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VARIETAL INFLUENCE OF COWPEA SEEDS CULTURE ON OVIPOSITION AND DEVELOPMENT OF *CALLOSOBRUCHUS MACULATUS (F)* (COLEOPTERA: BRUCHIDAE

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ABSTRACT

This study investigated oviposition and development of *Callosobruchus maculatus* from same source on two cowpea seed cultures, Tvu 1890 and Tvx 3000 in order to determine their effects on successive generations of the bruchids when reared on different varieties of cowpea, Tvx 3236, Ife Brown and IT83E-716. Mean oviposition, hatching and adult emergence on Tvu 1890 and Tvx 3000 were 60, 50 (83.3%), 40 (66.7%), and 50, 39 (78.0%), 30 (60.0%) respectively. Performance of *Callosobrucus maculatus* on Ife Brown , Tvx 3236 and IT83 E-716 from different cultivars gave different values for number of eggs laid ,hatched and adult emergence with Tvu 1890 enhancing performance of *Callosobruchus maculatus*. Oviposition, per cent hatching and adult emergence within same variety and between cultures differed significantly. Statistical analysis reveals a significant diference between cultures and within oviposition, hatching and adult emergence. The management of *Callosobruchus maculatus* in the field and store has been very difficult since information provided from laboratory experiments are inconsistent. The bruchid is able to break the biotypes of improved varieties of cowpea, this is possible because of the effect of the rearing cultures on successive generations of the insect.

KEYWORDS: *Callosobruchus maculatus, Vigna unguiculata*

INTRODUCTION

Cowpea (Vigna unguiculata (L.) Walp., is a common grain legume in the tropics where it serves as a major source of protein for humans and livestock (Santos,1971). Its availablility and utilization is reduced significantly due to damage by larvae of the cowpea seed bruchid, *Callosobruchus maculatus* (Jackai and Daoust, 1986; Lale and Efevobohan, 1991). The larvae usually bore into the seed to begin infestation from farm stores. However, the adult bruchid can fly up to about half a mile and so field crops within this distance around the crop stores are likely to be infested (Iloba and Osuji, 1986) with infestation spreading to other nearby cowpea crops under favourable environmental conditions.

The factors that confer resistance to cowpea varieties against bruchid infestation are morphological and biochemical in nature and both are inherited (Lale and Abdulrahman, 1989). These factors are known to affect the expression and stability of cowpea resistance to *C. maculatus*. The morphological factor affects feeding and oviposition and ingestion of the pest (Kumar, 1984) while the biochemical factor influences the metabolic process of the pest (Kogan, 1977).The inheritance of bruchid resistance in cowpea as studied by Redden *et al.*, (1983) and Adjadi *et al.*,(1995) revealed that two successive genes are required in the homozygous condition to confer resistance against *C. maculatus* infestation. These genes are digenetically inherited (I'TA, 1983, Adjadi *et al.*, 1985).

Varieties with inherent resistance to bruchids are being developed by International Institute for Tropical Agriculture, Nigeria. The susceptibility of these cowpea varieties to *C. maculatus* varies as it is the case with varieties of other grains (Dobie, 1981, Mbata, 1992). Possible causes of resistance in varieties of pulses are linked to physical factors such as mechanical barrier offered by the testa (Boughdad *et al.*, 1986) or chemical inhibitors present in the cotyledons (Singh *et al.*, 1982, Gatehouse and Boulter, 1983). Two factors that affect the performance of bruchids on cowpea include host selection, which is sensory and the ability to complete larval development.

So far, the published information concerning the susceptibility of seeds of various legumes to bruchid infestation is very inconsistent (Lale, and Abdulrhaman 1998). Most studies associated with the crop are centred on the field selections of resistant varieties to bruchid. Field study only may not reveal the finer nuaces of resistance. Man often selects along a particular line which leads to a single optimum but nature does same in a disruptive way which leads to many maxima of different characteristics.

This study therefore was carried out to determine the performance of *C. maculatus* on some varieties of cowpea when reared on different cowpea cultures and to develop a technique for screening cowpea varieties in the laboratory with the hope of revealing the effect of culture on test varieties.

MATERIAL AND METHODS

The cowpea varieties and bruchids used for this experiment were obtained from the international Institute for Tropical Agriculture, Ibadan, Nigeria. The experiments were conducted at the Zoology laboratory,University of Calabar at ambient temperature of 27± 3.0°C, relative humidity of 71% and day light of 6hours. Calabar is located on latitute 4.6°N and longitute 8.2°E.

10g each of cowpea seed varieties (Tvu 1890 and Tvx 3000) were placed in two culture containers- kilner jars. Each jar contained two pairs of freshly emerged adult male and female *C. maculatus* from common culture. This was replicated four times and monitored by observation for mating, oviposition, hatching and adult emergence. A pair of freshly emerged adult male and female, *C. maculatus* from each culture was then transferred into three separate rearing jars containing 5g Ife Brown,Tvx3236 and IT83E-716 cowpea seed varieties and replicated four times. 10% glucose solution in moist cotton wool was provided on top of the wire mesh size netting of each jar.

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Daily visual observations was made to monitor mating periods and fecundity rate of females; adult male and female were removed after four days to avoid multiple mating. The total number of eggs deposited in each rearing jar was counted and monitored for hatching, emerging adult insect were counted and removed but counting terminate seven days after the first generation emergence commenced. A two way analysis of variance with replication was used to analyze the result obtained.

RESULTS

TABLE 1: MEAN OVIPOSITION, HATCHING AND EMERGENCE OF F_1 ADULT *Callosobruchus maculatus* ON PARENT CULTIVARS OF *Vigna unguiculata* IN CULTURE

	Tvu 1890	Tvx 3000
Mean oviposition	60 .01[a]	50.00[a]
Mean hatching	50.02[a] (83.3)	39.00[a] (78.0)
Mean adult emergence	40.01[a] (66.7)	30.02[a] (60.0)

Figures in parenthesis are per cent of total. Mean followed by same alphabeth in superscript within each row of each column are significantly different (P=0.05).

TABLE 2: VARIETAL EFFECTS OF RESISTANCE IN PARENT CULTURE ON OVIPOSITION, HATCHING AND EMERGENCE OF F_1 ADULT *Callosobruchus maculatus* RAISED ON DIFFERENT COWPEA CULTIVARS

CULTURE	Tvu 1890			Tvx 3000		
	Ife Brown	Tvx3236	IT83E-716	Ife Brown	Tvx3236	IT63E-716
Oviposition	60[ab]	50[ab]	62[ab]	42[ab]	31[ab]	51[ab]
Hatching	49[b] (81.7)	41[b] (71.0)	44[b] (71.0)	30[b] (71.4)	20[b] (64.5)	40[b] (78.4)
Adult emergence	39[a] (79.6)	36[a] (87.6)	39[a] (88.6)	24[a] (80.0)	18[a] (90.0)	35[a] (87.5)

Each datum is a mean of four replicates. Figures in parenthesis are per cent of total. Means not followed by same alphabet in superscripts within column are significantly different (P=0.05).

RESULT

Actual fecundity per female and mean hatching of *C. maculatus* obtained by direct counting after oviposition for six days is presented in Table 1. Mean oviposition was significantly higher (P<0.05) on Tvu 1890 by 10% than Tvx 3000 (Table 1). However, actual number of eggs laid by the bruchids was comparatively higher and lower when the bruchids were transfered seperately to Ife Brown, Tvx 3236 and IT83E-716 from Tvu 1890 and Tvx 3000 respectively. Similarly, mean oviposition, hatching and adult emergence differed significantly (P=0.05) (Table 2). Egg hatched and adult emergence was significantly higher in Ife Brown (81.7%) and IT83E-716 (78.4) in bruchids transferred from Tvu 1890 and Tvx 3000 respectively. Analysis of variance indicated that oviposition, hatching and adult emergence are significantly different from each other and among the different cultivars.

DISCUSSION

The result demonstrated significant varietal effect and influence of parent culture on the oviposition, mean hatchability and percent adult emergence of *Callosobruchus maculatus*. The oviposition preference for Ife Brown and IT83-716 varieties and the observed reduction in mean oviposition, hatching and F_1 adult emergence in Tvx 3236 could be a reflection of resistant factors present in the seed coat and cotyledons (Lale and Efeovbohan, 1998). This may also be true for the parent cultures as Tvu 1890 is more preferred to Tvx 3000.

Over the years, different methods of controlling this bruchid with differing level of effectiveness have been devised. However, from the farmer's point of view, the cheapest and most effective method of protecting cowpea against *C. maculatus* in storage is the use of resistant varieties. Thus, the use of cowpea varieties whose seeds could deter and /or reduce oviposition or significantly delay insect development

would offer farmers an economical and ecological acceptable means of controlling bruchids in tropical storage (Ofuya and Credland, 1995). The mechanism conferring resistance in plant has been classified into tolerance, antixenosis and antibiosis (kogan and Ortman, 1978); of these mechanisms, only antixenosis and antibiosis have been shown to be involved in the resistance of cowpea varieties to bruchid attack in storage (Lale and Efeovbokhan, 1991).

In antixenosis, the plant characters affect the behaviour and orientation of the insect for food, shelter and oviposition such that the pest chooses not to feed or oviposit on resistant cultivars compared to susceptible ones (Kumar,1984). Antixenosis is usually due to the presence in the resistant plants chemical substances which deter feeding or oviposition but may also be due to the absence of certain chemical attractants or stimulants compared to susceptible ones, it therefore involves oviposition stimulation and deterrency (Epino and Rejesus, 1983). In the case of antibiosis, the pest feeds, or attempt
to feed on the resistant plant but fail to develop properly. Growth of the insect is slower compared to the susceptible ones. Smaller adults may result or larvae may die before reaching maturity hence reducing the umber of adult emergence, and egg production may also be significantly curtailed. Antibiosis is thus directly harmful to the insects and is due primarily to the presence of toxic substances in the plant though lack of essential nutrients may play a part (Fenemore, 1984).Reports on the effects of physical factors such as seed texture, size and thickness of pod wall on oviposition are inconclusive and the number of eggs laid by the bruchid is inconsistent.

Egg hatchability was low on variety Tvx 3236. This could be due to failure of fertilization and mortality during egg stage. According to Utida (1972) hatchability is a function of collision among adults and deposited eggs. This assertion may not hold in this work since only a female and a male pair per replicate was used. Therefore, hatchability may be influenced by resistant factor.

All the cowpea and bruchids used for this investigation were obtained from common source, and bruchids were maintained in a common culture. Status of varietal resistance achieved by the cowpea varieties, Tvu 1890, Tvx 3000, Ife Brown, Tvx3236, and IT83E-716 are different and this is maintained within each variety. Trial with Parent cultures, Tvu 1890 and Tvx 3000, yielded a significant difference (P=0.05) in the number of eggs laid, hatched and adult emerged. This shows that Tvu 1890 is more susceptible to *C. maculatus* as Tvx 3000 is least prefered; antibiosis and antixenosis may be involved. Bruchids maintained in the same culture and transferred from different parent cultures (Tvu 1890 and Tvx 3000) into cowpea of the same status of resistance yielded significantly different result in the number of eggs laid, hatched and adult emerged. The
bruchids transfered from Tvu 1890 had a higher oviposition, hatchability and adult emergence on the test varieties (Ife Brown, Tvx3236 and IT83E-716) than those from Tvx 3000 on the same test varieties.

Factors conferring resistance in the test varieties may be physical , chemical, antixenosis or antibiosis, this is inherited and maintained within the variety, variabilities in mean oviposition, egg hatchability and adult emergence is therefore attributable to the effect of culture on the bruchids. The insect may have adapted to the culture-variety and is unable to perform significantly on the test variety though resistant factors play a role, this is minimal as observed in TVX 3236. This suggest why bruchids fly about a few kilometers in the field where they are unrestricted to select varieties of cowpea for infestation, this is also the reason for the inconsistency and inconclusiveness in some test parameters of bruhids' biology. How long does this effect last on successive generations of bruchids is an area that merits investigation.

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