Interspecific Hybrids in the Genus *Mentha*¹

I. *Mentha longifolia* (Linn.) Huds × *M. rotundifolia* Linn.

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Received August 28, 1969

The Genus *Mentha* belonging to the family *Labiatae* is very variable. Index Kewensis (1895-1959) lists 280 species in the genus but Bailey (1958) considers only 30 species as genuine others being only varieties or hybrids. Being insect pollinated *Mentha* species hybridize freely in nature. Thus there exists great confusion in the nomenclature of *Mentha* species and the parentage of the hybrid species. Briquet (1897) divides genus *Mentha* into two subgenera *Pulegium* (Mill) Lamk, et DC. and *Menthastrum* Coss. et Germ. Subgenus is further subdivided into three sections based on the nature of their inflorescence: 1) *Verticillatae* Linn. 2) *Capitatae* Linn. and 3) *Spicatae* Linn.

Schuroff (1929) considers *M. spicata* as a hybrid between *M. longifolia* and *M. rotundifolia* on the basis of morphological characters and chromosome numbers.

In the present studies interspecific hybrids have been produced between two species namely *M. longifolia* and *M. rotundifolia* belonging to section *spicatae*, in order to test the speculation of Schuroff (loc. cit.) and to understand the interrelationship between these two species.

Material and methods

1. *Mentha longifolia* (Linn.) Huds commonly known as "Horse mint" is a plant of temperate region growing wild near water channels in the old world. In India this species is found in the temperate Himalayas, down to the foot hills in the subtropics. Several varieties are reported in this species based on characters of inflorescence and the hairiness. The flowers may be white, purplish or white spotted with purple, and are arranged in whorls which form spikelike structures (Fig. 1). The hairs or trichomes are simple unbranched with thickenings on the walls (Fig. 2). The plants for studies were collected from Kashmir valley where it is wild. These were grown in the Regional Research Laboratory, Jammu.

¹ Part of the thesis submitted for award of Ph. D. Degree to the Jammu and Kashmir University.

2. *Mentha rotundifolia* Linn. is a European species also growing wild in temperate regions. Its leaves are sessile and verrucosa and may be ovate or oval with crenate margin. The plants are hairy, the hairs being branched

Figs. 1-4. 1, *Mentha longifolia* (Linn. Huds. Kashmir I.N.O. 301/60. 2, unbranched simple trichomes of *M. longifolia* (Linn.) Huds. $\times 180$. 3, branched trichome of *M. rotundifolia* Linn. $\times 180$. 4, *M. rotundifolia* Linn. (West Germany) I. No. S-324/61.

and later fixed in 1:3 acetic alcohol. The squashes were prepared by the method of Darlington and LaCour (1962) and stained in aceto-orcein. Meiotic

once or twice and their walls have got thickenings (Fig. 3). Flowers in whorls are arranged in spikes, corolla white, purplish or white with purple spots; anthers always purple; nutlets dark brown (Fig. 4). Seeds of the *M. rotundifolia* were obtained from the Botanical Garden at Dresden in West Germany and the plants were raised at Jammu. Individual plants of these two species were grown close together for cross-pollination. Seeds from *M. longifolia* which was used as female parent were collected and seedlings grown.

Somatic chromosome counts were made from temporary squash preparations of root tips of leaf primordia prefixed in saturated aqueous solution of paradichlorobenzene for 2-3 hrs. at 10-15°C,

studies were made from pollen mother cells. Young flower buds were fixed in 1:3 propionoalcohol in which a few drops of propionic acid saturated with iron acetate were added so that whole fixative appeared wine coloured. Smears were made in propionocarmine without iron acetate as mordant. All chromosome counts were made from temporary preparations and camera lucide drawings made at table level.

Table 1

Characters	<i>M. longifolia</i>	F ₁ hybrid	<i>M. rotundifolia</i>
1	2	3	4
Height	50 to 70 cm	50 to 70 cm	40 to 60 cm
Colour	greyish green	greyish green	green
Hairs	unbranched	unbranched	branched
Petiole	0.2 to 0.4 cm	0.1 to 0.3 cm	sessile
Leaf shape	oblong-lanceolate	oblong	oblong
Leaf apex	acute	acute	obtuse
Leaf margin	serrate	serrate	crenate
Leaf size	1.5×0.6 cm to 4×1 cm	2×1 cm to 5×1.6 cm	1.5×1.0 cm to 4.5×2.5 cm
Upper leaf surface	smooth	smooth	verrucose
Lower leaf surface	nerves on lower surface-not prominent	nerves on lower surface prominent	nerves on lower surface prominent
Inflorescence	1 to 3 terminal spikes	3 terminal spikes	5 terminal spikes
Length of spike	3 to 7 cm long on each branch	3 to 7 cm long on each branch	4 to 10 cm long on each branch
Pedicil	0 to 0.5 cm	1 to 1.5 cm	1 to 1.5 cm
Calyx teeth	triangular green	lanceolate, purple at tips	lanceolate, purple at tips
Corolla	lilac	lilac with purple specks	light purplish
Anthers	white anthers	purple anthers	purple anthers
Seed formation	70 per cent	52 per cent	73 per cent
Chromosome numbers	2n=24	2n=24	2n=24

Observations

The morphological characters of *M. longifolia* and *M. rotundifolia* along with their F₁ hybrids are given in Table 1. It will be seen that the F₁ hybrid resembles the female parent *M. longifolia* in height, colour, hairs, petiole, leaf apex, leaf margin, upper surface of leaf and length of spike but resembles the male parent *M. rotundifolia* in leaf shape, leaf size, lower surface of leaf, inflorescence, pedicil, calyxteeth and anthers (Fig. 5).

Cytology: 24 chromosomes were found in root tips and leaf primordia cells of both the parents (Figs. 6 and 7). Meiosis is regular with 12 bivalents

Fig. 5. F_1 hybrid between *M. longifolia* (Linn.) Huds (Kashmir) and *M. rotundifolia* Linn. West Germany.

M. longifolia (L.) Huds and *M. rotundifolia* Linn. are morphologically sufficiently distinct to be placed into two separate taxonomic species; but they

at diakinesis and 1st metaphase (Figs. 8 and 9). 1st anaphase and 2nd divisions are also normal. Chiasmata are terminal and vary in number from one to two per bivalent. One bivalent is associated with the nucleolus.

24 somatic chromosomes were also found in root tip cells of the F_1 hybrid (Fig. 10). During meiosis normal pairing was observed between the chromosomes of two parents resulting in 12 bivalents seen at diakinesis and 1st metaphase (Fig. 11). 1st anaphase separation and 2nd division were both normal, resulting in tetrad formation. Pollen grains were normal and viable. Seed formation in *M. longifolia* was 70 per cent and in *M. rotundifolia* 73 per cent whereas in F_1 hybrid it was reduced to 52 per cent.

Conclusion: It appears that have not evolved genetical barriers or developed structural differences in the chromosomes to keep them separate when they get chance to

Figs. 6-11. 6, $2n=24$ chromosomes at metaphase in *M. longifolia* (Linn.) Huds $\times 2,000$. 7, $2n=24$ chromosomes at metaphase in *M. rotundifolia* Linn. $\times 2,000$. 8, 12 bivalents at diakinesis in a PMC of *M. longifolia* $\times 2,000$. 9, 12 bivalents at diakinesis in a PMC of *M. rotundifolia* $\times 2,000$. 10, $2n=24$ chromosomes in F_1 hybrid between *M. longifolia* and *M. rotundifolia* $\times 2,000$. 11, 12 bivalents at diakinesis in a PMC of F_1 hybrid between *M. longifolia* and *M. rotundifolia* $\times 2,000$.

hybridise in nature. The only barrier to keep these two species distinct appears to be their geographical distribution. *M. longifolia* is found in temperate Asia whereas *M. rotundifolia* is European. Thus the assumption of Schuroff (1929) that *M. spicata* $2n=48$ is a hybrid between *M. longifolia* and *M. spicata*, is disapproved both cytologically and morphologically from the present studies.

Summary

Fertile hybrids were produced between the two species *M. longifolia* (Linn.) Huds and *M. rotundifolia* L. which in nature are widely separated in their distribution. The hybrid inherited characters from both the parents. The speculated origin of *M. spicata* L. from the two parents has been disproved both cytologically and morphologically.

Acknowledgment

My thanks are due to Dr. E. K. Janaki Ammal for her guidance and encouragement during the present work.

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