2

Bioscience Research Communications
Vol. 13, No. 6, December 31, 2001
Printed in Nigeria

0795-8072/2001 $12.00 + 0.00

BRC 200069/13603

Prostephanus truncatus (Horn) (Coleoptera: Bostrichidae) ability to breed and damage potential on cassava dried chips

A. T. Hassan and K. O. K. Popoola

Entomology Unit, Department of Zoology, University of Ibadan. Ibadan, Oyo State, Nigeria

(Received July 11, 2000)

ABSTRACT: Stored dried cassava chips are known to become heavily damaged by *Prostephanus truncatus* (Hurn). A laboratory study was undertaken to determine the extent of losses that this insect pest could cause on TME 30572, the mean weight loss (±SD) rose to 36.93 ± 24.43% over the period of 112 days compared with 63.2 ± 3.37% for TME1, under the same period and experimental condition. At each time interval of 28 days during which the cassava dried chips were examined, the weight loss in both varieties was on the increase, except, the 112 days where their was a drop in the weight loss in TME 30275 variety which was statistically significantly (t=0.033, P<0.05). Percentage mortality rate rose from 0% to 10.6% in TME 30572 larval, while zero mortality was recorded for TME1 larval. On the other hand, percentage mortality was on the increase in emergent adults for both cassava varieties. The highest percentage mortality in TME1 emergent adult was inflicted in TME1. However, storing TME 30572 rather than TME1 will not solve the problem of infestation and damage by *P. truncatus* because considerable damage is been inflicted on TME 30572. The experiment was conducted under ambient temperature of 30.3 ± 3.7°C and relative humidity of 84.7 ± 2.0% in the laboratory.

Key Words: Cassava dried chips; Cassava pests; *Prostephanus truncatus*; Weight loss.

Introduction

Prostephamus truncatus (Horn) is primarily insect pest of cassava, causing measurable damage on dried cassava chips. The structure of the dried cassava root may quickly be reduced to dust (Ingram and Humphiries, 1972; pingale et al., 1956). Pattinson (1968), estimated thhat insects feeding during storage in Tanzania may cause as much as 12% reduction in the total cassava chips export from the country. In malaysia, Parker and Booth (1979) have recorded a maximum of 16% weight loss in dried cassava chips after 2 months of storage. Farm stored cassava and maize in Tanzania have recently become subjected to serious infestation by *P. truncatus* (Horn) a beetle which was restricted to central America (Hodges et al., 1983). These heavy infestation of *P. truncatus* in cassava agree with the speculation of Chittenden (1911) that edible roots and timber may constitute the natural breeding sites for this species. The other known host on which *P. truncatus* may breed is a soft variety of wheat (shires, 1977).

Previous to 1981, there were no records of this pest in Africa but in that year the beetle was identified as the pest causing severe losses in farm stored maize in the hot dry Tabora region of Tanzania (Golob and Hodges, 1982). Since, 1981 *P. truncatus* has spread widely within Tanzania and has now reached Southern Kenya (Kega and Warui, 1983) and Burundi (Tropical Development and Research Institute (TDRI), (unpublished records). Early in 1984 a serious and sustained outbreak of pest occured in Togo, West Africa (Harnisch and Krall, 1984). Also ESCAP team in International Institute Tropication of Tropical and Agricultural research (IITA), Ibadan Nigeria recorded the presence of *P. truncatus* in some border towns, between Nigeria and Republic of Benin in 1994. The border towns include Kosubosu, Shaki, Imeko, Oja Odon and Ayetoro to mention but a few, (J.B. Ojo, personal communication, 1996). The present experiment was to provide information on the damage likely to occur in storage of TME 30572 and TME1, it also aimed at determine which of the two varieties is suitable for breding.

Materials and Methods

Laboratory study

Sixteen lots of abut 100g of each cassava dried chips were weighed (to nearest 0.g) into glass jars of about 300ml.. Each group of 16 were then divided into four portions of four. One group from each cassava variety was left uninfested (control setup), but six (4 females and 2 males) matured adults of *P. truncatus* from culture stock were introduced into the other jars. All jars were covered with Muslm cloth, and were bounded with rubber band to hold them tight before they were stored in the laboratory under ambient temperature and relative humidity.

The initial moisture content of the cassava varieties were determined by heating method. 50g of dried cassava chip (4 replicates) were heated in ventilated oven for two hours at 120°C to obtain a constant weight.

At 28, 56, 84 and 112 days, the four control jars were weighed, also the other three and three others of experimental jars for each variety were removed for examination by separating frass from fragment. The separation was done with sieve with mesh size N0 120 (London standard). All larval and adults insects were removed from the fragment and sorted into dead and living specimen for counting, also the frass were weighed and the weight were used to determine weight loss. The emergence weight losses for 30572 and tme1 roots at each time interval were compared using the student's t-test. Differences were regarded as significant at $P<0.05$. DAily temperature and relative humidity were recorded with the aid of thermometer and hydrometer, throughout the experimental period.

Results

Determination of pest status

Weight losses

The weight losses recorded in the roots over the days storage period were presented in Table 1. These losses were attributed to *P. truncatus* through feeding and boring activities. Steady percentage weight loss increament was recorede for both cassava varieties concerned. Cassava variety TME 30572 had 8.89% ± 2.61% by 28th day, this rose to 18.55% ± 5.37% by 56th day. Further damage were infected on the dried cassava chips and by 84th day, 25.87 ± 17.87% of weight loss was obtained. Lastly, percentage weight loss by 112th day was 36.93 ± 24.43%. While on the other hand, TME 1 had 3.03% ± 0.26% by 28th day, 12.9% ± 3.86% by 56th day, 37.1 ± 8.82% by 84th day and finally, 63.2% ± 3.37% of cassava dried chips was damaged. A significant difference between the two varieties - TME 30572 and TME 1, was obtained during time interval of 112 days. (112 days, t = 0.033, P<0.05) Reading, from other three storage period intercals were not statiscally, significant. However TME 1 suffered more damage compares to TME 30572.

Emergence

Numbers of matured and immatured *P. truncatus*, progeny and mortality at four different storage periods were recorded in Table 2. This experiment was conducted under mean range temperature and relative humidity of (30.0 ± 5.14 - 30.9 ± 0.45°C) and (82.8 ± 8.2 - 55.0 ± 2.02)%. The test span the period of 112 day. A mean range of (8.3 ± 8.2 - 55.0 ± 17.4) Larval emergence was recorded in TME 30572, while laval emergence mean range score for TME 1 was (0.3 ± 0.5 - 26.67 ± 14.7). The mean range for adult emergence in TME 30572 and TME 1 were 0.3 ± 0.5 - 107.3 ± 16.0 and 0 - 111.0 ± 3.7 respectively. Emergence of *P. truncatus* on TME 30572 and TME 1 cassava varieties were not statistically difference for 28th, 56th and 84th days intervals. Only, 112th day had significant difference 112 days, t = 0.024, P<0.05) (Vide Fig. 3)

Mortality

Mortality rate was high in TME 30572 when compared with TME 1. Mean range of (0.106) was obtained in TME 30572. In contrary, zero mortality rate was recorded in TME 1.

In the control setup, emergence and mortality was not recorded in both cassava varieties. Since *P. truncatus* was not introduced into the jars where the dried cassava chips were kept. (Table 2).

Table 1: The mean Percentage Weight Loss in Two Cassava Varieties - TME 30572 and TME 1 Under Laboratory Conditions.

Storage Period (days)	Cassava Varieties Weight loss (%)	
	TME 30572	TME 1
28	8.89 ± 2.61	3.03 ± 0.26
56	18.55 ± 5.37	12.9 ± 3.86
84	25.87 ± 17.87	3.71 ± 8.82
112	36.93 ± 24.43	63.2 ± 3.37
Control	0	0

Discussion

It is clear that weight losses in cassava due to *P. truncatus* activities can be very high with an overall average of 10% by 28th day which approached 50% by 84th day in TME 30572, recorded during the present study. In comparison, the mean weight loss due to *P. truncatus* in TME 1 stored for the period of 112 days was put at 65%. These heavy infestation of *P. truncatus* in cassava agreed with the speculations of Chittenden (1911) that edible roots and tubers may constitute the natural breeding sites for this species. DAmage on TME 1 was greater due to certain factors such as the degree of softness ror hardness of the cassava variety. TME 1 is softer when compared with TME 30572. Due to this fact pest could penetrate more during boring activity, which account for degree damage and oviposition rate. It is, obvious that oviposition rate is very important when considering breeding of pest. According to Hodges and Meik, (1984). Adult *P. truncatus* appeared to prefer fermented to unfermented cassava when given a direct choice, although this selection seems only to operate over a short distance. The reason for this preference is not certain, although as the fermented material has a slightly lover density it may be selected because it is easier to penetrate.

Table 2: Mean Larval and Adults Emergence and mortality of P. truncatus

Storage period (days)	Temperature (°C)	Humidity r.h. (%)	Cassava varieties	Emergence		Mortality	
				Larval	Adult	Larval	Adult
28	30.9 ± 0.45	85.4 ± 4.25	TME 30572	55.0 ± 17.4	0.3 ± 0.5	0	0
			TME 1	26.3 ± 17.2	0	0	0
56	30.8 ± 0.66	83.0 ± 14.67	TME 30572	8.3 ± 8.2	107.3 ±	5	4.7
			TME 1	26.67 ± 14.7	16.0 60.0 ± 19.8	0	1.7
84	30.1 ± 0.84	87.75 ± 2.02	TME 30572	37.7 ± 23.7	98.0 ± 63.6	0	13.6
			TME 1	7.3 ± 1.2	92.7 ± 33.6	0	11.2
112	30.0 ± 5.14	82.8 ± 14.50	TME 30572	49.3 ± 15.6	100.7 ±	10.6	13.5
			TME 1	0.3 ± 0.5	46.4 111.0 ± 3.7	0	9.8
control			TME 30572	0	0	0	0
			TME 1	0	0	0	0
range	30.0 ± 5.14 - 30.9 ± 0.45	82.8 ± 14.50 - 87.75 ± 2.02	TME 30572	8.3 ± 8.2- 55.0 ± 17.4 26.67 ±	0.3 +0.5- 107.3 ± 16.0	0-10.6	0-13.6
			TME 1	14.7 0.3 ± 0.5- 26.67 ± 14.7	0- 111.0±3.7	0	0-11.6

Emergence of adult.:

At 28th day, adults emergence were very low in both cassava varieties as this could be due to laboratory conditions of 30.3°C ± 3.7°C and 84.7 ± 2.0%, temperature and relative humidity under which the experiment was conducted. This might have prolong first folia generation life cycle beyond 28th day. Studies of the life cycle of *P. truncatus* over a wide range of temperature (12.40%) and humidities (30-90% r.h) suggest that the optimum condition for development on maize are 32°C and 70-80% r.h.

Bell and Walters (1982) observed that the life cycle was completed in 24-25days. In constract, Shires (1979 and 1980), rearing the pest in loosely packed maize flour, recorded a developmental period of 35.4 days. By 56th to 84th day, more adults were observed and at 112th day a *logistic development* was observed for TME 30572. Furtehrmore, by 28th day no adult emergent was observed in TME 1. Emergent of adult was first observed at 56th day, then 84th and 112th day. Adult emergent increased steadily in

TME1. No mortality was recorded for 28th day in *P. truncatus* fed on the 2 cassava varieties. Also mortality was not recorded for larvae of TME1 and all the larvae moulted to adults thereby increasing adult population, which in turn helps to step up damage, increasing weight loses stradily. This factor may also account for the significant difference at 112th day ($t=0.337$, $P<0.05$). On the other hand, mortality was observed in adults and this could be due to increase in both larval and adult of *P. truncatus* fed on TME 30572.

Both cassava varieties support breeding of *P. truncatus*. TME 30572 support faster breeding life cycle while lifecycle of TME1 is prolonged. TME 30572 adult emergence is not steady but TME1 had a steady growth.

In conclution, TME1 is more susceptible to *P. truncatus* damage and it support breeding better than TME 30572. Storage of TME 30572 than TME1 will not solve the problem of damage in store, because considerable damage is been done to both varieties in store. Therefore, a suitable control measure have to be adopted when storing any of the two varieties for a period of between 28 days (1 month) to 112 days (4 months).

References

Bell R.J. and Watters F.L. (1982) Environmental factors influencing the develo;ment and rate of increasing the development and rate of increase of *Prostephanus truncatus* (Horn) (Coleoptera: Bostriena dae) on stored maize .J. *Stored proct. Res. 18,* 131 - 142.

Chittenden F.H. (1911): papers on insects affecting stored products. The lesser grain borer. The larger grain borer. *Bull. Bur. Ent. U.S. Dep. Agric. 96,* 29-52.

Golob, P. and Hodges, R.J. (1982): Study of an outbreak of *Prostephanus truncatus* (Horn) in Tanzania. Report G. 164. *Trop. prod. Inst.* London.

Harnisch, R. and Krall. S. (1984): Further distribution of the larger grain borer in African. FAO *Plant prot. Bull. 32* 113-114.

Hodges, R.J., Daustan, W.R., Magazine, I. and Golob, P. (1983a): An outbreak of *Prostephanus truncatus* (Horn) (Coleptera: Bostrichidae) in East Africa. *Prot. Ecol. 5,* 183-1914

Hodges, R.J. and Meik, J. (1984): Infestation of Maize cobs by *Prostephanus truncatus* (Horn) (Coleptera: Bostrichidae)- Aspects of biology and control *J. stored. Prod. Res. 21,* 73-77.

Ingram, J.S. and Humphries, J.R.O. (1972): Cassava storage: a review. *Trop. Sci. 41,* 131-148.

Kega, V.K. and Warui, C.W. (1983): *Prostephanus truncatus* in Coast Province, Kenya. *Trop. Stored Prod. Int. 46., 2.*

Parker, B.C. and Booth, R.H., (1979): Storage of cassava chip. (*Manihot esculenta*): Insect infestation and damage. *Expl. Agric. 15.,* 145-151.

Pattinson, I. (1968): Crop storage problems. Report to the Government of Tanzania. U.N. *Devl. Prog.;* FAO, No. T.A. 2454.

Shires, S.W.., (1977): Ability of *Prostephanus truncatus*(Horn) (Coleoptera: Bostrichidae) to damage and breed on several srored food commodities *J. stored Prod. Res. 13,* 205-208.

Shires, S.W. (1979): Influence of temperature and humidity on survival, development period and adult sex ration in *Prostephanus truncatus* (Horn) (Coleoptera Bostichidae). *J. Stored Prod. Res. 15,* 5-10.

Shires, S.W. (1980): Life history of *Prostephamis truncatus* (Horn) (Coleoptera: Bostrichidae) at optimum conditions of temperature and humidity. *J. stored Prod. Res. 16.,* 147 - 150.