YPONOMEUTIDAE OF THE GALÁPAGOS ISLANDS, WITH DESCRIPTION OF A NEW SPECIES OF PRAYS (LEPIDOPTERA: YPONOMEUTOIDEA)

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ABSTRACT.—The Yponomeutoid fauna of the Galápagos Islands (Ecuador) comprises two species, Prays galapagosella n. sp. (Plutellidae: Praydiane) and Atteva hysginiella (Wallengren, 1861) (Yponomeutidae: Attevinae). Atteva monerythra Meyrick, 1926, is synonymized with A. hysginiella. Atteva hysginiella was reared from Castiel galapageia Hooker f. (Simaroubaceae): its genitalia and immature stages are described and illustrated.

KEY WORDS: Amblothridia, Araliaceae, Atemelia, Atteva, Attevidae, Attevinae, biodiversity, Coleophoridae, Colombia, Cynosia, Depressariidae, Depressariinae, Ecuador, Elachistidae, Eucatagma, Gelechiidae, Gelechioidea, Neotropical, Orinympha, Pepilla, Platiella, Plutellidae, Praydinae, Prays galapagosella n. sp., Pseudorhomyna, Simaroubaceae, South America, taxonomy, Tortricidae.

This is the 8th paper contributing to a survey of all Lepidoptera of the Galápagos Islands, Ecuador, following collecting efforts by the first author in 1989 and 1992 (see Landry and Gielis, 1992, and Landry, 1993, for more details).

The depauperate yponomeutid fauna of the Galápagos comprises two species, both presumably endemic. Apparently, one of these had not been collected before 1989 and is here described as new in the genus Prays Hübner (Praydiane). The second species, beautifully coloured, a species of Atteva (Attevinae), has been recognized for 137 years, but we present here for the first time a description of the genitalia, final instar larva, pupa, as well as host plant records.

MATERIAL AND METHODS

In 1989, from January to March, and in 1992, from March to June, the first author collected specimens of Lepidoptera with a mercury-vapour lamp on the islands of Española, Floreana, Genovesa, Isabela, Marchena, Pinta, Rábida, San Cristóbal, Santa Cruz, Santa Fé, Santiago and Seymour Norte (see Landry and Gielis, 1992, and Landry, 1993, for further details). Smaller specimens were collected in small vials and kept alive until the next day, when they were killed and mounted (Landry and Landry, 1994). Selected specimens of the larger species were killed with ammonia upon collecting and pinned usually the next day.

The type of the new species of Prays described hereafter is deposited in the Canadian National Collection (CNCI), Ottawa, Canada. Some of the other specimens collected in 1989 and 1992, are or will be deposited in the following collections: the first author’s personal collection (BLC); CNCI; the National Museum of Natural History, Washington, DC, USA (USNM); the Natural History Museum, London, England (BMNH); the Charles Darwin Research Station (CDRS), Isla Santa Cruz, Galápagos Is., Ecuador; and the Museo Ecuatoriano de Ciencias Naturales (MECN), Quito, Ecuador. Other institutions cited from which specimens of Atteva were borrowed: California Academy of Sciences, San Francisco, USA (CASC); and Naturhistoriska Riksmuseet, Stockholm, Sweden (NHRS).

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TROPICAL LEPIDOPTERA

Fig. 1-6. 1) *Prays galapagosella* sp. nov., holotype ♂ from Finca Vilema, Santa Cruz Island. 2) *Prays galapagosella*, paratype ♀, same locality as Fig. 1. 3) *Atteva hysginiella* ♂, Punta Cormoran, Floreana Island. 4) *Atteva hysginiella* (Wallengren) ♂, 2 km west Puerto Villamil, Isabela Island. 5) *Atteva hysginiella* resting on twig of larval host plant. 6) Webbing and feeding damage of *Atteva hysginiella* on *Castela galapageia* Hooker f. (Simaroubaceae); arrows point at larvae.

R4 and M1 on forewing, between Sc+R1 and M1 on hindwing (visible only on denuded wing; Fig. 7). Abdomen: brown dorsally, pale brown ventrally.

Male abdominal sclerites (Fig. 13): Segment 8 with broad pleural lobes; tergum 8 strongly sclerotized, free apical half pointed and down-curved, basal half broadly emarginate, with short lateral wing-like extensions; sternum 8 broader than long, broadly emarginate basally, apically with lateral angles slightly produced. Intersegmental membrane between segments VI and VII with an invagination on each side forming a pouch with androconial hairs; pouches extended cephalad to middle of segment 5. Male genitalia (Fig. 8-12): Tegumen convex dorsally, laterally narrow; in dorsal outline with lateral constriction or notch (Fig. 9); postero-lateral teguminal processes about as long as tegumen, beak-like in lateral aspect, downwardly oriented, base dorso-laterally flanged at level of uncus, distal half setose, apex attenuate with a few small ventral pegs (Fig. 12). Uncus short, broadly fused to tegumen dorsally, apex truncate with pair of tiny protrusions and four setae. Gnathos (?) a pair of simple bars (caudal aspect) curved antero-ventrally beneath anal tube, meeting but not fused medially; anal tube with supporting ventral sclerotized bar (Fig. 9). Valvae (Fig. 8-10), apically rounded and down-curved; ventral margin recurved upwards on inner side, forming a furrow from base to subapex; cucullus setose mostly on apical half; sacculus
Fig. 7. Prays galapagonella sp. nov., wing venation. Note very fine setae at apex of both wings.

a curved narrow band, better sclerotized than coccus, apically with glabrous rounded knob pointed inwardly. Vinculum narrow laterally, with narrow saccus about 0.25x length of valva. Juxta (or anellus?) large, well developed as pair of densely setose, spatulate lobes dorsally projected, bracing aedeagus at mid-length, laterally fused to posterior margin of vinculum (Fig. 8). Aedeagus about as long as valva; narrow; slightly downcurved; vesica with series of extremely fine, hair-like cornuti (Fig. 11).

Female abdomen and genitalia (Fig. 14): Papillae anales elongated; well-connected on distal half dorsally; slightly longer than segment 8; strongly setose ventrally. Posterior apophyses as long as papillae, not extending beyond anterior margin of segment 8; straight. Segment 8 strongly sclerotized; sternum with strongly emarginate and reinforced anterior margin; posterior margin straight, with bunch of setae on papillae, not extending beyond anterior margin of segment 8; straight.

Saccus about 0.25x length of valva. Juxta (or anellus?) large, well developed a curved narrow band, better sclerotized than cucullus, apically with glabrous of both wings.

Types.- Holotype ♂: GALAPAGOS Is. (Ecuador) – Santa Cruz Id., Finca Vilema, 2 km W Bella Vista, 1 Apr 1992, leg. B. Landry (MVL) (CNCI type # 22216, slide MIC 3990).


Distribution.— In the Galápagos Islands of Isabela, Pinta, San Cristóbal, Santiago and Santa Cruz.

Flight period.— Available dates are from January 20 to May 25.

Hostplant and Biology.— Unknown.

Notes.— Kyriki (1984) singled out the Prays genus group on the basis of two autapomorphic characters: the absence of the accessory cell in the forewing, and the strongly sclerotized, and broader than long, male sternum VIII. He included 6 nominal genera in this genus group, among which Pepilla Guenée is a junior objective synonym of Prays (see Nye and Fletcher, 1991). The other 5 genera are, in order of appearance in the literature: Prays Hübner, [1825], Atemelia Herrich-Schäffer, 1853, Eucatagma Busck, 1900, Oribrinympha Meyrick, 1927, and Pseudorinympha Clarke, 1971. We chose to put our new species in the genus Prays because it agrees with it in genital characters and because it is the oldest name of the group. However, there are no phylogenetic definitions of these 5 nominal genera. Pseudorinympha was described based on a single female and its status remains questionable (Clarke, 1971). Oribrinympha was synonymized with Atemelia by Kyriki (1990). In wing venation characters, P. galapagonella is more similar to both Prays and Atemelia in having R4 and R5 originating from a common, albeit very short, stalk.

Prays and the Praydinae have been included in the family Plutellidae (e.g., Heppner, 1991, 1993). Kyriki's (1990) analysis included Praydinae in a redefined concept of Yponomeutidae, which we follow, along with Nielsen and Common (1991), Scoble (1992), Robinson et al. (1994), and Dugdale et al. (in press). Albeit tentative, Kyriki's classification is currently the only cladistic one available for the Yponomeutoidea.

Atteva hygginella (Wallengren) (Fig. 3-6, 15-32)

Amphlothridia hygginella Wallengren, 1861:386.

Cydosia sylpharis Butler, 1877.[87].

Atteva monerythra Meyrick, 1926:278, syn. nov.

Type material.— All primary type specimens were examined. The labels are printed or handwritten in black ink, unless otherwise indicated.

Amphlothridia hygginella Wallengren, 1861. Holotype ♀ with the right forewing glued back to the thorax; only the forelegs are complete, the right metasternum is missing and the other three legs are without variable numbers of tarsal segments; the right antenna without the last few flagellomeres. Labelled: "Pana/ma" [square, white, printed]; "Kinb." [rectangular, white, printed]; "Amphlothridia/ hygginella/ Walleng." [rectangular, beige, handwritten]; "genitalia slide/ BL 971 9" [rectangular, pale green, printed (except for 9)] (NHRS).

Cydosia sylpharis Butler, 1877. Holotype ♀ with somewhat rubbed forewings, with the inner margin and the outer margin partly damaged, and without the left fore- and hindlegs and the last few flagellomeres of the left antenna. Labelled: "Holo/ype" [circular, red-bordered, white, typed]; "Albergmarle/ Isl./ 76 32" [rectangular, grey, handwritten]; "Cydosia/ sylpharis/Butler Type" [rectangular, white, handwritten]; "sylpharis/ Butler." [rectangular, white, handwritten, with printed horizontal line near bottom]; "TYPE" [rectangular, white, printed, black-bordered, with thin horizontal line at basal third]; "genitalia slide 9 /JFL 1468" [rectangular, pale green, printed (except for 9)] (BMNH).

Atteva monerythra Meyrick, 1926. Holotype ♀ missing right hindleg and last few flagellomeres of each antenna. Labelled: "Holo-type" [circular, red-bordered, white, printed]; "Charles Island/ Galapagos/ at light/ 31.7.1976/ St. George Exped. /C. L. Collenette." [square, white, printed except for first, third and fourth lines]; "M 26" [rectangular, white, handwritten]; "Atteva/ monerythra/ Meyr/ Tr. Ent. Soc. Lond. p 278 (1926)/ TYPE 9" [rectangular, white, handwritten except for "TYPE"], black-bordered, with thin horizontal line at basal third; "Brit. Mus. 1925/488." [rectangular, white, printed, upside down, with number 5 mostly damaged by pin hole]; "♀ genitalia on/ slide 29.v 1948/ J.F.G.C. 7533" [rectangular, white, printed except for numbers, sub-bordered with thin black line] (BMNH).

Diagnosis.— This is a striking species unlike any others in the Galápagos. Its forewing venation, shining blue green with bright yellow and (in most specimens) reddish markings, is especially distinctive (Fig. 3-5).

Description.— Meyrick's description (1926: 278) of the colouration of A. monerythra is accurate and it is repeated here verbatim:

"Head dark indigo-blue, sides of crown, two spots on forehead and the outer margin partly damaged, and without the left fore- and hindlegs and the last few flagellomeres of the left antenna. Labelled: "Holo-type" [circular, red-bordered, white, typed]; "Albermarle/ Isl./ 76 32" [rectangular, grey, handwritten]; "Cydosia/ sylpharis/Butler Type" [rectangular, white, handwritten]; "sylpharis/ Butler." [rectangular, white, handwritten, with printed horizontal line near bottom]; "TYPE" [rectangular, white, printed, black-bordered, with thin horizontal line at basal third]; "genitalia slide 9 /JFL 1468" [rectangular, pale green, printed (except for 9)] (NHRS).

Atteva monerythra Meyrick, 1926. Holotype ♀ missing right hindleg and last few flagellomeres of each antenna. Labelled: "Holo-type" [circular, red-bordered, white, printed]; "Charles Island/ Galapagos/ at light/ 31.7.1976/ St. George Exped. /C. L. Collenette." [square, white, printed except for first, third and fourth lines]; "M 26" [rectangular, white, handwritten]; "Atteva/ monerythra/ Meyr/ Tr. Ent. Soc. Lond. p 278 (1926)/ TYPE 9" [rectangular, white, handwritten except for "TYPE"], black-bordered, with thin horizontal line at basal third; "Brit. Mus. 1925/488." [rectangular, white, printed, upside down, with number 5 mostly damaged by pin hole]; "♀ genitalia on/ slide 29.v 1948/ J.F.G.C. 7533" [rectangular, white, printed except for numbers, sub-bordered with thin black line] (BMNH).
Fig. 8-13. Male abdomen and genitalia of *Prays galapagosella* sp. nov.: 8) Vinculum, juxta, valvae (setae omitted), ventral aspect, aedeagus shown in outline. 9) Genitalia, dorsal aspect, aedeagus and valval setae omitted. 10) Genitalia, lateral aspect, aedeagus shown in outline. 11) Aedeagus, lateral aspect. 12) Teguminal process with setae and apical pegs (lateral aspect). 13) Abdominal segments 6-8, dorsal aspect, showing coremata (with inset) and modified 8th segment with sclerotized tergum (T8), sternum (S8), and expanded pleural lobes (P18). (Abbreviations: gna = gnathos; jx = juxta; ptp = postero-lateral teguminal process; teg = tegumen).
yellow. Abdomen blue-blackish, a lateral stripe and ventral series of blotches yellowish-white. Anterior coxae orange in front. Fore-wings dark indigo-green; markings pale yellow, viz. a streak below costa from near base to 3/5 variably interrupted into spots or dots, an irregular streak in disc from 1/3 to 2/3, a submedian streak from near base to 4/5, a subdorsal streak (dorsal near base) to middle or 3/4, an irregular spot towards apex, and a group of dots before lower half of termen; a small red spot beneath costa lateral to 3/4, occasionally connected by white dots along costa towards apex; cilia white, basal half dark fuscous. Hind-wings subhyaline white, tinged grey on posterior half, veins on posterior half and a terminal fascia becoming broader towards apex dark fuscous; cilia white, basal half dark fuscous on termen.

There is a slight amount of variation in the extent of red-spotting and the yellow streaks on the forewings (Fig. 3-4). Male hindlegs with tibia and tarsus reduced, the latter very slender, without spines nor claws, apex of last tarsus with two longitudinal sclerotized cuticular thickenings, posterior margin finely tapered triangle. S8 ± elongate trapezoid, shorter than T8, medially melanized area, area on T6-7 triangular. T8 sclerotized as elongate, distally tarsus reduced, the latter very slender, without spines nor claws, apex of last processes. Gnathos developed, recessed under tegumen, distal arm digitiform, (Fig. 16). Uncus developed, apically bilobate, medially with X-shaped saccular margin of valvae; apex with whorl of blunt flat spines (Fig. 27-28). Spiculate microsculpture (Fig. 23-24); postero-lateral teguminal processes anterior margin with deep medial notch (Fig. 17), with lateral zone of fine spiculate microsculpture (Fig. 23-24); postero-lateral teguminal processes (Fig. 16-17, 19) as long as tegumen (dorsal length), extended down to saccular margin of valvae; apex with blunt flat spinules (Fig. 27-28). Vinculum narrow, transverse, with long saccus ca half length of genitalia (Fig. 16). Uncus developed, apically bilobate, medially with X-shaped strengthening sclerotizations (Fig. 17). Tuba analis with elongate, narrow lateral supporting sclerotization, extended to two-thirds of teguminal processes. Gnathos developed, recessed under tegumen, distal arm digitiform, slightly upcurved, darkly melanized, dorsal surface covered with dense, finely pointed microsculpture (Fig. 17, 23, 25). Valvae broad, distal two-thirds spoon-shaped, inner surface corrugated, sparsely setose (Fig. 20, 23); at one-third a large, inwardly recurved, coarsely wrinkled spatulate lobe; antero-dorsal angle extended into short apodeme; outer wall of anterior third with arched sclerotized strengthening bar; antero-ventral (saccular) angle inwardly protruded into square lobe with outer surface covered with dense, short setae (Fig. 19, 26). Aedeagus slender, tubular, with slightly curved apical band at one-third, with 5 large, slender, dehiscent cornuti about half length of aedeagus (Fig. 21-22).

Female genitalia (Fig. 15): Papilae anales moderately sclerotized, elongate, with some long setae. Posterior apophyses thin, extending slightly beyond anterior margin of tergum 8, slightly curved inwardly at apex. Tergum VIII with short and long setae in the middle apically; with straight lateral sclerotized bands curved downwards from apical third (dorsal branches of anterior apophyses of Kyri (1984), connected at base to a transverse sclerotized band widest on each side, and to which the anterior apophyses (or ventral branches of anterior apophyses of Kyri (1984)) are also connected. The latter thin, slightly shorter than posterior apophyses, broadly curved at base, straight afterwards. Sternum VIII weakly sclerotized, sparsely setose on whole surface, but with more setae in the middle apically. Ostial plate rectangular, apical of ostium, about three times wider than long, more sclerotized laterally, with 2-3 setae on each side. Ductus bursae well sclerotized ventrally for short distance (about one-tenth of length), scobinated on a little more than first half of length. Ductus seminalis attached dorso-medially at base of ductus bursae. Corpus bursae rounded, signum a small, denticulate plate, or with linear border (Fig. 19). Subbursae connected to signum by slender, branching ducts. Corpus bursae surrounded by a group of microsclerites. The processes of the genitalia (Fig. 27-28) are somewhat analogous to those seen on the gnathos in some gelechioid groups (Coleophoridae, Depressariidae, Elachistidae, etc.).

The genitalia of A. hyginiella, and of the widespread continental A. punctella (Cramer), are remarkably similar in both sexes. However, the two species are easily separable on coloration and geographical distribution.

Biological Notes.— Final instar larva: Head entirely red-brown to rusty brown with irrate patches of paler yellowish brown, with white spots surrounding setal base; area around sternum, mandibles, and ventromost portion of fronto-clypeus dark brown to black; antennae and palpi black. Head capsule width 2.3-2.6mm. Thorax with black and pale, unevenly distributed irrationes. Ground color of abdomen olive-green (faded to yellowish white in preserved specimens), with brown to black irrationes/reticulations, longitudinally striped with black and white laterally and dorsally; dorsum with three white stripes each lined by thin black stripes; middle of each segment between stripes with dark brown area forming diffuse broad spot; one broader white stripe laterally at level of L setae from T3 to A10. A1-A8 with subventral elongate brown, diffuse spot. Legs and prolegs dark brown to black. Setae and crochete arrangements as in A. exquisita (A. punc- tella (illustrated in Powell et al., 1973), abdominal crochets a little more numerous (40-45). Body length about 19-30mm.

Pupa (Fig. 31-32).—Ground color yellowish white with antennae, mouthparts, dorsum of head and thorax, and sides of abdomen with brown shading, areas between several wing veins brown (thus highlighting the veins); dorsum of abdomen with three longitudinal white lines mediately, interrupted on intersegmental joints, each line surrounded by brown lining on each side. Prens with two short humps between antennal bases, each with two hooked setae. A10 crenemeter with flat, notched apical process bearing four apical hooked setae; with eight ventral (four small, four large), four dorsal, and two lateral stiff hooked setae around base of process. Antennae, haustellum, and forewings extended to two-thirds of A4. Abdomen smooth, without tergal spines. Spiracles on A2-A7 barely protruded (not on raised tubercles).

Powell et al. (1973) noted that in the pupa of A. exquisita Busck the frontal humps form marked protuberances and the cremaster hook of the saw to be numerous and fragile.

Distribution.—In the Galapagos Islands of Baltra, Fernandina, Floreana, Isabela, Marchena, Pinta, Pinzon, Rábida, San Cristóbal, Santa Cruz, Santa Fé, Santiago and Seymour Norte. Specimens examined: 29 ♂, 39 ♀ (BLC, BMNH, CNCI, CASC, NHRS).

Flight Period.—We have seen specimens collected all months of the year except August, November and December. The species could be multivoltine like A. exquisita Busck from southwestern USA and Mexico (Powell et al., 1973).

Hostplant and Biology.—The first adult reared one adult male, eclosed 7 Mar 1992, from caterpillars found in a loose web on the shrub Castela galapageia Hooker f. (Simaroubaceae), on Santa Cruz Island (CNCI) (Fig. 6). A pair of adults were also reared from the same host plant on Santiago and issued 14 Jun 1964 (CASC). This plant is endemic to the Galápagos and probably present on most of the islands of the archipelago (Wiggins and Porter 1971). Several members of the genus Atteva feed on Simaroubaceae (Fletcher, 1920; Powell et al., 1973) but one Australian species feeds on Polyscias (Araliaceae) (Common, 1990).

Notes on Synonomy.—In his description of A. monerythra, Meyrick (1926) indicated that it differed from A. hyginiella by the absence of "antemedian and terminal red spots" on the forewing of that species. While we have not found any specimens from Floreana (the type locality of A. monerythra) with an antemedial red spot among ten specimens examined, several have a small or a large terminal spot. One specimen from Floreana also has a red spot medially on the inner margin of the forewing. Although this specimen is unusual, it shows that on the same island, the red and yellow markings are variable in size and shape and probably of no taxonomic value, even at the subspecific level. The genitalia examined (4♂, 4♀) from specimens collected on various islands did not show consistent differences. One male, (slide MIC 3634, CNCI) has the apex of the saccus forked, apparently an aberration.

Note on Ranking of Atteva.—Some authors have given the Attevae, or "Atteva group" of Kyri (1984, 1990), family status (e.g., Heppner, 1991, 1996), thus reinstating Mosher's (1916) old concept initially based on pupal characters. This, however, has not gained universal acceptance (e.g., Nielsen and Common, 1991; Scoble, 1992;
Fig. 14-15. Female genitalia, ventral aspect: 14) Prays galapagosella sp. nov.; inset with arrow: lateral aspect of signum, thorn-like process pointed inwards bursa. 15) Atteva hyginiella (Wallengren).
Male abdomen and genitalia of *Atteva hysginiella* (Wallengren): 16) Vinculum- valvae in ventral aspect, with visible parts of gnathos, anal tube and postero-lateral teguminal processes; aedeagus and setae omitted. 17) Genitalia, dorsal aspect, aedeagus omitted. 18. Abdominal segment 8, dorsal aspect, showing modified, sclerotized tergum (T8), sternum (S8), and expanded pleural lobes (P8). 19) Genitalia, lateral aspect, aedeagus omitted. 20) Valva, lateral aspect, setae of cucullus omitted. 21) Aedeagus, dorsal aspect. 22 Aedeagus, lateral aspect. Abbreviations: ats = anal tube sclerite; ptp = postero-lateral teguminal processes; sp = setal patch; un = uncus; gna = gnathos.
Fig. 29-30. Leg structures of Atteva hysginiella: 29) hindleg, with normal complement of tibial spurs, tarsal spines and claws. 30) hindleg, showing tibia without spurs and reduced tarsus without spines and claws. Insets: enlarged views of last two tarsomeres. Whole legs and inset tarsi each drawn at same magnifications, respectively.

Robinson et al., 1994). Atteva is aberrant within the Yponomeutidae due to the presence of chaetosemata in the adult, and the pupa with labial palpi that are not exposed. Possession of chaetosemata generally is a plesiomorphic trait. These structures are present in most primitive Lepidoptera and in many Ditrysia. Their presence in Atteva could represent a reversal, thus, a specialization. The concealed labial palpi of the pupa are also a specialization. In a cladistic framework, these are insufficient grounds for excluding Atteva from the Yponomeutidae. For the time being, we prefer to retain the more traditional placement of Attevinae as a subfamily within the Yponomeutidae, which was supported by Kyrki's (1990) analysis, until a more refined phylogenetic analysis of the family is carried out to support rank changes.

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