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A NEW SUBSPECIES OF *COLIAS ALEXANDRA* W. H. EDWARDS AND NOTES ON *COLIAS HECLA* LEFEBVRE (PIERIDAE: COLIADINAE)[1]

Clifford D. Ferris[2]

INTRODUCTION

Considerable confusion has existed for many years regarding *Colias hecla* Lefèbvre and the orange form of *C. alexandra* W. H. Edwards that occurs in the Yukon Territory. The latter species has been unrecognized and erroneously placed as *hecla* in many collections. The late F. H. Chermock recognized these two species and intended to describe the new *alexandra* subspecies. A manuscript name appeared on several specimens in his collection, now placed in the Allyn Museum of Entomology.

I have been aware of this *alexandra* phenotype for a decade, but it was not until late summer 1979 that I acquired sufficient additional specimens to provide a reasonably sized study series. Additional specimens borrowed from museum and private collections completed the type series. This butterfly appears to have a limited geographic distribution and is not well represented in collections.

To facilitate the discussion of *C. hecla* and *alexandra*, I will first describe the new taxon from the Yukon Territory. The name applied is not the one proposed by Chermock and never published.

Colias alexandra kluanensis Ferris New Subspecies

Types and Location

This subspecies is described from 30 males and 25 females taken along the Alaska Highway from east of Haines Junction to west of Kluane Lake, Y.T., Canada. The Holotype male was collected at Haines Junction, Y.T., Canada on 4.vii.69. The Allotype female was taken at milepost 1053, Alaska Highway on 20.vii.76. These two specimens and their labels are illustrated in Figs. 1-6. The locality labels are white paper stock

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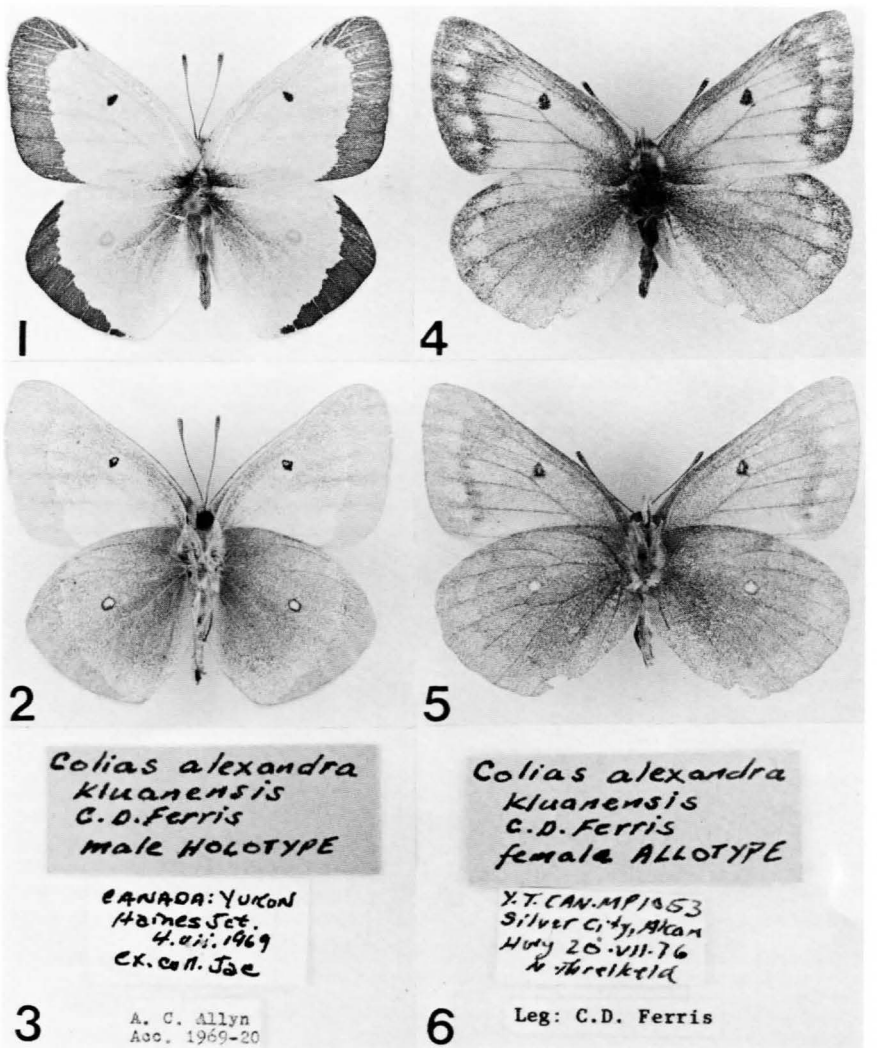
imprinted in black. The Holotype and Allotype labels are red and green, respectively, imprinted in black. The Holotype, Allotype and 16 paratypes are placed in the Allyn Museum of Entomology, Sarasota, Florida. Paratype data are as follows: Haines Jct., Y.T., 13.vii.66 ♂; 14.vii.66 3 ♂; 16.vii.66 ♂, ♀; 17.vii.66 ♀; 20.vii.66 ♂; 21.vii.66 ♂; 27.vii.66, ♀; 5.vii.69 ♂. Milepost 1119 Alaska Highway, 27.vii.62 3 ♂, 2 ♀. Additional paratypes are placed as follows: C. D. Ferris Collection. Haines Jct., Y.T., 4.vii.69 ♂; Milepost 1118 Alaska Hwy., 16.vii.70 ♂, ♀; Milepost 1053 Alaska Hwy., 15.vii.76 ♂; 18.vii.76 3 ♀; 19.vii.76 ♀; 20.vii.76 ♂, 2 ♀; 23.vii.76 3 ♂, ♀; 25.vii.76 ♀; 30.vii.76 2 ♂; Milepost 1054 Alaska Hwy., 20.vii.76 ♀. J. A. Legge, Jr. Collection. Milepost 1106 Alaska Hwy., 17.vii.69 ♀; Milepost 1119 Alaska Hwy., 27.vii.69 4 ♂, 7 ♀. Canadian National Collection. Burwash Landing, Y.T., 27.vii.48 2 ♂; Champagne, Y.T., 4.viii.48 ♂, ♀; Kluane, Y.T., 28.vii.48 ♂; Dry Creek, Y.T., 23.vii.48 ♂.



Figures 1-6: *Colias alexandra kluanensis,* new subspecies. 1-3, Holotype ♂, dorsal (1), ventral (2), and specimen labels (3). 4-6, Allotype ♀, dorsal (4), ventral (5), and specimen labels (6).

Diagnosis and Description

This subspecies falls into the "orange group" of *Colias alexandra* (Ferris, 1973). It is phenotypically closest to *krauthii* (Klots) from the Wyoming-Dakota Black Hills, although there are some similarities to *christina* W. H. Edwards. The females, however, are closer to *krauthii* than *christina.*

Male

Forewing 24 mm. (Holotype); range 21-26 mm. WINGS. Ground color intermediate between Spectrum Orange, no. 17 and Orange Yellow, no. 18 dorsally (all color designations refer to Smithe, 1975); ventrally the wings are dusted with dark scales giving a fairly uniform pale mossy green aspect. DFW heavily dusted with dark scales at base; basal half of DHW heavily dusted with dark scales and closely matches VHW color. Dorsal wing borders are solid black lightly overscaled with yellow-orange along veins; width of DFW border is approximately 20% of wing width. DFW cell-end spot is black and vertically ellipsoidal; DHW discal cell spot is orange, darker than background color, and nearly circular. VFW cell-end spot repeats dorsal spot, but is smaller and more delicate. VHW discal cell spot is pronounced, centrally silver and rimmed by dark pink (Ferruginous, no. 41) scales. FW fringes are pink from apex to vein Cu_2, then yellow; HW fringes are generally yellowish shading into pink from veins Cu_1 to 2A. HW is slightly produced or angled between veins M_1-M_2, and is produced at vein 2A. HEAD. Antennae approximately 50% of length of FW costa; shaft pink, club with dark scales dorsally, yellowish and nearly unscaled ventrally, tip yellowish. Palpi repeat ventral wing color, slightly darker dorsally. Eyes pinkish-brown and smooth. Frons hairy and concolorous with palpi. THORAX. Dorsally covered with a few pink hairs interspersed among dark gray-green hairs; ventrally the thoracic hairs match wing color. LEGS. Femur matches ventral thorax gray-green color then shades into pink along tibia; tarsomeres pink. ABDOMEN. Covered with very dark gray-green and blackish hairs along dorsal ridge, shading ventrally to match ventral wing ground color.

Female

Forewing 26 mm. (Allotype); range 24-27 mm. WINGS. Ground color as in male, but slightly paler dorsally. Cell spots as in male, but generally larger and more pronounced; VFW spot with silvery center. DFW border edged with black basally, distally and along veins, with yellow spots of varying size in cell spaces. DHW border narrow with black scaling becoming obsolete between veins Cu_1-Cu_2. The yellow cell-space spots appear as in FW, but are not basally black-bordered except in spaces Rs and M_1. The fringes are as in the male but with more pronounced pink hairs. The antennae, legs and body are as in the male, except that the antennae are approximately 40% of the length of the FW costa.

Variation

The major variation in the males is: wing expanse (as noted above), width of black wing borders (11-22% of DFW width), size of DFW cell-end spot and VHW discal spot (Figs. **18-20, 24-25**). The major variation in the females is: wing expanse (as noted above), amount of yellow that appears in the dark dorsal wing borders (Figs. **29-31**), size of DFW and VHW cell spots (Figs. **29-31, 26, 44**). The wing borders vary from nearly uniformly dark to very pale with very little dark marking (Figs. **30-31**).

Bionomics and Distribution

On July 20, 1980 Gary Anweiler observed oviposition on a leaflet of *Hedysarum boreale* Nutt. var. *mackenzii* (Rich.) C. L. Hitchc. (Leguminosae) at Destruction Bay, Kluane Lake, Y.T. The immature stages of *kluanensis* are unknown. Based upon specimens collected intermittently over a 32 year period, the adult flight period extends

from the first week of July to the first week of August. The black dots in Figure 7 indicate collection localities. Data to date indicate that the butterfly ranges for approximately 260 miles along the Alaska Highway, from the vicinity of Whitehorse (mile 917) westward to Dry Creek (mile 1178). The center of the distribution appears to lie between Haines Junction (mile 1016) and the eastern end of Kluane Lake at the abandoned settlement of Silver City or Kluane (mile 1053.3).

The butterflies frequent open and disturbed areas including roadsides, old pipeline rights of way, old burns, cleared areas, and dry meadows. Typical vegetation associations are: *Salix, Betula, Potentilla,* sparse grass and bearberry ground cover, *Hedysarum.* This last plant seems to be a pioneer in disturbed areas (*fide* Anweiler *in litt.*). Typical habitat elevations range from 2300-2800' (700-850 m).

There are specimens in the Canadian National Collection labeled only "Dawson, Y.T./Treadgold", from which I have seen two males. These appear to be *C. alexandra christina.* I have seen no other Dawson specimens, although I have seen specimens of fairly typical *christina* from just east of the Richardson Mts. in the Northwest Territories.

The type series represents only a portion of the specimens of *kluanensis* examined. Some additional specimens were received after the type series had been labeled, and other specimens were not included because they lacked complete label data.

Etymology

The name *kluanensis* is a Latin construction in the genitive case of the place name Kluane.

DIFFERENTIATION OF *C. alexandra kluanensis* FROM *C. hecla*

As noted in the Introduction, these two species are frequently confused. Some preliminary notes about *hecla* are necessary. Specimens from western arctic North

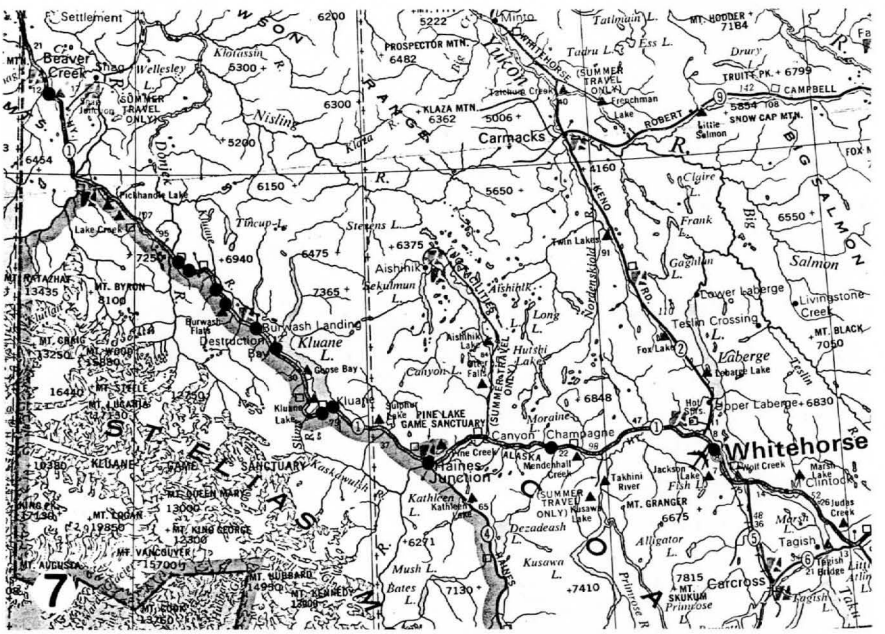
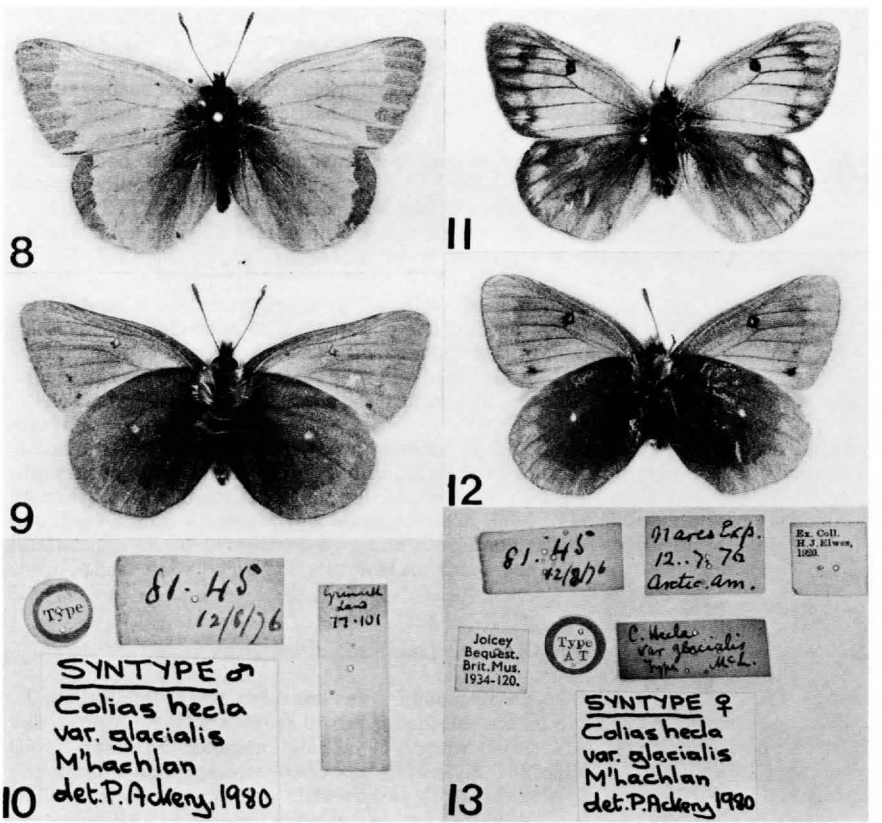


Figure 7: Distribution map for *C. a. kluanensis.* Round dots mark collection sites.

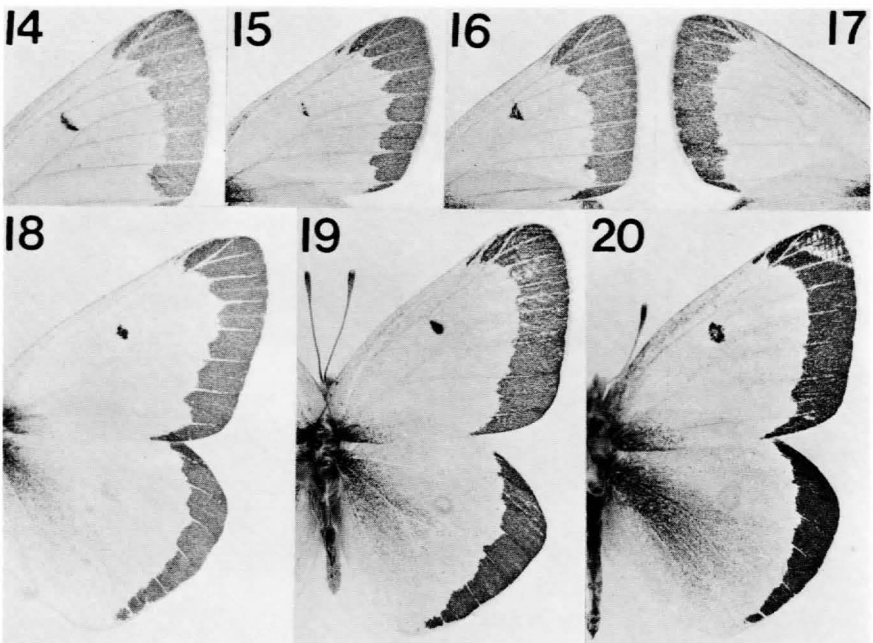
America have been referred to *hela* Strecker by dos Passos (1964) and *glacialis* M'Lachlan in Howe (1975). dos Passos treated *glacialis* as a junior synonym of *hecla*. I have examined the 3-specimen type series of *hela* in the Strecker collection at the Allyn Museum, and from color slides, the 4-specimen type series of *glacialis* in the British Museum (N.H.). A male and a female of *glacialis* that bear "type" labels are illustrated in Figures **8-13.** They are very dark and melanic-appearing insects typical of high arctic species. Note the collection site is 81°45' N. Lat. By comparison, western arctic material from lower latitudes is pale (see Howe, 1975, pl. 74, figs. 6, 9) and closest to typical *hecla*. *C. hecla hela* is intermediate between *hecla* and *glacialis* and is restricted to the area from Churchill, Manitoba northward. I have also examined specimens of *hecla hecla* from Greenland housed in the Allyn Museum collection. Although most authors cite Greenland as the type locality for *hecla*, Lefèbvre lists "l'Islande" = Iceland. This perhaps accounts for Ruehl's name *groenlandica*, now considered a junior synonym of *hecla*. Consequently I will compare *alexandra kluanensis* with *hecla hecla*. Further discussion of *hecla* appears subsequently.



Figures 8-13: *Colias hecla glacialis*. 8-10, Syntype ♂, dorsal (8), ventral (9), and specimen labels (10). 11-13, Syntype ♀, dorsal (11), ventral (12), and specimen labels (13). Original photographs courtesy of the British Museum (N.H.).

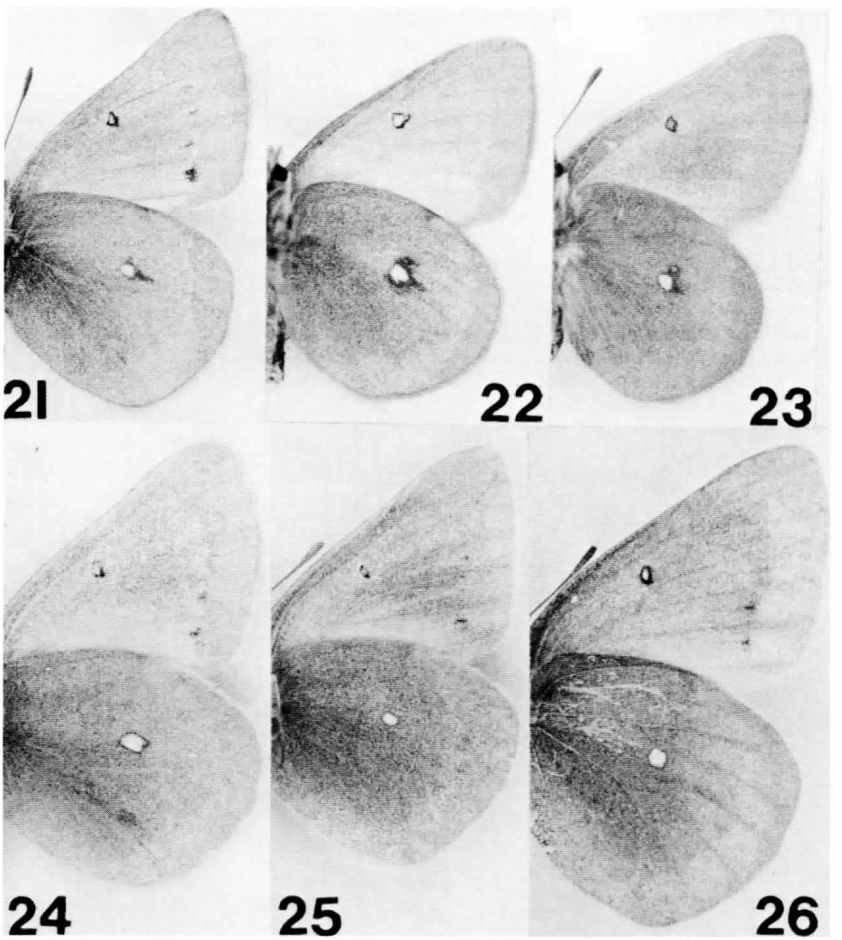
There are several consistent differences between *kluanensis* and *hecla* that permit their separation. In the males, the shape of the DFW cell-end spot is diagnostic as shown for *hecla* in Figures **14-17** and *kluanensis* in Figures **18-20.** In *kluanensis,* this spot is black and ellipsoidal, while in *hecla* it is generally pale, frequently red-orange colored and varies in shape from crescentric to triangular. This spot is absent in some specimens of *hecla.*

Relative to both sexes, the following differences occur: 1. The FW apex is generally sharper in *kluanensis* and the HW is produced at vein 2A and angled in the vicinity of veins M_1-M_2, while the HW of *hecla* is uniformly rounded. 2. The VHW cell spot in *kluanensis* is large and single (rarely with satellite spot) and uniformly rimmed by pink scales; in *hecla* this spot is frequently double and usually non-uniformly rimmed showing a distally pointed smear of pink scales (see Figs. **21-26**). 3. The wing fringes in *hecla* are more uniformly pink than in *kluanensis* with yellow hairs in the region of FW vein 2A only. 4. *C. a. kluanensis* is generally slightly larger in size than *hecla.* 5. The two species are sympatric but not synchronic. In the region of sympatry, the adult flight records that I have for *hecla* range from early June to 5 July, while for *kluanensis* they range from 4 July to 4 August. *C. hecla* appears to peak about the third week in June, while *kluanensis* peaks from mid- to late July.



Figures 14-20: DFW cell spots in males of *C. hecla* and *C. alexandra.* 14-17, *C. hecla* from Haines Jct., Y.T. (14-15), and Mayo Lake Rd., Y.T. (16-17). 18-20, *C. alexandra* from Dawson, Y.T. (18), Haines Jct., Y.T. (19, Holotype of *kluanensis*), and mile 1053 Alaska Hwy., Y.T. (20).

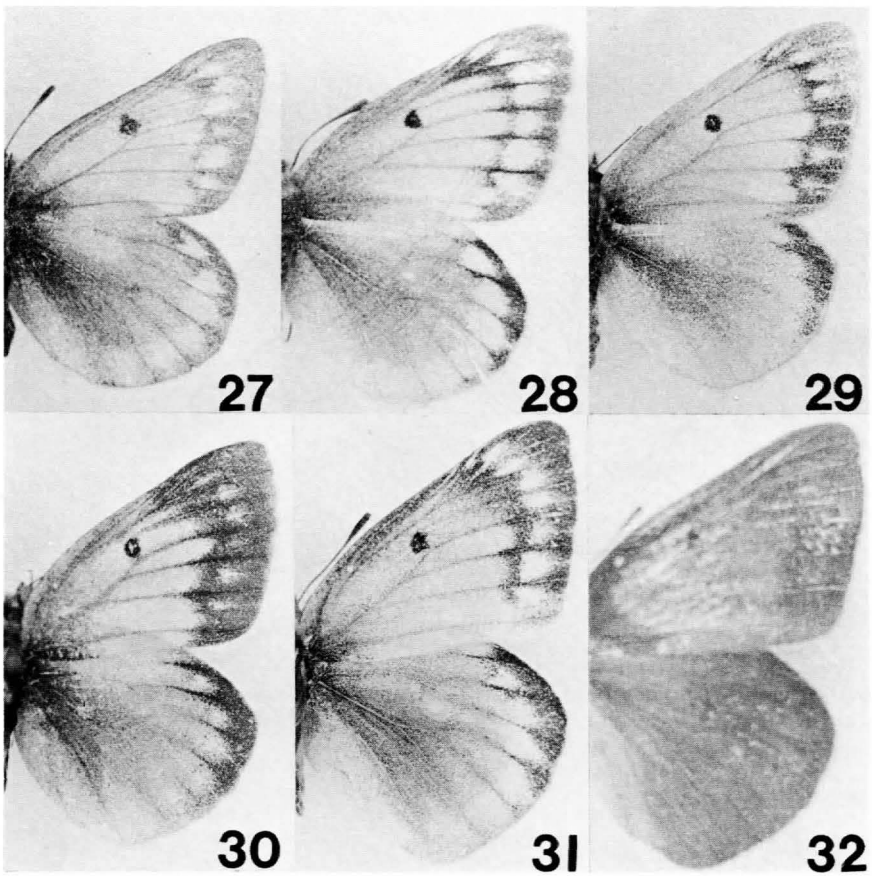
The females of the two species are sometimes very difficult to separate. In addition to the general differences cited above, two other differences occur. *C. hecla* females are polymorphic ranging from very dark individuals to specimens in which the dorsal black borders are essentially obsolete; white females occur occasionaly. The females of *kluanensis* always have well defined dark borders and I have yet to see a white female in this subspecies, although they occur frequently in other *alexandra* subspecies. The



Figures 21-26: VFW and VHW cell spots in *C. hecla* and *C. a. kluanensis*. 21-23, *C. hecla* males from Mayo Lake Rd., Y.T. (21-22), and Haines Jct., Y.T. (23). 24-26, *C. a. kluanensis* from Burwash Landing, Y.T. ♂ (24), Dry Creek, Y.T. ♂ (25), and mile 1053 Alaska Hwy., Y.T. ♀ (26).

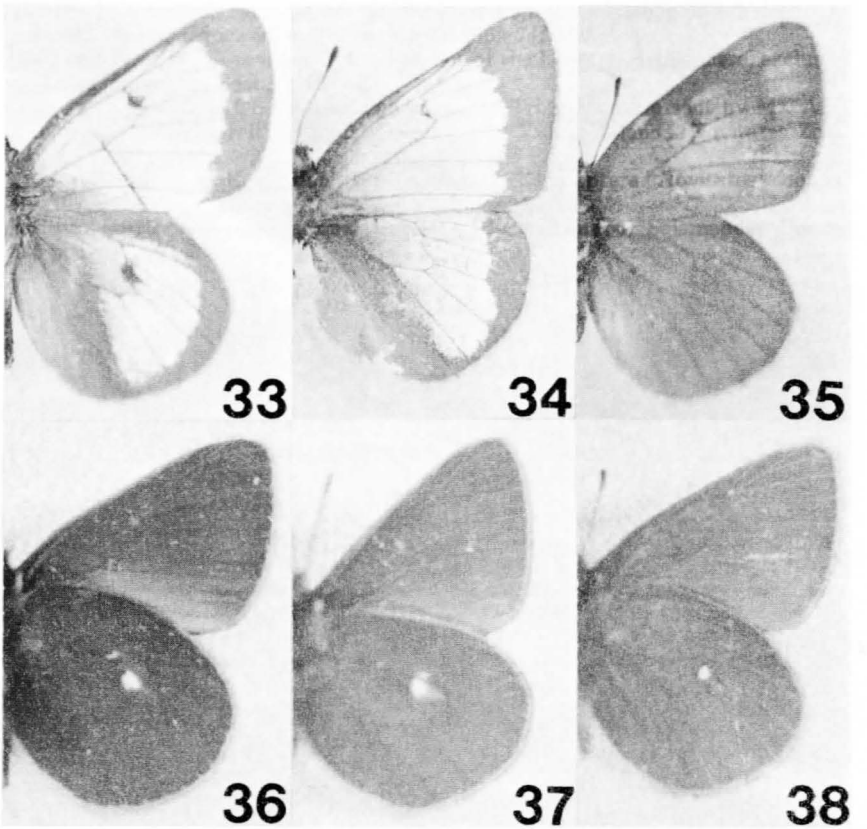
yellow spots in the marginal bands of *hecla* are brighter and more pronounced than in *kluanensis*, especially on the HW, as shown in Figures **27-32.**

There are several other differences between the two species that appear only under ultraviolet photography, as shown in Figures **33-44.** In all male specimens of *kluanensis*



Figures 27-32. Dorsal aspects of females of *C. hecla* and *C. a. kluanensis.* 27, *C. hecla* from Kluane Lake, Y.T.; 28, possible *C. hecla* X *kluanensis,* Swede Johnson Creek, Y.T. 29-32, *C. a. kluanensis* from Champagne, Y.T. (29), mile 1054 Alaska Hwy., Y.T. (30), and mile 1053 Alaska Hwy., Y.T. (31-32); UV photograph in (32).

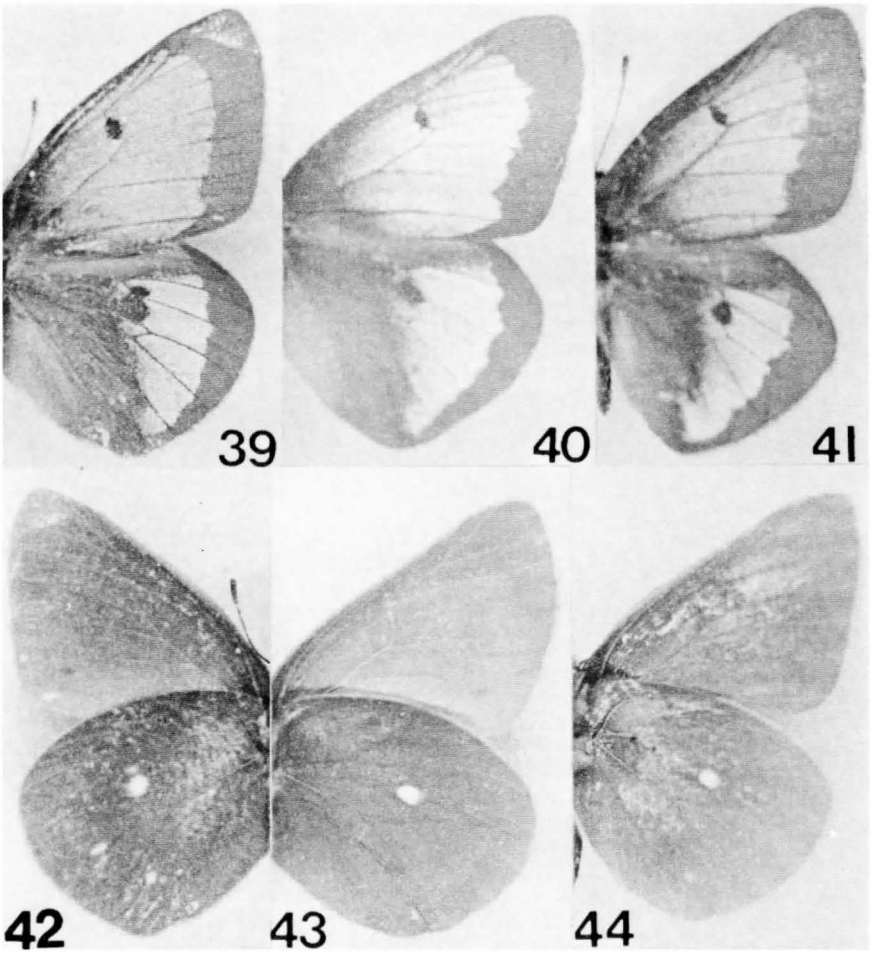
examined, the DHW cell spot was essentially non-reflective and appeared black (Figs. **39-41**). In *hecla*, this spot is non-uniformly reflective (Figs. **33-34**). The wing fringes of *hecla* are less reflective and appear darker (Figs. **36-38**) than in *kluanensis* (Figs. **42-44**).



Figures 33-38: UV patterns in *C. hecla*. 33-34, males dorsal from Mayo Lake Rd., Y.T. 35, ♀ dorsal from Keno Hill, Y.T. 36-37, males ventral from Mayo Lake Rd., Y.T. 38, ♀ ventral from Keno Hill, Y.T.

POSSIBLE HYBRIDS

Based upon museum specimens examined, it appears that the following natural hybrids may occur: *hecla* X *alexandra kluanensis* and *alexandra kluanensis* X *philodice vitabunda* Hovanitz. The first case is manifested by specimens that exhibit oddly shaped DFW cell-end spots and/or VHW discal spots that are double or distally produced. This has been seen especialy in specimens from Haines Junction where the end of the flight season of *hecla* overlaps the beginning of the flight season of *kluanensis*. The second case is represented by specimens that appear to be typical *kluanensis* except that a clearly defined row of submarginal spots appears on the VHW as in *eurytheme* Boisduval and *philodice vitabunda*. *C. p. vitabunda* and *C. a. kluanensis* are sympatric and synchronic in the vicinity of mile 1053 of the Alaska Highway.



Figures 39-44: UV patterns in *C. alexandra*. 39-41, males dorsal from mile 1053 Alaska Hwy., Y.T. (39), Dawson, Y.T. (40), and Haines Jct., Y.T. (41, Holotype). 42-44, males ventral from mile 1053 Alaska Hwy., Y.T. (42), and Dry Creek, Y.T. (43). 44, ♀ ventral from mile 1054 Alaska Hwy., Y.T.

PRELIMINARY COMMENTS ON SUBSPECIATION AND DISTRIBUTION OF *Colias hecla* IN NORTH AMERICA

As previously indicated, there is considerable confusion in the literature concerning the North American subspecies of *C. hecla* and their geographic distribution. *C. hecla hecla* is illustrated in three easily obtained books: Holland (1931), pl. 73, figs. 22-24; Klots (1951), pl. 22, fig. 7; Howe (1975), pl. 74, fig. 6, 9 (captioned incorrectly as *glacialis*). The type locality of *hecla* needs to be resolved. Contemporary authors state Greenland, while Lefèbvre clearly stated Iceland in the original description. Perhaps Wolff (1964, p. 16) is correct in stating: "Greenland is the type locality of this species, although LEFEBURE [*sic*] — not being familiar with geographical details of remote regions like these — named it after a volcano in Iceland."

The nominate subspecies appears to have a disjunct range that includes: Greenland, Southampton Is., Baffin Is., Northwest Territories (Tuktoyaktuk, Aklavik, Arctic Red River) and Alaska, where the white female form is commonly taken. In the western arctic, the width of the black wing margins in the males varies considerably. When series of specimens from given localities are examined, the narrow-margined form, as shown in Howe (pl. 74, fig. 6), appears to be a common variation within the normal variability of *hecla*.

C. hecla hela, shown in Howe (pl. 97, fig. 24), is a much darker insect than nominate *hecla*. Ventrally it is dark mossy-green heavily dusted with dark scales, while typical *hecla* is mossy-green. The females of *hela* are typically much darker D and V than *hecla* and do not appear to produce white females. This subspecies has been examined in long series from Churchill, Manitoba and from three localities in the Northwest Territories: Eskimo Point, Wager Bay, Baker Lake. It appears restricted to the central portion of the District of Keewatin.

specimens from Ellsmere Is. As shown in Figures **8-12**, it is the darkest of all of the *hecla* subspecies. This subspecies was originally taken in Grinnell Land which lies in the NE portion of Ellsmere Is., roughly between the 80th and 81st parallels and the 68th to

C. hecla glacialis is certainly a valid subspecies based upon my examination of photographs of the types in the British Museum. I have examined a few additional

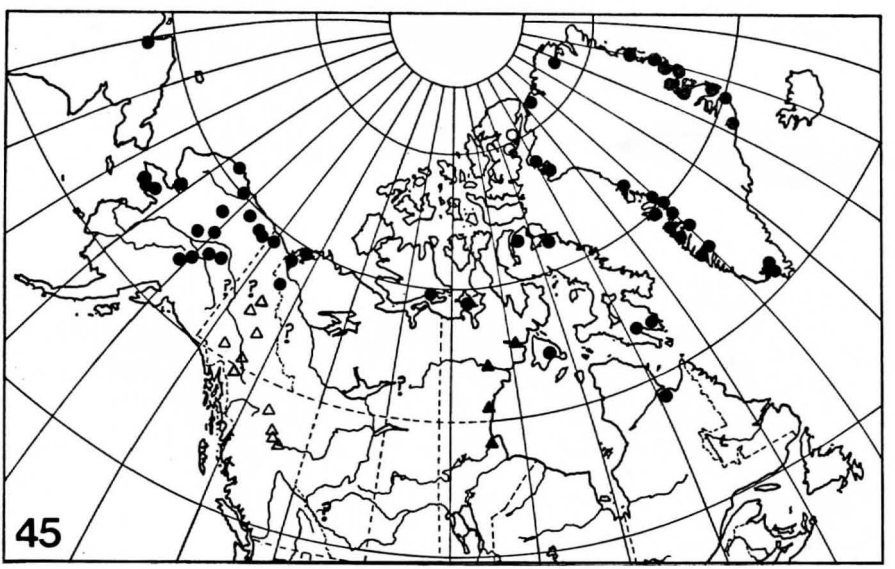


Figure 45: Preliminary distribution of *C. hecla* in North America and Greenland: *hecla*, black dots; *glacialis*, open circles, *hela*, black triangles; pale form, open triangles, blend-zone and dubious forms (?).

84th meridians west longitude. M'Lachlan (1878) recorded two males and a female from 81°45' N. Lat.; a female from Hayes Sound, 79° N; a newly emerged and crippled male from Discovery Bay.

A fourth form of *hecla* occurs in the southwestern arctic. It reaches its northern limits in the vicinity of Dawson, Mayo Lake and Keno Hill, Y.T., where specimens that intergrade into typical *hecla* occur. The white female form also occurs in this region. Additional Yukon records include Swim Lakes and Whitehorse. The butterfly ranges southward into British Columbia where there are records from Atlin, Alaska Highway 11 miles north of Trutch, Summit Lake, Beatton River crossing of the Alaska Highway (ca. mile 148), and Pink Mountain (mile 143 Alaska Highway).

In both sexes of this form, the dark wing margins are very much reduced. The orange ground color is pale with considerable yellow in the females. The VHW discal spot tends to be large and double.

This southern form of *hecla* probably merits a subspecific name, but additional study material is necessary. I have examined less than two dozen specimens from the southern Yukon and British Columbia, representing material in two museums and two private collections. Further study is required before any nomenclatural decision is made. The full range of this form needs to be determined. Ehrlich and Ehrlich (1961) report *hecla* from Red Deer, Alberta. Presumably this population is the same as occurs in British Columbia, but I have not seen material. My study of *hecla* is continuing.

Figure 45 illustrates a preliminary distribution for *Colias hecla* in North America.

ACKNOWLEDGMENTS

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