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EFFICACY OF PLANT EXTRACTS AND INORGANIC SALTS AGAINST CIGARETTE BEETLE *LASIODERMA SERRICORNE* (F).

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Cigarette beetle, *Lasioderma serricorne* (F.) is primarily a pest of stored tobacco, tobacco seed and tobacco products like cigarettes and cigars. It causes major economic loss to the tobacco industry worldwide. In addition to tobacco, both the adult and larval forms damage other stored commodities both edible and non-edibles like rice, dry pet-food, pharmaceuticals, books, leather, spices and various seeds. Seed is the precious item for the future crop. Seed treatment with insecticides, fumigation and heat treatment are some of the techniques followed by the seed processing units with limited success. Tobacco seed is treated with one or the other insecticide to protect it from damage caused by cigarette beetle. To replace the pesticides, some of the plant extracts and inorganic salts were tested to protect tobacco seed from the damage by cigarette beetle.

Fresh leaf samples (100 g each) of 34 selected plant species were collected separately and allowed to dry under shade for 12 h. Each dry leaf sample was powdered and extracted with acetone for 12 h in Soxhlet extraction unit and the solvent was removed by vacuum evaporator. Crude leaf extracts thus obtained were used in this study by dissolving the extract in acetone to the final concentration of µg/µl. Each crude extract was mixed with tobacco seed (var. Hema) @ 1, 2, 3, 5 and 10 µl/g seed and placed in 15 ml flat bottomed glass culture tubes with screw caps. Ten newly hatched grubs of cigarette beetle were allowed to feed on the treated seed. In another study, stalk solutions (1, 2, 3, 5 and 10 µg/µl) of 13 inorganic salts *viz.*, calcium carbonate, copper sulphate, ferric phosphate, ferrous sulphate, magnesium sulphate, manganese sulphate, potassium chloride, potassium iodide, potassium aluminium sulphate, potassium dihydrogen phosphate, sodium chloride, sodium fluoride and tricalcium phosphate were prepared separately in distilled water. One ml each of the above stock solution is added to 1 gram tobacco seed separately kept in 15 ml flat bottomed glass culture tubes with screw caps. Newly hatched grubs (10) of cigarette beetle were allowed to feed on the treated seed. There were four replications per each treatment. Both the experiments were conducted under laboratory conditions at 25 ± 2°C. Observations on mortality of grub and emergence of adult beetle were recorded at every 48 h interval. Earlier, the stock culture of cigarette beetles was maintained in the laboratory on untreated tobacco seed. The experiment was conducted for two years during 2005-2007 and the data recorded were analysed statistically (Gomez and Gomez, 1984).

The results with 34 extracts at five concentrations were presented in Table 1. The plant extracts differed significantly in causing mortality of the cigarette beetle grubs and the mortality increased with increased concentration of extract. Mortality of grub ranged between 0.0 to 20.0 and 0.0 to 22.0% due to 1 and 2 µg concentration of the extract, respectively. The extracts of *Leucas* sp., *Piper* sp. and *Ocimum* sp. inhibited the development of the grub and caused the highest mortality (48%) of the grubs at 10 µg concentration followed by the extracts of *Nictanthus* sp., *Adiantum* sp., *Myconia* sp. and *Datura stramonium*. The extracts of *Lantena camera* and *Dendrobium* sp. recorded the lowest mortality of the grubs at all concentrations. From the above, it is evident that acetone extracts of *Leucas* sp., *Piper* sp. and *Ocimum* sp. might contain some compounds with insecticidal property that caused mortality to the grubs of cigarette beetle.

Table 1: Mortality of *L. serricorne* by plants extracts*

Name of the plant species	Larval mortality (%)				
	1 µg	**2 µg**	**3 µg**	**5 µg**	**10 µg**
Leucas sp.	18 (25.1)	22 (27.9)	24 (29.3)	26 (30.6)	48 (43.8)
Metastomata malbathricum	00 (00.0)	06 (13.9)	06 (13.9)	08 (16.4)	14 (21.9)
Cleodendron unfortunatum	10 (18.3)	12 (19.9)	12 (20.1)	14 (21.9)	32 (34.4)
Nictanthus sp.	14 (21.9)	18 (25.1)	18 (25.1)	22 (27.9)	42 (40.3)
Piper sp.	20 (26.4)	20 (26.6)	22 (27.9)	26 (30.6)	48 (43.8)
Myconia sp.	14 (21.9)	18 (25.1)	18 (25.1)	18 (25.1)	38 (38.0)
Adiantum sp.	10 (18.3)	18 (25.1)	18 (25.1)	22 (27.9)	40 (39.2)
Thivita nerifolia	10 (18.3)	06 (13.9)	10 (18.3)	12 (20.3)	28 (31.9)
Adhatoda vasica	00 (00.0)	00 (00.0)	06 (13.9)	06 (13.9)	14 (21.9)
Nishinda sp.	00 (00.0)	04 (11.5)	06 (13.9)	10 (18.3)	20 (26.6)
Cyda cordifolia	04 (11.5)	06 (13.9)	06 (13.9)	06 (13.9)	18 (25.1)
Acasia safeda	00 (00.0)	00 (00.0)	04 (11.5)	04 (11.5)	14 (21.9)
Calotropis procera	08 (15.9)	10 (18.3)	14 (21.9)	18 (25.1)	36 (36.8)
Oxalis sp.	08 (15.9)	12 (19.9)	14 (21.9)	14 (21.9)	34 (35.6)
Datura stramonium	12 (19.9)	16 (23.5)	16 (23.6)	18 (25.1)	38 (38.0)
Calamus sp.	04 (11.5)	10 (18.3)	10 (18.3)	14 (21.9)	34 (35.6)
Vinca rosea var. Alba	04 (11.5)	08 (15.9)	10 (18.3)	10 (18.3)	30 (33.2)
Vinca r osea var. Ruby	04 (11.5)	10 (18.3)	10 (18.3)	14 (21.9)	32 (34.4)
Anona reticulata –leaf	00 (00.0)	00 (00.0)	00 (00.0)	04 (11.5)	16 (23.6)
Tagitus erecta var. African	00 (00.0)	04 (11.5)	06 (13.9)	06 (13.9)	14 (21.9)
Terminalia arjun	04 (11.5)	06 (13.9)	10 (18.3)	14 (21.9)	34 (35.6)
Ocimum sp.	00 (00.0)	04 (11.5)	14 (21.9)	24 (29.3)	48 (43.8)
Acacia auriculiformis	00 (00.0)	04 (11.5)	06 (13.9)	10 (18.3)	22 (27.9)
Annona reticulata- seed	00 (00.0)	00 (00.0)	00 (00.0)	04 (11.5)	14 (21.9)
Juniperus sp.	00 (00.0)	00 (00.0)	04 (11.5)	06 (13.9)	20 (26.6)
Juniperus sp. thorny	00 (00.0)	00 (00.0)	00 (00.0)	04 (11.5)	14 (21.9)
Lantena camera	00 (00.0)	00 (00.0)	00 (00.0)	04 (11.5)	06 (13.9)
Dendrobium sp.	00 (00.0)	00 (00.0)	00 (00.0)	04 (11.5)	10 (18.3)
Aegle marmelos	00 (00.0)	00 (00.0)	04 (11.5)	10 (18.3)	34 (35.6)
Dendrobium aphyllum	00 (00.0)	00 (00.0)	00 (00.0)	06 (13.9)	14 (21.9)
Alstonia scholaris	00 (00.0)	04 (11.5)	06 (13.9)	14 (21.9)	30 (33.2)
Cestrum nocturnum	00 (00.0)	00 (00.0)	00 (00.0)	04 (11.5)	12 (20.3)
Cuscuda sp.	00 (00.0)	00 (00.0)	00 (00.0)	06 (13.9)	16 (23.6)
Cajanus cajan (seed coat)	00 (00.0)	04 (11.5)	06 (13.9)	10 (18.3)	26 (30.6)
Control (Malathion)	80 (63.5)	80 (63.5)	80 (63.5)	80 (63.5)	80 (63.5)
SEm±	**2.6**	**2.1**	**1.8**	**1.7**	**1.6**
CD (P=0.05)	**7.8**	**5.9**	**5.4**	**4.6**	**4.4**
CV (%)	**18.1**	**14.7**	**13.2**	**11.8**	**5.8**

* Figures in the parentheses are angular transformed values.

Plant extracts of *Ocimum* sp. is highly toxic to beetles of the species *Sitophilus granarius, S. zeamais, Tribolium castaneum, Prostephanus truncatus* and *Lasioderma serricorne* if admixed to grain. Complete control was achieved after 24 h at a dosage of 0.5 µg/kg or 0.5 mg/kg of grain. Furthermore, it was proved that admixture of these compounds with low quantities of vegetable oils like sunflower seed oil or sesame oil increased toxicity to insects and persistency (Obeng-Ofori *et al.*, 1997). According to Ojimelukwe and Adler (1999), a mixture of ground seeds of brown pepper *Piper guinense* and ground fruits of *Xylopia aethiopica*, controlled 95% of adult *Callosobruchus chinensis* in peas within 48 h.

The current findings indicated that the extracts of *Leucas* sp., *Piper* sp. and *Ocimum* sp. @10 µg/g concentrations inhibited the development of the grub and caused the highest mortality of the grubs. These results are in agreement with the findings of Obeng-Ofori *et al.* (1997) and Ojimelukwe and Adler (1999).

The experiment with 13 inorganic salts at 1, 2, 3, 5 and 10 µg/g concentrations were evaluated for the control of *L. serricorne* and the results were presented in Table 2. The inorganic salts differed significantly in causing mortality to the grubs of cigarette beetle and the mortality increased with the increased concentration of the inorganic salt. The maximum mortality (100%) of the grubs were recorded when the seed (1g) was mixed with 10 µg sodium chloride or potassium chloride or ferrous sulphate (82%).

Davis *et al.* (1984) reported that tricalcium phosphate acted as a legume grain protectant against three bean weevils (Navy beans, Cowpeas and *Vigna unguiculata*) at low levels (dusted at 0.1 and 0.25% by weight). Sodium chloride mixed with turmeric powder and mustard oil to basmati rice protected it from the damage by rice weevil (Jilani and Su, 1983). Magnesium carbonate mixed with wheat seed protected it from the damage by *Trogoderma granarium* (Sharma and Verma, 1971). In the current study, sodium chloride, potassium

Table 2: Mortality of *L. serricorne* influenced by some inorganic salts*

Inorganic salt/Conc.	Mortality (%)				
	1 µg	**2 µg**	**3 µg**	**5 µg**	**10 µg**
Calcium carbonate	18 (50.1)	20 (53.1)	18 (50.1)	14 (43.8)	16 (47.9)
Copper sulphate	30 (65.7)	24 (58.4)	20 (53.1)	16 (46.8)	10 (36.6)
Ferric phosphate	50 (89.9)	42 (80.7)	34 (71.2)	24 (58.4)	18 (50.1)
Manganese sulphate	24 (58.4)	22 (55.8)	20 (53.1)	18 (50.1)	16 (46.8)
Magnesium sulphate	16 (46.8)	14 (42.9)	18 (50.1)	10 (36.6)	10 (36.6)
Potassium aluminium sulphate	32 (68.7)	22 (55.8)	18 (50.1)	18 (50.1)	16 (46.8)
Potassium dihydrogen phosphate	28 (63.8)	18 (50.1)	20 (53.1)	12 (40.5)	12 (40.5)
Potassium iodide	18 (50.1)	10 (36.6)	12 (40.5)	6 (27.9)	8 (32.8)
Sodium chloride	72 (116.1)	82 (129.8)	86 (136.0)	94 (151.9)	100 (179.9)
Sodium fluoride	32 (68.7)	28 (63.8)	26 (61.2)	22 (55.8)	20 (53.1)
Tricalcium phosphate	28 (63.8)	24 (58.4)	26 (61.2)	20 (53.1)	20 (53.1)
Potassium chloride	64 (106.2)	72 (116.1)	82 (129.8)	90 (143.2)	100 (179.9)
Ferrous sulphate	56 (96.8)	64 (106.2)	68 (111.0)	72 (116.1)	82 (129.8)
Control (untreated)	4 (23.0)	4 (23.0)	0	4 (23.0)	0
SEm±	**2.6**	**1.7**	**0.9**	**1.9**	**1.66**
CD (P=0.05)	**8.0**	**5.2**	**2.9**	**5.8**	**5.0**
CV (%)	**10.72**	**7.3**	**3.8**	**11.3**	**6.68**

* Figures in the parentheses are angular transformed values.

chloride and ferrous sulphate protected the tobacco seed and it might be due to inhibiting one or the other growth processes of *L. serricorne* or must be acting as a stomach poison and thereby causing mortality.

Thus the results showed that the crude extracts of *Leucas* sp., *Piper* sp. and *Ocimum* sp (10 mg/kg) or inorganic salts *viz*., sodium chloride or potassium chloride or ferrous sulphate (10 mg/kg) can be used as tobacco seed protecting agents against *L. serricorne*.

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