

Anatomical Studies in the Italian Millet (*Setaria italica* Beauv.) in Relation to Termite Resistance

by

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Introduction: Incidence of termites as pest in the Italian millet (*Setaria italica* Beauv.) has not been reported in the past. The standing crops of certain valuable varieties resistant to rust have been found to be severely damaged by termites in the Millets Breeding Station. Since susceptibility to termites in these valuable cultures interfered with the breeding programme on the improvement of this crop, anatomical studies as an initial step towards the understanding of the resistance in the resistant varieties were made and the same are reported in this article.

Materials and Methods: The general characters of the standard strains and the varieties chosen for the anatomical studies are presented in Table I.

TABLE I.

Characters of Strains and Varieties Studied.

Numbers	Origin	Tillering habit	Productive habit	Rust infection	Termite incidence
Co. 1	Mosu Tenai, Coimbatore.	8-12 tillers per plant	High yielder	Susceptible	Resistant
Co. 3	Perum Tenai, Coimbatore.	5-12 tillers per plant	do.	do.	do.
MS. 7272/4	Japanese Tenai	Single stalked	Poor yielder	Resistant	Susceptible
MS. 7235/4	do.	do.	do.	do.	do.

Detailed studies were made on the mode of attack and the extent of damage caused by the termites in the susceptible varieties. Transverse section of the underground roots and the roots which develop from the basal nodes and are partly exposed before striking the soil, were taken by hand. The sections were stained with saffranin (1% aqueous solution) and camera lucida drawings at table level were drawn with 10 X eye piece.

Observation: *Study of the mode of termite damage:* During the last five years ever since the Japanese varieties were introduced they were found to be susceptible to the termite damage. They were continuously grown for the isolation of rust resistant cultures in different seasons and fields, and irrespective of season or field the standing crop was found to be attacked by the termites right from the seedling stage to the final

mature stage. Periodical counts of plants attacked by the termites were made during the summer season 1959 in plots of 260 sq. links in two of the susceptible varieties and the same are presented in Table II.

TABLE II.

Extent of damage caused by the termites.

Numbers	Total number of plants affected till								Plants un-affected
	20 days	30 days	40 days	50 days	60 days	70 days	80 days	90 days	
1. MS. 7272/4	30	45	62	81	103	136	161	193	Nil
2. MS. 7235/4	52	69	81	93	123	141	169	197	Nil
3. Co. 1	All the plants were unaffected.								
4. Co. 3									

When the affected plants in the various stages were uprooted and examined, it was seen that the termites attack initially the roots just below the culm. Making an entry inside the culm by biting the roots at the base the termites pass upwards feeding on the tissues inside. Invariably a small colony with egg masses was seen around the affected plants in the soil. The plants showed temporary wilting in the initial stage and subsequently after a few days the plants dried up and fell down. During the monsoon season frequent rainfall have been noted to check the incidence of the pest to some extent.

Anatomical studies: The anatomical characteristics noted in the different layers in the transverse sections of the roots which develop from the basal nodes and the underground roots are presented in Tables III and IV respectively (Fig. 1).

TABLE III

Anatomical characters of the basal node roots.

Numbers	Exodermal cells	Exodermal cell wall thickening	Endodermis thickening	Sclerenchyma cell walls	Pith
1. MS. 7272/4	5-celled	very poor thickening	poor thickening and not well defined	slightly thickened	thin walled cells and disintegrated
2. MS. 7235/4	4-celled	do.	do.	do.	do.
3. Co. 1	6-celled	well thickened	inner and radial walls thickened	well thickened	thin walled cells and remain intact
4. Co. 3	do.	do.	do.	do.	do.

TABLE IV.

Anatomical characters of the underground roots.

Numbers	Exodermal cells	Exodermal cell wall thickening	Endodermis thickening	Sclerenchyma cell walls	Pith
1. MS. 7272/4	3-celled	thickened	inner walls thickened	poor thickening	thin walled cells and disintegrated
2. MS. 7235/4	do.	do.	do.	do.	do.
3. Co. 1	3-celled	highly thickened and cell much reduced	inner and radial walls highly thickened	well thickened cell walls	pith area much less and cells remain intact
4. Co. 3	do.	do.	do.	do.	do.

Discussion: The continuous incidence of termites has been the problem since the Japanese varieties were introduced. Along with the growth of the crop from the seedling stage, plants affected by the pest increase in number and finally the whole population gets damaged. The Japanese varieties are maintained to isolate rust resistant cultures. They are characteristically single stalked in tillering habit and hence are poor yielders. As such specific items of work have been programmed to infuse rust resistance into the standard high yielding strains by hybridisation.

A perusal of the data presented will indicate that in the case of the roots from the basal nodes there was no thickening of the cell walls of the exodermal layer in the susceptible varieties. The endodermal thickening was also comparatively less and the thickening of the sclerenchymatous cell in the stele was also found to be not so well developed as in the case of the resistant varieties. In the case of the underground roots also, although there was the thickening of the cell walls in the exodermal layer it was not so prominent in the susceptible varieties both in the exodermal cells and in the sclerenchymatous cells in the stelar region, as it was in the resistant varieties.

At the time of taking the transverse section of the roots by hand, difficulty in running the knife was felt in the case of the resistant varieties because of the better thickening of the exodermal cell walls and the endodermal layer. But the transverse sections were taken very easily in the case of the susceptible varieties and which fact explains as to why the termites find it very easy to bite their roots and feed on the tissue.

Summary: Termites have been noted to attack the Italian millet for the first time. The susceptible variety is attacked from the seedling stage onwards. Anatomical examination of the roots reveal that the susceptible varieties have very poorly developed exodermal layer, endodermal layer and sclerenchymatous tissue in the stelar region.

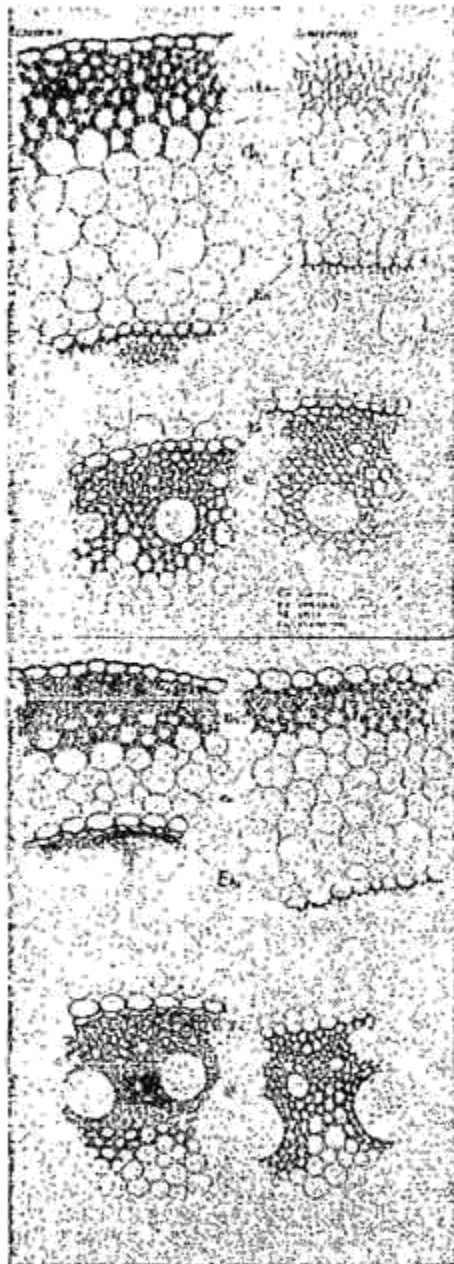


FIG.

Root structure of the resistant and susceptible varieties.

Top left:

Aerial root of the resistant variety.

Top right:

Aerial root of the susceptible variety.

Bottom left:

Underground root of the resistant variety.

Bottom right:

Underground root of the susceptible variety.

(Cortex and stelo are shown separately in each).

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