



Figures 45-52. Eggs and reared larvae of *E. mackinleyensis* and *E. fasciata*. Eggs were collected by P. Ross from captive females, 1985, Dempster Highway, Yukon. Fig. 45. Egg micropyle of *E. mackinleyensis*. Scale line = 20 μ m. Fig. 46. First instar larva of *E. mackinleyensis*. Scale line = 0.2 mm. Fig. 47. Second instar larva of *E. mackinleyensis*. Scale line = 1 mm. Fig. 48. Larval head capsule of third instar larva of *E. mackinleyensis*. Scale line = 1 mm. Fig. 49. Lateral view of third instar larvae of *E. mackinleyensis*. Scale line = 1 mm. Fig. 50. Dorsal view of third instar larvae of *E. mackinleyensis*. Fig. 51. Micropyle region on egg of *E. fasciata*. Scale line = 20 μ m. Fig. 52. Head of first instar of *E. fasciata*. 0.2 mm.

Phylogenetic Relationships.— The *E. magdalena* /*mackinleyensis* species pair exhibits many characters which unite them as sister species: structure of male genitalia; lack of maculations from most adults; when maculations are present, a similarity of design; and presence of andriconial scales in the males. Other related species are *E. erinnyn* (Siberia, except for the presumed Canadian record); and *E. fasciata*.

Material Examined.—

Adults (males, females). CANADA: Yukon; Dempster Highway, Km 154 to 156, 34, 10 (CNC, HILC, PIKE, PRES, SHEP, SPER). Dempster Highway, Km 465 to 468, 3, 1 (CNC). U.S.A.: Alaska; Atigun Gorge, north ridge, 2, 4 (SHEP).

Immatures. CANADA: Yukon; Dempster Highway, Eggs 20 eggs and egg shells, 17 first instar larvae, 16 second instar larvae, 12 third instar larvae, 2 fourth instar larvae, 1 fifth instar larvae and associated exuviae (HILC).

Erebia magdalena Strecker 1880

(Figures 1 – 5, 8 – 36, 39 and 41 – 43, Tables 1 – 3)

Recognition.— This is perhaps the plainest butterfly species in North America, most specimens exhibiting a uniform dull black to dark brown color.

Description.—

Adults (Figures 1–4, 31–36, and 41). Wings dark blackish brown, population variations occur with some individuals exhibiting banding ventrally, and others developing a rust colored patch. See the discussion on character states under Character Analysis. Body similar color to the wings. Antennae annulated with gray white, club ferruginous above, black below (Figure 41).

Male genitalia as illustrated (Figures 31–36). Spination of uncus not expanded to inner surface as in *E. mackinleyensis* (Figures 37 and 38). Chromosome numbers reported by Maeki and Remington (1960) for *E. magdalena* from Gunnison County, Colorado were 10 large, 11 medium and 8 small for a sum of 29.

Immatures (Figures 5, 9–28, 39, 42; Table 3). Pupa (Figures 26 and 42). Alberta specimen (n=1); Length, 14 mm long. Head and thorax regions olive to dark green with abdomen medium brown tinged with green, without distinct markings, spines or hairs. Cremaster blunt, rounded (Figure 42), sculpturing on abdominal sclerites is a series of short longitudinal lines (Figure 42). Silk not observed. Colorado specimen; (from photo, YOUN) similar to Alberta specimen.

Larva, fifth instar (Figures 5 and 27). Alberta specimens (n=10); Integument with numerous blunt hairs (Figure 10). Head capsule dark brown, ground color of body green with black mottled maculations (Figure 5). Head capsule width 3.00 ± 0.10 mm. Colorado specimens (n=2); head capsule lighter brown, photo of larvae show light green ground colour, head capsule width 3.15 mm.

Larva, fourth instar. Alberta (n=10); Similar to fifth instars except smaller and with fewer hairs. Head capsule (Figure 14), width 2.19 ± 0.04 mm, n= 10. Colorado specimens (n=2); Ground colour cream in preserved specimens, head capsule width 2.15 mm.

Larva, third instar (Figures 11 and 28). Alberta specimens (n=5); similar to fourth instars, with reduced maculation and fewer hairs. Head capsule (Figure 15) width 1.55 ± 0.02 mm. Colorado specimens not seen.

Larva, second instar (Figures 12 and 29). Alberta specimens (n=4); hairs very few, no obvious maculations, ground color green. Head capsule, brown, lightly rugose (Figure 16) width 1.18 ± 0.04 mm. Colorado specimens not seen.

Larva, first instar (Figures 13 and 30). Alberta specimens (n=25); hairs very few, in discrete pattern. Ground color various from cream to light green with no dark maculations. Head capsule (Figure 17) with markedly rugose sculpture. Head width measurements 0.812 ± 0.018 mm. Colorado specimens (n=2); Similar ground colour, cream in preserved specimens, head capsule width 0.743 mm. Published illustration in Edwards [1888, collected by Mr. Bruce at Hall Valley, Mount Bullion (Edwards 1951)].

Egg (Figures 8, 21–25). Alberta specimens (n=25); ovoid with rounded ridges on sides (Figure 21). Top and bottom with rounded bumps (Figures 22 and 23). Micropile centered at

apex (Figure 24). Color cream, darkened just before hatching. Length 1.45 ± 0.07 mm with diameter of 1.22 ± 0.07 mm. Bottom glued to substrate during oviposition (adhesive pad on bottom of egg, Figure 23). Colorado specimens (n=3); Similar in appearance, length 1.36 mm, diameter 1.23 mm. Published illustration in Edwards (1888).

Geographical Distribution.— *Erebia magdalena* is known from the high alpine meadows of northern New Mexico, through Colorado, Utah and Wyoming north to southern Montana, and west central Alberta and adjacent British Columbia.

Chorological Affinities.— Few other species of butterflies share the high mountain slopes with *E. magdalena*. Other species of *Erebia* may be found as strays in high mountain habitat, but none are closely related to *E. magdalena*.

Phylogenetic Relationships.— As indicated, *E. mackinleyensis* and *E. magdalena* appear to be sister species. *Erebia magdalena* populations show recognisable differences which can be attributed to subspeciation on isolated mountains. Taxa included are *E. m. magdalena* Strecker and *E. m. saxicola* new subspecies.

Erebia magdalena magdalena Strecker 1880
(Figures 3, 4 - 36, 39 and 43, Tables 1 - 3)

Recognition.— These butterflies are dark brown to black, with individuals in southern populations exhibiting mesial bands (predominantly in females) and occasionally with rust colored scales, but seldom developed as a distinct patch.

Description.—As described for *E. magdalena*.

Geographical Distribution (Figure 58).— *Erebia magdalena magdalena* is known from northern New Mexico, through Colorado, eastern Utah, north to Wyoming and southern Montana.

Chorological Affinities.— Few other high elevation butterflies are found in the same habitat. Some of these are *Oeneis melissa* (*O. m. lucilla* Barnes and McDunnough, in Colorado *O. m. beani* Elwes, in Montana and Wyoming). Other high elevation species are found in adjacent habitats of moist meadows such as *O. polixenes* (Fabricius), *O. taygete* Geyer and *Colias nastes streckeri* Grüm-Grschimailo. No other species of *Erebia* shares the high mountain habitat with *E. magdalena*.

Phylogenetic Relationships.— The very local isolated populations scattered over many mountains has facilitated population differentiation. The analysis of the different populations shows a clinal type relationship (Graphs A and B), with individual character states showing no clear trends. The greatest shift is shown with the Alberta population, described below as a separate subspecies.

Material Examined.—

Adults (males, females). U.S.A.: Colorado; Boulder County; Arapahoe Pass 1, 0 (USNM). Arapahoe Pass Trail 3, 0 (YOUN). Boulder 3, 2 (USNM). Mount Audubon 11, 3 (ALME, AMNH, CNC, USNM). Mount Navajo, ridge east of, 1, 2 (ALME, USNM). Navajo Peak, 1, 0 (USNM). Needles Eye Tunnel, Corona Pass 1, 2 (ALME, SHEP). Niwot Ridge, near Ward 1, 0 (CNC). Clear Creek County; Loveland Pass 40, 11 (ALME, INHS). Mount Kelso 0, 2 (PIKE, YOUN). Custer County; Hermit Pass 1, 0 (PRES). Grand County; Berthoud Pass 2, 0 (YOUN). Corona Pass 2, 0 (ALME). Wheeler Basin 0, 2 (YOUN). Gilpin County; Corona Pass 4, 0 (ALME, AMNH, PRES). Gunnison County; Copper Lake, above 1, 0 (USNM). Cumberland Pass 2, 0 (SHEP). East Maroon Pass 9, 1 (SPER). Yule Pass 0, 1 (SPER). Hinsdale County; Mount Umcompadre 0, 1 (SPER). La Plata County; Chicago Basin 1, 0 (AMNH). Larimer County; (Rocky Mountain National Park) 6, 3 (ALME, CNC, USNM). Longs Peak 3, 1 (ALME, AMNH). Peacock Lake 1, 1 (ALME). Specimen Mountain 2, 2 (ALME, USNM). Park County; 2, 0

(USNM). Hall Valley 9, 9 (ALME, USNM). Hoosier Pass 0, 1 (AMNH). Bullion Peak 1, 0 (USNM). Pennsylvania Mountain 0, 1 (ALME). Storm Peak 1, 0 (ALME). Montana: Carbon County; Beartooth Plateau 5, 3 (SHEP). New Mexico: Taos County; Wheeler Peak 4, 3 (INHS). Utah: 3, 0 (ALME, UASM). Summit and Duchesne Counties; Bald Mountain 8, 1 (ALME, PRES). Summit County; 1, 0 (ALME). Uintah County; Leidy Peak 8, 3 (ALME). Wyoming: Fremont County; 1, 0 (USNM).

Immatures. U.S.A.: Colorado: Boulder County; Corona Pass, Eggs 3 (shells), 1st instar 1 (UASM). Grand County; 1st instar 1, 4th instar 1, 4–5th instar (died in moult) 1, 5th instar 1, photographs of larvae and pupa (YOUN).

Erebia magdalena saxicola, NEW SUBSPECIES

(Figures 1, 2, 4, 5, 8 - 33 and 41, Tables 1 - 3)

Derivation Of Subspecific Epithet — The subspecies is named for its association with rocky habitat. All specimens were captured on a boulder field on top of a mountain. *Saxicola* from Latin means 'inhabits rocks'.

Type Material.— Holotype: male, Adams Lookout, Alberta Forestry Service, Wilmore Wilderness Park, Alberta, 1.viii.81, G.J. HILCHIE. Allotype: 24.vii.81, same locality data.

Paratypes: 27 males, 19 females, Adams Lookout, AFS, Wilmore Wilderness Park, Alberta, 4.vii.81, K. AVERY; 1.viii.81, G.J. HILCHIE; 11.vii.82, F.A.H. SPERLING; 12.vii.82, F.A.H. SPERLING; 12.vii.82, E.M. PIKE; 13.vii.82, E.M. PIKE; 24.vii.82, G.J. HILCHIE; 25.vii.82, G.J. HILCHIE; 29.vii.84, G.J. HILCHIE; Mount Hamell, 23.vii.84, K. AVERY; 25.vii.84, K. AVERY; 30.vii.84, K. AVERY; 26.vii.85, G.J. HILCHIE; 27.vii.85, G.J. HILCHIE; 28.vii.85, G. HILCHIE; Dore River, near McBride, British Columbia, 15.viii.84, D. L. THREATFUL.

Type material is deposited in the following institutions: holotype, allotype, and 6 paratypes, CNC; 4 paratypes, USNM; 6 paratypes, UASM; 5 paratypes, Alberta Provincial Museum, Edmonton; 8 paratypes, AVER; 10 paratypes, HILC; 5 paratypes, SPER; 2 paratypes, PIKE. 2 paratypes, SHEP.

Type Locality.— Adams Lookout, Alberta Forestry Service, Wilmore Wilderness Park, 43 km southeast of Grande Cache, Alberta, Canada.

Recognition.—This subspecies is distinguished from *Erebia magdalena magdalena* by the following features: males have scattered white hairs on the ventral surface of the wings; females have scattered white scales and hairs on the ventral surface of the wings (Figures 1, 2 and 4) with concentrations near the apex of the forewing, mesial wing bands absent; geographic range confined to Alberta and B.C.

Description.—

Adults (Figures 4, 31–33 and 41). Male: wings with ground color, dorsal and ventral dark brown to black without pattern, androconial scales present; forewing length 23.8 ± 1.2 mm, range 21.4–26.1 mm; hind wing length 19.9 ± 0.9 mm, range 17.7–21.7 mm, $n=28$; ventral surface of wings with scattered white hairs near apex of forewing and on central area of hind wing (Figure 2). Genitalia typical for *E. magdalena* as illustrated in Warren (1936, Plate 35, Figure 327 and 330). Claspers various in shape (Figures 32 and 33). Gnathos, uncus and aedeagus typical for *E. magdalena* (Figure 31).

Haploid chromosome number is 29 (mode number from counts).

Female: wings with color similar to male; forewing length 25.0 ± 1.4 mm, range 22.1–27.7 mm; hindwing length 20.5 ± 1.3 mm, range 17.2–22.8 mm, $n=20$; ventral surface of wings with white hairs near tip of forewing and on most of hindwing (Figure 1). Twelve of 16 females examined had from a few to hundreds of white or very pale scales near the tip of the forewing and on the central area and margins of the hindwing. Four females appeared to have their wings dusted with white scales when viewed at low magnification.

Immatures (Figures 5–30). As figured and previously described.

¹One standard deviation

Habitat.— *Erebia magdalena saxicola* inhabits alpine boulder fields (ca. 2200 to 3000 m), interspersed with patches of vegetation (Figure 6).

Geographic Distribution (Figure 58).— Known from Adams Lookout, (Wilmore Wilderness Park) and Mount Hamell in Alberta and in an adjacent area in British Columbia which are widely disjunct from the next nearest known populations, found in southern Montana.

Chorological Affinities.— *Erebia discoidalis* Butler, *E. epipsodea* Butler, and *E. disa* Thunberg overlap in range with *E. m. saxicola* None of these species share the high mountain habitat.

Phylogenetic Relationships.— *Erebia magdalena saxicola* is the sister group of *Erebia magdalena magdalena*.

Material Examined.— Type material only.

LIFE CYCLE AND BEHAVIOUR OF *EREBIA MAGDALENA SAXICOLA*

Behaviour of Adults

Males and females (about 1:1) are in the same flight area from July 4 to August 1. They fly over areas of rocks covered with the black lichens *Hypogymnia oroarctica* Krog., *Umbilicaria proboscidea* (L.) Schrad., *U. hyperborea* (Ach.) Hoffm., *Pseudephebe pubescens* (L.) Choisy, and the yellow crustose lichen *Rhizocarpon geographicum* (L.) DC. Rock areas are interspersed with patches of vegetation in the centers of polygon frost formations (Figure 6). Vegetation is high mountain alpine, with the ground cover dominated by *Dryas hookeriana* Juz., *Salix arctica* Pall. and *Silene acaulis* L. Other plant taxa are *Saxifraga oppositifolia* (L.), *Oxotropis podocarpa* A. Gray, *Cassiope tetragona* (L.), *Carex* spp. and various alpine grasses, *Festuca saximontana* Rydb. and *Poa alpina* (L.) (Porsild, 1974).

Erebia magdalena saxicola adults fly in association with many alpine butterfly species but only a few are found in the same habitat [e.g., *Boloria astarte* (Doubleday and Hewitson) and *Oeneis melissa* (Fabricius), see Table 4.]. Some of these species are near the limits of their ranges, e.g., *Boloria napaea alaskensis* (Holland) is at its southern limit and *Boloria alberta* (Edwards) is at its northern known limit.

Adults fly in sunshine from about 1000 hr to 1730 hr. Females have a wandering flight over the rocks, periodically landing to bask or visit flowers. Males appear more directed in flight, and dark butterflies that pass near them are pursued with great vigor. These included female *E. magdalena*, other males, and males and females of *Oeneis melissa*.

Oviposition

Oviposition in the field occurs in areas of loose rock which are covered by black lichen. One female observed ovipositing backed down the side of a rock (Figure 7) and laid a single egg on the underside near an edge (egg shown on rock in Figure 8). Eggs laid in the field are not placed near plants.

Development

In the laboratory, females laid eggs on any substrate (rocks, cage, water container), preferring sides and lower surfaces. Oviposition normally occurred in the early morning, with some eggs being laid in late afternoon.



Cooper, Kenneth W. 1990. "Linear, longitudinal markings on the outer elytral surface of beetles: intemeurs or striae?" *Quaestiones entomologicae* 26(4), 695–699.

View This Item Online: <https://www.biodiversitylibrary.org/item/213508>

Permalink: <https://www.biodiversitylibrary.org/partpdf/204043>

Holding Institution

Harvard University, Museum of Comparative Zoology, Ernst Mayr Library

Sponsored by

IMLS LG-70-15-0138-15

Copyright & Reuse

Copyright Status: In copyright. Digitized with the permission of the rights holder.

Rights Holder: University of Alberta

License: <http://creativecommons.org/licenses/by-nc-sa/4.0/>

Rights: <https://biodiversitylibrary.org/permissions>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.