

SHORT NOTE

Efficacy of some carbaryl mixed baits in mass luring and killing of sunflower and sorghum infesting *Pachnoda interrupta* (Olivier) (Coleoptera: Cetoniidae)

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The sorghum chafer *Pachnoda interrupta* Olivier (Coleoptera: Cetoniidae) has become a new potential serious pest of sunflower, sorghum and millet in Sudan (Abdalla *et al.*, 2012; 2013) and no measures are known at present for its control. It is present in the semi-arid parts of Africa, which are subjected to seasonal variation in rainfall and temperature, mainly in the Sahel and Sudan ecoregions (Schmutterer, 1969; Grunshaw, 1992; Jago, 1995; Sastawa and Lale, 2000). In the Sudan, *Pachnoda* genus has six occasionally reported species; *P. interrupta* Olivier, *P. marginata* (Drury) var. *zonaria*, *P. cordata* (Drury), *P. sinuata* F., *P. discoidalis* Moser and *P. massajae* Gerst. Among them, *P. interrupta* is the only species that attained the “pest” status recently in Sudan (Abdalla *et al.*, 2013). According to Abdalla *et al* (2012), *P. interrupta* caused disc damage to the sunflower hybrids: Pan 7351, Pan 7033, Pac 361, Hysun 33, ARC 310, Sirena and Pac 317, in a range of 1.0% - 84.8%; panicle damage to the sorghum genotypes Jumbo, Pannar, Kambal and Sugar graze of 0.6%, 1.8%, 99.7% and 96.7%, respectively, and panicle damage to the millet genotypes Ashana, Ugandi and a local millet hybrid in a range of 98.2%-98.8%. Clarke and Crowe (1978) stated that *P. interrupta* can become a serious pest of sorghum heads when failed / delayed rainy seasons occur. Jonas *et al.* (2009) reported *P. interrupta* as a key pest of sorghum and sunflower, causing 58%-71% reduction of sorghum yield in Ethiopia. Yitbarek and Hiwot (2000) reported that *P. interrupta* eats immature grains of some crops, hampers fructification and seed setting, and causes sorghum yield loss of up to 70% in severely affected areas.

The control measures followed elsewhere consist of cultural, use of attractants and biological and chemical methods. The attractants comprise eugenol extracted from clove, rotting fruits of banana, guava, mango, peach and cactus. The chemical includes mixing baits with insecticides and spraying (Jonas *et al.*, 2009). Yitbarek and Hiwot (2000) stated that many scarabaeid beetles including *P. interrupta*, display attraction to the yellow colour.

The objectives of this study were to evaluate yellow coloured traps, banana essence, clove extract, rotting fruits of banana, guava, and mango, mixed with carbaryl 85% WP at 2.5% product (w/v) in mass luring and killing of the beetle, in sunflower and sorghum fields.

The study was conducted at the Gezira Research Station Farm, during 2012-2013 season, in *P. interrupta* infested sunflower and sorghum fields. The materials included white plastic boxes (31cm in width, 20 cm in length, 20 cm in depth); plastic cups (8 cm diameter at top, 5.5cm at bottom and 9.5 cm in height); yellow thin oilcloth; sponge (1cm in depth, 5cm in width and 10cm in length); sticky tape; rotting fruits of banana, guava, and mango; banana essence; clove extract and carbaryl 85% wettable powder (WP). The oilcloth was stuck to the inner sides and bottom of the plastic box with tapes to form a yellow trap (YT). A 2.5% (w/v) solution of carbaryl 85% WP was prepared (Robert, 1994). The treatments were: (i) Yellow trap (YT) + rotting fruits of banana (RFB) + carbaryl (C). (ii) YT + rotting fruits of guava (RFG) + C. (iii) YT + rotting fruits of mango (RFM) + C. (iv) YT +

banana essence (BE) + C. (v) YT + clove extract (CE) + C. (vi) YT + C. (vii) White plastic box (WB) + C. 200g of rotting banana, guava and mango fruits were cut into small pieces and each was placed at bottom of the YT, then 400 ml of the carbaryl solution was added to each. The CE treatment was prepared by soaking 14 g of cloves in 500 ml water for 24h then filtered. The sponge was placed inside the plastic cup, put at the bottom of the YT; 20 ml of CE was added to the sponge and 400 ml of the carbaryl solution to the bottom of the YT. The BE was added in the same foregoing way after diluting 10 ml in 10 ml of water.

The traps were randomly distributed in the fields (Fig. 1), at 4-15 replicates. Inefficient treatments were replicated 4 times then discarded.

400 ml of water was daily added to YT/box, at 8 am, during the first four consecutive days, to maintain the concentration and compensate for evaporation. The captured *P. interrupta* adults were counted every five days and the traps were re-baited, re-poisoned and re-located again. Data were transformed to \sqrt{x} when necessary. Analysis of variance and Duncan's Multiple Range Test were used in the statistical analysis.



Figure 1. Yellow traps in a sorghum field.

On sunflower fields, *P. interrupta* appeared at the flowering-milky stage. Infestation had hybrid dependence. Its damage started from the periphery of the disc and developed towards the centre, following fertilization. The beetles were mostly found in clusters, influenced by irrigation, rainfall, growth stage of the plants and field management (Fig. 2; 3). As shown in Table 1, YT + RFB + C treatment recorded significantly the highest numbers of lured and killed beetles, compared to all other treatments ($P \leq 0.001$). The highest number of captured beetles in one trap was 2005 and the average was 398/trap/5 days (Fig. 4). This indicated that the RFB used as a luring agent in this treatment was more preferable as food for the beetle than the sunflower seeds. Other than the captured beetles, many were observed dead in the field, out of the traps, indicating their feed on the toxic baits and death after taking-off; their numbers were not included in the counts.

Figure 2. *P. interrupta* attack to sunflowerTable 1. Numbers of *Pachnoda* adults captured per trap / 5 days in fields of sunflower and sorghum, Gezira Research Station field, 2012-2013 season.

Treatment	<i>Pachnoda</i> adults captured/ trap / 5 days in field of			
	Sunflower		Sorghum	
	Max.	Average	Max.	average
YT + RFB + C	2005	(398)19.2 a	0.0	0.0
YT + RFG + C	207	(67) 7.7 b	0.0	0.0
YT + RFM + C	NC	NC	0.0	0.0
YT + BE + C	1.0	(0.2) 0.4 c	0.0	0.0
YT + CE + C	1.0	(0.3) 0.5 c	0.0	0.0
YT + C	1.0	(1.0) 1.0 c	0.0	0.0
WB + C	1.0	(0.3) 0.3 c	0.0	0.0
Sig.level		***		
SE±		0.95		
CV%		25.7		

YT= yellow trap. RFB = rotting fruits of banana. RFG = rotting fruits of guava. RFM = rotting fruits of mango. BE = banana essence. CE = clove extract. WB = white box. C = carbaryl. NC = not considered. Average data on sunflower were transformed to \sqrt{x} . Actual figures in parenthesis. Means in columns followed by the same letter are not significantly different at 0.001% level (***) according to Duncan's Multiple Range Test.



Figure 3. *P. interrupta* damage to sunflower disk
 Figure 4. Captured *Pachnoda* beetles /trap/5 days. Treatment YT + RFB+ C.

The treatment YT + RFG + C ranked second, by recording 207 and 67 beetles, for the highest and average values, respectively. The YT + BE + C, YT + CE + C and YT + C were found inefficient in luring the beetle. This indicated that the beetles prefer the natural rotting fruits of banana more than its synthesized essence and the rotting fruits of banana and guava more than the clove extract. It was also proved that the yellow colour of the trap was not stimulating enough to lure the beetles to the poisoned baits, as it showed similar results to the treatment WB + C. This ultimately indicated that the rotting fruits of banana and guava in the treatments YT + RFB + C and YT + RFG + C were the key luring agents rather than the yellow colour of the trap. It was observed that the higher the number of traps used, the higher the number of beetles caught.

On sorghum fields (Table 1), the damage started at the flowering stage (Fig. 5), from the top of the panicle/spikes and developed orderly downwards (Fig 6). The beetles avoided direct sun rays, were found mostly in clusters on shady parts of the panicle and consumed all or most of the grain's endosperm, and the damaged panicles turned chafed. None of the tested treatments, including those containing the rotting fruits of banana and guava, lured the beetles from sorghum. This proved exclusive preference of sorghum as food, over all other nutritive substances in the area, including the tested materials.



Figure 5. *P. interrupta* attacking sorghum.

Figure 6. *P. interrupta* damage to sorghum Panicles (chafed heads).

These results completely agree with those reported from Ethiopia, where the use of toxic baits has become popular among farmers in recent years. According to the FAO (2002), *P. interrupta* beetles were being attracted to ripe banana, guava, etc, and banana was found to be consistently the best attractant material; it is now being used in the formulation of bait for the control of the sorghum chafer, and the methods have been claimed as effective by the FAO.

Other individual beetles lured and killed by the YT+ RFB + C treatment were: *Pachnoda marginata* Drury, *P. cordata* Drury, *Glycyphana sanguinobuta* Oliv. *Rhabdotis sorbrina* G&P (Coleoptera: Cetoniidae) and *Agrypnus notodonta* Latr. (Coleoptera: Elateridae). At the time of outbreaks, this treatment might serve as a possible option for their capturing and killing.

In conclusion, the treatment that contained rotting fruits of banana (200 g) + carbaryl 85% WP (400 ml of 2.5% (w/v) / trap), proved efficiency in luring and killing of the sorghum chafer *P. interrupta* in sunflower fields, and hence, is recommended to be placed, in containers regardless to their colour, inside sunflower fields to check the beetles, or outside the fields to divert the beetles away from the crop.

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من حقول زهرة *Pachnoda interrupta* فعالية بعض الطعوم المخلوطة بالكاربوريل في جذب وقتل خنفساء الشمس والذرة الرفيعة

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الخلاصة

لقد أصبحت خنفساء الذرة آفة جديدة وذات خطورة كامنة على محاصيل زهرة الشمس والذرة الرفيعة والدخن بالسودان وليس لها وسائل مكافحة معروفة في الوقت الحاضر. هدفت الدراسة إلى تقييم المصائد الصفراء اللون، روح الموز، خلاصة القرنفل، ثمار الموز والجوافة والمانجو المتعفنة، والمخلوطة جميعها بمبيد الكاربوريل 85% (بدرة قابلة للذوبان) بتركيز 2.5% تجهيزه (وزن/حجم)، في جذب الخنفساء بأعداد كبيرة وقتلها في حقول زهرة الشمس والذرة الرفيعة. أجريت هذه الدراسة بمحطة بحوث الجزيرة خلال موسم 2013/2012 واشتملت على سبعة معاملات. في حقول زهرة الشمس، سجلت معاملة "المصيدة الصفراء + ثمار الموز المتعفنة + الكاربوريل" أعلى عدد للخنفاص المنجذبة والمقتولة مقارنة بجميع المعاملات الأخرى و بمعنوية عالية جدا. بلغ أعلى عدد تم جذبه وقتله بمصيدة واحدة خلال فترة 5 أيام 2005 خنفساء، وبلغ المتوسط 398 خنفساء للمصيدة الواحدة / 5 أيام. يثبت هذا أن ثمار الموز المتعفنة المستخدمة كعامل جذب في هذه المعاملة أكثر تفضيلا للخنفساء كغذاء من حبوب زهرة الشمس. أتت معاملة " المصيدة الصفراء + ثمار الجوافة المتعفنة + الكاربوريل " بعد المعاملة السابقة، بتسجيلها 207 خنفساء كأعلى عدد سجل بمصيدة واحدة خلال 5 أيام ومتوسط 67 خنفساء للمعاملة / 5 أيام. في حقول الذرة الرفيعة، لم تسجل كل المعاملات المختبرة أي جذب للخنفساء. يدل هذا بوضوح إلى تفرد الذرة كغذاء للخنفساء من بين جميع المواد الغذائية المتاحة في المنطقة، ومن بينها المواد المختبرة. أوصت الدراسة باستخدام معاملة " المصيدة الصفراء + ثمار الموز المتعفنة + الكاربوريل"، بوضعها داخل حقول زهرة الشمس لمكافحة خنفساء الذرة، أو خارج الحقول لتحويل الخنفاص بعيدا عن المحصول.