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LONG-TERM ECOLOGICAL STUDIES WITH LIGHT-TRAPS THEIR PRACTICAL AND SCIENTIFIC VALUE

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The food producers in this world, the farmers, know better than most that we humans are not the only creatures around who need food and shelter. Numerous species of insects are active in natural and in man-made environments. Most of these are completely harmless to man, do not take their crops for food or act as vectors for diseases either for man himself or for his livestock. Most of these insects lead their lives in a way such that they have no negative influence at all on the economy. They are simply a delight for the eye such as so many of the beautiful moths and butterflies are highly beneficial to man in their activities as pollinators or as predators on insect pests.

Some insects, however, can cause serious damage. Mosquitos, sandflies, botflies and others bring diseases, caterpillars of some moths, some grasshoppers and others eat the food which is meant for human consumption and mites or aphids transmit plant diseases to our crops. Agricultural and medical entomologists are concerned with the control of such insect pests. All too often they are called in at the very last moment when the activities of the pest have reached alarming proportions and then, without other background information it may be difficult to avoid the intensive use of insecticides. This is not the place to recall all the dangers of such insecticides such as the killings of beneficial insects. These have been documented in many studies. But what alternatives are there ? What is needed obviously is a well planned strategy of control of the pests concerned which is both economic and effective, which causes the least possible damage to the environment and which does not make the products to be protected toxic to man. In order to plan such a strategy, detailed studies are needed of the life history of insects. However, this is usually not enough. It is extremely useful to have, as part of the control strategy, a monitoring program where any changes in abundance of the species concerned are kept under close scrutiny so that a warning can be given to the appropriate authorities and to the farmers as soon as the pest starts to reach numbers which could cause economic damage. Such a monitoring program requires a regular sampling of

the insects, followed by an immediate study of the samples taken, and a system to disseminate the information obtained in newspapers, in a regular newsletter or something along these lines.

The sampling methods obviously depend on the insects to be sampled, and this is not the place to review all the available techniques. However, in many instances one is concerned with the numbers of flying insects, the ones which are on their way to feeding sites and to place to lay their eggs. Sometimes some system of aerial netting is advised. For small insects like aphids or psyllids a suction trap is usually a preferred technique. In many cases, however, one takes advantage of the nocturnal habits of the flying insects and their propensity to be caught at lights, and sets up a light-trap of some description (for technical details see Southwood, 1966).

In the vast majority of cases the studies done have a very limited scope. One is concerned with one or two pest species in one locality. The light-trap catches do have information on many other insect species, but for practical and/or economic reasons that information is not taken advantage of. Those other insects may include species which are a pest on the crop of a neighbour, or on crops grown in the next town. There could be species which are of medical importance. Lack of funds and time often do not permit the extraction of all that extra information out of the insect samples obtained. Lack of taxonomic expertise is often quoted as an extra reason.

Such limited studies should not be put down. In fact they can be extremely important and although the scope of these studies are limited, they do give an important contribution to the study and the control of the insect species concerned. Examples of such studies abound in the pages of scientific journals on agricultural or medical entomology to prove this point. In some cases the study is extended to all the species in a family or even order of insects in order to take better advantage of the information collected. After all, with such an extended study fewer of the insects which died in the trap died in vain. Good examples of such extended studies also exist in India (Goel, 1976 a, b; 1977 & 1978). Examples of studies which concentrate on certain species in India are Goel (1980), Banerjee & Choudhuri (1980), Banerjee (1977 & 1980), Bandyopadhyay (1975), and Nath & Sen (1979) just to name a few. I myself am involved in such extended studies in the Neotropics in Panama (Wolda, 1978a, b; 1980 & 1981; Wolda & Fisk, 1981) with different groups of insects.

One important dimension is missing in all these studies. The samples are taken in one or, at best, a few localities. One, therefore, has to rely entirely on local events and is unaware of buildups of the species concerned

in neighbouring areas, which could cause massive invasions. If such invasions occur one is invariably caught by surprise because local events could not predict them. How, then, can one deal with those invasions ? An excellent solution is to set up a network of light-traps over a large area. There are some outstanding examples of such networks. In Hungary there is a network of 20 light-traps in operation since 1959 (Vojnits, 1975; Meszaros 1976; Meszaros *et. al.*, 1979). Ten of these traps are in parts of the country with cooler summers and the other 10 in areas with warmer summers. The practical value of the information obtained is invaluable and so is the scientific output of these studies. The best example of a network of light-traps is in Great Britain, which has expanded to some areas on the European continent in the Netherlands and Denmark. It is part of the Rothamsted Insect Survey which also includes an extensive network of suction traps (Taylor, 1968 & 1974). In some of his publications Taylor dramatically illustrates the importance of having a network of traps instead of just one (Taylor, 1978 & 1980; Taylor & Taylor, 1979). Maps of the British Islands show spectacular spatial dynamics of several species. They show that the spatial distribution of the species is not the same every year and that information on the abundance of a given species in one locality does not necessarily enable one to predict the abundances in surrounding areas. The idea of studying the spatial aspects of distributions of abundance of insect pests into account is, of course, not new. Its necessity has been realized for a long time e.g. in Canadian Forestry (Brown, 1970; Turnock, 1972) and Agriculture (Riegert, 1968). There is, of course, also a temporal variation in abundance in each locality so that the spatial maps change rapidly as temporal and spatial dynamics interact (Taylor, 1974). For an ecologist interested in population dynamics such data are exciting and extremely important. They increase in value if the network is run over a long period of time (Taylor & Woiwod, 1980).

If such a system of light-traps existed in some part of India, the predictions necessary for the timing of control measures could be made much more accurate than is possible now and large sums could be saved both in loss of crops and in economic losses because of control measures carried out at the wrong time. Would such a system be costly ? It certainly would cost some money to install the traps and to pay people to service the traps at regular intervals. However, it might be possible to run at least part of the system with the help of volunteers as is done in Great Britain. One could take advantage of already existing light-traps in some localities and coordinate the efforts with the people involved in order to get the insects collected and sorted in a standard manner. These people could be trained to sort the important insects from the samples obtained or, alter-

natively, could be asked to send the samples to a Central Sorting Center. Such a center could, for instance, be run by an Entomology Department of a University. One could consider sending out weekly or bi-weekly bulletins to farmers, agricultural centres etc. who are interested in the actual state of some important insect pest. It would be recommended to publish a summary of the results at the end of each year for a wider audience (Taylor & French, 1980. It seems probably that the costs involved of setting up such a monitoring program would soon be recovered.

Food production is one of the crucial problems facing the world and anything which improves quantity and/or quality of the food produced and anything which lowers the cost of doing so should deserve serious consideration.

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