FURTHER INSECT STUDIES

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In connection with the establishment of an ITEX program integrated in the Zackenberg Basic monitoring program (at the Zackenberg Research Station in Northeast Greenland) we have decided to include a few insect observations in the ITEX phenological observations (Meltofte and Thing 1995). Accordingly, I suggest that a certain number of insect studies are incorporated in the general ITEX program.

Pollination

The most important insect/plant relationship is pollination, which influences population dynamics for plants as well as for insects. A change in temperature is likely profoundly to change the frequency of insect visits and the taxonomical composition of pollinators (Kevan 1972; Philipp et al. 1990). It is therefore suggested that some simple quantitative/qualitative measure of insect visitation to the flowers of the ITEX plants is initiated, so that numbers of insect visits/flower/hour may be established.

Methods

1. All instances of herbivory should be noted during the routine observations, and the plants should be carefully examined in order to reveal attacks by sucking insects (e.g. aphids on *Dryas*, psyllids on *Salix*). Samples of such herbivores should be taken and preserved in 70 % alcohol for later identification by specialists. In cases where a significant portion of leaf area has been eaten, this should be stated (as a rough percentage) and, if possible, the insect species responsible should be caught and identified.

2. In all the plots where *Dryas* flowering is studied, the number (percentage) of flowers attacked by the caterpillars of *Sympistis zetterstedtii* (or other moths) should be recorded, possibly differentiated into "slightly affected", "partly destroyed", and "totally destroyed" in accordance with the quantity of the gynoecium eaten.

3. Presence in the studied plots of *Nysius groenlandicus* must be recorded, and the number of bugs occurring in the flowers and fruits noted. When infected, samples of seeds should be collected for later microscopic analysis.

4. A measure of pollination frequency may be obtained by counting the total visits payed by insects to a fixed number of flowers during a time unit, for instance half an hour, during optimal weather conditions: clear sun and weak wind, and in the middle of the day (e.g. 10 A.M.- 4 P.M.). The initial identification of the insects in the field should be carried out to a certain level, for instance:

1) "small flies" (mainly including *Spilogona* spp.)
2) empidids flies
3) syrphid flies
4) blow flies
5) mosquitos
6) midges
7) butterflies (could be subdivided)
8) moths (could be subdivided)
9) bumble bees

Samples of pollinating insects might be collected by net and pooter, preserved in alcohol and identified by specialists.

Insect herbivory

Even though insect foraging on arctic plants generally is negligible (Downes 1965), in some cases this factor must be of great importance - for the single plant individual as well as for plant populations in large areas. A few examples from Greenland may illustrate this.

1. Insect herbivory of vegetative parts

A number of insect taxa do in fact live from the vegetative parts of arctic plants, either devouring leaf tissue (most butterflies and moths, many beetles and flies) or by sucking cell content or phloem juice (aphids, scale insects, psyllids, plant hoppers, most true bugs, thrips).

It is often difficult to detect the presence of sucking insects due to their small size and concealed habits, and even more difficult to assess their impact on the viability of the food plants. As an example: In high arctic Greenland the aphid *Myzus polaris* lives on the hidden parts and roots of *Dryas octopetala*, and is not easily detected, (Meltofte and Thing 1995). Ignorance of the existence of this herbivorous relationship may interfer seriously with the ITEX results obtained.

2. The noctuid moth *Sympistis zetterstedtii*

In both West Greenland (Disko) and Northeast Greenland (Zackenberg) extensive predation of the larva of this circumpolar arctic moth on the sexual parts of the flowers of *Dryas (integrifolia* and *octopetala*) has been observed. The intensity varies greatly from year to year, possibly in a cyclic manner. In some years no caterpillars can be found in the flowers, in others up to (at least) 70 % of the flowers in a population may be destroyed (Philipp et al. 1990;

Meltofte and Thing 1995). Obviously, this aspect must be taken into account when the outcome of the sexual reproduction of *Dryas* is considered.

3. The Greenlandic Seed Bug (*Nysius groenlandicus*)

This species of Heteroptera is found all over Greenland and is abundant especially in inland sites with a warm, dry summer climate (more than 100/m^2 is not uncommon), but it may also be abundant during periods with sunny summers in coastal areas (Böcher 1976). The species is furthermore common in Iceland and in alpine areas of Scandinavia, possibly with a wide arctic/alpine total distribution in the Palaearctic Region.

Like most members of the family Lygaeidae, *Nysius groenlandicus* feeds exclusively on seeds (Böcher 1972). The effect of this has never been studied, but most probably the viability of the seeds is thereby totally destroyed. Often, cushions of *Silene acaulis* with ripe capsules are densely populated by bugs, and up to ten individuals have been found in one capsule of *Melandrium triflorum*, and 25 in one capitulum of *Taraxacum croceum*. At least in Greenland it is therefore essential to obtain an idea of presence and number of *Nysius groenlandicus* in the ITEX plots as far as seed production is concerned. In other arctic/alpine areas other lygaeid species ought to be considered.

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