contrast to this, the fall in vitamin content was drastic when the fruits were attacked by *Phomopsis mangiferae* and brought down the vitamin content of the fruit to 2.7 mg 100 g. Similarly amla fruits which are the richest source of vitamin C, also lost the vitamin under storage conditions. However, the loss was not significant. 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 fruits[4]. Similar rapid decline in ascorbic acid content in mangoes[6] 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 degenerating enzymes either by the fungus or by the host-pathogen complex[6].

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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 studied[1-9]. 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) treatment[5,6]. 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 (HZ) 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 M_1 generation. Since the species *T. subulata* is self-incompatible, M_2 plants were raised by allowing the pin and thrum plants to open-pollinate. For the study of carpellary pistillode and gynoecium characteristics, whole mount preparations 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 earlier[4].

Pistillode mutants were screened only in thrum plants in both the M_1 and M_2 generations after 0.01, 0.1 and 1.0% HA treatment for 12 hr and 0.1% HZ 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 M_1 generation.

The average number of capsules containing pistillodes 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. Vegatative 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 characterised by structure akin to gynoecium with a short filliform "style", "stigma" and "ovary", which are devoid of ovules and hence sterile. Abnormal pistillodes 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*

	Gynoecium length (in cm)	Style length (in cm)	Stigma length (in cm)	Stigmatic papillae length (in μm)	Number of stigmatic arms
Control (Thrum)	0.90 (0.6–1.0)	0.52 (0.45–0.6)	0.19 (0.1–0.2)	37.0 (26–56)	62 (35–96)
Mutant	0.38 (0.35–0.43)	0.28 (0.20–0.34)	0.08 (0.045–0.1)	0.06 (0.012–0.1)	5 (3–8)

Mean of 50 measurements.

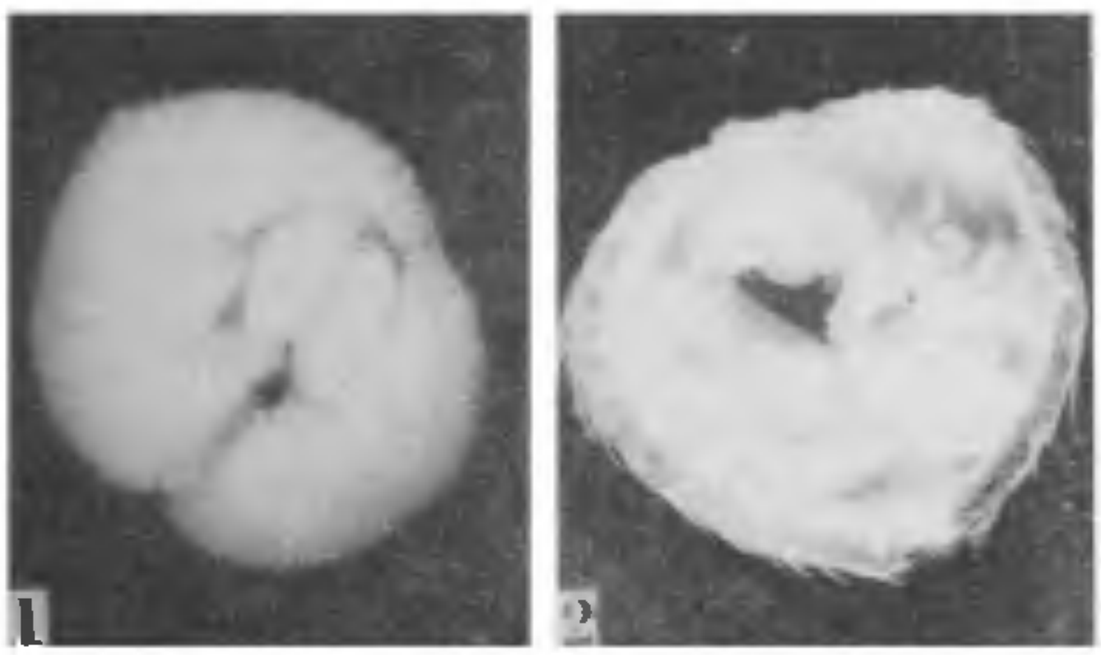

Plate 1. Figures 1–3. 1. Normal capsule of *T. subulata* showing only seeds (×40). **2.** Capsule of mutant thrum plant of *T. subulata* showing pistillodes (×40). **3.** Pistillode showing incompatible reaction with the thrum pollen as evidenced by callose plugs on the stigma (×200).

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 I, 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).

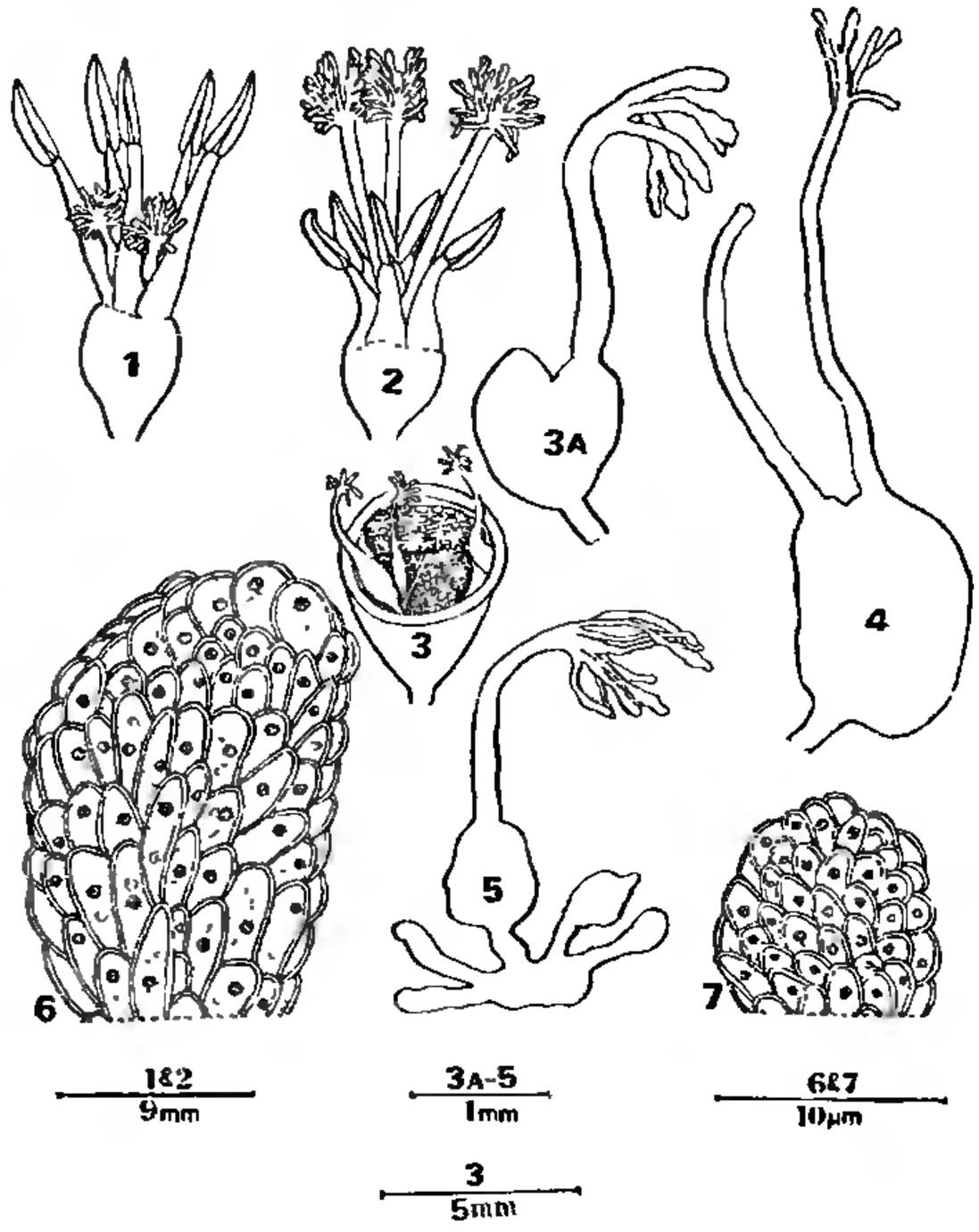

Plate 2. Figures 1–7. Camara lucida drawings of normal pin and thrum flower forms and pistillode mutants of *T. subulata*. **1 & 2.** Thrum and pin forms, **3.** The capsule of pistillode mutant cut across showing the pistillodes and seeds, **3A & 4.** Fused pistillodes, **5.** Normal pistillode, **6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

The pistillode mutant segregated to produce 130 normal plants and 45 pistillody plants in the M_2 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.*

	Number of capsules observed	Number of capsules with pistillodes	Number of pistillodes/ capsule	Number of seeds		Aborted seeds	
				without pistillode capsules	with pistillody capsules	without pistillody capsules	with pistillody capsules
Control (Thrum)	200	—	—	30 (20–35)	—	2 (1–2)	—
Mutant	182	76	3 (1–8)	20 (15–24)	13 (9–18)	5 (2–7)	8 (5–11)

following irradiation and is shown to be due to single recessive gene[10-12]. Manga[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[13] obtained pistillody in hybrid plants of *Aegilops caudata* × *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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REACTION OF MIXED RACES OF *XANTHOMONAS CAMPESTRIS* PV. *MALVACEARUM* (E. F. SMITH) DYE

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BACTERIAL blight of cotton is induced by *Xanthomonas campestris* pv. *malvacearum* (*Xcm*). Mixtures of races (genotypes) of *Xcm* are generally used for screening segregating breeding materials[1-3]. However, a mixture of races may give a synergistic, mixed or antagonistic reaction[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[4-6]. The isolates used were *Xcm*R-32 (race-32), *Xcm*R-8 (race-8) and *Xcm*-V$^-$ (avirulent race-32; virulence lost by repeated transfers on artificial media in about 7 years[6]). The aqueous suspension of *Xcm* isolates was adjusted to 0.1 or 0.2 $E_{620\,nm}$ 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$^-$ gave a resistant hypersensitive reaction (HR, a rapid necrosis within 24 hr followed by tissue collapse) on all the cvs; *Xcm*R-32 gave HR on cv VII, while *Xcm*R-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