The Andhra Agric. J 65 (4): 885-889, 2018

Management of Bruchid, *Callosobruchus Maculatus* Fab. through Monitoring and Chemical Interventions in Stored Pulses

S V S Gopala Swamy and G V Suneel Kumar
Post Harvest Technology Centre, Bapatla, A.P.

ABSTRACT

The incidence of pulse bruchid, *Callosobruchus maculatus* was monitored using TNAU- two in one model funnel traps in stored pulses including bengalgram, redgram, blackgram and greengram at Agricultural Research Station, Darsi, Prakasam district, Andhra Pradesh during Rabi, 2015-16. Among these pulses, the mean numbers of pulse bruchids per trap were maximum (58.67 and 61.67 respectively) during 11^{th} and 12^{th} standard weeks in greengram, indicating its higher susceptibility to *C. maculatus* compared to blackgram, redgram and bengalgram. After each spraying, there was an immediate drop in the trap catches and following the third spraying, the emergence of adults from all the pulses was found negligible. Thus, chemical intervention as surface treatments while monitoring bruchid incidence using the TNAU- two in one model funnel traps could effectively minimize the population buildup in stored pulses.

Key Words: *Funnel traps, monitoring, pulse bruchid*

Grain legumes such as bengalgram, redgram, blackgram and greengram are the principal source of dietary protein and are an integral part of daily diet for most of the Indian population. Despite the fact that India is the largest producer of pulses, it resorts to import pulses to the tune of 2-3 million tonnes every year to meet the domestic demand. Hence, there is an urgent need to enhance the production of pulses to meet the requirements for achieving food and nutritional security. Apart from productivity enhancement of pulses, reducing the postharvest losses is also very important. The pulse bruchids, *Callosobruchus chinensis* L. and *C. maculatus* cause extensive losses to grain legumes in storage both in terms of quantity and quality. Bruchids cause an average of 10 – 15% loss across crops/regions in storage (Sharma *et al*., 2016). The grains may be completely hollowed out by feeding activity of the larvae, and characteristic emergence holes are evident only after the adult leaves the seeds (*Giga and Smith, 1983*). Infestation of pulse beetle starts in the field itself and carried to store, where sometimes it causes total destruction of the seeds within six months (Srinivasan *et al*., 2010). Management of bruchid pests in stored grain legumes relies majorly on surface treatment of walls, floor and gunny bags with chemical insecticides and sometimes on phosphine fumigation. Though chemical control is the most effective weapon for pest management, repeated application of toxic insecticides leads to development of resistance, insecticide residues in the produce; hence they are to be used rationally. However, early detection of insect infestations is essential for reducing storage losses and quality assurance and it is possible with traps compared to normal sampling methods (Rajesh *et al.,* 2015). With this in view, an effort was made to manage the pulse beetle, *C. maculatus* while monitoring its incidence using TNAU- Two in one traps in various pulses stored in a godown at Agricultural Research Station, Darsi, Prakasam district, Andhra Pradesh.

MATERIAL AND METHODS

Different pulses *viz*., bengalgram (*Cicer arietinum* L.) cv. JAKI 9218, redgram (*Cajanus cajan* L.) cv. LRG 41, blackgram (*Vigna mungo* L.) cv. LBG 752, and greengram (*Vigna radiata* L.) cv. LGG 460, produced under seed production programme during *Rabi*, 2015-16 were stored after processing in gunny bags (40 kg) and stacked in a rectangular godown compartment at Agricultural Research Station, Darsi. Prior to keeping them in the godown, the floor and walls of the godown were surface treated by spraying malathion 50 EC @ 10 ml/l using 3 l of spray fluid per 100 m^2. The two in one (TNAU) model funnel traps were used for monitoring bruchid insects in these pulses. The trap contains a perforated tube, collecting tube, cone shaped pit fall trap, perforated lid and bottom tapering cone. The trap was inserted in pulses grain in such a way that perforated lid of the trap was at the surface and walking insects on grain surface were captured easily and collected in the cone. From each stack, three bags were randomly selected and one trap was inserted in each bag and tied the opening of the bag. There were three replications for each produce, thus a total of 12 traps were installed. Monitoring was initiated from 11^{th} standard week and continued till the 35^{th} standard week. The data on insect population *i.e.,* number of insects collected in each trap were counted for every 2 – 3 days and it was pooled for a week and presented as mean number of adults per trap. A total of six rounds of surface treatments were imposed using deltamethrin 50 EC @ 10 ml/l or malathion 50 EC @ 10 ml/l alternately followed by the each peak catch of adults in funnel traps. The incidence of *C. maculatus* in each pulse grains was analyzed and compared over the period based on least significant difference (LSD) at $P= 0.05$. Similarly, the total population collected in all the traps was used to understand their temporal distribution under insecticide protection.

RESULTS AND DISCUSSION

The weekly trap catches indicated that there were significant differences in the incidence of pulse bruchid among the different pulses during the study period (Table 1). The mean numbers of pulse beetles trapped during the first two weeks were the maximum in all the stored seed legumes. Among these pulses, the mean numbers of pulse bruchids per trap were maximum (58.67) during 11th standard week in greengram, followed by blackgram (28.0), redgram (18.33) and bengalgram (11.67). Whereas, during the 12th standard week maximum number of beetles (61.67) were trapped in greengram followed by redgram (33.0), bengalgram (7.0) and blackgram (6.67). Discerning the higher trap catches for two consecutive weeks, insecticide spraying was given due to which, there was decline in the numbers of beetles trapped for another three weeks, though gradually increased later. Up to 25th standard week, the population emergence was high in all the pulses when compared to the later period. The mean numbers of pulse bruchids ranged from 0 to 33.0 in redgram, 0 to 61.67 in greengram, 0.33 to 28.0 in blackgram and 0 to 11.67 in bengalgram. As in this case of higher numbers of bruchid populations trapped from greengram, Bhargava *et al.* (2008) and Bharathi *et al*. (2015) also observed significantly higher susceptibility index of *C. maculatus* on greengram compared to other pulse host grains.

After the first treatment, two peaks of trap catches were observed with a total of 151 and 162 beetles recorded in 17th and 24th standard weeks respectively (Fig 1). After third spraying, the emergence of adults from all the pulses was found negligible. Immediate drop in the trap catches was also noticed after each spraying. Observance of higher numbers of pulse beetles during the first two weeks may be due to fast buildup of population probably resulted from cross and field infestations prior to initiation of monitoring. The decrease in the numbers of beetles compared to captures during initial period indicated that even the surface treatments with insecticides could effectively arrest the population buildup of pulse bruchid as they were timed appropriately while monitoring through traps. The cumulative mean number of bruchids collected in traps gradually declined after the second treatment and became negligible in all the pulses (Table 2 and Fig 2), indicating that the traps were useful not only in regular removal of adults but also in scheduling the time of intervention for further reducing population buildup.

The present findings were in conformity with the earlier reports. The pitfall traps removed substantial number of adults resulting in reduced damage by pulse beetle during storage in all grams tested (Mohan *et al*., 2001). Amsalu *et al*., (2008) proved that TNAU two in one model pulse beetle trap as a good indicator for timely detection of bruchids in stored pulses at farm/ retail outlet level. Duraimurugan *et al*. (2011) employed treatment of neem oil 60 EC@ 10 ml/kg of greengram seeds in combination with the use of pit fall traps and achieved good protection from pulse bruchids. Likewise, TNAU stack probe traps were used effectively for detection and monitoring of pests in

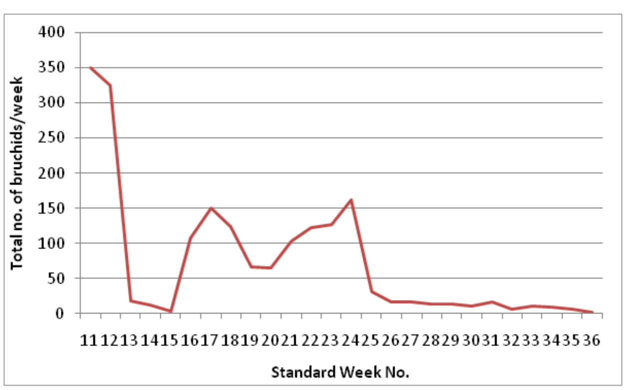

Fig 1. Emergence trend of bruchid population in stored pulses at Agricultural Research Station, Darsi.

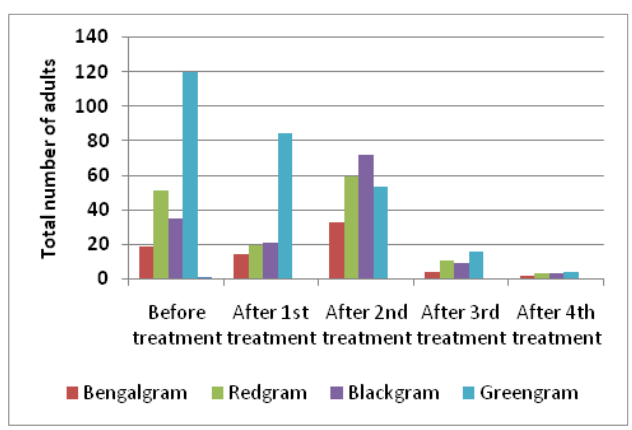

Fig 2. Trap captures of bruchids in different pulses following the chemical interventions

Table 1. Incidence of pulse bruchid, *C. maculatus* in stored pulses at Agricultural Research Station, Darsi during 2016

Std week No.	Period	Mean number of pulse bruchids / Funnel trap / week				Total no. of adults/week
		Bengalgram	Redgram	Blackgram	Greengram	
11	18-Dec	11.67 (3.45)	18.33 (4.32)	28.0 (5.32)	58.67 (7.64)	350
12*	19 - 25	7.0 (2.68)	33.0 (5.77)	6.67 (2.49)	61.67 (7.88)	325
13	26 -1 Apr	0.33 (0.88)	2.33 (1.64)	2.67 (1.71)	0.67 (1.05)	18
14	8-Feb	0.33 (0.88)	0.67 (1.05)	2.0 (1.43)	1.0 (1.18)	12
15	15-Sep	0.0 (0.70)	0.0 (0.70)	0.67 (0.99)	0.33 (0.88)	3
16	16 - 22	2.67 (1.76)	3.33 (1.91)	3.33 (1.89)	26.67 (5.16)	108
17	23 - 29	3.67 (2.0)	7.33 (2.79)	4.67 (2.23)	34.67 (5.92)	151
18*	30 - 6 May	7.33 (2.72)	5.33 (2.35)	7.67 (2.84)	21.0 (4.64)	124
19	13-Jul	5.0 (2.21)	8.33 (2.94)	3.33 (1.78)	5.67 (2.42)	67
20	14 - 20	4.33 (2.14)	4.33 (2.14)	8.33 (2.91)	4.67 (2.25)	65
21	21- 27	3.0 (1.82)	11.67 3.44)	15.33 (3.97)	4.67 (2.23)	104
22	28 - 3 Jun	3.0 (1.84)	12.0 (3.53)	14.0 (3.80)	12.0 (3.51)	123
23	10-Apr	6.67 (2.61)	10.0 (3.19)	13.33 (3.71)	12.33 (3.55)	127
24*	17-Nov	10.33 (3.28)	12.67 (3.62)	17.33 (4.22)	13.67 (3.77)	162
25	18 - 24	1.0 (1.18)	2.33 (1.68)	2.67 (1.76)	4.33 (2.16)	31
26	25 - 1 July	0.33 (0.88)	1.67 (1.46)	1.33 (1.35)	2.0 (1.56)	16
27	8-Feb	0.67 (1.05)	1.33 (1.35)	1.33 (1.35)	2.0 (1.58)	16
28	14-Sep	0.33 (0.88)	1.33 (1.35)	1.33 (1.35)	1.67 (1.46)	14
29	15 - 22	0.67 (1.05)	1.67 (1.46)	0.33 (0.88)	2.0 (1.58)	14
30	23 - 29	0.33 (0.88)	1.0 (1.18)	1.0 (1.23)	1.33 (1.35)	11
31*	30 - 5 Aug	0.67 (0.99)	1.33 (1.35)	1.0 (1.18)	2.33 (1.68)	16
32	12-Jun	0.67 (1.05)	0.33 (0.88)	0.33 (0.88)	0.67 (1.05)	6

Table cont....

33	13 - 19	0.33 (0.88)	1.0 (1.18)	1.0 (1.23)	1.33 (1.35)	11
34	20 - 26	0.33 (0.88)	0.33 (0.88)	1.0 (1.18)	1.67 (1.46)	10
35	27 - 2 Sept	0.33 (0.88)	0.67 (0.99)	0.67 (1.05)	0.33 (0.88)	6
36	9-Mar	0.0 (0.70)	0.33 (0.88)	0.33 (0.88)	0.0 (0.70)	2
	CD (P=0.05)	0.76	0.68	0.83	0.76	
	SEm±	0.27	0.24	0.29	0.27	

Figures in parentheses are "X+1 transformed values; *A spraying was done, after taking the trap counts.

Table 2. Effect of surface treatments on population emergence of pulse beetles

	Cumulative mean population (no.) collected in traps				Total Population (No.)
	Bengalgram	Redgram	Blackgram	Greengram	
Before treatment	18.67	51.33	34.67	120.33	675
After 1st treatment	14.33	19	21	84.33	416
After 2nd treatment	32.33	59	71.67	53	648
After 3rd treatment	4	10.67	9	15.67	118
After 4th treatment	1.67	2.67	3.33	4	35

storage bags of wheat grains (Hategekimana *et al.*, 2013), and turmeric rhizomes (Rajesh *et al.*, 2015), as they could detect insect infestations in stored produce more precisely compared to normal spear sampling method, especially during post fumigation period. Thus, use of pit fall traps is not only useful in predicting the time of emergence of the bruchids, if used in more numbers substantial number of adults can also be removed as soon as they emerged from grains, resulting in reduced oviposition and grain damage. Since the pulse bruchid is an internal feeder, removal by trapping of adults and surface treatments can help in suppression of subsequent population buildup. Similarly, Mbata *et al*. (2014) also monitored potato tuber moth, *Phthorimaea operculella* (Zeller) in potato fields as well as in storage facilities using Delta sticky traps baited with synthetic pheromone, for predicting the most appropriate times to institute intervention measures to mitigate damage by the moth.

Monitoring of bruchid infestations using pit fall traps from the beginning is very essential, so that early removal of adults from initial emergence prevents oviposition and further multiplication in storage. Thus, TNAU two in one funnel traps can be recommended for early detection of *C. maculatus* in stored pulses either in steel bins or in gunny bags.

CONCLUSION

It can be concluded that the TNAU two in one model funnel traps are useful gadgets for predicting the most appropriate times for instituting the intervention measures to mitigate damage to stored pulses.

LITERATURE CITED

Amsalu D, Mohan S, Kuttalum S and Nagappan R 2008 Cross boarder technology transfer- A case study with TNAU trapping technologies in Gondar, Ethiopia, Africa for the management of stored product insects. *Research and Reviews in BioSciences*, 2(1): 48-50.

Bhargava M C, Choudhury R K and Yadav S R 2008 Biology and host preference of pulse beetle (*Callosobruchus chinensis* L.) on different pulses. *Journal of Maharashtra Agricultural University*, 33: 44-43.

Bharathi D T, Krishnayya P V, Madhumathi T and Manoj Kumar V 2015 Population development and damage by pulse beetle, *Callosobruchus maculatus* on different pulse host grains. *The Andhra Agricultural Journal*, 62(4): 879-884.

Duraimurugan P, Raja K and Regupathy A 2011 An eco-friendly approach for management of pulse beetle, *Callosobruchus maculatus* through neem formulations assisted with pitfall trap. *Journal of Food Legumes,* 24(1): 23- 27.

Giga D P* and *Smith R H 1983 Comparative life history studies of four *Callosobruchus* species infesting cowpeas with special reference to *Callosobruchus rhodesianus* (Pic) (Coleoptera: Bruchidae). *Journal of Stored Products Research, 19*: *189-198*.

Hategekimana A, Mohan S, Ramaraju K and Thirupathi V 2013 Efficiency of stack probe trap for detection, validation of fumigation and distribution of stored grain insects in bag stacks. *Journal of Renewable Agriculture,* 1(3):39-43.

Mbata G N, Badji K and Brewster C C 2014 Monitoring populations of *Phthorimaea operculella* in potato fields and in storage in Senegal. *International Journal of Pest Management*, 60 (4): 300-306.

Mohan S, Devadoss C T and Mahendran K 2001 New devices for pulse beetle management. *Plant Protection Bulletin*, 53: 27-32.

Rajesh A, Mohan S and Nelson S J 2015 Efficacy of TNAU-Stack probe trap in detection, monitoring of pests and validation of fumigation in turmeric bag-stack storage. *Current Biotica*, 9(2): 159-165.

Sharma H C, Tamo M, Mustapha El B and Ranga Rao G V 2016 Pest management in grain legumes: potential and limitations. Integrated pest management in the tropics; pp. 275-292 (Dharam P Abrol. Editor), New India Publishing Agency, New Delhi (India).

Srinivasan T, Duraimurugan P, Singh S K and Chattopadhyay C 2010 Bruchids infestation in pulses and its management. *Indian Farming*, 60: 13-16.

Received on 23.01.2018 and revised on 02.07.2018