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THE LEAF-CURL DISEASE OF CHILLIES CAUSED BY THRIPS IN THE GUNTUR AND MADURA TRACTS *

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Introduction Chillies (*Capsicum annum*) is one of the important crops grown widely for use both as a green vegetable and as a dry stored product for condiment, pickles, etc.; it is one of the chief commercial crops in the Guntur district in the Northern Circars and in the Periyakulam area in the Madura district.

In recent years, this crop has been noted to be subject to a serious disease known as the 'leaf-curl' disease. Though there may be other factors causing this leaf curl, one important causative agent noted is a tiny insect called chillies thrips (*Scirtothrips dorsalis*, Hood), about 1/25" in length and having a straw yellow colour. This minute active insect attacks the plant in all its stages, sucks up the sap from the tender portions and causes the leaf to shrivel up. The adult has wings and flies away when disturbed. Specimens of this creature can be easily collected in all stages of growth from plants in any infected field. The description of this insect and some notes on its bionomics are given by Hood (1919) and the senior author (1928.)

The main purpose of this paper is to point out that in addition to proper cultural practices which, of course, influence successful

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chillies production, the control of the most important insect pest of this crop is an equally important and determining factor in this direction. A summary of the investigations carried on on this insect pest to supply fundamental items of information on this subject to the chillies cultivator in South India, is therefore given.

The Insect, its life history and habits. The insect was first noted by the senior author on castor shoots and chillies in Coimbatore in 1916 and was described as a new species by Hood under the name *Scirtothrips dorsalis*. It is generally found in the tender shoots, buds and flowers of chillies plants, the older leaves being rarely frequented. The tender buds and leaf-folds afford not only juicy food for the creature but also shelter during the different stages, which are passed on the plant itself. The eggs are white and very minute and laid on or just under the leaf tissue. The young ones hatch out in four or five days and crawl on to the tender shoots to feed. The just hatched larvae are pale white in color and more or less resemble the adults, only differing in being wingless and smaller. Four or five days later a second moult takes place. The nymphs at this stage wander about in search of suitable places for pupation and after the second moult enter into a semiquiescent stage known as the prepupa which occupies from 12 to 24 hours. They then enter the pupal stage. Pupation is found to take place largely in the leaf axils, leaf curls, under the calyx of flowers and fruits and in other tender parts of the plant where they could find suitable receptacles. The pupation period lasts from 3 to 5 days after which they become adults with fully developed wings. The whole life cycle is passed within 10 to 15 days. Under humid conditions, the egg and the pupal stages are extended by about two days. A single female was found to lay 2—4 eggs per day for a period of about thirty two days, thus showing that one female is normally capable of laying a hundred or more eggs.

Nature and Extent of Damage. Thrips have a lacerating and sucking type of mouth parts and the wounds made on the tender tissues affect the normal development of the plant, resulting in malformed eaves, buds and fruits. In bad cases of damage, the shoot hardly develops and the leaves drop down. This invariably happens in the Guntur area where the rains cease in December and dry weather sets in and the soil moisture is insufficient to cope with the evaporation from the damaged leaf surfaces. The damage is thus due to the retardation and in severe cases, to the complete cessation of the physiological functions of the chief assimilating organs (leaves) of the plant.

Studies on the Pest and its Control. This pest was first reported to be serious in the Guntur area in 1926 and observations on the occurrence and extent of damage caused by the same were first stated in 1927. In the Madura district, the disease was in evidence as

a serious pest in a few villages in the Periyakulam taluk three years ago and as a result of representations to the Agricultural Department made by the local cultivators, investigation of this malady was started. As these two areas represent diverse conditions of soil, weather, agricultural practices and varieties of chillies grown, the investigations carried on are given in two separate parts referring mainly to the peculiarities of each area which have a bearing on the pest and its control.

THE GUNTUR AREA

In this tract chillies form one of the major crops occupying an extensive large area of about 71,000 acres. This is grown under dry conditions in rotation with cereals as *jonna* (*Andropogon sorghum*) or *variga* (*Pennisetum typhoideum*) preceding it and tobacco (*Nicotiana tabacum*) or groundnut (*Arachis hypogaea*) following it.

Pest incidence: The leaf curl which disease is known as 'Mudatha' (leafcurl) or 'Korivi' (burnt faggot) is prevalent in the whole area, every field being attacked without exception. The pest appears in two distinct periods, with an interval of two months; in the nurseries in August-September when it is not serious, and in the planted field from the third week of November till the end of March when the crop is removed (harvested). The loss due to the attack of this pest is appreciably high. In bad seasons whole-sale destruction of the crop results whereas in other seasons loss of 25-50 per cent of the total yield is quite common. In the nurseries, the pest appears in a mild form, early in August, when the young shoots appear slightly curled. In the second half of August and early in September, when dry weather prevails, the pest increases in seriousness and may often assume serious proportions. The method of hand-watering the seedling beds by pouring water over the seedlings, checks the multiplication of the thrips to a great extent in the nurseries. Their numbers are further reduced when the seedlings are topped, a practice prevalent in these parts before transplanting. The monsoon which follows keeps them under check in the field till the middle of November. It is about this time when the monsoon would have spent itself, the leaf curls begin to appear on stray plants in the field. They spread out to other plants as well and, by the end of December, there may not be a free plant left in the field. After this period, the development of the pest proceeds at an accelerated pace. In adverse cases, the leaves are shed, fresh formed buds become brittle and drop down and the plants present a stag-head appearance. This stage is called 'Korivi' stage whereas, during the earlier stages, it is commonly defined as 'Mudatha'.

Factors influencing pest appearance in the tract. Weather: Heavy rains check the pest multiplication whereas dry weather promotes it. October and November are crucial months for this crop and during this period it reacts to a great extent both to an excess of

moisture and lack of it. In years of sufficient rainfall the plants are able to withstand the pest and when the rainfall is insufficient they easily succumb to it. A well distributed rainfall in November assures a good yield and checks this pest. Very often it happens to be abnormal, heavy downpours are received and the plants die of water logging in the field. When the rains are late, heavy shedding of flowers is notified.

Soil: As regards other factors like soil, drainage, manure and rotation, the variations observed cannot be said to be of a conclusive nature. In red soil areas, where the effect of heavy rains was minimum and in slightly alkaline fields, the plants were noted to resist the attack of thrips to a greater extent as judged by their bushy and vigorous growth. The same was observed in the case of plants situated at a higher level in a few fields.

Manures and rotation: Periodical observations made in plots with different manurial treatments on the Agricultural Research Station, Guntur, did not show any differences in the extent of attack. As for rotation, the system adopted is somewhat indefinite, but a chillies crop after a cereal was always found to be better than any other crop. Chillies grown in rotation with ground nut was always found to be a poor crop.

Varieties: No difference was noted in the extent of damage by these insects in the different varieties of chillies grown in this tract.

Groundnut cultivation: Enquiries from several places have shown that the pest is of recent origin and dates back to the period of introduction of groundnuts. This might be a probable explanation to the recent appearance and spread of the pest. The thrips found on chillies is found in considerable numbers on groundnut leaves also. In addition to chillies and groundnuts, castor, pomegranate, beans, mango, cotton, *Cassia* sp. and various weeds in this tract provide alternate food for this insect. A continuous supply of host plants is thus available throughout the year enabling the pest to appear season after season.

Control measures and economic aspect. From the year 1926 onwards this pest has been in evidence in the tract though the insect was noted by the senior author as early as 1916 in the course of his systematic studies. Experiments in the control measures which consisted of insecticidal methods were started in Guntur in 1928 and have been going on for over five years. The details of the early trials and failures and of the gradually encouraging results during these years are omitted here. Several substances and combinations were tried and after these different experiments it was found that dusting with fine tobacco powder was found to give the best result so far obtained. Many of the other insecticides tried had to be given up, some because

of their prohibitive cost and some because they were not effective. Uniformly successful results have been obtained by the application of tobacco dust. This method has given an increased yield of 34%, 13% and 50% to 60% in the seasons 1931--32, 1932--33 and 1933--34 respectively. Even during the year 1934--35 when the crop was a thorough failure, the increase from dusted over control plots was 18% to 26%.

The cost of tobacco dust and the charges for its application are comparatively very low. Tobacco is largely grown in this area and waste tobacco is available in plenty. From a candy (500 lbs.) of waste tobacco costing not more than Rs. 5, 350 lbs. of fine tobacco powder can be obtained and this quantity is found sufficient for an acre. It has been found that three applications of the dust gave equally good yields. The dusting can be commenced at the end of November or early in December and a second dusting may have to be applied a fortnight later. The third application can be deferred to a period of 15 to 20 days depending on the seasonal conditions. In years of severe attack and heavy rains resulting in high shedding of early formed flowers, a fourth dusting in third week of January may be necessary. Each application requires 100 to 150 lbs. of dust per acre depending on the growth of the plant and an acre can be covered in 2 days of 8 hours each. The results have so far shown that the treatment is quite cheap and an appreciable extra yield could be obtained. The seasonal conditions of this tract also favour this operation as plenty of dew is deposited in the cool mornings in November, December and January and dusting can be done early in the mornings.

THE PERIYAKULAM AREA

The chillies tract in the Periyakulam area is situated in the midst of numerous hill ranges with the Cumbum valley enclosed in the middle. The average annual rainfall in this area comes to about 30", the greater part of the rain being recorded during the season—September to January. In this region, about 5,000 acres of this crop are grown under irrigation, chiefly covering the areas about Andipatti and Uthamapalayam. The crop is planted in two seasons in this tract; the early or *Kodai* crop planted about the end of April and the late or *Kalam* crop planted about the middle of July. But, of late, to ward off the leaf-curl disease caused by thrips the ryots are trying all seasons and the seedlings are planted from the end of April to July in quick succession in one place or another. This indiscriminate practice gives the pest good facilities for breeding throughout the season. The crops generally grown in rotation with chillies are *cholam* and *ragi*. Tobacco is included in the rotation if the irrigation water is brackish. Some ryots round about Andipatti grow chillies after chillies with heavy manuring and good cultivation.

Pest incidence and factors influencing it: The pest is often serious and during certain very bad seasons 50 % or more of the normal out-turn is lost and there have been cases where the crop has proved a complete failure.

Rotations: Chillies crop coming just after cholam does not grow healthy and vigorous and hence easily succumbs to thrips attack. A mixed crop of onions and chillies is predisposed to thrips attack and as such both suffer badly.

Weather: Chillies come up best during warm rainy weather. Gentle, light, frequent showers just after planting and heavier rains later induce healthy and vigorous growth. The pest thrives best and multiplies rapidly in dry warm or slightly humid weather. The summer plantings are over by the end of May and during June and July which are dry months the tender plants are more susceptible to thrips attack and demand attention. The ryots of some villages having realised the injurious effect of this season do not often raise a *Kodai* crop. The mal-influence of adverse seasons may be slightly modified by profuse, frequent irrigation and better cultivation and thus the plants kept healthy and vigorous.

Control methods and economics: In this particular tract the trials of past two years lend favour to the following suggestions regarding thrips control:—Cultural: During normal seasons the plants may be protected and kept free from leaf-curl disease by giving better preparatory cultivation, heavy manuring, frequent irrigation, clean cultivation and above all, getting healthy seedlings for planting. These latter can be protected against thrips attack by immersing them in tobacco decoction before planting. The preventive measures noted above go a great way to minimise pest incidence during the rest of the season. During adverse seasons and conditions, however, the plants may be given a few timely applications with tobacco to keep them vigorous and deter thrips from gaining the upper hand. Tobacco may be applied in the form of a dry dust or as a spray liquid. Dusting is, though easier and cheaper, not possible when there are strong winds and moisture is absent on the foliage. Dusting the seedlings in the nursery is economical and efficient but in the field it is found better to spray under the above conditions. The plants are sprayed first about a month after planting and repeated every fortnight depending upon the rainfall. The total number of sprayings required for the crop right through from the time of planting to harvest depend upon—the season and time of planting, the duration of the crop and its vigor which often depends upon the manure it has received and the treatments given. In general, the early planted crop requires more sprayings than the late planted ones as the former has not the advantage of the monsoon showers during its early growing period. A vigorous growing, well manured crop may be protected with a minimum of three sprayings as was done at one of our trial plots (Ranganathapuram).

Economic aspect: Taking on an average that four sprayings are required to keep the crop free from thrips the cost of spraying does not go beyond Rs. 10 per acre, including tobacco, labour, soap, etc., etc. The cultivator generally spends from Rs. 80 to Rs. 120 in raising a crop of chillies and Rs. 100 may be taken as the average cost of cultivation. The cost of treatment to give protection to the plants from thrips attack comes to only Rs. 10 per acre and it is found that this cost is only one tenth the cost of cultivation. A treated plot has given an increased profit of Rs. 189-13-4 per acre over that of an average plot for the tract.

General considerations. Having given some idea of the conditions and trials in the two tracts we may make some general observations on this subject. Though the investigations carried on in the two areas on the same insect reveal certain variations in the different features which influence the incidence of the pest, especially because in the one tract the crop is cultivated under purely dry conditions as contrasted with an irrigated crop in the other, the habits of the pest are found more or less similar in both and the control measures tried and found successful are almost similar in both. The experiments carried on in this connection for the past few years have shown that, out of all insecticides tried, tobacco in different preparations has proved the best stuff for controlling thrips on chillies. It has also been found that waste tobacco for this purpose is easily available in large quantities and at cheap rates in both the tracts and as such, there is absolutely no difficulty in procuring the insecticidal material whenever needed. It may also be noted that the application of tobacco dust has an advantage over the other forms of nicotine treatment due to the slow liberation of nicotine fumes in lethal quantities over an extended period of time. This protects the plants from daily reinfestation. It is also known that it has a fertilising and stimulating effect on plant growth. It is also an effective material against other insects like plant lice, mealy bugs and scales which might infest the plant now and then.

The application of tobacco preparations, as has been referred to before, may be made in two ways, according to local conditions, viz., either as a dry fine powder or as fine liquid spray. The latter method of spraying with tobacco decoction will have to be resorted to in localities where strong winds prevail and dusting becomes impracticable and ineffective. For this purpose, chillies growers cultivating fairly large areas will be well advised in owning a spraying machine which will be useful not only for use against chillies pests but for many pests on various garden crops. It will also be found very advantageous if several cultivators of a village maintain a large sized spraying machine on a co-operative basis and give it on hire to various applicants. In judging the effect of applying tobacco for the leaf curl disease due to thrips a number of things has to be remembered. The

severity of the disease depends a good deal upon the general treatment the crop is given, such as the cultural attention, the quantity and the time of application of manure, the season in which it is grown, the previous crop and the interval between these, other diseases such as the vermicularia of chillies and finally, the co-operation and the willingness of the ryots to carry out the suggestions in time and effectively.

Before concluding, it may be added that under some very favourable and optimum conditions of soil, weather, moisture, etc., it might be possible to find in the same village a few plots which might fare as well or even better than the sprayed plots. This means that these plots due to favourable seasonal conditions and proper cultural attention have withstood the pest; while others, due partly to nature's freak and often to the cultivator's indifference suffer from the pest and have, therefore, to pay the medical bill, viz., the cost of spraying. As the ideal conditions cannot be expected always and in every area, it is believed that cultivators will be well advised to protect their growing chillies crop not only by proper cultural methods but also by precautionary and curative measures against thrips attack which may occur any time. The trials for the past two years have more than confirmed this view and our suggestions for control measures have satisfied the numerous chillies growers who are enthusiastically taking our suggestions.

Though the solution of the chillies thrips problem has been successful so far, further field scale trials will go a great way not only to confirm or modify these conclusions but might add a good deal to the experiences so far gained. It is therefore hoped that further trials may be carried out in this direction by district officers whenever opportunities offer themselves.

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