SUGARCANE PESTS IN SOUTHERN AFRICA

SOUTH AFRICAN SUGARCANE RESEARCH INSTITUTE

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Introduction

Described in this bulletin are insect pests that most frequently damage sugarcane in southern Africa. Pests have been categorised by the type of damage they cause and are considered in order of their importance in the industry.

Guidelines are Included for control of these pests. However, confirmation of pest identity and control options from SASRI specialists are advisable before taking action. Symptoms of damage can be similar for different pests and expensive control options may be implemented where not necessary.

It is important to note that SASA is mandated by law to ensure the control of pests and diseases. Therefore, when planning programmes of control, growers should seek the advice of their local extension specialist who is supported by SASRI experts registered with the South African Council for Natural Scientific Professions (SACNASP). SASRI does not sell any agricultural remedies and consequently has no vested interest in any one of the registration holders or their respective products.

For further information on the insects described in this book and others, consult “Insects of Cultivated Plants and Natural Pastures in Southern Africa”, edited by G.L. Prinsloo and V.M. Uys and published in 2015 by the Entomological Society of Southern Africa.

Stalk Borers

These are the most serious pests of sugarcane in southern Africa. Their larvae bore into sugarcane stalks and extensively mine them, thus reducing their quality and weight. Of these borers, eldana *(Eldana saccharina)* is the most economically important. Sesamia (Sesamia calamistis) has been, and remains, of lesser importance. The spotted sugarcane borer *(Chilo sacchariphagus)* is a biosecurity threat whilst the spotted maize borer *(Chilo partellus)*and the Maize stem borer *(Busseola fusca)* are potential pests in sugarcane.

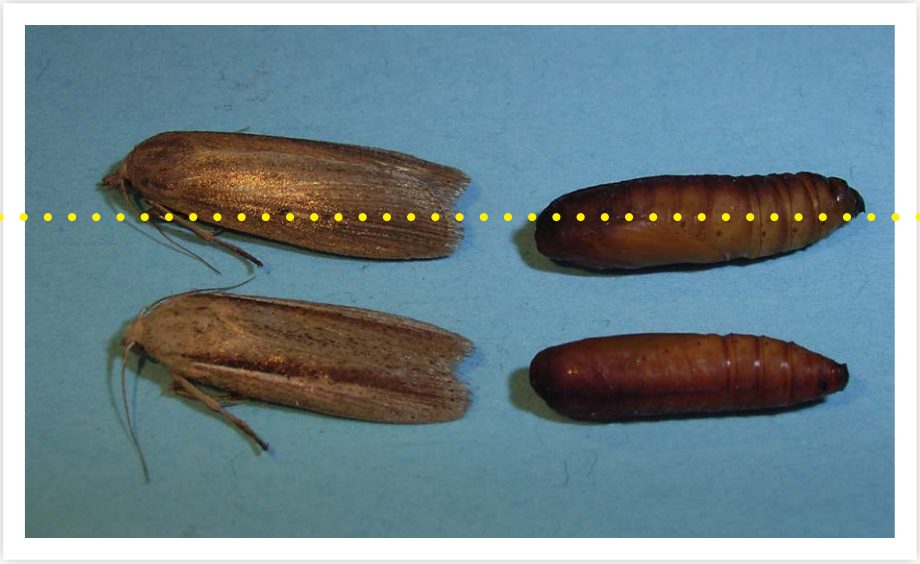
Eldana borer

Eldana saccharina Walker (Lepidoptera: Pyralidae)

Identification

The adult is an inconspicuous brown moth. The larval stage attacks mature sugarcane by entering the stalks and boring out the internal tissues on which it feeds. The larvae are tough and leathery and very active when removed from their shelter within the stalk. They may descend from the sugarcane stalk on silken threads which they spin.

Eldana larvae can be distinguished from the less serious Pink borer, sesamia, by its colour, greater activity and characteristic backwards movement when disturbed. In colour, eldana larvae are brown to black, whereas sesamia larvae are pinkish.



An eldana female moth and pupa on top, and an eldana male moth and pupa below.

Late instar eldana larva and frass in sugarcane.
Note: Fusarium fungal infection in stalk material (red colour)

Biology

Eldana's life cycle follows a typical moth pattern. The minute first stage larva feeds initially as a scavenger on the outside of the mid to lower portions of stalk protected by the dead leaf sheaths. Later instars enter the stalk, and for the rest of the active larval period, feed on the internal tissues of the mid to lower portions of the stalk. When mature, the larva spins a cocoon and pupates, either inside the boring, next to a window bored in the rind of the stalk, or on the outside, frequently behind a dead leaf sheath. The adult moth emerges from the pupa, mates and lays as many as 500 eggs, which result in further larvae. Breeding is continuous and there are several generations in a year.

Being an indigenous insect, eldana has a number of preferred wild host plants that it also attacks. These are primarily sedges, the most important of which are *Cyperus papyrus* and *Cyperus dives.* Eldana is controlled in sedges by its natural enemies.

The predominant indigenous sedge host plants of eldana, Cyperus papyrus (left), and the flowering head of Cyperus dives (right). Larvae are found either in the flowering heads of both plants, or in the rhizomes when not covered by water.

Damage

Eldana larvae bore primarily in the sucrose-rich lower half of sugarcane stalks. Therefore, this pest (unlike many other lepidopteran borers) has a major effect on quality and lesser effect on tonnage. It is estimated that for every 1% of sugarcane internodes bored, 1% of the estimated recoverable crystal (ERC%) is lost.

Control

To effectively manage eldana, an integrated management system is recommended. These are listed below and details can be found in a more comprehensive SASRI publication, *IPM for eldana control.*

- Where possible, establish patches (clumps) of wild host plants preferred by eldana. Within sugarcane-breaks, plant melinis grass which is repellent to eldana moths.
- Poor soils of low organic matter induce stress, which encourages eldana. Sub-soil aluminium toxicity and soil compaction should be ameliorated as this allows root access to water deeper in the soil profile during drought.
- Green-manuring between replant cycles to increase soil organic matter is recommended.
- In areas prone to eldana, plant varieties that are less susceptible to eldana. Consult variaty information sheets for eldana ratings.
- Clean (eldana-free) seedcane is important for future crop development. Only use seedcane sourced from a certified or approved nursery.
- Reduce stress factors such as weeds, diseases, nematodes and poor nutrition especially potassium. Consider application of a silicate slag in place of lime where this is recommended to neutralise soil acidity.
- Apply only the amount of nitrogen fertiliser recommended by SASRI based on expected yield given mid to long-term rainfall predictions.
- Consider stripping off dry leaves from stalks in fields intended for carry-over. The best time is just prior to the summer eldana moth peak (around September).
- Use farm surveys to supplement P&D team surveys. Adjustments to field harvest order can then be made sooner and less crop loss will be incurred. Remember that frequent small surveys are more useful than infrequent detailed surveys.
- Cut selectively on the good and poor soils of the farm, and try not to carry over cane growing on poor soils.
- Avoid soil compaction and stool damage by using controlled in-field traffic.

- At the time of harvest, burn sugarcane that is heavily infested with eldana or drought stressed, or both. However, bear in mind that crop residue conservation can be beneficial in terms of water and natural enemy conservation. Avoid indiscriminate burning and always leave tops scattered.

- Pay attention to field hygiene. After harvest of infested cane, remove whole stalks from the field and leave no stubble.

- There are a variety of insecticides registered for control of eldana. Any need for the use of insecticides should be based on the results of scouting, specific field characteristics (e.g. variety, soil type) and mid- to long-term weather predictions. Insecticide programmes should be designed taking into account factors such as the effects on natural enemies of the respective products, principles promoted by the Insecticide Resistance Action Committee and respective product label directions. To be certain that these factors are well-represented, design the programme in consultation with a SASRI Extension Specialist.

- Prevent insecticide drift onto indigenous host plants of eldana, as there is a complex of natural parasitoids attacking eldana larvae and pupae in them.

Pink Borer

Sesamia calamistis Hampson (Lepidoptera: Noctuidae)

Identification

Sesamia larvae grow to a length of 40 mm. They lack conspicuous markings and look smooth and shiny. Colour is variable but usually creamy-pink/white. This borer is less active than eldana, and is not a web spinner. The adult is a small khaki to white coloured moth with no obvious distinguishing marks. The pupa does have not have the distinct sagittal ridge on the dorsal side of the thorax, unlike the eldana pupa, and forms in a loose cocoon, made up of silk and frass if beneath a leaf sheath, or is naked in its larval boring.

Late instar sesamia larva

Adult sesamia moth

Sesamia pupa in loose cocoon under leaf sheath.

Biology

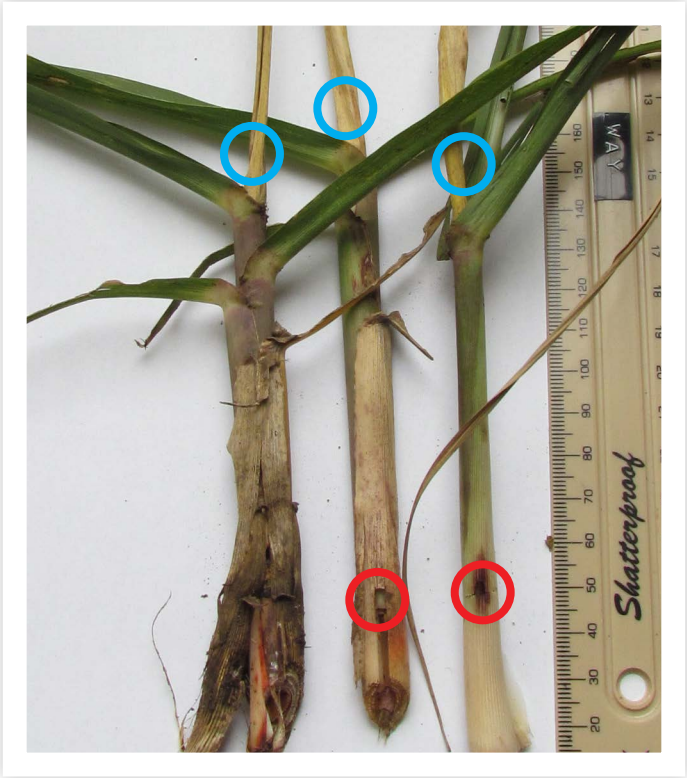
Eggs are laid in batches of about 20 eggs under green and recently dead leaf sheaths with females laying about 300 eggs each over 2-3 nights after emergence. Eggs hatch after about 7-9 days and young larvae bore into the soft tissue of young sugarcane shoots. Larvae take about 30-60 days to develop inside the sugarcane shoot, and/or top portion of the stalk, and pupae take about 10 days to develop. Unlike eldana, sesamia pupae are not encased in a tightly formed cocoon. An entire life cycle takes about 60-80 days.

Damage

Sesamia damage is generally more severe in young sugarcane. The larvae bore into the growing point usually killing the shoot, causing typical 'dead heart' symptoms. Often on splitting open the boring, a foul smell can be noticed.

Control

As with many borers, excessive use of N fertilisers can encourage infestations. Often infestations are controlled by natural enemies and the indigenous parasitoid *Cotesia sesamiae* Cameron (Hymenoptera: Braconidae) is frequently found where larvae are recovered. There are currently no insecticides registered for sesamia control.



Typical dead heart damage (blue circles), and larval tunnel holes (red circles)

Spotted sugarcane borer

Chilo sacchariphagus Bojer (Lepidoptera: Pyralidae)

Identification

The adult is a slim, inconspicuous, khaki-coloured moth. The larva is more striking, being pale in colour but with rows of black spots along the upper surface of the body.

The spotted sugarcane borer is a pest in Mozambique and is thus a biosecurity threat to the South African industry where it has not yet been found.

It is important to not confuse the spotted sugarcane borer *Chilo sacchariphagus with the common* spotted maize borer *Chilo partellus,* which can sometimes be found in sugarcane in South Africa . It looks very similar and can lead to misidentification. **It is thus very important that if such spotted larvae are found, they are sent to a specialist entomologist for positive identification.**

Leaf damage is characteristic for both species, showing ‘shot holes’ in the younger green leaves, often in bands.

Male and female
C. sacchariphagus moth

A late instar *C. sacchariphagus* larva
in the growing portion of a sugarcane stalk

Typical young instar damage to green leaves and 'shotholes' which are rows of holes caused by neonate larvae boring through the uncurled leaf when the young green leaf was still in the whorl stage.

Biology

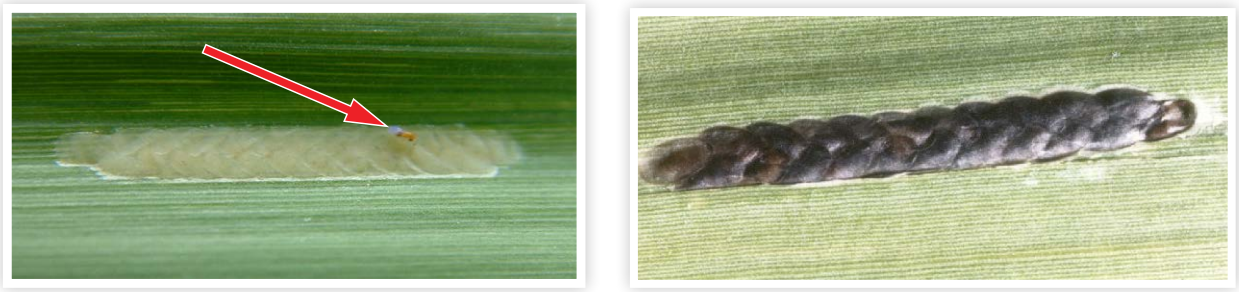
Eggs are laid on the green leaves of sugarcane and hatch after about 10 days. Young larvae move into the whorl and bore into the developing leaves and growing point. The larvae develop over 45 days, feeding on the upper internodes of stalks. The pupal stage, which is not in a cocoon and is found in the larval boring next to a window cut into the sugarcane rind, lasts about 14 days.

Control

There are a range parasitoids available for biological control in other countries such as Mauritius and Mozambique. These parasitoids attack various stages of the borer's life stages. This pest has yet to invade the South African industry. Should it invade, the chemicals used against eldana will be effective against this pest.

A *Chilo partellus* (spotted maize borer) late instar larva being parasitised by a female *Cotesia flavipes* adult (left), and mature *C. flavipes* maggots emerging from a parasitised larva, and pupating in small wooly white cocoons.

A female *Xanthopimpla stemmator* adult parasitoid (left), and a *C. sacchariphagus* pupa in a boring with a *X. stemmator* maggot that has emerged from it (right)



A female *Trichogramma bournieri* adult parasitoid ovipositing in a *C. sacchariphagus* egg batch laid on a green sugarcane leaf blade (top), and a *C. sacchariphagus* egg batch fully parasitised by *T. bournieri* (bottom). The parasitised eggs turn black in colour.

Maize stem borer

Busseola fusca Fuller (Lepidoptera: Noctuidae)

Identification

Adult moths are stout bodied and light to dark brown in colour. Its thorax is densely covered in scales. Larvae are much like sesamia larvae, except larger as they mature. They range in colour from creamy white to pinkish, with a row of smaller black dots (spiracles) along each side of the body. The main trachea can be seen as a light purple line just under the cuticle below the black dot spiracles. Diapausing larvae (dormant in winter) are creamy-white. The pupae is dark brown, and not inside a cocoon.

An adult *Busseola fusca* moth

A late instar *B. fusca* larva. Note the dark line across the body indicating the borer's trachea.

Biology

This species in not common in South African sugarcane yet, but increasing reports of it infesting sugarcane are being received especially in the cooler regions of the sugar industry, where maize grows well. Its life cycle in sugarcane is not yet known. In maize, eggs are laid in clumps behind green leaf sheaths of younger plants. Females can lay between 200-300 eggs under field conditions. Dark brown larvae on hatching, migrate to the whorl and eat the chlorophyll cells in young whorl leaves, causing the appearance of small 'windows' in the expanding leaves. As the larvae grow and feed these windows get larger. In maize, larvae are known to migrate between plants just after egg hatch, and then again 2-3 weeks later when they start to bore into stalks. When larvae bore into stalks, frass is clearly evident. Larvae pupate in their tunnel and pupation lasts for 2-3 weeks. The full life cycle of the insect takes 9 weeks. There are three distinct moth peaks, beginning at the start of the rainy season in October/November.

Control

There are no control options available for sugarcane. In maize, cultural control practices include winter tillage, removal of volunteer plants, and destruction of the stubble, as this is where larvae will lie dormant through winter. Habitat management is also used successfully to manage this pest in maize crops in East Africa, and to a lesser extent in South Africa. These measures are equally applicable in sugarcane, as the same push and pull plants that are used to manage eldana in sugarcane, also manage *Busseola fusca* populations.

Sap Feeders

These are generally small insects that feed by tapping into the sap stream and sucking the juices from the plant. A black sooty mould (Capnodium) often develops on the sticky honeydew which the insects produce and deposit on the plant surface as they feed, and this itself can affect crop development.

Yellow sugarcane aphid

Sipha flava Forbes (Hemiptera: Aphididae)

Identification

Nymphs and adults of yellow sugarcane aphid are yellow on sugarcane, but may be straw coloured to bright yellow or light green on other host plants. Nymphs resemble the adults, but are wingless and smaller. Adults are usually wingless, but winged females do occur, with a body length of 1-2 mm. The aphid has two double rows of dusky coloured spots along the top of the abdomen and the latter is covered in short stiff hairs.

Winged and wingless forms, and nymphs, of yellow sugarcane aphid.

Biology

This aphid is native to North America, but has spread to Central and South America, and to Africa. It was first recorded from southern African sugarcane in 2013 at Pongola and Umfolozi (KZN). It now occurs throughout the South African sugar industry and in Swaziland, Tanzania, Mauritius and Mozambique, and is especially problematic in Zambia. The aphid may occur in dense populations on the lower leaf surface and will spread down towards the base of the leaf or to other leaves after the host leaf becomes discoloured and begins to die. Nymphs mature as adults after 18-22 days and adult females produce 1-5 nymphs per day for about 22 days. Most damage occurs during spring and mid to late autumn. Small numbers of white sugarcane aphid may sometimes occur among populations of yellow sugarcane aphid. The aphids can move actively if disturbed and are easily dislodged from the leaf surface. Adult aphids also demonstrate increased plant-to-plant movement from the late afternoon (as UV index drops) into the night. Plant-to-plant movement occurs via the canopy itself, and also down the plant, along the ground to adjacent plants. They have been observed to move as far as four metres.

Damage

Feeding occurs on the underside of the leaf and initially results in leaf yellowing and reddening, with characteristic brownish-red puncture marks where aphids have inserted their mouthparts to suck the sap. Prolonged feeding leads to an overall reddening or red-brown colouration of affected leaves, and premature death of leaves and stalks. The most commonly affected leaves are the third to fifth green leaves below the growing point of the stalk. The death of three of these leaves due to aphid feeding can cause yield loss of up to 20%. Young plants <1 m in height appear most susceptible, but older plants may also support severe infestations.

Characteristic leaf damage (yellowing and reddening) caused by aphid feeding

Control

Monitoring of fields for aphid populations is important if specific control measures, principally foliar insecticides, are to be implemented, and these should only be used if natural enemies, such as ladybird beetles, fail to keep populations in check. High temperatures (above 35°C) and heavy rainfall can also reduce aphid infestations. There are marked differences in resistance (indicated by degree of aphid leaf damage) of commercial South African varieties to the yellow sugarcane aphid, which can be used to advantage in its management. Where necessary, aphids can be treated with a registered insecticide. The enhancement of plant biodiversity around sugarcane fields is a useful measure to attract and retain insects that are predatory towards yellow sugarcane aphid.

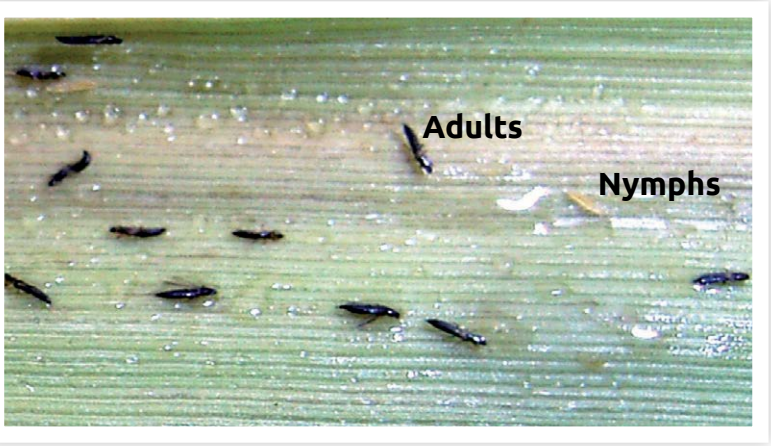
Yellow sugarcane aphids being attacked by ladybird beetle larva

Sugarcane thrips

Fulmekiola serrata Kob. (Thysanoptera: Thripidae)

Identification

Adults are long and thin, less than 1 mm long. They can be seen as small dark specks in the curled central leaf of sugarcane plants. The body of the adult is brown to black and the forewings are light brown with the base pale brown. The legs and antennae are mainly brown to yellow. The first instar nymphs are almost transparent, but become pale yellowish-white after the first moulting.



Sugarcane thrips adults (black) and nymphs (pale coloured)

Biology

Fulmekiola serrata nymphs and adults seek to stay out of the light and live in the central leaf roll and rolled leaves. In the mornings and evenings and on cloudy days, some adults move to the leaf surface. When disturbed, they fly away or jump to another leaf. The adults show strong attraction to tender leaves. Eggs are laid singly on the upper surface of the central leaf roll.

Females oviposit over about a week. Typically one female lays about 80 eggs. After hatching, a transparent, elliptical egg mark can be seen on the leaf. The nymphs gather in the central leaf roll and rarely move. The damage done by the nymphs is often the most serious. The pseudopupae hide in rolled leaves without feeding or moving.

Thrips damage is more severe in water-stressed plants and higher numbers occur on sugarcane that has received higher applications of nitrogen fertiliser. Young and plant sugarcane support higher populations than older and ratoon sugarcane does, respectively. Higher numbers also occur in rainfed rather than in irrigated crops, especially in the coastal regions. Populations of thrips peak during the summer months (December to February), but remain low throughout winter (June to August).

Damage

Thrips lacerate the leaf tissues of sugarcane with their sucking mouthparts and feed on the plant sap. The damaged central leaf roll (leaf spindle) shows yellowish-white blotches when it unfurls. Afterwards, the blotches turn yellow and become irregular patches or stripes, which may cover most of a seriously damaged leaf. Some dead tissue may also be present. The damage is therefore evident on older leaves even though the thrips are not present on these. Feeding results in the young leaf tips becoming withered, bound together, bent downwards and sometimes twisted.

Sugarcane with typical symptoms of thrips damage to young leaf tips (left) and on fully unfurled leaves (right)

Control

A combination of control options is the best approach to managing this pest.

- Alter planting dates to coincide with periods when thrips numbers are lower (March through to August).
- If crops are planted or ratooned during summer, use resistant varieties.
- If using susceptible varieties, treat with a registered insecticide where necessary.
- Adhere to the recommended nitrogen fertiliser rates and avoid crop stress.
- A variety of natural enemies may reduce thrips numbers within the spindles. Constrained use of insecticides will assist in conserving these natural enemies.

Maize leaf aphid

Rhopalosiphum maidis Fitch (Hemiptera: Aphididae)

Identification

Winged and wingless forms exist, with a life history similar to that of the white sugarcane aphid (see page 20). They are distinguished from the latter by their dark grey-green or bluish-green colour, large size - about 2 mm long - and the dark areas around the base of the abdominal horns.

Biology

The aphids form large colonies on leaves, composed of females that reproduce parthenogenetically, i.e. young can develop from unfertilised eggs. There are normally four nymphal instars. Nymphal development is completed in 5 days (at 30°C). The number of nymphs average 68 per wingless female and 49 nymphs per winged female. Wingless females live for about 32 days, while winged females live for only 10 days.

Damage

Best known as a pest of maize, they are also found on sorghum and other cereal crops, and a number of wild grasses. They do not prefer sugarcane and will survive on it for only a few days. Their importance as a pest lies in their implication as a vector of sugarcane mosaic virus. Another aphid species, *Hysteroneura setariae,* is also implicated as an important vector of this disease. Although the maize aphid is a more efficient transmitter of the virus, its numbers in sugarcane tend to be lower than the less efficient but more numerous *H. setariae*.

Control

Control by natural enemies (such as ladybird beetles) is adequate, but should be reinforced by keeping maize, the principal host plant and a potential source of mosaic, away from the vicinity of sugarcane fields where possible. Also, ensure effective weed control.

Note: The spread of sugarcane mosaic virus occurs most commonly in young sugarcane in midsummer. To reduce this risk, avoid planting and harvesting mosaic-susceptible varieties from mid- October to at least the end of January, particularly in mosaic-prone areas.

Maize aphid adults and nymphs. The dark “horns”, or cornicles, are clearly evident on the ends of the abdomens in some of the individuals.

White sugarcane aphid

Melanaphis sacchari Zehntner (Hemiptera: Aphididae)

Identification

Adult females are soft-bodied and vary in colour from pale yellow or green to brownish or pinkish, about 1-2 mm in length, and may be winged or wingless. They have two small tubes resembling horns at the end of their abdomen.

White sugarcane aphid adult winged form

Biology

No males or eggs are found, the females producing young directly, without mating *(parthenogenesis).* The young are wingless and some individuals remain so throughout life. Others, which increase in proportion as winter approaches, develop two pairs of membranous wings in the adult stage.

Damage

The aphids are sap suckers and excrete honeydew onto the plant surfaces, on which sooty mould may develop. The resulting blackening of the leaves often draws attention to a heavy infestation, and the leaf stomata may be blocked by the mould, thereby affecting growth. Newly formed leaves replace those damaged by the aphid and no permanent injury results.

Control

Natural biological control is adequate.

Maize leafhopper

Cicadulina mbila Naudé; ***C. parazeae*** Ghauri; ***C. storeyi*** China (Hemiptera: Cicadellidae)

Identification

Adults are delicate, wedge-shaped insects, 2-4 mm long, with transparent wings marked with longitudinal brown lines at their centres. The head is yellow, while the thorax and abdomen are yellow beneath and brown on top. Two small brown or black spots are found between the eyes on the front margin of the crown of the head of the adult. Nymphs are pale yellow, 2-3 mm long, and resemble adults except for being wingless.

Maize leafhopper adult

Biology

The female inserts very small eggs singly into slits of living green leaf tissue of the host plant, using her ovipositor. Lifetime egg production may average more than 100 eggs per female. Depending on ambient temperature, eggs take 9-21 days to hatch. Nymphal development, in which there are five instars, is completed in a further 14 to 21 days. The nymphs and adults suck juices from the younger green leaves of their host plant. Adults can mate from 2-6 days after the final nymphal moult, but there is typically a longer period before egg laying. The lifespan of the adult lasts 8-50 days, averaging from 8-28 days for males and 14-33 days for females. Below 20˚C the development period is prolonged, explaining the reduced leaf hopper occurrences during winter months. Adults can disperse by flying.

The nymph stage of the maize hopper lifecycle

Damage

The leafhoppers may become conspicuous on sugarcane, especially young foliage, where their feeding causes speckling of leaves. The insect can transmit maize streak virus (MSV). Variety N44 was degazetted due to its susceptibility to the disease.

Control

This is a sporadic pest and there is no registered insecticide for maize leaf hopper control in sugarcane.

Sugarcane plant hopper

Perkinsiella saccharicida Kirkaldy (Hemiptera: Delphacidae)

Identification

Adults are light green, 4-6 mm long, with a longitudinal band in the middle of the rear quarter of the forewing. Nymphs are smaller, thicker bodied and wingless.

Perkinsiella adult

Biology

Eggs are laid in batches of up to 12, with about 20-60 eggs per batch, in the leaf midrib near the junction between the leaf blade and the sheath, where they cause conspicuous red blotches. Occasionally batches of eggs are inserted in the stems and may cause distortion. Eggs hatch after about 5 days. The nymph stage lasts about 30 days and the whole life cycle takes about 40-50 days. Adults are more active and can disperse by short flights from plant to plant. Often, when disturbed, adults do not fly but move away in a crab-like manner to conceal themselves. Sooty mould may develop on the planthopper's sticky honeydew secretions.

Damage

Perkinsiella is an exotic insect from Australasia and is considered a serious pest of sugarcane in other parts of the world where it is a vector of the viral pathogen causing Fiji leaf gall. For example, damage caused by this pest in the USA caused a 17% reduction in yield. Fortunately we do not have Fiji leaf gall in the South African industry and so the pest is not currently a problem.

Control

Natural control by predators and parasites is usually adequate.

Mites
Eriophyidae

Identification

Typically, microscopic eriophyid mites are tiny worm-like arthropods. Gall-formers tend to be more delicate because they remain in the galls they form. However, rust mites tend to be broader and flatter because they remain on the leaf surface.

Biology

There is an egg stage and two to three nymphal stages. The details of the biology of the species on sugarcane are not known, and the following information is from related species. Small white eggs are laid on the leaf surface. They hatch after about 3-7 days. The larva emerges (cigar shaped and about 0.1 mm long). The adult emerges after two nymphal stages and is about 0.18 mm long. The entire life cycle lasts about 3 weeks.

Mite damage to sugarcane leaf, with characteristic red-brown spots.

Damage

Gall mites and especially rust mites can damage the leaves of sugarcane. Such rust-like damage may be confused with the sugarcane disease brown rust (*Puccinia melanocephala*). However, the rust disease leaves a brown stain on the fingers when rubbed along the leaf, while mite damage does not. Such leaf damage can be quite severe, particularly on varieties N16 and N27. Damage is especially prominent after a long dry spell.

Control

Being a rare and sporadic pest, there are no detailed control recommendations. Where mites are known to be a chronic problem, if possible avoid growing varieties susceptible to mite damage (N16 and N27).

Mealybugs

Saccharicoccus sacchari Cockerell (Pink mealybug) **and Dysmicoccus boninsis** Kuwana (Grey mealybug) (Hemiptera: Pseudococcidae)

Identification

Mealybugs are soft-bodied, egg-shaped, pink or grey insects up to 5 mm long, often covered by a white waxy powder. They are found in clusters between the base of the leaf sheath and the stalk, where they suck juice. Grey mealybugs also feed on the leaves.

Biology

Males are rare and the females can produce fertile eggs without mating. The eggs hatch within an hour of being laid and the fairly active nymphs migrate upwards towards the younger internodes of the stalk. As the nymphs grow bigger they become less active, because their legs do not develop in proportion to their bodies. The adults are almost sedentary.

Pink mealybugs feeding at internode

Damage

Mealybugs stunt the growth of sugarcane and there is some evidence that a substance produced by them, or by the bacteria and yeasts associated with them, is toxic to the plant. They are spread to new plants by ants, which tend to exploit the honeydew they excrete. Both pink and grey mealybugs occur in our sugarcane, with the former being more common. They are found in virtually any sugarcane field, and tend to become more abundant when the plant is under stress, e.g. from ratoon stunting disease. Mealybugs are presently of minor importance as pests due to improvements in the methods of handling planting material, which have ensured that sugarcane setts no longer act as a source of infestation.

Control

No control measures necessary as mealybugs are kept under control by natural enemies.

Sugarcane leafhopper

Numicia viridus Muir (Hemiptera: Tropiduchidae)

Identification

Sugarcane leafhoppers are small, inconspicuous insects, which are not easily noticed in the field unless infested shoots are bent over and shaken to dislodge the insects. Adults are bright green, winged, and about 5-7 mm long, with wings slightly longer than the body. Nymphs are wingless, pale green to yellow, smaller than the adults, and secrete stiff threads of wax appearing as a white tuft at the tail end of the body. Adults move by hopping or making short jerky flights.

Numicia adult (winged individual) (right)
and nymphs with wax tufts at tail end of body (left)

Biology

The leafhopper invaded sugarcane from adjacent wild host plants (grasses and sedges) in the early 1960s, and prefers irrigated over rainfed cane. Nymphs and adults feed by sucking the sap from green leaves. Females lay their eggs in a row of punctures in the midrib on the underside of a mature green leaf, towards its tip. This causes a red discolouration, which can be seen on the upper side of the leaf. There are three distinct generations per year, with adult numbers peaking in February, May and October.

Damage

There is evidence that, when feeding, this insect poisons the plant. The first symptom is a weakening of the leaf tissue, which leads to buckling and drooping of the leaves. Later, the leaves become a blotchy yellow colour and often die at the tips and along the edges. In severe cases, the growing point of the stalk is affected, with the stalk becoming soft and limp, especially at the top. This can lead to development of side shoots near the top of the stalk, causing reduced crop yields and sucrose content.

Control

Control by natural enemies (parasitoids of eggs, nymphs and adults) is well established and keeps leafhopper populations below economically damaging levels.

Soft scale

Pulvinaria saccharia De Lotto (Hemiptera: Coccidae)

Identification

Adults have oval, convex, yellow-coloured bodies and are found on the underside of green leaves. They are about 3-5 mm long and are immobile. An infestation is spread by the 'crawler' stage (the first instar nymph), which can be carried by wind and on implements or clothing.

Biology

Details for this species are not known, but a closely related species has the following life cycle, and *P. saccharia* is probably similar.

Pulvinaria saccharia

There are no males, and the female lays her eggs beneath her body on the leaf surface. About 1000 eggs can be laid per female. There are three instars, the first of which is mobile and can be considered the stage that is most likely to spread an infestation. All stages feed on the sap of the plant. The duration of the life cycle for this species is not known, but for the closely related species, *P. iceryi*, it is between 35-60 days under tropical glasshouse conditions.

Damage

Feeding is by piercing the leaf surface and drawing off the plant juices. Infested leaves soon turn yellow, notably on the outskirts of the feeding area, as this is the section of leaf deprived of water and nutrients due to scale feeding. In cases where large numbers feed on a plant, leaves wilt and die. Damage is exacerbated by a black, sooty mould which grows on the surface of the attacked leaves. This reduces photosynthesis and aggravates the effect of scale damage to the plant.

Control

Natural control is normally adequate. However, occasional outbreaks occur, possibly due to drought reducing the efficacy of natural enemies. There is no registered insecticide for scale control in sugarcane.

Froghoppers or spittle bugs

Locris areata and ***L. arithmetica*** (Homoptera: Cercopidae)

Adults are about 7 mm long. Nymphs, which are smaller, are protected from desiccation by the froth or spittle they produce. While not a pest of sugarcane in Africa, they are serious pests elsewhere.

Adults of spittle bugs *Locris areata* (left) and *L. arithmetica* (right)

Soil Pests

These pests occur in the soil and usually feed on the roots of sugarcane plants, with the exception of the longhorn beetle where the older larvae also feed on the lower part of the stalk. By feeding on the root system, soil pests reduce the ability of the plant to take up water and nutrients, to withstand attack by other pests and diseases, and to respond efficiently to farmer inputs (e.g. fertiliser or irrigation).

Plant parasitic nematodes

Plant parasitic nematodes are microscopic, worm-like organisms that live in the soil and feed on the roots of sugarcane plants. To date, over 90 species of 29 different genera have been found associated with sugarcane cultivation. The most important genera being *Meloidogyne, Xiphinema, Pratylenchus* and *Paratrichodorus.*

Identification

Nematodes are microscopic making identification difficult. All plant parasitic nematodes are identified by the presence of a stylet, which is a syringe like device that is used to puncture roots and extract nutrients. Identification to genera and species level is done by a trained microscopist using morphological characteristics such as body length, size and shape of head and tail, swimming movements, position of sexual organs and banding patterns. To ascertain if nematodes are present in a field, soil and root samples should be taken and sent to an appropriate lab for testing. The genera present provide the basis of recommendations for nematode control.

Feeding by nematodes reduces the root system of the plant.

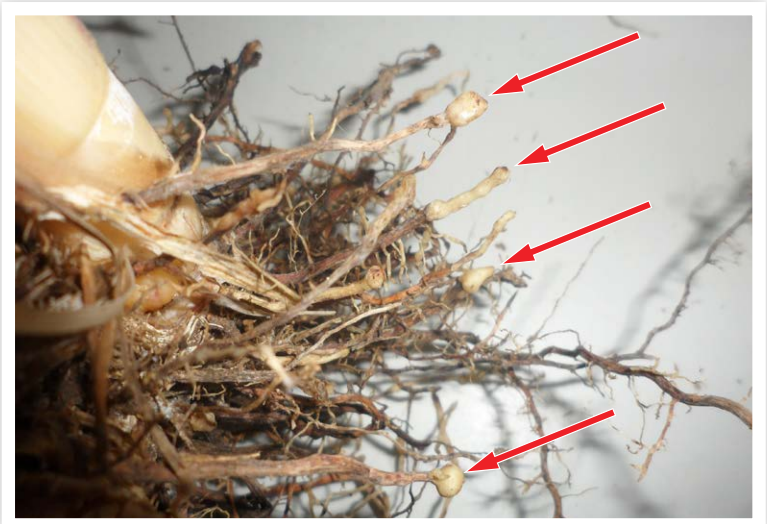
Biology

Nematodes typically have six life stages consisting of the egg stage, four larval (or juvenile) stages and an adult stage. The length of the life-cycle varies for each nematode genus and species and can range from 3-4 weeks for Meloidogyne species to 16-36 weeks for some Xiphinema species. This is however affected by the type of crop, age of crop, soil type and length and type of season.

Damage

Nematodes feed on both the sett and shoot roots of sugarcane. Feeding (mainly by the endoparasitic nematodes, *Meloidogyne* and *Pratylenchus*) on the sett roots of newly germinating sugarcane results in a reduction in the number of new tillers. This results in uneven germination which leads to competition between differently sized shoots and ultimately to a reduction in stalk number. Feeding (mainly by the ectoparasitic nematodes, *Xiphinema* and *Paratrichodorus*) on the newly forming shoot roots results in less uptake of water by the plant which in turn results in reduced stalk elongation and eventually shorter stalks.

Large open rows and reduced stalk elongation due to nematode infestation.



Sometimes galls or swellings at the tips of roots are present. These however are usually very rare.

Control

Once nematodes are present in a field, it is nearly impossible to eradicate them. The best way to cultivate that field is to manage the nematode problem. The variety of recommended solutions available to sugarcane farmers include the use of chemical nematicides, planting tolerant cultivars, planting during the cooler months (when nematode activity is reduced), applying organic amendments as a physical barrier around the cane sett in the furrow at planting and growing suitable green manure crops between sugarcane cycles.

Whitegrub

Coleoptera: Scarabaeidae

The term whitegrub refers to the larval stage of various types of beetles belonging to the scarabid family. South African scarab beetles are problematic in sugarcane and occur throughout our industry. The larval or grub life stage, which lives below ground (in the soil), feed on sugarcane roots. There may often be as many as 30-40 individuals comprising different taxa in the root zone underneath a single sugarcane stool.

Identification

The larvae are characteristically "C-shaped" with a white body, a tan to brown head and often with a bluish-black hind end. The pupae are oval to elliptical, normally found in earthen cells made by the last larval instar, varying from 5-25 mm long depending on the species. They are initially white but over time the pupa becomes darker and reddish-brown in colour. Whitegrub species do not develop cocoons and the body parts or appendages are free and visible from the outside. White grub beetles are robust and hard-shelled. The length of the adults ranges from about 5-24 mm. The body colours of these beetles range from shiny black to pale brown with longitudinal bands and darker margins.

White grub pupae

White grub larva

Adults of different white grub species

Biology

During every wet spring and summer season, mainly from November to January, beetles actively fly throughout all the regions in the industry. After rain and at dusk they leave the soil and actively disperse to locate mates. After mating, the beetles lay eggs singly at the base of the sugarcane plant. Each female lays a total of about 60 eggs. The eggs take two weeks to hatch. The first instar grub or larva feeds on the organic matter present in the soil. The larvae grow in size, and undergo moulting through two further larval or grub stages, called instars. The three larval stages take about 2-3 months to complete development. The second and third instar larvae feed on the plant roots hairs, root-lets and lateral roots of sugarcane plants. White grub larvae are very mobile even in very compacted soil, and once fully fed, the third, and final larval instar, moves down the soil

profile to pupate away from the roots at a soil depth of about 30-60 cm. Beetles emerge from their pupae and move to the soil surface to continue the life cycle. The complete life cycle can take 1-2 years to complete, depending on species.

Damage

Damage causes a reduction in the rate of plant growth, the stalks fall over or lodge, or in extreme cases the whole sugarcane plant dies. Symptoms caused by these insects are often mistaken for nutrient deficiencies or pathogens, and therefore the status of white grubs in sugarcane is often underestimated.

The damage in sugarcane crops that is caused by whitegrub is usually sporadic and localised within fields, and is indicated by areas of patchy or poor growth with yellow leaves and lodged stalks. In extreme circumstances, those plants without roots have no anchorage and therefore lodge.

In young crops, damage in the form of 'dead-hearts' is present. This is caused by adults of *Heteronychus licas* (black sugarcane beetle). Adult feeding symptoms can be identified as a tattered hole just beneath the soil surface on the stalk bearing the dead heart.

Ratoon crops are worse affected than plant crops. Stressed crops seem to generally support higher infestations.

Sugarcane roots damaged by larvae of whitegrub causing 'dead-hearts', root damage and stool and sett damage.

Control

The majority of the whitegrub life cycle occurs underground. They can therefore be detected by digging out poorly growing stools and searching the roots and surrounding soil for life stages. Once detected, field populations can be reduced by replanting and implementing deep ploughing and harrowing between crops. This action will physically kill the larvae. In addition, larvae on the surface will be predated on by birds and small rodents. In fields with high infestations of whitegrub, manipulate the planting date to avoid synchrony between swarming adults and the presence of stalks less than 50 cm in height, because they are unable to feed through the rind of taller stalks. There are currently no registered chemicals.

Longhorn Beetle

Cascosceles newmannii Thomson (Coleoptera: Cerambycidae)

In 2015, this pest was discovered for the first time attacking sugarcane at Entumeni, inland from Eshowe in the Zululand region of KwaZulu-Natal. This pest is currently restricted to the Entumeni area.

Identification

Larvae are yellowish to creamy whitish and range from 2-9 cm in length. The body is distinctly segmented, relatively smooth and thick skinned. They have enlarged thoracic segments behind the head. The pupae are soft bodied and encased in a soil cocoon. Adult beetles are tan to light or dark brown in colour. Males are on average 47 mm in length while females are 35 mm. The mandibles of males are greatly enlarged.

Biology

The approximate development period of the longhorn beetle grub is two years. Females lay single, yellow, elongated eggs, most probably in the soil around the base of the stalk. One female can carry up to 3 000 eggs in her abdomen. After the larvae emerge, they feed on the roots and eventually penetrate the base of the sugarcane stalk, where they form tunnels 8 – 30 cm upwards into the stalk. Only one larva has been found per stalk in the field. The pupal stage of the beetle is about one month and is encased in an earthen cocoon in the soil below the sugarcane stool, at about 20 cm depth. Adults emerge from late January to the end of March. Females appear to be sedentary and spend more time on the ground, while the males are strong fliers. Mating takes place on the ground. The adult stage of the beetle, which apparently does not feed, usually lasts a month.

Stalk damage as a result of longhorn beetle (above) as well as the various stages of the beetle through the larval to pupal stages leading to the male and female beetles. The male on the left has large mandibles, while the female on the right has small mandibles.

Damage

Larval damage consists of hollow tunnels made into the below-ground section of the sugarcane stool and up to 20 cm above the ground into the sugarcane stalk. Areas infested with larvae are characterised by stunted and lodged stalks, brown leaves or dead hearts. Infested stalks are easily pulled from the ground indicating a weakened root system. The tunnels caused by this pest are evident on the cut surface of sugarcane stubble and at the bottom end of harvested stalks. Feeding by this pest hollows out the inside of the stalk leaving the rind intact. Borings are larger than those caused by eldana.

Control

Current control measures include harvest and plough-out of the sugarcane crop immediately after detection. A fallow period of at least one year must be implemented.

Termites

Hodotermes spp.* and *Macrotermese spp. (Isoptera)

In South Africa termites, called white ants, do not normally harm growing sugarcane but they may use it as a source of moisture during dry periods.

Identification

Termites are soft-bodied, creamy coloured insects that are found in groups in the soil. They have distinct types comprising soldiers and workers.

Termitarium in sugarcane.

Debris from termite activity.

Biology

Termites are social insects and colonies comprise soldiers, workers and reproductives (Kings and Queens), one pair per colony. Once established, a colony is essentially ageless, with winged reproductives being produced annually, around November.

Damage

Damage to sugarcane is rare and is often associated with drought conditions when the termites will attack sugarcane setts or the lower parts of stalks.

Control

In the sugar industry, insecticide treatment is rarely needed. Often where termites are a problem, irrigation can reduce the impact that termites have.

Nitidulid beetles

Carpophilus spp.

Nitidulid beetles are small shiny black or dark brown in colour. They are 3-4 mm long with clubbed antennae. Their wing covers or elytra are truncated (short) leaving the hind end of the abdomen exposed. The larvae are slender, creamy-white grubs which reach a length of about 6 mm. Larvae and beetles are sometimes found in setts that have failed to germinate. They may be attracted there by fungal growth or by fermenting vegetable matter. This is regarded as a secondary pest.

Adult (dorsal and lateral view).

Earth pearls

Margarodes spp.

Earth Pearls are the encysted larvae of a sucking insect that feeds on the roots of sugarcane. They appear as yellow glistening spheres on the soil surface. They are often found in large numbers in the soil or on the surface near roots when land is prepared for replanting. Earth pearls can damage roots of poorly developing crops. While not an important pest in South Africa, it deserves mention because it often attracts attention when present in large numbers.

Trash caterpillar or ratoon worms

Mythimna phaea* Hampson and *Mythimna spp. (Lepidoptera: Noctuidae)

Identification

Adult moths are the colour of crop residues, and the caterpillars are striped in alternate light and dark shades of a brown-grey or light green-yellow colour.

Leaf Feeders

These insects feed on the sugarcane leaves. In so doing they reduce the leaf photosynthetic area, which can have an impact on crop yield. These pests however are usually localised within specific areas in the industry and are not usually widespread.

Armyworm

Spodoptera exempta Walker (Lepidoptera: Noctuidae)

Identification

Army worm moths are dark coloured, with brown to black forewings and white hindwings. The larvae, which attack the leaves of young sugarcane, and especially of young plant sugarcane, are green and black in colour, with longitudinal black stripes and a green underside.

A gregarious morph of an army worm larva. The dark colour is a distinguishing feature.

Biology

Moths lay eggs in batches of about 10-600 on leaves, and cover the eggs with black hair scales. A single female lays about 1 000 eggs over a period of up to 6 nights. Eggs hatch in 2-5 days. After emerging, the larvae drop from the oviposition site on silken threads, to be dispersed by wind. Once located on a host plant they start feeding. There are normally 6 larval instars and food consumption increases rapidly in the latter stages of development. The larvae can occur in two 'phases' – a gregarious phase and a solitary phase. Gregarious larvae are predominantly black and very active and older gregarious larvae may 'march' in large numbers (hence the name 'army worm'). This usually happens when food runs out or when development is complete and they are searching for pupation sites. Solitary phase larvae are predominantly greenish and cryptic in their behaviour. They are sluggish, and actively avoid the sun. Full grown larvae burrow into soft, damp soil to construct a silk-lined chamber 2-3 cm below the surface, where they pupate. The pupal period lasts about 10 days. On emergence the moths migrate over large distances.

Damage

Mature sugarcane is usually not severely damaged, but young plant crops can be completely defoliated, as the larvae eat the leaf blades, leaving only the harder leaf midrib. Outbreaks occur in late summer when growth is usually good, so that the sugarcane usually recovers quickly. However, the destruction of the crop canopy may necessitate additional weeding.

Control

Armyworms are controlled naturally by diseases and parasites.

Grasshoppers/Locusts

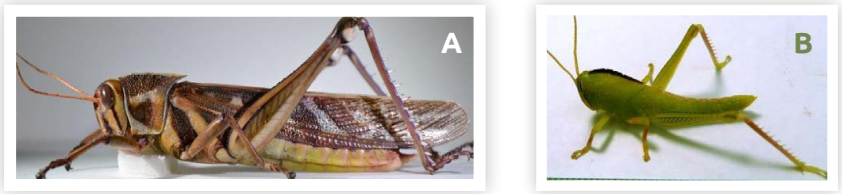
There are several species of grasshoppers/locusts that occur in the SA sugar industry, and many have the potential to cause significant damage. The red locust is the species that needs closest monitoring, because it swarms and can migrate long distances. However, not all grasshoppers/ locusts are pests. For example small black hoppers, found on grasslands, or on grass in abandoned fields next to sugarcane, grow into the multi-coloured "elegant grasshopper" (Zonocerus elegans) and do not move into sugarcane in high numbers.

Identification

Because of the similar appearance of the various species of grasshoppers/locusts, it is necessary to consult an expert for identification and advice on whether control measures are necessary.

Red Locust (Nomadacris septemfasciata) adult male (A), gregarious type hopper (B) and solitarious typeb hopper (C).

Petamella prosternalis adult male (A), brown coloured hopper (B) and green coloured hopper (C).



Bird Locust (Ornithacris cyanea) adult male (A) and hopper (B).

Biology

Generally, locusts occur in two different types - solitary and gregarious (swarming), whereas most grasshoppers do not have a swarming phase. The timing of the life cycles of different species vary greatly. The red locust breeds at the onset of winter and persists over winter in the adult stage while Petamella lays its eggs before winter and then dies. Hoppers of most species start emerging from their egg packets in the soil from end of October/early November.

Damage.

Locusts are particularly damaging as they have adults that can swarm and migrate thereby causing extensive damage. When hoppers are in their gregarious phase, they can devastate a crop by feeding in very large numbers, stripping off all the green leaf material and leaving only the bare midrib. Although grasshoppers do not swarm and migrate, they can build up into large local populations, which as adults can be devastating, especially Petamella.

Control

Control is most effective during the hopper stage, but **only those species identified as sugarcane pests should be controlled.** The most effective control measure is to scout for hopper (gregarious morph) bands in spring (October through to November) and treat with a registered insecticide. These are normally aggregated (see below), and will be easy to treat. Prevent hoppers reaching the adult stage as treating swarming adults is notoriously difficult and expensive. As oviposition sites are in bare ground, it is recommended that during the red locust's oviposition period (October through to December), a crop residue (trash) cover is left on the bare soil after harvest, and that other bare soil patches surrounding sugarcane either be planted with a green manure or other ground cover crop to reduce suitable oviposition sites.

Hoppers of the red locust in their gregarious phase typically clumped together. Scouting should take place for these, and when found can be spot treated with a registered insecticide or biocide.

Trash caterpillars found in a crop residue blanket.

Biology

Eggs (about 500 in total) are laid on the base of leaves or on crop residues. These hatch in about 7 days and the larvae disperse. The larvae feed on the green leaves during the night and hide under the crop residue blanket during the day. The larvae develop over a four week period and pupate in a cell in the soil. Pupal period is about 10 days. The entire life cycle lasts between 40 and 60 days.

Damage

The larvae attack the leaves of young ratoons between April and November, eating the leaf blades but leaving the midrib. They are capable of defoliating the crop completely. Serious damage can cause losses of up to 17 tons cane/ha. They are a problem only when mulching is practised rather than burning.

Control

A wide variety of parasitic insects and pathogens attack trash caterpillars in the field and are important natural controlling factors. Usually, by the time an outbreak is noted, it is already under control by natural enemies and insecticide application at that stage will not help.

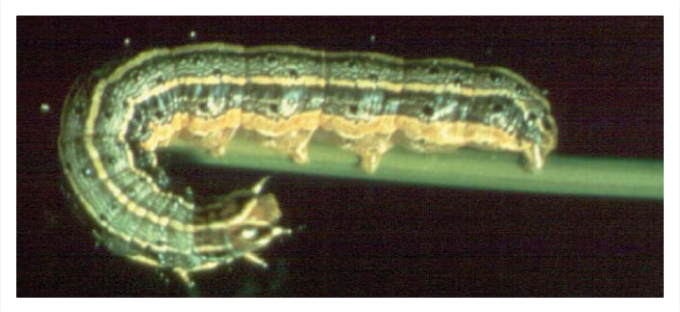
Fall armyworm

Spodoptera frugiperda (Lepidoptera: Noctuidae)

This insect from North America feeds on many plants and has recently been recorded moving through maize areas in eastern and southern Africa. In 2017 it was recorded from maize fields on the northern borders of South Africa. It has since spread to maize and sorghum in the sugarcane growing areas of Mpumalanga and KwaZulu-Natal. Although fall army worm was recorded on young plant sugarcane of N57 in the Malelane area, the infestation was very minor and successfully suppressed with insecticides used to controll this pest in maize.

Identification

The moth is ash-grey with mottled front wings and white or light grey spots near the tips and approximately 32-40 mm in length. The back wings are white with a narrow, smoky brown edge. The eggs are light grey and covered with greyish fuzz. When fully grown (51 mm), larvae vary in colour from light green to almost black with several stripes along the body. The dorsal surface of the head capsule is marked with a light-coloured inverted “Y” .



Fully grown fall armyworm larva.

Fully grown fall armyworm larva. Note set of four dots on the end of the abdomen.

Biology

Moths become active at twilight and feed on nectar. They have an average life span of 2-3 weeks. The female moths lay eggs at night in masses of up to several hundred on light-colored surfaces, such as fence rails, tree trunks, and the underside of tree limbs. These masses darken with age, and the eggs hatch within 2-4 days. All the eggs within a mass hatch at about the same time. The enclosed larvae spin down to the ground on silken webs and begin to feed. Development from egg to fully grown larva requires about 2-3 weeks. At this point, larvae burrow into the soil and form pupae. The moths emerge in about 10-14 days.

Larva Pupa in leaf roll

Control

In USA, where this pest is prevalent, integrated control is practised. These include monitoring techniques, field scouting methods, pheromone traps, biological control and cultural methods. Insecticides have provisionally been registered against this pest in South Africa to control any outbreaks and prevent spread of the pest.

Leaf folder moth

Marasmia trapezalis Guenee (Lepidoptera: Crambidae)

This moth can be quite common, but not seriously damaging to sugarcane leaves. The larvae knot the tops of sugarcane leaves and feed on the leaf surface. Larvae are yellowish or greenish. Leaf folder moth is controlled by wasp parasitoids. Their white barrel-shape cocoons are found in the folded leaf blade.

Larval stage of the insect feeding on sugarcane leaf

Leaves folded by the insect

Larvae

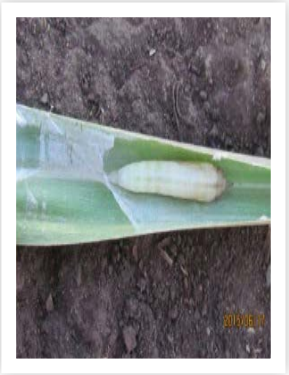
'Tube feeding' moth

Parnara mathias Fabricius. ***and P. detecta f. karschi*** Aurivillius (Lepidoptera: Hesperiidae)

The larvae can damage seedlings by rolling the leaves into tubes in which the larvae live. Never reported as a serious pest.

Leaf roll made by moth larva

Larva



Pupa in leaf roll

Tussock moth

(Lepidoptera: Noctuidae) Unknown species.

An unidentified Tussock moth occasionally feeds on sugarcane leaves but is not cause for concern.

Larva

Ogoa simplex

Lepidoptera: Erebidae: Lymantriinae

The larval stage of these moths are very rarely seen feeding on sugarcane.

Larva

Pupa

NOTES

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