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STUDY THE EFFECT OF TREE EUCALYPTUS LEAVES, SHELL AND FRUITS ON COWPEA BEETLE (*CALLOSOBRUCHUS MACULATUS*), WHICH AFFECTS CHICKPEAS IN STORES

Mohammed Saheb Abed

Al-Mussaib Technical Institute, Al-Furat Al- Awsat Technical University, 51009 Babylon, Iraq.

Abstract

Cowpea beetle is one of the major resistances to chickpea storage. The need of resisting growth of cowpea beetle is necessary of safe storage. We have studied the growth of *C. maculatus* on *Vigna unguiculata*, V*igna radiata* and *Vigna angularis* under different temperature and humidity conditions. Tree Eucalyptus is used to analysis the control of *C. maculatus*. Different concentration and various product of Tree Eucalyptus is used to analysis control measure of cowpea beetle. This Extract is used with different concentration of T. Eucalyptus. Leave of T. Eucalyptus, its shell and Fruits extract is used along with different concentration level. It is observed that Tree Eucalyptus is a strong resistance control for cowpea beetle. Result analysis concludes that Tree Eucalyptus leaf extracts with 30% and 20% of distilled water concentration is the best control prevention for cowpea beetle on chickpeas. Cowpea prevention is resisted to 85-95% on Day 2 after treatment of 20% and 30% concentration of Tree Eucalyptus leaves.

Key words: *Callosobruchus maculatus, T. Eucalyptus, chickpea, cowpeas beetle.*

Introduction

Chickpea (*Cicer arietinum* L.) is a popular food grain, all over the world. *Callosobruchus maculatus* and Hubner are most important factors which resist the production and storage of chickpea. It has caused loss of 325$ million in tropics (Chakraborty *et al.,* 2011). There found to be many problems in production and storage of chickpea. This includes, pod borer, *Helicoverpa armigera* and decreased in production yield because of chlorotic dwarf, also starch and sucrose affects the chickpea seedling from growing (Sharma *et al.,* 2005). Various mechanism has developed to prevent crop loss and to improve the safety storage. For resisting from pod borer and *Helicoverpa armigera*, antibiosis is used (Horn *et al.,* 1995). For Chlorotics dwarf analysis and prevention different mechanisms has been developed, starch and sucrose analysis also can do to understand real causes (Kaur *et al.,* 2009) . In this analysis similar kind of issue is considered. Chickpea also called as *Cicer arietinum* L. is a major issue in chickpea storage in stores.

Average age of cowpea beetle is 15 days, even though it has proven that they are harmless to human, but effect the quality of Chickpea. Cowpea beetle oviposit eggs on cowpea. The size of chickpea bean is relatively larger than other beans and hence chickpea is most likely to reside on chickpea beans. Along with chickpea beans, cowpea beetle also presents on mung beans and adzuki beans (Osman *et al.,* 2015).

They are harmless for humans, but they attack on beans, it is a big headache for farmers. In small countries, a local treatment is used for prevention of cowpea beetle. They crush the leave of *Cassia occidentalis* and mix it with chickpea beans to detect cowpea beetle in that. different variety of Cassia is used for treatment of cowpea beetle. It is also used in different form at different places. Few uses the warm-water extract to prevent cowpea beetle, powdered form leaves of cassia is also useful in treatment, oil extracted from cassia seeds is better which is also used for prevention of cowpea beetle in peas. This mechanism was useful in different scenario, it is observed that oil extracted from seed is useful for increasing keeling of eggs but it doesn't stop oviposition, on the other hand warm-water treatment is useful in prevention of oviposition.

A significant loss in storage of chickpea is observed

Author for correspondence : E-mail : mohammedalglehawy@gmail.com

because of cowpea beetle. It therefore necessary to increase protection level of chickpeas for sustained agriculture. These technologies should be low cost so that even developing countries can adopt it. Many researches are going on to increase the prevention and development of botanical mechanism (Osman *et al.,* 2015). Many technologies are already present for chickpea storage this includes treatment from cassia, deep freezing mechanism and Hermetic. However, it is observed that in practical these techniques are either less effective, time consuming or cost-intensive.

Many botanical control measures are already used as a pest control for chickpea beans. *Vitex negundo*, *Eucalyptus globulus*, *Ipomoea sepiaria*, *Azadirachta indica*, *Carthamus tinctorius*, *Sesamum indicum* and *Acacia nilotica*. This botanical biological pest control has been proven a good prevention for cowpea beetle.

Freezing technology is also useful in storage, and preventing oviposition but it requires temperature to be maintained at -18^{0}C, if freeing is not fast then oviposition cannot be prevented (Rahman and Talukdar, 2006). With advancement in technology, bags have been developed which can store chickpea beans safe for longer time. It comes under Hermetic mechanisms, in this it reduced the oxygen level present inside the container and forcefully kills insects it also reduces the feeding rate. This technology has improved cowpea storage mechanism (Johnson and Valero, 2000).

Earlier studies have suggested that different type of protection over wheat is carried out by biochemical and botanical treatment (Chakraborty *et al.,* 2011). This includes chilies, garlic and peppermint. Using this plants product instead of chemical product is more cost effective and these chemical pesticides is not able to manage changing environmental conditions. This plant products are very much cost effective and it sustain the environmental changing conditions (Murdock and Bayou, 2014). Form this research it is observed that this plant products contain bioactive chemicals. This are chemical doesn't affect crop and hence this is another benefit of using natural products over chemical products (Kaur *et al.,* 2009).

Osman, M.F. Mahmoud and K.M. Mohamed also prove susceptibility of beans to *C. maculatus* and influence of temperature on different attributes. This research is mainly based on susceptibility of pulse beetles. In this research chickpea, cowpea, field bean, pea and white bean is analysed to detect bean beetle at different temperature. It is observed that susceptibility rate of chickpea is good, and hence its analysis of bean beetle is possible up to a great extent (Kienholz *et al.,* 2005).

There is a limited research on plant product as a substitute control mechanism for controlling growth of cowpea beetle. Use of Tree Eucalyptus and its product at different concentration may offer environmentally friendly, effective, sustainable, cost effective and safer alternatives to cowpea beetle. This Experiment was aimed at determining the effect of Tree Eucalyptus leaves, shell and fruits at different concentration level. These studies also compare percentage of killing of adult cowpea beetle at different product of T. Eucalyptus. These results are analysed for Tree Eucalyptus leave, it's stake and its fruits, also it is compared at different concentration level, for this purpose distilled water is used for dilution. It is possible to eliminate cowpea beetle in chickpea. This research is carried out on chickpea beans, and we might get similar result for other beans like cowpea beans and field bean. This treatment of Tree Eucalyptus is found to be very effective, it is also a time effective and sustainable. This mechanism can also be implemented by small farmer as it a cost-effective technique (Lienard *et al.,* 2012).

This paper contains the information about material and method, statistical analysis, result analysis and conclusion of this research. In material and method topic, basic concept and basic terminology is explained which includes topics about Insects, Cowpea seeds, Plant products, and dilution concentration and experimental tests. Statistical analysis topic covers the ratio of proportion of water used in each samples of the tree product. Finally, for analysis purpose killing of adult insects at leaf extract, shell extract and fruits extract at different temperature. It is observed that leaf extract gives good result at concentration of 20% and 30%.

Experimental Concept

In chapter covers, basic concept and basic terminology which includes topics about Insects, Cowpea seeds, Plant products, and dilution concentration and experimental tests. Measured conditions which were used for this analysis is explained in this section. Understanding of Experimental site and temperature humidity is required before making any conclusion. Basic concepts about seeds and beetle is cleared in this section. Plant Products which are used like fruits and leaves is also explained in brief. Later in this section the complete procedure of material and method of work is explained.

The Experimental Site

This experiment is carried out in laboratory insect, department of plant production at technical institute of Musayb using bean beetle of type *Callosobruchus*

maculatus.

The Insects

Infested chickpea variety Tswana from seed multiplication unit is used to collect Adult cowpea weevils. *Callosobruchus maculatus* is a beetle which is used in these experiments, around 200 unsexed adults are placed in three litter of jar, this jar is half filled by chickpea seeds. This cowpea may escape from the jar hence muslin cloth is used to cover the top side of jar. Temperature of room is maintained at 25-28O C and relative humidity is maintained at around 60% to 90%. These adult *Callosobruchus maculatus* were allowed to mate for seven day in the above-mentioned temperature and humidity. After they lay eggs, they were removed from the jar and examined for research purpose.

Chickpea Seeds

The Chickpea seeds were purchased at Babylon superstore Iraq. Before utilizing it in experiments they should be examined and details were recorded. Quality check is also carried out at lab. This is a necessary to check quality of chickpea seeds, because cowpea beetle egg and suspicious material is not possible to detect by visual observations.

Plant Product

In previous studies it is observed that Cassia leaves oil extract and warm-water treatment produces different result, hence in this research different plant product are extracted and made them in powdered form. Plant leaves, fruits and shell is used for this purpose. All these products are used in extracted and crushed form. The main purpose of using different product is analysing the result obtained by each of them separately so that performance of this technique can be further improved by accessing correct plant product. Leave were crushed easily but for fruits and shell different methods were used to crush and create a power form. Plant leave crushed is weighted around 0.035gm while fruits and shell extracted was measured around 0.55 gm and 0.25 gm respectively.

Experimental Test

10 gm of leave, shell and fruits extracted is prepared and added to distilled water for crating solutions at different concentration. Then 100 gram of chickpea seeds

Fig. 1: *Callosobruchus maculatus*.

were added to a small glass and mixture of water and extracted plant products. This water level is different for each of this solution. For each plant product 3 different solutions were prepared which contains 10%, 20% and 30% of concentration of plant product extract. After this newly emerged cowpea beetle were added into each solution for observation, this cowpea beetles are adults and capable for reproduction. Each plant product has different concentration level hence nine such solutions were prepared and examined for 3 days to determine the killing of *Callosobruchus maculatus* and to observer control of Tree Eucalyptus on bean beetle. These are the steps present in Experimental Test.

Materials and methods

The samples of infected chickpea, containing the insect infection from the private warehouses for storage of seeds in the province of Babel, were obtained on 15/12/2016 to raise the insect in the temperature of the laboratory. 400 insect and the required number of trials was 360 insects where 10 insects were added all refined, which contained chickpea seeds 100g for the capacity of 150g and the cans were closed.

For this research adult cowpea beetle is collected, for analysis purpose. As discussed in the previous section 360 bean beetle were collected, and 10 beetle were used for single research. It is added into mixture of distilled water and different plant product extract. Captured image of Adult cowpea beetle is as below:

The method of preparation of the abstract was the following:

For experimental purpose, Different plant product were used and its recorded is maintained for determining best plant product for prevention from *Callosobruchus maculatus* on chickpea beans. Bean beetle prevention is necessary to be observed over all these 3 different conditions.

The weight of 100 grams of all the leaves, shell and fruits were then grinded in the electric mill duration of 15 minutes and then add 100 cm^3, where the percentage of this concentration of 100%.

The leaves, stalks and fruits are then grinded separately

Percentage of killing of adult insects in leaf extract

In this analysis is it is observed that at first, second and third day 30% concentration killing was 73%, 87% and 84% respectively, in case of 20% concentration this result turns out to be weak for first and third day, but on second day, the percentage of killing was 64% which is maximum. On 10% concentration the values further get decreased and it becomes 11%, 12% and 10% for day one, two and three respectively, which indicates the accuracy in case of leaf extract is good for higher concentration.

Percentage of killing of adult insects in Shell extract

In this analysis is it is observed that at first, second and third day 30% concentration killing was 38%, 47% and 42% respectively, in case of 20% concentration this result turns out to be weak for first and third day, which is around 17%, 17% and 15% respectively. On 10% concentration the values further get decreased and it becomes 11%, 12% and 10% for day one, two and three respectively, which indicates the accuracy in case of leaf extract is good for higher concentration.

Table 1: Analysis result for Leaf Extract.

Control	Abstract concentration %10	Abstract concentration %20	Abstract concentration%30	Date of Treatment
0%	11%	55%	73%	First date
4%	12%	64%	87%	Second date
1%	10%	50%	84%	Third date

Fig. 2: Adult Cowpea beetle.

Fig. 3: Leave and Stalk of T. Eucalyptus.

Percentage of killing of adult insects in Fruits extract

In this analysis is it is observed that at first, second and third day 30% concentration killing was 38%, 47% and 42% respectively, in case of 20% concentration this result turns out to be weak for first and third day, which is around 17%, 17% and 15% respectively. On 10% concentration the values further get decreased and it becomes 11%, 12% and 10% for day one, two and three respectively, which indicates the accuracy in case of leaf extract is good for higher concentration.

Fig. 1, 2 and 3 shows Analysis result of Leave, Stalk and Fruits Extract at different concentration. It is observed from the chart that Leave as a plant product prevent and kills more bean beetle as compare to Shell Extract and

Table 2: Analysis result for Leaf Extract.

Control	Abstract concentr-ation %10	Abstract concentr-ation% 20	Abstract concentr-ation%30	Date of Treatment
0%	6%	17%	38%	First date
4%	5%	17%	47%	Second date
1%	5%	15%	42%	Third date

Table 3: Analysis result for Leaf Extract.

Control	Abstract concentr-ation %10	Abstract concentr-ation% 20	Abstract concentr-ation%30	Date of Treatment
0%	0%	5%	21%	First date
4%	0%	6%	20%	Second date
1%	0%	4 %	22%	Third date

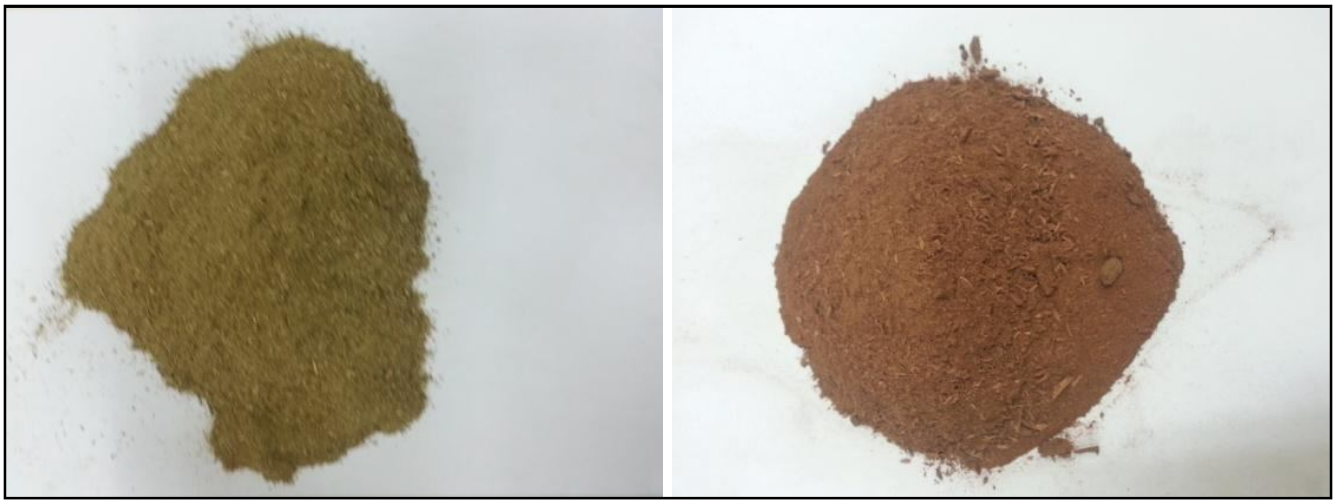

Fig. 4: Grinded Leave, Stalk and Fruits.

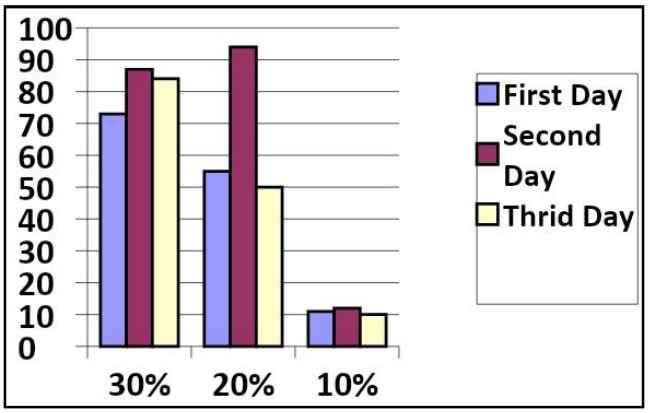

Fig 5: Analysis result for Leaf Extract.

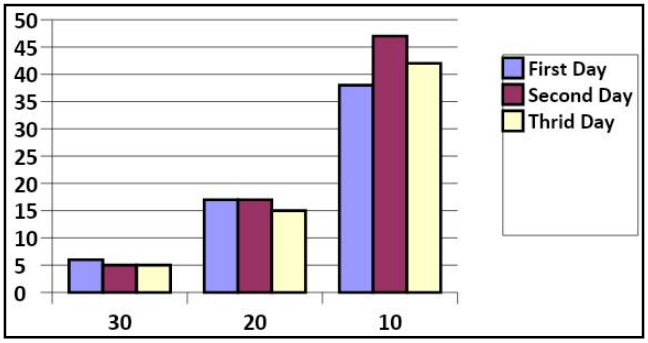

Fig. 6: Analysis result for Stalk Extract.

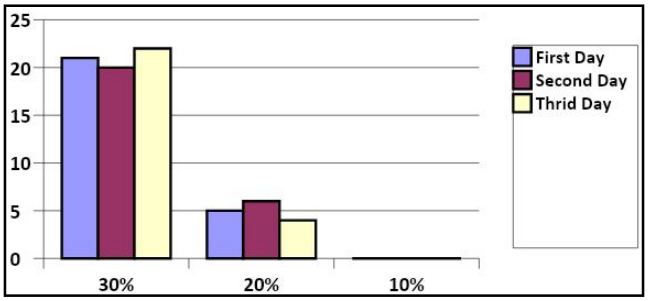

Fig. 7: Analysis result for Fruit Extract.

Fruit Extract. In case of Leave extract the killing is more prominent in day 1 for concentration of 30%, while in case of 20% distilled water concentration, day 2 killing is more prominent.

Fig. 8 explains that, killing of bean beetle is high at second day on Leave, shell and Fruits extracted at any concentration level of water.

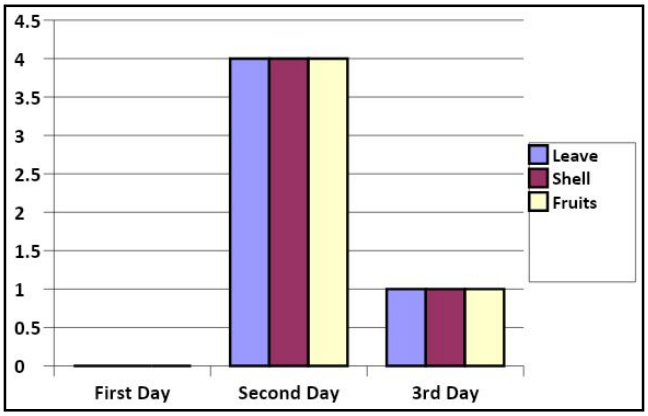

Fig. 8: Analysis of control of Leave, shell and Fruits.

Henderson formula:

Henderson formula is used to calculate the percentage reduction in treatment over control.

corrected % = ((X1)(X2)) × 100

Where,

X1 = Insect population in Co before treatment X Insect population in T after Treatment

X2 = Insect population in Co after treatment X Insect population in T before Treatment

T = Treated, Co = Control.

This Result analysis is applied on Henderson's formula to computed Corrected %, for this Control and Treated killing of insects were considered.

Result Analysis, after applying Experimental data on Henderson Formula:

Treatment (First Day, 30%)	Corrected
Leaf Extract	77.78 %
Shell Extract	33.33%
Fruit Extract	12%

This is a result outcome after applying Henderson Formula on Result Dataset.

Conclusion

For result analysis, result of Plant products were recorded and compared with each other, along with that diluted water mixture of extract is also compared at different concentration level is it is observed that at first, second and third day 30% concentration killing was 73%, 87% and 84% respectively. This result when compared with other plant products then it is found to be the best-case result, and when the same plant product which is leave is used with 20% concentration then killing rate was 55%, 64% and 50% for day1, day2 and day3 respectively. From the observation of control, it is concluded that any mixture works at higher rate in day 2.

This research is carried out on chickpea beans, and the results were extremely good. So that we might get similar result for other beans like cowpea beans and field bean. This treatment of Tree Eucalyptus is found to be very effective, it is also a time effective and sustainable. This mechanism can also be implemented by small farmer as it a cost-effective technique.

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