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Banana weevil (*Cosmopolites sordidus*) reduces availability of corms for seedling production through macropropagation technology

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1 SUMMARY

Banana *(Musa* spp.) is one of the most important fruits in Kenya for food security and income generation for major smallholders who own less than 10 hectares of land. The weevil *(C. sordidus)* is a devastating pest of banana especially in the warm regions. The larva is the most damaging stage of the weevil and causes tunnelling in the corm. Macropropagation technology is a cost effective method for mass production of banana seedlings from the corm. Heavy attacks by weevils on corms reduce their suitability of selection for propagation, leading to rejection. In this study, selected farms (in Central and Eastern regions of Kenya) were assessed for certification as sources of healthy banana corms for Macropropagation. In Eastern region, some plantations were heavily infested with weevils leading to a rejection rate of over 20% where the temperatures are warm, (25°C - 30°C) and favour thriving of the weevil. Although weevils are not transmitted from the corm to the suckers generated through macropropagation, the results show that chemical and cultural control measures should be taken to reduce weevil attacks and thereby increase availability of higher quality corms for propagation. The corms that are lightly infested should be well pared to remove all larvae and cured fully before placing in the propagation chamber.

2 INTRODUCTION

Bananas and plantains serve as staple food for many people and are ranked as the fourth most important food crop after rice, wheat and milk (Ploetz, 2004). They are a source of income for majority smallholders and contribute to food security because it is a perennial crop that fruits all year round. Bananas can be eaten ripe or cooked. They can be processed into flour, crisps and wine. They are also used as fodder for animals. The fibre is used to make handicrafts such as mats, wall hangings and lamp shades. Despite its importance the production is hindered by pest infestation. The banana weevil (*Cosmopolites sordidus*) is an important pest of bananas and plantains throughout the tropics (Gold et al, 2001). It is found in almost all areas where bananas are cultivated in the tropics and subtropics. Banana weevil damage caused by the tunnelling larvae can reduce yield and plantation life, and heavy infestation can lead to crop failure in newly planted fields.

The weevil is classified under Coleoptera and superfamily Circulionoidea. Dissemination of the weevil is majorly through infested plant material and movement of the adults to adjacent farms. The pest status of the weevil can vary depending on the agroecological zones and the banana cultivars. It is an important pest of the East African highland cooking banana (Musa spp. genome group AAA-EA) and plantain (AAB) in Africa. Weevil damage is

more where temperatures are higher (Gold et al., 2003) and is inversely related to altitude. In East and West Africa, weevil damage is not common above 1500m (Lescot 1988). It is more prevalent in low altitude areas with temperatures ranging from 25°C to 30°C. Their population is higher during the rainy season but they are present throughout the year. There are four main stages of the weevil life cycle: the egg, larvae, pupa and adult. Females use their rostrum to create holes in the corm in which they lay their eggs. The eggs hatch into larvae within 5 – 8 days. The larvae pass through 5 – 6 instars lasting 30 – 50 days depending on temperature. The larvae feed actively and develop into a pupa which lasts 5 – 9 days. The adults have wings but rarely fly. They walk slowly, are negatively phototrophic and mimic death when they are touched. The reproductive activity of the banana weevil is relatively low with high field mortality. Thus field oviposition rates are a negative function of density (Gold et al, 2002).

Larvae damage leads to interference with root initiation, plant nutrition and water transport. The tunnels also provide entry points for secondary pests. Infested plants show symptoms of reduced vigour, leaf chlorosis and chocking of the bunch in the pseudostem (Pinese and Elder 2004).

Macropropagation is a method of producing clean planting material that is affordable to farmers from the corm. This method involves depression of apical dominance to enhance lateral growth by activation of latent buds in humidity chamber conditions resulting in high production of planting material. The effect of the weevil on quality and availability of corms for propagation has not been determined. The objective of the study was to determine whether weevil infestation affects the availability of corms for Macropropagation technology.

3 MATERIALS AND METHODS

A survey was carried out in Eastern and Central provinces of Kenya to determine the major constraints in banana production. A questionnaire was used to collect the data and a photocard used to aid the farmers in identifying symptoms and pests. Banana plants showing symptoms of weevil infestation were sampled randomly and uprooted for assessment of the damage.

Macropropagation nurseries were established in six farmers' field sites. These were in Eastern and Central provinces having different agro ecologies. High altitude areas, Mathioya (1915Masl) and Meru Central (1680 Masl), Mid-altitude areas Ntharene (1360 Masl) and Kerugoya (1340 Masl) and Low altitude areas, Mitunguu (1071 Masl) and Embu East (1265 Masl). Corms of farmer preferred varieties were obtained from maiden suckers and from newly harvested banana plants using established protocols. Corms were obtained from farms that were certified to be free from visibly detectable pests and diseases. These were pared to remove the roots, washed and disinfected in 10% jik® (Sodium hypochlorite) for 15 minutes. They were then rooted in sterile sawdust in the propagators and watered after every two days to maintain humidity. Scoring was done on percentage of the total exposed tissue of corms occupied by the tunnels according to (Bridge and Gowen 1993). Infestation level was scored at four levels; 0% - no tunnels, <10% - slight damage, 11 - 30% - moderate damage and >30% - severe damage. The corms that were not heavily infested (10% - 25% damage) were treated with boiling water to kill any larvae and eggs present (Gettman *et al.,* 1992). Corms with more than 30% damage were rejected and could not be used for Macropropagation.

4 RESULTS AND DISCUSSION

From the survey, it was found that the number of weevils was high in the Eastern region which has relatively warmer temperatures (Table 1). Mitunguu area in Imenti South had the highest number of farms infested by weevils. This could be attributed to majority of the farmers using untreated suckers to initiate new plantations and for expansion of orchards. The farms surveyed in Mathioya, Kiharu and Muranga did not show presence of weevils. This is possibly because these areas are relatively

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cool and do not provide a conducive environment for the weevils to thrive. Also in this area, the most preferred varieties are Cavendish which the farmers plant deep and manage well**.** They also plant desert bananas such as Cavendish (AAA), Kampala and Sweet banana which are relatively resistant to the banana weevil (Gold *et al.*, 2001).

Table1: Table showing the percentage incidence of farms with weevils

Location	Presence of weevils (%)
Muranga	0
Mathioya	0
Kiharu	0
Kirinyaga West	17
Kirinyaga Central	15
Kirinyaga East	11
Embu East	37
Meru Central	25
Imenti South Mitunguu	62
Imenti South Kothine	43

There was a significant difference (P=0.002) between the study locations with regard to weevil infestation (Fig 1). Mitunguu area is a low altitude area (1071 Masl) and the farmers mostly rely on irrigation water for cultivating the bananas. Thus creating a good environment for the weevil to develop. Batisa Filho et al., (1991), found that larval populations of the weevil are positively related to temperatures and rainfall. Some farms were severely affected and had high mats therefore corms could not be selected. According to Abera (2000) many eggs are oviposited in bananas with high mat due to the exposed corms which increase susceptibility to weevil attack.

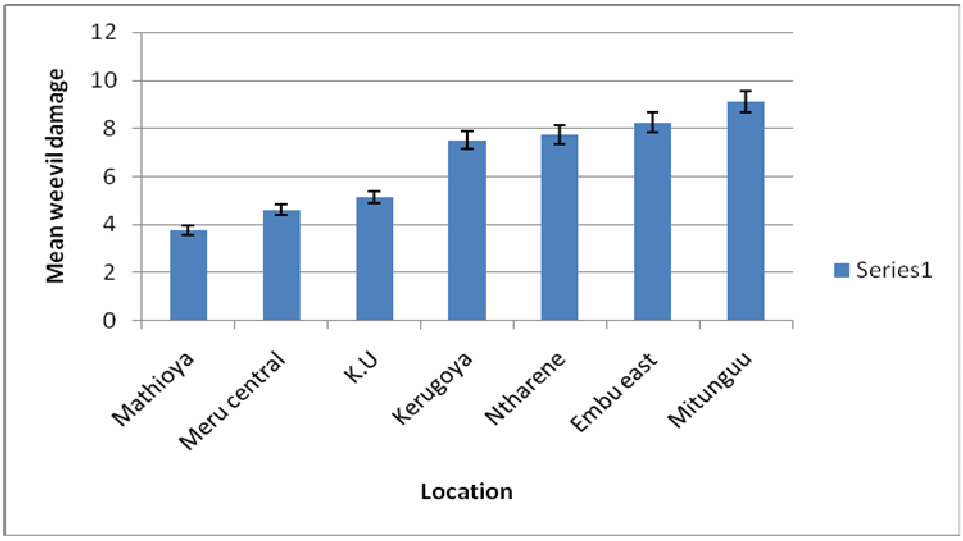

Fig 1: Mean score of weevil infestation on corms in the study areas.

There were significant differences (P=0.000) between the varieties with regard to weevil incidence. Kiganda variety, an East African highland banana showed high infestation as compared to other varieties (Fig 2, Table 5). This confirms the findings of Gold *et al.* (1994) where the East African highland banana was found to be most susceptible.

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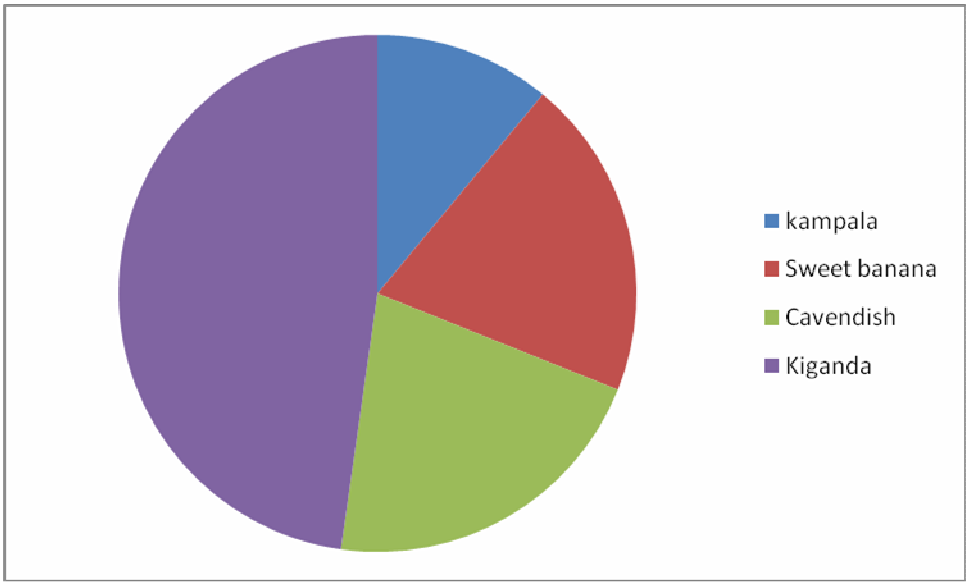

Fig 2: Weevil infestation in the different varieties.

Table 5: Means of weevil infestation in the districts

Location	*Mean*
Mathioya	3.7500a
Meru central	4.6250ab
K.u	5.1250ab
Embu East	6.5000ab
Kerugoya	8.1667ab
Ntharene	8.2500ab
Mitunguu	9.1250c

Means followed by the same letter are not significantly different at P<0.005

After paring the roots during macropropagation, some of the corms in Eastern province especially Mitunguu area were rejected due to severe weevil infestation (Fig 1). Such corms had more than 30% of the corm surface showing weevil damage through tunnelling. Aside from increasing the availability of higher quality corms for macropropagation, there is need for the farmers to control the banana weevil to maximise yield from their plantations.

Fig 3: A banana corm showing severe infestation by weevils.

Weevil damage is usually exhibited on the cortex and the central cylinder of the corm where the larvae feed (Gold and Messiaen, 2000). The banana plants may not exhibit any above ground symptoms of weevil infestations especially if the attack is not severe. Corms that show slight damage due to weevils should be treated using pesticides, cured for three days to dessicate any form of the weevil present or dipped in boiling water for 30 seconds (Hauser, 2007). Corms for Macropropagation are obtained from existing banana plantations that have been certified to be free from pests and diseases. Therefore, fields should be kept free from weevils. This can be done by use of chemicals such as Dursban and Vydate. Farm sanitation (Masanza et al., 2005), use of pheromone traps, pseudostem traps and use of entomopathogens can be employed to control the weevil. Control can also be done through host plant resistance (Kiggundu *et al*., 2003) and botanical pesticides such as neem (Musabyimana et al. 2001).

6 CONCLUSION AND RECOMMENDATION

Weevil infestation in farms reduces the chances of obtaining quality corms for macropropagation. Farmers should be cautioned against introducing weevils to their farms through planting infested suckers so as to minimise losses from weevil damage. Corms can be selected from mother plants that are resistant to the weevil.

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