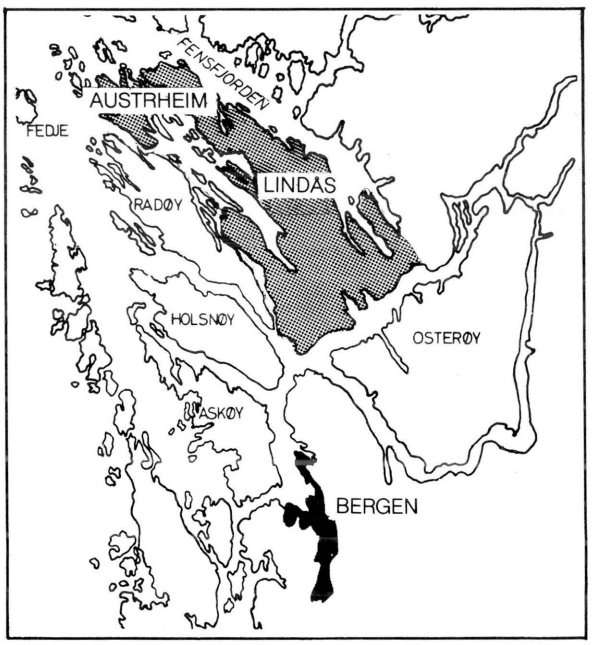
LINDÅS PROSJEKTET



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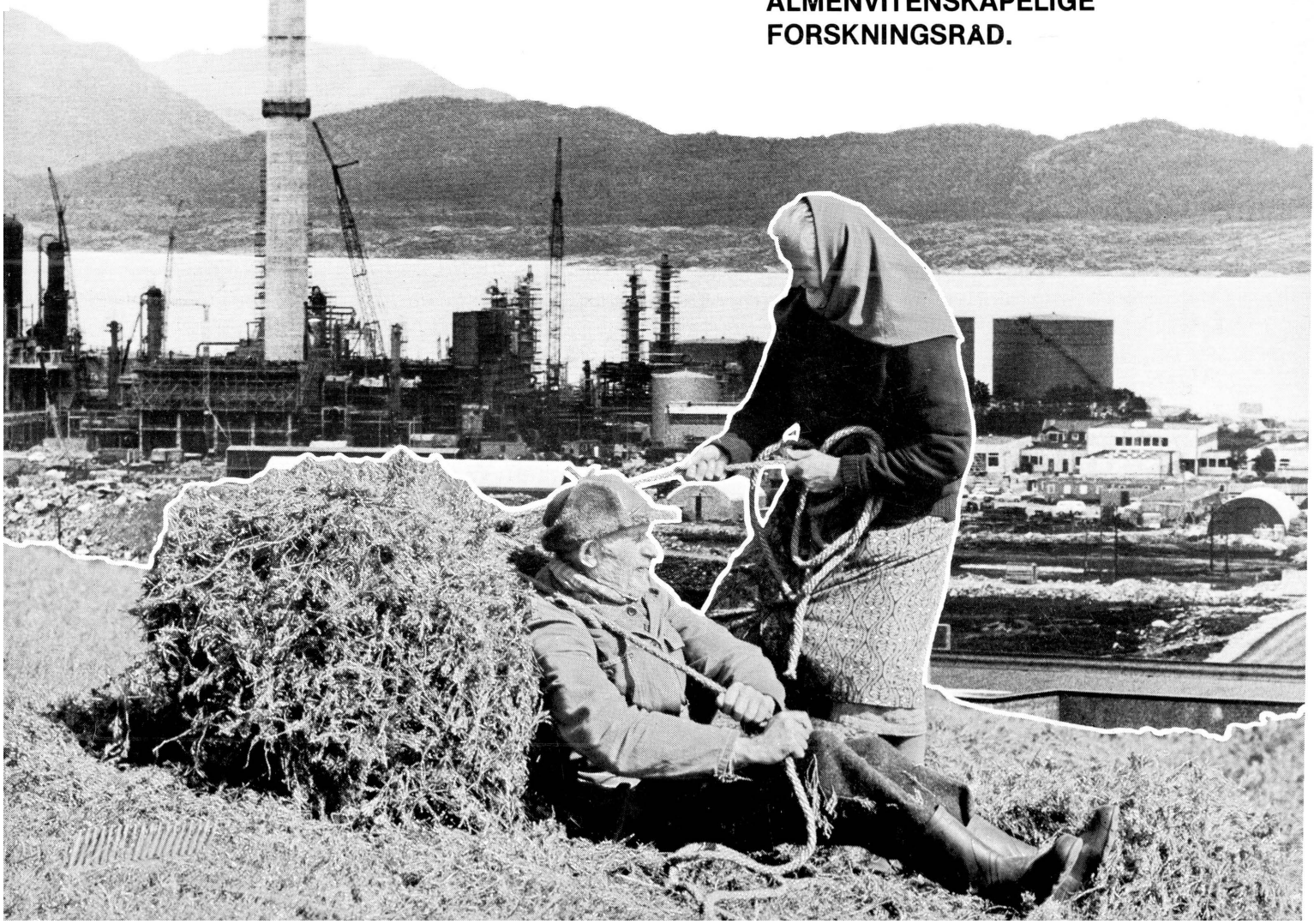
Erling Hauge

Spiders (araneae) of a West Norwegian calluna heath

This report is based on invertebrate sampling in connection with the Lindåsprosjektet, University of Bergen

Bergen 1976.

NORGES ALMENVITENSKAPELIGE FORSKNINGSRÅD.



ZOOLOGISK MUSEUM, UNIVERSITETET I BERGEN

SPIDERS (ARANEAE) OF A WEST NORWEGIAN CALLUNA HEATH

This report is based on invertebrate sampling in connection with the Lindåsprosjektet, University of Bergen

Erling Hauge

Bergen 1976

Contents.

Part I

Part II

PART I

1. INTRODUCTION

The Calluna heaths in Western Norway have been strongly influenced by human activities for hundreds of years. Scarcity of food for domestic animals, particularly in late winter, often forced the peasants to cut the Calluna for fodder. The heaths have also been used to a great extent as grazing land, resulting in the burning of large areas of Calluna vegetation, usually at intervals of about 3-4 years. This has made it possible for animals to graze on the nutrient plants preceeding Calluna species. The result of this activity has been that for centuries the vegetation has not been allowed to develop beyond the Calluna stage. Larger areas of primeal forest have not been known for at least 600 years. To-day the situation is changing. The general welfare and improved methods of agriculture make this kind of utilization of the Calluna heath less important. The Calluna heath, being a stage in the succession towards a forest wood climax, is changing character. The forest has started to predominate, at the moment on a very small scale, but even so in some places small birches are rapidly growing up in the absense of the destructive fires, and some farmers have begun to plant spruce.

The aim of this study was to secure a collection of the invertebrate fauna existing in this Calluna heath to-day. My further work on the collected material has been concentrated on spiders, which are dealt with in the present report. The study is part of the so-called "Lindåsprosjektet", supported financially by NAVF.

I should like to thank Professor S.-A. Bengtson and Professor H. Kauri for their criticism of this manuscript, and my wife who turned it into readable English.

2. STUDY AREA AND THE LOCALITIES

The study area is located in the Lindås/Austrheim "kommunes", and the two main localities are situated approximately 2 km west of Fonnes in Lindås (Fig. I).

Situated in the outermost parts of the West Norwegian coast, where precipitation is usually heavy all year round, with mild winters and relatively cool, rainy summers, these areas may be characterized as oceanic, or probably superoceanic Calluna heath. Under normal conditions they constitute a relatively humid habitat. Though somewhat hilly, the landscape is very open and, in the absence of taller vegetation, exposed to winds. The area as a whole is divided between the mainland and a system of islands separated by fairly narrow straits and inlets.

This barren landscape might be expected to be relatively uniform, which is true to a large extent. Some variation does occur, however, and two main types of habitat have been selected which may be considered as typical for the greater part of this vast area. These two types have been used as areas for quantitative sampling over a period of more than one year, and are described briefly in Table I.

Figure I. Map showing Fonnes on the western coast of Norway.

3. SAMPLING ROUTINE AND METHODS

3.1. Quantitative sampling

Quantitative sampling was carried out from spring 1972 to early autumn 1973 at intervals of about 3 weeks to one month, depending on the season.

At Loc. I, 12 samples, each 0,25 m^2, were taken in each sampling period from April to October 1972. Sampling involved the use of a vacuum cleaner identical to that used by IBP on the Hardangervidda (Kauri, Moldung and Solhöy 1969). The moss cover within the 0,25 m^2-samples was removed and then the underlying humus cleaned with the vacuum cleaner. As a control, a block (1/16 m^2) of the raw humus was afterwards removed at a depth of 4-5 cm. All this material was dried in a Tullgren funnel with a 60 W lamp. From November 1972 to August 1973 smaller but more numerous samples were taken (up to 48) by simply cutting out 1/16 m^2-size pieces of the raw humus and vegetation to a depth of 4-5 cm, and drying these in Tullgren funnels as before.

At Loc. II usually 10, but sometimes 8-16 samples of the Sphagnum layer were removed by hand and dried upside down in Tullgren funnels.

Except for the series taken on, i.e. if on that one date only, 23 May 1972, all the samples from Loc. I were collected within a small restricted area of approximately 30 x 100 m. From November 1972 to June 1973 additional samples were taken from another Hylocomium area concurrently with the samples from Loc. I. This area was identical with that from where the samples were taken on 23 May 1972. This was done because it was suspected that these areas were not identical with regard to the densities

of certain species. This viewpoint is discussed in part II in connection with the annotated list. Data from these last mentioned series of samples have been omitted in the calculations of the abundances of the populations (Fig. 2) and the species abundances from Loc. I, but have been included and explained in the material when calculating diversities etc.

The samples from Loc. II were taken mainly from a very small and restricted area of 30 x 30 m.

3.2. Pitfall traps

A varying number of pitfall traps were used in the area. 19 traps were operated from 31 March - 14 April 1972, 28 traps from 14 April - 18 September, and 38 traps from 18 September 1972 - 3 August 1973. Most of these traps were placed in series of 5-10 at each site of the Hylocomium type of vegetation. The additional 10 traps from 18 September 1972 (see above) were placed in a bog area. The traps were usually emptied along with the quantitative sampling. All pitfall trap material is lumped together in Table IX and X. The traps consisted of glasses with an opening 5,7 cm in diameter and they were half filled with 4% formaline and covered by a metal lid.

4. RESULTS

4.1. The ground-living spiders, their densities and seasonal variations.

4.1.1. Loc. I, the "Hylocomium area"

Table II shows the mean values of the densities (indiv./m^2) and the corresponding standard deviations of the spiders. The same values are demonstrated graphically in Fig. 2.

A large decrease from May to mid-summer 1972 is followed by an increase starting in September, and reaching a maximum in December. The populations decrease until February 1973, but from this date seem to stabilize at a level higher than in the summer of 1972, and most noticeable in midsummer 1973.

4.1.2. Loc. II, the Sphagnum area

The densities of the spiders in the Sphagnum samples (Fig. 3) show a certain similarity to those of Loc. I with regard to seasonal variations, but in general are much lower. A maximum in total numbers appears in May 1972 (186 indiv./m^2). This is confirmed by a series of samples taken "outside" the programme on June 7 1972, from which the total population is estimated to be 185,6 indiv./m^2 (52,8 adults/m^2 and 132,8 juveniles/m^2). There is a drop in density towards early summer 1972. The densities are then relatively stable and low, as in Loc. I, until September. The minimum was 57,6 indiv./m^2 in August. Afterwards the increase in the autumn culminated in November. The densities stabilized during winter 1973, until a drop occurred in May 1973 to a level approximately the same as in the preceding summer.

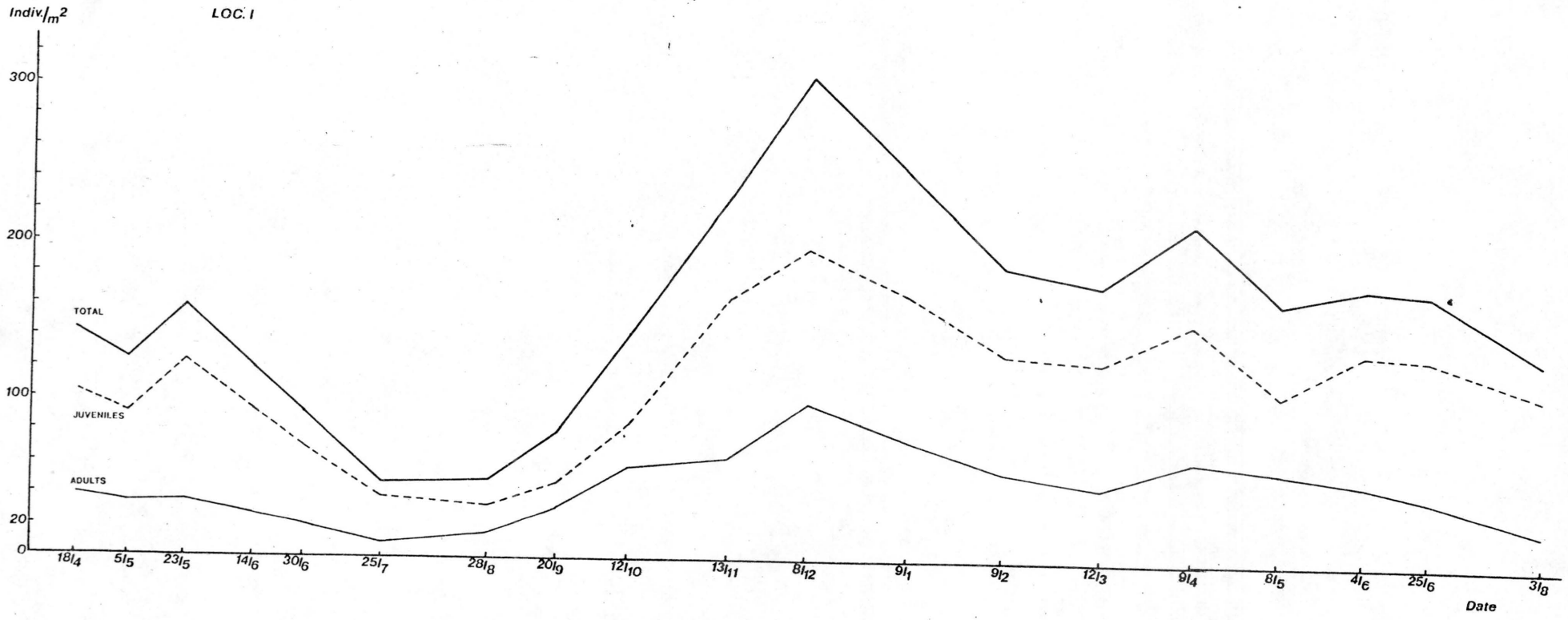


FIG.2. Loc.I. Density of spiders,1972-73.

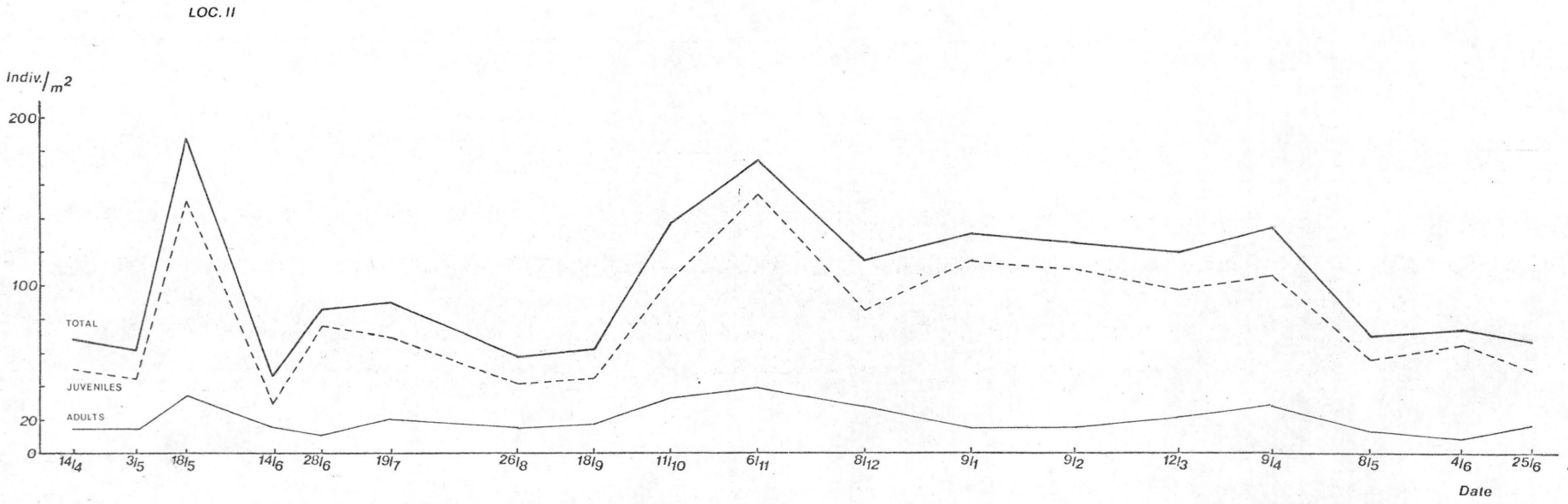


FIG.3. Loc.II. Density of spiders,1972-73.

4.2. Species composition

The total number of species and their ecology, phenology etc. is given in the Annotated list in Part II. Some general aspects are discussed here (and in the following chapter on species diversity).

Tables III and IV give a list of the 10 predominant species from each of the two habitat types, and these are demonstrated graphically in Fig. 3.

The picture is the familiar one of a few predominant species, a median group with fairly dominant species, and finally a large group of species with low dominance (< 2,0%). This picture is clearest at Loc. II where Robertus arundineti alone accounts for 42,8% of all adult specimens (Tab. IV; i.e. nearly as much as the sum of the three most dominating species from the Hylocomium habitats (45,8% as seen in Tab. III).

4.3. Diversity

The diversity index for the adult species has been calculated for each sampling period at the Sphagnum and Hylocomium habitats, using the Shannon-Wieners index $H_{\log e}$. The results are presented in Table V

The uniformity and low diversity of the Sphagnum spider fauna compared with the Hylocomium habitats is clearly demonstrated. With one exception the Sphagnum samples always show the lowest indices. In both years there seems to be a maximum diversity in spring (highest value in 1972, $H_{\log e} = 2,30$). The lowest diversity was recorded in summer (lowest value: 0,56). The mean value for all sampling periods in the Sphagnum area is 1,26. On the contrary the diversity indices from the Hylocomium material (though varying somewhat from time to time) seem to remain more

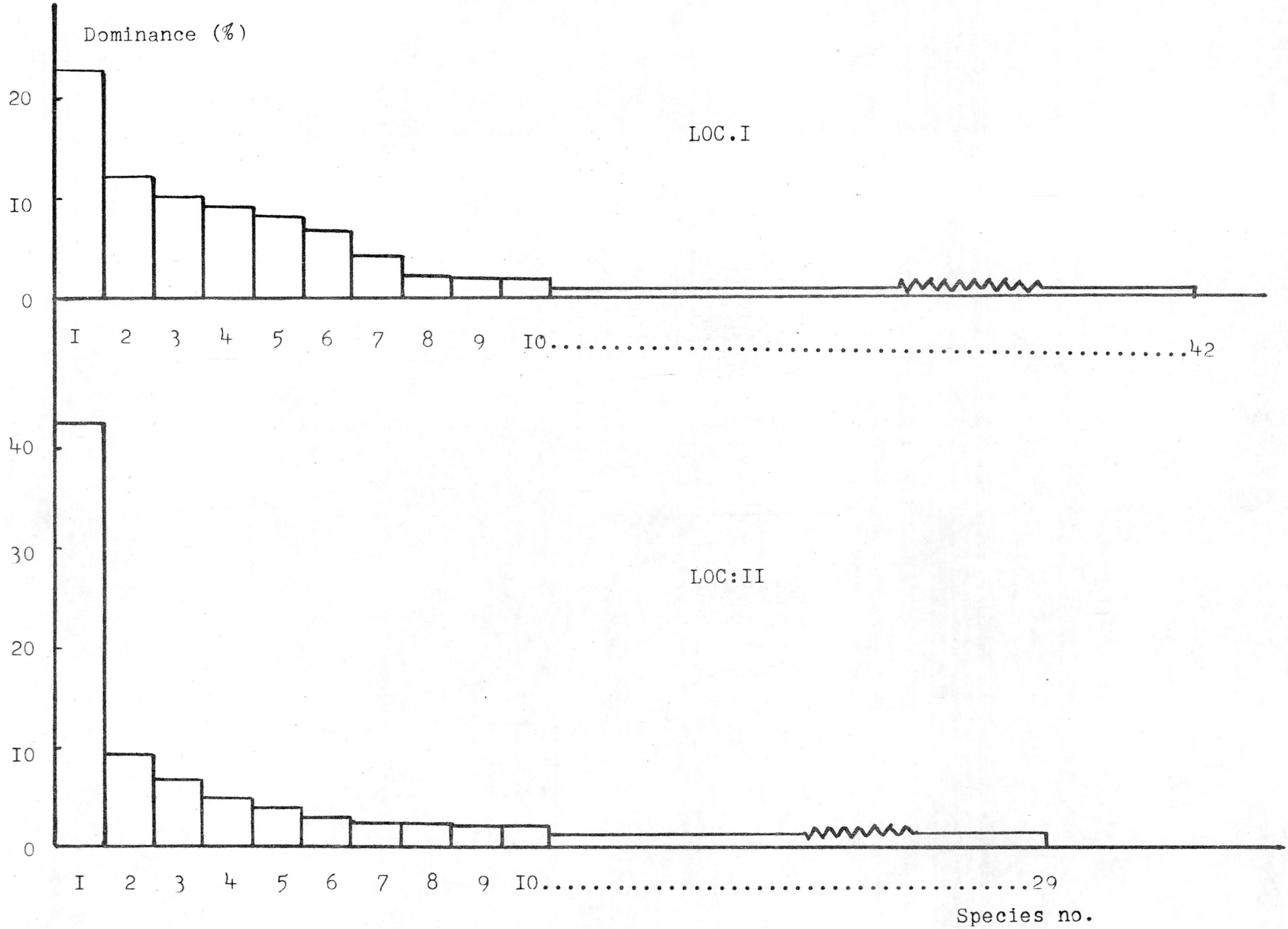


FIG.3a. Loc.I and II. Dominance of species (adults).

constant and at a higher level than in Sphagnum, usually higher than 2,0. The mean value for sampling periods taken as a whole is 2,18.

5. DISCUSSION

The large increases in the densities of terrestial spider populations in late autumn/early winter observed in both my localities (Fig. 2 and 3) have also been pointed out by, amongst others, Duffey (1962) and Huhta (1965). They also noticed a tendency towards a decrease in the number of spiders in mid-summer. Duffey (1962) and Bristowe (1939) state that this decrease is particularly noticeable in dry summers because many Linyphiidae species are susceptible to desiccation. The climatic conditions in Western Norway during certain periods of 1972-1973 are taken into consideration, similar conclusions may be drawn from my results. The winter of 1972 was hard compared with "normal" conditions in W. Norway. A snow-free period of frost from late December 1971 resulted in extremely hard frozen earth until March 1972. The spring of 1972 was warm and dry for long periods, and there was an unusually warm summer in 1972, again with long dry periods. There were also some dry spells in August and September 1972, but in the autumn the climate returned to "normal", i.e. to a wet and windy type of climate. Late autumn 1972 and in particular the winter of 1973 were unusually mild. On the contrary spring 1973 was unusually cold, wet and late, and the summer of 1973 more rainy than the previous summer, with few and only short spells of drought. Both at Loc. I and at Loc. II (Fig. 2 + 3) the dry summer of 1972 may have been the cause of the great decrease of spiders at that time. It is, however, quite obvious that the loss of spiders is less drastic at Loc. II than at Loc. I. The explanation must, at least to some extent, be that the Sphagnum mats are better able than the

other mosses to keep the water content near the ground at a higher and more constant level, even in long periods of drought. This means that its inhabiting fauna is more independent of changes in the macro-climatic conditions, which was also the impression gained at the place there during dry periods. The Sphagnum never dried out completely, while the Hylocomium mats were completely dry at the end of the dry periods.

As can be seen from Fig. 2 and 3 the variations of the total numbers of spiders are due mainly to variations in the juvenile population of the spiders. The curves showing adult spiders are relatively smooth and flat. The differences between the highest and the lowest density at Loc. I is 91,3 indiv./m^2, and the corresponding value for Loc. II (Fig. 3) is only 43,2 indiv./m^2.

Figs. 4 and 5 show that juveniles always comprise the majority of the spiders. At Loc. I the percentage of young individuals is quite stable in late autumn/winter (Fig. 4). A slight increase occurs in spring, towards July, when it reaches its maximum of 81,1% (at least in 1972). Similarly there also is a decrease from July to September 1972, when the minimum of 59,2% is reached. The percentage decrease of the juveniles from August 28 to October 1972 might be due more to a rapid growth in the adult populations than to an increased hatching intensity of juveniles at the same time. The opposite seems to be the case between 12 October and 13 November 1972. The high number of adult spiders in December 1972 (Fig. 2) does not correspond with the low number of juveniles in August 1972. So there must be, as also pointed out by Huhta (1965), a very intense reproduction (i.e. hatching) of spiders in early autumn, and a rapid maturing of the individuals. From this it follows that most of

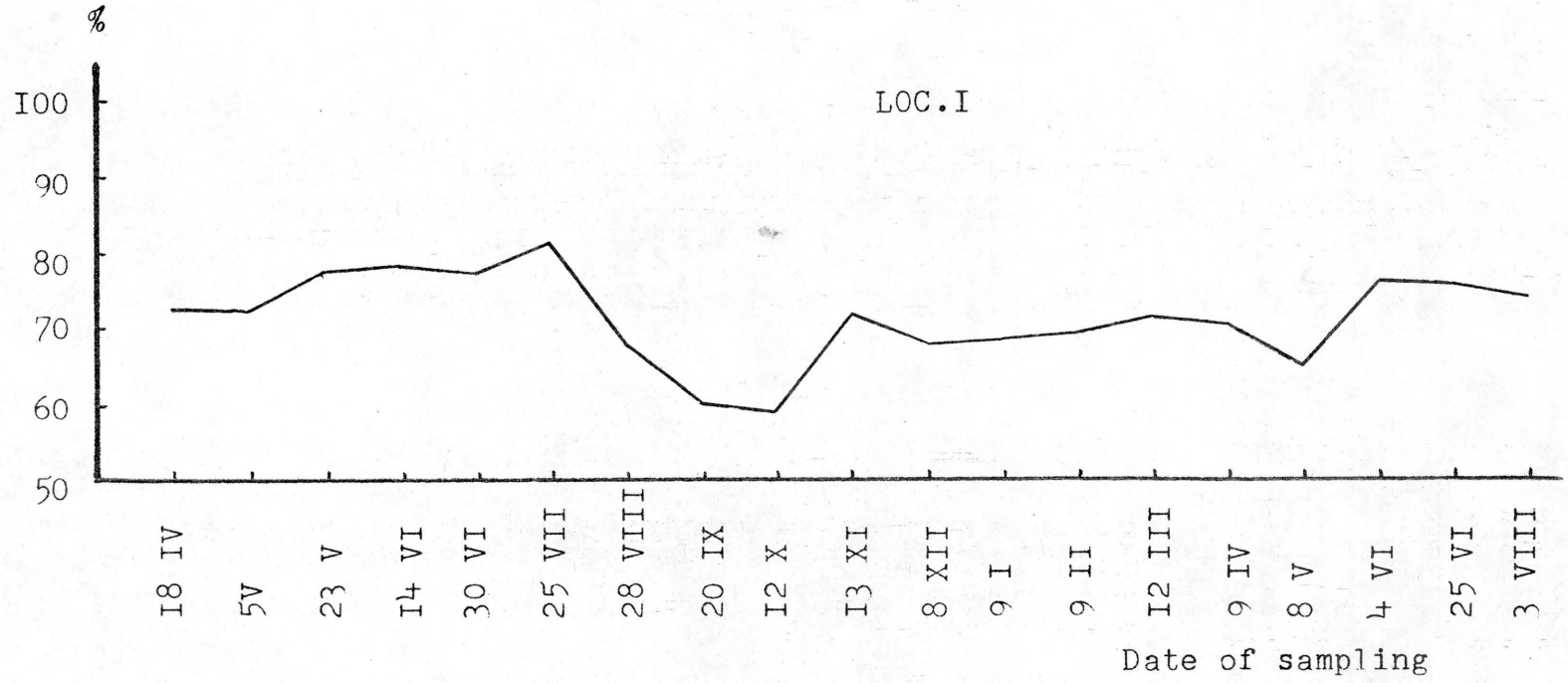


FIG.4. Loc.I, juvenile araneae in percentage of total number of spiders,1972-73.

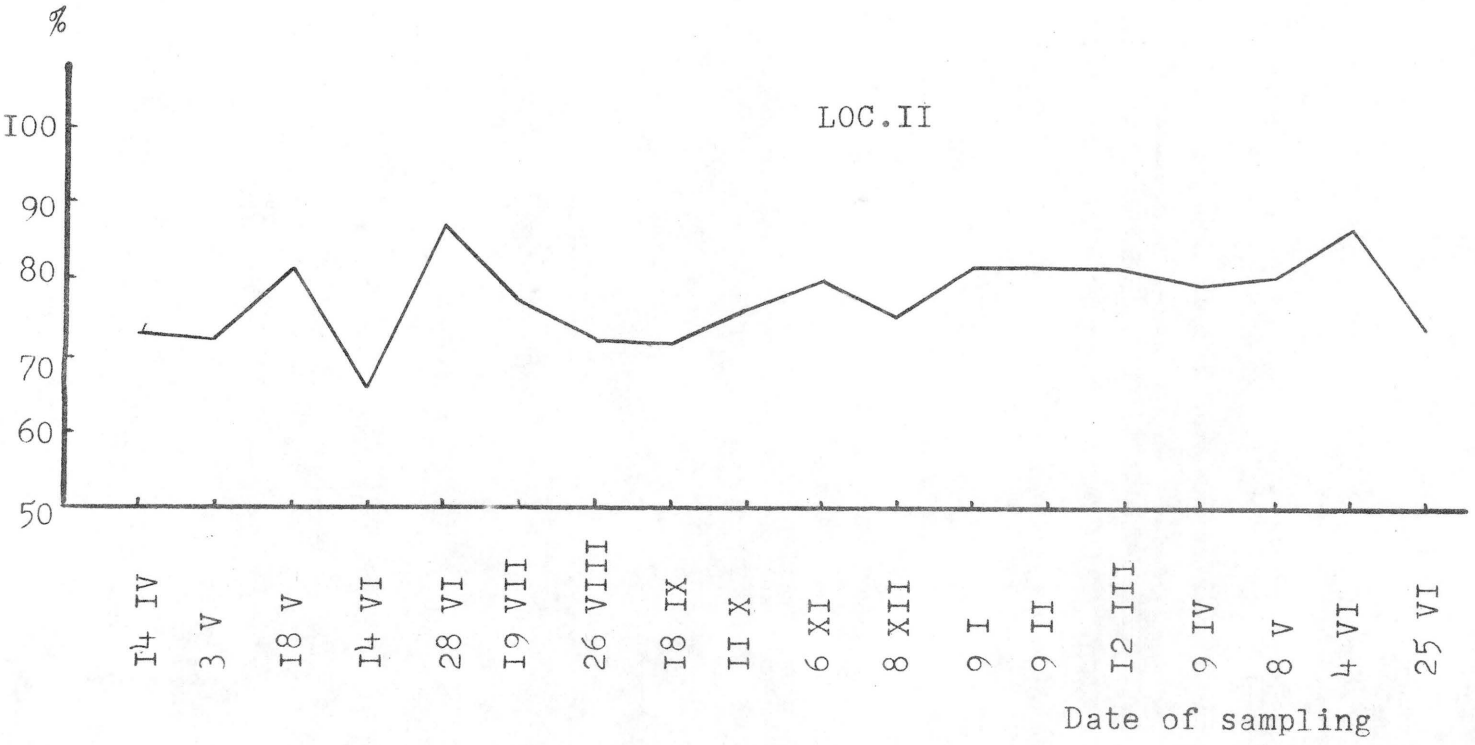


FIG.5. Loc.II, juvenile araneae in percentage of total number of spiders,1972-73.

the spiders present at mid-summer, when the general abundance is comparatively low (Fig. 2) at least in dry summers, mainly are largely present at the egg stage at that time as a result of the maximum spring population of adult spiders), and as such are not registered during sampling in mid-summer. This together with the comparatively high mortality of spiders in hot and dry summers, must result in the abundances of spiders being extremely low in such circumstances.

At Loc. II (Fig. 5) the percentage of juveniles drops below 70% only once (14 June 1972). Generally the percentage for this locality lies nearly 10% higher than the corresponding values from Loc. I. Otherwise the % is relatively high and constant during the whole year, except for a tendency towards a falling percentage of juveniles during mid-summer/early autumn 1972, and probably the same will happen in June the following year.

Fig. 6 shows that the family Linyphiidae, together with the Theridiidae, are the overall dominating group of terrestial juvenile spiders at Loc. I. (The Theridiidae, without exception, are of the genus Robertus.) Similar diagrams could be drawn for the adult population and for the corresponding datas for Loc. II. Figs. 7 and 8 show that the decrease in the numbers of individuals in these two families largely accounts for the large decrease in the population density in general during the dry summer of 1972.

The great fall in numbers of adult spiders in mid-summer (Fig. 2) is certainly not only due to the dry conditions, but also to the natural mortality of old individuals, with the main copulatory period in spring, and particularly to the short lives of the males.

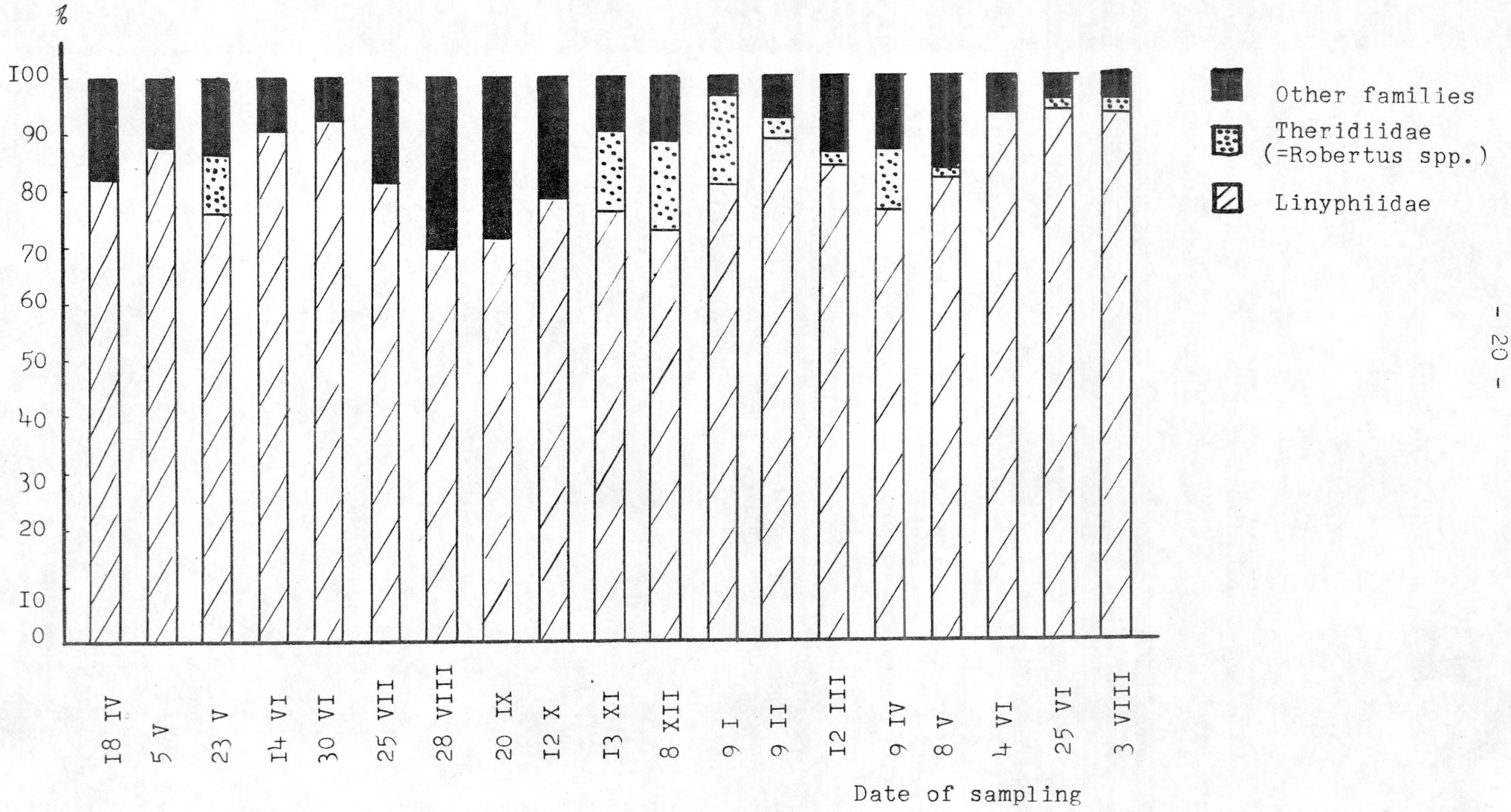


FIG.6. Loc.I,juvenile araneae. Representation of three families groups,1972-73.

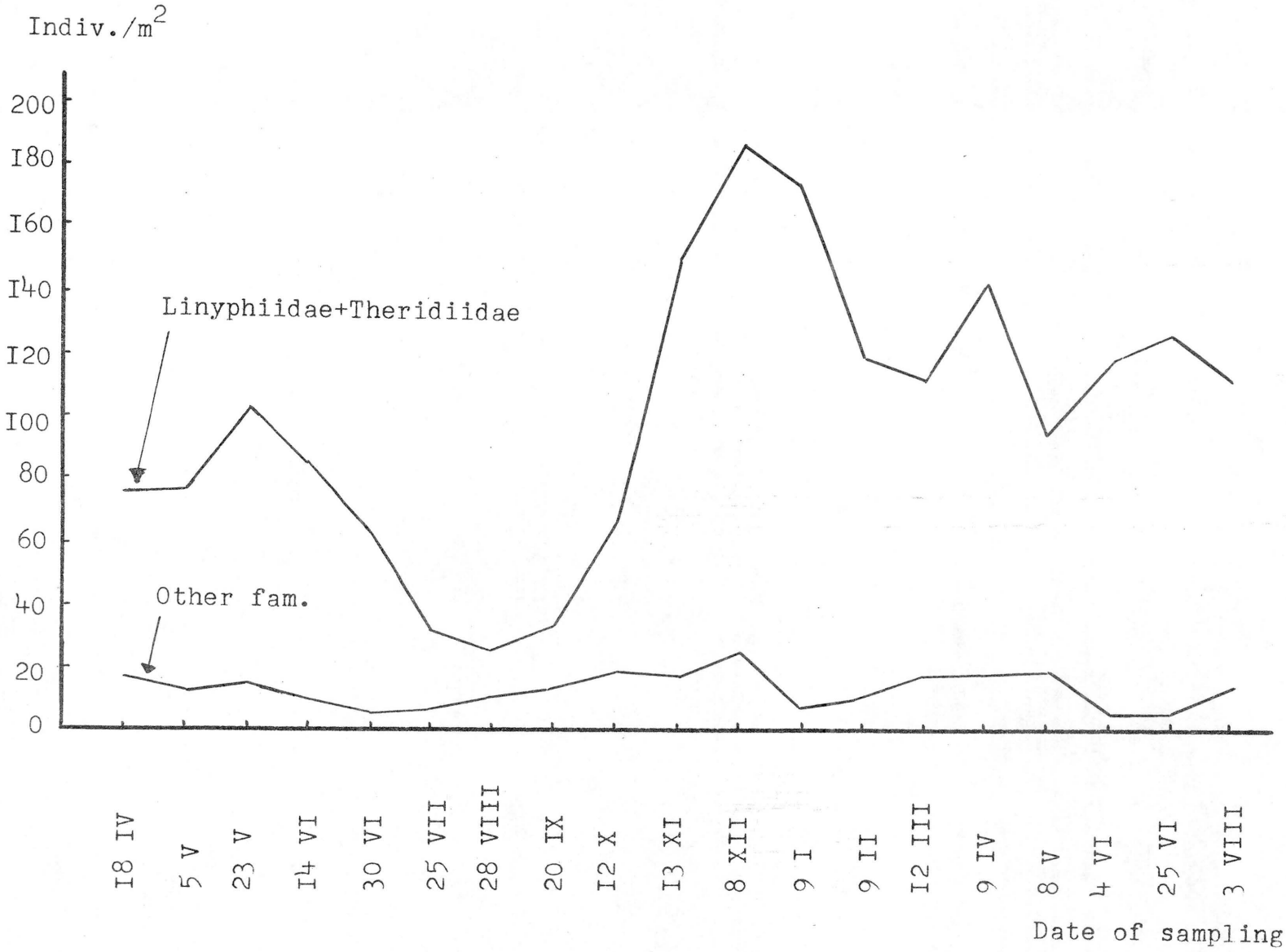


FIG. 7. Loc.I. Juvenile araneae. Abundance (indiv./m^2) of Linyphiidae + Theridiidae and the other families, 1972-73.

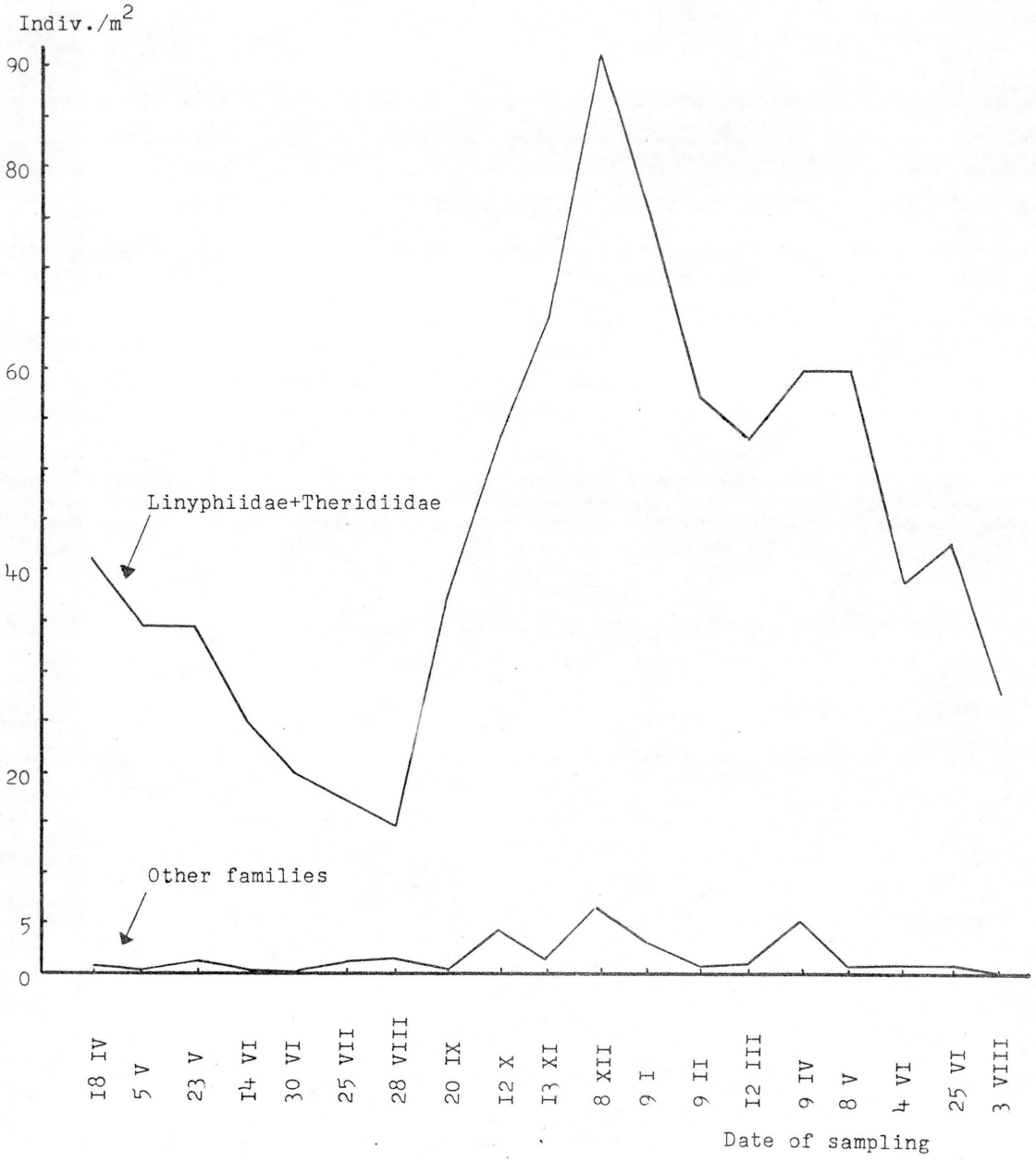


FIG.8. Adult araneae at Loc.I. Abundances of Linyphiidae + Theridiidae and the other families, I972-73.

Table V and Figure 4 both indicate a richer and more diverse spider fauna in the Hylocomium habitats than in the Sphagnum samples. Fourty-two species were found in the first mentioned habitats but only 29 in the Sphagnum. In Sphagnum, Robertus arundineti alone accounts for 42,8% of all adult specimens, the most dominant species from the other Loc. (Minyriolus pusillus) accounts for only about half of this percentage. The relatively high diversity indices in Sphagnum in the periods 20 March to 14 June 1972 (Table V) may be due partly to the fact that these sample series were taken in more spread and smaller Sphagnum aggregations surrounded by other mosses, while the remaining sample series were from a larger and more continous Sphagnum area. It is obvious that in the first series there must have been some interaction or exchange of species between the two habitat types, more than in the large and homogenous Sphagnum mats. The Sörensen's indices given in Table IV indicate a greater relationship between the two habitat types up to 14 June 1972 than after that date. Also extensing the total sampling area in the Hylocomium habitats from December 8 1972 (see page) resulted in relatively higher and more stable diversity indices from period to period. Therefore it is quite clear that the sampling design within an area has a certain influence upon the calculated species diversity, and that from the "Hylocomium areas" the last 10 sample periods give the most correct picture of the species diversity at this location, and that the 16 last sampling periods in the Sphagnum (Tab. V) give the most correct values from that type of habitat.

The fluctuations of the diversity indices may also be partly because the calculations are based on adult specimens only.

The following examples may be compared with the diversity

indices from the Calluna heath at Lindås (Tab. V): The mean value of the diversity indices calculated for 26 decidous forests ("edellövskoger" including pure oak forests) investigated in Western Norway during summer/autumn 1974 was 1,81. The mean value for three mixed forests of evergreens and decidous trees was 2,27, and for 5 forests with evergreens only (pines and spruces) the mean value was 7,15. Seen in relation to these figures the mean values from our Calluna heath areas seem to be very flattering, at least with regard to the "Hylocomium areas" with a mean value of 2,18 (Sphagnum 1,26).

As already mentioned a characteristic species from the Sphagnum is Robertus arundineti, hardly ever found in the Hylocomium samples (1 individual). Perhaps also Araeoncus crassiceps and Silometopus elegans should be considered more typical for the Sphagnum samples, elegans in particular. Haplodrassus signifer is not found in the Hylocomium samples.

Species not found in Sphagnum are: Pocadicnemis pumila, Jacksonella falconeri, Erigone atra, Agyneta subtilis (while cauta and conigera also are found in Sphagnum), Maro lehtineni, Centromerus arcanus, Macraggus rufus, Microlinyphia pusilla, Robertus scoticus, Ero furcata, Oxyptila atomaria, Neon reticulatus, Zelotes latreillii. These species comprise 33,3% of all species in Table , or in other words: 1/3 of the species from the Hylocomium list are absent in the Sphagnum samples. Among the species very common and dominant in Hylocomium, but less common in Sphagnum are: Minyriolus pusillus in particular, Ceratinella brevipes, Wideria antica, Cnephalocotes obscurus, Peponocranium ludicrum, Tapinocyba pallens, Micrargus herbigradus, Lepthyphantes mengei, L. ericaeus, and Gonatium rubens. Relatively common in both habitats are: Gongylidiellum vivum, G. latebricola, Trachynella nudipalpis, and perhaps Erigonella hiemalis.

6. SUMMARY

Only a small fraction of the vast Calluna heath areas of the Lindås/Austrheim communities have been studied, but a few points can be summarized as follows:

1. Under normal humid conditions the densities of terrestial spiders, the Linyphiidae in particular, may be relatively high. Maximum densities of more than 300 individuals/m^2 have been estimated in more complex habitats with a mixture of several mosses like Hylocomium splendens (in particular), Pleurozium, Hypnum etc., and a maximum of just under 200 indiv./m^2 in the Sphagnum aggregations, which are more uniform and more stable with regard to humidity. In comparison: A maximum of approximately 300 indiv./m^2 has been estimated (in September 1967) in birch forest localities in Northern Norway. Palmgren (1965) found from 24-169 indiv./m^2 at different localities in N. Finland. Huhta (1965) gives average densities of spiders from 11 different Finnish forests ranging from approximately 30 to approximately 150 indiv./m^2. In Nordmarka, near Oslo, Palmgren (1964) found 61 and 72 indiv./m^2 in two Hylocomium samples, and a mean value of 120 indiv./m^2 (range 82-134) in Sphagnum. Almquist (1973) sampled 73,5 specimens/m^2 in his Calluna vulgaris-community in Southern Sweden in November/December 1961.

2. It also is quite evident that the system, particularly in the "dry" Hylocomium habitats, is very sensitive to long periods of drought, while in places where the humidity has

remained more constant, as in the Sphagnum mats, long dry periods seem to have less effect upon the densities of the inhabiting spider fauna. After these extreme periods of drought the spider populations are able to recover rapidly and to build up and maintain relatively high and stable densities during the mild winter seasons.

3. There is a relatively high diversity in the spider fauna compared with some other localities in W. Norway, and it has been possible to record great differences between the two main vegetation types chosen. About 1/3 of all species (34,1%) are absent from one of the two habitats.

PART II

7. ANNOTATED LIST OF SPECIES, WITH NOTES ON THEIR ECOLOGY AND PHENOLOGY

A total number of 74 spider species listed below were found in the study areas. This comprises less than 15% of the known species in Norway. Little is known about the distribution in Norway of many of these species. Eight species are reported here for the first time in our country, and a number of species are found for the first time in W. Norway.

The comments to the species are mainly based on the following data:

1. All quantitative samples taken in the Hylocomium vegetation type (including Loc. I), listed in Table VII.
2. All quantitative samples from pure Sphagnum, listed in Table VIII.
3. The material from the pitfall traps, listed in Table IX and X.
4. Additional data from minor collecting periods in 1971 and 1974 are given separately, when necessary.

When discussing the different aspects of the biology of the different species, apart from literary references, I also refer to personal experience, in the main to four larger collections of unpublished material from the following areas:

A. The Finse area, S. Norway (1200-1400 m above sea level).

Material from a pitfall trap in the summers of 1969-71 in connection with the Norwegian IBP programme. Normal duration of the season from end of June - end of September.

B. The Jotunheimen area (950-1300 m above sea level). Material from a pitfall trap in connection with the Norwegian IBP programme. Duration of season: Beginning of June - beginning of November, somewhat depending on the altitude.

C. The Stigstuv area, Hardangervidda. Pitfall and quantitative material in connection with the Norwegian IBP programme.

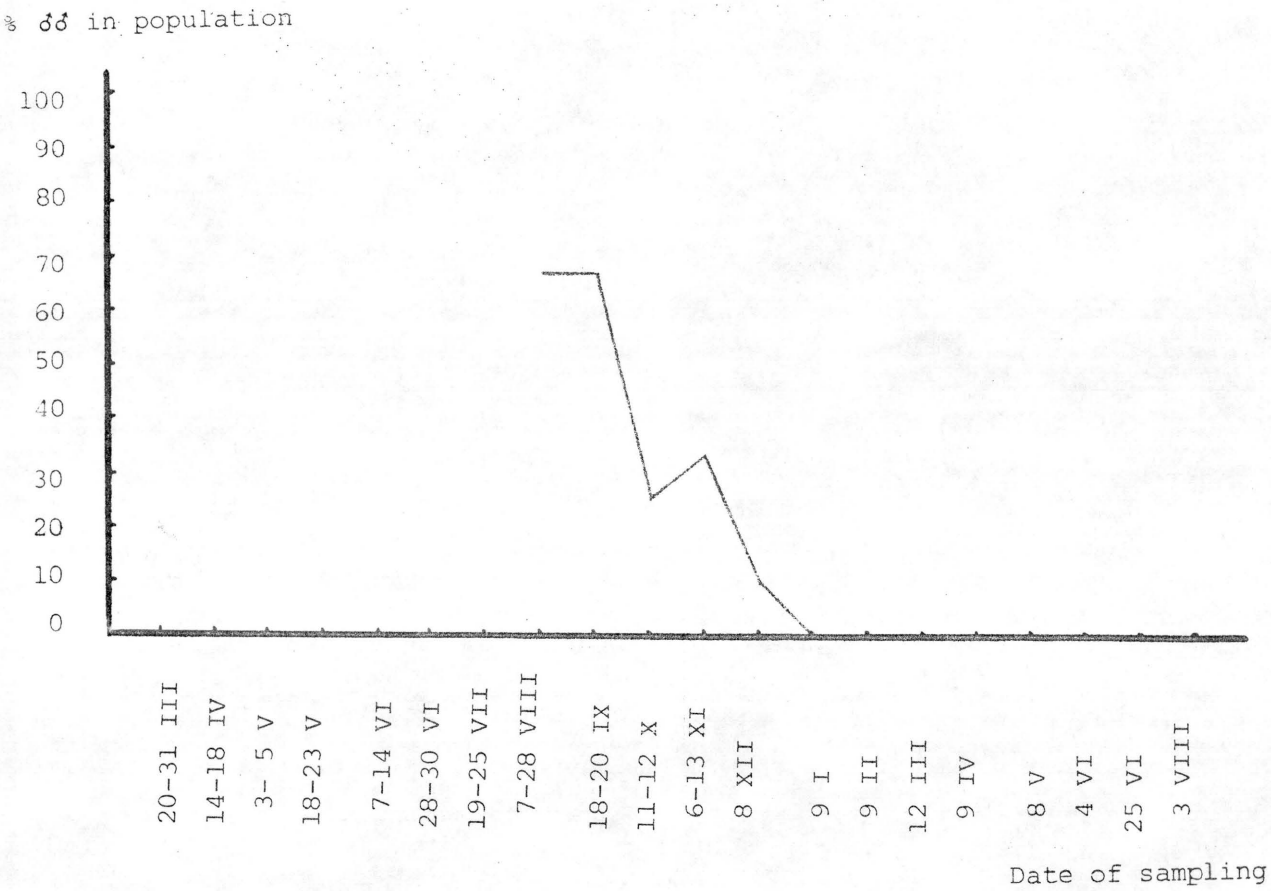
D. The Skjomen fjord, Northern Norway. Quantitative samples in birch forest in 1967 from mid-May - mid-September, and in 1968 from June-August.

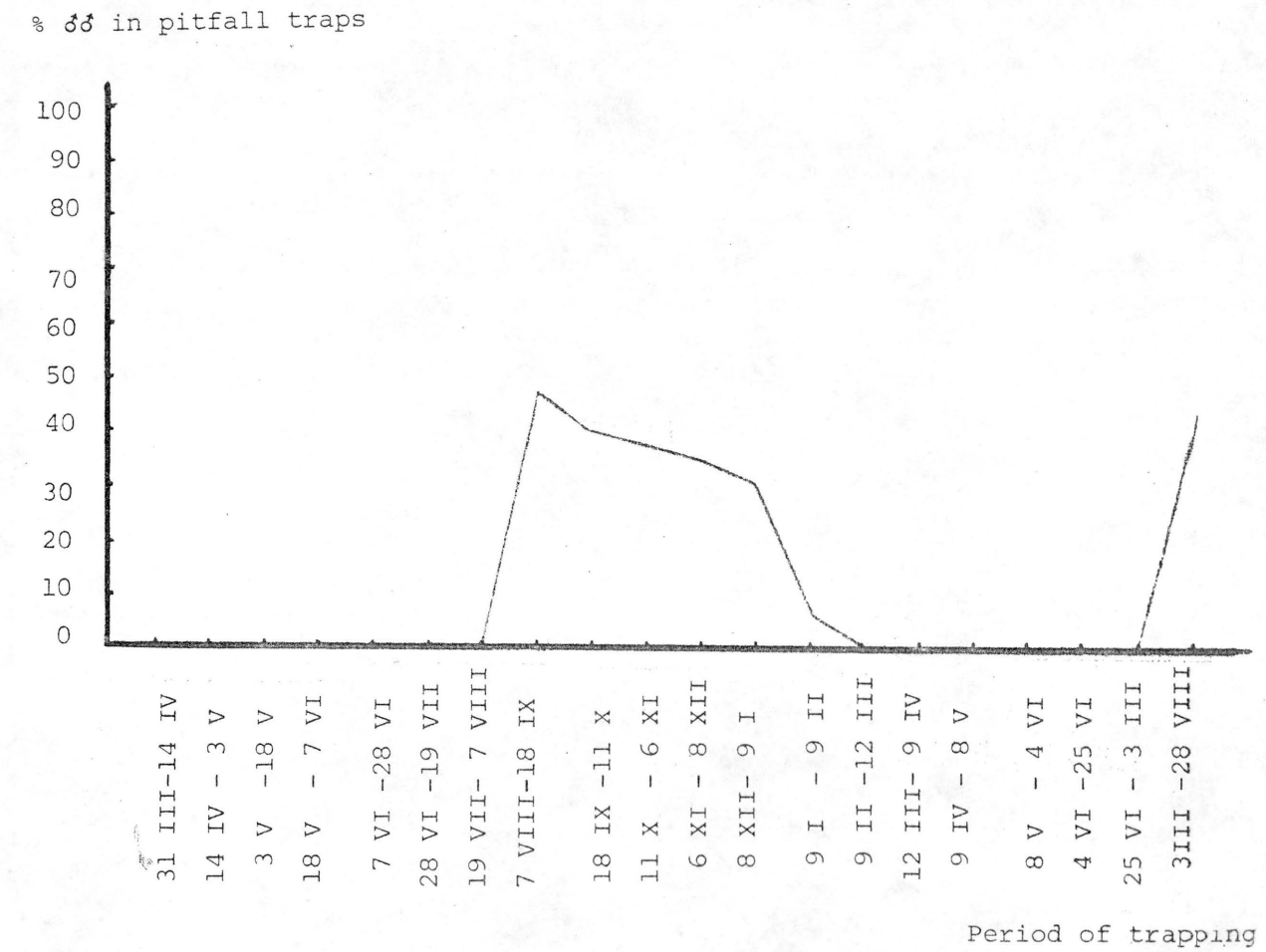
Gonatium rubens (Blw.)

Total number of specimens: 103 ♂♂ + 376 ♀♀, the majority in pitfall traps (97 ♂♂ + 131 ♀♀) and only one ♀ in pure Sphagnum.

Adult oo are present and active throughout the whole year (Tab. VII, VIII and Fig. 10), but probably somewhat scarce at mid-summer. Males are trapped from August to January/February, which agrees quite well with results given by Merret (1969) (August-December). Wiehle (1960) states that most adults are found in August-September, which is quite reasonable if one supposes that the peak activity period of the males and the main copulatory periods are coherent. Fig. 9 shows that this appears to be the case: The males' activity period coincides well with the period when they are actually present in the area. In the population at

FIG. 9
GONATIUM RUBENS (Blw.)





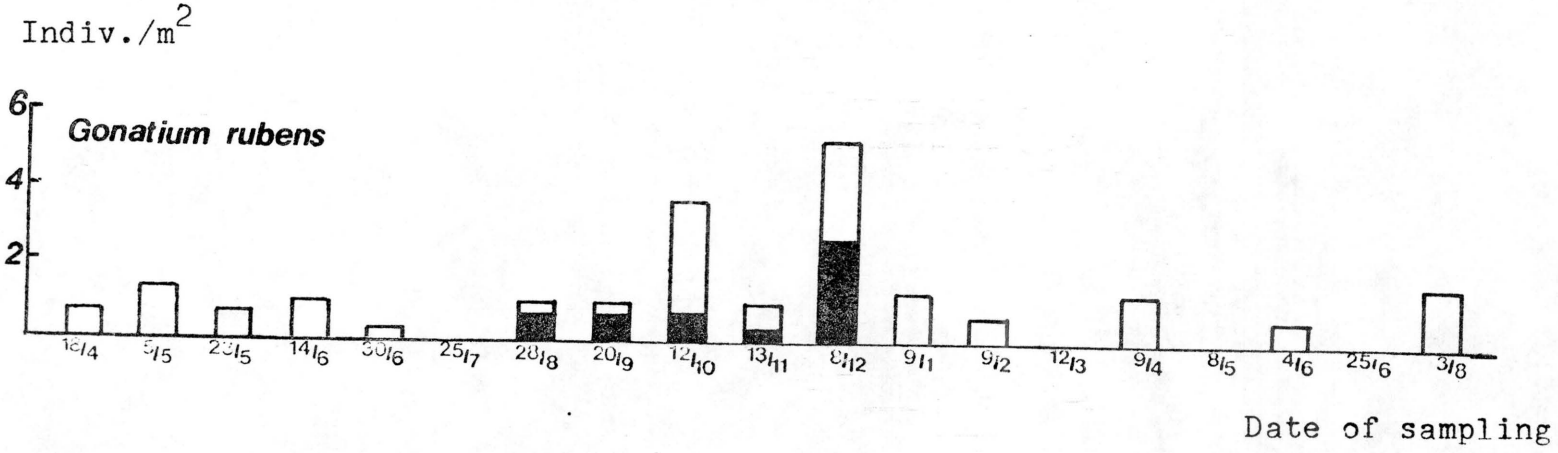


FIG.IO. Gonatium rubens (Blw.). Abundances at Loc.I, I972-73.

Black ♂♂,hvite ♀♀.

Tvärminne Palmgren (1972) found both sexes from spring to autumn, the largest percentage in summer. In the short seasons at Finse (normal duration from end of June - end of September) females were trapped throughout the whole season, while the earliest date when males appeared in the traps was from about mid-July (most in early August) and to the end of the season. In Jotunheimen most females were trapped at the beginning of the season in early June, and at the end, from mid-October - end of November. The males were trapped from about mid-August. In Skjomen, N. Norway, I found a few ♂♂ from 8 August to 9 September 1967, 1 ♀ at the end of June + 3 ♀♀ in July.

Ceratinella brevipes (Westr.)

Total numbers of specimens: 28 ♂♂ + 38 ♀♀, only one of them (1 ♀) in pure Sphagnum. The few males taken in pitfall traps (4 specimens) were all trapped from March - June, in agreement with Merret's (1969) material. According to Schaefer (1971), the activity period for ♂♂ is from May - July, with a maximum in June, and for the ♀♀ from May - Septemer. In Northern Finland Palmgren (1965) found males in spring and autumn, and also a few ♀♀ in the summer. In Skjomen, N. Norway, I found ♀♀ from May to September 1967, 1 ♂ in the middle of May and the majority of males from about the middle of July to about August. In 1968 I found 8 ♂♂ + 12 ♀♀ in June, July, and August.(38% in June, 50% in July, and 33% in August males). Though rather scarce in the Finse area, adult ♀♀ were trapped either at the beginning of the season or at the end of the season, a single ♂ was trapped between 17 July and 3 August 1969. In the Jotunheimen area a few ♀♀ were trapped during the very first trapping period after the thaw. At Stigstuv, Hardangervidda, 1969-1971, the females

from the quantitative samples were found mostly either in the first or in the last sample series of the season, 2 ♂♂ were found in August. In my quantitative samples (Table VII + VIII) males are found from November 1972 to May 1973, a single ♂ also 30 June 1972. The females are present throughout the year.

The March-June trapping period in Merrett's (1969) material and in my oceanis population is about one month ahead of Schaefer's (1971) May-June period.

A "normal" cycle for this species could be described as follows: An adult population is built up in the autumn. Obviously these individuals do not mate, but overwinter and the males become sexually active during the period spring to early summer. The trapping period of the females is rather longer and may overlap to some extent with the new autumn female generation. In more northern areas, like my Skjomen localities, the processes may be slower in some years so that the destinction between spring and the following autumn population is more diffuse. What happens in the high mountain areas is rather uncertain, but it is probable that the species here have a longer generation cycle than in the lowland areas.

Wideria antica (Wid.)

Total numbers of specimens: 69 ♂♂ + 46 ♀♀, only one of the females from pure Sphagnum.

The males seem to reach their peak of sexual activity in March/April-May, corresponding to some extent with results from Tretzel (1954): A stenochron species with male activity in March-May. However, I also trapped 2 ♂♂ (+ 1 ♀) 4-20 October 1971, 2 ♂♂ in January-March 1973, which is more in accordance with Braun's (1961) and with Merret's (1969) results. The latter also

suggests a small peak of activity in the autumn, but with the main activity concentrated in April-May.

In my quantitative samples (Table VII) both sexes seem to be present as adults throughout the year, but are probably less abundant in June-Junly. Huhta (1965) found 3 ♂♂ in September and 1 ♂ in December. Palmgren (1972) grouped the species in the seasonal type VIII, i.e. adult males and females are found in spring, summer, and autumn, but with a relatively low percentage of males in summer. Wiehle (1960): Adult oo and oo from autumn to spring.

According to Tretzel (1954) and Palmgren (1972) the species seems to have a wide ecological range, but Palmgren states that the species is "... decidely preferring dry habitats...". It is found in forests (Wiehle (1960), and in Sphagnum in the forest floor (Waaler 1967, 1972), Braun (1961): dry habitat. Huhta (1969) states that it prefers open forests. I found 1 ♀ 8 June 1971 in a relatively open birch forest near Harstad, Troms (up to now the most northern record in Norway). However, it is most probably a characteristic species for certain open areas. Almquist (1973) found adult specimens in all but two of his sand dune habitats, the Calluna locality included.

Trachynella nudipalpis (Westr.)

Total numbers of specimen: 64 ♂♂ + 25 ♀♀, 9 ♀♀ in pure Sphagnum. Also 2 ♂♂ + 3 ♀♀ were trapped 4-20 October 1971 and 3 ♂♂ + 1 ♀♀ 27 October - 27 November 1971, which together with Table IX shows as is well-known, that the species is winter active. Here it is trapped from September/October to the beginning og May. This is rather earlier in the autumn than described by Merrett (1969) who reports male activity from mid-January, but

more in accordance with Williams (1962), who trapped the species from October to June. From my material the peak of male activity can be calculated to last from December/January to February/ March. Tretzel (1954) found a very short activity period at Erlangen (♂♂: in april, ♀♀: February to April, (1960). Heydemann (1960), on the basis of a material from the German North Sea coast, characterizes this species as a typical eurychrone winter active species. In the Jotunheimen areas a few ♀♀ were trapped, mainly at the end of the seasons. Wiehle (1960): Adult ♂♂ and ♀♀ in spring and autumn. In Northern Finland Palmgren (1965) found adult ♀♀ in spring and autumn, ♂♂ only in the autumn, while in S. Finlaand he (Palmgren 1972) found an increasing percentage of males from spring to autumn. In Skjomen (N. Norway) i found ♀♀ in May and July-September, ♂♂ in August and September. In Lindås (Table VII + VIII) adult males are present in the population from November to February, the females from September to June, which is almost identical with the activity period (the pitfall trapping).

A forest and open land species, and pronouncedly hygrophil (Brændegård 1958, Palmgren 1965).

Cornicularia cuspidata (Blw.)

Total numbers of specimens only 14: 1 ♂ + 3 ♀♀ found in Hylocomium 20 October 1971, 1 ♂ + 4 ♀♀ trapped in the same area 20 October - 27 November 1971, 1 ♀ sampled 9 January, 1 ♀ 9 February, 1 ♀ 13 March 1973, 2 ♀♀ 2 October 1974.

Mainly a forest species, but occurring also in open land with some cover (Palmgren 1972) and found also in the Norwegian high mountain areas. Tretzel (1952): Hemiombrobiont. Palmgren's data on habitats also seem to agree with Tretzel's characteri-

zation: hygrobiont.

Tretzel (1954) reports a main copulatory period in May/June and according to Wiehle (1960) both sexes are found from August-late autumn. Palmgren (1972) found ♂♂ and ♀♀ from spring to autumn in S. Finland, with an increasing percentage of males. Casemir (1951) found adults at all seasons. The few specimens in my material (Table VII) are spread from October to March with no males later than February, but from several localities in Kvinnherad, Hardanger, W. Norway, some ♂♂ were found in May 1970 and 1971. In Skjomen, N. Norway, I found ♂♂ in May-June and in September 1967, and one ♂ in July 1968. The few ♂♂ from the Finse area were trapped in August-September (+ 1 ♂ 16 June - 3 July 1970). In the Jotunheimen areas some ♀♀ were trapped at the beginning and at the end of the seasons, ♂♂ not earlier than 20 August, but as late as 17 October - 27 November. In Lyngen, Troms, one ♂ was trapped in July 1969 (Hauge 1971).

Erigonella hiemalis (Blw.)

Total numbers of specimens: 161 ♂♂ + 131 ♀♀ (of which 2 ♂♂ + 9 ♀♀ in pure Sphagnum samples). In addition there is one female 4 October 1971 in Sphagnum, 1 female 20 October and 1 male 27 October 1971 (both from Hylocomium).

The species is one of the more abundant ones at Loc. I (Fig. II), but with the highest densities in the most humid Hylocomium areas (Fig. 12). It is also possible that the species had suffered somewhat under the dry conditions in the summer of 1972 (Fig. II), except for the very particular sample series of 23 May from the more "humid" site. This picture is in accordance with the characteristics given by Palmgren (1972): "A meadow species, with a marked preference for meadows of median moisture,

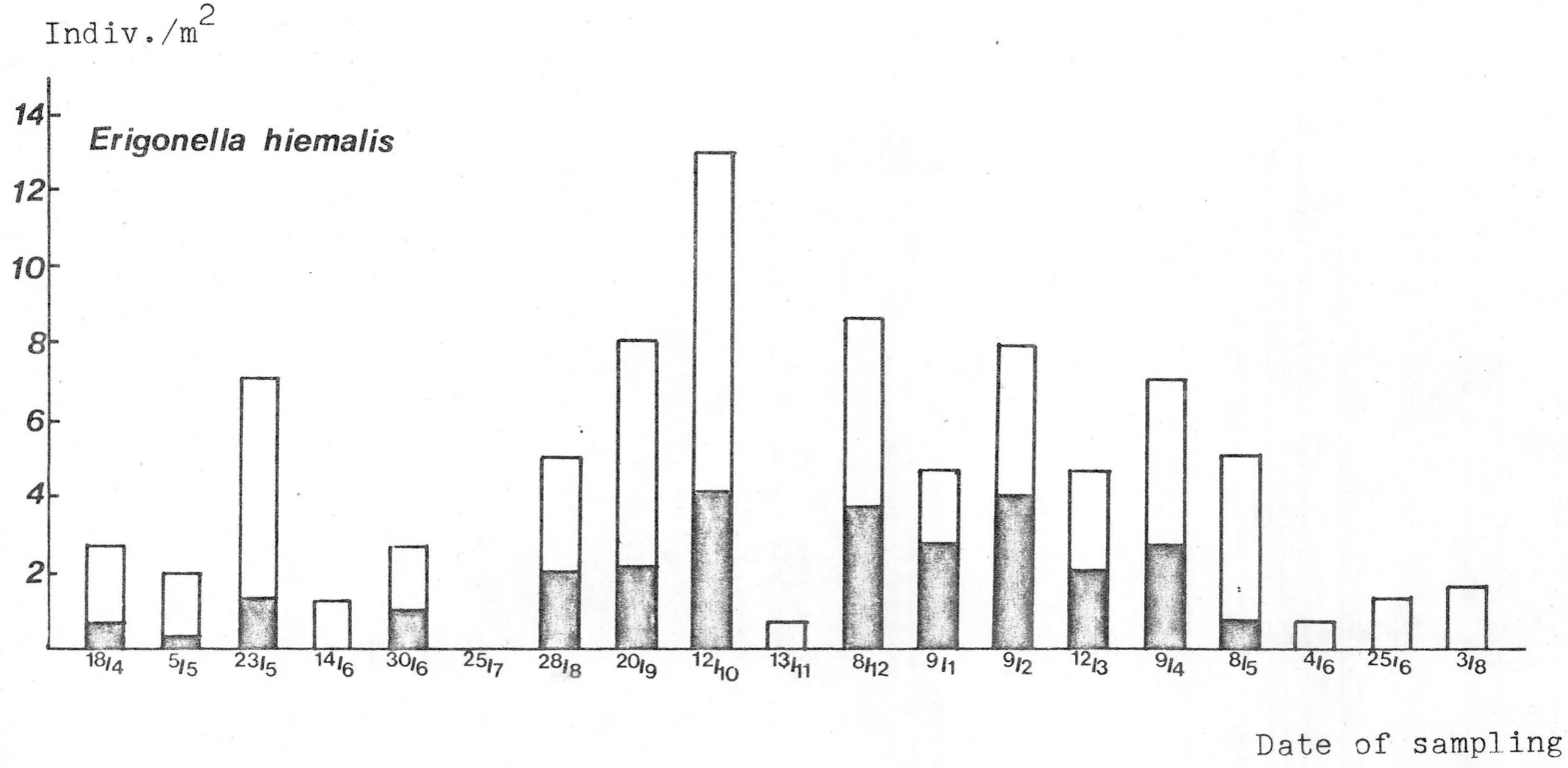


FIG.II. Erigonella hiemalis (Blw.). Abundance at Loc.I,1972-73.

Black ♂♂,hvite ♀♀

FIG.I2

ERIGONELLA HIEMALIS (Blw.)

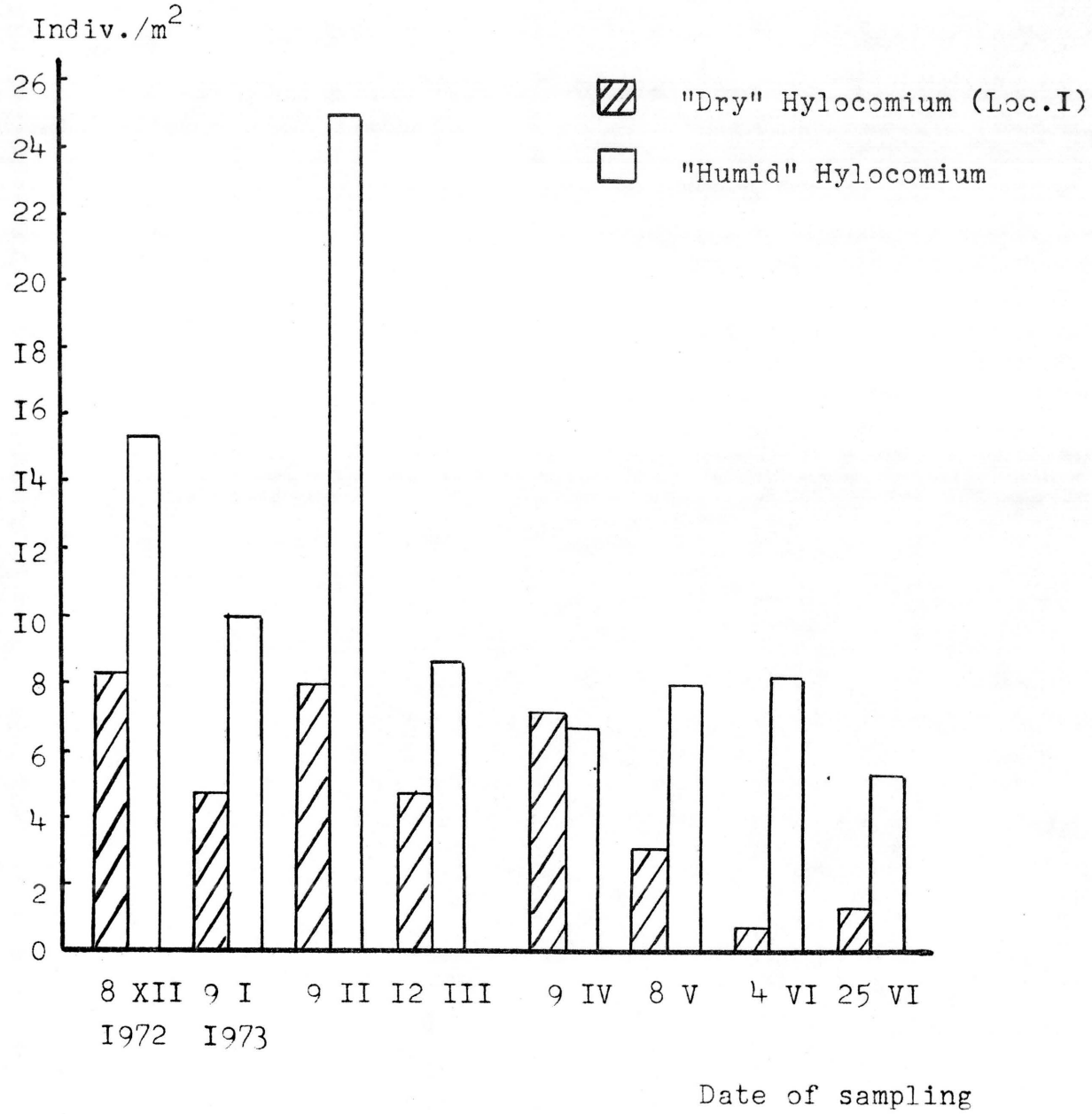
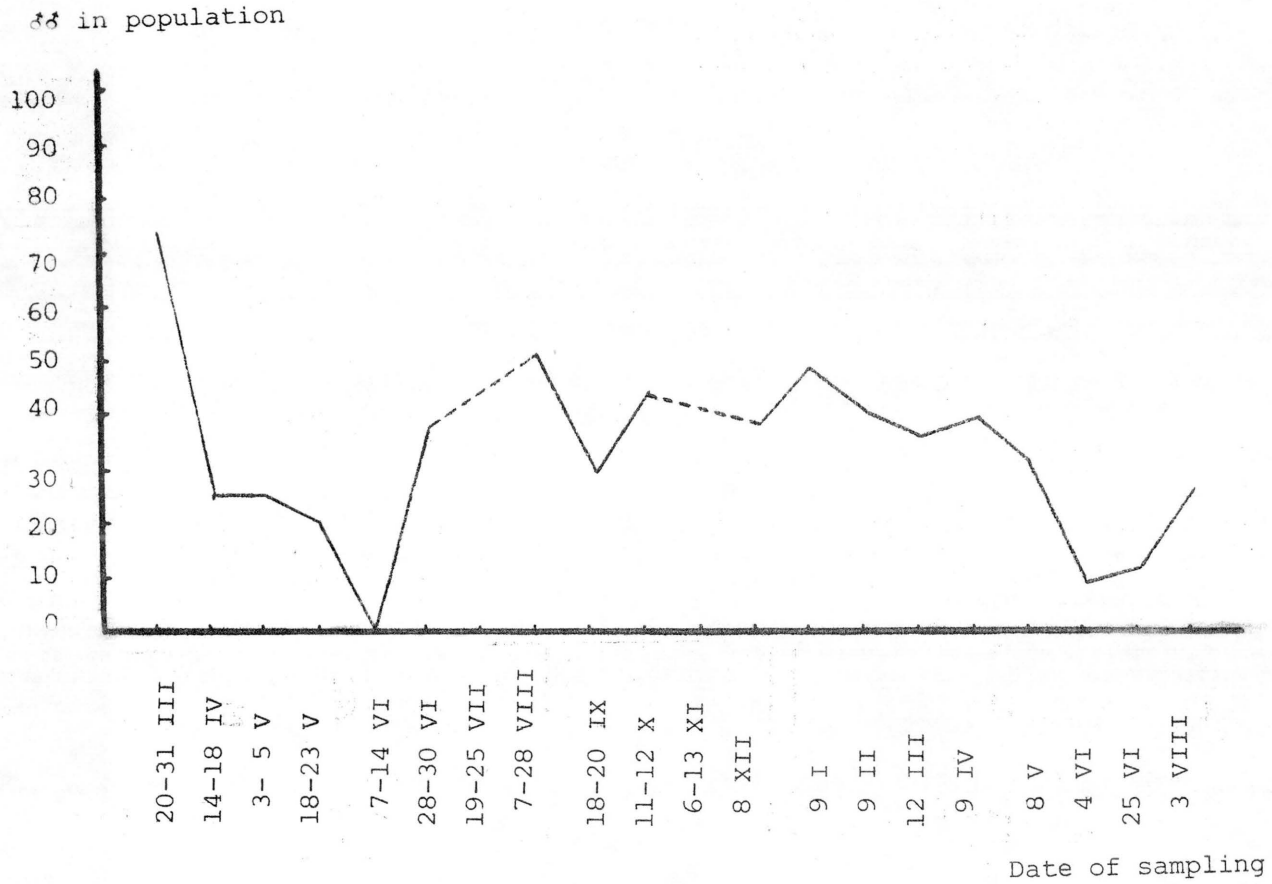
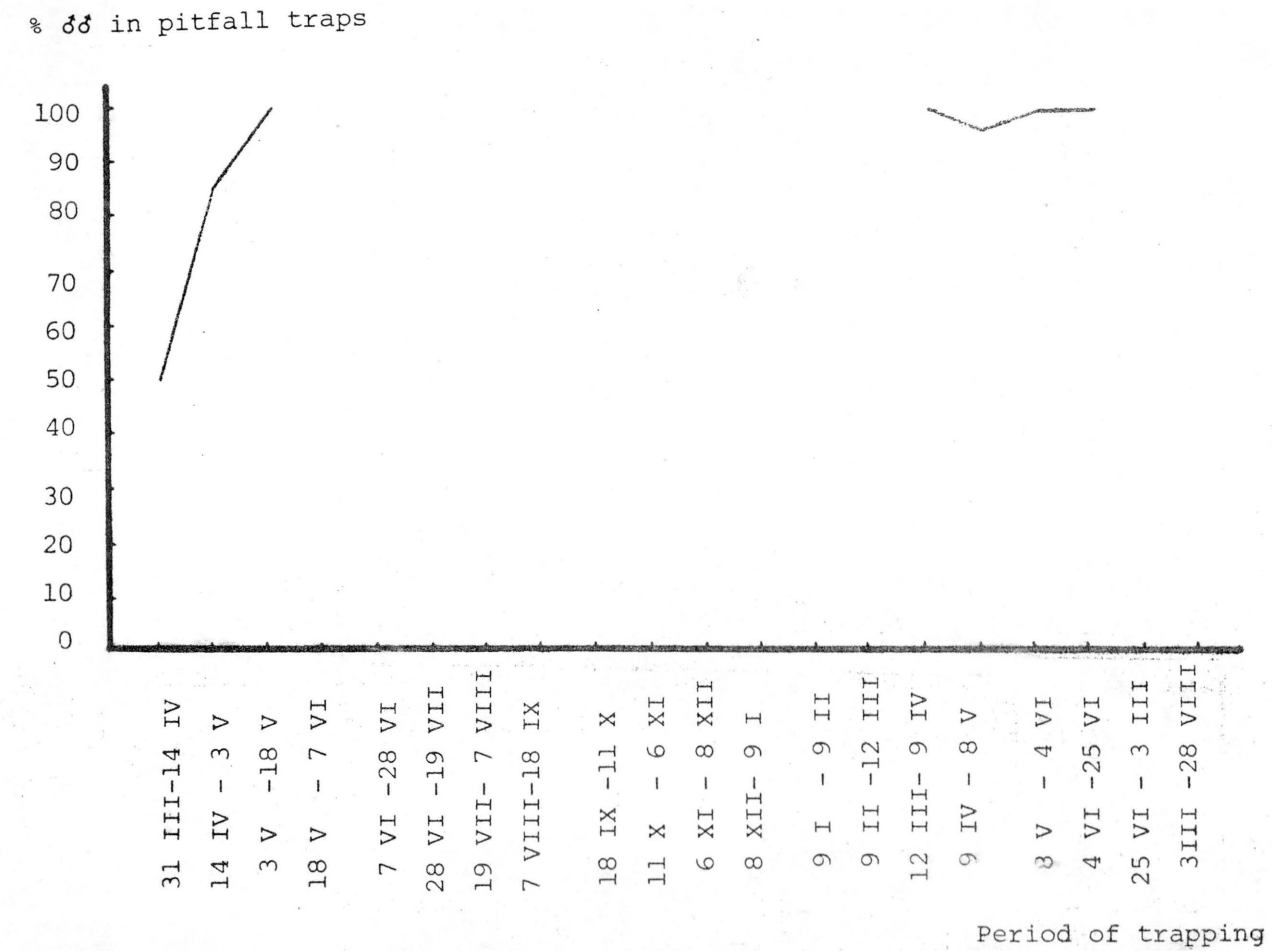


FIG. 13

ERIGONELLA HIEMALIS (Blw.)





but also fairly abundant in dry meadows."

Table IX indicates a peak activity period for males in April/May, but males were also trapped as late as June (1973) and females in June/July. Wiehle (1960) indicates that the adults are most active in February/March, while Tretzel (1954) found his few specimens in May, and in distinctly humid places (Tretzel 1952). Engelhardt (1958) found adults in May and November, and Palmgren (1972) males and females from spring to autumn, with a continuing increasing percentage of males. Fig. II and Tables VII + VIII show that adults are present in my areas throughout the year, but, particularly the males, are sparse in mid-summer. In the period when no males are found in the pitfall traps, the actual percentage of the male population amounts to about 50, except for November 1972, when my material was small and very insignificant. As also will be seen from Fig. 13, the percentage of the males in the population is at its lowest values near or just after the end of the male activity period (the pitfall trap material), indicating a rapidly dying male population, with males almost non-existent by mid-summer. The same is not always true for some of the other species in my area.

Tapinocyba pallens (Cbr.)

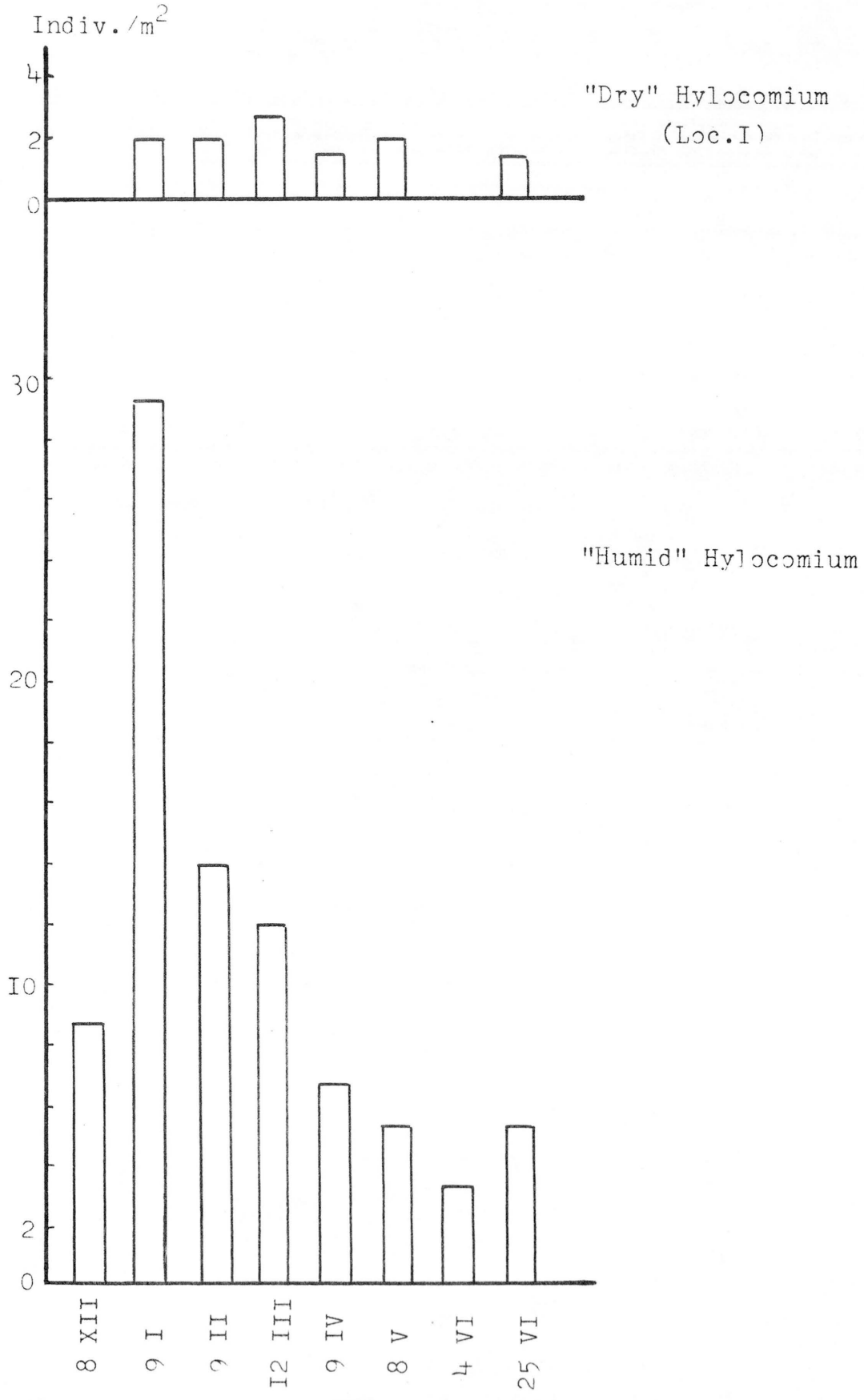
Total number of specimens: 27 ♂♂ + 137 ♀♀. The species is clearly most abundant in the more humid parts of the area (Fig. 14), and at Loc. I (Fig. 15), somewhat more abundant in the wet summer of 1973 than in the drier summer of 1972, though not very common in pure Sphagnum (only 4 ♀♀). My own experience with this species from N. Norwegian birch forest is that the species has relatively large populations and is very often the dominant species in the moss and foerna of shady sites with a dense blanket of

Dryopteris spp., particularly where the moss cover is sparse. It is much less numerous in open, drier, and lighter Vaccinium/Empetrum-dominated sites. Apart from in the outermost localities Almquist (1973) found this species in all his open habitats, but mainly on the dune heaths. He found a relatively large number of specimens (68) in his Calluna-community, but typically also the greatest number of specimens (115) in the northern exposed, humid, Bryophyta-communities. According to Tretzel (1952, 1955) the species is considered hemihygrophil. Huhta (1965): "optimum in moist spruce stands").

With regard to its phenology, only 1 ♂ + 1 ♀ were taken in the pitfall traps, the male in May/June (Table IX). In the frame samples, however, (Table VII) males are present from October to June, the females throughout the year, except for some periods in mid-summer. The percentage of males in the population (Fig. 16) is greatest in December 1972 (38,5%) and from then on decreases towards zero in June 1973. Also Huhta (1965, Fig. 14) showed that there was a general tendency for the populations of this species to be low at mid-summer, particulary in the case of the males. He found no males in July, very few in June and August, but the species was quite abundant in the rest of the year. Tretzel (1954) classifies the species in the Micrargus herbigradus-Typus: One copulation period in summer and one in winter, and with an obvious peak of activity of males in May. Palmgren (1972) found ♂♂ in spring and autumn, ♀♀ also in summer. In 1967 in Skjomen, N. Norway, I found ♂♂ and ♀♀ from May-September. A maximum of males occurred in May (approximately 22% of the adult population), in the second half of June the corresponding percentage was approximately 3% males, in first half of July approximately 5%, increasing to approximately 22% males in September.

FIG. I4

Tapinocyba pallens (Blw.)



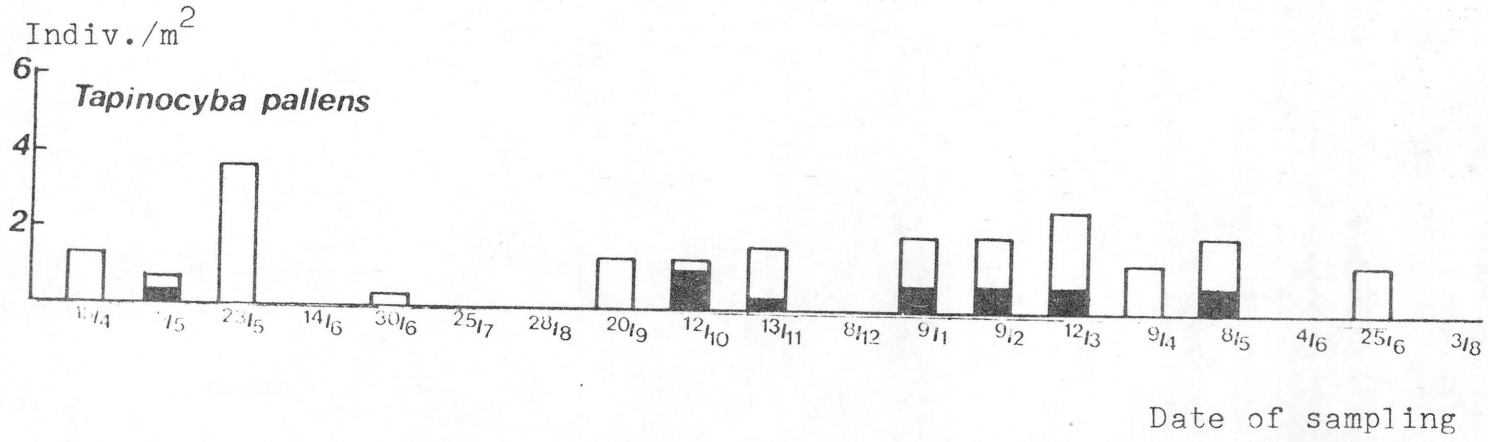


FIG. 15. Tapinocyba pallens (Cbr.). Abundances at Loc.I,1972-73.

Black ♂♂, hvite ♀♀.

TAPINOCYBA PALLENS (Cbr.)

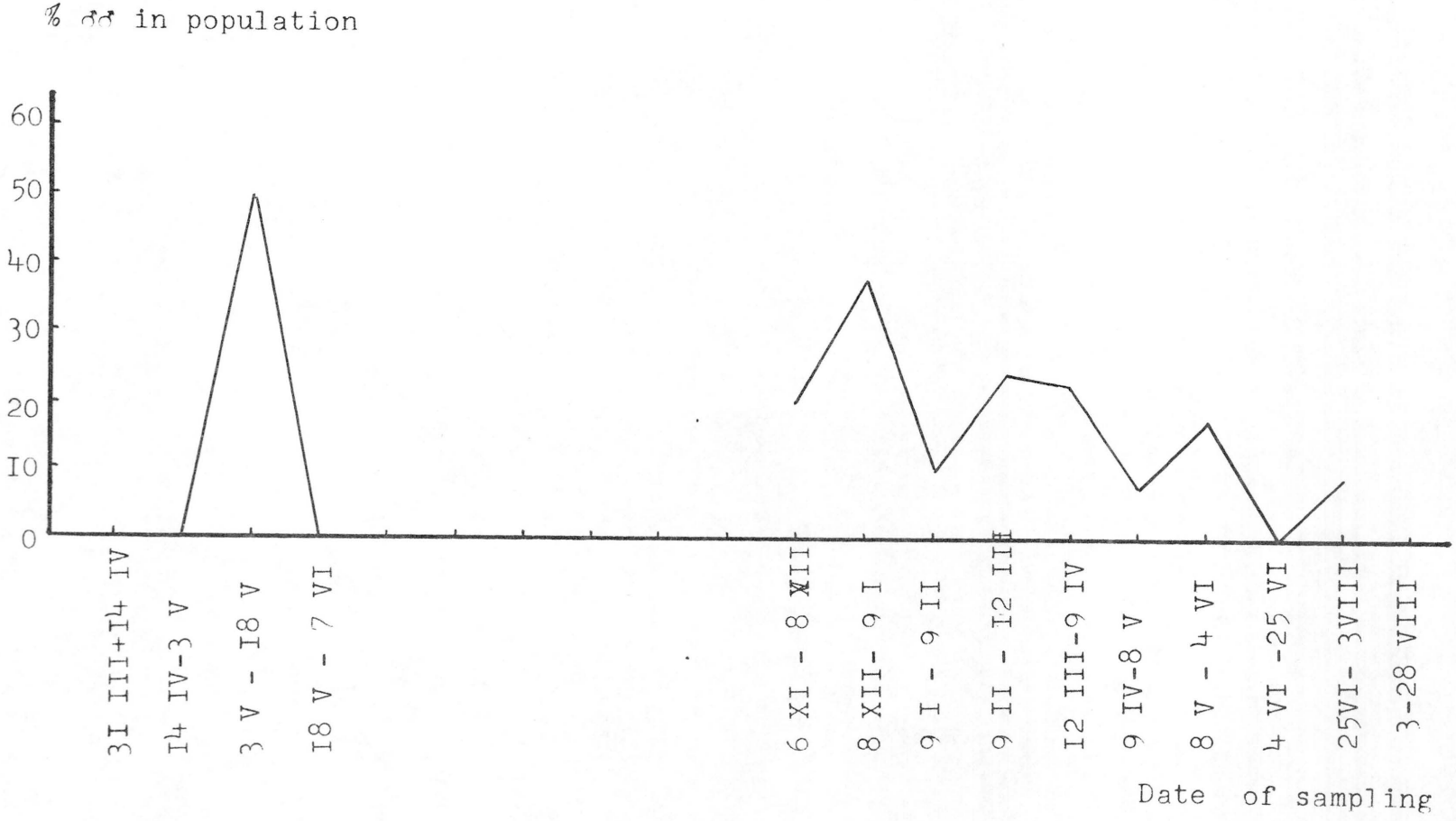


FIG. 16. Tapinocyba pallens (Cbr.). Percentage of ♂♂ in the population, 1972-73

The same tendency was present in 1968: 9% males in June, 0% in July, 12% in August (calculated on a total of 26 ♂♂ + 269 ♀♀). In the Nordic countries, at least, the species should therefore be classified at typical eurychrone with adult males and females from late summer/early autumn to late spring/early summer, with a low population density at mid-summer (only ♀♀), but in the northern part of these countries there is a tendency for the spring and autumn male generations to overlap.

Peponocranium ludicrum (Blw.)

Total number of specimens: 45 ♂♂ + 73 ♀♀ (of which only 2 ♂♂ in Sphagnum samples). One ♂ was trapped 3-6 June 1971. Figure 17 shows a relatively smooth development of the population at Loc. I, with a maximum abundance coinciding with the time when males are present, and also with the short periods when males are found in the pitfall traps (Table IX and Figure 18). From mid-summer 1972 (ca. July) to May 1973 the species was completely absent from the pitfall catches and the numbers decreased during this period. The very short period of male sexual activity (around May, Table IX and Fig. 18) should confirm Merrett's (1969) statement that May is the period of main activity. Fig. 18 also shows that the percentage of males in the population is at its greatest some time before the period of maximum sexual activity, and that the males are present in the population as adults quite a long time before they are found in the pitfall traps.

The species is characteristic for open coastal areas of western Europe (Wiehle 1960: "Atlantische verbreitung"). Almquist (1973) found the species in all habitats, except on the foreshore.

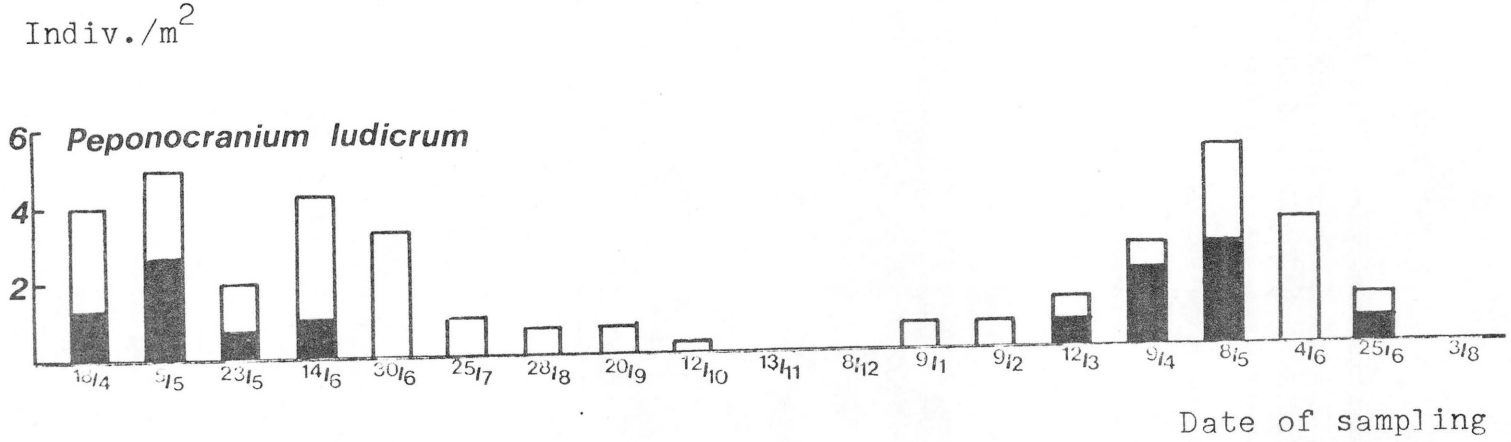
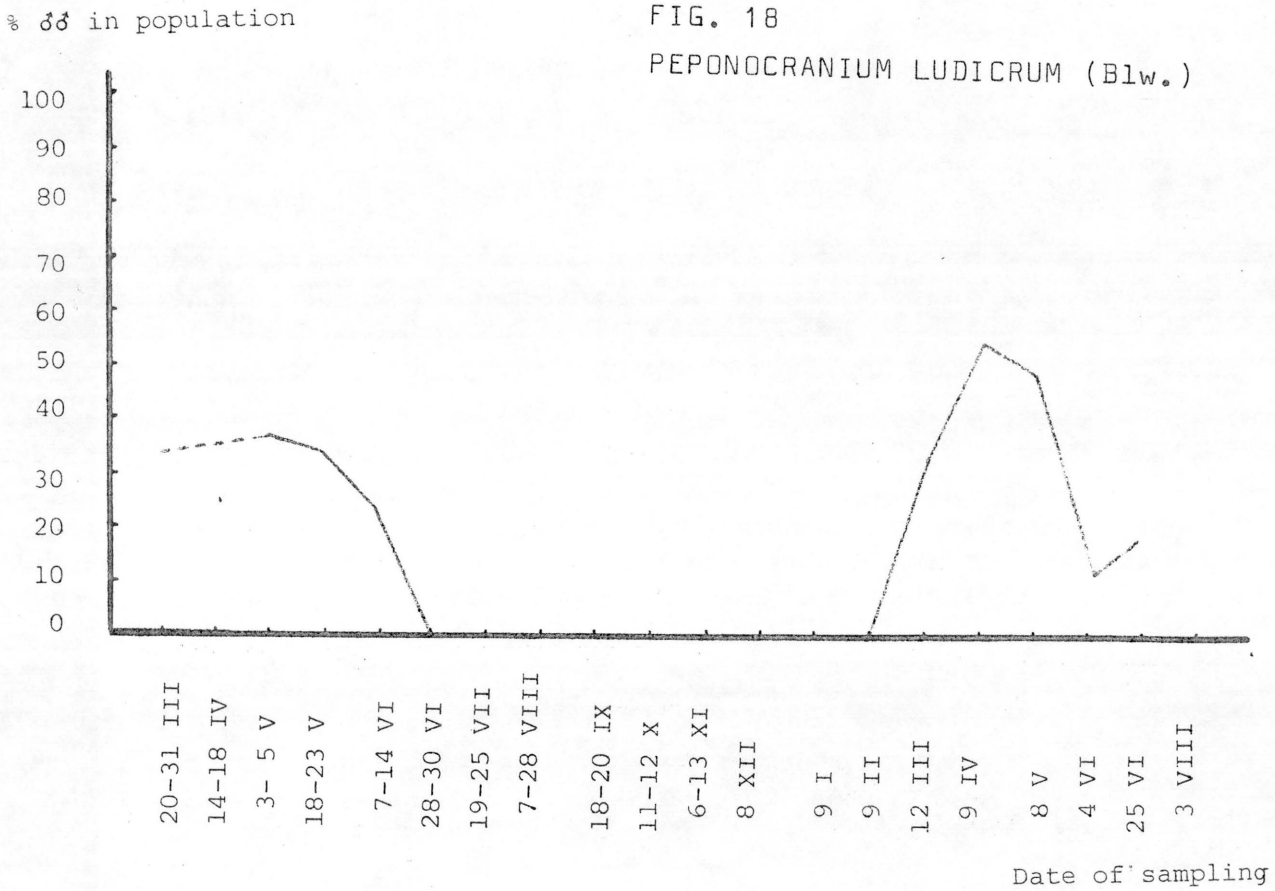


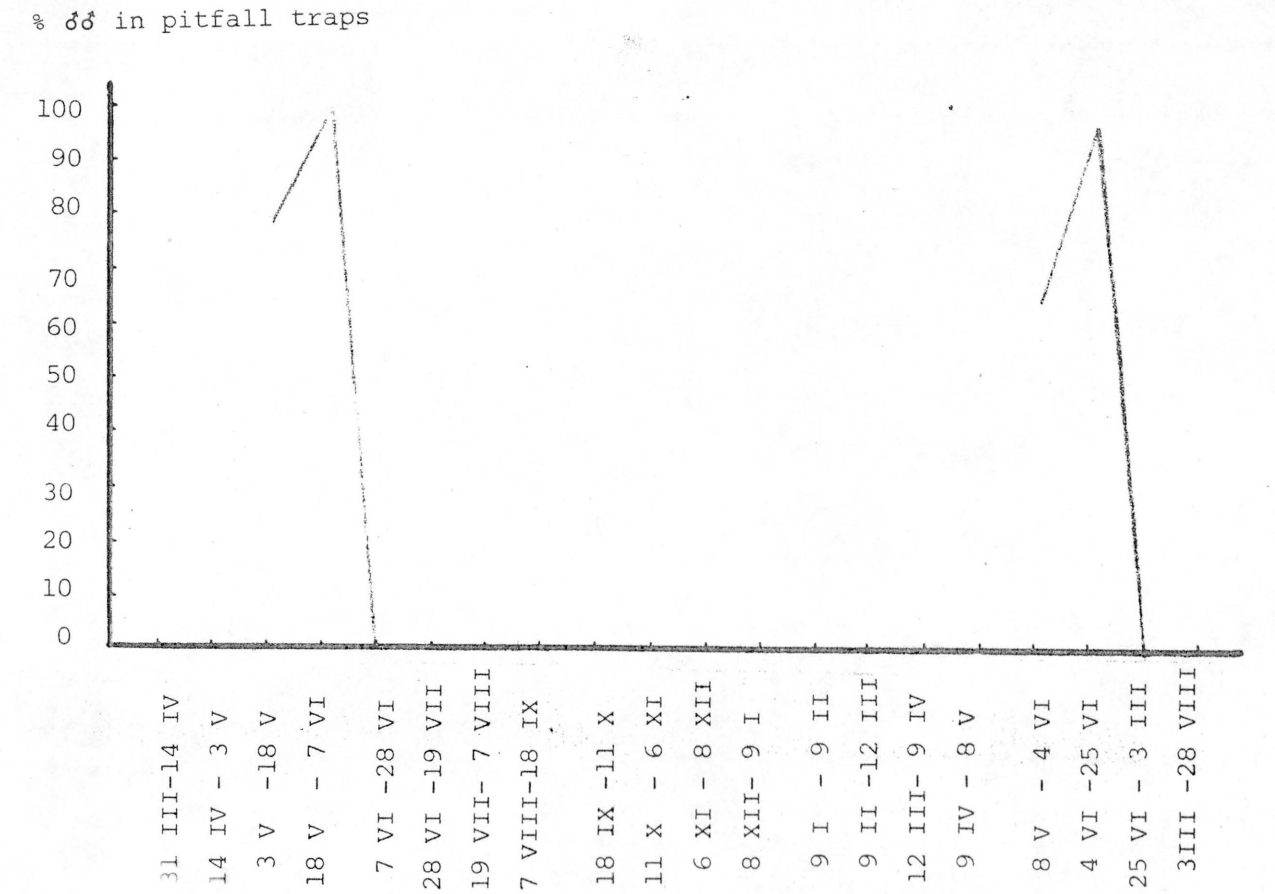
FIG. I7. Peponocranium ludicrum (Blw.). Abundances at Loc.I,1972-73.

Black ♂♂, white ♀♀.

FIG. 18

PEPONOCRANIUM LUDICRUM (Blw.)





The species is reported here for the first time in Norway.

Pocacicnemis pumila (Blw.)

Only 10 ♀♀ (none in Sphagnum). Except for the females in pitfall trap in August 1972, most of the specimens were found in the square samples in June, but some also in March and August. According to Palmgren (1972) males are present in spring, the females also in the summer. Similarly Tretzel (1954) and Engelhardt (1958) report: Reifezeit April to July. In N. Norway I found male during a very short period from 1-28 June 1967 and females from mid-May to approximately mid-July. In 1968 in the same area: 17% males in June, females also in July and August. Huhta (1965) found 1 ♀ as late as September in Finnish Lapland.

The species is perhaps primarily a species of open forests, but also of meadows and swamps (Huhta 1965) though not compact Sphagnum (Palmgren 1972). Tretzel (1952) suggests a wide ecological range of habitat (euryphot-euryhygr.).

Micrargus herbignadus (Blw.)

Total numbers of specimens: 21 ♂♂ + 26 ♀♀. Females were found from November 1972 to June 1973, males from November to May (Table VII and VIII). In the pitfall traps most males were found in May (Table IX), but also 2 oo in June/July, which agrees to some extent with information from Tretzel (1952) with regard to the summer active period. But in contrast to Tretzel's (1952) statements the generation emerging in my areas in the autumn seems to overwinter as inactive adults. While the species is absent from my quantitative samples for quite a long period (mid-May - mid-November), at least in the dry summer of 1972,

Palmgren (1965, 1972) on the other hand reports both sexes from spring to autumn, and with a relatively high percentage of males in the population throughout the period. Engelhard (1958) also reports adults in the summer (March-August). In N. Nordland (Skjomen) I found females from May to September 1967 and males in May/June and August/September. In 1968 I found both sexes in June, July, August.

Silometopus elegans (Cbr.)

Total number of specimens: 7 ♂♂ + 5 ♀♀, all except 2 ♂♂ in pure Sphagnum. The information given by Wiehle (1960) about habitats suggests that the species is hygrophilous. The only specimen taken in pitfall traps (1 ♂) was from June 1973. In addition one ♀ was trapped 3-5 June 1971. According to Lockett & Millidge (1953) the period for mature specimens (♂ + ♀) is spring and summer, but Table IX shows that both sexes can be found as early as February.

The species is reported for the first time in Norway.

Tiso vagans (Blw.)

Rare: 1 ♂ + 1 ♀ in May and 1 ♀ in December in Hylocomium (Table VII) and one ♀ in Sphagnum (Table IX).

Probably a species of moist, open land, according to Wiehle (1960). Tretzel (1952): Photobiont-hygrobiont. It is also found in forests (Hauge 1972, Waaler 1972).

Minyriolus pusillus (Wid.)

Total numbers of specimens: 169 ♂♂ + 407 ♀♀, of which 10 ♂♂ + 23 ♀♀ in pure Sphagnum samples and 1 ♂ + 2 ♀♀ taken in pitfall traps (the male in June/July 1972).

It is the most dominant species at Loc. I, but with a relatively low population in the dry summer of 1972 (Fig. 18). It was common in the smaller Sphagnum aggregation samples up to 14 June 1972 (Table VIII), but less abundant in the larger Sphagnum aggregation later on. In this connection it is worth mentioning the characterization of the species as hemihygrophil (Tretzel's 1952) ("Unter Vermeidung starker Trockenheit und Feuchtigkeit..."). According to Palmgren, (1972),however, it decidedly prefers dry habitats. In Germany it must be characterized as a typical forest species (Wiehle 1960). Similarly, according to Palmgren (1972), it is rare in meadows. Almquist (1973) found only a few individuals in his heath localities, only 9 specimens in the Calluna locality. Merrett (1969) trapped a single female in his heathland in Dorset, but as will be seen from Table VII and IX there are great differences between the number of specimens trapped and the number of specimens which are actually present in the area, as demonstrated by my quantitative material (Table VII). Huhta (1965) found that the species was common in many forests in N. Finland. My own experiences from Norway agree with Palmgren's (1972) statement: "A well developed moss/or lichen stratum seems essential".

Fig. 18a and Table VII show that both sexes are present throughout the year. However, Fig. 19 does not indicate any definite maximum in the percentage of males present in the populations. It seems to vary round about 30%. Neither the different datas from authors cited by Merrett (1969) nor Merrett's own datas indicate any definite period of male sexual activity. Engelhardt (1958) reports adults only in April-May, Tretzel (1954) also in July and September. Huhta (1965, Fig. 14) found females at all seasons, but in contrast with my results lacked males in

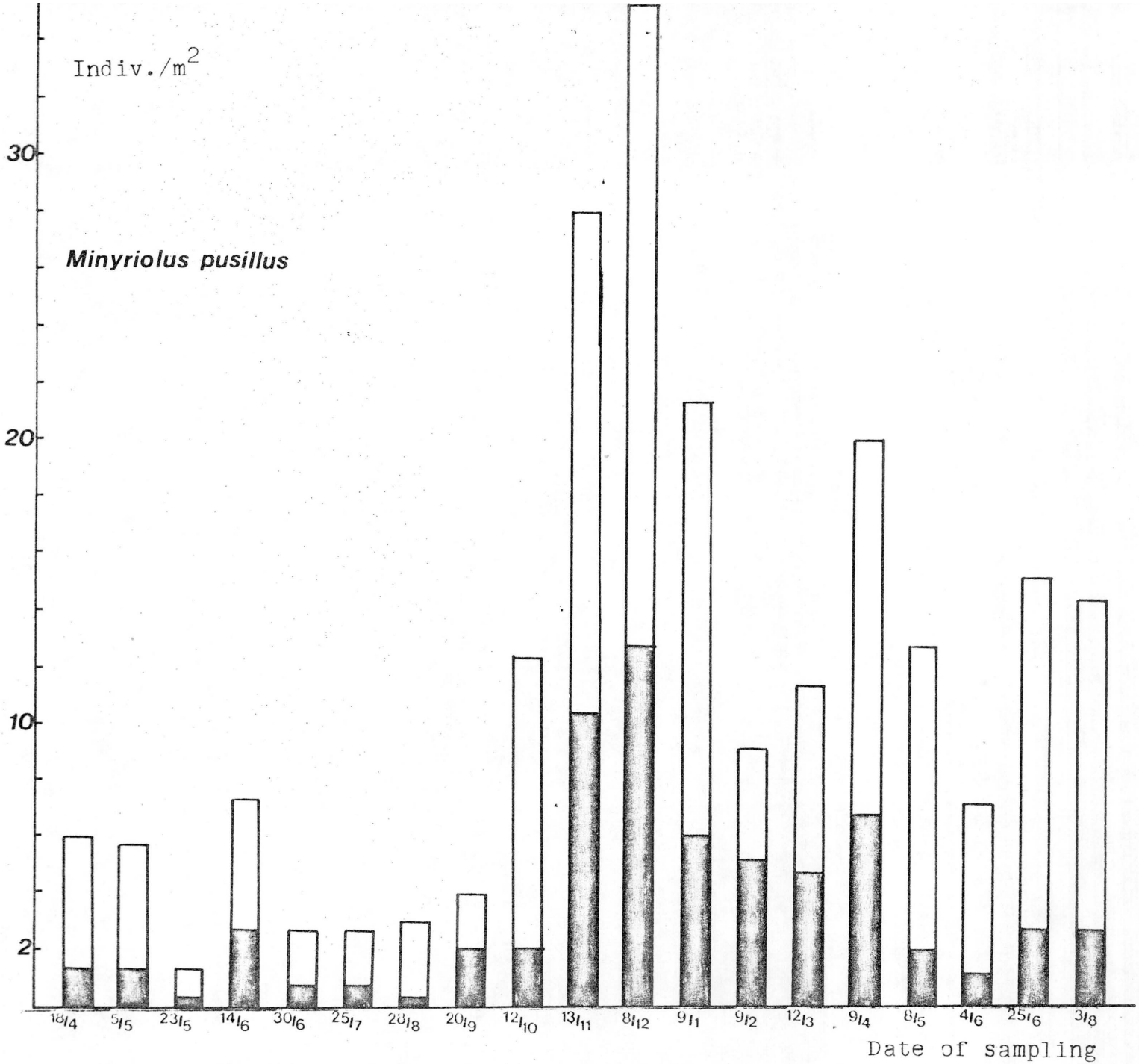


FIG.I8a.Minyriolus pusillus (Wid.). Abundances at Loc.I,I972-73. Black ♂♂, white ♀♀

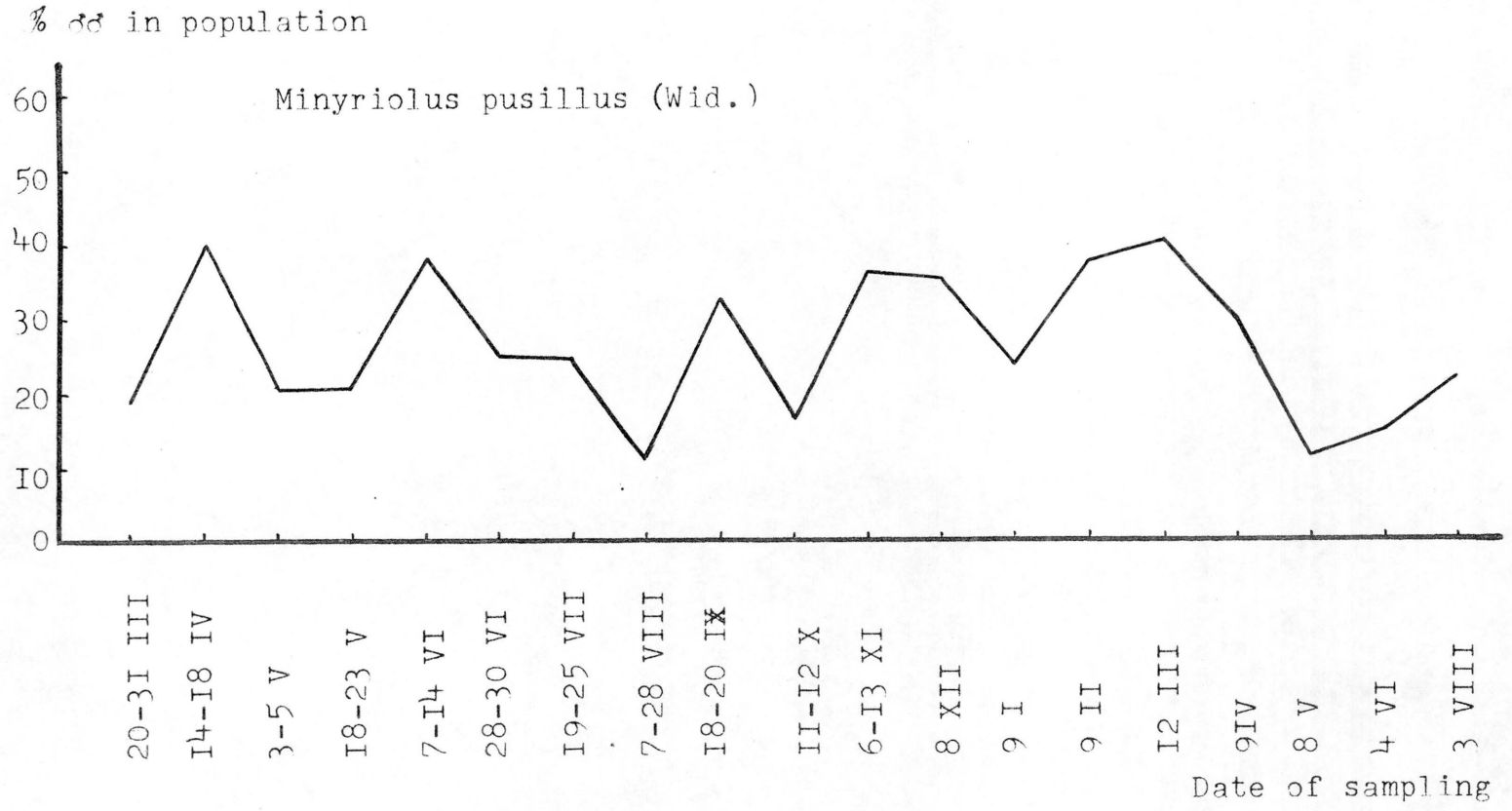


FIG. 19. Minyriolus pusillus (Wid.), percentage of ♂♂ in the population, 1972-73

January-March, and found a relatively low percentage of males in May and July. He obviously found the largest density of the population in the autumn and the highest proportion of males in August. In 1967 in Skjomen, N. Norway, I found females from May-September. Males were lacking for that district in May that year, but for the rest of the season the percentage of males in the population was relatively high: June (approximately 20%), July (approximately 12%), August (approximately 33%), September (approximately 20%). In June, July, and August 1968 the corresponding data were, 12, 10, and 28%, indicating: Very few males in spring (see Huhta 1965), increasing to a relatively even male percentage in June-July (perhaps a slight decrease in mid-summer) and a marked increase in male percentage in the autumn. In Finland Palmgren (1972) also found ♂♂ + ♀♀ from spring to autumn, but with a relatively low percentage of males in the summer.

Jacksonella falconeri (Jackson)

Total number of specimens: 29 ♂♂ + 10 ♀♀ (none in Sphagnum).

The species probably has a very short period of male activity in April-May (Table IX). Merrett (1969) trapped his single specimen in April. From studies at high altitudes in the Alps (1300 m) Thaler (1973) suggests a male activity period ("Bewegungsaktivität") in April-June. He also trapped a few males from January-March and 1 ♀ in December-March, and he suggests that the species overwinter as adults in an inactive state. This seems to be confirmed by my material (Tables VII and IX): Females were found in October-January, males in August, October, January, March, and May with a short sexual activity period at the end of this period.

The species is recorded for the first time in Norway.

Cnephalocotes obscurus (Blw.)

Total number of specimens: 69 ♂♂ + 53 ♀♀.

Male sexual activity in April-June, with a peak in May, coinciding very well with results described by both Merrett (1969) and Tretzel (1954). I also trapped 2 ♂♂ in August 1973, indicating a second activity period in autumn, as also suggested by Tretzel (1954). Females have a much longer active period (until August, Table IX). Also Duffey (1956) trapped adults for a long period (March-September), and except for June found adults in his quadrate samples throughout the year. They are absent in my quantitative material (Table VII) in August-October, most males are found in April-May, but a few oo also from November-March and in July. This, together with the absence of adults in the pitfall traps in winter, indicates an overwintering of adults, which become sexually active in spring. In S. Finland Palmgren (1972) found both sexes from spring to autumn, with a relatively high and constant percentage of males all the time, while in N. Finland (Palmgren 1965) he found males only in the autumn. In Skjomen, N. Norway, I found females up to the end of July, 1 ♂ in June and 1 ♂ in July.

Gongylidiellum latebricola (Cbr.)

Total number of specimens: 40 ♂♂ + 222 ♀♀ (only 2 ♂♂ + 12 ♀♀ in pure Sphagnum). A very few specimens (7 ♂♂ + 1 ♀) of this common species were taken in the pitfall traps during an extensive period from April-May to September/October. Most authors report adult specimens in the summer half year only: Lockett & Millidge (1951): Adults in spring and autumn. Wiehle

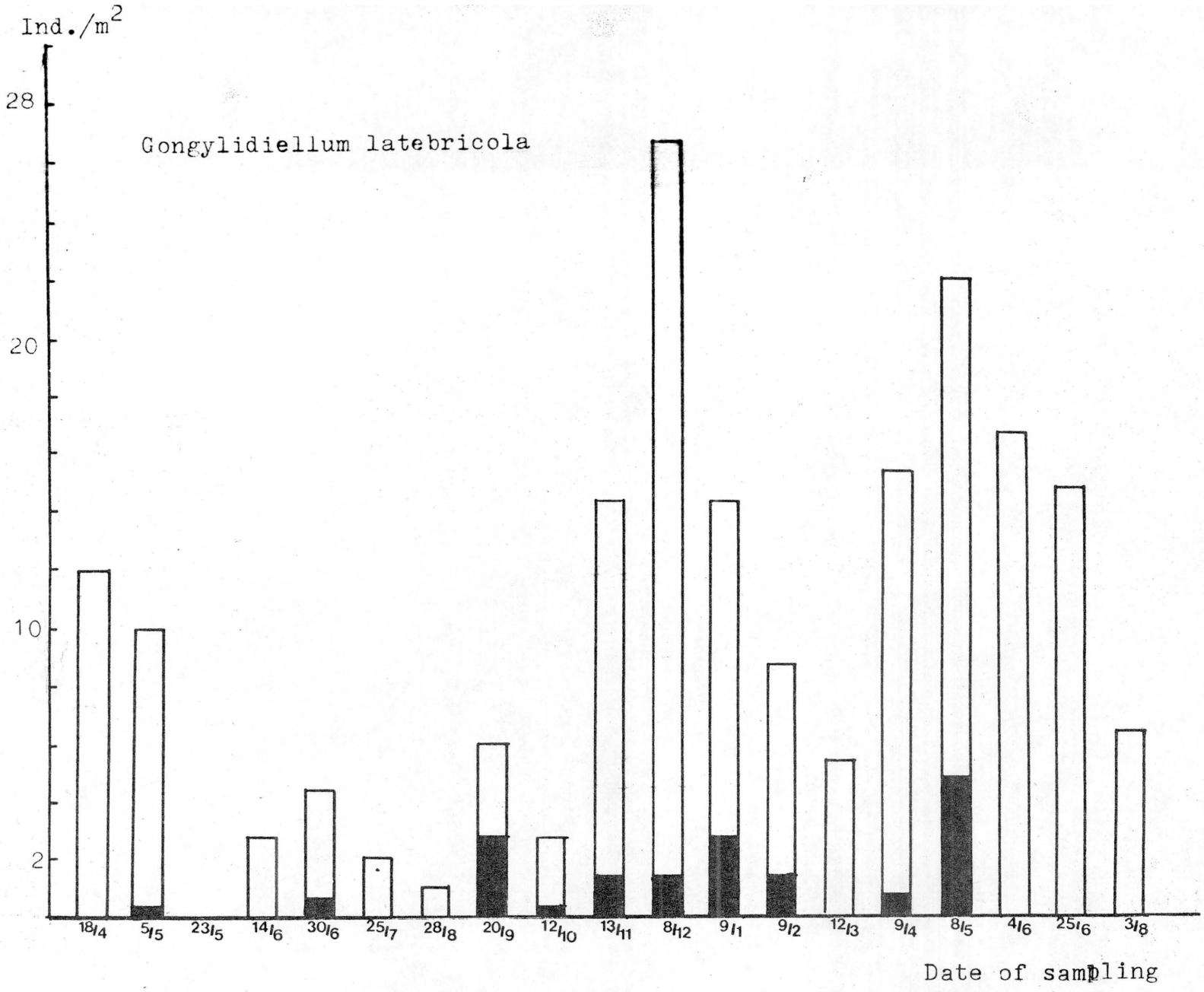


FIG. 20. Gongylidiellum latebricola (Cbr.). Abundances at Loc. I, 1972-73. Black ♂♂, whtie ♀♀.

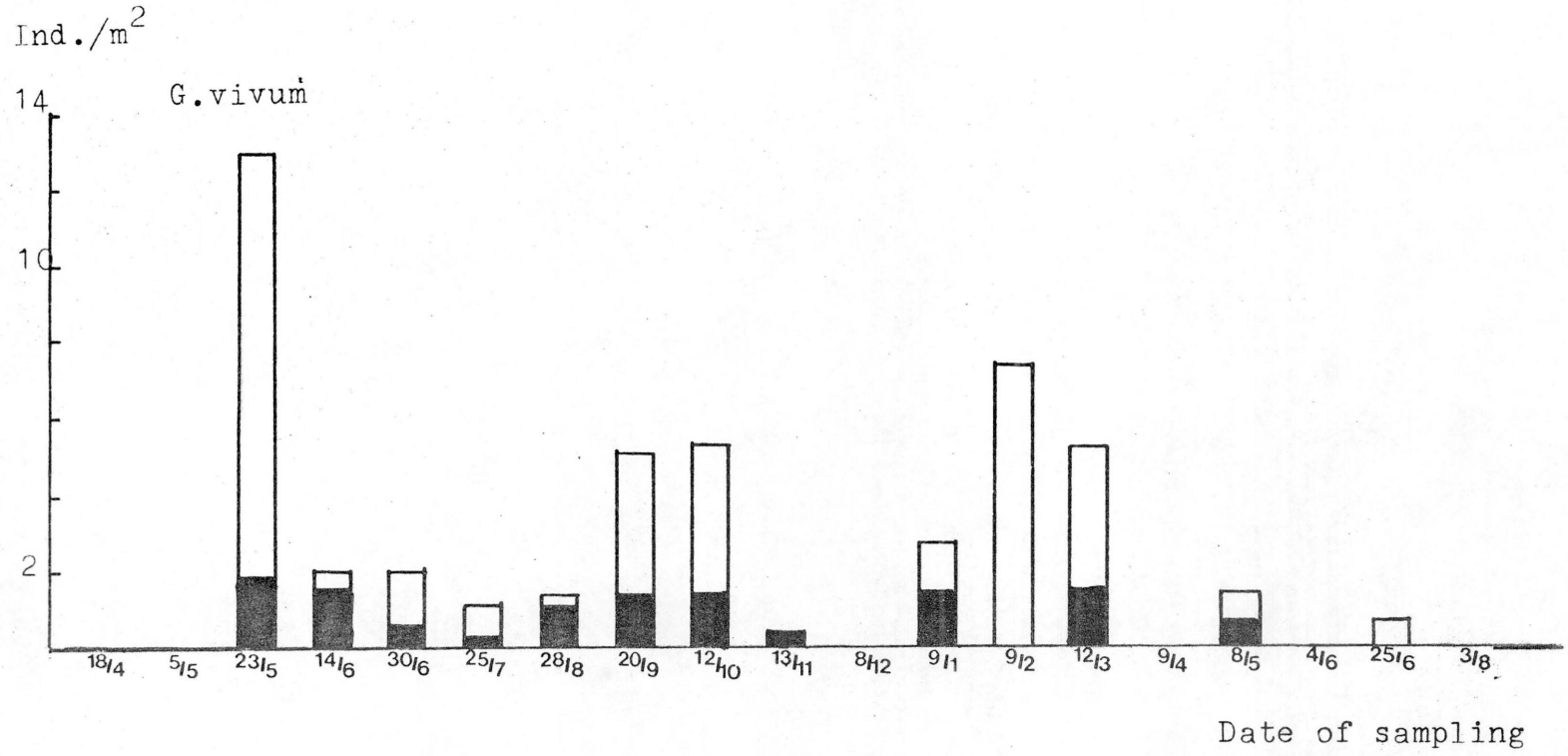


Fig. 2I. Gongylidiellum vivum (Cbr.). Abundances at Loc.I, 1972-73.
Black ♂♂ , white ♀♀.

(1960): "Die Reifezeit ist auf das Sommerhalbjahr beschränkt und erreicht im Juli ihren Höhepunkt." Tretzel (1954) trapped males from May to October (with a maximum in July) and characterizes the species as eurychrone "und in Durchschnitt auf das Sommerhalbjahr beschränkt". Palmgren (1972), also found both sexes from spring to autumn, with a maximum percentage of males in spring. In my square samples, however, (Tables VII and VIII) adults seem to be present in the area practically the whole year round. Males are proportionally scarce from June to August, which is within the period of peak activity for the males suggested by Tretzel (1954) and Wiehle (1960).

G. vivum (Cbr.)

The species is not hitherto recorded in Norway. Total number of specimens: 69 ♂♂ + 241 ♀♀ (of these 12 ♂♂ + 7 ♀♀ were taken in pure Sphagnum samples).

The picture is much the same as for G. latebricola: It is quite abundant in the area during the whole year, but very few were taken in pitfall traps (only 4 ♂♂ in May and June 1972/1973). Additional data from 1971: Five males trapped 3-6 June, 3 males trapped 27 October - 27 November, and 1 female 4-20 October. This indicates two periods of sexual activity more or less in accordance with the following authors: Tretzel (1954): A single male trapped in June. The males in Merrett's (1969) material were found from March to June and from late autumn to winter (January). Schaefer (1971) trapped the species almost all year round, with a peak of male activity in June. Lockett & Millidge (1951): Adults in spring, early summer and autumn. Wiehle (1960): Adults mostly in the autumn and spring. In my area (Tables VII and VIII) adult males and females are

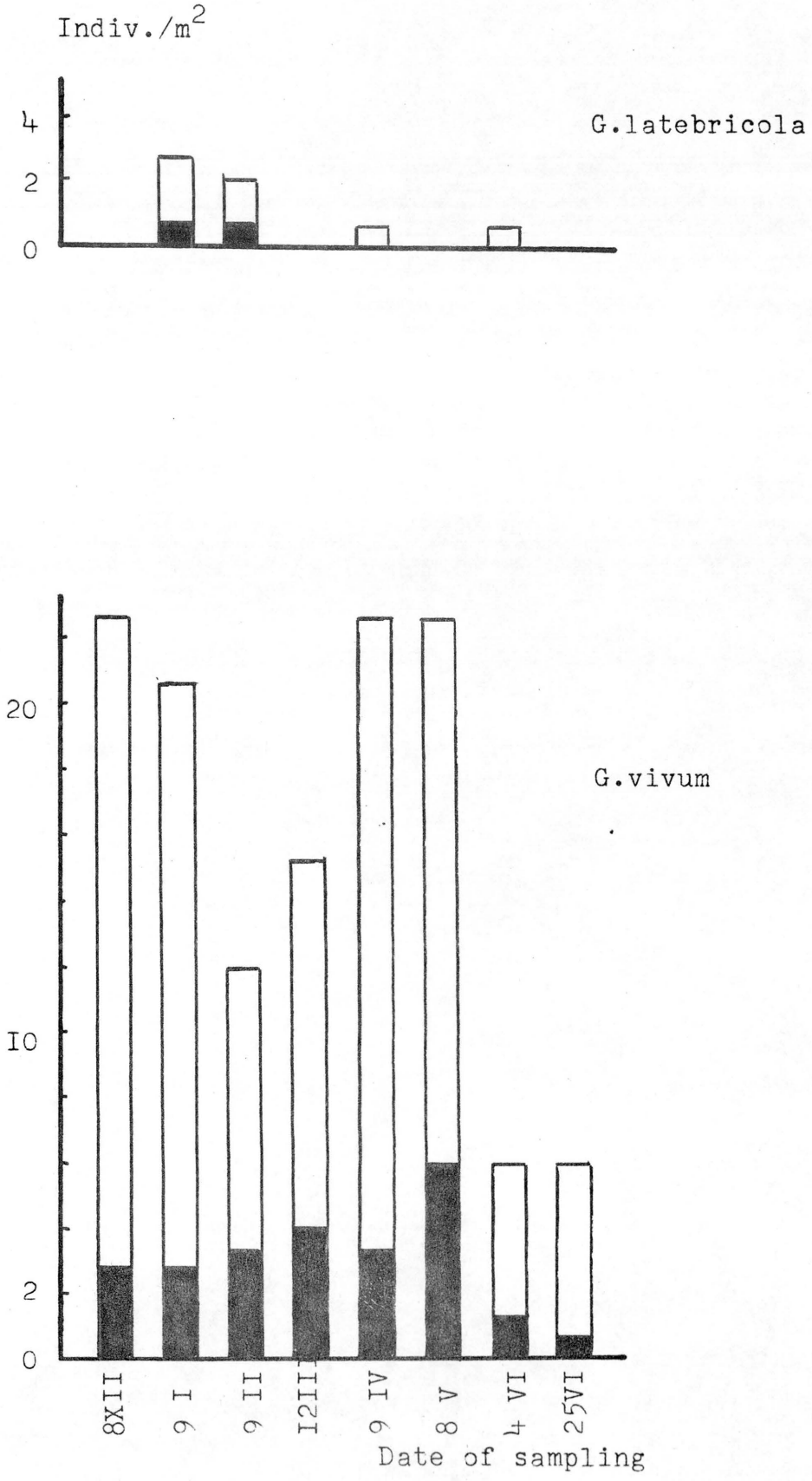


FIG.22. Gongylidiellum and G.vivum. Abundances in "Humid" Hylocomium, Dec.1972-June 1973. Black ♂♂, white ♀♀.

obviously present throughout the year (also in winter), and no definite peak in the percentage of males can be observed.

Since both Gongylidiellum species are common in mye areas, some interesting comparisons in ecology must be pointed out.

G. latebricola should primarily be characterized as a more typical forest species, while C. vivum is an open land species, and probably also should be called a characteristic species for Calluna heaths (?).

According to Figures 20 and 21, latebricola is the most abundant species at Loc. I, except for the series from 23 May 1972 (see page), where roles of the two species are changed. The same change in tendency is clear in Figure 22, where vivum dominates over latebricola in the supposedly more humid site.

These two closely related species thus seem to live together in the Calluna heath, both with mature specimens during the whole year. There seems to be much overlapping in area, they have even been taken together in the same small samples of 1/16 m^2. But the general impression is that latebricola dominates over vivum in the drier parts, while vivum takes over where the stratum is apparently more humid. Wiehle (1960) claims that G. vivum prefers a high humidity. Cherret (1964) found G. vivum on each of his two more humid Calluna/Eriopherum localities, at the less humid Juncus squarrosus locality and on the very dry Festuca/Nardus locality. Cherrett gives no exact numbers for the two species, but his information implies a relatively wide range of tolerance for different humidities by G. vivum. The presence of latebricola only on his middle humid Juncus squarrosus locality perhaps supports Tretzel (1952) when he groups G. latebricola among the hemihygrophilous species. As a matter of fact I also found both species in my Sphagnum samples (Tables IV and

VIII), but they were less dominating here than in the Hylocomium areas (Tables III and VII). Duffey (1968) found many specimens of vivum in the humid Dune slacks and in the neighbouring Dune meadows, and in lesser numbers in the more exposed localities. Both species are absent from Almquist's (1973) sampling areas. Instead he found G. murcidum in his Calluna vulgaris and Bryophyta communities. Palmgren (1972) gives latebricola a broad ecological valence: The light green Sphagnum in swampy spruce forest ("typical habitat"), in bog with some cover, and even on dry meadows. The response to humidity by latebricola is perhaps indicated by Figure 20: The abundances at Loc. I were low in the dry summer of 1972 in comparison with the drier summer of 1973. This also seems to be true of the hygrophilous Erigonella hiemalis (Blw.).

A more proper investigation of the ecology of these two Gongylidiellum species should be carried out in these heather areas at a later date.

Typnochraestus digitatus (Cbr.)

One single ♂ in a pitfall trap January/February 1973. A winter active species (Tretzel 1954, Schaefer 1971).

Second record from Norway.

Metopobactrus prominulus (Cbr.)

Rare. 1 ♂ in a pitfall trap in May/June, 1 ♀ in August. First record from Norway, but we have some unpublished findings from some of the high mountain areas in S. Norway.

Araeoncus crassiceps Westr.

Rare. One ♂ from Sphagnum + 2 ♀♀ from Hylocomium trapped

between 3 and 6 June 1971, 1 ♂ trapped 3-28 August 1973. Merrett (1969) classifies the species as clearly stenochrone, with male activity from May to July. This should now be extended to August. Tretzel (1954): "Vergleichen wir aber die Untersuchungen aus Nordeuropa, so scheint es, als würde die Kopulationszeit um 1 Monat verspätet eintreten."

Dicymbium nigrum (Blw.)

Rare. A single ♂ in pitfall traps between 9 April and May 1973, which is very near the time of peak male activity (April) described by Tretzel (1954).

Erigone atra (Blw.)

One single ♂ found 18 April 1972.

Centromerus sylvaticus (Blw.)

One single ♂ from pitfall trap 11 October-6 November 1972. A typical winter active species (Tretzel 1954, Kronestedt 1968), but usually a forest species.

Centromerus prudens (Cbr.)

A single ♂ trapped between 6 November and 8 December 1972, coinciding with the male peak activity period of "late November or early December" suggested by Merrett (1969) and stated by Schaefer (1971).

This is the second record of the species in Norway.

C. arcanus (Cbr.)

Total numbers of specimens: 26 ♂♂ + 24 ♀♀. The species was taken in pitfall traps during a short period in May/June 1973

(Table IX), and 10 out of the 14 trapped males were taken in a series of traps from the bog area. Lehmann (1959): Pronounced Sphagnophil. Most of my remaining specimens were found in the most humid Hylocomium areas, none in pure Sphagnum samples. Palmgren (1972) states that the species is found in loos, not compact Sphagnum. He usually found the species in humid places, see also Palmgren (1965) and Tretzel (1952). It is very abundant in many Finnish forests (Huhta 1965), and this is also my own experience from North Norwegian Hylocomium-dominated birch forest.

The species is considered a winter active species. Tretzel (1954) found ♂♂ in December and February. Engelhardt (1958): Reifezeiten February-March. Huhta (1965) found ♀♀ in all seasons, while ♂♂ were absent in June-August. Kronestedt (1968) found male activity restricted to May. He also found both sexes throughout the year, though males were lacking in July and August. Palmgren (1972) also found ♀♀ from spring to autumn, ♂♂ absent in the summer. In Northern Finland, however, he (Palmgren 1965) found adults only in spring (13% ♂♂). In the Skjomen area, N. Norway, 1967 I found ♂♂ and ♀♀ from May to September. The percentages of males in the population were as follows:

Month	May	June	July	August	September
% males	25	12,5	1,2	21	29

In 1968 I found ♀♀ from June-August, ♂♂ only in June (15%) and in August (1%).

In my square samples from Lindås (Table VII) most ♂♂ were found from November-March, females also in June-August, and, as mentioned above pitfall catches of males were restricted to May/June.

All the above information confirms the winter mature nature of the species: A relatively short period at southern latitudes (Tretzel's and Engelhardt's data), the mature period extending from both sides into the summer half year in southern Scandinavia (Huhta's, Kronestedt's, Palmgren's data from S. Finland, and my own from Lindås) (i.e. females present even during mid-summer), and finally my data from N. Norway where males also are present in mid-summer, though in a very small percentage.

The sexually active period of the males, however, still seems to be limited to a very short period in spring.

Agyneta subtilis (Cbr.)

Rare. Only 2 ♂♂, one 13 November 1972 and one 25 June 1973, in Hylocomium.

A. conigera (Cbr.)

Rare. Only two ♂♂ from pitfall traps in the summer of 1973 (Table IX), and the rest (2 ♂♂ + 4 ♀♀) in the quadrate samples in June (Table VII). Humid habitat preference is indicated for this species by Huhta (1965) and Palmgren (1965, 1972).

A. decora (Cbr.)

Total numbers of specimens: 11 ♂♂ + 2 ♀♀ (of which all females and 2 ♂♂ in pure Sphagnum). Seven out of the 11 males were trapped from June to August, the remaining oo from the quadrate samples in May/June. Further 7 ♂♂ were caught in pitfall traps 3-6 June 1971.

A. cauta (Cbr.)

The most common Agyneta species in the area: 66 ♂♂ + 64 ♀♀

(1 ♂ + 3 ♀♀ in Sphagnum in June 1972). Table IX indicates an active period in summer from May towards August, with a peak of males in June. All specimens from the quantitative samples were found from May-August. In addition 13 ♂♂ + 4 ♀♀ were taken in pitfall traps 3-4 June 1971.

Lehmann (1959) and Braun (1961) indicate that the species should be considered as a typical sphagnobiont.

Meioneta beata (Cbr.)

Total number of specimens: 6 ♂♂ + 9 ♀♀ (1 ♀ in Sphagnum). Further three ♂♂ were trapped 3-6 June 1971. The males seem to be concentrated from June to July, but females were also trapped in August, November/December. One female was found 20 September 1972 (Table VII).

The species has been recorded only once in Norway previously: 11-12 June 1875 (Holm 1973).

M. saxatilis (Blw.)

One single female was trapped 3-6 June 1971 in a boggy area with Sphagnum. Second record in Norway.

Maro lehtineni Saaristo 1971

Total numbers of specimens: 3 ♂♂ + 7 ♀♀. All specimens from winter and early spring: 2 ♂♂ + 3 ♀♀ in December 1972, 1 ♀ March 1973, 1 ♂ + 3 ♀♀ in April 1973, and all from the Hylocomium areas.

The species is new to Norway. Previously known only from Finland (Saaristo 1971) and Iceland (Lindroth et al. 1973).

Centromerita concinna (Thor.)

Total number of specimens: 298 ♂♂ + 229 ♀♀. Though not very abundant in the quadrate samples (5 ♂♂ + 20 ♀♀). C. concinna is temporarily the most dominant Linyphiidae species in the pitfall traps, with a clear maximum activity in November/December. Males are absent from April to September, and females probably absent in August. This picture agrees with that described by Merrett (1969) and Schaefer (1971). As will be seen from Table VII most of the specimens from my quantitative samples were found during winter. Further pitfall trap catches from 1971: 1 ♀ 3-6 June, 172 ♂♂ + 26 ♀♀ 27 October-27November. Palmgren (1972) found females from spring-autumn, males in the autumn only. Almquist (1973) found many specimens in his Calluna-locality.

C. bicolor (Blw.)

Rare, only three males, of which two in pitfall traps from September to November, and the thirs in December/January. According to Palmgren (1972) this species prefers drier habitats than C. concinna.

Oreonetides abnormis (Blw.)

One single male in a pitfall trap September/October 1972, which is somewhat later than the usual male activity period (Broen & Moritz 1963, Merrett 1969).

Pnaulethrix hardyi (Blw.)

One male in a pitfall trap in September/October 1972, and two males + one female trapped 27 October-27November 1971. Previously recorded only once in Norway.

Macrargus rufus (Wid.)

Total number of specimens: 32 ♂♂ + 18 ♀♀ (none in pure Sphagnum samples).

The pitfall trap catches from October/November-March/April (Table IX) confirm the typical winter active species, as stated by Tretzel (1954). Both sexes were found in my quadrate samples also in August, September, and in May (Table VII). According to Engelhardt (1958), adults are found from October to June (males only up to April). Benz (1969) found one male in August at St. Gallen, Switzerland. Huhta (1965) found males and females throughout whole year except in June, July. Palmgren (1965), however, found males only in the autumn in N. Finland, while in S. Finland (Palmgren 1972) he found males and females from spring to autumn, the highest percentage of males in the population being in the autumn. In N. Norway I found a few females in June-September in 1967 and 1968, and one male in August.

The species should probably be considered primarily as a forest species, at least in Germany where Wiehle (1960) considers it typical for deciduous forests. In Fennoscandia it should probably be considered as more eurytopic. Huhta (1965) and Palmgren (1972) found the species very abundant in evergreen forests. Almquist (1973) found a few specimens in sand dune localities.

Stemmyphantes lineatus (L.)

Rare. Four ♂♂ + 1 ♀, all in pitfall traps from December/January to March/April, a period is within the time of activity indicated by Tretzel (1954) and Schaefer (1971). I also trapped three females between 27 October and 27 November 1971.

Bolyphantes luteolus (Blw.)

Total number of specimens: 6 ♂♂ + 7 ♀♀. The males + 5 females from November to January, 2 ♀♀ in September and October. I also trapped 4 ♂♂ + 19 ♀♀ 27 October-27 November 1971.

Lepthyphantes mengei (Kulez.)

Total number of specimens: 65 ♂♂ + 174 ♀♀. Only one ♀ was found in pure Sphagnum samples, the majority (59 ♂♂ + 148 ♀♀) were from pitfall traps. The females are active throughout the year (Table IX). The males were trapped in spring/early summer: May-June/July (1972), and March/April-July (1973), but most of them seem to appear in autumn/early winter (September/October 1972-January/February 1973, and are probably at a maximum in October/November. This indicates two main activity periods, as was also suggested by Tretzel (1954) on the basis of a small material: one in spring/mid-summer and a second in late autumn/winter. There is a period at mid-summer when males are not found in the pitfall traps (Table IX) and neither were they found in my quantitative samples at this time (Table VII). This does not agree with information from Merrett (1969) who found a continuous activity period for the males from May to September. Palmgren (1965) found females from spring to autumn in N. Finland, males in spring and summer. Palmgren (1972) also found females from spring to autumn in S. Finland, but males only in summer and autumn. I found 2 ♂♂ + 2 ♀♀ in N. Norway in September 1967 and 3 ♀♀ in August 1968.

L. ericaeus (Blw.)

Total number of specimens: 122 ♂♂ + 234 ♀♀ (only 1 ♂ + 2 ♀♀ in pure Sphagnum samples).

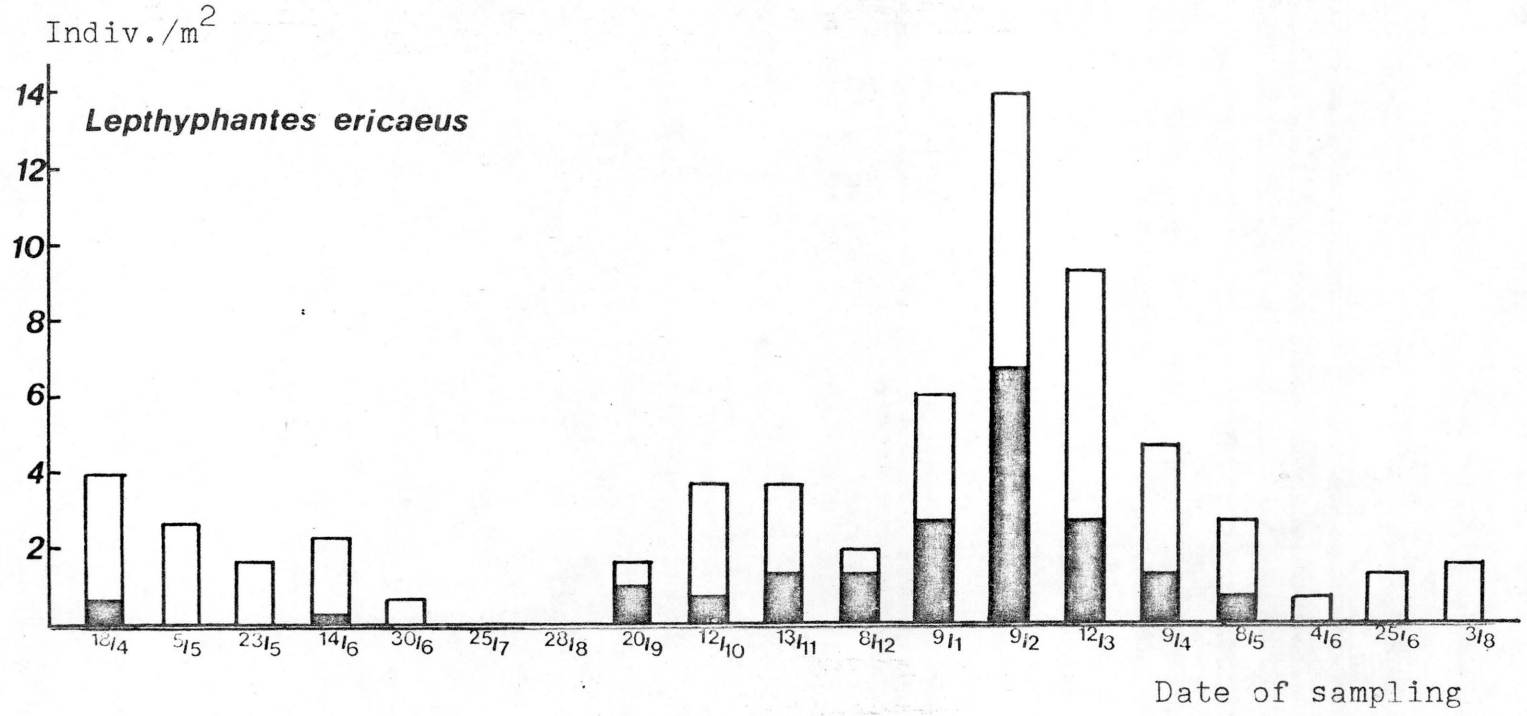
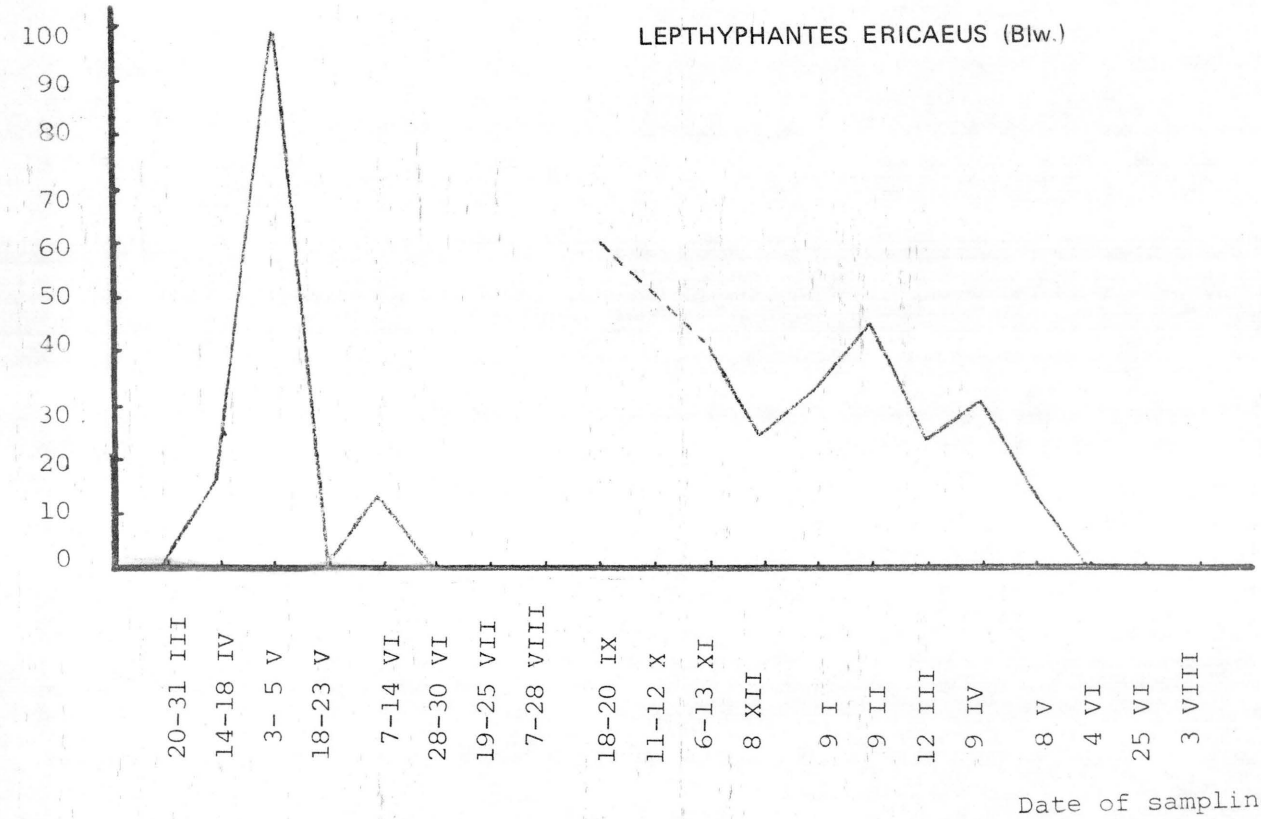


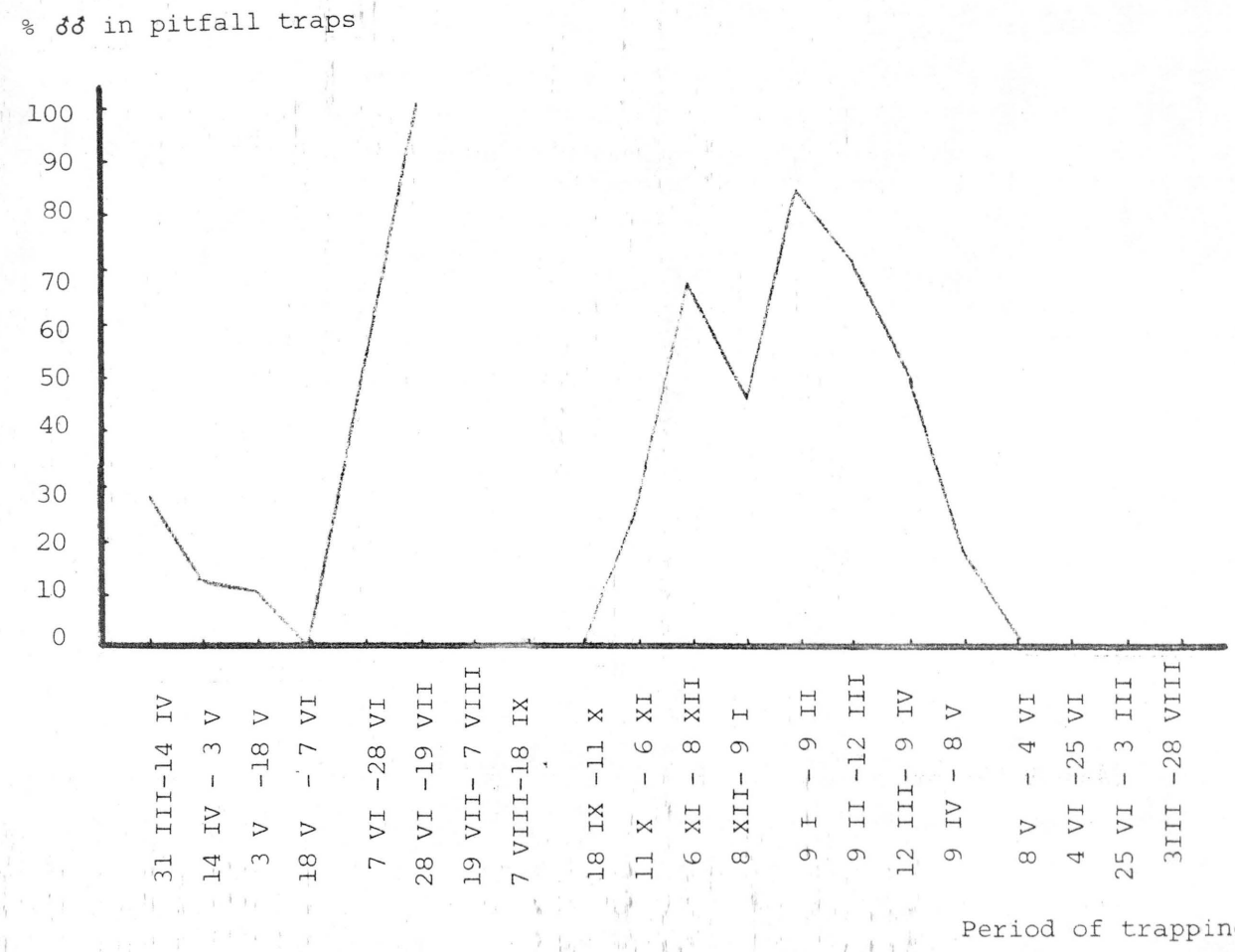
FIG. 23. Lepthyphantes ericaeus Blw. Abundances at Loc.I, 1972-73.

Black ♂♂, white ♀♀.

FIG. 24

LEPTHYPHANTES ERICAEUS (Blw.)





The species is very common in the pitfall traps (Table IX), where males seem to be active from October/November until May (perhaps also June). It was also common in the quadrate samples (Table VII and Figure 23). August is in fact the only month when no adults are present in my material.

A main activity period for the males is possibly from about November-January, when there is a large proportion of males in the pitfall traps material (Fig. 24). Fig. 24 also shows a steadily decreasing percentage of males in the population over a long period from mid-September 1972 to June 1973.

The species can therefore be characterized as eurychrone, with a very long male activity period from late autumn to mid-summer, with a possible peak in the winter months.

Primarily the species should be considered typical for open coastal areas. Both Duffey (1968) and Almquist (1973) found the species in most of their sand dune habitats. The species is reported here for the first time in Norway, but it has also been found on several localities in W. Norway, also in forests.

L. zimmermanni Bertkau.

One male and one female were found 2 October 1974.

Bathyphantes gracilis (Blw.)

One male was found in a pitfall trap in February/March (Table IX). Merrett (1969) also trapped his four males at that time (mid-January-mid-February).

B. setiger Cbr.

One male was trapped in February/March (Table IX).

Poeciloneta globosa (Wid.)

A single female was found in a pitfall trap 31 March-14 April 1972.

Microlinophia pusilla (Sundev.)

A single female was found 4 June 1973.

Trochosa terricola Thor.

Total number of specimens: 561 ♂♂ + 173 ♀♀. The great majority of these specimens were caught in the pitfall traps. Material from my quadrate samples and pitfall traps (Tables VII, VIII and X) taken together shows that adult specimens are present in the area throughout the year, but they become inactive from about November to February. Figure 25 clearly shows a high percentage of males trapped each spring. This percentage drops abruptly towards mid-summer (probably also in absolute numbers, both males and females), increases again during autumn 1972 to a maximum until the species suddenly disappears from the pitfall traps for a period at mid-winter and suddenly starts to appear again with a high percentage of males in late winter/early spring 1973. This high male percentage falls abruptly again around July 1973, and increases again during the last trapping period in August 1973. Most specimens found in the quadrate samples were found in the inactive period in winter (Fig. 25).

Therefore, at least as far as adult males are concerned the figures suggest a building up of a new generation during the autumn. This generation overwinters in an inactive state, plays a part during the spring activity period of the adults and dies out during the summer. T. terricola may therefore possibly be considered a diplochrone species with one peak in spring

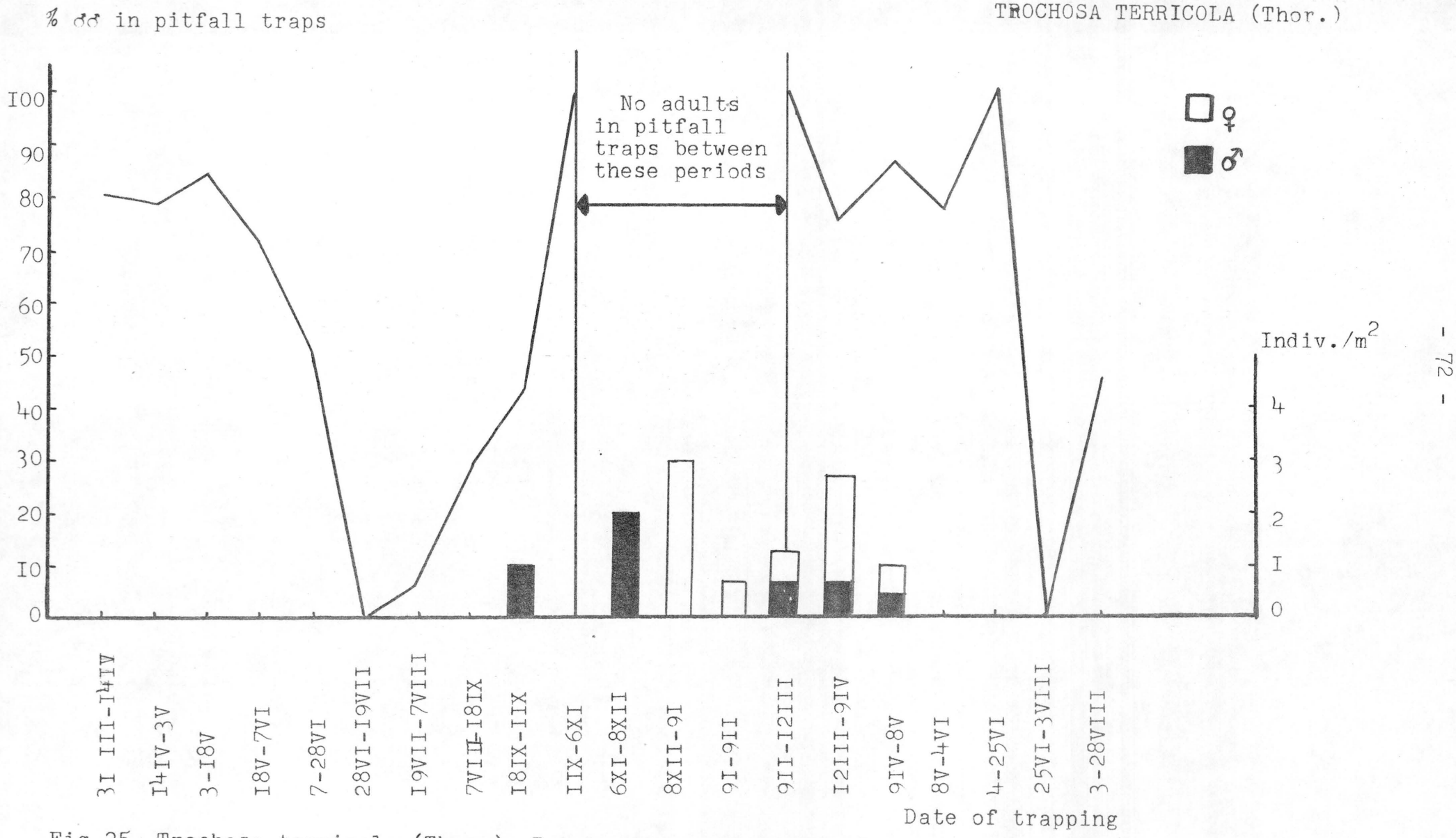


Fig.25. Trochosa terricola (Thor.). Total material 1972-73. Comparison between pitfall trap materiale (%♂♂) and materiale from the quantitative samples (indiv./m^2).

(probably the main period) and another in the autumn, as suggested by Tretzel (1954) and Merrett (1968). Palmgren (1972) found males and females from spring to autumn, but with a smaller percentage of males in the summer. Kekenbosch (1958) found females in April-June, males in May-June only.

Typically most specimens from my quantitative samples were found in the period of inactivity during mid-winter (Fig. 2). The species is probably greatly underestimated for the rest of the year due to the active individuals' ability to escape during the sampling prosess.

Alopecosa pulverulenta (Cl.)

Total number of specimens: 50 ♂♂ + 21 ♀♀, all in pitfall traps.

The species has a much shorter activity period than Trochosa terricola (Table X) and appears later in spring: Males active in May-June, females until August. This short duration of male activity corresponds more with statements by Merrett (1969), and Broen & Moritz (1963) than with the March to July-period indicated by Tretzel (1954).

Pardosa pullata (Cl.)

Total number of specimens: 194 ♂♂ + 198 ♀♀, all caught in the pitfall traps. Male and female activity starts with a sudden peak in May. The males disappear in July (Table X), but in the cooler summer of 1973 4 ♂♂ were found in August. Females were trapped until August. Kekenbosch (1958) found males and females in May, females also in June. Duffey (1968) found most specimens in June and September (sex ratio not specified). Palmgren (1972) found the highest percentage of males in spring,

much less males in summer and none in the autumn. He found some females also in autumn. Schaefer (1971) reports male activity from May to July, with a peak in May. Females were trapped until September. Merrett (1968) and Tretzel too (1954) give a longer activity period for the females, but his peak activity for males fallswithin the period indicated by my material.

P. nigriceps (Thor.)

Total number of specimens: 98 ♂♂ + 129 ♀♀, all from the pitfall traps. A characteristic heather species. Starts activity at about the same time as P. pullata, but females have been found somewhat later in the autumn (August/September) than the females of this species. Males of P. nigriceps were in 1973 also found as late as August, but not in 1972 (for explanation see also P. pullata). The male peak activity in May to June agrees with that indicated by Tretzel (1954), Merret (1968), and Kekenbosch (1958). Almquist (1969), in material collected by hand, found both sexes in May-August and in November, and males also in October.

P. palustris (L.) (= P. tarsalis (Thor.))

Total number of specimens: 1 ♂ + 3 ♀♀, the male was trapped in June, the females from June to August.

Pirata piraticus (Cl.)

One female in pitfall traps 3-6 June 1971 (in a Sphagnum area).

Pachygnatha degeeri (Sundev.)

Total number of specimens: 107 ♂♂ + 275 ♀♀. The majority

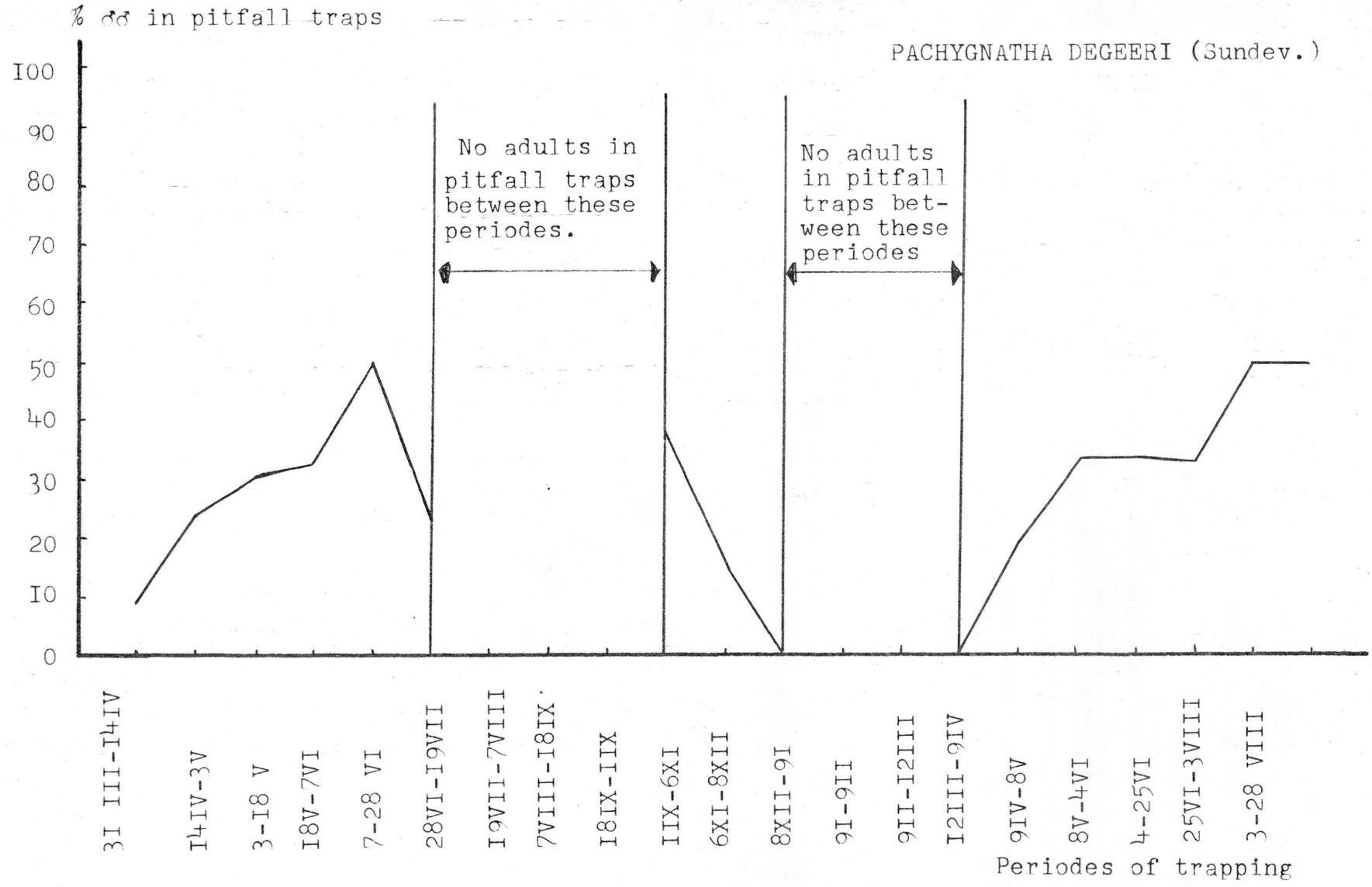


FIG.26. Pachygnatha degeeri (Sundev.). Percentage of ♂♂ in the pitfall traps,1972-73.

were taken in pitfall traps: Males and females from 31 March-19 June 1972 (Table X) with a steadily increasing percentage of males (Figure 26). The species disappears suddenly from the pitfall traps from mid-July-mid-September, reappears between 19 September and 5 December, with a decreasing percentage of males, and is entirely absent between 8 December 1972 and 9 January 1973. In the next period, 9 January-9 February, only females were trapped, and the percentage of males increases steadily from period to period, this time until August.

If Tables VII and X are seen together, it is clear that the females at least are present in the area most of the year, but males may be scarce or absent from November to March.

Merrett (1968) admits the great difficulties in defining the exact picture of the phenology of this species. Schaefer's (1971) results agree quite well with my own. He found females during the whole year, while the males were absent for a time in winter (January-February). Palmgren (1972) found both sexes from spring to autumn, with a relatively stable percentage of males throughout the period. Huhta (1965) found his single male in November.

Duffey (1956) classifies the species as a common aeronaut, which possible explaines the very diffuse picture of phenology and the strong dominance of the species in the pitfall traps in contrast to its rareness in my quantitative samples?

Euryopis flavomaculata (L. Koch).

Total numbers of specimens: 15 ♂♂ + 5 ♀♀, all from the pitfall traps. According to Tretzel (1952), a typical forest species, but with some affinity to Calluna.

In both years most males were trapped in June, in 1973 one

female as late as August. Tretzel (1954) found males in May-June (a peak in May), but also in August, females from April to June and in September. He obviously considers this species as diplochron, with both activity periods in the summer halfyear.

Robertus arundineti (Cbr.)

Total numbers of specimens: 27 ♂♂ + 131 ♀♀, of which only 3 ♂♂ + 2 ♀♀ in the pitfall traps and only 1 ♀ in Hylocomium. It is the dominating species in the Sphagnum samples with more than 40% of the total number of adult specimens. Braun (1961) characterizes the species as hygrophil, which is supported by data from authors such as Wiehle (1937), Rabeler (1931), Tretzel (1952), and Lehmann (1959):A typical Sphagnum species. Humid, open habitats dominate in the lists given by Palmgren (1972, 1974). Lehmann's statement that adults overwinter in Sphagnum, is perhaps supported by Table VIII, which indicates, at least in the case of the females, that adults are present in the areas during winter. July (1972) is the only month when males were not found. Also relatively few males were found in the summer by Palmgren (1972), more in spring and autumn. Palmgren (1974) gives the following periods for mature specimens: Males in April-December, females in April-October. Tretzel (1954) found his specimens in May and November.

Very few specimens were taken in the pitfall traps as follows: 1 ♂ in March/April, 1 ♂ + 2 ♀♀ in June, 1 ♂ in August/September (Table X).

R. lividus (Blw.=)

Total numbers of specimens: 24 ♂♂ + 50 ♀♀, of which 1 ♂ (June) and 2 ♀♀ (June-August) in the pitfall traps. Otherwise

the males were found in March-June and in January, females were absent in July-September. Huhta (1965) found females in all months of the year, no males in April, June-July and December. Palmgren (1974) reports males and females throughout the year. In N. Finland Palmgren (1964) found males in the autumn only, while Palmgren (1972) also found males in spring and summer, but rather few in summer. In 1967 and 1968 I found males in May-June and August in N. Norway, females from May to August.

Robertus scoticus Jackson

Total numbers of specimens: two ♂♂ + 19 ♀♀, all found in the Hylocomium quantitative samples. The males were found 8 December 1972, the females concentrated mainly in November to January (Table VII), but also 2 specimens were found in May-June.

Braun (1961) uses the characterization "arcto-montane Spinne" and indicates a main copulation period in the autumn. In Finland Huhta (1965) found the species to be very abundant in some of his forest localities. The females were present throughout the whole year, the males only absent in December. Also Palmgren (1974) reports both sexes at all seasons, and in the vicinity of Tvärminne Palmgren (1972) found both sexes from spring to autumn, but relatively few males in the summer. The following are my figures for N. Norway:

	11-15 May	24 May-11 June	13-28 June	6-16 July	6-14 Aug.	4-9 Sept.
% ♂♂	16,7	3,7	0	0	16,3	37,5
♂/♀	3/15	1/25	0/17	0/16	5/26	3/5

These figures, like those of Palmgren (1972) show a definite

decrease in the percentage of males during mid-summer. In the following summer, however, the numbers for the same ares were: In June 21% ♂♂ (14/66), in July 15% ♂♂ (6/59), and in August 17% ♂♂ (12/70), indicating great variations from year to year.

Antistea elegans (Blw.)

Three ♂♂ + 3 ♀♀ in pitfall traps, all males in August 1972 + 1973, the females 3-6 June 1971. Tretzel (1954) trapped his 2 ♂♂ in August and the ♀♀ in May (1 specimen), June (1 specimen), and August (3 specimens). Merrett (1968) suggests a peak in male activity in September and a range of activity from August to mid-November.

Hahnia pusilla C. L. Koch

Total numbers of specimens: 3 ♂♂ + 17 ♀♀. The males and 1 female were trapped from March/April to May/June. The period of activity suggested by Tretzel (1954) lasts from February to July. My quantitative samples (Table VII and VIII) show that the species , or at least the females, is present as adults in August, November, and December. Huhta (1965) also found males in September in N. Finland. Palmgren (1972) found both sexes from spring to autumn.

Ero furcata (Villers)

Total numbers of specimens: 3 ♂♂ + 3 ♀♀. One ♂ in pitfall traps 19 July-7 August 1972, 1 ♀ 9 April-8 May 1973, 1 ♂ 8 May-4 June 1973. Pearson & White (1964) found males in July and August, Broen & Moritz (1963) in May, Huhta (1965) caught 1 ♂ in October, Palmgren (1972) found both sexes in spring and autumn, while males were absent from his material in the summer. The

rest of my records: 1 ♂ 25 July 1972 and 2 ♀♀ 9 April 1973 (Table VII).

Xysticus cristatus (Cl.)

Rare: Four ♂♂ + 4 ♀♀. Three males were trapped in April-June, September and October. The fourth male was found 9 April 1973. The females were found in August and January-March (Table VII): Palmgren (1950) reports adults from May to March in S. Finland, while in N. Finland they were restricted to March-July. Females were found also in August. Palmgren (1965) found ♂♂ + ♀♀ in spring and summer in N. Finland. I found a single ♀ in N. Norway 15 May 1967.

Oxyptila atomaria (Panz.)

One ♀ trapped in July/August 1972 and 1 ♀ in March/April 1973, 1 ♂ found 25 July 1972 and as late as 9 February 1973. Lockett & Millidge (1951): Adults during spring and summer months. Palmgren (1950) has records from May, July, and October. Kekenbosch (1958): March and June (♀♀) and May (♂♂). Palmgren (1972). Females from spring to autumn, males in the summer (maximum) and autumn. Merrett (1967) concludes that the species may become active at almost any time.

Neon reticulatus (Blw.)

Total numbers of specimens: two ♂♂ + 3 ♀♀, all females and 1 male 8 May 1973, 1 ♂ 25 June 1973. Tretzel (1954): ♂♂ from April to July, ♀♀ from April to December. These records are the first from Western Norway.

Euophrys petrensis C. L. Koch

Only 2 ♂♂ in pitfall traps in June 1973. Tretzel (1954) trapped males from May-July, and observed a peak of male activity in June, as did Merrett (1969). I have additional records from W. Norway, Kjosmyr (HOi: Kvinnherad) were I found 1 ♂ 23 May 1971 and 1 ♀ 27 May 1970. The species has been reported only once before in Norway (Klausen, in press, personal communication).

Salticus cingulatus (Panzer)

One ♂ + 2 juveniles 2 October 1972. Only one record from W. Norway previously: Grip, Møre & Romsdal (Tambs Lyche 1942).

Heliophanus ritteri Scop.

One ♀ 2 October 1972. The species is new to W. Norway. Hitherto known only in the vicinity of Oslo (Collett 1875).

Zelotes latreilleii (Sim.)

Total numbers of specimens: 42 ♂♂ + 48 ♀♀. Most of these were taken in pitfall traps from April/May to August/September (Table X), but there are relatively few males in summer (7 June-19 July 1972). This supports the diplochrony suggested by Tretzel (1954). He trapped males from April to June, with a peak in April, and in August to September. He also caught females in July. Merrett's (1968) results disproves this pattern. He trapped males from March/April to September, but with a peak in May, and females from April to October/November. Compared with my material this represents an extension of the active period af about 1 month at both ends of the season. Schaefer (1971) also reports a longer trapping period: males from April to October, again with a peak in May, and females also

in March. Engelhardt (1958): Reifezeiten April-June, August-September.

The species har not been reported previously from W. Norway, and there exist only few additional records from E. Norway. Additional record from W. Norway: one ♂ 14 June at Ulvøya, Nordåsvann (HOy: Fana) (B. Berland leg.).

Haplodrassus signifer (C. L. Koch)

Total numbers of specimens: Nine ♂♂ + 10 ♀♀. The males were taken in pitfall traps in May and June (Table X), agreeing fairly well with figures given by Tretzel (1954), Merret (1967), and Broen & Moritz (1969). Females trapped in January/February 1973 (Table X) and specimens found in December 1972 and March 1973 (Tables VII and VIII), seem to fall outside this pattern.

Gnaphosa leporina (L. Koch)

The total numbers of specimens (20 ♂♂ + 7 ♀♀) were all taken in pitfall traps from May to August. In both years they began to appear in the traps somewhat later than Zelotes latreilleii and Haplodrassus signifer. The species, at least in the case of the females, seems to have a much shorter activity period here in W. Norway than in Dorset (Merrett 1967).

Micaria sileciaca L. Koch

A single ♂ was found in a pitfall trap in June 1973. The species is new to Norway.

Drassodes lapidosus Walck.

Only one ♀ trapped 3-6 June 1971 in Calluna and 1 ♂ in the same period in a newly burnt area.

Clubiona trivialis C. L. Koch

A typical Calluna and open land species.

Of the total catch (25 ♂♂ + 36 ♀♀) 11 ♂♂ were taken in pitfall traps in June-August. Both sexes seem to be present almost the whole year round, however, (Tables VII and VIII), as reported also by Almquist (1963). Some other authors report adult specimens during the summer halfyear: Palmgren (1965) in N. Fingland, ♀♀ from spring to autumn, ♂♂ absent in the summer. Palmgren (1972) on the other hand found a maximum percentage of males in summer in S. Finland. Also Kekenbosch (1956) found both sexes from May to the end of September. He also (Kekenbosch 1958) found males and females in October, and ♀♀ as early as March. On the other hand Engelhardt (1958) gives a much shorter period (May-June).

Scotina gracilipes (Blw.)

Rare. In pitfall traps in June (1 ♂) and August (1 ♀). Second record from Norway.

Agroeca proxima (Cbr.)

Total numbers of specimens: 7 ♂♂ + 7 ♀♀. The males were cought in pitfall traps from July/August to September/October, and the females from August/September to October/November. This is approximately the same period found by Tretzel (1954), Merrett (1969), and Almquist (1969). Merrett and Kekenbosch (1962), however, reported the species as late as December. It should be noted that most of the specimens were trapped during the dry 1972-season and only one the following year. According to Locket & Millidge (1951) the species is found in dry places. Tretzel (1952), however, characterizes the species as hemihygrobiont.

This is the first record in Norway.

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	Loc.I ("Hylocomium loc.")	Loc.II ("Sphagnum loc.")
Calluna	Usually dense	Sparse, scattered
Moss cover	Usually 4-6 cm thick. Dominated by Hylocomium splendens. Pleurozium schreberi, Hypnum cupressiforme, Dicranum scoparium and Polytrichum commune. Sphagnum usually scarce, when present in shilded north and east exposions.	Practically completely dominated by Sphagnum spp., often in large, dense mats. Moss cover very often much thicker than at loc. I.
Common higher plants	On dry exposions small ingredients of Vaccinium vitis-idae and Empetrum sp. Lycopodium clavatum, Blechnum spicant, Arctostaphylos uva-ursi, Molinia coerula, Erica tetralix, Suclisa pratensis, Scirpus germanicus.	Eriophorum sp.
Soil	Raw humus with typical sandy podsol profile.	Peaty, watersoaked, excact boundaries between moss cover and the soil very undeterminably.
Humid conditions	Moss cover under long term drought periodes very dry.	Always maintaining a high water content.

Table I. Brief description of the two habitat types.

Date of sampling	Total number of spiders $\bar{X}$	SD	Adult spiders $\bar{X}$	SD	Juvenile spiders $\bar{X}$	SD	Area covered
18 April 1972	144,0	68,3	39,7	27,8	104,3	48,4	
5 May	126,3	48,0	35,0	20,8	91,3	37,9	
23 May	159,7	56,2	35,7	22,8	124,0	49,6	
14 June	119,7	36,0	26,7	16,4	93,0	28,7	12 samples á 0,25 m^2
30 June	92,0	40,8	21,3	16,1	70,7	31,0	
25 July	47,6	27,8	9,0	7,3	38,6	23,2	
28 August	50,0	28,7	16,3	9,3	33,7	25,8	
20 Sept.	80,0	40,6	31,7	27,7	48,3	17,2	
12 Oct.	143,7	44,0	58,7	16,2	85,0	35,1	
13 Nov.	232,8	145,7	65,4	49,3	167,4	115,7	48 á 1/16 m^2
8 Dec.	308,0	176,8	100,3	64,1	208,5	137,0	
9 January 1973	247,3	92,2	77,3	32,6	170,4	81,7	
9 February	188,7	79,5	56,7	33,3	132,0	64,2	
12 March	176,7	91,2	50,2	30,2	126,5	72,0	24 samples á 1/16 m^2
9 April	217,8	115,2	64,7	35,1	153,1	98,1	
8 May	166,7	145,4	59,3	42,3	108,0	118,0	
4 June	178,1	158,8	52,4	24,4	135,7	144,4	
25 June	175,3	71,8	42,7	37,1	132,7	57,5	
3 August	131,6	95,3	23,1	21,3	108,5	97,6	10 s. á 1/16 m^2

Table II. Locality I, densities of spiders, expressed with their mean values $\bar{X}$ and the corresponding standard diviations SD.

Species with dominance of more than 2.0%:			
Minyriolus pusillus	23.2	45.8 %	81.9 %
Gongylidiellum vivum	12.3		
G. latebricola	10.3		
Erigonella hiemalis	9.5		
Lepthyphantes ericaeus	8.4		
Tapinocyba pallens	6.9		
Peponocranium ludicrum	4.3		
Ceratinella brevipes	2.6		
Gonatium rubens	2.4		
Robertus lividus	2.0		
Species with dominance less than 2.0 %:			
The remainding species of Table VII (32 species):			18.1 %

Table III. Dominances of the species (adults only) in the Hylocomium habitats. (Based on the total materiale in Table VII).

Species with dominance of more than 2.0%:		
Robertus arundineti	42.8	
Minyriolus pusillus	9.4	
Robertus lividus	6.8	
Gongylidiellum vivum	5.1	
L: latebricola	4.0	82.0 %
Erigonella hiemalis	3.1	
Clubiona trivialis	2.8	
Silometopus elegans	2.8	
Trachynella nudipalpis	2.6	
Trochosa terricola	2.6	
Species with dominances less than 2.0 % :		
The remainding species of Table VIII (19 species): 18.0 %		

Table IV. Dominances of the species (adults only) in the Sphagnum habitats.(Based on the total materiale in Table VIII).

Hylocomium habitats		Sphagnum habitats	
Date of sampling	Diversity index	Diversity index	Date of sampling
31 March 1972	1.67	1.49	20 March 1972
18 April	2.22	1.95	14 April
5 May	2.30	2.01	3 May
23 May	2.00	2.30	18 May
-	-	1.68	7 June
14 June	2.32.	1.22	14 June
30 June	2.15	0.68	28 June
25 July	1.68	0.85	18 July
-	-	0.57	7 July
28 August	2.25	0.68	26 August
20 September	2.23	0.56	18 September
12 October	1.43	1.17	11 October
13 November	1.74	1.08	6 November
8 December	2.49	1.13	8 December
9 January 1973	2.47	1.25	9 January 1973
9 February	2.33	1.17	9 February
12 March	2.50	1.33	12 March
9 April	2.47	2.01	9 April
8 May	2.47	1.49	8 May
4 June	2.56	1.26	4 June
25 June	2.41	0.74	25 June
3 August	1.85	-	-

Table V. Species' diversity of the two habitat types.

Shannon-Wiener's index ($H_{\log e}$) calculated for the adult spiders in the quantitative samples.

Dates of sampling (Hylocomium+Sphagnum)	Sörensen's index of similarity	
20 + 31 March 1972	0.35	
14 + 18 April	0.46	
3 + 5 May	0.32	$\bar{x}$ = 0.45
18 + 23 May	0.64	
7 + 14 June	0.45	
28 + 30 June	0.13	
19 + 25 July	0.18	
7+26 + 28 Aug.	0.22	
18 + 20 Sept.	0.00	
11 + 12 Oct.	0.33	
6 + 13 Nov.	0.41	
8 December	0.23	$\bar{x}$= 0.21
9 January 1973	0.26	
9 February	0.22	
12 March	0.14	
9 April	0.49	
8 May	0.21	
4 June	0.00	
25 June	0.09	

Table VI. A comparison of the two habitat types when using the Sörensen's index of similarity.

Species	31.III	18.IV	5.V	23.V	14.VI	30.VI	25.VII	28.VIII	20.IX	12.X	13.XI	8.XII	9.I	9.II	12.III	9.IV	8.V	4.VI	25.VI	3.VIII
Ceratinella brevipes (Westr.)	0/1	0/2	0/3	0/3	-	1/2	-	0/3	0/2	-	2/1	1/1	3/4	2/6	4/3	7/4	3/1	-	-	0/1
Wideria antica (Wid.)	-	1/1	0/1	-	0/1	-	-	1/1	2/1	-	0/1	4/4	1/3	2/4	1/1	0/2	0/4	0/1	-	0/1
Trachynella nudipalpis (Westr.)	-	-	-	0/1	-	-	-	-	-	-	1/0	1/2	3/3	1/1	0/5	0/4	0/2	0/2	-	-
Cornicularia cuspidata (Blw.)	-	-	-	-	-	-	-	-	-	-	-	-	0/1	1/0	0/1	-	-	-	-	-
Gonatium rubens (Blw.)	-	0/2	0/4	0/2	0/3	0/1	-	2/1	2/1	2/6	1/2	4/6	0/6	0/3	0/2	0/3	-	0/1	-	0/1
Peponocranium ludicrum (Cbr.)	1/2	-	4/7	2/4	3/10	0/10	0/3	0/2	0/2	0/1	-	-	0/1	0/2	1/2	5/4	10/10	1/7	1/3	-
Pocadicnemis pumila (Blw.)	-	-	-	-	0/1	-	-	-	-	-	-	-	-	-	0/2	-	-	0/4	0/1	0/1
Silometopus elegans (Cbr.)	-	-	1/0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tiso vagans (Blw.)	-	-	0/1	-	-	-	-	-	-	-	-	0/1	-	-	-	-	1/0	-	-	-
Minyriolus pusillus (Wid.)	0/1	5/10	4/13	1/3	5/11	2/6	2/6	1/8	3/6	6/28	31/53	19/34	13/42	13/21	22/32	17/38	4/28	3/16	4/23	3/10
Cnephalocotes obscurus (Blw.)	0/1	4/6	4/5	2/4	0/2	0/1	1/0	-	-	-	2/1	1/0	1/3	0/2	2/0	-	1/1	-	0/1	-
Tapinocyba pallens (Cbr.)	-	0/1	1/1	0/5	-	0/1	-	-	0/1	-	1/4	5/8	5/42	6/18	5/17	1/11	2/9	0/5	1/9	-
Jacksonella falconeri (Jacks.)	-	0/1	0/1	-	-	-	-	1/0	-	1/1	0/1	-	3/3	-	1/0	2/0	2/3	-	-	-
Gongylidiellum latebricola (Cbr.)	1/12	0/24	1/17	-	0/5	2/11	0/6	0/3	5/10	-	4/39	2/38	5/24	3/13	0/8	1/23	7/26	0/26	0/22	0/5
G. vivum (Cbr.)	2/4	-	-	5/27	1/2	2/4	1/2	3/1	2/10	2/11	1/0	4/30	6/28	5/24	7/21	5/29	10/26	2/7	1/8	1/1
Micrargus herbigradus (Blw.)	-	0/1	1/0	-	-	-	-	-	-	-	1/0	-	3/0	0/2	2/3	3/1	1/1	0/3	0/5	-
Erigonella hiemalis (Blw.)	2/1	2/5	1/5	4/15	0/4	3/5	-	6/6	7/13	13/17	0/2	14/22	11/21	20/31	7/13	3/13	6/14	1/13	1/9	1/3
Erigone atra (Blw.)	-	1/0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agyneta cauta (Cbr.)	-	-	-	-	0/3	0/4	-	-	-	-	-	-	-	-	-	-	1/0	3/6	0/3	0/1
A. decora Cbr.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1/0	1/0	-
A. subtilis (Cbr.)	-	-	-	-	-	-	-	-	-	-	0/1	-	-	-	-	-	-	-	0/1	-
A. conigera (Cbr.)	-	-	-	-	1/1	0/1	-	-	-	-	-	-	-	-	-	-	-	-	1/2	-
Meioneta beata (Cbr.)	-	-	0/1	-	1/0	-	-	-	0/1	-	-	-	-	-	-	-	1/0	-	-	-
Maro lehtineni (Saaristo)	-	-	-	-	-	-	-	-	-	-	-	2/3	-	-	0/1	1/3	-	-	-	-
Centromerus arcanus (Cbr.)	-	-	-	-	-	-	-	-	-	-	3/12	-	0/3	3/1	3/1	3/4	-	0/1	0/1	0/1
Centromerita concinna (Thor.)	-	-	-	-	0/2	-	-	-	1/0	-	1/1	2/2	0/1	0/2	0/4	0/3	-	1/0	-	-
Macrargus rufus (Wid.)	-	-	0/1	-	-	-	-	1/1	1/2	-	1/0	-	0/3	-	1/0	-	0/1	0/1	-	-
Lepthyphantes mengei Kulcz.	-	-	-	2/4	0/2	-	-	-	2/4	-	0/1	0/1	0/4	0/2	0/5	0/1	0/2	1/0	0/6	-
L. ericaeus (Blw.)	0/2	2/10	5/0	0/5	1/6	0/2	-	-	3/2	-	4/7	6/16	6/12	16/19	8/26	5/11	2/11	0/3	0/4	0/1
Microlinyphia pusilla (Sundev.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0/1	-	-
Robertus lividus (Blw.)	-	1/0	-	1/1	-	0/1	-	-	0/1	-	0/9	0/5	3/5	-	3/4	5/4	0/1	0/2	1/0	0/2
R. scoticus Jackson	-	-	-	-	-	-	-	-	-	-	0/4	2/9	0/4	-	-	-	0/1	0/1	-	-
R.arundineti (Cbr.)	-	-	-	-	-	-	-	-	-	-	-	-	-	1/0	-	-	-	-	-	-
Pachygnatha degeeri Sundev.	-	0/1	-	-	-	-	-	-	-	-	-	0/1	-	-	-	0/1	0/2	-	-	-
Hahnia pusilla C.L.Koch	-	0/1	-	-	-	0/1	0/1	-	-	-	0/1	0/6	-	-	-	0/1	-	-	-	-
Ero furcata (Villers)	-	-	-	-	-	-	1/0	-	-	-	-	-	-	-	-	0/2	-	-	-	-
Xysticus cristatus (Cl.)	-	-	-	-	-	-	-	0/1	-	-	-	-	0/1	0/1	-	0/1	-	-	-	-
Oxyptila atomaria (Panz.)	-	-	-	-	-	-	1/0	-	-	-	-	-	-	1/0	-	-	-	-	-	-
Neon reticulatus (Bl.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1/3	-	1/0	-
Clubiona trivialis L.Koch	-	-	0/1	-	-	-	0/1	2/1	0/1	-	1/0	6/7	0/5	0/2	2/2	0/5	0/1	1/2	0/4	-
Zelotes latreillei (Sim.)	-	-	-	-	-	-	-	-	-	-	-	-	1/0	-	-	-	-	0/1	-	-
Trochosa terricola Thor.	-	-	-	-	-	-	-	1/0	-	2/0	-	0/1	0/4	1/0	1/1	0/3	1/0	-	-	-

Table VII. Quantitative materiale from the Hylocomium habitats from 31 March 1972 to 3 August 1973.
Adult spiders only (♂♂/♀♀).

Species	1972														1973						
	20.III	14.IV	3.V	18.V	7.VI	14.VI	28.VI	19.VII	7.VIII	26.VIII	18.IX	11.X	6.XI	8.XII	9.I	9.II	12.III	9.IV	8.V	4.VI	25.VI
Ceratinella brevipes (Westr.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1/0	-	-	-
Wideria antica (Wid.)	-	-	0/1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cnephalocotes obscurus (Blw.)	-	1/0	-	-	-	-	-	-	-	-	-	0/1	-	-	0/2	-	-	-	-	-	-
Erigonella hiemalis (Blw.)	1/0	0/1	1/3	0/1	-	-	-	-	-	-	-	-	0/1	-	0/1	-	-	-	0/1	-	0/1
Trachynella nudipalpis (Westr.)	-	0/1	-	0/3	0/1	-	-	-	-	-	0/1	-	0/1	0/1	-	0/1	-	-	-	-	-
Gongylidiellum latebricola (Cbr.)	-	1/5	0/1	-	1/0	0/2	-	0/1	-	0/1	-	-	-	-	-	-	-	0/2	-	-	-
G. vivum (Cbr.)	1/0	1/0	1/0	4/2	0/2	1/0	1/0	-	-	-	-	1/0	-	-	-	-	1/2	0/1	-	-	-
Minyriolus pusillus (Wid.)	2/3	3/2	0/2	2/8	0/1	3/1	-	-	-	-	-	-	-	-	-	-	-	0/1	-	-	-
Araeoncus crassiceps Westr.	-	0/2	0/1	-	-	-	-	-	0/1	-	-	-	-	-	-	-	-	-	-	-	-
Tapinocyba pallens (Cbr.)	0/1	-	-	0/3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Peponocranium ludicrum (Cbr.)	-	-	-	1/0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0/1
Silometopus elegans (Cbr.)	-	-	-	1/0	-	-	0/1	-	-	-	-	-	-	-	-	2/1	2/0	-	0/1	0/2	-
Tiso vagans (Blw.)	-	-	-	-	-	0/1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meioneta beata (Cbr.)	-	-	-	0/1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agynata decora Cbr.	-	-	-	2/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A. cauta (Cbr.)	-	-	-	1/2	0/1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Centromerita concinna (Thor.)	0/1	0/2	0/1	-	0/1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lepthyphantes ericaeus (Blw.)	-	-	-	0/1	-	-	-	-	-	-	-	-	1/0	-	-	-	-	-	0/1	-	-
L. mengei Kulcz.	-	-	-	-	0/1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Micrargus herbigradus	-	-	-	-	-	-	-	-	-	-	-	-	0/1	-	-	-	-	-	0/3	-	-
Gonatium rubens (Blw.)	0/1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Robertus lividus (Blw.)	0/2	2/0	3/2	4/1	0/5	-	-	0/4	-	-	-	0/1	-	-	-	-	-	-	-	-	-
R. arundineti (Cbr.)	2/12	0/5	-	-	2/12	-	0/7	0/8	1/9	2/5	0/3	1/9	5/13	2/11	1/9	1/8	1/6	2/3	0/2	0/1	3/3
Hahnia pusilla C.L.Koch	-	0/1	-	-	-	-	-	-	-	0/1	-	-	0/1	-	-	0/1	-	0/1	-	-	-
Clubiona trivialis L.Koch	0/1	-	-	3/0	-	-	-	-	-	-	-	0/1	0/2	1/1	0/1	-	-	-	-	-	-
Trochosa terricola Thor.	-	-	-	-	0/1	-	-	-	0/1	-	-	0/1	-	1/0	0/1	1/0	-	1/1	-	0/1	-
Haplodrassus signifer (C.L.Koch)	-	-	-	-	-	-	-	-	-	-	-	-	-	0/1	-	-	0/1	-	-	-	-
Pachygnatha degeeri Sundev.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1/0	-	1/0	1/1	-	1/1	-
Xysticus cristatus (Cl.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1/0	-	-	-

Table VIII. Quantitative materiale from the Sphagnum habitats, 20 March 1972 to 25 June 1973.

Adulte spiders only (♂♂/♀♀).

	31/3-14/4	14/4-3/5	3/5-18/5	18/5-7/6	7-28/6	28/6-19/7	19/7-7/8	7-26/8	26/8-18/9	18/9-11/10	11/10-6/11	6/11-3/12	8/12-9/1	9/1-9/2	9/2-12/3	12/3-9/4	9/4-3/5	8/5-4/6	4-25/6	25/6-2/8	3-28/8
Gonatium rubens (Bl.)	0/11	0/45	0/11	0/4	0/5	0/2	0/1	3/2	6/8	22/33	21/35	15/28	9/21	2/30	0/41	0/33	0/23	0/8	0/4	0/1	3/4
Ceratinella brevipes (Westr.)			1/0													1/0	1/0	0/1	1/0		
Wideria antica (Wid.)	2/0	14/2	0/1	2/3		1/2	1/2					1/0		1/0	1/0	18/2	13/3	1/0	0/1	0/2	0/1
Trachynella nudipalpis(Westr.)										4/1	2/1	4/0	16/1	14/0	13/0	4/0	1/0			6/1	
Erigonella hiemalis (Bl.)	2/2	18/3	4/0		0/1	0/1										1/0	24/1	3/0	1/0		
Tapinocyba pallens (Cbr.)						0/1												1/0			
Cnephalocotes obscurus (Bl.)		2/2	11/2		2/3	0/1	0/1	0/1		0/1						0/1	4/3	27/4	2/3		2/1
Jacksonella falconeri (Jacks.)		5/0	2/0													1/0	8/0	3/0			
Peponocranium ludicrum (Bl.)			7/2	3/0	0/1	0/1												2/1	1/0	0/1	
Micrargus herbigradus (Bl.)			4/0			2/0												4/1			
Metopobactrus prominulus (Cbr.)			-	1/0				0/1													
Minyriclus pusillus (Wid.)					0/1	1/0								0/1							
Gongylidiellum vivum (Cbr.)			2/0		1/0														1/0		
G. latebricola (Cbr.)					1/0			1/0		2/0				0/1			1/0		1/0		1/0
Araeoncus crassiceps (Westr.)																					1/0
Typhocraestus digitatus (Cbr.)														1/0							
Cornicularia cuspidata (Bl.)			1/0														1/0	1/0			
Dicymbium nigrum (Bl.)																	1/0				
Pocadicnemis pumila (Bl.)								0/1													
Silometopus elegans (Cbr.)																			1/0		
Centromerus sylvaticus (Bl.)											1/0										
C. prudens (Cbr.)												1/0									
C. arcanus (Cbr.)																		13/0	1/0		
Agyneta decora (Cbr.)																			4/0	1/0	2/0
A. cauta (Cbr.)				12/4	28/12	2/10	0/2												11/4	7/10	0/3
A. conigera (Cbr.)																			1/0	1/0	
Meioneta beata (Cbr.)		0/1		1/1				0/1				0/1							2/1	1/1	
Centromerita concinna (Th.)	0/1	0/8	0/2	0/1		0/1				1/4	27/8	186/29	76/15	2/10	1/14	0/5	0/3	0/6	0/1	0/1	
C. bicolor (Bl.)										1/0	1/0		1/0								
Oreonetides abnormis (Bl.)										1/0											
Phaulothrix hardyi (Bl.)										0/1											
Macrargus rufus (Wid.)											2/1	1/0	0/1	1/0	16/3	8/4					
Stemonyphantes lineatus (L.)													1/0		1/1	2/0					
Polyphantes luteolus (Bl.)										0/2	4/4		2/1								
Lepthyphantes mengei Kulcz.	0/2	0/13	1/10	2/13	1/12	2/7	0/1	0/4	0/1	6/12	31/6	3/2	6/9	1/9	0/2	1/6	1/6	2/12	1/6	1/6	0/4
L. ericaeus(Bl.)		2/5	2/13	1/8	0/6	3/3	1/0			0/2	1/3	2/1	4/5	27/5	10/4	9/9	1/5	0/15	0/7	0/6	
Bathyphantes gracilis (Bl.)															1/0						
B. setiger Cbr.															1/0						
Poeciloneta globosa (Wid.)	0/1																				

Table IX. Pitfall trap materiale. Adult spiders (♂♂/♀♀)(Linyphiidae), in the different trapping periodes from 31 March 1972 to 28 August 1973.

	31/3-14/4	14/4-3/5	3/5-18/5	18/5-7/6	7-28/6	26/6-19/7	19/7-7/8	7-26/8	26/8-18/9	18/9-11/10	11/10-6/11	6/11-3/12	8/12-9/1	9/1-9/2	9/2-12/3	12/3-9/4	9/4-8/5	8/5-4/6	4-25/6	25/6-3/8	3-23/8
Trochosa terricola Th.	3/2	32/22	56/11	5/2	1/1	0/4	1/13	5/12	9/13	3/4	1/0				3/0	24/6	169/20	32/23	2/0	0/12	9/11
Tarentula pulverulenta (Cl.)			28/7	11/4	1/1		0/3											2/3	8/0	0/2	0/1
Pardosa pullata (Cl.)		1/1	47/20	15/23	7/22	6/21	0/1	0/1										44/34	41/26	29/41	4/3
P. nigriceps (Th.)			11/20	12/9	9/12	4/13	0/4	0/2	0/2									13/15	33/21	13/25	3/6
P. tarsalis (Th.)						0/1													1/1		0/1
Pachygnatha degeeri (Sundev.)	1/10	21/64	11/24	9/18	7/7	2/7				5/8	1/6	0/1		0/3	0/7	8/35	12/24	18/35	7/14	3/3	2/2
Euryopis flavomaculata(C.Koch)				1/0	3/3														8/0	3/1	0/1
Robertus arundineti (Cbr.)					1/1				1/0							1/0			0/1		
R. lividus (Bl.)																			1/1	0/1	
Antistea elegans (Bl.)								1/0													2/0
Hahnia pusilla C.Koch			1/0													1/0		1/1			
Ero furcata (Villers)							1/0										0/1	1/0			
Xysticus cristatus (Cl.)		1/0								1/0								1/0			
Oxyptila atomaria (Panz.)							0/1									0/2					
Micaria silesiaca L.Koch																			1/0		
Zelotes latreillei (Sim.)		3/0	4/6	5/3	0/2	0/1	4/2	1/6	2/2								2/1	9/9	3/3	1/3	7/9
Haplodrassus signifer(C.Koch)		0/1	2/0	2/4										0/1				2/0	3/1	0/1	
Gnaphosa leporina (L.Koch)			1/0	3/1	4/3	3/1													2/1	6/1	1/0
Clubiona trivialis C.Koch					1/1															2/0	8/1
Agroeca proxima (Cbr.)							1/0	1/0	2/2	2/1	0/4									1/0	
Scotina gracilipes (Bl.)								1/0											1/0		
Euryopis pretensis C.Koch																			2/0		

Table X. Pitfall trap materiale. Adulte spiders (♂♂/♀♀), except Linyphiidae, in the different trapping periodes from 31 March 1972 to 28 August 1973.