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Abundance of warble fly (Oedemagena tarandi) larvae in semi-domestic reindeer (Rangifer tarandus) in Finland

TIMO HELLE

HELLE, TIMO. Abundance of warble fly (Oedemagena tarandi) larvae in semi-domestic reindeer (Rangifer tarandus) in Finland. Rep. Kevo Subarctic Res. Stat. 16: 1 – 6. Illus. 1980. – The percent of infestation and number of warble fly larvae per animal for semi-domestic reindeer were studied in six herding co-operatives in northern Finland. The larvae were counted on freshly slaughtered animals between November 22. and February 22. Reindeer were more infested by warble fly larvae in Mountain and Forest Lapland than in the coniferous forest belt. The number of larvae per infested animal increases exponentially with the percent of infestation. The males/castrates and calves were infested to a much greater extent than the females. These differences are difficult to explain only by ecological and behavioural factors relating to warble fly infestation. It is suggested that at least the females are capable of reducing the number of larvae through immunological reactions.

KEY WORDS: – Lapland – reindeer – warble fly (Oedemagena)

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Introduction

Most reindeer and caribou populations are infested by two parasitic insects, the warble fly (*Oedemagena tarandi* L.) and the nostril fly (*Cephenomyia trombe* L.). The warble fly larvae live under the skin on the animal's back and those of the nostril fly in the nasal cavities and pharyngeal sack. The breathing holes of warble fly larvae reduce the value of the hide; occurring in great numbers these parasitic larvae weaken the condition of animals and are a direct mortality factor in extreme cases. According to Saveljev (1968), the annual losses in the Soviet Union caused by parasitic insects are 25 – 30 % of the total income from reindeer husbandry. In Sweden, the corresponding loss is estimated as being 10 – 15 % (Nordkvist 1975).

Since the year 1977, several herding co-operatives in Finland have treated their reindeer with larvicidal drugs (Warbex and Fention preparations) in order to break the parasitic cycle of flies in reindeer. This study provides data on the normal abundance of warble fly larvae in different parts of the Finnish reindeer management area. Such information is needed when deciding how often mass treatments must be repeated. The environmental conditions prevailing for the animals under Finnish reindeer husbandry differ radically from those which obtain for most wild or semi-domestic populations; this situation provides an opportunity to test earlier hypotheses concerning warble fly infestation with respect to the age, sex, and habitat selection of animals.

Material and methods

The material was gathered in three successive winters in six herding co-operatives in different parts of the reindeer management area (Fig. 1). The herding co-operatives of Muotkatunturi and Näkkälä are situated in Mountain Lapland, where the reindeer live in summer on fells above the tree line. In the herding co-operatives of Kyrö and Kemin-Sompio, the reindeer utilize bog areas in addition to open fells and roam in coniferous forests as well. In the two southernmost sample areas, Poikajärvi and Halla, the most preferred summer ranges are open bogs and cleared areas, but the reindeer have close contact also with coniferous forests.

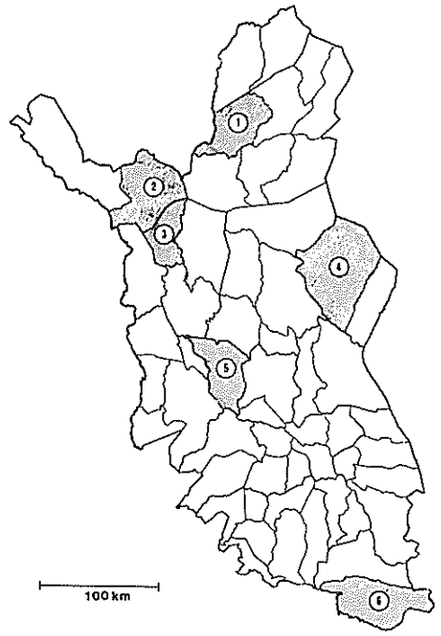

Fig. 1. Finnish reindeer management area and the herding co-operatives of this study. 1 = Muotkatunturi, 2 = Näkkälä, 3 = Kyrö, 4 = Kemin-Sompio, 5 = Poikajärvi and 6 = Halla.

In the whole area the reindeer – except old males and castrates – congregate in late June into large post-calving herds comprising many hundreds or even thousands of animals. The summer ranges are nearly identical with the calving grounds (Lapin Seutukaavaliitto 1973). In Poikajärvi and Halla, the post-calving herds begin to disperse in the middle of July, but farther north this does not take place earlier than in the beginning of August.

The densities of reindeer over 1-year old vary from 1 (Muotkatunturi and Halla) to 2 (Kyrö) animals per km^2.

The egg laying of warble flies occurs in northern Lapland between June 15. and September 15., with the peak being around July 25. (Itkonen 1948, Oinonen 1964).

According to Lisitzin (1977), warble fly larvae are to be found in Finland in the skin of reindeer from October/November onwards. The larvae for this study were counted on the hides of freshly slaughtered animals between November 22. and February 22. In total, the material consists of 337 males/castrates, 209 females, and 381 calves. The studied males/castrates were in most cases 2 – 7 years old, whereas the mean age of the females apparently reached 10 years. It is estimated that at least 90 % of the calves were males.

Results

The infestation percentages are given in Table 1 and the mean number and range values of larvae per animal in Table 2.

Table 1. The infestation percentage among males/castrates (I), females (II) and calves (III) (n = number of animals in sample; – = no observation).

	1977 – 78			1978 – 79			1979 – 80		
	I	II	III	I	II	III	I	II	III
Muotkatunturi	–	–	–	100 n 36	86 n 22	100 n 42	–	–	–
Näkkälä	71 n 88	67 n 3	–	89 n 63	59 n 34	100 n 9	94 n 17	88 n 33	87 n 15
Kyrö	92 n 25	65 n 17	100 n 58	89 n 19	88 n 17	98 n 63	–	–	–
Kemin-Sompio	–	–	–	88 n 24	100 n 25	100 n 17	78 n 19	56 n 18	96 n 26
Poikajärvi	80 n 5	38 n 8	95 n 20	–	–	–	–	–	–
Halla	26 n 19	29 n 7	42 n 62	56 n 9	59 n 17	63 n 32	46 n 13	38 n 8	57 n 7

Table 2. The mean (± S.E.) and range values for number of warble fly larvae among males/castrates (I), females (II) and calves (III). The number of animals in sample is given in Table 1; – = no observation.

Herding co-operative	1977 – 78				1978 – 79				1979 – 80			
	I	II	III	Significance of difference I v. II / II v. III	I	II	III	Significance of difference I v. II / II v. III	I	II	III	Significance of difference I v. II / II v. III
Muotkatunturi	–	–	32±7 0–98	p<0.001 / p<0.001	–	–	75±6 1–178		–	–	–	
Näkkälä	24±6 0–210	1±1 0–2	23±6 0–312	p<0.001 / NS	58±13 0–198	12±3 0–62	24±5 6–58	p<0.001 / NS	21±5 0–60			
Kyrö	23±9 0–216	4±2 0–22	52±10 0–260	p<0.05 / p<0.01	–	–	24±6 0–71	NS / NS	–	–	–	
Kemin-Sompio	–	–	–		–	–	50±9 2–144	p<0.05 / NS	13±4 0–76	3±1 0–15	103±20 20–344	p<0.001 / p<0.001
Poikajärvi	22±13 0–60	7±5 0–33	11±3 0–32	p<0.05 / NS	–	–	–		–	–	–	
Halla	1±1 0–7	0±0 0–1	3±1 0–29	NS / NS	1±1 0–3	1±0 0–1	6±3 0–52	NS / NS	3±1 0–10		11±4 0–86	NS / NS

Despite the paucity of data in the central and southern parts of the management area and the great annual variation in numbers of larvae, it seems clear that the reindeer of Mountain and Forest Lapland are more heavily infested by warble flies than those living entirely in the coniferous forest belt. Such a conclusion is supported also by summer field observations. In the herding co-operative of Käsivarsi, situated in the neighbourhood of Näkkälä, imagoes of warble flies are seen very commonly and these were killed earlier in great numbers on white reindeer hides (Oinonen 1964). On the other hand, in the summer of 1975 I collected a great number of insect samples from two hand-reared reindeer castrates in Kuusamo, the central part of the management area, and these samples did not contain warble flies.

The mean number of larvae on the males/castrates in all 12 subsamples was higher than on the females and in six cases the difference was statistically significant. On the calves, the mean figure in one subsample was equal and in ten subsamples greater than on the females; in five cases, the difference was statistically significant.

The abundance of larvae varied considerably in various winters. The highest values were found in winter 1978 – 79, but the reason for this remains unclear.

Fig. 2 shows a clear positive correlation between the percent of infestation and the mean number of larvae per infested animal separately for males/castrates, females, and calves. Especially for the calves and males/castrates, the mean number of larvae per animal increases sharply in an exponential relationship with the percent of infestation.

Discussion

The earlier reports referring to the abundance of warble fly larvae have been concerned with semi-domestic or wild populations, which live in summer on arctic tundras or open fells. Nordkvist (1967) mentions as a general figure for Swedish semi-domestic reindeer 100 – 200 larvae per animal. In the Soviet Union, the normal figures for semi-domestic reindeer range from 100 to 200, too, but in extreme cases the animals are infested by 1000 to 2000 larvae (Saveljev 1968). Kelsall (1975) studied the warble fly distribution in nine barren-ground caribou populations in the Canadian Arctic; the mean number of larvae per animal exceeded 100 among the males in five populations and among the females in two.

In Finland high figures are to be found only for males and calves in northernmost Lapland, whereas the reindeer living in the coniferous forest belt are infested to a considerably lesser degree. This may indicate that the warble fly is adapted primarily to cope with open habitats. According to Saveljev (1968), the sexes meet each other for mating on the tops of mountains or hills rising clearly above the surroundings, and the same places are used year after year (see also Lisitzin 1977). In taiga areas such places are largely lacking and for this reason,

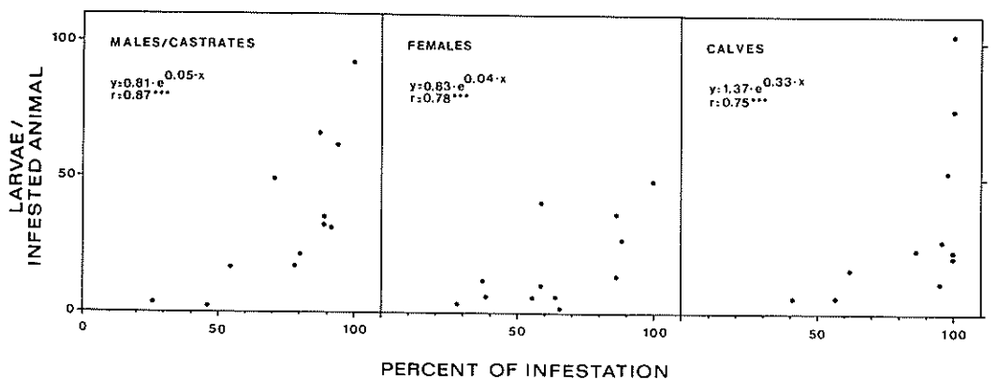

Fig. 2. Correlations between the percent of infestation and mean number of larvae per infested animal. Each point represents 3–88 reindeer (see Table 1 and 2).

the females may fail in searching for the more sedentary males. In addition, warble flies avoid shadowy places (e.g. Itkonen 1948, Oinonen 1964, Espmark 1967), which obviously causes them difficulties in finding and attacking the reindeer.

As in the present findings, the number of larvae per animal as well as the percent of infestation are higher among the males than among the females also in wild reindeer of the Taimyr Peninsula (Mitšurin 1965) and in Canadian barren-ground caribou (Kelsall 1975). Mitšurin gives two explanations for this. First, warble flies deposit their eggs only on the thin, growing summer hair, and, because the males moult earlier than the females, they are subjected to successful attacks of warble flies longer. Secondly, in the case of the wild reindeer of the Taimyr Peninsula, the summer ranges of the males are situated farther south where the higher temperatures provide more favourable flying conditions for warble flies. Kelsall (1975) states that in many barren-ground caribou populations, the females tend to move away from areas of larvae emergence and pupation, whilst the males are crossing exactly these areas during the best flying season of warble flies.

However, these explanations can hardly solve this problem in the case of Finnish semi-domestic reindeer. When the most warble flies pupate, about July 25., even the females have a new pelage. In contrast to the migratory populations, the summer movements of both sexes in herding co-operatives studied here are very limited and no clear segregation by sex in an areal sense is observable; it must be taken into account that warble flies can fly 20 – 30 km and even more (Skjenneberg & Slagsvold 1968).

One would expect that differences in the numbers of warble fly larvae between sexes are due to sex-specific grouping patterns during the summer period. Helle (1980) noted in Kuusamo that about 85 % of the female segment occur in large post-calving herds, whilst the most mature males and castrates are living alone in summer. Kelsall (1968), Skoog (1968) and Skogland (1974) suggest that group formation may benefit the senior members of the herd, since the flies seem to attack more on the herd's perimeter. However, this consideration fails to explain the great number of larvae and the high percent of infestation among the calves, as their place in the herd is predicted by the social status of their mothers.

The behavioural defence reactions against warble flies, such as twitching, shaking of the body, and rapid movements, show great individual differences. In general, the white animals, characterized by a low level of activity, are particularly subject to the attacks of warble flies, but differences in this respect are mentioned for wild coloured animals, too (Bergman 1917, Espmark 1967, Skjenneberg & Slagsvold 1968). There is, however, no evidence that behavioural defence reactions of males and calves are less effective than those of the females as their higher level of infestation would suggest; according to Espmark (1967), defence behaviour of the calves begins to develop at the age of 2 – 3 weeks and is more violent than that of adult animals when the calves are 1.5 – 2 months old.

It is known that warble fly larvae are subject to high mortality in the first larval stage, especially in animals in good physical condition (Saveljev 1968) and dead larvae are often found also in winter in caribou hides (Kelsall 1975). These observations give reason to put forward a suggestion to the effect that the abundance of warble fly larvae in reindeer is not only dependent on the times of successful egg layings of warble flies but also on the capacity of the infected animal to destroy the larvae. This hypothesis, in pointing out individual and age- and sex-related differences in the efficiency of these physiological defensive reactions, may explain more reliably the observed differences in warble fly infestation between the males and females and between females and calves in Finnish semi-domestic reindeer than hypotheses dealing only with the ecology and behaviour of the reindeer.

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Herbivorous insects of the birch in Iceland

SEPPO KOPONEN

KOPONEN, SEPPO. Herbivorous insects of the birch in Iceland. Rep. Kevo Subarctic Res. Stat. 16. 7 – 12. Illus. 1980. – The herbivore fauna of the mountain birch in southwestern and northern Iceland was studied by sweep netting in 1979. The predominant groups were lepidopteran larvae and aphids. *Epinotia solandriana* and *Operophtera brumata* dominated among lepidopteran larvae in summer samples and *Acleris notana* in autumn. The most abundant aphid was widely-distributed *Euceraphis punctipennis*. The highest density of herbivores and the heaviest consumption was observed at Heidmörk, southwestern Iceland. However, no real defoliation was found. Certain herbivore groups common and typical in most parts of the subarctic birch forest zone were absent from the Icelandic material: psyllids, symphytans, cecidomyids, and mining insects. In addition, no special birch-feeding coleopterans were found.

KEY WORDS: – herbivores – Iceland – insects – moths – mountain birch

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Introduction

The subarctic birch forest zone is well-developed especially in Fennoscandia, but occurs to some extent throughout a wide holarctic zone. When Iceland was settled about 1100 years ago "about half of the land was vegetated, 80 % of which was birch woodlands of some description" (Bjarnason 1974). Human activity, and grazing and trampling by domestic animals caused great destruction of the birch forests in Iceland. To-day, only 100 000 – 125 000 hectares of birch forests are found in Iceland (Bjarnason 1974, Anon. 1977). These small and isolated birch woodlands and their insect fauna are an interesting study object, especially when compared with data from surrounding areas with mountain birch vegetation.

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The tradition of entomological study is long in Iceland. This is also true of birch defoliation. Thus there is published information about birch forest damage by lepidopteran larvae in 1750. The damage was reported by customs officer Olaus Olavius but the species causing the damage is unknown (see Wolff 1971). Birch forest defoliation was observed in southern Iceland, 1908, by Böving (1925). This damage was due to the tortricid moth *Epinotia solandriana* (see Wolff 1971). Defoliation in birch forests has been locally observed rather commonly since these older reports. The lepidopteran species reported to cause them are *Epinotia solandriana, Acleris notana* (mentioned as *A. ferrugana*; however, cf. Bradley et al. 1973), *Erannis defoliaria*, and *Operophtera brumata* (Lindroth 1931, Björnsson 1968, Wolff 1971, Sigurdsson 1977, Hallgrímsson 1979). The interesting observation by Hallgrímsson (1977) of dwarf birch defoliation by