

Geographical variation in food plant selection of *Eupithecia gelidata* Möschler, 1860 (Lepidoptera, Geometridae)

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The relict bog populations of *Eupithecia gelidata* Möschl. in South Bohemia are obligatorily associated with *Ledum palustre* L., which is here the dominant shrub, all *Salix* species being absent. In the subarctic and boreal populations of *E. gelidata*, alternative food plants are willows (*Salix* spp.). Under laboratory conditions, larvae of the Bohemian populations can accomplish their development feeding on *Salix*, but *Ledum* is clearly preferred. The larvae living on *Ledum* and *Salix* are usually differently coloured. Thus, in spite of the different food plants and coloration of the larvae, the species seems to be taxonomically homogeneous.

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Eupithecia gelidata Möschler, 1860 is a typical subarctic/boreal species of Holarctic distribution (McDunnough 1949, Wolff 1964, Juul 1948, Spitzer & Jaroš 1983, 1986, Bolte 1990). In the boreal and temperate zones, the species seems to be tyrphophilous and tyrphobiotic (Fig. 1), but in the Subarctic near the northern timberline it is also distributed outside peat bogs (cf. Krogerus 1960, Mikkola & Spitzer 1983). The southernmost and very isolated relict populations of *E. gelidata* (ssp. *hyperboreata* Stgr.) were recorded from South Bohemia (Třeboň env., Spitzer & Jaroš 1983, 1986). The isolated locality (Fig. 2) is a raised acid bog with *Ledum palustre* L. as dominant shrub, this being the only food plant of the larvae. The “Labrador Tea” — *Ledum palustre* sensu lato (for taxonomy and distribution, see Tolmatchev & Jurtzev 1980) — is the most frequently recorded food plant of *E. gelidata*, which is often considered to be restricted to this plant

(Urbahn & Urbahn 1939, Juul 1948, McDunnough 1949, Krogerus 1960, Spitzer & Jaroš 1983, 1986, Skou 1986, Prentice 1988). But several authors have also occasionally recorded *Salix* spp., *Betula* sp. and even *Alnus* sp. (see Wolff 1964, Prentice 1963, Bolte 1990). Moreover, in Norway and Sweden *E. gelidata* does occur (mostly records of adults) in some regions where *Ledum palustre* does not grow or is extremely rare (Skou 1986, Svensson, unpubl. records). We therefore investigated alternative food plants of the relict bog populations of the species.

Results

Field and laboratory investigation on *E. gelidata* were carried out in South Bohemia. In the field, the Červené blato bog population is strictly asso-



Fig. 1. Habitat of *Eupithecia gelidata* Möschl. in Finnish Lapland. An aapa peat bog near Kittilä with *Ledum palustre* and *Salix* spp. (Photos: K. Spitzer).



Fig. 2. Habitat of *Eupithecia gelidata* Möschl. in South Bohemia. The raised peat bog Červené blato near Třeboň with *Ledum palustre* as dominant shrub, but no *Salix* spp.

ciated with *Ledum palustre* (see Spitzer & Jaroš 1983, 1986). No willows (*Salix* spp.) occur in the locality, and they are not known at all on oligotrophic raised bogs in South Bohemia (but there are palaeoecological records; Jankovská 1980).

Several possible food plants of boreal and subarctic distribution were tested under laboratory conditions: *Ledum palustre* L., *Salix cinerea* L., *Betula verrucosa* Ehrh. and *Vaccinium uliginosum* L. The only food plants accepted by the larvae from Bohemia were *Ledum palustre*

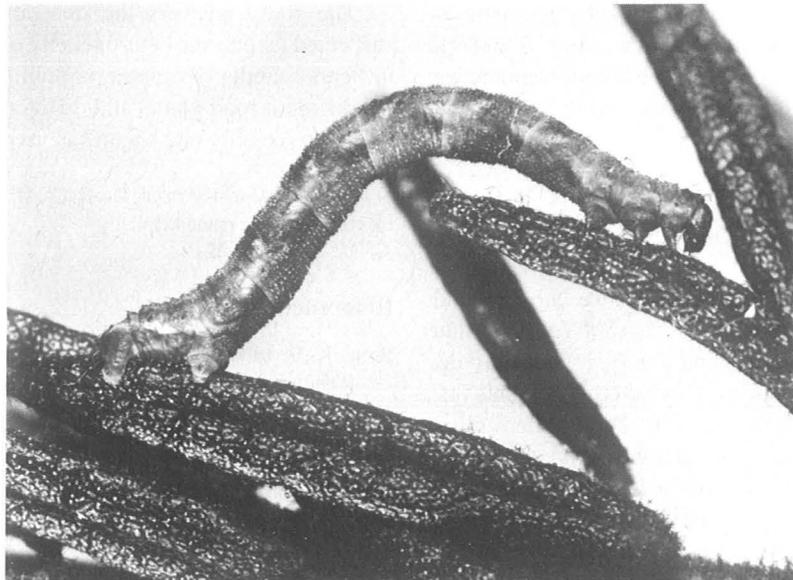


Fig. 3. Greenish-brown spotted larva of *Eupithecia gelidata* Möschl. feeding on *Ledum palustre* in South Bohemia.

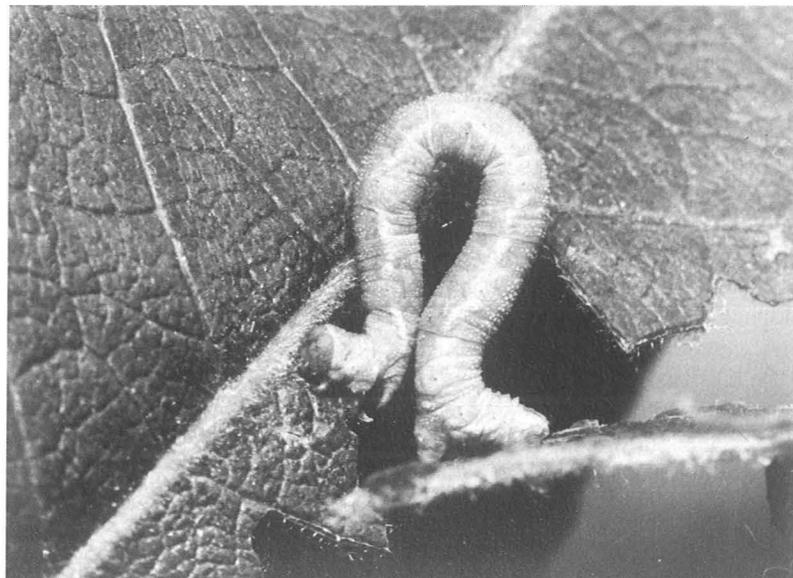


Fig. 4. Green larva of *Eupithecia gelidata* Möschl. originating from the south Bohemian population feeding on *Salix cinerea* in the laboratory.

and *Salix cinerea*; *Betula* and *Vaccinium* were not eaten and the larvae died. If *Ledum* and *Salix* were offered together, the larvae always preferred *Ledum*; *Salix* was neglected by the 1st instar larvae or occasionally eaten for a short time before they moved to leaves of *Ledum*. If the

plants were offered separately (Table 1), the larvae developed equally well on *Salix* and *Ledum*.

The larvae feeding on *Ledum* were mostly (80–90%) greenish-brown spotted (see colour fig. 3 in Spitzer & Jaroš 1986) and about 10–20% were uniformly greenish. The uniform green or

greenish-yellow coloration was characteristic of larvae feeding on *Salix cinerea* (Fig. 3 and 4). Further study is needed of the colour frequencies and their cryptic significance and determination mechanism.

Discussion and conclusions

Apart from *Ledum palustre* (sensu lato), several specifically northern willows (*Salix* spp.) might be alternative food plants for *E. gelidata* larvae, at least in subarctic and boreal environments (cf. Wolff 1964 and Bolte 1990). The southern relict populations of *E. gelidata* are strictly confined to "habitat islands" of cold acid raised bogs with *Ledum palustre* (sensu stricto) as dominant shrub. This is the stenotopic South Bohemian bog community of *Pino rotundatae* — *Sphagnetum ledetosum* sensu Březina 1975 — see Spitzer & Jaroš 1983, 1986, where willows do not occur. When tested for their food preference under laboratory conditions, larvae from South Bohemia could accomplish their development only on *Ledum* and *Salix*, but *Ledum* was significantly preferred. These results agree with records from the northern Holarctic, where larvae of *E. gelidata* are often associated with willows (Wolff 1964, Prentice 1963, Bolte 1990), but the main food plant is generally *Ledum* (Urbahn & Urbahn 1939, Juul 1948, McDunnough 1949, Skou 1986). The "induced monophagy" of the stenotopic bog populations of *E. gelidata* in Central Europe is determined by the history of the edaphic climax of the cold, acid peatland habitats, where willows (*Salix* spp.) disappeared during the holocene ecological succession (see Jankovská 1980), but *Ledum palustre* survived as a dominant shrub with specifically associated lepidopteran fauna.

Table 1. Larval development of *Eupithecia gelidata* Möschl. on two food plants (20–25°C), S. Bohemia.

	<i>Ledum palustre</i>	<i>Salix cinerea</i>
Number of larvae	46	37
Mortality (n)	5	6
Larval development (days)	19–20	19–21

The study answers the question about the suspected taxonomic heterogeneity of *E. gelidata* in Fennoscandia (Svensson unpubl.): in spite of the different food plants and different coloration of the larvae only one species is involved.

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