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## Pharmacological studies on *Salvia haematodes* Wall.

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### Summary

The aqueous extract of the root of *Salvia haematodes* has been investigated for its pharmacological actions on the cardiovascular and central nervous system. It was found to possess significant cardiogenic and anticonvulsant activities. It was not found toxic up to the dose of 5 g/kg given orally in order to evaluate its acute toxicity.

**Key words:** *Salvia haematodes*; pharmacological investigation; cardiogenic; anticonvulsant.

### Introduction

The roots of *Salvia haematodes* Wall. (Labiatae) are used by traditional medicine practitioners in India for cardiac disorders, seminal debility (Dymock et al., 1972) and as a nervine tonic (Nadkarni, 1954; Dymock et al., 1972). Khan (1886) has recommended its use in gout. However, the survey of literature shows that this species of *Salvia* has not received the attention of the pharmacologists and no reports on its pharmacological effects are available to substantiate the alleged activities. Hence, the present study was undertaken to investigate the effects of the aqueous extract of *S. haematodes* on various biological systems.

### Materials and Methods

The roots of *S. haematodes* were pulverized and extracted in distilled water. The filtrate was dried at 40°C, refrigerated for pharmacological studies and dissolved in normal saline before use.

Studies on cardiovascular system were carried out on frog's heart mounted conventionally and on isolated frog heart prepared by Straub's method (1931). The hypodynamicity was produced

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Table 1. Effect of aqueous extract of *Salvia haematodes* Wall. on pentobarbitone-induced narcosis, motor activity and electroshock seizures

Parameter	Control	Test	Chlordiazepoxide
Pentobarbitone-induced narcosis (min) . . . . .	370.83 ± 18.68	450.00 ± 22.21*	—
Spontaneous motor activity (30 min) . . . . .	729.70 ± 110.25	442.50 ± 62.75*	412.75 ± 65.69*
Distance travelled (feet in 30 min) . . . . .	263.75 ± 25.99	77.50 ± 23.27**	75.00 ± 18.42**
Supramaximal electroshock seizures:			
Flexion (sec) . . . . .	1.92 ± 0.20	1.25 ± 0.32*	—
Extension (sec) . . . . .	9.67 ± 0.42	8.17 ± 0.32*	—

Values denote mean ± S.E.M.

\*  $p < 0.05$       \*\*  $p < 0.01$       Student's *t* test

by perfusing the heart with  $\frac{1}{2}$   $\text{Ca}^{++}$  frog Ringer solution. The cardiac efflux was measured and the myocardial contractions were recorded kymographically. Effect of the extract on blood pressure and respiration was observed on dogs, anaesthetized with pentobarbitone sodium (35 mg/kg i.v.). Studies on smooth muscle and skeletal muscle were carried out on the isolated guinea pig ileum and frog rectus abdominis preparations, respectively. Spontaneous activity in mice was measured in an activity cage (Gargya Research Institute, Delhi), following the method of Borsy et al. (1960). The spontaneous movements and distance travelled in 30 min were recorded in separate groups. Chlordiazepoxide (25 mg/kg, orally) served as a reference standard. The effect on pentobarbitone induced narcosis in mice was studied after the method of Dandiya and Cullumbine (1959). The method of Toman et al. (1946) was followed to observe the effect on supramaximal electroshock seizures in mice. The rectal temperature of rats was recorded at 0, 30, 60, 90 and 120 min after the drug administration. Six to ten observations were recorded in all the experiments.

Acute toxicity studies were carried out in adult healthy albino mice of either sex, weighing between 22–25 g. The extract was administered orally to four mice for each dose level and mortality during the next 24 h was noted.

The extract was administered in the dose of 1 g/kg body weight orally one hour before the studies on motor activity, sleeping time and electroshock seizures. All the results have been statistically analyzed by Student's *t* test.

## Results

The extract, in the dose of 500  $\mu\text{g}$  to 1 mg, significantly increased the myocardial contractions and cardiac efflux; the increase in the heart rate was not significant. In failing heart, the rate and cardiac efflux as well as force of contraction were significantly improved. The extract in doses of 5–40 mg/kg body weight produced a dose dependent biphasic response on blood pressure of dog; the transient steep fall was followed by a significant increase in blood pressure. The fall in blood pressure was blocked by atropine, resulting in a further rise in

blood pressure. The hypertensive effect was not blocked by tolazoline hydrochloride (10 mg/kg). During hypotensive phase, the respiration was stimulated.

On smooth muscle of guinea pig ileum and skeletal muscle of frog rectus abdominis, the extract inhibited the acetylcholine induced contractions. Histamine induced contractions of guinea pig ileum were also antagonized by the extract.

The spontaneous movements and distance travelled by the mice in 30 min were significantly decreased (Table 1). The pentobarbitone induced narcosis was potentiated and a significant decrease in both flexion and extension phases of the electroshock seizures was observed. The rectal temperature also registered a significant fall at 60 and 90 min after the drug administration. Acute toxicity studies showed no toxicity up to a dose of 5 g/kg body weight, as no toxic symptoms or mortality was caused by this dose.

## Discussion

The aqueous extract produced positive inotropic and chronotropic effects on isolated and continuous frog heart perfusion; the effects were more pronounced in hypodynamic heart. These effects may be attributed to the presence of a glycoside as the phytochemical analysis of the extract showed the presence of glycoside and gave negative test for saponins (unpublished results). The transient steep fall in blood pressure which was blocked by atropine suggests a cholinergic effect; whereas the rise in blood pressure may be due to direct vasoconstriction or due to a significant increase in force of contraction and cardiac output which are supported by our experiment on frog's heart. The anticholinergic and antihistaminic effects on guinea pig ileum are in contradiction with the findings on blood pressure. We are, as yet, not able to justify these effects of the drug. However, these results are very much reproducible (blood pressure studies were conducted on 8 dogs and experiments in ileum were repeated on 12 guinea pigs). The astringent activity of *S. hematodes* has been reported by some authors (Kabiruddin, 1924; Nadkarni, 1954), and Khan (1980) found it clinically effective in cases of diarrhoea, supporting the anticholinergic effect of the drug on smooth muscle. The curare-like effect on skeletal muscle could not be confirmed in mice, where the drug failed to produce curare-like flaccid paralysis up to a dose of 5 g/kg body weight.

The potentiation of sleeping time and significant decrease in motor activity suggest a CNS depressant activity. The anticonvulsant activity and hypothermia produced by the extract also confirm the sedative effect of the drug (Table 1). A close analogue of *S. haematodes* i.e. *Salvia lucanthea* Cav. has been reported as anticonvulsant and CNS depressant by Dhar et al. (1973). The findings suggest that *S. haematodes* possesses activities similar to benzodiazepine type of sedative-hypnotic-anxiety compounds which also antagonize

the electroshock seizures (Swinyard and Castellion, 1966; Millichap, 1969; Browne and Penry, 1973). Further studies to isolate the active constituent and to determine the mechanism of action are in progress.

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