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The biology of *Mercurialis perennis* L. polycormones

KRYSTYNA FALIŃSKA

Institute of Botany, Polish Academy of Sciences and Białowieża Geobotanical Station, Warsaw University, 17-230 Białowieża, Poland

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Abstract

The developmental cycle of *Mercurialis perennis* L. polycormones lasts about 6 years. Under natural conditions polycormones arise by way of vegetative propagation. Their development and growth depend on the age, size and developmental state of the part of the plant from which the new individual arises. Development of the polycormone is most intensive in the first three years. During that time the young individuals increase their number of above-ground and underground shoots according to geometrical progression. A certain stabilization in growth and spread was observed in the 4th and 5th year of life. At that time the polycormones are of spherical or oval shape and their structure is mono- and polycentric. Their surface area is 0.51-2.0 m² and the number of above-ground shoots amounts to 80-200. In the following years the intensity of regeneration decreases. Polycormones developing in garden culture reach their senile phase in the 3rd and 4th year of life, whereas in natural conditions in the 5th and 6th year. Then gradual dying of the oldest parts of the polycormone starts its division into several independent units. The rapid increase of the area occupied by the newly arising individuals leads to obliteration of the boundaries between them. The development of the aggregation-field distribution specific for this species is preceded by random and aggregation-random distribution of the polycormones in the *Tilio-Carpinetum* herb layer. It is evaluated that compact one-species patches of *Mercurialis parennis* L. form in forest communities in about 10 years.

INTRODUCTION

Mercurialis perennis L. belongs to the relatively rare dioecious species in the herb layer of forest communities. It mainly multiplies vegetatively, and is a perennial plant which, according to the classification of Łukasiewicz (1962), belongs to rhizomic caulophytes. The underground part of *Mercurialis* is formed of rhizomes, adventitious roots, regenerative and joining shoots. The latter connect distant agglomerations of above-ground shoots (Fig. 1). The intensive spread of individuals with simultaneous vegetative propagation lead in a relatively short time to the obliteration of their distinctness. Owing to the difficulties in distinguishing individuals, the above-ground shoots are frequently considered as independent units (Mukerij 1936, Hutchings and Barkham 1976, Toropova 1977, Kowal and Latowski 1978, Falińska 1979). In the present investigations it was assumed that "an individual is a morphologically complete and physically uninterrupted organism which is an ontogenetic and phytocenotic unit" (Smirnova et al. 1976).

The aim of the studies was to acquire a better knowledge of the biology of polycormones. Their following characteristic properties were investigated: 1) the way of arising and spread of the polycormone, 2)

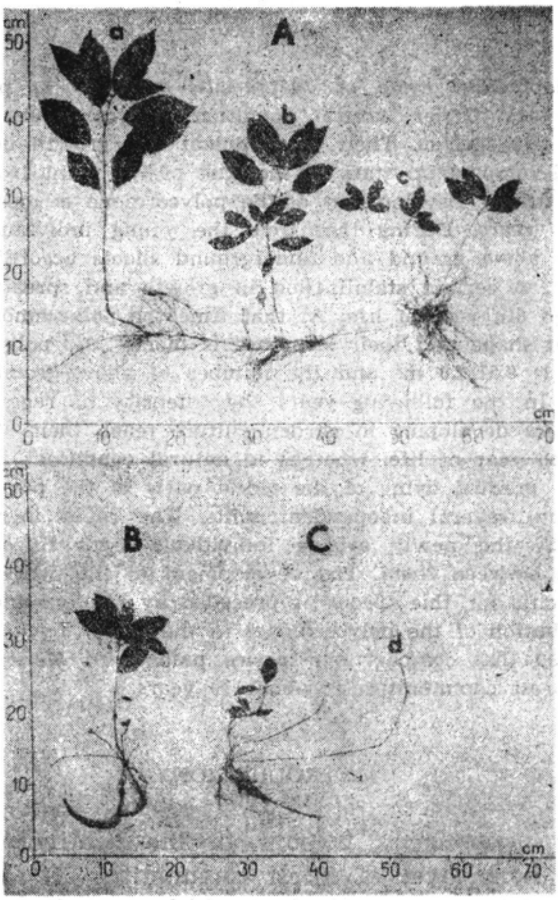

Fig. 1. Characteristic distribution of above-ground shoots: mature (a) and juvenile (b, c) and of underground organs in a two-year polycormones of vegetative origin (A). Two-year individual of generative origin (B). One-year individual after detachment from parent polycormone (C), regenerative shoots (d)

the size and variations in the area occupied by the individual, 3) the dynamics of the number of above-ground shoots, 4) the proportion of generative, virginal and juvenile shoots in the structure of the polycormone, 5) the ratio between the biomass of above-ground parts to that of the underground parts, 6) the durability of the joining rhizomes between the aggregations of above-ground shoots, that is the durability of the polycormone as individual, 7) the causes of disintegration and integration of polycormones. The data served for establishing to what degree the properties of polycormones decide of the spatial, age and sex structure of *Mercurialis perennis* L. populations.

MATERIAL AND METHODS

The investigations were performed in the period 1975-1980 in the forest communities of the Białowieża National Park and in the experimental garden.

FIELD STUDIES

Study plots. The *Mercurialis perennis* L. individuals preserve their distinctiveness above all in the early developmental phases of the population. Therefore, the study plots were established in the period of penetration of this species into the *Tilio-Carpinetum* herb layer (A, B). In a patch of this forest (where in 1974 development of the first individuals of *Mercurialis perennis* had been noted) two study plots A and B were established. These study plots of 400 m² (20 × 20 m) were divided into 4 × 4 m plots and numbered (Fig. 2). Moreover, two other study areas of 250 m² (Fig. 3) used earlier for studies on this species were utilised.

Observations. Over five seasons (1975-1979) polycormones were mapped in a 1 : 100 scale as they developed on the particular plots (Figs. 2, 3). The conditions are optimal for distinguishing the boundaries of the *Mercurialis perennis* polycormones in the period of intensive development of juvenile shoots on their peripheries, that is in April and September. Mapping of the areas occupied by individual polycormones was easier at this time also, owing to the low compactness of the herb layer. For detailed investigations on the development and growth of *Mercurialis parennis* L. polycormones 30 of them were labelled on the A and B study plots (Fig. 2). In each vegetative season these individuals were mapped in a 1 : 10 scale and the distribution of juvenile virginal (mature but not flowering) and generative shoots was marked. The developmental stages of the shoots were classified after Rabotnov (1969).

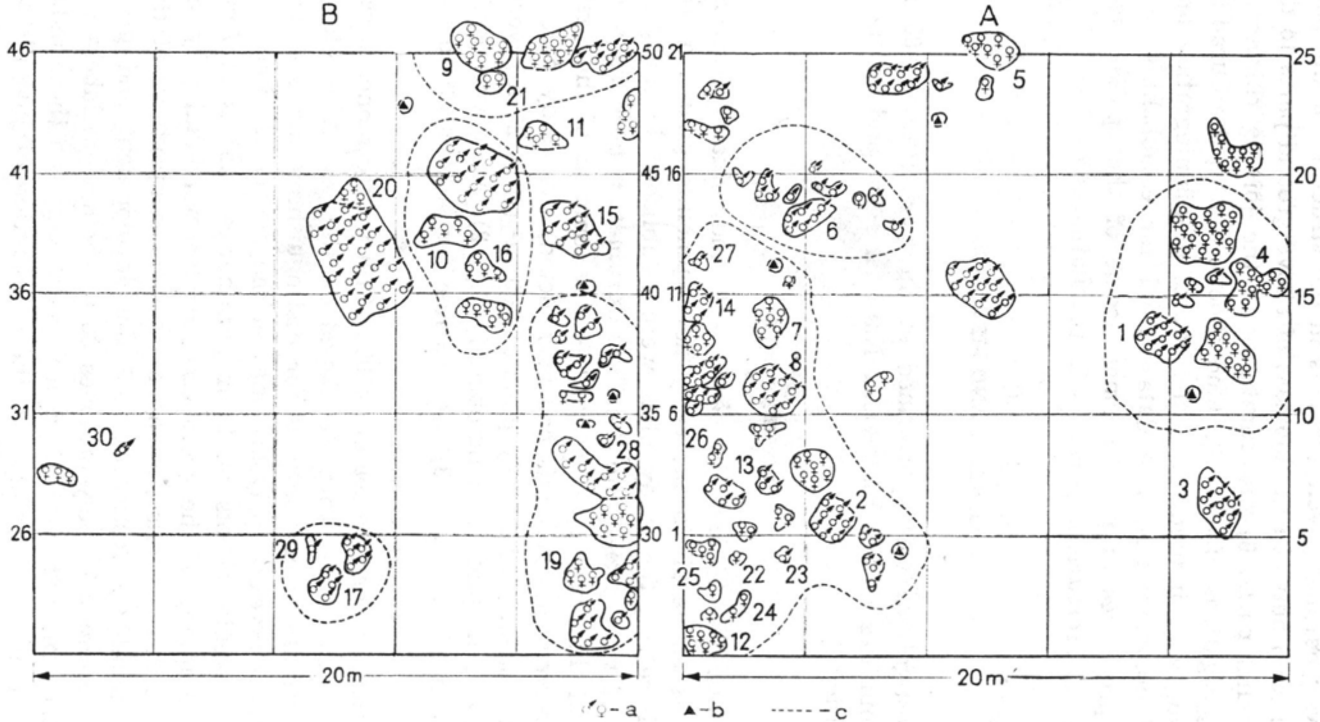

Fig. 2. Size and distribution of *Mercurialis perennis* polycormones in *Tilio-Carpinetum* herb layer. a — polycormones in generative phase, b — juvenile polycormones developing from seeds, c — polycormones in phase of integration, 1-30 polycormones chosen for observation of development biology

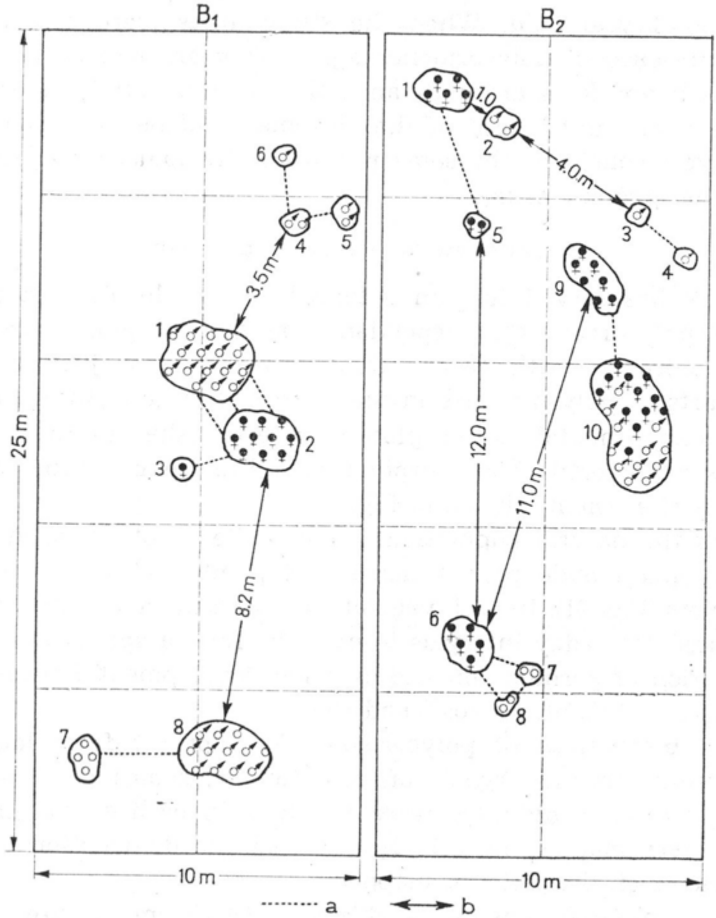

Fig. 3. Size and distribution of *Mercurialis perennis* L. polycormones in herb layer of *Tilio-Carpinetum*. a — aggregations connected by a common rhizome system, b — distance between polycormones of various ages. State as of 1980 after collecting of various-aged polycormones

Collection of material. In 1980 on the study plots A and B ten male and ten female specimens were taken at the phase of flowering from among the labelled 4- and 5-year-old polycormones. The same number was taken from the experimental garden where they grew since 1975. The collected plants served for determination of rhizome length, number of rooted shoots and durability of joining shoots and for calculating the ratio of the biomass of above-ground shoots to that of the underground ones. Moreover, from the areas B_1 and B_2 different-aged individuals were taken in each season. Their age was established on the basis of the calendar in which the beginning of development of the individuals on the particular plots was recorded. A total of 30 polycormones aged from one to six years was collected. The oldest individuals were 7 and 8 years old. When the study areas were established in 1974 the presence of polycormones aged 1-2 years had been recorded. The plants taken from areas B_1 and B_2 served for studying the changes in the habit, and length of the rhizomes in dependence on the age of the polycormone. For the same purpose individuals were also collected from the garden culture.

INVESTIGATIONS IN GARDEN CULTURE

These studies served to gain a knowledge of the development and growth of polycormones in dependence on their origin: a) from fragments of rhizomes with regenerative buds, b) from juvenile shoots, c) from parts of polycormones in the course of their disintegration.

In the experimental garden plots were established in 1975 of 0.50× ×0.50 m size on fertile *Tilio-Carpinetum* soil and experiments were run according to the scheme shown in Fig. 4.

1. From the natural population 100 juvenile shoots were taken both from male and female polycormones and planted at a 10 cm spacing on the 8 plots (Fig. 4I). In each vegetation season the above-ground shoots were counted at 10-day intervals to note the rate of spread on the plots. For evaluation of germination and seedling development 100 seeds were sown on each of two plots (Nos 5 and 10).

2. For observations of polycormone development from large fragments of underground organs, on ten plots rhizomes of two-year-old male and female individuals were planted. In each season the polycormones were mapped in a 1:10 scale and the distribution of above-ground shoots on the plot was mapped.

3. On 30 plots fragments of rhizomes 10-15 cm in size with regenerative shoots were planted. In this experiment polycormone formation, frequently noted in natural populations, was simulated.

LABORATORY ANALYSES

The polycormones collected from natural populations (50) and the experimental garden (20) served for further investigations. The area occupied by the network of rhizomes and roots was referred to as the underground surface area of the polycormone. For this purpose after digging out the polycormones their underground parts were placed on trays (Fig. 5) so as to arrange them according to their natural pattern. Then a scheme was prepared in a 1:10 scale (Fig. 6) and the number of rooted points in the rhizome system, the distances between the aggregations and the number of regenerative and senile shoots were recorded. The method is shown in Fig. 6. In each polycormone measurements were taken of: the length of juvenile, virginal and generative shoots and rhizomes. The above-ground shoots and rhizomes were weighed after drying at 85°C.

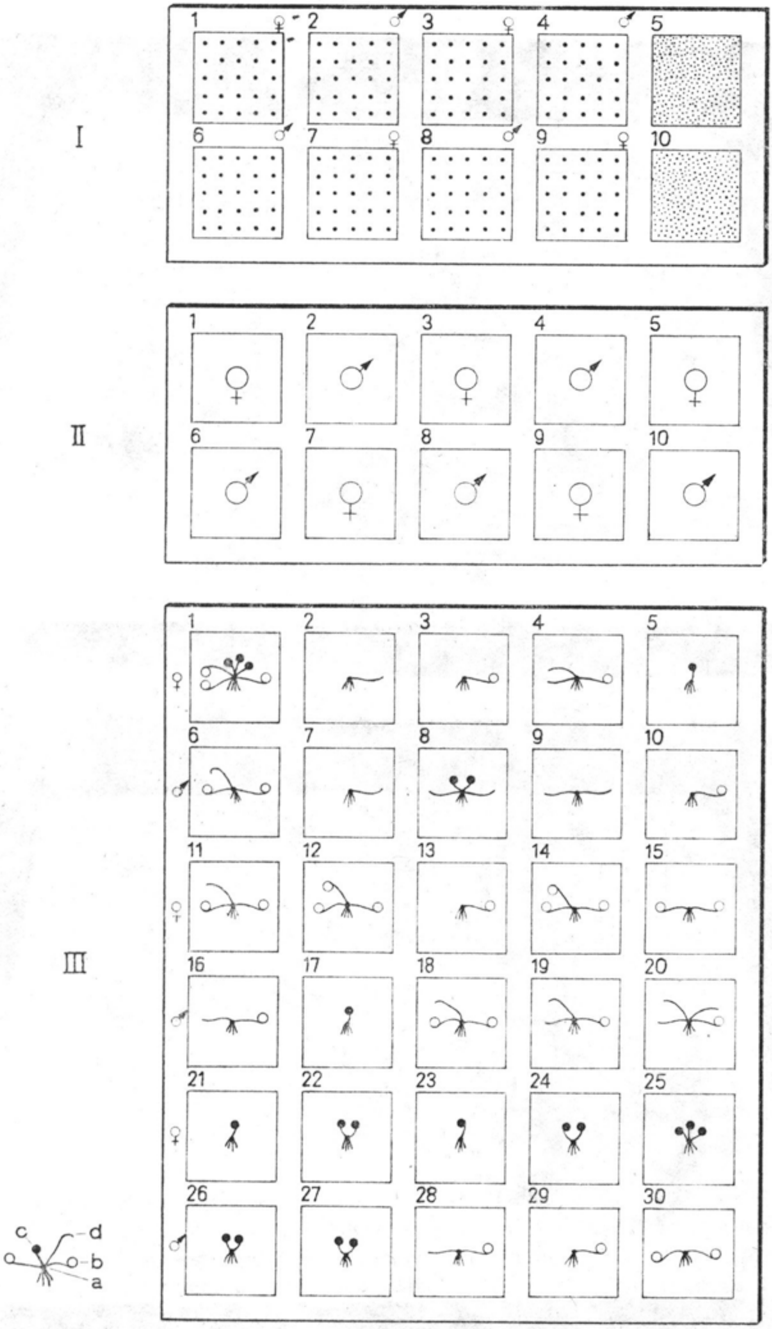

Fig. 4. Scheme of experiment in garden culture. Plots of 0.50 × 0.50 m size. I — development of individuals from juvenile shoots (cf. Fig. 1c) and seeds — plots 5 and 10. II — development of individuals from rhizomes of 2-year polycormones (cf. Fig. 1A). III — development of individuals from regenerative shoots. a — site of rooting of plant, b — regenerative bud, c — regenerative shoot, d — rhizomes

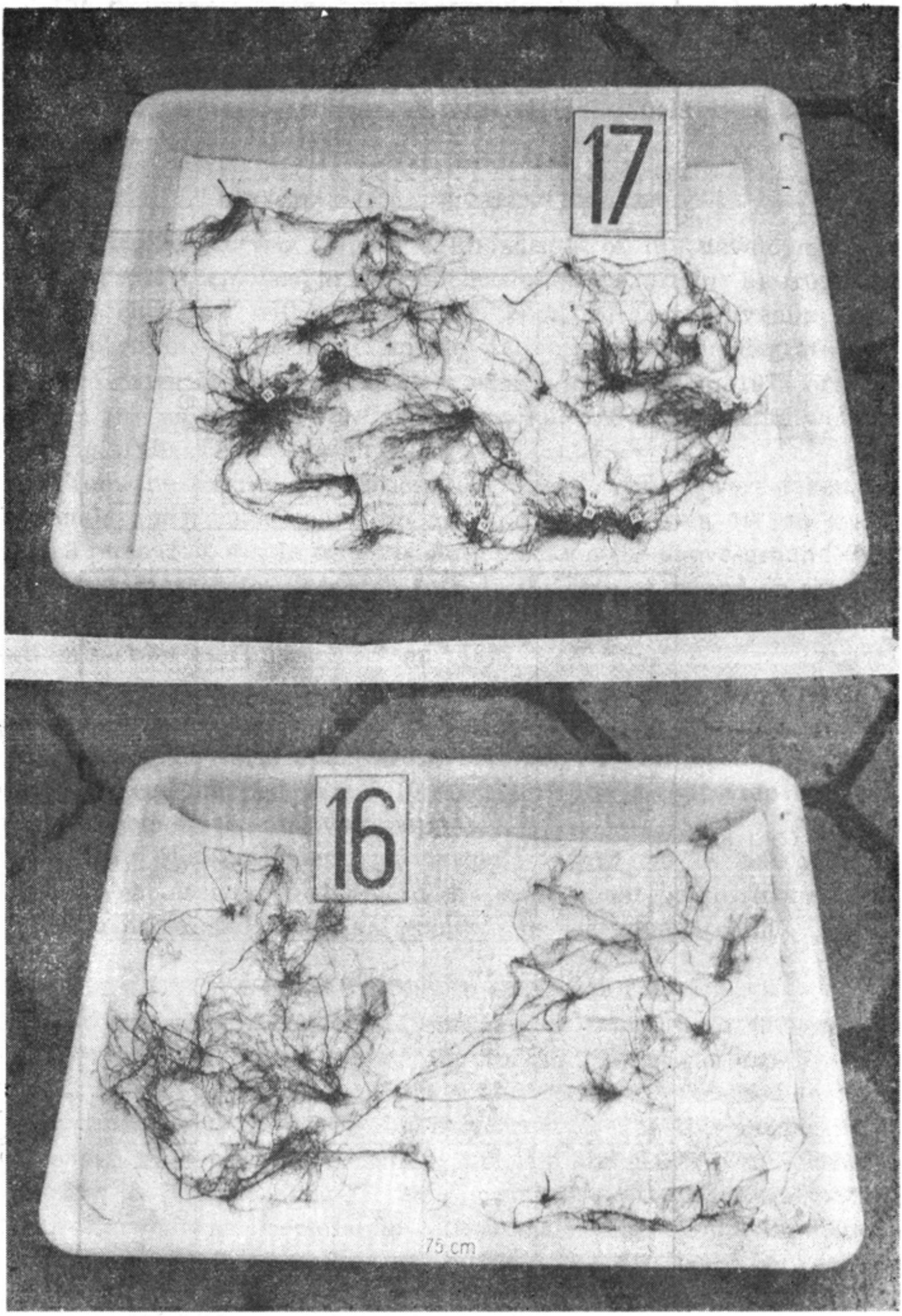

Fig. 5. Underground polycormone organs with monocentric (17) and polycentric (16) structure

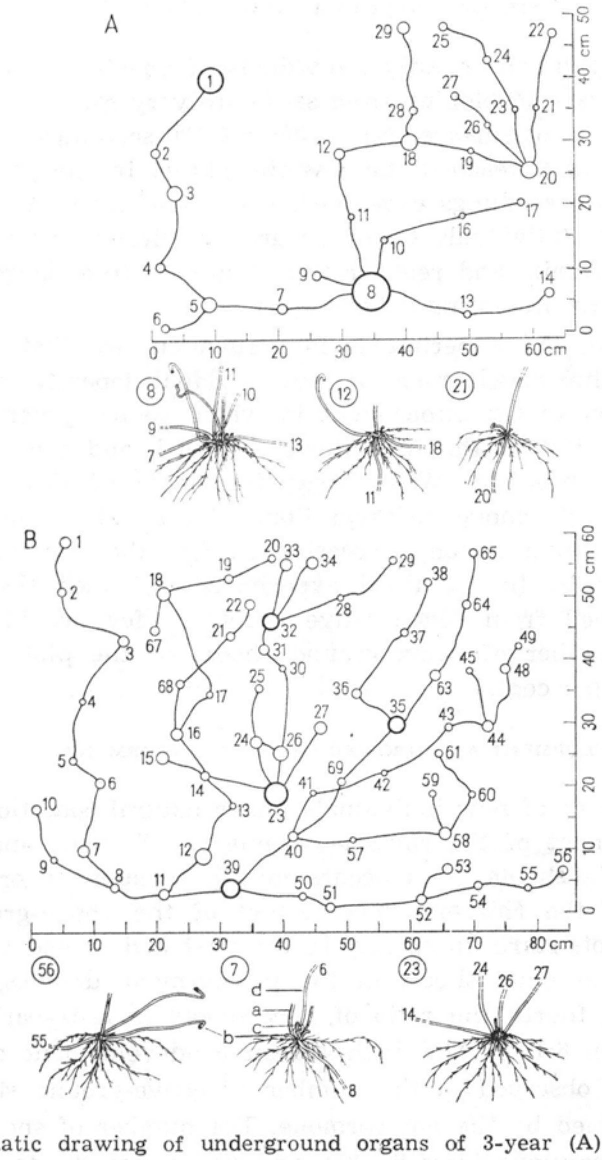

Fig. 6. Schematic drawing of underground organs of 3-year (A) and 5-year (B) polycormone. Figures denote the successive appearance of rooted shoots. Owing to the simultaneous appearance of shoots in various parts of the polycormone, the picture is not unmistakeable. The size of the circle corresponds to that of the shoot aggregation. This is illustrated by chosen shoot aggregations: a — above-ground shoots, b — regenerative shoots, c — senile shoots, d — branchings of rhizomes connecting aggregations

RESULTS

EFFECTIVENESS OF PROPAGATION

In natural populations mainly individuals of vegetative origin were observed. Individuals developing from seeds are very rare. In the course of five years on a joint surface area of 800 m^2 120 seedlings were noted, of which as few as 8 reached the juvenile phase. In the garden from 200 seeds only four seedlings developed, none of which survived to the next season. New individuals under natural conditions arise either by detachment of juvenile and regenerative shoots or from large rhizome fragments of the disintegrating polycormone.

It results from the experiments in garden culture that successful survival and further development of the individual depends on the way in which it arose. In the experiment in which rooted juvenile shoots were set 92 per cent of the individuals survived, and the number of shoots increased threefold. When large fragments of rhizomes were set, simulating polycormone disintegration, all the individuals survived to the next vegetative season, increasing twofold the number of their above-ground shoots. In the third experiment in which the new individuals developed from regenerative shoots as few as 38 per cent survived. The number of above-ground shoots on the plots increased by as little as 20 per cent.

DEVELOPMENT AND GROWTH OF THE POLYCORMONES

The development of new individuals under natural conditions begins with the detachment of the rhizome fragment with buds and regenerative or juvenile shoots. This occurs mostly in summer or autumn. After rooting of the rhizome, development of the above-ground and underground shoots starts in spring. In the first and second season the number of above-ground shoots in the polycormone doubles, whereas in the third and fourth the ratio of new shoots to last-year's ones is 3:1, 4:1 and even 6:1. In the fifth season of development a relative stabilisation was observed in the number of above-ground shoots and in the area occupied by the polycormone. The number of shoots varies then in the polycormone from 80-200, and generative shoots constitute 50-70 per cent. Most frequently polycormones are of spherical or oval shape (Figs. 5, 7, 8). The dimensions of the area occupied by one individual vary from 0.5-2.0 m^2. In this phase the process of gradual dying of the central part of the polycormone begins, with a simultaneous increase in the number of juvenile shoots in the peripheral parts. This process leads to a gradual obliteration of the mono- and polycentric character of the polycormones.

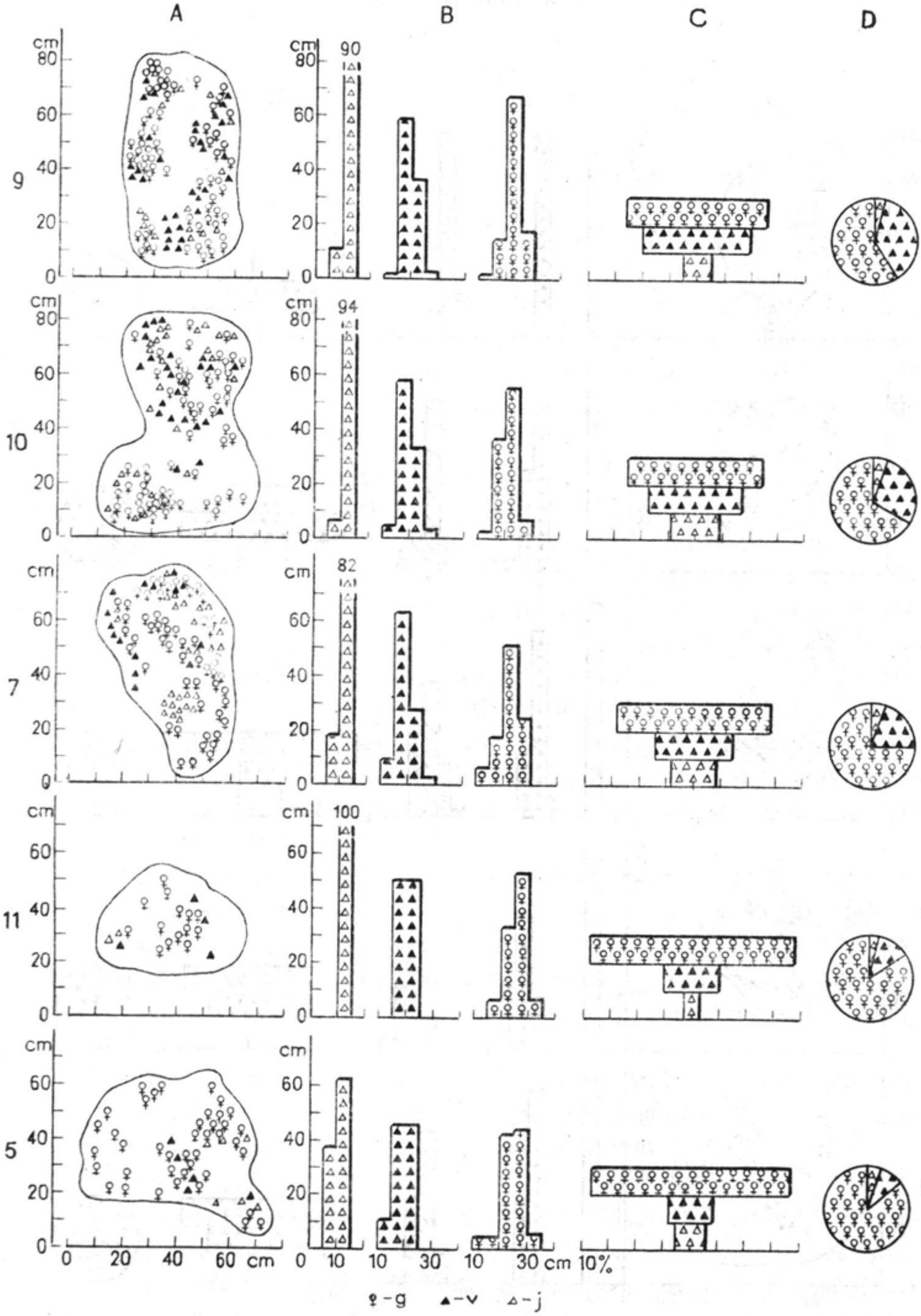

Fig. 7. Properties of chosen female polycormones 4 and 5 years old in natural population. A — area occupied by polycormones, B — size structure of juvenile (j), virginal (v) and generative (g) shoots. C — pyramid of developmental states of above-ground shoots, D — proportion of juvenile, virginal and generative shoots in the biomass of the above-ground part. Polycormones ordered according to the proportion of generative shoots

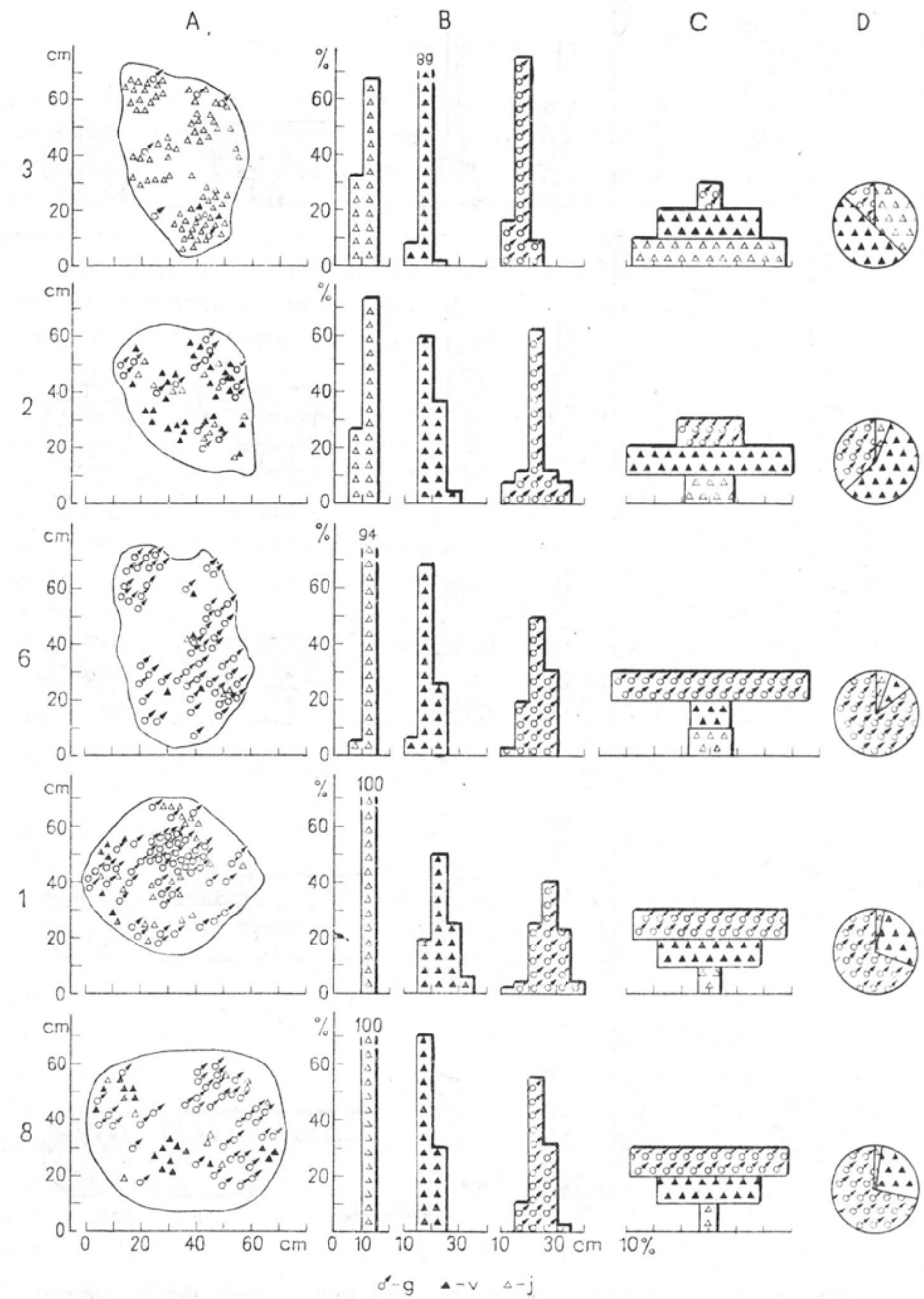

Fig. 8. Properties of chosen male polycormones 4 and 5 years old in natural population (legend as in Fig. 7)

Gradual dying of the central part is usually preceded by an increase in the density of above-ground shoots in the polycormone. Then the regenerative shoots root at a considerable distance from the centre (0.5-1.0 m). This phenomenon is represented for instance by the polycormone no. 6 and the aggregations nos 7 and 8 derived from it on plot B_2 (Fig. 3). The newly forming aggregations of shoots either detach themselves from the parent individual or still remain connected with it for one or two seasons. The detached fragments of the polycormone spread very intensively. The number of regenerative shoots formed to that of the above-ground shoots ratio is 5:1 or 6:1. When the shoot density in the polycormone reaches the critical value of 80-100 above-ground shoots per 1 m^2 this ratio is 1:1 or 0.5:1.

Under natural conditions the division of the polycormone is not always connected with the dying of the oldest rhizomes. It may also be due to the activity of animals or plants forming the herb layer of the *Tilio-Carpinetum*. It was observed that disintegration of the polycormone depends on: its developmental phase, the area occupied by the individual, the density of above-ground shoots and the number of aggregations developing at a large distance from the parent polycormone. Disintegration was most frequently observed when the area exceeded 1.0-1.5 m^2 and the number of above-ground shoots reached 150-200.

Three processes are associated with the development of polycormones, running usually parallelly but with different intensity in the particular periods of their life:

1. Intensive spread, that is an increase of the number of above-ground shoots and elongation of rhizomes as well as an increase in the area occupied by an individual polycormone.

2. Renewal, that is development of above-ground shoots on the site of last-year's (senile) ones, this maintaining their relatively constant number in the polycormone.

3. Vegetative propagation, that is the arising of new independent units as the result of division of the polycormone into two or more parts or of the detachment of small fragments of rhizomes with regenerative or juvenile shoots.

Two basic periods may be distinguished in the life of the polycormone. The first one is characterised by a 10-20-fold increase in the occupied surface and the number of above-ground shoots, an increase in the proportion of generative shoots to 50-70 per cent, a change in the ratio of regenerative to mature shoots from 5:1 to 1:1, a change in the proportion of the biomass of the above-ground part to that of the underground part (Table 1). The second life period of the polycormone is characterised by gradual dying of the oldest parts of the rhizomes.

Table 1

Polycormones biomass at various ages in herb layer of *Tilio-Carpinetum*

Polycormones age, years	Biomass of parts, g		Ratio a: b
	above-ground (a)	underground (b)	
0-1	0.916±0.106	0.801±0.196	1: 0.87
1-2	1.860±0.76	3.540±0.92	1: 1.90
2-3	9.170±2.15	10.890±3.60	1: 1.19
3-4	35.980±9.12	15.12±4.22	1: 0.42
4-5	54.550±8.12	36.320±6.60	1: 0.67

Under natural conditions polycormones attain the senile phase in the 5th and 6th year of life, whereas in garden culture in the 3rd and 4th (Fig. 9). This phase is characterised by the lack of regenerative and the presence of numerous above-ground shoots (30-50%), this causing a gradual diminution of the number of above-ground shoots. Juvenile shoots develop above all in the younger peripheral parts of the polycormone. Dying of rhizomes and the lack of regeneration in the central part lead to disintegration of the polycormone. This process starts the development of new individuals which detach themselves from the polycormone fragments. A model of this process is shown in Fig. 10.

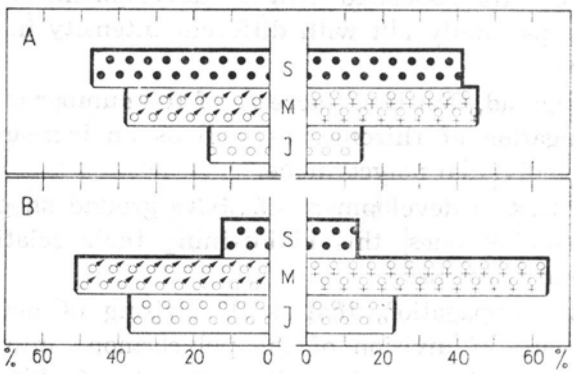

Fig. 9. Pyramid of development states of polycormones of population from garden culture (A) and in *Tilio-Carpinetum* herb layer (B). J — young polycormones, M — mature ones, S — mature ones with dying prevailing over regeneration

AGE AND SEX STRUCTURE

Polycormones developing from juvenile shoots were considered at the moment of their formation as annual. The juvenile phase is, namely, preceded by development of buds and regenerative shoots in the past-year's season. Determination of the age of individuals arising from

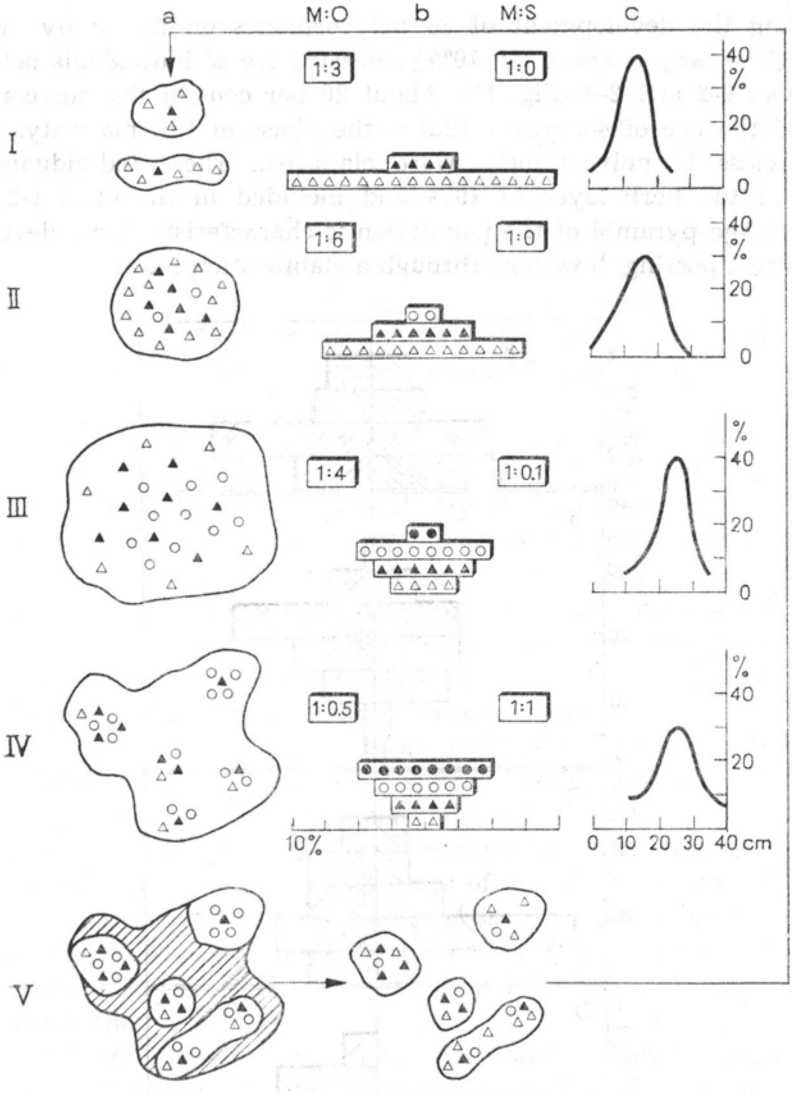

Fig. 10. Model of development and spread of *Mercurialis perennis* L. polycormones. Phases: I — initial development, II — maturation, III — maturity, IV — ageing, V — polycormone disintegration, a — polycormone area, b — pyramid of developmental stages, c — size structure of generative shoots; M — mature, S — senile, O — regenerative

large fragments of the dividing polycormone is not unmistakeable. It results from the investigations performed that the separating polycormone fragments may be different-aged. The youngest part (1-2 years old) lie at the periphery of the polycormone (Fig. 6), while the oldest (3-5 years old) closer to the centre. The age structure of the *Mercurialis perennis* L. population was elaborated on the basis of the calendar recording the development of 89 polycormones on the study areas A and B. The largest group (60-70%) consists here of individuals belonging to classes 0-2 and 2-4 (Fig. 11). About 20 per cent of the polycormones reached the age of 4-6 years, that is the phase of full maturity. To the oldest class 11 polycormones were classified. These individuals were noted in the herb layer in 1974 and included in the class 1-2 years old. The age pyramid of the population is characteristic for a developing population, passing, however, through a stabilisation phase.

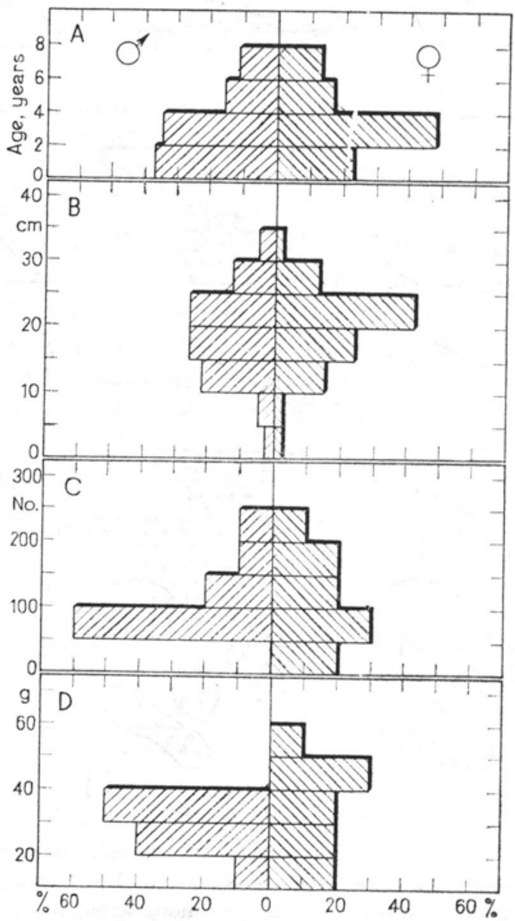

Fig. 11. Properties of *Mercurialis perennis* L. population. Diagrams of frequency classes of: A — polycormone age and sex, B — size of above-ground shoots, C — number of above ground shoots, D — biomass of male and female polycormones

In observations of the development of individuals in the garden culture and under natural conditions four age groups of *Mercurialis perennis* L. were distinguished:

1. Young polycormones (aged 1-2 years) occupying an area of 0.10-

-0.25 m^2, formed of 2-20 mostly juvenile shoots. When the new individual arises by detachment of a fragment of a mature polycormone, it reaches the generative phase as early as the first or the second vegetative season. If, however it develops from regenerative or juvenile shoots, this phase is attained in the second or third year of life.

2. Maturing polycormones (aged 2-3 years) exhibit prevalence of juvenile and virginal shoots. The area occupied varies within the limits of 0.25-1.00 m^2 and the number of shoots from 20 to 100. To this group may belong young individuals as well as older ones aged more than two or three years. The development of the polycormones is dependent, as in the first group, on the age of the rhizome fragment from which the new unit arose.

3. Mature polycormones (aged 4-6 years) occupy an area of 1-3 m^2 and produce 100-200 shoots including 30-60 per cent of generative ones. The ratio of mature to juvenile shoots may be 3:1 or even 10:1.

4. Senile polycormones are characterised by a similar area occupied as in group 3, but in spite of numerous rootings, above-ground and regenerative shoots appear no more. Within the area occupied by the polycormone more and more "empty patches" are seen and the number of juvenile shoots seldom exceeds 10 per cent. In the underground organs the process of gradual dying prevails over renewal.

In the period 1975-1977 a threefold prevalence of male individuals over the female ones was observed on the areas A and B. In 1980 on both areas jointly there developed 49 male and 40 female polycormones (1:1.22). The differences in the sex structure are particularly wide in younger age classes, that is up to 3 years of age. In the group of young individuals this ratio is 1:2 in favour of the male polycormones. The proportions in the group of mature individuals are close to 1:1.

It results from comparison of the properties of male and female polycormones that:

1. Female ones produce more generative shoots than the male ones in the same developmental phase (Figs. 7, 8). The density of above-ground shoots is higher in female polycormones.

2. Male polycormones produce more juvenile shoots, this leading to an earlier detachment of the peripheral parts of the polycormone. In each season more new male than female polycormones appear on the study area.

SPATIAL STRUCTURE OF POLYCORMONES AND OF THEIR POPULATION

With age the polycormones change their shape and size, this influencing the dynamic character of the spatial structure of the *Mercurialis perennis* L. population (Table 1). In the initial phase of development the *Mercurialis* population shows a random distribution of the individuals. On area A 32 individuals started to develop in 1974 and on area B twenty one. They consisted in general of 2-3 above-ground shoots. The rapid growth of the polycormones in the years 1975-1977 led to the development of an aggregation-random distribution. Owing to the intensive development and growth of the polycormones in the successive years, the process of disintegration and coalescence of the newly formed polycormones occurs almost simultaneously. This leads as consequence to an aggregation-field distribution characteristic for this species. The beginning of this process was observed in the years 1979-1980 on the areas A and B (Fig. 2).

PROPERTIES OF *MERCURIALIS PERENNIS* L. POLYCORMONES

New *Mercurialis perennis* L. polycormones arise mainly by way of vegetative propagation. The regenerative shoots together with the adventitious roots and fragments of rhizomes, after detaching themselves from the parent plant fulfill the function of a vegetative diaspore, giving rise to new individuals. They may also form by division of the polycormone into two or more parts. The plants become independent owing to intensive development of both the above-ground and the underground parts.

Young individuals in the first period of development (aged 1-3 years) increase the number of their above-ground and underground shoots according to a geometrical progression. This is also true for the increase of the area occupied by the polycormone. Their development and growth largely depend on the initial situation, that is the number of regenerative shoots, length of rhizomes and adventitious roots of the outset plant fragment.

The polycormone in its development passes through the following phases: formation, maturation and ageing. The first step includes rooting of the migrating plant fragments and formation of the first above-ground shoots. The polycormone is at that time almost spherical and consists of several or a dozen or so juvenile or virginal shoots. In the second step the polycormones multiply the number of their shoots and spread, occupying a much larger area. Frequently in this period the monocentric character of their structure is obliterated. Around the first settling aggregation of shoots several smaller ones arise at a distance of 50-70 cm from the polycormone centre. In the third phase of development the central oldest part usually dies gradually, and its division into several independent units begins. The new individuals start to grow intensively. Owing to their rapid spread the boundaries between them are obliterated.

In the early period of population development the sex ratio of the polycormones is 3 : 1 in favour of the male individuals, whereas later it is close to 1 : 1 (Table 2).

Table 2

Area occupied by polycormones in *Tilio Carpinetum* (see also Fig. 2)

Area occupied by polycormone, m^2	Number of polycormones			
	♂	♀	total	%
0-0.25	18	9	27	30
0.26-0.50	6	9	15	17
0.51-0.75	7	6	13	15
0.76-1.00	6	5	11	12
1.0-2.0	6	6	12	14
>2.0	6	5	11	12
Total	49	40	89	100

The spatial structure of the *Mercurialis perennis* population shows a wide variability: in the first period (1-2 years) the individuals are randomly distributed; in the second (3-4 years) the intensive spread of the polycormones tends to aggregation-random distribution; the third period (5-6 years) is characterised by the coalescence of polycormones, this leading to the formation of large patches of one species. The spatial distribution then becomes almost aggregation-field, specific for this species in forest communities.

The functioning of polycormones as composite individuals depends on their morphobiological properties and the social structure arising in the course of their development (Figs. 7, 8).

It was found that for full development of each above-ground shoot a space of 100 cm^2 is necessary. The above-ground shoots in the polycormone developed at regular intervals of 10-20 cm. As the density of above-ground shoots increases, the number of regenerative shoots diminishes. When the density exceeds 100 shoots per 1 m^2, division of the polycormone was observed even before it attained the senile phase. Under natural conditions the durability of the polycormone is ensured by continuous, permanent substitution of senile by juvenile shoots.

The differentiated size structure and that of the developmental stages of the above-ground shoots decide of the definite social structure of the polycormone. Mature shoots are in general situated in the central part of the polycormone or of the aggregations of shoots arising within it. Juvenile shoots mainly develop in the peripheral parts of the polycormone, this facilitating their eventual detachment. The above ground shoots of various size form in the polycormone a layered structure favourable to the coexistence of several score or even several hundred above-ground shoots (Figs. 7, 8).

DISCUSSION

The problem of the individual in ecological investigations is the subject of numerous theoretical and methodical considerations. One of the causes limiting the development of the ecology of perennial herbaceous plants is the difficulty of distinguishing individuals under natural conditions. Perennials during their development for several of a dozen or so years increase manifoldly their underground and above-ground parts. Serious technical difficulties in collection of unimpaired plants are the cause of conventional treatment of rooted above-ground shoots as independent individuals (Rabotnov 1969). It results, however, from the present studies performed on the biology of polycormones development that they are artificially distinguished units, since *Mercurialis perennis* individuals in the form of single shoots do not occur under natural conditions. Regenerative shoots develop as early as the juvenile phase and by rooting form individuals with several shoots. Thus, this is a specific character of polycormones. In this case treatment of above-ground shoots as independent units does not give sufficient grounds to investigations on many functional and structural population aspects. The conventional individual is rather a necessity of methodical nature. To quote an example: the sex structure of *Mercurialis perennis* L. evaluated on the basis of generative shoots and individuals in the biological sense gives a somewhat different picture. The ratio of female to male shoots is 1 : 3 and that of male and female polycormones 1 : 1. Observations on the biology of male and female polycormones in garden culture and under natural conditions confirm the earlier advanced hypothesis (Falińska 1979) that these differences are the result of an unequal rate of spread and maturation of polycormones of different sexes.

Many practical and theoretical problems could be better solved if in population investigations it would be possible to deal with individuals in the biological sense. This concerns particularly such population aspects as age structure, spatial structure, interaction between individuals, dynamics of the abundance of individuals on the given site.

Nevertheless, some problems of population ecology can be solved by assuming the conventional definition of an individual. To those problems belong: the density of the plant, the structure of the developmental states and size of shoots and seed production. Sometimes polycormones are treated in population investigations as clones (Toropova 1977). This is not correct from the point of view of the definition of a clone, according to which clones constitute independent individuals arising by way of vegetative propagation, whereas polycormones arise by growth of above-ground and underground parts. It is the processes contributing to the disintegration of the polycormone that lead to the formation of clones. Polycormones are sometimes treated as colonies, and this is not irrational. Above-ground and underground shoots forming the polycormones occupy various places in space and fulfill various functions similarly as they do in colonial organisms.

In the present study polycormones were treated as composite individuals functioning owing to a definite spatial structure and the differentiated role of their particular parts, resulting from the morphological-developmental properties of perennial herbaceous plants.

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REFERENCES

Falińska K., 1979. Modifications of plant populations in forest ecosystems and their ecotones. Pol. Ecol. Stud. 5: 89-150.

Hutchings M. J., Brakham J. P., 1976. An investigation of schoot interactions in *Mercurialis perennis* L. a rhizomatous perennial herb. J. Ecol. 64: 723-745.

Kowal T., Latowski K., 1978. Badania nad produkcją biomasy u *Mercurialis perennis* L. Prace Komisji Biologicznej PTPN. 50: 5-25.

Mukerij S. K., 1936. Contributions to the autecology of *Mercurialis perennis* L. J. Ecol. 24: 39-81.

Łukasiewicz A., 1962. Morfologiczno-rozwojowe typy bylin. Prace Komisji Biologicznej PTPN 27: 398.

Rabotnov T. A., 1969. On coenopopulations of perennial herbaceous plants in natural coenoses. Vegetatio 19: 87-95.

Smirnova O. W., Zaugolonova L. B., Ermakova I. M., 1976. Cenopopulacii rastenij. "Nauka", Moskwa, p. 217.

Toropova H. A., 1977. Rozwitie zarsli prolesnika *Mercurialis perennis* L. (*Euphorbiaceae*). Bot. Zhur. 62: 1433-1441.

Biologia polikormonów Mercurialis perennis L.

Streszczenie

Cykl rozwojowy polikormonów *Mercurialis perennis* L. trwa około 6 lat. W warunkach naturalnych polikormony powstają głównie na drodze rozmnażania wegetatywnego. Ich rozwój i wzrost zależy od wieku, wielkości i stanu rozwojowego części rośliny, z której powstaje nowy osobnik. Najintensywniejszy rozwój polikormonu przypada na pierwsze trzy lata. Wówczas młode osobniki zwięk-

szają liczbę pędów nadziemnych i podziemnych w postępie geometrycznym. Pewną stabilizację w rozrastaniu i powiększaniu areału obserwowano w 4 i 5 roku życia osobnika (ryc. 7, 8). Polikormony mają wówczas kształt kulisty lub owalny (ryc. 2, 3), a budowę mono- i policentryczną. Ich areał wynosi 0,5-2,0 m^2, a liczba pędów nadziemnych 80-200. W latach następnych spada intensywność odnawiania. Polikormony rozwijające się w kulturze ogrodowej fazę senilną osiągają w 3 i 4 roku życia, gdy w warunkach naturalnych w 5 i 6. Wtedy obumieranie najstarszych części polikormonu zapoczątkowuje jego podział na kilka samodzielnych jednostek. Szybkie powiększanie się areału nowopowstających osobników prowadzi do zaniku granic między nimi (ryc. 2). Ukształtowanie się właściwej temu gatunkowi struktury łanowo-skupiskowej poprzedza przypadkowe i losowo-skupiskowe rozmieszczenie polikormonów w runie grądu. Oceniono, że zwarte jednogatunkowe płaty *Mercurialis perennis* L. w zbiorowiskach leśnych kształtują się około 10 lat.