

## Tribal pest control practices of Tamil Nadu for sustainable agriculture

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In an attempt to revalidate indigenous pest control practices enlivening in certain hillocks of Tamil Nadu, more than 125 practices covering crops like rice, vegetables, etc. store produce and domestic habitations have been documented. From the collection, based on popular usage, certain pest control practices were selected and subjected them for their efficacy in the laboratory and field conditions. All of them showed their potency against various pests.

**Keywords:** Pest control, Indigenous pest control, Sustainable agriculture, Crop protection

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Tribal people are known for their rich indigenous knowledge in controlling various insect pests, which got evolved over generations. Realizing this, various workers have emphasized the value of the tribal knowledge based pest control techniques for sustainable crop protection. In a maiden study, appropriateness of tribal knowledge based pest control techniques in crops like rice, vegetables and stored grains was found against various pests<sup>1</sup>. Following this, series of studies were carried out to ascertain the scientific basis of action of certain products of plants and of natural origin against the pests. A successful attempt was made to remodel the tribal rat trap for use in rice fields<sup>2,5</sup>. Crop pests are managed with the indigenous practices involving various plant species available locally and the other naturally available waste products. Over the years, these practices have become gradually more effective. Unfortunately, very little importance has been lent to their skills and ultimately they vanish gradually. It is only in the fitness of things that this precious tribal wisdom of knowledge is preserved. It is in this perspective, systematic survey of seven hills of Tamil Nadu was made to document indigenous practices adopted by the tribal folks and subsequent revalidation of the scheduled practices in certain crops.

### Methodology

The study spanned for a period of 3 yrs from 2003 covered 7 hills of Tamil Nadu, viz. Kalrayan, Kolli,

Pachamalai, Javvadu, Yelagiri, Shervaryon, and Yercaud (Fig. 1). Several trips were made to the tribal hamlets for every 6 months and the elder people of the hamlets were interviewed to gather their knowledge on traditional pest control activities. Such indigenous knowledge based practices were documented crop wise and pest wise. Certain potential practices were chosen and evaluated in laboratory and field conditions.

One kilogram of fresh leaves of the plants washed in clean water was made into a paste with water. The product was strained through muslin cloth to obtain clear filtrate. One litre of the filtrate was then evaporated to 1/2 ltr capacity by keeping in water bath. The resultant solution was taken as a stock

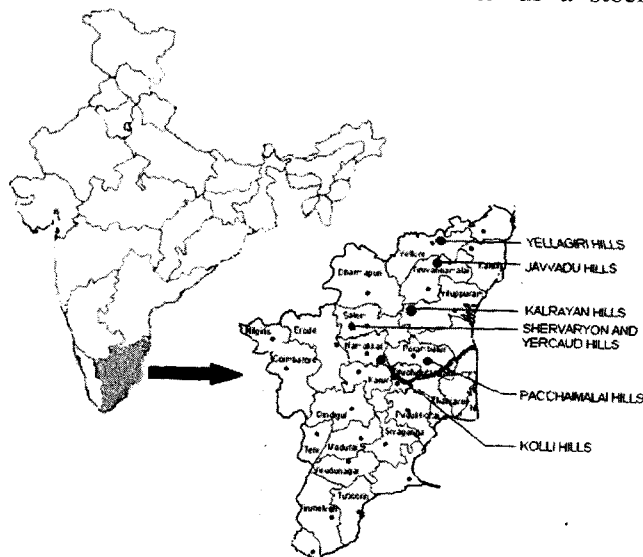


Fig. 1 — Location map of the study area

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solution, to which other ingredients were added before treatment.

One kilogram of fresh leaves was collected; air dried in shade for a month and kept in hot air oven for one hour at 40°C to facilitate easy grinding. The dried leaves were ground into fine powder and sieved through a sieve to obtain fine dust. The fine dust was stored in glass bottles in airtight condition and used.

#### For rice pests

*Vitex* leaf extract (5%), *Lantana camara* leaf + *Tulsi* leaf extract (5%), *Nerium* + *Ipomoea* leaf extract (5%), *Agave* leaf flesh extract + kerosene (2.5%), *Jatropha* leaf extract + cow urine (5%), *Adathoda* leaf extract + cow dung slurry (2%), rice bran + kerosene, and *Brammathandu* leaf extract + toddy (3%)

#### For groundnut pests

*Vitex* leaf extract (5%), lemongrass + *tulsi* leaf extract (5%), garlic + kerosene + chilli fruit extract (2%), *Agave* leaf flesh extract (2.5%), *Eucalyptus* leaf extract (5%), fenugreek + betel vine + onion + butter milk + castor oil (3%), and tobacco leaf extract (5%).

#### For pulses pests

*Vitex* leaf extract (5%), *Datura* leaf extract (3%), sweetflag leaf and rhizome extract (2.5%), chilli + garlic + kerosene (2%), *Neem* oil + *Vetiver* extract (4%), fenugreek + betel vine + onion + butter milk + castor oil (3%), and *Brammathandu* leaf extract (5%).

#### For vegetable pests

*Vitex* leaf extract (5%), *Agave* leaf flesh extract (5%), *Jatropha* leaf extract (5%), *Anna* leaf + *Aduithina palai* leaf extract (3%), *Aloe vera* flesh + turmeric + chilli powder (2.5%), *Calotropis* leaf extract + garlic + onion + chilli powder (3%), and *Nerium* leaf extract (5%).

#### For store grain pests

*Vitex* leaf powder (5%), *Vitex* + *Neem* leaf powder (2.5%), turmeric powder (3%), *Eucalyptus* + wood ash (5%), *Acorus* tuber dust (3%), and *Annona* seed powder (5%).

Insects were collected from the natural habitat and their cultures were maintained in the laboratory. For the evaluation studies in laboratory, 2<sup>nd</sup> and 3<sup>rd</sup> instars of the insects were chosen. Leaf discs of 5 cm diameter were dipped in the extracts and air dried for 30 min before allowing the insect to feed on the

treated leaf discs. Each treatment was replicated thrice with 10 insects in each of replication. An untreated check was maintained with plain water treatment. Observations on the pest damage were taken after 24 hrs, 48 hrs and 72 hrs, whereas insect mortality observations were taken after 1, 2, 7 and 14 days of treatment<sup>7</sup>. For determining pest damage, after every 24 hrs the damaged portion of the leaf were drawn on a piece of tracing paper and the area of damage was calculated by using a graph sheet. Any portion covering more than ½ area of the small square of graph is included; if it covers less than half then excluded. In case of stored grain pests (rice weevil, rice moth, pulse beetle, red flour beetle), 100 gm of grains were kept in small cloth bags and treated with selected treatments with 3 replicates. 10 insects were allowed to feed in each replication. Insect mortality was recorded after 1, 2, 4 and 7 days of treatment<sup>1</sup>. In the field evaluation, plots of 4 x 5 m<sup>2</sup> size were formed with 3 replications. Treatments were given to the respective plots. Spraying of the treatment material was done in the early morning hours. 6 observations on the number of insects were taken at ten days interval, till harvest of the crop.

## Results

From the collection of indigenous pest control knowledge, it became obvious that these treasured knowledge based techniques were abundant. Of about 125 tribal practices recorded, 80% were adopted against pests of field crops, 15.20% against pests of stored products and 4.80% against household pests. A comprehensive listing of tribal practices is illustrated (Table 1). While scanning these practices, it was observed that varieties of crop pests were dealt with by the traditional folk practices (Fig. 2). It was found that the pests of rice had large share of the practices with 26.4% adoption followed by that of vegetable pests (16.8), fruit crop pests (12), storage pests (11.2) and other group of pests. Besides the role of the

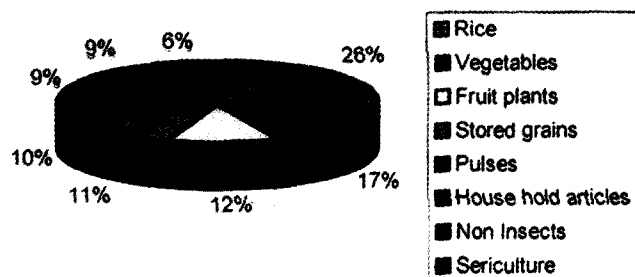


Fig. 2 — Categories of the pests covered in the tribal pest control

Table 1 — Tribal pest control practices gathered from Tamil Nadu

Tribal pest control practices	Collection site	Crop	Used against
<i>Lantana camara</i> leaf, fruit paste + wild tulsí leaf + 50 gm pepper and chilli powder – Boiled for 1-2 hr and filter	Kalrayan	Rice	Earhead bug
Scratching top leaves of 45-50 days old rice plants with palm leaves	-do-	-do-	Leaf folder
Rice bran (2 kg) kerosene (1 L)	-do-	-do-	Yellow stem borer
Rice seed + dried pig dung + red earth(1 day before sowing)	Kolli	-do-	Thrip
<i>Agave americana</i> leaf + 2-3 drops lime juice (fermented for 4-5 days)	-do-	-do-	Leaf folder
Argemone leaf, stem & fruit extract + well fermented toddy	-do-	-do-	-do-
Tobacco leaf extract 200ml/L	Pacchamalai	-do-	Earhead bug
Calotropis leaf broadcasting in the field	-do-	-do-	Hopper
Blue Vitex leaf soaked in	-do-	-do-	Leaf folder & earhead bug
<i>Aloe vera</i> gel + chilli powder	Javvadu	-do-	Yellow stem borer
Gypsum + sugar solution poured into rodent holes	Yelagiri	-do-	Rats
Nerium + <i>Ipomea carnea</i> leaf extract (2 kg), boiled for 30 min, filtered +soap solution+ jaggery	Kalrayan	All crops	Leaf eating insects
Adathoda + wild tulsí+ <i>Cordiospermum</i> leaf extract + cow dung + urine – soaked over night – supernatant removed, rest diluted with water and sprayed	-do-	-do-	All pests
Lemon grass + <i>Ocimum</i> leaf extract + butter milk + cow urine	Kolli	-do-	Sap feeders Leaf feeders
Tribal rat trap	Kalrayan	-do-	Rats
Blue gum leaf extract	Kolli	Vegetables	<i>Spodoptera litura</i>
Growing insectivorous plants ( <i>Utricularia</i> & <i>Nepenthes</i> )	Yellagiri	Vegetables	Sap feeders
Aegle leaf extract	Javvadu	-do-	Borers
Vetiver extract + neem oil	-do-	-do-	Fruit and shoot borer
Powdered <i>Acorus</i> seed	-do-	Cotton	Sap feeder
Spreading <i>Calotropis</i> leaf in cotton field	Yelagiri	-do-	<i>Spodoptera litura</i>
Jatropha leaf + pig urine	Kolli	Coffee	Berry borer
Coffee plants are tied up with lemon grass up to a height of 50 cm of stem	Yercaud	-do-	White stem borer
Coffee plants are washed during onset of winter with lime	Shervaryon	-do-	-do-
Sand sprinkling at the crown region of coconut tree	Yelagiri, Kalrayan	Coconut	Red palm weevil & Rhinoceros beetle
Nerium + Cassia + Forest tulsí leaf extract	-do-	Mango, coconut	Beetles
Turmeric + castor inter cropping	-do-	Castor	Capsule borer
Adathoda leaf + cow dung slurry	Kolli	Pepper	Pollu beetle
Latex of (Mango + Calotropis + Jatropha) + hot water	-do-	Tapioca	White fly Aphids
Rice seed + <i>Annona squamosa</i> seed powder	Kalrayan	Rice	Storage pests
Pulse seed + red earth	-do-	Pulses	Pulse beetle
Pongam + Neem + Chloroxylon leaf extract smearing inside storage bin	-do-	-	Storage pests
Pearl millet + goat urine made into pellets	Pacchamalai	-	Rats
Coffee seed treated with castor and ground nut oil	Yercaud	Coffee	Storage pest
Seeds of Ragi + Pepper powder	-do-	-	Do
<i>Acorus</i> tuber powder	Javvadu	Pulse	Pulse beetle
Dried powder of Nerium fruit + ash	Kalrayan	-	Termite
Tephrosia + Anonna +Neem +Calotropis leaves burnt near house	Kolli	-	House fly
<i>Ipomoea pestcabrae</i>	Pacchamalai	-	Ants

practices against pests in various kinds of crop plants, there are various practices for controlling storage grains pests (Table 2). While analyzing various products used in the pest control, a good number of plant species and an array of natural substances were observed. Varieties of plant species used by the tribal men are tabulated (Table 3). Important plant species include *Vitex*, *Acorus*, *Pepper*, *Neem*, *Pongam*, *Aristolochia*, *Aloe*, *Holy Basil* and *Adathoda*. Based on the pest control practices documented, certain practices were selected and evaluated against the respective crop pests and store grain pests in both laboratory and field conditions (Fig. 3).

All the tribal practices tested against pests of rice revealed significant performance over the untreated check. Among the treatments, *Vitex* leaf extract + buttermilk and *Adathoda* leaf extract + cow dung slurry showed to be the most promising treatments followed by *Jatropha* leaf extract + cow urine and *Venguruchen* (white) stone powder + Ash and other treatments. (Table 2)

The results showed the potency of the pest control practices against vegetable pests (Fig. 4). *Vitex* leaf extract revealed as the best antifeedant along with *Calotropis* leaf extract + garlic + onion + chilli powder, followed by *Jatropha* leaf extract, *Aloe vera* leaf flesh + turmeric + chilli powder. Among various concentration of *Vitex* leaf extract evaluated, all the concentrations caused significant insect mortality compared to the untreated check with *Vitex* leaf extract 10% showing the best result followed by 5%

and 3% (Table 5). The treatment *Calotropis* leaf extract + onion + garlic + chilli powder caused the highest mortality of the brinjal fruit and shoot borer, pumpkin caterpillar and tapioca whitefly tested,

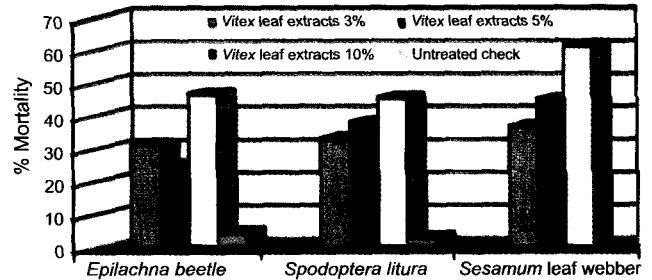


Fig. 3 — Laboratory efficacy of *V. negundo* leaf extracts

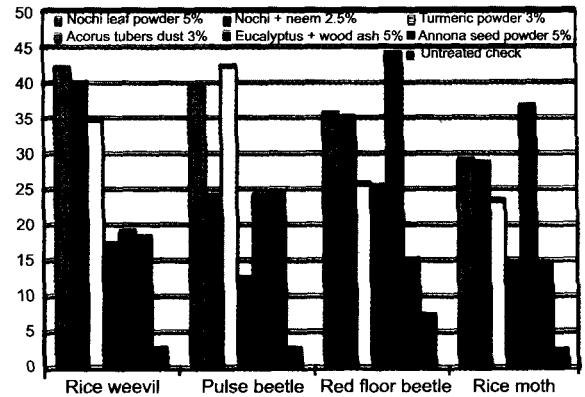


Fig. 4 — Efficacy of tribal pest control practices

Table 2 — Tribal pest control practices used against store grain pests

Tribal Practices	Gathered from	Used against
Rice seed + <i>Annona squamosa</i> seed powder	Kalrayan hills	Storage pests of rice
Pulse seed + red earth paste	-do-	Pulse beetle
Pongam+neem+ poorichan leaf paste smearing (Inside storage bin)	-do-	All storage pest
Rice seed + Turmeric powder	-do-	Store pests of rice
<i>Annona squamosa</i> seed powder + seeds	Koli hills	All storage pest
Pepper power + cereals	-do-	Storage pest of cereals
<i>Acorus</i> rhizome powder	-do-	Pulse beetle
Eucalyptus leaf + wood ash	Pachamalai hills	All Storage pests
Maize seed + cow dung paste	-do-	Storage pest of maize
Rice seed + <i>Annona squamosa</i> seed powder	-do-	Storage pests of rice
Turmeric + dried leaf of ( <i>Vitex</i> + neem) + rice seed	-do-	Storage pests of rice
Wild tulsii leaf paste smearing (Inside storage bin)	-do-	All storage pest
Ragi seed + pepper powder	Yercaud	Storage pests of ragi
Coffee seed + castor oil + Ground nut oil	-do-	Storage pest of coffee

Table 3 — Plant Species used by tribal for pest control

Common name	Plant name	Area recorded from	Used against pest
Indian privet	<i>Vitex negundo</i> L.	Kalrayan, Kolli, Pacchamali, Javvadu	All Pests
Datura	<i>Datura stramonium</i> L.	Kalrayan, Kolli, Pacchamalai	All pests
Acorus	<i>Acorus calamus</i> L.	Javvadu, pacchamalai	Sap feeders
Betelvine	<i>Piper nigrum</i> L.	Koli	Sap Feeder
Wild tulsi	<i>Agave americana</i> L.	Kalrayan, Kolli, Pacchamalai	All pest
Jatropha	<i>Jatropha curacas</i> L. <i>J. glandulifera</i> Roxb.	Kolli, Javvadu	Coffee berry borer, Rice pest
Aloe	<i>Aloe vera</i> L. Brm.f.	Kalrayan, Kolli, Javvadu	Rice leaf feeder, Stem borer
Aristolochia	<i>Aristolochia bacteolata</i> Lamk.	Kalrayan, Kolli, Javvadu	All pests
Onion	<i>Alium cepa</i> L.	Kalrayan, Javvadu, Kolli, Pacchamalai	All pests
Garlic	<i>Alium sativum</i> L.	Kalrayan, Javvadu, Kolli, Pacchamalai	All pests
Turmeric	<i>Curcuma domestica</i> Valetton	Kalrayan, Javvadu, Kolli, Pacchamalai,	Storage pests
Tulsi	<i>Ocimum sanctum</i> L.	Kalrayan, Javvadu, Kolli, Pacchamalai,	All pests
Adathoda	<i>Adathoda vasica</i> Nees.	Kalrayan, Kolli, Javvadu	All pests
Ipomoea	<i>Ipomoea carnea</i> Jacq.	Kalrayan,	Leaf eaters
Ipomoea	<i>Ipomoea pes-caprae</i> (L.) R. Br.	Pacchamalai	Ants
Tobacco	<i>Nicotiana tobaccon</i> L.	Pacchamalai	Rice earhead bug
Eucalyptus	<i>Eucalyptus globules</i> Lablle.	Kolli, Pacchamalai	Storage pests
Prosopis	<i>Prosopis juliflora</i> (Sw.) DC	Kalrayan, pacchamalai	Rice leaf folder
Glyricidia	<i>Glyricida sepium</i> (J) K.W.	Pacchamalai	Rats
Custard apple	<i>Annona squamosa</i> L.	Kalrayan, Kolli, Pacchamalai	Storage pest
Tephrosia	<i>Tephrosia vogelii</i> Hook. f.	Kolli	House fly
Wild chilli	<i>Capsicum frutescens</i> L.	Kalrayan, Kolli, Pacchamalai, Javvadu	All pest
Tamarind	<i>Tamarindus indica</i> L.	Kalrayan, Kolli, Javvadu, Pacchamalai,	Rice army worm
Nerium	<i>Nerium indicum</i> Mill.	Kalrayan, Pacchamalai, Yelagiri	Beetles, Termite
Vettiyeer	<i>Vetiveria zizanioides</i> (L.) Nash	Kolli, Javvadu	Fruit and Shoot borer
Neem	<i>Azadirachta indica</i> A. Juss	Kalrayan, Kolli, Javvadu, Pacchamalai,	All pests
Pongam	<i>Pongamia pinnata</i> L.	Kalrayan, Kolli, Javvadu, Pacchamalai,	All pests
Calotropis	<i>Calotropis gigantea</i> (L.) R. Br.	Kalrayan, Kolli, Yellagiri, Pacchamalai,	Grasshopper, Leafhopper, <i>Spodoptera litura</i>
Argemone	<i>Argemone mexicana</i> L.	Kolli	Rice leaf folder
Lemon grass	<i>Cymbopogon citrates</i> (DC.) Stapf.	Kolli, Yercaud, Shervaryon	Sap feeder

followed by the *Vitex* leaf extract, and rest of the treatments revealing their significant effect over the untreated control (Table 5). All the treatments showed significant result over the untreated check (Fig. 5). *Vitex* leaf powder and *Vitex* leaf + *Neem* leaf + turmeric powder showed highest mortality of the rice weevil followed by turmeric powder alone. All other treatments also showed their significant effect. Turmeric powder followed by *Vitex* leaf powder and *Vitex* leaf + *Neem* leaf + turmeric powder had brought

in highest mortality against the pulse beetle. The rest of the treatments also had significant results. *Acorus* dust caused control of red flour beetle, followed by *Vitex* leaf powder and *Vitex* leaf + *Neem* leaf + turmeric powder, turmeric powder and *Eucalyptus* + wood ash.

### Discussion

Tribal pest control practices are prepared from the cheapest materials available locally and are easy to

Table 4 — Laboratory efficacy of certain tribal pest control practices against pests of rice

Treatment	% Damage		% Mortality
	Leaf folder	GLH	Grasshopper
Vitex leaves + BM extract	0.93 <sup>a</sup>	41.73 <sup>a</sup>	39.25 <sup>a</sup>
Lantana + Tulsi leaf extract	25.86 <sup>e</sup>	8.00 <sup>e</sup>	8.00 <sup>e</sup>
Nerium + Ipomoea leaf extract	22.13 <sup>d</sup>	12.00 <sup>d</sup>	13.25 <sup>d</sup>
Agave leaf + Kerosene	13.17 <sup>c</sup>	19.25 <sup>c</sup>	17.50 <sup>c</sup>
Jatropha leaf + Cow urine	7.66 <sup>b</sup>	39.00 <sup>b</sup>	29.75 <sup>b</sup>
Adathoda leaf + Cowdung slurry	2.70 <sup>a</sup>	44.00 <sup>a</sup>	38.00 <sup>a</sup>
Rice bran + Kerosene	11.73 <sup>c</sup>	19.50 <sup>c</sup>	18.75 <sup>c</sup>
Argemone plant extract + Toddy	7.66 <sup>b</sup>	39.00 <sup>b</sup>	29.25 <sup>b</sup>
Untreated check	62.25 <sup>f</sup>	2.25 <sup>f</sup>	2.50 <sup>f</sup>
CD (P = 0.05)	2.5	2.51	3.0

Each value is a mean of 3 replications

Mean values with similar alphabets do not vary between each other

prepare and eco-friendly<sup>3-6</sup>. Further, there is more number of tribal pest control practices against rice insect pests than other crops. The insect pests of rice can be controlled effectively with *Vitex* leaf + butter milk extract, *Jatropha* leaf + cow urine, *Adathoda* leaf + cow dung slurry and *Agave* leaf + kerosene<sup>2,3,4</sup>. Various concentrations of *vitex* leaf extract showed efficacy against pests like *epilachna* beetle, tobacco cut worm and *Sesamum* leaf webber and also as insect deterrent<sup>3-5</sup>. Major insect pests of the vegetables can be controlled by *Vitex* leaf extract, *calotropis* leaf extract + garlic + onion + chilli powder and *Aloe vera*

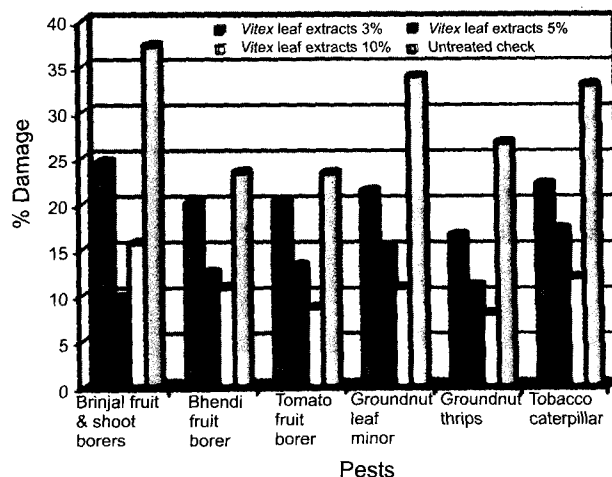


Fig. 5 — Field efficacy of *V. negunda* leaf extracts

flesh + turmeric + chilli powder<sup>3,4</sup>. For various stored grain insects pests, *Vitex* leaf powder, *Vitex* leaf + *Nem* leaf+ turmeric powder and turmeric powder showed promising result<sup>2,3</sup>. Almost all the tribal pest control practices are derived from locally available pesticidal plants (Table 2), which accounted for their activity against the insect pests. Based on these findings, certain tribal pest control practices are recommended for field application: for rice crop, *Adathoda* leaf + cow dung slurry, *Vitex* leaf + butter milk extract, *Jatropha* leaf + cow urine and *Agave* leaf + kerosene; for vegetables, *Vitex* leaf extract, *Calotropis* leaf extract + garlic + onion + chilli powder, and *Aloe vera* flesh + turmeric + chilli powder; for stored grain, *Vitex* leaf powder, *Vitex* leaf + *Nem* leaf+ turmeric powder and turmeric powder.

Table 5 — Efficacy of tribal pest control practices against pests of vegetable crops

Treatment	% Damage			% Mortality		
	<i>H. armigera</i>	<i>Epilachna</i> beetle	<i>E. vitella</i>	Brinjal fruit & shoot borer	Tapioca White fly	Pumpkin caterpillar
Vitex leaf extract	6.00 <sup>a</sup>	11.00 <sup>a</sup>	5.66 <sup>a</sup>	20.66 <sup>b</sup>	20.33 <sup>b</sup>	16.00 <sup>b</sup>
Agave leaf flesh extract	20.70 <sup>c</sup>	26.00 <sup>b</sup>	14.00 <sup>c</sup>	15.66 <sup>c</sup>	12.66 <sup>d</sup>	15.33 <sup>b</sup>
Jatropha leaf extract	27.33 <sup>d</sup>	8.70 <sup>a</sup>	8.00 <sup>ab</sup>	30.33 <sup>a</sup>	16.33 <sup>c</sup>	10.33 <sup>c</sup>
Anna leaf + Aristolochia leaf extract	14.00 <sup>b</sup>	25.00 <sup>b</sup>	25.00 <sup>c</sup>	20.33 <sup>b</sup>	20.00 <sup>b</sup>	9.33 <sup>c</sup>
<i>Aloe vera</i> flesh + turmeric + chilli powder	17.00 <sup>bc</sup>	17.00 <sup>ab</sup>	14.00 <sup>c</sup>	15.00 <sup>c</sup>	15.33 <sup>c</sup>	15.00 <sup>b</sup>
<i>Calotropis</i> leaf extract + garlic + onion + chilli powder	5.70 <sup>a</sup>	7.33 <sup>a</sup>	9.00 <sup>b</sup>	32.00 <sup>a</sup>	25.66 <sup>a</sup>	20.66 <sup>a</sup>
Nerium leaf extract	29.00 <sup>d</sup>	26.33 <sup>b</sup>	18.33 <sup>d</sup>	11.00 <sup>d</sup>	10.33 <sup>c</sup>	5.33 <sup>c</sup>
Untreated check	64.33 <sup>e</sup>	49.00 <sup>c</sup>	64.30 <sup>e</sup>	3.33 <sup>e</sup>	2.00 <sup>f</sup>	1.33 <sup>f</sup>
CD (P = 0.05)	5.15	8.10	3.15	3.4	2.1	2.64

Each value is a mean of 3 replications

Mean values with similar alphabets do not vary between each other

## Conclusion

From the present study, it could be concluded that the indigenous pest control practices followed by the tribals are primarily against various crop pests and are capable of covering a wide range of crops without having any adverse effect on the environment. These practices are cheap, easy to prepare and use. Hence, these practices can be very well nurtured and involved into the plant protection schedule in a sustainable way. It is further envisioned that the collection of such tribal knowledge based pest control being adopted in the tribal pockets of various states in India are worth promising and are to be documented systematically in a coordinated way.

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