

ON THE LAND MOLLUSCS OF THE KEVOJOKI RIVER VALLEY IN FINNISH LAPLAND

TORSTEN SILVOLA

Department of Zoology, University of Turku,
Turku, Finland

I. INTRODUCTION

Two extensive monographs on the mollusc fauna of Finland appeared at the beginning of this century (LUTHER 1901 and MELA 1902), but it was not until the fifties that attention was again directed to molluscs in this country. The published investigations related mainly to the distribution of molluscs in southern Finland, with only a few observations on the molluscs in northern regions (KOLI 1955, PETÄJÄ & VESANTO 1955, SILVOLA 1957).

The following observations on molluscs were made in the Kevojoki River valley in the northernmost commune, Utsjoki (latitude 69°30' N), of Finnish Lapland. The greater part of this area where the field work was done, a valley less than one kilometre wide and about 60 kilometres long, includes the Kevo National Park (Fig. 2).

The Kevojoki River valley extends in the north-south direction through the treeless mountainous regions of Finnish Lapland. The valley contains many canyons and especially the eastern bank is precipitous, even vertical in places. The bare precipitous cliffs may be up to one hundred metres high.

The river varies in width from two metres at its sources to some twenty metres at its mouth where it empties into Lake Kevojärvi. At places the river flows into pools and in its middle reaches there is a string of lakes (Njaggaljärvet) in a canyon extending over a distance of some ten kilometres. The river valley is described in greater detail in other papers of this volume.

A luxuriant flora grows in areas sheltered from the winds in the valley and owes its existence to the water from abundant snow that melts in the spring. The only forests in Utsjoki commune are found in valleys and here they mainly consist of birch and pine, of which even the latter forms stands. In favourable places, small groves occur and in the middle reaches and higher up numerous meadow forests of birch (cf. HÄMET-AHTI 1963).

Owing to the abundant vegetation the fauna is rich and varied, up to ten times as numerous as in the surrounding areas.

The area is not inhabited, but a few peat huts that are still in use have been erected by fishermen.

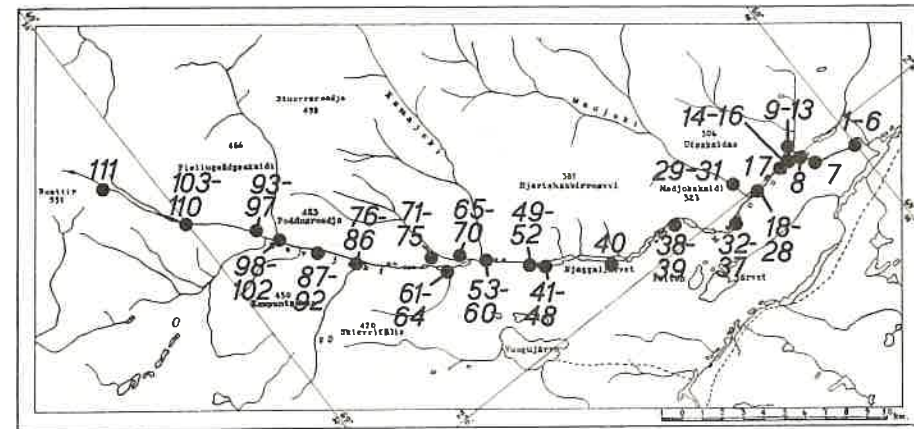


Fig. 1. Sampling sites.

This investigation was carried out in July, 1956, when over one hundred samples were collected from plots 50 cm square. The samples were taken in the mornings from 3 to 10 a.m.; the weather varied from rainy to clear and from calm to windy, and the temperature was always above $\pm 0^{\circ}\text{C}$. The sampling sites were chosen so that material from all biotopes would be collected. The plot was sampled by the plucking method starting from one corner and advancing slowly to the opposite corner over a period of 10–25 minutes. No instruments such as nets or sieves were used, although they might have been of advantage. The reason for their absence was the weight of all material and equipment which had to be carried over long distances.

The samples for which adequate information was collected numbered 110. The molluscs in them were identified with the aid of STEENBERG's handbook (1911) and the papers of MELA (1902) and LUTHER (1901). The identifications were made partly on site, but also, especially the identifications of *Vertigo* species, at the Zoological Museum of the University of Turku with the assistance of Mr. H. VESANTO, M.Sc.

The hundred and ten samples collected from the area were grouped into eight biotopes. The biotopes were defined on the basis of the plant life by taking also into consideration the forest type. The map in Fig. 1 shows the sampling sites.

II. THE MOLLUSC FAUNA OF VARIOUS BIOTOPES

1. *The luxuriant groves*

The eight samples from these biotopes represent 7.3 per cent of the total number of samples. The proportion is high, but as these biotopes were few in number and characterized the area studied as compared with other regions

of the commune, the relatively large number of samples is probably justified. The wood species were birch and chokecherry. These species do not form true forests, for the groves covered only small areas (forests with tall ferns, HÄMET-AHTI 1963). The florae of the sampling sites are listed below.

Table 1
Molluscs of samples from luxuriant groves.

Sample no.	2	3	4	32	33	34	35	37	Total
<i>Euconulus fulvus</i>	5	1	2	1	24	20	1	8	62
<i>Perpolita petronella</i>	4	4	—	2	4	6	2	2	24
<i>Discus ruderratus</i>	5	1	3	2	13	15	10	4	53
<i>Vitrina pellucida</i>	8	4	3	—	4	3	9	4	35
<i>Acanthinula harpa</i>	1	—	—	—	6	2	1	—	10
<i>Perpolita hammonis</i>	2	1	—	—	3	3	2	5	16
<i>Cochlicopa lubrica</i>	6	2	—	—	3	5	8	2	26
<i>Arion subfuscus</i>	—	—	—	—	—	1	—	—	1
Total	31	13	8	5	57	55	33	25	227

Sample no. (2) 4.7 from the soil under a nettle patch in a luxuriant vegetation at the foot of Kotkapahta cliff. (3) from the soil under a patch of *Dryopteris filix-mas* and litter in the preceding grove. (4) as in the preceding, but from the soil under a patch of *Ribes spicatum*. (32) 8.7 from the soil under *R. spicatum* in a grove at the foot of Linkkapahta cliff. (33) as the preceding, but from litter under patch containing *Rubus saxatilis*, *Paris quadrifolia*, *Melica nutans* and *Galium uliginosum*. (34) as the preceding, but from the soil under a nettle. (35) as the preceding, but from a layer of chokecherry leaves and branches in a place about 100 metres from the preceding near the Kevo Falls.

2. Litters of the meadow forests

The number of samples from these groves was 23 (20.9 per cent), which is too few compared with those from luxuriant groves. The wood species in these biotopes were birch and poplar, the trees being often as tall as 10 metres, and shorter mountain ash. Sometimes juniper and willow grew in the vicinity (Fig. 38 in HÄMET-AHTI 1963).

(5) 4.7 from the soil under *Cornus suecica* near the Kotkapahta Cliff. (9) 5.7 from the soil under litter beside a moss turf in which blueberry and *Vaccinium vitis-idaea* grew near Pikku Kevojärvi. (11) as in the preceding, but from the soil under the bark and decayed trunk of a poplar. (19) 1.7 from the soil under a moist layer of dead leaves and branches in a path containing blueberry, *Vaccinium vitis-idaea*, *V. uliginosum*, *Empetrum hermaphroditum* and moss near the mouth of the Madjoki River. (31) 3.7 from a layer of dead leaves and branches between sparse grass near a willow bush close to a shore subject to floods near the mouth of the Madjoki River. (42) 12.7 from moss turf between blueberry and *Cornus suecica* in a place on a slope near the south end of the Njaggaljärvet lakes. (45) 13.7 from

Table 2
Molluscs in the litters of meadow forests.

Sample no.	5	9	11	19	31	42	45	46	48	49	66	79	83	84	89	92	94	95	98	99	100	101	102	Total
<i>Euconulus fulvus</i>	40	5	7	3	18	13	7	1	4	29	8	2	6	20	9	2	6	2	4	1	6	3	3	199
<i>Perpolita petronella</i>	6	—	1	3	1	1	2	2	—	2	1	1	5	—	5	7	3	4	14	7	5	4	5	79
<i>Discus ruderratus</i>	11	—	34	3	—	—	6	3	1	8	7	—	6	1	20	1	29	1	25	10	12	12	10	200
<i>Vitrina pellucida</i>	2	1	7	1	2	—	1	2	12	1	4	3	1	—	6	—	1	1	2	—	2	2	1	52
<i>Acanthinula harpa</i>	—	20	—	4	—	7	—	—	1	1	5	1	—	—	—	—	4	5	—	—	1	—	—	49
<i>Perpolita hammonis</i>	12	—	—	—	—	1	—	—	—	3	—	—	1	7	2	2	—	—	—	1	2	—	—	31
<i>Vertigo alpestris</i>	1	1	1	4	2	—	—	1	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	12
<i>Vertigo arctica</i>	—	—	—	—	—	3	1	—	—	1	—	—	—	4	—	—	—	—	—	—	—	—	—	11
<i>Arion subfuscus</i>	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	3
Total	72	29	50	18	26	23	17	9	19	46	26	8	19	32	42	12	43	13	45	19	28	21	19	636

the soil under *Hylocomium splendens* and *Lycopodium annotinum* in an area containing poplars and birches up to six metres tall on a slope near the south end of the Njaggaljärvet. (46) the same site and date as the preceding, but from dead leaves and branches under *Ribes spicatum*. (48) from *Hylocomium splendens* under *Cornus succica*, date and site as for sample (45). (49) from litter under *Cornus*, *Vaccinium vitis-idaea* and *Ledum palustre* in a grove of 9-metre-long birches a short distance south of the preceding site. (66) 15.7 from poplar litter on the bank of the Roajaatshe tributary. (79) 16.7 from birch leaf litter in a patch of *Lastrea phegopteris* on the bank of a brook flowing from the Skierrifälis mountain. (83) from moist birch litter between *Geranium silvaticum* and *Rubus saxatilis* in a site at the mouth of the preceding brook. (84) from moist litter of *Filipendula ulmaria* on the preceding site. (89) 17.7 from birch litter beside a rock at the mouth of a brook. (92) from a drier litter beside the rock in the preceding site. (94) 17.7 from litter between *Cornus succica*, blueberry and *Vaccinium uliginosum* in a grove of birch and poplar 8 metres tall near the mouth of the Fiellu Brook. (95) in the preceding site, and under the same flora but without blueberry. (98) from litter in a patch of *Polystichum lonchitis*, *Geranium silvaticum*, *Solidago virgaurea*, *Melica nutans*, juniper and *Rubus saxatilis* in a grove of birch and poplar less than one kilometre up the brook mentioned in the preceding. (99) from litter in a patch like that in the preceding, but three metres higher up the slope. (100) from a plot similar to the preceding, but three metres further up. (101) from a plot similar to the preceding, but four metres further. (102) from a plot similar to the preceding, but *Polystichum lonchitis* was absent.

3. Grasses of the meadow forests

The number of samples taken from the grass-covered plots was 15, which is 13.6 per cent of all samples. The total number of samples from these meadow forests is hence 38, or 34.5 per cent of all the samples. The trees of these biotopes are birch and poplar, often up to 10 metres tall, shorter mountain ash, juniper and willow (Fig. 38 in HÄMET-AHTI 1963).

(41) 12.7 from the moss under blueberry and *Cornus succica* on a slope at the south end of the Njaggaljärvet. (53) from the ground under a patch of *Lastrea linnaeana*, *Saussurea alpina*, *Cornus succica*, *Viola biflora*, *Chamaecrion angustifolium*, *Salix* sp.

Table 3
Molluscs of the grasses in meadow forests.

Sample no.	41	53	54	55	60	68	80	81	82	85	87	88	90	91	110	Total
<i>Euconulus fulvus</i>	12	2	2	—	27	2	19	6	21	9	2	1	8	4	2	117
<i>Perpolita petronella</i>	3	2	1	2	—	1	1	1	2	—	1	—	1	1	4	20
<i>Discus ruderratus</i>	1	—	—	—	7	16	—	—	4	2	—	—	3	1	—	34
<i>Vitrina pellucida</i>	1	—	—	1	—	1	3	—	1	1	3	3	1	1	4	20
<i>Perpolita hammonis</i>	1	2	—	1	1	1	3	—	1	3	—	—	1	1	—	15
<i>Vertigo alpestris</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	3	—	3
<i>Vertigo arctica</i>	—	—	—	—	—	—	1	—	—	—	2	—	3	—	—	6
<i>Vertigo</i> sp.	—	—	—	—	—	—	—	2	1	—	—	—	—	—	—	3
Total	18	6	3	4	35	21	27	9	30	15	8	4	17	11	10	218

and *Geranium silvaticum* near the mouth of the Kamaajoki River. (54) from a thin layer of dead leaves from the same forest as the preceding. (55) from a thin layer of dead leaves under *Salix* sp. and *Geranium silvaticum* from the same forest as the preceding. (60) date and site as the preceding, but from a luxuriant growth of *Rubus saxatilis* and *Cornus succica*. (68) 16.7 from a meadow under *Salix* sp., *Filipendula ulmaria*, *Trollius europaeus*, *Cornus succica* and *Geranium silvaticum* on the bank of the Roajaatshe River. (80) 16.7 from the soil under *Trollius europaeus* and *Solidago virgaurea* in a forest at the mouth of the brook descending from the Skierrifälis mountain. (81) as (80), but from the soil under moist *Filipendula ulmaria*. (82) as (80) from the ground under *Cornus succica* and among moss. (85) from a thin layer of litter under *Geranium silvaticum* in the same meadow as the preceding. (87) 17.7 from the ground under *Filipendula ulmaria*, *Solidago virgaurea*, *Cirsium heterophyllum* and *Milium effusum* in a meadow. (88) as the preceding, but the plants were *Cirsium heterophyllum*, *Filipendula ulmaria*, *Rubus saxatilis*, *Paris quadrifolia*, *Lastrea linnaeana* and blueberry. (90) as the preceding, but from the ground under moist *Filipendula ulmaria*. (91) from a drier plot than the preceding on which *Geranium silvaticum*, *Solidago virgaurea* and *Anthoxanthum odoratum* grew in the same meadow. (110) 18.7 from litter among *Geranium silvaticum*, *Viola biflora*, *Lastrea phegopteris* and *Cirsium heterophyllum* in the upper part of the Kevo Cliff.

4. Litters of *Hylocomium-Myrtillus* forest type (HMT)

These specimens were from litters in forests where tundra birch 4 to 6 metres tall grow and which may be taken to belong to the *Hylocomium-Myrtillus* forest type HMT (Figures 26, 28 and 44 in HÄMET-AHTI 1963). The twelve samples represent 10.9 per cent of all samples collected. Pine trees a few metres tall were sometimes found in these semiforests in the lower and upper reaches of Kevojoki.

(12) 5.7 from litter under *Empetrum hermaphroditum* and *Vaccinium vitis-idaea* in a group of aspens near the Pikku Kevojärvi Lake. (17) 4.7 from a patch of *E. hermaphroditum*, *V. myrtillus* and *V. vitis-idaea* on the Pukksalskaidi. (22) 1.7 from litter under *Ledum*

Table 4
The molluscs in litters from forests of HMT.

Sample no.	12	17	22	23	47	52	56	59	64	71	72	83	Total
<i>Euconulus fulvus</i>	4	8	4	5	18	5	2	11	18	3	1	6	85
<i>Perpolita petronella</i>	4	—	—	—	1	—	1	1	1	5	1	5	19
<i>Discus ruderratus</i>	—	—	3	3	—	1	2	7	20	2	5	6	49
<i>Vitrina pellucida</i>	3	—	—	—	—	—	1	—	—	8	4	1	17
<i>Acanthinula harpa</i>	—	8	—	2	—	—	—	—	2	—	—	—	12
<i>Perpolita hammonis</i>	—	—	—	—	—	—	—	—	—	—	—	1	1
<i>Vertigo alpestris</i>	—	—	—	1	1	2	—	1	—	—	—	—	5
<i>Vertigo arctica</i>	—	1	—	4	1	—	—	—	—	—	—	—	6
<i>Vertigo</i> sp.	—	—	2	—	—	—	—	—	—	—	—	—	2
Total	11	17	9	15	21	8	6	20	41	18	11	19	196

palustre, *V. vitis-idaea* and moss near the mouth of the Madjoki River. (23) as in the preceding, but the flora consisted of *V. uliginosum*, *Cornus suecica*, *Rubus arcticus*, *Tricentalis europaea* and moss. (47) 13.7 under *C. suecica* at the southern end of the Njaggaljärvet. (52) 12.7 from a patch of *Lastrea limnaca* and juniper below the nests of a House Martin cliff colony one kilometre south of Njaggaljärvet. (56) 14.7 from the mouth of Kamajoki. (64) 14.7 from litter under the nests of House Martin colony. (71) 16.7 about two kilometres south of the Roajaatshe River. (72) from a layer of dead poplar leaves about two kilometres south of Roajaatshe. (83) 16.7 from litter under *Geranium silvaticum* and *Rubus saxatilis* at the mouth of a brook flowing from the Skierrifälis mountain.

5. Mosses under blueberry in *Hylocomium-Myrtillus* forest type

Fifteen samples (13.6 per cent) were taken from mosses under blueberry. The plants were the same as in the preceding biotope. The total number of samples from forests of the *Hylocomium Myrtillus* type (HMT) was 27 (24.5 per cent) (Figures 26, 28, 44 in HÄMET-AHTI 1963).

Table 5

Molluscs of the mosses under blueberry in *Hylocomium-Myrtillus* (HMT) areas.

Sample no.	10	16	20	29	30	36	69	70	73	74	75	78	96	97	109	Total
<i>Euconulus fulvus</i>	—	9	—	1	—	1	4	—	6	—	4	2	1	2	—	30
<i>Perpolita petronella</i>	5	1	—	1	—	—	—	—	—	—	—	—	—	—	—	11
<i>Discus ruderatus</i>	17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	31
<i>Vitrina pellucida</i>	—	—	—	1	—	—	—	1	—	1	—	—	—	—	8	11
<i>Acanthinula harpa</i>	1	1	2	—	1	—	1	1	—	2	1	—	1	4	26	41
<i>Vertigo alpestris</i>	—	—	—	—	1	—	1	—	—	—	—	—	—	—	—	2
<i>Vertigo</i> sp.	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
<i>Arion subfuscus</i>	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
Total	24	11	2	3	2	1	6	2	6	3	6	2	20	14	26	128

(10) 5.7 from the shore of Pikku Kevojärvi. (16) 5.7 from above the Kōnkäänpahta Cliff. (20) 1.7 from an area where blueberry, *V. uliginosum*, *V. vitis-idaea* and *Empetrum hermaphroditum* grew among pine trees near the mouth of the Madjoki River. (29) 3.7 from a bank of Madjoki. (30) as sample (29). (36) 8.7 from a pine wood where also birch grew near the Kevo Falls. (69) 15.7 from a patch one kilometre to the south of Roajaatshe. (70) as (69). (73) 16.7 one kilometre south from (69). (74) as the preceding. (75) as (73). (78) 16.7 from the bank of a brook flowing from the Skierrifälis mountain. (96) 17.7 from the mouth of the Fiellu brook. (97) the same place and date as the preceding. (109) 18.7 from under blueberry and *Phyllodoca coerulea* on Kevo Cliff near the upper reaches of the falls.

6. *Empetrum-Vaccinium* type (EVT) areas

The samples taken from *Empetrum* and *Vaccinium* areas numbered 16 (14.5 per cent). The trees in these areas were birches varying from 2 to 4

metres in height, but also pine occurred often, especially in the lower reaches of the river, where it grew as tall as ten metres. *Empetrum hermaphroditum* grew in all the areas sampled (Figures 42 and 43 in HÄMET-AHTI 1963).

Table 6

Molluscs of the *Empetrum-Vaccinium*-type areas.

Sample no.	1	7	8	13	15	28	38	39	40	50	51	57	58	65	86	93	Total
<i>Euconulus fulvus</i>	2	1	4	5	—	—	—	—	3	7	2	14	12	3	3	4	60
<i>Perpolita petronella</i>	—	—	1	—	—	1	—	—	—	—	—	—	1	—	—	—	3
<i>Discus ruderatus</i>	—	—	1	—	—	—	—	—	1	—	6	—	3	—	—	—	11
<i>Vitrina pellucida</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	2
<i>Acanthinula harpa</i>	—	—	—	—	—	—	—	—	1	—	—	—	—	1	—	—	2
<i>Vertigo alpestris</i>	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	2
<i>Vertigo</i> sp.	—	3	—	4	—	—	—	—	—	1	—	—	—	—	—	—	8
Total	2	4	7	9	1	1	0	0	5	8	8	14	16	5	4	4	88

(1) 4.7 from leaf litter on the upper slope of the Kotkapahta Cliff. (7) 5.7 from litter under *V. vitis-idaea* on the upper slope near the mouth of the Madjoki River. (8) 4.7 from litter in the valley of the Siedgajoki River. (13) 5.7 from leaf litter near Pikku Kevojärvi Lake. (15) 5.7 from dry moss interspersed by micromammalian paths below the Kōnkäänpahta Cliff. (8) 3.7 from litter under *Empetrum hermaphroditum*, juniper and tundra birch near the mouth of Madjoki. (38) 11.7 from moss and litter in the Njaggaljärvet pine wood. (39) as sample (38). (40) 11.7 from leaf litter on the upper slope of a hill in the middle region of the Njaggaljärvet. (50) 12.7 from litter on lichen and moss under House Martin nests one kilometre south of the Njaggaljärvet. (51) 12.7 from leaf litter in the same area as the preceding. (57) 14.7 from leaf litter at the mouth of the Kamajoki River. (58) 14.7 as sample (57). (65) 15.7 from leaf litter on the bank of Roajaatshe. (86) 17.7 from lichens at the mouth of the Skierrifälis brook. (93) 17.7 from juniper and birch leaf litter half a kilometre north of the mouth of the Fiellu brook.

7. *Cladina* type (CLT) areas

The number of samples collected from areas of this type in which birch trees less than two metres tall grow was 11 (10.0 per cent) (Figures 22, 23, and 41 in HÄMET-AHTI 1963).

(61) 14.7 from litter on a narrow ledge where six *Vertigo alpestris* were found under House Martin nests near the Roajaatshe River mouth. The following samples contained no molluscs.

(6) 5.7 from under *Empetrum hermaphroditum* and lichen near the Kotkapahta Cliff. (18) 4.7 from litter under *E. hermaphroditum*, *Arctostaphylos uva-ursi*, *V. vitis-idaea* and *Ledum palustre* one kilometre up the river above the Pikku Kevojärvi. (21) from litter under *V. vitis-idaea*, *A. uva-ursi* and lichens in a birch stand near the mouth of the Madjoki River. (27) 3.7 from *A. alpina* and lichens. (43) 12.7 from litter under lichens among rocks near the south end of the Njaggaljärvet. (44) as sample (43), but from moss. (63) 14.7 from

dry litter under *Ledum palustre* in an area covered by faeces below House Martin nests near the mouth of the Roajaatshe River. (67) as sample (63), but from lichens. (76) 16.7 from mosses on the Skierrifälis slope. (77) as sample (76).

8. Treeless meadows

Ten samples (9.0 per cent) were taken from meadows, most of which were covered by sparse vegetation. Only two of the samples contained molluscs (24 and 107).

(24) 1.7 two *Euconulus fulvus* individuals from a meadow of *Trollius europaeus*, *Alchemilla* sp., *Anthoxanthum odoratum*, *Saussurea alpina*, *Polygonum viviparum* and *Luzula sudetica* near the mouth of the Madjoki River. (107) 18.7 from litter under *Trollius europaeus* and *Viola biflora*, where single *Euconulus fulvus* and *Vertigo arctica* were found near the Kevo Cliff. (14) 14.7 from litter under *Cornus suecica* and *Chamaenerion angustifolium* below the Kõnkäänpahta Cliff. (25) 1.7 from an area close to that from which sample (24) was taken, near the mouth of the Madjoki River. (26) as sample (25), but from litter under *Rubus arcticus*, *R. saxatilis*, *Galium uliginosum* and *Solidago virgaurea*. (103) 18.7 from litter under *Dryopteris austriaca* near the Kevo Cliff. (104) as sample (103), but from litter under *Angelica archangelica* at the water edge. (105) as the preceding, but the flora consisted of *Lastrea phegopteris*. (106) as sample (103), but the flora consisted of *Polygonum viviparum*, *Mnium* sp. (moss), *Viola biflora*, *Geranium silvaticum*, *Trollius europaeus* and *Oxyria digyna*. (108) as sample (103), but a little higher up, from litter under *Dryopteris austriaca*.

III. SPECIES

Cochlicopa lubrica Müll. This species is predominantly an inhabitant of the luxuriant groves for it was not found in the other areas. The species was found in six samples, from both soil and litter. These samples were taken among *Urtica dioeca*, *Rubus saxatilis*, *Paris quadrifolia* and *Melica nutans* in areas where chokecherry grew. The sampling sites were located at the feet of the Kotkapahta and Linkkapahta cliffs where the luxuriance of the vegetation was due to the droppings of birds. These groves were the most favourable as far as the vegetation and molluscs were concerned since the numbers of different species and individuals were greatest in them. Two samples from these groves in which *Cochlicopa* were not found were taken from under a *Ribes spicatum* bush.

MELA (1902) mentioned that this species lives in moist places and MÄKELÄ (1938) has confirmed this. SIPONEN (1957) stated that it is found in luxuriant groves, and LUTHER (1901) has reported that this is predominantly so. This is clearly evident in the Kevojoki area, where the species occurs only in luxuriant groves. In the number of individuals it is the fourth in the

meadow forests and eighth in the whole area studied. The mean incidence is 13 individuals per square metre (see Tables 8 and 9). The mollusc species that accompany it in order of decreasing number of individuals are *Euconulus fulvus*, *Discus ruderratus*, *Vitrina pellucida*, and *Perpolita petronella*; the last-mentioned is less numerous than *Cochlicopa* (compare SILVOLA 1957).

According to MELA (1902) and LUTHER (1901), the species is found throughout Finland. The species has been found only once in Inari, northern Lapland, in the valley of Paatsjoki River, which no longer is a part of Finland (cf. LUTHER 1901).

Vertigo arctica Wall. MELA (1902) and SIPONEN (1957) have reported that this species prefers to live on blueberry plants. SAARINEN (1956) found three individuals of this species in two areas of the *Myrtillus* type. The method of sampling employed in the present study is probably the reason why the species was not found more often. It seems, however, that this *Vertigo* species is almost solely an inhabitant of the litter and grass of meadow forests and the litter of the *Hylocomium-Myrtillus* biotope. According to its abundance figures, it is almost equally common in both biotypes (see Table 8). MÄKELÄ (1938) has stated that the species is found in luxuriant groves and *Oxalis-Myrtillus* biotopes.

The species has spread throughout the country (LUTHER 1901), although MELA (1902) states it to be a species mostly occurring in Lapland. The latter is confirmed by the observations of PETÄJÄ & VESANTO (1955) who found the greatest number of individuals of this species in northernmost Lapland.

Vertigo alpestris Alder. This species is absent from the most luxuriant and least fertile biotopes. Only a few individuals were found by SIPONEN (1957) at Siilinjärvi. LUTHER (1901) stated that it occurs throughout the country and in all biotopes, but MÄKELÄ (1938) and SIPONEN (1957) concluded that it occurs only in the most fertile biotopes. In the Kevojoki area, the species was found most often in the meadow forests and the litters of *Hylocomium-Myrtillus* areas, and it was the only mollusc species encountered in areas of the *Cladina* type, and even this sample was taken from an unusual location, on a ledge of a cliff below House Martin nests. The allocation of the sample to a certain biotope is uncertain.

The species has previously been found on the banks of Inarinjoki River in Lapland (LUTHER 1901). MELA (1902) has stated that it is found as north as in Lapland. PETÄJÄ & VESANTO (1955) did not encounter the species.

Vertigo sp. A part of the individuals of this family were damaged on collection and a part fell to the ground and were not recovered. For this reason the number of unidentified *Vertigo* species is given in the tables.

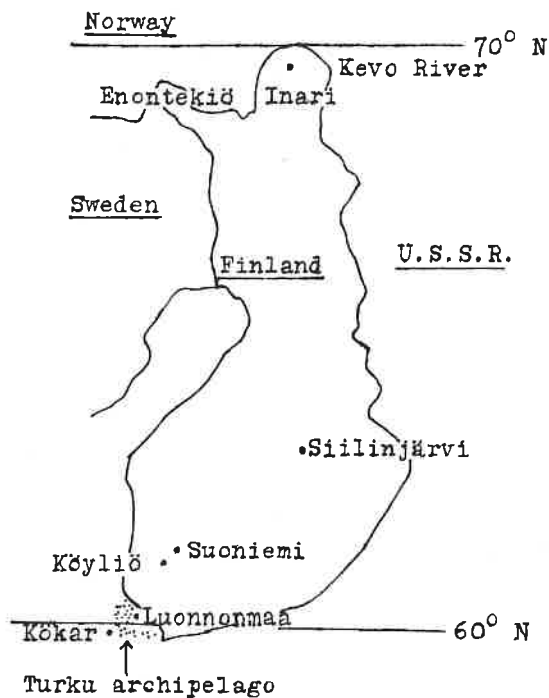


Fig. 2. The areas of study mentioned in this paper.

Acanthinula harpa Say. Both MELA (1902) and LUTHER (1901) stated that this species is a northern species, which, however, occurs in certain regions in southern Finland. It was not found by MÄKELÄ (1938) in Suoniemi, but SIPONEN (1957) concluded it to be a species living in *Myrtillus*-type, *Vaccinium*-type and *Oxalis-Myrtillus*-type areas and luxuriant groves. From these observations and those made in the Kevojoki valley, the species seems to prefer blueberry plants. SIPONEN (1957) mainly collected the species with a hoop net. The species is the fifth in frequency and in the number of individuals in the Kevojoki area and is not found in grasses and lichens.

The northern distribution of the species is seen in the following table where the numerators give the number of samples containing the species, and the denominators the total number of samples.

InL, Kevojoki, Northern Finland, SILVOLA (1964)	34/110
PS, Siilinjärvi, Central Finland, SIPONEN (1957)	28/150
St, Suoniemi, SW Finland, MÄKELÄ (1938)	0/192
St, Köyliö, SW Finland, SILVOLA & VESANTO (1958)	0/25
V, Luonnonmaa, SW Finland, SAARINEN (1956)	0/134
A, Kōkar Island, SW Finland, PETÄJÄ & VESANTO (1959)	0/31

Discus ruderratus Stud. This species, which is clearly an arctic species according to LUTHER (1901), prefers to live in rotting wood throughout the country. This is the conclusion of MELA (1902), MÄKELÄ (1938), SAARINEN (1956), SIPONEN (1957) and the present writer. It is frequently found in large numbers in such places; this shown by the fact that it is third in order of incidence and definitely second in number after *Euconulus*. The incidence is as high as that of *Euconulus* or higher in luxuriant groves, in the litter of meadow forests and in the mosses of *Hylocomium-Myrtillus* areas. Its incidence in Lapland is possibly somewhat less than expected, for LEHTINEN (1954) has reported that it is probably the most common mollusc in Lapland.

Perpolita hammonis Ström. This species, which occurs throughout the country according to MELA (1902) and LUTHER (1901) is the sixth in both incidence and numbers in the Kevojoki area. In Siilinjärvi, it is second after *P. petronella* (SIPONEN 1957). The variation of the relative incidence and number of individuals of these two species in the north-south direction is shown in the following table. The information is from the same publications as the information on *Acanthinula harpa*. The numerator is the number of individuals and the denominator the number of positive samples.

	<i>Perpolita petronella</i>	<i>P. hammonis</i>
Kevojoki area	156/54	63/25
Siilinjärvi	288/73	174/81
Suoniemi	468/80	361/98
Köyliö	268/10	78/11
Luonnonmaa	17/5	102/51
Kōkar Island	2+/2	147+/17

This species is found in more places and in greater numbers in the southern parts of the country. It is the most common species in the archipelago outside Turku in southwestern Finland (LEHTINEN 1954 and SAARINEN 1956). *Perpolita hammonis* and *P. petronella* are equally common in the south of Häme province according to WUORENRINNE (1957). VESANTO & PETÄJÄ (1955) and KOLI (1955) found the species only once in Lapland.

MELA (1902) stated that *Perpolita hammonis* occurs in all types of forests, but according to MÄKELÄ (1938) it fares best in luxuriant groves and in moist places in general. The species was encountered in the Kevojoki area only in the three most luxuriant biotopes and the abundance of the species was directly proportional to the luxuriance of the vegetation.

Perpolita petronella Charp. The table above shows that this species becomes more widespread and numerous from south to north. KOLI (1955) concluded that this species is the most common one in the north. The species was second to *Discus ruderratus* in number of individuals in the Kevojoki area and

was found in every other sample. It seems to prefer moist and luxuriant biotopes. SAARINEN (1956) stated that the species fares best in moist biotopes and SIPONEN (1957) stressed the small requirements of the mollusc and stated it to occur in highest frequency in *Vaccinium* areas.

Vitrina pellucida Müll. SIPONEN (1957) found only a few individuals of this species in Siilinjärvi although the species has spread throughout the country (MELA 1902 and LUTHER 1901). In incidence it is, however, third in Luonnonmaa (SW Finland) and one of the most common in Enontekiö (SAARINEN 1956, KOLI 1955, and PETÄJÄ & VESANTO 1955). In the Kevojoiki area it was the fourth in incidence and in absolute numbers. It is generally an inhabitant of moist places (MELA 1902 and MÄKELÄ 1938). In the Kevojoiki area it was most common in the luxuriant groves and meadow forests. Its incidence is greatest in the luxuriant biotopes and diminishes gradually as the vegetation becomes drier and sparser. It is the most common species in the luxuriant groves of the Turku archipelago (LEHTINEN 1954).

Euconulus fulvus Müll. This species occurs throughout the country in a variety of habitats (MELA 1902 and LUTHER 1901). It is the most common and numerous species in the Kevojoiki area, and thrives in all biotopes. This mollusc, which occurs in large numbers in places, is among the first in both incidence and number elsewhere in the country (LEHTINEN 1954 and SAARINEN 1956).

Arion subfuscus Drap. This species is found throughout the country (MELA 1902 and LUTHER 1901), but its incidence is nowhere very high (compare MÄKELÄ, SIPONEN, KOLI, PETÄJÄ & VESANTO, SILVOLA & VESANTO). It was found in the smallest number of places and in lowest frequency in the Kevojoiki area, where it thrives only in the most luxuriant biotopes.

IV. GENERAL ASPECTS

As the study of mollusc distribution was based on 110 samples taken from an area of about 40 square kilometres and the total area of sampled sites was 27.5 m², the material may be considered fairly representative. This is justified as conclusions have been based on much smaller numbers of samples (MÄKELÄ 1938 and SIPONEN 1957, for example.)

The number of individuals in the samples from different type areas varied greatly, which is in part a natural consequence of the suitability of the biotope as a habitat for the mollusc. The figures in column 2 of Table 7 give the mean numbers of molluscs in samples from each of the biotopes. The

Table 7
Information on biotopes

	1	2	3	4	5	6	7	8
Luxuriant groves	227	28.6	8	5.9	113.5	8	7.3	2
Litter of meadow f.	636	27.7	9	5.1	110.6	23	20.9	5.75
Grasses of meadow f.	218	14.5	8	3.8	58.1	15	13.6	3.75
Litter of <i>HMT</i> areas	196	16.3	9	3.8	65.3	12	10.9	3
Mosses of <i>HMT</i> areas	128	8.8	8	2.3	34.1	15	13.6	3.75
<i>EVT</i> areas	88	5.5	7	1.75	22	16	14.5	4
<i>CIT</i> areas	6	0.5	1	0.1	2.2	11	10	2.75
Treecless meadows	4	0.4	2	0.3	1.6	10	9.1	2.5
Whole area	1503	13.7	11	3.03	54.7	110	99.9 2/km ²	27.5

1 = Individuals in biotope. 2 = Average number of individuals. 3 = Species. 4 = Average number of species. 5 = Mean abundance. 6 = Number of samples. 7 = Per cent of all samples. 8 = Sampled area in m².

mean number is highest (28.6) in the luxuriant groves, which hence are the most favourable environments, but almost as favourable are the litters of meadow forests where the mean number was 27.7. The difference is hardly significant. The next two biotopes are much less favourable. A similar threshold is noted when one goes to the mosses of *HM*-type and *EV*-type areas. In the least favourable biotopes, molluscs are rare, only about one individual in every other sample.

Column 5 in Table 7 gives the mean number of molluscs per square metre (the abundance). The figures are four times as large as the numbers in column 2 because the area of the plot sampled was one fourth of a square metre. The figures in column 5 do not reveal anything new, but facilitate comparison with the results of other investigators.

The table shows further the number of species found in each biotope. The numbers for the first six biotopes are approximately equal, and vary from seven to nine. The numbers for the next biotopes are definitely smaller.

Differences are noted when the figures in column 4 are compared. These figures should be compared with those in column 2. The mean number of species per sample is six in the luxuriant groves and five in the litters of the meadow forests. The next two biotopes, the grasses of the meadow forests and the litters of the *HM*-type areas, are poorer in this respect, but similar to each other.

When the incidence figures are compared with those reported from Siilinjärvi (SIPONEN 1957), the mean number of species is lower in the Kevojoiki area, which is quite natural. The mean numbers of individual molluscs, however,

Table 8
Distribution of molluscs in different biotopes in the Kevojoki Valley.

	Number of individuals								Total	Dominance in per cent								Whole area	
	1	2	3	4	5	6	7	8		1	2	3	4	5	6	7	8		
<i>Euconulus fulvus</i> ..	62	199	117	85	30	60	—	3	556	27	31	53	43	23	68	—	75	37	
<i>Perpolita petronella</i>	24	79	20	19	11	3	—	—	156	11	12	9	10	9	3	—	10	10	
<i>Discus ruderatus</i> ..	53	200	34	49	31	11	—	—	378	23	31	16	25	24	12	—	25	25	
<i>Vitrina pellucida</i> ..	35	52	20	17	11	2	—	—	137	15	8	9	9	9	2	—	9	9	
<i>Acanthinula harpa</i> ..	10	49	—	12	41	2	—	—	114	4	8	—	6	32	2	—	8	8	
<i>Perpolita hammonis</i>	16	31	15	1	—	—	—	—	63	7	5	7	0.5	—	—	—	4	4	
<i>Vertigo alpestris</i> ..	—	12	3	5	2	2	6	—	30	—	2	1	3	2	3	100	—	2	2
<i>Vertigo arctica</i> ...	—	11	6	6	—	—	—	1	24	—	2	2	3	—	—	25	—	2	2
<i>Vertigo</i> sp.	—	—	3	2	1	8	—	—	14	—	—	1	1	1	—	—	1	1	
<i>Cochlicopa lubrica</i> ..	26	—	—	—	—	—	—	—	26	12	—	—	—	—	—	—	—	2	
<i>Arion subfuscus</i> ..	1	3	—	—	—	1	—	—	5	0.5	0.5	—	—	—	—	—	—	0.5	
Total	227	636	218	196	128	88	6	4	1503	99.5	99.5	98	100.5	101	99	100	100	100.5	

1 = luxuriant groves, 2 = litters of meadow forests, 3 = grasses of meadow forests, 4 = litters of HM-type areas, 5 = mosses under blueberry in HM-type areas, 6 = litters of EV-type areas, 7 = *Cladonia*-type areas, 8 = treeless meadows.

Table 9
Distribution of molluscs in different biotopes in the Kevojoki Valley.

	Number of individuals per m ²									Number of positive samples										Percentage of positive samples								
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9
<i>Euconulus fulvus</i> ..	31	35	31	28	8	15	—	1	20	8	23	14	12	9	12	—	2	80	7	100	100	94	100	60	75	—	20	73
<i>Perpolita petronella</i>	12	14	5	6	3	1	—	—	6	7	20	12	8	4	3	—	—	54	6	88	87	80	67	27	19	—	—	50
<i>Discus ruderatus</i> ..	27	35	9	16	8	3	—	—	14	8	19	7	9	2	4	—	—	49	6	100	83	47	75	13	25	—	—	45
<i>Vitrina pellucida</i> ..	18	9	5	6	3	0.5	—	—	5	7	19	11	5	4	2	—	—	48	6	88	83	73	42	27	13	—	—	44
<i>Acanthinula harpa</i> ..	5	9	—	4	11	0.5	—	—	4	4	10	—	3	11	2	—	—	30	5	50	43	—	25	73	13	—	—	27
<i>Perpolita hammonis</i>	8	5	4	0.5	—	—	—	—	2	5	9	10	1	—	—	—	—	25	4	63	39	67	8	—	—	—	—	23
<i>Vertigo alpestris</i> ..	—	2	1	2	0.5	0.5	2	—	1	—	8	1	4	2	2	1	—	18	6	—	35	7	33	13	13	9	—	16
<i>Vertigo arctica</i> ...	—	2	2	2	—	—	—	0.5	1	—	6	3	3	—	—	—	1	13	4	—	26	20	25	—	—	—	—	10
<i>Vertigo</i> sp.	—	—	1	1	0.5	2	—	—	0.5	—	—	2	1	1	3	—	—	7	4	—	—	13	8	7	19	—	—	6
<i>Cochlicopa lubrica</i> ..	13	—	—	—	—	—	—	—	1	6	—	—	—	—	—	—	—	6	1	75	—	—	—	—	—	—	—	6
<i>Arion subfuscus</i> ..	0.5	0.5	—	—	0.5	—	—	—	0.5	1	3	—	—	—	—	—	—	5	3	13	13	—	—	—	—	—	—	5

Figures 1—8 as in Table 8, 9 = incidence in the whole area, 10 = number of positive biotopes.

are higher in the Kevojoki area. The Siilinjärvi area is hence more favourable for a greater number of species, but the Kevojoki area for a greater number of individuals. The reason may be the isolated nature of the Kevojoki area which is surrounded by mountain vegetation. The spreading of some species to this area has been prevented for this reason if these species would have fared at all in these northern latitudes. The greater number of individuals may also be a consequence of a preceding favourable period of proliferation.

The total number of molluses collected from the area was 1503, or 13.7 molluses per sample. From the data in Table 8, it follows that the average sample would have contained all of the following five species: *Euconulus fulvus*, *Perpolita petronella*, *Discus ruderratus*, *Vitrina pellucida* and *Acanthinula harpa*. *Perpolita hammonis* would be present in every second, and *Vertigo alpestris* in every third sample.

It is of interest to note that the number of molluses per square metre in the Kevojoki area biotopes is in some cases of the same order as in Siilinjärvi (SIPONEN 1957), in some cases of the same order as in Suoniemi (MÄKELÄ 1938), sometimes intermediate or higher than in either, but never lower than in both areas. The overall result is hence that, regardless of whether the biotopes are comparable or not, the frequency of molluses is higher in the Kevojoki area than in the other two areas of study. The mollusc population is also much lower in Degerfors in northeast Sweden (FORSLUND 1944) than in the Kevojoki area.

A definite variation of the species distribution is noted on going up the Kevojoki area from its mouth. The mollusc population varies on going up the river in the order of the biotopes, from luxuriant groves through coniferous wood biotopes and meadow forests to woodless meadows, but so that molluses characteristic of the *HM*- and *EV*-type areas are found throughout the whole area. Although the elevation from sea level increases continuously up the river, it does not influence the vegetation, except for the pine trees, before the last five kilometres where also birch is rare and short. This latter area is well represented by the sample 111 taken in July, 1957, which included only a few individuals of the species *Euconulus fulvus*, *Perpolita petronella*, and *Vitrina pellucida*. These species, especially *Perpolita petronella*, have been found also by other investigators in similar areas.

When one goes up the slopes and cliffs alongside the river, the mollusc population varies in a similar manner as in the preceding, but so that all biotopes are found in the bottom of the valley and on the lower reaches of the slopes, whereas meadow forests are practically absent from the upper parts of the cliffs. The other biotopes still occur in the upper parts, but the *EV*- and *CL*-type areas predominate until finally the areas are devoid of trees and contain only shrubs and grass in an alpine region. It may be roughly

said that the mollusc population varies from the bottom of the valley to the tundra in the same way as from the mouth to the source of the river along its banks.

The collected material does not permit a decision as to whether the angle of the slope or the compass direction influences the distribution of the molluses and the clarification of this point must be left to later investigation.

Besides other invertebrates, FORSLUND (1944) found in Degerfors in northeast Sweden 12 mollusc species of which eight were encountered in the Kevo River area; these eight species are *Arion subfuscus*, *Perpolita* sp., *Euconulus fulvus*, *Discus ruderratus*, *Acanthinula harpa*, *Cochlicopa lubrica*, *Vertigo alpestris* and *V. arctica*. A comparison of the numbers of molluses reveals that *Arion subfuscus* and *Perpolita* species were relatively more common and *Euconulus fulvus* less common in Degerfors than in the Kevojoki area. The four species found in Degerfors but not in Kevojoki were *Columella edentula*, *Helicigona arbustorum*, *Punctum pygmaeum* and *Limax arborum*. The first three species have, however, been found in Enontekiö (KOLI 1955 and PETÄJÄ & VESANTO 1955). Owing to the different nature of the studies, further comparisons are not possible.

An examination of the tables reveals that the number of difficultly detectable small *Vertigo* molluses is both absolutely and relatively large and larger than in Siilinjärvi. It should be noted, however, that hoop nets were not used in the Kevojoki area, the molluses being picked by hand. Since a hoop net would have increased the number of individuals of these species, regardless of how thorough the hand picking may have been, one must conclude that the incidence of the species is very high in the Kevojoki area. It is even higher than in any other area examined in Lapland and is not hence due to a recent increase in their population. The observations in Lapland have been carried out within the same period of the short summer. It may be that the mollusc population was high all over Lapland in the year in question. The animal population of Lapland varies greatly from year to year and this may also apply to molluses. The question cannot be solved without collecting more information.

The number of unshelled molluses was very low in the Kevojoki area; when the investigation was carried out only five individuals of *Arion subfuscus* were collected. Their number is generally low everywhere, although not as low as this.

Of species previously found in Lapland, *Punctum pygmaeum* and *Columella edentula* were not encountered. The latter species would probably have been collected if a hoop net had been used. On the other hand, one species, *Cochlicopa lubrica*, was found that has been encountered only once in Inari on the banks of the Paatsjoki River in an area that no longer belongs to

Finland (compare LUTHER 1901 and SILVOLA 1957). *Vertigo alpestris* has been found only once in northernmost Finnish Lapland, in Kuoppaniva (LUTHER 1901).

Acknowledgements. — I am indebted to Mr. H. VESANTO, M.Sc., for aid in identification and to the Zoological and Botanical Society of Turku, which supported my work with a grant.

REFERENCES

- FORSLUND, K. H., 1944: Studier över det lägre djurlivet i nordsvensk skogsmark. — Medd. Statens Skogsförsöksanstalt 34, 1—283.
- HÄMET-AHTI, L., 1963: Zonation of the mountain birch forests in northernmost Fennoscandia. — Ann. Bot. Soc. 'Vanamo' 34: 4, 1—127.
- KOLI, L., 1955: Lisähavaintoja Enontekiön (EnL) kotilofaunasta. — Luonnon Tutkija 59, 119—120.
- LEHTINEN, P. T., 1954: Tutkimuksia maanilviäisten esiintymisestä erilaisissa biotoopeissa osassa Turun saaristoa. — Manuscript in the Library of the Zoological Department of the University of Turku.
- LUTHER, A., 1901: Bidrag till kannedomen om land- och sötvattengastropodernas utbredning i Finland. — Acta Soc. F. Fl. Fenn. 20: 3, 1—125.
- MELA, A. J., 1902: Nilviäisemme. — Luonnon Ystävä 6, 161—185.
- MÄKELÄ, T., 1938: Kuorellisten ja kuorettomien etanain esiintyminen eri metsätyyeissä Suoniemellä ja sen ympäristössä. — Ann. Univ. Turku. A, 6: 11, 1—29.
- PETÄJÄ, A. & VESANTO, H., 1955: Pikahavaintoja nilviäisistä Pohjois-Suomessa. — Luonnon Tutkija 59, 90—93.
- „ 1959: Nilviäishavaintoja Köökarista. — Turun Ylioppilas VI, 76—95.
- SAARINEN, R., 1956: Kuorellisten ja kuorettomien etanoiden esiintyminen Luonnonmaalla eri biotoopeissa. — Manuscript in the Library of the Zoological Department of the University of Turku.
- SILVOLA, T., 1957: *Cochlicopa lubrica* (Müll.) Utsjoen Kevojoelta (InL.). — Luonnon Tutkija 61, 154—155.
- SILVOLA, T. & VESANTO, H., 1958: Eräitä maanilviäisten löytöpaikkatietoja Satakunnasta. — Arch. Soc. 'Vanamo' 13, 86—93.
- SIPONEN, H., 1957: Maanilviäisten esiintymisestä eri metsätyyeissä Siilinjärven pitäjän alueella. — Manuscript in the Library of the Zoological Department of the University of Turku.
- STEENBERG, C. M., 1911: Bløddyr I. Landsnegle. — Danmarks Fauna 10.
- WUORENRINNE, H., 1957: Über die Molluskenfauna von Südwest-Häme, Südfinnland. — Arch. Soc. 'Vanamo' 12, 69—73.

OCURRENCE OF MACROLEPIDOPTERA IN THE BIOTOPES
OF THE KEVOJOKI AREA IN INARI LAPLAND
(FINLAND)

REIJO JUSSILA

Department of Zoology, University of Turku,
Turku, Finland

I. INTRODUCTION

Material for this study was mainly collected in the Kevojoki River area in the summer of 1956 (Fig. 1). Spring came early that year. *Trollius europaeus* and *Geranium silvaticum* were in bloom and the birches in full leaf all the time I was in the area (30. VI.—20. VII.). The weather was excellent; it rained only on the first two days, and the sun shone almost the whole time. The north wind brought cold weather in the last few days, and Lepidoptera did not fly. Some observations made in 1959 and 1961 are included. For previous studies in Inari Lapland, see EURANTO & al. (1957) and JUSSILA (1957, 1963).

The frequency in every biotope is estimated according to the following scale:

- fqq = very common; the species was found in almost every observation area
fq = common; species found in more than 50 % of the observation areas
stfq = fairly common; in 36—50 %
p = local (passim); in 21—35 %
str = rather rare; in 11—20 %
r = rare; in 5—10 %
rr = very rare; in less than 5 %

The abundance of Macrolepidoptera species in different biotopes is estimated according to the following scale:

- cpp = very abundant; more than 50 specimens in an observation area of 50—100 m²
cp = abundant; 21—50 specimens
step = fairly abundant; 11—20 specimens
sp = occasional; 8—10 specimens
stpe = rather scarce; 5—7 specimens
pe = scarce; 2—4 specimens
pce = very scarce; 1 specimen