

A NEW RACE AND DISCUSSION OF THE *BOLORIA EPITHORE* COMPLEX (NYMPHALIDAE)

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INTRODUCTION

On the basis of published records, six species of the genus *Boloria* Moore are known to occur in the state of Washington. They are *B. titania* (Esper), *B. selene* (Denis & Schiff.), *B. astarte* (Doubleday), *B. toddi* (Holland), *B. freija* (Thunberg), and *B. epithore* (Edwards). Of these, only *selene* ssp. and *epithore* have been encountered in Oregon. In California, the only known representative of the *Boloria* complex is *epithore*. In this paper, the authors shall endeavor to examine and discuss the entity known simply as *epithore* for more than a century.

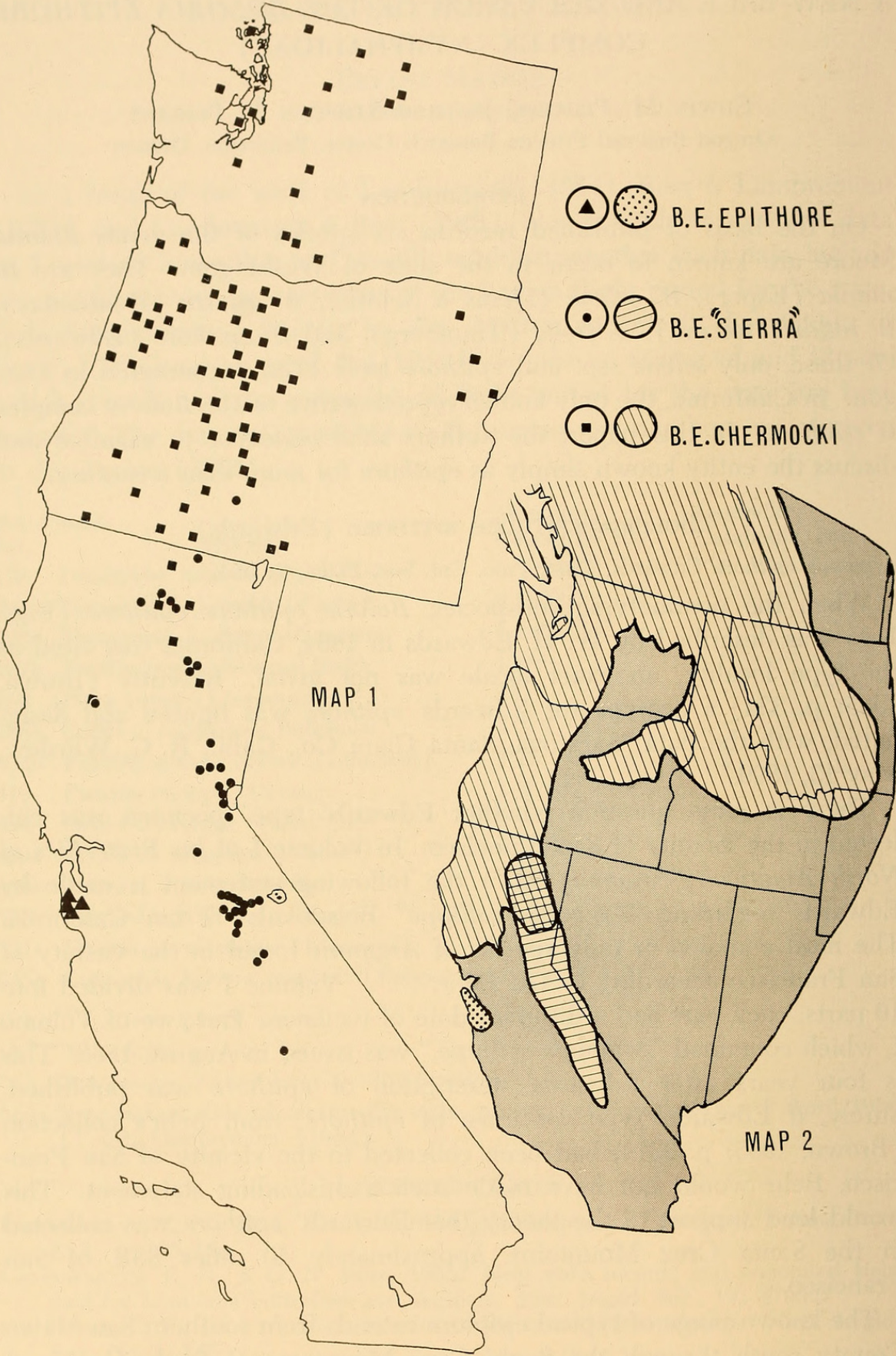
BOLORIA EPITHORE EPITHORE (Edwards)

Argynnis epithore Edwards, 1864, Proc. Ent. Soc. Phila., 2: 504.

When the nominotypic subspecies, *Boloria epithore epithore* (Figs. 1-4) was described by W. H. Edwards in 1864, California was cited as the type locality; an exact locale was not given. Recently (Brown, 1965: p. 334) a neotype for Edwards' *epithore* was figured and designated, with the data "Saratoga, Santa Clara Co., Calif., R. C. Winslow, May 13, 1899."

There is some question whether Edwards' type specimen was collected in the vicinity of San Francisco. In Volume I of his *Butterflies of North America* ("Argynnis VI.") the following statement is made by Edwards regarding "*Argynnis callippe*" Boisduval: "From California. The most common or only species of *Argynnis* found in the vicinity of San Francisco according to Dr. Behr. . . ." Volume I was divided into 10 parts; each part had a different date of issuance. Part two of Volume I, which contained "*Argynnis callippe*," was issued in August, 1868. This is four years after Edwards' description of *epithore* was published. Surely, if Edwards' type specimen of *epithore*, from Behr's collection (Brown, 1965: p. 337), had been collected in the vicinity of San Francisco, Behr would not have made such a misleading statement. This would lend support to the theory that Edwards' *epithore* was collected in the Santa Cruz Mountains, approximately 40 miles SSE of San Francisco.

The known range of typical *epithore* extends from southern San Mateo County south through the Santa Cruz Mountains of Santa Cruz and Santa Clara counties (Map 1). R. L. Langston (*in litt.*), of Berkeley,



California, and O. E. Sette (*in litt.*) of Los Altos, California, state that they have never encountered *epithore* north or south of these limits. However, in 1910, Williams (Ent. News, 31: 30) stated that *epithore* had been collected "a good many years ago" in Golden Gate Park, San Francisco. Thus, there is reason to believe that the species did range northward prior to the concentrated urbanization of the San Francisco peninsula. Throughout its limited range, colonies of *epithore* are local and not easily discovered.

The authors have examined a series of 23 males and nine females from the following locales:

SANTA CRUZ CO.: Vicinity Boulder Creek, Big Basin, 1200 feet.

SAN MATEO CO.: San Lorenzo Woods, 600 feet.

Statistical data pertinent to typical *epithore* is outlined in Table 1.

In describing the superficialities of *epithore*, Edwards' original description will be utilized:

"*Argynnis epithore*, Boisduval *in litt.* . . . Male. Expands $1\frac{5}{10}$ inch. Primaries rounded as in *Myrina*, not angular at apex and excavated on the margin, as in *Bellona*, to which last it is most closely allied. Upper side pale fulvous at the base; hind margins bordered by a slight, interrupted line, with small lunules; otherwise the usual markings. Under side of primaries fulvous, yellowish at apex, with ferruginous sub-apical patch. Secondaries have an angular submesial band of irregular spots, as in *Bellona*, each whitish, sprinkled in the centre with ferruginous, in the cell a round black spot; beyond the band to the margin a slight violet tinge, with a submarginal series of round spots and marginal lunules."

Although somewhat cursorily treated, the foregoing description is applicable to those *epithore* which occur in the Santa Cruz Mountains. There are, however, two discrepancies. Edwards indicated that the submedian-median band of the ventral secondaries contains "spots, as in *Bellona*, each whitish, sprinkled in the centre with ferruginous . . ." Of the 32 examples examined by the authors from the Santa Cruz Mountains, only one, weathered female displays "whitish" spots. However, even these spots have a noticeably yellowish hue; the remainder of the series have yellowish cream spots. Perhaps Edwards' connotation—"whitish"—was intended to imply an off-white color. Secondly, Edwards' explicit comment regarding the "pale fulvous" color of the dorsal, basal regions is not consistent with the 32 examples used in this study,

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EXPLANATION OF MAPS

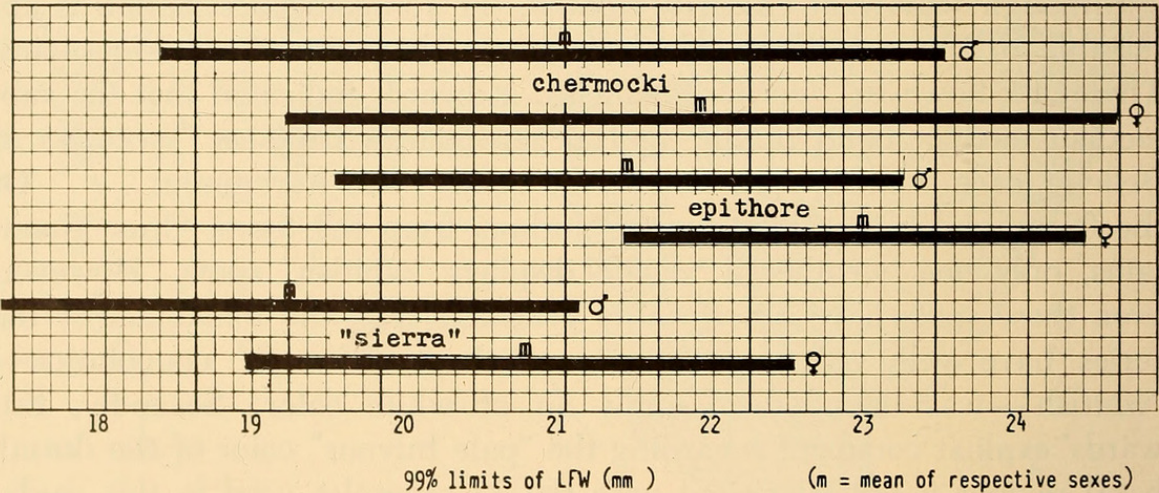
Map 1: Distribution of *Boloria epithore* complex in the Pacific Coast states. Each symbol corresponds to one or more specimens used in this study.

Map 2: Projected distribution of *Boloria epithore* complex in western North America based upon records and specimens of the authors.

TABLE 1

	<u>CHERMOCKI</u>		<u>EPITHORE</u>		<u>"SIERRA"</u>	
	male	female	male	female	male	female
N	72	66	23	9	57	27
99% limits	21.10+2.53	22.01+2.74	21.50+1.78	23.00+1.39	19.30+1.91	20.79+1.80
Mean (mm)	21.10	22.01	21.50	23.00	19.30	20.79
P. ^e .m. (mm)	0.08	0.09	0.10	0.19	0.08	0.13
S.D. (mm)	0.98	1.06	0.69	0.54	0.74	0.70
v	24.22	27.95	11.76	7.38	13.50	12.23
σ	4.919	5.283	3.429	2.717	3.674	3.507
"t score" compared to:						
<u>CHERMOCKI</u>	-----	-----	2.86	4.50	18.00	7.18
<u>EPITHORE</u>	2.86	4.50	-----	-----	15.71	9.21
<u>"SIERRA"</u>	18.00	7.18	15.71	9.21	-----	-----

TABLE 2



since all were found to have black or fuscous dusting on the hindwings dorsally (usually extending outwardly as far as the postbasal region); the forewings dorsally have only slight black, basal dusting. Thus, these specimens are certainly not "pale fulvous at the base." The male specimen used by Edwards in describing *epithore* may have been an extreme example, which was generally very light in coloration. In size, Edwards'

type (which measured "1 $\frac{5}{10}$ inch" in expanse, or approximately 38 mm) is slightly smaller than the average size of those Santa Cruz County specimens examined.

The recently designated neotype of *epithore* has a left forewing (LFW) measurement of 24 mm (Brown, *in litt.*). This expanse is somewhat larger (Table 2) than that average measurement derived by the authors, although a difference in locality and altitude may account for this variation.

BOISDUVAL'S USE OF THE NAME EPITHORE

The introduction of the name *epithore* cannot be attributed to Edwards, although he was the first to publish it. In his original description, Edwards states: "This species, as I am informed by Dr. Behr, is undescribed and only named in letters of Dr. Boisduval." The original description in which Boisduval used the name *epithore* appeared in 1869 (Ann. Soc. Ent. Belg., 12: 58; no. 50).

In an attempt to determine the locality from which Boisduval's type of *epithore* was collected, the authors have encountered certain contradictory information.

The lectotype of Boisduval's *epithore* (figured by Brown, 1965: p. 335) is in the collection of the Carnegie Museum. Its superficial appearance is analogous to female *epithore* from the Santa Cruz Mountains. The large size—25.0 mm LFW (Brown, *in litt.*)—is characteristic of typical *epithore*; however, the greatest LFW measurement made by the authors on female *epithore* from Santa Cruz County was only 24.0 mm. Table 2 indicates that the LFW radius of the lectotype of Boisduval's *epithore* exceeds the "99% Limits" (Brown, 1951) of the series used in this study.

The specimen figured by Brown as the "Type" of *Argynnis epithore* Boisduval has an unconnected median row of black spots on the dorsal secondaries. On the primaries these spots tend to be slightly fused or connected by transverse black scales along the veins. This characteristic is common only to nominotypic *epithore*. Conversely, the lack of connected spots is sometimes evident in Plumas County material. In addition, the specimens from this latter region are not as large as those which occur in the Santa Cruz Mountains. The greatest LFW measurement of female *epithore* from Plumas County was 22.5 mm. Furthermore, Boisduval refers to the submedian-median area of the ventral secondaries as being "jaune saupoudrée de brun" (brown-powdered yellow). This coloration is not only visible on *epithore* from the Santa Cruz Mountains, but also on specimens from populations inhabiting Plumas County. In his original description, Boisduval states: "M. Lorquin a trouvé cette

espèce dans les hautes montagnes de l'est où elle est fort rare et difficile à prendre" (Mr. Lorquin found this species in the high mountains of the east where it is extremely rare and difficult to capture). Although it would seem that he clearly indicated that the material he had examined did come from an area or areas in the mountains of eastern California, a statement in Volume 3 of Edwards' *Butterflies of North America* strongly indicates that Boisduval's locality statement may be misleading.

From "Argynnis VIII."—"Argynnis *adiante*" Boisduval, Edwards states: "The male figured on our Plate is the original type of Dr. Boisduval, sent me by himself, and bearing his label as 'type *adiante*'." Edwards then quotes Boisduval as saying: "This beautiful *Argynnis* was taken in some numbers by M. Lorquin, on the edges of the woods, in the eastern part of California." Edwards continues: "Of late years *adiante* has not been a very common species in collections, owing to its local habits, apparently. Professor J. J. Rivers writes me that 'it is found above Los Gatos in the Santa Cruz Mountains. It also occurs at several localities in the same range, and in Santa Clara and San Mateo counties; but it does not appear to be found farther south than about nine miles north of Santa Cruz city.' Apparently Dr. Boisduval was mistaken in the locality." Boisduval described *adiante* (now a synonym of *Speyeria egleis adiate* (Edwards)) on page 61 of the same publication which contained his original description of *epithore*. Both the *adiante* and *epithore* types used by Boisduval in his original descriptions were collected by Lorquin. In both original descriptions, Boisduval referred to eastern California and the high mountains of the east as the localities from which the respective types were collected. However, dos Passos & Grey (1947) fixed the type locality for *adiante* as the "Santa Cruz Mountains, California." The type locality for Edwards' *adiaste* is also in the vicinity of the Santa Cruz Mountains.

In view of the above information, it becomes apparent that Boisduval's type of *epithore* most probably was collected in the vicinity of the Santa Cruz Mountains and not somewhere in "the high mountains of the east."

Because Boisduval's original description of *epithore* appeared five years after Edwards' use of the name, Edwards' *epithore* takes priority.

ELDORADO Strand

Brenthis epithore Boisduval, cum. ab. *eldorado* Strand, 1914, Archiv für Naturgeschichte, 80(A) pt. 11: 156.

Embrik Strand described *eldorado* on the basis of six examples from Plumas County, collected from June 10 to June 17, 1913, and one speci-

men from El Dorado County, collected between June 25 and June 28, 1913.

The distinguishing features indicated by Strand in his description are: (1) the black markings on the underside of the forewings are large and consequently appear to be near to one another; (2) the two transverse spots in the middle of the field (in cells M_3 and CU_1) are connected by means of a median, black longitudinal line; (3) the angled figure in the cells (discal cell) completely or almost completely touches the discocellular spots; and (4) the three or four postmedian spots touch or almost touch the transverse lines in the form of black flecks. Strand also mentions that the black design above is stronger in both wings.

From this information and a study of material from both Plumas and El Dorado counties, the authors conclude that Strand's name, *eldorado*, represents an aberration. However, the degree of divergence from the normal form does not appear to be extensive. Under the rules of the International Code of Zoological Nomenclature, *eldorado* must be regarded as being of infrasubspecific rank.

WAWONAE Gunder

Brenthis epithore Bdv., ab. *wawonae* Gunder, 1924, Ent. News, 35(5): 156.

The type of *wawonae* was collected at Wawona (in Yosemite National Park), Mariposa County, California on July 6, 1922 and is pictured in J. A. Comstock's *Butterflies of California*, Pl. 26, fig. 10. The distinctive feature of *wawonae* is found on the secondaries where the row of postmedian spots is "lacking."

As is *eldorado*, *wawonae* is now considered an infrasubspecific entity.

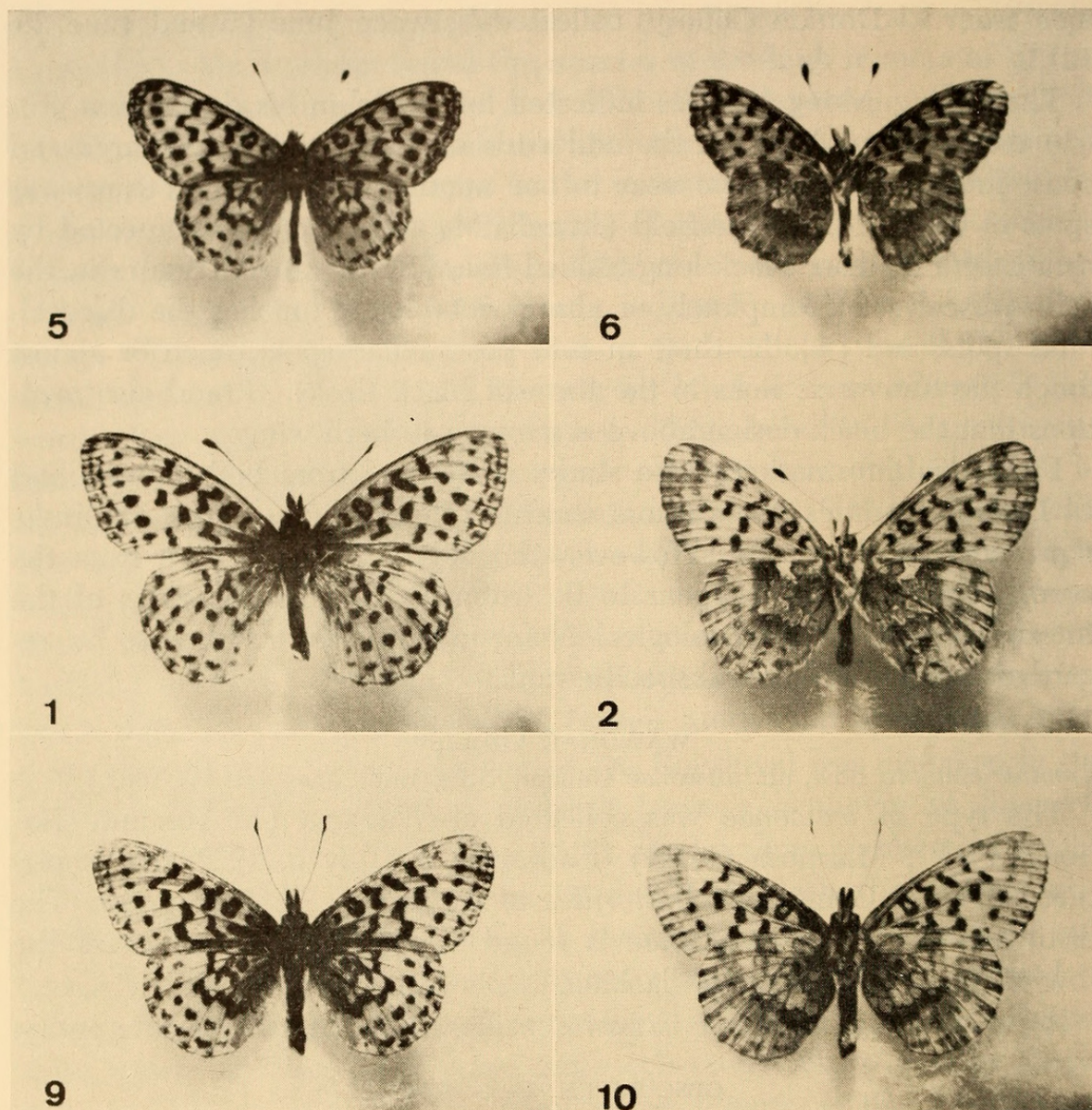
OBSCURIPENNIS Gunder

Brenthis epithore Bdv., ab. *obscuripennis* Gunder, 1926, Ent. News, 37(1): 7.

The type of this aberration, a female, was collected at Chilcolin, British Columbia, Canada, on May 30, 1915. In the original description Gunder states: "Primaries entirely fogged over with dark shading, obscuring and submerging maculation, especially on the inner half with cell quite dense where only a single yellow brown spot shows; normal row of round black spots indistinctly visible. Secondaries, outer half normal; confused yellow brown maculation of inner half externally edged by black shading which extends also along the costal margin, basal area quite dark." The above quotation applies to the dorsal surfaces. Because it is a melanic aberration, and since it was originally described as such, *obscuripennis* must also be considered infrasubspecific.

***Boloria epithore chermocki* Perkins and Perkins, new subspecies**

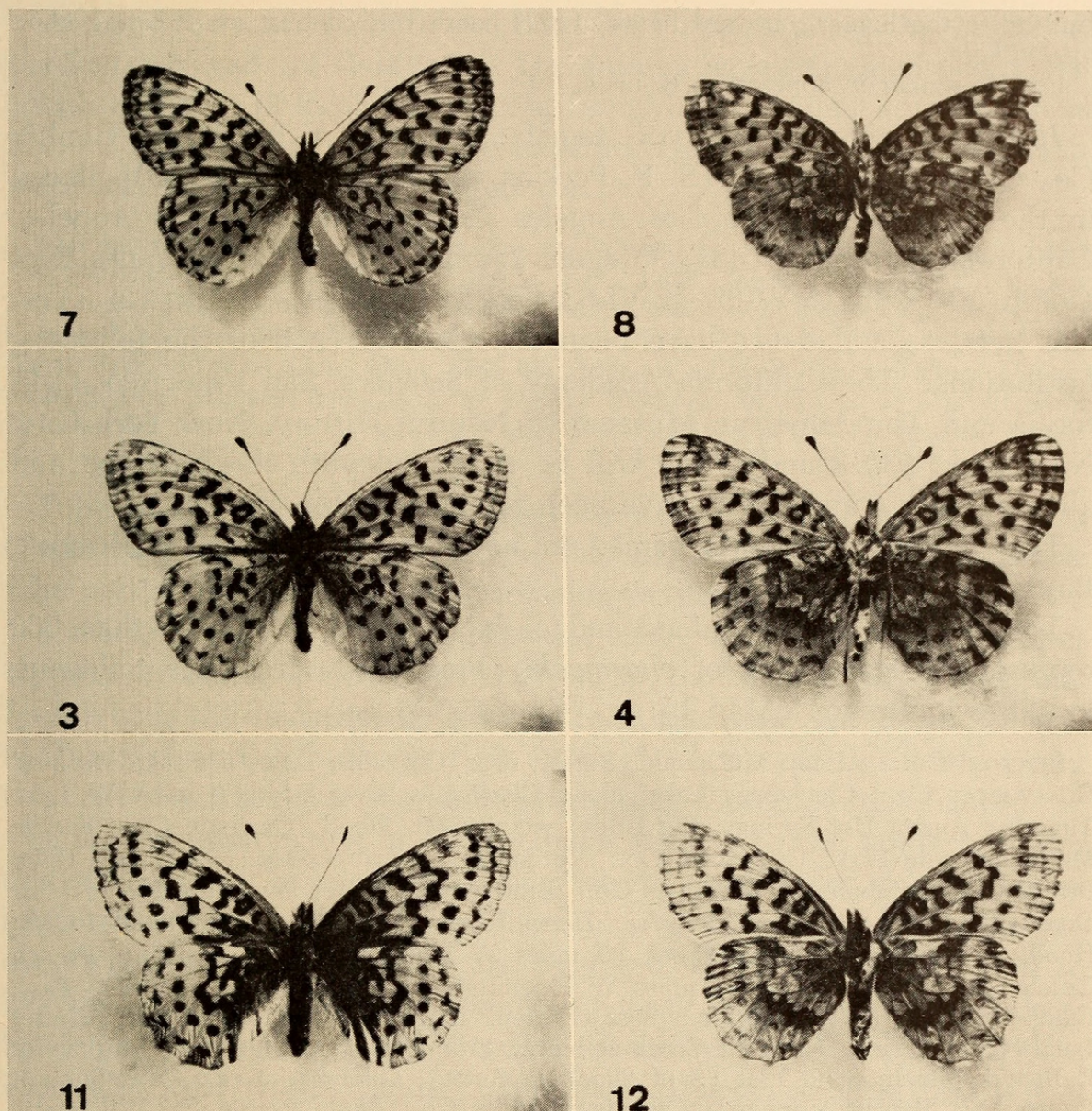
Males: Dorsal LFW (Expanse: 21.10 ± 2.53 mm), holotype 21.40 mm.



EXPLANATION OF PLATE I

Adult males of *Boloria epithore* complex: 5) "sierra," Donner Summit near Truckee, Placer Co., Calif., 3-VIII-60 (T. C. Emmel); 6) "sierra," Yosemite National Park, Mariposa Co., Calif., 3-VII-62 (E. M. Perkins, Jr.); 1) *epithore*, Big Basin, Santa Cruz Mts., Santa Cruz Co., Calif., 4-V-46 (O. E. Sette); 2) *epithore*, Big Basin, Santa Cruz Mts., Santa Cruz Co., Calif., 4-V-46 (O. E. Sette); 9) *cher-mocki* (holotype), 2.9 miles E Dolph, Yamhill Co., Oregon, 18-VI-62 (S. F. Perkins); 10) same, ventral aspect. Figures to the left are dorsal; those to the right are ventral.

Females: Dorsal LFW (Expanse: 22.01 ± 2.74 mm), allotype 23.00 mm. *Male*: Upper surface: Black spots within median band on both primaries and secondaries tending to be fused or connected, giving effect of a continuous, irregular black line; on typical *epithore*, these spots only slightly connected on primaries, on secondaries without connecting scales. Black basal suffusion heavily represented, often extending outwardly as far as submedian area; on *epithore*, black suffusion seldom extending beyond postbasal region. Segment of vein RS on secondaries bordering cell



EXPLANATION OF PLATE II

Adult females of *Boloria epithore* complex: 7) "sierra," Greenhorn Mts., Kern Co., Calif., 24-VI-61 (R. E. Stanford); 8) "sierra," below Huntington Lake dam, Fresno Co., Calif., 9-VII-60 (O. E. Sette); 3) *epithore*, Big Basin, Santa Cruz Mts., Santa Cruz Co., Calif., 6-VI-45 (O. E. Sette); 4) *epithore*, Big Basin, Santa Cruz Mts., Santa Cruz Co., Calif., 10-VI-45 (O. E. Sette); 11) *chermocki* (allotype), 2.9 miles E Dolph, Yamhill Co., Oregon, 18-VI-62 (E. M. Perkins, Jr.); 12) same, ventral aspect. Figures to the left are dorsal; those to the right are ventral.

noticeably accentuated by black scales connecting this segment to angled figure in cell; rarely an indication of this on *epithore*.

Undersurface: On secondaries, submedian-median row of spots chrome-yellow, this region in *epithore* cream to yellow with noticeably heavy, ferruginous dusting. Postbasal area of secondaries, below denticulate white spot bordering vein RS (infrequently invaded by yellow scales) yellow-brown to orange-brown (latter more common), in this respect, basal and postbasal areas analogous; these areas on *epithore* red-brown. Postmedian band of secondaries purplish to lilac inwardly, con-

trasting to the lighter, outward limits of this band; this contrast much less evident on *epithore*.

Female similar in appearance to male.

Holotype, male and allotype, female: 2.9 miles E of Dolph, Yamhill Co., Oregon, 18 June 62 (S. F. Perkins and E. M. Perkins, Jr.); placed in the collection of the Los Angeles County Museum, Los Angeles, California. Paratypes (48): Oregon, Yamhill Co.: 0.5 to 2.9 miles E of Dolph, 10-VI-62, 18-VI-62, 12-VI-63, and 27-V-65, 29 ♂♂, 19 ♀♀ (Perkins'); 6 ♂♂ and 4 ♀♀ have been deposited in each of the following institutions: The California Academy of Sciences, San Francisco, California and The American Museum of Natural History, New York City, New York; 9 ♂♂ and 6 ♀♀ will be deposited with the holotype and allotype; 8 ♂♂ and 5 ♀♀ have been retained by the authors.

This new subspecies is named in honor of Franklin H. Chermock, Baltimore, Maryland.

The authors have examined and/or have records for more than 300 representative examples of *chermocki* (Figs. 9–12) from the following localities in Oregon (Map 1):

BENTON CO.: Alsea; McDonald Forest near Corvallis; Mary's Peak; Hoskins. CLACKAMAS CO.: Clackamas Lake; along Clackamas River Road; 6 miles W Lake Timothy; Austin Hot Springs; Big Eddy; vicinity Mt. Hood. CLATSOP CO.: Saddle Mountain State Park. COLUMBIA CO.: Vernonia. DESCHUTES CO.: Deschutes River Bridge (W Terrebonne). DOUGLAS CO.: Bradley Creek Meadows; junction of Muir Creek–Rogue River; Diamond Lake. HOOD RIVER CO.: Cloud Cap Road to Mt. Hood. JACKSON CO.: Kane Creek (5 miles W Gold Hill); Mt. Ashland; French Gulch road; Tubb Springs (4 miles W Pinehurst). JEFFERSON CO.: Santiam Pass; Camp Sherman. JOSEPHINE CO.: near O'Brien. KLAMATH CO.: Davis Lake; Crater Lake National Park; Crescent Creek at highway 58; Skookum Meadows; 5–10 miles E Beaver Marsh; Sand Flat (S of Skookum Butte); Gilchrist. LAKE CO.: Summit Prairie (SE Warner Canyon); Lakeview. LANE CO.: Mule Prairie (N Willamette Pass); Oakridge; Hills Creek Dam road; Blue Pond Forest Camp; Willamette Pass. LINCOLN CO.: Elk City. LINN CO.: Cascadia; Monument Peak; Front Creek Camp (S Santiam highway); Tombstone Prairie; Lost Prairie; Marion Mountain; Big Meadows; Santiam Pass. MARION CO.: Elk Lake. POLK CO.: Valsetz; Falls City. TILLAMOOK CO.: Lee's Camp (Highway 6). UMATILLA CO.: NE Tollgate (Blue Mountains). WALLOWA CO.: Lostine River. WASCO CO.: Wapanitia; Bear Springs Campground. YAMHILL CO.: Baker Creek Valley and vicinity of Dolph.

Throughout its range, including Washington, southern British Columbia, southern Alberta, Idaho, Montana, and extreme north central California (refer to Map 2), *chermocki* remains constant in superficial appearance.

A DWARFED SIERRA NEVADA FORM—"SIERRA"

There remains one *epithore* entity which is pertinent enough to a complete discussion of the species complex to warrant inclusion in this paper.

A dwarfed form of *epithore* (Figs. 5–8) occurs along the length of the Sierra Nevada of California. The authors have examined nearly 100 specimens from 12 localities, ranging from Shasta County in the north to Kern County in the south. The localities from which these specimens were collected (Map 1) are as follows:

AMADOR Co.: 27 miles ENE Jackson. EL DORADO Co.: McKinney Creek, 3 miles SW Tahoma P.O., Lake Tahoe; Tahoma P.O., Lake Tahoe. FRESNO Co.: below Huntington Lake Dam; Round Meadow, Huntington Lake. KERN Co.: Tiger Flat Campground, Greenhorn Mountains. MARIPOSA Co.: Highway 120, Yosemite National Park. PLACER Co.: Deer Park Ski Area, 2 miles W Lake Tahoe; Donner Summit, near Truckee; Yuba Gap, W Donner Summit. SHASTA Co.: near Bigelow, 16 miles SE Mt. Shasta; 15 miles SW Mt. Shasta; 26 miles SE Mt. Shasta. SIERRA Co.: near Gold Lake Lodge. TEHAMA Co.: Mill Creek, 8 miles SW Mt. Lassen.

Populations of the typical dwarfed form occur neither north of Sierra County nor south of Kern County (Map 2). Within this range, its size (the outstanding characteristic) remains constant.

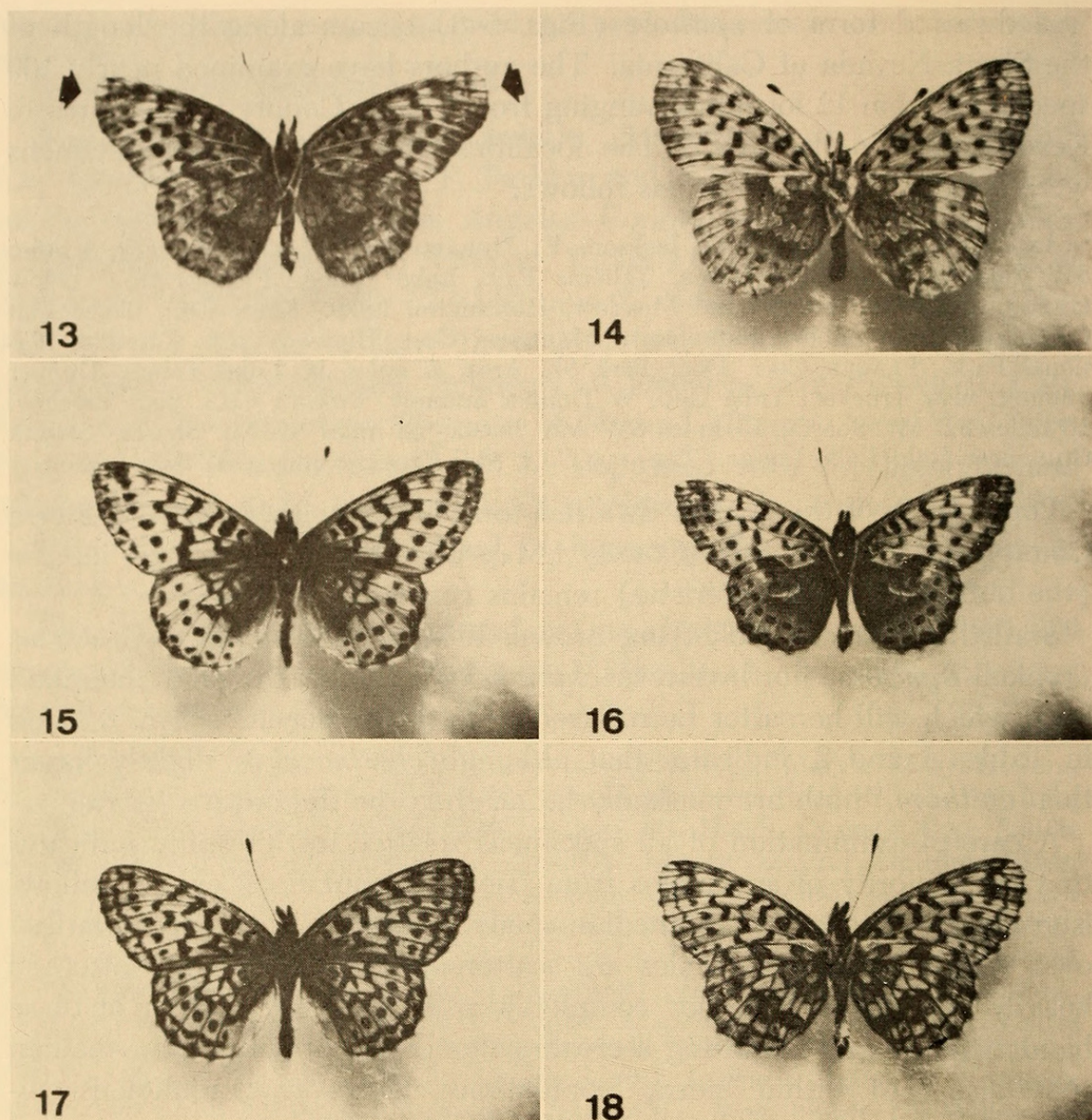
Statistical analysis (following Brown, 1951) of 254 *epithore* specimens (typical *epithore*, northwestern *chermocki*, and the dwarfed mountain form which will hereafter be referred to in this paper as “sierra”), listed in Tables 1 and 2, indicates that although *chermocki* is slightly larger than *epithore*,¹ both are markedly larger than the diminutive “sierra.”

A careful examination of all specimens relative to this study indicates that the majority of specimens from “sierra” populations evince yellowish-colored spots in the submedian–median bands (ventral secondaries) over which ferruginous scales are scattered. These scales are often so heavily aggregated that they completely mask the ground color of these bands. Specimens exhibiting a cream-colored row of submedian–median spots also exist within “sierra” populations. However, gradation is evident from one extreme (cream) to the other (yellow).

In 1961, Ray Stanford of Los Angeles, California discovered a population of “sierra” while collecting in the vicinity of Tobias Peak, located in the Greenhorn Mountains south of the Tulare–Kern county line. Several examples from this population display a golden-yellow, dorsal ground color. This phenomenon also exists to minimal varying degrees in typical *epithore* and *chermocki* populations.

It is debatable whether Stanford's Kern County capture represents the southernmost record for *epithore*. For instance, Lloyd M. Martin (*in litt.*) indicates one earlier record (“early 1930's”) from the Greenhorn Mountains of Kern County. The material was collected by Monroe Walton, of Glendale, California. However, both the deposition of the

¹ Based on the “99% Limits” comparison in Table 2. According to the mean comparisons in Table 1, however, *epithore* surpasses *chermocki* in size.



EXPLANATION OF PLATE III

Comparison of four species of *Boloria*: 13) *toddii ammiralis* Hemming, male, ventral, Baltimore, Baltimore Co., Md., 11-V-63 (F. H. Chermock); 14) *epithore* Edwards, male, ventral, Big Basin, Santa Cruz Mts., Santa Cruz Co., Calif., 4-V-46 (O. E. Sette); 15) *frigga sagata* Barnes & Benjamin, male, dorsal, Caribou Bog, Boulder Co., Colorado, 23-VI-64 (J. A. Justice); 16) *frigga sagata*, male, ventral, Caribou Bog, Boulder Co., Colorado, 23-VI-64 (J. A. Justice); 17) *kriemheld* Strecker, male, dorsal, 4 miles W Teton Pass, Teton Co., Wyoming, 17-VII-63 (E. M. Perkins, Jr.); 18) same, ventral aspect.

material and the precise locality of capture are unknown. Wright (1906, plate XVII, fig. 152) figured a lesser fritillary from the ". . . San Francisco Mts., Arizona, 1887; F. Stephens . . ." which he identified as *Boloria kriemheld* (Strecker) (1879)." However, Wright's locality information and classification are somewhat questionable. Kilian Roever (*in litt.*) and R. F. Sternitzky (*in litt.*) indicate that they have never encoun-

tered species of the genus *Boloria* in Arizona. In appearance, the specimen figured by Wright more closely resembles *epithore* than *kriemheld*. However, in his original description of *kriemheld*, Strecker indicated that he not only had specimens from Colorado, but also Arizona. F. M. Brown (*in litt.*) states: "The types were taken in September on the Rio Florida (east of Durango) in southwestern Colorado by Lt. MacCauley. I have seen them and they are so labeled." The authors have examined examples of *kriemheld* from the Uintah Mountains of Summit County, Utah. These specimens are definitely *kriemheld*, not *epithore*, with which they have often been confused. Extensive series from western Wyoming have also been examined; the name *kriemheld* applies to these as well. A comparative discussion of these entities will follow later in this paper.

Assuming conducive criteria to be present (both climatic and ecological), species of *Boloria* (perhaps *kriemheld* since Arizona was included in its original description), might exist in the San Francisco Peaks of Coconino County. Roever (*in litt.*) states: "Although surface water is generally nonexistent in that area, there is one wet meadow at about 9,000'. There are also a number of likely spots for *Boloria* in the White Mountains which I have checked without success."

Coincident to this study, the authors considered the possibility that "sierra" might represent an unnamed subspecies. However, since the only constant, major distinction between it and typical *epithore* is size, there seems little justification in assigning a name to it.

Clinal tendencies of the dwarfed "sierra" are evident in Sierra County. Northward, in Plumas County, the specimens become larger and possess submedian-median rows of yellow spots on the hindwings ventrally which, although similar to those of *chermocki*, are subdued by fulvous-colored dusting. In each of the northern California populations examined by the authors (Sierra County, Plumas County, and Shasta County) there are intermixed specimens which resemble *epithore*, "sierra" and *chermocki*. In Klamath County, Oregon, occasional examples resemble the Sierran dwarf, although the yellow of the submedian-median row of spots on the hindwings ventrally is more vivid. A moderate dusting of these spots exists which is not unlike examples from both Plumas and Shasta counties.

The authors contend that naming of an entity which exhibits such extreme variability (not only within a single population, but from population to population) would add to the already replete lists of synonymic redundancies. Both *epithore* and *chermocki* are consistent within and among given populations.

COMPARISON OF EPITHORE COMPLEX TO OTHER SPECIES

Confusion apparently exists among the species *toddi* (Holland), *frigga* (Thunberg), *kriemheld* (Strecker), and *epithore*. The authors have included figures of *Boloria toddi ammiralis* (Hemming), *Boloria frigga sagata* (Barnes & Benjamin), *Boloria kriemheld* (Plate III), and representative examples of the *epithore* complex (Plates I, II).

The distinctive feature of *toddi* subspecies (Fig. 13) is found on the forewings. The outer margin is strongly convex towards the middle, and "cut off" near the apical area (Fig. 13, arrows), then concave above the tornal angle, as opposed to a slight, uniform convex curvature of the outer margin of the other species.

The dorsal ground color of *frigga sagata* (Fig. 15) is more somber (less orange) than that found in the *epithore* complex. The black dusting of the basal area of the hindwings dorsally is more extensive in *sagata* than noted among individuals of *epithore*. The discal region of the hindwings ventrally (Fig. 16) is heavily clouded with fulvous scales; in cell M_2 of the submedian–median band, a nearly oval spot occurs in which the upper half is fulvous and the lower half white. This dichromatic spot is not found in *epithore*.

The discal and basal areas of the hindwings ventrally of *kriemheld* (Fig. 18) are completely free of dusting, unlike the *epithore* complex (Fig. 14). The postbasal and submedian bands are in strong contrast to one another; the submedian band is pale yellow and the postbasal band is red–brown to orange–brown. The veins are prominently dusted with black scales on the upper surface (Fig. 17). This characteristic is not typical of any of the *epithore* constituents.

It is hoped that a comparison of the figures will serve to differentiate the four species discussed herein and that utilization of the text will facilitate future determinations.

CONCLUSIONS

(1) The *Boloria epithore* complex presently consists of two distinct subspecies. They are: *Boloria epithore epithore* Edwards and *Boloria epithore chermocki* Perkins & Perkins. There also exists a dwarfed mountain form which must remain unnamed because of inadequate criteria for nomenclatorial designation.

(2) A revised treatment of the *epithore* complex is proposed:

603 *epithore* (Edwards), 1864

a. *e. epithore* (Edwards), 1864

ab. *eldorado* (Strand), 1914

ab. *wawonae* (Gunder), 1924

b. *e. chermocki* Perkins & Perkins, 1966

ab. *obscuripennis* (Gunder), 1926

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LITERATURE CITED

- BROWN, F. M., 1951. Simple statistics for the taxonomist—I. *Lepid. News*, 5: 4-6.
1965. The types of nymphalid butterflies described by William Henry Edwards. *Trans. Amer. Ent. Soc.*, 91: 332-338.
- BROWN, F. M., D. EFF, & B. ROTGER, 1957. Colorado Butterflies. *Proc. Denver Mus. Nat. Hist.*, Denver, 368 pp.
- COMSTOCK, J. A., 1927. Butterflies of California. Published by the author; Los Angeles, 334 pp.
- DOS PASSOS, C. F., 1964. A synonymic list of Nearctic Rhopalocera. *Mem. Lepid. Soc.*, no. 1, Yale University, New Haven, 145 pp.
- DOS PASSOS, C. F., & L. P. GREY, 1947. Systematic catalogue of *Speyeria* (Lepidoptera, Nymphalidae) with designations of types and fixations of type localities. *Amer. Mus. Novitates*, 1370, 30 pp.
- EDWARDS, W. H., 1868-1872. The Butterflies of North America. Vol. I. The American Entomological Society, Philadelphia.
1874-1884. The Butterflies of North America. Vol. II. The American Entomological Society, Philadelphia.
- EHRlich, P. R., & A. H. EHRlich, 1961. How to Know the Butterflies. Wm. C. Brown Co., Dubuque, 269 pp.
- GARTH, J. S., & J. W. TILDEN, 1963. Yosemite butterflies. *Jour. Res. Lepid.*, 2: 1-96.
- HOLLAND, W. J., 1955. Butterfly Book. Rev. ed. Doubleday & Co., Inc., Garden City, 424 pp.
- KLOTS, A. B., 1951. A Field Guide to the Butterflies of North America, East of the Great Plains. Houghton Mifflin Co., Boston, 349 pp.
- MCHEHRY, P., 1964. Generic, specific and lower category names of Nearctic butterflies. Part III—Argynnids. *Jour. Res. Lepid.*, 3: 231-243.
- NEWCOMER, E. J., 1964. Butterflies of Yakima County, Washington. *Jour. Lepid. Soc.*, 18: 217-228.
- WRIGHT, W. G., 1906. Butterflies of the West Coast. 2nd ed. Published by the author; San Bernardino, 255 pp.



1966. "A new race and discussion of the Boloria epithore complex (Nymphalidae)." *Journal of the Lepidopterists' Society* 20, 103–117.

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