exists with the Cannaceæ, specially with the genus *Canna*.

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Department of Botany, B. S. TRIVEDI.
Lucknow University, C. L. VERMA.
Lucknow, *May* 13, 1970.

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GROWTH SUBSTANCE CONTENT IN TOMATO SEEDS

TOMATO seeds (*Lycopersicum esculentum* Mill), few days after collection from the fruits, showed poor germination while those stored for longer periods germinated well. The presence of some inhibiting substances in tomato juice was shown to be the cause for the failure of germination of the seeds inside the fruits.[1] However, leaching of the seeds was shown to decrease the inhibitor content and improve germination in tomato,[3] Xanthium and lettuce,[8] and in the excised embryos of *Fraxinus excelsior*,[6] and groundnut embryo axis.[4] The present investigation was undertaken to find out the difference, if any, between seeds dried for 48 hours and those stored for longer periods, in their growth substance content.

Seeds were collected from freshly harvested tomato fruits and air-dried for 48 hours and were designated as 'fresh' seeds, and those stored for over six months under laboratory conditions were designated as 'stored' seeds. Both 'fresh' and 'stored' seeds were sown in petriplates (6" dia.) containing just-moistened (3 ml.) filter-papers. The plates were covered by the lid with moistened filter-paper on the inside to maintain humidity.

The percentage germination of both 'fresh' and 'stored' seeds, at the end of 72 hours after sowing, was 9 and 56 (mean of 3 replications) respectively. The poor germination in the former might be due to the presence of more inhibitors than in the stored ones.

The growth substance content was extracted from both 'fresh' and 'stored' seeds, following the method of Villiers and Wareing.[7] The chromatograms after development were cut into ten equal strips and each strip was eluted in 2% sucrose solution overnight and the eluates were assayed for their biological activity using the rice coleoptile straight growth technique.[2] 2% sucrose solution served as the control.

The growth substance content showed active inhibition in both acidic and neutral fractions of 'fresh' seeds (Fig. 1, A). In the acidic fraction of 'stored' seeds, however, growth inhibition occurred at Rfs 0·5–0·6 and 0·7–1·0 and in neutral fraction at Rfs 0·1–0·3, while the rest of the Rfs in both the fractions showed growth promotion, more so at Rfs 0·0–0·1 and 0·3–0·4 of the acidic fraction (Fig. 1, B). The presence of more inhibitors than the promoters in the 'fresh' seeds and *vice versa* in the 'stored' ones explains the poor germination in the former compared with the latter.

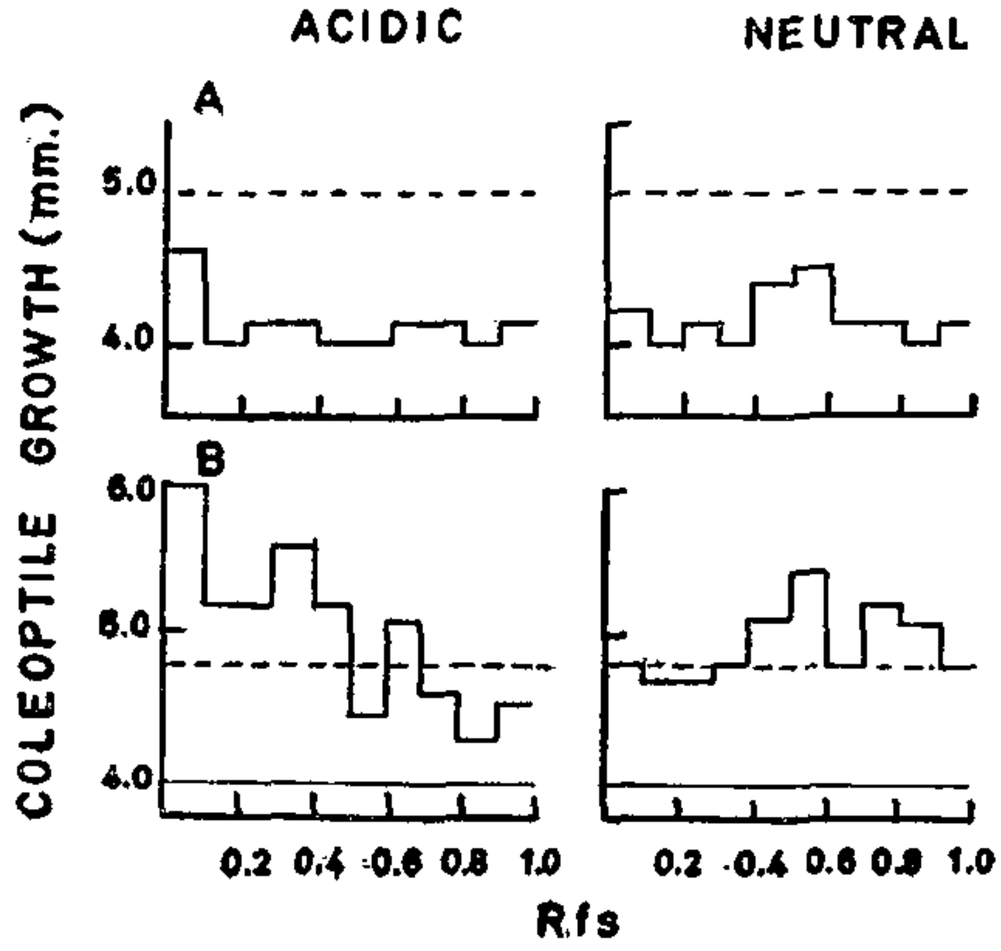

FIG. 1. Growth substance content in (A) 'fresh' seeds and (B) 'stored' seeds. Dotted lines indicate the coleoptile growth in the sucrose control solution.

The inhibitor content decreased and the germination improved in 'fresh' tomato seeds when they were kept for leaching; the leachate collected from the seeds also exhibited the presence of inhibitors, confirming thereby that the poor germination in tomato was only due to inhibitory substances in the seeds.[3] In groundnut (var. TMV.3) seeds also the germination percentage improved with storage, corresponding with a decline in growth inhi-

bitor content and increase in growth promoters.[5] Thus, storage of the tomato seeds for longer periods decreased the inhibitors and enhanced the level of growth promoters.

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Dept. of Botany,
S.V. University,
Tirupati (A.P.),
May 25, 1970.

V. RAJAGOPAL.
N. SREERAMULU.
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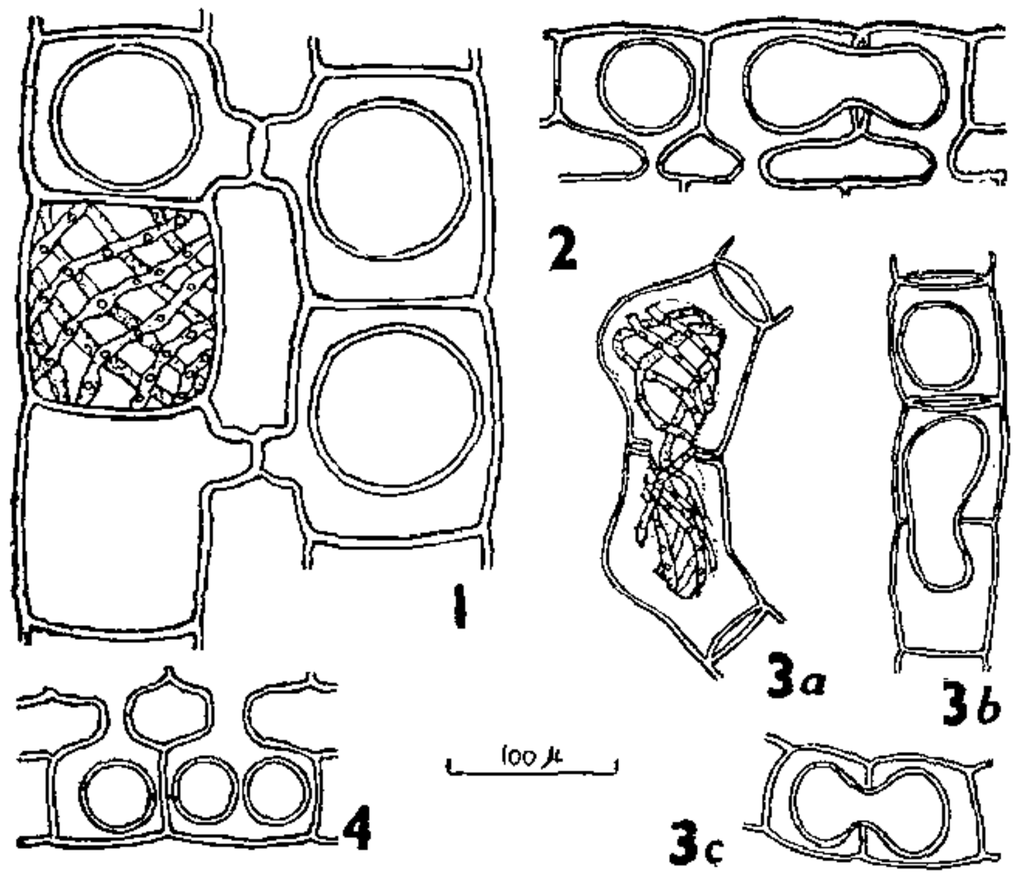
ABNORMAL CONJUGATIONS IN *SPIROGYRA*

SEVERAL forms of abnormal or anomalous conjugation processes have been observed in various species of *Spirogyra*.[1-10] These involve formation of seemingly triploid or tetraploid zygospores,[1-4 6 8] conjugation between three or more cells,[1-4 6 8] gametic fusion across the transverse septum between adjoining cells,[1 5 8 10] and parthenogenetic formation of zygospores by the gametes individually.[7 9 10]

In the course of cytotaxonomic studies on filamentous Conjugales, the authors came across a number of abnormal conjugating processes. It is intended to record them here as they illustrate the range and plasticity of this biological phenomenon within the genus.

In *Spirogyra varifoveolata* Prasad et Dutta[11] most of the cells show normal conjugation and zygospore-formation, but in some cells (Fig. 1), even though the conjugation tubes are produced, azygospores or parthenospores are formed inside either conjugating cell from the gametic protoplasts. It may be mentioned that although cases of similar abnormality have been observed in other species of *Spirogyra*, no information is available on the future fate of such azygospores in any species and it is not known whether such azygospores or parthenospores are viable and capable of germination or not.

In another material of *Spirogyra*, the specific identification of which could not be made due to non-availability of mature zygospores, certain other types of abnormalities were seen. The cells of these filaments measure 50–63 μ × 90–158 μ and possess 3–4 chloroplasts making 1·5 to 4 turns in each cell.



FIGS. 1–4. Figs. 1–2. *Spirogyra varifoveolata* Prasad *et* Dutta. A pair of conjugating filaments with one pair of cells forming normal zygospore in the female cell and another pair of cells showing azygospores in both the male and female cells. Figs. 2–4. *Spirogyra* sp. Fig. 2. Conjugating filament showing a normal zygospore and a "tetraploid' zygospore. Fig. 3 *a*. A filament showing early direct lateral conjugation. Fig. 3 *b* & *c*. Filaments with zygospores formed as a result of directlateral conjugation and a parthenospore. Fig. 4. Filaments with one normal zygospore and two parthenospores in the female cells.

It was observed that in some cases, the two adjacent female cells of a filament containing fused protoplasts formed as a result of scalariform conjugation got fused together again after dissolution of the transverse septum separating the two female cells and formed a zygospore traversing the two cells (Fig. 2). This zygospore, presumably, is tetraploid. Several authors have called such zygospore as tetraploid but it must be pointed out that this nature cannot be established with certainty without cytological investigation.

In another case, the cells showed direct lateral conjugation. The middle walls (septa) between two adjacent cells dissolve and the contents of the two cells fuse to form a zygospore between the two cells (Fig. 3 *a*–*c*). It is interesting to note here that the gametes in this case behave isogamously producing the zygospore in between the conjugating cells, although in the genus *Spirogyra* as a whole, anisogamy is the rule. Similar cases of direct lateral fusion reported by Iyengar[5] exhibit