ITEX INSECT: *GYNAEPHORA GROENLANDICA / G. ROSSII*

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Woolly-bear caterpillars, *Gynaephora groenlandica,* are important predators on the leaf buds and young catkins of *Salix* spp. early in the season. Field observations have shown a strong preference for *Salix* arctica, and for the reproductive success as well as for vegetative growth of the willows, the number and activity of the caterpillars may be of great importance. When present in the ITEX plots, especially those with *Salix* spp., notes should be taken on the *Salix* sheets or on the sheets especially designed for *Gynaephora* observations.

The life cycle of this moth is exceptional as it may take several years to develop from first instar larva to adult insect. In Greenland, on Disko Island, outbreaks were seen in 1978 (Kristensen, pers. comm.) and again in 1992 (Mølgaard pers. obs.), which indicates fluctuations with peak populations with 14 years interval, which is similar to the life cycle duration at Alexandra Fjord (Kukal and Kevan, 1987). During this long developmental time the larvae are exposed to parasitism, which may be as important as climate in population regulation of this high arctic insect.

The caterpillars emerge early in the season and obviously they feed almost exclusively on *Salix* buds. A preference for male leaf buds and young male catkins has been seen, which probably adds to an explanation of the female biased distribution of the two gender in *Salix arctica* observed on several localities in Greenland (Christensen and Mølgaard, 1991). The caterpillars orientate themselves in a preferred direction, which has been related to the predominant wind (Kevan et al. 1982) or to insolation (M°lgaard, upubl.) in order to maintain optimal conditions for metabolism under basking (Kukal, 1990).

Based on the potential impact the caterpillars may have on the plants in combination with the extraordinary life history of *Gynaephora* we consider it valuable for the ITEX activities and recommend that the woolly bear caterpillar is included as the first 'ITEX insect'. Detailed observations over the range of ITEX sites may throw light on the feeding habit, the impact on the plants, the influence on the *Salix* male/female ratio, the insect life cycle and periodicity of 'outbreks', and the background for the preferred orientation.

Species identification

Two species of *Gynaephora* (Lepidoptera:Lymantriidae) are found in North America, *G. groenlandica* (Wocke) and *G. rossii* (Curtis). Collectively, their geographic distribution ranges from eastern Greenland across arctic North America to Siberia, and includes isolated populations in alpine areas of New England, the southern Rocky Mountains, and Japan (see map). A third species, *G. selenitica* (Esper), is found in Europe but may not occur at tundra sites. The two North American species occur together at many sites in the Canadian Arctic and may be separated by the following characteristics.

EGGS: Eggs themselves may be indistinguishable morphologically; however, egg masses are often laid on cocoons, which differ between the two species (see below).

LARVAE: Because of their small size and their tendency to stayout of site, newly-hatched larvae are unlikely to be encountered in the field unless found when they are still on the cocoons where the eggs from which they hatched were laid. Older larvae may be separated according to the form and colour patterns of the larval hairs. Larvae of *G. groenlandica* have long hairs that range from dark brown to golden yellow, depending on how recently they have moulted, and have two distinct tufts of black followed by two of yellow on the back (these are often replaced by four tufts of black fringed with yellow in the final instar) as well as a black tuft at the tail end. The larval hairs of *G. groenlandica* have small barbs along the shaft but are not plumose.

Larvae of *G. rossii* have shorter hairs and have black hair tufts fringed with yellow along the back, but have no black tuft at the tail end and usually appear greyish overall because they have grey plumose hairs that are slightly longer than the black tufts. The differences in form and colour patterns of the larval hairs become visible after the first larval moult and become progressively more distinct with each subsequent moult.

COCOONS: Cocoons of *G. groenlandica* are broadly oval and range in colour from off-white to deep yellow or occasionally grey. They are constructed in two separate layers with a distinct air space between the two layers and are approximately 2.5-4.0 cm in length by 1.5-2.5 cm in width. Cocoons of *G. rossii* are more narrowly oval and range in colour from light to dark grey. They are constructed in a single layer and are approximately 2.0-3.0 cm in length by 1.0-1.5 cm in width. Larval hairs are incorporated into the structure of the cocoons, giving them their overall colours, and the difference in form of the hairs (plumose or not; see above) may be seen if cocoons are torn open and the torn edges examined under magnification.

ADULTS: Both species are medium-sized greyish moths and have similar wing patterns; however, the wing patterns of *G. rossii* are generally quite bold and include a broad black band along the margin of the hindwings whereas the wing patterns of *G. groenlandica* are very faint and generally lack the black border on the hindwings completely (see Plate 1 in Ferguson 1978).

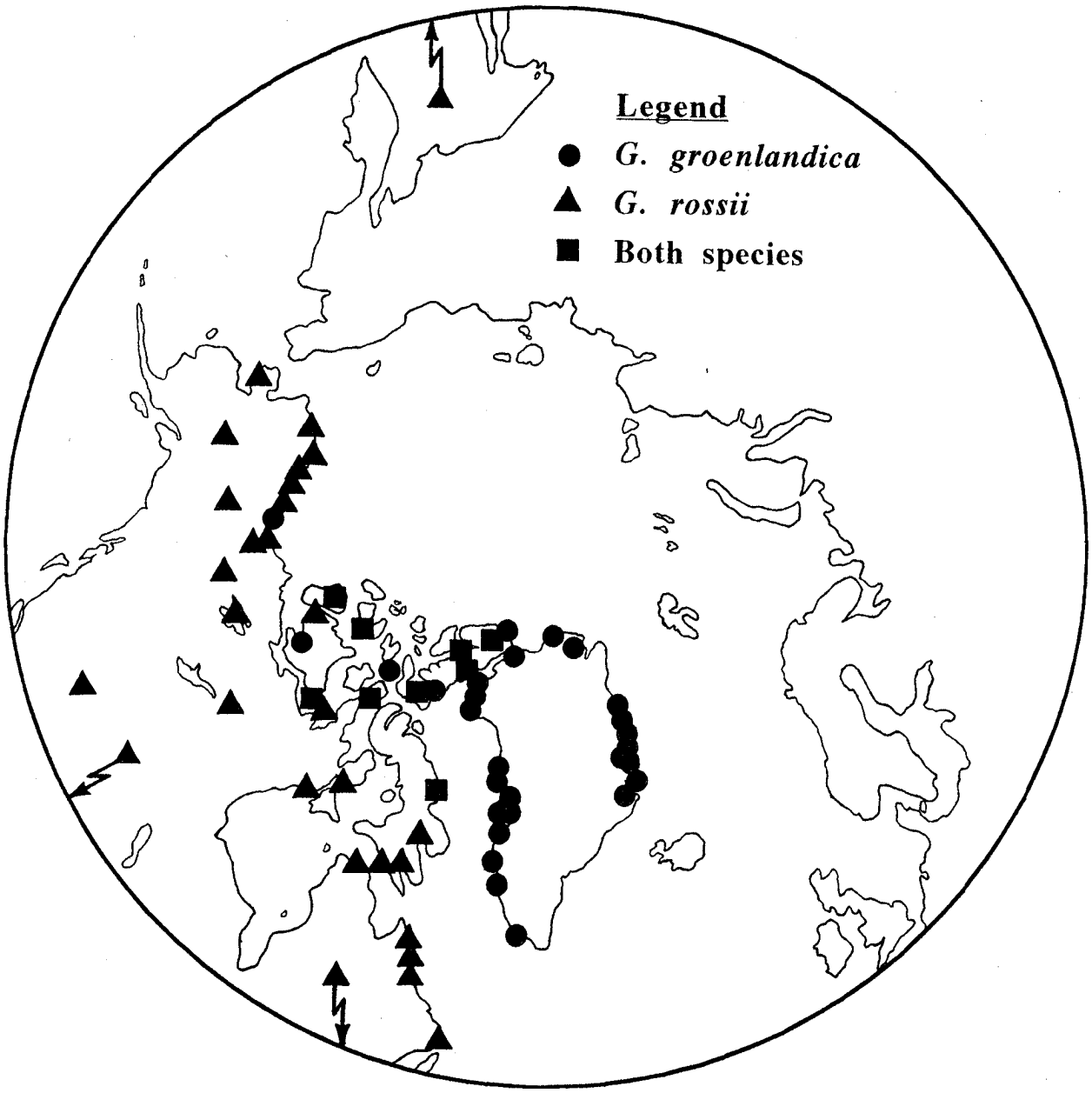

Fig. 1: *Geographic distribution of* G. groenlandica *and* G. rossii*, compiled from Wolff (1964), Ryan and Hergert (1977), and personal observations.* Gynaephora rossii *is also known from Siberia but specific records could not be obtained in time to include here.*

Activity of 'free-ranging' *Gynaephora* may be monitored within ITEX plots using the data sheet included in the manual. In order to follow development and activity over the longer term the insects must be confined in some way to prevent escape and allow for monitoring on an individual basis. Larvae may be confined in the field by constructing 'corrals'. Both 15-cm aluminum flashing and 10-cm plastic lawn-edging have been used for this purpose at Alexandra Fiord and have proven effective in confining the larvae. Great care must be taken that there are no gaps that might allow the larvae to escape by crawling under the corral walls. Walls may be secured in place using tent pegs or wire and these should be placed along the outside of the corrals walls; otherwise the larvae may climb them. Corrals may be constructed in any size; however, for single or a few larvae, a diameter of approximately one metre is recommended and may be used in combination with OTCs.

PHENOLOGICAL DATES

P1: First day snow-free

P2: First caterpillar

P3: First *Salix* leaf bud burst (male/female)

P4: First flower out (male: pollen shed/ female stigma visible)

P5: First pupae

P6: First adult (male/female)

P7: Mating

P8: Egg laying female

QUANTITATIVE MEASUREMENTS

Q1: Length of caterpillar (or stage, may be difficult if they curl up)

Q2: Orientation of basking caterpillar (nearest 5° on compass, however not usable at Ellesmere Island))

Q3: Colour (yellow/brown/black, to give information on moulting rythm)

Q4: Number of caterpillars feeding on male *Salix* (buds/ leaves/catkins) per unit area, plant or shoot

Q5: Number of caterpillars feeding on female *Salix* (buds/ leaves/catkins) per unit area, plant or shoot

Q6: Number of caterpillars feeding on other plant species (per unit area)

Q7: Estimate of density (caterpillars/unit area; high/low)

Q8: Orientation of pupae

Note: With respect to Q8: Orientation of pupae, the last shed larval skin remains in a clump at the tail end of the pupa within its cocoon - this can be seen with appropriate lighting (the cocoons are translucent) or felt by gently squeezing the cocoon - and this may be used to determine which way the pupa is 'heading'.

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