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an examination of such possibilities it will be hazardous to indiscriminately introduce and grow new varieties side by side with existing good ones. This risk is very real, especially as many more factors than two are known to exist in the production of efficient chlorophyll in cereals generally.

Summary. Chlorophyll deficiences resulting in pale and albino seedlings have been met with in the pearl millet (Pennisetum typhoides, Staff and Hubbard). A factor C produces chlorophyll. In its absence the seedlings are white and die. C is a simple dominant to c. A second factor E conditions the efficient manifestation of C. C with E produces good green seedlings. Without E, the plants are pale green and weak. E is a simple dominant to e, but can operate only when C is present.

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THE '*SOORAI*' DISEASE OF PADDY

BY

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Introduction. The 'Soorai' disease of paddy is caused by a mealy bug—*Ripersia oryzae*, Green,—belonging to family Coccidae, order Rhynchota. The insects suck the plant sap and, as a result of their attack, the affected plants get stunted in growth. In severe cases of infestation the earheads get smothered and either fail to emerge from the sheath or when emerged do not produce healthy grains. The infestation is seen to occur in patches in the field.

Distribution of the Pest. Numerous reports of the occurrence of the pest are on record in the files of the Government Entomologist, the first one being in 1909, from Salem District. The pest has been reported from the following taluks in the Madras Presidency.—Berhampore, Anakapalle, Peddapuram, Nellore, Trichinopoly, Ariyalur, Mayavaram, Tanjore, Kumbakonam, Palni, Attur, Salem, Dharapuram, Palghat and Walluvanad.

In view of the fact that reports of the pest are being received from the various parts of the Presidency, an attempt is made to present the facts so far ascertained regarding the pest as a result of the studies made at the Agricultural Research Station, Aduthurai.

Description of the pest and its stages. As stated before, the disease is caused by the mealy bug *Ripersia oryzae*. The adult female (vide Plate) is elongate, more or less cylindrical, purplish in color and covered with a mealy covering. It is about 4 mm. long and practically incapable of any movement. The male is a very tiny, delicate, winged creature, very seldom seen. The adult females and their young ones known as 'nymphs' are found between the stalk and the leaf sheaths in the earlier stages of the plant and in the later stages at the harvest time these are found between the earhead stalk and the sheathy leaf.

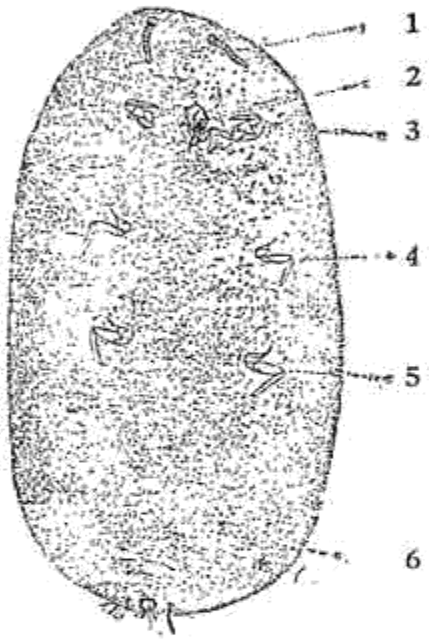
Eggs are laid by the female in groups under the mealy covering. These are about ½ mm. long, cylindrical in shape and light yellow in color. The eyes of the nymphs could be seen clearly through the transparent egg shell. The females are known to lay large numbers of eggs. Ten big-sized females laid 126 ; 140 ; 151 ; 152 ; 165 ; 209 ; 225 ; 292 ; 299 ; and 319 eggs respectively. The egg period ranges from a few minutes up to one day. The newly hatched young and those about a day or two old are found actively moving about. The nymphal period ranges from 17 to 34 days.

Incidence of the Pest. The degree of infestation of affected plants depends on many factors, one of these being the actual number of bugs noted on the plant. In some of the badly infested plants the population of the bugs is rather alarming. The results of the examination of a few affected plants are given below.

Bug population in 'Soorai' affected plants.

No.	Date of examination.	Variety of paddy.	Total No of tillers of plant.	No. of infested tillers.	No. of adult bugs.	No. of nymphs.	Total population of adults & nymphs for the plant.
1	18—11—30	Nellore Samba.	8	8	66	530	596
2	20—11—30	GEB. 24.	13	13	164	430	594
3	12—12—31	Adt. 1	7	5	14	566	580
4	,,	,,	4	4	15	258	273
5	,,	,,	5	5	22	264	286
6	,,	,,	5	5	16	195	211
7	,,	,,	3	3	17	325	342
8	,,	,,	6	5	7	60	67
9	,,	,,	4	4	9	152	161
10	,,	,,	4	4	17	479	496
11	,,	,,	6	6	28	411	439
12	,,	,,	5	5	12	220	232

Loss due to Soorai. It has not been possible to get definite data regarding the loss of yield due to soorai disease. The loss seems to be more in seasons of drought. Again, as in the Tanjore delta, the short duration crop (*Kuruvai*) does not seem to be much affected by the mealy bug. It is the long duration crop (*Samba*) which suffers most.



THE PADDY MEALY BUG (adult female) (Ripersia oryzae, Gr.)

1. Antenna. 2. Mouth parts. 3, 4, 5, Legs. 6. Pygidium.

The yields of a few affected plants were recorded separately and the following table gives an idea of the loss due to this disease in Aduthurai farm.

Yields of affected & healthy plants.

Crop	Variety of paddy	Yield of grains from diseased plants-per 100 plants	Yield of grains from healthy plants calculated per 100 plants	Loss for 100 plants	Number of plants from which yield has been taken.
		(in grams)	(in grams)	(in grams)	
Samba	A. E. B. 65	140	727	587	50
	Adt. 5	190	678	488	50
	G E. B. 24	173	606	433	40
Kuruvai	Adt. 3	241	607	366	100
	Adt. 4	193	469	326	30

It may be stated in this connection that plants from which mealy bugs were mechanically removed, when transplanted, gave fairly good yields.

Host Plants. As a result of the studies at the Agricultural Research Station, Aduthurai, it is definitely known that the following varieties of grasses serve as breeding grounds for the pest— *Andropogon annulatus; Apluda varia; Chloris barbata; Cymbopogon caesius; Cynodon dactylon; Digitiria sanguinalis var. aliaris; Eleusine aegyptiaca; Eragrostis interrupta; Eriochloa polystachyia; Isachne australis; Ischaemum ciliare; Iseilema laxum; Leptochloa chinensis; L. polystachyia; Panicum colonium; P. javanicum; P. prostratum; P. refens; Paspalum scroibiculatum; Saccharum spontaneum* and *Setaria glauca.* In addition to these, the following Cyperaceae have also been noted as host plants *Cyperus rotundus; Fimbristylis argentea; F. miliacea; F. tenera;* and *Juncellus pygmaeus.* The existence of the numerous weeds mentioned above has been one of the factors standing in the way of effectively controlling the pest.

Method of Spread of the Pest. During the off-season when there is no paddy in the fields the pest breeds, as noted before, on a variety of grasses and spreads later on into the nurseries. It is these nurseries which act as the main source of infestation. Seedlings containing bugs are carried from the nurseries into the fields and the pest multiplies in large numbers and gradually spreads the disease. It is known definitely that the bugs can spread from one plant to another if they touch one another. Water and wind also may act as agents in the spread of the pest.

Natural Enemies. A few predaceous and parasitic insects are found attacking the mealy bugs but these are not found in sufficient numbers to check the pest. Two or three Chalcids, one or two lady birds and certain Agromyzid fly maggots have been found as natural enemies of the pest.

Control Methods. This is a pest which is very difficult to contro As stated above, the mealy bugs are found in a secure position betwee the stalks and leaf sheath. It is not possible, therefore, for any insec ticide to reach the pest. So, spraying is out of the question.

Attempts were made to see whether heaping of affected paddy seedlings in bundles (in conical heaps) and covering them with we gunny bags had any effect on the mortality of the pest. The heap were examined on the 5th day; the mealy bugs were, however, found healthy.

Manurial and varietal trials have also been tried but have not given any conclusive results.

It is proposed to study the natural enemies of the pest to see whether they could be utilised as a practical method of control.

The only method which can be suggested at present is to watch the nurseries for early symptoms of infestation and pull out the affected seedlings and burn them.

The Government Entomologist will be glad to receive any available information regarding the pest from the District staff and also others interested in the subject.

ESTIMATION OF NITROGEN BY OXIDATIVE DIGESTION.*

When an organic substance containing nitrogen—such as a protein—is continuously boiled with concentrated sulphuric acid, it undergoes digestion, yielding carbon dioxide and sulphur dioxide (together with considerable amounts of acid fume) as gaseous products and leaving a residue, which generally contains all the nitrogen as ammonium sulphate. On this reaction is based the well-known Kjeldahl method,[1] which was first introduced in 1883 and which, in one or the other of its several modifications is still most extensively adopted for the estimation of nitrogen. A conservative estimate would indeed show that in scientific research alone—apart from routine analyses in Government laboratories, factories or private practice—a few millions of determinations are being annually carried out by that method.

With increasing experience, it was realized that the acid digestion did not proceed either so smoothly or so quantitatively as was originally expected. It was also soon recognised that in the case of rather resistant materials like soil, yeast or cereal husk, the Kjeldahl method cannot be depended on for very accurate estimates. There was still no remedy and it was not until 1925 when Bal[2] drew attention to the highly discrepant results which he obtained with the black cotton soils of the Central Provinces that some fresh advance was made. Bal

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