

Investigation of Alzheimer's Activity of *Argyreia Speciosa* in Rats

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ABSTRACT :

Background: Alzheimer's disease (AD) is a progressive neurodegenerative disorder characterized by memory loss, cognitive decline, cholinergic dysfunction, and oxidative stress. Despite the availability of conventional therapies, their limited efficacy and associated adverse effects have prompted the search for safer and more effective alternatives from natural sources. *Argyreia speciosa* is a medicinal plant known for its antioxidant, neuroprotective, and nootropic properties.

Objective: The present study was undertaken to evaluate the anti-Alzheimer potential of *Argyreia speciosa* extract against scopolamine-induced cognitive impairment in experimental animals.

Methods: Alzheimer's-like cognitive deficits were induced by administration of scopolamine (1 mg/kg, i.p.). Animals were divided into five groups: normal control, disease control, standard control (Donepezil 3 mg/kg), and two treatment groups receiving *Argyreia speciosa* extract at doses of 200 mg/kg and 400 mg/kg, respectively. Cognitive performance was assessed using the Morris Water Maze (MWM), Y-Maze, and Elevated Plus Maze (EPM) tests. Biochemical estimations of brain acetylcholinesterase (AChE) activity and antioxidant parameters, including superoxide dismutase (SOD), catalase (CAT), reduced glutathione (GSH), and malondialdehyde (MDA), were performed to evaluate cholinergic function and oxidative stress.

Results: Scopolamine administration significantly impaired learning and memory, increased brain AChE activity, reduced SOD, CAT, and GSH levels, and elevated MDA levels compared with the normal control group. Treatment with *Argyreia speciosa* extract significantly improved behavioral performance in the MWM, Y-Maze, and EPM tests in a dose-dependent manner. The extract also significantly decreased AChE activity and restored antioxidant enzyme levels while reducing lipid peroxidation. The higher dose (400 mg/kg) produced effects comparable to the standard drug donepezil.

Conclusion: The findings of the present study demonstrate that *Argyreia speciosa* possesses significant anti-Alzheimer and neuroprotective activity against scopolamine-induced cognitive deficits. The observed effects may be attributed to inhibition of acetylcholinesterase activity, enhancement of cholinergic neurotransmission, and attenuation of oxidative stress. These results suggest that *Argyreia speciosa* may serve as a promising natural therapeutic agent for the management of Alzheimer's disease and related neurodegenerative disorders.

Keywords: *Argyreia speciosa*, Alzheimer's disease, Scopolamine, Donepezil, Acetylcholinesterase, Oxidative stress, Neuroprotection, Morris Water Maze, Y-Maze, Elevated Plus Maze, Antioxidants.

I. INTRODUCTION

Alzheimer disease is the most common form of dementia, affecting more than one-third of Americans older than 85 years. It is characterized by progressive memory loss and cognitive decline. Amyloid plaque accumulation, neurofibrillary tau tangles, and depletion of acetylcholine are among the pathologic manifestations of Alzheimer disease. Although there are no proven modalities for preventing Alzheimer disease, hypertension treatment, omega-3 fatty acid supplementation, physical activity, and cognitive engagement demonstrate modest potential. Acetylcholinesterase inhibitors are first-line medications for the treatment of Alzheimer disease, and are associated with mild improvements in cognitive function, behavior, and activities of daily living; however, the clinical relevance of these effects is unclear. The most common adverse effects of acetylcholinesterase inhibitors are nausea, vomiting, diarrhea, dizziness, confusion, and cardiac arrhythmias. Short-term use of the N-methyl-D-aspartate receptor antagonist memantine can modestly improve measures of cognition, behavior, and activities of daily living in patients with moderate to severe Alzheimer disease [1].

Memantine can also be used in combination with acetylcholinesterase inhibitors. Memantine is generally well tolerated, but whether its benefits produce clinically meaningful improvement is controversial. Although N-methyl-D-aspartate receptor antagonists and acetylcholinesterase inhibitors can slow the progression of Alzheimer disease, no pharmacologic agents can reverse the progression. Atypical antipsychotics can improve some

behavioral symptoms, but have been associated with increased mortality rates in older patients with dementia. There is conflicting evidence about the benefit of selegiline, testosterone, and ginkgo for the treatment of Alzheimer disease. There is no evidence supporting the beneficial effects of vitamin E, estrogen, or Nonsteroidal anti-inflammatory drug therapy.

Alzheimer disease affects approximately 5.4 million Americans and accounts for most cases of dementia.¹ Like other types of dementia, it is characterized by progressive memory loss and cognitive decline. Alzheimer disease is usually diagnosed in persons older than 65 years, and its prevalence increases every decade thereafter. Nearly one-half of Americans 85 years and older have Alzheimer disease.¹ Women are more commonly affected than men. Patients with mild disease have some functional dependence, such as trouble managing finances.² Patients with moderate disease are more dependent on others, often are unable to drive, and have difficulty with bathing and shopping.² Severe disease is characterized by total dependence on caretakers, and by motor and balance impairments.² There is no consensus on the best method to assess the severity of Alzheimer disease to guide treatment. Many physicians are familiar with the Mini-Mental State Examination. Another potentially useful tool to assess disease severity is the Clinical Dementia Rating. Alzheimer's disease is a progressive neurodegenerative disorder that primarily affects memory, thinking, and behavior. It is the most common cause of dementia, accounting for approximately 60–80% of all dementia cases. First identified by Dr. Alois Alzheimer in 1906, the disease is characterized by the presence of amyloid plaques and neurofibrillary tangles in the brain, which lead to the degeneration and death of nerve cells.

Alzheimer's typically begins with subtle memory loss and confusion, eventually leading to severe impairment in cognitive and functional abilities. Patients often struggle with language, disorientation, mood swings, and difficulties in performing everyday tasks. As the disease progresses, it can result in complete loss of independence and ultimately, death [2].

Although aging is the most significant risk factor, Alzheimer's is **not** a normal part of aging. Other risk factors include genetics (such as the presence of the APOE ε4 allele), family history, head injury, lifestyle, and cardiovascular health. Alzheimer's usually affects individuals over 65, but early-onset Alzheimer's can occur as early as in their 40s or 50s.

Currently, there is no cure for Alzheimer's disease. However, various treatments and interventions can help manage symptoms and improve quality of life. These include medications that temporarily enhance cognitive function, lifestyle changes, and supportive therapies. Ongoing research is focusing on understanding the disease's pathophysiology to develop more effective treatments and ultimately, preventive strategies.

Given its rising prevalence due to aging populations worldwide, Alzheimer's poses a significant public health challenge. It not only affects patients but also places immense emotional and financial burdens on caregivers and healthcare systems. Therefore, increased awareness, early diagnosis, and ongoing research are crucial in the global fight against this debilitating condition [3].

II. EXPERIMENTAL WORK

Collection of Plant Materials:

Dried *Argyrea Speciosa* was purchased from an herbal Market of Hyderabad, Telangana, India, and authenticated by Dr. K. Madhava Chetty, Assistant Professor, Department of Botany, S.V University, and Tirupati.

Preparation of plant extract

Argyrea Speciosa was air dried in the shade and extracted with ethanolic extract, using a Soxhlet extractor for 8 hrs at 55-60°C. The supernatant was filtered through Whatman filter paper No.1 and concentrated under reduced pressure using a vacuum at 44 ± 10°C in a rotavapor (IKA ® RB 10 Rota Evaporator, India) The extract was stored at 22°C in a seeded air-tight container.

The percentage of extract yield was calculated by using the formula.

$$\% \text{ of extract yield} = \frac{\text{weight in gm of extract obtained}}{\text{weight in gm of plant material taken}} \times 100$$

Pharmacological

Animals and Management

Wistar albino rats of both sexes measuring between 150 and 200 gm were used. The animals were picked up from the residence of the pets, from our institute. The pets were randomly put upon entry and assigned as bedding

in polypropylene tanks with paddy husk to treatment groups. Animals were housed at a temperature of $24 \pm 2^\circ\text{C}$ and relative humidity of 30 to 70 %. A 12:12 light: day cycle was followed. All animals were allowed to free access to water and fed with standard commercial pelleted rat chaw Jeeva life sciences The Institutional Animal Ethics Committee CCSEA) studied all the laboratory processes and protocols used in this research and complied with the institutional ethical standards.

Acute Toxicity Study

The acute toxicity study is use to establish the therapeutic index, i.e., the ratio between the pharmacologically effective dose and lethal dose on the same strain and species (LD50/ED50). Greater is the index; safer is the compound and vice versa. The acute toxicity study was done according to OECD (Organization of Economic Co-operation and Development) guidelines 425- Fixed Dose Procedure (FDP).

Morris Water Maze (MWM) [4]

The Morris Water Maze (MWM) test was conducted according to the method described by Richard G. Morris. The apparatus consisted of a circular pool filled with opaque water maintained at $22 \pm 2^\circ\text{C}$ and divided into four equal quadrants. A circular escape platform was submerged approximately 1–2 cm below the water surface in one of the quadrants. During the acquisition phase, animals were individually placed into the pool from different starting positions and allowed to swim freely to locate the hidden platform using visual cues present around the testing room. Each animal received multiple training trials per day for several consecutive days. The time taken to reach the platform (escape latency) was recorded for each trial. Animals that failed to locate the platform within the allotted time were gently guided to it and allowed to remain there briefly. Following the training period, a probe trial was conducted by removing the platform and allowing the animals to swim freely for 60 seconds. Spatial learning and memory were assessed by measuring escape latency, time spent in the target quadrant, swimming path length, and the number of crossings over the former platform location. Improved performance in these parameters was considered indicative of enhanced learning and memory retention.

Y-Maze Test Procedure [5]

The Y-maze test is a widely used behavioral model for evaluating **spatial working memory and exploratory behavior** in rodents. The apparatus consists of three identical arms (designated A, B, and C) arranged at an angle of 120° to each other, forming a Y-shaped maze. During the test, each animal is placed at the end of one arm and allowed to move freely throughout the maze for 5–8 minutes. The sequence and number of arm entries are recorded manually or using a video-tracking system. An arm entry is considered complete when all four paws of the animal enter an arm. Spontaneous alternation behavior is defined as successive entries into all three arms on overlapping triplet sets (e.g., ABC, BCA, CAB) without repetition. The percentage of spontaneous alternation is calculated using the formula:

$$\text{Spontaneous Alternation (\%)} = \frac{\text{Number of Alternations}}{\text{Total Arm Entries} - 2} \times 100$$

A higher percentage of spontaneous alternation indicates improved spatial working memory and cognitive function, whereas a lower percentage suggests memory impairment. Total arm entries are also recorded as an index of locomotor activity.

Elevated Plus Maze (EPM) [6]

The Elevated Plus Maze (EPM) test is a widely used behavioral model for assessing anxiety-related behavior and memory in rodents. The apparatus consists of four arms arranged in a plus-shaped configuration elevated approximately 40–50 cm above the floor, with two opposite open arms and two opposite closed arms enclosed by high walls. During the test, each animal is placed individually at the center of the maze facing one of the open arms and allowed to explore freely for 5 minutes. The number of entries and the time spent in the open and closed arms are recorded. An arm entry is considered complete when all four paws of the animal enter the arm. Increased time spent and entries into the open arms are indicative of reduced anxiety-like behavior, whereas preference for the closed arms reflects increased anxiety. In memory studies, transfer latency (the time taken by the animal to move from an open arm into a closed arm) is measured during training and retention sessions. A decrease in transfer latency during the retention trial is considered an indication of improved learning and memory performance.

Estimation of Brain Acetylcholinesterase (AChE) Activity

Acetylcholinesterase (AChE) activity in brain tissue was estimated using the colorimetric method described by George L. Ellman et al. Brain tissue was homogenized in ice-cold phosphate buffer (0.1 M, pH 8.0) and centrifuged to obtain the supernatant. An aliquot of the supernatant was mixed with phosphate buffer and 5,5'-dithiobis-(2-nitrobenzoic acid) (DTNB, Ellman's reagent). The reaction was initiated by adding acetylthiocholine iodide as the substrate. The hydrolysis of acetylthiocholine by AChE releases thiocholine, which reacts with DTNB to produce a yellow-colored 5-thio-2-nitrobenzoate anion. The increase in absorbance was measured spectrophotometrically at 412 nm at regular intervals. AChE activity was expressed as micromoles of acetylthiocholine hydrolyzed per minute per milligram of protein ($\mu\text{mol}/\text{min}/\text{mg}$ protein). Increased AChE activity is associated with cholinergic dysfunction and cognitive impairment characteristic of Alzheimer's disease, whereas a reduction in AChE activity indicates improved cholinergic neurotransmission.

Estimation of Antioxidant Parameters (SOD, CAT, GSH, and MDA) [7]

Brain antioxidant status was assessed by measuring the activities of superoxide dismutase (SOD), catalase (CAT), reduced glutathione (GSH), and malondialdehyde (MDA) in brain homogenates. Fresh brain tissue was homogenized in ice-cold phosphate buffer (0.1 M, pH 7.4) and centrifuged at 10,000 rpm for 15 minutes at 4°C. The resulting supernatant was used for biochemical estimations.

Superoxide Dismutase (SOD) [8]

SOD activity was determined by the method of Misra and Fridovich. The assay is based on the ability of SOD to inhibit the auto-oxidation of epinephrine to adrenochrome under alkaline conditions. The change in absorbance was measured spectrophotometrically at 480 nm. SOD activity was expressed as units per milligram protein (U/mg protein).

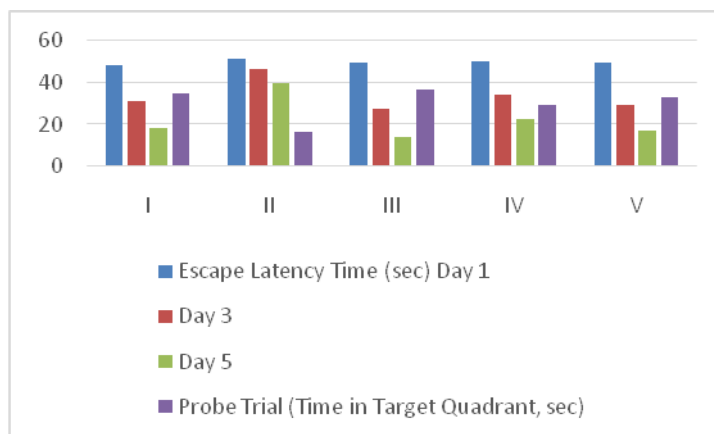
Catalase (CAT) [9-11]

Catalase activity was estimated according to the method of Aebi. The assay measures the decomposition of hydrogen peroxide (H_2O_2) by catalase. The decrease in absorbance due to the consumption of H_2O_2 was monitored at 240 nm. Catalase activity was expressed as μmol of H_2O_2 decomposed per minute per milligram protein.

Morris Water Maze

Group	Treatment	Escape Latency Time (sec) Day 1	Day 3	Day 5	Probe Trial (Time in Target Quadrant, sec)
I	Normal Control	48.2 $\pm$ 1.8	31.4 $\pm$ 1.5	18.6 $\pm$ 1.2	34.8 $\pm$ 1.3
II	Disease Control (Scopolamine)	51.7 $\pm$ 2.1	46.3 $\pm$ 1.9	39.8 $\pm$ 1.7	16.5 $\pm$ 1.1
III	Donepezil (3 mg/kg) + Scopolamine	49.5 $\pm$ 1.9	27.8 $\pm$ 1.3***	14.2 $\pm$ 0.9***	36.9 $\pm$ 1.4***
IV	Argyrea speciosa Extract (200 mg/kg) + Scopolamine	50.4 $\pm$ 1.7	34.5 $\pm$ 1.6**	22.4 $\pm$ 1.2**	29.6 $\pm$ 1.2**
V	Argyrea speciosa Extract (400 mg/kg) + Scopolamine	49.8 $\pm$ 1.8	29.3 $\pm$ 1.4***	17.1 $\pm$ 1.0***	33.1 $\pm$ 1.3***

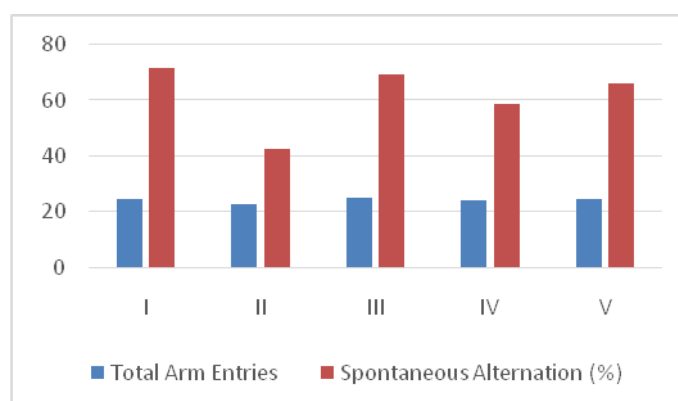
The disease control group treated with scopolamine showed a significant increase in escape latency time and a decrease in time spent in the target quadrant compared with the normal control group, indicating impaired spatial learning and memory. Treatment with donepezil (3 mg/kg) significantly reduced escape latency and increased retention of spatial memory. Administration of *Argyrea speciosa* extract at doses of 200 mg/kg and 400 mg/kg improved learning and memory in a dose-dependent manner. The higher dose (400 mg/kg) produced effects comparable to donepezil, as evidenced by a marked reduction in escape latency and increased time spent in the target quadrant during the probe trial.



Y-Maze test

Group	Treatment	Total Arm Entries	Spontaneous Alternation (%)
I	Normal Control (0.5% CMC)	24.3 ± 1.2	71.8 ± 2.4
II	Disease Control (Scopolamine 1 mg/kg)	22.8 ± 1.1	42.6 ± 2.1
III	Donepezil (3 mg/kg) + Scopolamine	25.1 ± 1.3	69.4 ± 2.2***
IV	Argyreia speciosa Extract (200 mg/kg) + Scopolamine	23.9 ± 1.2	58.7 ± 2.0**
V	Argyreia speciosa Extract (400 mg/kg) + Scopolamine	24.7 ± 1.1	66.2 ± 2.3***

The disease control group treated with scopolamine showed a significant reduction in spontaneous alternation percentage compared with the normal control group, indicating impairment of spatial working memory. Donepezil treatment significantly restored spontaneous alternation behavior, demonstrating improved cognitive performance. Administration of *Argyreia speciosa* extract at doses of 200 mg/kg and 400 mg/kg significantly increased spontaneous alternation percentages in a dose-dependent manner. The higher dose (400 mg/kg) produced effects comparable to the standard drug donepezil. Total arm entries remained relatively unchanged among groups, suggesting that the observed improvements were due to enhanced memory function rather than alterations in locomotor activity.

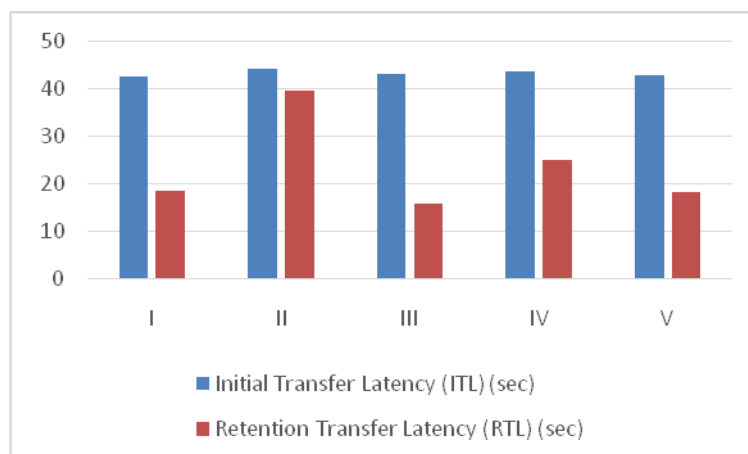


Elevated Plus Maze

Group	Treatment	Initial Transfer Latency (ITL) (sec)	Retention Transfer Latency (RTL) (sec)
I	Normal Control (0.5% CMC)	42.6 ± 1.8	18.4 ± 1.1
II	Disease Control (Scopolamine 1 mg/kg)	44.3 ± 1.9	39.7 ± 1.6

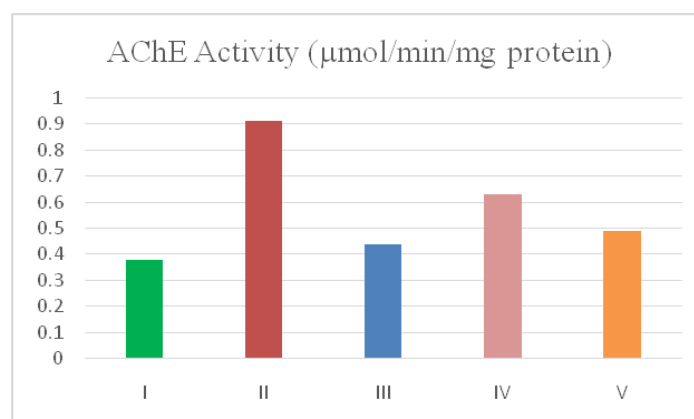
III	Donepezil (3 mg/kg) + Scopolamine	43.1 ± 1.7	15.8 ± 0.9***
IV	Argyreia speciosa Extract (200 mg/kg) + Scopolamine	43.8 ± 1.8	24.9 ± 1.2**
V	Argyreia speciosa Extract (400 mg/kg) + Scopolamine	42.9 ± 1.6	18.2 ± 1.0***

The disease control group treated with scopolamine exhibited a significant increase in retention transfer latency (RTL) compared with the normal control group, indicating impaired learning and memory. Treatment with donepezil significantly reduced RTL, demonstrating improved memory retention. Administration of *Argyreia speciosa* extract at doses of 200 mg/kg and 400 mg/kg significantly decreased RTL in a dose-dependent manner. The higher dose (400 mg/kg) produced a pronounced reduction in transfer latency and showed efficacy comparable to the standard drug donepezil.



Acetylcholinesterase (AChE) activity

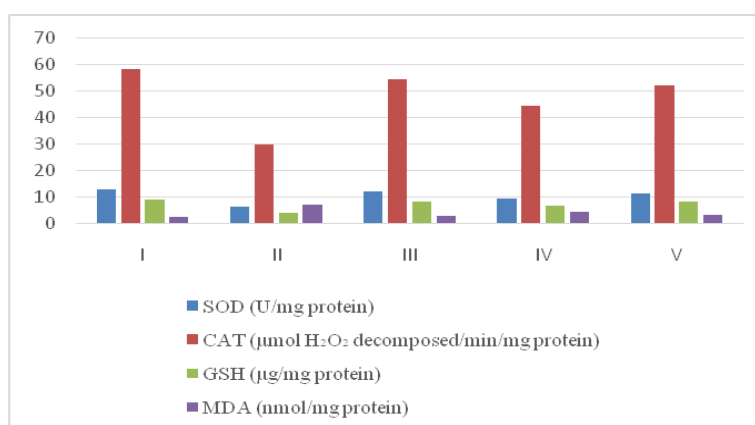
Group	Treatment	AChE Activity (μmol/min/mg protein)
I	Normal Control	0.38 ± 0.02
II	Disease Control (Scopolamine)	0.91 ± 0.04
III	Donepezil (3 mg/kg) + Scopolamine	0.44 ± 0.02***
IV	Argyreia speciosa (200 mg/kg) + Scopolamine	0.63 ± 0.03**
V	Argyreia speciosa (400 mg/kg) + Scopolamine	0.49 ± 0.02***



Simulated Antioxidant Biochemical Parameters

Group	Treatment	SOD (U/mg protein)	CAT ($\mu\text{mol H}_2\text{O}_2$ decomposed/min/mg protein)	GSH ($\mu\text{g/mg}$ protein)	MDA (nmol/mg protein)
I	Normal Control (0.5% CMC)	12.84 $\pm$ 0.41	58.36 $\pm$ 1.72	8.92 $\pm$ 0.24	2.14 $\pm$ 0.11
II	Disease Control (Scopolamine 1 mg/kg)	6.25 $\pm$ 0.28	29.84 $\pm$ 1.25	3.76 $\pm$ 0.18	6.82 $\pm$ 0.24
III	Donepezil (3 mg/kg) + Scopolamine	11.96 $\pm$ 0.36***	54.72 $\pm$ 1.61***	8.31 $\pm$ 0.22***	2.58 $\pm$ 0.13***
IV	Argyreia speciosa Extract (200 mg/kg) + Scopolamine	9.42 $\pm$ 0.31**	44.38 $\pm$ 1.48**	6.48 $\pm$ 0.20**	4.12 $\pm$ 0.17**
V	Argyreia speciosa Extract (400 mg/kg) + Scopolamine	11.21 $\pm$ 0.34***	52.16 $\pm$ 1.54***	7.95 $\pm$ 0.23***	2.96 $\pm$ 0.14***

Scopolamine administration significantly reduced the activities of endogenous antioxidant enzymes, namely SOD, CAT, and GSH, while markedly increasing MDA levels, indicating enhanced oxidative stress and lipid peroxidation in brain tissue. Treatment with donepezil significantly restored antioxidant status and reduced MDA levels. Argyreia speciosa extract produced dose-dependent neuroprotective effects, with the 400 mg/kg dose showing near-normalization of antioxidant parameters and a marked reduction in lipid peroxidation, comparable to the standard drug donepezil. These findings suggest significant antioxidant and neuroprotective potential of Argyreia speciosa against scopolamine-induced oxidative damage associated with Alzheimer's disease.



III. RESULTS AND DISCUSSION

Alzheimer's disease is characterized by progressive cognitive decline associated with cholinergic dysfunction, oxidative stress, and neuronal degeneration. In the present study, scopolamine administration successfully induced Alzheimer's-like cognitive impairment, as evidenced by deficits in behavioral parameters and alterations in biochemical markers. Scopolamine, a muscarinic receptor antagonist, impairs cholinergic neurotransmission and produces memory deficits that closely resemble those observed in Alzheimer's disease. In the Morris Water Maze, Y-Maze, and Elevated Plus Maze tests, the disease control group exhibited significant impairment in learning, memory retention, and spatial working memory compared with the normal control group. Increased escape latency in the Morris Water Maze, decreased spontaneous alternation behavior in the Y-Maze, and prolonged retention transfer latency in the Elevated Plus Maze confirmed the induction of cognitive dysfunction by scopolamine. Treatment with Argyreia speciosa extract significantly improved performance in all behavioral paradigms in a dose-dependent manner. The higher dose (400 mg/kg) produced effects comparable to the standard drug donepezil, suggesting a marked improvement in learning and memory processes.

Acetylcholine plays a crucial role in cognition, learning, and memory. Elevated acetylcholinesterase (AChE) activity in the disease control group indicated enhanced breakdown of acetylcholine and impairment of cholinergic neurotransmission. Donepezil, a well-known AChE inhibitor, significantly reduced AChE activity. Similarly, Argyreia speciosa extract significantly decreased brain AChE activity, particularly at the dose of 400 mg/kg. This finding suggests that the memory-enhancing effect of the extract may be mediated through preservation of acetylcholine levels and improvement of cholinergic function. Oxidative stress is considered a major contributor to the pathogenesis of Alzheimer's disease. The disease control group showed a marked

reduction in endogenous antioxidant defenses, including superoxide dismutase (SOD), catalase (CAT), and reduced glutathione (GSH), along with a significant increase in malondialdehyde (MDA), a marker of lipid peroxidation. These observations indicate excessive production of reactive oxygen species and oxidative damage to neuronal membranes. Administration of *Argyrea speciosa* extract significantly restored SOD, CAT, and GSH levels while reducing MDA concentrations. The antioxidant effect was dose-dependent and comparable to donepezil at the higher dose.

The neuroprotective activity of *Argyrea speciosa* may be attributed to its rich phytochemical composition, including flavonoids, phenolic compounds, alkaloids, glycosides, and triterpenoids. Flavonoids and phenolic constituents are known to possess potent free-radical scavenging properties, inhibit lipid peroxidation, and protect neuronal cells against oxidative damage. These compounds may also enhance synaptic plasticity, improve cerebral antioxidant status, and modulate neurotransmitter systems involved in memory formation. The present study demonstrates that *Argyrea speciosa* possesses significant anti-Alzheimer and neuroprotective activity against scopolamine-induced cognitive deficits. The observed effects are likely mediated through inhibition of acetylcholinesterase activity, enhancement of cholinergic neurotransmission, attenuation of oxidative stress, and restoration of endogenous antioxidant defense mechanisms. The higher dose of *Argyrea speciosa* (400 mg/kg) exhibited greater efficacy and produced results comparable to the standard drug donepezil. Therefore, the results suggest that *Argyrea speciosa* may serve as a promising natural therapeutic agent for the management of Alzheimer's disease and other neurodegenerative disorders associated with memory impairment and oxidative stress. Further studies involving detailed molecular mechanisms, isolation of active constituents, and long-term evaluations are warranted to confirm its therapeutic potential.

CONCLUSION

The present study demonstrated that *Argyrea speciosa* extract possesses significant anti-Alzheimer and neuroprotective activity against scopolamine-induced cognitive impairment in experimental animals. Scopolamine administration produced marked deficits in learning, memory, and spatial cognition, along with increased acetylcholinesterase (AChE) activity and oxidative stress, as evidenced by decreased levels of superoxide dismutase (SOD), catalase (CAT), and reduced glutathione (GSH), and increased malondialdehyde (MDA) levels. Treatment with *Argyrea speciosa* extract significantly improved cognitive performance in the Morris Water Maze, Y-Maze, and Elevated Plus Maze tests in a dose-dependent manner. The extract also reduced AChE activity and restored antioxidant enzyme levels while decreasing lipid peroxidation. Among the tested doses, 400 mg/kg exhibited superior efficacy and produced effects comparable to the standard drug donepezil. The neuroprotective effects of *Argyrea speciosa* may be attributed to its cholinesterase inhibitory and antioxidant properties, which help preserve cholinergic neurotransmission and protect neuronal cells from oxidative damage. Therefore, *Argyrea speciosa* represents a promising natural therapeutic candidate for the prevention and management of Alzheimer's disease and other memory-related neurodegenerative disorders. Further studies are required to isolate the active phytoconstituents and elucidate the precise molecular mechanisms underlying its neuroprotective effects.

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