

Agricultural Entomology

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As a result of intensive work during the past half-a-century, we have a large number of published records regarding the insect fauna, pest occurrences and their life-history studies, etc., in relation to all important crops grown in our State. The two publications of Ayyar T. V. R., "Annotated list of insects affecting the important cultivated crops of South India (1932) and "Handbook of Economic Entomology for South India" (1940) give considerable information on entomological problems of South India. These are of inestimable value to guide future work. More recent achievements are in the field of insecticidal method of control. These and related progress, are to some extent brought out in the Departmental Memoirs of 1950. Appreciable work had also been done in the biological method of insect control and the pioneer work on the control of the cottony cushion scale in the Nilgiris and the Black-headed caterpillar of coconut carried out by Y. R. Rao and others (1944 and 1950) stands to the credit of the Madras State. "Bee-Keeping in South India" is another departmental publication, which is serving a very useful purpose by embodying valuable information on apiculture, relating to bees.

Insecticidal methods of control gained prominence after World War II. This feature accounts for giving a new and permanent place for Entomology in Extension Service.

Emphasis on insecticidal methods of control, have, however, brought in new problems. We have a strong and powerful weapon in our hands, and our immediate problem is to study (i) to what extent we can use, (ii) how best it can be applied, (iii) to what extent it is really useful, (iv) to know where and why it fails and (v) what exactly the other methods are that have to be brought in.

(1) To what extent we can use insecticides: Pesticides in use are mounting in quantity, thanks to convincing results and the increasingly effective propaganda exercised by the extension staff. A change in the mind of the cultivator is evident. He no longer keeps quiet when any pest is threatening destruction of his crops. One of the most important aspects of this change has been the recognition that crops can be made more productive by control of pests at proper times by proper methods, but if neglected due to ignorance or indifference, will result in considerable loss. In many places, primitive methods of farming still prevail. Lands should be made more productive by adopting modern scientific methods. Small holdings should get maximum income. One of

the methods is to reduce loss of yields from pests. There is much scope for increased use of pesticides.

In this connection, many insecticides have been departmentally tested as to their efficacy, the dosages at which they can be applied, the insects against which they are successful, the plants or crops which can be treated safely and the method of application without hazard to the operators. The synthetic chemicals and systemic insecticides are useful against a variety of pests and are safe to apply on almost all plants, with few exceptions. Sulphur has specific action against mites. DDT works well for controlling jassids, caterpillars, and beetles. BHC is useful to control a variety of pests and shows quicker action, but imparts a taint or off-flavour in the case of root crops, when applied to soil. Both DDT and BHC may injure foliage, especially of cucurbitaceous plants. The research on this line has to continue not only to study the beneficial and adverse effects independent of insecticidal action, but also to find out ways and means of assessing residues on treated material. There are limitations imposed by operational difficulties and risks that arise on the use of highly poisonous chemicals such as organophosphates, which injure man by contact, inhalation and by ingestion. The use of these requires careful planning, technical skill and experience and careful supervision. The use of these insecticides is therefore to be taken up with due caution and popularised only by slow degrees however effective they are. Problems of residues, of handling of substances deadly to man, and problems of deciding the economic use of the insecticides, are fields where more work and more information are urgently necessary.

(2) **How best insecticides can be applied:** During a severe outbreak, where the crop in extensive areas is brimming with insects of the same species, really spectacular effect is seen, by the action of insecticides applied on a large scale. But invariably it so happens that the insects have already caused havoc to the crop, even when we take immediate measures to treat the crops. In killing insects, we have incurred some expenditure too. One often feels that the presence of insects should have been noted earlier, to avert damage and minimise loss. Thus timely application is one of the most important aspects of the problem. Secondly, often we meet with more than one insect, in one and the same crop either at the same time or at different growth-phases of the crop. In many of our crops, the margin of profit is so low that it does not admit of expenditure for repeated treatments. Investigations now in progress towards determining critical stages, when the minimum number of treatments will assure maximum efficiency, are highly important. A further step would be to choose insecticides of multipurpose value and apply the same as prophylactic treatments. Hopeful indications in this line are not wanting. The pesticides Folidol and Endrin are new-comers satisfying these requirements. Though both are highly

poisonous, they have the merit of destroying a variety of insects at one stroke, and at the same time stimulating the plants to better growth and higher yields. The recovery of the affected plant is a new feature. Some borer pests, hitherto a serious problem, for example, the paddy stem borer and cotton boll worm, seem to yield to treatment with these insecticides. The problem on the choice of insecticide and preparation of a spray schedule for each important crop, would be the next line of approach in insecticidal method of control. Insecticidal method of pest control has come to stay and for years to come a major part of our researches is bound to be directed towards perfecting this. Newer and better chemical formulations are being discovered from time to time and even against external feeders, for which we have already evolved suitable remedies, better and more effective remedies are to be found. To speed up pest control work within a limited time over large areas, the possibilities of dusting or spraying by aeroplanes through State agency or by private firms and organisations at nominal cost to ryots, have also to be explored. The first of its kind has been reported in connection with control of *Pyrilla* of sugarcane in Bhopal.

(3) To what extent insecticidal method is really useful : We are going ahead with insecticides. The cultivator begins to think of nothing else than insecticides in tackling his insect problems. The intrinsic merit of this method is quick action and destruction of insects before our very eyes. But on the whole, the effect is temporary. On principle any insecticide which will leave a poisonous material as residue, however useful it may be for destroying insects, is not admissible, especially on food crops. This is a matter for serious consideration. On one side, we would like to have insecticidal action after one treatment to persist for long, with a view to check every new wave of insect attack, and at the same time we want no poisonous residue to remain for long on the treated crop to avoid danger to human beings and livestock. The real fact is that control by pesticides is only of temporary effect. It requires repetition, to save a crop completely from seedling to harvest. The operation does not eliminate causes for recurrence of the pest or pests in one and the same crop, during the same season. Hence at every season of crop growing, the same pests may appear regularly, in spite of tons of chemicals used in one season. In the light of these considerations, the insecticidal method of control has to be considered only as a measure of immediate practical value and for lasting and collective benefit reliance has to be placed on methods other than insecticidal.

(4) To know where and why insecticidal method fails : Insecticides act on pests by contact, inhalation or by ingestion. Some insecticides such as BHC, Folidol, etc. may combine one or more or all these qualities when once the insecticide reaches the insect. Insects living in concealed situations in roots, stems, buds, fruits, etc., for example the cotton stem weevil, borers affecting paddy, cholam, mango, orange, coffee, etc.,

caterpillars boring into buds, flowers of jasmine, brinjal or borers like mango stone weevil, fruit borer in brinjal, fruit flies in gourds, melons, plums, mangoes, etc., are all affected only slightly by application of insecticides outside. Similarly, mealy bugs and hairy caterpillars have protective coverings. These require special investigation for evolving satisfactory methods of control. In the case of all borers the adults lay eggs from outside. In the case of mealy bugs, the protective covering is least during a short period of the early young stage. In the case of hairy caterpillars, like *Amsacta*, newly-hatched young ones have less of hairs. The insecticides applied, should therefore be timed to the occurrence of these critical stages, failing which the efforts will be fruitless.

(5) What exactly are other methods to be brought in: (a) The problem of pest and pest control has to be viewed in a more comprehensive manner as a State problem. While insecticidal method of control has established and will continue to have a permanent and important role in the solution of all future pest control problems, other practicable methods also have to be explored. Investigations of a long-range and more costly nature likely to result in permanent good have to be undertaken. Control by biological methods, is one of this kind. It is practised widely in many countries. It is not new to India. Our State has done some pioneer work in the line. Use of the imported beetle *Rodolia cardinalis*, its multiplication and liberation and its subsequent establishment in the Nilgiris and effective control of the fluted scale, is a notable example. The control of the black-headed caterpillar of coconut by parasites is another notable achievement in this line. Indications of promise have already been obtained in the use of the egg parasite *Trichogramma* to control sugarcane borers and cotton bollworm. *Cryptolaemus montrouzieri* is noted as an effective natural enemy of Brinjal mealy-bug. There is unlimited scope for work in this direction, in view of the large array of parasites and predators recorded in our region. While insecticidal methods are no doubt effective and unavoidable to meet individual cases of pest outbreaks, it is no solution for the problem as a whole. Pests occur again and again and any natural force built up to check undue multiplication of particular pests would go a long way, especially with reference to those that are chronic pests in the State. The benefit is not merely to individual cultivators but to the region as a whole. The work, if established once, results in inestimable good for years. It is not within the scope of individual cultivators to undertake such a job. It is purely a State aid. Expansion of work in the direction of application of biological methods in pest control is necessary, whenever possible. Secondly, in any systematised pest control campaign, a knowledge of the relationship between weather factors and incidence of pests is a definite advantage. Our attempts at forecasts of pest outbreaks, can be made more precise. Insecticidal measures can be taken up at the very start of infestation. Prophylactic treatment can be reduced to the periods of likely occurrence of pests. Biological control, can be intensified at times favourable for the parasites to multiply in nature. This again is a long - range study.

Lastly, the answer to "What next" will not be complete without mentioning one or two points relating to fundamental systematic studies, Education and Extension. Systematic Entomology forms the basis of all economic work on insects and for all-round progress in entomological research in the State, it is very necessary that we develop this aspect and evolve specialists in this line of work also. In the field of Education, the subject of Agricultural Entomology is even now considered as a minor subject and what was squeezed into a two-year period, remains the same. It is high time that this subject is given its right place, in view of the increasing importance that is now given for Plant Protection work. The student taking the degree, should be equipped with fuller information. Changing the syllabus alone without adding more hours is ineffective. The subject should have the work distributed to the full three-year period of the course. In the field of Extension, for some years to come, there should be more practical demonstrations under direct departmental supervision, especially when dealing with highly poisonous substances as insecticides. It may even be necessary that in special cases, results of research done in State lands should be put to further observation in cultivator's fields to carry conviction. There is unlimited scope for expansion of plant protection work in the State.

Conclusion: We are aware of the pests that infest various crops. For control of pests the use of pesticides is the rule of the day. It is gaining momentum. Science is tending towards the use of very poisonous substances for pest control. We should proceed with caution. In the meantime, information should be built up as to how to use the various insecticides with safety to the crop, safety to man and livestock and at the same time destroying pests. Insecticidal method of control does not confer long-range benefits, and it is likely to prove uneconomical with falling prices of produce and the low margin of profit. It should be the State's endeavour to adopt the more peaceful method of biological control of aiming at common and lasting good to all, without much cost to the cultivators. Wherever possible, Education and Extension should aim at maximum equipment and intelligent application of findings of research by convincing demonstrations in cultivator's fields in a more extensive scale.

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