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Autosomal polymorphism in *Rumex thyrsiflorus*

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R. thyrsiflorus is a dioecious plant species with diploid chromosome number: ♀ — 2X+12a, ♂ — X+2Y+12a. Świetlińska (1963) and Żuk (1963) found that the karyotypes of plants from natural populations differ in the morfology of the autosomal set. To obtain more accurate data concerning autosomal polymorphism in this species an extensive analysis of karyotypes from 23 natural populations (mainly from Poland) was undertaken.

MATERIAL AND METHODS

The seeds were collected from 20 localities in Poland (Table 1 and Fig. 1) and in Czechoslovakia (near Zvolen), Hungary (Darog, near Esztergom) and Bulgaria (Rhodope, Stara Reka Valley). In each population karyotypes were established for 9—12 plants a total of 218 karyotypes — 80 karyotypes from male plants and 138 from female ones.

Cytological investigations of chromosomes were performed on metaphasal plates from root tips of germinating seeds. Root tips after 4 hours pretreatment with 8-oxyquinoline were fixed in acetic alcohol (3:1) and stained with 2 % orceine solution with 1N HCl (9:1) then squashed in 1 % orceine solution. The drawings were performed with an Abbe camera lucida with a Zeiss X 90 immersion objective and a X K15 eyepiece. The photographs were taken with the same objective and MF-Projectiv K 4:1 eyepiece.

RESULTS

In most of the populations investigated a great variability in autosomal sets was observed. The karyotypes of individual plants differed not only in the frequency of various types of autosomes but also in their morphology. Among the sex chromosomes no pronounced morphological variation was observed therefore the investigation of chromosome polymorphism was restricted to the autosomes only.

According to Kihara and Yamamoto (1931) three main types of autosomes can be identified in *Rumex*:

1) i-type — rod-shaped chromosomes with subterminal centromere,

2) j-type — chromosomes with subterminal centromere; the length of the arms is distinctly different,

3) v-type — short, almost medial centromeres.

Besides the above mentioned types also the i-chromosomes with satelites (T-type) and the accessory B-chromosomes were found in some populations.

Most frequent in all populations were the i-type chromosomes (Table 1). Their number ranged for individual karyotypes from 6 to 10. The number of j-type chromosomes ranged from 0 to 6 and the number of v-chromosomes from 0 to 2. The least frequent were the karyotypes with T chromosomes. Single T chromosomes were observed in 7 populations. The accessory B chromosomes were found in three localities only, their number ranged from 0 to 5.

In Table 1 the populations are listed according to the number of v-type autosomes. At the top of the list are four populations in which no v-chromosomes were found. It is seen from the map that all these populations originated from western

Map. 1. Distribution of the studied natural populations R. thyrsiflours in Poland

Poland. The populations consisting exclusively of plants having 2 v-chromosomes (Nos. 15—20) are distributed in north-east and central Poland. The populations with plants having 0, 1 or 2 v-chromosomes are rather irregularly distributed. Thus it seems that there is no distinct correlation between the frequency of v-chromosomes and the geographical region from which the populations were studied. The same is true also for j-type autosomes. The populations with high and low frequency of j-chromosomes are rather randomly distributed. It seems however, that this type of autosomes is more frequent in populations in which v-chromosomes were not found (Tab. 1).

In general the most frequent were the karyotypes with autosome composition i+j+v (Fig. 1, 5, 7). Such karyotypes occurred in 68 % of the studied plants. The karyotypes without v-chromosomes (i+j) occurred in 28 % of plants. The karyotypes without j-chromosomes (i+v) were quite rare (about 6 % of plants).

Table 1

Frequency of various types of autosomes in *Rumex thyrsiflorus*

No.	Locality	Number of plants examined	Frequency of karyotypes	Frequency of autosomes									
				i	mean	j	mean	v	mean	T	mean	B	mean
1	Ostrowo	12	5 3 2 2	9 7 8 6	7,9	3 5 4 6	4,1						
2	Nowa Sól	9	7 1 1	9 8 10	9,0	3 4 2	3,2						
3	Karwia	11	8 1 1 1	8 10 8 9	8,0	4 2 4 3	3,7			1	0,9		
4	Sławno	9	3 2 2 1 1	10 8 10 8 9	9,0	2 4 2 4 3	2,9						
5	Zielona Góra	10	4 1 1 2 1 1	9 10 10 10 8 9	9,2	2 1 1 2 4 3	2,1	1 1 1	0,6			1 2 1	0,6
6	Nowosiółki	10	2 2 2 1 1 1 1	10 11 10 11 9 9 9	10,0	1 2 1 3 1 2	1,3	1 1 2 1	0,7				
7	Poznań	10	2 1 1 1 1 2 1 1	9 9 9 10 10 9 7 8	9,1	2 2 2 1 1 3 4 3	2,1	1 1 1 1 1 1 1	0,8			3 1 5 3 3 2	2,0
8	Szypliszki	10	8 2	10 8	9,8	1 2	1,0	1 2	1,2				

Tabele 1, cont.

No.	Locality	Number of plants examined	Frequency of karyotypes	Frequency of autosomes									
				i	mean	j	mean	v	mean	T	mean	B	mean
9	Ostróda	9	3 2 1 1 1 1	9 9 9 6 7 10	8,3	1 2 2 4 4 2	2,5	2 1 1 2 1	1,3				
10	Wrocław	10	5 2 2 1	10 9 9 8	9,4	1 2 1 2	1,3	1 1 2 2	1,3				
11	Łódź	10	5 2 1 1 1	9 8 7 8 8	8,7	2 3 3 2 2	2,4	1 1 2 2 2	1,3			2 4 1	1,5
12	Białuty	9	5 2 1 1	9 9 8 8	9,3	1 2 2 3	2,1	2 1 2 1	1,6				
13	Sztutowo	10	3 3 2 1 1	6 7 8 8 5	6,5	4 4 2 2 5	3,4	2 1 2 2 2	1,7	1 1 1	0,4		
14	Bieżanów	12	8 1 1 1 1	9 10 10 7 11	9,1	1 1 3	1,1	2 2 1 2 1	1,8	1 1	0,1		
15	Puławy	9	4 4 1	9 10 9	9,5	1 3	0,8	2 2	1,8				
16	Krzelów	9	3 3 2 1	9 8 8 10	8,9	1 2 2	1,1	2 2 2 2	2,0	1	0,3		
17	Nadarzyn	9	5 3 1	9 8 7	8,4	1 2 3	1,9	2 2 2	2,0				

Tabele 1, cont.

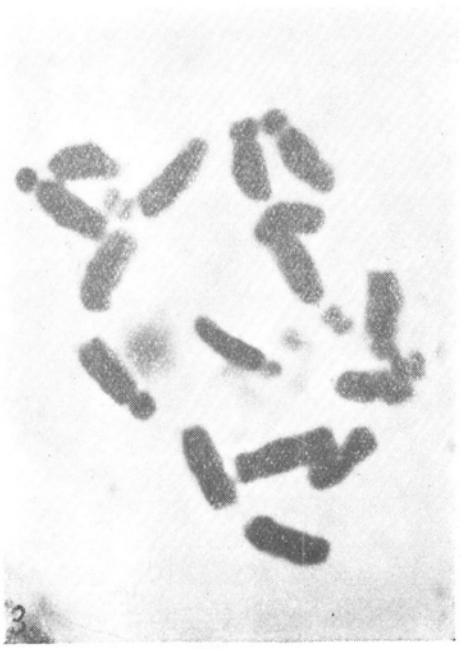
No.	Locality	Number of plants examined	Frequency of karyotypes	Frequency of autosomes									
				i	mean	j	mean	v	mean	T	mean	B	mean
18	Puńsk	11	6 4 1	7 8 6	7,3	3 2 4	2,7	2 2 2	2,0				
19	Wierzba	10	8 2	7 8	7,2	3 2	2,8	2 2	2,0				
20	Zelwa	11	8 2 1	9 8 8	8,3	1 2 2	1,3	2 2 2	2,0	1	0,2		
21	Czechoslovakia (near Zvolen)	9	4 2 2 1	9 8 10 9	8,8	2 2 2 3	2,1	1 2	0,9	1 2	0,9		
22	Hungary (Darog)	9	4 2 1 1 1	8 8 9 10 10	8,2	4 4 3 2 2	3,0			1 1 1	0,5		
23	Bulgaria (Rhodope)	10	9 1	6 8	6,2	4 3	4,0	2 1	1,9				

It should be pointed out that autosomal polymorphism was observed not only in different populations, but also the plants from the same populations differed in the frequency of various types of autosomes. In 20 populations analysed only two (8 and 19) had rather uniform karyotypes. The rest consisted of plants highly differentiated in their autosomal sets. This was true particularly for the sample from Nowosiółki (6) in which among 10 plants 7 different autosomal sets were found.

The populations from Czechoslovakia, Hungary and Bulgaria represent more or less the same type of autosomal variability as the Polish ones. There are no clear-cut differences in the frequency of the various types of autosomes in individual karyotypes in comparison with the Polish material.

Within the three main types of autosomes many morphological differences were observed. For example the j-chromosomes differ in their length and position of the centromere even in the same metaphasal plate. In Fig. 6 we see two pairs of j-chromosomes one much longer than the other one. Chromosomes of the v-type are usually metacentric, but in some plants also submedial ones were observed (Figs 1, 2). The most uniform were the i-chromosomes with the exception of one pair distinctly shorter than the remaining ones (Figs 2, 6).

Fig 1—2 Root tip metaphases of *R. thyrsiflorus* *1* — Bieżanów ♂ (X+2Y+1j+2v+9i); *2* — Czechoslovakia (near Zvolen) ♂ (X+2Y+2j+1v+7i+2T). × 2500



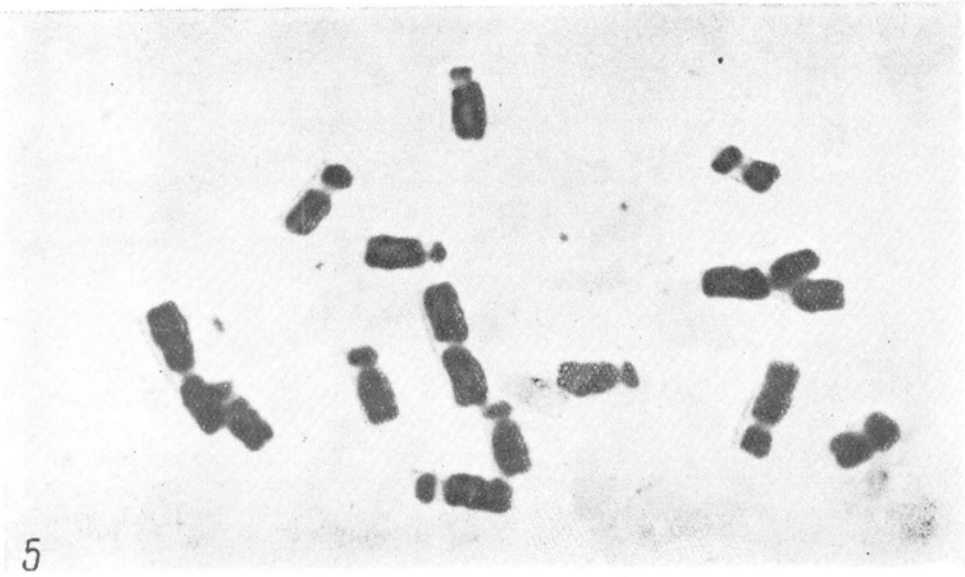


Fig. 3—5. Root tip metaphases of *R. thyrsiflorus*. *3* — Łódź ♀ (2X+3j+1v+10i+4B); *4* — Ostróda ♀ (2X+4j+2v+6i); *5* — Ostróda ♀ (2X+2j+2v+8i). × 2500

Fig. 6—8. Root tip metaphases of *R. thyrsiflorus*. *6* — Karwia ♀ (2X+4j+10i); 7 — Poznań ♀ (2X+3j+1v+8i+5B); *8* — Nadarzyn ♀ (2X+2v+10i). × 2500

DISCUSSION

The analysis of the karyotypes within *R. thyrsiflorus* revealed high variation of the autosomes in this species. Karyotypes of plants from different localities and even from the same population differed in the number and also in the morphology of various types of autosomes. In fact all 20 populations differed from each other in their karyotypes. A special attention was paid to the frequency of j and v type chromosomes. Although it seems that groups of populations from the same area have a similar frequency of j or v-chromosomes, the number of the populations examined is too small to demonstrate the geographical distribution of different karyotypes. Differentiation of autosomes in populations from Czechoslovakia, Hungary and Bulgaria shows that autosomal polymorphism exists probably within the whole area of this species.

The character of the autosomal variation and its role in the evolution of the species is not clear so far. *R. thyrsiflorus* is known to occupy highly differentiated habitats. It grows on the dry balks and road sides but also on moist meadows and in the woods. It is possible that autosomal polymorphism is connected with the selection of the most appropriate karyotypes in particular ecological enviroments. It was found (Świetlińska, 1963) that closely related species *R. acetosa*, which grows in more uniform habitats has much more uniform karyotype. It is also worth while to point out that j and v chromosomes known to occur in *R. thyrsiflorus* karyotypes in different numbers are partly heterochromatic (Żuk, in press).

SUMMARY

Analysis of *R. thyrsiflorus* karyotypes from 23 natural populations reveales high variation of the autosomes. The individual plants differ in the frequency of various types of autosomes even within the same population. In some populations supernumerary B chromosomes were found. The autosomes of one type were not uniform in their morphology. Different karyotypes reveal no clear regularity in their geographical distribution.

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Zmienność autosomów u Rumex thyrsiflorus

STRESZCZENIE

Na podstawie analizy kariotypów z 23 naturalnych populacji *R. thyrsiflorus* stwierdzono dużą zmienność autosomów u tego gatunku. Powszechnie występowały 4 typy autosomów. Liczba poszczególnych typów autosomów była różna nawet u roślin z jednej populacji. W niektórych populacjach występowały chromosomy dodatkowe typu B. Autosomy poszczególnych typów często różniły się morfologicznie. W rozmieszczeniu geograficznym różnych kariotypów nie stwierdzono wyraźnej regularności.