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YAM WEEVIL, PALAEOPUS COSTICOLLIS MARSHALL
(COLEOPTERA; CURCULIONIDAE; CHRYPTORYNCHINAE) By MICHELLE SHERWOOD[1]

INTRODUCTION: The yam weevil, *Palaeopus costicollis* is a pest of quarantine importance on yams exported to the United States from Jamaica and hence requires methyl bromide fumigation as a phytosanitary treatment. Under the Montreal Protocol methyl bromide will be phased out by 2015 bringing about the need to identify alternatives to this fumigant. This prompted an investigation into the biology and ecology of the pest to identify alternative management methods. The information below is a compilation of the information garnered to date.

DESCRIPTION: The **eggs** are 0.71mm long and 0.4mm wide opaque creamy white in colour and elongated in shape. The **larval** stage has four instars with sclerotized brown head, and white body, which progressively becomes yellow at each instar. Larvae are scarabaiform larva i.e. legless, with a cylindrical C-shaped body (Figure B). The pupa is 3.2 – 4.9 mm long and 1.8 – 2.5 m wide. The **pupa** is a typical exarate coleopterous type i.e. pupating without being enclosed in a cocoon. Instead, before pupating the last instar larvae will encase itself in residue from the yam tissue material. The legs are folded back on themselves, and like the body, is initially light yellow in colour, then becomes brighter yellow, progressively brown then dark brown as the pupa matures. The **adult** female is 3.9 mm long and 1.90 mm wide and the male 3.6 mm long and 1.8 mm wide. The body is uniform dull black, while the appendages are reddish brown. The body has erect stiff scalelike setae, which are dark brown in colour.

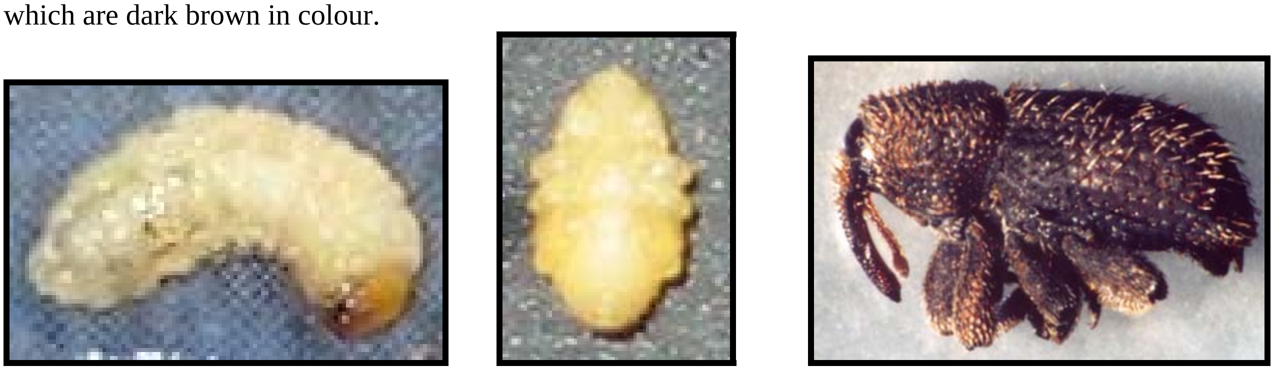
A B C

Figure 1: Larval (A), Pupal (B) and Adult (C) stages of the Yam Weevil, *Palaeopus costicollis* Marshall

DISTRIBUTION: The presence of this insect in the Caribbean was thought to be as a result of the travel and trade by man to areas where yam had been cultivated for centuries and with which these insects have been long associated (Coursey, 1967). *P. costicollis* has also been reported in Cuba (Kasasian *et al.*, 1986) Haiti and West Africa (Purseglove, 1978). A survey conducted in Jamaica from 1999- 2000, determined that this pest was distributed island wide in all yam growing areas (Sherwood, 2004). Other species of the genus *Palaeopus* Faust. are mainly located in the Caribbean *P. grenadensis* Faust in Grenada found at Balthathar Windward side; *P. subgranulatus* Faust in St. Vincent; *P. adspersus* Faust and *P. laticollis* Faust in Venezuela (Marshall, 1917).

HOST RANGE: *P. costicollis* is a polyphagous pest which feeds and reproduces on the mature food storage areas of sweet potato (*Ipomea batatas*) (Edwards 1949), ginger (*Zingiber officinale)* (USDA, 1995; Sherwood, 2004) and most species of locally cultivated yams i.e. *Dioscorea cayenensis, D. rotundata D. alata* and *D. esculenta* (Sherwood, 2004). All wild related species of the above plants are considered potential alternative hosts of the pest (Sherwood, 2004) of which there are four known related wild species of *Dioscorea*, 10 of *Z. officinale* and 32 of *.I batatas* in Jamaica (Adams, 1972). The Acom yam variety (*Dioscorea bulbifera*) was not found to be a suitable host for yam weevil (Sherwood, 2004).

DAMAGE SYMPTOMS:

The injury caused by *P. costicollis* is very similar to that of *Cylas formicarius* and *Euscepes batatas* in sweet potato (Ritchie, 1918). The adults will cut into the yam cortex with their sharp mandibles creating holes 2 mm deep. However, the larvae do

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the most damage, as they will chew on the interior of the yam tissues starting from near the cortex after hatching to the center of the yam as they mature. Many tunnels are created by the larvae, becoming larger as the larva matures. The yam tissues then become dark brown as the tissues are predisposed to infection from pathogens. Pupation takes place near the yam surface; the emerging adults chew their way out creating holes 2 mm wide

Figure 2: Damage caused by yam weevil to yam tuber (*Dioscorea* sp.) and ginger rhizomes (*Zingiber officinale*)

BIOLOGY AND ECOLOGY:

Sex Differentiation: The male possesses a depression on the first abdominal segment and 2/3 of the rostrum is coarse while 1/3rd is smooth. The first (2/3rd) abdominal segment in the female is flattened with no depression and 2/3rd of the rostrum is smooth while 1/3 rd is coarse.

Lifecycle, fecundity and behavior: The female weevil will chew 2 mm inside the yam periderm, oviposit its eggs singly followed by the holes being sealed. Each female is able to oviposit between 21 - 80 eggs in 24 hours. The duration of the lifecycle between egg to adult stage is 6 – 10 weeks depending on the yam variety. Generally the lifecycle duration for each stage is, eggs 5 – 7 days, larvae 24 – 40 days, and pupae 12 –20 days (Sherwood, 2004). Yam weevil is a multivoltine pest with up to six generations per year as yams are planted throughout the year. The population of the weevil exists in a 1:1 ratio, male: female; the adult weevils prefer shaded and cool areas; the yam weevil possesses no flight wings as the elytra is fused along the middle and hence is unable to fly, hence, when disturbed the adult weevil will feign death by falling on their back or side and remain motionless until danger has subsided, a behavior typical of species in the family (Sherwood, 2004). The weevil will crawl on the soil within the field and is transported to other fields by the movement of yam heads from one farm to the other purchased by farmers as planting material (Sherwood, 2004).

Effect of abiotic factor on Population Dynamics: The results of an on farm crop/ pest phenology study identified a number of factors impacting on *P. costicollis* population (Sherwood, 2004). There is no relationship between rainfall levels and yam weevil populations (Sherwood, 2004). The entire lifecycle of the weevil takes place inside the yam tuber and is only interrupted by the change in the plants biochemistry depending on the stage of the crop. The larval, pupal and adult stages of the yam weevil were only detected at the first three to four months after planting and the adult at harvest when the crop reached maturity (9 months) and no stage present between the 4th – 8th month of the crop. The break down of starch to the sugar, mannose, has been reported to occur in mature yams (Brookes, 1977), hence, the suitability of mature yams for adult weevil oviposition. The presence of a terpenoid especially in yellow flesh yams during the immature stage of the crop prevents feeding and hence oviposition by yam weevil, as it is bitter to the taste and is toxic (Martin *et al*., 1975). It is for this reason that field populations are low despite having six lifecycles per year. A third factor which may reduce the level of damage in the yam tuber is its morphological protective coat which is hardy on the outside and sticky on the inside as is the case in many other intact agricultural products (Eden, 1952; Samuel and Chatter, 1953).

Factors that impact on yam weevil presence: In an island wide survey conducted between 1999 -2000 in major yam growing areas in Jamaica (Sherwood, 2004) several on farm practices were identified that affected the population of the weevil. It was determined that the use of infested yam heads as planting material, from the previous crop or bought from other farmers within or outside the district was the main source of infestations. The partial burying of yam heads at planting, the practice of leaving yam heads to burn and the heaping of yam heads on hills to burn are also farmer practices that favour the growth of the weevil population. The practice by farmers to delay harvesting yams predisposes the yam to weevil infestation, for as the yam matures it is more likely to become infested. The presence of alternative hosts within or near yam fields as well as the coexistence of nematodes and yam weevil implies that the nematode damage predisposes the yam, to yam weevil infestation and vice versa. Farmers typically reused the same lands for cultivation each year.

IMPACT: Farmers surveyed from 1999-2000 (Sherwood, 2005) reported no loss or damage to their crop due to this pest. No yam weevil damage was observed on yams harvested during a crop/pest phenology study. Yam weevil is a storage pest which can cause occasional damage in the field (Edwards, 1949; Sherwood, 2004). It has the potential to become economic if infestation levels in the field increase sufficiently. In addition, if infested tubers are stored for long periods, the damage level may become economic (Sherwood, 2004). The research carried out (Sherwood, 2004) determined that there was no damage from the fifth to the 11^{th} month (Maturity) of the yam crop (*D. cayennensis*) when the crop was harvested. On mature yam tubers in storage the injury caused by *P. costicollis* is very similar to that of *Cylas formicarius* and *Euscepes batatas* in sweet potato (Ritchie, 1918). The lesions produced in the tubers by both larvae and adults are liable to cause rotting and if planted setts are attacked, the extent of damage may kill the sett before it can sprout. The head end of the tuber is more likely to be attacked, which is especially serious as it is this part which is most commonly used as planting material. Tuber setts used for planting may fail to develop if heavily attacked (Coursey, 1967; Sherwood, 2004).

INTEGRATED PEST MANAGEMNENT

Cultural: The main cultural practices recommended for the control of yam weevil were (1) Choose land in fallow for at least two years (2) Harvest on time (9 months for most yam varieties) (3) Practice crop rotation with crops that are not alternative hosts for *P. costicollis* such as vegetables, legumes and maize. (4) Intercrop with crops that are not alternative hosts to *P. costicollis*. (5) Remove all tubers from the field after harvest (6) Practice shallow burying of setts at planting to prevent exposure to yam weevil adults (Ritchie, 1919; Edwards, 1949; Kasasian *et al.*, 1986; Sherwood, 2004).

Chemical: The use of heat treated yam setts for 35 minutes at 51^0C which are then placed in an insecticidal dip for 15 minutes or treat planting material with insecticides. The use of pirimiphos methyl (Actellic®) and Malathion has been proven to be very effective against the pest (Sherwood, 2004). The use of pirimiphos methyl (Actellic®) or Malathion in the planting hole before the yam setts are planted may also be effective (Sherwood, 2004).

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