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Observations on Snake Repellent Property of Some Plant Extracts

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ABSTRACT

The repellent property of certain plant extracts and oils against snakes has been investigated. For this purpose 15 hexane extracts of plants and 11 oils were tested in the laboratory in a specially designed cage. Out of the materials tested, *Acorus calamus* extract and pine oil were found to exhibit excellent snake repellent property.

1. INTRODUCTION

There are about 3,000 species of snakes in the world[1] of which only about 400 species are known to be poisonous. In India out of 216 recorded species, only 52 are reported to be poisonous[2]. It is estimated that every year out of 2,00,000 cases of snake bite; 15,000 (7.5 per cent) are fatal.

Snakes in general are very important for maintaining ecological balance in nature and their venom is extremely useful in medical research. Inspite of their importance in ecology, snakes pose a serious hazard to farmers, engineers, defence personnel and all others who are engaged in field work. In order to protect them from the danger of snake bite, proper snake antivenin which is handy for use in the event of an accident is always essential. Even though, the need for developing prophylactic snake repellent substances which could be applied to clothings or sprayed near the human habitations, is obvious. Although a lot is written in ancient Indian literature and contrary to the wide beliefs in folklore about snake repellent plants, there is no proven scientific evidence to support the claims made. Some credible means include

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use of electrified fence to prevent Habu (*Trimeresurus flavoviridis*) snakes[3], and lethal effect of pesticides on reptiles[4].

The present study was undertaken with a view to evaluate snake repellent property of plant extracts and essential oils of aromatic plants.

2. MATERIALS AND METHODS

Twenty six treatments were tried in the experiments which comprised chemical extracts of the leaves of 15 plants and 11 oils of plant origin. Extracts from the leaves of 15 plants (soxhlet extraction) are tried in one set using hexane as solvent. A second set of treatments consisted of 11 oils which were commercially obtained. They were all of research grade purity. After preliminary trials, 10 per cent concentration of the plant extracts was fixed for the solvent. All dilutions were made in hexane.

Table 1. Hexane extracts of plants and oils showing high repellency at 10 per cent concentration

S.No.	Treatment	Response index				
		Naja naja	*Vipera russelli*	*Bungarus caeruleus*	*Ptyas mucosus*	*Elaphe helena*
	Hexane Extracts of Plants					
1.	*Allium sativum* (garlic)	0.15	0.0	0.15	1.0	
2.	*Acorus calamus* (*vekhand*)	0.92	0.85	1.0	1.0	
3.	*Azadirachta indica* (neem)	0.0	0.8	1.0	1.0	
4.	*Nicotina tobacum* (tobacco)	0.85	0.0	0.67	0.15	
5.	*Vitex negundo* (*nirgundi*)	0.72	0.0	0.0	0.0	
6.	Hexane (control)	0.0	0.0	0.0	0.0	0.0
	Oil Extracts of Plants					
1.	*Acorus calamus* (*vekhand*)	1.0	0.85	1.0	1.0	1.0
2.	Pine	1.0	1.0	1.0	1.0	1.0
3.	Citronella	0.0	0.0	1.0	0.0	0.93
4.	Thyme	0.92	1.0	1.0	0.0	0.92

The experimental reptiles used in the bioassay for eliciting quantified repellent response (repellency index–RI) to the treatment were three poisonous snakes, viz. *Naja naja* (cobra) *Vipera russelli* (Russell's viper), and *Bungarus caeruleus* (krait), and two non-poisonous snakes, viz. *Ptyas mucosus* (rat snake) and *Elaphe helena* (trinket snake) which were all adults, measuring more than one metre in length.

Five cages, after the design of Dorris Gove and Burghardt[5] (Figs. 1 and 2) were used to test the negative responses of the snakes. Each cage had three compartments (Fig. 2) 1, 2 and 3. Before subjecting the experimental snake to treatment, the snake was released in compartment 1. It was given six hours to settle down in any of the three compartments to which it had free access through a small door which has opening

into the release compartment. The experiment began six hours after the release, after the snake had come to rest, when a rectangular filter paper (15 × 15 cm) evenly sprayed by a spraying gun with 10 ml of the treatment material was quietly lowered into the compartment against a wall (Fig. 1). Observations were timed from the moment the treatment material was lowered until the experimental snake, reacting to the treatment moved and came to rest in another compartment within the next six hours. The negative response of the experimental snake was quantified as the RI, the ratio of time it spent in the treated compartment.

$$RI = \frac{\text{Total period of exposure (6 hr)} - \text{period spent in the treated compartment}}{\text{Total period of exposure}}$$

The maximum RI was unity when the snake immediately responded to the treatment as soon as the treatment paper was lowered. The following scale for RI was fixed.

Range	Grading
0.0–0.4	Poor
> 0.4–0.6	Promising
> 0.6–0.9	Satisfactory
> 0.9–1.0	Excellent

3. OBSERVATIONS AND RESULTS

In the first experiment (Fig. 1(a)), the snake from the release compartment number 1 settled down in the compartment 3. When the filter paper treated with *Acorus calamus* (hexane) and essential oils of *Acorus calamus* and pine was lowered into this compartment, the snake left the compartment and finally settled in compartment 2. The repellency index in the three replicates was in the range of 0.67 to 1.00.

In the second experiment (Fig. 1(b)), the snake had moved to compartment 3, but when treated filter paper was lowered into this compartment and compartment 2, the snake moved back to the compartment 1, which only was available to the snake.

In the third experiment (Fig. 1(c)), the snake finally came back and settled down into compartment 1 after sampling the other compartment (release compartment).

In the fourth experiment (Fig. 1(d)), the release was made into compartment 1, but since it had already been treated with the experimental material on filter paper, it responded to the treatment immediately and moved into the compartment 3. Though it has equal access to compartment 2, the snake preferred compartment 3, possibly because of closer proximity to its landing spot.

In the fifth experiment (Fig. 1(e)), in which the cage was kept as control, i.e., without any treatment, the snake stayed in the release compartment 3 itself. Here,

it could have chosen compartment 2 also which, being open, was available to it. Both experiments 4 and 5 show that compartment 3 was favoured when compartment 2 was also available as an alternative.

It can be seen from Table 1 that 5 out of 15 hexane extracts of plants and 4 out of 11 oils elicited high repellency (negative response) from one or more species of snakes. Other extracts (Table 2) have shown little or no repellent property on snakes.

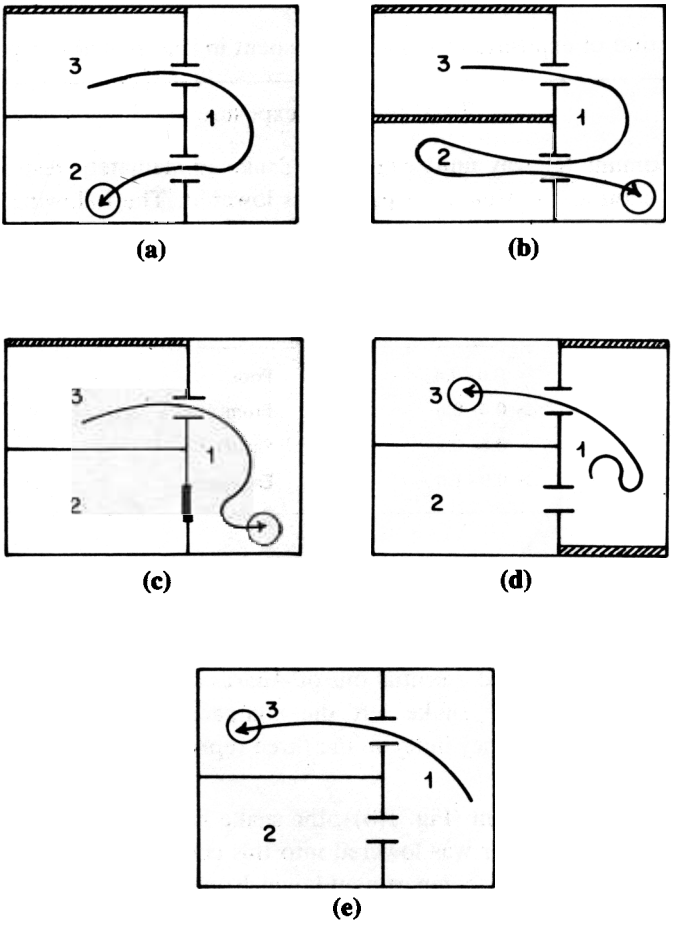

Figure 1. Diagram indicating placement of the test material containing filter paper (striped) as treatment in various compartments of the five cages eliciting escape response of the snake through communication holes.

4. DISCUSSION

As indicated in Table 1, all the three poisonous and the two non-poisonous snakes responded distinctly negative to *Acorus calamus* extract. The response was excellent

in *Bungarus caeruleus* and *Naja naja* as well as the two non-poisonous snakes, it was satisfactory in *Vipera russelli.*

In the experiments the snakes could have moved freely from one compartment to another inside the cage and settled down later, in a particular compartment which it found most comfortable. This station of rest was abandoned only when the

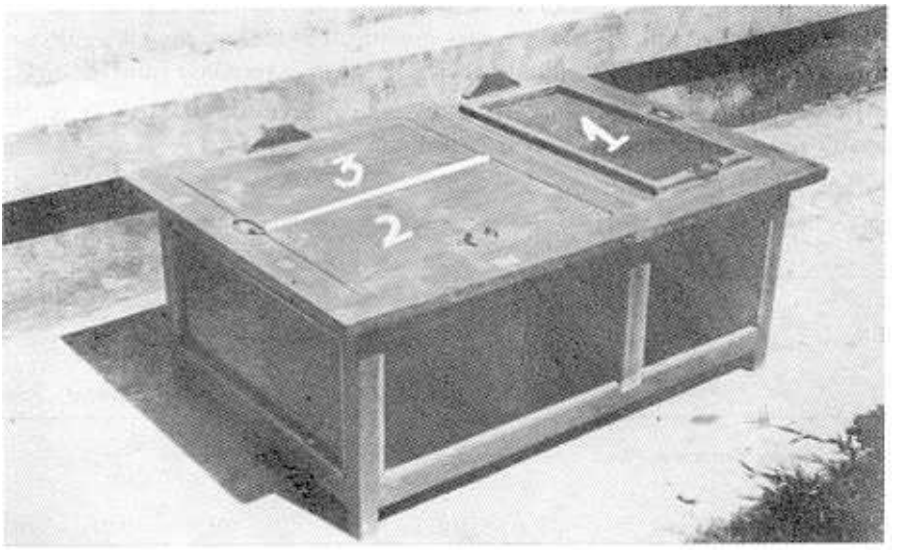

Figure 2(a). Photograph of the cage for testing the repellent activity of snakes

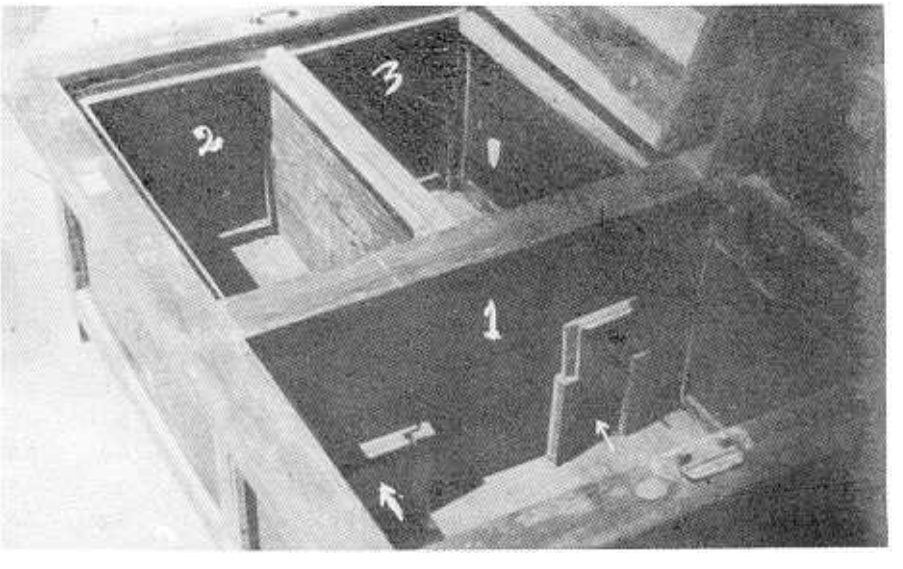

Figure 2(b). Photograph showing the three compartments and two entrances of the test cage.

disagreeable stimulus involved the station and the experimental snake moved to another station where it could again come to rest. It was observed that only *Acorus calamus*, of all other plant extracts, elicited almost excellent repellent response (Table 1). Similarly in the case of *Allium sativum, Azardirachta indica, Nicotina tobacum* and *Vitex negundo* some response was observed in all the five species of snakes. However, this response was not very conclusive as it was observed only in the case of one or two species. In the case of other plant extracts and oils, there was no response on the part of snake species investigated. Hence, they have no snake repellent properties as they could not elicit any negative response from the snakes.

Based on the above study only *Acorus calamus* and pine oils show snake repellent property which could merit further investigations.

Table 2. Hexane extracts of plants and oils showing little or no repellency at 10 per cent concentration

S.No	Treatment	Response index				
		Naja naja	*Vipera russelli*	*Bungarus caeruleus*	*Ptyas mucosus*	*Elaphe helena*
	Hexane Extracts of Plants					
1.	*Allium cepa* (onion)	0.0	0.0	0.0	0.0	0.0
2.	*Boerhaavia difusa (punarnava)*	0.0	0.0	0.0	0.0	0.0
3.	*Jasminus sp. (wish mogra)*	0.4	0.0	0.0	0.0	
4.	*Mentha arvensis (pudina)*	0.0	0.58	0.0	0.0	0.0
5.	*Ocimum basilicum (subja)*	0.8	0.2	0.2	0.2	0.0
6.	*Ocimum sanctum (tulsi)*	0.15	0.83	0.67	0.15	
7.	*Rubia cardifolia (manjistha)*	0.8	0.0	0.0	0.0	0.0
8.	*Aristolochia indica*	0.0	0.0	0.0	0.15	0.08
9.	*Trachyspermum ammi (aguvan)*	0.0	0.0	0.15	0.85	0.58
10.	*Zingiber officinalis (adrak)*	0.0	0.0	0.0	0.0	0.0
11.	Hexane (control)	0.0	0.0	0.0	0.0	0.0
	Oil extracts of Plants					
	Juniper oil	0.0	0.86	0.0	0.0	0.0
2.	Cedarwood oil	0.15	0.85	0.15	0.0	0.88
3.	Neem oil	0.0	0.0	0.0	0.0	0.0
4.	Clove oil	0.0	0.63	0.17	0.17	0.0
5.	Eucalyptus oil	0.0	0.0	0.0	0.0	0.0
6.	Lemon grass oil	0.15	0.17	0.0	0.5	0.67
7.	Sweet basil oil	0.0	0.0	0.0	0.0	0.0

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