

Acknowledgments

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THE "ARROWHEAD BLUE," *GLAUCOPSYCHE PIASUS* BOISDUVAL (LYCAENIDAE: PLEBEJINAE)

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This started as a short note calling attention to the distribution of *Glaucopsyche piasus* Bdv. in Canada. It has developed into a study of this insect throughout its range. The Arrowhead Blue, like practically all Plebejinae of North America, was originally placed in the genus *Lycaena*, now reserved for the Coppers. Scudder (1876) created the genus *Phaedrotes* with *Lycaena catalina* Reakirt (1866) as the type species. Interestingly, Scudder considered that *catalina* was a synonym of *sagittigera* Felder (1865) yet designated it the type species. I suspect that he did this because the type of *catalina* was known to him and that of *sagittigera* was in Europe. Edwards (1884) did not accept the new genus, nor did Skinner (1898), but Dyar did (1902). Placement in *Phaedrotes* was followed in general from then (1902) until Nabokov (1945) placed the Arrowhead Blue in *Scolitantides* Hübner [1819]. Since then most authors have followed Nabokov.

The Generic Assignment

Mr. Harry Clench called to my attention the fact that *Phaedrotes* is in the tribe Glaucopsychini, and he had demonstrated that *Phaedrotes* is a subjective synonym of *Glaucopsyche*! Huebner's genus *Scolitantides* with *Papilio battus* [Denis & Schiffermüller] 1775 as type is quite different from

Phaedrotes. It is closer in appearance and structure to *Philotes* (sensu lato) Scudder. Neither Clench nor I can find any structural way to separate the Arrowhead Blue from *Glaucopsyche*. This in spite of marked pattern differences. The male genitalia, generically "good" among the Glaucopsychini, are the same in the two "genera." The venation is the same, both have similarly medium-hairy eyes and tousled long-hairy frons. Both bear androconal scales similar in size and shape with about 12 rows of reticulations each. On *piasus* these rows converge on the base of the stalk, on *lygdamus* they do not. Both utilize legumes as larval hosts. *Scolitantides* not only has different male genitalia but the larvae feed on *Sedum* and there are no androconia on the wings of the males.

Just enough work was done to fix the place of the Arrowhead Blue. It shows definitely that a careful world-wide study of the tribe Glaucopsychini is needed. Clench and I agree that the current concept of *Philotes* results in a compound genus. The type species is *sonorensis*, a *Sedum* feeder that lacks androconia (like *Scolitantides*) whereas the other species placed with it feed on *Oxytheca* and *Eriogonum* and have androconia.

Search of several museum collections demonstrates that *Glaucopsyche piasus* is not common. Personal experience with them is that they are rather local and never abundant. Perhaps because there are no really good series to study in any one collection the variation among them has been overlooked. Eight names have been used with these insects and all but one of these, *daunia* Edwards, apply to California specimens.

Study of the specimens available in the Canadian National Collection, the American Museum of Natural History, the Carnegie Museum, the Field Museum and my own collection shows that *Glaucopsyche piasus* can be divided into two groups of subspecies. For convenience I will call these the *piasus*-group and the *daunia*-group.

piasus-group: lacks a large black spot in Cu_1 - Cu_2 in the submargin on the under side of the hind wing; on the under side of the forewing the spot at the end of the cell usually is small and linear, and near the middle of the cell there is a pair of small spots.

daunia-group: has a large black spot in Cu_1 - Cu_2 and often in M_3 - Cu_1 in the submargin of the under side of the hind wing; on the under side of the forewing the spot at the end of the cell is large and comma-shaped, the geminate spots in the middle of the cell often are fused.

The Taxa of the *piasus*-Group

The earliest name applied to the species is *piasus* Boisduval (1852). For many years this name was misapplied to a form of *Celestrina* from California. Oberthür's figure (1911) shows that the surviving male syn-type represents the form of Arrowhead Blue found in the lowlands of central California. On the under side of this form there is very low con-

trast between the dull greyish ground color and the not much darker grey patterning (see Figure 2). The type is one of the sort upon which the arrowhead-shaped white marks are fused into a whitish band. Such individuals appear in all populations examined.

Another sort of Arrowhead Blue is *sagittigera* Felder (1865). It is a form with considerable contrast in the pattern on the under side of the hind wing (see Figure 5) and with a series of obscure russet spots on the margin of the upper side of the hind wing of the female. The habitat is given as "Sonora (Lorquin)." As Brown (1967) pointed out, that means, according to Boisduval, the vicinity of Los Angeles, California. *Sagittigera* has been erroneously placed for many years as a synonym of *piasus piusus*. It is the proper name for the taxon commonly called *catalina* Reakirt (see Figures 16-18). Gunder's slightly aberrant (confluent spots on under forewing) *gorgonioi* belongs to this moiety.

An unrecognized west coast fraction occurs in the northern parts of the range of the species in California and in Oregon. This is a form on the underside of which there is considerable contrast, similar to that of *sagittigera*. These butterflies differ from *sagittigera* by lacking the russet marks on the upper side of the hind wings of the female. They are almost universally confused with *piasus piusus* from which they differ in degree of contrast on the under side. I have not seen enough of this variety to name it and recommend its study to a west coast lepidopterist with sufficient material. A synopsis of the west coast names follows:

Glaucopsyche piusus piusus (Boisduval), 1852

Ann. Soc. Entomologique de France, 2nd series, 10: 229. Figured by Oberthür, 1911, Lepid. Compareé, 9: 41, pl. 237, no. 1950 (type). Type locality: "California" probably the vicinity of San Francisco. Type in U.S.N.M. (see figs. 1-4.) (*Lycaena piusus*)

viaca W. H. Edwards, 1871, Trans. Amer. Ent. Sec., 3: 209. Type locality: "Sierra Nevada, Cal." Type in A.M.N.H. (*Lycaena viaca*)

Range: From the San Bernardino Mountains, California, northward to at least Butte Falls, Jackson Co., Oregon. Except in southern California, the subspecies *piasus piusus* appears from coastal areas up to transitional forests in the mountains.

Glaucopsyche piusus sagittigera (Felder & Felder), 1865

Reise Novara, Lepidoptera II, p. 281, pl. 35, figs. 20, 21. These figures are poor but recognizable. Type locality: "Sonora" [vicinity of Los Angeles, Calif.] Type is in British Museum, Tring, Herts, England. (see figs. 5-6) (*Lycaena sagittigera*)

catalina Reakirt, 1866. Proc. Acad. Nat. Sci., Philadelphia, 16: 244. Figured by Strecker (1874) Lepid. Rhop.-Het., pl. 10, fig. 1, 2. These are fair. Type locality: Los Angeles, California. Type in Field Museum, Chicago, Ill. (see figs. 16-18, the types.) (*Lycaena catalina*)

lorquini Behr, 1867, Proc. Calif. Acad. Nat. Sci., 3: 280. Type locality: "California." Type destroyed. A letter from Behr to Strecker dated 28.viii.1875 states that *lorquini* is a synonym of *catalina* Reakirt. (*Lycaena lorquini*)

rhaea Boisduval (1869). Ann. Soc. Entomologique de Belgique 12: 51. Figured by Oberthür (1911) Lepid. Compareé 9: 43, pl. 239, nos. 2078 and 2079. Type locality: vicinity of Los Angeles, California. Type in U.S.N.M. (*Lycaena rhaea*)

gorgonioi Gunder (1925), Ent. News 36: 4, pl. 1, fig. P (colored). Type locality: San Gorgonio Mountain, San Bernardino Co., Calif. Type in A.M.N.H. (*Phaedrotes piasus catalina* ab. *gorgonioi*)

Range: Apparently restricted to the coastal regions in the vicinity of Los Angeles and now in danger of extinction.

The Taxa of the *daunia*-Group

The *daunia*-group has much wider range than does the *piasus*-group but thus far only one name has been proposed for it. It is found from northern New Mexico to southern Alberta and west into the Great Basin and northward to southern British Columbia. Within this extensive range there occurs some variation.

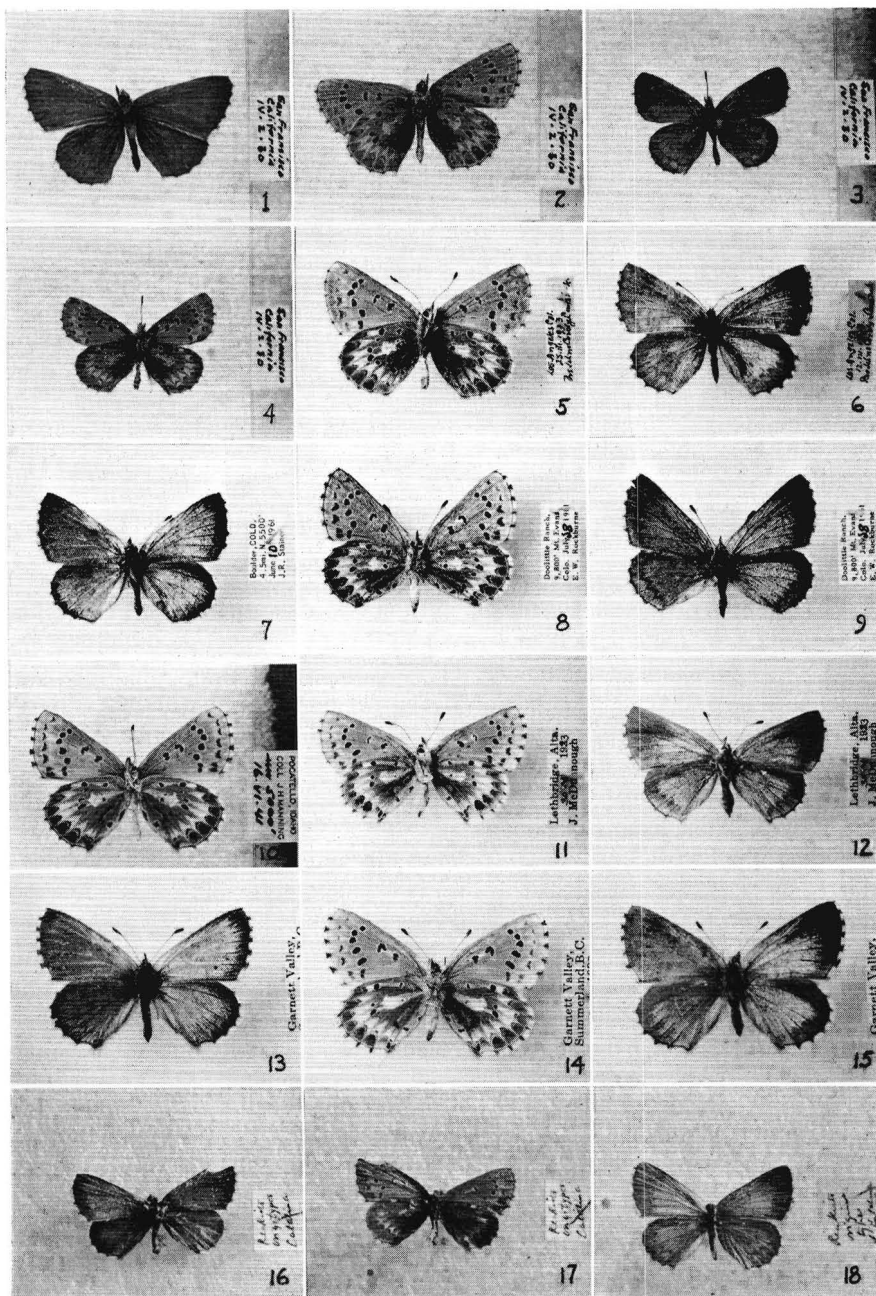
Material from northern New Mexico (Jemez Springs and Fort Wingate) tend to show a little russet coloring on the margins of the upper hind wing of the females. These specimens are in all other respects related to *daunia* and not *sagittigera*. The females of typical *daunia* from Colorado occasionally show a trace of russet on the upper hind wing. The broad dark vadium is reduced in the anal region to a submarginal series of dark patches. These patches of dark scales are linear or lunate and there is a noticeable lighter area marginad of them.

On the females from British Columbia, Idaho and western Washington, the vadium is broad, inwardly diffuse and totally lacking any rusty scales, nor is there any evidence of the broken crenate submarginal line, or its development, that is common to *piasus* and *daunia*. This moiety is recognized below with a subspecific name.

Glaucopsyche piasus daunia W. H. Edwards, 1871

Trans. Amer. Ent. Soc. 3: 272. Type locality: "Colorado" [Turkey Creek, Jefferson Co., Colo.] Type is in the Carnegie Museum, Pittsburgh, Pa. (see fig. 7-9). (*Lycaena daunia*)

Range: From northern New Mexico through the Rocky Mountains to Alberta. The Alberta specimens in the Canadian National Collection, Ottawa, Ontario, are these: Calgary, head of Pine Creek, 31.v.1915, F. H. Wolley-Dod, 1 ♂; Cypress Hills, nr. Elkwater, 4500 ft., 13.vii.1951, D. F. Hardwick, 1 ♂; Lethbridge, 30.vi.1923, J. McDunnough, 1 ♂ (illustrated); Waterton Lakes, 24.vi.1922, C. H. Young, 1 ♂, and 8.vi.1923, J. McDunnough, 1 ♂.



***Glaucopsyche piasus toxeuina* Brown, new subspecies**

Male. Upper side violet blue as on *sagittigera*, not specular blue as on *daunia*. Vadum relatively narrow, inwardly diffuse. Fringes checkered white and black with the black at the ends of the veins.

Underside: Darker and more contrasty than typical *piasus*, about as on *daunia*. Background about the same shade of grey as on *daunia*, not as brownish as on *sagittigera*. Forewing submarginal angular interneural marks poorly defined, especially in apical area (similar to *sagittigera*), not as sharply defined as on *daunia*. Post discal row, black spots circled with white, essentially the same on all subspecies. The two cell spots on *toxeuma* are equally strongly developed and on the whole larger than on *piasus* and *sagittigera* and more like on *daunia*.

Distal notch of each sagittate white mark on hind wing outlined in black, not as sharply as on *daunia* but more like on *sagittigera*. These marks larger on *toxeuma* than on either *daunia* or *sagittigera*. In submargin between Cu_1 and Cu_2 a black spot capped with a diffuse crescent of rusty scales and then black caret at base of white sagittate mark. A similar, much less noticeable mark just anterior to anal vein. Occasionally such a mark found in M_3-Cu_1 . These marks absent from *piasus* and *sagittigera* and usually more highly developed in *daunia* than on *toxeuma*.

Female. Similar coloring to male with broader vadum. Vadum on forewing often reaching end of cell and diffuse inwardly. On hind wing no evidence of the submarginal sharply defined broken crenate line found on *daunia* nor diffuse rusty patches seen on *sagittigera*.

Under side: As on the males with post discal series of spots often incomplete. In these cases the minute spots between R_s-M_1 , M_3-Cu_1 and Cu_1-Cu_2 disappear.

In addition *toxeuma* tending to be somewhat larger than specimens of the other subspecies.

Holotype. No. 11,470, a male from Garnett Valley, Summerland, B. C., 22.v.1933, A. N. Gartrell in the Canadian National Collection, Ottawa, Ontario. Radius of left forewing, 16.7 mm. Allotype: a female from the same series as the holotype but collected on 10.v.1933. Radius of left forewing, 17.0 mm. Paratypes: 9 males and 4 females collected 10–28.v.1933 by either A. N. Gartrell or J. McDunnough. All in the Canadian National Collection.

The name is a transliteration of the Greek word for “that which is shot,” in other words, an arrow. The holotype and allotype are shown in Figures 13–15.

Range: South central British Columbia southward in eastern Washington and Idaho (at least to Pocatello).

Although I have restricted the type series to specimens from the type locality, the Canadian National Collection contains the following material assignable to *G. piasus toxeuina*:

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Figs. 1–18. *Glaucopsyche piasus* Bdv. 1–4, *G. piasus piasus* Bdv., San Francisco, Calif., coll. F.M.B.; 5–6, *G. piasus sagittigera* Felder, Los Angeles, Calif., C.N.C.; 7–9, *G. piasus daunia* Edw., Boulder, Colo., C.N.C.; 10, *G. piasus toxeuina* Brown, Pocatello, Ida., coll. F.M.B.; 11–12, *G. piasus daunia* Edw., Lethbridge, Alta., C.N.C.; 13–14, *G. piasus toxeuina* Brown, Garnett Valley, B. C., holotype, C.N.C.; 15, *G. piasus toxeuina* Brown, Garnett Valley, B. C., allotype, C.N.C.; 16–17, *G. piasus catalina* Reakirt, lectotype, Field Mus.; 18, *G. piasus catalina* Reakirt, paratype female, Field Mus.

BRITISH COLUMBIA: Keremeos, Shingle Creek Rd., 9.vi.1933, A. N. Gartrell, 1 ♂, and 18.vi.1933, C. B. Barrett, 1 ♂; Okanagan Falls, 15-23.v.1953, J. R. McGillis, 3 ♂♂; Oliver, 14-15.vi.1953, D. F. Hardwick & J. E. H. Martin, 3 ♂♂, 1 ♀; Osoyoos, 19.v.1895, 1 ♂, 23.v.1895, 1 ♂, 19-24.vi.1938, J. K. Jacob, 14 ♂♂, 7 ♀♀, and 15-22.vii.1953, J. R. McGillis, 7 ♂♂, 2 ♀♀; Osoyoos, Anarchist Mt., 7.v.1936, A. N. Gartrell, 1 ♂; Penticton, 23.v.1953, J. R. McGillis, 1 ♂; Summerland, Garnett Valley, 10-28.v.1933, J. McDunnough & A. N. Gartrell, 10 ♂♂, 5 ♀♀, type series of *toxema*; Vasseau, 14.v.1920, W. B. Anderson, 1 ♂; Vernon, 20.v.1906, Bush-Wilson, 1 ♂, 12.v.1908, 1 ♂, 22.v.1919, W. B. Anderson, 1 ♀, and 16.v.1953, D. F. Hardwick & J. E. H. Martin, 4 ♂♂, 5 ♀♀.

In addition to the above there is a short series in my collection from Robson, B. C., collected by N. R. Foxlee on 23-26 May in 1936 and 1937. Except for these it might be assumed that the subspecies is confined to the Okanagan Valley in British Columbia. The distributional data for such an assumption probably is in artifact of collecting. Very definitely there is a lack of material from both east and west of the Okanagan Valley in the Canadian National Collection. When that is remedied we will have a better idea of the range of *piasus* in Canada.

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A RECORD OF *EUPHYDRYAS ANICIA* (NYMPHALIDAE) IN OKLAHOMA

In June 1959, I took a male of *Euphydryas anicia* Doubleday at Lawton, Comanche Co., Oklahoma near Fort Sill, a major artillery training base for the Army. It seems possible that a pupa or a number of pupae were brought to Fort Sill in some plants a soldier brought with him or in a shipment of goods to the base. This seems the only plausible explanation of *anicia*'s presence in Oklahoma, hundreds of miles from it's nearest recorded range.

I have collected in Lawton for eight seasons since 1959, mostly in June, and have never seen another specimen. This is the first record of the species from east of the hundredth meridian in Oklahoma that I have knowledge of.

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