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The Time Table of Vegetative Spreading in Oak Fern (*Carpogymnia dryopteris* (L.) Löve & Löve) and May-Lily (*Maianthemum bifolium* (L.) F. W. Schmidt) in Southern Finland

Kasvullisen leviämisen aikataulu metsäimarteella (*Carpogymnia dryopteris* (L.) Löve & Löve) ja oravanmarjalla (*Maianthemum bifolium* (L.) F. W. Schmidt) Etelä-Suomessa

Eino Oinonen

SUOMEN METSÄTIETEELLINEN SEURA

Suomen Metsätieteellisen Seuran julkaisusarjat

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THE TIME TABLE OF VEGETATIVE SPREADING IN OAK FERN (*CARPOGYMNIA DRYOPTERIS* (L.) LÖVE & LÖVE) AND MAY-LILY (*MAIANTHEMUM BIFOLIUM* (L.) F.W. SCHMIDT) IN SOUTHERN FINLAND

EINO OINONEN

SELOSTE:

KASVULLISEN LEVIÄMISEN AIKATAULU METSÄIMARTEELLA (CARPOGYMNIA DRYOPTERIS (L.) LÖVE & LÖVE) JA ORAVANMARJALLA (MAIANTHEMUM BIFOLIUM (L.) F.W. SCHMIDT) ETELÄ-SUOMESSA

HELSINKI 1971

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1. INTRODUCTION

11. Connections with previous studies

The present study is part of a series of investigations the goal of which is to assess the time table of vegetative spreading in some of the commonest Finnish perennial forest plants.

In this series of studies the key position is held by the bracken (*Pteridium aquilinum* (L.) KUHN), for which a number of characteristics could be found that made it possible to distinguish members of an individual clone from other clones. Plotting the dimensions of individuals, separated with the aid of these characteristics, against the length of the time elapsed since the latest fire on the site, showed that there was a rather close correlation in most of the instances studied, and on this basis it was possible to assess the time table of vegetative spreading in bracken (OINONEN 1967 a).

On the best occasions the date of the most recent fire could be determined through borings carried out on trees that had been damaged by the fire in question, whereas, in some cases even written documents had to be used for information in this respect (OINONEN 1967 b, 1970). In most of the study areas, however, no trees with fire scars were found, and sometimes the clones were so large that even the oldest trees that have been found in Finland could not have been used, even if they had been growing on the site in question. When trees with fire scars were lacking, less distinct traces had to be used to estimate the date of the fire: the occurrence of resinous wood in bore cores taken from old standard trees and sharp limits between periods of different rates of growth. As fires usually lead to the emergence of regrowth which later develops into relatively even-aged stands or tree stories, the age of the oldest trees in various tree stories could be used in checking uncertain fire date determinations.

Some of the bracken clones studied grew very far from neighboring ones of the same species, and as violent fires, particularly on sites with a heavy humus layer, may have reduced their size, the true character of the dimensions of detached clones often remained uncertain. The true character of the dimensions of clones was best established with the aid of other clones of similar or nearly similar size found in the same study area. Fortunately enough, such replicates were found on many occasions. As, however, replicates were not found in all study areas, or they could not be distinguished from other components in complex, mixed stands, other plant species were used to support the estimations instead of the bracken. It was expected that certain plant species, regenerating by means of diaspores and vegetative spreading at least in principle resembling those of bracken, could be linked to the time table of vegetative spreading by measuring detached stands of structural or phenological uniformity of these species where they were found growing together with bracken (OINONEN 1967 c, pp. 5—7). This expectation has already been fulfilled for five species: *Lycopodium complanatum* L. (op. cit.), *L. clavatum* L. and *L. annotinum* L. (OINONEN 1968) and *Convallaria majalis* L. and *Calamagrostis epigeios* (L.) ROTH (OINONEN 1969).

The time tables of vegetative spreading in all these plant species have been used to support the compilation of time tables for additional species; thus the possibilities for comparisons and the support gained from replicates have increased continuously. Besides, it has been possible to determine the date of the fire with a much greater degree of accuracy than before, because the lack of trees with fire scars as well as stands, that have emerged after fires, but have been cut later, can be compensated for by similar aged stands of these species. Continued studies have also made it possible to check the reliability of the time tables previously published.

12. On the identification of individual clones

Among the species studied up to now, the possibilities of identifying individual clones are best for bracken. Clearly distinguishable individual forms are also found in *Lycopodium complanatum* and *Convallaria majalis* and sometimes in *Calamagrostis epigeios* (during flowering), but in *Lycopodium clavatum* and *L. annotinum* only in exceptional cases. Of the species now under study the oak fern (*Carpogymnia dryopteris* (L.) Löve & Löve = *Dryopteris linnaeana* C. Chr.) proved to be extremely difficult to identify ocularly in summertime, whereas in the fall, when the leaves turned yellow, clear differences in color could sometimes be observed between various patches or stands formed by this species. The may-lily (*Maianthemum bifolium* (L.) F. W. Schmidt), on the other hand, must be regarded as one of the easiest species in this respect because of the large individual variation in the shape of its leaves (Figs. 1—3). May-lily clones may sometimes be separated even when growing in complex mixed stands.

The possibilities of errors in identifying individuals are naturally greater, the smaller the individual variation, and on the other hand, the more frequently that the species in question is regenerated through diaspores. The rarer certain exceptional individual forms in a species are, the smaller is the probability that two or more individuals of similar appearance will be found on the same site. The probability that more than one clone of similar appearance occurs on the same site increases with the increase in frequency of the type of individuals in question. The time factor has a similar influence: the older the individual clones on a certain site, the greater is the possibility that they have got in touch with each other and formed confusingly interwoven mixed stands. If, in an area covered by such mixed stands, new individuals of the same species emerge, identification of individual clones may be associated with some degree of difficulty.

Because of the above-related possibilities of errors in clone identification, the material of the present study was restricted to include only clearly discernible clones. In the case of the species that showed the greatest difficulties in clone identification, only detached stands were included in the material. An additional criterion taken into consideration in this connection was the circular or partly circular shape of the stand. On some occasions individuals of two or more species had started growth from the very same spot, whereas in other instances they touched each other or even overlapped, each of them being at the same time the only representative of their species in a large area. When, in addition, tree stories of corresponding age have been found in the near vicinity, and above them single standards from earlier generations which have been damaged by fire, there has been excellent possibilities for comparisons. As this was the situation in quite a number of sites where fires had occurred at various times, the time table could be based on firm evidence even in the case of these ideal instances. Particularly when large detached stands are in question the age of which is considerably greater than that of the trees on the site, detached stands of different species with exactly the same point of origin or growing in the immediate vicinity are the only objects that can be used for comparison in order to support the evidence produced by replicates and to compensate for lacking replicates. Such parallelity may sometimes be created by chance. If, for example, there are numerous occurrences in a certain area, and these form a sliding series in respect to their size, there are always counterparts to be found among them, but it is only when there is no other alternative and when the phenomenon occurs repeatedly within a certain area that simultaneous emergence and even rate of spreading can be held as the reason for their occurrence. Thus counterparts and replicates of considerable size strongly support the assumption made on the basis of individual characteristics, structural and phenological homogeneity, detachedness and shape that the stands in question are clones. Alone, even the best taxonomic means cannot pro-

Fig. 1. A part of a may-lily clone having a wide incision at the base of its leaves.

duce any better evidence, as their the strength of this evidence rests mainly on separation of the differences; full assurance that a stand belongs to the same clone can often not be obtained by taxonomic means. If, however, the goal is set beyond the scope of the present study — that is to say, if it is intended to separate the individuals composing uniform, interwoven mats of vegetation — success depends to a decisive degree on to what extent taxonomic means can be of help.

In all the plant species for which time tables have been previously prepared, regeneration through diaspores in the forest is not a phenomenon taking place at the same rate from year to year, for they show a certain kind of irregular periodicity, which also varies from stand to stand. There are also differences in this periodicity between various plant species, and on the other hand, the factors promoting regeneration or making it possible at all, are more often brought out in more densely populated areas than in the backwoods. There is also variation in the frequency of regeneration from site to site. A common feature of all these species is their inexhaustive capacity for spreading vegetatively, which is indicated by the large size of many stands. No signs whatsoever have been observed which would imply that growth cessation occurs due to decrepitude. As regards capability of competing, there are big differences between various species, and this is also true with respect to their ability to resist fire.

Lycopodium clavatum and *L. annotinum*, because their shoots grow above the ground surface, show poor fire resistance. *Pteridium aquilinum*, *Lycopodium complanatum*, *Convallaria majalis* and *Calamagrostis epigeios*, on the other hand, resist fire quite well because they have rhizomes which, particularly in sites having a thin humus layer, grow down into the mineral soil. In the two club mosses first mentioned, the stands formed by single individuals have primarily emerged after the last fire on the site, or they have developed from small relicts that have survived it. In the latter four species, on the other hand, the composition of individuals is formed by clones brought about in connection with various fires, and which at least have partly survived later fires without size reductions. Their size

Fig. 2. A part of a may-lily clone having a hole at the base of its leaves.

consequently corresponds to their true age. As for their ability to resist fire, *Carpogymnia dryopteris* and *Maianthemum bifolium* belong to the average species (see also KUJALA 1926 b, p. 18). Their rhizomes usually grow at a depth of 1—2 cm in the humus layer (KUJALA 1926 a, p. 55), which in fires occurring during dry spells may be burned completely. When only light fires are in question, however, the stands of these species may survive.

A few detached stands of the species now in question were repeatedly measured during 5—8 years. Thereby it was found that the stands were permanent (see also PETTERSSON 1958) and that they continued spreading

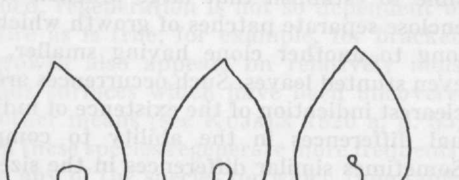

Fig. 3. The individual variation of the cordate leaves of may-lily is identified most clearly by the shape of the incision at their base; this may be broad or narrow, or its edges may overlap, so that a hole is formed. On leaves growing on flower-bearing shoots, however, the incision is clearly open, even in the case of the last-mentioned morphologic type. Although there are other individual characteristics in may-lily, clone identification was primarily based on the shape of this incision and of the lobes bordering it.

steadily. New individuals did not appear in their vicinity. Thus it may be concluded that such stands have a position of priority as long as this is not disturbed by external factors such as fire, disease, pests, shadowing from tree stands growing too densely, logging waste and introduction of new plant species with a greater ability to compete. Partial destruction of a stand may bring about introduction of new individuals within the area formerly covered by it, but these are usually condemned to a subordinate position, i.e., they form a filling. Such fillings of later origin have sometimes been found in large stands and clusters[1] of *Lycopodium complanatum* and in large stands of *Convallaria majalis* and *Maianthemum bifolium*, but rather seldom in clones of bracken. For *Lycopodium clavatum* and *L. annotinum* as well as for *Calamagrostis epigeios* and *Carpogymnia dryopteris* this problem remains open because of the great difficulties involved in the identification of clones.

Overlapping growth of several individuals of the same species seems to be a common phenomenon in all species that are readily identified, and this is probably true also for other plants. In the course of their spreading, large clones may enclose smaller individuals, but it is only very rarely that conclusive proof has been obtained for the assumption that one individual would suppress another one, or force it out. A small clone growing within the area covered by a large one may just as well be a newcomer as a relict. On some occasions, however, it has been possible to establish that large bracken clones enclose separate patches of growth which belong to another clone having smaller, and even stunted leaves. Such occurrences are the clearest indication of the existence of individual differences in the ability to compete. Sometimes similar differences in the size and density of leaves are also found in places where two clones meet. There are also sometimes differences along the arcs forming the outer edge of the stands, and these differences indicate that there are variations in the capacity of one individual to penetrate into the area covered by another clone. Quite often, however, there are large clones of the same species which grow intermixed with each other in the same area, and which are of equal strength. The study material also covers a number of cases in which detached, circular stands consist of two or several individuals which have spread rather evenly over the same area. These have a common point of origin. Such occurrences are particularly common in the may-lily, but they have also been found in the lily-of-the-valley and the ground pine, and sometimes in bracken, too. This phenomenon is easily understood in the case of those plant species whose seeds are spread by birds or other animals, whereas for plants reproducing by means of spores which are distributed by air currents, pure chance is involved — several spores happened to fall in the same place and germinated. Despite this fact, completely detached clones, which are rather common for bracken, are not infrequent for the may-lily.

[1] In the present context the term cluster refers to individual stands that have been split into fragments (see OINONEN 1967 b).

13. On the principles applied in handling the material of the study

For each species studied it was attempted to collect sufficient data in order to make it possible to eliminate possible errors in identification and fire date determination as well as due to the occurrence of clones of misleading dimension. Because replicates and occurrences of other species of a size implying similar age were found to quite varying extents in various study areas, only the largest clone of those in the same size category was used for comparison, in each species in question. This was also done in order to narrow down to the greatest possible extent the inaccuracies of interpretation which are caused by the differences in the time between fire and the manifestation of the plants in different sites and species. From the viewpoint of material handling, the sites used in this study could not be classified in a satisfactory manner. In some cases this was because large clones covered sites of different quality, and in other instances, because the clones of various species which were used for the comparisons were growing on sites of different quality within the same study areas. Moreover, different plant species differ from each other in their site requirements. The growth, both of subterraneous and of aerial shoots, is affected by a number of other factors, except soil quality, and the importance of these factors may be greater than, and even contradictory to that of site quality. So, for instance, excess shading in a spruce stand sometimes completely nullifies the effects of favorable moisture conditions and nutritional state by suppressing various plant species which have earlier grown on the site. For this reason it was considered appropriate in the present study, to focus attention on sites of average quality, simultaneously, however, taking samples at random both from poorer and from better sites. Consequently, the type of environment best represented by the present material is pine forests growing on *Vaccinium* site type, which receive much light.

Because in a great number of study areas the largest clone found was not the largest possible on the respective site, the average values of the rate of spreading, obtained from the clone dimensions in question, do not indicate any potential maximum, but are slightly lower. The time table of vegetative spreading thus reflects the mean of the maximum values for the study areas and for various species. For the species dealt with earlier, however, this value has proved to hold; large amounts of material collected for support have given almost similar results.

When considering the validity of the time tables of vegetative spreading it is important that the results obtained could be checked by comparing them with data on independent series. When linking the clone size together with time, it is possible to use parallel series: 1) clone size and stand age and 2) clone size and date of fire. When the regression lines obtained from these series are parallel, the results are in conformity. The distance between the lines is determined by the length of the average period between fire and regeneration and by the age of the tree at the height of boring. This distance is increased to some extent because it has not always been possible to take the boring for age determination from the oldest tree of the age class in question; besides, this may have been removed in cuttings. Usually the borings were taken from a height of about 30 cm, but when particularly large trees were in question, the age had sometimes to be determined from borings taken at higher points. The errors incurred in this way resulted in a slight increase in the difference between the butt age of the tree stand and the length of the time after fire (Oinonen 1968, pp. 19—20).

When comparing between the size of detached clones with the butt age of the tree stand, the figures used are free from subjective interpretations. This is also true in comparisons between detached clones of different plant species, growing on the same site. When the time tables of species for which time tables have already been prepared are used for comparison, the date of fire can be determined on the basis of the clone dimensions of the species in question, and the results thus obtained can, in turn, be compared with those obtained from comparisons between clone dimensions and fire dates which have been determined from increment cores. Consequently, the results obtained in one way can be checked in a number of ways (see Oinonen 1968). When the time tables of various plant species are put side by side and checked against the support thus obtained from various sources, a »cobweb» (Fig.10) is formed, in which there is no room for any large deviations.

14. Regeneration by diaspores in oak fern and may-lily on forest soil

Carpogymnia dryopteris and *Maianthemum bifolium* quite often share the same site. Although, in the case of these species, new plants frequently emerge in areas recently burned, regeneration is not so dependent up on fire as is true, for example, for bracken. Regrowth also appears on relatively moist humus surfaces which have been uncovered by other means (see Kujala 1926 a, p. 55). Both these species regenerate more frequently than any of the species for which time tables were worked out earlier; despite this fact, however, it may be concluded that regeneration by diaspores is not a very common phenomenon in may-lily or in oak fern. In the former this kind of regeneration is more frequent than in the latter. With regard to regeneration, oak fern makes greater demands on the moisture conditions than may-lily. Completely detached, small patches are not found very often, except on soil that has been uncovered very recently. Both the species in question usually form uniform stands with distinct borders, and those of may-lily, may in particular have a circular shape, sometimes even resembling fairy rings.[1]

According to KUJALA (1926 a, p. 55), the annual growth of the rhizomes of *Carpogymnia dryopteris* is 3—5 cm, whereas for *Maianthemum bifolium*, he only mentions that the species shows intensive vegetative spreading. The material presented here shows that vegetative spreading is of similar magnitude in both these species. When similar aged clones are growing on the same site, either one may be slightly larger than the other, and sometimes they have exactly the same size. The growth achieved varies to some extent from site to site. It seems that spreading is faster on moist sites of high fertility than on drier and poorer sites which, with regard to other site factors, are of equal quality. Considering this situation only with regard to the clone dimensions, however, may involve slight errors; the differences in size observed may also partly be due to differences in the frequency of regeneration. It is possible that clones growing on poor sites have emerged at a somewhat later date after the fire than those growing on moist sites. On dry sites regeneration by seeds and spores is more dependent on the rainfall of the growing season than on moist sites. This methodological problem also attains actuality in the study of other plant species when their rate of spreading is studied on sites of different quality on the basis of the size of clones.

2. THE STUDY MATERIAL

The material of the present study was collected from southern Finland, from a total of 39 communes, primarily located in the western parts of this region. About 400 clones of oak fern and of may-lily were measured.[2] It was not possible in every case to compare the data obtained from these measurements with the date of the fire, the age of the tree stand or the size of clones for which time tables had been prepared previously. On the other hand, however, support was gained from parallel clones of plant species which shall be dealt with in future papers. The material of the present study (Appendices 1 and 2) comprised the following numbers of stands which had been interpreted — on some occasions only assumed — as being clones (of the replicates found, only the four largest were included in the material):

Carpogymnia dryopteris	280 (174 study areas)
Maianthemum bifolium	258 (153 » »)
Convallaria majalis	194
Calamagrostis epigeios	150
Pteridium aquilinum	480
Lycopodium clavatum	125
L. annolinum	289
L. complanatum	208
Total	1 984

In some cases (78 in number) the study areas [1] and the clones of other species, which were used for comparison, had already been dealt with in previous studies (OINONEN 1967 a-c, 1968, 1969, 1970). These have been indicated with a special remark in the appendices in order to make it possible to show in detail how the present material is connected with previous studies. Some of the clones are growing in localities known from history, thus providing support for the checking of results. The battle stations and battle fields of 1941 at Hanko peninsula were given special attention

[1] An example of this is the 26 m, arc-shaped clone on the island of Hynninsaari, Punkaharju (Appendix 2, no. 114). The clone is detached and grows in a plain area, and when looking at it from the top of a nearby hill, one can easily distinguish it from the moss cover because of the semi-circular, arc-shaped spot of color it forms.

[2] Measuring was carried out at ground level. Usually only the largest diameter of the clones was determined, but on some occasions, their greatest width was also measured at right angles to their length.

[1] In the present study the concept »study area» refers to a locality where data have been collected, which has been burned by the same fire and in which the tree stand is uniform with regard to its history. In large study areas where certain parts had been burned by more recent fires, the subareas thus formed were considered as being separate study areas when making comparisons between stands and these later fire dates.

in this study in order to establish the maximum size of clones with regard to time (Appendix 1, no. 14).

The following table shows the number of cases in which oak fern and may-lily stands could be compared against replicates, clones of species used for comparison, butt age of the tree stand and time after fire.

	Carp.dr.	Mai.b.	Conv.m.	Cal.e.	Pt.a.	L.cl.	L.a.	L.c.	Age of trees	Date of fire [2]
Carp.dr.[1]	59	32	61	46	141	43	70	66	113	78
Mai.b.		66	74	55	114	47	81	73	102	76

The number of bracken clones included in the present material is relatively large because of the fact that the presence of this species was considered of essential importance in the selection of study areas. Bracken was the first species studied in the present series of investigations, and thus, of central importance for its continuation. Particularly in the beginning of the study, stands of other species were measured on the same sites only when they were detached or showed a circular form, or when they had distinct, individual characteristics.

If replicates of the species under study are disregarded, it may be concluded that oak fern and may-lily can be compared, on the same sites, with the stands of a maximum of seven other species and two date estimates obtained from borings on the tree stand. There is, however, only one case in which the species of study could be compared with this maximum number of other plant species, and, it was on an exceptional study area: the battle stations of 1941 on the Hanko peninsula, which in this connection were considered as one study area. The numbers of species used for comparison in various study areas were as follows:

Carpogymnia dryopteris

Number of species for comparison	0	1	2	3	4	5	6	7	Total
Number of study areas	3	51	28	44	27	16	4	1	174

Maianthemum bifolium

Number of species for comparison	0	1	2	3	4	5	6	7	Total
Number of study areas	1	26	35	32	25	20	13	1	153

The study material included the following numbers of stands having a common point of origin, or which overlapped or had a common tangent:

Number of stands

	Conv.m.	Cal.e.	Pt.a.	L.cl.	L.a.	L.c.
Carp.dr.	1	—	17	1	4	3
Mai.b.	2	4	5	1	5	3
Pt. a.	2	—	—	2	4	1
L.a.	1	—	—	—	—	1
L.c.	2	—	—	—	—	—

Parallel series of data were compared using the least squares method.[1] For each species, the largest stand representative of a certain size class was taken into consideration, and in the case of the *Lycopodium* species, only those which were assumed to be primary stands.

As the material contains a number (89) of study areas in which additional stands were

[1] In this and in the following context, the abbreviations refer to various plant species as follows:

Carp. dr. = *Carpogymnia dryopteris*
Mai.b. = *Maianthemum bifolium*
Conv. m. = *Convallaria majalis*
Cal. e. = *Calamagrostis epigeios*
Pt. a. = *Pteridium aquilinum*
L. cl. = *Lycopodium clavatum*
L.a. = *L. annotinum*
L.c. = *L. complanatum*

[2] This group also includes certain other precise dates concerning regeneration by diaspores, based on war events, abandoning of fields, draining and reforestation. Uncertain dates of fire, or those indicated with a question mark in the appendices, on the other hand, are not included.

[1] Mr. Pertti Hari, Phil.lic., was kind enough to perform the computing required at the Computing Center, University of Helsinki.

investigated and measured in various years, the age of the stands measured in a certain study area is not always exactly the same. In the study areas referred to here, the differences in age between various stands ranged from one to six years, the arithmetical mean being 2.4 years when weighted by the number of cases. These inaccuracies in age determination, however, are primarily concerned with old bracken and *Lycopodium* stands only, for which an error of a few years is of minor importance. The figures obtained from measurements could have been corrected with the aid of average data from the time tables already prepared, but this was not considered necessary.

3. RESULTS OF THE STUDY

31. Regressions between various data

The comparison carried out on the size of stands of various species included all the parallel stands listed in Appendices 1 and 2, except for the largest pair in the latter, which comprised a 155.5 m may-lily and a 489 m bracken stand (no. 121). One end of this may-lily stand touches a road, and may thus have been cut at its edge; consequently, there is the possibility that the potential size of this stand could be slightly larger than shown by measurement.

There are also a few other, large stands which could have been disregarded in this study because, if the data obtained from measurements on them include errors, for example, due to fires after the date of their emergence, such errors have relatively greater effect on the results in these large stands than the inaccuracies occurring in smaller stands. However, setting an upper limit for the size of the population members used in the regression analysis, would have meant subjective selection and might have given the results an erroneous weight, and so it was decided to use all of the material in the calculations. This solution was also supported by the high degrees of correlation found between the numerical series used.

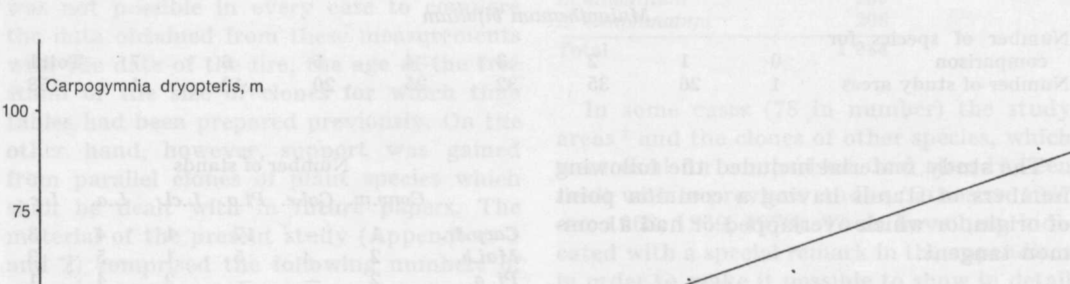

Fig. 4. The regression between oak fern and bracken.

$$y = 0.317 + 0.347\,x$$

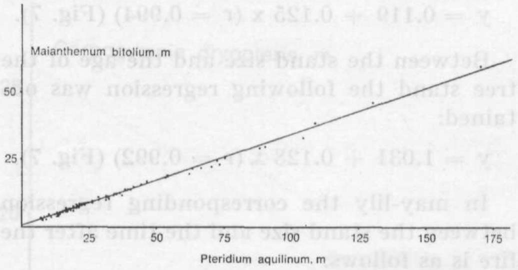

Fig. 5. The regression between may-lily and bracken.
$y = 0.485 + 0.339\ x$

311. Oak fern and may-lily stands in comparison with those of *Pteridium aquilinum*

On the basis of comparison carried out on 142 pairs of oak fern and bracken stands, the regression between their size is as follows:

$y = 0.317 + 0.347\ x\ (r = 0.997)$ (Fig. 4).

The corresponding regression between may-lily and bracken stands as based on the comparison between 111 pairs is as follows:

$y = 0.485 + 0.339\ x\ (r = 0.997)$ (Fig. 5).

A stand size of 100 m in bracken (corresponding to an age of about 283 years; OINONEN 1967 c, 1969, pp. 10—13) corresponds to a stand size of 35.0 m in *Carpogymnia dryopteris* and 34.4 m in *Maianthemum bifolium.*

312. Oak fern and may-lily stands in comparison with those of *Convallaria majalis*

The study material covers 59 pairs which allow comparison between the stands of oak fern and lily-of-the-valley. The regression equation obtained is as follows:

$y = 0.213 + 0.998\ x\ (r = 0.998)$.

Comparison between may-lily and lily-of-the-valley was performed on 72 pairs, and the regression equation obtained was as follows:

$y = 0.191 + 0.981\ x\ (r = 0.995)$.

A stand size of 35.4 m in *Convallaria majalis* (corresponding to 100 m in bracken; OINONEN 1969, p. 10) corresponds to 35.5 m in oak fern and 34.9 m in may-lily.

313. Oak fern and may-lily stands in comparison with those of *Calamagrostis epigeios*

The following regression equation was obtained for the relationship between the stand size in oak fern and wood small-reed on the basis of 45 pairs of stands:

$y = 0.264 + 0.991\ x\ (r = 0.998)$.

Comparison between the stands of may-lily and wood small-reed was based on 56 pairs of stands and gave the following equation:

$y = 0.377 + 0.993\ x\ (r = 0.996)$.

A stand size of 35.3 m in wood small-reed (corresponding to 100 m in bracken; OINONEN 1969, p. 13) corresponds to a stand size of 35.2 m in oak fern and 35.1 m in may-lily.

314. Oak fern and may-lily stands in comparison with those of *Lycopodium clavatum*

Comparison between oak fern and *Lycopodium clavatum* was performed on a total of only 36 pairs of stands. The following regression equation was obtained:

$y = 2.690 + 0.248\ x\ (r\ 0.995)$.

The corresponding comparison between may-lily and *Lycopodium clavatum* was based on 44 pairs of stands, and here the regression equation obtained was as follows:

$y = 2.533 + 0.256\ x\ (r = 0.989)$.

A stand size of 131 m in *Lycopodium clavatum* (corresponding to 100 m in bracken; OINONEN 1969, p. 11) corresponds to a stand size of 35.2 m in oak fern and 36.2 m in may-lily.

315. Oak fern and may-lily stands in comparison with those of *Lycopodium annotinum*

Comparison was performed between oak fern and *Lycopodium annotinum* on 67 pairs of stands. The regression obtained is as follows:

$$y = 2.020 + 0.301\,x \ (r = 0.992).$$

Comparison between may-lily and *Lycopodium annotinum* was carried out using 77 pairs of stands, and here the following regression equation was obtained:

$$y = 2.197 + 0.875\,x \ (r = 0.985).$$

A stand size of 115 m in *Lycopodium annotinum* (corresponding to 100 m in bracken; OINONEN 1969, p. 11) corresponds to a stand size of 36.7 m in oak fern and 35.2 m in may-lily.

316. Oak fern and may-lily stands in comparison with those of *Lycopodium complanatum*

Comparison between oak fern and ground pine was made on 61 pairs of stands and gave following regression:

$$y = 2.315 + 0.414\,x \ (r = 0.998).$$

Comparison between may-lily and ground pine was based on 64 pairs, and the regression equation obtained was as follows:

$$y = 2.560 + 0.382\,x \ (r = 0.993).$$

A stand size of 82 m in *Lycopodium complanatum* (corresponding to 100 m in bracken; OINONEN 1969, p. 12) corresponds to a stand size of 36.3 m in oak fern and 33.9 m in may-lily.

317. Stands of oak fern in comparison with those of may-lily

Comparison was performed on only 30 pairs of stands. The regression equation obtained is as follows:

$$y = 0.123 + 1.023\,x \ (r = 0.995) \ \text{(Fig. 6)}.$$

A stand size of 34.3 m in may-lily (corresponding to an age of about 283 years; see Section 318) corresponds to a stand size of 35.1 m in oak fern.

318. The size of oak fern and may-lily stands in comparison with the date of fire and the age of the tree stand

In oak fern the regression between the stand size and the time that has elapsed since the fire is as follows:

$$y = 0.119 + 0.125\,x \ (r = 0.994) \ \text{(Fig. 7)}.$$

Between the stand size and the age of the tree stand the following regression was obtained:

$$y = 1.031 + 0.128\,x \ (r = 0.992) \ \text{(Fig. 7)}.$$

In may-lily the corresponding regression between the stand size and the time after the fire is as follows:

$$y = 0.254 + 0.120\,x \ (r = 0.994) \ \text{(Fig. 8)},$$

and, correspondingly, the regression between the stand size and the age of the tree stand, is as follows:

$$y = 0.587 + 0.130\,x \ (r = 0.987) \ \text{(Fig. 8)}.$$

3181. Rate of vegetative spreading in oak fern and may-lily

On the basis of the results obtained from the present material, 12.6 cm is annually added to the diameter of the stands of oak fern, which means that radial growth of the stands is 6.3 cm per year.

The corresponding rate of spreading in may-lily is 12.3 cm per year, or 6.1. cm in radial direction.

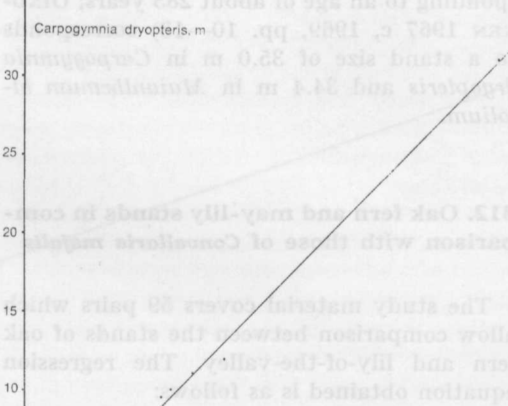

Fig. 6. The regression between oak fern and may lily.

$$y = 0.123 + 1.023\,x$$

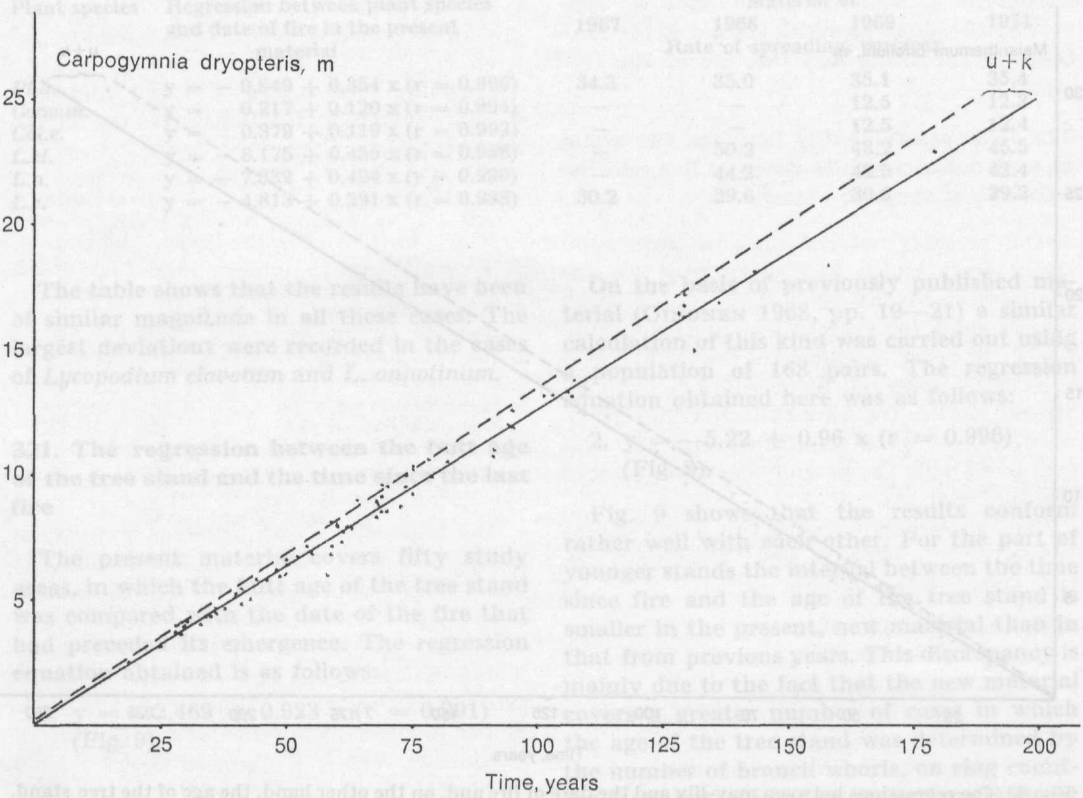

Fig. 7. The regressions between oak fern and the date of fire and, on the other hand, the age of the tree stand.

$$y = 0.119 + 0.125\,x \text{ and } y = 1.031 + 0.128\,x$$

u + k = the date of regeneration + the butt age

The rate of vegetative spreading is consequently of similar magnitude in both these species; simultaneously, it is of similar magnitude as that of *Convallaria majalis* and *Calamagrostis epigeios*, which both spread at a rate of 12.5 cm per year (Oinonen 1969, p. 13).

319. Compilation of the results obtained from the comparisons performed

As shown by the table presented below, the results obtained from the comparisons related in the foregoing context do not vary to any large extent. The results of greatest accuracy

Material used for comparison	Stand size at the age of 283 yrs, m (*Pl.a.* = 100 m) *Carp.dr.*	*Mai.b.*
Pl.a., time table of spreading	35.0	34.4
Conv.m., » » »	35.5	34.9
Cal.e., » » »	35.2	35.1
L.cl., » » »	35.2	36.2
L.a., » » »	36.7	35.2
L.c., » » »	36.3	33.9
Time since fire	35.5	34.3
Size of *Carp.dr.* according to regression when that of *Mai.b.* = 34.3 m	35.2	34.3
Average	35.6	34.9

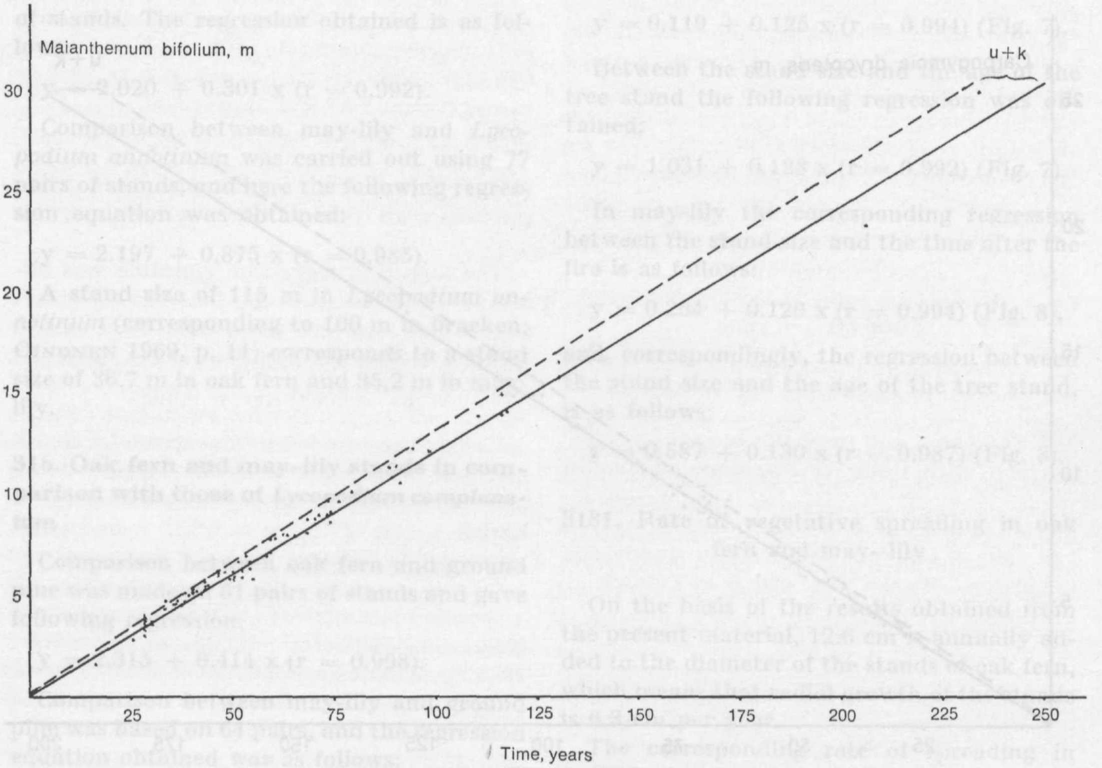

Fig. 8. The regressions between may-lily and the date of fire and, on the other hand, the age of the tree stand.
$y = 0.254 + 0.120\,x$ and $y = 0.587 + 0.130\,x$
$u + k$ = the date of regeneration + the butt age

were obtained from comparisons with the date of fire because this could be determined with a great degree of accuracy; thus the only variation occurring was in the size of the stands. On the other hand, in comparisons carried out on the stand size between two different plant species, there is variation in both of the members forming the pair of comparison.

The table shows that bracken, lily-of-the-valley and wood small-reed are of nearly equal value when used for comparisons between stands of oak fern and may-lily and those of other species growing on the same site. The species mentioned above gave results which were almost identical to those obtained from comparisons with the date of fire; consequently, in comparisons of this kind, each one of them can be used as a substitute for any other species. As regards the minimum time between the fire and regeneration by diaspores, as well as the evenness of vegetative spreading, these five species are probably rather similar.

Variation in this respect is clearest and most capricious in the *Lycopodium* species, and this is easily understandable considering the fact that their manifestation time shows appreciable variation (OINONEN 1968, p. 29). In addition, the rate of vegetative spreading is not so even in *Lycopodium* as in the species mentioned above.

320. The stand size of the species used for comparison as compared with the date of fire

The next table includes the data required for a comparison with the results of previous studies (OINONEN 1967 a, c; 1968; 1969).

Plant species	Regression between plant species and date of fire in the present material	Material of 1967	1968	1969	1971
		Rate of spreading, cm/year			
Pt.a.	y = − 0.649 + 0.354 x (r = 0.996)	34.3	35.0	35.1	35.4
Conv.m.	y = 0.217 + 0.120 x (r = 0.994)	–	–	12.5	12.3
Cal.e.	y = 0.379 + 0.119 x (r = 0.992)	–	–	12.5	12.4
L.cl.	y = − 8.175 + 0.455 x (r = 0.988)	–	50.2	48.2	45.5
L.a.	y = — 7.339 + 0.424 x (r = 0.990)	–	44.2	42.5	42.4
L.c.	y = − 4.813 + 0.291 x (r = 0.988)	30.2	29.6	30.6	29.2

The table shows that the results have been of similar magnitude in all these cases. The largest deviations were recorded in the cases of *Lycopodium clavatum* and *L. annotinum*.

321. The regression between the butt age of the tree stand and the time since the last fire

The present material covers fifty study areas, in which the butt age of the tree stand was compared with the date of the fire that had preceded its emergence. The regression equation obtained is as follows:

1. y = —2.469 + 0.923 x (r = 0.991) (Fig. 9).

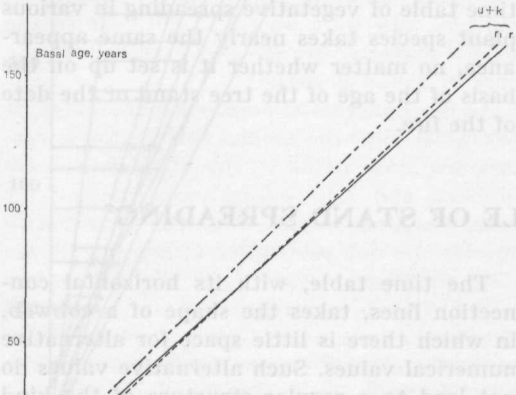

Fig. 9. Regression between the butt age of the tree stand and the time after the fire preceding the emergence of the stand in question.

y = −2.469 + 0.923 x
u + k = the date of regeneration + the butt age
r = regression according to the present material
r_1 = regression according to the previous material (y = −5.22 + 0.96 x; OINONEN 1968, p. 20)

On the basis of previously published material (OINONEN 1968, pp. 19—21) a similar calculation of this kind was carried out using a population of 168 pairs. The regression equation obtained here was as follows:

2. y = —5.22 + 0.96 x (r = 0.996) (Fig. 9).

Fig. 9 shows that the results conform rather well with each other. For the part of younger stands the interval between the time since fire and the age of the tree stand is smaller in the present, new material than in that from previous years. This discrepancy is mainly due to the fact that the new material covers a greater number of cases in which the age of the tree stand was determined by the number of branch whorls, on ring counting from low stumps or on borings taken at the root collar. The age in these ways obtained is slightly larger than the corresponding value as obtained from borings at a height of 30 cm or higher. Both in the previous and *in the present material*, the margin between the length of the time after fire and the age of the tree stand increases with increasing stand age, although the change is negligible up to a stand age of at least 100 years (Fig. 9).

As mentioned in the introduction, fire date determinations may include a few erroneous interpretations despite the fact that all uncertain cases were removed from the material. This is due to the fact that the limits of the areas touched by the fire could only be determined in a few cases, and in addition, because the age could not always be determined on the very spot where the plant stands under examination were growing. The proportion of such erroneous age determinations in the material can be found out by comparing the stand size with the age of the tree stand. Stand age includes no misinterpretations, and this is also true for the size of detached stands.

The next section gives a comparison between the date of fire as obtained by converting the stand size with the aid of the time table of spreading and the age of the tree stand.

322. The relationships between the stand size as converted into dates of fire and the butt age of the tree stand

The present material includes data from study areas which have been used for the compilation of the time table of the plant species used for comparison in this partial study. In order to eliminate the influence of such study areas on the results, i.e., to avoid vicious circles, the data collected from them were treated as a separate group (4), and compared with the new, independent part of the material (3).

The regressions between the stand size as converted into dates of fire [1] and age of the tree stand are as follows:

3. The new material:
$y = -1.159 + 0.899\,x\ (r = 0.989)$

4. The previous material:
$y = -5.553 + 0.976\,x\ (r = 0.994)$

The regression between the butt age and the date of fire as presented in Section 321 is as follows:

1. The new material:
$y = -2.469 + 0.923\,x\ (r = 0.991)$

[1] Including all the plant species of the study.

2. The previous material:
$y = -5.22 + 0.96\,x\ (r = 0.996)$

Inserting the values $x = 100$ and $x = 200$ years in these equations gives the following results:

	Date of fire $x = 100$, $x = 200$ years	
	Age of tree stand, years	
3. The new material, stand size/date of fire	89	179
1. The new material, age/date of fire	90	182
4. The previous material, stand size/date of fire	92	187
2. The previous material, age/date of fire	91	187

The table shows that different methods of comparison give almost similar results. At the age of 100 years the variation ranges from 1.2 to 3.6 %, and at the age of 200 years, from 1.9 to 4.4 %. On the basis of this result it may be concluded that the possible errors occurring in the determinations of the dates of fire are few in number and negligible in magnitude. The new material shows a good conformity with the previous material. The time table of vegetative spreading in various plant species takes nearly the same appearance, no matter whether it is set up on the basis of the age of the tree stand or the date of the fire.

4. COMPARATIVE TIME TABLE OF STAND SPREADING

Fig. 10 shows the regression lines of vegetative spreading in the plant species dealt with in the present study as compared with the date of fire. The lines are representative of the average maximum rate of spreading in the study areas covered by the material, because, when more than one stand of the same size category was found in a study area, only the largest one was taken into consideration. A number of the best examples included in Appendices 1 and 2 are presented in the figure to show how the parallelity of various plant species conforms to the time table. This material includes also stands for which data have been presented in previous papers, thus showing the connection between the new and the previous material.

The time table, with its horizontal connection lines, takes the shape of a cobweb, in which there is little space for alternative numerical values. Such alternative values do not lead to a regular structure of the kind presented. If, for some species, spreading values at variance with those presented here are tested, the whole structure collapses due to contradictions. According to the material obtained from the battle grounds at Hanko peninsula (from the year 1941), however, the maximum rate of spreading, both in oak fern and in may-lily, is slightly greater than indicated by the average maximum stand size obtained from the study areas of the present work, or about 14 cm/year, in the case of diameter growth, and about 7 cm/

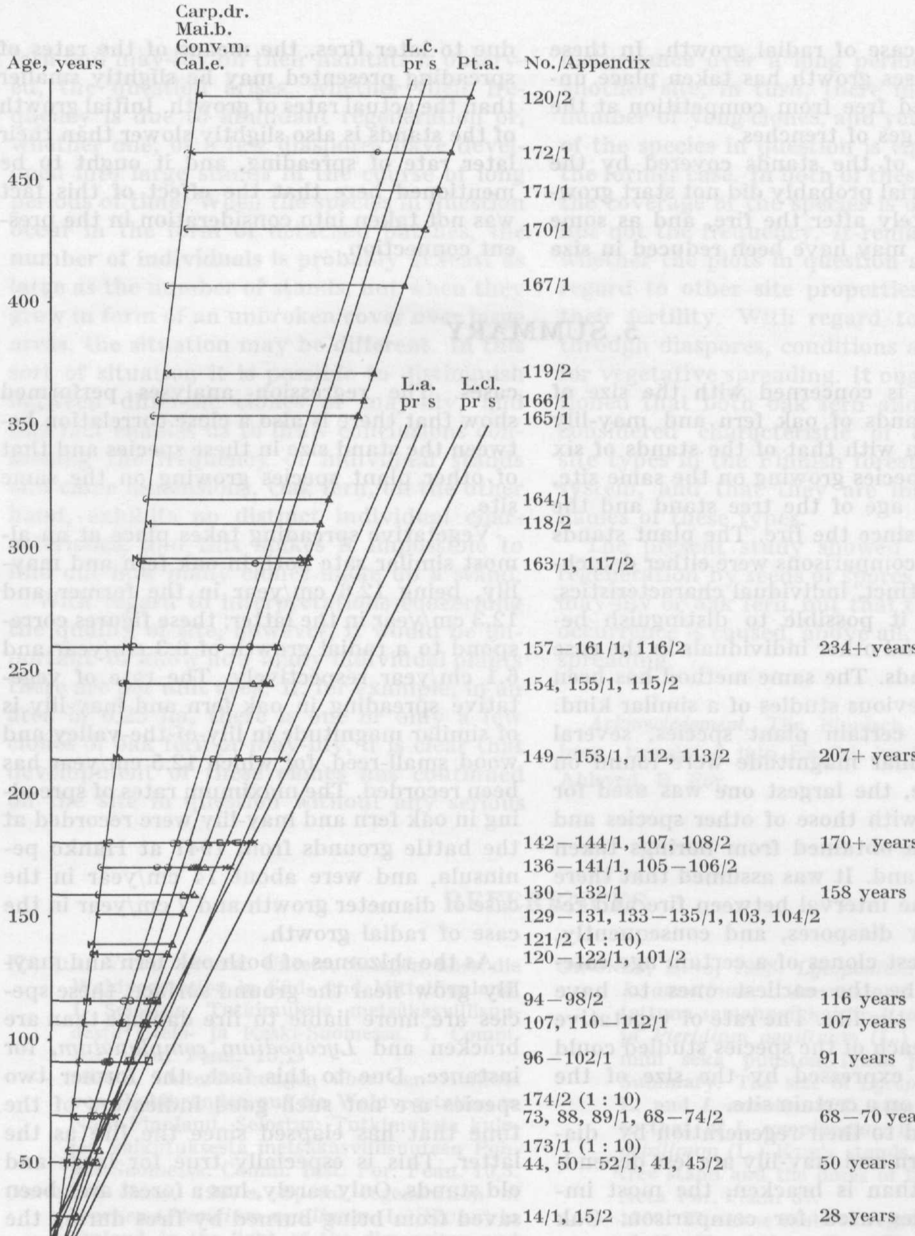

Fig. 10. Time table of the rate of vegetative spreading in various plant species.

C = *Carp.dr.* = *Carpogymnia dryopteris*
M = *Mai.b.* = *Maianthemum bifolium*
ᗜ = *Conv.m.* = *Convallaria majalis*
+ = *Cal.e.* = *Calamagrostis epigeios*
△ = *Pt.a.* = *Pteridium aquilinum*
× = *L.cl.* = *Lycopodium clavatum*
□ = *L.a.* = *L. annotinum*
○ = *L.c.* = *L. complanatum*
pr = primary stands, s = secondary stands

year, in the case of radial growth. In these maximum cases growth has taken place unhampered and free from competition at the bottom or edges of trenches.

As a part of the stands covered by the present material probably did not start growing immediately after the fire, and as some of the stands may have been reduced in size due to later fires, the means of the rates of spreading presented may be slightly smaller than the actual rates of growth. Initial growth of the stands is also slightly slower than their later rate of spreading, and it ought to be mentioned here that the effect of this fact was not taken into consideration in the present connection.

5. SUMMARY

The paper is concerned with the size of individual stands of oak fern and may-lily in comparison with that of the stands of six other plant species growing on the same site, and with the age of the tree stand and the time elapsed since the fire. The plant stands used in these comparisons were either detached or had distinct, individual characteristics, which made it possible to distinguish between them and other individuals in the case of mixed stands. The same method has been applied to previous studies of a similar kind.

When, for certain plant species, several stands of similar magnitude were found on the same site, the largest one was used for comparisons with those of other species and with the data obtained from borings taken on the tree stand. It was assumed that there may be a time interval between fire and regeneration by diaspores, and consequently, that the largest clones of a certain age category would be the earliest ones to have emerged after the fire. The rate of vegetative spreading in each of the species studied could thus be best expressed by the size of the largest clones on a certain site.

With regard to their regeneration by diaspores, oak fern and may-lily are less dependent on fires than is bracken, the most important species used for comparison. Oak fern and may-lily emerge rather frequently in place where the humus layer or mineral soil has been uncovered in one way or another, provided that the soil is sufficiently moist. Likewise, they appear on sites burned by fires, often quite soon after the fire.

Vegetative spreading takes place at a rather even rate in both of these species. On the basis of the present material, it can be concluded that the correlation between the stand size of oak fern and may-lily and the date of fire and age of the tree stand is good in most cases. The regression analyses performed show that there is also a close correlation between the stand size in these species and that of other plant species growing on the same site.

Vegetative spreading takes place at an almost similar rate both in oak fern and may-lily, being 12.6 cm/year in the former and 12.3 cm/year in the latter; these figures correspond to a radial growth of 6.3 cm/year and 6.1 cm/year respectively. The rate of vegetative spreading in oak fern and may-lily is of similar magnitude in lily-of-the-valley and wood small-reed, for which 12.5 cm/year has been recorded. The maximum rates of spreading in oak fern and may-lily were recorded at the battle grounds from 1941 at Hanko peninsula, and were about 14 cm/year in the case of diameter growth and 7 cm/year in the case of radial growth.

As the rhizomes of both oak fern and may-lily grow near the ground surface, these species are more liable to fire damage than are bracken and *Lycopodium complanatum*, for instance. Due to this fact, the former two species are not such good indicators of the time that has elapsed since the fire as the latter. This is especially true for large and old stands. Only rarely, has a forest area been saved from being burned by fires during the last 150—200 years. All fires are not disastrous; the study material includes single stands of oak fern and may-lily which have reached a considerable size, and which, on the basis of comparisons with the stands of other species found on the same sites, most probably are clones. Evidently, the individual stands of these two species are immortal. Death can only be caused by external factors, and vegetative spreading arrested only by various obstacles.

When the frequency of occurrence of oak

fern and may-lily on their habitats is observed, the question arises, whether their frequency is due to abundant regeneration or, whether one, or a few diaspores have developed into large stands in the course of long periods of time. When the species in question occur in the form of detached patches, the number of individuals is probably at least as large as the number of stands, but when they grow in form of an unbroken cover over large areas, the situation may be different. In this sort of situation it is possible to distinguish between different clones of may-lily, and this fact enables us to draw conclusions concerning the frequency of individual stands and clone dimensions. Oak fern, on the other hand, exhibits no distinct individual characteristics, and this makes it impossible to find out how many clones make up a stand.

With regard to interpretations concerning the quality of site, however, it would be important to know how many individual plants there are per unit area. If, for example, in an area of 0.25 ha, there is one or only a few clones of oak fern or may-lily, it is clear that development of these clones has continued on the site in question without any serious disturbance over a long period of time. On another site, in turn, there may be a large number of yong clones, and yet, the coverage of the species in question is equal to that in the former case. In both of these sample plots the coverage of the species is of equal value, but not the frequency. It remains uncertain, whether the plots in question are equal with regard to other site properties, particularly their fertility. With regard to regeneration through diaspores, conditions are not similar for vegetative spreading. It ought to be mentioned that both oak fern and may-lily are considered characteristic of certain forest site types in the Finnish forest classification system, and that they are included in the names of these types.

The present study showed that no mass regeneration by seeds or spores takes place in may-lily or oak fern, but that their abundant occurrence is caused, above all, by vegetative spreading.

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KASVULLISEN LEVIÄMISEN AIKATAULU METSÄIMARTEELLA (*CARPOGYMNIA DRYOPTERIS* (L.) LÖVE & LÖVE) JA ORAVANMARJALLA (*MAIANTHEMUM BIFOLIUM* (L.) F. W. SCHMIDT) ETELÄ-SUOMESSA.

SELOSTE

Johdanto

Tässä tutkimuksessa on selvitetty kasvullisen leviämisen nopeutta metsäimarteella (*Carpogymnia dryopteris* = *Dryopteris linnaeana*) ja oravanmarjalla (*Maianthemum bifolium*) kloonien laajuuden ja iän perusteella. Näiden lajien yksinäisten tai yksilötunnusten (kuvat 1–3) avulla erotettujen kasvustojen laajuutta on verrattu samanpaikkaisen puuston tai puustojakson ikään ja kuloista kuluneeseen aikaan. Muutamilla näytealoilla on voitu käyttää hyväksi myös paikallishistoriasta saatuja tietoja metsikön syntymävaiheista. Kasvustojen laajuutta on verrattu niin ikään muiden kasvilajien samanpaikkaisiin esiintymiin, erityisesti niihin lajeihin, joiden kasvullisen leviämisen aikataulu on saatu kootuksi aikaisemmissa tutkimuksissa (Oinonen 1967–69).

Keskeisimpänä vertailulajina on ollut sanajalka (*Pteridium aquilinum*), jolla on joukko hyviä yksilötunnuksia ja jonka kloonit ovat varsin tasaisesti leviäviä ja usein suuria ja vanhoja. Riittävän vanhojen puustojen puuttuessa, ja paloaikojen jäädessä niin muodoin ratkaisemattomiksi, on sanajalkaesiintymiä voitu käyttää eräänlaisina sijaisina ajan määrityksissä leviämisaikataulun avulla. Koska suurten yksinäiskasvustojen laajuuden aitous jää usein epävarmaksi – kasvusto on voinut osaksi tuhoutua myöhemmissä kuloissa – niin saman suuruuden samanpaikkaiset toistumat ovat tällöin parhaana varmennuksena laajuuden aitoudelle. Saman varmennuksen antavat myös muiden lajien rinnakkaissuuruiset kasvustot toistumineen. Näistä syistä on aineiston keruussa otettu huomioon kaikki ne kasvilajit, joiden leviämisaikataulu on jo saatu ratkaistuksi.

Kasvustojen yksilöiminen

Oravanmarjan yksilökokonaisuuksien erottelussa on käytetty hyväksi pääasiassa lehtimuodon yksilöllistä vaihtelua (kuvat 1–3). Apukriteerinä on ollut usein esiintymän yksinäisyys ja ympyrämäinen muoto. Joissakin tapauksissa on erillisiä klooneja voitu rajoittaa myös sekakasvustoista.

Metsäimarteelta ei löydetty rakenteellisia, silmin havaittavia yksilötunnuksia, vaan oli tyydyttävä vain edellä mainittuihin apukriteereihin. Syksyllä, lehtien kellastuessa, todettiin joskus värieroja eri kasvustoissa.

Molempien lajien kohdalla olivat tärkeänä arvosteluperusteena saman kasvustosuuruuden toistumat ja toisten kasvilajien paralleeliset kasvustot. Eri ikäisistä ja eri aikoina palaneista metsiköistä mitattujen kasvustolaajuuksien tuli olla suoraviivaisessa regressiosuhteessa keskenään, mikäli kasvustojen yksilöimisperusteet olivat oikeat.

Aineisto

Aineisto on kerätty Etelä-Suomesta, painopisteen ollessa lounaisessa osassa aluetta. Mitattuja esiintymiä on n. 400 kpl sekä metsäimarteella että oravanmarjalla. Näistä on 280 metsäimarrekasvustoa (174 näytealaa) ja 258 oravanmarjakasvustoa (153 näytealaa) voitu sisällyttää tulosten laskentaan (liitteet 1 ja 2). Vertailulajien kasvustojen lukumäärät ilmenevät asetelmasta sivulla 11. Osa näytealoista on samoja, jotka ovat olleet esillä aikaisemmissa julkaisuissa (Oinonen 1967–70). *Nämä on* osoitettu erikseen liitetaulukoissa.

Tulokset

Aineiston rinnakkaisia lukusarjoja on verrattu pienimmän neliösumman menetelmän avulla. Kunkin lajin saman suuruusluokan toistumista on otettu huomioon suurin ja liekolajien kasvustoista vain primaarisiksi oletetut.

Vertailukohteiden väliset regressiot ilmenevät oheisesta luettelosta.

Metsäimarre/Sanajalka

$y = 0.317 + 0.347\,x\ (r = 0.997)$ kuva 4

Oravanmarja/Sanajalka

$y = 0.485 + 0.339\,x\ (r = 0.997)$ » 5

Metsäimarre/Kielo

$y = 0.213 + 0.998\,x\ (r = 0.998)$

Oravanmarja/Kielo

$y = 0.191 + 0.981\,x\ (r = 0.995)$

Metsäimarre/Hietakastikka

$y = 0.264 + 0.991\,x\ (r = 0.998)$

Oravanmarja/Hietakastikka

$y = 0.377 + 0.993\,x\ (r = 0.996)$

Metsäimarre/Katinlieko

$y = 2.690 + 0.248\,x\ (r = 0.995)$

Oravanmarja/Katinlieko

y = 2.533 + 0.256 x (r = 0.989)

Metsäimarre/Riidenlieko

y = 2.020 + 0.301 x (r = 0.992)

Oravanmarja/Riidenlieko

y = 2.197 + 0.875 x (r = 0.985)

Metsäimarre/Keltalieko

y = 2.315 + 0.414 x (r = 0.998)

Oravanmarja/Keltalieko

y = 2.560 + 0.382 x (r = 0.993)

Metsäimarre/Oravanmarja

y = 0.123 + 1.023 x (r = 0.995) kuva 6

Metsäimarre/Palosta kulunut aika

y = 0.119 + 0.125 x (r = 0.994) —»— 7

Oravanmarja/Palosta kulunut aika

y = 0.254 + 0.120 x (r = 0.994) —»— 8

Metsäimarre/Puuston ikä

y = 1.031 + 0.128 x (r = 0.992) —»— 9

Oravanmarja/Puuston ikä

y = 0.587 + 0.130 x (r = 0.987) —»— 9

Tulokset ovat jokseenkin yhtäpitävät eri vertailuissa, kuten ilmenee asetelmasta sivulla 15, missä kasvustojen laajuus on muunnettu 283 vuoden ikää vastaavaksi (*Pteridium aquilinum* = 100 m) eri vertailukohteiden kautta.

Kasvullisen leviämisen nopeus metsäimarteella ja oravanmarjalla

Metsäimarre leviää 12.6 cm/v. kokonaisena kasvustona eli 6.3 cm/v. säteen suuntaan.

Oravanmarja leviää 12.3 cm/v. kokonaisena kasvustona eli 6.1 cm/v. säteen suuntaisesti.

Leviämisnopeus on laskettu keskiarvona näytealoittaisista enimmäisarvoista. Maksiminopeus on molemmilla n. 14 cm/v. kokonaisissa kasvustoissa.

Metsäimarteen ja oravanmarjan leviämisnopeus on aineiston mukaan jokseenkin tarkoin sama kuin kielolla ja hietakastikalla, joilla se on 12.5 cm/v. kokonaisissa kasvustoissa (Oinonen 1969, s. 13). Leviämisen maksiminopeus on myös likimain yhtä suuri kaikilla neljällä lajilla.

Tarkistus

Koska kasvustolaajuuksia on verrattu kahteen aikalukemaan, puuston ikään ja palosta kuluneeseen aikaan, on mahdollista vertailla keskenään näiden toisistaan riippumattomien lukusarjojen antamia tuloksia. Tässä on menetelty siten, että kasvustolaajuudet (kaikki lajit yhdessä) on muunnettu paloajoiksi ja laskettu näin saadun lukusarjan regressio puuston ikään. Vertailukohtana on kairausten avulla esiin saatujen paloaikojen ja puuston iän välinen regressio (kuva 9).

Tulokset ovat seuraavat:

Puuston ikä/Paloajoiksi muunnetut kasvustolaajuudet:

1. y = −1.159 + 0.899 x (r = 0.989)

Puuston ikä/Paloaika kairausten mukaan:

2. y = − 2.469 + 0.923 x (r = 0.991)

Kun paloajalle (x) annetaan arvot 100 ja 200 v., on puuston ikä:

Yhtälössä 1. 89 v. ja 179 v., ja

yhtälössä 2. 90 v. ja 182 v.,

joten tulokset ovat hyvin yhtäpitävät.

Laskelma osoittaa, että mikäli paloajoikojen määrityksissä on sattunut erehdyksiä — kairauksia ei voitu kaikkialla suorittaa täysin samanpaikkaisesti ja toisaalta ei voitu määrittää tarkoin paloalueiden rajoja — ne ovat olleet pieniä ja niitä on ollut vähän.

Kasvustojen leviämisen rinnakkaisaikataulu

Kuvaan 10 on koottu tässä tutkimuksessa käsiteltyjen kasvilajien kasvullista leviämistä osoittavat, paloaikoihin perustuvat regressiosuorat. Joukko parhaita esimerkkejä liitetaulukoista 1 ja 2 on merkitty näille suorille vaakasuorin yhdysviivoin osoittamaan havainnollisesti eri lajien sekä uuden ja aikaisemman aineiston kytkeytymistä toisiinsa näytealoilla.

Rinnakkaisuuksissa saattaa olla joissakin tapauksissa osuutta sattumalla, mutta suurin osa lienee kuitenkin todellisia klooneja. Tämä varaus koskee erityisesti metsäimarretta, jolta ei löydetty sopivia yksilötunnuksia, sekä vertailulajeista katin- ja riidenliekoa ja hietakastikkaa.

Suuret kasvustot viittaavat potentiaalisesti rajattomaan kasvulliseen leviämiseen kaikilla tutkimuksen kasvilajeilla.

Appendix 1. *Carpogymnia dryopteris* stands and their parallels on the same site.

No.	Size of the stand, m							
	Carp.dr.	Mai.b.	Conv.m.	Cal.e.	Pt.a.	L.cl.	L.a.	L.c.
1	2.5×2.3, 2.1	—	—	—	6.0	1.6	—	—
2	2.7	2.6, 2.3, 2.2	3.1	—	—		0.2 (6 v.)	—
3	2.8×2.7, 2.7	—	—	—		1.2	0.4	—
4	3.1	—	3.2	—	—	—	2.8×2.8	—
5	3.1, 2.8	2.8, 2.6	3.2, 3.0, 2.9	—	8.1, 7.9, 5.5	—	4.7, 4.6, 4.3, 4.0	2.6, 2.1, 1.9
6	3.3×3.1	—	2.6, 2.5	—	8.3	—	—	0.8
7	*3.4* [2]			—		—	—	*3.4×3.1*
8	3.5	3.4, 3.4, 3.3	3.9	—	—	—	—	4.0
9	3.5	3.6	3.9	3.5	6.2	—	5.4	0.8
10	3.6, 2.0, 1.9	—	—	—	—	—	4.6—1.0 (52 kpl)	—
11	3.6, 3.5, 3.0	—	—	—	—	—	—	—
12	3.6, 3.6, 3.2	2.4	—	—	7.6×7.5	—	4.7, 4.4, 2.8	3.2, 2.7, 2.2
13	3.7	3.7	3.5	—	9×9			—
14	3.9, 3.5, 3.2, 3.0	4.0, 4.0, 4.0, 3.8	3.7, 3.5, 3.4, 3.3	3.6, 3.4, 3.4, 3.1	10, 9.5, 9, 9	3.0, 2.5, 2.1, 1.9	4.5, 4.2, 4.1, 4.1	2.6, 2.5, 1.9, 1.6
15	3.9	3.7, 3.6, 3.6	3.8, 3.6, 3.3	3.3	11, 10.5, 10.5 10	4.8, 4.5, 4.0		—
16	4.0		4.3	—	9			
17	4.0×3.7	4.7×4.1		—	—	—	6.6, 6×6	
18	4.1, 4.0, ×3.8	—	—	—	7.2	—		3.3
19	4.1, 4.1, 3.7, 3.2	3.6	4.2, 3.9, 3.8, 3.6	—		8.1×6.0	8.2, 5.4, 4.4, 3.7	4.2×4.0
20	4.2	3.9	—		13.4, 13.1, 10.2	—	7.2×7.1	—
21	4.3	—	4.3	4.3	—	—	6.6, 5.9, 4.3	6.0, 5.8, 3.2
22	4.3, 4.0	4.6, 4.5	4.6, 4.5, 4.4	—	10, 10	—	8.1×8.0	—
23	4.4	—	4.6	4.9	—	5.5	7.3, 5.4	5.8, 4.4
24	4.6	5.1, 4.9, 4.8, 4.6	4.7, 4.6, 4.6, 4.6	—	—	—	8.9, 6.5	—
25	4.6, 4.6, 4.5, 4.5	—	4.3, 4.2, 4.0	—	13.3, 12.9, 11.7	9.1, 7.1	9.7, 8.8, 6.4, 6.2	5.1, 4.4, 4.0
26	4.7		5.2, 4.4	—	—	—	—	—
27	4.7, 4.7	—	4.8, 4.3	—	—	—	11.0, 10.5, 9.4	—
28	4.8, 4.8		4.8	—	14, 13	11.7	10.5	—
29	4.9		—	—	—	—	8.0	—
30	5.0	5.3	—	—	13	—	10.6, 10.1, 8.5	—
31	5.0, 5, 5, 5	5.2		—	14×14, 13	11.8, 11.2	8.5, 8.0	7.3, 7.1, 7.0
32	5.1, 4.8, 4.7	5.1, 5.0, 4.8, 4.7	4.7		13	11.5, 11.4, 10.4	8.2	6.1
33	5.2	5.3×5.3, 5.1, 5.0	—	—	14, 13.5	9.7	8.6, 8.1	8.0
34	5.4	—	—	—	15	11.7	—	—
35	5.4	—	—	—	14, 13	—	—	—
36	5.5	—	—	—	—	—	—	—
37	5.6, 5.4, 5.1, 5.0	—	—	—	14.5	12.7, 12.1, 11.0, 8.3	12.1, 11.9, 11.7, 11.0	—
38	5.7	—	—	—	—	10.6	12.2, 10.1, 8.4	—

Age of the tree stand, years	Date of fire, years ago	Forest site type [1]	Locality	Year	Additional information
67+, 15+	—	OMT	Somero, Levonmäki	1968	Edge of ditch made 19 years ago
19+	—	VT	Pohja, Koppskog	1968	Forest regeneration area
44+, 18+	—	OMT	Pohja, Sällvik	1968	—»—
60+	—	VT	Suomusjärvi, Lahnajärvi	1967	Stumps blasted ca. 25 yrs. ago
60+, 38+, 19+	—	VT	Suomusjärvi, Varesjärvi—Huhdanoja	1967—68	O. 1968, no. 14, p. 46 [4]
52+, 18+	—	VT	Somerniemi, Kaskisto	1968	Forest regeneration area
56+, 20+	—	VT	Sammatti, the vicinity of Lohilampi	1962	—»—
31+, 22+	—	VT	Nummi, Nummensillanoja	1968	—»—
85+, 25+	31?	VT	Kiikala, Iso-Joutseno	1968	Margin in core 30—31 yrs. ago
20+	—	KpKg	Karjalohja, Härjänvatsa	1962	O. 1968, no. 20, p. 46, forested field
40+	—	LhKp	Tammisaaren mlk., Skällargård	1968	28—29 yrs. old ditch
68+, 25+	—	VT	Kiikala, Varesjoki	1967	Forest regeneration area
22+	25—28	VT	Pohja, Raasepori railroad station—Kaskimaa	1965—68	O. 1967 a, no. 1, p. 25
—	—	VT-LhT	Tenhola, Skogby—Harpaskog—Lappohja	1968	Battle stations from 1941, O. 1969, no. 16, p. 20
88+, 23+	30	VT	Lohjan mlk., Muijala	1969	
30+	—	VT	Suomusjärvi, Lahnajärvi	1967	Forest regeneration area
39+	33	VT	Yläne—Säkylä highway, at the border of communes	1965	
27+	—	VT	Sammatti, the vicinity of Lohilampi	1962	Forest regeneration area
114+	—	VT	Suomusjärvi, Laperla	1968	Stumps blasted ca. 30 yrs. ago
35+	?	VT	Karjalohja, Härjänvatsa	1969	Forest regeneration area
65+, 30+	34	VT	Kiikala, Heposuo—Hautakrotit	1967	O. 1969, no. 28, p. 20
78+, 32+	35	VT	Somerniemi, Kaitalammi	1966	
66+, 30+	36	VT	Kiikala, Kakarlammi	1968	
72+, 31+	38	VT-OMT	Lohjan mlk., road 53, at the border of Karjaa mlk.	1968	At the railway
140+, 68+, 29+	36	VT	Suomusjärvi, Huhdanoja	1967	
40+	?	MT	Huittinen, Huhtamo	1966	The stand has emerged after fire
55+, 35+	41?	VT	Suomusjärvi, Lahnajärvi	1967	Margin in core 40—41 yrs. ago
79+, 22+	41	VT-MT	Vihti, Ojakkala	1968	
63+, 30+	37?	OMT	Kiikala, Lammensuo	1966	Margin in core 40—41 yrs. ago
88+	43	VT	Lohjan mlk., Muijala	1969	
54+, 35+	39?	VT	Lohja, Keskilohja	1964	O. 1968, no. 26, p. 40
60+, 31+	38—40	VT	Nummi, Nummensillanoja	1966—68	
83+, 32+	40	VT	Somerniemi, Saarijärvi	1966—67	O. 1968, no. 16, p. 40
72+	41	VT-MT	Karjaan mlk., Meltola	1969	
50+, 35+	42?	OMT	Tenhola, Harparskog—Lappohja	1968	Margin in core 41—42 yrs. ago
40+	?	VT	Lokalahti, Varanpää	1966	Tree stand born after a fire
73+, 39+	?	VT-MT	Pusula, Mäkkylä	1968	
35+	?	VT-MT	Sammatti, Innolampi	1962	

No.	Size of the stand, m							
	Carp.dr.	Mai.b.	Conv.m.	Cal.e.	Pt.a.	L.cl.	L.a.	L.c.
39	5.8	5.4	4.9	5.2	16, 15.5, 15, 15	—	—	—
40	5.8, 5.5, 5.3	—	—	—	15.5, 15.3	11.8, 11.2	12.0, 10.2, 9.1	—
41	5.8	—	5.7, 5.7, 5.2		17.1, 16.7, 16.2, 15.5	—	13.9, 13.0, 10.6	7.7
42	5.8	—		5.8		—	—	—
43	5.9, 5.7, 5.6, 5.6	5.8	5.7, 5.7	—	17, 16	14.5	13.0, 13.0, 12.1	10.2, 10.0, 8.9, 8.1
44	6.0	—	—	—	17, 16.5	—	13.1, 12.9, 12.7	9.6, 8.7
45	6.0	—	5.8	6.0, 6.0	17	—	—	10.6, 10.3
46	6.0	—	—	—	15	—		—
46	6.0	—	—	—	15	—	—	—
47	6 × 6, 6 × 5	—	—	—	—	—	—	—
48	6.1	—	—		17, 16.5	—	—	—
49	6.2, 6.2, 6.1, 6.0	—	—	6.1, 5.8	17		14.3	9.7, 9.5, 9.4
50	6.3	—	—		17.7	—		—
51	6.4, *6.3*, 6.1, 6.0	—	6.7, *6.1*	6.4, 6.1	*17.5*, 17.5	—	15.0, 14.5, *13.9*	10.4, *9.9* × *8.2*
52	6.6 × 6.3, 6.4	—	—	5.9	17	—	16.3, 15.9	10.3, 10.0, 9.2
53	6.7, 6.3, 6.0	6.0	—	—	—	—	17.4, 16.7, 15.7	—
54	6.8, 6.0	7.3, 6.7	6.4		18, 18, 18, 17,5	—	15.0	—
55	*6.8*	—	—	—	*20.4*	—	—	—
56	6.8, 6.0	5.8	—		18, 17	17.7	17, 17, 15	12,1 × 11.1
57	7.0, 6.1	6.5	—	7.2	17.5	18.7	—	—
58	7.1, 6.9, 6.2	—	—	—	—	—	23.7*[3]	—
59	7.1	—	—	7.4	19.9, 19 × 17	—	—	12.7
60	7.3, 7.2 × 6.5	—	8.0, 7.9	—	21.5, 20.3, 19.5	—	19.5	—
61	*7.4*	—	—	—	21.5	—	*21.6*	13.3 × 12.7
62	7.6	7.4, 7.3	—	—	*22.1*, 22, 21, 21	—	*19.8*, 18.6	—
63	*7.7*	—		—	21	27.7*	21.8	*12.4*, 11.0
64	7.8	—	—		20	21 (24m. v. 1970)	19.5	—
65	7.9, 7.3	—	7.2		23	—	19.4, 18.4	12.4
66	7.9	8.1, 7.9		—	21.5	—	—	11.9
67	8.0, 7.6, 7.3	—	—			22, 19.5	17.5, 17, 16.5	—
68	8.1, 8.0, 7,6, *7.5*	—	—	—	22, 22, 21.5, *21.0*		21.4, 16.8	13.8
69	8.1, 8.0	7.3	8.0 (× 10.2)	8.1	—	—	20.5, 19.7, 19.0	15.4
70	8.3, 8.1	—	—	—	23.5, 22	23.7, 21.8	—	—
71	8.4	8.6, 8.0	—	—	22.5		—	19.8*
72	8.5		—	8.5	23.5, 23	—	23.3, 21.7	—
73	*8.5* × *8.5*, 7.5, 7.4	—	—	—	*23.5*, 22	—	—	—
74	8.7	—	—	9.0	22	26	24	—
75	8.7	—	8.5, 8.5, 8.4	—	24	—	—	—
76	8.8	—	—		23		21	14.4
77	*8.8*	—	—		*21.8*	—	—	—
78	8.9	—	8.5	—	24	—	—	14.2
79	8.9	—	—		26, 24		—	14.7 × 14.5
80	9.0, 8.0, 7.8	—	—	—	21		—	—
81	9.0	—	—	9.2, 9.1	—	—	22, 21.5	—
82	9.0, 9 (× 14)	—	—	8.8	22.5, 20	—	19.7, 18	—
83	*9.1*	—	—	—	—	—	*24.3*	—

Age of the tree stand, years	Date of fire, years ago	Forest site type [1]	Locality	Year	Additional information
28	?	OMT-LhT	Tenhola, Lappohja	1968	
66+, 38+	?	VT-MT	Somerniemi, Rinkinattikko	1967	
62+, 45+, 35+	44—46?	VT	Suomusjärvi, Huhdanoja	1967—69	O. 1969, no. 63, p. 22
68+, 41+	44	VT	Pohja, Koppskog	1968	
89+, 48+	48—49	VT	Lohjan mlk., Muijala	1969	
57+, 48+	50	VT	Somerniemi, Valkee	1967—68	O. 1969, no. 67, p. 48
159+, 45+	51?	VT-MT	Somerniemi, Liesjärvi	1964—65	O. 1969, no. 64, p. 22
43+	?	VT-MT	Sammatti, Lohilampi	1965	O. 1967 a, p. 36
—	—	—	Punkaharju, Kokonharju	1963	Gravelpit abandoned in 1905
82+, 45+	?	VT	Tammela, Liesjärvi	1970	
55+, 43+	48	VT	Kiikala, Varesjoki	1966	
67+	50?	VT-MT	Lohjan mlk., road 53, at the border of Karjaan mlk.	1968	Near the railway
86+	50	VT-MT	Suomusjärvi, Laperla	1968	
73+	50	VT-OMT	Pusula, Mäkkylä	1968	
178+, 65+	50—52	VT-OMT	Kiikala, Lammensuo	1967—69	
257+, 45+	52?	VT-OMT	Tenhola, Harpaskog	1968	Margin in core 52—53 yrs. ago
82+	59	VT	Kemiö, Mjösund	1966	
78+, 46+	54—55	VT	Lohja, Lohjannummi	1964—65	O. 1968, no. 92, p. 50
83+, 43+	54?	VT-OMT	Pohja, Sällvik	1968—69	Margin in core 52—53 yrs. ago
195+, 46+	54	OMT	Tammisaaren mlk., Skällargård	1968	
69+, 45+	59	VT-MT	Siuntio, Tallmo	1966	
105+, 47+	59—61	VT-MT	Somerniemi, Valkee	1967—69	O. 1968, no. 100, p. 50
50+	?	VT	Suomusjärvi, Vähänummi—Myllymäki	1967	
56+	?	VT	Tenhola, Harpaskog	1968	
89+, 50+	61	VT	Karjaan mlk., Meltola	1969	
279+	63	VT	Tammisaaren mlk., Källvik	1964	O. 1968, no. 50, p. 42
180+, 60+	62	VT	Kiikala, Lammensuo	1969	
89+, 55+	60	VT-OMT	Suomusjärvi, Siitoinjärvi	1967	
66+, 50+	60	VT-MT	Somerniemi, Rinkinattikko	1967	
75+, 50+	59	OMT-LhT	Vihti, Ojakkala	1968	
145+, 68+, 46+	61—62?	VT	Suomusjärvi, Varesjärvi	1967—68	O. 1968, no. 103, p. 50
85+	68	VT	Kiikala, Iso-Joutseno	1968	
166+, 101+, 59+	62? 65?	VT	Kiikala, Korkianummi	1966	
151+, 117+, 50+	68—69	VT-MT	Kiikala, Lamminjärvi	1967—68	O. 1969, no. 40, p. 30
101+	70	OMT	Lohjan mlk., Karkalinniemi	1965	O. 1967, no. 54, p. 40
108+, 65+	69—73	VT	Sammatti, Lohilampi—Oino	1964—68	
70+	?	VT	Karjalohja, Haudanaho	1966	
82+	66	VT-MT	Somerniemi, Äyräsnummi	1970	
40+	?	OMT	Huittinen, Huhtamo	1967	
95+, 62+	68	OMT	Tenhola, Harparskog	1968	
62+	?	VT	Karjaan mlk., Meltola	1969	
114+	68	OMT	Suomusjärvi, Laperla	1968	
89+, 70+	71	VT	Lohjan mlk., Muijala	1969	
113+, 53+	64	OMT	Karjaan mlk., Kaskimaa	1965	O. 1968, no.101, p. 50
98+, 64+	69	VT	Sulkava, Kolkonmäki	1967	

No.	Size of the stand, m							
	Carp.dr.	Mai.b.	Conv.m.	Cal.e.	Pt.a.	L.cl.	L.a.	L.c.
84	*9.2*	—	9.1	8.6, 8.4	*26.5*, 23, 22.5	37 × 35*	26.6	—
85	9.2	—	—	9.4, 9.4, 9.3, 9.2	25, 24.5, 24	23, 36.8*	25	17.0, 16.6
86	9.3, 9.2, 9.2	—	—	—	—	24.1, 22.0	22	15
87	9.5	8.6	9.0	—	26	26.6, 24	—	—
88	9.5 × 9.3	—	—	—		—	—	17.5
89	9.6, 9.2, 8.0	—	—	—	23.7, 23.6, 23.5	—	23.5, 23.5, 23.5	15.4
90	9.9, 9.0	—	—		29		33.5*	—
91	10.0, 9.0	9.2 × 8.3	—	9.6	26, 24, 24	—	—	15.2, 14.5
92	10.2	—	—	—	24.5, 24	—	24.5	17.6, 16.2, 15.9
93	10.3, 10.0, 9.1, 9.0	—	—	—	25.5	24	27.1, 27, 24 6	16.5
94	10.5	—	11.1, 10.9	—	30, 29, 27	30, 29	30, 29, 27, 24	—
95	10.6	—	10.3 × 10.2	—	27	27.9 × 27.5	—	—
96	10.7, 10.3, 9.9	—	10.8	—	30, 30, 30	28, 27.7	25.6	26.5*
97	10.7	—	—	—	31.3	—	—	—
98	*10.7*	—	—	—	*30.8*	—	—	—
99	10.7, 10.2	—	—	—	32, 31, 30, 29	31, 29	—	21.5, 19.5
100	10.7	—	10.0	—	—	—	31, 39*	22.8, 22.5, 21.0
101	11.0	10.6	—	11.0, 11	32, 31, 30	—	—	—
102	11.5, 10.8, 10.4	—	—	—	32.5, 29.5	—	—	—
103	11.9, 11.5, 9.8	—	—	11.8, 11.5, 11.5	—	—	—	—
104	11.9, 10.1	12.6, 10.9	12.2, 11.8, 10.2	11.5	36	—	35.6	—
105	12.0, 11.2	—	12.8, 11.7, 11.5	12.0	31	37, 36, 35.6, 34	—	23
106	12.6	—	11.8	—	34, 32	—	—	—
107	13.1, 13.1, 12.2	—	—	13.9, 12.0	38, 37.7, 34, 34	43	—	—
108	13.2	—		13.0	35, 34.5, 34, 33	—	33.5	—
109	13.2, 13.2, 12.9, 12.7	—	—	12.1	37	46	35, 31.6	—
110	13.2	—	—	—			—	28
111	13.3	—	—	—	38, 37, 37, 35	—	—	26.8
112	13.6	—	—	—	—	43		—
113 133	14.9, 14.9, 14.0, 13.8	—	—	15.0, 14.5, 14.5	45, 44, 42	—	42.8	31.9
114	*14.9*	—	—	—	42.5, *41*	—	—	—
115	15.0	—	14.3	—	44, 43	49.8*	—	29.9, 29
116	15.0	—	15.6	15.3, 15.2, 15.0	—	—	—	30.3, 38.3*
117	15.2	—	15.9, 15.8, 15.7, 14.7	—	44	—	—	31.3
118	15.2	—	—	15.0, 14.2	—	—	—	—
119	15.3	—	—	—	44, 43.6 (× 73), 42	55 × 50	—	33.5
120	15.8	—	—	—	46, 46, 44	—	—	34.7
121	16.0	—	—	15.0	48	—	—	—
122	16.1	—	—		47, 46, 44, 43	—	—	—
123	16.3	—	15.2		46, 45, 43	50, 64*	—	—
124	*16.3*	—	—		*52*, 49.5	—	—	—
125	16.4	—	—	16, 16	44	—	—	32, 39*
126	*16.8*	—	—		47, *43.5*	—	43, 41.5	38*
127	16.9, 16.2, 15.3	—	—	—	46	—	—	—
128	*17.2*	—	—	—	46, 45, 45	—	*47*, 46	38*

Age of the tree stand, years	Date of fire, years ago	Forest site type [1]	Locality	Year	Additional information
79+, 63+	?	OMT	Vihti, Ojakkala	1968	O. 1969, no. 113, p. 24
87+, 69+	73—75	VT	Lohja, Lohjannummi	1967—69	O. 1969, no. 117, p. 24
74+, 66+	?	VT-OMT	Somerniemi, Mäyrämäki	1967	
178+, 65+	74	VT-OMT	Kiikala, Lammensuo	1967	
169+, 57+	70	OMT	Kiikala, Kurhaperä	1970	
155+, 60+	68—69	VT-OMT	Suomusjärvi, Huhdanoja	1967—68	O. 1968, no. 114, p. 50
195+, 45+	79	VT-OMT	Tammisaaren mlk., Skällargård	1968	
105+	72—74	VT-MT	Somerniemi, Valkee	1967—69	
149+, 66+	73—75	VT	Kiikala, Varesjoki	1966—68	
169+, 65+	75	VT-LhT	Pusula, Kaukela	1968	
110+, 73+	80—82	VT-MT	Karjalohja, Härjänvatsa	1964—66	O. 1969, no. 59, p. 32
106+	78	VT	Kiikala, airfield—Iso-Joutseno	1968	O. 1969, no. 126, p. 26
89+, 76+, 68+	?	VT-OMT	Karjaan mlk., Meltola	1969	
231+, 75+	?	VT	Suomusjärvi, Lahnajärvi	1967	
49+	?	OMT	Huittinen, Huhtamo	1967	
100+, 78+	88—91	VT	Somerniemi, Väärijärvi—Herakas	1967—70	O. 1968, no. 67, p. 42
82+, 47+	?	VT	Somerniemi, Härjenlahti	1967	O. 1968, no. 127, p. 52
212+, 60+	88—91	VT-MT	Pohja, Koppskog	1965—68	
82+	?	VT-OMT	Tammela, Liesjärvi	1970	
182+, 83+	95	MT-OMT	Pohja, Sällvik	1968	O. 1969, no. 69, p. 32
155+, 62+	104?	VT	Suomusjärvi, Huhdanoja	1967—68	O. 1968, no. 133, p.52
121+, 79+	94	VT-OMT	Vihti, Ojakkala	1968	
130+, 85+	95	VT-OMT	Karjaa, Kaskimaa	1965—66	
169+, 99+	107	VT-OMT	Somerniemi, Juuttaanjälki—Ätämö	1965—70	
195+, 45+	101	OMT	Tammisaaren mlk., Skällargård	1967	
172+, 84+	103	VT-OMT	Pusula, Kaukela	1968	
52+	?	VT	Oripää—Loimaa roadside	1965	
137+, 88+	106	VT-MT	Lohjan mlk., Muijala	1969	
89+	?	MT	Suomusjärvi, Siitoinjärvi	1967	
115+	?	VT	Heinolan mlk., Vierumäki	1966	O. 1967 c, no. 99, p. 41
111+, 89+	?	OMT	Karjaan mlk., Meltola	1969	
89+	?	VT-MT	Lohjan mlk., Muijala	1969	
191+, 55+	131	VT	Pohja, Ekerö	1965—69	
110+, 89+	?	VT-MT	Suomusjärvi, Siitoinjärvi—Lahnajärvi	1967	O. 1969, no. 156, p. 26
182+	124?	OMT	Pohja, Sällvik	1969	
123+	?	VT	Kerimäki, Mäkrä	1963—67	O. 1968, no. 94, p. 44
109+	?	VT	Suomusjärvi, Riitusjärvi	1969	
73+	?	OMT	Karjalohja, Härjänvatsa	1965	
111+	?	VT-OMT	Karjaan mlk., Meltola	1969	
153+, 125+, 69+	129	VT-OMT	Somerniemi, Saarijärvi	1967	
60+	?	VT-MT	Karuna, Päistärpää	1966	O. 1970, p. 196. Borders on a field
171+, 92+	124—128	VT-MT	Karjalohja, Härjänvatsa	1962—66	O. 1967 c, no. 100, p. 41
149+, 56+	128—129	VT-MT	Kiikala, Varesjoki	1966—67	O. 1968, no. 143, p. 52
148+, 72+	136	OMT	Pusula, Kaukela	1964	
163+, 119+	129	VT-OMT	Kiikala, Lamminjärvi	1967	O. 1968, no. 144, p. 52

No.	Size of the stand, m							
	Carp.dr.	Mai.b.	Conv.m.	Cal.e.	Pt.a.	L.cl.	L.a.	L.c.
129	17.7, 17.2	—	—	17.6, 17.5	52, 46(×75)	—	—	—
130	18.1	—	—		52.5, 51, 49.5	—	—	—
131	18.2	—	—	—	53.5	—	—	—
132	*18.4*	—	—		*57.5*, 57.5	—	—	—
133	18.5	—	—		52	—	—	—
134	18.8	—	—		53, 51, 49, 48	—	—	—
135	19.2	—	—	—	52, 52	—	—	—
136	19.3, 19.1, 18.4	—	20.9, 19.3	19.9	56 (×65)	—	—	—
137	19.3	—	19.3, 19.0	—	57, 56	—	—	—
138	19.5	—	—	19.0	58, 52, 51, 50	—	—	42
139	*20.6*	—	—	—	*66*	—	—	—
140	21.2	—	—		60	—	—	—
141	21.5	—	20.3, 19.1		60, 56	72	—	47
142	22, 21.8, 21.1, 20.6	—	*21.2*, 20.6, 19.6, 19.3		61, 60, 59.5, 58	79	—	49.5, 46, *44*, 44
143	22.0, 20.4, 20.4, 19.8	—	22.0, 21.7, 21.7, 20.4	22.8, 22.2, 21.8	62, 62, 61, 59.5	82	67.3	49, 47, 45, 44
144	23.0	—	23.1	22.5, 20.7	63, 63, 62, 62	—	74.5*	—
145	24	—	24.5, 24	—	63. 61	—	—	—
146	24, 23	—	23.1	23, 23	68, 64, 64, 63		—	53
147	24.1	—	—	23.7	67, 65.5		—	—
148	24.3	—	—	23.5	71, 70, 67, 67		—	—
149	25.5		25.5, 25.1	26	75, 74.5, 74. 74	—	—	64.8*
150	25.5	—	—	—	67		—	—
151	25.8	—	—	—	*74*.3, 73.7	*93.3*	—	—
152	26	—	—	—	76, 70.8 (×94.5)	—	—	—
153	26.7	—	—	25.5	75	—	83	—
154	27.7	—	—	—	81, 76, 74	—	—	—
155	*28*	—	—	—	*86*	—	—	—
156	28.3	—	—	—	75		—	—
157	31	30	32.8	31.4	90, 90, 90, 88	—	—	80*
158	31.4	—	32		90, 86(×109)		—	68
159	31.7, 30.9	—	33		90, 90, 86, 86		—	—
160	33	—	—		90, 88, 87	—	—	—
161	33.2	—	—		91	—	—	—
162	35	—	—	—	100, 93	—	—	—
163	36, 35.5, 34.2	—	37	34.7	103, 101, 101, 100	—	—	82, 81, 81
164	37.7	—	—	—	112, 103, 98	—	—	—
165	*41.1*	—	—	—	*124*	—	—	—
166	43	—		—	126, 124, 121, 120	—	—	—
167	*47* × *41.5*	—	—	—	*143*	—	—	—
168	49.5, 46	—	51.5, 50, 49.8, 46.5	51.6, 49	152	—	—	—
169	*54.3*	—	56, 54	—	167, 165, *164*, 155	—	—	—
170	54.7	—	—	—	151	—	—	—
171	55	—	—	—	157	—	—	—
172	58	—	55	—	162, 162, 162, 161	—	—	132
173	70	—	68	—	188.5	—	—	—
174	*91*	—	—	—	250, 240, *235*, 232	—	—	—

Age of the tree stand, years	Date of fire, years ago	Forest site type[1]	Locality	Year	Additional information
300+, 182+, 83+	140? 149?	VT-OMT	Pohja, Sällvik	1968	O. 1969, no. 100, p. 32
195+, 50+	143	OMT-LhT	Tammisaaren mlk., Skällargård	1968	
150+	?	OMT	Tammela, Porras	1970	
60+	158	VT-LhT	Kaarina, Ala-Lemu	1966	Battle field from the War for Finland in 1808–09
103+	?	OMT	Kemiö, Mjösund	1966	
119+	?	VT	Heinolan mlk., Vierumäki	1966	
149+	152–158?	OMT	Tammisaaren mlk., Källvik	1964–70	O. 1967 a, p. 64
121+, 79+	?	VT-OMT	Vihti, Ojakkala	1968	O. 1969, no. 171, p. 28
169+, 144+	?	VT-MT	Kiikala, Kurhaperä	1970	
140+, 59+	?	VT-OMT	Karjaan mlk., Kaskimaa	1965–67	
70+	?	OMT	Saari, Tarnala	1966	O. 1970, p. 196, Borders on a rock
119+	?	VT	Heinolan mlk., Vierumäki	1966	
106+, 59+	?	VT-MT	Somerniemi, Kalaton-lampi	1964–70	O. 1969, no. 169, p. 28
163+, 119+, 60+	?	VT-MT	Kiikala, Iso-Joutseno–Lamminjärvi	1966–70	O. 1969, no. 172, p. 28
167+	?	VT	Kiikala, Korkianummi–Hautakrotit	1966–70	O. 1968, no. 110, p. 44, 1969, p. 16
167+, 60+	178–179	VT-OMT	Tenhola, Skogby–Harparskog	1968	O. 1969, p. 16
215+, 170+	188	VT-MT	Pohja, Baggby	1965–66	
334+, 179+, 60+	180–185	OMT	Kiikala, Lammensuo	1965–70	
180+	?	OMT	Tammela, Liesjärvi	1970	
84+	?	VT	Karjaan mlk., road 53, at the border of Lohjan mlk.	1964–66	
207+, 149+	?	VT	Kiikala, Varesjoki–air field	1965–69	O. 1969, no. 181, p. 28
169+, 46+	?	OMT	Somero, Lautela	1967	
115+	?	VT	Heinolan mlk., Vierumäki	1966	O. 1968, no. 112, p. 44
50+	?	VT	Tammela, Liesjärvi	1966	
195+, 50+	?	OMT-LhT	Tammisaaren mlk., Skällargård	1968	
197+, 50+	?	OMT-LhT	Tenhola, Harpaskog	1968	
215+, 74+	?	OMT	Pohja, Baggby–Dragsvik	1966	
192+, 83+	?	OMT	Pohja, Sällvik	1968	
234+, 70+	?	VT-MT	Karjalohja, Härjänvatsa	1963–68	O. 1969, no. 122, p. 34
123+, 108+	?	VT	Punkaharju, Kokonharju–Takaharju	1963–66	O. 1967 c, no. 123, p. 49
160+	?	VT-OMT	Somerniemi, Liesjärvi	1964–66	
111+	?	OMT	Karjaan mlk., Meltola	1969	
50+	?	OMT	Muurla, Tuohittu	1966	
82+	?	VT-OMT	Somerniemi, Jyrkkälampi	1970	
302+, 200+, 95+	278–281?	VT-OMT	Kiikala–Somerniemi, air field – Juuttaanjälki	1964–70	O. 1967 c, no. 130, p.52
167+	?	VT-OMT	Kiikala, Korkianummi	1966	
60+	?	VT-MT	Kemiö–Mjösund roadside	1966	Both detached stands
131+, 97+	?	VT-OMT	Nummi–Somerniemi, Nummensillanoja–Hosojankulma	1964–70	
72+	?	VT	Pusula, Mäkkylä	1968	
82+	?	VT-LhT	Karjaan mlk., Mustio	1966–69	
90+	?	VT	Kiikala–Somerniemi, Immenlampi–Valkee	1966–67	
66+	?	VT-MT	Somerniemi, Rinkinattikko	1967	
167+	?	VT-OMT	Kiikala, Korkianummi	1966	
68+	?	VT-OMT	Suomusjärvi, Huhdanoja–Myllymäki	1967	O. 1969, no. 199, p. 28
109+, 82+	?	VT-OMT	Somerniemi, Härjenlahti	1970	
60+	?	VT-MT	Kiikala–Somerniemi, air field – Kalaton	1966–68	

[1] See CAJANDER 1949
[2] Slanted numbers: stands have same origin, overlap, or grow next to each other
[3] Probably secondary
[4] O. = OINONEN

Appendix 2. *Maianthemum bifolium* stands and their parallels on the same site.

No.	Size of the stand, m						
	Mai.b.	Conv.m	Cal.e.	Pt.a.	L.cl.	L.a.	L.c.
1	1.3	1.4, 1.4, 1.4, 1.2	1.4	—	—	—	—
2	1.6	1.7, 1.4	—			—	—
3	2.0	1.9 × 1.9, 1.9	—	—	—	*Δ*, *Δ* (5 v.)	—
4	2.6, 2.6	2.4, 2.4, 2.4	—			—	—
5	3.0, 2.8, 2.4	2.7, 2.6, 2.5	—			2.4	—
6	3.0, 2.8, 2.6	3.2, 3.0, 2.7	—	5.6		—	—
7	*3.0*,[2] 2.3	—	3.4	—	—	*3.1*,[2] 0.8	—
8	*3.0*		—			*4.2*	—
9	*3.0*	—				4.6	1.5, *0.5*
10	3.3, *3.2*, 3.2	—		*5.6*		*3.4 × 3.4*	0.8
11	3.3 × 2.7	—	—	—	—	—	—
12	3.6	—		9.0, 7.5	4.2	1.6	2.8
13	3.8		3.1	*9.5*	*3.4*	—	—
14	3.8, 3.6	—	—	9.5		5.4 × 5.1	3.2, 3.1
15	3.8	—	3.6	—		—	—
16	*3.8*	3.6, 3.1	—			—	*1.9*
17	4.0, 3.8 × 3.8	3.9, 3.8	—	—		5.9, 4.5	4.1, 3.5, 3.4, 2.6
18	4.2, 4.0	—		9.8 (7m v.1965)		5.3, 4.5	3.1
19	4.3	4.3, 4.2, 4.1	—	—	—	14*[3]	4.8, 4.6, 3.0
20	4.3, 3.9, 3.7	3.9, 3.8, 3.7	—			5.2, 5.0	—
21	4.5, 4.3, 4.0	—	—	12.0	—	—	—
22	*4.5*		*4.9*	12.7		5.7	—
23	4.5		—	11.5, 11.0	7.7, 6.1	10.1, 9.7, 9.7, 9.6	6.7, 6.0
24	4.6	5.1	—			—	—
25	4.7	4.6	4.9	14.0	10.3	7.3	5.8, 5.2
26	*4.7*, 4.5	5.0	5.0	13.5, 13.0, 13.0	—	*7.9*	—
27	4.7	4.9	—		10.7	9.4, 9.2, 7.1	6.8
28	5.0, 4.5, 4.3	4.9	5.2 × 4.8, 5.1	14, 14, 13	6.4	11.7	5.8
29	5.0, 5.0, 5.0 × 4.6	4.6	—			—	6.3, 5.1
30	5.0, 5.0 × 5.0, 4.5	5.0, 4.6	—	13	9.1, 8.2	11.2, 8.5, 8.0	7.0 × 7.0, 6.5
31	5.2	5.2	—	15	11.8	11.5	—
32	5.2, 5.1, 5.1, 4.7		—	13	11.7, 10.9, 7.4	7.1, 6.3	6.6
33	5.2, 5.1, 5.1	5.2, 5.1		12.8		7.0, 7.0, 15.3*[3]	—
34	*5.2 × 5.1*, 5.1	5.2, *5.1 × 4.8*	—	14, 13.4	10.0	11.5, 9.3	6.9, 6.3
35	5.4, 5.3, 5.1, 4.9		5.8, 5.3	15(13m v.1964)		—	—
36	5.4 × 4.6	5.4, 5.2, 5.1	—	14, 14, 13	13.1, 11.7	12.2, 10.5, 10.3, 8.8	8.7, 8.0
37	5.4	5.3		14.5		—	7.3
38	5.5, 5.4, 5.1	5.6, 5.2, 5.1	—	—	—	11.7, 10.5, 9.8, 8.9	—
39	*5.6*, 5.6, 5.5, 5.1	*5.5*	—	14.4		12.3, 12.2	—
40	5.8	6.0	—	17 (× 21)	—	—	—
41	5.9		—	18, 17, 17		13.7, 11.1	—
42	5.9, 5.9					14.4	9.9, 9.1, 8.5, 7.8
43	6.0, 5.9	6.0	—	—	—	13.2, 12.7, 11.7	10.2, 9.4

Age of the tree stand, years	Date of fire, years ago	Forest site type [1]	Locality	Year	Additional information
13	—	VT	Lohjan mlk., Muijala	1969	A forest regeneration area
16	16	VT	» » »	1969	A forest regeneration area treated with prescr. burn.
16	—	VT	» » »	1969	A forest regeneration area
20	—	VT	» » »	1969	—»—
43+, 20+	—	VT	Kiikala, Mustasovansuo	1968—69	—»— O. 1969, no. 9, p. 20 [4]
18+	?	VT	Lohjan mlk., road 53, at the border to Karjaan mlk.	1968	Forest regeneration area
—	—	—	Tenhola, Skogby	1968	Trench from 1941
—	—	—	Tenhola, Harparskog	1968	—»—
20+	—	VT	Kiikala, Korkianummi	1966—70	Forest regeneration area
—	—	—	Tenhola, Harparskog	1968	Trench from 1941
78+	—	VT	» »	1968	Bomb hole from 1941
—	—	—	Karjaan mlk. road 53, at the border of Lohjan mlk.	1966	Graveyard from the 1940—44 war
30	?	VT	Somerniemi, Jakkula	1968	Forest regeneration area
35+, 29+	?	VT	Suomusjärvi, Varesjärvi—Huhdanoja	1968	—»—
—	—	—	Tenhola, Lappohja	1968	Russian grave from 1941
63+	—	VT	Somerniemi, Kaitalammi	1966	O. 1969, no. 15, p. 20
40+	—	VT	Suomusjärvi, Pöytäkangas	1967	Stumps blasted during the 1940—44 war
28+	?	VT	Lohja, Keskilohja, near the railway	1969	O. 1967 a, p. 28
64+, 30+	33	VT	Snappertuna, near Raasepori railway station	1967	O. 1969, no. 31, p. 20
31+	?	VT-MT	Lohjan mlk., road 53, at the border of Karjaan mlk.	1968	At the railway
100+, 30+	—	VT	Sammatti, Lohilampi	1965	O. 1967 a, p. 35
61+	37	VT	Pohja, Fårsjö	1968	
35+	?	VT-MT	Somerniemi, Valkee	1967	
59+, 30+	36	VT	Muurla—Salo roadside	1966	
178+, 43+, 32+	35—36	VT	Kiikala, Mustasovansuo	1968—69	O. 1969, no. 36, p. 20
30+	38	VT	Pohja, Kullasjö	1969	
118+, 36+	38?	VT-MT	Kiikala, Varesjoki	1968	
77+	42	VT-MT	Tenhola, Harparskog	1968—69	O. 1969, no. 9, p. 30
63+, 34+	?	VT	Suomusjärvi, Pöytäkangas	1967	Forest regeneration a rea
86+, 74+, 30+	37—39	VT	Sammatti, Luskala	1964—66	O. 1968, no. 12, p. 40,n 42, p. 48
110+, 40+	41	VT-OMT	Karjaan mlk., Meltola	1969	
36	—	VT-MT	Karjalohja, Härjänvatsa	1962	Field abandoned in 1926, O. 1968, no. 25, p. 40
37+	41?	VT-MT	Karjaan mlk., Stormora	1969	
79+, 38+	40	VT	Vihti, Nummela	1968	O. 1969, no. 48, p. 22
60+, 40+	38—43	VT	Pohja, Koppskog	1964—69	O. 1967 a, no. 11, p. 31
69+, 34+	43	VT	Vihti, Ojakkala	1968	O. 1969, no. 54, p. 22
40+	?	VT	Kiikala, Korkianummi	1966—70	
67+, 35+	41—44	VT-MT	Lohjan mlk., road 53, at the border of Lohjan mlk.	1966—69	O. 1969, no. 46, p. 22
84+	41—43	VT	Karjaan mlk., road 53, at the border of Lohjan mlk.	1966—68	O. 1969, no. 46, p. 22
85+	50	VT	Kiikala, Iso-Joutseno	1968	
95+, 47+	50	VT	Somerniemi, Kalaton-lampi	1968—70	
49+	52	VT	Somerniemi, Likolampi	1970	
135+, 78+, 45+	46	VT	Somero, Terttilä	1967	O. 1968, no. 74, p. 48

No.	Size of the stand, m						
	Mai.b.	Conv.m.	Cal.e.	Pt.a.	L.cl.	L.a.	L.c
44	6.2, 6.0	6.0, 5.5	—		—	—	—
45	6.2, 6.1	—	6.8, 6.7	18	13.3	—	—
46	6.2×6.1		—	16, 15	12.1	12.5	9.8
47	6.2×5.1	6.0, 5.9	—	18, 18, 17, 16.5	14.6	13.5	11.8, 11.2, 10.9, 10.6
48	6.2	6.5	—	—	—	13.9	—
49	6.3×6.0	6.4, 6.2, 5.7	5.9	17	17, 15, 14.8, 14	15.3	11.9, 9.0
50	*6.5*		—	*16.5*	—	—	—
51	6.6		—	18, 18	15.0	14.5	—
52	6.7	6.4, 6.3, 6.2, 6.2	—	18, 17.5	15.8	—	—
53	*6.7×6.4*, 6.5	—	—		—	15.8, 14.0	*9.6*
54	6.7	—	—	18, 18, 18	—	—	—
55	6.8, 6.7	6.5	7.3, 6.7	21, 18.7, 17.5	—	17.6, 16.9, 16.4	—
56	7.0×6.7, 6.2, 6.1		6.3, 6.0	16	—	—	14.5*
57	7.0, 6.8	6.9	6.9, 6.7	20, 19, 18, 18	19	18, 16.5	11.3, 11.2, 10.9
58	7.0, 6.6			19, 18	—	—	12.0, 16*
59	*7.0*		*7.1*	—	—	—	—
60	7.2, 7.0		—		19.9, 19.3, 19.0	18	
61	*7.7*	—	—	*21.2*	—	—	—
62	7.8×7.5, 7.3	8.0, 7.7	8.1	21.5, 21.3	21.3	20.5, 19.7, 19.0	13.3
63	7.8	7.7, 7.5	7.8	21	17.2	19.1	13.8
64	7.8, 7.3	—	—		18.2	—	12.5, 12.5
65	8.0	7.7	8×7	22, 19.5	—	—	12.5
66	8.0, 8	8.4	8.5, 8.0	22.5, 21.5, 20.5, 20	21.5, 33*	19.7, 18.5	14.0
67	8.0×7.2	—	8.3	20	—	*16.3*	*13.7*
68	8.1	8.7, 8.5	8.7, 8.5×8.5	23.5, 21.5	19.8	18.5	15.2×15.0
69	8.8	8.3	8.7, 8.7, 8.2	24	22	26	
70	8.8, 8.5, 8.2	8.8, 8.6	—	22	24.6, 21.5, 20.8	20.5	15.2, 14.9
71	9.0, 8.8, 8.0	—	8.8, 8.5, 8.4	—	—	22.8	17.2, 16.0, 21.3*
72	9.0, 8.0, 8.0	—	—	24, 23.5, 23.5	—		—
73	9.0, 8.1	8.8	—	23.3, 21.5	—	—	17.1, 16.3, 20.3*
74	9.0	9.5	—	24.5	25.9	24.5, 24, 22.5	16.5
75	9.7, 9.2, 9.2, 9.1	8.9	10.1, 8.7, 8.7, 8.4	25.5, 25, 24	25.5, 25.0, 23.7	23.0, 21.6	—
76	9.7, 9.5, 9.0		9.5, 9.0	26, 24	25.6	24	—
77	10×9	10, 10	10.3, 9.6	31, 30, 29	29	—	26×34*
78	10.0	9.3	9.8	—	—	—	23*
79	10.1	—	9.5×9.0, 9.5	28×27, 27	39*	28	—
80	10.2, 9.8	—	—	28, 27, 26.5	—		—
81	10.6, 10.6, 10.4, 10.3		—		—		22.3
82	10.9, 10.7	10.0	11.0, 10	28	—	—	21.4
83	10.9, 10.2, 10.2	—	10.9, 9.7	31	—	—	24.1×20.2*
84	11.0×10.0	—	11.2	28	—	—	20
85	11.0, 10.9	—	—	28	—	—	21.1, 19.1
86	11.4	11.9, 11.7, 11.4	—	32, 31, 30	—		—
87	11.4, 9.7, 9.2	11.6	—	31, 31, 29	—	—	—
88	11.6	11.5, 11.5	11.5	31.7, 31	—	35.6×35.1	28.4*
89	11.9		—	37, 36, 30, 30	—	—	30*

Age of the tree stand, years	Date of fire, years ago	Forest site type [1]	Locality	Year	Additional information
83+, 40+	46	VT	Sammatti, Luskala	1964	
45+	50	VT	Tenhola, Lappohja	1968	
163+, 45+	47–48	VT	Somerniemi, Hosojankulma	1965–66	
110+, 45+	48–52	VT	Somerniemi, Salakkajärvi	1966–70	
92+, 45+	52?	VT	Valkeala, road 6, the vicinity of the crossroads to Tuohikotti	1966	O. 1969, no. 84, p. 24
89+, 45+	50–54	VT	Nummi, Nummensillanoja	1966–70	O. 1969, no. 80, p. 22
43+	?	OMT	Eurajoki, Hankkila	1967	The tree stand has emerged after a fire
85+, 48+	?	VT-MT	Lohjan mlk., Muijala	1969	
110+, 48+	51	VT	Pohja, Kullasjö	1969	
90+	54	VT-MT	Suomusjärvi, Sallittu	1968	
50+	?	VT-OMT	Tenhola, Harparskog	1968	
53+	?	VT-MT	Tenhola, Skogby	1968–69	
70+	–	VT	Karjalohja, Härjänvatsannummi	1963	O. 1967 c, no. 128, p. 50
74+	56–58	VT	Somerniemi, Kaitalammi – Väärijärvi	1966–68	O. 1967 c, no. 42, p. 30
83+	54?	VT	Sammatti, Luskala	1964	O. 1967 c, no. 63, p. 33
51+	?	VT	Sammatti, Lohilampi	1968	
51+	59	VT	Somerniemi, Saarijärvi	1966	O. 1968, no. 47, p. 42
55+	?	VT	Pohja – Tenhola, Skarpkulla	1970	
145+, 52+, 46+	61–62?	VT	Suomusjärvi, Varesjärvi	1967–68	O. 1969, no. 96, p. 24
80+, 50+	59	VT	Vihti, Ojakkala	1968–70	
137+, 74+, 52+	59–60	VT	Kiikala, airfield – Mustasovansuo	1967–68	
115+	63	VT	Kiikala, Nummenharju	1965	
109+, 60+	64–65	VT	Pohja, Raasepori railway station – Kaskimaa	1964–65	O. 1968, no. 53, p. 42
98+, 50+	62	VT	Kiikala, Korkianummi	1967	O. 1968, no. 91, p. 50
85+, 61+	66–68	VT	Somerniemi, Kalaton-lampi	1966–68	O. 1967 c, no. 59, p. 33
63+	70	VT	Pohja, Brödtorp	1968–69	O. 1969, no. 43, p. 30
110+, 63+	66–68	VT	Somerniemi, Kaitalammi – Saarijärvi	1966–68	
151+, 83+, 58+	70–73	VT	Sammatti, Luskala	1965–69	O. 1969, no. 44, p. 30
64+	–	VT-MT	Karjalohja, Sonnilampi	1965	An abandoned field, O. 1967 a, no. 12, p. 31
231+, 55+	68–69?	VT	Suomusjärvi, Vähänummi	1967–68	O. 1967 c, no. 72, p. 36
119+, 63+	70–71	VT	Kiikala, Varesjoki	1968–70	
149+, 60+, 53+	73	VT	Tenhola, Skogby	1968	O. 1969, no. 112, p. 24
143+, 66+	71–76	VT-MT	Karjalohja, Härjänvatsa	1964–69	O. 1968, no. 62, p. 42
110+, 67+	82–83?	VT	Somerniemi, Salakkajärvi	1966–67	O. 1969, no. 125, p. 26
89+	74–75?	VT	Liperi, Möleikkö	1966	
142+, 80+, 60+	73–79?	VT	Sammatti, the vicinity of Lohilampi	1962–68	O. 1969, no. 54, p. 32
118+	79	VT-MT	Suomusjärvi, Sallittu	1968	
114+, 72+	93	VT	Kiikala, Nummenharju	1964–65	O. 1967 c, no. 81, p. 38
53+	?	VT	Sammatti kk.	1970	
108+, 68+	88–89	VT	Pohja, Brödtorp	1968–69	
75+	?	VT-MT	Sammatti, Lohilampi	1962	O. 1967 c, no. 73, p. 36
93+, 50+	84?	VT	Suomusjärvi, Pöytäkangas – Huhtilampi	1967	
111+, 80+	90	VT-MT	Karjaan mlk., Meltola	1969	
167+, 76+, 59+	88	VT	Tenhola, Skogby	1968	
84+, 54+	?	VT	Karjaan mlk., road 53, at the border Lohjan mlk.	1966–68	O. 1967 c, no. 95, p. 40
145+, 72+	?	VT	Nummi, Ridankorpi	1970	

No.	Size of the stand, m						
	Mai.b.	Conv.m.	Cal.e.	Pt.a.	L.cl.	L.a.	L.c.
90	11.9	*12.4*, 12.4	—	34, *30*		—	—
91	12.2×12.0	11.7, 11.2	11.2	35, 35, 33.5, 32		38.7, 37	22.8
92	*12.3*, 11.4		*12.3*	34, 31.5		37.2	22.8, 22.7, 22.5
93	12.3	—	—	—	36.6		21.5
94	13.9	—	14.0, 13.2	39, 37	44, 44, 43, 42	36	—
95	14.0, *13*	14, 14, 14	14, 14, 14, 14	38, 36	41.5	38, *36*	28, 28, 28, 28
96	14.1, 13.8	—	—	40, 37.5	41.6	43, 41.4, 37	26.5
97	15.0×13	—	14.4, 14.3, 13	41. *37*, 41 (×50)	—	*41.2*, 35.5	31.8, 28.5
98	15.2	—	—	41, 40, 39.5	—	41.5	—
99	15.9	15.5	15.5	44, 43.5, 41	54.5, 53.5, 53.0	50, 47	32.7
100	16.6	15.8	16.0, 15.6	46, 46, 46, 43.5	—	48	—
101	17.0, 16×14, 16	—	16.0, 16	46	—	—	—
102	17.7	—	17.8 (×23.5)		—	—	—
103	18.5	—	—	53	—	—	—
104	18.9	—	—	53.5, 53, 50 × 39	—		
105	19.8		—	62	—		—
106	20.0	—	—	59	70	—	—
107	*21.7*		*21.2*	63, 62, 60	—	—	—
108	22.0×21	—	23, 21, 20, 19.6	66, 63 (×93)	—	—	51, 55*
109	22.5×18	20.5	—	70, 70	—	—	57*
110	*23.4*	—		*73*, *73*, 69.5, 66.5	—	—	—
111	24.6, 25 (×29)	—		72, 63, 62, 61	—	—	—
112	25.5	—	—	75, 68, 68, 63	—	—	—
113	26×24.5, 26, 26	26	—	75	—	—	—
114	26	—	—		—	—	60, 58, 55
115	29.5, 29.3	—	29.1, 29×20.7	88, 87, 86, 84	—	—	—
116	30	—	—	90, 90, 88, 84	—	—	—
117	33.5	—	—	104, 100, 98	—	—	85, 85
118	38.9	—	—	108.5	—	—	—
119	46.5	—	—	130, 130	—	—	—
120	60×50	—	—	170, 162, 160	—	—	—
121	*155.5*	—	—	*489*	—	—	—

Age of the tree stand, years	Date of fire, years ago	Forest site type [1]	Locality	Year	Additional information
84+	?	VT	Tenhola, Lappohja	1968	O. 1969, no. 141, p. 26
137+, 88+	98	VT-OMT	Lohjan mlk., Muijala	1969	
82+	?	VT-MT	Somerniemi, Äyräsnummi	1970	
148+, 90+	94	VT	Kiikala, Koivulammi	1967	O. 1968, no. 75, p. 42
70+	110	VT	Karjalohja, Härjänvatsa	1964	O. 1968, no. 82, p. 42
167+, 101+	112—116	VT	Sammatti, Luskala	1964—68	O. 1969, no. 81, p. 32
152+, 108+	116—117	VT	Kiikala, Varesjoki—airfield	1966—67	
167+, 101+	112—116	VT-MT	Kiikala, Korkianummi	1966—70	O. 1968, no. 139, p. 52
76+	?	VT-MT	Tammisaaren mlk., Kittelmossen—Vitsand	1968—69	O. 1970, s. 195, from the time of the Crimean war (1854)
150+, 120+, 60+	129—130	VT	Nummi—Somerniemi, Lakiasuo—Herakas	1967—68	O. 1968, no. 89—92, p. 44
149+, 77+	129—130?	VT-MT	Tenhola, Skogby—Harparskog	1968—69	O. 1969, no. 94, p. 32
70+	?	VT-MT	Karjalohja, Härjänvatsa	1964	
77+	?	VT	Somerniemi, Suojoki	1968	
115+	?	OMT	Hyvinkää, Märkiönjärvi	1970	
188+	?	VT	Tenhola, Lappohja	1968—69	
148+	?	VT	Suomusjärvi, Sallittu	1968	The tree stands has appeared after a fire
145+, 80+	?	VT	Sammatti, Lohilampi	1964	
160+	?	VT	Tammela, Liesjärvi—Kyynärä	1970	
209+, 170+	181—182?	VT	Sammatti, Luskala	1964—68	O. 1967 c, no. 46, p. 46
137+, 82+	?		Lohjan mlk., Muijala	1969	
245+, 190+	206	VT	Kemiö—Sandö tienvarsi	1966	
60+	?	VT	Tammisaaren mlk., Kittelmossen	1968	
156+, 60+	?	VT	Suomusjärvi, Huhdanoja	1968—69	
209+, 80+	?	VT	Sammatti, Luskala	1964	O. 1967 c, no. 119, p. 46
154+	?	VT	Punkaharju, Hynninsaari	1963	
60+	?	VT-MT	Tammisaaren mlk., Leksvall—Kittelmossen	1968	O. 1969, no. 121, p. 34
148+, 70+	?	VT	Sammatti, Lohilampi	1963—64	
204+, 140+	?	VT	Karjaa—Snappertuna, the vicinity of Raasepori railway station	1966—69	O. 1967 c, 116, p. 45
71+	?	VT	Kitee—Rääkkylä roadside, near the commune border	1966	
60+	?	VT-MT	Pohja, Fårsjö	1968—69	
80+	?	VT-MT	Sammatti—Karjalohja, the vicinity of Lohilampi	1963—64	
102+, 70+	?	VT	Rääkkylä—Kitee roadside, km 21—19	1966	O. 1967 b, p. 41. Mai.b. touches a road

[1] See Cajander 1949
[2] Slanted numbers: stands have same origin, overlap or grow next to each other
[3] Probably secondary
[4] O. = Oinonen

OINONEN, EINO O.D.C. 181.71

1971. The time table of vegetative spreading in oak fern (*Carpogymnia dryopteris* (L.) LÖVE & LÖVE) and may-lily (*Maianthemum bifolium* (L.) F. W. SCHMIDT) in southern Finland.
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The rate of vegetative spreading in oak fern and may-lily was studied by comparing the size of stands formed by individual plants of these species with those of other species growing on the same sites as well as with the time that had elapsed since the last fire on the sites and the age of the tree stand. The average maximum rates of spreading showed to be of similar magnitude in both species, being 12.6 cm/year in oak fern and 12.3 cm/year in may-lily; these values correspond to a radial growth of 6.3 and 6.1 cm/year respectively. The maximum radial growth recorded was about 7 cm/year in both species.

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CENTRALSKOGSNÄMNDEN SKOGSKULTUR

SUOMEN PUUNJALOSTUSTEOLLISUUDEN KESKUSLIITTO

OSUUSKUNTA METSÄLIITTO

KESKUSOSUUSLIIKE HANKKIJA

SUNILA OSAKEYHTIÖ

OY WILH. SCHAUMAN AB

OY KAUKAS AB

RIKKIHAPPO OY

G. A. SERLACHIUS OY

TYPPI OY

KYMIN OSAKEYHTIÖ

SUOMALAISEN KIRJALLISUUDEN KIRJAPAINO

UUDENMAAN KIRJAPAINO OSAKEYHTIÖ

KESKUSMETSÄLAUTAKUNTA TAPIO

KOIVUKESKUS

A. AHLSTRÖM OSAKEYHTIÖ

TEOLLISUUDEN PAPERIPUUYHDISTYS R.Y.

OY TAMPELLA AB

JOUTSENO-PULP OSAKEYHTIÖ

TUKKIKESKUS

KEMI OY

MAATALOUSTUOTTAJAIN KESKUSLIITTO

VAKUUTUSOSAKEYHTIÖ POHJOLA

VEITSILUOTO OSAKEYHTIÖ

OSUUSPANKKIEN KESKUSPANKKI OY

SUOMEN SAHANOMISTAJAYHDISTYS

OY HACKMAN AB

YHTYNEET PAPERITEHTAAT OSAKEYHTIÖ