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THE EFFECT OF THE SIZE OF COTYLEDONS ON THE DEVELOPMENT OF INDIVIDUALS IN IMPATIENS NOLI-TANGERE L. POPULATION

ABSTRACT: In two forest phytocoenoses of the Białowieża National Park populations of annual species *Impatiens noli-tangere* have been investigated. It has been observed that the size of cotyledons of seedlings decides about the survival, biomass production during the ontogenetic cycle, diaspore production and the competitive force of an individual. All these characters attain higher values in plants from seedlings with large cotyledons than from those with small cotyledons. Similar are the relations which characterize individuals of both phytocoenoses examined: oak-hornbeam forest and swampy alder forest.

KEY WORDS: *Impatiens noli-tangere*, populations of annual plants, survival, competition, home range, oak-hornbeam forest, swampy alder forest.

C o n t e n t s

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1. INTRODUCTION

Seeds have a genetically coded period and type of state of repose, time and ability of germinate, and also vitality. But these characters undergo environmental modifications depending on such factors as: temperature, moisture, light and fertility of habitat.

Seed germination and formation of seedlings belong to significant factors deciding about the final number of population of a given species in a specific environment. This is so, because the mortality in these early stages of ontogenesis is usually the highest. Several investigations have been carried out on the mechanisms of controlling the density of seddlings, influence of biotic and abiotic factors on their survival, formation by juvenile individuals of their future spatial population structure (H a r p e r and W h i t e 1970, S y m o n i d e s 1974, 1979, W i l k o ń-M i c h a l s k a 1976), on competition phenomena in the earliest stages of ontogenetic development (Z a r z y c k i 1968).

It is also known that the size of the seed determines the size of seedling. It also affects the increase rate of assimilation area and biomass increment (B l a c k 1956). The size of the seed reflects thus its abundance in reserve substances, which are the main food source for the growing plant during germination. Independent existence of a seedling starts from the moment it appears on the soil surface and the cotyledons develop, which when turning green become the photosynthetizing organs (P o t a p c z y k 1971). The surface area of this assimilation area may decide about the survival of seedlings. This dependence has been proved for seedlings of <u>Caltha palustris</u> L.: survival of seedlings with large cotyledons was 80%, whereas those with small cotyledons - only 20-30% (F a l i ń s k a 1977).

The aim here is to determine the effect of the size of cotyledons on the morphological-physiological characters of an adult individual. It has been also investigated to what extent the size of cotyledons of seedlings affects successive stages of ontogenesis, life span of a given individual, size of generative reproduction. A question has been asked whether having information about the seedling growth it is possible to determine the future importance of an individual in the population.

For this purpose the Impatiens noli-tangere population has been chosen. It should be given special attention because it is one of the few annual species of the herb layer in forest ecosystems of the Białowieża National Park. Studies on Impatiens noli-tangere population are carried out in order to determine the mechanisms which allow these plants for the co-occurrence with perennials - main herb layer components. Perhaps the differentiation in the seedling stage is a kind of adaptation, thanks to which Impatiens noli-tangere population is not driven out from the herb layer of complex forest ecosystems by perennials.

2. AREA, METHODS, MATERIAL

The studies were conducted during the vegetation season between May and July 1980 on constant research areas in the Białowieża National Park. Within the phytocoenosis of oak-hornbeam forest (Tilio-Carpinetum stachyetosum Traczyk 1962) and swampy alder forest (Circaeo-Alnetum Oberdorfer 1953) 10 squares, 1 m × 1 m, were chosen for detailed analyses. When the seedlings of Impatiens noli-tangere appeared (second half of May) their numbers were determined for each square and cartograms of position of particular plants in the scale 1 : 10 were made. Seedlings were then counted every 10-15 days, depending on the duration of particular development stages of Impatiens noli-tangere.

According to the size of cotyledons all seedlings were divided into two classes: seedlings with small cotyledons (5-9 mm in length) and with large cotyledons (10-14 mm in length).

Out of all experimental squares, pairs were chosen with similar numbers of Impatiens noli-tangere seedlings. On one square from each pair all aboveground parts of plants of the accompanying species (weeded plots) were removed systematically during successive observations; on the other square the herb layer consisting of perennials was left untouched (unweeded plots). On each square 20 seedlings with small and large cotyledons were marked at random (May 24). On the same day 50 seedlings with small and large cotyledons were collected at random in the vicinity of research areas of both phytocoenoses of oak-hornbeam forest and swampy alder forest.

In the following observations the number of marked Impatiens noli-tangere individuals were recorded with consideration to particular stages of plant development. These data were used to plot curves of individual survival in both phytocoenoses.

The next group of 50 plants were collected in the juvenile stage (June 13) and these were plants which grew from seedlings with small and large cotyledons marked on the weeded and unweeded plots.

The stage of generative maturity - dissemination of seeds by Impatiens noli-tangere plants (July 16) was assumed as the stage determining the final number budget. Again 50 plants grown from seddlings with small and large cotyledons were collected from among the remaining marked individuals on plots in the oak-hornbeam forest and in the alder swampy forest.

In order to compare the characteristics of plant habit in successive stages of individual development (seedling, juvenile individual, generatively mature plant) for all plants the height and length of the root system were given with an accuracy to 1 mm, the size and number of leaves, number of ramifications. Also the fresh weight was given with an accuracy to 0.001 g. The numbers of cleistogamic flowers, ovaries of fruits, ripe fruit and seeds were assumed as a measurement of individual reproduction.

For seedlings and generatively mature plants the home range has been also determined, which is understood as an area delimited by the "crown" vertical projection. The aboveground part of plant projection used as a measure of home range is due to the fact that the root system of the species examined is poorly developed. Its weight is hardly 10% of the weight of the whole individual (F a l e n c k a 1981). In the seedling stage the home range was the area of an ellipse delimited by vertical projection of cotyledons, whereas in the plant stage - a circle of a diameter of the plant "crown" span.

The significance of differences among mean values of characteristics of the habit and reproduction of plants from seedlings with small and large cotyledons was determined using Student t-test at a significance level 0.05.

3. RESULTS

The results show that in successive stages of the ontogenesis of Impatiens noli-tangere the values of all characters are lower for individuals from the class with small cotyledons than for plants from the class of large cotyledons; these differences are statistically significant, sometimes several-fold (Table I). This regularity characterizes both the phytocoenosis of the oak-hornbeam forest and that of the swampy alder forest. When comparing the results from three dates of plant collection, and thus the successive development stages of Impatiens noli-tangere, it has been determined that in the ontogenesis the most dependent on the size of cotyledons are: height and fresh weight of an individual. The latter depends directly on the number and size of leaves. Whereas the length of root system of an individual is the least dependent on the size of cotyledons (Table I).

The presence of perennials accompanying Impatiens noli-tangere affects its quantitative contribution to the herb layer and the survival of plants from this species. According to Figure 1 in May the contribution of Impatiens noli-tangere to the phytocoenosis of oak-hornbeam forest is 16.3%, whereas in the swampy alder forest it is 50%, i.e., three times higher. In the stage of fructification and seed dissemination Impatiens noli-tangere covers 35% in the phytocoenosis of the oak-hornbeam forest and 61.2% in the phytocoenosis of the swampy alder forest.

When removing the aboveground parts of accompanying perennials, higher survival of Impatiens noli-tangere from the class of small cotyledons has been recorded. This dependence is characteristic both of the phytocoenoses of the oak-hornbeam forest and the swampy alder forest (Fig. 2). On the weeded plots in the oak-hornbeam forest the survival is significantly higher (79%) than on unweeded ones (67%). In the swampy alder forest these values are: 81% on weeded plots and 62% on unweeded plots.

Table I. Characteristics of Impatiens noli-tangere individuals in different stages of ontogenesis Presented are mean values and standard deviations

Development stage	Character	Small cotyledons		Large cotyledons	
		oak-hornbeam forest	swampy alder forest	oak-hornbeam forest	swampy alder forest
Seedling	height (mm)	52.8 ± 12.1	43.6 ± 14.1	68.1 ± 9.4	58.9 ± 14.2
	fresh weight (g)	0.036 ± 0.017	0.044 ± 0.030	0.106 ± 0.041	0.141 ± 0.090
	length of root system (mm)	29.6 ± 10.9	25.6 ± 11.3	32.4 ± 11.3	33.4 ± 15.4
Juvenile	height (mm)	103.3 ± 14.0	121.8 ± 23.5	134.1 ± 27.1	234.4 ± 42.1
	fresh weight (g)	0.134 ± 0.075	0.145 ± 0.090	0.448 ± 0.300	1.316 ± 0.729
	length of first pair of leaves (mm)	16.3 ± 3.4	16.9 ± 4.3	20.1 ± 4.9	28.3 ± 6.2
	breadth of first pair of leaves (mm)	13.6 ± 2.5	13.2 ± 3.2	16.8 ± 4.2	22.5 ± 5.1
Generative	height (mm)	135.4 ± 31.4	205.8 ± 56.8	209.8 ± 50.8	430.2 ± 90.1
	fresh weight (g)	0.041 ± 0.030	0.187 ± 0.149	0.444 ± 0.396	2.026 ± 1.157
	number of leaves	15.8 ± 4.1	19.9 ± 6.6	30.8 ± 10.1	45.9 ± 16.1
	number of fruit ovaries	4.6 ± 1.3	6.9 ± 2.7	9.9 ± 5.3	13.6 ± 5.9
	number of ripe fruit	1.7 ± 0.7	1.4 ± 0.6	2.6 ± 1.2	2.8 ± 1.4
	number of seeds per plant	1.6 ± 0.8	1.6 ± 0.6	2.9 ± 1.5	4.9 ± 2.4

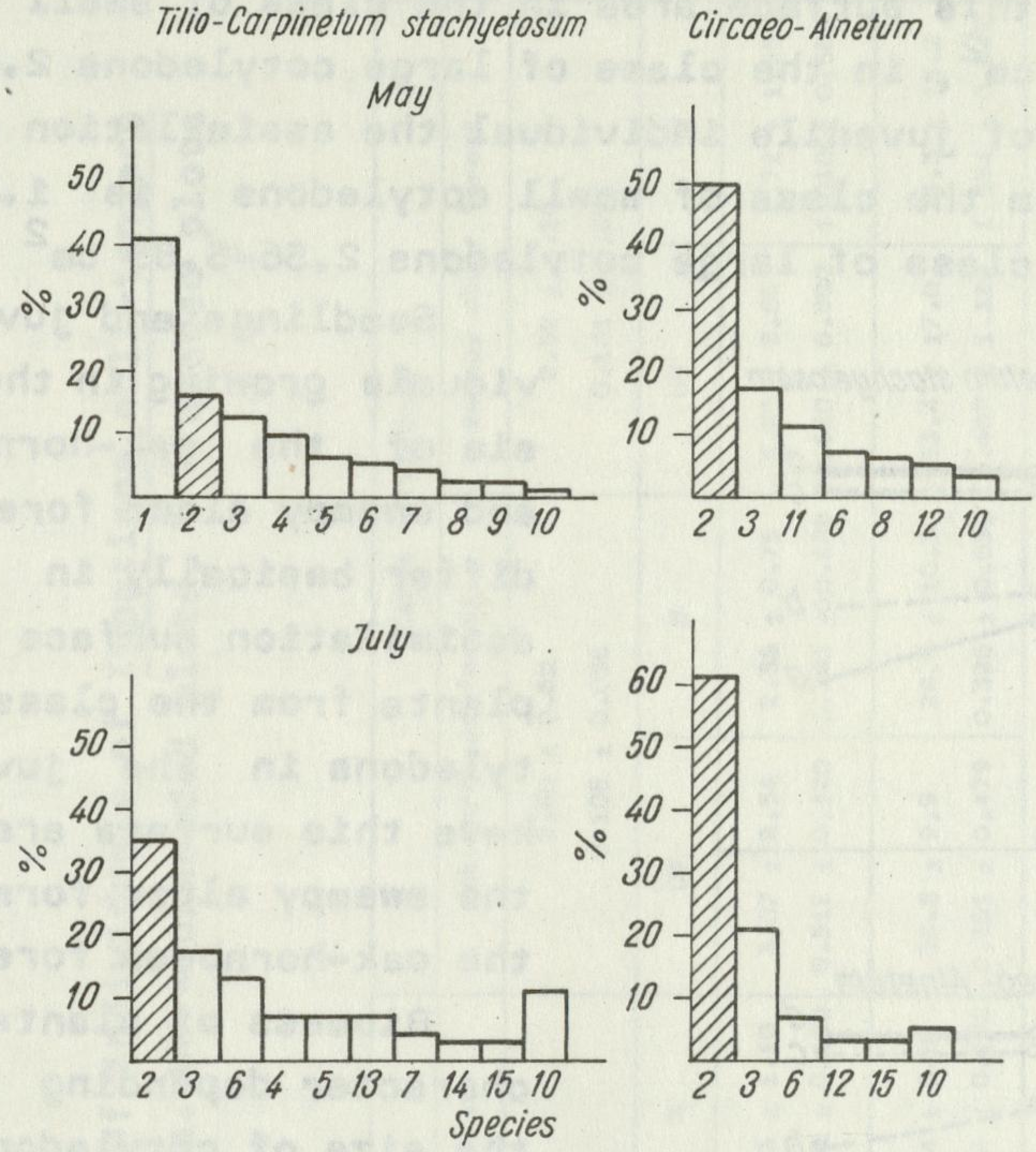

Fig. 1. Contribution of species accompanying Impatiens noli-tangere in the herb layer
1 - Anemone nemorosa L., 2 - Impatiens noli-tangere, 3 - Stellaria nemorum L., 4 - Asperula odorata L., 5 - Stachys silvatica L., 6 - Urtica dioica, L., 7 - Stellaria holostea L., 8 - Ficaria verna Huds., 9 - Dentaria bulbifera L., 10 - other species contributing less than 5%, 11 - Cardamine amara L., 12 - Chrysosplenium alternifolium L., 13 - Aegopodium podagraria L., 14 - Galeobdolon luteum Huds., 15 - Geranium robertianum L.

The survival of plants from the class of large cotyledons is higher than of individuals from the class of small cotyledons. It is almost complete in both phytocoenoses and insignificantly variable on weeded and on unweeded plots (Fig. 2).

It has been also checked to what extent the size of cotyledons of a seedling is responsible for the assimilation surface area in the course of ontogenesis. The assimilation surface area of seedlings is the size of their cotyledons, whereas for juvenile individuals - the surface area of the first pair of leaves. The comparison shows that during individual development the differences in the assimilation surface area between plants from the class of small and large cotyledons, increase. And so: in the seedling stage this surface area in the class of small cotyledons is 0.96-1.10 cm^2, in the class of large cotyledons 2.60-2.82 cm^2. In the stage of juvenile individual the assimilation surface area of plants from the class of small cotyledons is 1.72-1.93 cm^2, and from the class of large cotyledons 2.56-5.85 cm^2 (Table II).

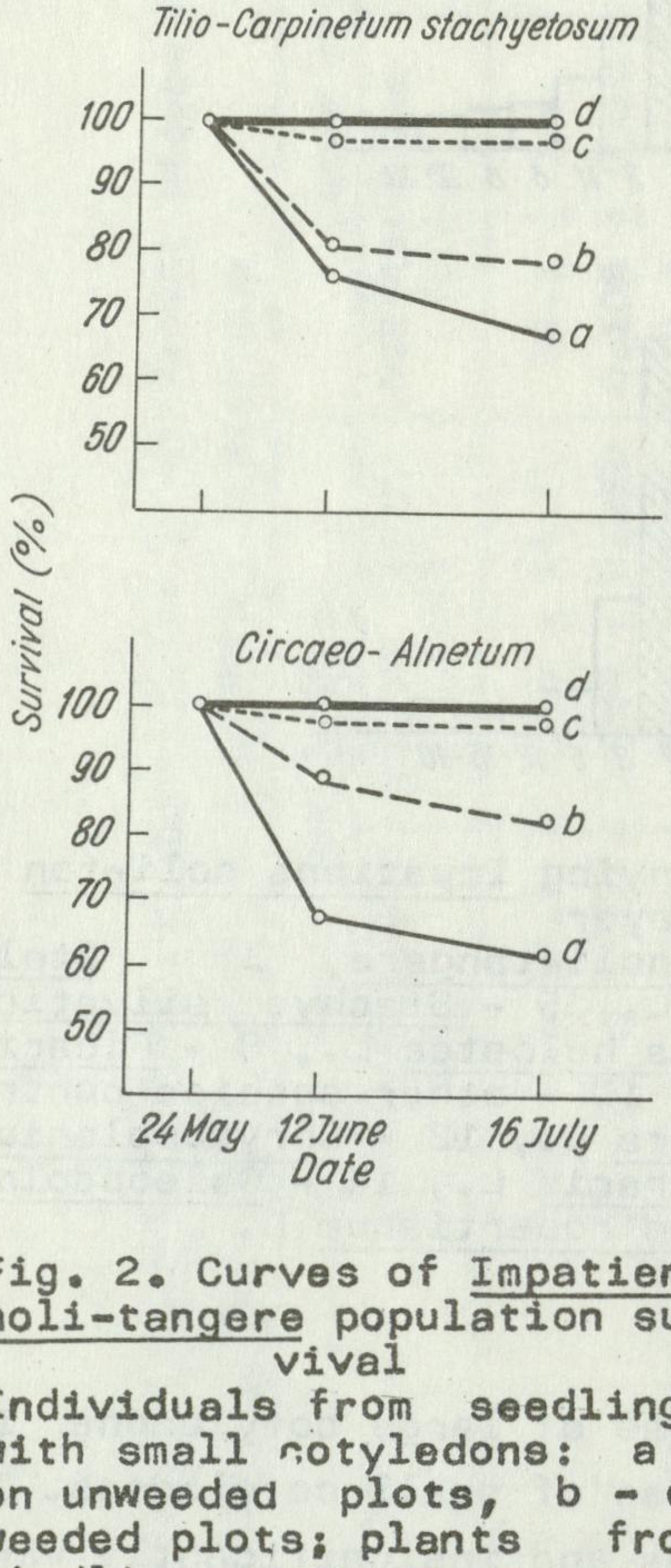

Fig. 2. Curves of Impatiens noli-tangere population survival
Individuals from seedlings with small cotyledons: a - on unweeded plots, b - on weeded plots; plants from seedlings with large cotyledons: c - on weeded plots, d - on unweeded plots

Seedlings and juvenile individuals growing in the phytocoenosis of the oak-hornbeam forest and swampy alder forest do not differ basically in the size of assimilation surface area. Only plants from the class of large cotyledons in the juvenile stage have this surface area bigger in the swampy alder forest than in the oak-hornbeam forest (Table II)

Biomass of plants is another character depending strictly on the size of cotyledons of the seedling from which the plants develop. In the seedling stage the differences in the biomass weight between individuals with small and large cotyledons are 2-3-fold, whereas in the stage of generatively mature plants these differences are even 10-fold.

The influence of different environmental conditions in the swampy alder forest and in the oak-hornbeam forest on the weight of plants from the class of small cotyledons becomes visible in the stage of generatively mature individuals: biomass of plants from the swampy alder forest in three times higher than in the oak-hornbeam forest (Table II). Individuals from the class of large cotyledons weigh more in the swampy alder forest during the ontogenesis In the juvenile stage they weigh three times more, and in the stage of generatively mature plants they weight five times more as compared with individuals from the oak-hornbeam forest phytocoenosis. This is undoubtedly due to the considerable difference in the

Table II. Assimilation surface area and biomass of individuals of <u>Impatiens noli-tangere</u>
Presented are mean values and standard deviations. UW - unweeded plots, W - weeded plots

Development stage	Character	Small cotyledons				Large cotyledons			
		oak-hornbeam forest		swampy alder forest		oak-hornbeam forest		swampy alder forest	
Seedling	assimilation surface area (cm^2)	1.10 ± 0.28		0.96 ± 0.42		2.60 ± 0.62		2.82 ± 1.10	
	fresh weight (g)	0.036 ± 0.017		0.044 ± 0.036		0.106 ± 0.036		0.141 ± 0.090	
		UW	W	UW	W	UW	W	UW	W
Juvenile	assimilation surface area (cm^2)	1.83 ± 0.80	1.77 ± 0.60	1.72 ± 0.67	1.93 ± 1.10	3.07 ± 2.54	2.56 ± 0.75	5.85 ± 2.86	4.72 ± 1.65
	fresh weight (g)	0.149 ± 0.090	0.118 ± 0.051	0.127 ± 0.060	0.162 ± 0.120	0.512 ± 0.420	0.383 ± 0.188	1.620 ± 0.890	1.010 ± 0.560
Generative	number of leaves	16.3 ± 4.4	15.2 ± 3.8	19.4 ± 7.4	20.4 ± 5.8	33.5 ± 9.9	28.0 ± 10.3	53.4 ± 17.0	38.3 ± 15.2
	fresh weight (g)	0.042 ± 0.030	0.039 ± 0.019	0.129 ± 0.106	0.244 ± 0.192	0.561 ± 0.479	0.326 ± 0.030	2.467 ± 1.326	1.584 ± 0.945

number of leaves, which is higher in the swampy alder forest (12--82) than in the oak-hornbeam forest (8-44). Furthermore, the removal of aboveground parts of plants from accompanying species has increased the biomass only for plants from the class of small cotyledons and only in their stage of generative maturity. This dependence has been observed only in the phytocoenosis of the swampy alder forest (Table II). The studies have shown that the size of cotyledons of seedling affects the generative reproduction of an individual. Individuals from the class of small cotyledons have a twice lower number of fruit ovaries and of ripe fruit than individuals from the class of large cotyledons in both phytocoenoses examined (Table III). The number of seeds in the oak-hornbeam forest per plant from the class of small cotyledons is twice lower than for an individual from the class of large cotyledons. In the swampy alder forest individuals from the class of small cotyledons produce three times less seeds than individuals from the class of large cotyledons (Table III).

In individuals from both classes of size of cotyledons in the oak-hornbeam forest and in the swampy alder forest there are no differences in the generative reproduction between weeded and unweeded plots.

In formation of the spatial structure of the population the home range of particular plants is of decisive significance. In the seedling stage measurements of the home range of Impatiens noli-tangere have shown that seedlings from the class of small cotyledons have over twice smaller home range than seedlings from the class of large cotyledons. This dependence characterizes both phytocoenoses examined: oak-hornbeam forest and swampy alder forest (Table IV). Because of the persistent and increasing during the ontogenesis difference in values of characters examined for plants from the class of small and of large cotyledons, it has been checked whether it is the same with the size of home range. In the stage of generative maturity, it has been found, that the home range of individuals from the class of small cotyledons is four-five times smaller than for individuals from the class of large cotyledons in the oak-hornbeam forest and the swampy alder forest (Table IV). It is worth indicating that the home range has increased between the seedling stage and the generative maturity stage for plants from the class of small cotyledons in the oak-hornbeam forest as much as 40 times and in the swampy

Table III. Generative reproduction of Impatiens noli-tangere on unweeded (UW) and weeded plots (W)
Presented are mean values and standard deviations

Parameters	Small cotyledons				Large cotyledons			
	oak-hornbeam forest		swampy alder forest		oak-hornbeam forest		swampy alder forest	
	UW	W	UW	W	UW	W	UW	W
Number of fruit ovaries	4.3 ± 1.3	4.8 ± 1.2	7.0 ± 3.3	6.7 ± 2.1	10.0 ± 4.9	9.8 ± 5.6	15.0 ± 6.4	12.1 ± 5.4
Number of ripe fruit	1.5 ± 0.6	1.8 ± 0.7	1.3 ± 0.5	1.4 ± 0.6	2.8 ± 1.5	2.3 ± 0.9	3.4 ± 1.4	2.7 ± 1.3
Number of seeds	1.7 ± 0.9	1.5 ± 0.7	1.4 ± 0.5	1.7 ± 0.7	3.1 ± 1.9	2.6 ± 1.1	4.1 ± 2.2	4.7 ± 2.6

Table IV. The home range of *Impatiens noli-tangere*
Presented are mean values and standard deviations

Home range (cm^2)	Small cotyledons		Large cotyledons	
	oak-hornbeam forest	swampy alder forest	oak-hornbeam forest	swampy alder forest
Seedling stage	1.10 ± 0.23	0.92 ± 0.38	2.57 ± 0.59	2.74 ± 1.09
Generative stage	45.5 ± 10.1	55.2 ± 19.32	227.9 ± 70.65	242.5 ± 101.85

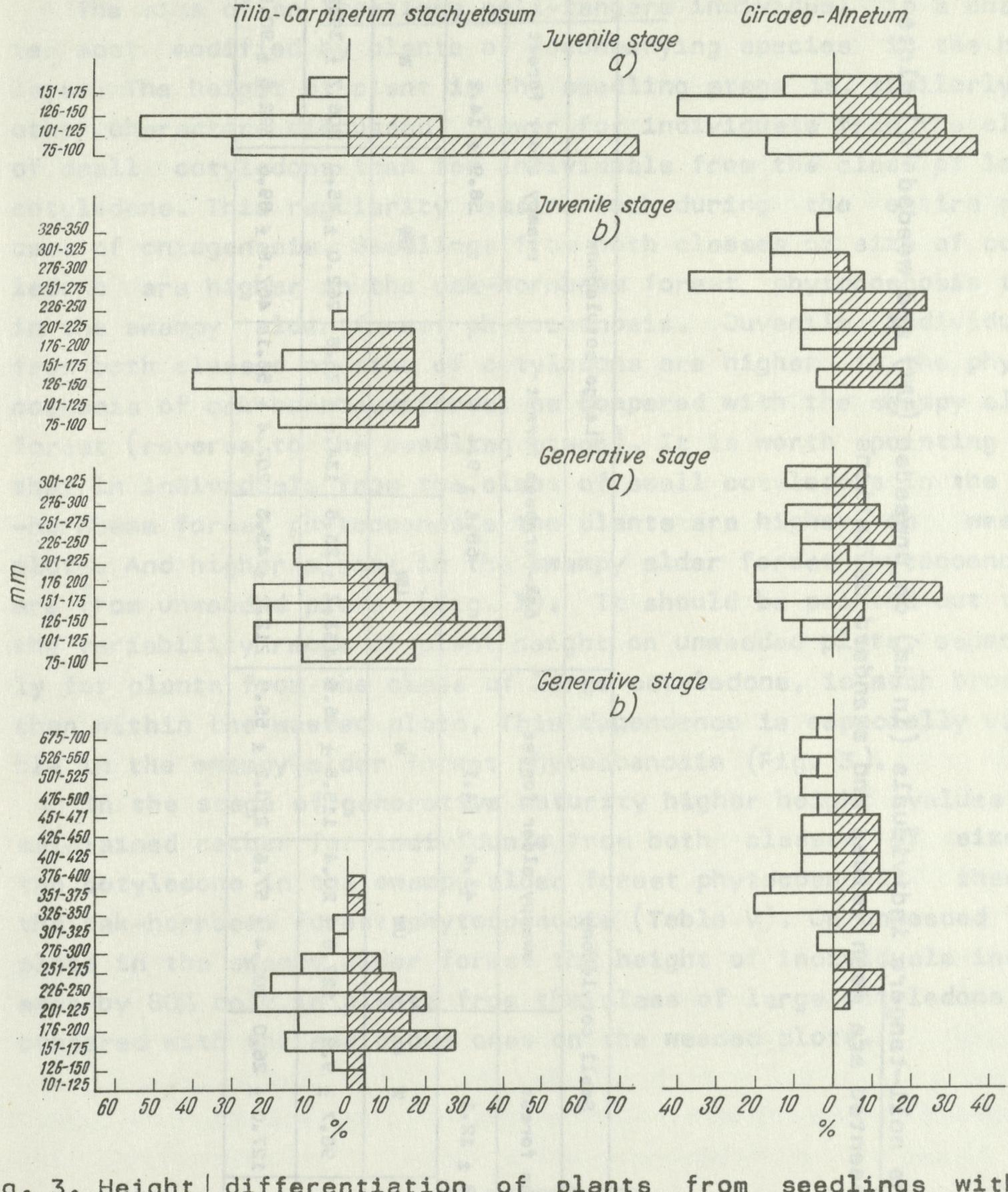

Fig. 3. Height differentiation of plants from seedlings with small cotyledons (a) and plants from seedlings with large cotyledons (b)
Not hatched areas - unweeded plots, hatched areas - weeded plots

alder forest 60 times. For individuals from the class of large cotyledons the home range has increased 86-89 times in both phytocoenoses. On the basis of these data it can be assumed that the home range of generatively mature plants is already determined in the seedling stage by the size of cotyledons.

able V. The size of Impatiens noli-tangere individuals (in mm) on unweeded (UW) and weeded (W) plots
Presented are mean values and standard deviations

Development stage	Small cotyledons				Large cotyledons			
	oak-hornbeam forest		swampy alder forest		oak-hornbeam forest		swampy alder forest	
Seedling	52.8 ± 12.1		43.6 ± 14.1		68.1 ± 9.4		58.9 ± 14.2	
	UW	W	UW	W	UW	W	UW	W
Juvenile	109.9 ± 18.0	96.7 ± 9.9	127.8 ± 20.4	115.8 ± 26.5	133.7 ± 25.6	134.4 ± 26.8	262.0 ± 45.0	206.7 ± 39.1
Generative	143.8 ± 36.7	127.0 ± 26.0	201.4 ± 57.6	210.2 ± 55.9	212.2 ± 43.5	207.4 ± 58.1	467.8 ± 89.6	392.6 ± 90.5

The size of an Impatiens noli-tangere individual is a character most modified by plants of accompanying species in the herb layer. The height of plant in the seedling stage is, similarly as other characters discussed, lower for individuals from the class of small cotyledons than for individuals from the class of large cotyledons. This regularity remains such during the entire process of ontogenesis. Seedlings from both classes of size of cotyledons are higher in the oak-hornbeam forest phytocoenosis than in the swampy alder forest phytocoenosis. Juvenile individuals from both classes of size of cotyledons are higher in the phytocoenosis of oak-hornbeam forest as compared with the swampy alder forest (reverse to the seedling stage). It is worth pointing out that in individuals from the class of small cotyledons in the oak-hornbeam forest phytocoenosis the plants are higher on weeded plots. And higher plants in the swampy alder forest phytocoenosis are from unweeded plots (Fig. 3). It should be pointed out that the variability range of plant height on unweeded plots, especially for plants from the class of large cotyledons, is much broader than within the weeded plots. This dependence is especially visible in the swampy alder forest phytocoenosis (Fig. 3).

In the stage of generative maturity higher height values are maintained rather for individuals from both classes of size of the cotyledons in the swampy alder forest phytocoenosis than in the oak-hornbeam forest phytocoenosis (Table V). On unweeded plots in the swampy alder forest the height of individuals increases by 80% only in plants from the class of large cotyledons as compared with the analogous ones on the weeded plots.

4. DISCUSSION

The differentiation in size of plants growing from seeds is the result of both genetic and environmental conditions (S o l b r i g and S a n d r a 1980). But is it difficult to divide the direct influence of these conditions in a given ecosystem.

It is known that genetic conditions decide to a considerable extent about the survival and size of an individual, and that less developed plants are first to die in the environment (M o r o z o w 1953, S u k a č e v 1953). Many studies indicate also that the earlier the seedling appears the greater its chances of survival and for production of offspring (M o r o z o w 1953, S u k a č e v 1953, H a r p e r 1977). This dependence has been confirmed under experimental conditions when the plants that have appeared earlier avoided disturbances in their growth, and the mortality was the highest in the group of individuals that started growing the latest (R o s s and H a r p e r 1972, S y m o n i d e s 1977, 1978).

The results obtained for Impatiens noli-tangere confirm the above mentioned regularities. The majority of seedlings of Impatiens noli-tangere appearing at the beginning of germination period (about 90%) have greater chances of survival, further growth and of attaining the stage of generative maturity. Whereas seedlings appearing at the soil surface at the end of the three-week germination period (first 10 days of June) usually die after few days (M. Falencka - unpublished data).

The survival of seedlings depends of their size, and their mortality is higher in any period for the smallest plants (C o o k 1979). Also, the size of seedlings affects the rate with which the plant attains the reproduction stage and the number of produced flowers and fruit (F a l i ń s k a 1977).

This is confirmed by studies on Impatiens noli-tangere, the development of which is predicted by the size of cotyledons in the seedling stage. Plants from the classes of large cotyledons have higher habit characters (height, size and number of leaves, assimilation surface area and number of ramifications) and fresh biomass weight during the entire ontogenetic cycle, and in the stage of generative maturity a higher number of cleistogamic flowers, fruit ovaries, ripe fruit and seeds. It should be pointed out that this regularity has been recorded in both phytocoenoses in the oak-hornbeam forest and in the swampy alder forest. The growth rate of an individual seems to be estabilished already at the beginning in the seedling stage by the assimilation surface area. Whereas the type of phytocoenosis only modifies the development possibilities of an individual (Fig. 3).

The survival of individuals out of seedlings with large cotyledons is almost complete (98-100%) in both phytocoenoses. Also the majority of them attain the stage of generative maturity (Fig. 2).

The results obtained for Impatiens noli-tangere show that the height and fresh weight of an individual are characters closely connected with the size of cotyledons during the entire ontogenesis. Thus, it can be said, that the size of generatively mature plants is determined by the seedling from which they develop, whether it has small or large cotyledons. The size of seedlings decides also about the home range in the reproduction stage, here understood as a space delimited by the "crown" vertical projection or of root system, depending which one covers the greater area and depending on the morphological type of species examined (A n d r z e j e w s k i and S y m o n i d e s 1982). It also decides about the generative production itself measured by the number of fruit ovaries, ripe fruit and seeds (Tables III, IV). This regularity is characteristic of plants in both phytocoenoses examined, in oak-hornbeam forest and in swampy alder forest. The rate of production of seeds and survival of seedlings are the functions of the plant size: the bigger the plant the greater the chances of its survival and of seed production (W e r n e r 1975, W i l k o ń-M i c h a l s k a 1976, S o l b r i g and S a n d r a 1980 and others).

Undoubtedly the final size of a plant in environment is controlled by an important factor of competition for the reserves in the environment (S o l b r i g and S a n d r a 1980). The elimination of aboveground parts of species of plants accompanying Impatiens noli-tangere reduces the competition of the perennials in the herb layer. The effect of this is a biomass increase of individuals from the class of small cotyledons in the stage of generative maturity only for the phytocoenosis of the swampy alder forest. Leaving the accompanying species on the unweeded plots results in an increase in height of individuals from the class of large cotyledons in the swampy alder forest, both in the juvenile and generatively mature stages (Table V, Fig. 3).

The diversity and plasticity of characters of Impatiens noli-tangere plants examined in the phytocoenoses of oak-hornbeam forest and swampy alder forest may be due to the broad variability characteristic not only of perennials but also for species of annual plants and to differentiated environmental conditions. Under conditions not differing much from the ecological requirements of the species a high plasticity of the phenotype is observed (T i t o v 1978).

5. SUMMING UP OF RESULTS AN CONCLUSIONS

The results obtained can be summed up as follows:

1. The size of cotyledons in the stage of Impatiens noli-tangere seedling determines the growth of future plant, its possibilities of survival to the stage of generative maturity and the rate of generative reproduction.

2. The height of an individual and fresh weight (Table I) are characters most closely connected with the size of cotyledons during the entire ontogenetic cycle, the least connected being the length of root system.

3. The size of cotyledons in the seedling stage determines the survival of a given group, thus individuals from seedlings with small cotyledons have a much lower survival than individuals from seedlings with large cotyledons, where the survival is almost total. This dependence is characteristic of both phytocoenoses.

4. The size of cotyledons in the seedling stage may decide about the differences of habit of future plants, about the home range and indirectly about the rate of generative reproduction of adult plants (Tables III, IV).

5. Differentiation of site conditions of phytocoenoses of oak-hornbeam forest and swampy alder forest considerably modifies the plant habit of Impatiens noli-tangere. On the whole, higher values of characters examined have been recorded in the phytocoenosis of the swampy alder forest, where the species has its best ecological conditions.

6. Removal of aboveground parts of accompanying species in the herb layer positively affects the survival of individuals from seedlings with small cotyledons.

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6. SUMMARY

The effect of the size of cotyledons of seedlings on further development and survival to the generative stage of individuals

of Impatiens noli-tangere, has been examined. The studies on Impatiens noli-tangere population have been carried out in the Białowieża National Park within the phytocoenosis of oak-hornbeam forest Tilio-Carpinetum stachyetosum and the phytocoenosis of the swampy alder forest Circaeo-Alnetum.

It has been proved that plants from seedlings with large cotyledons have significantly higher values of: height, assimilation surface area, fresh weight of biomass, number of leaves as compared with plants from seedlings with small cotyledons. These differences are frequently several-fold (Tables I, II, V). Furthermore, in the generative stage, the plants from seedlings with large cotyledons have twice more fruit ovaries and ripe fruit than plants from seedlings with small cotyledons (Table III).

The home range of plants, measured by "crown" vertical projection, is four times bigger for individuals from seedlings with large and not small cotyledons (Table IV). Plants from seedlings with large cotyledons survive almost totally as opposed to the much lower survival of plants from seedlings with small cotyledons (Fig. 2). The removal of aboveground parts of plant species accompanying Impatiens noli-tangere in the herb layer increases the survival of plants growing from seedlings with small cotyledons.

It has been recorded that all characters examined have higher values in the phytocoenosis of the swampy alder forest as compared with that of the oak-hornbeam forest (Tables II-V).

7. POLISH SUMMARY

Zbadano wpływ wielkości liścieni siewki na dalszy rozwój oraz przeżycie do fazy generatywnej osobników Impatiens noli-tangere. Badania populacji niecierpka przeprowadzono w Białowieskim Parku Narodowym w obrębie fitocenozy grądu niskiego Tilio-Carpinetum stachyetosum i fitocenozy łęgu przystrumykowego Circaeo-Alnetum.

Wykazano, że rośliny pochodzące z siewek o dużych liścieniach charakteryzują się istotnie wyższymi wartościami: wysokości, powierzchni asymilacyjnej, ciężaru świeżej biomasy, liczby liści w porównaniu z roślinami pochodzącymi z siewek o małych liścieniach. Różnice te są często kilkukrotne (tab. I, II, V). Ponadto w fazie generatywnej rośliny pochodzące z siewek o dużych liścieniach mają 2 razy więcej zawiązków owoców i owoców dojrzałych niż osobniki pochodzące z siewek o małych liścieniach (tab. III).

Areał osobniczy roślin, mierzony rzutem pionowym rozpiętości "korony", był 4-krotnie większy u osobników powstałych z siewek o dużych liścieniach niż małych (tab. IV). Osobniki pochodzące z siewek o dużych liścieniach charakteryzuje prawie całkowita przeżywalność w odróżnieniu od znacznie niższej przeżywalności roślin pochodzących z siewek o małych liścieniach (rys. 2). Usuwanie części nadziemnych roślin gatunków współtowarzyszących w runie Impatiens noli-tangere zwiększa przeżywalność osobników rozwijających się z siewek o małych liścieniach.

Odnotowano, że wszystkie badane cechy mają wyższe wartości w fitocenozie łęgu niż grądu (tab. II-V).

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