BULLETIN OF THE ALLYN MUSEUM

3701 Bayshore Rd.
Sarasota, Florida 33580

Published By
The Florida State Museum
University of Florida
Gainesville, Florida 32611

Number 91 18 January 1985

A REVIEW OF *COLIAS MEADII* W. H. EDWARDS WITH A DESCRIPTION OF A NEW SUBSPECIES FROM IDAHO (PIERIDAE: COLIADINAE)[1]

Nelson S. Curtis[2] and Clifford D. Ferris[3]

INTRODUCTION

Most species of *Colias* in North America are extremely variable, and numerous subspecific and form names have been established. An exception is *Colias meadii* W. H. Edwards, for which only two subspecific and two form names have been erected. The nominate subspecies was described from Colorado by Edwards in 1871. The type locality was later fixed by Brown (1973) as Mosquito Pass, Lake-Park Cos., Colorado. An albinic female form "medi" was named by Gunder in 1934 based upon a single specimen collected on Breckenridge Peak, 11,000' (3350m),"Empire Co." [*sic*] (probably Summit Co.), Colorado on 8 August, 1919. In 1885 Strecker described *elis* from a series of 15 females collected on Kicking Horse Pass, 10,000' (3050m), British Columbia (on the border between Banff National Park, Alberta and Yoho National Park, British Columbia). Dufrane named an aberrant female form "lambillioni" in 1947.

There has been considerable confusion in the literature as to the geographic distribution of the two *meadii* subspecies. The subspecies *elis*, and intergrades between *meadii* and *elis* have been reported from Wyoming as recently as 1975 (Klots in Howe, p. 359). Ferris (in Ferris and Brown, 1981, p. 159) stated that nominate *meadii* ranges from northern New Mexico through Colorado, Utah, Wyoming and into southern Montana. Although the albinic form "medi" is extremely rare over most of the geographic region occupied by *meadii*, it occurs commonly on the Beartooth Plateau along the Wyoming-Montana border. Collection records from Ferris for 1970-73 indicate that 52% of the females taken were the albinic form. Broken down into specific years, the data are: 1970, 50%; 1971, 80%; 1972, 74%; 1973, 31%. These data may be somewhat biased from albinic females having perhaps been collected in preference to normal females. During the four seasons noted, 28 of the 54 females collected were albinic. It is not clear from these data whether the albinic form is of purely genetic

[1]Published with the approval of the Director, Wyoming Agricultural Experiment Station as Journal Article No. JA 1300.

[2]University of Idaho, Moscow, Idaho 83843.

[3]Bioengineering Program, University of Wyoming, Laramie, Wyoming 82071. Research Associate: Allyn Museum of Entomology/Florida State Museum, Sarasota, FL; Florida State Collection of Arthropods, Division of Plant Industry, Florida Department of Agriculture and Consumer Services, Gainesville. Research Associate in Entomology: Los Angeles County Museum of Natural History, Los Angeles, CA.

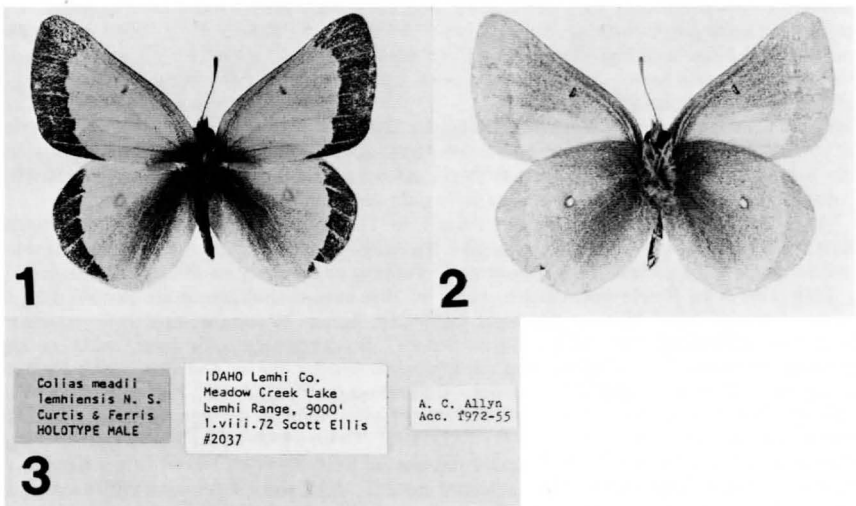
origin or related to extrinsic factors such as annual climatic variations. This form also occurs with considerably lesser frequency in the Wind River Range, Fremont-Sublette Cos., Wyoming.

The subspecies *elis* occurs from northern Montana (Glacier National Park area) throughout the Rocky Mountains of Alberta and British Columbia. The northern extent of its range remains unclear. There are occasional reports of its occurrence on Pink Mtn. in northern British Columbia, and there is one report from the Yukon Territory (see comments in Ferris *et al.*, 1983, p. 828). Many of the extreme northern records, after examination of available specimens by Ferris, have proved to be the confusion of *C. hecla* Lefèbvre and *C. alexandra kluanensis* Ferris with *C. m. elis*, (see Ferris 1981, 1982). Despite the fact that the type series of *elis* consisted of 9 orange females and six white females, the albinic female form appears to be very rare and is easily confused with the females of *C. nastes streckeri* Grum-Grschimailo where the two species fly together.

Until recently, Idaho populations of *meadii* remained enigmatic. Very few specimens existed in collections, and those that did were primarily males. Based upon their field efforts during the past seven years, the authors have accumulated sufficient study material from Idaho to clarify this picture. Two phenotypes occur; one is a clinal form and the other is a very distinctive entity which is described below as a new subspecies. Following the description of this new taxon, further comments are offered concerning the *meadii* complex and its geographic distribution.

Colias meadii lemhiensis N. S. Curtis and Ferris

Types and Location: This subspecies is described from 68 ♂ and 48 ♀ collected by N. S. Curtis (104), C. D. Ferris (11), and S. L. Ellis (1) in Lemhi Co., Idaho. The male Holotype was collected by Scott L. Ellis near Meadow Creek Lake, 4 mi. W. of Gilmore, 9100' (2775m), Lemhi Range, Salmon National Forest, Lemhi Co., Idaho on l.viii.72. 30 ♂ and 21 ♀ paratypes were collected by Curtis at the type locality and along the Gilmore-Meadow Lake Road, 8000' (2440m) and above, between 13.vii and 6.viii in the years 1977-79, 1982-83. 7 ♂ and 4 ♀ paratypes were collected by Ferris at the same locality on 14.vii.81. Additional paratypes were collected by Curtis as follows: 10 ♂, 4 ♀



Figures 1-2: *Colias meadii lemhiensis*, new subspecies. 1-2. Holotype ♂, D (1) and V (2). 3. Specimen labels for Holotype.

on Big Windy Peak, 8000' (2440m) and above, Lemhi Range, 6.5 air miles SSE of the type locality, 15.vii.79; 20 ♂, 19 ♀ in the Bitterroot Range, 24 air miles almost due north of the type localilty, 5-6.viii.83. This locality is 5 mi. W. of the Summit of Bannock Pass at an elevation of 8000' (2440m). Because of the variability of the females of this new subspecies, no female Allotype is designated.

Diagnosis and Description: Among other features, this subspecies is characterized by its large size,† reduced HW discal spot (D and V), and pale-colored females in which white examples occur regularly. The Holotype is illustrated in Figs. **1-2**.

Holotype male. Forewing costa 25 mm. WINGS. Dorsal ground color intermediate between Spectrum Orange (Smithe #17) and Orange Yellow (#18), but closer to the former. Borders Dusky Brown (#19) with veins defined basad in the same color as ground. DFW cell spot small, Flame Scarlet (#15) with miniscule black pupil. DHW discal spot Flame Scarlet, slightly elliptical with pale center. Ventrally the ground color is a mixture of Orange Yellow (#18) and Spectrum Yellow (#55). The outer portions of the VFW are heavily dusted with dark scales. The inner two-thirds of the VHW are heavily dusted with olivaceous color. When viewed under the microscope, this region consists of olivaceous hairs and black scales overlying the ground color. The VFW cell spot is narrowly elliptical, with a pale center ringed by dark scales. The VHW discal spot is silver-centered ringed by Geranium Pink (#13) scales. The dorsal dark margins "print through" ventrally. The fringes are pink with a few yellowish intrusions. The DFW basad show some melanism; the DHW basad are covered by a mixture of pale yellow and black scales overlaid with yellowish hairs, thus producing an overall dark-dusted effect. The male sex patch at the humeral angle of the DHW is composed of Vinaceous (#3) to Geranium Pink (#13) scales. HEAD. Antenna (one missing) 10 mm (40% of FW costa length): shaft dorsally roughly the same color as the dorsal wing ground overlaid with Geranium Pink scales; ventrally paler, unscaled with a distinct pit in each segment; club pale and bald. Palpi and frons, pale (washed out) yellow (very roughly Cream Color #54) with hairs darker-tipped. Eyes smooth and Amber (#36). THORAX. Black, adorned with whitish and pinkish hairs dorsally; yellowish hairs ventrally. ABDOMEN. Black, covered sparsely with yellow scales and hairs dorsad; more heavily ventrad. LEGS. Femur, black covered with yellow scales and hairs. Tibia and tarsomeres, Buff-Yellow (#53) to Cream Color (#54) with spines of the same color, some pink-tinged. Tarsomeres especially spinose. The pin labels are illustrated in Fig. **3**. All labels are inscribed in black. The holotype label is red; the other two labels are white.

The holotype and one male and three female paratypes are deposited in the collection of the Allyn Museum of Entomology/Florida State Museum, Sarasota, Florida. The remaining paratypes are currently in the collections of the authors.

Variation in the Males: The males of this subspecies are relatively uniform in facies. The major variations are: size and shape of the DFW cell spot; size and shape of the VHW discal spot (some specimens have a small satellite spot above the main spot); width of the DFW dark margins relative to wing width as measured in the middle of the cell space Cu_1 and expressed as a percentage (13.6-23.8%); amount and extent of dark scales and hairs on the wing surfaces ventrally; length of FW costa (24-27 mm). Figs. **4-5** show a typical male from the Gilmore locality. Note the presence of small satellite HW discal spots.

Description of and Variation in the Females: The females (Figs. **6-9**) are extremely variable in all of the same characters as the males, and in wing ground color as well, which varies from dead white through various shades of yellowish and yellowish-orange to almost the normal male orange color. It is rare, however, for the dorsal orange color to approach that of the males. The variation in the color of the body and leg hairs follows that of the wings. The antennae are as in the males, with the dorsal pink scaling somewhat more pronounced. The DFW cell spot is Dusky Brown (#19) to black, pronounced, and sometimes has a pale center. The DHW discal spot changes in color with the dorsal ground color, varying from orange to white. In the albinic form, this spot is normally white, but it is bright orange in a few specimens. This spot is

†All specimen photographs are to the same scale.

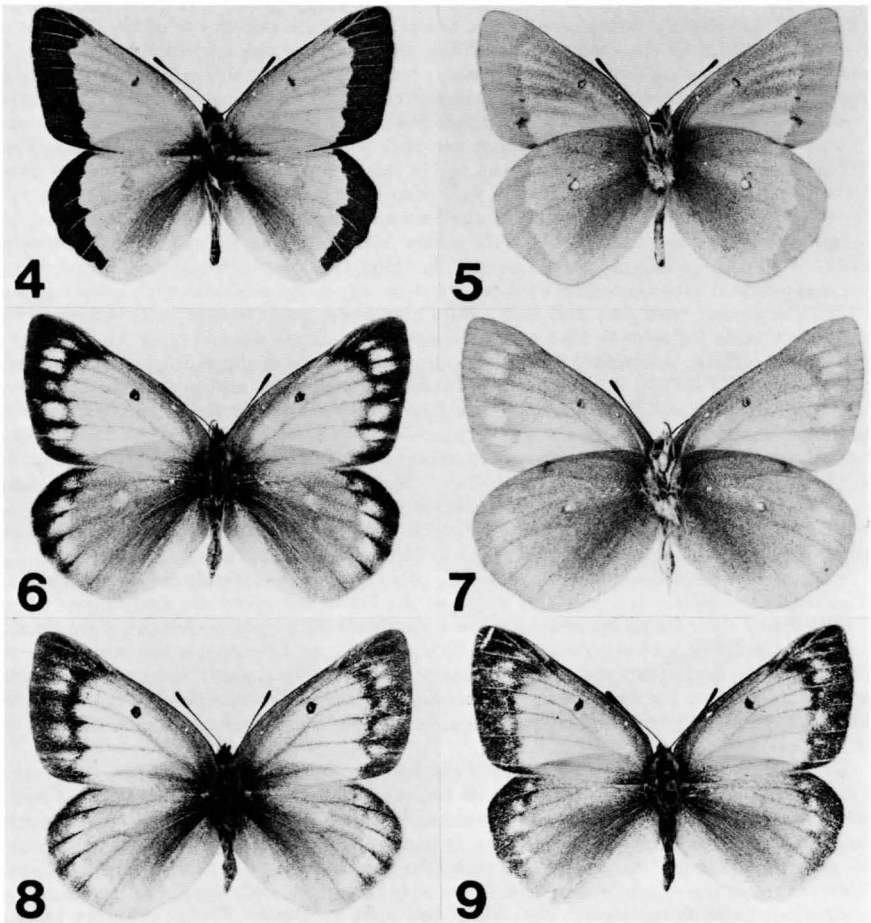
considerably larger dorsally than ventrally, while in the males there is essentially no variation between the two wing surfaces. The extent of the pale areas in the dark wing borders dorsally varies greatly. The FW costa length varies from 25-28 mm.

In both sexes, the shape of the FW apex varies from definitely rounded to sharply acute. A certain percentage of both sexes displays discrete or faint "eurytheme" spots ventrally, which may be evident on either FW or HW or both.

Flight Period: Mid-July (early-season years) to end of first week in August (specimens getting rather worn).

Distribution: Lemhi Range and Bitterroot Range in Lemhi Co., Idaho and presumed to occur in the Bitterroot Range in contiguous Beaverhead Co., Montana.

Bionomics: Adults fly in open clearings in the forest (Lemhi Range) and in open treeless alpine meadows (Bitterroot Range) at elevations from 8000-9100' (2440-2775m). Oviposition has been observed on the legume *Astragalus miser* Dougl.

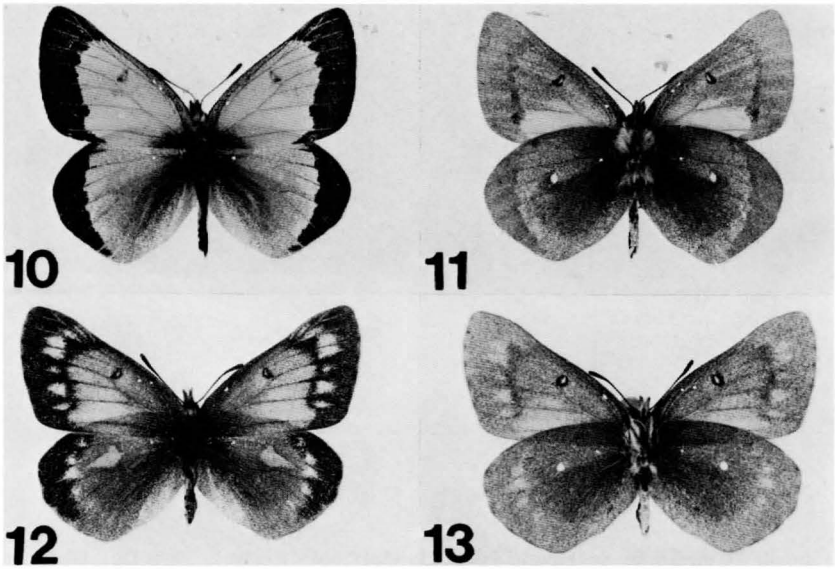


Figures 4-9: *Colias meadii lemhiensis*. 4-5. ♂ D (4) and V (5). 6-8. ♀ ♀ D (6) and V (7) yellow-orange form. D. (8) "alba" form. D (9) orange form. The specimens shown in (4-8) were collected in the Lemhi Range on 14.vii.81. The specimen shown is (9) was collected in the Bitterroot Range on 5-6.viii.83. Specimens are in the C. D. Ferris collection.

Comparison with Other Subspecies: Nominate *meadii* (Figs. **10-18**) is smaller than *lemhiensis* (FW costa: 19-24 mm ♂; 21-26 mm ♀) and generally darker in color and more strongly marked. Except for occasional aberrants, the female dorsal ground color is the same as in the males. In the females, the dorsal dark wing borders are more intensely colored than in *lemhiensis*, and less area is occupied by pale openings or spots. The HW discal spot is more pronounced in both sexes than in *lemhiensis*, and this spot may be smeared distally as shown in Fig. **12**. Adults are occasionally taken below treeline (Snowy Range, Albany Co., Wyoming, 9200' [2800m]), but normally this subspecies inhabits open windswept meadows at or above treeline from 10,800' (3295 m) upwards, depending upon locality. The flight period is generally about two weeks later than that of *lemhiensis*. Various alpine clovers have been reported as larval hosts, including *Trifolium dasphyllum* T. & G. Adult flight of *meadii* is rapid, erratic and close to the ground, while *lemhiensis* flies a bit more slowly and somewhat higher above the ground. The albinic females of *meadii* seldom exhibit a dead white ground color. Usually the ground has a yellowish or pinkish cast.

The subspecies *elis* (Figs. **19-22**) is also large (FW costa: 23-26 mm ♂; 25-27 mm ♀) and is generally much more brightly marked than *lemhiensis*, especially the females. Male ground color is similar. As in nominate *meadii*, the dorsal ground color of the females repeats that of the males. The open areas in the dorsal dark borders are normally bright yellow, and the dark scaling of the borders may be nearly absent. The HW discal spots are larger and more pronounced dorsally than in *lemhiensis*, but about the same ventrally. The body hairs, leg hairs and spines, and the antennal scales are darker in color and exhibit more pink color in both *meadii* and *elis* than is found in *lemhiensis*. As noted in the introduction, white females ("alba" form) are rare in both *meadii* and *elis*, excepting in NW Wyoming, while they occur commonly in *lemhiensis* (17 of 48 in the type series = 35%).

While *elis* does occur above treeline, it is also commonly taken well below treeline in lush meadows where adults may be collected easily while they nectar at flowers. The flight of *elis* is slow and leisurely in these habitats as compared to that of *meadii* and

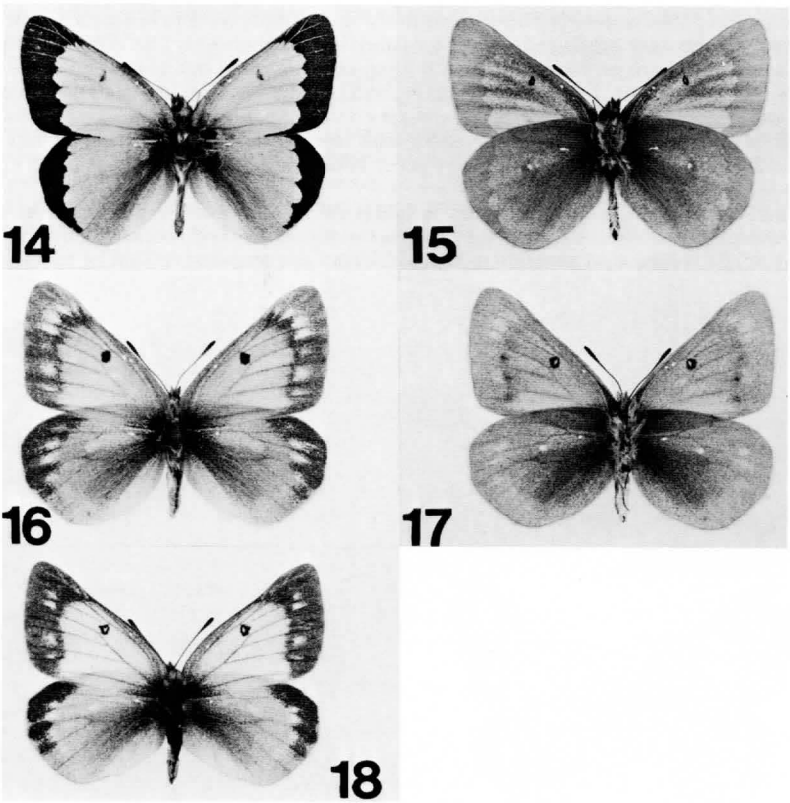


Figures **10-13:** *Colias m. meadii*. **10-11.** ♂ D (**10**) and V (**11**), Guanella Pass, Clear Creek Co., Colorado, 11.viii.68. **12-13** ♀ D (**12**) and V (**13**), Nellie Creek Trail, Hinsdale Co., Colorado, 24.vii.80. Specimens are in the C. D. Ferris collection.

lemhiensis. In southern Alberta, treeline is roughly at 7000' (2135m) depending upon latitude, and Ferris has taken *elis* at 6000' (1830m) in meadows along the old Kananaskis Forest Trunk Road. The flight period of *elis* parallels that of *lemhiensis*.

Intermediate Forms: Material from Sawtell Mtn., 9900' (3020m), NW of Macks Inn, Fremont Co., Idaho is close to nominate *meadii*, but in some characters, such as coloration of the females and size, is intermediate between *meadii* and *lemhiensis*. Old museum specimens from the Tobacco Root Mts., Madison Co., Montana show some characters, such as larger size and paler color, that are intermediate between *meadii* and *elis* (*fide* S. Kohler), as does also a single female specimen in the Canadian National Collection from Upper Gallatin Canyon, Montana, 7000' (2135m) collected 2.viii.28.

Comparison with Other Species: C. meadii is very similar to *C. hecla* and some of the orange forms of *C. alexandra* W. H. Edwards. Males of *meadii* have a characteristic sex patch at the humeral angle of the DHW (shown clearly in Fig. 1), which is absent in these other two species as pointed out by Ferris (1982). In the southern Rocky Mts., *alexandra* and *meadii* are usually isolated by an altitudinal separation of several thousand feet, and only yellow *alexandra* forms occur which are easily distinguished from



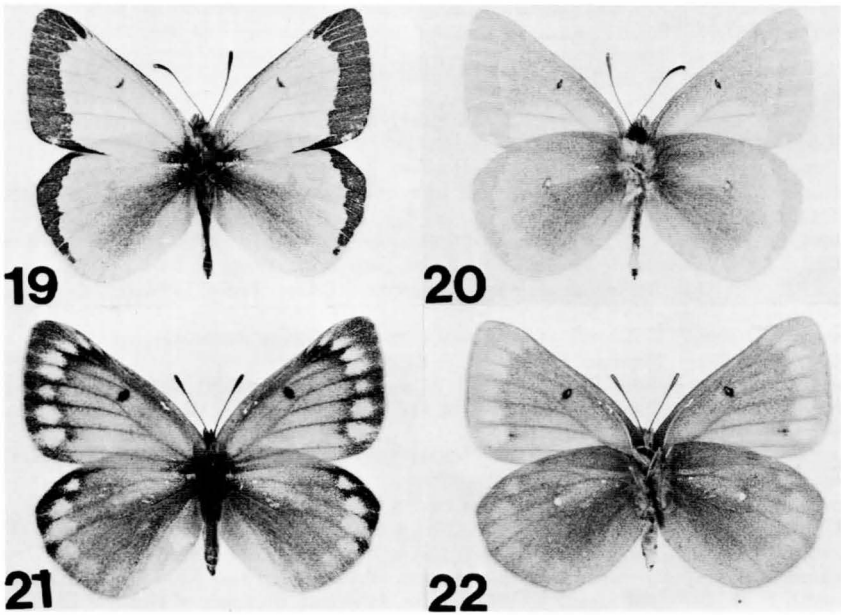
Figures 14-18: *Colias m. meadii* from the Beartooth Plateau, Park Co., Wyoming. **14-15.** ♂ D (**14**) and V (**15**), 3.viii.73. **16-17.** ♀ D (**16**) and V (**17**), 26.vii.72. **18.** ♀ D form "medi," 2.viii.71. Specimens are in the C. D. Ferris collection.

orange *meadii*. *C. meadii lemhiensis* has been taken synchronously and sympatrically with a yellow form of *C. alexandra* in the Lemhi Range. *C. meadii elis* is sympatric with *C. hecla canadensis* Ferris, an orange race, in the vicinity of Nordegg, Alberta, but the *canadensis* records are from early-to-mid June, while *elis* does not fly until mid-to-late July. The situation on Pink Mtn., in northern British Columbia is clouded. *C. hecla canadensis* definitely occurs in this locality and there is at least one questionable record for *meadii elis*.

There is a *meadii*-like male specimen in the Canadian National Collection taken by the Canadian Arctic Expedition in 1916 at Bernard Harbour, N.W.T. This specimen may represent *Colias hyperborea* Grum-Grschmailo, 1900 (T.L. Lena Valley, northern Siberia). This species is very similar to *meadii* and the males also have an androconial patch at the humeral angle of the DHW. It may be that *hyperborea* is a subspecies of *meadii* and study of this matter is in progress.

DISTRIBUTION

Fig. 23 is a distribution map of the *Colias meadii* complex as it is currently known. Nominate *meadii* occurs in the southern and central Rocky Mountain massif from northern New Mexico to the Yellowstone region in Montana. *C. meadii elis* occurs from northern Montana (Glacier National Park region) northward. Intermediate forms occur in Idaho just to the west of the Montana-Wyoming boundary, and in Montana north of the Yellowstone region along the northern perimeter of the range of typical *meadii*. The Sawtell Mtn. population occurs in the Centennial Mts., a range that extends in an east-west direction, and is quite distinct from either the Bitterroot or Lemhi Ranges which are aligned in a north-south direction. The Snake River Plain is presumed to be the isolating mechanism between *lemhiensis* and *meadii* populations which occur to the east and south. We consider *lemhiensis* to be a relict population.



Figures **19-22**: *Colias meadii elis*. **19-20**. ♂ D (**19**) and V (**20**), Plateau Mtn., Alberta, 15.vii.70. **21-22**. ♀ D (**21**) and V (**22**), Nigel Creek Trail at E. boundary of Banff Park, 18.vii.70. Specimens are in the C. D. Ferris collection.

The mountainous regions along the Idaho-Montana border are not transected by very many roads. Consequently only a limited amount of butterfly collecting has been attempted in this region historically. As more collectors penetrate into this area, we suspect that additional colonies of *meadii*, intermediate between *meadii* and *elis*, will be discovered, thus resolving the somewhat disjunct distribution shown en Fig. 23. The disjunction shown in south-central Wyoming results from the Great Divide Basin and there is no suitable habitat for *meadii*. State and County records for *meadii* are as follows:

NEW MEXICO: Taos. COLORADO: Boulder, Chaffee, Clear Creak, Conejos, Costilla, Custer, Dolores, Eagle, El Paso, Fremont, Gilpin, Grand, Gunnison, Hinsdale, Huerfano, Jackson, Lake, La Plata, Las Animas, Larimer, Mineral, Ouray, Park, Pitkin, Pueblo, Rio Grande, Saguache, San Juan, Summit, Teller. UTAH: Daggett, Duchesne, Summit, Uintah. WYOMING: Albany, Carbon, Fremont, Park, Sublette, Teton, Yellowstone National Park. IDAHO: Fremont, Lemhi. MONTANA: Carbon, Flathead, Gallatin, Glacier, Madison, Park, Stillwater, Sweetgrass. We have not been able to confirm the questionable records for Powell and Silver Bow Cos. indicated by Stanford's map (in Ferris & Brown, 1981, p. 392 #103). The principal Canadian records are from the Rocky Mountain crest along the border between Alberta and British Columbia.

ACKNOWLEDGMENTS

We would like to thank Steve Kohler, Missoula, MT for supplying Montana collection records and information used in the preparation of this paper. Special thanks are due Dr. Lee D. Miller, Curator, Allyn Museum of Entomology/Florida State Museum who loaned specimens for examination and made publication of this paper possible. The oviposition substrate was identified by Douglas Henderson, Herbarium Curator, University of Idaho.

LITERATURE CITED

Brown, F. M. 1973. The types of the pierid butterflies named by William Henry Edwards. Trans. Amer. Ent. Soc., 99:29-118.

Dufrane, A. 1947. Pieridae. Bull. Ann. Soc. ent. Belg., 83:46-73.

Edwards, W. H. 1871. Descriptions of new species of North American butterflies. Trans. Amer. Ent. Soc., 3:266-277.

Ferris, C. D. 1981. A new subspecies of *Colias alexandra* W. H. Edwards and notes on *Colias hecla* Lefèbvre (Pieridae: Coliadinae). Bull. Allyn Mus., (63):1-12.

_____. 1982. Revision of North American *Colias hecla* Lefèbvre (Pieridae: Coliadinae). Bull. Allyn Mus., (71):1-20.

Ferris, C. D. and F. M. Brown. 1981. Butterflies of the Rocky Mountain States. Univ. of Oklahoma Press, Norman, Okla. xviii + 442 pp., ill.

Ferris, C. D., dos Passos, C. F., Ebner, J. A. and J. D. Lafontaine. 1983. An annotated list of the butterflies (Lepidoptera) of the Yukon Territory, Canada. Can. Ent., 115:823-840.

Gunder, J. D. 1934. Various new butterflies (Lepid., Rhopalocera). Can. Ent., 66:125-131.

Howe, W. H. ed. 1975. The Butterflies of North America. Doubleday and Co., Inc., Garden City, L. I., New York. xiii + 633 pp., ill.

Strecker, H. 1885. Description of a new *Colias* from the Rocky Mountains, and of an example of polymelianism in *Samia cecropia*. Proc. Acad. Nat. Sci. Phila., 37:24-27.

Smithe, F. B. 1975. Naturalist's Color Guide. American Museum of Natural History, New York.

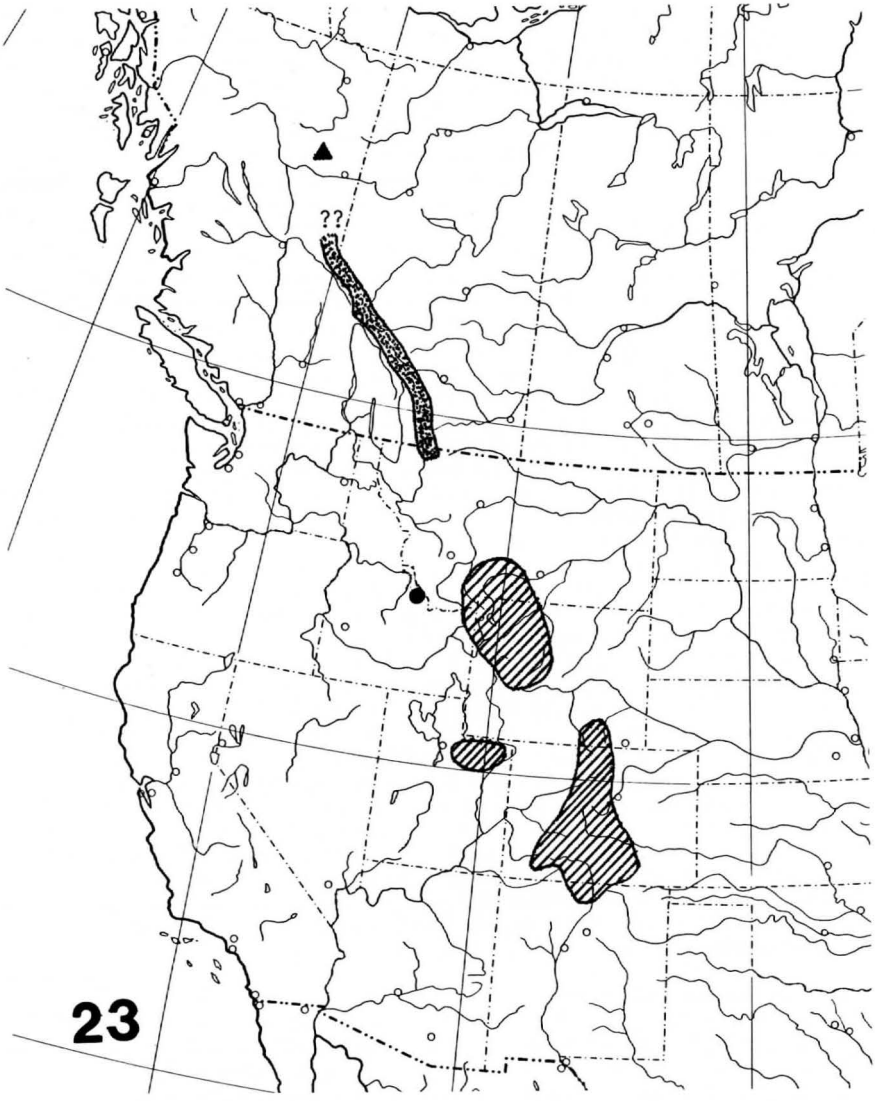


Figure 23: Distribution of *Colias meadii* in North America. Inclined-line region = *m. meadii*. Stippled region = *m. elis*. Round black dot = *lemhiensis*. Solid triangle is the location of Pink Mtn., British Columbia.

This public document was promulgated at a cost of $704.00 or $1.173 per copy. It makes available to libraries, scholars and all interested persons the results of researches in Entomology.