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### Effect of plant stages on analgesic and anti inflammatory activity of the leaves of *Tectona grandis*

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#### ABSTRACT

The methanolic extracts of the frontal and mature leaves of *Tectona grandis* were comparatively evaluated for their analgesic and anti inflammatory activity. The analgesic and anti inflammatory activities were evaluated using the Eddy's hot plate and Carrageenan induced paw edema models in rats respectively. The results of the analgesic activity have revealed that the frontal leaves and the mature leaves of *Tectona grandis* have showed significant analgesic activity. The analgesic activity of the high dose of the mature leaves (500 mg/kg body weight) was almost equal to the analgesic activity caused by the low dose (250 mg/kg body weight) of the frontal leaves extract at 15, 30, 60 and 120 min. The results of the anti inflammatory activity have shown that the frontal leaf extract when administered at a dose of 250 mg/kg body weight had significant activity after 15 min which was comparable to the standard. However the mature leaves extract did not show any significant activity at the same dose.

**Key words:** *Tectona grandis*, analgesic, anti inflammatory.

#### INTRODUCTION

*Tectona grandis*; belonging to the family verbinaceae has been used as an anti diabetic, in wound healing, as an analgesic and anti inflammatory agent [1-3]. The various phyto constituents reported are flavonoids, phenolic acids, quinones, terpenes etc [4-6]. We have already reported the comparative phytochemical analysis and wound healing activity of the frontal and the mature leaf extract [7]. The study was designed with an aim of comparatively studying the analgesic and anti inflammatory activity of the frontal and the mature leaf extracts. This paper reports the results of the studies which may be of significant important in future investigations towards relating the mechanism of action, the nature and amount of chemical constituents of plants which show analgesic, anti inflammatory and wound healing activities.

#### MATERIALS AND METHODS

The frontal leaves of *Tectona grandis* were collected, identified and authenticated by the Regional Research Institute, Bangalore where the specimen voucher (RRCBI Acc no 12474) has been deposited. The material was shade dried, pulverized and preserved in air tight containers. The methanolic extract of both the mature and the frontal leaves was prepared by using Soxhlet apparatus which was then concentrated.

**Acute toxicity studies:**

The acute toxicity study was carried out according to the limit test described by the OPPTS guidelines (office of the prevention, pesticides and toxic substance).

Colony bred male rats of Wister strain (200-250 g) were maintained under standard conditions. The rats were acclimatized for 5 days and fasted over night. Test dose of 2 g/kg was given to the animals orally [8].

**Comparative analgesic activity of the methanolic extracts of the frontal and mature leaves of *Tectona grandis*:** Analgesic activity of the frontal and mature leaves was evaluated using the Eddy's hot plate method [9, 10].

**Selection of animals:**

Healthy animals were selected and divided into 6 groups of six animals each. Group 1 served as the control, group 2 was administered with standard Indomethacin, group 3 and 4 were treated with 250 mg/kg body weight (lower dose) and 500 mg/kg body weight (higher dose) of the frontal leaves extract and group 5 and group 6 were treated with the methanolic extract of the mature leaves in the same doses. The Eddy's hot plate was maintained between 55-56 °C. The animals were placed on the hot plate and the time taken for licking was recorded using a stop watch. The reaction was observed at 0, 15, 30, 60 and 120 min.

**Statistical analysis:** Results were tabulated and the data was expressed as mean  $\pm$  SEM. The difference between experimental groups were determined using one way analysis of variance (ANOVA) followed by Dunnett test.  $P < 0.01$  was considered significant  $P < 0.05$  was considered significant.

**Comparative anti inflammatory activity of the methanolic extracts of the frontal and mature leaves of *Tectona grandis*:**

The anti inflammatory activity of the extracts was evaluated by Carrageenan induced paw edema model [11, 12, 13]. The animals were selected as mentioned above and the animals were divided into four groups. Group 1 served as a control, group 2 was given Ibuprofen, group 3 was given frontal leaf extract at a dose of 250 mg/kg and group 4 was administered with mature leaf extract at the dose of 250 mg/kg. All the rats were injected with 0.1ml of Carrageenan in normal saline into the sub planter region of the right hind paw. The volume of the paw was measured at 0, 15, 30, 60 and 120 min using plethysmograph.

**Statistical analysis:** Results were tabulated and the data was expressed as mean  $\pm$  SEM. The difference between experimental groups were determined using one way analysis of variance (ANOVA) followed by Dunnett test.  $P < 0.05$  was considered significant.

**RESULTS AND DISCUSSION****Table 1: Comparative analgesic effect of the methanolic extracts of the frontal and the mature leaves**

Groups	Dose	0 min	15 min	30 min	60 min	120 min
Control		5.4 $\pm$ 0.20	5.6 $\pm$ 0.24	5.8 $\pm$ 0.20	5.4 $\pm$ 0.24	5.2 $\pm$ 0.20
Standard	10 mg/kg	5.4 $\pm$ 0.20	6.0 $\pm$ 0.31	6.8 $\pm$ 0.20 <sup>*</sup>	6.4 $\pm$ 0.24 <sup>*</sup>	6.0 $\pm$ 0.44
Mature	250 mg/kg	4.6 $\pm$ 0.24	6.4 $\pm$ 0.24	6.8 $\pm$ 0.20 <sup>*</sup>	6.4 $\pm$ 0.24 <sup>*</sup>	6.2 $\pm$ 0.20
Mature	500 mg/kg	4.8 $\pm$ 0.20	6.6 $\pm$ 0.24 <sup>*</sup>	7.0 $\pm$ 0.31 <sup>**</sup>	7.0 $\pm$ 0.31 <sup>**</sup>	6.6 $\pm$ 0.20 <sup>**</sup>
Frontal	250 mg/kg	5.4 $\pm$ 0.20	8.0 $\pm$ 0.00 <sup>**</sup>	8.8 $\pm$ 0.20 <sup>**</sup>	8.4 $\pm$ 0.24 <sup>**</sup>	7.4 $\pm$ 0.20 <sup>**</sup>
Frontal	500 mg/kg	4.8 $\pm$ 0.20	6.2 $\pm$ 0.20	7.2 $\pm$ 0.20 <sup>**</sup>	7.0 $\pm$ 0.00 <sup>**</sup>	6.2 $\pm$ 0.20

All values are mean  $\pm$  SEM, n=6, <sup>\*</sup> $P < 0.05$  indicates significant and <sup>\*\*</sup> $P < 0.001$  is extremely significant when compared with control.

**Acute toxicity studies:**

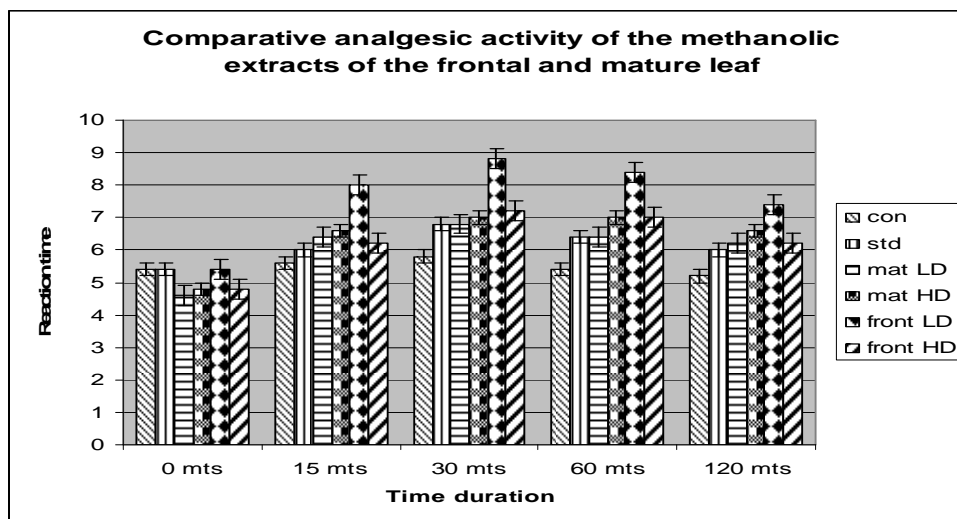
The methanolic extract of the leaves of *Tectona grandis* did not show any mortality up to a dose of 2000 mg / kg body weight. Therefore the dose selected was 1/4<sup>th</sup> and 1/8<sup>th</sup> of the dose i.e. 250 mg / kg and 500 mg / kg body weight was used for the analgesic and anti inflammatory activity.

**Comparative analgesic activity of the methanolic extracts of frontal and mature leaves of *Tectona grandis*:**

Analgesic activity of the frontal and the mature leaf extract was evaluated using the Eddy's hot plate method. The results of the analgesic activity have revealed that the frontal leaves and the mature leaves of *Tectona grandis* have showed significant analgesic activity. The analgesic activity of the high dose of the mature leaves (500 mg/kg body

weight) was almost equal to the analgesic activity caused by the low dose (250 mg/kg body weight) of the frontal leaves extract at 15, 30, 60 and 120 min. The mature leaf extract at a lower dose of 250 mg/kg body weight and the frontal leaf extract at a higher dose (500 mg/kg body weight) showed activity at 30 min of administration of the extract.

**Fig 1: Comparative analgesic effect of the methanolic extracts of the frontal and the mature leaves**

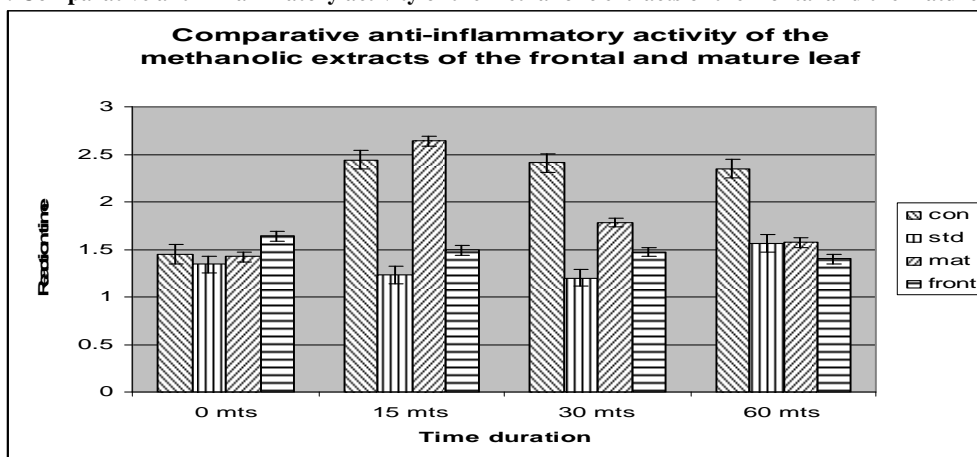


**Table 2: Comparative anti inflammatory activity of the methanolic extracts of the frontal and the mature leaves**

Groups	Dose	0 min	15 min	30 min	60 min	120 min
Control		1.45±0.08	2.44±0.25	2.41±0.06	2.35±0.24	2.34±0.21
Standard	10mg	1.34±0.12	1.23 <sup>*</sup> ±0.06	1.20 <sup>*</sup> ±0.06	1.56 <sup>*</sup> ±0.02	1.07 <sup>*</sup> ±0.03
Mature	250mg	1.42±0.10	2.64±0.11	1.78±0.14	1.57±0.12	1.53±0.12
Frontal	250mg	1.64±0.20	1.49 <sup>*</sup> ±0.20	1.47 <sup>*</sup> ±0.80	1.40 <sup>*</sup> ±0.06	1.1 <sup>*</sup> ±0.38

All values are mean ± SEM, n=6, \*P<0.05 indicates significant when compared with control.

**Fig 2: Comparative anti inflammatory activity of the methanolic extracts of the frontal and the mature leaves**



**Comparative anti inflammatory activity of the methanolic extracts of the frontal and mature leaves:**

The anti inflammatory activity of the frontal and the mature leaf extract of *Tectona grandis* were evaluated using the Carrageenan induced paw edema.

The results have shown that the frontal leaf extract when administered at a dose of 250 mg/kg body weight had significant activity after 15 min which was comparable to the standard. However the mature leaves extract did not show any significant activity at the same dose.

The results of the comparative studies of the frontal and the mature leaves have shown that the analgesic and anti-inflammatory activity of the frontal leaves extract were quite significant when compared to the activities of the mature leaf extract. The difference in the activity of the two extracts was attributed to the difference in the stages of development. The various development stages play an important role in the production of plant metabolites. Literature review has revealed that the quantity and nature of the phytoconstituents vary with the different stages of development in plants and this may result in a difference in the pharmacological activity [10]. We have earlier reported that the amount of total flavonoids and phenolic acids are more in the frontal leaves when compared to the mature leaves. The difference in the constituents may be responsible for the difference in pharmacological activities of the mature and frontal leaf extracts as reported by us in the phytochemical investigation of the plant [7].

### CONCLUSION

The results of the study reveal that the frontal leaf extract has shown better activity when compared to the mature leaves by virtue of the difference in the amount of phytoconstituents. Hence it can be concluded that the stages of development of plant play an important role in the pharmacological activities.

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