

BIOLOGY AND TAXONOMIC STATUS OF *BOLORIA*
NATAZHATI (GIBSON) (NYMPHALIDAE)

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ABSTRACT. *Boloria natazhati* (Gibson 1920) is briefly redescribed and its known occurrences documented. The subspecific name, *nabokovi* (Stallings & Turner 1947), is synonymized under *B. natazhati* and its type locality is relocated and restricted.

Additional key words: arctic, scree, dolomite, *Boloria freija*, *Dryas integrifolia*.

Boloria natazhati has been one of the least collected and least understood insects of the North American Arctic. It was described from six specimens from Mt. Natazhat, St. Elias Mountains, Yukon Territory (Y.T.), at an elevation of 2470-2620 m (Gibson 1920). Two other specimens from Bernard Harbour, Northwest Territories (N.W.T.), were recognized at that time. Since 1920, *B. natazhati* has been encountered infrequently, probably because of the inaccessibility of its habitat.

Soon after its description, the status of *B. natazhati* was questioned. Stallings and Turner (1947) suggested that it probably represented a dark race of *Boloria freija* (Thunberg 1791), and dos Passos (1964) placed *B. natazhati* as a subspecies of *B. freija*. Nothing of the biology or habitat of this species was known by Stallings, Turner, or dos Passos; therefore, given the superficial similarity between *B. freija* and *B. natazhati*, it is not surprising that they were considered conspecific at the time.

While reviewing specimens of *Boloria* in the Canadian National Collection (CNC) in 1981, J. D. Lafontaine and J. H. Shepard noted that specimens from Victoria Island, N.W.T., Coppermine, N.W.T., and the types of *B. natazhati* were larger and darker than the remaining specimens of *B. freija*. Specimens of the latter had been common at Coppermine and the existence of two unusually large, dark specimens, which matched the types of *B. natazhati*, prompted Lafontaine and Shepard to contact the collector, Mr. S. Hicks. He recalled that he had collected on rocky areas as well as on wet tundra, and that the nominal "Coppermine" locality included some of the offshore islands as well as the mainland in the vicinity of Coppermine, N.W.T. If not necessarily sharing the same habitat, it appeared that specimens identifiable as both *B. freija* and *B. natazhati* were at least nearby.

Following the advice of one of us (JTT) and J. D. Lafontaine, and based on appearance and presumed sympatry at Coppermine, Scott (1986) restored *B. natazhati* from the status of a subspecies of *B. freija* to full species status. Although at that time we felt confident that *B. natazhati* was indeed a distinct species, we had no supporting evidence until now.

On 13 July 1982 one of us (DMW) collected a pair of *B. natazhati* in a barren valley of the White Mts., a limestone massif within the northern Richardson Mts., Y.T. Together, we were able to visit this valley again, from 30 June to 9 July 1987, where we obtained sufficient specimens of both *B. natazhati* ($n = 125$) and *B. freija* ($n = 24$) (specimens in the Troubridge collection and the CNC), flying together, to enable us to determine that they look and behave as separate species. Similar observations were made when the senior author visited Bernard Harbour, N.W.T., from 2–17 July 1988, and Mt. St. Paul, British Columbia (B.C.) from 19–25 June, 1989, and 16–18 June, 1990.

Synonymy for *boloria natazhati* (Gibson)

Brenthis natazhati Gibson 1920; Holland 1947. Report of the Canadian Arctic Expedition, 3(i):21i–22i. [Type locality: 141st meridian N. of Mt. Natazhath, Yukon; Canadian National Collection, Ottawa].

Boloria freija natazhati: dos Passos 1964; Howe 1975.

Clossiana freija natazhati: Miller & Brown 1981; Ferris et al. 1983; Hodges 1983; Tilden & Smith 1986.

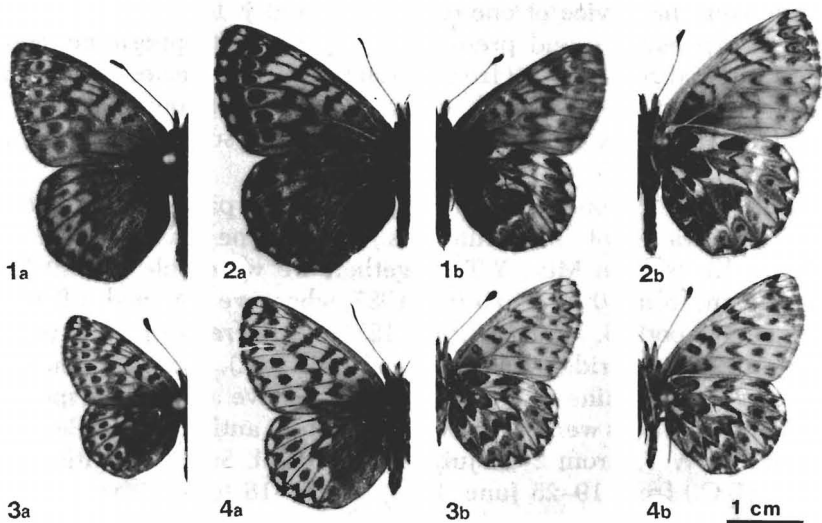
Boloria natazhati: Scott 1986.

Boloria freija nabokovi Stallings & Turner 1947; dos Passos 1964; Howe 1975. [Type locality: Alaska Military Highway, 102 miles north of Summit 2, Ravine, 1830 m; Museum of Comparative Zoology, Harvard University.] **NEW SYNONYMY**

Clossiana freija nabokovi: Miller & Brown 1981; Hodges 1983; Tilden & Smith 1986.

DIAGNOSIS

Boloria natazhati may be distinguished from *B. freija* as follows (Figs. 1–4): many *B. natazhati* have a blue, iridescent sheen to the upper wing surface, absent in *B. freija*; *B. natazhati* is larger (mean male forewing length 22.5 mm ($n = 20$) among specimens from the White Mts., Y.T.) than *B. freija* (mean male forewing length 19.0 mm ($n = 18$) from the same habitats as the former); the upper wing surface of *B. natazhati* is darker and duskier (ground color a dull, brownish-orange) than that of *B. freija* (ground color a brighter orange); the color of the ventral surface of the abdomen of *B. freija* is light brown in individuals from all populations we have studied with the single exception of Baffin Island, N.W.T., where it is black as is that of *B. natazhati*; the basal half of the ventral hindwing of *B. natazhati* is covered with long (2 mm), dark hairs, absent in *B. freija*; the submarginal area of ventral hindwing cells Rs, M1, and Cul of *B. natazhati* is



FIGS. 1-4. *Boloria natazhati* and *B. freija* from the White Mts., Yukon Territory, 29 June to 9 July, 1987, J. Troubridge.

Fig. 1. *B. natazhati*, male; a. upperside, b. underside.

Fig. 2. *G. natazhati*, female; a. upperside, b. underside.

Fig. 3. *B. freija*, male; a. upperside, b. underside.

Fig. 4. *B. freija*, female; a. upperside, b. underside.

often purplish-gray, but that of *B. freija* is usually orange to reddish-orange, and the wing surface of fresh *B. natazhati* has a greasy appearance (reminiscent of *Charidryas damoetas* (Skinner 1902)), which is absent in *B. freija*. The male genitalia are similar to those of *B. freija*. The juxta is lyre-shaped and the number of spines at the tip of the lower arm of the valva is variable.

Distribution and Habitat

Thus far, *B. natazhati* has been found at the following sites (Fig. 5): Holman, N.W.T.; Kuujjua Valley, N.W.T.; in the vicinity of Coppermine, N.W.T. (probably Seven Mile Island); Bernard Harbour, N.W.T.; Canyon Range, MacKenzie Mts., N.W.T.; Mt. Natazhat, Y.T.; 8 km west of Sheep Mt., Y.T.; White Mts., Y.T.; Montana Mt., Y.T.; Sentinel Range, Rocky Mts., B.C. (the type locality of *nabokovi*, here restricted); Mt. St. Paul, B.C., and on the ridge above Slana, Alaska.

In the White Mts., Y.T., *B. natazhati* was found only on white dolomite scree slopes and alluvium from 900–1500 m (Fig. 6). Where the more acidic sandstone formations abut the dolomite, *B. natazhati* was found commonly on the dolomite, but was not seen over the sandstone, nor did it venture more than a few meters from the rocks into

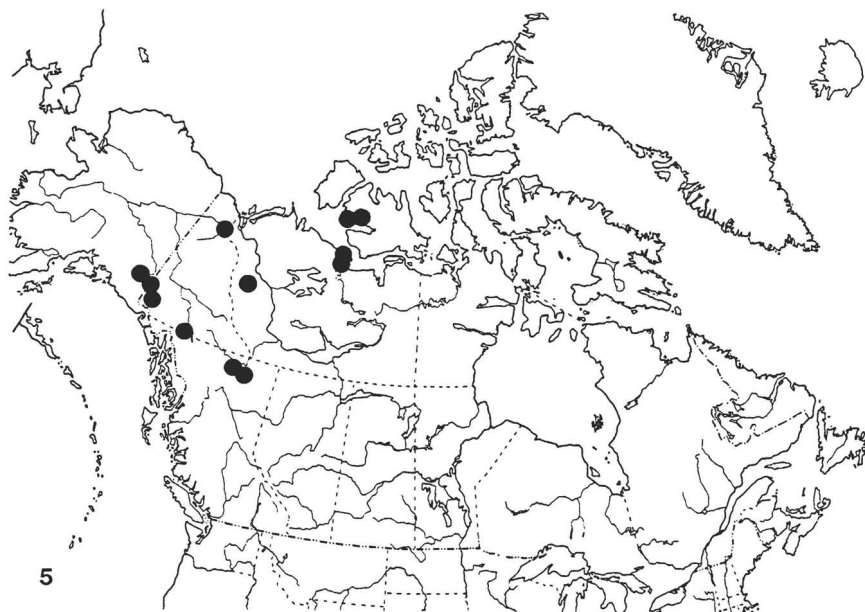
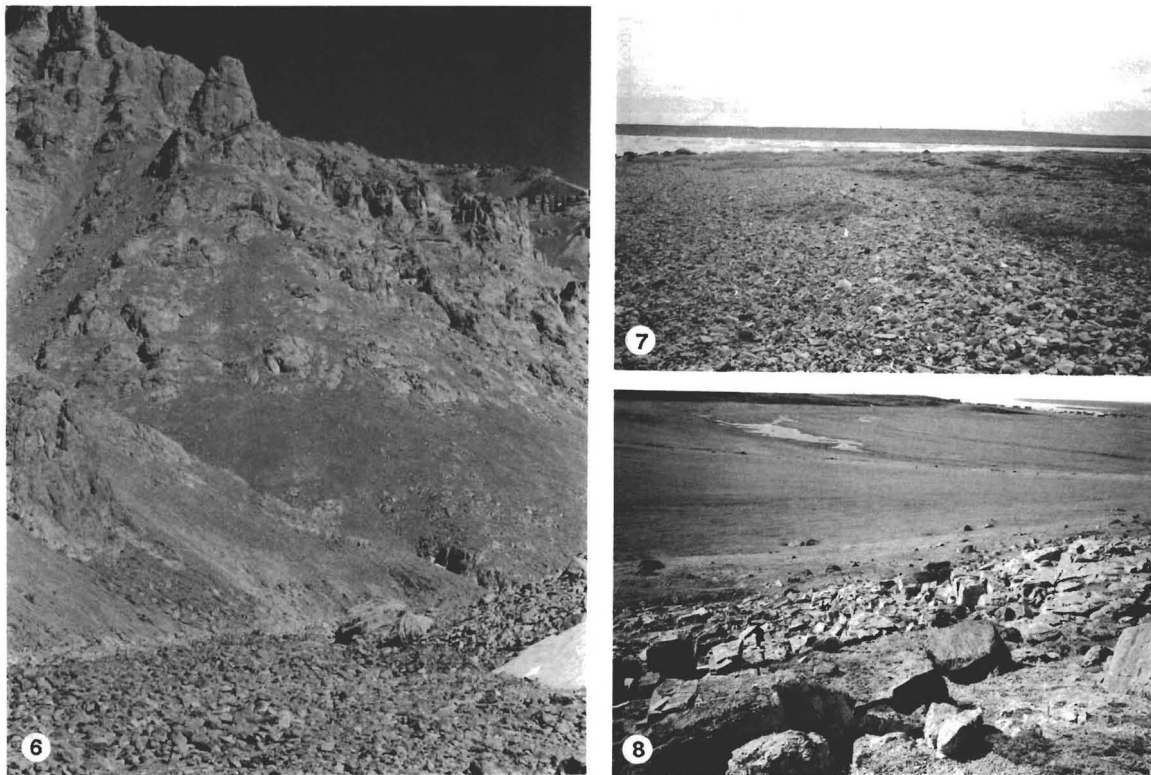


FIG. 5. The known distribution of *B. natazhati* (see text exact locality descriptions).

vegetated areas. The valleys and scree slopes that supported the greatest densities of *B. natazhati* were also the least vegetated. The habitat in the White Mts. is similar to the habitat in which *B. natazhati* occurs in the Sentinel and Stone Ranges of the northern Rocky Mts.

The habitat at Coppermine, N.W.T., is primarily wet tundra. Outcrops of gabbro are present on ridges but no extensive areas of scree are present. The wet tundra at Coppermine does not provide suitable habitat for *B. natazhati*, although *B. freija* is present. Our collecting at Coppermine in 1984 and 1988 did not produce *B. natazhati*; however, extensive areas of dolomite and gabbro scree were observed but not investigated on some of the offshore islands. We assume that the "Coppermine" specimens in the CNC came from one of these islands.

The unnamed peninsula bordered by Dolphin and Union Strait to the north and Coronation Gulf to the south is dominated by vast areas of barren dolomitic bedrock outcrops. *B. natazhati* is abundant throughout this peninsula. Bernard Harbour, N.W.T., is more heavily vegetated than most other areas on this peninsula. *B. natazhati* flies in low numbers with *B. freija* on the south slopes of the drumlins at Bernard Harbour, most commonly in unvegetated areas, but is abundant on the dolomite scree of the raised beaches that occur along the entire length of the south shore of Dolphin and Union Strait (Fig. 7).



FIGS. 6-8. Typical habitat for *B. natazhati*.

Fig. 6. Barren limestone scree slopes and alluvium in the White Mts., Y.T.

Fig. 7. Raised beaches of dolomite cobbles along Dolphin and Union Strait, at Bernard Harbour, N.W.T. Patches of the probable foodplant, *Dryas integrifolia* are seen in hollows at the left of the photo. The white strip through the upper part of the photo is sea ice.

Fig. 8. Dolomite block field, north of Holman, Victoria Island, N.W.T.

On Victoria Island, *B. natazhati* is widely distributed but *B. freija* has not yet been found. Our work has been restricted to the vicinity of Holman (Fig. 8) and the Kuujjua River valley on the Diamond Jenness Peninsula. Both sites are thinly vegetated with diverse geology. Most hills are composed of dolomite, capped with extrusive igneous rock, that occurs as gabbro. The gabbro is dominated by calcic feldspar and darker, mafic minerals and the pH is therefore basic as opposed to the acidic nature of intrusive igneous rocks. In the Kuujjua River valley, *B. natazhati* is generally distributed but most common on the hilltops, which were covered with gabbro scree. At Holman, *B. natazhati* is generally distributed on the gravel areas but most common on scree, which was not always located on hilltops. It did not seem to prefer white dolomite over dark gabbro at this location.

Larval Foodplant

At Holman and at Bernard Harbour, several females of *B. natazhati* were observed ovipositing on *Dryas integrifolia* Vahl (Rosaceae). At each of these sites, *D. integrifolia* was found growing in matts in depressions among the rocks. No other plants were found in the immediate area and females were almost always found in association with patches of *D. integrifolia*. Although no larvae were found feeding, this is the assumed foodplant of *B. natazhati*.

DISCUSSION

In the White Mts., Y.T., at Mt. St. Paul, B.C., and at Bernard Harbour, N.W.T., *B. freija* flies together with *B. natazhati* at the same time and in the same habitat. Although scree habitat is normal for *B. natazhati*, *B. freija* is usually found in wet tundra and taiga habitats. We found no intermediate specimens, therefore we have evidence of sympatry without hybridization. This alone is adequate evidence that *B. natazhati* and *B. freija* are distinct species. The presence of a lyre-shaped juxta and lateral lobes on the aedeagus are synapomorphies that link *B. natazhati* and *B. freija* as sister species.

The geographic variation found between colonies of *B. natazhati* is of note. When compared to specimens from the type locality, specimens from the other locations differ as follows: those from the White Mts., Y.T., average larger and darker; those from the Sentinel and Stone Ranges, B.C., are similar to those from the White Mts., Y.T., in size, but are darker in color; those from the MacKenzie Mts., N.W.T., are similar; those from Bernard Harbour, N.W.T., are similar in size but are darker and less colorful and most closely resemble those from the Sentinel Range, B.C.; and those from Victoria Island are smaller and more orange.

Although most of the populations of *B. natazhati* that we have studied are not genetically continuous and vary slightly in color and size, we see no need to clutter the literature with subspecific names.

Restriction of Type Locality of *nabokovi*

We regard the holotype of *B. freija nabokovi* as being conspecific with *B. natazhati* and we therefore place *nabokovi* as a junior synonym of *B. natazhati*. Until specimens were found in the Stone Range, B.C., in 1989, additional specimens of *nabokovi* had not been found since the holotype and paratype were collected in 1943. We believe this is because the type locality has been misinterpreted in the literature (Howe 1975, Miller & Brown 1981, Tilden & Smith 1986). Although Miller and Brown (1981) list the type locality as "mile 102, Alaska Military Highway, British Columbia," Stallings and Turner (1947) actually published a different account in the following words: "Alaska Military Highway, 102 miles *north of Summit 2* [italics ours], Ravine, 6000'." The second summit crossed by the Alaska Highway in 1943 was Steamboat Mountain (elevation 1067 m). Habitat we have associated with colonies of *B. natazhati* can be found 102 miles north of Steamboat Mountain in the Sentinel Range, Muncho Lake Provincial Park, B.C. Although this now seems to be an awkward way of describing Muncho Lake Provincial Park, there were no named landmarks in 1943 when the *nabokovi* types were collected, the year after the opening of the highway, and this may have been the only logical way of describing the location. Therefore, we here restrict the type locality of *nabokovi* to the Sentinel Range of the Rocky Mts., B.C., at 1830 m elevation. With on-going construction and straightening of the highway, the current kilometer measurement at this location is subject to change. Although we have not found *B. natazhati* in the Sentinel Range because of seemingly endless bad weather, it was found on Mt. St. Paul in the nearby Stone Range in 1989 and 1990 by the senior author.

Justification for the Use of *Boloria*

Synapomorphies for the genus *Boloria* Moore, 1900 *s. lat.*, *sensu* North American authors prior to 1981 (including synonyms *Clossiana* Reuss, 1919 and *Proclossiana* Reuss, 1926 but not including *Brenthis* Hübner, 1819 or any other genus of Argynninae), are described as follows: 1) loss of all lobed, spine-like or serrated blade-like structures on the dorsomedian surface of the valve, *viz.* basal lobe of cucullus, apical spine of sacculus, and crista; 2) rounded anterior end of the juxta; 3) bifid uncus; and 4) aedeagus closed basally. These synapomorphies indicate that the species of *Clossiana* and *Proclossiana* are subsets of

a larger concept, *Boloria sensu* North American authors before 1981, and justify our use of *Boloria* for *B. natazhati*.

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