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TRIBAL PEOPLE FROM BHOR REGION USING PLNTS TO CONTROL STORE FOOD GRAINS PESTS AND VALIDATION OF *CALOPHYLLUM INOPHYLLUM* L. OIL

P V Patil[2], S P Taware[1], S Punalekar[1] and D K Kulkarni[1]
[1] Botany Group, Agharkar Research Institute, Pune-4.
[2]Anantrao Thopte College, Bhor, Pune District.
dilipkkulkarni@gmail.com
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ABSTRACT

Agricultural crops are attacked by many insects and pests. Our traditional knowledge of controlling or repelling insects-pests has ancient roots in Sanskrit literature. Ancient agriculturists had different forms of control measures such as prayer, magic spells, cultivation techniques, mechanical practices and application of host by organic and inorganic substances to protect their crops from the depredations of weeds, diseases and insect pests. Rural people from Bhor region of Pune district using more than 10 plants for controlling insects / pests on food grains have been reported. The present paper also deals with the validation of plant parts on common Pulse beetle *Callosobruchus maculatus* Fab. This information will be useful for further studies on botanical pesticides.

Key words: Botanical pesticides from Bhor region, validation of *Calophyllum inophyllum* oil

INTRODUCTION

Our ancient literature like Atharvaveda, Kallavagga, and Rigveda mentioned protection of crops from locusts, mice, borers, mildews, blights, birds, etc. by using plant resources or by performing ceremonies, by making noise or din, by setting traps, etc. In 'Vrikshayurveda' the 'science of medicine for plants' had relevant *mantras* to utter one hundred and eight times and write them down on the leaf of the tree affected by locusts, rats, birds, ants, etc. In Visva-vallabha, vermin and rats can also be destroyed by medicines that emit offensive smell or have acrid taste. Fumigation with the fumes of white mustard, Ramava, Vidanga, Vaca, black pepper, beef, Ambu, horn of buffalow and flesh of pigeon mixed with the powder of Lodhra, at once destroys the colonies of insects infesting the trees. White mustard, Sesamum, Vidanga mixed with ghee, irrigation with diluted milk for seven days are effective in destroying insects like Kandara. All these practices of insect control were used in ancient India (Raychaudhuri 1964). Nene (1999) reported pests that are named in Sanskrit and which affect crops during the time of Sage *Parashara.* These are *Gandhi, Shankhi, dhuli,* etc. *Gandhi* (offensive odour) is from Gandhi bug (*Leptocorisa varicornis* F.), *Shankhi* must be a snail (*Pila* sp.) and *Dhuli* meaning powdery mildew.

Agricultural production today is dependent on commercially available synthetic chemical pesticides to combat a variety of weeds, insects, fungi and other agricultural pests. Some of these pesticides are considered to be acutely or chronically toxic to human and other segments of the environment and pose potentially serious health risks to non-target organisms and species. They occur in the mother's milk and probably in the tissues of the unborn child (Singh *et al.* 1996). These are hazardous chemicals formulated as synthetic pesticides which need to be replaced by exploitation of plant based products. According to the published reports plants like *Mentha piperita* L., *Acorus calamus* L., *Piper nigrum* L., *Pongamia pinnata* Poirr. and *Azadirachta indica* A. Juss. have been evaluated for their insecticidal property and found satisfactory (Tripathi *et al.* 2001). Neem tree has attracted global attention in finding new chemicals for control of locusts, gypsy moths, cockroaches and other insects. Such plant resources have been receiving attention in recent years.

These plant chemicals have different properties like attractants, ovicides, insecticides, anti-feedants (Muruganam *et al.* 1998), etc. Majority of insects are having particular semio-chemicals hence different insecticidal properties of plants need to be studied. Selvakumari (2009) reported insecticidal activity of *Typhonium roxburghii* Schott. Belongs to family Araceae was tested on *Tribolium castaneum* Herbst. The plant has repellent activity for its petroleum ether fraction of the benzene extract and corn oil. Much of the insect's behavior is mediated by chemicals in its environment. By turning these chemicals to our own advantage, it is possible to attract pests to traps or baits or repel them from our homes, our crops or our domestic animals (Singh and Upadhyay 1993, Singh 1999, Sharma *et al.* 2000).

This traditional knowledge of pest control needs to be revitalized in Indian pest management programmes. Farmers store perishable bulbs and root crops by covering it with dung pest or kept in ash. Rural grain storage is prevalent in Kothal (mud bins) or bins prepared by using dried twigs of *Clerodendrum spp.*, Bomboo (*Bambusa arundinacea* Willd.), Nirgudi (*Vitex nedungo* L.), etc.

Skilled persons from villages are preparing conical structure called as *Kanagi*. This structure kept in house over a stone base at least 9" above ground. Traditional practice of plastering of bins with cow-dung and then white washing with slaked lime or covering the surface with gypsum is known to keep the pests away.

Farm storage systems must provide maximum protection against deterioration of the commodity by inclement weather and pests, and also to deter theft. Traditional farm storage systems have been evolved over long periods to satisfy these requirements. Most are well adapted to their environment and losses are generally low, often below 5 % of grain weight over a storage season. However, for resource poor farmers living at or near subsistence even losses of this magnitude have important implications for food security. Rectifying these losses can only be achieved by subsistence farmers if changes are made to the traditional system of storage which bear no cost (other than of the farmers own labour), such as improving the design of the storage structure and using grain protectants which occur naturally in the local environment. Traditionally, protectants against insect infestation fall into two groups: those materials such as ashes, minerals and oils, in which physical barrier effects are responsible for the control of insects; and the use of whole plants, or parts of plants where there may be some chemicals with insecticidal or repellent effect. In the present studies management of store grain pests by local or tribal people from Bhor region of Pune district of Maharashtra State using 10 plants to control stored grain pest have been recorded. Laboratory validation of the plant parts like leaves, fruits, seed oil, etc have been done on a common store grain insect/pest of pulses viz. Pulse beetle *Callosobruchus maculatus* Fab.

MATERIAL AND METHODS

Area under study

Bhor taluka cover an area of 892.0 sq. km.and 810 sq.km. It is situated 54 km south of Pune, at 18º 45' N latitude and 73 º 15' E longitudes. Bhor region has 185 villages and total population is 1, 54,903. The forest is classified into reserved forest, protected forest, acquired private forest and compensatory afforested land. Bhor area has average rain fall 643.5-800 mm from June to September. The mean daily maximum temperature is 38.10 °C in summer. In the month of May maximum temperature may reach to 41.09 °C. December is the coldest month and minimum temperature is 8-9 °C. The climate of the area is humid during rainy season and moderate in winter and summer season. The hilly area is of basalt rock formation. The soils of the area are alluvial along the banks of river and black cotton soil in eastern part while red and brown soils on western part.

The main occupation of local people is agriculture. Majority of the people are dependent on their farm produce and some people collect forest products like fruits, gum, honey, medicinal plants from surrounding forest area. They have an appropriate knowledge of the environment, including species and ecological relations that exist among them by their long association with nature. The data on several important plants used for store grain pests to control their farm produce were collected during field survey. Questionnaire designed was used for data collection.

During the field survey 60 villages, out of 182 villages were visited for data collection from Bhor region. Ten plant species used by tribal people to control food grain pests of *Kharif* and *Rabi* season crops are presented in table 1. Plants were identified with the help of Flora of Kolhapur district- (2002)

Methodology used for laboratory testing:

Oil of *Calophyllum inophyllum* L. seeds was extracted using pet ether as solvent with the help of soxhlet apparatus.

Bioassay: a common store grain pest of pulses – Pulse beetle *Callosobruchus maculates* Fab.(Coleoptera :Bruchidae) was selected for the lab test. The insect culture was maintained on cow pea seeds in broad glass jars. One day old adults were used for the test.

The oil was applied to the cow pea seeds in five doses viz. 1ml/kg, 3ml/kg, 5ml/kg, 7ml/kg, 9ml/kg. For each concentration 25 gm seeds were taken in a glass test tubes and oil was applied on them accordingly. Seeds were shaken vigorously for the uniform coating of oil. Four replications of each concentration were maintained. Ten one day old adults were introduced in each test tube. The tubes were then closed with muslin cloth using rubber band. Adult mortality was counted in each tube after 24, 48 and 72 hrs.(Table 2).

RESULTS AND DISCUSSION

The results indicate the strong toxicity of *Calophyllum inophyllum* L. oil on the pulse beetle. The mortality increases with increasing concentration. In 9ml/kg of concentration 100 percent mortality was observed after 24 hours. The oil even in lower concentration paralyses the adults. Prolonged exposure leads to death. Many scientists have validated traditional knowledge of food grain pest control (Nene, 2006). In this context, vegetable oils are studied by Singh *et al.* (1993), Rajapakse and Senanayake (1997). Castor oil 10 ml/ kg seed gives complete protection to mung bean seeds against the bruchids for 18 months without impairing germination. Oils like Sesamum, Peanut and Sunflower had no deleterious effects on viability, palatability, cooking quality or physical appearance of pulse legume

Table 1: Traditional method for store pest management

Botanical Name	Family	Local name	Application	Part used
Calophyllum inophyllum L.	Cluciaece	*Undi.*	Legume seeds covered with oil	Oil
Melia dubia Cav.	Meliaceae	*Nimbara. Limbara*	Dried leaves are kept in the bins.	Leaves
Pongamia pinnata Poir.	Leguminaceae	*Karanj*	Dried leaves	Leaves
Catunaregam spinosa Tirveng.	Rubiaceae	*Gela*	Fruits kept in bins	Fruits
Madhuca longifolia Mac. Brid.	Sapotaceae	*Mahua*	Oil applied to grain	Oil
Eucalyptus globulus Labills.	Myrtaceae	*Nilgiri*	Leaves kept in bin	Leaves
Gnidia glauca Gling.	Thymalaceae	*Rametha*	Leaves kept in bin	Leaves
Tectona grandis L.	Verbenaceae	*Sag*	Leaves inside the bin	Leaves
Pogostemon benghalensis O. Ktze.	Lamiaceae	*Phangali*	Seeds and leaves kept in bin	Seed and leaves
Vitex negundo L.	Verbenaceae	*Nirgudi*	Leaves kept in bin	Leaves

Table 2 : Mortality of *Callosobruchus maculates* in different concentrations of *Calophyllum inophyllum* oil

Treatments	Control				1ml/kg				3ml/kg				5ml/kg				7ml/kg				9ml/kg			
Replications	I	II	III	IV	I	II	III	IV	I	II	III	VI	I	II	III	IV	I	II	III	IV	I	II	III	IV
24 hours	0	0	0	0	0	0	1	0	5	1	5	8	7	2	2	2	6	2	1	7	10	9	10	10
48 hours	0	0	0	0	2	1	2	0	3	1	3	2	2	5	2	4	3	6	3	3	-	-	-	-
72 hours	0	0	0	0	0	0	1	0	2	2	1	-	1	1	2	1	1	2	2	-	-	-	-	-

seeds. Mauha *(Madhuca longifolia* Mac. Brid.) seed oil at 5 ml /kg applied on cow pea seeds had shown the similar results (Raja and Ignacimuthu 2001, Verma 2006). This indicates that control of store grain pests using botanicals is economical, effective and environmentally safe when implemented properly (Muniappan and Viraktamath, 1993). Traditional knowledge of Mahadeokoli tribe from Western Maharashtra needs to be validated in respect of food grain storage practice (Kulkarni and Kumbhojkar 1996, 2003). The preliminary trials of alcoholic leaf extract of *Gnidia glauca* Gling, *Melia dubia* Cav., *Pogostemon benghalensis* O. Ktze. and *Vitex negundo L.* has also shown positive activity. Local people from Bhor area have used exotic plant *Eucalyptus globulus* Labills. Leaves are mixed in the grains to control insects.

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