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SOME TAXONOMIC NOTES ON THE NEARCTIC *HOLOMELINA* (ARCTIIDAE) WITH A PARTIAL KEY TO THE SPECIES

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It is well known that species determination in the genus *Holomelina* Herrich-Schäeffer (not *Eubaphe* Hübner)[1] is difficult. Moreover, the exact application and rank of many of the taxa are certainly questionable. This paper is the first in a series on the biology and species relationships of the *Holomelina*. The objectives of the present paper are: (1) to provide a reliable key to the Nearctic *Holomelina* exclusive of the *aurantiaca* and *opella* complexes, (2) to make preliminary comments on the taxonomy of these complexes as they now stand, and (3) to explain several systematic changes from the current classification as exemplified by McDunnough (1938). Future manuscripts will include taxonomic studies of new species, as well as analyses of distributional, biological, and genetic data.

I. THE HOLOMELINA AURANTIACA COMPLEX

McDunnough's synonymic list cites eight of the twenty-five new world species as occurring north of Mexico, including the generotype, *aurantiaca* (Hübner). This species is the main constituent of a complex that ranges from Nova Scotia to Manitoba, southward through Florida and the Greater Antilles, westward into the Dakotas, Wyoming, Utah, and New Mexico, and thence southward at least to Guatemala. Throughout much of this distribution, several sibling species associate sympatrically with *aurantiaca*, or replace it entirely. A dozen species or forms have been

[1] The genus *Eubaphe* Hübner (1823, Zuträge z. exot. Schmett., 2: 20) has been widely used in the Arctiidae, but when first published, it was monobasic, having as its type, *E. lobula* Hbn., a geometrid; *aurantiaca* Hbn. which is sometimes cited as the type of *Eubaphe*, was not described until a later date (1827–1831, loc. cit., 3: 9). The next valid name to replace *Eubaphe* in the Arctiidae appears to be *Holomelina* Herrich-Schäeffer (1856, Samml. aussereurop. Schmett., 1: 15, 17), the type of which is *aurantiaca* (Fletcher, 1954).

described with the complex; but most of the original descriptions are inadequate, and often the types have been lost, or their identity is uncertain, so that most have been placed in the synonymy with *aurantiaca*.

Clearly at least two of these are referable to separate species. The first, *Holomelina ferruginosa* (Walker) was described in 1855 from St. Martin's Falls on the Albany River, Hudson Bay, Canada and had been assigned specific rank through the time of McDunnough. Because of a lack of clear-cut, structural differences in male genitalia, Forbes (1960) recognized only *aurantiaca* and *lamae* (Freeman) as distinct. He did not comment on *ferruginosa*, presumably due to a lack of reference material. Biologically, however, *ferruginosa* is certainly a separate species, and in addition has priority over two forms, "immaculata" and "trimaculosa," cited by Forbes under *aurantiaca*.

Data assembled from other collectors show that in northern areas where both species are limited to one generation per year, flight periods must be nearly identical and ecological isolating factors are as yet unrecorded. As no difference in the genitalia which might present a physical barrier to copulation has been detected, it is likely that some sort of ecological (i.e., physiological) preference creates a degree of isolation. Moreover, one would expect such siblings to occupy different niches to minimize competition; the mechanism is most likely multifactorial. In other populations, for example, there are evidences of behavioral barriers. Connecticut *aurantiaca* females fly readily, though not quite so far and actively as the males; while *ferruginosa* females are reluctant to fly at all. Different mating times are also quite probable. Under 16-hour photoperiod laboratory conditions, one *aurantiaca* complex strain from New Jersey mated approximately four hours before light switch-off, while a *lamae* strain from Maine mated some four hours after switch-off.

In Connecticut, the total situation is quite different, since *ferruginosa* is single brooded and seems to be isolated by flight period and environment from its double-brooded sibling, *aurantiaca*. The author has taken *aurantiaca* over the last five years in several Connecticut localities between 5–16 June and 3–23 August in open, and often abandoned, fields. *H. ferruginosa* has been collected at Branford, Connecticut (the only known occurrence in the state) in 1963–1964 between 5–30 July. The habitat is somewhat open, grassy woods. At present the exact southern extension of the two species in this type of relationship is uncertain, but its distribution is at least New Jersey through Illinois, according to the report of Wyatt (1939) giving similar observations from Illinois.

The third species, *Holomelina lamae* (Freeman), was described in 1941 from New Brunswick and Nova Scotia with a sphagnum bog habitat and

is currently known from Manitoba, northern Wisconsin, and coastal Maine and New Hampshire. *H. lamae,* like *ferruginosa*, seems structurally identical to *aurantiaca,* but *lamae* populations are strictly confined to this distinct, localized environmental niche, and are thereby isolated from the other two sibling species. Ferguson (1953) reports that in Nova Scotia *aurantiaca* and *ferruginosa* may fly within sight of the bog, but do not enter, so that one may conclude that such isolation is both ecological and behavioral. Ferguson also notes that *lamae* is active diurnally, while the two sibling species in question generally fly only when flushed; *lamae*, on the other hand, is not attracted to "blacklight" as are the other two.

Further information on relationships between these sibling species will come from hybridization studies currently in progress. It would be difficult to measure quantitatively genetic interchange among the three, if such occurs, as each so-called population exhibits extensive but parallel variation, presumably under the control of similar genes. Probably no attempt to describe these siblings could be completely successful, as the number of individual variants in a given population as well as clinal divergence preclude the use of any single character as an absolute. Yet cautious utilization of the following descriptions should suffice for eastern material with the exception of Florida.

Holomelina aurantiaca (Hübner)

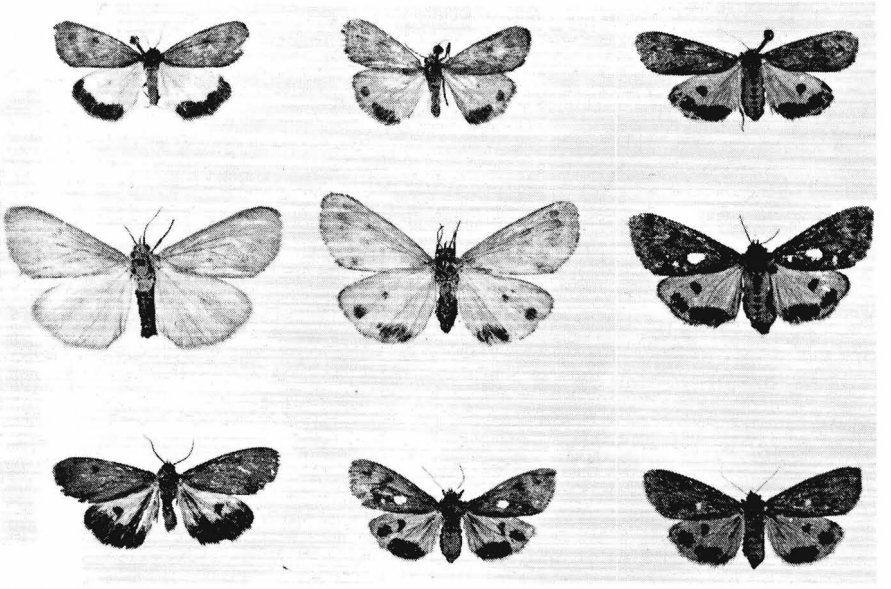
Eubaphe aurantiaca Hübner, 1827, Zuträge z. exot. Schmett., 3: 9

MALE. *Upperside*: Forewing pale orange to brown, often with a darker, obscure postmedial band and discal spot; fringe concolorous. Hindwing light orange to carmine red, rarely light yellow, rarely immaculate, usually a complete, distinct terminal band, often with discal spot; fringe either concolorous with terminal band or with ground color. *Underside*: Immaculate reddish orange, the forewing being a shade deeper than the hindwing.

FEMALE. *Upperside*: Forewing pale orange, in northern material suffused with brown, more heavily over the basal two-thirds; dark, transverse postmedial bands alternate with light orange, partially overscaled with brown; usually a dark, obscure discal spot; whitish cream spots below origin of Cu_2 and beyond (especially in northern specimens). Hindwing light orange, discal spot usually present, terminal markings rarely absent, mostly comparatively reduced to irregular blotches or spots in submarginal area. *Underside*: Forewing immaculate orange. Hindwing lighter, with reduced terminal markings of the upperside, or immaculate.

Palpi, head, and thorax orangish brown to ocher, abdomen orange, often with dorsal and lateral spots on segments, sometimes appearing as an unbroken line or band.

Length of forewing: apex to base, in male 9.5 mm to 11.0 mm, average 10.0 mm; in female 10.0 mm to 12.0 mm, average 11.0 mm; average for both sexes, apex to outer angle 6.0 mm. Hindwing: outer angle to base, 8.0 mm; base to end of vein Cu_1, 8.0 mm.



EXPLANATION OF PLATE

Adults of *Holomelina* (upperside). Top row, *H. aurantiaca* (Hübner): left, ♂, Simsbury, Hartford Co., Connecticut, VIII-11-64; middle, ♂, same data; right, ♀, Farmington, Hartford Co., Conn., VI-9-60. Second row, *H. ferruginosa* (Walker): left, ♂, Branford, New Haven Co., Conn., VII-5-63; middle, ♂, same locality, VII-18-63; right, ♀, same locality, VII-22-63. Lower row, *H. lamae* (Freeman): left, ♂, Seawall Bog, Acadia National Park, Mt. Desert Island, Maine, VII-25-64; middle, ♀, same data; right, ♀, same data.

Holomelina ferruginosa (Walker)

Crocata ferruginosa Walker, 1854, Cat. Lep. Brit. Mus., 2: 535

MALE. *Upperside*: Forewing immaculate light orange or orange generally suffused with brown, darker basally with a dark postmedial and often medial and submarginal bands parallel to outer margin; rarely small whitish cream spots in submedian interspace; dark, indistinct discal spot or bar in darker specimens; fringe concolorous with forewing or fuscous. Hindwing lighter than forewing, usually light orange, often immaculate, rarely pale yellow; terminal band at times present, fragmented into a series of blotches, larger subterminally with upper portions more distant from outer margin, rarely nearly complete; fringe concolorous with ground color or fuscous. *Underside*: Forewing salmon pink, brighter subcostally, more orange near outer margin. Hindwing immaculate light orange.

FEMALE. *Upperside*: Forewing orange, suffused with brown, a dark wavy postmedial band; whitish cream spots usually present. Dark discal spot often elongated into bar over discocellular area; fringe concolorous or dark brown. Hindwing orange or yellowish orange; terminal band rarely nearly complete, not quite to outer margin, usually broken into two irregular blotches, the larger submedially; a thick discal dash, spot or outwardly convex crescent over middle discocellular area. *Underside*: Forewing brownish orange; upperside discal spot or dash, traces of upperside post-

medial as black spots and bars repeated as well-defined black markings. Hindwing has the definitive black terminal markings of the upperside, though somewhat reduced.

Length of forewing: in male 12.0 mm to 13.0 mm, average 12.5 mm; in female 11.5 mm to 13.0 mm, average 12.0 mm; apex to outer angle average, 8.0 mm in male, 7.0 mm in female; outer angle to base average, 9.5 mm in male, 9.0 mm in female. Hindwing: base to end of vein Cu_1, 10.0 mm in male, 8.5 mm in female.

Holomelina lamae (Freeman)

Eubaphe lamae Freeman, 1941, Canad. Ent., 73: 123

MALE. *Upperside*: Forewing dark brown; in most populations (not Maine) a definitive whitish cream spot just below origin of Cu_2; an obscure black spot at upper end of cell. Hindwing light orangish yellow to yellow with a broad, black terminal band extending over at least 40%; inner edge of terminal band sinuous and extending to base along anal veins over fold or inner margin; discal spot large, black, distinct, frequently fused to or included in terminal band; fringe fuscous. *Underside*: Forewing salmon pink with a black discal spot. Hindwing orangish yellow, suffused with black markings in terminal area, especially subterminally, not over veins.

FEMALE. *Upperside*: Forewing brown, as in male, except with distinct orange tinge distally; generally with a larger whitish cream spot below origin of Cu_2, often with additional spots in submedian interspace; dark postmedial band present, often obscured. Hindwing light orange or yellowish orange, occasionally with a broad, black terminal band, not quite to outer margin, usually fragmented into spots and bars larger subterminally and streaked towards base as black shading in the anal region; black discal spot large, distinct, often elongated into a bar; fringe orange–yellow. *Underside*: As in male, with terminal band of secondaries repeated below.

Palpi, head, and thorax reddish brown to orange; abdomen lighter, more often with black dorsal spots on each segment, rarely fused. (In some females such spots may extend into wide bands, and the basal segment is wholly blackish.)

Length of forewing: in male 8.5 mm to 9.5 mm, average 9.0 mm, in female 9.5 mm to 10.5 mm, average 10.0 mm; apex to outer angle average 5.5 mm in both sexes; outer angle to base average 6.5 mm in male, 7.0 mm in female. Hindwing: base to end of vein Cu_1 average, 7.0 mm in both sexes.

II. The status of Holomelina opella nigricans

Crocata opella Grote, 1863, and *C. nigricans* Reakirt, 1864, were both described from Pennsylvania; and although distinct in appearance, have been regarded as forms of a single species by recent authors. Larval descriptions of *Holomelina opella* by Dyar in 1897 and of *nigricans* by Forbes in 1910 indicate that these forms have differences in early stages. The obvious inference submitted by Forbes (1910, 1960), is that *nigricans* is an independent taxon. However, no morphological dissimilarities between the male genitalia (which might be considered mechanical reproductive barriers) have been noted in northern material. Even if these were present, they might not necessarily represent a significant reproductive isolating factor.

Brown (1961) believes that different flight periods and discrete larval differences in themselves do not signify "specificity." The criterion that Brown emphasized in his statistical treatment of wing character variation

in two closely sympatric *Coenonympha* (Satyridae) populations was gene flow from one pool to another, and for him such probable "contamination" or interchange of a great extent precluded any determination of "specificity," even though the units in question apparently were not reproductive isolates, and presumably discrete to a certain degree. Brown viewed the contaminating genes as essentially relative to superficial appearance and not involving any physiological divergence. However, as was pointed out in discussion of the *aurantiaca* complex, such factors may be difficult to determine, especially in view of several practical considerations, viz., yearly fluctuations in the population levels, and difficulty in obtaining wild females and population samples. In addition there is some question as to the identity of the "nigricans" type, so that for the present the author refuses to admit an unqualified separation of *opella* and *opella* "nigricans," and prefers to postpone answering the question by treating the two as a complex.

III. The priority of Holomelina fragilis

McDunnough (1938) recognized both *fragilis* (Strecker) and *costata* (Stretch) as species. A recent examination of the *fragilis* types indicates that they are conspecific with *costata*. *H. fragilis* was described in 1878 from Pagosa Springs, Colorado, seven years before *costata* was described from Texas (collected by Belfrage, but exact type locality unknown). Considerable variation in the gray ground color of the forewing and amount of crimson suffusion is not clearly associated with either a cline or subspeciation as indicated by previous authors. Thus *H. costata pallipennis* (Barnes and McDunnough), described from Glenwood Springs, Colorado, should also fall as a synonym of *H. fragilis*. *H. fragilis* specimens have a pronounced tendency to fade, and this in particular is likely responsible for past confusion.

A partial key to Nearctic Holomelina

1. Palpi approximately equal to half head vertex width 2
   Palpi approximately equal to or greater than head vertex width 4
2. HW immaculate orange ocher; FW light fuscous-gray suffused with crimson; underside and costa scarlet ..... *fragilis* (Strecker)
   HW terminally shaded with black–brown 3
3. FW underside crimson with black marginal band; FW upper gray–brown with crimson costa; HW crimson to red–yellow with black–brown terminal band ..... *intermedia* (Graef)
   FW underside mostly gray or gray–black, crimson costally. FW upper dark gray with crimson costa; HW crimson with light black terminal band .. *laeta* (Guérin)
4. FW yellow–brown with crimson costa; HW crimson with black sinuous terminal band running from below base on inner margin to near apex ..... *ostenta* (Hy. Edwards)
   Costal edge concolorous with FW or indistinct HW discoidal spot present 5

5. Males (frenulum simple, hooks present) 6
   Females (frenulum multiple, hooks lacking) 7
6. HW in northern material generally solid blackish; or FW costal edge contrasting; HW markings indistinct; clasper apex forked ..... *opella* complex
   HW usually largely orange or bright yellow; clasper apex slender, simple ..... *aurantiaca* complex
7. HW with indistinct discoidal spot, and all blackish or mixed with reddish or yellowish ocher with black shaded terminally from inner margin .. *opella* complex
   HW very rarely immaculate, usually black in terminal area and discal spot; in some species shaded towards base along inner margin or fold; FW in northern material often with white spots; abdomen usually with lateral or dorsal black spots ..... *aurantiaca* complex

Summary

1. This paper is the first in a series on the *Holomelina*; it suggests several taxonomic changes and indicates areas of uncertainty currently under investigation.

2. The *aurantiaca* complex is widely distributed and consists of several sibling species; those not in confusion are *ferruginosa* (Walker) and *lamae* (Freeman). Identification and several discrete barriers to possible hybridization of these siblings are discussed.

3. Preliminary biological evidence suggests that *opella* and *nigricans* are independent taxa.

4. *H. costata* and *costata pallipennis* are synonymized under *fragilis* (New Synonymy).

5. Males in certain populations of the *aurantiaca* and *opella* complexes are very close in maculation and consequently are best determined by genitalia.

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Literature Cited

Brown, F. M., 1961. *Coenonympha tullia* on islands in the St. Lawrence River. Cand. Ent., 93: 107–117.

Ferguson, D. C., 1953. On the identity and status of *Eubaphe lamae* Freeman (Lepidoptera, Arctiidae). Cand. Ent., 85: 371–373.

FLETCHER, D. S., 1954. A revision of the genus *Eubaphe* (Lepidoptera : Geometridae). Zoologica, 39: 153–166.
FORBES, W. T. M., 1910. New England caterpillars, no. 2. *Eubaphe nigricans* Reakirt. Jour. N. Y. Ent. Soc., 18: 163–164.
1960. Lepidoptera of New York and neighboring states, pt. IV. Mem. Cornell Univ. Agri. Exp. Sta., 371: 1–188.
FREEMAN, T. N., 1941. New species of Canadian Lepidoptera. Cand. Ent., 73: 123.
DYAR, H. G., 1897. The larva of *Crocota opella* Grote. Psyche, 8: 119.
MCDUNNOUGH, J. H., 1938. Check list of the Lepidoptera of Canada and the United States of America. Mem. So. Calif. Acad. Sci., 1: 1–275.
WALKER, F., 1855. Cat. Brit. Mus. Lep. Het., 2: 535.
WYATT, A. K., 1939. Notes on certain forms of *Eubaphe*. Cand. Ent., 71: 96–99.

PROBABLE SECOND U.S. RECORD FOR *EREBIA DISCOIDALIS*

On 24 May 1964 W. R. Pieper, Ray Glassel, and I were collecting in Lake County, Minnesota. About 20 miles north of Two Harbors, we stopped at the little town of McNair. The general area is one of acid bogs, characterized by black spruce, white cedar, and tamarack. Ground cover is mostly mosses (sphagnum, hipnum, haircap, etc.) with occasional gatherings of checkerberry, Labrador tea, leather-leaf, and claytonia.

Just behind the buildings at McNair (NE ¼, S 24, T 56 N, R 11 W) is an open, grassy meadow, sparsely dotted with speckled alder and quaking aspen, both of shrub size. In this meadow we captured three badly worn but typical red-disked alpines, *Erebia discoidalis* (Kirby).

Macy and Shepard (1941)[1] list the only U.S. record for this species as Itasca Park (Clearwater County), Minnesota on 31 May 1935. The most recent literature that I have is Ehrlich and Ehrlich (1961),[2] where the Itasca Park record is again cited as the only U.S. record. We have reason to believe, then, that the three specimens taken by us on 24 May are the second documented occurrence of *Erebia discoidalis* for the U.S. If any readers know of other specimens, I would be interested in the details.

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[1] Ralph W. Macy & Harold H. Shepard, *Butterflies* (Minneapolis: University of Minnesota Press, 1941), p. 91
[2] P. R. Ehrlich & A. H. Ehrlich, *How to Know Butterflies* (Dubuque: Wm. C. Brown Co., 1961), p. 97.