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NEW BUTTERFLY SUBSPECIES FROM WYOMING (NYMPHALIDAE, PIERIDAE)

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*Boloria*² *pales halli*, new subspecies

This is a very distinct subspecies of *pales* from high altitudes in the Wind River Range, Sublette Co., Wyoming, the recording of which extends the known range of *pales* in North America many hundreds of miles to the southward. *Halli* may be characterized as follows:

MALE.—Average length of fore-wing, 18.3 mm.

Ground-color of upper side of wings bright orange-brown, very lightly tinged with pinkish or reddish. The usual transverse rows of spots and irregular lines are all present. Those in the basal half (or slightly more than half) of the wings are somewhat narrower than in most of the Palaearctic forms of the species, as is also the case with *B. pales alaskensis* (Holland). The fore-wings are dusted with fuscous scaling at the bases, somewhat more broadly along the inner margin than along the costa. The hind-wings are more heavily shaded basally than the fore-wings; but this shading almost always fails to reach the end of the discal cell.

Ground-color of under-side of fore-wing somewhat duller, and with a slightly more pinkish tinge than that of the upper side. The spots and bands of the upper side "show through" very faintly, those in and at the end of the discal cell more strongly. The apex and a narrowing border that does not reach the anal angle are yellow, slightly tinged with greenish. In this yellow area some of the spots of the upper side are repeated, of a brownish-red color; but these are of much smaller extent than the corresponding spots on the upper side.

Ground-color of under-side of hind-wing yellow slightly tinged with greenish; dark markings brownish red to bright red. In the great majority of the specimens the dark markings are so considerably diluted by dusting of the greenish-yellow ground-color that the entire wing shows a noticeable lack of contrast between the light and dark areas. With the exception of the large spot at the end of the cell, all of the markings, which in other subspecies of *pales* (especially most of the Palaearctic ones) are bright silvery white, here show only faint traces of a pearly

luster, if any. The spot at the end of the cell is consistently white in color and only faintly pearly, never silvery, being thus less lustrous than in any of the other Nearctic subspecies and most of the Palaearctic ones. Especially noteworthy is the considerable reduction of the submarginal row of red, triangular spots which in other subspecies form the inner borders of the marginal row of silvery spots. In *halli* most of these red spots are reduced in size; this, in conjunction with the above-mentioned almost total absence of white, pearly or silvery, results in a very characteristic obliteration of the marginal row of spots.

The males show comparatively little variation in color and markings, far less than would be expected in a species occupying a habitat that is subject to such extreme climatic changes.

FEMALE.—Average length of fore-wing, 19.02 mm.

Ground-color of most of the area of upper side of both wings light gray, tinted with light brownish yellow. The color tends to be noticeably lighter, brighter and more yellow in the costal, subcostal and apical light areas and spots of the fore-wing, and in the anal light spots of the hind-wing. In sharp contrast to the general ground-color, the costal and subapical region of the hind-wing has the ground-color bright orange-brown, as bright as the ground-color of the male. Dark markings much heavier and more suffused than in the male.

Ground-color of under-side of fore-wing a somewhat darker, more reddish brown than in the male. The black markings of the upper side are nearly all repeated here, though much smaller than on upper side. The apical and outer-marginal light area is of a definitely more greenish yellow than in the male. The dark red markings in this area are as in the male. The black dots at the ends of the veins are heavier than in the male.

Ground-color of under-side of hind-wing a more greenish yellow than in the male, the greenish tinge being more pronounced in the areas which on the upper side of the wing are black or fuscous. The dark red markings average only very slightly heavier than in the male; but since their hue is in greater contrast with the ground-color, the wing has a more contrasty and variegated appearance. As in the male the pearly or silvery white markings are all very much reduced in size and luster.

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² *Boloria* Moore, genotype *pales* (Denis and Schiffermueller) should, in the author's estimation, be recognized as a valid genus. *Pales* has usually been placed in the genus *Brenthis* Huebner. See also note under the next subspecies here described.

There is a great deal of variation in the extent of the black markings and fuscous dusting on the upper side of the wings of the females, proportionately more than in the males. There is also considerable variation in the intensity of the dark red markings of the under-side of the hind-wings.

TYPE LOT.—Holotype male, allotype female, 139 male paratypes and 57 female paratypes, vicinity of Green River Pass, Wind River Range, Sublette Co., Wyoming, July 18–31, 1939, collected by David Bigelow and the author. The holotype, allotype and a series of paratypes have been deposited in the collection of The American Museum of Natural History. The remaining paratypes are in the collections of Mr. Bigelow and the author. Series of them will be distributed to numerous museums.

COMPARISON WITH OTHER NORTH AMERICAN SUBSPECIES OF *pales*.—Three other names have been applied to forms of *pales* in North America; these are:

- (1) *Brenthis pales* var. *alaskensis* HOLLAND, 1900, Ent. News, XI, p. 383.
- (2) *Boloria reiffi* REUSS, 1925, Intern. Ent. Zeitung, XIX, pp. 279–280.
- (3) *Boloria pales nearctica* VERITY, 1932, Deutsch. Ent. Zeitschr., Iris, XLVI, pp. 104 and 108.

Of these I have been able to study satisfactory material of *alaskensis* only for comparison with *halli*. Of this subspecies I have studied critically 30 males and 23 females from various southern and western localities in Alaska, and Atlin, B. C. These are in the American Museum, dos Passos and Klots collections.

Reiffi was described from a single male from an unknown locality in British Columbia. Reuss mentions particularly the brilliance and contrast of the red and silver markings of the under-side, a characterization that applies to one of the Atlin, B. C., specimens studied by me but not to the other. I suspect that *reiffi* will eventually prove to be a synonym of *alaskensis*.

Nearctica was described by Verity on the basis of Lehmann's description (Seitz, *Macrolepidoptera*., V, p. 423, 1913), as *Argynnis pales*, of a number of specimens from extreme northwestern Alaska, Lat. 69° 40' N., Long. 141° W.). I have seen

only one specimen, a male from Point Barrow, Alaska (dos Passos collection), to which this name would be applied. It evidently represents an extreme Arctic subspecies.

Below are listed the chief characteristics that serve to differentiate *halli* from these three named forms. In the case of *alaskensis* this is based on comparison with the material listed above; with regard to *reiffi* and *nearctica* it is based mostly on the descriptions of these forms by Reuss, Verity and Lehmann.

From *alaskensis*, *halli* is distinguished by the following:

- (1) The deeper orange-brown ground-color of the upper side of the wings of the males.
- (2) The much lighter, yellow-brown tinged, gray ground-color of the upper side of the wings of the female, which contrasts strongly with the bright yellow-brown, costal and apical region of the hind-wing. In *alaskensis* females the ground-color of most of the area of the wings is a much darker, duller yellow-brown; that of the costal and apical region of the hind-wing is not as bright as in *halli*; and so the general appearance of *alaskensis* females is much duller and less contrasty.
- (3) The reduction in size, on the upper side of both wings of the males, of the submarginal row of black spots. In *alaskensis* these tend to be more produced inwardly, forming inward-pointing triangles. In *halli* they tend to be less triangular in shape. These spots also "show through" less on the under-side in *halli*, a characteristic which accentuates the lack of marginal spots in this form (see no. 7 ff.).
- (4) The slightly greater reduction of the basal fuscous dusting on the upper side of both wings of the males. This is more noticeable on the hind-wings, for in *halli* the dusting almost always fails to reach the end of the discal cell, while in *alaskensis* it nearly always does so.
- (5) The reduction of the dark, red-brown, subapical markings on the under-side of the forewings of both sexes.
- (6) The reduction and dilution by the ground-color of the dark, red-brown markings of the under-side of the hind-wings of both sexes.
- (7) The reduction of the white, pearly or silvery markings of the under-side of the hind-wings of both sexes, especially the almost total loss of the marginal row of pearly or silvery spots. In *halli* there are at most only faint suggestions of these spots in all but a few specimens. An exception is the spot in cell Cu₁ which is usually fairly well defined and slightly pearly. In *alaskensis* this row of spots is nearly always well defined, being definitely silvery or pearly, and margined inwardly with red-brown.
- (8) The brighter, slightly more greenish-yellow color of the apex and margin of the under-

side of the fore-wing and the ground-color of the under-side of the hind-wing.

From *reiffi*, *halli* is distinguished by the following:

(1) The lack of contrast on the under-side of the hind-wings of both sexes, between the greenish-yellow ground-color and the dark, red-brown markings; this is due to the reduction in extent and dilution in hue of the latter. *Reiffi* is stated in the original description to have the yellow ground-color strong and outstanding ("stark, vortretende, gelber Grundfarbe").

(2) The great reduction of the white, silvery markings of the under-side of the hind-wings. *Reiffi* is stated in the original description to have the silver marks strong and normal.

From *nearctica*, *halli* is distinguished by the following:

(1) The greater reduction in the males of the basal fuscous dusting on the upper side. *Nearctica* was described (by Lehmann, whose description forms the basis for Verity's application of the name) as having the fore-wings heavily dusted basally, and the hind-wings broadly shaded with greenish black as far as the apex of the cell. In practically all specimens of *halli* the black basal shading definitely does not extend to the end of the cell, a characteristic which also as noted serves to differentiate it from *alaskensis*.

(2) The lack of contrast and variegation of the markings of the under-side of the hind-wings. Lehmann calls *nearctica* "uncommonly variegated" in this respect.

(3) The reduction of the white, silvery markings of the under-side of the hind-wings.

FIELD NOTES, ETC.—*Halli* was very common in Hudsonian Life Zone meadows, at and above timberline, which in the vicinity of Green River Pass is at about 10,000–10,500 ft. altitude. The males were everywhere, visiting flowers of *Arnica*, *Erigeron*, *Polygonum* and *Eriogonum*. The females were much less common, although the presence of many rather worn individuals toward the end of our collecting period showed that we had collected through the height of the *halli* season. We took specimens everywhere that we collected in Hudsonian Zone, i.e., in Stroud Creek Canyon, around Peak Lake, along the upper reaches of Trail Creek, around Summit Lake and the Elbow Lakes, in the upper parts of Pine Creek Canyon, and all along the trail from Summit Lake to Palmer Lake. Without a doubt the

species occurs over an area of two hundred or more square miles in the Wind Rivers, for this mountain range has a very large area above timberline. This being so, I am very much surprised that I failed to take the species in 1935 on the mountains around Green River Lake, for on at least two of these I collected far above timberline. It is possible that some temperature factor limits the species to the interior areas of the range in proximity to the glaciers and the very high peaks.

Females were proportionately much less often observed visiting flowers than were the males; but individuals were frequently observed resting in the low willows (*Salix*) that form dense mats in the Hudsonian Zone bog areas.

Specimens were very rare in the higher meadows of the true Arctic-Alpine Zone above 11,000 ft. alt., which is surprising. Only occasional strays from the lower levels were seen. This is in direct contrast to some of the other butterflies such as *Euphydryas*, *Aglais milberti*, *Plebeius saepiolus*, *Erebia theano ethela*, *E. tyndarus callias*, etc., which, although they occur most abundantly in Hudsonian Zone, frequently fly up into even extreme Arctic-Alpine Zone and are often common there.

On the wing, *halli* males appear to have a somewhat lighter, more rapid, and more darting flight than the species of *Brenthis* taken in the same localities. The slightly pinker hue of the ground-color of the wings of the male is more noticeable in specimens in flight in the sunshine than in dried specimens. On the wing the females resembled very strongly the dark, worn specimens of *Phyciodes* that were flying with them. The flight of the females is much less swift and less graceful than that of the males.

ACKNOWLEDGMENTS.—The first specimens of *halli* collected are said to have been taken in the Wind River Range many years ago by Mr. Carl Rungius, the well-known artist. Later, Mr. Gaylord C. Hall of New York City, who has done much collecting in this range, took a series. On hearing that I intended collecting at high altitudes in the Wind Rivers, Mr. Hall generously placed his knowledge of

the region, and of collecting and conditions there, at my disposal. So it is with great pleasure that I name this subspecies for him.

Clossiana¹ aphirape laddi,

new subspecies

In a previous paper (Journ. N. Y. Ent. Soc., 1937, XLV, p. 328) the author recorded the capture of four specimens of *aphirape* in the Snowy Range, Wyo., and commented upon their apparent difference from *C. aphirape caelestis* (Hemming) (*alticola* (Barnes and McDunnough)), the Colorado subspecies. In July, 1939, an additional series of the Snowy Range form was collected by Anthony Ladd of New York City and the author. These agree so consistently with the previously collected specimens that the author has no hesitation in naming the Snowy Range population as a new subspecies which is dedicated to the co-collector.

From *C. aphirape caelestis* (Hemming), its nearest relative, *laddi* is distinguished by the following characteristics:

(1) The very considerably darker, red-brown color of the subapical patch on the under-side of the fore-wing, and the similarly darker, red-brown color of the submarginal, median and post-basal bands of the under-side of the hind-wing. In *caelestis* these dark markings are of a much lighter, more yellow-brown.

(2) A tendency for the submarginal rows of round, black spots on both upper and under-sides of the fore-wing to be somewhat sinuate, bending proximally below M₂ and distally again below Cu₂. In *caelestis* this row of spots tends to be straighter.

Laddi is not an extremely distinct subspecies in the sense of every specimen being distinguishable from any specimen of any other subspecies. Very few subspecies are. But that there is a very considerable and almost constant difference between it and *caelestis* is evident at a glance upon comparison of series of the two forms. No

specimen in the type series of *laddi* (17 specimens) is as light-colored beneath as even darker than average specimens of *caelestis*; and of the *caelestis* available for comparison (24 topotypical specimens, Hall Valley, Colo., and 7 specimens from other Colorado localities) only two, both females (which sex averages darker beneath), are as dark as any of the *laddi*.

As mentioned in a previous paper (*loc. cit.*) the Snowy Range is not very definitely separated from the Colorado mountain ranges, so that the presence there of different subspecies is a bit surprising. Study of series of other Snowy Range butterflies seems to show, however, that in a number of the species there are slight but constant differences from the corresponding Colorado forms.

Aside from the darker coloring beneath, *laddi* shows no other points of difference from *caelestis* and similarity to *dawsoni* or other Canadian subspecies. This particularly refers to the silvery hue of the white spots and the ocellate spot in the dark, basal spot in the cell, both on the under-side of the hind-wing, which were discussed in my previous paper (*loc. cit.*) as points of difference between *caelestis* and *dawsoni*.

TYPE SERIES.—All specimens of type series from Snowy Range, Albany Co., Wyo. Holotype ♂, 9 ♂ and 3 ♀ paratypes, July 7, 1939, collected by Ladd and Klots in willow bog, Hudsonian Zone, alts. 10,400 to 10,800 ft. Allotype ♀, 1 ♂ and 1 ♀ paratype, August 13, 1935, collected by Klots, in willow bog, near Class (Lewis) Lake, Hudsonian Zone, alt. 10,900 ft. 1 ♂ paratype (with wings incompletely expanded) July 17–23, 1935, collected by Klots, in willow bog near Class (Lewis) Lake, Hudsonian Zone, alt. 10,900 ft.

Holotype, allotype, 3 ♂ and 1 ♀ paratypes in The American Museum of Natural History. The remainder of the paratypes are in the author's collection. Some will be distributed to museums.

Colias gigantea harroweri,
new subspecies

For many years this, as well as other yellow *Colias* from western North America,

¹ *Clossiana* Reuss, genotype *selene* (Denis and Schiffermueller), should be recognized as the generic name for those North American species other than *Boloria pales* which have heretofore usually been placed in *Brenthis* Huebner. *Brenthis* should be restricted to the Palaearctic species *hecate* (Esper) the genotype, *ino* (Rottemburg) and *daphne* (Denis and Schiffermueller). Reuss has erected the subgenus *Proclossiana* for *aphirape*; but the validity of this seems a bit dubious.

has been passing under the name of *Colias christina* form *astraea* Edwards. A small series taken by the author in 1935 (now a part of the present type lot) was thus tentatively named (Journ. N. Y. Ent. Soc., 1937, XLV, p. 321). Further collecting in 1939 in the same locality in which this 1935 material was taken has furnished additional specimens and evidence which not only warrants the description of this form as new but also shows that in all probability it is a southern subspecies of *Colias gigantea* Strecker. The type locality of *gigantea* is in the vicinity of Churchill, Manitoba.

MALE.—Average length of fore-wing, 24.5 mm.

Ground-color of upper side of wings yellow, slightly greenish tinged. Black border of normal width, tending to be rather smooth inwardly, somewhat produces basally along inner margin of fore-wing. Veins strongly yellow in black borders. Black discal spot of fore-wing present in all specimens studied, usually strongly defined, sometimes large, reduced to a trace in only one of the twelve males of the type series, and very small in one other. Discal spot of hind-wing "showing through" from under-side as a very pale orange spot.

General color of under-side somewhat lighter yellow than that of upper side, paler on the inner margin, and deeper, almost orange, at the extreme base of the fore-wing. Fore-wing fairly heavily dusted with fuscous scales along costa, more lightly dusted on disc beyond end of cell and on apex. Discal spot of fore-wing prominent, with many yellow and some yellow-brown scales internally.

Under-side of hind-wing rather greenish yellow, evenly but not very heavily dusted with fuscous scales; this dusting tends to be lighter toward the outer margin. Discal spot of hind-wing large, often double, pearly internally, diffusely ringed with purplish brown which frequently invades and tints the central, pearly region.

Fringes pink, more yellowish above than below. Fringe of fore-wing becomes yellow below vein Cu_2 of 2dA. On the under-side the costal margin of both wings is distinctly purplish pink; and the outer margin of the fore-wing and the outer and anal margins of the hind-wing are more narrowly pink.

FEMALE.—Upper side: Ground-color bright yellow. Black border absent, or present as only a trace in the subapical region. Discal spot of fore-wing present, large, fuscous or black. Discal spot of hind-wing large, double, solid, bright orange.

Under-side: Fore-wing. Basal and discal parts of wing yellow, somewhat orange tinted; apical, terminal and inner-marginal parts pale yellow, fuscous dusting as in male somewhat

heavier. Discal spot prominent. Hind-wing pale yellowish, evenly but not very heavily dusted with fuscous scales. Discal spot large, more or less double, only slightly pearly internally, very diffusely ringed with light purplish brown of a rather more dilute hue than in male.

Fringes as in male, more broadly pink.

TYPE LOT.—All are from Clear Creek, vicinity Lower Green River Lake, Sublette Co., Wyo., alt. 8400 ft. Holotype male, three male and two female paratypes, August 3, 1935, collected by Klots; allotype female, nine male and one female paratypes, July 16, 1939, collected by Klots, except the female paratype which was collected by David Bigelow.

FIELD NOTES.—The allotype female was ovipositing on willow (*Salix*) when captured. All the specimens were taken in a somewhat acid, moss (*Hypnum*)—willow bog area that lies in the Clear Creek "bottom" about three-quarters of a mile below the "natural bridge" which is shown on the Fremont Peak quadrangle of the U. S. Topographic Map. A number of other females were seen dropping into the vegetation of the bog as if to oviposit. Willow is probably the only possible food-plant for the species in this bog. The species is very strongly limited to the bog environment; of all those seen in 1935 and 1939, including at least a dozen and a half that were not taken, none were outside of the limits of the bog area.

DISCUSSION.—As mentioned previously, this form has for many years been passing under the name of *Colias astraea* Edwards, of which the type locality is Yellowstone National Park, Wyoming. The name *astraea* should be used only for pale orange or yellow specimens of the species *christina* Edwards, although the type specimen of *astraea* (in the Carnegie Museum) has considerable orange on the upper side of the wings. It may be noted that Edwards described *astraea* from a single male only, so that the male and female figured as "types" by Holland (Butterfly Book, revised edition, 1931, Pl. LXVII, fig. 26, 27) are not types at all, but merely specimens from the Edwards collection. The male thus illustrated is considerably less orange than the true type.

McDunnough (Canadian Entomologist,

1922, LIV, p. 135, and 1928, LX, p. 270) has called attention to the essential differences between *gigantea* and the yellow forms of *christina*, pointing out the food-plant difference between the two species. From these observations and my own it seems that the forms of the *christina-emilia-alexandra* complex are legume feeders, while *gigantea* feeds exclusively on willow. Correlated with this is a marked difference in habitat: *christina* flies in the meadows and dry open country, while *gigantea* is limited in the southern part of its range to willow bogs and in the north to tundra.

In this respect some observations of Mr. Jack May, the experienced Canadian lepidopterist, are pertinent. In a letter to me a number of years ago Mr. May stated that he had found an excellent locality for *gigantea*, namely, in the large swamps in the interior of the Riding Mountains, Manitoba. I have received a considerable series of these specimens from him.

Accordingly I have no hesitation in assigning this Wyoming form to *gigantea*, of which species it constitutes the most southern subspecies. The name *harroweri* should certainly be applied to Wyoming, Idaho and Montana specimens of *gigantea*; and it probably should also be used for those from the southern regions of Manitoba, Alberta and British Columbia. The southern Canadian specimens are not typical, however, showing in some respects intergradations to *g. gigantea*, and in other respects intergrading to *christina*, *emilia*, *alexandra* and *occidentalis* in a very puzzling way.

The following material has been studied critically in preparing these diagnoses (American Museum and Klots collections):

(1) *harroweri*, in addition to the type series, 75 males and 21 females from various localities in Wyoming, Montana, Idaho, Manitoba, Alberta and British Columbia.

(2) *g. gigantea*, 52 males and 12 females, all topotypes from Churchill, Manitoba; 19 males and 17 females from Alaska.

Because of the variation shown by *harroweri* it has seemed best to limit the type series to the specimens from the Clear Creek colony for which there is habitat data.

COMPARISON WITH *g. gigantea*.—From *g. gigantea*, *harroweri* is distinguished by the following:

(1) The black borders of the upper sides of the wings of the males, which are somewhat wider than in *g. gigantea*.

(2) The color of the apex of the under-side of the fore-wing and of the entire under-side of the hind-wing of the males. In *harroweri* these areas are of a greenish yellow which does not contrast strongly with the ground-color of the rest of the fore-wing. In *g. gigantea* these areas are of a richer, somewhat orange-yellow which contrasts with the paler, more dilute hue of the rest of the fore-wing.

(3) The fuscous dusting of the under-side of the hind-wings of both males and females. In *harroweri* this is much sparser than in *g. gigantea*.

(4) The ground-color of the females. In *harroweri* this is usually bright yellow, as in all four specimens of the type series, three out of four specimens from Yellowstone Park, and thirteen out of seventeen specimens from southern Manitoba and Alberta. Of the five exceptions one from Yellowstone and one from southern Manitoba are white, and the other three are pale yellow. Of twelve female topotypes of *g. gigantea* six are white and six are very pale yellowish.

(5) In a number of other characters there seem to be minor differences; these are: size, in which *harroweri* seems to average very slightly smaller than *gigantea*; the black discal spot of the fore-wing, which seems to average slightly larger in *harroweri*; and the border of the fore-wing of the female, which seems to be slightly less reduced in *gigantea*. The number of specimens available for study is not great enough, however, to warrant any assurance with regard to these.

I take pleasure in naming this subspecies for Mr. James K. Harrower of the U. S. Forest Service, Pinedale, Wyoming.