Studies on host preference of banana weevil borer, *Cosmopolites sordidus* GERM. (Curculionidae-Coleoptera).

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ETUDE SUR LES PREFERENCES DE MILIEU DE DEVELOPPEMENT DU CHARANÇON DU BANANIER *COSMOPOLITES SORDIDUS* (GERM.) (CURCULIONIDAE - COLEOPTERA).

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RESUME - Conduite d'essais en laboratoire et au champ, en Jamaïque, pour connaître les préférences,comme hôte,du charançon du bananier *Cosmopolites sordidus*. Résultats en laboratoire : le charançon préfère la souche à toute autre matière végétale et davantage celle de variété tétraploïde ; la 'Valery' et la 'Robusta' sont moins recherchées ; il est indifférent quant à l'âge de la souche ; la zone corticale est choisie plutôt que celle du cylindre central.

Au champ, la 'Valery' et la 'Lacatan' sont moins attaquées que les autres variétés ; le tétraploïde 65-3405-1 s'est avéré beaucoup plus touché. Bien que le coefficient d'infestation augmente avec l'âge du plant, on ne peut en conclure que les plus vieilles souches sont davantage atteintes que les plus jeunes.

AVANT-PROPOS

Les actes de la Ve Réunion de l'ACORBAT (Guayaquil - Equateur - 22-26 juin 1981) n'ayant pas été publiés, nous avons jugé utile de présenter dans la revue FRUITS des communications pouvant encore avoir un intérêt aujourd'hui.

Tel est le cas de la communication de Dr ITTYEIPE qui présente les résultats d'une étude intéressante sur les relations hôte-ravageur du charançon noir du bananier (Cosmopolites sordidus), *réalisée au sein du Département de la Recherche et du Développement de la «Banana Company» de Jamaïque.*

La Rédaction

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INTRODUCTION

All species of the Genus *Musa* are attacked by the banana borer weevils *Cosmopolites sordidus* GERM.) and no cultivar is known to possess any useful degree of resistance to the pest (SIMMONDS, 1966). However, it has been reported that some cultivars are more susceptible to the borer attack, than others. 'Gros Michel' cultivar was reported to be more susceptible than 'Lacatan' (HORD and FLIPPIN, 1956). In Jamaica 'Valery', 'Lacatan' and the tetraploid (*Musa* AAAA) 65-3405-1 were found to be only 'lightly' infested with borers (SHILLINGFORD, 1974). In Panama 'Valery' and 'Manzano' cultivars were found to be relatively resistant to this pest (FEAKIN, (1972). It has also been suggested that the borers usually attack mature plants, the growth and production of which are not affected considerably as a consequence (OSTMARK, 1974 ; 1975).

Identifying and growing less susceptible cultivars may be a sound method of managing this pest, for both economical and environmental reasons. Hence laboratory and field studies were carried out in Jamaica to determine the host preferences, if any, of the banana borers.

MATERIAL AND METHODS

Laboratory experiments.

Laboratory experiments were carried out to determine the preference if any, of banana borers, for banana corm tissue to other vegetable tissues, for corm tissues of different banana cultivars, age groups and morphology.

• Experiment 1.

First of all in order to establish that banana borers can select host material, an experiment was conducted using different kinds of vegetable tissues. Tissues of *Solanum tuberosum* L. (Potato). *Allium cepa* L. (Onion), *Saccharum officinarum* L. (Sugarcane), *Brassica rapa* L. (Turnip), *Sechium edule* JACQ. (Christophene), *Dioscorea cayenensis* LAM. (Yam) *Colocasia esculenta* L. (Dasheen) and banana corm (*Musa sapientum* L.) were used.

Fresh, cylindrical pieces of equal size (4 cm diameter and 4 cm long) of these vegetables were arranged inside a cage at equal distances along the circumference of a circle 68 cm in diameter. Thirty five borers were then released in the centre of the 'arena'. The insects were enclosed in a match box with a hole in its base so that they were all similarly oriented and came down 'head first' out of the box. The match box was kept raised from the floor of the cage by thumbtacks stuck underneath it. The cage was then covered with black cloth making the inside light proof as banana borers are negatively phototactic.

Statistical analysis of the number of borers/piece of host material were carried out to see whether they were distributed equally or not on the host materials offered.

The host materials were examined every four hours after the release of borers and the number of borers/piece was noted. The experiment was repeated by rearranging the host materials randomly on a fresh piece of paper. Five readings were taken at each trial and the experiment was replicated six times using fresh material each time.

• Experiment 2.

This experiment was carried out to see whether banana borers are attracted differently to corm tissues of different banana cultivars. The design was the same as in Experiment 1 except that corm tissues of different banana cultivars - 'Valery', 'Lacatan', 'Williams Hybrid', 'Grande Naine', 'Queensland C' and 'N', 'Robusta', 'Robusta Sport', 'Tetraploid (*Musa* AAAA) 65-3405-1' and 'Tetraploid 64-168-12' were used. Pieces of corm cortex were of equal size (6 cm diameter and 6 cm long) of same physiological age and from freshly reaped plants. Five readings were taken at each trial and the experiment was repeated six times.

• Experiment 3.

This experiment was designed to find out whether banana borers have any preference for host tissue of different age groups. Equal sized (6 cm diameter and 6 cm long) central cylinder tissue pieces, taken from 'Valery' corms aged approximately 1 month, 3, 5, 7, 9, 11, 13 and 15 months, were exposed to the borers as in Experiment 1. Five readings were taken at each trial and the experiment was repeated six times.

• Experiment 4.

The preference of banana borers to the inner (central cylinder) and outer (cortical) corm tissue was tested in this experiment. Four pieces each of equal size (6 cm diameter and 6 cm long) of the two types of tissue were arranged as in previous experiments. This experiment was repeated six times.

Field investigations.

The eight cultivars examined in this study were 'Grande Naine', 'Lacatan', 'Queensland C', 'Queensland N', 'Tetraploid 65-3405-1', 'Tetraploid 64-168-12', 'Valery' and 'Williams Hybrid'. Thirty five corms of each cultivar were selected randomly and were examined immediately after harvest. The cortical tissue around the corm was removed and the coefficient of infestation (VILARDEBO, 1973) was determined from the extent of corm surface tissue damaged. The coefficient of infestation was taken as an index of the susceptibility of the cultivar to borer attack. Fields where all the eight cultivars were grown together only were examined.

In an attempt to assess the susceptibility of bananas of different age groups to the borer attack, corms of plants of average ages 1 to 15 months were examined and the coefficients of infestation were determined. This part of the study was carried out in a heavily borer infested field of 'Valery' bananas which was being dug out for replanting. Corms were sorted out into appropriate age groups and the severity of borer attack was assessed from the extent of tunnelling revealed upon removing the outer cortical tissue around the corm (VILARDEBO, 1973). A minimum of 35 corms of each age group were examined.

RESULTS AND DISCUSSIONS

Results of laboratory experiments are given in Tables 1 - 4. The results of experiment 1 (Table 1) indicate that borers did discriminate between host materials provided. Banana corm tissue was distinctly preferred to all other plant matter tested. Potato, dasheen and yam were next in the order of preference while turnip was least preferred. When the tissues were fresh this differential attraction did not appear to be moisture related (positive hydrotaxy) as christophene fruit and potato tissues were more moist than all the others. (However, it was observed that in abandoned experiments as the tissue piece dried up, more borers always congregated under the potato pieces which did not dry up as fast as the other tissues. This appeared to be a potisive response to moisture. CUILLÉ (1950) and ROTH and WILLIS (1963) had already established that *Cosmopolites* was attracted not only to higher humidities but also to liquid water).

Results of experiment 2 show that borers did not discriminate between the corms of different banana cultivars as they did between the vegetable matter in the first experiment. However, there was distinct preference for the two tetraploid cultivars. 'Valery' and the two 'Robusta' cultivars were the least preferred. The fact that a significantly smaller number of adult borers only were attracted to 'Valery' and 'Robusta' tissues in the laboratory does not necessarily indicate that these cultivars are less susceptible to borer attack in the field as most of the damage is caused by the tunnelling and feeding activity of the larvae. It is possible that more eggs are laid on the corms to which more adult borers are attracted and that the extent of larval feeding and tunnelling on a corm is proportionate to the number of eggs laid on it.

Statistical analysis of the data for the response of banana borers to corms tissues of different age groups (Table 3) showed that there was no significant difference in the number of borers attracted to the different corms. Although this may seem to contradict the suggestion of OSTMARK (1974) that banana borers do not usually attack corms until they are nearly mature, the lack of preference to corms of different ages may only be for feeding and may not be for breeding. Hence no definite conclusion as to which age group is more susceptible to borer attack can be drawn. However, it may be concluded that corms of all ages up to fifteen months are equally attractive as food material for adult borers.

The results of experiment 4 in Table 4, show that the borers distinctly prefer the outer, cortical tissue of the corm to the inner, central cylinder tissue. Although this may be only a morphological constraint, this could be one of the reasons why in the field, borer tunnels are more often found in the cortex than in the central cylinder of the corms. This is of survival value to the plant because had the preference been to the central cylinder tissue, the growth point (apical meristem) could have easily been destroyed resulting

TABLE 1 - Preference of banana borer weevils to various vegetable tissues.

	Vegetable tissue							
	Banana	Christophene	Dasheen	Onion	Potato	Sugar Cane	Turnip	Yam
Mean number of borers/piece	10.4e*	1.9ab	4.2c	2.3b	6.9d	1.2a	0.7a	3.5c

* - number followed by same letters are not significantly different from each other at 5% level by Duncan's Multiple Range Test.

TABLE 2 - Preference of banana borer weevils to corm tissues of different banana cultivars.

	Cultivars									
	Grande Naine	Lacatan	Queensland 'C'	Queensland 'N'	Robusta	Robusta Sport	Tetraploid 3405-1	Tetraploid 168-12	Valery	Williams Hybrid
Mean number of borers/ piece of corm tissue	3.2b*	2.3ab	3.3b	3.1b	1.5a	1.5a	5.5c	4.8c	1.4a	3.4b

* - Numbers followed by the same letter are not significantly different at 5% level by Duncan's Multiple Range Test.

TABLE 3 - The preference of banana borer weevils to 'Valery' banana corm tissue of different age groups.

	Average age of corm in months							
	1	3	5	7	9	11	13	15
Mean no. of borers/piece of corm tissue	3.3a*	3.4a	3.5a	4.3a	4.0a	3.9a	3.6a	3.4a

* - Numbers followed by the same letter are not significantly different from each other at 5% level by Duncan's Multiple Range Test.

in the death of the plant. In young surckers, due to the thinness of the cortex, borers often enter the central cylinder and damage the growth point : hence the greater mortality among newly planted suckers.

TABLE 4 - Preference of banana borers to tissue taken from the inner (Central cylinder) and outer (Cortical) region of the 'Valery' banana corm.

	Inner tissue	Outer tissue	P value
Mean No. of borers/ piece of corm tissue	2.00	4.40	< 0.001*

* - Indicates significance by student's «t» test.

The results of examining 35 corms of each of the eight cultivars are given in Table 5.

The coefficient of borer infestation was the least in 'Valery' cultivar. This is in agreement with previous reports from Jamaica (SHILLINGFORD, 1974) and from Panama (FEAKIN, 1972). The coefficient of infestation for 'Lacatan' cultivar was also very low (cf. HORD and FLIPPIN, 1956) and not significantly different from that of 'Valery' ($P > 0.10$).

It may be concluded that, of the cultivars examined, 'Valery' and 'Lacatan' were the least susceptible cultivars to borer attack. Corm tissue of 'Valery' cultivar also was the least preferred by borers in the laboratory experiments (Table 2). In this study the tetraploid cultivar 65-3405-1 appeared to be the most susceptible to borer attack, although SHILLINGFORD (1974) had assessed the borer infestation level in this cultivar as 'light'. The other tetraploid cultivar 64-168-12 although suffereing a fairly high degree of damage was significantly less susceptible than 65-3405-1 ($P < 0.01$).

In the laboratory experiments it was found that both tetraploid cultivars were more attractive to adult borers than other cultivars (Table 2). However, the attraction of adults to the corm of a cultivar is not necessarily indicative of its susceptibility.

Although the tetraploid cultivars had a very high coefficient of infestation these cultivars did not appear to be seriously affected, visibly. No incidence of toppling was observed in the field. It could be that with larger corms the tetraploids were able to with-stand borer attacks better than the other cultivars.

Results of examining corms of different age groups are given in Table 6.

TABLE 5 - The coefficient of borer infestation on eight different banana cultivars.

	Cultivars							
	Grande Naine	Lacatan	Queensland 'C'	Queensland 'N'	65-3405-1	64-168-12	Valery	Williams Hybrid
Coefficient of infestation	17.5c	4.67a*	10.63b	6.50ab	27.50d	20.46c	4.38a	8.83b

* -Figures followed by the same letter are not significantly different from each other at 5% level by Duncan's Multiple Range Test.

TABLE 6 - The coefficient of borer infestation on eight different age groups of banana plants.

Parameter assessed	The age of corms in months							
	1	3	5	7	9	11	13	15
Coefficient of infestation	0.65a	0.90a*	1.73a	5.56b	9.69b	17.46c	20.60c	25.00d

* - Figures followed by the same letter are not significantly different from each other at 5% level by Duncan's Multiple Range Test.

It is evident that older corms suffered greater damage. Regression analysis between age and coefficient of borer infestation showed that the latter increased with age (Fig. 1, $r = +0.958$, $P < 0.001$). Prima facie this may appear to support the hypothesis of OSTMARK (1974, 1975) that the borers leave the younger plants and attack the older ones. However, it should be noted that the coefficient of infestation is a cumulative measure of the borer damage done during the entire lifetime up to the point of examination. From this data it cannot be concluded that the borers preferentially attacked the older corms as the exact age at which the damage was done could not be determined. It could be that the older corms having been 'exposed' for a longer time had more chances to be 'found' and attacked by borers or that the older corms being larger had better chances to be 'found' by the borers and that having a larger surface area they could accomodate more eggs and larvae. Borers usually lay their eggs on the exposed part of the corm and the corms of young suckers being usually under the soil, may also be less accessible to borers. Laboratory experiments showed that borers had no preference for corm tissues of any particular age group (Table 3). However, further studies are necessary before any definite conclusion can be drawn on the hypothesis that older corms are more susceptible to banana borers.

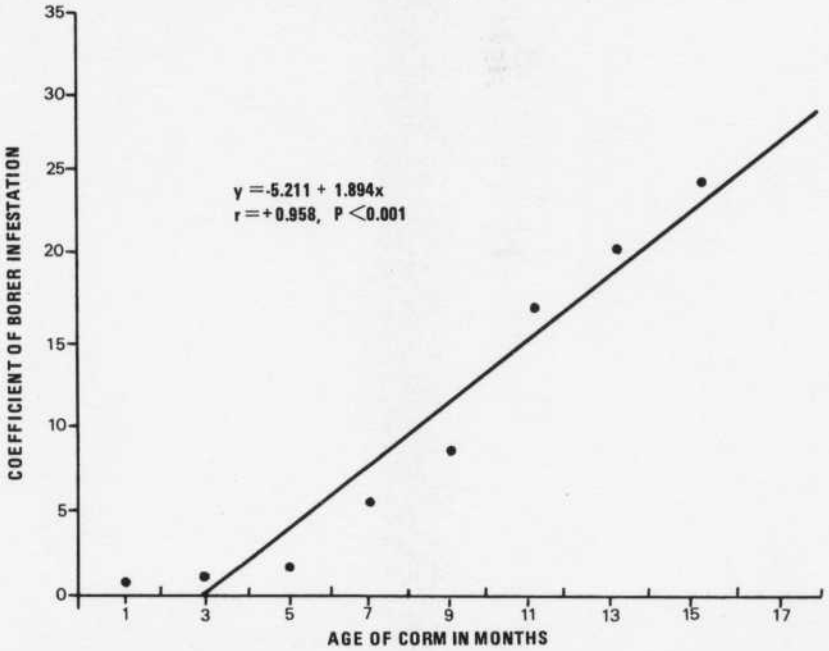

FIGURE 1 - RELATIONSHIP BETWEEN AVERAGE AGE OF CORMS AND COEFFICIENT OF BANANA BORER INFESTATION

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