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present day bus services have no doubt improved the situation, but many villages could not be reached even by these, for want of motorable roads. The road transport has a great future in our country because of the obvious huge cost of construction and working of railways. The loss sustained per annum by slow movement of produce due to no roads or bad roads, in these progressive days, has not been ascertained. The economics of the use of the rubber tyred cart in the rural areas, have to be studied fully, before recommending these for popular use. There is scope for further improvement of the bullock cart and this line deserves investigation.

Conclusion. There is a vast field of great importance and potentiality waiting to be developed on modern lines and it is on this, the countryside, the future prosperity and the measure of the power of our influence over other countries depend. The Royal Commission on Agriculture concluded, "If the inertia of centuries is to be overcome it is essential that all the resources at the disposal of the State should be brought to bear on the problem of rural uplift. What is required is an organised and sustained effort by all those departments whose activities touch the lives and the surroundings of the rural population." The first effort in this direction would be the organisation of a *Rural Science Research Institute* in every province. This institute will not only undertake the research on the lines mentioned above but also to some extent coordinate the activities of the different departments and bodies engaged in the uplift of the rural population. Compared to what has been done in the United States of America, Russia and other countries where rural areas dominate, the state of affairs in our country can be said to be even primitive. Every one should fully realise the implications of the following words of Lord Linlithgow, "India's wealth in an overwhelming degree is in her agriculture and upon the field of the cultivators is founded the whole structure of India's economy."

Thevetia neriifolia Juss.—A New Indigenous Vegetable Insecticide

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Introduction. There is now an urgent necessity for finding out suitable substitutes for the foreign insecticides which are difficult to procure under the prevailing war conditions. Investigations were therefore started at the Agricultural Research Institute, Coimbatore, to determine whether any of the locally available plant poisons could effectively serve as insect killers. A few well-known poisonous plants like *Thevetia neriifolia*, Juss. (roots, stem bark, leaves and kernels), *Nerium odorum* Soland. (root, stem bark and leaves) *Strychnos Nux-vomica* L. (seeds) and *Abrus precatorius* L. (seeds) were tested. Of these only the kernels of *Thevetia neriifolia* Juss, were found to possess insecticidal values of a high order.

The plant is originally a native of South America and West Indies. It appears to have been introduced into India in remote times and has since established itself all over the country. It is chiefly grown for ornamental and hedge purposes and is known as *Paccha ganneru* in Telugu and *Ponnaroli* in Tamil. Its reputation as a poison is well-known. According to Chopra (1933) the seeds have long been known to be highly poisonous and been commonly used for suicidal and homicidal purposes. Kirtikar and Basu (1933) state that two highly toxic principles—*Thevetin* and *Thevetidine*—have been isolated from the kernels and the bark. The kernels contain about 66 % of oil and according to Watt (1893) the oil is said to be limpid, almost colourless having an agreeable mild taste like that of almond oil.

An attempt is made to present in this paper the results of the preliminary trials carried out with the kernels of *Thevetia neriifolia* Juss. against a wide range of insect pests. The value of the kernels as a powerful contact insecticide is recorded for the first time.

Material and Methods. Ripe and shed fruits were gathered and the fleshy mesocarp removed from them. The seeds were cracked with a mallet and the kernels inside used as the basic material for the toxicity trials. The oil was extracted from the kernels and the insecticidal properties of the oil as well as the cake also were studied. The kernels and the cake were used as infusions and the oil as an emulsion. The former was prepared by mashing and soaking a known quantity of the material in a measured volume of water for a fixed duration The infusion was then filtered and soft soap equal in weight to that of the kernels or cake used, was then added to the filtrate. The emulsion was prepared by shaking equal quantities of the oil and soft soap in cold water and then made up to the required strength. The liquid was then sprayed against insect pests and the percentage of mortality recorded. In order to secure uniformity of treatment for all the laboratory trials, the insects concerned were exposed to the spray for 20 seconds at half a foot distance under a pressure of six kilograms per square centimeter.

Laboratory Trials. (a) *Preparation of the extract.* A few trials on the methods of preparing the extract were conducted. These consisted of soaking the mashed kernels in cold water for different durations ranging from six to 24 hours and also by boiling them for five minutes. The infusions, as already mentioned, were filtered and soft soap was then added, as otherwise they were not efficacious. In the absence of soft soap any ordinary washing soap was found to serve the purpose quite well. Biological tests were conducted with the extracts prepared under different conditions and it was found that the one drawn after 24 hours soaking and the one prepared by boiling were equally efficient.

(b) *Dosage.* Infusions in different strengths were tried against various groups of insects to determine the optimum dosage for each group. Soft bodied insects like aphids easily succumbed to a concentration of $\frac{1}{4}$ ounce of the kernels (0·156%) in a gallon of water, while a high mortality was

noted in the case of caterpillars and beetle grubs with 2% concentration (0·312%). Scale insects and mealy bugs however required two to three sprayings with a higher concentration of 4 oz. for a gallon of water (0·624%) at intervals of three or four days. The stronger dosage is necessary as the spray has to permeate through the protective covering and kill the adults; the subsequent treatments are for killing the nymphs that may hatch out after the first spray. Infusions of the cake and kernel and emulsion of the oil were tried side by side against *Eupterote mollifera* W. at a uniform strength of $\frac{1}{2}$ ounce per gallon of water and the extract of the kernels was found to be the best of the three.

Field Trials. More extensive biological trials were made on diverse groups of insects with the cold extract of the kernels soaked for 24 hours to which an equal quantity of soft soap was added. The results amply indicate the efficiency of *Thevetia* kernels as a contact insecticide. Its success against *Saissetea nigra* N. and the mealy bugs which are generally difficult to control is very encouraging.

Statement.

No.	Pests concerned.	Quantity of *Thevetia* kernels used per gallon.	Quantity of soap added per gallon.	Average percentage of mortality.	Number of trials.
	I. Rhynchota.				
1.	Saisseta nigra N. (The black scale)	1 oz.	1 oz.	94·5	2
2.	Pseudococcus filamentosus Var. corymbatus Ckll. (mealy bug on cotton)	1 ,,	1 ,,	100·0	1
3.	Pulvinaria maxima, Gr. (The nim scale)	1 ,,	1 ,,	100·0	1
4.	Aphis malvae K. (plant lice on cucurbits)	$\frac{1}{4}$,,	$\frac{1}{4}$,,	100·0	1
5.	,, taversi D. (,, on citrus)	$\frac{1}{4}$,,	$\frac{1}{4}$,,	100·0	4
6.	,, gossypii G. (,, ,, cotton)	$\frac{1}{4}$,,	$\frac{1}{4}$,,	100·0	3
7.	,, medicagenis K (,, on house beans)	$\frac{1}{4}$,,	$\frac{1}{4}$,,	98·5	5
8.	,, nerii B. (,, ,, calotropis)	$\frac{1}{4}$,,	$\frac{1}{4}$,,	100·0	1
9.	,, maidis F. (,, ,, cholam)	$\frac{1}{4}$,,	$\frac{1}{4}$,,	100·0	1
10.	Urentius echinus D. (The brinjal lace-wing bug)	$\frac{1}{4}$,,	$\frac{1}{4}$,,	100·0	1
11.	Aleurodes sp. (mealy wings on Phyllanthus sp.)	$\frac{1}{2}$,,	$\frac{1}{2}$,,	100·0	1
	II. Lepidoptera.				
1.	Eupterote millifera W. (The drumstick hairy caterpillar)	$\frac{1}{2}$,,	$\frac{1}{2}$,,	98·5	6
2.	Parasa lepida Cr. (The castor slug)	$\frac{1}{2}$,,	$\frac{1}{2}$,,	70·0	3
3.	Papilio demoleus L. (The lemon butterfly)	$\frac{1}{2}$,,	$\frac{1}{2}$,,	100·0	1
	III. Coleoptera.				
1.	Epilachna 12 punctata M. (the brinjal epilachna beetle)	$\frac{1}{2}$,,	$\frac{1}{2}$,,	93·0	1
	IV. Hymenoptera.				
1.	Solenopsis geminata F. (The small red ant)	$\frac{1}{4}$,,	$\frac{1}{4}$,,	100·0	1
2.	Camponotus compressus F. (The black ant)	$\frac{1}{2}$,,	$\frac{1}{2}$,,	100·0	
	V. Acarina.				
1.	Tetranychus telarius L. (The castor mite)	$\frac{1}{4}$,,	$\frac{1}{4}$,,	89·0	

Stomach and Deterrent Effects. There is little or no doubt regarding the fatal action of the kernels when taken internally since one gram of the material caused an immediate collapse, when administered to a dog weighing about 10 lb. Trials were conducted against caterpillars of *Eupterote mollifera* W., *Achoea janata* L., *Parasa lepida* Cr., *Laphygma exigua* Hb., and grubs of *Epilachna 12 punctata* M., by spraying the leaves of their respective host plants and allowing the insects to feed on them. All these except *Parasa lepida* Cr., refused to feed for two days and subsequently died of starvation. Hibiscus plants on which blister beetles—*Mylabris pustulata* Th., were feeding were sprayed with $\frac{1}{2}$ oz. concentration of the kernels. No beetles were found on the treated plants on the subsequent days while a number of them were feeding on the unsprayed plants. A $\frac{1}{4}$ oz. concentration was sprayed on brinjal and citrus plants infested by *Solenopsis geminata* F., and they were not reinfested for a number of days. Though it has not been possible to establish the stomach effect of the kernels from these trials, there is enough evidence to indicate the repellent properties of the infusion.

Effect of the Treatment on the Foliage. It has definitely been found that the maximum dosage of *Thevetia* kernels necessary for the control of insects is one ounce in a gallon of water. Trials were conducted to see whether the infusion at this concentration caused any injury to the foliage of the plants on which it was sprayed. The extract was sprayed on tender as well as mature leaves of mango, sapota, guava, ziziphus, rose, cotton, brinjal, tomato, snake gourd, lablab, etc., and no deleterious effect was noted on the sprayed plants.

Thevetia oil as a Deterrent against Termites. Dealwood plants and pieces of card-board were smeared with *Thevetia* oil and buried under the soil with appropriate controls. Examined after a period of 4 months the controls were found completely eaten away, while the treated samples were only slightly damaged.

Analysis of the Seeds. A large quantity of the seeds was collected on a particular date and stored. Samples were periodically drawn from the stock and subjected to chemical and biological tests to study whether there is any deterioration in the oil contents and toxicity of the kernels. No appreciable variation was noted in the moisture and oil contents by the Government Agricultural Chemist, in his analysis of the samples even after nine months of storage. Biological tests conducted against *Eupterote mollifera* W., and *Aphis malvae* K., with a dosage of $\frac{1}{2}$ oz. and $\frac{1}{4}$ oz. respectively for a gallon of water also did not show any appreciable variation in the toxicity.

Summary.

1. The utility of *Thevetia neriifolia* kernels as an efficient contact insecticide is established. Aqueous extracts are found highly toxic against a wide range of insects. Optimum strengths for soft and hard bodied insects are indicated.

2. Kernels, cake and oil of *Thevetia neriifolia* Juss. possess toxicity in varying degree ; of these the kernels are the most toxic.

3. Addition of soap equal in quantity to that of the kernels used is necessary to secure the maximum effect.

4. Aqueous extracts of the kernel are found, in some cases, to confer immunity from attack by insects for short periods to plants sprayed with them.

5. *Thevetia* oil is found to act as a deterrent against termite attack.

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Paper Making as a Cottage Industry.

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The History of paper. In olden days, our anscestors used to write their records and invitations on the leaves of palms like palmyra. As days passed on, the Chinese were the first to prepare paper in cottages. Then as we were trading with them some of our people learnt the art from them, but they kept it a secret. After the invasion of the Mahomedans, it was taken to their country, and thus the industry spread over the whole of Europe, but it almost perished in India. Then after centuries, the industry was again brought to India and began flourishing well. But as a result of the industrial revolution the mills came into existence, thereby adversely affecting the cottage Industry.

Now again, the industry is being popularised. The All India Village Industries Association is doing its best for the revival of many cottage industries, including that of paper.

Raw materials used in paper making. All fibrous plant material are used in paper making. They can be divided into two main divisions. Soft materials like the rice straw, plantain leaf sheath, waste paper, etc., and hard materials like the jute, sunnhemp, rags, bamboo, etc.

Processes involved in paper making. The raw material has to undergo the following treatments before it is actually made into paper.

Sorting and dusting. Every raw material has to be sorted well and dusted, so that it may be free from foreign matters.

Cutting. The raw material is then cut into small and uniform pieces so that it may be easier to handle them in the several processes of pulp making.