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Obtainment of some new intergeneric and interspecific hybrids between wild Brassiceae

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ABSTRACT

SOBRINO VESPERINAS, E. (1988). Obtainment of some new intergeneric and interspecific hybrids between wild Brassiceae. *Candollea* 43: 499-504. In English, English and Spanish abstracts.

Eleven new intergeneric and interspecific hybrids involving the genera *Diplotaxis, Brassica, Hutera, Rhynchosinapis, Eruca,* and *Moricandia,* are briefly described, indicating their general characters and fertility, and also the index "number of viable seeds/pollinated flower", on the experimental hibridations. The pollen grains of these F_1 hybrids have been studied morphologically by SEM. Pollen grains of *M. suffruticosa* (Desf.) Coss. & Durieu × *M. arvensis* (L.) DC. and *D. tenuifolia* (L.) DC. × *D. muralis* (L.) DC., acetic carmine positive, present strong anomalies and diverge from the *Cruciferae* general type.

RESUMEN

SOBRINO VESPERINAS, E. (1988). Obtención de nuevos hibridos intergénericos e interspecificos en Brassiceae. *Candollea* 43: 499-504. En inglés, resúmenes en inglés y español.

Se describen brevemente once nuevos híbridos intergenéricos e interespecíficos, obtenidos utilizando los géneros *Diplotaxis, Brassica, Hutera, Rhynchosinapis,* y *Moricandia,* con indicación de sus caracteres generales y fertilidad, así como del índice, "número de semillas viables/flor polinizada", en las hibridaciones experimentales. En estos híbridos F_1 se ha realizado un estudio morfológico del grano de polen, mediante SEM. Los granos de polen de *M. suffructicosa* (Desf.) Coss. & Dur. × *M. arvensis* (L.) DC. y *D. tenuifolia* (L.) DC. × *D. muralis* (L.) DC., acetocarmín positivos, muestran importantes anomalias, que divergen del tipo general, presente en la familia *Cruciferae*.

Introduction

The tribe *Brassiceae* include the most important Crucifer crops. This is the reason why the potentialities for genetic exchange between its members has attracted much attention since long.

The first hybrid artificially obtained (HERBERT, 1824 in SIKKA, 1940) was done by crossing *Brassica napus* L. and *B. campestris* L. the greater part of later hybrid studies have been carried out with *Brassica* and only a few of its closest allies (*Sinapis, Raphanus,* etc.). Only starting with the work of HARBERD (1972), a wider array of genera is being used. More recently, QUIROS & al. (1986) have studied the hibridation posibilities between crops belonging to *Brassica* and some wild species with $x = 7$.

The present work increases the available information in this field, with the presentation of some additional hybrids and their peculiarities. The used species grow often in the Mediterranean area, and some times they have populations, which are near geographically.

Material and methods

The plant material used derives from the seed collection which is maintained by the Department of Biology in the Escuela T. S. de Ingenieros Agrónomos, Universidad Politécnica, 28040

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Cross combination	*Germination*	*Pollen fertility*	*Viable seeds pollinated flower*
Diplotaxis tenuifolia (L.) DC. (GC-0980) × *D. pitardiana* Maire ... (GC-1931)	33	20(1)	5.90
D. tenuifolia (L.) DC. (GC-0980) × *D. muralis* (L.) DC. (GC-0980)	67	97(2)	0.67
Eruca pinnatifida (Desf.) Pomel (GC-1813) × *Brassica repanda* .... (Willd.) DC. subsp. *nudicaulis* (Lag.) Heywood (GC-0905)	6	-(4)	6.00
Hutera rupestris Porta (GC-1577) × *H. leptocarpa* Glez-Albo ..... (GC-1166)	100	94	0.10
H. leptocarpa Glez-Albo (GC-1166) × *H. rupestris* Porta (GC-1577)	67	99	0.31
H. leptocarpa Glez-Albo (GC-1166) × *Rhynchosinapis longirostra*.. (Boiss.) Heywood (GC-1175)	25	93	1.44
Moricandia spinosa Pomel (GC-1845) × *M. suffruticosa* (Desf.) ... Coss. & Dur. (GC-1833)	98	93	7.70
M. spinosa Pomel (GC-1845) × *M. nitens* (Viviani) Dur. & Barr.... (GC-1833)	68	68(3)	1.33
M. suffruticosa (Desf.) Coss. & Dur. (GC-1833) × *M. arvensis* (L.) DC. (GC-0863)	70	54(3)	1.55
M. arvensis (L.) DC. (GC-0863) × *M. nitens* (Viviani) Dur. & Barr. (GC-2129)	55	82	3.14
M. nitens (Viviani) Dur. & Barr. (GC-2129) × *M. arvensis* (L.) DC. (GC-0863)	67	99	0.22

(1) The fertile pollen was normal, and the sterile had normal morphology with smaller size.
(2) All fertile grains of pollen showed an anomalous structure.
(3) The sterile pollen grains were fully deformed, and the fertile partially showed an anomalous structure.
(4) Plants died in the rossete stage.

Table 1. — Characteristics relationated with the viability on some original hybrids obtained between wild species in the tribe *Brassiceae.*

Madrid (GOMEZ-CAMPO & al., 1978). The number and anagram of each sample within that collection is shown in the Table 1.

Parental plants were grown in pots under glasshouse conditions. Crossing was made during the spring by hand emasculation and bud pollination. Morphological characters of the hybrids in relation to their parents were studied in the second year. Pollen samples were observed by optical and scanning electron microscopic techniques.

The number of flowers pollinated was never very high, and it varied widely (from 15 to 30) according to each case.

Nomenclature is according to TUTIN & al. (1964).

Results

Table 1 summarizes the data obtained from our experimental crosses. Only those combinations that we believe to be new have been included. Each hybrid combination is commented below:

Diplotaxis tenuifolia (L.) DC. × **Diplotaxis pitardiana** Maire

The hybrids were vigorous plants, with very low pollen fertility (20%) and completely sterile under conditions of free pollination. The study of pollen samples with SEM detected a part of completely normal pollen, while the sterile grains showed a normal morphology but were smaller in size (Fig. 1). The general appearance of the hybrids as intermediate between the parents.

Diplotaxis tenuifolia (L.) DC. × **Diplotaxis muralis** (L.) DC.

This combination was first carried out in the inverse direction by HARBERD & McARTHUR (1972). In our case, the hybrids were morphologically similar to the father, *D. muralis.* The fertility

of pollen grains, stained with carmine acetic, was 97%, but they all showed deformations when observed with SEM (Fig. 2).

Under free pollination the hybrids produced few seeds.

Eruca pinnatifida (Desf.) Pomel × **Brassica repanda** (Willd.) DC. subsp. **nudicaulis** (Lag.) Heywood.

Five hybrid plants were obtained, but they had limited vigour. Their morphological characters were intermediate between both parents. Unfortunately all plants died in the rossete stage when they had 7 to 9 leaves, though they did not show any chlorophyl deficiency, nor morphological anormalities, except a poor vigour.

Hutera rupestris Porta × **Hutera leptocarpa** Glez. Albo
Hutera leptocarpa Glez. Albo × **Hutera rupestris** Porta
Hutera leptocarpa Glez. Albo × **Rhynchosinapis longirostra** (Boiss.) Heywood

The hybrids showed normal vigour and their seed fertility was full. Other cross combinations between more distant taxa of both genera have been reported by HARBERD & McARTHUR (1972). The authors found 12 bivalents ($n = 12$) in a 96% of the studied metaphases. Further studies on the inheritance of the morphological traits in the fruit would be of interest, as important differences exist in the fruit morphology between *Hutera* and *Rhynchosinapis.*

Moricandia spinosa Pomel × **M. suffruticosa** (Desf.) Coss. & Durieu
Moricandia spinosa Pomel × **M. nitens** (Viv.) Dur. & Barr.
Moricandia suffruticosa (Desf.) Coss. & Durieu × **M. arvensis** (L.) DC.
Moricandia arvensis (L.) DC. × **M. nitens** (Viv.) Dur. & Barr.

The cross combination between these species produced vigorous hybrids. The seed fertility was high in general. Only in the combination *M. suffruticosa* × *M. arvensis* was the sterility very high and the pollen grains observed with the SEM had a large amount of anomalous forms (Figs. 3 and 4), though in many cases were acetic carmine positive.

Several other crosses involving *Moricandia moricandioides* (Boiss.) Heywood as a parent were totally sterile and have not been included in the Table 1.

Discussion

The female parents of the genera contained in the table usually have a high number of seeds per pod (15-60) with the only exception of *Hutera* which has 6-12. This must be taken into account to interprete the index "viable seeds/pollinated flower", which is related to the efficiency of artificial crossings.

HARBERD & McARTHUR (1972) suggest that *D. muralis* is an allotetraploid derived from *D. tenuifolia* and *D. viminea.* As *D. muralis* can be used to produce androsterile lines in plant breeding, the hybrids with related species involve some applied interest.

The hybrid combination *Eruca pinnatifida* × *Brassica repanda* subsp. *nudicaulis* suggests the existence of affinities between both taxa. U & al. (1937) obtained a hybrid between *Eruca sativa* × *Brassica oleracea.* It must be taken into account that *B. repanda* is a taxon with very special characteristics within the genus, so that it perhaps shows the maximum morphological affinities with *Eruca.*

The genetic exchange between the species of *Hutera* and between one of them and *Rhynchosinapis longirostra* is very easy. Our results show clearly that their isolation is more related to geographical barriers than to genetic mechanims. The idea of a single generic taxon like was maintained by GOMEZ-CAMPO (1977), is therefore supported, though the nomenclatural priority is not for *Hutera* but for *Coincya* (GREUTER & RAUS, 1983).

In the formation of F_1 hybrid combinations between the studied species of *Moricandia* no barriers seem to exist, except in the hybrids involving *M. moricandioides,* which is isolated within

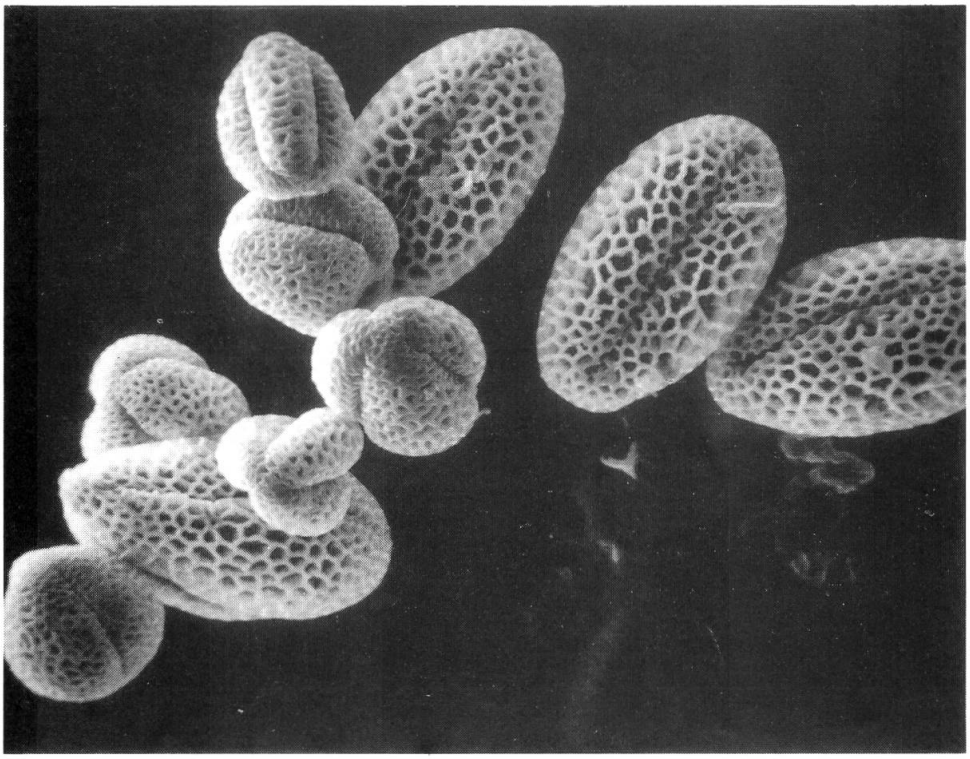
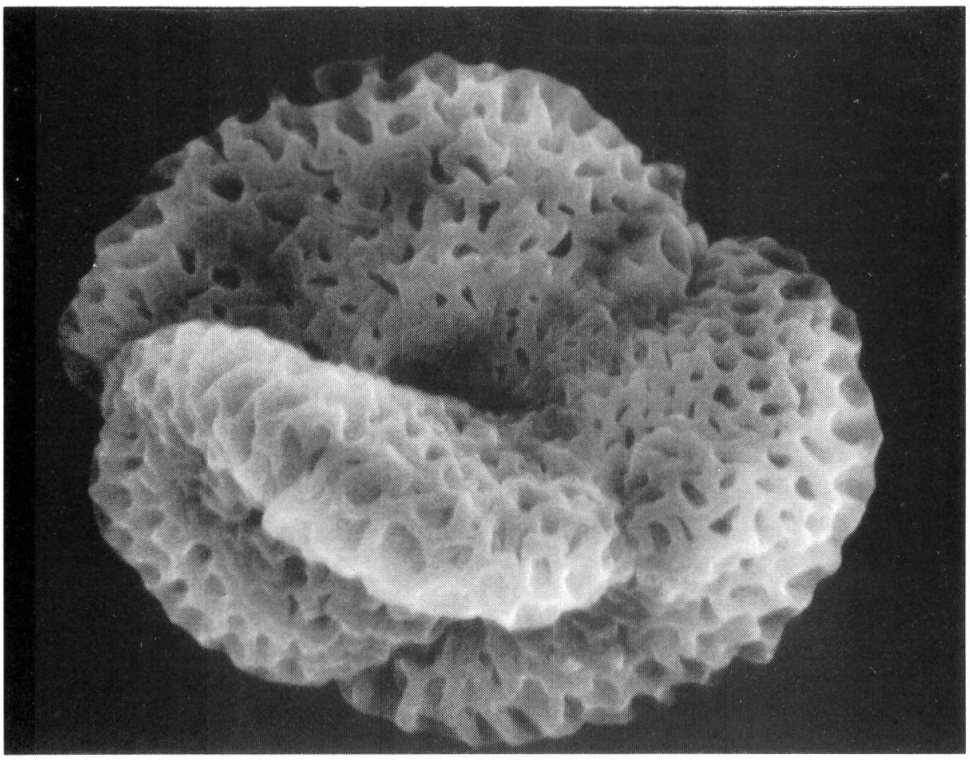


Fig. 1. — *Diplotaxis tenuifolia* (L.) DC. × *Diplotaxis pitardiana* Maire.
Normal and sterile grains of pollen (× 1400). SEM photograph by M. E. Tortosa.

Fig. 2. — *Diplotaxis tenuifolia* (L.) DC. × *Diplotaxis muralis* (L.) DC.
Deformed grain of pollen (× 6000). SEM photograph by M. E. Tortosa.



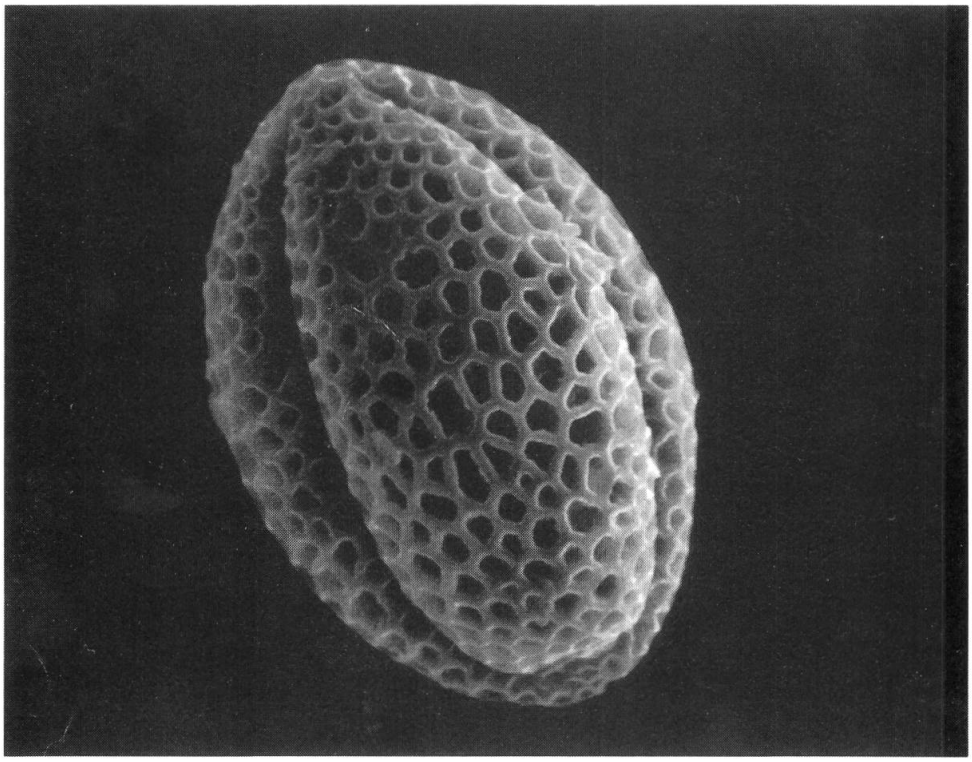
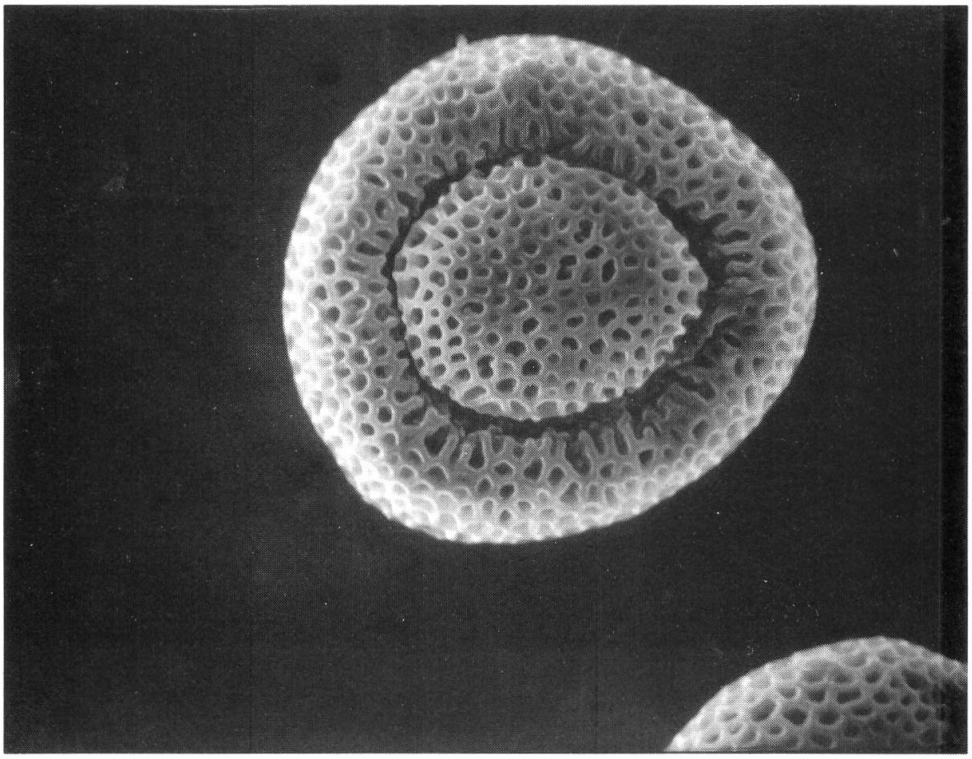


Fig. 3. — *Moricandia suffruticosa* (Desf.) Coss. & Durieu.
Normal grain of pollen (× 4000). SEM photograph by M. E. Tortosa.

Fig. 4. — *Moricandia suffruticosa* (Desf.) Coss. & Durieu × *M. arvensis* (L.) DC.
Anomalous grain of pollen (× 3000). SEM photograph by M. E. Tortosa.



the genus. The genetic exchange is possible in the produced F_1 hybrids, except in the combination *M. suffruticosa* × *M. arvensis.* Our results are noteworthy from the point of view that a polyploid series where *M. spinosa* is 6 *x, M. sufruticosa* 4 *x,* and all others are 2 *x* has been reported for this genus (SOBRINO, 1978).

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