

THE GREEN LEAF-SUCKER OF SUGARCANE *NUMICIA VIRIDIS*, MUIR

By J. DICK

Summary

An account is given of an outbreak, in Swaziland, of a leaf-sucking insect, *Numicia viridis*, Muir, on sugarcane of the variety N:Co.310. A brief description of the insect is followed by a discussion on symptoms and effects on the sugarcane plant. Among control measures, burning and harvesting of millable cane and treatment of the remainder with malathion dust were effective in reducing the infestation. A survey has revealed the presence of *Numicia*, although only in small numbers, on sugarcane in Natal.

Historical

The land selected for sugarcane cultivation on Tambankulu Estate, in the north of Swaziland, is level or, at most gently sloping and the volcanic soil is rich and of good structure. A scientifically designed and efficiently operated system of overhead irrigation makes available adequate supplies of water, brought in channels from the Komati River. From the start, fertilizer application has been generous. Under these conditions the cane, which consisted exclusively of the variety N:Co.310, developed so rapidly and appeared so healthy that it aroused the envy of visiting growers from other areas.

Towards the end of 1961, somewhat more than four years after cane was first planted in this area, it began to be noticed that the crop in some fields was beginning to suffer from a malady, the cause of which was not immediately apparent. Although some insects were observed, it was not at first obvious that they were responsible for the condition, and investigations were carried out on a number of other factors including soil and fertilizer, trace elements, water supply and drainage, and the possible occurrence of diseases. By July, 1962, however, when symptoms had become acute over a considerable part of the thousand-acre sugarcane plantation, insects were present in such large numbers that their connection with the malady became apparent.

Identity of the Insect

Specimens, which were sent to the South African Division of Entomology and thence to an expert in Brussels, were identified as *Numicia viridis*, Muir, (Fulgoroidea: Tropiduchidae). The original description of this species² is contained in a paper, published in 1931, dealing with specimens in the British Museum. The habitat is given as Natal: Weenen and Pondo-land: Port St. John and the date of collection as 1924. There is no record of host plants but, from the localities cited, it is obvious that they were not collected on sugarcane.

The species is not mentioned in the Review of Applied Entomology up to 1962, nor does the name appear in the "List of Sugarcane Insects" by H. E.

Box¹ nor in "A Selected Bibliography of the Insects of the World associated with Sugarcane" by J. S. Wade.³ It may be deduced that *Numicia viridis* is a native insect and not a recent introduction. This is supported by the fact that it has now been collected, in small numbers, in other parts of Swaziland as well as at various localities in Natal. It has not previously been recorded as a pest of sugarcane or of any other crop.

Description

The adult female is a bright green insect with a body about 4.8 mm. long and rather flat outer wings 6 mm. long. The male is similar but smaller. When the insects were observed in July and August they were inactive and spontaneous locomotion was limited to a rather slow walk. There is, however, some evidence that they may become more active in summer. When disturbed, they escape by hopping or by short, jerky flights. Although some local observers claimed that *Numicia* was attracted to lights, this may have been due to confusion with some other insect since no specimens were collected at electric lights near the most heavily infested area and attempts at attracting them to the headlights or parking lights of a vehicle, driven into the canefields at night, were unsuccessful.

Eggs are laid in batches of between ten and twenty, which are placed in a row in the midrib, towards the tip of the cane leaf. Each egg is inserted into a separate puncture in the tissue of the midrib, on the lower surface of the leaf, by means of the ovipositor of the female. The resultant injury to the leaf generally causes a red discoloration which can be seen from the upper side. As is common among insects in this group, each egg has a lid, or operculum, which protrudes from the leaf and becomes detached when hatching occurs. This appears to require at least four weeks in August but may possibly be quicker in summer.

The nymphs are paler in colour, smaller and more slender than the adults. They do not have wings. A number of glands at the hind end of the body secrete stiff threads of wax which appear as a tuft at the end of the tail. Both nymphs and adults feed by sucking the juice from the leaves of cane plants by means of a proboscis which is inserted into the tissue of the leaves.

There are probably six instars, including the adult stage, and the entire life cycle requires practically six months during the colder half of the year. Development is presumably more rapid in summer and there is some evidence of two generations occurring during the warmer period.

Symptoms and Effects

Recognizable symptoms do not appear until the insects are present in appreciable numbers, although it is suspected that, by this stage, the cane may already have been adversely affected. In infested canefields, the first symptom noticed is a weakening of the leaf tissue, which leads to buckling and drooping of the leaves. Later, the leaves develop a blotchy yellow discoloration and often die at the tips and along the edges. In severe cases, the growing point of the cane shoot is affected and the stick becomes soft and flabby, especially at the top. At this stage, growth of the crop is noticeably retarded.

When samples were analysed at the Experiment Station, the sucrose content, purity and fibre percentage of cane showing severe symptoms were low by comparison with those of cane from less heavily infested fields. Representative figures are shown in Table 1. Even in the more healthy cane the sucrose was low, but this might have been largely due to immaturity.

Table 1

Insect incidence	Purity	Sucrose % Cane	Glucose Ratio	Fibre % Cane
High	75.0	7.93	7.49	6.90
Low	84.8	12.17	1.71	9.34

In preliminary investigations on the nature of the symptoms, some attention was paid to the various means by which a sucking insect might affect a plant. These include mechanical injury, removal of nutrients, transmission of diseases and toxic effects.

Mechanical injury to sugarcane by *Numicia* includes the effect of the puncture made by the proboscis in search of juice. If *Numicia* feeds within the vascular tissue, disorganization and blockage of the conducting elements might be an important factor. This, however, still requires investigation. In addition, when the insects are numerous, damage to the vascular tissue of the midrib during the process of oviposition may be severe and it is suspected that this factor may account for the dead leaf-tip symptom.

As far as removal of nutrients is concerned, the quantity of juice consumed by a single insect must be small. However, in such a severe infestation as occurred at Tambankulu, when up to five hundred insects might be present on a single stool, the importance of this factor would be considerable.

The diseases transmitted by plant-sucking insects are generally those associated with the presence of a virus. Young ratoons, even in the most heavily infested area, did not show the characteristic yellow discoloration, and shoots emerging from setts collected in this area and planted at Mount Edgecombe, appeared to be healthy. From this evidence it may presumably be inferred that no virus disease is involved.

Healthy plants, which were inoculated with the juice from severely affected leaves, developed no

symptoms except those of gumming disease. This disease is present in the relatively mild, chronic phase in much of the cane at Tambankulu. It is independent on the insects and does not appear to have been an important factor in the debility of the cane.

At Mount Edgecombe, the leaves of young, healthy plants of N:Co.310 were inoculated with a liquid prepared by grinding the bodies of *Numicia* with a small amount of distilled water. Three methods of inoculation were tried: inserting a hypodermic needle into the spindle, rubbing the leaves with a mixture of the inoculant and kieselguhr as an abrasive, and running the liquid down the centre of the spindle which was then punctured with a needle. Treatment with the insect extract, by any of these methods, resulted in an obvious yellow discoloration of the leaves, similar to that observed in the fields at Tambankulu. Where drops of the inoculum had fallen on the leaves distinct blotches appeared. These at first resembled water-marks, but they became yellow after about a week. In controls, inoculated with water alone, the only symptom was slight mechanical injury caused by the needle or the abrasive and there was no yellow discoloration. The results of this experiment suggest that the blotchy discoloration of the leaves, which is characteristic of heavily infested areas, and possibly some of the other symptoms, may be due to poisoning of the plants by the insects. Unlike a virus disease, such a toxic effect would be quantitative, so that the more heavily infested areas would be more severely affected.

A cane crop which has been subjected to severe attack is unlikely to recover completely, and some loss in yield is almost certain to occur. One after-effect is the development of side-shoots near the top of the stick. This presumably indicates that the growing point has been injured.

Alternative Hosts

At Tambankulu, at the period when the cane was most heavily infested, a search was made in wild grasses in an attempt at discovering alternative hosts. Since this took place during the dry, winter season, there was very little green foliage in the veld, and no specimens of *Numicia* were found. A cursory examination of grasses along river banks and water-courses also failed to reveal the presence of the insects, although some were found in a lawn, apparently of *Stenotaphrum secundatum*, surrounding the swimming bath at Tambankulu. Inspection of rice fields and volunteer maize near the heavily infested area gave negative results.

More recently, on an estate on the Natal South Coast, where *Numicia* had been found in appreciable numbers on sugarcane, patches of maize appeared to be free. On this estate, several batches of eggs were found in the leaves of Johnson grass, *Sorghum halepense*.

Possible Natural Enemies

At least half of the adult leaf-suckers seen at Tambankulu towards the end of July, 1962, were carrying the larvae of a moth, presumably belonging to the family Epipyropidae. These larvae, which are

short and broad, somewhat resembling mealybugs in appearance, occur on the dorsal surface of the adult *Numicia*, under the wings. When fully grown, they pupate in white, silken cocoons on the cane leaves, and give rise to adults which are small, stout moths with vestigial wings. No males have been seen and, since the females commence oviposition almost immediately after emergence, reproduction is thought to be parthenogenetic. The minute eggs are laid in a cluster of five or six hundred, next to the empty pupal case. The value of these insects as a control factor is doubtful since they do not appear to cause any significant mortality of *Numicia* or to prevent the females from producing eggs. They may be passengers rather than true parasites, and possibly feed on the waxy secretions of the leaf-suckers. They have not, as yet, been found on specimens of *Numicia* collected in Natal.

Coccinellid beetles, identified as *Micraspis quadristriata*, Fabr., were present in fair numbers on infested cane but were not actually observed feeding on *Numicia*. They are known to attack various species of Aphids.

A few eggs of the leaf-sucker were found to have been parasitised by minute wasps. On the whole, however, natural control did not appear to be very effective.

Insecticides

At the beginning of August, 1962, a small-scale insecticide trial was carried out in one of the most heavily infested plots at Tambankulu. The chemicals were applied from the ground by means of small, portable power machines of a type which can deliver either dusts or sprays. The insecticides used were dusting powders of malathion (5%), sevin (10%) and BHC (5%), which were applied at between thirty and forty pounds per acre, and emulsion sprays of Rogor E, and a mixture containing toxaphene (40%) and DDT (20%), both at approximately two pounds of active ingredient in thirty to forty gallons of water per acre.

It was noticed that the dusting powders gave far better penetration of the dense cane foliage than did the sprays. Although it was impossible to obtain accurate mortality counts, observation indicated that malathion dust had produced a satisfactory kill and that it was the most rapid in taking effect. When examined three days later, malathion plots still appeared to be the best. Aerial applications of malathion dust at about thirty pounds per acre were therefore recommended as a control measure.

It was at first feared that at least two applications, at intervals of four or five weeks, might be necessary since malathion did not appear to be very effective against the eggs. However, a single dusting, carried out at a period when the egg stage was at a minimum, reduced the population so effectively that no further treatment was necessary.

In a subsequent trial, carried out by the officers of the Swaziland Department of Land Utilization, parathion and telodrin sprays were somewhat more effective than malathion dusts when applied by air-

craft. On account of the dangerous toxicity of these materials to humans, their large-scale use was not recommended.

Other Control Measures

All cane at Tambankulu is burned before harvest. Examination indicated that this would normally destroy all stages of *Numicia*. Before the application of insecticides, it was therefore recommended that infested cane of a millable age should be harvested as soon as possible. Since burning in rainy weather might not be completely effective, it was suggested that, in this event, the remaining trash should be set on fire again when dry.

Under the present system of irrigation, sugarcane at Tambankulu never experiences water stress and even the ripening-off process is not severe. In consequence, the foliage is extremely lush and the plant has almost the appearance of a greenhouse crop. These factors may have encouraged the spectacular increase in populations of *Numicia*. As a long term project, it has therefore been suggested that the effect should be investigated of altering the water regime so as to enforce greater hardiness in the cane.

Although there is, as yet, no reliable evidence of resistance to *Numicia* in any variety of sugarcane, it is considered that the exclusive cultivation of N:Co.310 at Tambankulu might be dangerous from several points of view. The introduction and testing of other varieties on this estate has therefore been recommended.

Regular inspection at Tambankulu and other localities in Swaziland is being maintained by local personnel, so that there should be adequate warning of any new increase in numbers.

Numicia Survey

The discovery of *Numicia* in appreciable numbers on an estate on the Natal South Coast caused some concern and it was decided that the Experiment Station staff should carry out a survey of selected areas throughout the sugar belt. The object of this investigation was to study the distribution and importance of the leaf-sucker and, where possible, to collect information on factors which might encourage its increase. The main part of this survey was carried out in January and February 1963, during which period all parts of the sugar belt, including Wartburg and Pongola were visited.

In selected sites, which were often those in which it was considered most likely that the insects would be present, the cane was examined for eggs or the appearance of any symptoms. In each site, four framed sheets of black plastic material, one yard square, were placed at random between the cane rows, and the cane above and around them was treated with malathion dust. After three or four hours, the sites were revisited and any insects which had fallen on the plastic sheets were collected and counted. Since a technique differing only in details has been used in Swaziland, valid comparisons could be made.

On the South Coast, the insects were found only on the estate already mentioned where, in some fields, numbers corresponding to about sixteen insects per stool were recorded. Since the discovery of the leaf-sucker in this area, careful observations on population trends have been made by the personnel of the company concerned and the most heavily infested areas have now been treated with malathion dust.

No specimens of *Numicia* were found in the Wartburg area, where eight sites were examined. Among twenty-one sites on the North Coast, fifteen did not yield any *Numicia* and the numbers in the other nine, being less than one individual per two stools of cane, were too low to be of practical importance.

In Zululand and at Pongola, although sixteen out of the thirty-four sites examined revealed the presence of the insects, the numbers were generally low. Only on the Umfolozi Flats, at Nyalazi River and on one plot at Pongola, were numbers greater than one individual per stool in evidence, the highest population found in the whole of this area being about three nymphs per stool in two fields on the Umfolozi Flats.

Thus, out of a total of eighty sites examined, twenty-five were positive but, in the worst of these, population numbers were far lower than those which caused injury to the cane in Swaziland. In no case did the cane show signs of having been affected by the insects.

Factors Conducive to Outbreaks

Since populations were low in practically all the sites examined, the survey gave very little information on factors which might be conducive to outbreaks.

S.A.S.A. Exp. Station,
MOUNT EDGECOMBE.

Two types of environment were more often positive, namely alluvial flats and areas irrigated by overhead spray. Observation of the area in Swaziland in which a severe infestation occurred suggests that increase in numbers is favoured by factors tending to produce a lush, rapid growth of cane foliage. Generous fertilizer applications and irrigation, with a regime which does not allow water stress to develop, are characteristic of this area.

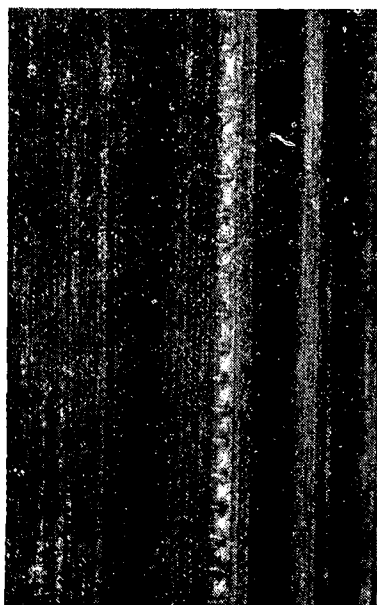
Acknowledgments

At the request of the South African Sugar Association and the Swaziland Government, Dr. T. J. Naudé of the Entomology Division of the South African Department of Agriculture spent a week at Tambankulu investigating the problem, and returned later to discuss the results of insecticide trials. His advice and assistance are gratefully acknowledged.

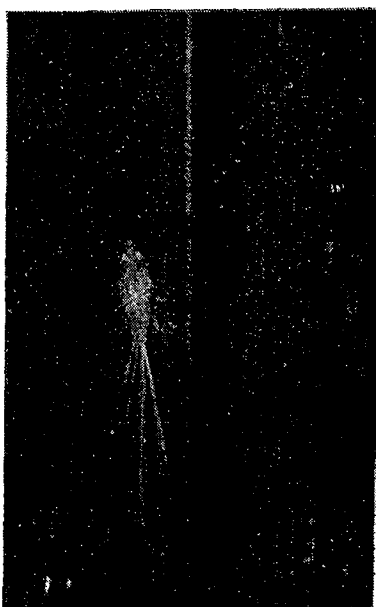
Mr. A. C. Venn, Mr. C. Stedman and Mr. A. Dicks of the Swaziland Department of Land Utilization carried out a survey of practically all sugarcane estates in Swaziland, and have kept the situation under constant observation. In addition, their co-operation in connection with insecticides trials was most valuable.

References

- ¹ Box, H. E. (1953): "List of Sugarcane Insects". 101 pp. London: Commonw. Inst. Ent.
- ² Muir, F. A. G. (1931): "New and little-known Fulgoroidea in the British Museum (Homoptera)". *Ann. Mag. Nat. Hist.* (10) 7, pp. 297-314.
- ³ Wade, J. S. (1951): "A selected Bibliography of the Insects of the World associated with Sugar Cane, their Predators and Parasites". Mem. No. 1, I.S.S.C.T. Honolulu, Hawaii.



1. Eggs in midrib of cane leaf, $\times 8$.



NUMICIA VIRIDIS.
2. Nymph $\times 5$.



3. Adult $\times 5$.

Mr. du Toit (in the Chair) said that fortunately the insect had now largely disappeared but the information given by the author would appear in our Proceedings and thus be of value to other countries should they experience such a situation in future.

Mr. C. Halse stated that *Numicia* had been found on other hosts such as cotton, maize and Napier Fodder. Hand dusting of the field was not very successful and populations remained the same as before.

There appeared to be a change in the life cycle from nymphs to adults and this appeared to be continuing, at least three cycles having taken place since the infestation was first observed.

Dr. Dick said he considered that the control might not have been as successful at Illovo as had been hoped, because the insecticide had been applied in smaller quantities than in Swaziland.

Mr. Halse asked if it could be that the insecticide was not effective at the egg stage and that a continuation of hatching of eggs developed.

Dr. Dick replied that while the insecticide had some effect on the eggs not all were killed.

Mr. K. Alexander asked if the eggs were laid in the midrib purely as a protective measure, for it would appear that the developing nymph did not draw any nourishment from the leaf.

Dr. Dick replied that this was probably so.

Dr. Brett thought that the host mentioned was probably not Johnson grass, or *sorghum halepense*, but *sorghum verticilliflorum*.

Dr. Shuker said the fields at Tambankulu were well grown and it was his impression that where the infestation occurred the yield could have been depressed by as much as fifty per cent.

Dr. Dick said he had not seen the cane at Tambankulu before it became infested but he had been told that there was a very great depression in yield due to the attack of the insect.