

THE CYTOGENETICS OF AN AMPHIDIPOID *SESAMUM* *ORIENTALE* × *S. PROSTRATUM*

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IN a previous communication the author¹ reported that a hybrid between *S. orientale* = *S. indicum*, $n = 13$ and *S. prostratum*, $n = 16$ was obtained for the first time and subjected to colchicine treatment for production of amphidiploids. The present note is a preliminary description of the cytogenetical behaviour of the amphidiploids.

A₁ GENERATION

Eight hybrid plants were treated with 0.4 per cent. aqueous solution of colchicine when they were in the seedling stage with 6 to 8 leaves. After treatment, the seedlings grew very slowly with all the symptoms of induced polyploidy; the mature plants had thicker and broader leaves, bigger and more hairy flower buds and flowers than the untreated plants. One flower in each branch of the different treated plants was examined for pollen size and fertility and it was found that the percentage of fertile grains varied in amount in the different flowers but they were bigger than those of either parent. Fig. 6 in the previous note shows photographs of pollen grains in the parents, in the F₁ hybrid and in a fairly fertile flower on a treated plant. The capsules formed on the different branches of the eight treated plants were examined for seed-setting. Although a good number of seeds set in most of the capsules, a closer examination revealed

that a large proportion of them were only 'developed ovules' with no embryos in them. The branches in all the eight plants were grouped into three classes on the basis of pollen fertility and the number of capsules, true seeds and developed ovules formed in each class is given in Table I.

TABLE I

Percentage pollen fertility	5-20 (Class I)	21-40 (Class II)	41-60 (Class III)
No. of branches	147	15	4
No. of capsules	89	19	3
No. of true seeds	7	33	33
No. of developed ovules	1128	405	39
Percentage of true seeds per capsule	0.63	7.3	45.8

It is interesting to notice that a large number of 'developed ovules' are formed on these plants and that the proportion of true seeds to developed ovules increases with the increase in pollen fertility.

A₂ GENERATION

Morphology of A₂ Plants.—A large number of 'developed ovules' and good seeds were sown

TABLE II

Details of characters	<i>S. orientale</i>	<i>S. prostratum</i>	Amphidiploid <i>S. orientale</i> × <i>S. prostratum</i>
Habit	Erect	Prostrate	Semi-erect and more vigorous than the parents.
Leaves	Petiolate, oblong to ovate, lower lobed palmately and upper simple with almost entire margin	Short petioled, simple, orbicular with crenate margin	Petiolate, simple throughout with a slight tendency to lobation in a few of the basal leaves, orbicular with dentate margin.
Inflorescence	Raceme; flowers solitary, axillary with two discoid gland-like structures representing rudimentary flowers	Raceme; flowers solitary axillary with no rudimentary gland-like structures	Raceme; flowers solitary, axillary with imperfectly developed glandular structures.
Flowers	Pedicellate, bracteate, zygomorphic, hermaphrodite, with very light purple corolla	Pedicellate, bracteate, zygomorphic, hermaphrodite, with purple corolla	Bigger in size, pedicellate, bracteate, zygomorphic, hermaphrodite (female-fertile, variably male sterile), with light purple corolla.
First flowering (days from sowing)	40	90	60
Fruit	Capsule four-chambered, quadrangular, 2.6 cm. long, 0.6 cm. broad opening from above; loculicidally down to about the base	Capsule ovoid, compressed, with tough pericarp, 1.9 cm. long, 1.0 cm. (at base) and 0.7 cm. (at apex) broad, opening loculicidally from top to only a short distance below	Capsules four-chambered, quadrangular, with tough pericarp, 2.1 cm. long, 1.0 cm. broad, opening loculicidally from top to less than half the capsule-length below.
Seeds	Many, white, smooth, with thin testa	Fewer, black, deeply reticulate, with thick testa	Many, black, larger than in both the parents, deeply reticulate, with thick testa.
Average weight of 100 seeds	0.3301 gm.	0.2340 gm.	0.4408 gm.

during 1943-44. While all the developed ovules failed to germinate, a majority of the good ones germinated and gave rise to 35 mature plants. All plants, except four, were very vigorous and more or less uniform for habit (semi-erect), flowering and other morphological characters. A reference to the four exceptional plants will be made later in the note.

Table II gives a brief summary of the morphological features of the parental species and the group of 31 plants obtained from colchicine-treated hybrids.

Cytology of A. Plants.—Thirty-one out of 35 plants had 58 chromosomes as their somatic number which is equivalent to the sum of the somatic numbers of the two parental species. Hence it is clear that all these plants are amphidiploids resulting from the duplication of chromosomes in the F_1 hybrid. The meiosis in the amphidiploids was very regular with the formation of 29 bivalents at metaphase I, which underwent even separation at anaphase I; metaphase II in many cells showed two groups of 29 chromosomes in each, although very occasionally 30 + 28 grouping was noticed. Figs. 1 and 2 represent metaphase I and II, respectively, in an amphidiploid plant. In spite of the regular meiosis, a high percentage of pollen sterility (60-90 per cent.) was noticed in the amphidiploid plants. But the capsules developed in a large majority of the flowers and contained many apparently good seeds. A closer examination again revealed that many of the seeds were only 'developed ovules'. The seed-setting in 22 amphidiploid plants is given in Table III.

TABLE III

Percentage of true seeds per capsule (average of 10 capsules)	10	10-19	20-29	30-39	40-49	50-59	
Number of plants	1	4	8	5	3	1	Total 22

The four exceptional plants resembled the *prostratum* parent in habit although more vigorous than the latter. They had forty-five somatic chromosomes and showed a typical 'Drosera scheme' of pairing at meiosis; 16 bivalents and 13 univalents were invariably noticed at metaphase I. Fig. 3 represents metaphase I in one of these plants. Evidently these plants had resulted from natural crossing between 'doubled' hybrids and *S. prostratum*.

DISCUSSION

The entirely different morphology and chromosome of the amphidiploid together with its regular meiosis and true-breeding nature justify its being classified as a new species. The one peculiar feature in this amphidiploid is its high pollen sterility in spite of regular meiosis,

although it appears to be highly female fertile. In this respect, the present amphidiploid resembles the cotton amphidiploids produced



by Beasley² and Harland.³ Beasley reported that allotetraploids produced by doubling the chromosome number in F_1 hybrid *G. arboreum* var. *neglectum* × *G. Thurberi* were ordinarily male sterile but rarely flowers had viable pollen. Harland, however, reported that his amphidiploid involving the same two parental species was completely male sterile. Greenleaf⁴ found that amphidiploids *N. sylvestris*—*tomentosa* and *N. sylvestris*—*tomentosiformis*, in spite of being regular in meiosis in mega- and micro-sporogenesis and having over 90 per cent. good pollen were completely female-sterile. He concluded that the sterility in his amphidiploids was genic and that the sterility in the corresponding F_1 hybrids was genic as well as chromosomal. It is possible that in the present *S. orientale-prostratum* amphidiploid also the sterility is genic but that the genic effect is only on pollen formation and not on ovule development.

Further work on these amphidiploids in respect of their crossability with the parental species and the development of ovules and pollen degeneration are under way. Attempts to produce the amphidiploid from triploid hybrids (di-*prostratum*-mono-*orientale* plants) by backcrossing them with *S. orientale* are also in progress. A further report of the results will be published elsewhere.

It is, however, proposed to classify this true-breeding synthetic plant as a new species under the name *S. indicatum*.

1. Ramanujam, S., *Curr. Sci.*, 1942, **11**, 426-28. 2. Beasley, J. O., *J. Hered.*, 1940, **31**, 39-48. 3. Harland, S. C., *Trop. Agriculture, Trin.*, 1940, **17**, 53-54. 4. Greenleaf, W. H., *Genetics*, 26, 1941, 301-24.