Anal. Inst. Bot. Cavanilles 32 (2): 197-202 (1975)

BIOSYSTEMATICS OF *RUMEX LONGIFOLIUS* DC. OF FENNOSCANDIA AND THE PYRENEES

by

J. JALAS and R. K. LINDHOLM

This paper is dedicated to Prof. S. Rivas Goday on his 70th birthday

The seed material forming the basis of this study is listed below with the chromosome numbers and places of collection. The Norwegian and Swedish samples were received through international seed exchange from the University Botanical Gardens of Bergen, Oslo and Lund, as well as from Hortus Botanicus Bergianus of Stockholm. The numbers in parentheses are those used throughout the study of LINDHOLM (1970).

SPAIN

Hs1 (1038)	$2n = 60$	Cataluña, Prov. de Lérida, E. of Tredos, between Viella and Puerto de la Bonaigua, ca. 1700 m. 22.8.1967 *J. Jalas.*
Hs2 (1072)	$2n = 60$	Cataluña, Prov. de Gerona, Puerto de Tosas, ca. 1800 m, roadside, 28.8.1967 *J. Jalas.*
Hs3 (1075)	$2n = 60$	Cataluña, Prov. de Gerona, Puerto de Tosas, ca. 1750 m, roadside, 28.8.1967 *J. Jalas.*

NORWAY

No1 (349)	$2n = 60$	Hordaland, Bergen, Hatleberg, ca. 50 m, 7.9.1967 *F. E. Wielgolaski.*
No2 (249)	$2n = 60$	Akershus, Lørenskog, Losby, 26.8.1967 *P. Sunding.*
No3 (250)	$2n = 40$	Akershus, Ås, 5.9.1967 *P. Sunding.*

SWEDEN

Su1 (911)	$2n = 60$	Skåne, Hälsingborg, Filborna, 1966 *H. Vallin.*
Su2 (908)	$2n = 60$	Halland, Halmstad, östra stranden, 1967 *R. v. Bothmer.*

Su3	(909) $2n = 60$	Västergötland, Mariestad, Leksberg, 1967, *R. v. Bothmer.*
Su4	(910) $2n = 60$	Västergötland, Mariestad, Mariestads mosse, 1967 *R. v. Bothmer.*
Su5	(4) $2n = 60$	Stockholm, St. Skuggan, 1967, *s. n.*
Su6	(3) $2n = 60$	Dalarne, Siljansnäs, Alvik, 1966 *s. n.*

FINLAND

Fe1	(240) $2n = 60$	Varsinais-Suomi, Sauvo, 1967 *I. Kytövuori.*
Fe2	(242) $2n = 60$	Uusimaa, Helsinki, 1967 *P. Uotila.*
Fe3	(243) $2n = 60$	Uusimaa, Porvoo, Suomenkylä, 1967 *A. Saarisalo.*
Fe4	(244) $2n = 40$	South Häme, Koski, 1967 *A. Saarisalo.*
Fe5	(245) $2n = 60$	South Häme, Hattula, 1967 *P. Uotila.*
Fe6	(246) $2n = 60$	North Häme, Sumiainen, Jänislahti, 1967 *A. Saarisalo.*
Fe7	(1) $2n = 40$	Kuusamo, church village, in front of KOP bank office, 26.12.1966 *T. Ahti.*

Herbarium material representing the strains that were cultivated is preserved in the Botanical Museum, University of Helsinki (H).

The seeds were sown in the greenhouse in the middle of March 1968 and the seedlings were transplanted out of doors in the last days of May and the beginning of June. Cultivation was continued until the autumn of 1969. The harvesting and biometrical treatment of the material, including the chromosome counts, were performed by the junior author, who also, under the guidance of the senior author, presented the results in a study report for the degree of candidate of philosophy (LINDHOLM, 1970). The present paper was prepared by the senior author on the basis of this unpublished report, in order to make available the results that seem relevant to the proper understanding of the infraspecific variation and distributional history of this species.

LEAF ROSETTES OF THE FIRST YEAR

In the first summer, all the seedlings developed a leaf rosette and none showed any signs of stem elongation.

Two main groups could be distinguished on the height of the rosettes and the leaf shape. The Pyrenean strains, together with *Su2*, *Su4* and *Fe7* (somewhat less clearly also *No2* and *No3*), are characterized by high rosettes, the leaves of which remain almost erect until late in the autumn. The leaves are large, with petioles about as long as the blades. The length/width ratio of the blades varies between 2.0 and

3.0 (— 3.2), the widest point being situated in, or somewhat above, the middle. The apex is broadly acute to almost rounded; the base varies from broadly cuneate to truncate or subcordate.

Most of the Finnish and Swedish strains belong to the second group. They have more appressed rosettes, whose leaves have blades up to 3x as long as their petioles, with the length/width ratio mostly clearly exceeding 3.0 (up to 4.7). The widest point of the blades is commonly somewhat below the middle; the apex is more narrowly acute, and the base cuneate to narrowly truncate. The leaf margin is typically much more undulate and crisped than in the plants of the first group.

The second year's growth

Some plants of each strain were kept in the greenhouse over winter 1968/69. With the exception of one single specimen of *No3*, none of these plants reached the flowering stage during the second summer but simply continued growing as a leaf rosette.

The plants cultivated out of doors formed fresh basal rosettes in May, whose leaves soon withered as the flowering stem began to elongate.

The shape of the basal leaves of the second year and the first cauline leaves proper is largely the same as that of the first year rosettes.

In the broad-leaved group the flowering stems normally exceed a height of 140 cm (*Hs3* forms an exception); the narrow-leaved strains are generally less tall. However, the variation is gradual and cline-like, except that *Fe6* shows a mean stem height ca. 30 cm below all the others.

Inflorescence

In a young flowering stem, the inflorescence normally commences at the seventh to eighth elongated internode. In the low-growing plants of *Fe6*, however, the lowest branches of the inflorescence arise as far down as at the second or third node. In the other populations, secondary flowering branches often also develop lower down on the stem during the later part of flowering.

In most cases the inflorescence can be described as ovate lanceolate, with branches pointing upwards at an angle of 20-40°. The inflores-

cences of *Fe3*, *Fe4* and *Fe5* are dense and more broadly ovate. The Pyrenean strains differ in having wide and sparse inflorescences with branches spreading at an angle of 70-80°.

Fruiting perianth segments (valves)

The shape of the valve varies, without any marked discontinuities, from semi-orbicular, somewhat wider than long, as in the Pyrenean plants and *Fe2* and *Fe5*, to ovate-cordate with an acute apex, as in most of the populations. The valve margin may be entire of shallowly and irregularly toothed.

Seeds

The seed length generally varies between 2.3 and 2.9 mm, and the width between 1.3 and 1.7 mm. There appears to be no significant correlation between seed shape and the other characters studied.

However, all the members of the Pyrenean populations and of *No3*, *Su1*, *Su6*, *Fe6* and *Fe7* have acutely trigonous seeds, with better developed edges than is typical of the rest.

Chromosome number

The chromosomes were counted in root tip mitoses on squash preparations of material fixed according to a modification of the Feulgen method and stained in the dark for at least 12 hours in Schiff's reagent.

By far the commonest chromosome number found in *Rumex longifolius* has been $2n = 60$, and this was also the case in the present study. The counts on Pyrenean material reported here are evidently the first from that particular part of the area of the species.

Hämet-Ahti and Virrankoski (1970: 180) were the first to report the deviating number $2n = 40$, in a Kuusamo population included in the present study as *Fe7*. This and *No3* and *Fe4*, the two other strains found to be tetraploids, with $2n = 40$, do not seem to belong together either morphologically or as regards geographic distribution, at least not in the light of the information available at present.

Discussion

On the basis of the morphological features studied, two extreme groups may be recognized, linked by various intermediate populations.

The Pyrenean group, also present in Fennoscandia, is characterized by fairly large and wide, but weakly undulated leaves, flowering stems commonly exceeding 150 cm, a not very dense inflorescence, wide and rounded valves, and seeds with well-developed edges. Typical members of this group are *Hs1*, *Hs2*, *Hs3*, *Su2*, *Su4* and *Fe7*. The Finnish strain *Fe7* is tetraploid ($2n = 40$), all the others being hexaploid ($2n = 60$).

The main Fennoscandian group has narrower and strongly undulated leaves, flowering stems that are mostly shorter than 150 cm, valves with an acute tip, and seeds with less pronounced edges. The strains *Su1*, *Su3*, *Su5*, *Su6* and *Fe4* have this combination of characters; *No2*, *Fe1* and *Fe2* differ from them only in having roundish valves, and *Fe5* in having wide leaves with a remarkably strong undulation. *Fe4* is tetraploid ($2n = 40$), the other strains being hexaploid ($2n = 60$).

The evident intermediates include the third tetraploid of the present material, *No3*.

According to the information available, the variation within the Pyrenean material is small compared with that found in Fennoscandia. Of course, the Pyrenean material is too limited to allow any far-reaching conclusions.

It is interesting to note that the *Rumex longifolius* of the Pyrenean exclave is morphologically more or less identical with some of the Fennoscandian populations of the species.

Ahti & Hämet-Ahti (1971: 47) report that plants morphologically similar to *Fe7* are widespread in northern Finland, and suppose this race to be of eastern origin. Here, of course, additional chromosome counts are urgently needed. Oddly enough, the tetraploid *Fe7* is the strain whose morphology most closely resembles that of the Pyrenean hexaploids.

Acknowledgements

This paper is respectfully dedicated to the great authority on Spanish vegetation and plant geography, Professor Salvador Rivas Goday, on the occasion of his 70th birthday 1.12.1975.

RESUMEN

Se criaron 19 poblaciones (3 de los Pirineos, 16 de Fenoscandia) a partir de semilla, se cultivaron en condiciones uniformes durante dos períodos de crecimiento, y se compararon sus números cromosómicos, y los caracteres de sus hojas, frutos y semillas. La variación en las poblaciones pirenaicas es pequeña, y cabe sensiblemente dentro del ámbito de variación que muestran las poblaciones de Fenoscandia. Dentro de la amplia variación de estas últimas poblaciones se pueden distinguir dos grupos morfológicos, pero no están muy bien definidos y difícilmente merecen consideración taxonómica, especialmente en cuanto que la distribución de los dos citotipos ($2n = 40$ y 60) no se corresponde con la agrupación por caracteres puramente morfológicos.

SUMMARY

Nineteen populations (3 from the Pyrenees, 16 from Fennoscandia) were raised from seed, cultivated under uniform conditions for two growing seasons, and compared as to chromosome number and characters of leaf, fruit and seed. The variation in the Pyrenean populations is small and clearly falls within the range of variation shown by the Fennoscandian populations. Two morphological groups can be distinguished within the ample variation of the latter populations, but they are not very well defined and hardly deserve taxonomical status, especially since the distribution of the two cytotypes ($2n = 40$ and 60) does not correlate with the grouping on gross morphological characters.

REFERENCES

AHTI, T. & HÄMET-AHTI, L. — 1971 — Hemerophilous flora of the Kuusamo district, northeast Finland, and adjacent part of Karelia, and its origin — Ann. Bot. Fennici, 8: 1-91.

HÄMET-AHTI, L. & VIRRANKOSKI, V. — 1970 — Chromosome numbers of some vascular plants of north Finland — Ann. Bot. Fennici, 7: 177-181.

LINDHOLM, R. K. — 1970 — *Rumex longifolius* DC. lajin espanjalaisten ja pohjoismaisten populaatioiden morfologisista eroista — Manuscript in the Library of Dept. of Botany, University of Helsinki.

Department of Botany
University of Helsinki (Finland)