CYTO-TAXONOMY OF *RHYNCHOSINAPIS* AND *HUTERA* (CRUCIFERAE-BRASSICEAE)

D. J. HARBERD and E. D. McARTHUR

Department of Agricultural Sciences, University of Leeds

Received 22.ix.71

Two species have been recognised in the genus *Hutera* and both have $2n = 24$ chromosomes. *Rhynchosinapis* is a larger genus and includes both diploid ($2n = 24$) and tetraploid forms (see Harberd, 1972, for the full bibliography). All of the diploids in the two genera so far tested are fully crossable with each other in all combinations, and this includes *R. cheiranthos*, *R. monensis*, *R. wrightii*, *R. pseudoerucastrum*, *R. hispida*, *R. longirostra*, *H. rupestris* and *H. leptocarpa*.

Sikka (1940) observed that his tetraploid, *R. cheiranthos*, regularly formed 24 bivalents at meiosis, and with the diploids *R. monensis* and *R. wrightii* being the only other species of *Rhynchosinapis* known cytologically at that time, suggested that *R. cheiranthos* is the allotetraploid derived from them. However, it is now known that *R. cheiranthos* is one of the species that exists in both diploid and tetraploid races so that this interpretation seems unlikely.

Seven diploid interspecific hybrids have been grown at Leeds—*R. cheiranthos* $\times$ *R. monensis*, and the six hybrids derived by crossing each of these species with *R. hispida*, *R. longirostra* and *H. leptocarpa* respectively. Some of the principal morphological characters of the species and hybrids are listed in table 1. Examination of the pollen in acetocarmine indicated that without exception the hybrids produced uniformly plump stainable grains indistinguishable from those of the parent species. It seemed unlikely, therefore, that there could be any major cytological disturbance at meiosis, and this was found to be so—apart from a few unpaired chromosomes in about 3 per cent. of the P.M.C. there was complete bivalent formation (table 2). Furthermore, there is no difference between the hybrids in this pairing behaviour, which is, in our experience, exactly like that of the parental species. Thus no evidence was found to suggest that there is any cytological differentiation between the diploid species included in this study—it may exist elsewhere in the genera of course but this seems unlikely since most of the taxonomic range had been included.

Our study of the tetraploids confirms Sikka's observation that they are essentially bivalent forming. Of 173 cells examined only a single doubtful quadrivalent was observed, all the other cells having 24 bivalents except that in 10 of the cells 2 or 4 of the chromosomes remained unpaired. Nevertheless we believe the tetraploid to be autotetraploid, our evidence being threefold:

1. The close morphological resemblance between the diploids as a group and the tetraploids, and the apparent absence of a second genome among the diploids.
2. The fact that triploid hybrids, table 3, behave in a typical autotriploid manner at meiosis.
3. One aberrant tetraploid with $2n = 50$ forms occasional quadrivalents and trivalents, table 4.

TABLE 1
Morphological characters of species and hybrids of Rhynchosinapis and Huttera

Character	<i>R. cheiranthos</i>	<i>R. monensis</i>	<i>R. hispida</i>	<i>R. longirostra</i>	<i>H. leptocarpa</i>	Hybrid (as applicable)
Leaf dissection	broad rounded lobes	narrow pointed lobes	narrow pointed lobes	broad rounded lobes	broad rounded lobes	narrow pointed lobes
Leaf hairiness	variable	glabrous	setose-hispid	densely hairy	tomentose	glabrous dominant to hairy or tomentose; setose hispid partially dominant to glabrous
Leaf colour	green	glaucous	green	green	green?	green
Siliqua position	± erect	± erect	± erect	pendant	± erect	spreading-pendant
Beak length	less than $\frac{1}{4}$ fruit	less than $\frac{1}{4}$ fruit	less than $\frac{1}{4}$ fruit	more than $\frac{1}{4}$ fruit	more than $\frac{1}{4}$ fruit	equal $\frac{1}{4}$ fruit or slightly less
Beak width	equal values	equal values	equal values	equal values	broader, moniliform	slightly broader, slightly moniliform

TABLE 2

Meiotic metaphase pairing in some diploid Rhynchosinapis and Huttera hybrids

Hybrid	Bivalents: Univalents:	Chromosome pairing			
		12	11	10	9
<i>R. cheiranthos</i> × <i>R. monensis</i>		—	2	4	6
<i>R. cheiranthos</i> × <i>R. hispida</i>		69	2	1	—
<i>R. cheiranthos</i> × <i>R. longirostra</i>		65	2	—	—
<i>R. longirostra</i> × <i>R. monensis</i>		32	—	—	—
<i>R. cheiranthos</i> × <i>H. leptocarpa</i>		53	1	—	—
<i>H. leptocarpa</i> × <i>R. monensis</i>		148	3	1	1
		59	1	2	—
		426	9	4	1

TABLE 3

Meiotic pairing in triploid Rhynchosinapis

Configurations			<i>R. pseudoerucastrum</i> (tetraploid) ×	
Trivalents	Bivalents	Univalents	<i>R. cheiranthos</i> (diploid)	<i>R. monensis</i> (diploid)
8	4	4	2	2
7	5	5	3	4
6	6	6	7	3
5	7	7	9	2
4	8	8	14	8
3	9	9	19	10
2	10	10	14	9
1	11	11	5	3
0	12	12	8	4
			81	45

TABLE 4

Meiotic pairing in an aneuploid tetraploid Rhynchosinapis

Configurations				
Quadrivalents	Trivalents	Bivalents	Univalents	
2	—	19	4	1
2	1	19	1	2
—	2	21	2	2
1	—	23	—	3
—	1	23	1	8
—	—	25	—	23
—	—	24	2	5
—	—	23	4	1

It appears that in this material chromosome pairing is limited to bivalent formation in the autotetraploids, but that this control has been broken down in the triploids, and also partially so in the aneuploid. A somewhat similar case has been reported by Mulligan (1967) in *Physaria vitulifera* (Cruciferae). The haploid chromosome number is four; diploids form four bivalents, tetraploids, eight bivalents, but triploids form trivalents, up to four in number.

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