contrast to this, the fall in vitamin content was drastic when the fruits were attacked by Phomopsis man-
giltae and brought down the vitamin content of the fruit to 2.7 mg 100 g. Similarly amla fruits which are the
geriest source of vitamin C, also lost the vitamin under storage conditions. However, the loss was not sig-
ificant. When the amla fruits were attacked by Phoma exigua the content has gone down to
52.3 mg 100 g. Gradual decrease in ascorbic acid content during incubation period may be due to
ripening of fruits5. Similar rapid decline in ascorbic acid content in mangoes6 and in amla was noted when
they were infected with Botryodiplodia theobromae and Aspergillus niger respectively. The loss of vitamin
C under pathogenesis may be due to production of suitable ascorbic acid degrading enzymes either by
the fungus or by the host-pathogen complex6.

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INDUCED PISTILLODY IN TURNERA
SUBULATA

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VARIOUS aspects of heteromorphic incompatibility in
Turnera subulata J. E. Smith have been studied1–4.
There is, however, no work on the effect of chemical
mutagens on heterostylous plants; although induced
self-compatibility and its crossing relationship have
recently been reported in T. subulata following
Hydroxylammonium chloride (HA) treatment5,6. This
report deals with the pistillody mutant in T. subulata.

Seeds (200) of T. subulata were soaked in distilled
water for 24 hr and treated with 0.01–1.0 % aqueous
solutions of hydroxylammonium chloride (HA) and
hydrazene (H2) separately for 24 hr at regular intervals
of 6, 12, 18 and 24 hr. After a thorough washing the
seeds were sown in pots and 30 days after sowing the
plants along with controls were transplanted in the
experimental field to study the M1 generation. Since
the species T. subulata is self-incompatible, M1 plants
were raised by allowing the pin and thrum plants to
open-pollinate. For the study of carpellar pistillode
and gynoecium characteristics, whole mount prepara-
tions were made in 10 % glycerine and measurements
made. Controlled pollinations on pistillodes were
made using its own pollen, normal thrum and pin
pollen; and the pollen tube growth was observed
following the technique used earlier4.

Pistillode mutants were screened only in thrum
plants in both the M1 and M2 generations after 0.01,
0.1 and 1.0 % HA treatment for 12 hr and 0.1 % H2
treatment for 12 and 18 hr respectively. The pistillodes
occur intermixed with the seeds in the capsules of
thrum plants. The percentage of these mutants is 5 %
in all the concentrations and durations of the two
mutagens tested but 6 % mutation frequency was
noted in 0.1 and 1.0 % of HA in M1 generation.
The average number of capsules containing pistil-
loides ranged from 37–50 % on each plant of the
pistillode mutant. Comparison of pistillode mutant
and normal pin and thrum flowers is given in tables 1
and 2 and is shown in plates 1 and 2. Vegetative and
floral characteristics of pistillode mutants and normal
plants are apparently similar but a close observation
reveals that the ovary of pistillode mutant contains
several pistillodes in addition to normal seeds, unlike
the normal ovary which contains only the seeds. There
are 3 placental masses per capsule, each carrying 8–15
seeds in a normal plant whereas in induced pistillode
plants 1–8 pistillodes develop from any of the three
placental tissue in a capsule. Each pistillode is charac-
terised by structure akin to gynoecium with a short
filliform "style", "stigma" and "ovary", which are
devoid of ovules and hence sterile. Abnormal pistil-
loides show twin "ovaries" with styles and stigma and
sometimes without pistil or stigma (plate II, figures 3
& 4). Unlike the stigma of normal thrum which is brush-
like with several large multicellular glandular papillae,
the stigma of pistillode mutant is characterised by 3–8
small finger like multicellular papillae (plate II, figures
3–7). Numerous unicellular trichomes akin to those of
thrum gynoecium occur on the pistillode.
Table 1  Comparison of gynoecium characteristics of control thrum and pistillode mutant of T. subulata

<table>
<thead>
<tr>
<th></th>
<th>Gynoecium length (in cm)</th>
<th>Style length (in cm)</th>
<th>Stigma length (in cm)</th>
<th>Stigmatic papillae length (in μm)</th>
<th>Number of stigmatic arms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (Thrum)</td>
<td>0.90 (0.6–1.0)</td>
<td>0.52 (0.45–0.6)</td>
<td>0.19 (0.1–0.2)</td>
<td>37.0 (26–56)</td>
<td>62</td>
</tr>
<tr>
<td>Mutant</td>
<td>0.38 (0.35–0.43)</td>
<td>0.28 (0.20–0.34)</td>
<td>0.08 (0.045–0.1)</td>
<td>0.06 (0.012–0.1)</td>
<td>5</td>
</tr>
</tbody>
</table>

Mean of 50 measurements.

Plate 1. Figures 1–3. 1. Normal capsule of T. subulata showing only seeds (× 40). 2. Capsule of mutant thrum plant of T. subulata showing pistillodes (× 40). 3. Pistillode showing incompatible reaction with the thrum pollen as evidenced by callose plugs on the stigma (× 200).

Pollination experiments on isolated pistillodes were made in vitro, with the pollen of normal pin and thrum and was also self-pollinated with its own pollen but in all cases absolute incompatibility was observed as evidenced by abnormal tubes with callose plug (plate 1, figure 3).

The mean number of seeds per capsule was much less with more aborted seeds in pistillode mutant compared to normal thrum (control) plants of T. subulata (table 2).

Plate 2. Figures 1–7. Camara lucida drawings of normal pin and thrum flower forms and pistillode mutants of T. subulata. 1 & 2. Thrum and pin forms. 3. The capsule of pistillode mutant cut across showing the pistillodes and seeds, 3A & 4. Fused pistillodes. 5. Normal pistillode, 6 & 7. Stigmatic papillae of normal thrum flower and pistillode mutant.

The pistillode mutant segregated to produce 130 normal plants and 45 pistillode plants in the M₁ generation, showing a 3:1 ratio suggesting the recessive nature of pistillode mutants.

Phyllody in various cereals has been reported in recent years; in barley, bread wheat, and pearl millet
Table 2  Comparison of mean number of pistillodes, capsule and seed set in control thrum and pistillode mutant of T. subulata.

<table>
<thead>
<tr>
<th></th>
<th>Number of capsules observed</th>
<th>Number of capsules with pistillodes</th>
<th>Number of pistillodes/capsule</th>
<th>Number of seeds without pistillode capsules</th>
<th>Number of seeds with pistillode capsules</th>
<th>Aborted seeds without pistillode capsules</th>
<th>Aborted seeds with pistillode capsules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (Thrum)</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>20 (20–35)</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Mutant</td>
<td>182</td>
<td>76</td>
<td>3</td>
<td>20 (15–24)</td>
<td>13</td>
<td>5</td>
<td>8</td>
</tr>
</tbody>
</table>

following irradiation and is shown to be due to single recessive gene\textsuperscript{10–12}. Manga\textsuperscript{12} noted some of the mutants that had the stamens modified to "carpel" and in others the mutant had multiple carpels with occasional formation of seeds. Kihara\textsuperscript{13} obtained pistillody in hybrid plants of \textit{Aegilops caudata} × \textit{Triticum aestivum} and found the original carpel to be functional. In the mutants presently studied fertility was greatly reduced by the induction of pistillody.

It is not clear why thrum plants alone are susceptible to pistillody. Whether this is due to the heterozygous nature of thrum (Ss) or due to teratogenic effect of the mutagen is not known at present.

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REACTIO N OF MIXED RACES OF \textit{Xanthomonas campestris} pv. \textit{Malvacearum} (E. F. SMITH) DYE

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BACTERIAL blight of cotton is induced by \textit{Xanthomonas campestris} pv. \textit{malvacearum} (Xcm). Mixtures of races (genotypes) of Xcm are generally used for screening segregating breeding materials\textsuperscript{1–3}. However, a mixture of races may give a synergistic, mixed or antagonistic reaction\textsuperscript{4}. The present report demonstrates the effect of different populations of the constituent races of Xcm on the reaction of mixed races on different cotton cvs with different bacterial blight resistant genes.

The methods used have been described earlier\textsuperscript{4–6}. The isolates used were XcmR-32 (race-32), XcmR-8 (race-8) and Xcm-V\textsuperscript{-} (avirulent race-32; virulence lost by repeated transfers on artificial media in about 7 years\textsuperscript{6}). The aqueous suspension of Xcm isolates was adjusted to 0.1 or 0.2 E\textsubscript{620 nm} and then mixed accordingly. The results (table 1) showed that the concentration of the constituent Xcm cells played an important role in the reaction of the mixed races. Normally Xcm-V\textsuperscript{-} gave a resistant hypersensitive reaction (HR, a rapid necrosis within 24 hr followed by tissue collapse) on all the cvs; XcmR-32 gave HR on cv VII, while XcmR-8 gave HR on cvs III, V, VI and VII and susceptible reaction (Sr) on the remaining cvs (table 1). The reaction of the virulent genotype was not