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Research Article

Plant extracts as potential for Anti-feeding activity of rodents and some important insects pest: An eco-friendly approach for pest control.

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Abstract

The present study was conducted to investigate the effect of leaf extract of neem (*Azadirachta indica*) and bel (*Aegle marmelos*) mixed with cow urine (neem + bel): cow urine: 9:2 ratio] that confirm protection against all types of rats and many agricultural pests and diseases on agricultural field of rice (*Oryza sativa*), pumpkin (*Cucarbita maxima*) and cauliflower (*Brassica oleracea*var. *botrytis*). 400 gm of neem leaves and 200 gm of bel leaves are cooked in a container for 20 minutes with 10 litre of tap/pond water. The container was filtered and kept at room temperature. Now 2 litres of cow urine was mixed with the extract and sprayed during evening hours for three or four times at monthly intervals. This extracts exerted strong anti-feedant activity to the rats and insects. The use of pesticides are regarded as ecologically non-degradable, unacceptable in the study area. Therefore, this study is an eco-friendly approach for pest control which are effective, biodegradable and do not have harmful effect of its own environment.

Keywords: *Aegle marmelos*, antifeedant activity, *Azadirachta indica*, eco-friendly approach, Plant extract.

Introduction

Agriculture is always affected by various abiotic, such as weather, climate, input application methods of fertilizers and seeds, method and timings of irrigation, government policies, marketing supplies (Anonymous, 1996) and biotic factors including insects, moulds, birds and rodents (Baloch et al., 1994). Among all these losses, insect pests are the most detrimental which cause about 43% of the total physical and nutritional loss occurring in the developing world, also threatening the living world for food security (Chomchalow, 2003). The losses by insects like bruchids and weevils do not include only the direct consumption of the seeds and food products, but also the other reasons such as the amassing up of insect cadavers, exuviae and webbings, which makes the food and seeds unfit for human consumption (Rajashekar et al., 2012). Lepidopteran larvae cause serious damage to crops viz. stem borers cause injury to the crop at every phase of crop development feed on the inner tissue. (Sarwar, 2013).

Rodents are also identified as one of the most important mammalian agricultural pest and cause damage to the standing crops due to their burrowing, cutting and hoarding activities, to food in storage, in poultry farms and to other commodities (Prakash and Ghosh, 1992). Rodents cause damage to young plants, fruits, seeds, panicles of the agricultural field and houses. In West Bengal 10-12% of rice and 6-10% of wheat are being lost every year which is a major loss to economy. Vegetable crops like tomato, brinjal, carrot, sweet potato, radish, cabbage, cauliflower,

onion, garlic, spinach, bottle gourd and okra are reported to be susceptible to rodent attack (Advani and Mathur, 1982).

To counter pests farmers frequently use chemical pesticides (Kudagamage and Nugaliyadde, 1995) which leads to numerous undesirable health consequences and serious environmental pollutional, so it cause toxicity to non-target organisms.

Tribal people are well known for their rich indigenous knowledge in controlling various insect and rodents pests. Keeping this in mind, a systematic survey with elder peoples was conducted and effects of different plant extracts was gathered. In this study an emphasis was given on the value of the tribal knowledge based pest control techniques for sustainable crop protection. A very simple and eco-friendly successful attempt was made with leaf extract of neem (*Azadirachta indica*) and bel (*Aegle marmelos*) mixed with cow urine [(extract of neem + bel): cow urine: 9:2 ratio] to confirm protection against all types of rats and many agricultural pests and diseases that minimize crop losson agricultural field *viz.* Rice (*Oryza sativa*), Pumpkin(*Cucarbita maxima*) and Cauliflower (*Brassica oleracea* var. *botrytis*).

Materials and Methods

The field survey and experimental data were collected from the people living in the Purba Medinipur district of West Bengal, India (9.75 meters above sea level at latitude 22°57 N-21°36 N and longitude 88°12 E-86°33 E) and the surrounding areas.

Several trips were made to the elder peoples of the villages of Purba Medinipur districts and were interviewed to gather their knowledge on traditional practices and their control activities. Such indigenous knowledge based practices were identified and adopted in laboratory and field conditions.

For field trials a 72'katha' agricultural land were used for research works at Kismat Bajkul, Purba Medinipur. This work was conducted with an experienced, aged farmer for a period of three years from 2012.

Feeding habitat of rodents and insects, damage type and assess of damages materials were noted for a one years. In the second and third year, some experimental practices were applied in certain crops specially of rice (*Oryza sativa*), pumpkin (*Cucarbita maxima*) and cauliflower (*Brassica oleracea* var. *botrytis*) (Table-1& 2).

4 kg of dried cow dung and 1 kg of neem cake with mixed with 10 kg of soil. Application of these mixture on in every 4 katha plot before the times of cultivation and be broadcasted two times again at farming times. Differences of quality and amounts of crops were also assessed.

Experiment-I: 400 gm of neem seed + 200gm of *Vitex* leaf + 200gm of *Tulsi* leaf are cooked for 20 minutes in 10litres of water.

Experiment-II: 400 gm of neem seed + 200 gm of *Vitex* leaf + 200 gm of *Tulsi* leaf are cooked for 20 minutes in 10 litres of water and add 2 littre of cow urine (storage 2-3 days before).

Experiment-III: 400 gm of neem seed + 200 gm of *Vitex* leaf + 200 gm of *Tulsi* leaf are cooked for 20 minutes in 10 litres of water and add 20gmchilli powder.

Experiment-IV:400 gm of neem leaves and 200 gm of bel leaves are cooked in a container for 20 minutes with 10 litre of water. The container was filtered and kept on room temperature.

Experiment-V: 400 gm of neem leaves and 200 gm of bel leaves are cooked in a container for 20 minutes with 10 litre of water. The container was filtered and kept on room temperature and add 2 litres of cow urine (storage 2-3 days before) with it.

Experiment-VI: None used.

Six experimental land plots (each plot 4 katha) of each crops of rice (*Oryza sativa*), pumpkin (*Cucarbita maxima*) and cauliflower (*Brassica oleracea* var. *botrytis*) were treated as experimental works and experiment - I, II, III, IV & V were sprayed separately during evening hours for three or four times at monthly intervals. One plot treated as control (experiment- VI).

Burrows of rats were counted throughout (central & periphery) the field in the cropping seasons. Hoarding crop materials were collected from the each burrow, weighed and kept properly for further analysis. Repeated works were also conducted in the second year.

On going the experiments, fields survey were visualized very carefully and data were noted at time to time.

For statistical analysis, the data were calculated by Student's 't' test procedure (Fischer, 1963).

Results

There are twelve indigenous practices were recorded from elder farmer of the Kismat Bajkul villagers of Purba Medinipur districts and were interviewed to gather their knowledge on traditional pest (insects and rodents pest) control activities.70% of the people of this district are associated with cultivation of land and at the present status of them 68% farmers use chemical methods, 22% farmers use both chemical and physical methods, while only 8% of the farmers use indigenous methods and 2% farmers do not use any control measure. According the different stages of crops, the abundance and diversity of pest's species are maximal of these area. Most practices are pest specific and such indigenous knowledge based practices were chosen and adopted in laboratory and field conditions. Farmers mostly faced pest damage among which leaf folder pest (19%), stem borer pest (5%), caterpillars (8%), bugs/ beetles pest (7%), leaf hoppers pest (14%), nematodes pest (22%), spot diseases (6%), rodents pests (8%) and others (11%). It was found that the pest so rice had large share of the practices with 58.3% adoption followed by other pests (Fig. 1-4). This was observed that highest pest populations were found in the high moisture times in all crops (Fig. 5-6).

Fig.1: Preparation for land for experiments. Fig. 2: Searching pests types near the paddy field.
Fig. 3: Two rat burrows in the control paddy field. Fig. 4: Experimental area.
Fig. 5: Survey at pumpkin field. Fig. 6: Searching pest at cauliflower field.

Table 1: Variations of damages by pests and their control of fields of rice (*Oryza sativa*), pumpkin (*Cucarbita maxima*) and cauliflower (*Brassica oleracea* var. *botrytis*).

Results after 60 days	Experiments																	
	I			II			III			IV			V			VI		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Leaf folder pest	+	+	±	+	+	+	±	±	+	±	+	+	±	±	±	+++	+++	+++
Stem borer pest	++	±	±	+	±	+	±	+	±	+	+	+	±	±	±	+++	+++	+++
Caterpillars	+	+	+	+	+	+	±	±	±	±	±	+	±	±	±	+++	+++	+++
Bugs/ beetles pest	++	+	++	++	++	++	+	+	±	+	+	±	±	+	±	+++	+++	+++
Leaf hoppers pest	+	±	±	+	+	+	±	+	±	±	±	+	±	±	±	+++	+++	+++
Rodents pests	++	+	+	++	+	+	+	+	+	±	+	+	±	±	±	+++	+++	+++
Nematodes pest	++	+	++	+	+	+	+	+	+	+	±	±	±	±	±	+++	+++	+++
Spot diseases	+	++	++	+	++	+	+	+	+	+	±	+	±	±	±	+++	+++	+++
ï :: Insignificant ; + :: Positive **;** ++ :: Moderately positive; +++ :: Highly positive **A**:: Rice field; **B**:: Pumpkin field; **C**:: Cauliflower field																		

Table 2: Data regarding numbers of burrows & crop damage of rodents in the experimental fields at Purba Medinipur district.

	No. of rat burrows	Hoarded Rice (A) (kg)	No. of biting on pumpkin	No. of biting on cauliflower
Experiment-I	2.5±0.50*p<0.05	1.60±0.40 NS	1.5±0.50 p<0.05	2.5±0.50 p<0.05
Experiment-II	1.5±0.50 p<0.05	1.38±0.25 p<0.05	1.5±0.50 p<0.05	1.5±0.50 p<0.05
Experiment-III	1.5±0.50 p<0.05	1.25±0.05 p<0.05	0.0±0.0 p<0.01	0.0±0.0 p<0.01
Experiment-IV	1.5±0.50 p<0.05	1.38±0.13 p<0.05	0.0±0.0 p<0.01	0.0±0.0 p<0.01
Experiment-V	0.0±0.0 p<0.01	0.0±0.0 p<0.01	0.0±0.0 p<0.01	0.0±0.0 p<0.01
Experiment-VI (Control)	6.5±0.50	1.75±0.25	8.5±0.50	5.50±0.50
* Mean ±Standard Error				

Most of the experiments, pests have effected on their life cycle and significance results were screening from the field survey. It is also observed that these experiments do not effect of its food production. But application of cow dung and neem cake use as good fertilizer which provide defence to plants against pests and deal with toxicty to both insect pests. Application of cow dung and neem cake is also help to reduce soil pest and nematodes. Rodents pests do not interest to make burrow of these experimental area. Broadcasted plants extract are also prevented from rat damages of young and adults plants (Table 2). The hoarded rice, damages of pumpkin and cauliflower were reduced significantly in all experiments. Another important observation is that pollinator insects, bees and other useful organisms are not affected by plants extract based pesticides.

Leaf folder pest, stem borer pest, caterpillars, bugs/ beetles pest, leaf hoppers pest, nematodes pest, spot diseases and rodents pests are studied carefully at the time of field survey. After use botanical products against pests in the form of various extracts containing a group of active ingredients but most successful anti-feeding activities was noticed after experiment-V (Table 1).

Discussion and conclusion

There is a surge of use of bio fertilizers as these are environmental friendly as against chemical fertilizers (Oladejo et al., 2015). But bio-fertilizer are natural and organic fertilizer that helps to keep in the soil with all the nutrients and live microorganisms required for the benefits of the plants. Biofertilizers are widely regarded as a desirable technique for controlling insects and pests, due to its minimal environmental impact and its avoidance of problems of resistance in the vectors and agricultural pests. The present experiments deal with cow dung and neem cake (4:1 ratio) with soil fertilizerscontain living microorganisms, it increases or promotes the supply of important nutrients crucial for the overall productivity of the soil.

Neem tops the list of 2,400 plant species that are reported to have pesticidal properties and is regarded as the most reliable source of eco-friendly bio-pesticidal property. Neem products are effective against more than 350 species of arthropods, 12 species of nematodes, 15 species of fungi, three viruses, two species of snails and one crustacean species. Neem formulations also has a significant effect against eggs of peach fruit fly *Bactrocera zonata* (Saunders). Over 195 species of insects are affected by neem extracts and insects that have become resistant to synthetic pesticides are also controlled with these extracts. The apprehension that large-scale use of neem based insecticides may lead to resistance among pests, as being observed with synthetic pesticides, has not been proved correct. Neem bio-pesticides are systemic in nature and provide long term protection to plants against pests (Nigam et al., 1994).

While scanning the elder people practices, it was observed that the pests of rice, Pumpkin and Cauliflower were deal with by the traditional practices but no systemic study was conducted hence the present investigation was undertaken. Our experiments clearly indicates that leaf of *Vitex*, *Tulsi*, *Lantana camara*, *Azadirachta indica*, *Aegle marmelos*, *Calotropis procera*, chilli powder, neem cake, neem seeds, cow urine and cow dung has activity against agriculturally important insects and rodents pests. When used in combination in different ratios can be effective in controlling damage to crops. They interfere in the developmental processes of pests while some leaf exudates are toxic to insects. Cow urine contains huge amount of bacteria which acts as a biopesticides in agricultural fields. Leaf glandular trichomes and the exudates such as cuticular waxes produced by them play a significant role in determining resistance and susceptibility to infestation by insects in these plants which was also found in the present investigation.

The present investigation has the potential to control pest population and it is also an eco-friendly approach which are biodegradable and do not leave any harmful effects on environment. This research strategy of applying the plants and its extracts with some ingredients of natural origin may be used as natural pesticides and may be reduced the use of chemical pesticides. Further research is warranted to confirm or refute our findings.

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