# EFFECTS OF INSECT HARASSMENT ON WEIGHT GAIN AND SURVIVAL IN REINDEER CALVES.

Effekter av insektforstyrrelser pä vektøkning og overlevelse av reinkalver.

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*Abstract:* Relationships between insect harassment and the weight gain and survival of reindeer calves were studied in two areas in Finland north of the Arctic Circle. The level of insect harassment explained a significant amount of the yearly variation in calf weights determined in autumn or early winter in both areas and directly influenced calf mortality in one of them. The lowest weights and calf percents were experienced in years when a bad winter was followed by a warm summer with severe insect harassment.

Key words: Reindeer, mosquito, *Oedemagena tarandi*, blood-sucking insects, weight, mortality.

***Rangifer** 4 (1): 24 - 27*

HELLE, T. & TARVAINEN, L. 1984. Räkän vaikutus poronvasojen painonlisäykseen ja eloonjäämiseen.

*Tiivistelmä:* Räkän (vertaimevät ja porossa loisivat hyönteiset) vaikutusta vasojen painoon ja vasaprosenttiin tutkittiin Alakylän paliskunnassa sekä Kaldoaivi - Paistunturin alueella. Kummallakin alueella räkkä selitti huomattavan osan vasojen syyspainojen vuosivaihtelusta ja Kaldoaivi - Paistunturissa se vaikutti suoraan myös vasaprosenttiin. Vasojen painot ja vasaprosentit olivat alhaisimmat vuosina, joina vaikeaa talvea seurasi kuuma, hyönteisille suotuisa kesä.

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*Sammendrag:* Effekter av insektforstyrrelser på vektøkning og overlevelse av reinkalver er studert i to områder av Finland nord for Polarsirkelen. Graden av insektforstyrrelser forklarte en signifikant andel av variasjonene fra år til år i kalvevekter bestemt høst eller tidlig vinter for begge områder. Den virket også direkte inn på kalvedødeligheten i et av områdene. De laveste vekter og kalveprosenter fant man i år der en dårlig vinter ble etterfulgt av en varm sommer med alvorlige insektforstyrrelser.

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Recently increasing attention has been paid to the direct influence of insect harassment on energetics of the reindeer and caribou (*Rangifer tarandus*). At its worst their blood loss is estimated at 125 g per day (Zhigunov 1968), in addition to which shaking, running, galoping, major shifts of habitat and other measures for avoiding the irritating insects make considerable energy demands on the animals (Thomson 1973, Reimers 1980, White 1983) at precisely the time when they must maximize their weight gain. It is therefore commonly suggested that the insects may have a detrimental effect on the animals' performance. The strongest evidence for this comes from Spitzbergen, which has no insects and where the reindeer achieve very rapid growth in summer and are capable of storing enormous fat reserves (Reimers 1980, Reimers & Ringberg 1983).

We set out here to test the validity of the insect hypothesis and to attempt to determine its ecological significance. The data concern the Finnish semi-domestic reindeer, and instead of areal comparisons we relate the yearly weight variation in 4 - 7-month-old calves to the level of insect harassment during the summer. Since no direct measurements of insect numbers are available, we describe the severity of insect harassment in terms of daytime air temperatures (2.00 p.m.) during the potential insect season. Mosquitoes (*Aedes* ssp.) and blackflies (*Simuliidae*) are universally active above 7°C to 8°C and gadflies (*Tabanidae*) and warble flies (*Oedema-*

*gena tarandi* and *Cephenomya trombe*) above 13°C to 17°C (Breev 1950, Skogland 1974, White & al. 1975). The flying activity of insects is also known to increase exponentially with temperature (Helle & Aspi 1984). On the other hand, the reindeer do not suffer from high temperatures themselves (Yousef & Luick 1975). Our data on the dressed weights of male calves slaughtered in October - January were collected from two areas: the herding district of Alakylä, situated in the coniferous forest belt about 50 km north of the Arctic Circle (5175 weights from the period 1968-69 to 1978-79), and the Kaldoaivi - Paistunturi area, lying above the forest line in the far north of Lapland (about 70° lat.; 8637 weights from the period 1974-75 to 1982-83).

The mean calf weights ranged between 16.2 and 21.9 kg in Alakylä and between 14.9 and 22.5 kg in the Kaldoaivi - Paistunturi region. The number of warm days in the summer explained a significant proportion of the yearly weight variation (mean weights were used) in both areas (Fig. 1.), the highest value in Alakylä being found for the period 20.6. - 31.7. including both the peak occurrence of mosquitoes (20.6. - 10.7.) and the flying season for gadflies (10.7. - 31.7.) It is known that even a few gadflies can cause as much panic in a reindeer as several hundred mosquitoes (Zhigunov 1968).

In the Kaldoaivi - Paistunturi area, however, the detrimental relationship was strongest when only the mosquito season was taken into account, apparently due to the scarcity of gadflies. Warble flies, on the other hand, are common in the very north of Lapland but rare in forest areas (Helle 1980), and are on the wing mainly in August, but no relationship was found between the number of warm days and calf weights in the Kaldoaivi - Paistunturi area, even though warble flies are commonly regarded as the most harmful insects of all.

We have not yet analyzed all the possible variables which might explain the yearly variation in weights, but preliminary results suggest that the other summer weather variables have much less influence than do temperatures during the insect season. The most important of the other factors seems to be the temperature sum during calving time (15.5. - 10.6., threshold value + 5°C), which obviously correlates with the availability of green forage being an important determinant of milk production in the females, which is in turn reflected in the nutritional status and weight gain of the calves (Varo & Varo 1971, White 1983). The availability of forage during the previous winter was measured by means of the winter survival index, i.e. the number of reindeer accounted in

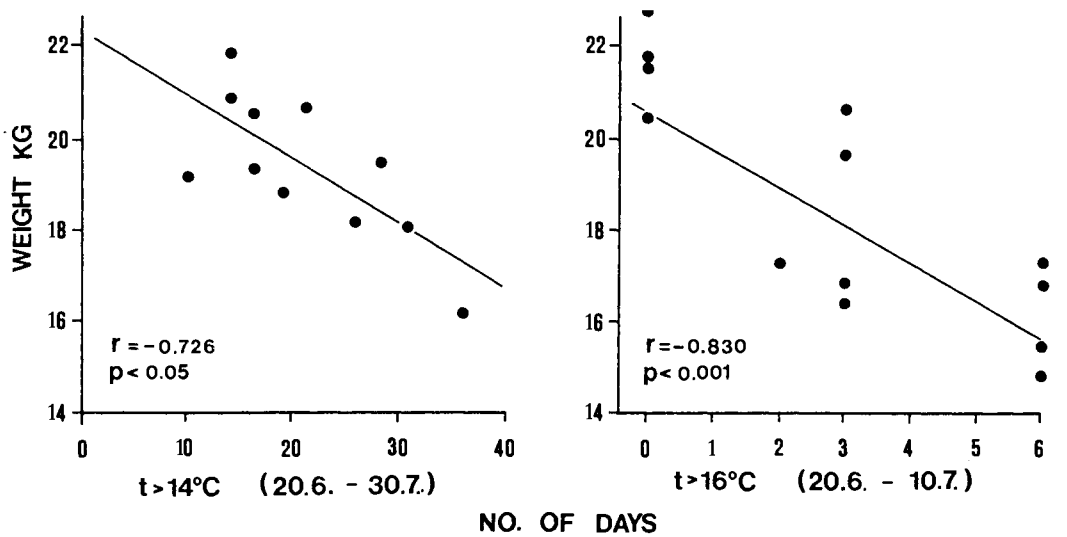


Fig. 1. The relationships between the number of warm days during the insect season and the mean dressed weights of reindeer calves in autumn - early winter in Alakylä (left) and Kaldoaivi - Paistunturi (right). Each plot is the mean value of 85 - 1712 weight records.

*Forholdet mellom antall varme dager under insektsesongen og de gjennomsnittlige slaktevekter for reinkalver om høsten eller tidlig vinter i Alakylä (venstre) og Kaldoaivi-Paistunturi (høyre). Hvert punkt er gjennomsnittsverdien av 85 - 1712 vektregistreringer.*

Table 1. Correlation analysis of the influence of winter survival index and insect harassment on calf weights in next autumn - early winter. Alakylä n = 11, Kaldoaivi - Paistunturi n = 13.

| | Alakylä | | Kaldoaivi-Paistunturi | |
|---|---|---|---|---|
| Simple correlation coefficients | r | p | r | p |
| Winter survival index and weight | 0.797 | <0.01 | 0.541 | <0.1 |
| Insect harassment and weight | -0.726 | <0.05 | -0.830 | <0.001 |
| Partial correlation coefficients | | | | |
| Winter survival index and weight | 0.824 | <0.01 | -0.034 | NS |
| Insect harassment and weight | -0.763 | <0.05 | -0.749 | <0.01 |
| Multiple correlation coefficients | | | | |
| Combined effect of winter survival index and insect harassment | 0.921 | <0.001 | 0.830 | p<0.001 |

percent of that in the previous year. A significant positive relationship was found between this index and calf weight in Alakylä (Table 1), suggesting that if the female is able to maintain a good condition in the late winter, she will bear a vigorous calf with fairly good growth properties (Thorne & al. 1976, Nieminen & Eloranta 1982, Rognmo & al. 1983). The combination of a high level of insect harassment and poor winter conditions explained in Alakylä 85 % of the weight variation (Table 1).

In Kaldoaivi - Paistunturi these two variables explained in total of 73 percent of the yearly variation in calf percent (determined in July) ranging in years 1968-83 (in total 23 records) between 7 and 66 percent; for winter survival index and insect harassment the partial correlation coefficients were 0.667 ($p<0.001$) and -0.435 ($p<0.05$) respectively. It is obvious that the light-born calves of undernourished females are particularly prone to insect harassment, which operates as an immediate mortality factor. Bergerud (1971) found a 30 % weight difference among newborn calves of the Newfoundland caribou as a result of the winter conditions, but this did not influence their subsequent survival. The calf weights recorded in Newfoundland nevertheless ranged between 6.1 and 9.0 kg vs. a mean birth weight of 4.9 kg among Finnish reindeer (Nieminen & Eloranta 1982). The birth weight of the Spitzbergen reindeer is only 2.5 - 3.5 kg, but calf survival is good (Reimers & Ringberg 1983), apparently due to the lack of insect harassment.

Our results support the hypothesis of Reimers (1980) that insect harassment constrains the growth of reindeer and indicate that insects directly influence the condition of the calves, leading to increased mortality, especially if the females are faced with a food shortage in late winter. Evidence also exists that the age at which the male reaches its final body size is dependent on the weight which it was capable of achieving during its first growing season (Varo 1972, Helle 1982). Being born in the «wrong» summer will detract from its fitness, since, as in many other polygynous ungulates, competitive ability during the rutting season is closely related to body size (Clutton - Brock & Harvey 1978, Prowse & al. 1980). As far as we know, the influences of insect harassment on the reindeer are unique, which may partly explain its spectacular behavioural responses to their presence, such as the formation of dense herds of thousands of animals (Baskin 1970, White & al. 1981, Helle & Aspi 1983) and habitat shifts over distances which are greater than in any other terrestial mammal (Kelsall 1968).

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*Manuscript received March 8, 1984*