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PHARMACOLOGICAL AND PHARMACOGNOSTICAL STUDIES ON LEAVES OF *Acacia dealbata Linn*

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ABSTRACT

Acacia dealbata Linn belongs to Leguminosae and was used commonly in Indian system of medicine for various ailments. In Tamil Nadu, the plant is called as Silver wattle. The leaf extract of the plant was used as a remedy for bronchial diseases and as an antidote to poisoning by alcohol and ammonia. The present paper deals with the detailed pharmacological studies on the aspects of anti tussive activity and pharmacognosy of the leaf "*Acacia dealbata Linn*", which includes macroscopical and microsopical (vein islet, vein termination number and stomatal index), anatomical characteristics, physicochemical parameters (such as ash values, extractive values and crude fiber content) and fluorescence characteristics of various extracts and leaf powder on treatment with different chemical reagents and observation under UV light (254 nm).

Key word : Pharmacological, Pharmacognostical, *Acacia dedlbata Linn*

INTRODUCTION

Acacia dealbata (Fam. Leguminosae) is a wild tree, which is abundantly available in most part of the Nilgiris. The local tribal people are using this for a number of medicinal purposes and the extract has been proved to be suitable for therapeutic purpose. It is used as a remedy in bronchial diseases and as an antidote to poisoning by alcohol and ammonia[1] but it has still not been explored properly and thus remains as a silent drug in herbal medicine. The present investigation is undertaken in order to bring out the detailed pharmacological and pharmacognostical characteristics of the leaf in its powdered form.

The plant *Acacia dealbata Linn* is an evergreen[1,2] tree with grayish white silvery bark and is native to Australian and Tasmanian countries. It was thoroughly naturalized in the Nilgiris and Palani hills, where it attains a height of over 12 m. The tree grows between the altitudes of 1800 and 2400 m. The leaves are bipinnate of about 14–18 pairs. The leaves are grey and flowers are yellow in color. The flowers are used for the preparation of mimosa perfume, which resembles yland. The bark is silvery in nature, which contains 9–17% tannin, which are used for tanning in South Africa. The bark contains a maximum of 28.2% tannins[3].

MATERIALS AND METHOD

Leaves were collected from the trees at Ooty. Standard methods of processing and microscopy were applied[1–3]. Quantitative microscopy was determined by methods prescribed by Wallis[3]. Physicochemical parameters were determined and its fluorescence analysis was observed under day and UV light at 254 nm. Anti tussive activity of the methanolic extract of the leaf was done the method prescribed by Pulok[4].

Observations of the Midrib

The Midrib shows a small projection and a convexity on the axial face. Transverse section of the leaf of *Acacia dealbata linn* shows the following characteristic features, when observed under microscope.

The tissues present in the T.S. of the leaf were mainly grouped into 3 regions.

(i) Upper epidermis

(ii) Lower epidermis

(iii) Mesophyll region

(i) Upper epidermis

It is a single layer made up of rectangular cells with a cutinized outer layer showing the presence of trichomes.

(ii) Lower epidermis

The lower epidermis consists of a single layer of cells where outer wall is cutinized showing the presence of trichomes as well as the sunken stomata.

(iii) Mesophyll region

Collenchyma cells are present below the upper epidermis and above the lower epidermis, which is followed by angular parenchymatous cells on either side. Vascular tissue is present below the upper epidermis and above the lower epidermis, where the Xylem is facing the center and phloem facing towards the epidermis. The vascular tissue is surrounded by a sclerenchymatous bundle sheath. Thin walled, rounded parenchymatous cells are present in the center of the midrib region.

The mesophyll consists of palisade parenchyma and spongy parenchyma. Palisade parenchyma is present on both the sides beneath the upper epidermis and above the lower epidermis; the spongy parenchyma is present in the center, chloroplast in both the palisade and spongy parenchyma.

Trichomes

Epidermal trichomes are unicellular, conical, and thick walled with warty cuticle, slightly curved at the base and apex is pointed. These trichomes are present on both the surfaces.

Quantitative microscopy[5]

In quantitative microscopical studies, the following data were determined and the results were tabulated.

Table 1

No.	Parameter	Value
1.	Stomatal index for both surface	16.1–17.7 to 19
2.	Vein islet number No	3–6
3.	Vein termination No	5–8
4.	Palisade ratio in upper epidermis	4.5–9.5 – 17

Physicochemical constants[5,6,9]

Physicochemical constants were determined and reported in Table 1. Fluorescence analysis of drug powder and extracts were carried out and the results are reported in Table 2 and Table 3.

RESULTS AND DISCUSSION

The histological studies and powder microscopy showed characteristic diagnostic features such as unicellular trichomes and sunken stomata. The quantitative microscopical studies provided valuable information regarding specific leaf constants such as vein islet number, vein termination number and stomatal index. The microscopical analysis and other physicochemical standards such as ash values, extractive values, crude fiber content and fluorescence analysis will be useful to identify the authenticity of the drug even for powder analysis.

In cold extraction, the alcohol (90% v/v) soluble extractive values were high as compared with water soluble extractive values. In continuous hot Soxhlet extraction[7], the ethyl acetate extract shows minimum extractive value, but the petroleum ether (30–60 ^{o}C) extract showed maximum. The preliminary phytochemical study shows the presence of volatile oil, triterpenoids, steroids, tannin and mucilage. Thus, the present study may be more useful for the pharmacognostical identity of the leaf and also helps in the detection of other impurities.

Physicochemical constants

Part used – Leaf : **Ash Value**

Table 2

No.	Parameter	Value (%)
1.	Total ash	3.25
2.	Acid insoluble ash	2.7
3.	Water soluble ash	7.6
4.	Sulphated ash	7.7

Table 3. Solubility

No.	Parameter	Value (%)
1.	Alcohol	5.7
2.	Water	1.8

Table 4. Extractive value

No.	Parameter	Value (%)
1.	Petroleum ether	5.7
2.	Benzene	4.6
3.	Chloroform	3.0
4.	Ethanol	4.0
5.	Ethyl acetate	3.0

Table 5. Fluorescence analysis of drug powder

No.	Extract	Day light	UV Light
1.	Petroleum ether	Yellowish brown	Yellowish brown
2.	Leaf powder + H_2O	Brown	Greenish brown
3.	Leaf powder + NaOH	Green	Green
4.	Leaf powder + HCl	Pale Grey	Dark grey
5.	Leaf powder + H_2SO_4	Grey	Grey

Table 6. Fluorescence analysis of leaf extract

No.	Extract	Day light	UV Light
1.	Petroleum ether	Yellowish brown	Yellowish brown
2.	Benzene	Dark green	Olive green
3.	Chloroform	Yellowish green	Dark green
4.	Ethyl acetate	Yellow	Yellowish green
5.	Ethanol	Bluish green	Dark green

Table 7. Preliminary phytochemical screening[8] of the leaf powder and various extracts of *Acacia dealbata Linn*

Extract	Flavanoid	V.oil	Alka–loids	Saponin	Triter–penoids	Steroid	Protein	Sugar	Tannin	Muc-ilage
Petroleum ether	Ab	+Ve	–	–	+Ve	+Ve	–	–	–	–
Benzene	Ab	+Ve	–	–	+Ve	+Ve	–	–	–	–
Chloroform	Ab	+Ve	–	–	+Ve	M	–	–	–	–
Ethyl acetate	Ab	+Ve	–	–	+Ve	–	–	–	–	M
Ethanol	Ab	+Ve	–	–	+Ve	–	–	–	+Ve	+Ve

Evaluation of anti tussive activity[4]

The extracts were screened for anti tussive activity by Miyagoshi *et al* (1986)

Method

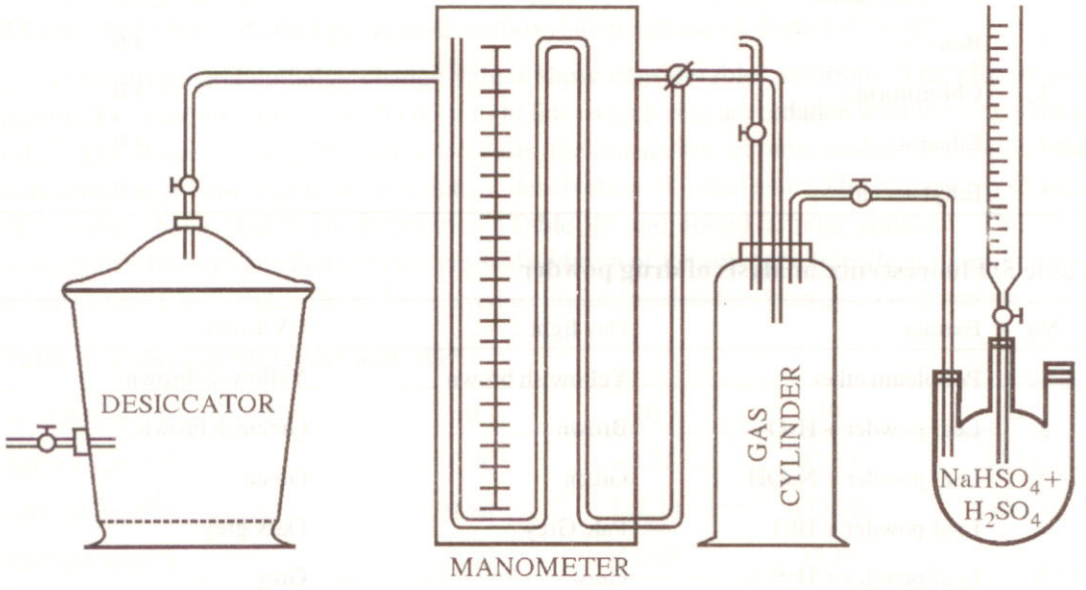

Fig. 1

Animals of mice weighing in the range of 20–22 g divided into three groups (3 animals in each group) of either sex were randomly selected for the study. First group served as a control by administering normal saline and second group served as a positive control with codeine phosphate. Third group served as the test group with methanol extract at a dose of 200 mg/kg body weight. Methanolic extract of the plant was suspended in normal saline and codeine phosphate linctus procured from market, was administered as such. Initially the frequencies of cough for three groups were observed by placing the animals in the desiccators for a specified time limit of 1 minute. The Cock's were opened, in order and when the pressure became 0 mm of H_2O, all the cock's are closed immediately. 5 mL of SO_2 gas was introduced into the desiccator. After a minute, the animal was taken out from the desiccator and frequency of cough was observed for 5 minutes in an un–ended glass funnel with a stethoscope at the tip, in which the mouse was confined. The procedure was repeated for all the 3 groups before the drug administration, 30, 60, 90 and 120 minutes after the drug administration.

Table 8. Anti tussive activity

No.	Name of the Sample	Percentage of cough suppression				
		0 min	30 min	60 min	90 min	120 min
1.	Solvent Control	61.6 ± 1.49	56.0 ± 2.42	50.5 ± 1.31	54.0 ± 1.70	56.8 ± 4.06
2.	Codeine phosphate	61.6 ± 1.49	49.0 ± 2.08*	30.0 ± 2.51*	9.3 ± 1.45***	9.0 ± 0.66*
3.	Methanolic extract	61.6 ± 1.49	50.6 ± 2.96*	38.6 ± 0.88*	17.6 ± 1.45*	12.0 ± 1.73**

*p = < 0.01; **p = < 0.1; ***p = < 0.0001

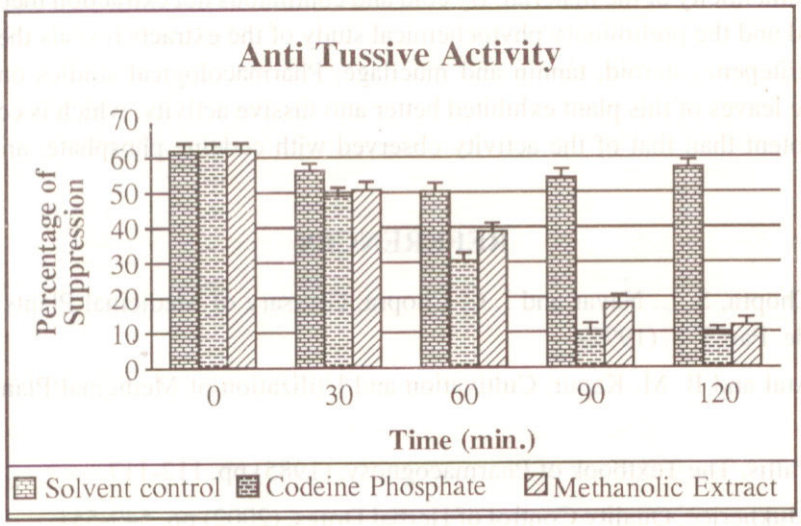

Fig. 2

Acacia dealbata Linn belongs to Leguminosae family and is a wild tree growing widely in the Nilgiris. The review of literature reveals that only feeble exploration was done on this plant. The studies pertaining to the plant like physical, chemical, pharmacognostical and Pharmacological aspects were explored and are tabulated in Tables 1-8. These studies may provide support for further exploration. Supporting to the traditional claims, the pharmacological part strongly supports that methanolic extracts of the leaves of this plant exhibited anti tussive activity in the demonstrated animal experimental model, which is comparable to the activity produced by codeine phosphate. Further characterization of methanolic extract may bring out the exploited active principles, responsible for anti tussive activity. It was observed that, during exposure of experimental animals to SO_2 gas, frequency of cough in control group remains more or less constant.

But in both cases of methanolic extract and codeine phosphate, the frequency of cough decreased in a dose dependent manner. The percentage of inhibition of the cough suppression was calculated and reported in the Table 8.

CONCLUSION

Pharmacological and pharmacogonstical studies of *Acacia dealbata Linn* provided valuable parameters in this piece of work. In pharmacognostical aspects, the histological studies showed the diagnostic features such as trichomes (unicellular non lignified) and stomata (sunken). In quantitative microscopical studies, the data reported were vein islet number, vein termination number and stomatal index. The microscopical analysis and other physicochemical standards such as ash value, extractive value, crude fiber content and fluorescence analysis are useful to identify the authenticity of the material. By cold and continuous hot extraction method, extracts were prepared and the preliminary phytochemical study of the extracts reveals the presence of volatile oil, tritepene, steroid, tannin and mucilage. Pharmacological studies on methanolic extracts of the leaves of this plant exhibited better anti tussive activity, which is comparable or even more potent than that of the activity observed with codeine phosphate, an anti tussive agent.

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