

INSECTS AND SUGARCANE.

By J. DICK, Ph.D.

If he compares his position with that of other producers of agricultural products, the South African sugar grower must be constantly reminded of his good fortune in not having serious insect pests to combat. In raising such a crop man interferes with natural conditions by covering relatively large areas with pure stands of a particular plant, thus creating an ideal environment for the increase and spread of insects which feed on it. The sugarcane plant, although it was grown in Natal by natives before the arrival of European settlers, is apparently not indigenous.³ When a plant is introduced from other countries its pests very often accompany it, and frequently become more serious than in the country of their origin, especially when they are introduced without the natural enemies that normally kept them in check. The South African sugar grower has indeed been fortunate in escaping serious insect invasions, especially when it is considered that cane for planting was for many years introduced without any adequate inspection.

The permanence of this freedom from serious insect pests must not be taken too much for granted. Infestations may arise in several different ways. Insects may be accidentally introduced from other countries in sugarcane or similar plants. At present this danger is very largely eliminated by the elaborate quarantine precautions which regulate the importation of plants. But it must not be forgotten that, although plants coming into the country by legitimate means are subject to the closest scrutiny before release, there is always the possibility of dangerous insects gaining access by more devious routes. When the sugarcane borer, *Eldana saccharina*, first became evident at Umfolozi in 1939, the suggestion was made that the insect had been brought across the border by natives entering the country to seek employment. Although this theory of the origin of the borer infestation is now not considered likely, since *Eldana* has not been found in territories from which such native labour originates, it has nevertheless drawn attention to the possibility of such methods of ingress. The natives frequently carry sticks of sugarcane or sweet sorghum for provision, and such sticks might easily harbour insect pests of various kinds.

A number of insects are already known to attack sugarcane in South Africa. These will be dealt with in another section of this paper. In general, they cause little appreciable damage because they do not occur in sufficiently large numbers, their outbreaks are sporadic and they soon disappear, or because the cane is resistant to their attack and rapidly recovers from its effects. It is possible, however, that any of these

insects may, through a change in one or more of the factors that influence their numbers or their effect on the cane, become sufficiently harmful to be regarded as a pest. An insect which occurs only infrequently may increase in numbers as a result of the destruction of its natural enemies by natural or artificial causes. Insect populations may increase abnormally as a result of exceptional climatic conditions or changes in cultural practices. Some varieties of cane are more susceptible to attack than others, so that a newly introduced variety might become infested by an insect which was but a minor pest of existing varieties. Soft canes, for example, are more readily attacked and give rise to larger populations of *Eldana saccharina* than hard varieties.

An insect which, under climatic and soil conditions that favour its host plant, does not cause serious damage, may, under different circumstances, become an important pest as a result of altered conditions lowering the resistance of the plant and making it more susceptible to attack. In Trinidad, for example, increase in the sugarcane froghopper, *Tomaspis saccharina*, is favoured by the presence of reducing sugars in the cane. This might account for the fact that the insects feed mainly at night when the proportion of reducing sugars is highest. Unsuitable soils, incorrect water-balance, and a number of other factors increase the proportion of reducing sugars in the cane, and consequently its attractiveness to the froghoppers.^{15,5} This problem is now regarded as one of plant physiology rather than of entomology.

An insect outbreak might also occur as a result of a species already present undergoing a change in diet and transferring its attentions from wild plants or from other cultivated plants to sugarcane. Instances of such changes in diet are not unknown, a South African example being afforded by the citrus snout beetle, *Sciobius granosus*. Originally feeding on wild bushes beside river beds, this insect has, within the last few years, become a pest of citrus in the Muden Valley. Such a change in diet may be due, for example, to eradication of the natural host plant of the insect, or to the building up of so large a population on the host plant that migration to other plants occurs, or possibly to some undetermined change in the insect itself.

INSECT PESTS OF SUGARCANE IN OTHER COUNTRIES.

It would be impossible in a short paper to give an adequate account of the entomological problems which have been encountered by cane-growers in other countries. I should like, however, to mention

a few of the more important insect pests of cane, and, for convenience, these will be arranged according to the part of the plant which they attack and the nature of the damage which they cause.

1. Biting insects damaging the leaves or tassels; these include locusts and grasshoppers among the Orthoptera, army worms and cutworms among Lepidoptera, and a number of leaf-eating beetles of various families, especially Scarabæidæ, Chrysomelidæ and Curculionidæ.

Locusts occur practically wherever sugarcane is grown. Their outbreaks are generally sporadic and, unless very young cane is attacked, the plants, as a rule, soon recover.

The general term "army worm" includes the larvæ of a number of species of moths of the family Noctuidæ. The more important army worms belong to the genera *Cirphis*, *Laphygma* and *Remigia*. Like the locusts, they occur in practically every cane-growing country. They also occur sporadically, large numbers appearing suddenly and almost as suddenly disappearing again. As a rule they are subject to the attacks of numerous natural enemies, including birds, predacious and parasitic insects, and infectious diseases. Jarvis² records the occurrence in Queensland of swarms of parasitic flies which had emerged from larvæ of *Laphygma exempta*.

2. Biting insects which damage the stem, seed-pieces or buds: these include crickets, budworms such as the Tineid, *Ereumetis flavistriata*, which occurs in Hawaii, and certain wireworms and false wireworms (Elateridæ and Tenebrionidæ). Although these insects may cause local damage, they are seldom sufficiently numerous to rank among the most important cane pests.

3. True borers which burrow into the stem or seed-pieces: these include termites (Isoptera), a number of Lepidoptera, especially of the families Pyralidæ and Noctuidæ, and some beetles, especially of the family Curculionidæ (weevils). This group includes some of the most serious of sugarcane pests, among which may be mentioned the Pyralid moth borer, *Diatræa saccharalis*, which occurs chiefly in America and the West Indies and has at times been so harmful as to threaten the existence of the industry: the large Noctuid moth borer, *Phragmatiphila truncata*, which is sometimes harmful in Queensland: and the New Guinea beetle borer, *Rhabdocnemis obscura* (Curculionidæ) which is considered the most serious pest of sugarcane in Hawaii.¹⁰

It is of interest that, in the United States, burning of the cane trash led to heavier infestations by *Diatræa saccharalis*. This was probably due to the fact that burning destroyed more of the parasites of

this insect than of the pest itself. Howard¹ records that, when the practice of ploughing-in the trash instead of burning was adopted, outbreaks of the borer became less severe.

4. Soil insects damaging the roots and sometimes seed-pieces: this group includes termites, which, especially in Queensland, often damage cane setts. The latter can often be protected by dipping in repellent substances before planting. Other insects in this group include mole crickets and beetles. The beetles include wireworms (Elateridæ) and the larvæ of a large number of Scarabæidæ, of which *Anomala orientalis* in Hawaii, and *Lepidoderma albohirtum* in Queensland, are among the most important.

5. Insects which feed by piercing the tissues and sucking the juices: these include thrips (Thysanoptera), and aphids, mealybugs, scale insects and leaf-hoppers among the Hemiptera. While these insects must cause a certain amount of direct damage by sucking the juices of the plant, many of them are of greater importance as vectors of diseases caused by fungi and viruses. In South Africa the best known virus diseases are mosaic, carried by *Aphis maidis*, and streak disease, carried by the Jassid, *Cicadulina (Balclutha) mbila*. As insects of this type are generally very difficult to combat, varieties of cane are sought which are immune to these diseases.

INSECTS ATTACKING SUGARCANE IN SOUTH AFRICA.

A short paper by van der Merwe, published in 1937,¹² gives a list of some of the more important insects that have been observed to attack sugarcane in South Africa. Munro and Fouché⁶ mention four species of scale insects and mealybugs (Coccidæ) recorded from cane. In several papers Storey^{7,8,9} and Storey and McClean¹⁰ discuss the transmission of mosaic and streak disease in South Africa. The following insects have been recorded:—

Hemiptera.

Aphidæ: *Aphis maidis*, Fitch, the maize aphid, does not occur in large numbers on cane, but is important as the vector of mosaic disease. It may migrate on to the cane from wild grasses, but appears to do little direct damage.

Aphis sacchari, the sugarcane aphid, is sometimes very numerous and might become a serious pest. Its outbreaks are, however, sporadic, and it appears to be controlled by natural enemies, so that artificial control measures have not been necessary.

Coccidæ: *Pseudococcus sacchari*, Ckll., the sugarcane mealybug, is the most frequently found of these insects and is, in fact, probably the most common insect on sugarcane in Natal. It sucks the juices of

the plant, occurring on the softer parts which are protected by the leaves. The direct effect of the attack appears to be slight, but impurities produced by the insects may make more difficult the process of clarifying the juice.

Other Coccids recorded from cane include *Aspidiotus destructor*, *Pulvinaria elongata*, var. *durbanensis*, Green, and a species of *Coccus*.

Jassidæ: *Cicadulina* (*Balclutha*) *mbila*, Naudé, an insect which is found on maize, sorghum and grasses more often than on sugarcane, is important as the vector of streak disease. Control of this disease is being sought more by the encouragement of immune varieties of cane than by combating the insect. A description of the insect and an account of its life-history have been published by van der Merwe,¹¹ and its role in transmission of streak disease has been discussed by Storey,^{8,9} and Storey and McClean.¹⁰

Delphacidæ: *Perkinsiella saccharicida*, Kirk., the sugarcane leafhopper, is occasionally found. This insect was formerly one of the most serious cane pests in Hawaii, but it is now kept under control by the egg-sucking Capsid bug, *Cyrtorhinus mundulus*, Bredd., which was introduced from Queensland and Fiji in 1920.

Cercopidæ: *Locris areata*, Walk., and *L. arithmetica*, Walk., spittle insects which normally live on wild grasses, sometimes occur on cane in moist areas. They are never sufficiently numerous to be important.

A number of other Homoptera, especially Cicadellidæ and Fulgoridæ, are often found in small numbers. Storey and McClean¹⁰ tested the ability of some 25 species to transmit streak disease, but did not discover a vector among them.

Isoptera.

Numerous species of termites occur in Natal and, although they are not specifically pests of sugarcane, certain species at times cause considerable damage, especially to recently planted cane. If the nest can be located it can be dug out or fumigated with a white-ant pump which injects fumes of arsenic and sulphur. In Queensland, termites attacking newly planted cane are sometimes dealt with by treating the setts with repellent substances before planting.

Orthoptera.

Nomadacris septemfasciata, Serv., the red locust, has up to the present been the most serious pest of cane in Natal. Although outbreaks are sporadic and the cane plant exhibits remarkable powers of recovery from the attacks of leaf-eating insects, severe defoliation, such as often occurs, has a harmful

effect on the development of the cane. The Department of Agriculture has, however, been engaged on this problem for many years, and arsenical baits have been developed which, if properly applied, almost completely eradicate the hopper stage of this insect.

The elegant grasshopper, or 'ntotiviaan, *Zonocerus elegans*, Thunb., although it appears to prefer many other plants, sometimes attacks cane. It is not, however, likely to become a pest of this crop. A paper by van der Merwe and Kent¹³ deals with this insect and its control.

Lepidoptera.

Noctuidæ: *Sesamia calamistis*, Hmps., the larva of which is a common borer in maize, sorghum, reeds and a number of the larger grasses, is quite often found boring in cane. In harder varieties, such as Co.281, it usually occurs in the spindle and sometimes kills the growing point. In softer varieties, such as P.O.J.2725, it may burrow into the stalk. It rarely occurs in sufficient numbers to be important.

Busseola fusca, Hmps., the maize stalk borer, is more rarely found in cane.

Cirphis leucostricha, Hmps., the sugarcane cutworm, sometimes causes noticeable damage, especially to newly ratooning cane in fields that have been cut and trashed. The insects are subject to the attacks of parasites, particularly Tachinid flies. They appear also to be destroyed when the trash is burnt.

Laphygma exempta, Walk., the army worm, is at times destructive to cane. Outbreaks occur suddenly and the leaves may be so severely damaged that the growth of the cane is adversely affected. This pest, which occurs in many other crops, is dealt with in a publication by the Department of Agriculture.¹⁶ The control measures which are recommended include the use of poison baits and barriers to prevent migration of the larvæ. The suddenness with which the insects appear, however, often finds the growers unprepared, so that considerable damage may be done before control measures can be adopted.

Pyralidæ: *Eldana saccharina*, Wlk., was first reported as causing considerable damage by boring into cane stalks at Umfolozi in September, 1939. The insect had been collected at Nyalazi River in 1928, but was not then recorded as damaging cane. It has been found attacking cane and various graminaceous crops in the Gold Coast and French West Africa. The origin of the infestation is still unknown, but it is now thought likely that the insect has occurred at Umfolozi for many years without being sufficiently numerous to attract attention before 1939. Dr. Naudé, Dr. Ripley and the author have repeatedly searched for the borers in wild vegetation, but with negative results. The

insects have also been sought in other cane-growing areas, but, with the exception of a single specimen obtained at Umhlatuzi, have only been found on the Umfolozi Flats. Since the outbreak was reported several collections of insects found boring in cane have been obtained from Portuguese East Africa, especially from the Sena Sugar Estates, but have contained no specimens of *Eldana saccharina*. Damage by *Eldana* is most severe in soft canes, the insect being comparatively rare in Co.281. Parasites do not appear to be common since, as yet, only one larva has been found to be parasitised, the parasite being a Tachinid fly.

Coleoptera.

Scarabæidæ: *Heteronychus licas*. Outbreaks of this insect have occurred in Portuguese East Africa and on the Umfolozi Flats in Zululand. They most commonly occur after floods. The adults are destructive, particularly to recently planted cane, attacking the soft parts of the plant close to the sett. They may also burrow into the sett. The larvæ live in the soil, probably feeding on dead organic matter, and do not appear to attack living plants. A Carabid beetle has been observed to prey on the adults.

A single outbreak has been recorded, in about 1912, of another Scarabæid beetle, the larvæ of which damaged the roots of sugarcane at Mount Edgecombe.

Curculionidæ: *Sympiezotrachelus impar*, a new weevil described by Marshall,⁴ is stated to have been found attacking sugar cane in Natal.

Various other beetles, particularly of the families Curculionidæ and Chrysomelidæ, can be collected on the cane, but it is not known to what extent they damage the plant.

Besides the insects which actually feed on it, the cane plant harbours many species which may be described as beneficial or neutral. The beneficial insects include the parasites and predators of insects feeding on the cane. The numerous Carabid and Coccinellid beetles, and many of the wasps and flies which can be collected from the plants would fall in this category. Among the neutral insects are accidental visitors and scavengers.

Summary.

The South African cane grower is fortunately free from serious insect pests, but outbreaks of harmful insects might arise in several different ways, such as accidental importation, increase in numbers or change of diet of insects already present.

An outline is given of the more serious pests of cane in other countries.

The insects known to attack cane in South Africa are listed. These include aphids, mealybugs and leafhoppers among the Homoptera; several termites; the red locust and the elegant grasshopper among Orthoptera; a cutworm, an army worm, and three Lepidopterous borers; and several leaf-eating Coleoptera of the families Scarabæidæ and Curculionidæ.

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Experiment Station,
South African Sugar Association,
Mount Edgecombe, Natal.
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The PRESIDENT remarked how lucky the industry was not to have any serious insect pests. He referred to the damage that had been done by insects in Louisiana and Puerto Rico.

Mr. DODDS called this interesting paper a landmark in the history of this Association, for it was

the first paper in our Proceedings by an entomologist who was employed by the sugar industry. The relative freedom from insect pests here may not exist indefinitely, and it would be wise in the meantime to learn from the experience of other countries and to be prepared.

Mr. MOBERLY related how, some years ago, the cane borer and mosaic nearly brought the sugar industry of Louisiana to an end. One factory after another had to close down, and the production dropped from a peak of 300,000 tons to 42,000. It was practically impossible to chew cane that year, it was so riddled by borer. It was the importation of new P.O.J. varieties that saved the industry. These facts were not only of historic interest, but served also as a warning to this country.

Mr. BOOTH was grateful that an entomological department had been started at the Experiment Station, and he thought that much useful work could be done on this subject.

Mr. DUCHENNE, relating his experience of damage to cane by the *Eldana saccharina* at Umfolozi, said that they had whole consignments of cane so badly affected by this borer that it was useless for sugar making. The analysis of such a consignment was 6 to 7 per cent. sucrose, 65° purity, and had a glucose ratio as high as 7 per cent. Healthy cane from the same consignment had a sucrose content of 13.5 per cent.

The PRESIDENT said the example of Louisiana given by Mr. Moberly was a good illustration of what the industry could save by having an entomologist.

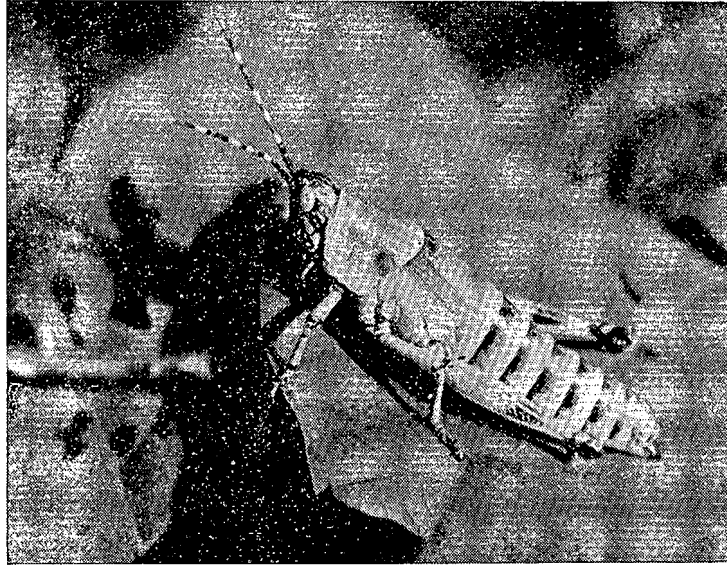


Fig. 1. *Zonocerus elegans*. About life-size.



Fig. 3.

P.O.J. 2725. Cane damaged by *Eldana saccharina*.

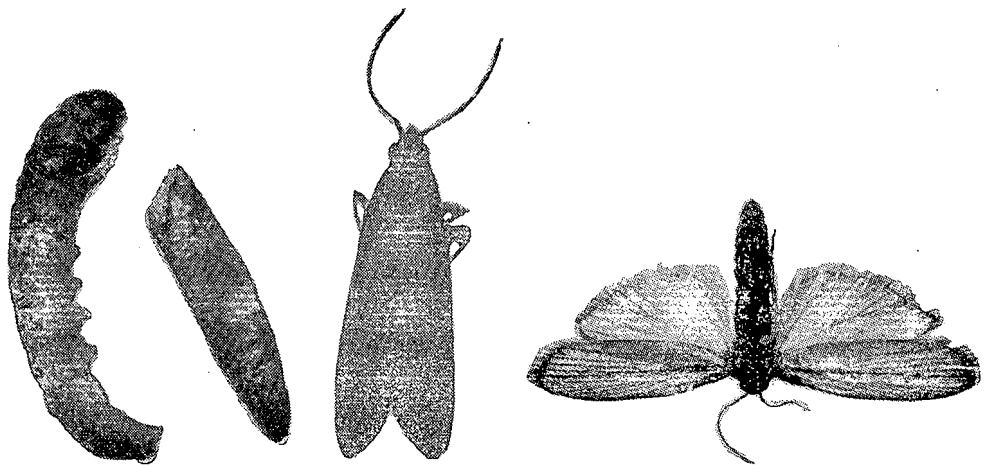


Fig. 2 *Eldana saccharina*, larva, pupal case and adult, $\times 2$

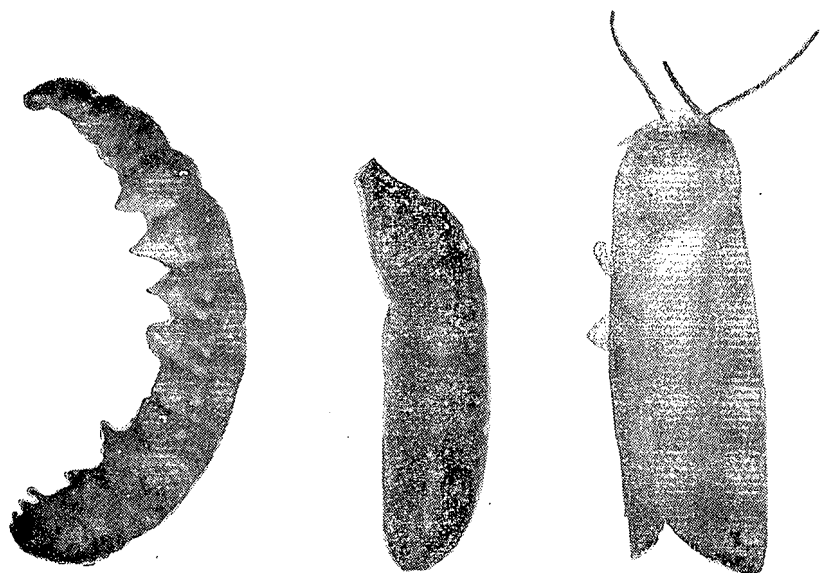


Fig. 4. *Sesamia calamistis*, larva, pupa and adult $\times 2\frac{1}{2}$.