

# Mobility of *Epirrita autumnata* (Lepidoptera, Geometridae), as indicated by altitudinal light trap sampling in Finnish Forest Lapland

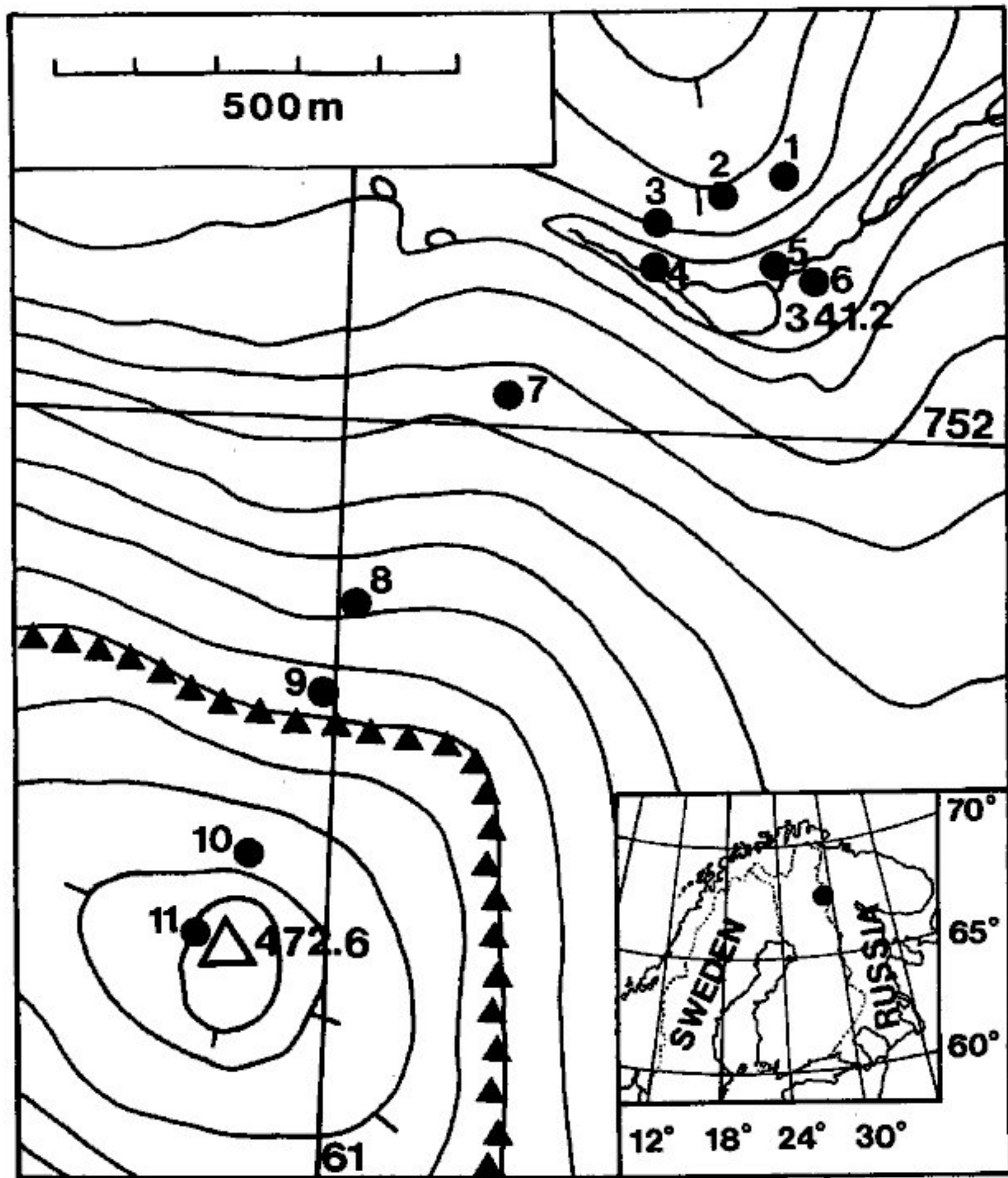
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**Abstract.** Eleven light traps with a 500 W blended light lamp installed in virgin habitats in the Väriötunturi fell area, E Finnish Forest Lapland (67°44'N, 29°37'E), were operated daily over the years 1978-1992. The total catch

of the autumnal moth *Epirrita autumnata* was 134787 individuals. The catch varied both between years and between traps, those located on the treeless summit hardly collecting any individuals at all. The most abundant catch was gained not from the mountain birch zone, but from lower altitudes, i.e. from the coniferous forest zone with a rich admixture of deciduous trees, especially birch. The reasons behind the differences are discussed in the light of the mobility of the moths involved.

**Key-words:** *Epirrita autumnata*, mobility, light trap, altitude.



**Fig. 1.** Location of the sites of the light traps (1-11) in the Väriötunturi fell area of Finnish Forest Lapland. Coordinates =Grid 27°E and height above sea level.

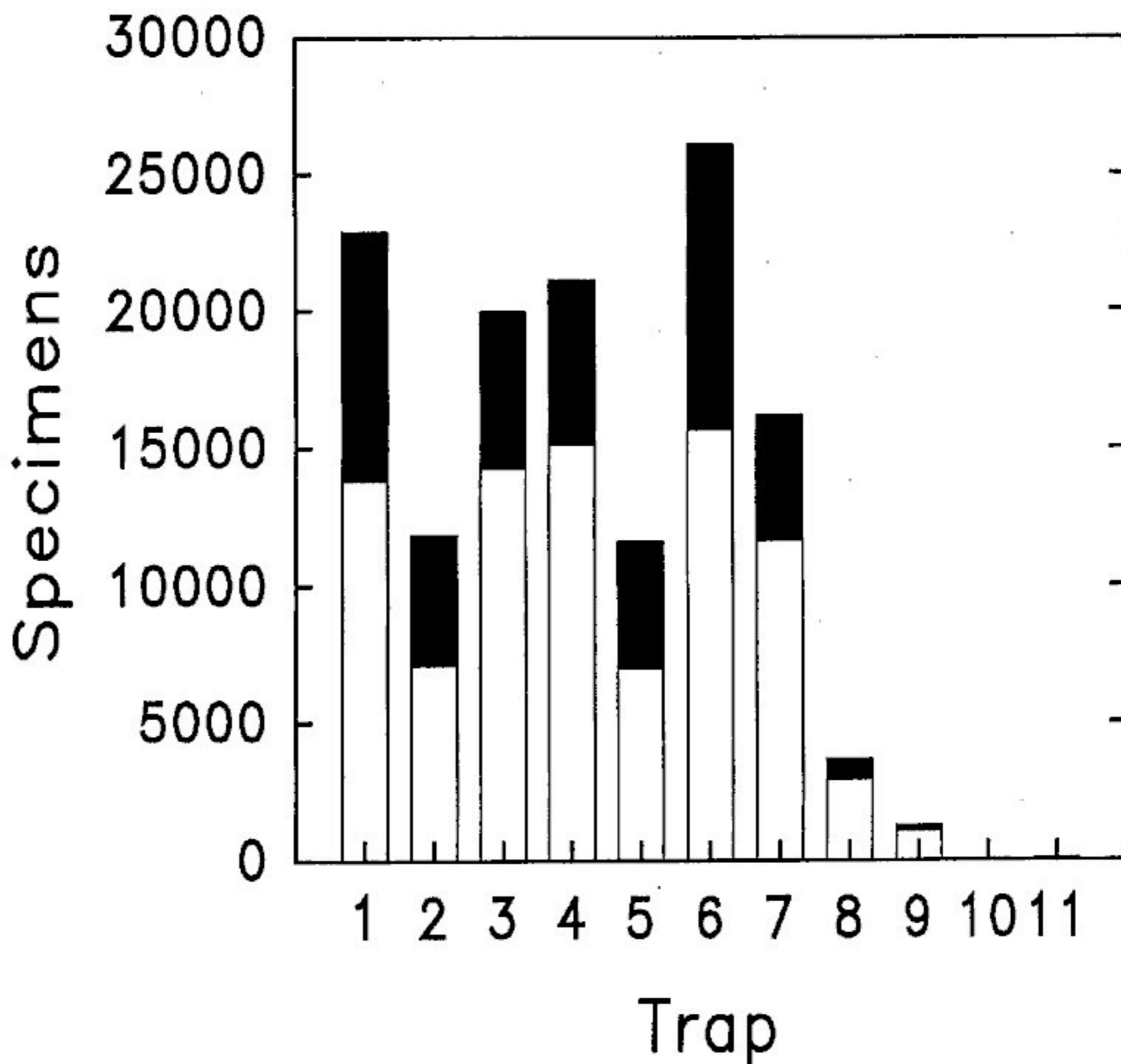


Fig. 2. Total catches of *Epirrita autumnata* (Bkh.; Lepidoptera, Geometridae) in traps 1-11, in the Värriötunturi fell area of Finnish Forest Lapland in 1978-1992.

### Introduction

The autumnal moth, *Epirrita autumnata* (Bkh.) is a holarctic geometrid distributed from Northern and Central Europe into Russia and Western Siberia (Mikkola *et al.* 1985). It has mass outbreaks at about ten-year intervals (Tenow 1972), when it can destroy vast areas of birch forest (Tenow 1972, Pulliainen 1976, Tenow and Bylund 1989). The area affected by such occurrences covers the whole of Northern Fennoscandia and extends to the mountainous areas further south, the distance between the extreme points being over 1500 km (Tenow 1972). *Epirrita autumnata* is fairly polyphagous, living on all kinds of herbs and dwarf shrubs, but its main food is *Betula* spp. (Seppänen 1970).

The aim of this paper is to provide records of the altitudinal distribution and mobility of *E. autumnata* in one fell area over a 15-year period.

### Material and methods

Eleven light traps of the "Jalas" model (see Jalas 1960) were installed in the following virgin habitats in the

Värriötunturi fell area, E Finnish Forest Lapland (67°44'N, 29°37'E; Grid 27°E 751:60, 61; 752:61) (Fig. 1): (1) three traps (Nos. 1-3) in a dry heath forest of old Scots pines (*Pinus sylvestris*); (2) three traps (Nos. 4-6) in a ravine covered by a mixed forest dominated by spruce (*Picea abies*); (3) three traps (Nos. 7-9) in a mountain birch forest (*Betula pubescens* ssp. *tortuosa*) on the northern slope of Värriötunturi; and (4) two traps (Nos. 10-11) on the treeless summit of Värriötunturi.

The lights (500 W blended light lamps) were switched on for the period 2000-0800 each night from mid-May to mid-October and the catches were collected each morning and stored in a freezer. They were later sorted, identified and sexed.

The period of continuous daylight in the Värriötunturi fell area lasts from 30 May to 14 July. The area is free of snow from approximately the end of May to mid-October.

The moths were collected in the same way every summer over the period 1978-92.

### Results

Altogether 134787 specimens of *Epirrita autumnata* were collected, comprising 89006 males and 45781

females.

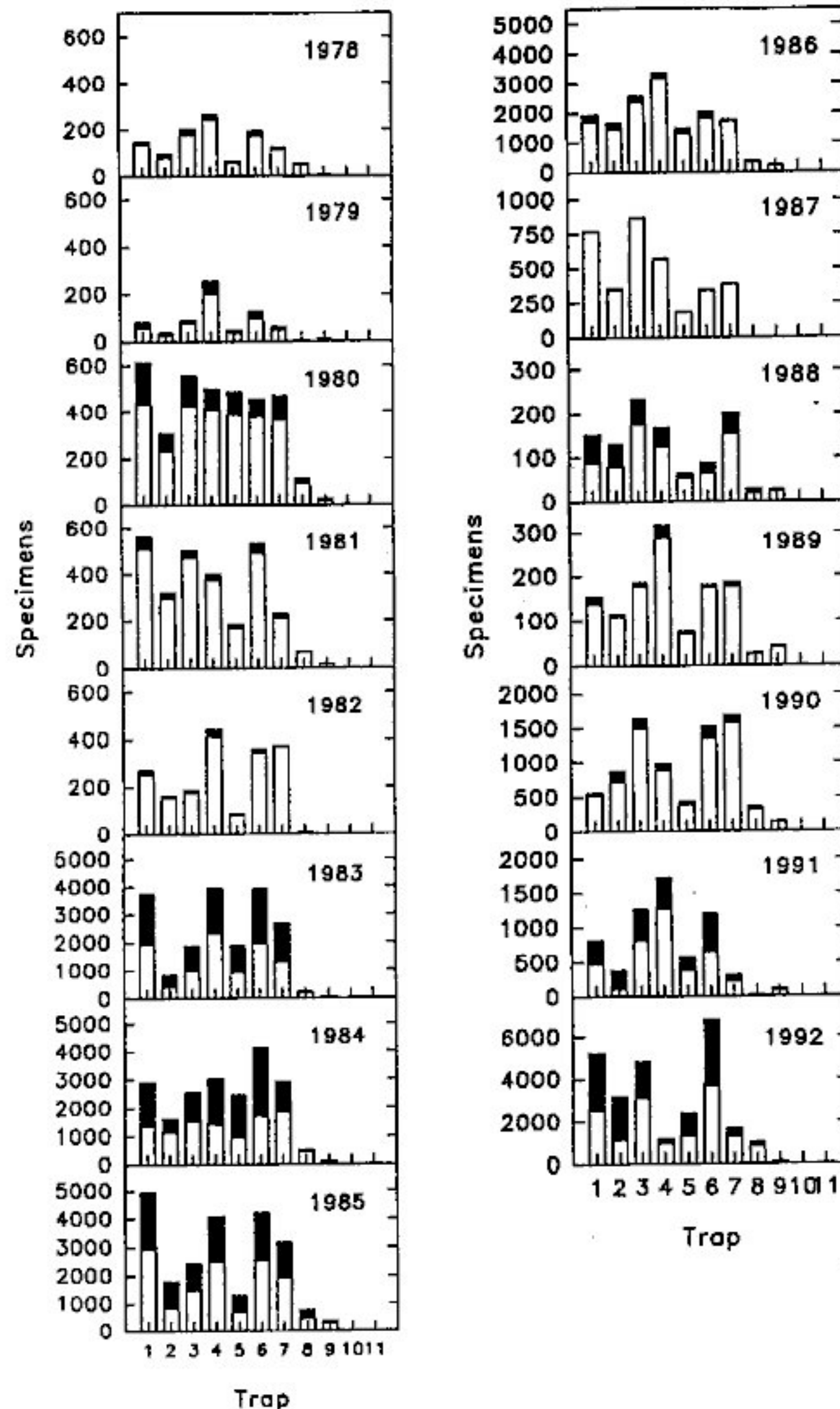
The most outstanding feature of the total catches is that the treeless summit traps contained hardly any individuals at all (Fig. 2) and traps nos. 8 and 9 in the upper part of the mountain birch forest were only a little better in this respect. The numbers of birches within a radius of 20 m around the traps were as follows (from trap no. 1 to trap no. 11: numbers of trunks): 21, 3, 37, 68, 261, 377, 488, 422, 180, 0, 0. There was no significant correlation between the numbers of individuals and the numbers of birch trunks either in the total catch or in the catches for individual years (Spearman rank correlation).

Although the general figure remained fairly similar from year to year, differences could be seen between the years in the effectiveness of different traps (Fig. 3). The proportion of females remained at about 20 % when catches were low, but increased to almost 50 % in peak years. A general male dominance in the catches from traps nos. 8 and 9 was apparent throughout (Fig. 3).

## Discussion

Although winter temperatures below  $-39^{\circ}\text{C}$  kill the eggs of *E. autumnata* and thus prevent some of the periodic mass outbreaks (Tenow and Bylund 1989), we did not find any correlation between frost sums and the numbers of specimens caught in the Värriö fell area possibly on account of the exceptional local conditions, i.e. extremely low temperatures do not occur there, and were not even recorded during the extremely cold winter of 1987/88 (Anon. 1988, Itämies *et al.* 1993). One must bear in mind, however, that the open summit areas are subject to almost continuous winds, even in winter, which, as is well known, may exaggerate the effects of frost.

The absence of the species from the summit traps can naturally be explained by the absence of its main food plant, *Betula pubescens* ssp. *tortuosa*, but it is significant that even at times of mass outbreaks, i.e. during the years



**Fig. 3.** Yearly catches of *Epirrita autumnata* (Bkh.; Lepidoptera, Geometridae) in the traps in the Värriötunturi fell area, Finnish Forest Lapland.

1983-86 and 1991-92 (see Itämies et al. 1993), hardly any specimens were caught in these summit traps. The continuous wind prevailing here must have a great influence on the flight of the moths and prevent them from entering these traps, and the general openness of the area may also be a hindering factor. The light traps themselves would certainly be effective at the time of year when the autumnal moths are flying, due to the dark nights.

The low catches in traps nos. 8 and 9 are also significant, as they were situated in the middle of the mountain birch forest zone. The trees here are admittedly sparsely distributed and still rather small, but the proportion of plant mass available as food for the moths must be higher than in the surroundings of traps 1-7, which gave the largest catches. The vegetation around the latter traps is higher and more closed, however, and this may have a great influence on the actual flight of the moths. The wings of *E. autumnata* are of such a shape and size that it cannot be regarded as a good flier, which may result in a rather restricted flying radius and emphasize the significance of the number of moths to emerge at a particular site. This in turn will emphasize the significance of the winter temperatures to which the eggs are exposed. For this reason, and on account of the relative thinness of the snow cover on the windy slopes of the fell, it is possible that the eggs may not be able to survive the winter in this zone every year.

The occurrence of autumnal moths in the traps can partly be explained by the amount of birch around them. Why did traps 1 and 2 collect so many specimens? The openness of the terrain on the one hand and the coverage on the other may explain part of this result, the light in the trap being visible from a long distance, so that it collects individuals from a wide area. Another explanation could be that the moths prefer to fly at a certain height, so that while circling around the fell they easily enter the radius of influence of the lights. It is also possible that the larvae may live on the dwarf shrubs in the field layer, which they can use as food (Seppänen 1970), and thereby maintain - when otherwise possible - an abundant population around these traps.

The present data support the idea of very low mobility on the part of *E. autumnata* moths (both larvae and adults), and it is interesting in this context to note the remarkable

coincidence of the mass outbreaks of this species over vast areas (see Tenow 1972). This leads us to seek some "universal" factor(s) which could result in such outbreaks simultaneously in the fell and forest areas of Lapland within Finland, for instance.

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