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Repellent effects of powder and extracts of leaf and root bark of *Calotropis procera* and *Parquetina nigrescens* on *Callosobruchus maculatus* (F). (Coleoptera: Chrysomelidae)

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Abstract
This study assessed the efficacy of powder and solvent extracts of the leaf and root bark of *Calotropis procera* and *Parquetina nigrescens* to repel *Callosobruchus maculatus*. This was with a view to developing a botanical based repellant for the control of bean weevil in cowpea storage. The powder and solvent extracts of leaf and root bark of *C. procera* and *P. nigrescens* were prepared and different concentrations of the powder and solvent extract of the plant materials used for repellency tests of *C. maculatus*. The results showed that the powder of *C. procera* and *P. nigrescens* leaf repelled higher number of insects than the powder of *C. procera* and *P. nigrescens* root bark, while repellency was generally higher in ethanolic extract of *C. procera* leaf and root bark than the methanolic extracts of *C. procera* leaf and root bark. There was significant difference ($P< 0.05$) in the number of insects repelled at every concentration. In conclusion, the study shows that the leaf and root bark of *C. procera* and *P. nigrescens* contain relative repellency properties that could be used in the control of infestation of cowpea seeds by *C. maculatus*.

Keywords: repellency, concentration, leaf, root bark and *Callosobruchus maculatus*

Introduction
Cowpeas play a critical role in the lives of millions of people in Africa and other parts of the developing world, as it serves as a major source of dietary protein that nutritionally complements low-protein cereal and tuber crops (Singh, 2002; Langyintuo *et al.,* 2003) [1, 2]. Cowpea seeds weevil, *Callosobruchus maculatus* (F.) (Coleoptera: Chrysomelidae), is a cosmopolitan field-to-store pest and a principal post-harvest pest of cowpea in the tropics (Caswel, 1981) [3].
Parkin and Bills (1995) [4] reported that the major insect pests infesting stored pulses belong to the Bruchidae family. They are prolific in their breeding and rapidly cause serious postharvest losses of cowpea seeds. It causes substantial quantitative and qualitative losses manifested by seed perforation and in weight, market value and germination ability of seeds (Ahmed *et al.,* 2009; Kumar *et al.,* 2009; Oluwafemi, 2012) [5, 6,7].
Repellents from plant origins are considered safe in pest control because they have low or none pesticide residue making them safe to the people, environment and ecosystem in (Talukder *et al.,* 2004) [8]. Powders and solvent extracts from various plants are good repellent against insect pests of stored grains (Rajashekar *et al.,* 2012) [9]. The aqueous extracts leaves, succulent stems, inflorescence and fruits of *Tephrosia vogelii* and *Lantana camara* were found to have repellent activity against *Sitophilus zeamais* in stored maize grain (Ogendo *et al.,* 200) [10], also, the leaves of *Lippia javanica* were found to have mosquito repellent activity (Lukwa *et al.,* 2009) [11]. Repellent activity of more botanicals is needed to develop a wide array of biological control measures against storage insect pests among which is *C. maculatus* in stored cowpea seeds.

Materials and Methods
The repellent effects of the powder and solvent extract of leaf and root bark of *C. procera* and *P. nigrescens* against *C. maculatus* were determined using the methods described by Shehu (2009) and Adarkwah *et al.* (2010) [12, 13].
Ten grammes (10 g) each of 1.25 %, 2.5 %, 5 %, 7.5 %, 10 % powder and 5 mL of 1 %, 2 % 3 %, 4 %, and 5 % of methanolic and ethanolic extracts of leaf and root bark of *C. procera* and *P. nigrescens* and were uniformly applied to half filter paper disc as uniform as possible. Treated filter papers with extracts were air dried for 1 h after which the two halves were joined together and placed in a Petri dish. Ten (10) of one to three-day old unsexed *C. maculatus* were introduced at the middle of each filter paper and covered with Petri-dish cover. The untreated side of the filter paper was used as control. The number of insects present on control (Nc) and treated sides (Nt) was recorded after 30 minutes. Percentage repellency (PR) values were computed as follows:

$$PR = \frac{Nc - Nt}{Nc + Nt} \times 100$$

Data analysis
Data obtained was subjected to analysis of variance (ANOVA) procedure of Minitab 16.1 (2007) [14]. Tukey's Test at $P = 0.05$ was used to compare means.

Results
Table 1 shows the results of the repellent effects of the powder of leaf and root bark of *C. procera* and *P. nigrescens* on the adult of the *C. maculatus*. At concentrations 1.25 – 10 %, powder of *C. procera* and *P.*

nigrescens leaf repelled higher number of insects than the powder of *C. procera* and *P. nigrescens* root bark. Highest repellency was obtained in the powder of *C. procera* leaf at all concentrations than other powder used. *P. nigrescens* root bark powder had the least repellent activity. There was significant difference (P< 0.05) in the number of insects repelled at every concentration.

The results of repellent effects of ethanolic and methanolic extracts of leaf and root bark of *C. procera* and *P. nigrescens* on the adult of *C. maculatus* are presented in the Table 2. Repellency was generally higher in ethanolic extract of *C. procera* leaf and root bark than the methanolic extracts of *C. procera* leaf and root bark. Similarly, ethanolic extracts of *P. nigrescens* leaf and root bark repelled more insects than the methanolic extracts of *P. nigrescens* leaf and root bark. Repellency decreased with decrease in concentrations of all the extracts. At every concentration, there was significant difference (P< 0.05) in the repellency among the extracts. Repellency was highest in 5% concentration of *C. procera* ehanolic and methanolic extracts of the leaves 95.00±5.00 and 90.00±5.00 with lowest repellency 15.00±0.00 in methanolic extract of *P. nigrescens* root bark.

Table 1: Repellent effects of powder of leaf and root bark of *C. procera* (Cp) and *P. nigrescens* (Pn) on the adult of *C. maculatus*.

Plant materials	Percentage Repellency (%) per gram weight of dry powder				
	1.25	2.5	5	7.5	10
C. procera leaf powder	25.00±5.00^{a}	30.00±5.00^{a}	40.00±10.00^{a}	45.00±5.00^{a}	55.00±5.00^{a}
C. procera root bark powder	15.00±5.00^{c}	20.00±10.00^{b}	25.00±5.00^{c}	30.00±5.00^{c}	30.00±5.00^{c}
P. nigrescens leaf powder	20.00±10.00^{b}	20.00±5.00^{b}	30.00±5.00^{b}	40.00±5.00^{b}	40.00±10.00^{b}
P. nigrescens root bark powder	5.00±5.00^{d}	10.00±0.00^{c}	20.00±5.00^{d}	20.00±0.00^{d}	25.00±5.00^{d}

Means in the same column with the same alphabets are not significantly different (P<0.05).

Table 2: Repellent effects of ethanolic and methanolic extracts of leaf and root bark of *C. procera* (Cp) and *P. nigrescens* (Pn) on the adult of *C. maculatus*

Plant materials	Percentage Repellency (%) per plant extract concentration (g ml^{-1})				
	1	2	3	4	5
C. procera leaf ethanolic extract	70.00±5.00^{a}	70.00±5.00^{a}	80.00±5.00^{a}	85.00±5.00^{a}	95.00±5.00^{a}
C. procera leaf methanolic extract	60.00±5.00^{b}	65.00±5.00^{a}	70.00±5.00^{b}	80.00±5.00^{a}	90.00±5.00^{a}
C. procera root bark ethanolic extract	35.00±5.00^{d}	40.00±0.00^{c}	40.00±5.00^{e}	50.00±5.00^{d}	60.00±5.00^{d}
C. procera root bark methanolic extract	25.00±5.00^{e}	25.00±0.00^{d}	35.00±5.00^{e}	50.00±5.00^{d}	50.00±5.00^{e}
P. nigrescens leaf ethanolic extract	50.00±0.00^{c}	50.00±5.00^{b}	65.00±5.00^{bc}	70.00±5.00^{b}	80.00±5.00^{b}
P. nigrescens leaf methanolic extract	40.00±5.00^{d}	55.00±5.00^{b}	60.00±5.00^{c}	70.00±5.00^{b}	70.00±5.00^{c}
P. nigrescens root bark ethanolic extract	40.00±5.00^{d}	40.00±5.00^{c}	50.00±5.00^{d}	60.00±5.00^{c}	80.00±5.00^{b}
P. nigrescens root bark methanolic extract	15.00±5.00^{f}	15.00±0.00^{e}	20.00±5.00^{f}	30.00±5.00^{e}	40.00±5.00^{f}

Means in the same column with the same alphabets are not significantly different (P<0.05).

Discussion

The repellent effect of solvent and powder extracts of leaf and root bark of *C. procera* and *P. nigrescens* observed in this study may be due to the presence of volatile compound that comes up with strong odour that could block the tracheal respiration of insects and eventually lead to death (Pugazhvendan *et al.*, 2012) [15].

This repellent action of the leaf and root bark of *C. procera* and *P. nigrescens* of solvent and powder extracts against *C. maculatus* indicates the presence of chemicals in the plant extracts that stimulate movement away from the source of stimulus (Dethier *et al.*, 1960; Eziah *et al.*, 2013) [16, 17]. The repellent effect of ethanolic extract of *C. procera* leaf and powder extract produced 95 % and 55 % repellent activity against *C. maculatus* respectively which shows that solvent extracts of plant materials are known to repel insects more than the powder extract (Dwivedi and Shekhawat, 2004; Nattudurai *et al.*, 2015) [18, 19]. Methyl salicylate, an aromatic ester which is known to contain insect repellent properties (Hardie *et al.*, 1994) [20] may not be present in large quantity in the root bark of *C. procera* and *P. nigrescens* as their repellent activity was relatively low when compared with their leaf extracts. The repellent nature of *C. procera* and *P. nigrescens* may enhance their protection potential against the infestation and damage of cowpea by *C. maculatus*.

References

1. Singh BB. Recent genetic studies in cowpea. In: Fatokun CA, Tarawali SA, Singh BB, Kormawa PM, Tamo M (eds) Challenges and Opportunities for Enhancing Sustainable Cowpea Production. International Institute of Tropical Agriculture, Ibadan, Nigeria, 2002, 3–13.
2. Langyintuo AS, Lowenberg-DeBoer J, Faye M, Lambert D, Ibro G. Cowpea supply and demand in West Africa. Field Crops Research. 2003; 82:215–231.
3. Caswel GH. Damage to stored cowpea in the northern part of Nigeria. Samaru J. Agric. Res.1981, 5, 4–5.
4. Parkin FA, Bills GT. Insecticidal dusts for protection of stored peas and beans against bruchid infestation, Bull. Ent. Res. 1955; 46:625.
5. Ahmed S, Din N. Leaf Powders of basil (*Ocimum basilicum* L.), lantana (*Lantana camara* L.) and gardenia (*Gardenia jasminoides* Ellis) affect biology of *Callosobruchu schinensis* L. (Coleoptera: Bruchidae). Pak. Entomol. 2009; 31: 5-9.
6. Kumar A, Shukla R, Singh P, Singh A, Dubeya N. Use of essential oil from *Mentha arvensis* L. to control storage moulds and insects in stored chickpea. J. Sci. Food Agric. 2009; 89: 2643–2649.

7. Oluwafemi AR. Comparative effects of three plant powders and pirimiphos-methyl against the infestation of *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae) in cowpea seeds. SOAJ Entomol. 2012, 1, 87–99.
8. Talukder F, Islam M, Hossain M, Rahman M, Alam M. Toxicity effects of botanicals and synthetic insecticides on *Tribolium castaneum* (Herbst) and *Rhyzopertha dominica* (F.). Bangladesh J. Environ. Sci. 2004; 10(2):365-371.
9. Rajashekar Y, Bakthavatsalam N, Shivanandappa. Botanicals as grain protectants. Psyche: A Journal of Entomology. 2012; 1-13.
10. Ogendo J, Belmain S, Deng A, Walker D. Comparison of toxic and repellent effects of *Lantana Camara* L. with *Tephrosia vogelii* hook and a synthetic pesticide against Sitophilus zeamais motschulsky (Coleoptera: Curculionidae) in stored maize grain. International Journal of Tropical Insect Science. 2003; 23(02):127-135.
11. Lukwa N, Molgaard P, Furu P, Bogh C. *Lippia javanica* (Burm F) Spreng: Its general constituents and bioactivity on mosquitoes. Tropical biomedicine. 2009; 26:85-91.
12. Shehu A. Biological Efficacy of Calneem oil against the cowpea beetle. *Calloobruchus maculatus* and the tropical warehouse moth. *Ephestia cautella* M. Phil Thesis, University of Ghana, Legon. 2009.
13. Adarkwah C, Obrng-Ofori D, Buttner C, Reichmuth C, Scholler M. Biorational control of red flour beetle *Tribolium castaneum* (Herbst) (Coleoptera: Tenebrionidae) in stored wheat with Calneem oil derived from neem seeds. Journal of Pest Sciences. 2010; 83: 471-479.
14. Minitab. Minitab version 16.1. Minitab Inc., State College. P. A. U.S.A. 2007.
15. Pugazhvendan SR, Ross PR, Elumalai K. Insecticidal and repellant activities of four indigenous medicinal plants against stored grain pest, *Tribolium castaneum* (Herbst) (Coleoptera: Tenebrionidae). Asian Pacific Journal of Tropical Disease. 2012; S16-S20.
16. Deithier VG, Browne LB, Smith CNThe digestion of chemicals in terms of the responses elicit from insects. Journal of Economic Entomology. 1960; 35 (1): 134-136.
17. Eziah VY, Buxton T, Owusu EO. (2013). Bioef ficacy of *Zanthoxylum xanthoxyloides* and *Securidaca longependuncata* against *Prostephanus truncates*(Horn) (Coleoptera: Bostrichidae) and *Tribolium castaneum* (Herbst) (Coleoptera: Tenebrionidae). Journal of Biopesticides. 2013; 6(1):54-62.
18. Dwivedi SC, Shekhawat NB. Repellent Effect ofSome Indigenous Plant Extracts against *Trogoderma granarium* (Everts). Asian Journal of Experimental Science. 2004; 18: 47-51.
19. Nattudurai G, Irudayaraj SS, Paulraj MG, Baskar K, Ignacimuthu S. Insecticidal and Repellent Activities of *Toddalia asiatica* (L.) Lam. Extracts against Three Major Stored Product Pests. Entomology, Ornithology and Herpetology. 2015; 4:148. doi:10.4172/2161-0983.1000148.
20. Hardie J, Isaacs R, Pickett JR, Wadhams LJ, Woodcock CM. Methyl salicylate and (-)-(1R,5S)- myrtenal are plant-derived repellents for black bean aphids, *Aphis fabae* Scop. (Homoptera: Aphididae). Journal of Chemical Ecology. 1994; 20: 2847- 2855.