
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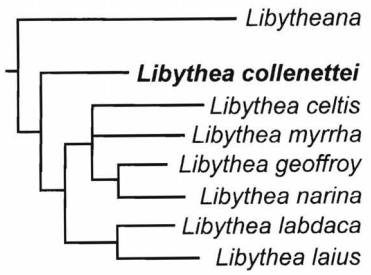

FIG. 14. A species-level phylogeny of *Libythea*, the supposed sister clade to *Libytheana*. Note the basal position of *collenettei* in *Libythea*. Adapted from Kawahara (2001).

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FIGS. 7–10. Male genitalia of *Libythea collenettei*. **7,** Lateral view of male eighth abdominal tergum with lateroventral margin bearing sharp teeth. **8,** Eighth abdominal tergum of male. Dorsomedial surfaces of projections with rows of long setae. **9,** Lateral view of male genitalia. **10,** Dorsal view of aedeagus. FIGS. 11–13. Female genitalia of *Libythea collenettei*. **11,** Lateral view of female genital segments; **12,** Ventral view of female genital segments; **13,** Lateral view of signum.