WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.453
Volume 14, Issue 11, 1352-1370. Research Article ISSN 2277–7105

PHARMACOLOGICAL SCREENING OF *TECTONA GRANDIS* BARK FOR MEMORY ENHANCING ACTIVITY IN RAT MODEL

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Article Received on
07 April 2025,

Revised on 27 April 2025,
Accepted on 17 May 2025

DOI: 10.20959/wjpr202511-36882

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ABSTRACT

Objective: This study was carried out to evaluate the memory-enhancing effect of *Tectona grandis* (teak) extract in rats. **Method:** Memory loss was induced in rats using scopolamine, a drug known to cause temporary amnesia. The rats were divided into different groups and treated with either *Tectona grandis* extract, a standard memory-enhancing drug. Their memory and learning were tested using methods like the Elevated Plus Maze and Morris Water Maze. The results showed that rats treated with *Tectona grandis* extract performed better in memory tests compared to the scopolamine group. **Conclusion:** This suggests that the extract may help improve memory, possibly due to its antioxidant and brain-protective properties. These findings support the traditional use of *Tectona grandis* for improving brain function.

KEYWORDS: *Tectona grandis*, Scopolamine, Alzheimer's Disease, Memory impairment, Acetylcholinesterase.

INTRODUCTION

Human brain is a complex and highly organized organ that serves as the center of the nervous system. It is responsible for processing sensory information, regulating bodily functions, and enabling higher- order cognitive abilities such as learning, memory, and decision-making. Structurally, the brain consists of billions of specialized cells known as neurons, which communicate with one another via electrical and chemical signals· These interactions form intricate neural networks that underlie all human behaviour and thought processes. Neurons are the fundamental working units of the brain. Each neuron comprises a cell body (soma), dendrites that receive input, and an axon that transmits signals to other neurons. Synapses—

the junctions between neurons—allow for this communication through neurotransmitter release. The plasticity of these connections plays a crucial role in learning and memory. Understanding the cellular and molecular mechanisms of neurons is essential to unravelling how the brain functions in both health and disease. Advances in neuroscience have significantly enhanced our knowledge of how neural circuits are formed, maintained, and altered by experience.[1]

Alzheimer's Disease

Alzheimer's disease (AD) is a crippling neurodegenerative condition marked by gradual cognitive deterioration and memory impairment, ultimately resulting in dementia and death. As the global population ages, Alzheimer's Disease has emerged as a significant public health issue, impacting more than 4 million individuals in the United States. In spite of thorough investigation, the causes and development of AD are still not fully comprehended.[2]

The primary pathology involves the degeneration of neurons and the loss of synapses within the hippocampus, cortex, and subcortical regions. This loss leads to significant atrophy of the impacted areas, causing memory loss, difficulty learning new information, mood changes, executive dysfunction, and challenges in performing daily living activities (ADLs). Individuals in the late–severe phase of AD will need extensive care due to total memory loss and the absence of their perception of time and location. It is thought that a therapeutic approach capable of delaying the onset or advancement of AD would significantly lower the case count in the coming 50 years. The two key pathological features of Alzheimer's disease are (a) the extracellular buildup of β-amyloid plaques and (b) the intracellular neurofibrillary tangles (NFT). Buildup of Aβ induces neurodegeneration, leading to clinical dementia typical of AD. AD begins with alterations in typical mental activities, initially manifesting as an inability to generate new memories due to challenges in solidifying new recollections, leading to rapid forgetting.[3] Alzheimer's disease is a long-lasting neurodegenerative condition that harms brain cells, leading to a decline in cognitive function and memory as time progresses. Alzheimer's disease is not a typical aspect of aging and is permanent. This condition is named after German physician Alois Alzheimer. In 1906, he detailed the symptoms of a patient referred to as "Auguste D.[4]

Symptoms of Alzheimer's Disease: - Cognitive Symptoms

1. **Memory Loss**: Forgetting recent events, conversations, or appointments.
2. **Language Difficulties**: Struggling to find words, understand written/spoken language, or

follow conversations.

3. Visuospatial Difficulties: Trouble judging distances, spatial relationships, or understanding visual information.

Non-Cognitive Symptoms

1. **Mood Changes**: Becoming easily agitated, anxious, or depressed.
2. **Personality Changes:** Becoming passive, suspicious, or withdrawn.
3. **Apathy:** Lack of interest, motivation, or initiative.
4. **Anxiety:** Feeling fearful, worried, or uneasy.
5. **Depression:** Feeling sad, hopeless, or losing interest in activities.[5]

PLANT PROFILE

Figure No :-1 *Tectona grandis.*

Taxonomical Classification of *Tectona grandis*[6]

Kingdom	**Plantae**
Class	**Asterids**
Sub-class	**Angiosperms**
Order	**Lamiales**
Family	**Verbenaceae**
Genus	**Tectona**
Species	***Grandis***

Geographical Distribution: *Tectona grandis Linn. f. (teak)* is a significant component of the high- value hardwood market and is crucial for the forest economy in numerous tropical nations. The natural range of teak extends from the Indian subcontinent through Myanmar and Thailand. It is typically found in deciduous forests and in well-drained alluvial soils. One-third of the natural distribution is located in India. Teak is scattered throughout Peninsular India, specifically in states like Madhya Pradesh, Maharashtra, Tamil Nadu, Karnataka, and Kerala, below the latitude of 24°N. Teak plantations thrive in tropical and

subtropical regions. Its distribution stretches from 73° E longitude in India to 104° 30′ in Thailand. Successful cultivation of teak necessitates well-drained alluvial soils and a sufficiently moist tropical climate. The ideal conditions for teak growth include soils formed from volcanic rocks (with a pH ranging from 6.5 to 7.5), temperatures between 13 and 40 °C, full daylight intensity of 75% to 94%, and annual rainfall varying from less than 900 mm to 3500 mm.[7]

Chemical Constituents of *Tectona grandis*

Leaves: - Flavonoids, Phenolic acids, Terpenoids, Anthraquinones, Glycosides

Bark; - Tectoquinone, Lapachol, β-Sitosterol, Stigmasterol

Wood: - Tectol, Tectonic acid, Quercetin, Kaempferol

Roots: - Phenolic compounds (Tectol, Tectonic acid), Terpenoids (α-Pinene, β-Pinene)

|**Seeds: -** Fatty acids (Oleic, Linoleic), Proteins (Globulins, Albumins)

Flowers: - Flavonoids (Quercetin, Kaempferol), Phenolic acids (Gallic, Ellagic)[8]

Uses

Teak (*Tectona grandis*) is widely used in traditional medicine for its expectorant, anti-inflammatory, antibacterial, and anthelmintic properties. It treats various conditions like bronchitis, diabetes, wounds, and skin disorders, with further research needed to understand its medicinal mechanisms.[9]

AIM AND OBJECTIVES

AIM: To study the pharmacological screening of *Tectona grandis* for memory enhancing activity in rat model.

OBJECTIVES

To produce learning and memory impairment by using Scopalamine in rats.

To study the effect of Tectona grandis bark on memory enhancing activity in rats by: -

- Morris water maze apparatus
- Elevated plus maze apparatus

PLAN OF WORK

In order to fulfill above objectives, the work was planned as follow.

1. Collection, Identification and Authentication of *Tectona grandis* plant material.
2. Extraction of *Tectona grandis* plant material by methanol using Soxhlet apparatus.

3. Preliminary phytochemical screening of plant extract.
4. Approval from IAEC for animal study protocol.
5. Selection and grouping of rats.
6. Induction of learning and memory impairment by using Scopalamine in rats.
7. Confirmation of learning and memory impairment by using Morris's water maze and elevated plus maze apparatus in rats.
8. Assessment of *Tectona grandis* extract for learning and memory enhancing activity in memory impaired rats.
9. Statistical analysis of obtained results.

MATERIALS AND METHODS

List of Chemicals Used in Study

Sr. No.	Chemicals	Company/Make
1	Petroleum ether	Thermosil Fine Chem Industries
2	Methanol	Thermosil Fine Chem Industries
3	Mayer's reagent	Prayogina Laboratories India
4	α-napthol	Burgoyne Burbidges &Co.
5	Conc.H_2So_4	Thermosil Fine Chem Industries
6	Glacial acetic acid	Samar Chemicals (India)
7	Ferric chloride	Thermosil Fine Chem Industries
8	Ninhydrin solution	Thermosil Fine Chem Industries
9	Lead acetate	Thermosil Fine Chem Industries
10	Ammonia solution	Thermosil Fine Chem Industries
11	Scopolamine	Sovereign Pharma Pvt. Ltd.
12	Donepezil	Alkem Laboratories Ltd.

Apparatus and Instruments

List of Instruments Used in Study

Sr. No.	Instruments	Company
1	Weighing balance	K-roy
2	Magnetic stirrer	Remi
3	Morris water maze apparatus	K-roy
4	Elevated plus maze apparatus	K-roy

METHOD

1. Collection & Authentication of Plant Materials

The bark of of *Tectona grandis* belonging to family-*Verbenaceae* was collected from the local area of Yavatmal district, Maharashtra, India. The plant material was Identified and authenticated by Vasantrao Naik College of Agricultural Biotechnology, Yavatmal.

(Ref No. VNCABT/Ytl/Hort/1598/2024 Date :- 29/11/2024)

2. Preparation of methanolic extract of *Tectona grandis* bark

The coarsely powdered bark was subjected to methanolic extraction by maceration. In maceration procedure, powdered bark was macerated in solvent; it was occasionally stirred at regular intervals of time. It was filtered and concentrated. Then it was dried by evaporation.

3. Experimental Design

Healthy female Sprague-Dawley rats (8 weeks old, 150–250 g) were housed under controlled conditions and fed a standard diet. All procedures followed CPCSEA and IAEC guidelines, with approval from the (IAEC) Reg.No.650/PO/Re/S-2002/ 2025/CCSEA/11.Date:9/01/2025

Animal Groups

For this study, rats were divided into following groups (n =6)

- **Group1 (Vehicle Control): -**Rats received only normal saline solution for 21 days.
- **Group 2 (Negative Control): -** Memory & learning impairment in rats was produced by using Scopolamine (2 mg/kg *i.p.*) for 21 days.
- **Group 3 (METG200 mg/kg): -** Memory & learning impairment in rats was produced by using Scopolamine (2 mg/kg *i.p.*) and treated with methanolic extract of *Tectona grandis* Bark (200 mg/kg) orally for 21 days.
- **Group 4 (METG 400 mg/kg): -** Memory & learning impairment in rats was produced by using Scopolamine (2 mg/kg *i.p.*) and treated with methanolic extract of *Tectona grandis* Bark (400 mg/kg) orally for 21 days.
- **Group 5 (Standard): -** Memory & learning impairment in rats was produced byusing Scopolamine (2 mg/kg *i.p.*) and treated with Donepezil (5 mg/kg) orally for 21 days.

Learning & Memory Impairment State was Checked in all Animals by Before & After Administration of Scopolamine

All animals in each group were assessed for the learning and memory impairment state by following animal models.

1. Elevated plus maze apparatus
2. Morris water maze apparatus

Reading of all animals in each group were noted down. These readings were referred as a day 0 for administration of Scopolamine. These reading was compared with the readings of animal model after administration of Scopolamine i.e. after 21 days.

Subjecting Selected Animals for Administration of Scopolamine for 21 Days

All groups were subjected for 21 days for administration of scopolamine except normal vehicle control group which was placed in normal condition in animal house.

Scopolamine is a muscarinic receptor antagonist that blocks cholinergic neurotransmission, causing memory impairment in rodents. Recent studies have reported that Scopolamine increases the accumulation of reactive oxygen species that cause oxidative stress, leading to memory impairment.[10]

Dosing of *Tectona grandis* bark extract and drugs to the rats

Daily dose of *Tectona grandis* bark extract was given orally to group METG (200 mg/kg) and METG (400 mg/kg) for the duration of 21 days. Scopolamine (2 mg/kg *i.p.*) was used for memory impairment in rats. Donepezil (5 mg/kg *p.o.*) was used as standard drug. Two different concentrations (200 mg/kg and 400 mg/kg) of the extract was prepared by dissolving the extracts in distilled water. All solutions were prepared freshly on test days and administered according to their standard routes.[11]

Study of Learning and Memory Impairment State on Day 0 & After 21 Days by Following Model

1. Elevated Plus Maze Apparatus
2. Morris Water Maze Apparatus

RESULTS

Phytochemical Screening Analysis

The phytochemicals present in methanolic extract of *Tectona grandis* Bark is shown in the following table.

Table 1: Phytochemical Screening of METG.

Sr. No.	Phytoconstituent	Test Performed	Extract Result
1	Alkaloids	Mayer's test	+
2	Carbohydrates	Molish's test	+
3	Cardiac glycosides	Keller-killani test	-
4	Tannins	Braymer's test	+
5	Protein and Amino acids	Ninhydrin test	-
6	Phenolic compounds	Lead acetate test	+
7	Flavonoids	Ammonia test	+
8	Anthraquinones	Borntrager's test	+
9	Saponins	Foam test	+
10	Terpenoids	Salkowski's test	+

+Present, - Absent

Phytochemical screening of the methanolic extract of *Tectona grandis* bark revealed the presence of various bioactive compounds such as alkaloids, carbohydrates, tannins, phenolic compounds, flavonoids, anthraquinones, saponins, and terpenoids, while cardiac glycosides and proteins were found to be absent. These findings indicate that the extract is rich in phytochemicals with potential medicinal properties**.**

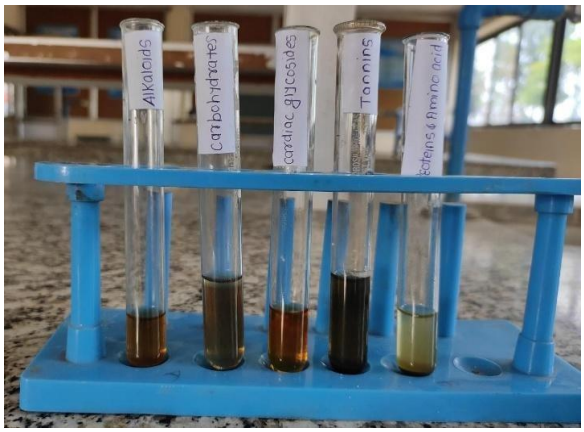

Figure No.2:- Phytochemical screening results of Alkaloids, Carbohydrates, Cardiac glycosides, Tannins, Proteins and Amin

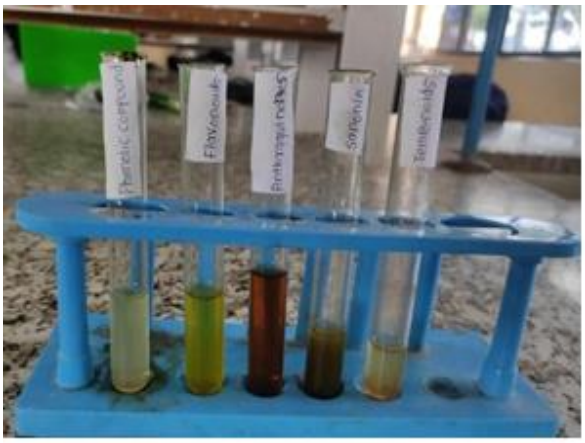

Figure No.3:- Phytochemical screening results of Phenolic compounds, Flavonoids, Anthraquinones, Saponins and Terpenoids.

Extraction and Yield Calculation of Methanolic Extract of *Tectona grandis* Bark Procedure

1. Sample Preparation.

Coarsely powdered bark of *Tectona grandis* was used for the extraction process.

2. Extraction

The powdered bark was extracted using methanol as the solvent in a Soxhlet apparatus.

3. Filtration

The extract was filtered using filter paper.

4. Solvent Removal

The filtrate was concentrated by evaporating the methanol using a water bath.

5. Drying and Storage

The dried extract was stored for further analysis.

6. Weighing the Extract

Weight of empty petri dish: 43.24 g Weight of petri dish with extract: 62.31 g

Actual weight of extract = 62.31 g – 43.24 g = 19.07 g

7. Total weight of powdered bark used: 240 g
8. %Practical yield of methanolic extract of Bark Of *Tectona grandis*

=Actual weight of Methanolic extract of Bark of *Tectona grandis*

×100 Total weight of powdered Bark of *Tectona grandis* used for extraction

=19.07 / 240 × 100 = 7.94 % w/w.

% Practical yield =7.94%w/w.

Acute oral toxicity studies

Figure No. 4: Observation of METG treated rats after 90 minutes.

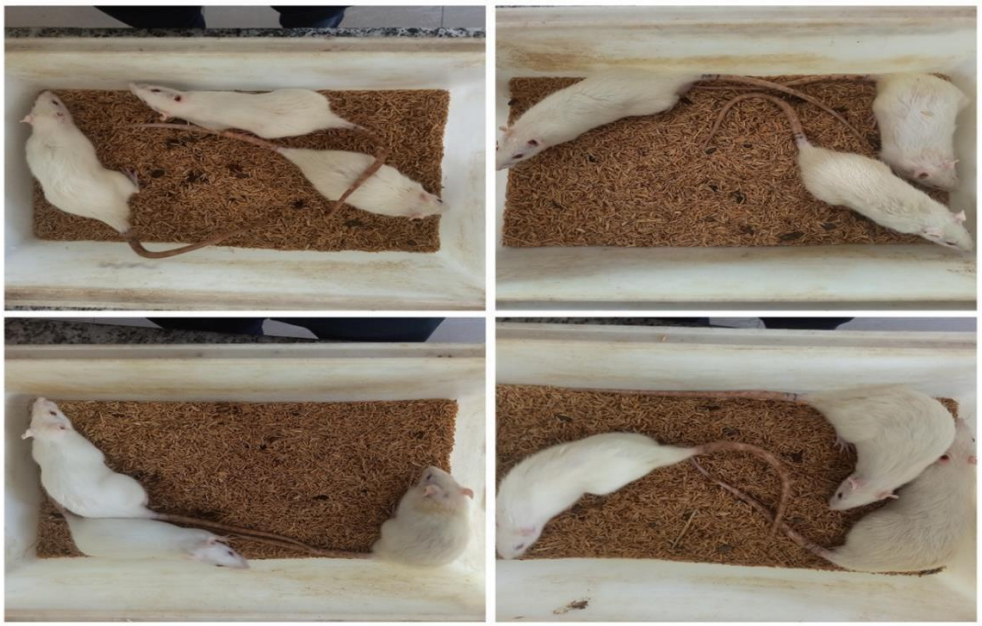

Figure No. 5: Observation of METG treated rats after 24 hours.

Figure No. 6: Observation of METG treated rats after 14 days.

There was no mortality and any toxic manifestations like increased motor activity, salivation, acute convulsion, coma, and death was observed after 14 days of dose administration. From this result, we can conclude that 1/5th concentration of 2000 mg/kg, i.e., 400 mg/kg methanolic extract of *Tectona grandis* bark was considered as the high dose of this extract, and 1/10th concentration of 2000 mg/kg, i.e., 200 mg/kg methanolic extract of *Tectona grandi s* bark was considered as the low dose of this extract for the further studies.

Evaluation of Behavioural Parameters Elevated Plus Maze Apparatus

Table No. 2: No. of Entries in close arm.

Sr. No	Groups	Number of entries in close arm on 0day (%)	Number of entries in closed arm on21day (%)
1.	Normal Control	49.4±0.48	50.11±0.67
2.	Negative Control	48.33±0.58^{ns}	60.2±1.61$^{@}$
3.	METG (200mg/kg)	49.93±0.47^{ns}	46.92±0.42**
4.	METG (400 mg/kg)	50.11±0.22^{ns}	45.27±0.4**
5.	Donepezil (5mg/kg)	49.66±1.54^{ns}	43.67±0.5**

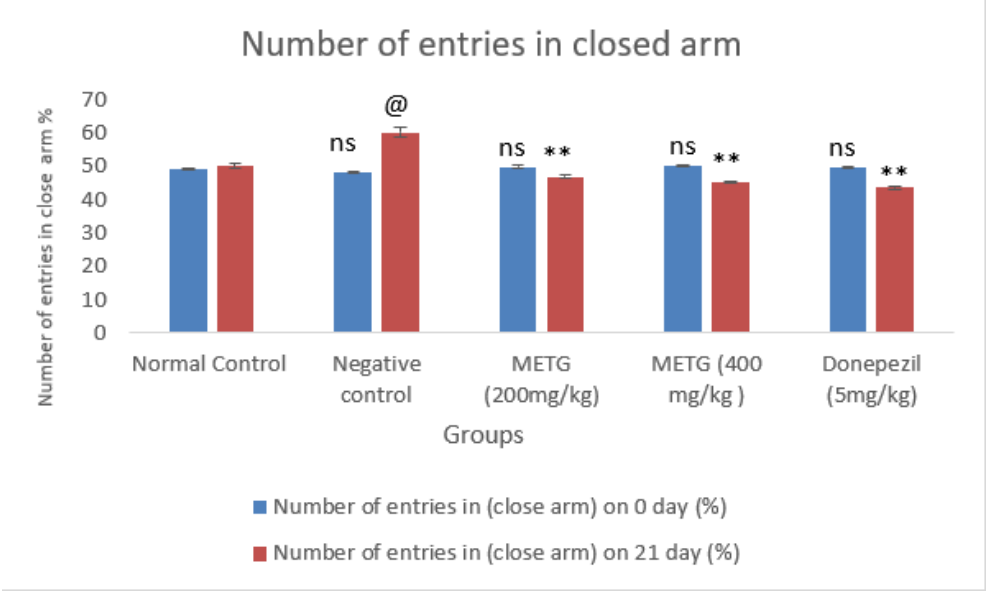

Figure No.6:- No of Entries in close arm.

Values are expressed in, Mean ±SEM (n=6);

ns= not significant, @P<0.05 when compared to normal control group. ns= not significant, **P<0.01 when compared to negative control group.

Table No.2 and Figure No.6 shows that the effect of *Tectona grandis* Bark in Elevated Plus Maze Apparatus in memory impaired rats. There was a significant (P<0.05) increase in the closed arm entries of negative control group as compared to normal control group. There was significant (P<0.01) decrease in closed arm entries in METG (200 mg/kg), METG (400 mg/kg), and Donepezil (5mg/kg) compared to negative control group on day 21.

Table No. 3: No. of Entries in open arm.

Sr. No.	Groups	Number of entries in open arm on day 0 (%)	Number of entries in open arm on 21 day (%)
1.	Normal Control	50.6±0.77	49.89±0.50
2.	Negative Control	51.67±0.57^{ns}	39.75±0.65$^{@}$
3.	METG (200 mg/kg)	50.07±0.15^{ns}	53.08±1.3**
4.	METG (400 mg/kg)	49.89±0.27^{ns}	54.73±0.71**
5.	Donepezil (5mg/kg)	50.34±1.67^{ns}	56.33±0.4**

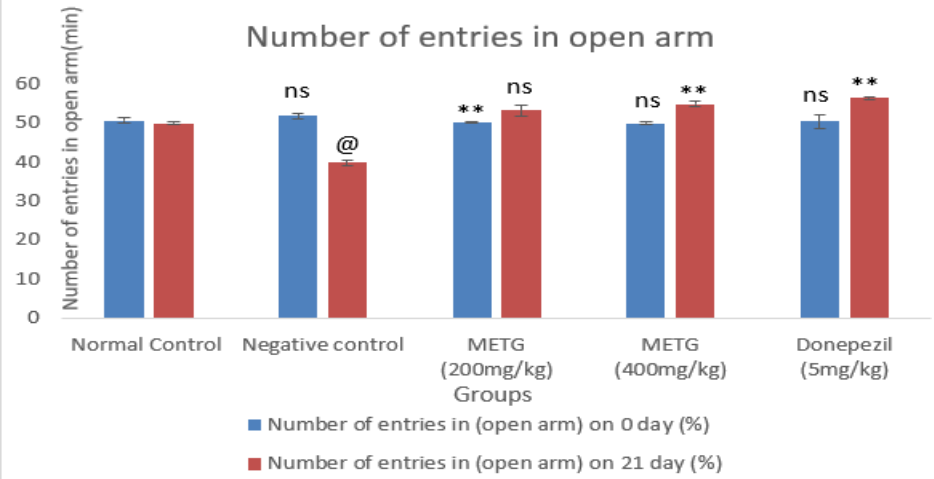

Figure No 7: No. of Entries in open arm.

Values are expressed in Mean ±SEM(n=6);

ns= not significant, @P<0.05 when compared to normal control group. ns= not significant, **P<0.01 when compared to negative control group.

Table No.3 and Figure No.7 shows that the effect of *Tectona grandis* Bark in Elevated Plus Maze Apparatus in memory impaired rats. There was a significant (P<0.05) decrease in the open arm entries of negative control as compared to normal control. There was significant (P<0.01) increased in open arm entries in METG (200 mg/kg), METG (400 mg/kg), and Donepezil (5mg/kg) compared to negative control group on day 21.

Table No. 4: Time spent in closed arm.

Sr. No.	Groups	Time spent in closed arm on day 0 (min)	Time spent in closed arm on 21day (min)
1.	Normal Control	4.1±0.20	4.12±0.08
2.	Negative Control	4.05±0.19^{ns}	4.47±0.06$^{@}$
3.	METG (200mg/kg)	3.55±0.12^{ns}	3.39±0.07**
4.	METG (400mg/kg)	3.58±0.44^{ns}	3.22±0.45**
5.	Donepezil(5mg/kg)	4.00±0.09^{ns}	3.18±0.05**

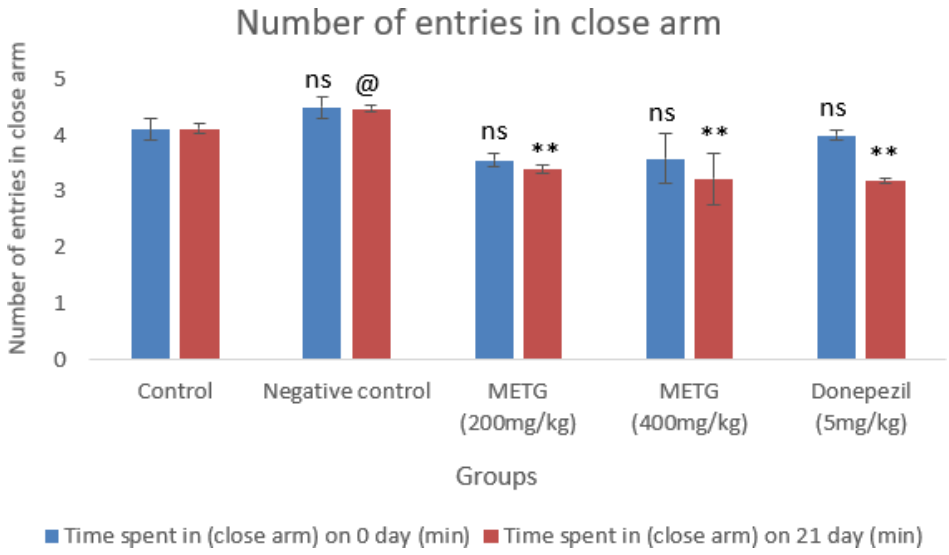

Figure No.8: Time spent in closed arm.

Values are expressed in Mean ±SEM(n=6);

ns= not significant, @P<0.05 when compared to normal control group. ns= not significant, **P<0.01 when compared to negative control group.

Table No.4 and Figure No.8 shows that the effect of *Tectona grandis* Bark in Elevated Plus Maze Apparatus in memory impaired rats. There was a significant (P<0.05) increase in the time spent in closed arm of negative control group as compared to normal control group. There was significant (P<0.01) decrease in the time spent in closed arm in METG (200mg/kg), METG (400mg/kg) and Donepezil (5mg/kg) compared to negative control group on day 21.

Table No. 5: Time spent in open arm.

Sr. No.	Groups	Time spent in open arm on day 0 (min)	Time spent in open arm on 21day (min)
1.	Normal Control	0.90±0.03	0.88±0.06
2.	Negative Control	0.95 ± 0.07^{ns}	$0.53\pm0.03^{@}$
3.	METG (200 mg/kg)	1.45 ± 0.28^{ns}	1.61±0.40**
4.	METG (400 mg/kg)	1.42 ± 0.09^{ns}	1.78±0.04**
5.	Donepezil (5mg/kg)	1.00 ± 0.10^{ns}	1.82±0.05**

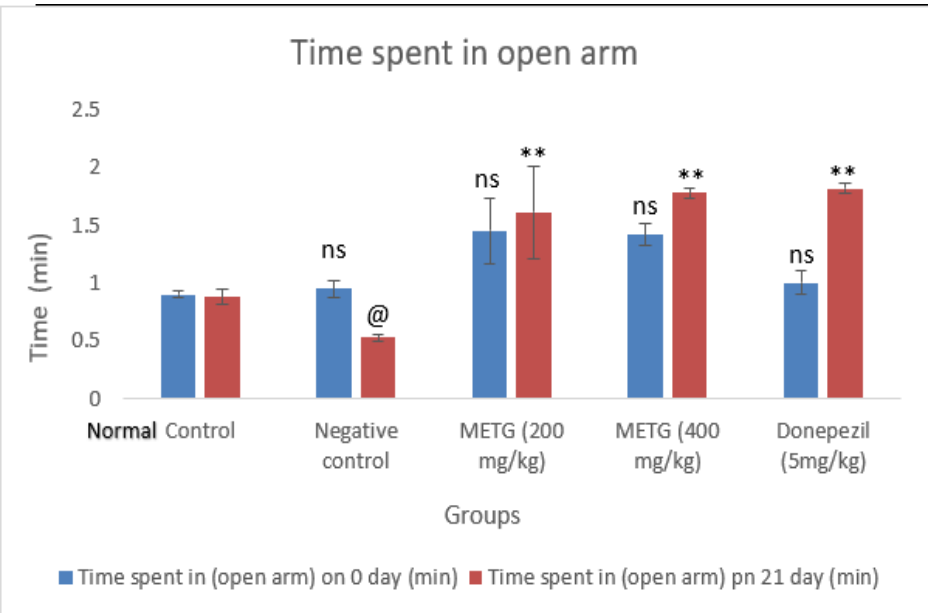

Figure No. 9: Time spent in open arm.

Values are expressed in Mean ± SEM(n=6);

ns= not significant, @P<0.05 when compared to normal control group. ns= not significant, **P<0.01 when compared to negative control group.

Table No.5 and Figure No.9 shows that the effect of *Tectona grandis* Bark in Elevated Plus Maze Apparatus in memory impaired rats. There was a significant (P<0.05) decrease in the time spent in open arm of negative control as compared to normal control group. There was significant (P<0.01) increase time spent in open arm in METG (200mg/kg), METG (400mg/kg) and Donepezil (5mg/kg) compared to negative control group on day 21.

Transfer Latency

Table No. 6: Effect of METG on transfer latency of rats in EPM apparatus.

Sr. No.	Groups	Transfer latency on Day 0 (Sec)	Transfer latency on Day 21 (Sec)
1.	Normal Control	22.66 ± 3.38	20.66 ± 1.36
2.	Negative Control	24.66 ± 1.36^{ns}	$50 \pm 14.88^{@}$
3.	METG (200mg/kg)	28.66 ± 4.50^{ns}	$32 \pm 13.70^{**}$
4.	METG (400 mg/kg)	29.33 ± 8.95^{ns}	$22.66 \pm 3.38^{**}$
5.	Donepezil(5mg/kg)	16.66 ± 1.36^{ns}	$14 \pm 2.36^{**}$

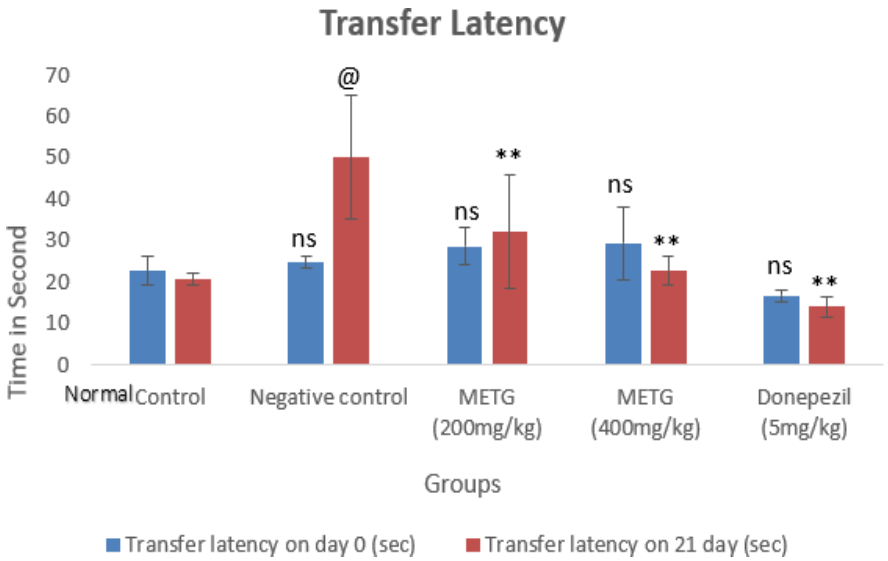

Figure No. 10: Effect of METG on transfer latency of rats in EPM apparatus.

All values are expressed as Mean ± SD

ns= not significant, @P<0.05 when compared to normal control group. ns= not significant, **P<0.01 when compared to negative control group.

Table No.6 & Figure No.10 shows the effect of *Tectona grandis* Bark on Transfer Latency in EPM in memory impaired rats. There was significant (p<0.05) increase Transfer Latency in negative control group as compared to normal. There was significant (p<0.01) decrease Transfer Latency in METG 200 mg/kg, METG 400 mg/kg, and Donepezil (5mg/kg) treated group compared to negative control group on day 21.

Escape Latency

Table No. 7: Effect of METG on escape latency of rats in MWM apparatus.

Sr. No.	Groups	Escape latency on Day 0 (Sec)	Escape latency on Day 21 (Sec)
1.	Normal Control	31.33 ± 6.59	28.33 ± 3.61
2.	Negative Control	34.66 ± 7.50^{ns}	40.66 ± 17.76$^{@}$
3.	METG (200mg/kg)	35.33 ± 3.38^{ns}	37.33 ± 8.82**
4.	METG (400mg/kg)	36± 6.75^{ns}	34.33 ± 11.36**
5.	Donepezil (5 mg/kg)	35.33 ± 4.92^{ns}	30.66 ± 11.81**

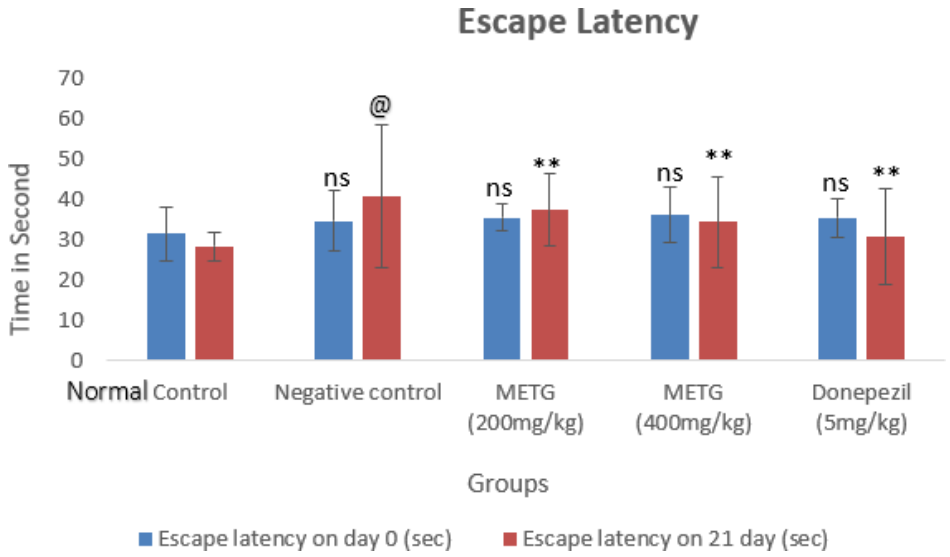

Figure No. 11: Effect of METG on escape latency of rats in MWM apparatus.

All values are expressed as Mean ± SD

ns= not significant, @P<0.05 when compared to normal control group. ns= not significant, **P<0.01 when compared to negative control group

Table No. 7 & Figure No.11 shows the effect of *Tectona grandis* Bark on EL in MWM in memory impaired rats. There was significant (p<0.05) increase EL in negative control group as compared to normal. There was significant (p<0.01) decrease EL in METG 200 mg/kg, METG 400 mg/kg, and Donepezil (5mg/kg) treated group compared to negative control group on day 21.

Retention Time

Table No. 8: Effect of METG on retention time of rats in MWM apparatus.

Sr. No.	Groups	Retention time on Day 0 (Sec)	Retention time on Day 21 (Sec)
1.	Normal Control	40.33 ± 0.51	48.66 ± 4.41
2.	Negative Control	38 ± 1.78^{ns}	35 ± 2.36$^{@}$
3.	METG (200mg/kg)	42 ± 3.22^{ns}	50 ± 4.73**
4.	METG (400mg/kg)	45± 2.73^{ns}	52± 4.98**
5.	Donepezil(5mg/kg)	41 ± 0.51^{ns}	54± 3.61**

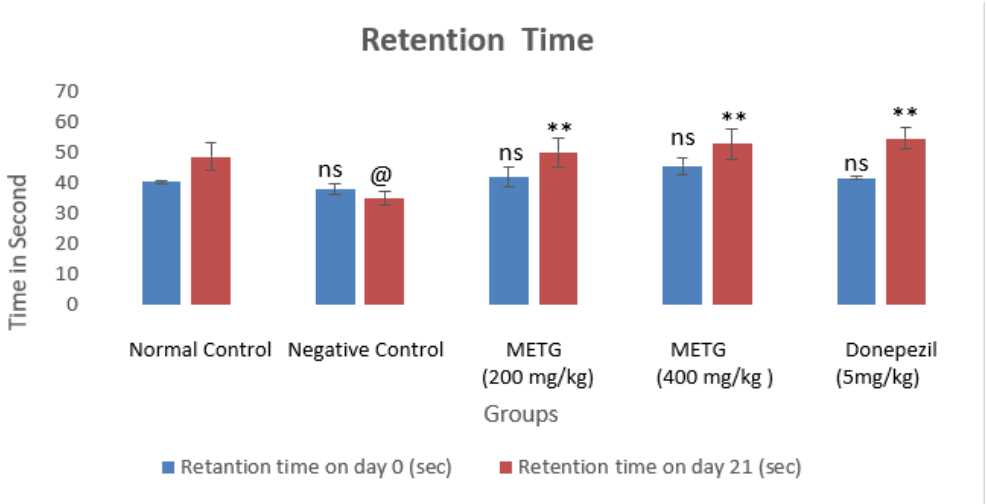

Figure No. 12: Effect of METG on retention time of rats in MWM apparatus.

All values are expressed as Mean ± SD

ns= not significant, @P<0.05 when compared to normal control group. ns= not significant, **P<0.01 when compared to negative control group.

Table No.8 & Figure No.12 shows the effect of *Tectona grandis* Bark on RT in MWM in memory impaired rats. There was significant (p<0.05) decrease RT in negative control group as compared to normal. There was significant (p<0.01) increase RT in METG 200 mg/kg, METG 400 mg/kg, and Donepezil (5mg/kg) treated group compared to negative control group on day 21.

DISCUSSION

Alzheimer's disease (AD) is characterized by memory impairment linked to cholinergic dysfunction and oxidative stress. Current synthetic drugs like Donepezil offer symptomatic relief but often come with side effects, prompting interest in herbal alternatives.[12] In this study, the methanolic extract of *Tectona grandis* bark (METG) demonstrated significant memory-enhancing effects in scopolamine- induced memory-impaired rats. Phytochemical screening confirmed the presence of neuroactive compounds such as flavonoids, phenolics, and alkaloids, known for their antioxidant and acetylcholinesterase (AChE) inhibitory properties.

Behavioural tests (EPM and MWM) showed that METG improved learning and memory by reducing transfer and escape latencies and increasing retention time, comparable to the standard drug Donepezil.

The observed effects suggest that METG may enhance cholinergic neurotransmission and mitigate oxidative stress, supporting its potential as a plant-based therapeutic for AD.

CONCLUSION

The negative control group exhibited a significant increase in transfer and escape latency, indicating cognitive impairment. In contrast, METG-treated groups (200 mg/kg and 400 mg/kg) and the standard drug Donepezil (5 mg/kg) significantly reduced both transfer and escape latency, while improving retention time, demonstrating enhanced learning and memory.

In the Elevated Plus Maze, the negative control group showed increased closed arm entries and time spent, suggesting anxiety-like behavior. Treatment with METG and Donepezil significantly decreased closed arm activity and increased open arm entries and time, reflecting anxiolytic and memory-enhancing effects. These results support the cognitive benefits of *Tectona grandis* bark extract in memory-impaired models.

ACKNOWLEDEMENT

This work was conducted in Pataldhamal Wadhwani College of Pharmacy, Yavatmal. The work was guided by Dr. Abhijit Shrirao and supervised by Dr. Nitin Kochar, Dr. Mohale and Dr. A. V. Chandewar.

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