

The Diseases of Cotton in the Madras Presidency

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PART I.

It is a matter of common experience that crops subjected to extensive and intensive culture are among those which are victims to the largest number of pests and diseases. The truth of this statement is in a large measure attributable to the great amount of attention bestowed by the scientist to the health of the plant by virtue of which all the pests and diseases which occur on the crop are recorded and studied. At the same time the fact cannot be denied that man's intervention in the natural development of plants and his unscrupulous exploitation of their resources renders them more susceptible to the inroads of insects, fungi, bacteria, etc.

The Entomologist who preceded me has given us a very interesting, though pathetic, account of the heavy losses caused by insect pests-indigenous and imported-to which the cotton crop is subject in our presidency. It is seldom that the plant pathologist lags behind the Entomologist in reciting a similar tale of woe, but in the case of cotton it is the peculiar good fortune of the pathologist to be so privileged. The number of cotton diseases occurring in India are not as numerous as the intensive study of the crop in the past would warrant, and those which are of economic importance to the cotton grower in South India are fewer still. As a result of this remarkable scarcity of important cotton diseases in our province, research on cotton diseases has not in the past loomed large in the

mycologist's annual programme of work. The only disease on which some intensive work has been done in Madras during recent years, is a seedling blight and boll-rot of the *Herbaceums* an account of which is given in part II of this paper.

Before I venture to enumerate and give an account of the diseases of cotton which are of some importance to us in South India, it would be worth while to analyse the causes that have led to the comparative freedom from diseases which the cotton crop in our presidency enjoys.

Firstly, it is an almost universal practice in this province to rotate cotton with a cereal like cholam or cumbu. This is a very commendable agricultural practice which satisfies the first principle of plant sanitation and hence has a very far reaching effect in the control of diseases. I do not for a moment attribute this practice of crop rotation to any acute development of the pathological sense among the agricultural classes, since its observance is merely the outcome of an economic necessity. The owner of a small holding in a cotton tract is obliged to raise at least one cereal crop which provides food for himself and fodder for his cattle, while his cotton functions as a remunerative money crop which provides him the wherewithal to purchase his other necessaries of life.

Secondly, the climatic conditions under which cotton is grown are ordinarily unsuitable for the promiscuous development of fungi and bacteria. Cotton is essentially a dry weather crop. Sowing is done during August-September in the northern districts and October-November in the southern districts so that the period of growth falls in a dry season characterised by low humidity relieved only by an occasional shower of rain.

Thirdly, the cotton plant, though a perennial in its wild state, is usually cultivated as an annual. The major crop is borne during the first six months and it is seldom remunerative to keep the crop going in order to produce a second and subsequent flushes. If the plants are pulled out immediately after the first crop is harvested, there is an interval between one crop and another during which the land either lies fallow or is sown to some other crop. In

either case, the parasites are necessarily starved out, for want of their favourite host-plant. It may, however, be mentioned in this connection, that there is a growing tendency in some cotton tracts, to prolong the duration of the crop with a view to produce a second flush. The interval between two crops of cotton is thus reduced to as low as a month or even less, with obvious evil results. The Cotton Pest Act primarily designed against two insect pests did go a long way to discourage this baneful practice being carried to the extreme. But the relaxation of the act in recent years is a retrograde step in as much as it unduly shortens the off-period between two cotton seasons with the result that pests and diseases are assisted in bridging the gulf between two seasons.

Fourthly, the practice of pulling out the crop by the roots, collecting the stalks and utilising them for fuel, fulfils the requirements of another important axiom of plant sanitation. Here again we have an instance where an economic necessity has turned out to be a virtue of far reaching consequence and perhaps with few parallels in any system of agriculture. The practice, now slowly gaining ground in some places, of composting the pulled out cotton stalks, is one which deserves special encouragement. This process not only supplies a valuable bulky organic manure, which returns to the soil practically all the ingredients taken out of it, but also aids in clearing the field of the diseased material and possibly helps their destruction by the heat evolved in the chemical changes occurring in the pit.

Fifthly, we have under cultivation several species and varieties of cotton which exhibit among themselves a wide range of variation in their susceptibility to particular diseases. As for example, I may mention the total immunity of Cambodia (*G. hirsutum*) and Karunganny (*G. indicum*) to the seedling blight and boll disease caused by *Colletotrichum* sp. while Uppam (*G. herbaceum*) is extremely susceptible to the disease.

Lastly, the discontinuous geographical distribution of the cotton tracts of the presidency, the suitability of different varieties for different areas and the differences in soils and seasons are bound to remain effective barriers in the natural spread of the diseases from one tract to another.

From a review of the several reasons adduced above, it is apparent that, barring a few notable lapses, there obtains in our system of cotton culture several agricultural practices which are highly commendable from the Plant Pathologist's point of view. As I already stated, many of these practices are the products of certain economic factors inextricably associated with the rural life of our ryot population. Whether they can be classed as the result of accident or of a well-planned design handed down from generation, the cumulative effect of the several beneficial practices is a comparative freedom of the cotton crop from epidemics which other tropical crops of similar importance seldom enjoy. Conversely, we are reminded that the adoption of rational agricultural practices constitutes a sounder insurance against diseases than the maintenance of disease gangs and spraying outfits and of the truth of the old maxim "Prevention is better than cure."

PART II.

In the second part of this paper, I shall attempt to give a short account of the chief diseases of the cotton crop in this presidency.

(1) *Wilt*. By far the most important cotton disease in India is "Wilt". There are two wilts of cotton known in India. The wilt familiar to the north and central Indian cultivator is practically unknown in Madras. This disease which is associated with a *Fusarium* and is allied to the American wilt, has been the subject of some acute controversy among two schools of mycological workers in the north. Whatever be the real cause of this disease, it causes a considerable amount of loss in central and western India, but we in the south are fortunately free from its depredations, and our only concern is to hold a vigilant look out for preventing its importation into our province. The other wilt which is of common occurrence in our cotton fields is caused by *Rhizoctonia bataticola*, a fungus which has a cosmopolitan host range, included in which are groundnuts, castor, cow pea, black gram, jute, etc. The disease is of common occurrence in the Cambodia crop, but stray cases have been noticed on Uppam and Karunganni also. Cotton is susceptible to this wilt first in the seedling stage when it

is capable of killing the seedlings outright. It assumes serious proportions only under unfavourable conditions, e. g., water logging caused by poor drainage. Plants which survive this stage remain practically free during the active growth of the plant until the major portion of the crop is harvested, when the weakening caused by heavy cropping renders them again susceptible to the disease. Unlike the north Indian wilt, the loss from this disease has never been known to reach alarming proportions. Good cultivation, rotation of crops and attention paid to the proper drainage of the fields are known to keep this disease under control.

(2) *Angular leaf-spot 'Black arm' and 'Stem flattening'*. Another disease which is sometimes a serious menace to cotton cultivation in some parts of the presidency is the 'Black arm' and 'Stem flattening'. It is caused by a bacterium (*Pseudomonas malvacearum*) which produces lesions on the leaves, branches and the main stem. On the leaves it produces angular leaf spots but the loss from this form of the disease is negligible. On the primaries and secondaries the organism causes a condition known as 'Black arm' which causes the breaking of the branches and the consequent loss of crop. An organism indistinguishable from the 'Black arm' bacterium causes a peculiar disease in South India, known as stem-flattening. It occurs on the main stem ordinarily below the point of primary branching. The disease begins to appear about 3 months after sowing. The first visible symptom is a black band round the stem. The bark usually remains intact, but occasionally splits lengthwise in the discoloured area. The next stage is the gradual flattening of the stem. The leaves now turn pale or red in some cases. The plant sheds its leaves and begins to show signs of wilting.

Nothing more than a cursory study of this disease has been possible in South India. The disease begins sporadically during abnormally heavy rains and during such periods the damage is considerable. Being of bacterial origin this is one of the important diseases awaiting investigation by a pathological Bacteriologist.

(3) *'Seedling blight' and 'Boll-rot'*. A disease which has come into prominence in some parts of the Coimbatore

district is the 'Seedling blight' and 'Boll-rot' caused by a species of *Colletotrichum*. Though this disease resembles the well-known 'Anthracnose' caused by *Glomerella* (*Colletotrichum*) *Gossippi*, it differs from the latter in several important details. The disease appears during two stages of the crop. First it occurs in the seedling stage when it attacks the cotyledons and the hypocotyle, in the latter case causing damping off. Seedlings which survive the attack exhibit a condition known as 'Sore-shin' which is but a healed up canker of the phloem of the tender stem. It is essentially a wet weather disease and when normal sunny weather returns, those plants which survive the attack completely throw off the disease. The next stage in which the crop becomes susceptible to attack is the fruiting stage when bolls in all stages of development may be attacked. On the bolls, the disease appears on the exposed surface starting either at the apex or the base. The first sign of infection is the formation of a small pinkish brown irregularly circular spot. As the infection progresses, the discoloured area extends, becoming dark grey in colour with the formation of several concentric rings of black pustules. When young bolls are attacked, they cease to grow, get hardened and fail to burst. The lint inside gets lumped up and is stained yellow. When partially mature bolls are attacked, they burst normally, but the lint is rendered brittle and does not protrude from the locks. Black pustules which are the acervuli of the fungus develop on the kapas and within the lint also. Seeds formed within infected bolls are generally poorly developed and show poor germination. Recent researches into the life history of this fungus have shown that the fungus is capable of hibernating within the seed coats of apparently healthy seeds.

Climatic factors. As in the case of the seedling blight caused by the same fungus, the progress of the disease is governed by high ranges of humidity and synchronises with humid damp weather. The disease appears in epidemic form during prolonged rainy weather the damage depending on the extent of the period during which wet weather prevails. With the return of normal sunny weather, the fungus stops development and fresh attacks cease to occur.

Control. The disease is strictly confined to the Herbaceous cotton, and at present it is known to occur only in parts of Coimbatore district. As the disease is carried through seed, the selection of seed forms an important preventive measure. If the disease appears during the seedling stage and weather conditions are favourable to its spread, one or two sprays of Bordeaux mixture will keep it in check. The same operation may be carried out with satisfactory results in the fruiting stage also.

Minor diseases—(1) Macrosporium sp. Among the minor diseases which have not merited serious attention so far, the chief is a leaf spot caused by *Macrosporium*. The fungus appears on the cotyledons of seedlings and should favourable weather conditions exist, it spreads to the foliage leaves causing their shedding. The disease has been observed on Cambodia, Uppam and Karunganny. Spraying with Bordeaux mixture has been tried against this disease with success.

(2) *Ramularia areola*. Another disease which is occasionally come across is *Ramularia* leaf spot. The disease was till recently observed only in the northern area, but it was recently reported on Cambodia in the Central Farm. It occurs chiefly on the old leaves as the plant reaches maturity and as yet, has never been found to produce any appreciable damage, to necessitate any treatment.

(3) *Rust (Kuehneola desmium)*. This is another fungus recorded on cotton in South India also, but beyond its merely academical interest, it has never been recognised as a disease of the cotton crop in this country. It occurs on the leaves and green stem and has a partiality for the un-acclimatised exotics and the perennial tree cottons while the annuals are practically free from it.

Before I conclude this paper I wish to take this opportunity to make an appeal to all the agricultural officers who are working in the cotton tracts to make it a special point to collect and send as much information as possible regarding any cotton diseases occurring within their jurisdiction and to assure them that all information so furnished to the Mycologist will be of immense value in supplementing our present knowledge of cotton diseases and in keeping a vigilant look out on the progress of those diseases in this presidency.