THE TOBACCO STEM BORER*

COMPARISON BETWEEN STEM BORER AND LEAF MINER

THE tobacco stem borer, *Phthorimoea heliopa* Low., is a close ally of the tobacco leaf miner, *P. operculella* Zell., already familiar to most growers. The two moths are moulded to the same generic pattern, being alike in size and with the habit of folding their wings roofwise when at rest. In freshly emerged specimens the colour differences are distinct, heliopa having the wings suffused with a brick-brown colour which contrasts strongly with the white flecked grey typical of the better known species. When specimens of each are collected in the field, they are, however, much the same in appearance. The scales responsible for the colour have been partly shed, and with them many of the distinguishing features. Hence there is a widespread confusion between the two forms, a confusion which is accentuated by their association together in the field. Perhaps this may explain the non-recognition of the pest previously, though tobacco has been grown for many years in Australia. Both species have been reared from the stems of plants which have collapsed in the field, and such losses can best be assigned to one or the other pest by the generalisation that superficial sub-surface burrowing is due to *P. operculella*, while core injury proper is caused by *P. heliopa*.

NATURE OF STEM BORER INJURY

The injury may be considered in the two aspects which most concern the grower, the first dealing with the insect's activity in the seed-bed. Here the early indications of trouble may be seen in several of the seedlings showing tip malformation. The centre leaves do not unfurl in the usual way; they may be undersized, but more often are merely malformed as if the growth vigour of the plant was insufficient to effect its ordinary unfolding and spread. When infested seedlings are removed from the seedbed for examination their stalks will be found to be distended into galls, each of which harbours a single larva of the moth. These galls usually, but not necessarily, lie near the tip of the plant. The obvious interference with the ordinary development of the growing point leads to secondary suckering, the suckers being thrown from the leaf axils below the swelling in the stem. In the ordinary course of transplanting, such plants are usually discarded, but their rejection gives no guarantee that the remainder of the seedlings are free from infestation. A gall of visible dimensions is produced only when the larva within is more or less mature, hence seedlings taken from beds with only a sprinkling of galled plants may not only carry the eggs of the moth, but also young larvae within the tissues, too small as yet to induce obvious gall formation. Such plants seldom flourish in the field. Sooner or later the main growing point is destroyed and the control of supplementary sucker growth from the lower parts of the stem compels considerable pruning at the expense of much labour. Though a crop may ultimately be harvested from such plants, it rarely has the uniformity which is considered so desirable in the field.

Attacks are, however, not limited to the seedbed, for plants may be perfectly free from the pest when set out in the field and yet succumb later on. Should the field infestation take place at an early stage, the plants react in much the same way as has been described for the seedlings.

* By J. Harold Smith, M.Sc., Entomological Branch in *Queensland Agricultural Journal*, Vol. XXXVIII, Part 4, October 1932.

Should they be firmly established, the larvae may develop freely within the stem without affecting the tip of the plant or causing obvious sucker growth. The mechanical disability suffered by the plants in such cases may not in itself be considerable, but too often the attack opens the way for saprophytic fungi, which may rapidly invade the healthy tissues of the stem and sooner or later induce the general collapse of the plants. Pith infestation is most common in replants growing amongst an already heavily infested crop, and this suggests that resistance to new attack increases with the age of the plant. Attacks shortly after transplanting are consequently most to be feared, as they predispose the plants to general collapse, which follows the local injury caused by the larvae and the fungal activity which it initiates.

LIFE-HISTORY

The life history follows more or less that of the better known tobacco leaf miner. Oval eggs, white in colour, and ornamented with reticulate surface sculpturing, are laid singly on either stem or leaf surfaces. Larvae emerge from these in a week or so—observations are limited to the summer months —and shortly commence to burrow into the stem of the plant. Subsidiary mining of the leaves preparatory to stem boring has been recorded from other countries, and this phenomenon has also been seen here. The majority of the burrows are initiated near the axils of the leaves under the shelter of their extensions at the point of insertion to the main stalk. The nature of the burrow depends entirely on the maturity of the host, and may thus be a localised gall-like excavation, such as that described from young plants, or a wandering burrow which widens as the occupant grows. Several larvae may be found together in the one plant. The larval period is completed in about four weeks. When full grown the larva hollows out a cavity abutting on to the surface of the plant, an exit hole is made, and both it and the cavity are sparsely lined with silk. In this chamber pupation takes place, the adult emerging in some eight days.

In thus pupating within the stem, the tobacco stem borer differs from its close ally, the leaf miner, for the latter ordinarily leaves the host plant in the last larval stage and completes its development in the ground or, if on the plant, within the shelter for decaying leaf fragments.

Little precise information is available regarding the seasonal activity of the pest or the duration of its several stages. Apparently the female moth is capable of laying in the vicinity of one hundred eggs, these being laid irregularly over a period of three weeks. The whole life cycle occupies some six weeks, while the independent adult life is by no means brief for adults have been kept alive without food for a month. Hence it may be safely conjectured that several generations occur in the year, these overlapping one another.

CONTROL MEASURES

With pests of this kind, control measures of any one type are not altogether satisfactory. Sprays afford no apparent relief for the burrowing habit takes the larva beyond the reach of either stomach poisons or contact sprays very early in its life. Recourse must therefore be made to the influence of several farming practices on the pest.

Seedbed injury usually appears most significant to the grower's eye, for an epidemic phase of moth activity may ensure the wholesale destruction of his plants. As the moth is on the wing during the late afternoon, some growers have attempted to cope with them by fastening down the hessian storm covers daily about 3 p.m. The method may help, but in itself is insufficient to exclude the moth from the beds altogether should the insect population be above normal. A better method would provide for their total exclusion from the beds, if the anticipated moth infestation promises to be considerable, the advisability of the practice depending entirely on the

general field losses during the previous season. Total exclusion could be effected by double covering the beds. Either stockinette or a mosquito-net material would serve as a first cover, this being stayed to the sides and ends of the beds and to be regarded as permanent. In practice it would prove most convenient to fasten one side and have the other attached to a running pole which could take up an accumulated slack. Watering should be carried out through the stockinette. The usual hessian cover in general use as a protection against storm waters—so common during the later months of the year—would provide additional protection when necessary. With the dual device, plants may be raised free from lepidopterous pests up to the transplanting stage.

Cultural practices may be of material assistance in keeping the moth population down to manageable proportions. It is presumed on fairly sound grounds that the moth has few indigenous host plants in the immediate vicinity of the major tobacco districts. Hence were the infestation of the growing crop limited to adults wintering on these, the actual loss would be inconsiderable. In practice, however, laxity in the removal and destruction of volunteer plants and residual stalks remaining in the field creates a fund of additional breeding material in which the pest may continue to thrive. Growers ought therefore to uproot all the plants in a cultivated area as soon as practicable once the leaf is removed in an endeavour to eliminate unnecessary breeding material. These plants have to be removed in any case before planting can be resumed in the following season, hence no additional labour is involved in the process. Ordinarily these uprooted plants will dry out rapidly if exposed to the sun and will be entirely unsuited for the further development of most of the larvae which they contain. Those approaching maturity will shortly pupate and complete their development, but others will doubtless be destroyed. With the general adoption of such clean up measures, the interim between the completion of harvesting and the commencement of the next season's planting should be sufficiently long to kill off the majority of the moths, in spite of their comparatively long adult life.

Where irrigation facilities are available, growers may be tempted in frost-free districts to grow a winter crop immediately after the summer leaf is harvested. In an area free from the stem borer the venture may be quite successful, but this pest can easily upset calculations. The incidence of this and allied insects in second crops is invariably greater than that in the first—a natural consequence of rapid reproduction when the food supplies are ample. Consequently multiple cropping should only be proceeded with when the significance of the pest fauna and the practicability of its control under epidemic conditions has been thoroughly realised. It may be found later that the stem borer alone will make the practice uneconomical in the major tobacco districts.

Once plants in the field are affected, much can be done with the judicious use of the knife to ensure a crop. If the growing point is affected, the plant may be cut back to a sucker in the axil of a lower leaf, which will then function as the tip of the plant. Given subsequent freedom from heavy infestation, a crop may thus be assured, while, even if minor attacks do follow, the plants may be sufficiently hardy to grow normally. Galled tips removed from the plant in the process should in all cases be collected and destroyed.

From the foregoing discussion of control methods it will be obvious that the suggestions merely conform with the requirements of good farming, varied to meet the problem raised by the advent of, perhaps, the most serious of pests into tobacco districts. Eradication of the insect is quite impossible; control is a reasonable probability, and the latter is the goal at which growers must aim.