Fruits - vol. 39, n°4, 1984

Resistance of banana cultivars to *Cosmopolites sordidus* (GERMAR, 1824).

A.L.M. MESQUITA, E.J. ALVES, R.C. CALDAS*

RESISTANCE DE CULTIVARS DE BANANIER A *COSMOPOLITES SORDIDUS* (GERMAR, 1824).

A.L.M. MESQUITA, E.J. ALVES et R.C. CALDAS

Fruits, avril 1984, vol. 39, n° 4, p. 254-257

RESUME - La résistance de 17 cultivars de bananier est étudiée à partir de morceaux de rhizomes maintenus «in vitro» au laboratoire. Il est observé le preferendum alimentaire et de ponte, le taux de mortalité des stades larvaires et pupal et les variations de durée du cycle. L'alimentation se fait de préférence sur le cultivar Mysore (AAB) tandis que celui Mata Ouro (AAAB) est choisi pour la ponte. Par comparaison avec des larves nourries avec le cultivar Nanica (AAA), la durée du développement larvaire est allongée de 6,59 jours avec le cultivar Figo Vermelho (ABB) ; c'est avec ce dernier que la mortalité larvaire est la plus élevée et que le poids des pupes est le plus faible.

INTRODUCTION

The banana weevil borer, *Cosmopolites sordidus* (GERMAR, 1824), is the most prejudicial to cultivation among the insects that attack the banana plant in Brazil, in the light of the injury inflicted on rhizomes and of the frequency of its occurrence in areas cultivated with the crop. The damage caused by the larvae is sometimes accentuated by attacks of other insects and microorganisms, accelerating the destruction and decomposition of the rhizome tissues.

According to SIMMONDS (1973), the insect attacks only the genus *Musa* and, among the cultivars, plantains are more susceptible. Of the wild bananas, *Musa acuminata* is generally susceptible, whereas *M. balbisiana* seems to be rather resistant. In Fiji, JEPSON (1914) found that the insect attacked all cultivated varieties with equal intensity, while CHESQUIERE (1925), cited by MONTELLANO (1954), HORD & FLIPPIN (1956) LOPES (1961) and ZEM et al. (1978) noted a preference of the insect for particular cultivars. HADDAD et al. (1979) concluded that, compared with the AAA group, cultivars of the AAB and ABB groups showed higher coefficients of infestation and larger numbers of adults captured in pseudostem baits, cut as 15 cm high with a cylindrical section of 12 cm superimposed.

CUNHA (1948) stated that, in Brazil, the cultivars 'Maça', 'Terra', 'Maranhão Caturra', 'Ouro Mel' and 'São Tomé' were more attacked than the Cavendish subgroup ('Nanica', 'Nanicão', 'Congo'), 'Java' and 'Figo'. ROBBS (1960) pointed out 'Nanicão' as the most resistant of the bananas cultivated in the state of Rio de Janeiro.

Although the concept of a resistant plant implies a dif-

* - Researchers at EMBRAPA/CNPMF, caixa postal 007, CEP 44.380 Cruz das Almas, BA.

Communication présentée à la VI^e Réunion ACORBAT, Pointe-à-Pitre Guadeloupe, 15-21 mai 1983.

ce in the injury caused to it, this characteristic may ɔe established by a study of the insect itself, once it sumed that the mechanisms of resistance can affect infesting population, either disturbing its biology ɔntributing to a low incidence of attack, as a result ıorphological, physiological or other characters (LA-1979). According to the same author, in the majority ıses of resistance, the effect of the plant can be inter-d as alterations of the insect's developmental phases, ality of juvenile forms and reduction in the weight dividuals.

ıe present work had the objective of establishing ectly the resistance of banana plants ro *Cosmopolites dus*, through a study of the biology of the pest when ɔn rhizomes of different bananas, on the hypothesis banana cultivars exist that are capable of modifying, vely, some biological parameters of the insect.

MATERIALS AND METHODS

e work was performed in the entomology laboratory MBRAPA, at the Centro Nacional de Pesquisa de lioca e Fruticultura, Cruz das Almas, Bahia.

r the evaluation of resistance aspects of bananas to *opolites sordidus*, rhizomes were taken from 17 ars in the following genomic groups :

ı - 'Ouro' ('Sucrier')
ıA - 'Ouro Mel'
'Caru Roxa' ('Red')
'Caru Verde' ('Green Red')
'Nanicão' (Cavendish subgroup)
'Nanica' ('Dwarf Cavendish')
'Leite'
ıB - 'Pacovã' (variation of 'Pome')
'Prata' (clone of 'Pome,)
'Prata São Tomé' (clone of 'Pome')
'Prata Sta Maria' (clone of 'Pome')
'Maça' ('Silk')
'Mysore' ('Mysore')
'Terra' ('French Plantain')
ıB - 'Figo Vermelho' ('Bluggoe')
ıAA - 'IC-2'
.AB - 'Mata Ouro, ('Pome' hybrid)

ɔ following methods were used :

ference tests for feeding and oviposition

ts of 100 unsexed adults were confined in a cylin- wooden box, 1 m in diameter and 20 cm deep, co- with a plastic sheet ; the bottom of the box was ɔd with a 3 cm layer of damp soil. Rhizome pieces of arious cultivars were distributed on this, equidistant thee insect population, and renewed every 48 hours, after a count of adults and numbers of eggs deposited on each. The results for preferences in feeding and oviposition were expressed from these counts as a percentage of the totals collected, of adults and eggs, respectively. In the former case, as well as numbers, there was also noted the amount of damage caused by adult feeding.

b) Raising of larvae

20 newly hatched larvae were fed on each cultivar, in Petri plates and lodged between two rhizome slices. The thickness of the slice was always less than the body height of the larva, to prevent its penetration and to facilitate the retrieval of exuviae. The feeding substrate was renewed every 48 hours. The larval period was determined in days from hatching until their entry into the pre-pupal stage. Every larva was fed on the same cultivar throughout this period ; for the calculation of larval and pupal mortalities only the last 10 replications were used. The pre-pupal stage was taken in days from the time the larva ceased to feed, its reactions becoming slow and its skin more rugose. The end of the period was marked by the shedding of the last larval skin.

c) Pupal period and pupal weight.

The period in days was taken this last ecdysis to the emergence of the imago. Pupae were weighed in the course of the first day of pupal life.

The durations of the successive phases were submitted to analyses of variance, on a fully rendomized layout, and the means compared by the Tukey test, at the 5 % level of probability. There were differences in numbers of replicates for some cultivar comparisons, because of insect deaths.

RESULTS AND DISCUSSION

The results are presented in Table 1, with the cultivars listed in descending of the respective larval periods. It can be seen that the various cultivars did have differential effects on the biology and preferences of *C. sordidus*. The cultivars 'Mysore' (AAB), 'Nanica' (AAA) and 'Prata Sta Maria' (AAB) had the highest rates for adult feeding, considering the numbers collected and also the amounts of rhizome eaten. 'Mata Ouro' (AAAA) stood out as the most prefered for oviposition.

Concerning the larval and pre-pupal periods, the analyses of variance evidence significant differences between cultivars. Larval periods induced by 'Figo Vermelho' (ABB), 'Pacovã' (AAB), 'Ouro' (AA) and 'Prata' (AAB) were significantly longer than those of 'Nanica' (AAA) and 'Leite' (AAA). This fact suggests that the two latter offer a feeding substrate of optimal quality for this insect species, if the adverse effect of plant on insect is viewed in terms of a prolongation of its developmental phases (LARA, 1979). Such an effect of the first four cultivars

TABLE 1 - Preferences for feeding and for oviposition, variation in developmental phases and pupal weights of *Cosmopolites sordidus*, as a function of the cultivar host. Cruz das Almas, Bahia, Brazil, 1983.

Cultivar (genome group)	Preference for feeding (%)	Preference for oviposition (%)	Larval (1) period (days)	Relative increase larval period (%)	Number (1) of ecdyses	Larval mortality (%)	Pre-pupal (1) period (days)	Pupal period (days)	Pupal mortality (%)	Pupal weight (g)	Relative pupal weight (%)
Figo Vermelho (ABB)	5,0	3,75	31.81 a	26.13	6.2 b	20.0	3.0 ab	7.0	11.1	0.061004	79.19
Pacovã (AAB)	5.5	3.75	31.42 a	24.58	6.5 a	30.0	2.4 b	7.5	0.0	0.070589	91.63
Ouro (AA)	4.3	7.50	30.68 a	21.65	6.4 a	20.0	3.5 a	7.3	0.0	0.068838	89.32
Prata (AAB)	4.7	2.50	30.63 a	21.45	6.2 a	10.0	2.5 ab	7.3	0.0	0.071054	92.23
Prata São Tomé (AAB)	5.9	7.50	30.18 ab	19.67	6.1 ab	10.0	2.5 b	7.2	0.0	0.070798	91.90
Prata Sta Maria (AAB)	7.4	6.25	29.75 ab	17.96	6.1 ab	20.0	2.8 ab	7.2	25.0	0 067532	87.66
Ouro Mel (AAA)	6.0	3.75	29.13 ab	15.50	6.1 ab	20.0	3.0 ab	7.3	0.0	0.066463	86.27
IC-2 (AAAA)	5.9	2.50	28.31 ab	12.25	6.3 a	0.0	2.6 ab	7.3	0.0	0.071837	93.25
Maçã (AAB)	7.0	5.00	28.19 ab	11.78	6.0 ab	0.0	2.4 b	7.2	0.0	0.077037	100.00
Caru Roxa (AAA)	4.3	5.00	28.00 ab	11.02	6.1 ab	10.0	3.0 ab	7.0	11.1	0.072096	93.59
Mysore (AAB)	7.9	6.25	27.87 ab	10.50	6.0 ab	20.0	2.7 ab	6.9	11.1	0.068659	89.13
Mata Ouro (AAAB)	6.9	11.25	27.86 ab	10.47	6.2 ab	20.0	2.8 ab	7.2	0.0	0.071680	93.05
Nanicão (AAA)	4.1	5.00	26.77 ab	6.15	6.1 ab	0.0	3.1 ab	7.3	11.1	0.068768	89.27
Terra (AAB)	7.3	5.00	26.55 ab	5.28	6.0 ab	0.0	2.7 ab	6.5	0.0	0.070663	91.73
Caru Verde (AAA)	5.8	8.75	26.02 ab	3.17	5.9 ab	10.0	3.1 ab	6.8	37.5	0 070368	90.34
Leite (AAA)	4.5	7.50	25.47 b	0.99	5.5 b	0.0	2.3 b	7.5	0.0	0.067281	87.34
Nanica (AAA)	7.5	1.25	25.22 b	0.00	6.0 ab	10.0	2.4 b	7.2	11.1	0.073669	95.63
C.V. %			17		8		29	18		25	
F Test (P = 0.05)			*		*		*	n.s.		n.s.	

(1) cultivars followed by the same letters do not differ significantly on a Tukey test
* - significant at the 5 % level of probability
n.s. not significant

' be further shown by the percentage mortalities of lar- The pre-pupal stage for 'Leite' (AAA) and 'Nanica' .A) was again significantly shorter than that for 'Ouro' .), reinforcing the comments above on these cultivars.

loreover, in relation to the number of ecdyses, larvae on 'Leite' (AAA) underwent significantly fewer skin ıges than those reared on 'Pacovã' (AAB), 'Ouro'), 'Prata' (AAB) and 'IC-2' (AAAA), suggesting that olongation of the larval stage is accompanied also by ıater number of ecdyses.

lthough, with other insect pests, the duration of the ıl period can also be affected (HATCHETT et al., ı), it is verified in this case that the effect is more ınt in the larval stage, without significant influence he pupae. The evidence is more marked on considera- of relative rates of larval and pupal mortality. The ıt reduction of the pupa, verified with 'Figo Vermelho' 3), gives an added index of adverse effect of the plant he insect, which, according to LARA (1979), might ue to the presence of substances inhibitory to deve- ent, nutritional unbalance or the absence of essential ents.

Since the cultivar 'Maçã' (AAB) showed a high preference for feeding, no mortality of larvae and the highest pupal weight it is concluded that this cultivar ought to be seriously damaged under field conditions, as was already found by CUNHA (1948) and by ZEM et al. (1978). 'Terra' (AAB), besides having shown elevated parameters for susceptibility, is a rather tall plant with relatively heavy bunches, (CUNHA, 1948 ; PEREIRA et al., 1981), and it becomes quite susceptible to attack as the tunnelling of larvae in the rhizome predisposes the plant to fall. Its retarded suckering, occasioning a long interval between the harvest of one plant and that of its follower, can aggravate still more the cultivar's susceptibility since, after reaping, the followers remain subject to attack for a long period. Generally, in areas where the pest is not controlled, a pronounced reduction is seen in the number of productive plants of this cultivar, compared with the previous cycle.

CONCLUSIONS

In the light of the results presented, the conditions in which the work was performed and the methods adopted, the following conclusions have been reached :

lults of the species *C. sordidus* prefer particular
s for feeding and oviposition.
ıe biology of the species varies with the cultivar

sceptibility varies both between and within genomic

e cultivars 'Figo Vermelho' and 'Ouro' and those
'Prata' subgroup are evidently resistant, while 'Na-
d 'Leite' are susceptible.

ACKNOWLEDGEMENTS

Acknowledgements are due to Kenneth SHEPHERD, consultant of IICA/EMBRAPA, for suggestions on the presentation and for the English translation ; to the EMBRAPA officer Antonio SANT'ANA DA SILVA for his assistance with the laboratory observations.

REFERENCES

'J.F.).
e moléstias.
ultura da bananeira. Rio de Janeiro, Serviço de Informação
la, 1948, Cap. 18, p. 93-102.

) (O.), SURGA (J.R.), WAGNER (M.).
ón de la composición genômica de las musaceas com el
le atracción de adultos y de larvas de *Cosmopolites sordi-*
(Coleop. Curculionidae).
omia Tropical, XXIX (5), 429-438, 1979.

TT (J.H.), BELAND (G.L.) HARTWIG (E.E.).
eding resistance to bollworm and tobacco budworm in tree
n plant introductions.
ci., 16 (2), 277-280, 1976.

.H.V.) et FLIPPIN (R.S.).
i of banana weevils in Honduras.
i. Entomol., 49, 296-300, 1956.

F.P.).
'or natural enemies for a Coleopterus pest of bananas.
ot. Agr., 1914, 18 p. (Bull. n° 7).

M.).
ios de resistencia de planta a insetos.
iba, Livroceres, 1979, 207 p.

LOPES (N.F.C.).
Principais pragas e doenças de bananeira.
Agricultura e Pecuária, Rio de Janeiro, 32 (447), 12-14, 1961.

MONTELLANO (C.B.).
Estudios biológicos del *Cosmopolites sordidus*, GERMAR, que infesta al rizoma de abaca.
Instituto Interamericano de Ciências Agrícolas, Turrialba, 1954, 83 p.

PEREIRA (L.V.), ALVES (E.J.), LUCCHINI (F.).
Influência de época de corte da inflorescência masculina da bananeira 'Terra' sobre a uniformidade dos frutos.
Cruz das Almas, BA, EMBRAPA/CNPMF, 1981, 16 p. (CNPMF Boletim de Pesquisa, 3).

ROBBS (C.F.).
Recomendações para o controle de doenças e pragas das plantas cultivadas no estado da Guanabara.
Agronomia, 18 (5), 67-69, 1960.

SIMMONDS (N.W.).
Plagas.
in : *Los plátanos, Barcelona, Blume*, 1973, Cap. 12, p. 315-382.

ZEM (A.C.), RODRIGUES (J.A.S.), ALVES (E.J.).
Comportamento de cultivares de bananeira (*Musa* spp.) ao ataque da broca do rizoma (*Cosmopolites sordidus* GERMAR). (Coleoptera-Curculionidae).
Ecossistema, 3 (3), 8-10, 1978.