International Journal of Science and Technology
(STECH)
Bahir Dar- Ethiopia
Vol. 3(3), S/No 8, September, 2014: 27-33
ISSN: 2225-8590 (Print) ISSN 2227-5452 (Online)
DOI: http://dx.doi.org/10.4314/stech.v3i3.3

Observations on the Biology of *Callosobruchus Maculatus* (Fab.) (Coleoptera: Bruchidae) under Ambient Laboratory Conditions

Barde, A. A.
Biological Sciences Programme
Abubakar Tafawa Balewa University, Bauchi
P.M.B. 0248, Bauchi- Nigeria
E-mail: bardeauwal@yahoo.com

Misari, S. M.
Crop Protection Department
Institute for Agricultural Research,
Ahmadu Bello University Zaria, Nigeria

&

Dike, M. C.
Crop Protection Department
Institute for Agricultural Research,
Ahmadu Bello University Zaria, Nigeria,

Abstract

Observations on the biology of Callosobruchus maculatus(Fab.) were carried out under ambient laboratory conditions. Pattern of oviposition, female adult longevity and F_1 progeny emergence in Callosobruchus

maculatus (Fab.) were observed. The results showed that over 60% of the total number of eggs was laid during the first 72 hours of the commencement of oviposition; however, oviposition rate and F_1 adult emergence of the bruchids decreased with time thereafter. The maximum adult C.maculatus survival period was about ten days.

Key words: *Callosobruchus maculatus*, pattern of oviposition, female adult longevity and F_1 adult progeny emergence

Introduction

The cowpea weevil, *Callosobruchus maculatus* (Fab.) is a very serious pest of cowpea seeds- *Vigna unguiculata* (L.) Walp which infests the seeds in storage (Prevett, 1961; Booker, 1967; Booth, 1976; Tun, 1979; Srinivasan & Durairaj, 2007). Infestations of the bruchids start in the fields and continue to multiply in storage where sometimes it causes total destruction of the seeds within a period of 3-4 months (Dongre et.al., 1996; Hall et.al., 1997; Sarikarin et.al., 1999). This causes a severe loss to the cowpea crop which is a staple food and essential source of protein in most developing countries including Nigeria, where animal protein is rarely available

A proper understanding of the biology of any pest is important in planning an effective control operation against the pest. Southgate (1979), had given a global review of the biology of the species of Bruchidae. Earlier observations on the biology of *C. maculatus* showed that the period of pre-adult development was negatively correlated with temperature and also affected to a lesser degree by the relative humidity of the environment (Howe and Currie, 1964; Booker, 1967). Other workers have studied the oviposition behaviour and progeny development of *C. maculatus* and related pest species (Strong et. al; 1968; Mitchell, 1975; Nwanze and Horber, 1975, 1976; Booker, 1967; Tun, 1979; Wasserman and Futuyma, 1981; Messina and Renwick, 1983; Wasserman, 1985; Giga and Smith, 1987; Ofuya, 1987; Barde et. al; 2012).

The present study was set to investigate on the pattern of oviposition, F_1 adult progeny emergence and adult female longevity of the cowpea bruchids, *C. maculatus* under ambient laboratory conditions.

Materials and Methods

Insect culture

Culture stocks of the C. maculatus were collected from infested cowpea seeds from Samaru-Zaria, Nigeria market.They were maintained on local cowpea variety (Kananndo) in two (2) jars, each with a capacity of 1 Kg. The jars were covered with perforated lids and kept under ambient laboratory conditions. This was to produce a steady and sufficient supply of cowpea bruchids of known age for experimental purposes.

Experimental technique

Twenty females and ten males of freshly emerged (0-24hr.) adults, *C. maculatus* were collected from the experimental insect culture and introduced into a petri-dish containing 50 clean cowpea seeds (variety 1696); this was replicated three times and arranged in a completely randomized design. The insects were removed and transferred to another sets of petri-dishes each containing 50 clean cowpea seeds after every 24 hours.

Daily records of the eggs laid on the cowpea seeds and the surviving females, *C. maculatus* were taken from each of the replicate in which the weevils were serially removed. This serial transfer process of the weevils continued until all the insects died. The petri-dishes from which the weevils were removed, were then kept undisturbed under ambient laboratory conditions to the time when the F_1 adult progeny of *C. maculatus* started emerging from the infested cowpea seeds.

The mean daily percentages of oviposition, female survivorship and F_1 adult progeny that emerged from the infested cowpea seeds were recorded separately.

Results

The results of this investigation showed that over 60% of the total number of eggs laid by the female cowpea bruchids, *C. maculatus* occurred within the first 3 days (72 hrs.) after the initiation of the oviposition in the bruchids (Table 1). This was followed by a decrease in the oviposition rates of the female adults cowpea bruchids with time. While about 60% of the adult females *C. maculatus* survived to the 4^{th} day from the commencement of oviposition but only about 10% survived to the 9^{th} day (Table 2). However, 100% adult females' mortality was recorded from the 10^{th} day.

Similarly, F_1 adult progeny emergence from the infested cowpea seeds was found to depend on the time at which the eggs were laid (Table 1).

Discussion

The oviposition process in adult females, *C. maculatus* reached a peak within 2 days after the commencement of oviposition and then declined with time. This finding agrees with the results reported earlier by Howe and Currie (1964), Booker (1967), and

Tun (1979). This suggests that the short period for the egg laying potential in cowpea bruchids may be an inherent survival mechanism for perpetuation of generations given the correspondingly short period of longevity. This could also ensure rapid multiple re-infestation of the cowpea in storage with consequent rapid population buildup. This is particularly important because the adult bruchids do not feed and have to depend on the energy and other essential nutrients reserve within their body. This may also explain the decline in oviposition potentials of the *C. maculatus* with time since the cowpea bruchids oviposit continuously without feeding after their emergence from the infested cowpeas.

With regards to adult females, *C. maculatus* longevity, low mortality rate was noticed from the first to the third day of the commencement of oviposition. This was followed by the drastic increase in the mortality rates of the female cowpea bruchids particularly between the third and fourth day of oviposition. A lot of energy was required during the oviposition process and this could result in the rapid depletion of the energy reserves in most of the female cowpea bruchids, leading to high mortality of the bruchids between this period. The few female bruchids that were left died gradually as more and more energy and other essential nutrients were used up with time. It was also observed that all the female bruchids died before reaching their 11^{th} day after the commencement of oviposition. This clearly indicated that the lifespan of females. *C. maculatus* was short as reported earlier by Tun (1979).

Table 1: Oviposition rate and F_1 adult emergence in C. maculatus (Fab.) under ambient laboratory conditions

Period (days)	Oviposition		F_1 adult emergence	
	Mean no. of eggs laid/ day	Mean daily% of egg laid	Mean no. of F_1 adult emerged/ day	Mean daily % of F_1adult emergence
1,	83	18.61	53	19.34
2.	125	28.03	81	29.56
3.	75	16.82	48	17.52
4.	56	12. 56	35	12.77
5.	34	7.62	20	7.30
6.	25	5.61	15	5.48
7.	20	4.29	11	4.02
8.	18	4.04	8	2.92
9.	10	2.24	3	1.10
10.	0	0	0	0
TOTAL	446		274	

Table 2: Female adult C. maculatus (Fab.) longevity under ambient laboratory conditions

Period (days)	Death rate		Survival rate	
	Mean no. of bruchids died/ day/20 females	Mean daily % of female bruchids died	Mean no. of bruchids survived/ day/20 females	Mean daily% of female bruchids survived
1.	0	0	20	100
2.	2	10	18	90
3.	4	20	16	80
4.	8	40	12	60
5.	10	50	10	50
6.	12	60	8	40
7.	13	65	7	35
8.	15	75	5	25
9.	18	90	2	10
10.	19	95	1	5
11	20	100	0	0

References

Barde, A. A., Misari, S. M. & Dike, M. C. (2012). Effect of cowpea seed coat texture on the oviposition and progeny development of *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae). *J. Biol., Agric. and Healthcare*, 2(11), 28-31.

Booker, R. H. (1967). Observations on three Bruchids associated with cowpea in Northern Nigeria. *J. Stored Product Research*, 3, 1-15.

Booth, S. A. (1976). Cowpea Storage. *Samaru Conference Paper*. No. 8. 11pp.

Dongre, T. K., Pawar, S. E., Thakur, R. G. & Harwalkar, M. R. (1996). Identification of resistant sources to cowpea weevil *C. maculatus* (Fab.) in *Vigna* spp. and in heritance of their resistance in black gram (*Vigna mungo* var. *mungo*). *J. Stored Prod. Res*., 32, 201-204.

Giga, D. P. & Smith, R. H. (1987). Egg production and development of *C. Rhodesionus* (Pic.) and *C. Maculates* (Fab.) (Coleoptera:Bruchidae) on several commodities at different temperatures. *J. Stored Prod. Res*., 23(1), 9-15.

Hall, A. E., Singh, B. B. & Ehlers, J. D. (1997). Cowpea breeding. *Plant Breed. Rev*. 15, 217-274.

Howe, R. W. &. Currie, J. E. (1964). Some laboratory observations on the rates of development, mortality, and oviposition of several species of Bruchidae breeding in stored pulses. *Bull. Entomol. Res*., 55(3), 437-477.

Messina, F. J. &.Renwick, J. A (1983). Ability of ovipositing seed beetles to discriminate between seeds with differing egg loads. *Ecol. Entomol*., 10, 225-230.

Mitchell, R. (1975). The evaluation of oviposition tactics in the bean weevil, *C. maculatus* (Fab.) in a strain of chickpea, *Cicer arietinum* L. *J. Stored Prod. Res*., 7(3), 213-216.

Nwanze, K. F. & Horber. E. (1975). Laboratory techniques for screening cowpeas for resistance to *C. maculatus* (Fab.). *Environmental Entomol*., 4, 415-419.

Nwanze, K. F. & Horber, E. (1976). Seed coats of cowpea affect oviposition and larval development of *C. maculatus* (Fab.). *Environ. Entomol*., 5, 213-218.

Ofuya, I. I. (1987). *C. maculatus* (Fab.) (Coleoptera: Bruchidae) oviposition behaviour on cowpea seeds. *Insect Sci. Applic*., 8(1), 77-79.

Prevett, P. T. (1961). Field infestation of cowpea, *Vigna unguiculata* pods by beetles of the families Bruchidae and Curculionidae in Northern Nigeria. *Bull. Entomol Res*., 52, 635-645.

Sarikarin, N., Srinives, P. & Saksoong, P. (1999). Effect of seed texture on bruchid infestation in mungbean, *Vigna radiata*(L.) *Wilczek. Sci. Asia*, 25, 203-206.

Southgate, B. J. (1979). Biology of the Bruchidae. *Ann. Rev. Entomol*., 24, 449-473.

Srinivasan, T. & Durairaj, C. (2007). Biochemical basis of resistance in rice bean, *Vigna umbellate* Thunb. (Ohwl and Ohashi) against *C. maculatus* (Fab.). *J. Entomology*, 4(5), 371-378..

Strong, R. G., Partida, G. J. & Warner, D. N. (1968). Rearing stored product insects for laboratory studies: bean and cowpea weevils. *J. Economic Entomol.*, 61, 747-751.

Tun, S. B. (1979). Control of cowpea storage pests and life history of cowpea weevil. *Samaru Misc. Paper* No.83, p. 13.

Wasserman, S. S. (1985). Oviposition behaviour and eggs distribution in the Southern cowpea weevil, *C. maculatus* (Fab.) (Coleoptera: Bruchidae). *J. Economic Entomol.*, 78, 89-92.

Wasserman, S. S. & D. J. Futuya. (1981). Evaluation of host plant utilization in laboratory populations of the Southern cowpea weevil, *Callosobruchus maculatus* (Fab.) (Coleoptera: Bruchidae). *Evolution*, 35, 605-617.