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DISTRIBUTION OF ARCTIC-ALPINE *LYCAENA PHLAEAS* L. (LYCAENIDAE) IN NORTH AMERICA WITH DESIGNATION OF A NEW SUBSPECIES[1]

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INTRODUCTION

The *Lycaena phlaeas* (L.) complex has been studied in detail by a number of workers. Two papers, in particular, have surveyed the literature. Ford (1923) presented observations on the world-wide geographic races of the butterfly. His treatment of Old World races is quite complete relative to the period when the paper was published. The North American discussion is rather incomplete, however, and Ford recognized only the taxa *hypophlaeas* Bdv. and *feildeni* M'Lachlan [misspelled as *fieldeni*]. Shields & Montgomery (1966) discussed the distribution and bionomics of arctic-alpine *phlaeas* in North America. They recognized four subspecies, as did dos Passos (1964): *arethusa* Wolley-Dod, *feildeni* M'Lachlan, *hypophlaeas* Bdv., and the non-arctic-alpine *americana* Morris. Harris is usually noted as the authority for the taxon *americana*. F. M. Brown (*in litt.*) has stated that the name appeared in *"Synopsis of the described Lepidoptera of North America. Part 1. - Diurnal and Crepuscular Lepidoptera."* Compiled for the Smithsonian Institution by John G. Morris, Smithsonian Miscellaneous Collections, Washington, D.C. 358 pp. 1862. Harris died in 1856 without having published the name *americana*. Thus the citation in dos Passos (1964) should read Morris, 1862 rather than Harris, 1862. Ford considered *hypophlaeas* and *americana* synonymous, which is not the case. He apparently ignored *arethusa*, described in 1907.

Since Ford's paper, additional North American races of *phlaeas* have been identified. Before these races are discussed, several other matters need to be examined. Generally speaking, the tails present on the secondaries of many Old World *phlaeas* are lacking in the New World races. Harry Clench (*in litt.*) has pointed out that our *phlaeas* is closest to the Manchurian race.

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Ford recognized the varieties of *L. phlaeas* as falling into three categories: geographical, seasonal, and casual variation. With the exception of *americana,* the North American races appear to be univoltine, so seasonal variation (spring, summer, fall, or wet and dry season broods) is not a factor to consider. Thus we are dealing with Ford's "constant broods" and geographic races, excecting *americana.* Aberrations (casual variation) occur with some frequency in all subspecies of *phlaeas,* and of the New World subspecies, are most common in *americana.* These will not be treated here. Robertson (1969) has discussed homoeosis and heteromorphosis in *L. phlaeas* at some length.

There are two characters which Ford used to separate populations of *L. phlaeas.* These are the orange subterminal line or band on the underside of the hindwings and the "critical spot". This is the spot which appears dorsally in space Cu_2 of the forewings. Ford classified it as either concave outward or concave inward. In many of the North American races, the "spot" is distinctly double or is fused in the form of a modified hourglass. Thus it is difficult to use this character. As Ford noted, one must use a statistical analysis of the "critical spot", as any given population will exhibit some variation and one spot form will predominate, although several forms may be present.

Ford also discussed the form *caeruleo-punctata* Stgr. to some extent. This is the form which exhibits a postmedian blue spot row (DHW) proximal to the orange band. In the North American races, the majority of the specimens examined exhibited this character. While it may have some value in separating Old World forms and geographic races, it does not appear to be a valid or useful taxonomic character for the New World subspecies.

DESCRIBED NORTH AMERICAN SUBSPECIES OF LYCAENA PHLAEAS

Lycaena phlaeas americana [Type Locality: Massachusetts] is by far the most common and widely distributed of the North American subspecies. Clench (*in* Ehrlich & Ehrlich, 1961) notes for its range: Nova Scotia and the Gaspé west to Minnesota, south to Virginia and montane northern Georgia, Missouri and Kansas. It has also been reported from Cass Co., North Dakota (Puckering & Post, 1960). In fresh specimens, the base color is a clear coppery red and not at all brassy. Excepting the tails on the secondaries, *americana* closely resembles the northern European butterfly. Figs. **2** and **3** illustrate *L. p. phlaeas* from Europe. *L. p. americana* is illustrated in Figs. **4** and **5**. The larval foodplants are noted as *Rumex acetosella* L., *R. acetosa* L., and *R. crispus* L. (Klots, 1951).

On a worldwide basis, the recorded larval foodplants for *Lycaena phaleas* are all members of the Polygonaceae and are primarily species of *Rumex* and *Oxyria.* In North America, the arctic-alpine races of *phlaeas* are restricted to the areas in which these two plant genera are found, although there are many areas in which the plants occur, but from which *phlaeas* has not been recorded.

The distribution and variation of *L. p. americana* is well documented in works such as Klots (1951) and Clench (*in* Erhlich & Ehrlich, 1961) and no further discussion of this subspecies will be attempted here. The ensuing treatment deals with the arctic and arctic-alpine races of *phlaeas* in North America. In these races, the ground color tends toward a brassy or bronze cast and is not nearly so bright as in *americana.* The insects are frequently rather dusky in aspect. The three described geographic races are: *feildeni* [T.L.: Ellesmere Island, Lat. 81° 45' N], *hypophlaeas* [T.L.: "northern California" (see discussion below)]; *arethusa* [T.L.: S. Fk. Sheep Ck., 35 mi. SW of Calgary, Alberta].

Lycaena phlaeas feildeni was described from two males and a female taken by Capt. H. W. Feilden during the 1875-86 arctic voyage of *H.M.S. Alert.* The butterflies were taken in an area where *Rumex reniformis* = *Oryria digyna* (L.) grew. In correspondence with A. O. Shields in January, 1968, J. A. Downes of the Entomology Research Institute, Ottawa, Ontario, Canada, mentioned that he had caged several female *L. p. feildeni* over *O. digyna* plants in July, 1962 at Lake

Hazen on Ellesmere Is. The butterflies oviposited on the leaves and petioles. "The larvae hatched and fed on the *Oxyria* leaves and were taken into 2nd and 3rd instars, but did not survive a rather imperfect attempt to hibernate them. The adults flew in areas where *Oxyria* was found, and in the course of one short search I found one egg on *Oxyria* in nature." Specimens from western Greenland and arctic Canada south to Baker Lake, Northwest Territory appear to be this subspecies. The insect is poorly represented in collections with the few extant specimens placed primarily in the Canadian National Collection and the British Museum (Natural History). The butterfly is shown in Figs. **10-11.**

Lycaena phlaeas arethusa appears restricted to the Canadian Rocky Mountains in the region from Calgary to Jasper in Alberta and along the associated Alberta - British Columbia border. On Plateau Mtn. south of Banff, it flies in small grassy meadows at 8200' in association with *Oxyria digyna* and *Rumex alpestris* (Scop.) Love (J.A. Legg, Jr. and C.D. Bird, *in litt.*). The flight period is typically the first two weeks in August. The butterfly is shown in Figs. **8-9.**

To date, *L. p. hypophlaeas* is restricted to the Sierra Nevada Mountains in California. Localities are noted in the Appendix. Shields & Montgomery (1966) show the range as extending roughly in a straight line from Bishop Pass to Cathedral Lake, 70 miles to the north. Collection sites generally follow the John Muir Trail. Elevations range from 9,000 to 12,000' with dates from 27.vii-14.viii. In the Sonora Pass area, Mono Co., oviposition has been observed upon *O. digyna* (J.R. Mori and A.O. Shields, *in litt.*).

There has been much confusion over *hypophlaeas* because of an apparent mistranslation of Boisduval's locality description, "Nord de la California". This was interpreted by some workers as "North of California" rather than "The northern [part] of California". This matter was set straight by Shields (1967).

Boisduval's description appeared in *Annales de la Société Entomologique de France. Deuxième Série, Tome Dixième,* Paris, 1852: 291. Translation of the text reads: "23. Polyommatus hypophlaeas. Very close to our *Phlaeas;* but smaller, with the spots more strongly marked, the wings more rounded; the underside of the hindwings ashy-gray-whitish, with the tawny marginal band well marked.

"Northern part of California. It is found throughout the northern United States."

Boisduval's type of *hypophlaeas* is in the collection of the United States National Museum. The type was collected by P. J. M. Lorquin but does not bear exact locality information. Shields (1967) suggested that the type locality for *hypophlaeas* should be in the Sierra Nevada Mountains based upon research by L. M. Martin and F. M. Brown.

To Boisduval's description, one can add the following information with respect to the other races of *phlaeas* found in North America: The ground color of the forewings dorsally is a distinct brassy-orange-copper color. There is a suggestion of dusky overscaling in many males. The dark FW marginal borders are the narrowest of the N. A. subspecies, with *americana* having the widest borders. The marginal orange band on the upperside of the hindwings is well developed in both sexes. A postmedian row of blue spots is frequently present just inside of this band. On the underside of the secondaries, the crenulate orange [Boisduval's "tawny"] band is distinct.

In addition to the areas cited above, populations of *L. phlaeas* are found in the high mountains of Oregon, Idaho, northwest Wyoming-southwest Montana, and in various localities in British Columbia, the Yukon Territory, and Alaska. Figure **1** shows the presently known distribution of arctic-alpine *phlaeas* in North America.

Too few specimens exist from most of these areas to permit in-depth study. These must be considered isolates until additional material is available. Further discussion appears later in this paper.

Until 1973, a handful of Wyoming-Montana specimens existed in a few museum and private collections. Although *phlaeas* has been taken at high altitude in Teton Co. and Yellowstone National Park in Wyoming, and Sweet Grass Co.,

Montana (Crazy Mtns.), the population center, at this writing, appears to be the Beartooth Plateau, which extends from northern Park Co., Wyoming into southern Carbon Co., Montana.

The butterfly is extremely local and adults do not stray more than a few yards from the suspected larval foodplant. Ferris located a habitat on the Beartooth Plateau in 1972 and he and S. Kohler of Missoula, Montana collected a series of well over 100 specimens during the 1973 season. Specimens from this region are distinct from the other North American *phlaeas* and a new subspecies is described below.

Lycaena phlaeas arctodon, new subspecies

The main differences between the new subspecies and the other named subspecies of *L. phlaeas* from North America are enumerated in Table **1.** The subspecies which are phenotypically closest to *arctodon* are *hypophlaeas* and *arethusa.* In *arctodon* the DFW spots are more prominent and the dark borders wider than in *hypophlaeas.* The copper color is redder than in *hypophlaeas. L. p. arctodon* does not exhibit the wide dark DFW borders of *arethusa* nor the smoky cast of the males. It is, by contrast, a very bright appearing insect and worthy of the name "copper". The DHW blue spots are more prominent than in *arethusa.* Very few specimens from the type series lack the blue spots. On the ventral surface, the HW submarginal red band is narrow, but strongly developed and strongly crenulate.

The females show very little variation in facies, and all manifest the DHW blue spots. The males exhibit more size variation than the females. The blue DHW spots are absent in some males, and others exhibit a dusky cast, but not so pronounced as in *arethusa.*

The critical spot varies in the type series as follows: concave inward ♂♂ 66%, ♀♀ 22%; concave outward ♂♂ 27%, ♀♀ 40%, double ♂♂ 7%, ♀♀ 38%.

Size variation in the type series (coastal FW length from thorax to apex): ♂♂ 12 - 15 mm; ♀♀ 14 - 16 mm.

The name for the new subspecies is derived from the Greek for "beartooth" and was suggested by Harry K. Clench of the Carnegie Museum.

Holotype male. The holotype was collected on the Beartooth Plateau and bears pin labels with the following data: a red label machine-printed in black ink: L. phlaeas arctodon / Ferris / HOLOTYPE Male; a white label, machine-printed in black with handlettered date in black ink: E. SIDE BEARTOOTH / PASS, CUSTER NF / CARBON CO. MONT. / 10,300' 3-viii-73; a white label, machine-printed in black ink: Leg: C. D. Ferris. The holotype is shown in Fig. **17.** FW length = 13.5 mm.

Allotype female. The female allotype bears a green label, machine-printed in black ink: L. phlaeas arctodon / Ferris / ALLOTYPE Female; a white label, machine-printed in black with handlettered date in black ink: E. SIDE BEARTOOTH / PASS, CUSTER NF / CARBON CO. MONT. / 10,300' 1-viii-73; a white label, machine-printed in black ink: Leg: C.D. Ferris. The allotype is shown in Fig. **18.** FW length = 14.5 mm.

Type series. The type series, including holotype and allotype, consists of 98 specimens from the following localities: **Montana,** E. side of Beartooth Pass, Custer NF, Carbon Co., 31.vii - 3.viii.74, 46♂♂, 39 ♀♀; 5.viii.72, 1♂ ; *leg*: C.D. Ferris; Beartooth Mtns., [Carbon Co.], 9 - 12.viii.41, 5 ♂, *leg.* G. H. & J. L. Sperry (AMNH); 15.viii.42, 1 ♀, *leg.* O. Buchholz (AMNH); **Wyoming,** Teton Co.: Teton Glacier, Teton Mtns., 19.vii.31, 1 ♂, 1 ♀, *leg.* J. D. Gunder (AMNH); Yellowstone N. P.: Mt. Washburn, 16.vii.34, 1 ♀, *leg.* H. H. & F. M. Brown (AME); 8.viii.35, 1 ♀, *leg.* P. S. & C. L. Remington: (AME); 22.vii.36, 1 ♂, *leg.* F. M. Brown (AME), **Idaho,** Lemhi Co., Meadow Creek Lake, 4 mi. W. of Gilmore, Lemhi Range, 1.viii.72, 1 ♂, *leg.* S. Ellis (AME).

The hollotype and allotype will be deposited in the collection of the Allyn Museum of Entomology. Paratypes have been placed in the collection of the Allyn

Museum of Entomology, the American Museum of Natural History, Carnegie Museum, the Los Angeles County Museum of Natural History, and will be placed in additional museum collections.

Distribution. To date, *L. p. arctodon* is known from the Beartooth Plateau on the Park Co., Wyoming - Carbon Co., Montana border, the Teton Mtns., Teton Co., Wyoming, Yellowstone National Park on Mt. Washburn, and from the Lemhi Range, Lemhi Co., Idaho. The specimens cited in the Appendix from Sweet Grass Co., Montana are presently referred to *arctodon.*

The insect flies at treeline or above in areas where the presumed foodplant, *Rumex acetosa* is found. At the type locality, *R. acetosa* grows in depressions in open meadows where some moisture remains from the spring snow melt. Adults of *arctodon* do not stray more than 5 to 10 yards from the *Rumex* plant. Numerous females were collected from the flower heads while they were resting in the characteristic head-down, wings-folded-over-back *Lycaena* resting position. During cloudy periods, the females could be removed easily with forceps from the flower heads.

The region from which *arctodon* has been described is not frequented by many collectors. The butterfly undoubtedly occurs elsewhere in the contiguous areas in appropriate habitat, but has not yet been collected. A single male *phlaeas* from the Wallowa Mts., Wallowa Co., Oregon is tenatively assigned to *arctodon.* As shown in Fig. **13,** the specimen is rather worn and appears to be slightly aberrant. The FW subapical spots are slightly elongated.

Figs. **19** and **20** illustrate the type locality for *L. p. arctodon.* Fig. **21** shows a mature *R. acetosa* plant growing at the type locality when the type series was collected. The mature plants varied from about 12 to 18 inches in height.

OTHER RACES OF L. PHLAEAS IN NORTH AMERICA

As shown in Fig. **1** collection records exist for various geographic areas in northwestern North America. Specimens from the Mackenzie Delta area (Tuktoyaktuk) are not typical *feildeni.* The copper color is brighter and the dorsal black spots are more distinct. Material from Meade River, Alaska (70°29' N) is close to *americana* in facies. The black spots on both wing surfaces are not quite so large as in *americana.* The specimens from Circle and Fairbanks, Alaska resemble *feildeni,* except that the dark FW border is much wider, and the subterminal orange band on the underside is quite well developed. Some specimens present quite a dusky aspect. McKinley Park specimens are somewhat larger in size than specimens from other Alaskan areas. The subterminal orange band (VHW) is pronounced and the specimens show slight but distinct tails. The copper color is quite bright.

Several unplaced specimens exist. In the collection of the Carnegie Museum is a specimen labeled "Trinidad, B.W.I." This is a very improbable locality for *L. phlaeas,* unless the specimen was imported. The butterfly appears to be typical *L. p. daimio* Seitz from Japan. The specimen has probably been mislabeled at some point in its history. The entomological collection at the University of California, Davis contains a male *phlaeas* from Wyoming taken 7.viii.35. A ranch locality is noted by its brand, but no country is listed. A search by the Wyoming Livestock Board back to 1909 has not found a registered Wyoming brand of the form shown on the label. The specimen appears to be *americana* rather than *arctodon.* The butterfly may have been an introduced specimen, or more probably was taken in another state and mislabeled.

F. M. Brown of Colorado Springs, has taken two specimens of *L. phlaeas* at the Fountain Valley School in El Paso Co., Colorado. Both were collected in October several years apart. Both are presumed to be imported *L. p. americana* (Brown, *in litt.*). The reason for this supposition is the collection date and locality. Many of the students at the school come from the Midwest and bring their own horses with them when they return to school in the fall and it is quite possible that

TABLE 1

SUBSPECIES	BLACK SPOTS		BLACK BORDERS - FW	ORANGE BORDERS - HW		COLOR	
	Dorsal FW	Ventral HW		Dorsal	Ventral	DFW	VHW
americana	Distinct. Critical spot (CS) frequently fused. Cell-end spot (CES) 1-1.5 mm wide.	Distinct. Postmedian row distally edged in white.	Wide, up to 15.5% of wing width, measured along vein Cu_1.	Wide & distinct.	Narrow, bright, & strongly crenulate.	Bright red copper.	Warm gray with suggestion of tan or light brown.
hypophlaeas	Distinct. CS double or only slightly fused. CES = 1 mm.	Distinct. Postmedian row with only suggestion of white edging distally.	Moderately narrow, 7.7% of wing width maximum.	Wide & distinct.	Very narrow, strongly crenulate & bright.	Brassy copper, dusky aspect esp. in males.	Ashy-gray.
feildeni	Delicate. CS double, small & concave if fused. CES = less than 1 mm.	Very small & sometimes indistinct; distal white edging present.	Narrow 7.2% of wing width, maximum.	Relatively narrow but distinct.	Very narrow & frequently indistinct.	Dull brassy copper, smoky but washed out aspect.	Dark ashy-gray.
arethusa	Distinct. CS double & distinct. Generally concave out if fused CES = 1 mm.	Very small; distal white edging present.	Wide, up to 14.3% of wing width.	Wide & distinct.	Narrow & rather faint in some specimens.	Dull, red-brassy copper, very smoky or dusky cast in most males.	Warm ashy-gray, lighter areas in postdiscal cell spaces.
arctodon	Distinct. CS (see text). CES = 1 mm.	Distinct; white edging nearly obsolete in most specimens.	Moderately wide, up to 10.6% of wing width.	Wide & distinct.	Very narrow, delicate, but distinct.	Bright brassy copper tending to coppery-red in females, dusky cast in many males.	Cool pale gray.
northern Alaska & western NWT races	Northern populations as in *feildeni*, specimens tend to become larger, more heavily and brightly marked in south central Alaska (McKinley National Park). Orange band on both surfaces of the hindwing becomes quite wide and very distinct in McKinley Park specimens.						

pupae of *americana* were contained in hay bales brought with the horses. *Rumex* is frequently found growing in hay fields. The specimens were sent to two museums when the Brown collection was distributed. They have, however, disappeared in transit and cannot be located in the two museum collections involved.

Hooper (1973) has listed *L. p. arethusa* for Saskatchewan based upon one specimen collected in a prairie region near Regina. The specimen was unavailable for examination, but it is undoubtedly *americana* based upon the locality.

When more material from Alaska becomes available for study, it will probably be found that one or more of those populations merit nomenclatural recognition. At the present time, insufficient study material is available. Dr. K. W. Philip, Fairbanks, Alaska, is working on these populations.

L. phlaeas is frequently sympatric and synchronic with *L. cupreus* (Edwards). J. F. Emmel (*in litt.*) has noted that *cupreus* in California replaces *phlaeas* in similar habitates in the Sierra Nevada Mountains. In that area, *L. cupreus* uses *Rumex paucifolius* Nuttall and *R. acetosella* L. as larval hostplants. In Colorando, Bruce (1896) found a larva of *L. cupreus snowi* (Edwards) on *Oxyria digyna*. On the Beartooth Plateau, *cupreus* and *phlaeas* fly together within exactly the same meadow. When the type series of *L. p. arctodon* was collected in 1973, several specimens of *L. cupreus* were taken concurrently. The specimens were somewhat worn, suggesting that *cupreus* may appear slightly earlier in the season. *Rumex acetosa* is the suspected larval foodplant for *cupreus* in this locality.

Work needs to be done on the habits of *cupreus* in the Rocky Mountains. In Colorado, *snowi* has been reported only from above timberline. In Wyoming and Montana, both low altitude (Transition Zone) and high altitude (Arctic-Alpine Zone) populations exist. The author has also collected *cupreus* in the Transition Zone near Sun Valley, Idaho.

It has been suggested by some workers that *cupreus* and *phlaeas* may be conspecific. Gunder (1926) in his discussion of *cupreus* commented: "*Note:* An aberrant

cupreus has been taken at Mammoth which is identical with *hypophlaeas."*

Elrod (1906) reported *L. phlaeas* from Miles City, Custer Co., Montana. He commented "Not rare at Miles City (Wiley). We have not taken it." The butterfly has not been reported in recent years from this area. Presumably *L. p. americana* would be the species found at Miles City.

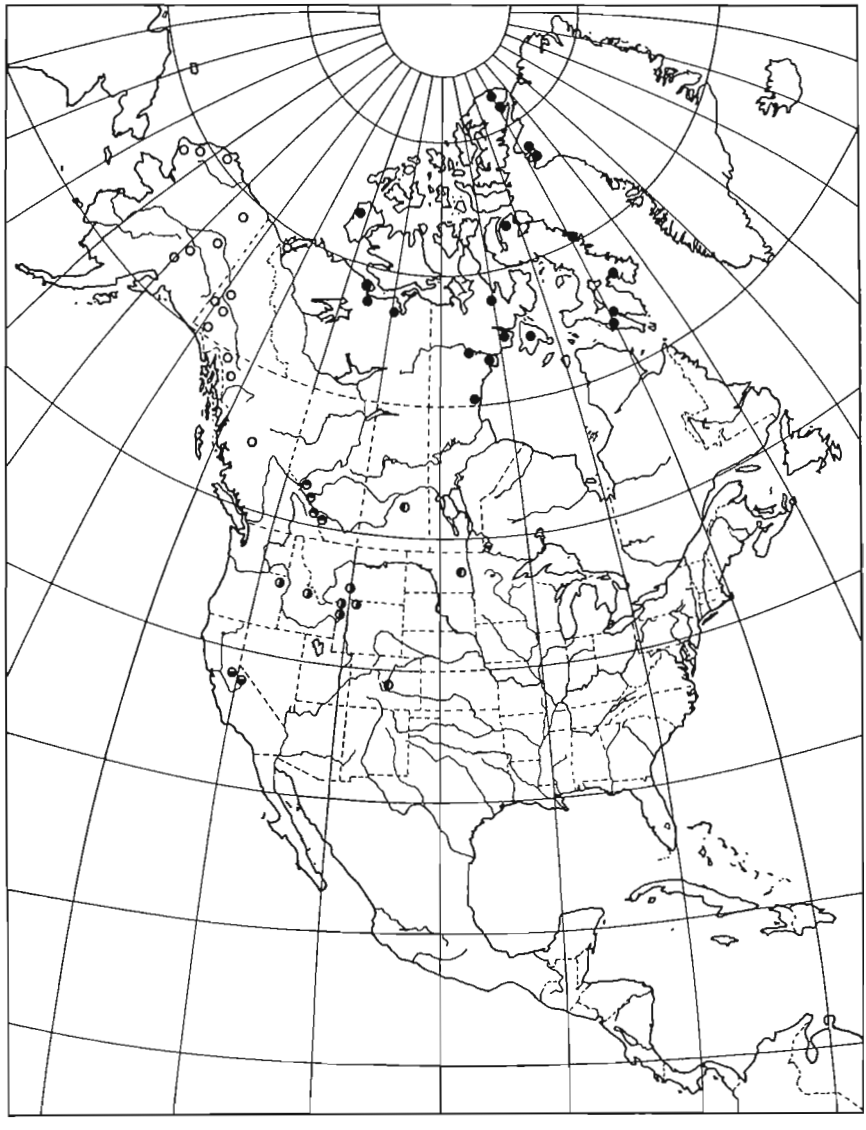

Figure 1. Distribution of arctic-alpine *L. phlaeas* in North America. The open circles represent unnamed races; solid circles = *feildeni;* circles with top half solid = *arethusa;* circles with bottom half solid = *hypophlaeas;* circles with left half solid = westernmost extension of *americana;* circles with right half solid = *arctodon.*

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The determination of *Rumex acetosa,* the presumed larval foodplant of *L. p. arctodon* was made by the staff of the Rocky Mountain Herbarium located at the University of Wyoming.

Mr. N. V. Blakeslee of the National Geographic Society, Washington, D.C., kindly provided geographic coordinates for some of the little known arctic localities cited in Fig. **1.**

The author would like to express his appreciation to Dr. Lee D. Miller and Mr. A. C. Allyn for making publication of this paper possible.

APPENDIX

Collection Records

Material Studied:

CANADA. ALBERTA: Plateau Mtn., 8200', large series 1-22.viii.68-71. NORTHWEST TERRITORIES: Tuktoyaktuk (Port Brabant), Mackenzie Delta, 25.vii.42, 2♂, ♀ (CM); Baker Lake, 9.vii.73, ♂, 16.vii.73, ♂ (CDF). Southampton Is., 1.viii.30, 2 ♂, 3.viii.30, ♂, 5.viii.30, ♀ (CM).

GREENLAND. McCormick's Bay, 4.viii.92, ♀, 6.viii.92, ♀; Robertson's Bay, 2.vii.92, ♀ (CM).

ALASKA. Meade River, 70°29' N, 157°24' W, 22.vii.73, ♂, ♀ (CDF); McKinley Park, Toklat River, 3050'-4250', 19.20.vii.62, 2♂, 2 ♀ (JAL); Circle, no date, 2 ♂, 2 ♀ (CM); Fairbanks, 31.vii.05, ♀ (CM).

CALIFORNIA. *Mono Co.:* Mammoth Mtn., 27.vii.34, ♂ (LACMNH); Barney Lake, 4.viii.35, ♂ (LACMNH); S. of Sonora Pass, 10,600', 21.viii.71, ♂ (CDF), *Tuolumne Co.:* Yosemite N.P., N. slope Mt. Dana, 11,000'-11,500', 6.viii.60, ♀, 7.viii.60, ♂, 8.viii.60, ♂, 9.viii.60, ♀, 13.viii.60, ♂, ♀ (LACMNH); 9.viii.60, ♂, ♀ (CDF); 6.viii.66, ♂, 3 ♀ (LACMNH); Kuna Crest, 11,000', 6.viii.33, ♂; Mt. Maclure, 12,500', 5.viii.33, ♂ (LACMNH).

IDAHO. *Lemhi Co.;* Meadow Ck. Lake, 4 mi. W. of Gilmore, 9000', Lemhi Range, 1.viii.72, ♂ (AME).

MONTANA. *Carbon Co.;* Beartooth Pass and Beartooth Plateau, 10,300'-10,900', 9-12.viii.41, 5 ♂ (AMNH); 15.viii.42, ♀ (AMNH); 5.viii.72, ♂; 31.vii-3.viii.73, 46 ♂, 39 ♀ (CDF).

OREGON. *Wallowa Co.:* Eagle Cap Wilderness Area, E. side of Matterhorn, Wallowa Mts., 16.viii.64, ♂ (CWN).

WYOMING. *Teton Co.:* Teton Glacier, Teton Mts., 19.vii.31, ♂, ♀ (AMNH); Yellowstone N. P., Mt. Washburn, 10,300', 16.vii.34, ♀, (AME); 10,366', 8.viii.35, ♀ (AME); 10,000', 22.vii.36, ♂ (AME).

Records of specimens examined by photograph or not examined:

CANADA. ALBERTA: Banff, 23-25.vii, "1" (AMNH); nr. Billings Lumber Mill, Calgary, 19.vii.03, "1" (AMNH); Brobokton Ck., btwn, Lake Louise and Jasper, 8,12,13,16.vii.07 (BMNH & CNC); nr. the spruce woods, 20 or 25 mi. SW Calgary, 5.vii-20-? 4 ♂, 8 ♀ Dod, 1907, 6 *arethusa* paratypes in CNC, ♂ & ♀ "types" in USNM); Crow's Nest Pass, S. Alberta (G. Geddes in Dod, 1907); Fallentimber Ck., 51°45' N,

114°39' W, 5500' (JAL); Foothills, Lineham's lower log camp, S. Fk. Sheep Ck., ca. 35 mi. SW Calgary, ♂ (Dod, 1907); Peyto Lake, Banff N.P., 51°43' N, 116°31' W (*fide* J. Scott). BRITISH COLUMBIA: Atlin, 4000', 2.viii.55 (CNC); Moosehorn Lake, 58°10' N, 132°07' W, 4500' (CNC); Western slope, Mt. Sidney Williams, 54°N, 125°W, ca. 5500', 31.vii.53, ♂ (BMNH); Spray Lake, "2" (in Anon., 1962). NORTHWEST TERRITORIES: Arctic Bay, Baffin Land, 2.viii.42, "1" (AMNH); Baker Lake, 30.vi-7.vii.51 (CNC), "2", F.H. Chermock; Bathurst Inlet, 1.viii.51 (CNC), "1", (Wyatt, 1957); Bernard Harbour, 68°45' N, 114°45' W, 6.viii.15 (CNC); Caribou valley, head of Clyde Inlet, Baffin Is., 29.vii.50, 2 ♂, ♀, 31.vii.50, ♂ (BMNH); Chesterfield Inlet, vii.66, "1" (Anon., 1967); 7.viii.58 (CNC); Coppermine, 2.viii.51 (CNC), late vii. 55, "series" (Wyatt, 1957); Cockburn Point, Coronation Coast, 68°52' N, 115°0' W, 1,2.ix.14 (CNC); S. slopes of Dyke Mtn., head of Clyde Inlet, Baffin Is., 26.vii.50, (BMNH); Eskimo Point, "2" (F.H. Chermock); Falcon Hollow, head of Clyde Inlet, Baffin Is., 27.vii.50 (BMNH); Frobisher Bay, Baffin Is., 6-20.vii.48 (CNC), viii.64, ♂ (BMNH); Grinnell Land, W. side of Smith Sound, 81°45' N (Capt. Feilden, holotype ♂, allotype ♀, and paratype ♂ in (BMNH), in M'Lachlan, 1878, TL of *feildeni*); Hazen Camp, Ellesmere Is., 81°49' N, 71°18' W, 29,30.vii.66, 23.vi-31.vii.61 (CNC); Holman, Victoria Is., 5.vii.52 (CNC); Lake Harbour, Baffin Is., 7.vii.35 (CNC); Mellville Pen., 56°51' N (probably 66°51' N), 84°51' W, 19.vii.48 (CNC); Pelly Bay, 19.vii.52 (CNC); Penny Highland area, Cumberland Pen., Baffin Is., 5.viii.53, ♂ (BMNH); Repulse Bay, 28.vii-9.viii.50 (CNC); Southampton Is., 5.vii.30, "1" (AMNH); "2" (CM); Wagner River, NW Hudson Bay, 65°26' N, 88°40' W, "1" (F.H. Chermock). YUKON: Dawson (CNC); nr. Haines Jct., 1966; 64°31' N, 138°30' W, 1916 (CNC).

GREENLAND. Qanaq, MacCormick Fjord, 77°41', 26.viii.41, ♀ (Wolff, 1964).

ALASKA. Arctic Village, 15,20.vii.64 (Anon., 1965); Cape Thompson, 26-29.vii.61 (CNC); Driftwood, 68°49' N, 161°09' W, 6.viii.52 (CNC); Highway Pass, McKinley N.P. (Legge, 1965); McKinley N.P., 4.vii.31, ♂ (LACMNH); 20.vii-1.viii.31, "20" (AMNH), Toklat River (Legge, 1965).

CALIFORNIA. *Fresno Co.:* nr. Baboon Lake, 1.viii.60, sight record by J.C. Montgomery; ridge S. of Golden Trout Lake, 4.viii.60, 4 ♂ (JCM); N. side of peak 12,492', Wahoo Lake, 3.viii.60, 5 ♂, 3 ♀ (JCM); S. side of peak 12,492', Wahoo Lake, 5.viii.60, 2 ♂ (JCM); Mt. Starr nr. Mono Pass, 12,800', 27.viii.69, "1" (R.L. Langston); *Fresno-Inyo Co. line:* Bishop Pass, 12,000', 31.vii.60, ♀ (JCM); Mono Pass (CDM); *Inyo Co.:* Ruby Lake, 13.viii.57, ♂ (UCB); Mono Pass, 12,500', 3.ix.65, 2 ♀ (UCB); *Madera Co.:* W. Slope above Emerald Lake, 10,000', ¼ mi. S. Thousand Is. Lake, 14.viii.61, "1" (T.P. Webster); *Tuolumne Co.:* Bert Lake below Mt. Maclure, 11,700', 6.viii.33, ♂, (LACMNH), (Garth, 1935); Cathedral Lake, 9000-9500', 16.vii.29, "1" (AMNH).

MONTANA. *Carbon Co.:* Upper Rocky Ck., Red Lodge, 4.viii.54, ♂ (UCB); *Sweet Grass Co.:* Halfmoon Park, Crazy Mtns., ca. 15-20 mi. NW Big Timber, 3,4.vii.66, 2 ♂, ♀ (J. Scott).

WYOMING. *Teton Co.:* Amphitheater Lake, Teton Mtns., viii.49, ♀, (UCM, Nabokov, 1950); *Park Co.:* Beartooth Lake, 21.viii.49, ♂ (UCM).

Abbreviations Used: AME = Allyn Museum of Entomology; AMNH = American Museum of Natural History; ANSP = Academy of Natural Sciences, Philadelphia; BMNH = British Museum (Natural History); CDF = C. D. Ferris collection; CDM = C.D. MacNeill collection; CM = Carnegie Museum; CNC = Canadian National Collection; CWN = C.W. Nelson collection; JAL = J.A. Legge, Jr., collection; JCM = J.C. Montgomery collection; UCB = University of California, Berkeley, collection; UCD = University of California, Davis, collection; UCM = University of Colorado Museum; USNM = United States National Museum.

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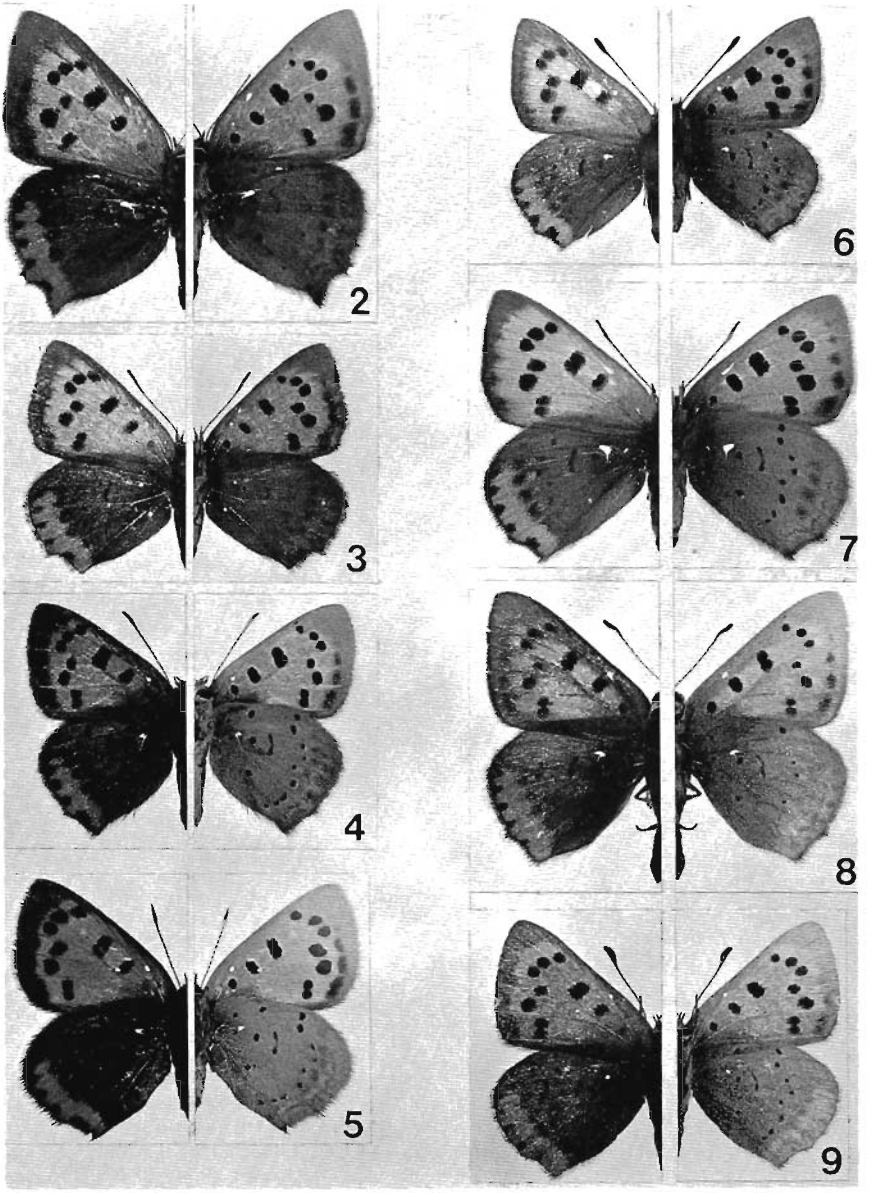
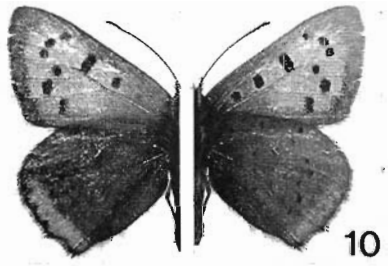
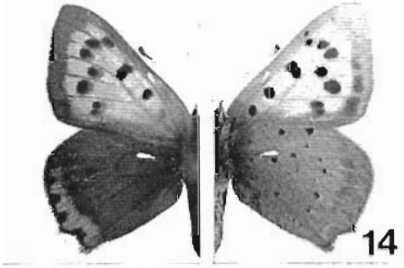
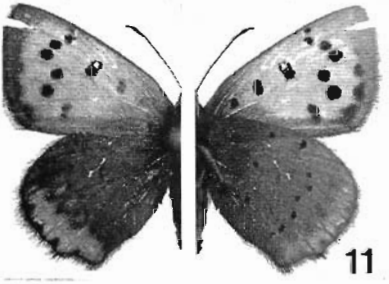
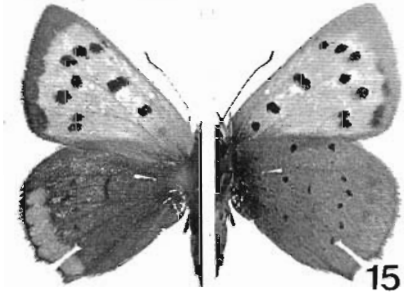


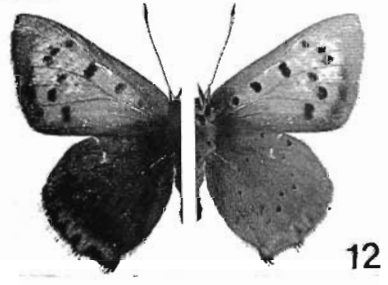
Figure 2. *L. p. phlaeas,* N. Knin, Bohemia, viii,55, ♂. Fig. 3. *L. p. phlaeas,* Vendée, France, 13.ix.54, ♀. Fig. 4 *L. p. americana,* Lincoln, Penobscot Co., Maine, 3.vi.64, ♂. Fig. 5. *L. p. americana,* Hoosick, Rensselaer Co., N.Y., 6.vi.67, ♀, Fig. 6. *L. p. hypophlaeas,* N. slope Mt. Dana, Yosemite N.P., 13.viii.60, ♂, (LACMNH). Fig. 7. Same, ♀, (LACMNH). Fig. 8. *L. p. arethusa,* Plateau Mtn., Alberta, 1.viii.69, ♂. Fig. 9. Same, 22.viii.68, ♀. Upperside shown at left; underside at right.

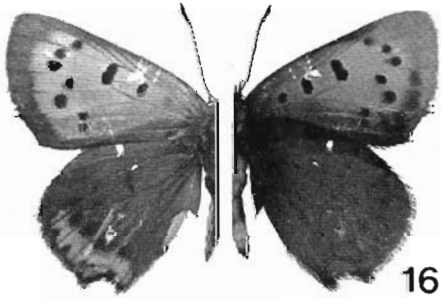












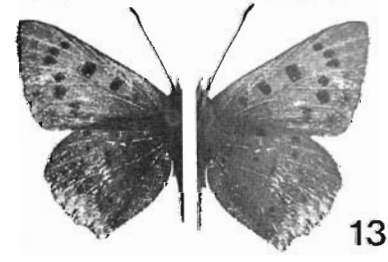
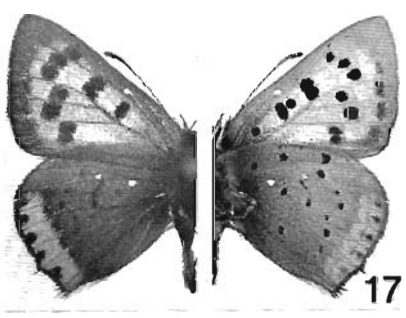
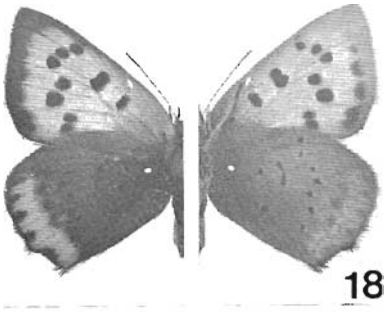
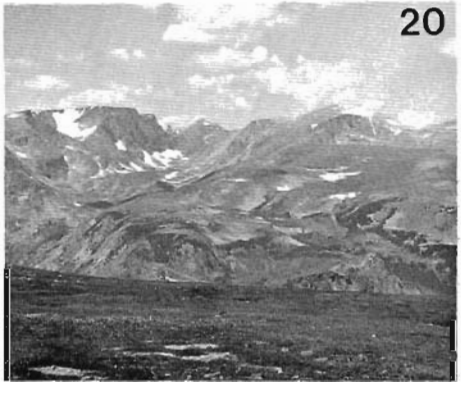


Figure 10. *L. p. feildeni,* Southampton Is., 3.viii.30, ♂, (CM). Fig. 11. Same. 5.viii.30, ♀, (CM). Fig. 12. *L. phlaeas* ssp., Toktoyaktuk (Port Brabant), Mackenzie Delta, NWT, 25.vii.42, ♂, (CM). Fig. 13. *L. phlaeas* ssp. (see text), Eagle Cap Wilderness Area. E. side Matterhorn, Wallowa Co., Ore., 16.viii.64, ♂ (CWN). Fig. 14. *L. phlaeas* ssp., Meade River, Alaska, 22.vii.73, ♂. Fig. 15. Same, ♀. Fig. 16. Same as 12, ♀, (CM). Upperside shown at left; underside at right.







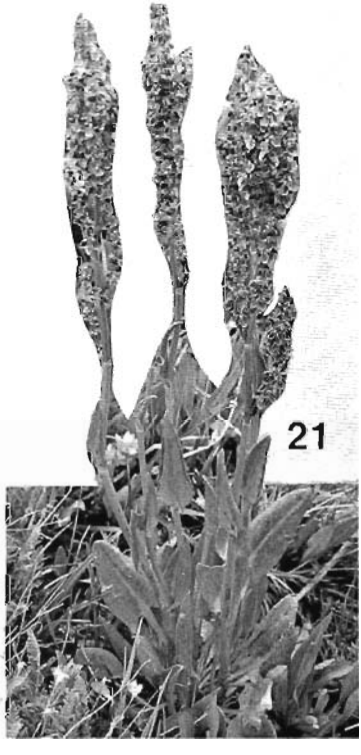


Figure 17. *L. p. arctodon* Ferris, holotype ♂, Beartooth Pass Area, 10,300', Carbon Co., Mont., 3.viii.73. Fig. 18. *L. p. arctodon* Ferris allotype ♀, same locality, 1.viii.73. Upperside at left; underside at right. Fig. 19. Type locality meadow on E. side of Beartooth Pass viewed from Hwy. 212. Fig. 20. Beartooth Mtns. viewed from W. summit of Beartooth Pass along Hwy. 212. Fig. 21. *Rumex acetosa* plant photographed at type locality of *L. p. arctodon.*