THE BANANA BORER

By W. Victor Harris, Senior Entomologist, Department of Agriculture, Uganda

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Introduction

In 1824 a black weevil—one of the group of beetles whose heads are drawn out into a snout or proboscis—was described by Germar under the name of *Calandra sordida,* from "India orientali". What eventually proved to be the same insect was in 1845 called *Sphenophorus striatus* by Fahraeus, whose specimens came from Brazil. The name was changed to its present form, *Cosmopolites sordidus* by Chevrolat in 1885, who gave as its known distribution Brazil, Java, Ceylon, Malacca, Saigon, China, Réunion.

It is first mentioned in connexion with bananas by Fletraux and Salle in 1889 in their account of the beetles of Guadeloupe, as being common in rotting bananas. But it was not until 1906 that it was regarded as a pest of bananas, and an account given of its destructive powers on the Island of Sao Thomé in the Gulf of Guinea. It appears to have been observed as a pest about the same time in localities as far apart as Madagascar and Fiji, so that there is no indication of where it originated or how it spread, except that it probably moved around the tropics with the edible banana as it was spread by man from its original home in the East Indies.

On the African Continent it was first observed in the lower Congo in 1913. Next comes Gowdey's report of it in Uganda in 1918, with his opinion that it is not of recent introduction. Though not recorded by the Germans in Tanganyika prior to 1914 it was found to be well established at Amani by A. H. Ritchie in 1922. By 1936 banana weevil had been recorded in most parts of Uganda. Four years later it was found established in the adjoining Bukoba district of Tanganyika and on islands in the extreme south of Lake Victoria. In 1945 the writer identified specimens of the pest from Zanzibar, and, in the following year, from the Kilimanjaro area of Northern Tanganyika. In the same year it was stated to be generally distributed in the French West African colonies.

A considerable time elapses between the first arrival of *Cosmopolites* in a new area and its becoming a serious pest. Hargreaves (1940) estimated that this took about ten years in Uganda.

Notes on the Damage

The banana borer lives in the rhizome or "bulb" of the banana plant. The young grubs destroy a considerable amount of tissue by eating their way in irregular tunnels through the rhizome. In the case of older plants, this reduces their vitality and resistance to drought, causing poor bunches of fruit to develop on stems too weak to resist high winds. The suckers developing in a heavily infested stool are weakly and slow growing, thus interfering with regular cropping.

Young plants, especially suckers newly set out, are seriously affected by borer attack as they are not in a position to replace damaged root tissues as fast as the borer destroys it. So they are stunted, and ultimately the roll of unopened leaves goes yellow, withers and dies.

Depending on the degree of infestation by borer, a banana garden will become progressively less productive as general conditions of cultivation deteriorate. Vigorous stools support quite a high population of borers without visible effect, but given a drought, a reduction in soil fertility, or faulty cultivation and the bananas will show a disproportionate distress. The establishment of new gardens is more difficult in localities where borers are abundant. In other words the importance of the banana borer depends on suitability of the climate and soil for banana growing, and to the degree in which careful cultivation is employed to make up for any deficiencies in either of these respects.

Life History and Behaviour

The borer has four distinct stages of development—(1) the egg, (2) the larvæ or grub, (3) the pupa, and (4) the adult weevil.

The egg is 1/12th in. in length, oval in shape and white in colour. The female weevil makes minute cavities near the base of a leaf in a growing plant, or in the side of a piece of cut stem on the ground and deposits her eggs singly in them.

The grub hatches out in from five to eight days depending on the temperature, and immediately starts to bore deeper into the rhizome or other tissues. Here it feeds and grows for two to three weeks. Fully fed, the

grub is half-an-inch long, smooth, fleshy, legless, and white with a conspicuous red-brown head.

The pupal or dormant stage lasts for five to seven days during which time the colour darkens slightly as the insect beneath its outer skin changes into adult form and takes on a brown colouring.

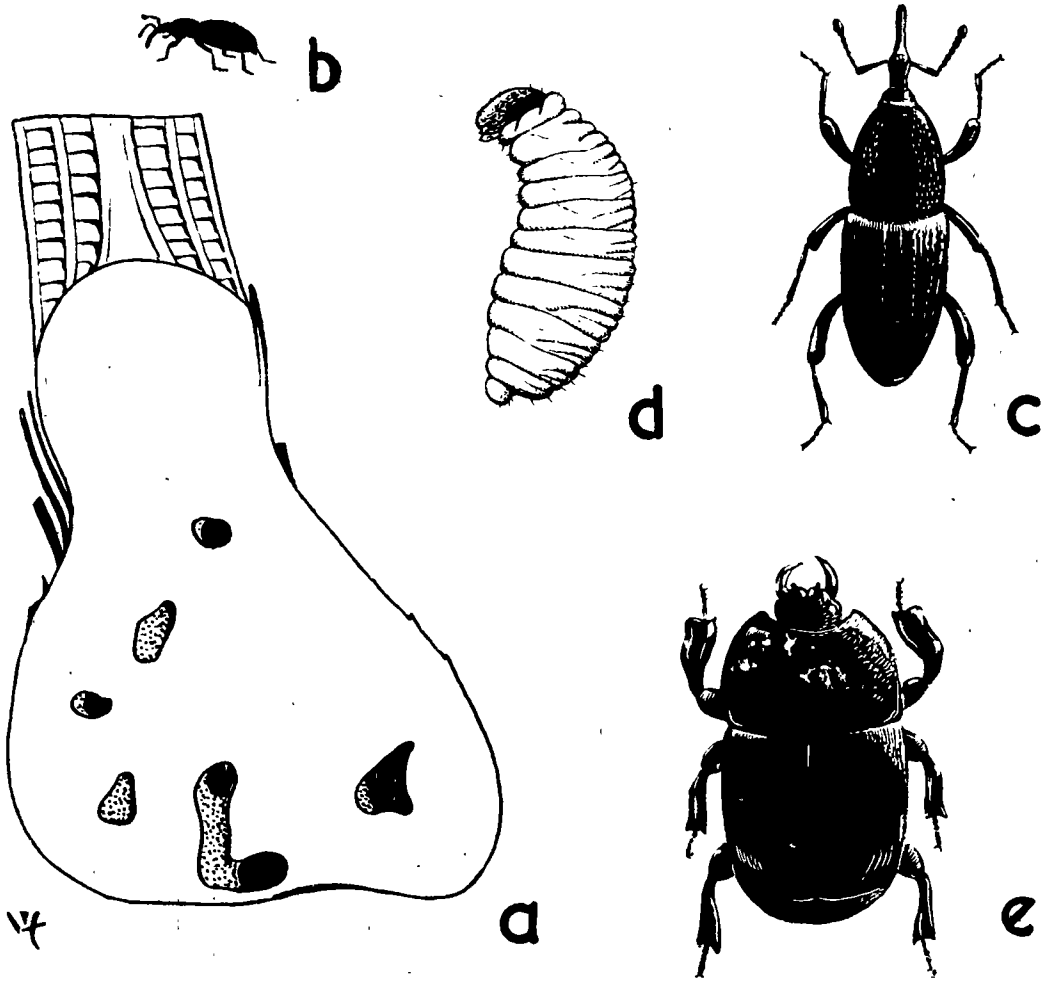
The weevil emerges, soft and brown, from the pupal skin and remains quiescent within its tunnel until its skin hardens and becomes almost black. It is half-an-inch long. Then it eats its way out to the surface, and takes shelter in the ground or under trash. It is a sluggish insect and is most active during the hours of darkness.

The time taken from one generation to the next is approximately a month under favourable weather conditions. It is believed that the adult banana borer can live two years.

Though the adult borer has wings there is little evidence that flying is a normal habit. In Fiji experiments indicated flight on warm humid nights at certain seasons of the year, but in New South Wales [Wallace, 1938] this could not be demonstrated and the spread of marked weevils collected in traps appeared to be comparable with walking ability only. Other results of the New South Wales experiments on migration showed that weevils had a fair range and frequency of movement between contiguous stools but that a strip of *Paspalum* grass varying from 12 to 24 yards wide proved an almost complete barrier to migration into an uninfested banana plot.

CONTROL

The obvious first step for the control of banana borer is to ensure that when planting suckers they are not already infested with grubs. Suckers should be dug up as required



THE BANANA BORER, *Cosmopolites sordidus*

(*a*) Section through a rhizome showing borer tunnel; (*b*) the adult borer, natural size; (*c*) adult borer × 3; (*d*) borer grub × 3; (*e*) the predatory beetle *Plaesius javanus* × 3.

for planting and not allowed to lie about overnight and act as bait for weevils. They should be freed from rotting sheaths where weevils might be hidden and then carefully examined for borer tunnels: paring away a thin layer of the rhizome will remove any eggs recently laid and expose any tunnels. Suckers showing extensive tunnelling should be discarded.

Planting the suckers with care so that they grow rapidly is the next step to avoid borer damage. Wallace [1938] has demonstrated in Queensland how planting suckers in holes six inches in diameter with unbroken sub-soil, followed by no weeding or tillage resulted in most of them being destroyed or seriously damaged in six months, while adjacent plants that had gone into holes twelve inches square with the sub-soil loosened and were kept free from weeds were all healthy and well developed.

Care of the banana field is generally recognized as being the main factor in borer control. According to Edwards (1934) in Jamaica "on most banana lands where a relatively high standard of cultivation is practised and wherever reasonable attention is given to field sanitation, the borer does not perceptibly affect fruit production", and that while "under complete economic control on the estates where a high standard of cultivation is practised, it is still very abundant where bananas are not grown intensively, as little or nothing is done under such conditions to combat the pest". Tillage and weeding are of primary importance throughout East Africa and with the establishment of a good mulch are all measures essential to maintaining the vigour of the bananas. As Smith (1939) has found in Australia, while some insects attack plants irrespective of their vigour, it has now been established that the susceptibility of a banana to weevil attack is largely determined by its vigour. To prevent the borer population reaching a dangerous level attention must be given to the regular removal of breeding places after a bunch has been taken. The spent stem requires to be cut off as near the ground as possible, and not left to rot in situ. In localities where it is the custom to leave these stems to help the growth of the next sucker, or to plant out suckers with a piece of old stem attached, they should have their tops sliced off as they start to rot, and the pieces buried. Old stems lying about will provide breeding places if not split up.

When suckers are removed from a stool or a rhizome cut for any other purpose, the cut surface must be covered with soil and not left exposed to attract weevils. Pieces of old rhizome removed in trimming a stool should be split up into small pieces.

Trapping borers is practised in many parts of the world. It is a useful addition to good cultivation if carried out with reasonable care. Pieces of well grown stems are used to attract the weevils, and may be either slices across the stem about three inches thick or else pieces of stem split lengthways and 18 in. long. These baits are placed on the ground in or beside a stool and covered with trash. They are left in position for three weeks and then removed and destroyed together with the weevils they have attracted. Fresh pieces of stem are then placed in the same position. They must not be forgotten, otherwise they will simply provide additional breeding grounds and aggravate the position. Baits inspected weekly can be used to obtain some idea of the degree of infestation in a banana garden. It is a waste of time to bait as a control measure in gardens where bananas are otherwise neglected. Good results have been obtained in Jamaica [Edwards, 1934], Congo Belge [Steyaert, 1944], and Queensland [Wallace, 1938].

A banana grower should not be discouraged from taking steps to reduce weevil attack on his land because his neighbours' gardens are neglected. Nor should this be used as an excuse for failure to have kept a banana garden in good heart. As Edwards told the Jamaica banana growers: "Contrarily to what planters generally believe by making wrong analogies with other agricultural insect pests which have different habits and biological peculiarities, the banana borer is not one of those pests which suddenly burst into plantations and effect much damage in a short time. When the borer population of a district or of a particular field is observed to be abnormally high, this should not therefore be ascribed to sudden outbreaks nor to mass migration from distant foci. An abundance of the pest in a field is the result of a cumulative increase of the insect population in the field itself or in the immediate vicinity during several generations and this indicates that measures of control have been inadequate during relatively long periods and that field hygiene has not been judiciously practised". At the same time concerted action by all the growers in one locality will produce a better return for the labour and more permanent results.

Biological Control

The idea of controlling an insect pest by introducing natural enemies is an attractive one. It is most likely to succeed in practice when the pest has arrived in a new country without the enemies which keep it down in its original home. The method is then to seek out the parasites and predators which attack the pest in its country of origin and try and establish them in the new one.

With the expansion of commercial banana growing in the early part of the present century, damage due to the borer weevil took on a more serious aspect. In 1912, the Fiji Department of Agriculture sent F. P. Jepson to Java to investigate the natural enemies of *Cosmopolites*. He found a beetle *Plaesius javanus*, of the family Histeridae, to be the main enemy of the borer there, and succeeded in conveying 3,792 living specimens to Fiji where they were liberated in 1919. Five years later *Plaesius* was found to be established over a wide area of Fiji, which in 1936 began to be a source of supply for other countries.

An attempt to establish *Plaesius javanus* in New South Wales in 1915 was a failure. No great success was achieved in Jamaica in 1918 and 1919, but a further attempt with Fiji material in 1937 and 1938 appears to have been successful. In a number of Pacific Islands good results have been obtained.

Three consignments of *Plaesius javanus* were sent from Java to Uganda in 1934 and 1935. They did not travel well and the few survivors cannot be assumed to have retained their full vigour. However they were liberated on a small island in Lake Victoria where the bananas were heavily infested with borers. Visits were paid to the island in 1937 and again in 1945 but no living *Plaesius* were discovered, and the damage done by borers in the banana gardens is said to have increased.

A second natural enemy of the banana borer was discovered in Malaya in 1936. This is a beetle *Dactylosternum hydrophiloides*, of the family Hydrophilidae. It was introduced into Queensland in 1938 and two years later Veitch (1941) reported that it was increasing rapidly.

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