CYTOTAXONOMIC STUDIES IN THE GENUS MENTHA IN THE NETHERLANDS

BY

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INTRODUCTION

The separation of the species of **Mentha** on the basis of morphology only, meets with serious difficulties, partly because of the great variability of the species, partly because of the ease with which they hybridize. It seemed therefore worth-while to search for additional cytological characters in order to supplement earlier studies in the cytotaxonomy of Mentha, notably those by RUTTLE (1931), MORTON (1956), SOBTI (1965), and BAQUAR & REESE (1965). Samples from Dutch populations were studied morphologically and cytologically; the investigation also included mints from cultivation. Chromosome counts of Dutch mints had already been carried out before by HEIMANS (1938), MORTON (1956), and GADELLA & KLIPHUIS (1963).

Some material was collected of all the Dutch species of the subgenus **Menthastrum**, which contains all species of **Mentha** native to the Netherlands except **M. pulegium** L., as well as of five of the six F_1-hybrids which are to be found in the Netherlands. No material of natural F_2-hybrids was collected. Samples of 148 clones were taken, some of them representing very rare forms. As far as possible they were examined cytologically and the results of these studies were compared with previously published data.

MATERIAL AND METHODS

The plants were dug out and planted in the experimental garden at "Fort Hoofddijk", Utrecht. Roottips were fixed in Karpechenko, embedded in paraffin and sectioned at 12 μ, stained according to Heidenhain's haematoxylin method, and enclosed in Canada balsam.

RESULTS

Species	Source	Number of clones collected	Seed production	Chromosome number	Previous results (lit.)[1]
M. aquatica L.	Loosdrecht (Utr.)	9	+	96	(36) 96
	Voorne (Z.-H.)	14	+	96	
	Grebbeberg (Utr.)	1	+	96	
	Uithof (Utr.)	8	+	96	

Species	Source	Number of clones collected	Seed production	Chromosome number	Previous results (lit.)[1]
	Terschelling (Fr.)	11	+	96	
	Zuid-Limburg	23	+	96	
	Braakman (Zl.)	2	+	96	
	Lijmers (Gld.)	1	?	96	
M. arvensis L.	Zuid-Limburg	2	+	90	(60) 72 (90) 96
		5	+	72	
		1	+	24	
		4	+	?	
	Terschelling (Fr.)	1	–	72	
	Wiessel (Gld.)	2	+	72	
	Heelsum (Gld.)	3	+	72	
	Helvoirt (N.-Br.)	3	+	72	
	Lijmers (Gld.)	5	+	72	
	Putten (Gld.)	1	?	72	
M. longifolia (L.) Huds.	cult.	1	+	24	18 24 36 48
M. rotundifolia	Zuid-Limburg	9	+	24	(18) 24 (36)
(L.) Huds.		1	–	36	
	cult.	1	–	36	
M. spicata L.	cult.	1	–	36	36 48
		1	+	48	
var. crispata	cult.	2	–	36	36 48
(Schrad.) Beck		1	+	48	
M.x dumetorum Schult.	Voerenbeek (Limb.)	7	–	84	84 96
	Eyserbeek (Limb.)	7	–	72	
	Voerendaal (Limb.)	1	–	72	
	Platsbeek (Limb.)	2	?	?	
M.x niliaca Jacq.	Putberg (Limb.)	2	–	36	24 36
	Eyserbeek (Limb.)	3	–	24	
	Platsbeek (Limb.)	2	–	24	
	Geul, Gulpen (Limb.)	1	?	?	
M.x piperita L.	cult.	3	–	72	(48) 66 72 132
M.x verticillata L.	Loosdrecht (Utr.)	2	+	96	42 84 96
	Terschelling (Fr.)	2	–	96	120 132
	Geul, Gulpen (Limb.)	3	?	96	

[1] Rare or unreliable numbers in parentheses.

Discussion

M. aquatica L.

The chromosome number of this mint is strikingly constant. The hundreds of counts published in the literature as well as our own always yielded 96 chromosomes, except for those of the two oldest authors, Schürhoff (1929) and Lietz (1930), who both counted 36 chromosomes.

Their results were however strongly criticized by RUTTLE (1931) and by BAQUAR & REESE (1965). The uniformity in chromosome number is indeed remarkable in view of the great variability of **M. aquatica**, which is however partly due to phenotypic modifications, as shown by observations of the cultivated garden material.

M. arvensis L.

The chromosome number 12, reported by JUNELL (1942), is the smallest number so far recorded for **Mentha**. It is the basic number of the polyploid series of **M. arvensis**, and as the lowest number in the polyploid series formed by the five species seems to be 24, the form with 12 chromosomes might be assumed to have arisen by parthenogenesis from the form with 24 chromosomes, a number met with in our material in a plant from St. Geertruid (Zuid-Limburg).

The number 72 is by far the most common one in **M. arvensis**, also in our material. The number 90 is irregular in the polyploid series, being a multiple of 6, not of 12; it might represent an intraspecific hybrid. Still it is not uncommon in **M. arvensis**. Any relation between chromosome number and habit of **M. arvensis** has not been found so far, except for the numbers 96, 120 and 132 which mostly belong to morphologically clearly distinct varieties (RUTTLE, 1931; MORTON, 1956).

M. rotundifolia (L.) Huds.

Beside the fact that our plants with $2n=36$ did not produce seeds, as the plants with $2n=24$ did, it should be stated that plants with 24 chromosomes are much more common and that in our material the two clones with $2n=36$ have longer and broader inflorescences; these also seem to be more numerous per plant and the flowers are brightly coloured: violet, dark lilac, not white or very pale lilac as usual.

These three points seem to be of some significance for the distinction of a sterile cytotype 36 and a fertile cytotype 24, which needs experimental confirmation.

M. spicata L.

Our plant with $2n=48$ produced seeds, as opposed to the one with 36 chromosomes. This corresponds with the description of fertile forms with $2n=48$ by MURRAY (1958) and of sterile forms with $2n=36$ (having many obvious hybrid features) by SCHÜRHOFF (1927, 1929). More data are needed before it can be decided whether this distinction between a fertile cytotype and a sterile hybrid cytotype is correct; morphologically they seem to be identical (MORTON, 1956).

M. spicata L. var. **crispata** (Schrad.) Beck

As in **M. spicata**, our plants with $2n=36$ did not produce seeds but the one with $2n=48$ did. This agrees with the sterile hybrid form of

WOLF (1929) with 2n = 36, and the fertile form of BAQUAR & REESE (1965) with 2n = 48. In our material the former type is rather hairy and has strongly crisped, ovate leaves, whereas the latter type is completely glabrous and has less strongly crisped, narrow leaves and looks rather like **M. spicata**. If our plants with 2n = 36 are also hybrids, this would agree with the fact that one of them has striking **rotundifolia** features, namely ovate leaves, almost white flowers, and forked hairs. On the other hand the strongly crisped leaves, the acute leaf apex, and the lanceolate sepals are **crispata** features. This point seems to be interesting enough for further study.

M.x dumetorum Schult. **(M. aquatica x arvensis)**

Apart from chromosome numbers the plants from the Voerenbeek and those from the Eyserbeek show also distinct morphological differences. The Eyserbeek plants have the very long, often interrupted pseudo-spikes typical for the **Spicatae**, and furthermore the upper three or four normal nodes bear long-pedunculate lateral spikes, entirely comparable with the lateral inflorescences of **M. longifolia**. The flowers of the Voerenbeek plants, on the contrary, are arranged like those of **M. aquatica**, i.e., in a terminal inflorescence (which is here elongate into a rather short, not interrupted pseudo-spike) and besides pseudo-verticillasters on the upper nodes.

As the Voerenbeek plants with 2n = 84 are more like **M. aquatica** than the Eyserbeek plants with 2n = 72 in the investigated material, it may be supposed that the former plants represent a back-crossing with **M. aquatica**, as their chromosome number seems to indicate.

M.x niliaca Jacq. **(M. longifolia x rotundifolia)**

None of our plants produced seeds, although according to MURRAY (1958) plants with 2n = 24 may be fertile. Characteristic differences between plants with 24 and with 36 chromosomes have not been observed, nor have they been described in the literature. It may be noted that plants with 2n = 36 are from moist habitats (rivulets) and the ones with 2n = 48 from dry places (road-sides).

M.x verticillata L. **(M. aquatica x arvensis)**

The chromosome number 96, found in all plants studied, seems difficult to derive from the parental numbers. JUNELL (1942) and SOBTI (1965) also reported this number. MORTON (1956) gave a rather complicated derivation, but it seems more plausible to explain it by a crossing of **aquatica** 96 **x arvensis** 96. The cytotype 96 of M. arvensis is usually assigned to the variety piperascens (i.a., by RUTTLE, 1931), but not always (SOBTI, 1965).

SUMMARY

1) 148 Dutch mints were assembled, partly from botanical gardens and partly from 12 sources throughout the country, and were cytologically investigated.

2) New chromosome numbers were found for **M. arvensis** (2n = 24) and for **M.x dumetorum** (2n = 72), and fourteen counts were in agreement with the literature.

3) Brief notes on the assembled species and hybrids are given. The distinction of pure and hybrid cytotypes in **M. spicata**, its variety **crispata**, and **M. rotundifolia** seems noteworthy.

4) One form seems to be a new **Mentha** hybrid, presumably **M. rotundifolia x crispata.**

5) Some relationships between cytological and morphological aspects are discussed, especially in **M. rotundifolia** and **M.x dumetorum.**

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