Plant Diseases

Bakanae Disease and Foot Rot of Paddy

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THIS disease was first described from Japan by Hori (1898, 1907) and it was considered by him to be due to a species of *Fusarium*. It is known as the "Bakanae" disease in that country. Subsequently the disease has been reported from China, India, British Guiana and the Philippines.

In yala 1950 it was brought to the notice of the Division of Plant Pathology that plants in certain paddy nurseries sown with *Vellai Illankalayan* were dying out at the age of two or three weeks from sowing. Although these nurseries were in widely different situations the seed was ultimately found to have come from a common source. Reports of a similar failure of seed from the same source had been received the previous year and an investigation of the problem was taken up. Investigations revealed that the *Vellai Illankalayan* seed that had been sown in the nurseries where seedling failure had been observed was infected by a species of *Fusarium* which is capable of causing the death of seedlings and also producing certain symptoms on adult plants in the field. The fungus has been indentified as *Fusarium moniliforme* Sheld, the causal agent of the foot rot disease of paddy reported from other countries. The perfect stage of the fungus is known as *Gibberella Fujikuroi* (Saw.) Wr.

SYMPTOMS

The most serious phase of this disease is that which occurs on the seedlings. When infected seed is sown the seedlings become pale and "thin" and subsequently die out. It has generally been observed that this seedling blight occurs mainly from two to three weeks after sowing. In extreme cases practically total failure of the nursery or broadcast crop has been known to occur.

Seedlings that may survive the nursery stage may die out at transplanting. These seedlings are scattered throughout the field and not confined to patches. When examined the bases of the seedlings are observed to be rotten.

Plants that have survived the initial attack in the seedling stage show characteristic symptoms in the field which will enable easy diagnosis of the disease. A very accurate description of this aspect of the disease is given by Thomas (1931) as follows :—

" Scattered here and there in the field are tall lanky tillers which come into ' shot blade ' earlier than the rest of the crop but bearing pale green flags which shoot up conspicuously above the general leaf level of the crop. Viewed from a distance on a bright sunny day such pale flags mar the uniform level of a platform of green leaf tips. There is a corresponding emergence of culms of the affected plants from their sheaths revealing the base of internodes. Even the most experienced agriculturist would at first sight take the occurrence of stray plants of such abnormal development to be the result of an admixture of seed of a short duration variety—a feature not uncommon in the average ryot's fields ".

The abnormal height of infected tillers is responsible for the term "Man Rice" given to paddy affected by this disease in British Guiana (Martyn 1930).

In Ceylon this condition of abnormally elongated tillers is called by the cultivator " wanda peedema " (sterile ripening). Indeed no setting of seed occurs in the affected plants and they generally die off in a few days. Infected plants generally show hardly any tillering and the elongation is a result of accelerated growth at the expense of lateral development. It has been shown by Yabuta and Hayasi (1940) that two substances could be isolated from cultures of the fungus, one of them " fusaric acid " causing a retardation of the growth in rice seedlings even at a dilution of one part per million. The other is " Gibberelin " an organic acid which is capable of causing elongation of shoots of a number of plants including rice.

The elongation of tillers (Bakanae phenomenon) may be suppressed under certain conditions and the affected plants may remain normal or even stunted.

When an infected tiller is examined internally after splitting the culm there is almost invariably a discoloration at the basal node, which is in most cases visible even externally as a brownish sodden area. Generally the cottony mycelium of the fungus may be seen within the hollow of the culm and in advanced cases of infection nodal discoloration may also extend to one or two of the nodes immediately above the basal one. A progressive browning and drying up of leaves from base upwards is also a common feature of affected plants as also is the development of adventitious roots from the first, second and even the third node from the base. The root system however is generally unaffected but owing to the rot at the basal part of the stem (foot rot) the diseased plants when pulled, break off at the base leaving the roots in the ground. On plants that have been killed by the disease the causal fungus may be visible as a white or pinkish-white incrustation on the surface of the infected parts. This pinkish incrustation is composed of the mycelium of *Fusarium* and millions of its spores. It must not be forgotten however that there are numerous saprophytic species of *Fusarium* that form similar incrustations on various dead or dying plants.

PREDISPOSING CONDITIONS

The optimum soil temperature for the development of the disease has been shown by Seto (1935) to be 35°C. Infection failed to appear at 20°C or at 40°C. Certain cultivators in the Kegalle area affirm that the incidence of this disease is less in maha than in yala. This is obviously related to the comparatively higher average temperatures obtained in the yala season. Seto also believed that soil moisture too plays an important part in the development of the disease.

Thomas (1937) found that nitrogen applied to the soil either as cattle manure or as ammonium sulphate favoured the development of the disease. It has been our observation that the same infected paddy sown in different fields by different cultivators showed varying degrees of severity of the disease. There is no doubt that many factors are responsible in determining the severity of disease incidence.

DISTRIBUTION

The Bakanae disease of paddy has been so far recorded from Gampola, Kandy, Wattegama, Kadugannawa, Kegalle and Matugama. Although this disease has been recognised as such only recently it probably has been a long time in Ceylon and is found in mild forms wherever paddy is grown.

ALTERNATE HOSTS

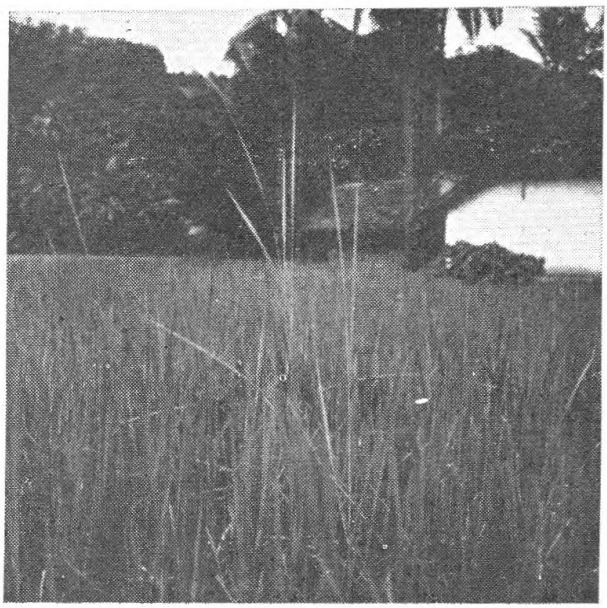
It is known that *Fusarium moniliforme* can infect sugar cane, maize, barley, *Panicum miliaceum*, and *Andropogon sorghum*.

RESISTANT VARIETIES

The Coimbatore strain G. E. B. 24, Aryan and the American variety Wateribune are reported resistant as also a number of Japanese varieties.

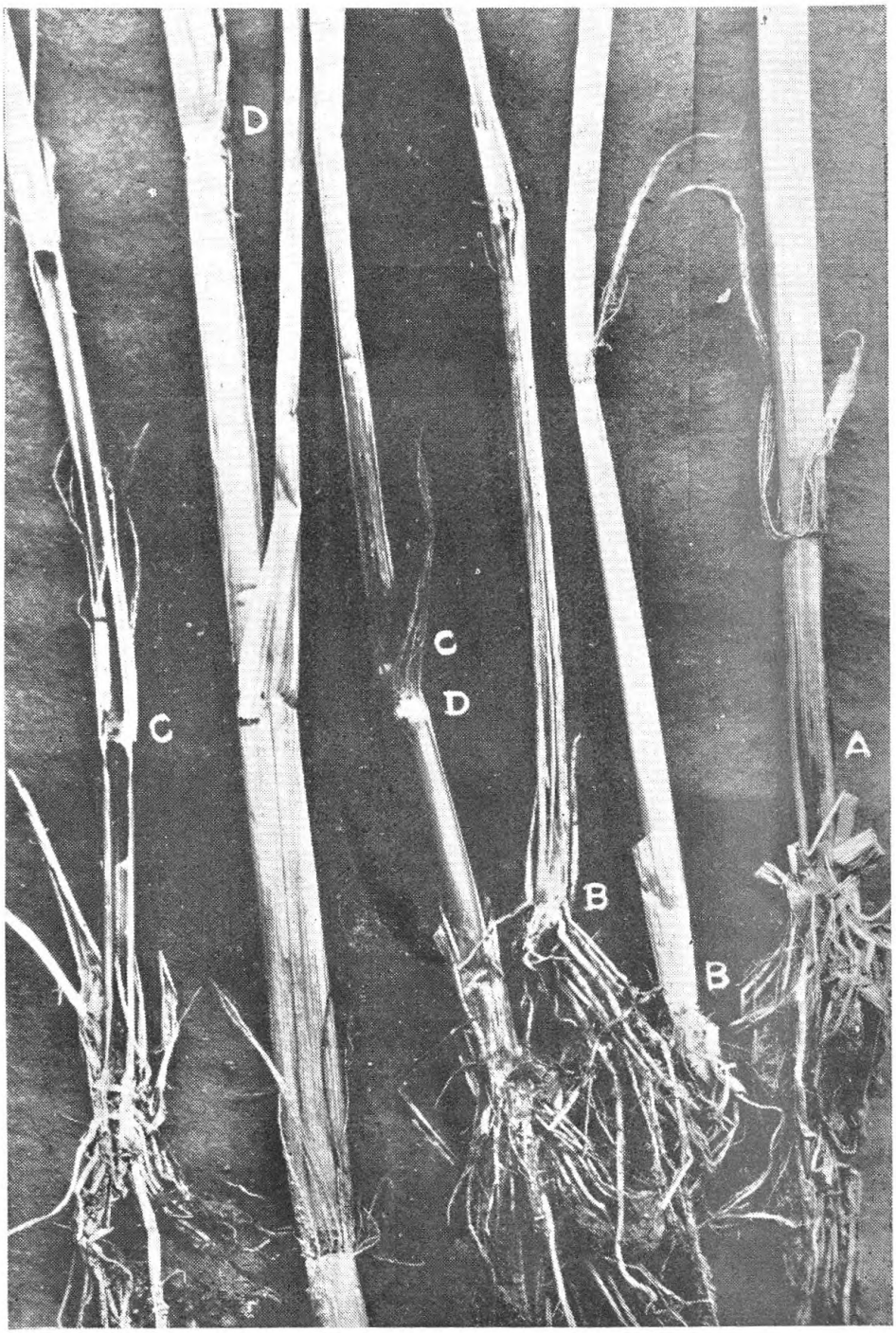
CONTROL

The disease is to some extent soil borne and the stubble should be burnt whenever possible. It is however largely seed borne and fortunately the infection is mainly on the surface of the seed. Hence it is quite amenable to treatment. We have found that seed dusting with an organo mercurial fungicidal dust Agrosan GN at the rate of 2 ounces per bushel very effectively controls the disease. In India (Thomas 1933 and Sundararaman 1936) found that most of the standard fungicidal seed dressings gave good control and for practical purposes Ceresan or Agrosan at the rate 1 gm. per $\frac{3}{4}$ to 1 lb. of paddy has been recommended. Although organo mercurial seed dressings have been found very effective, owing to their poisonous nature their use, in the absence of suitable supervision in the actual dusting and subsequent handling of the treated paddy cannot be recommended. Under these circumstances less effective but non-poisonous fungicides like copper-lime dust may be used.



BAKANAE DISEASE AND FOOT ROT OF PADDY

Paddy plants affected by the Fusarium disease showing elongation compared with healthy plants.



BAKANAE DISEASE AND FOOT ROT OF PADDY

Paddy plants attacked by the Fusarium disease showing :—

(*a*) discoloration of the base.
(*b*) white mycelium at the base.
(*c*) discoloration of second internode.
(*d*) mycelium at upper nodes.

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