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Study of the effect of neem leaves powder and orange peels powder on weevil growing on maize grains

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Abstract- A laboratory study with the purpose of investigating the effects of neem leaf and orange peels powder against *Sitophilus zeamais*, (Coleoptera: Curculionidae) was conducted at Department of Botany, J. P. University, Chapra, Saran. Three sets of testing were set including treatment of seeds with two different plant powder extracts such as Orange peels powder and neem leaf powder and a control where no plant powder were applied to the grains. The dosage of powder, 5g, 10g, 15g, 20g, 25g, and 30g were applied to 500 grains included weevil mortality, survival and grain damage. In view of the percentage of mortality, the toxicity of powder's increased gradually with increasing concentration. The dead adult weevils were counted within 6 weeks after the maize was treated by neem leaf powder and orange peels powder. The results from the study showed that the highest percentage weevil mortality was recorded for neem followed by Citrus. The lowest and highest mortality rate have been seen of 5g & 30g for neem extract of 24 & 28 respectively, where of these value was noticed of 4 & 8 at 30g & 5g respectively for Citrus extracts. The percentage calculated 80 & 93.3% of 5g & 30g of neem extract whereas 73.3 % & 86.6% for Citrus extract respectively.

Key words: Neem Leaf, Orange Peel, *Sitophilus*, Maize grain.

INTRODUCTION

Maize (*Zea mays* L.) is a cereal grain belonging to the family of Gramineae. It is a cereal grain linked to wheat, rice, oat and barley. In terms of world grain manufacture, it is ranked second next to wheat.¹ Maize can flourish in diverse climatic condition and is grown-up by small holder families in many countries of the world. In India maize is habitually grown during the Kharif season with high temperature and low and surplus rains, creating adverse condition for changing length of time

during the two growing seasons (that is from March to June and from mid of July to September). It is measured as versatile plant with many uses. First of all, it is one of the major sources of food for both human and animals. Distant from this, it is being processed into various food and industrial products together with starches, sweeteners, oil, beverages, industrial alcohol and firewood ethanol. Maize is a significant staple food for human being and animals. According to Addo-Quaye *et al.* (1993)², it has an average composition of 13.2% protein, 60% starch, 1.2% sugar and 2.5% crude fibre. It is principally an energy giving food because of its high starch content. The grain is also used to feed monogastric such as pigs and

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poultry as the main basis of energy whereas the plant also serves as fodder for ruminants.² The starch is used in creation ice cream, alcohol, beverages, cosmetics and adhesive, cooking oil, salad oil, glycerine, soap and pharmaceuticals can as well be made from maize.³

Post harvest losses occur between harvest and the moment of human utilization. They include on-farm losses, such as when grain is threshed, winnowed, and dried, as well as losses next to the chain through carrying, storage and processing. Harvesting is done by defiance the ear from the stalk using the hand with both cutlass and sickle. This is done through natural draying using Sun draying or non-natural draying like photovoltaic solar energy.⁴ Maize weevil (*Sitophilus zeamais*) is a major pest that attack stored maize grains in the tropics and temperate regions of the world.^{5,6} In spite of the mentioned uses of maize, it is attacked by different storage pests. Maize weevil (*Sitophilus zeamais*) is a major pest that attack stored maize grains in the tropic and temperate regions of the world.^{5,6} The attack may begin in the adult crop when the Moisture Content (MC) of the grain had fallen to 18-20%.⁷ The pest as well infests other stored cereal grains as substitute hosts. Famous among its secondary hosts is wheat, rice, sorghum and barley both in field before harvest and in storage. This pest is an internal feeder and causes significant loss to cereals affecting the quantity, as well as quality of stored cereal grains through storage.⁸

Such plant materials include powders from parts of the neem tree (*Azadirachta indica*). Mixing dried neem leaves with grain in storage is classic example of natural produce use that has been practiced by farmers in many countries for many years. The main active insecticidal ingredients are present mainly in the seeds, leaves, and other parts of the neem.⁹ Its various plant parts have been habitually used to control domestic insect pests in stored grains, crop, in human and cattle medicine. Hence, the objective of this laboratory experiment was to determine the effect of ground neem leaf and orange peels against maize weevil and storage of neem leaf and orange peels on its insecticides movement. Many studies reported its effective use in administration insect pest. Plant based necessary oil like citrus and neem have stepped in market place and is best suited for organic food invention in developing and industrial Countries. Azadirachtin,

extracted from neem leaf, act on target organism as antifidant growth regulator. For example, plant powders from neem and citrus had strong insecticidal activity on *Sitophilus oryzae* and *S. granaries*, *S. zeamais*.¹⁰ The study proves the insecticidal activity of plant powder of neem leaf and orange peels against *S. zeamais* in addition; the current study was designed to investigate the suitability of these plant powders to protect stored maize grains.

MATERIALS & METHODS

Experimental Site: - An experiment was conducted at the laboratory at Department of Botany Jai Prakash University, Chapra. Which is located between latitude 180° (90° at the North and 90° South) and 360° of longitude (+180° eastward and -180° westward). The distance between each degree of latitude is about 69 miles (110 kilometers).

Insect Culture:- The adult *S. zeamais* used for the experiment were cultured in a plastic container under ambient laboratory temperature of 34.5°C. The fresh maize grains were purchased from Mashrak Saran.

Experimental details:- Adult *S. zeamais* used for the experiments were obtained from already infected private warehouses, Mashrak Saran. Plant protection Orange peels were collected from an orange juice seller in Chapra. Neem leaves were obtained from the B.S.M. Degree College Campus in Mashrak.

An amount of five hundred (500) of maize grains per treatment was mixed independently with tested powders. 500 (five hundred) grains of maize were placed in small plastic container.

Two plant powder extract were applied for three weeks to see the efficacy of the powders. Different amount of the powder, thus 5g, 10g, 15g, 20g, 25g, and 30g were measured using an electronic balance scale and were separately kept in small plastic containers. The containers were covered with a fine mesh muslin cloth held in place with rubber bands for exposure to air. Thirty (30) adult *S. zeamais* were introduced into each container and shaken well, so that the powder gets mixed over the weevils. After mixing it is covered with muslin cloth and tied with rubber bands. The grains in the controls contain no plant powder. The setup was kept for 6 weeks and the observations were made weekly.

RESULTS

The safety of stored products by the use of plant materials is a general practice among smallholder farms in India. The plant powder showed different levels of bioactivity against adult *S. zeamais* during the 6 weeks experimental periods (Table-1). The toxicity of powder improved slowly with increasing amount of extract. Neem leaf powder resulted in weevil mortality up to lowest and

highest mortality rate been seen in 5g & 30g for neem extract of 24 & 28 in numbers respectively. Where these value was noticed of 22 & 26 at 30g & 5g respectively for citrus extracts. The percentage alteration has also been calculated for neem and citrus extracts. The maximum percentage alteration has been calculated is 20 & 6.6 of 5g & 30g for neem extract whereas 16.6 & 3.3 for citrus extract respectively.

Table 1- Percentage weevil mortality of maize grain treated with different dose of plant powder extracts, during summer season.

Total no-of grain taken	Control		Dose (gram)	Experimental					
	Total no-of insect taken	Mortality		Neem extract			Citrus extract		
				Mortality	Differences	% Alteration	Mortality	Differences	% Alteration
500	30	4	5g	24	6	20	22	8	26.6
500	30	4	10g	25	5	16.6	24	6	20
500	30	4	15g	25	5	16.6	24	6	20
500	30	3	20g	26	4	13.3	25	5	16.6
500	30	3	25g	26	2	10	26	4	13.3
500	30	3	30g	28	2	6.6	26	4	13.3

In this study:- The percentage of weevil of maize grain treated with different dose of plant powder extract during summer season have been described in table- 2 & percentage by fig- 2. Dose of neem and citrus extract (5g, 10g, 15g, 20g, 25g and 30g) have been applied on 500 maize grains, inoculated e⁻ 30 insects.

The lowest and highest mortality rate been seen of 5

& 30g for neem extract of 24 & 28 respectively. Whereas these value was noticed of 4 & 8 at 30g & 5g respectively for citrus extracts. The percentage alteration has after calculated for neem and citrus extracts.

The maximum percentage alteration has been calculated of 20 & 6.6 of 5 & 30g for neem extract whereas 26.6 & 13.3 for citrus extract respectively.

Table 2-Percentage weevil survival of maize grain treated with different dose of plant powder extracts, during summer season.

Total no-of grain taken	Control		Dose (gram)	Experimental					
	Total no-of insect taken	Survival		Neem extract			Citrus extract		
				Survival	Differences	% Alteration	Survival	Differences	% Alteration
500	30	26	5g	6	24	80	8	22	73.3
500	30	26	10g	5	25	83.3	6	24	80
500	30	26	15g	5	25	83.3	6	24	80
500	30	27	20g	4	26	86.6	5	25	83.3
500	30	27	25g	3	27	90	4	26	86.6
500	30	27	30g	2	28	93.3	4	26	86.6

In current study:- The percentage of weevil survival of maize grain treated with six doses of plant powder extract during summer season have been described in table- 2 & percentage by fig- 2. Dose of neem and citrus

extract (5 g,10 g.....30 g) have been applied on 500 maize grain, inoculated e⁻ 30 insects.

The lowest and highest survival rate been seen of 5 & 30 g for neem extract of 6 & 2 respectively. Where of

these value was noticed of 26 & 22 at 30 & 5g respectively for citrus of extracts.

The percentage alteration has after calculated for neem and citrus extracts. The maximum percentage

alteration has been calculated of 80 & 93.3 of 5 & 30 g for neem extract therefore 73.3 & 86.6 for citrus extract respectively.

Table 3- Showing damage of maize grain after application of plant extract (N+C) during summer season.

Total no-of grain taken	Control		Dose (gram)	Experimental					
	Total no-of insect taken	Damage		Neem extract			Citrus extract		
				Damage	Differences	% Alteration	Damage	Differences	% Alteration
500	30	30	5g	8	492	98.4	10	490	98
500	30	30	10g	8	492	98.4	10	490	98
500	30	30	15g	6	494	98.8	8	492	98.4
500	30	32	20g	5	495	99	7	493	98.6
500	30	32	25g	5	495	99	6	494	98.8
500	30	33	30g	3	497	99.4	5	495	99

In this survey: -The percentage damage of maize grain treated with different doses of plant powder extract during summer season have been described in table- 2 & percentage by fig-2. Dose of neem and citrus extract (5g, 10g, 15g.....30g) have been applied on 500 maize grain, inoculated e- 30 insects.

The lowest and highest damage rate has been seen at 5 and 30g neem extract of 8 & 3 respectively. Whereas value was noticed of 490 & 495 at 30 & 5g respectively for citrus of extract.

The percentage alteration has after calculated for neem and citrus extract. The maximum percentage alteration has been calculated of 98.4 & 99.4 of 5 & 30g for neem extract therefore 98 & 99 for citrus extract respectively.

DISCUSSION

Results from the current study shows that the uses of the said botanical powders have the great potential in protection of the maize grains against *S. zeamais*.

Comparing the Neem leaf powder and Orange peels powder treatment, the highest mortality rate was recorded at the neem leaf powder (93.3). However, this high amount recorded at the neem leaf powder is by below than the considered the minimum effective concentration. According to Collingwood and Marchart (1971)¹¹ the concentration that causes at least 95% mortality is considered the minimum effective concentration. Comparing the findings of the present study with other findings, the present study is in line with the findings of lleke and Oni (2011)¹² and Khaliq *et al.* (2014)¹³. From

their study on the toxicity of some plant powders to maize weevil, *S. zeamais* Motschulsky (Coleoptera: Curculionidae) and on stored wheat grains (*Triticum aestivum*), lleke and Oni (2011)¹² found mortality of adult *S. zeamais* that increase with concentration from 2.5-25% w/w. Moreover, Khaliq *et al.* (2014)¹³ found at concentration of 5% w/w maize weevil mortality of 35.81% from *Glycyrrhiza glabra* and mortality rate of 35.55% due to 24 h exposure to the same plant.

Weevil Mortality:- Weevil mortality was high in grains treated with the plant extract compared to the control. Maize grains treated with neem leaf powder recorded high weevil mortality than grain treated by citrus peel powders. The control treatment had more weevils surviving than dead as was expected. Higher plant dosage on the other hand were effective and controlling the weevils than lower dosages (5g). It was observed from the experiment that high dosages of the plant extract resulted in high weevil mortality. Trends seen in weevil mortality were inversely correlated with weevil survival as high weevil mortality resulted from low weevil survival and vice-versa. It was also observed that increasing the dosage of neem leaf powder from 30g and completely killed the weevils. Citrus peel powder was effective at 25g and above of the powder applied. Hence it can be said that the higher dosage applied, the more effective it becomes, thus the higher mortality seen in the weevil population.

Results are in harmony with of several previous workers, who found toxicity effect of plant material on stored grain pests. The National Research Council

(1992)¹⁴ showed that azadirachtin, the active component of Neem disrupts the metamorphosis of insect larvae. Akou-Edi (1984)¹⁵ indicated that neem leaf powder and oils were effective in repelling and killing maize weevils. Sharaby (1988)¹⁶ also reported that orange peel oil have toxic effect on weevils due d-limonen. Onu and Sulyman, (1997)¹⁷ pointed out that plant volatile essential oils of some Citrus species had insecticidal properties against stored grains insect pest.

Weevil Survival:- The current study showed that the maize grains treated with the plant extracted powder recorded low weevil survival. Out of the two plant extract used maize grain treated with neem leaf powder had less weevils surviving compared to that leaf treated with citrus peel powders. The control treatment as was expected had almost all the weevils surviving since there was no application of the plant powder extract. On the other hand, plant powder dosage 15g and above was more effective in controlling the weevils than lower dosage (5g & 10g). Appert, (1987)⁴ reported that the leaves of neem tree garlic, dry peel of citrus, are used for storing maize by farmers who believe that these plants could deter storage insects. Sowunmi and Akinusi (1983)¹⁸ indicated that maize seeds could be protected from attack by weevils using 1% & 2% & neem kernel powder.

Grain Damage:- In conditions of grain damage, minimal damage from weevils was recorded in the grain treated with the two plant powder extracts. Grain damage was very low in seeds treated neem leaves powder. The low values recorded can be attributed to the high mortality of the weevils to the plant extract application since low numbers of weevils are ineffective in causing substantial damage in storage. The lowest and highest damage rate has been seen at 5g, & 30g neem extract of 8, & 3 respectively. Whereas value was noticed of 488 & 495 at 5g & 30g respectively for citrus of extract. The percentage alteration has after calculated for neem and citrus extract. The maximum percentage alteration has been calculated at 98 & 99.4 of 5g & 30g for neem extract while 97.6 & 99 for citrus extract respectively.

Kraus *et al.* (1981)¹⁹ also reported that neem extracts have anti-feeding and growth disrupting properties. The orange peel oil was toxic to *Culex pipiens*.²⁰ Odeyemi *et al.* (2000)²¹ indicated that application of citrus peel powder caused mortality of weevils.

CONCLUSION

The results showed that plant powder extracts were more effective at higher dosage of 25g & 30g. It was also observed that the quality of the maize grains was better in grains stored with neem leaf powder and orange peel powders. The two plant powder indicates that higher dosage is more efficient in management of pests. Again, when the plant powders were applied to maize grains in storage, there were important reductions in maize damage.

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