observations made in England, Australia and U.S.A. where phages 42 D and 44 A were reported occurring predominantly.

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## EFFECT OF GRAFTING ON FRUIT-SET AND EMBRYO DEVELOPMENT IN CROSSES BETWEEN *CORCHORUS OLITORIUS* AND *C. CAPSULARIS*

THE two important cultivated species of jute, *Corchorus olitorius* L. and *C. capsularis* L. have both the somatic chromosome number $2n = 14$, nearly identical karyotypes and characters which can ideally supplement the needs of each other, but all attempts to cross directly the two species at diploid or tetraploid level have so far remained unsuccessful.[1,2] Ganesan *et al.*,[3] found that in crosses with *C. capsularis* as the pistillate parent, the flowers dropped within three days after pollination, while with *C. olitorius* as the pistillate parent viable seeds could not be obtained owing to the premature abortion of the young embryo at the globular stage.

We have tried various techniques during 1957 and 1958 to make the hybrid embryo grow at least to the heart shaped stage so that the embryo can be excised and cultured artificially on a suitable medium. The techniques tried included smearing the ovary with various hormones, use of X-rayed pollen for crossing, using plants raised from irradiated seeds as parents and lastly, grafting the two species reciprocally and using the grafted plants for crossing. Among these, grafting gave some interesting results, which are summarised in this report.

Simple cleft grafts proved successful and *C. olitorius* and *C. capsularis* were found to be graft-compatible (Figs. 1 and 2). Reciprocal

FIG. 1. *C. olitorius* grafted on *C. capsularis* root stock.
FIG. 2. *C. capsularis* grafted on *C. olitorius* root stock.

crosses were done and fixation of the ovaries and style was made at regular intervals after pollination. Microtome sections were stained in iron-hæmatoxylin. Embryo and embryosac dissections were also carried out. The results of the study are given in Table I.

From the data it is clear that firstly, grafting while increasing the percentage of fruit setting, did not lead to any marked improvement in the growth of the hybrid embryo when *C. olitorius* was used as the pistillate parent and secondly, in crosses with *C. capsularis* as the pistillate parent, there was a striking increase in the percentage of fruit-set. The ovules dissected between 13 to 16 days after pollination in crosses made with grafted plants as parents, had globular proembryos. However, the mature seeds were in all cases shrivelled and empty. The free nuclear endosperm failed to become cellular in all the crosses. On the other hand no hyperplasia or any other morphologically

TABLE I

| Cross | Fruit-set % | State of development on different days after pollination | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 | 7 | 10 | 15 | 20 | 35–40 |
| *Corchorus olitorius* selfed or *C. capsularis* selfed | 100 | Pollen tube enters the embryo sac | Zygote Endosperm free nuclear | Globular pro-embryo Endosperm free nuclear | Embryo at torpedo stage Endosperm cellular | Embryo with well differentiated cotyledons Endosperm cellular | Mature dicotyledonous embryo surrounded by the endosperm |
| *C. olitorius* × *C. capsularis* | 42·3 | ,, | ,, | 10-12 celled proembryo Endosperm free nuclear | 10-12 celled proembryo Endosperm free nuclear | 10-12 celled proembryo Endosperm free nuclear | *Shrivelled seeds with abortive embryo and degenerated endosperm |
| *C. olitorius grafted on C. capsularis* × *C. capsularis* | 66·5 | ,, | ,, | ,, | ,, | ,, | ,, |
| *C. capsularis* × *C. olitorius* | 5 | ,, | ,, | Empty ovules | | | Empty shrivelled seeds |
| *C. capsularis grafted on C. olitorius* × *C. olitorius* | 25 | ,, | ,, | Ovules with globular proembryos | | | Empty shrivelled seeds |

*Occasionally heart-shaped embryos were also observed.

detectable abnormality was observed in the nucellus or integumentary cells. Since both the embryo and endosperm are of hybrid origin there may be a common cause for their inability to grow and differentiate normally. It seems probable that complimentary genetic lethals control the early embryo lethality in this cross and thus serve as the isolation barrier necessary to preserve the individual distinctness of the two species. Mechanisms such as chromosomal differentiation or geographical isolation consequently seem to have been unnecessary for this purpose. Hence, in addition to attempts to modify the physiological environment of the hybrid embryo by techniques such as grafting or using a 'bridge' species in the cross[4] or ovary and ovule culture, it may be worthwhile trying to induce mutations that will inactivate the incompatibility reaction.

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## CYTOLOGICAL OBSERVATION ON *PERIPLANETA AMERICANA*

CYTOLOGICAL data on Blattidæ are recorded by Stevens,[1] Wassilieff,[2] Morse,[3] Harvey,[4] Mathey,[5] Schrader,[6] Suomalainen.[7] The present study adds more information regarding meiosis of *Periplaneta americana*.

The testes were fixed in Belling's modification of Navashin's mixture. Sections were cut at 10–15 μ and stained in iodine crystal violet and Feulgen light green.

Spermatogonial prophase nucleus are vacuolated with indistinguishable chromatin threads, which are thinly scattered thoughout the nucleus with a little more aggregation towards the periphery. Innumerable bipartite chromatin dots with circular space around them are visible. The big heteropycnotic X-chromosome is centrally or eccentrically placed often with the nucleolus.

Resting cells at primary spermatocyte are similar to the spermatogonial prophase except in its smaller size and comparatively dense heteropycnotic mass.

Size-variation of X in the early spermatogonial and early meiotic cells are due to the association of other heteropycnotic bodies with it. A proportional decrease in the volume of X is viewed when other heteropycnotic bodies are separated from it.

Diplotene seems to be absent. The diakinesis is brief with a pronounced "pre-metaphase stretch". Chiasmata cannot be detected in any one of these stages. The orientation of the homologous pairs simulate a true picture of