Int. J. Sci. R. Tech., 2025 2(11)
A Multidisciplinary peer-reviewed Journal
www.ijsrtjournal.com [ISSN: 2394-7063]

Original Article

Overview on the Recent in Pharmacological Profile of *Terminalia Catappa*

Suvarna Borade*, Ghule U. V., Dr. V. A. Kashid, Fiza Shaikh, Mayur Vare, Darshan Pagar, Pratik Pagar, Yash Gavande

MABD Institute of Pharmaceutical Education & Research, Babhulgaon Yeola (423401) Maharashtra

ABSTRACT

The Terminalia catappa Linn, a well-known plant in the Ayurvedic medical system, is a member of the Combretaceae family and is also referred to as Deshi badam. Young leaf juice is used internally to treat headaches and colic, as well as to make ointments for scabies and leprosy. The flavonoids apigenin 6-c-(-galloyl)-L-D-glycoside, apigenin 8-c-(2-galloyl)-L-D-glycoside, isovitexin, vitexin, isoorienthin, rutin, and tannin, as well as gallic acid, ellagic acid, puricalagin, and punicalin, have been shown to have high antioxidant properties. The antidiabetic potential of T. catappa fruits has been studied in relation to serum parameters and fasting sugar levels. The extract of T. catappa leaves and fruits has been shown in an increasing number of pharmacological studies to have anticancer, antioxidant, anti-HIV transcriptase, anti-inflammatory, antidiabetic, and hepatoprotective properties; however, the active ingredients and associated mechanisms are still unknown. Data from our lab recently showed that the ethanol extract of T. catappa leaves contained a chloroform fraction.

Keywords: Anti metastatic, Antioxidant, Hepatoprotective, Catappa leaves

INTRODUCTION

The leaves of the Combretaceae plant Terminalia catappa L. are commonly used in Southeast Asian traditional medicine to treat hepatitis and dermatosis. Tropical almonds (Terminalia catappa) are a large, spreading tree that can withstand strong winds, salt spray, and moderate salinity in the rhizosphere. They are found all over the world, from Indo-Malesia to Australia. Because of its vast fibrous root system, it plays an important ecological role in coastal stabilisation and prefers well-drained, aerated sandy soils. Terminalia catappa has significant ecological and commercial value. Its timber is prized as a long-lasting and aesthetically pleasing hardwood that may be used for furniture and interior building. It is grown for shade, ornamentation, and tasty nuts. Usually starting around age three, fruiting yields tasty and nutritious seeds that are eaten after being extracted. According to phytochemical research, the leaves' wide range of pharmacological actions are attributed to their abundance of flavonoids, tannins, saponins, alkaloids, and phenolic chemicals. Numerous studies have shown that T. catappa has antibacterial, antioxidant, and anti-inflammatory hepatoprotective, antidiabetic, and anticancer properties, Recent pharmacological studies have confirmed the multifunctional therapeutic effects of the plant, validating many of its traditional uses. Due to its rich phytochemicals profile and wide rang of biological activities, terminalia catappa represents a valuable candidate for further research in pharmaceutical and clinical application. The scientific names Phytolacca javanica osbeck, Terminalia Mauritian blanco, and Terminalia maluccana lamk are not preferred. Roxb Terminalia provera. Alite (Solomon Islands pidgin) is a common name. Societies: autaraa, aua, auarii, auari, and iraa (Cooks: mangaia) kamani haole, kamani, ula, fake kamani (Hawaii), kauariki, kaukauariki, and taraire Tropical, beach, or Indian almond (English) natapoa (Vanuatu: Bislama) Talie (Samoa) The fruit contains a lot of tannic acid, which can discolour sidewalks, pavement, and automobiles. Additionally, it leaves a lot of debris on the ground [3].

Botanical profile: -

Family: Combretaceae

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Common names: include Indian almond, tropical almond, Malayalam's Badam, Hindi's Jangli Badam, and Tamil's Nattuvadumai. Widely distributed throughout tropical Asia, Africa, and coastal areas from North Australia and Polynesia to Malaysia

Conventional applications:

The Indian almond, or *Terminalia* catappa (Combretaceae), has long been used as an antidiabetic.
Terminalia catappa has been utilized as an Antioxidant
Terminalia catappa has been utilized as an hepatoprotective
Terminalia catappa has been utilized as an Anti-inflammatory
Terminalia catappa has been utilized as an Anti-cancer agent

The fact that T. catappa L. extracts has been previously reported to reduce the wound healing properties in rats when applied as a component of topical wound healing treatments. The ethanol extract of T. catappa L. leaves demonstrated antifungal and anti-inflammatory properties in animal models.

Bioactive constituents:

The study found that the leaves of Terminalia catappa L. contained terpenoids, alkaloids, tannins, steroids, cardiac glycosides, flavonoids, phenols, saponins, and coumarins [5]. Additionally, the leaves contained punicalagin, gallic acid, and an iso vitexine derivative. Chemical characterization of the phenolic-rich extracts of T. catappa also identified eleven chemical constituents, including gallic acid, catechin, chlorogenic acid, caffeic acid, ellagic acid, epicatechin, rutin, quercitrin, quercetin, and kaempferol. In addition, the leaf and stem bark revealed eight chemical constituents, including resveratrol, gallic acid, catechin, caffeic acid, ellagic acid, rutin, quercetin, quercetin, and phenolic compounds Respectively

Phytochemistry: -

The following describes the pharmacological bioactivity of a few of the identified phytochemicals in T. catappa:

Chebulagic Acid:

It is benzopyran tannin, which has been described as having hepatoprotective, antioxidant, and immunosuppressive properties. It exhibits antagonistic activity against both candida albicans and Staphylococcus aureus. Terminalia chebula and Terminalia catappa contain it.

Gallic acid:

One well-known antioxidant phenolic compound is gallic acid. It produces protective activity against cardiovascular diseases by inhibiting lipid peroxidation and increasing antioxidant enzymes. Gallic acid is a naturally occurring additive used in bio-based high-density polyethylene.

Quercetin: -

Because of its anti-inflammatory and antioxidant properties, this plant pigment has been employed extensively in medicine. It helps prevent heart disease, lower inflammation, kill cancer cells, and regulate blood sugar levels.

Oleanoic Acid:

It is a pentacyclic triterpene found in nature. It has anti-inflammatory and anti-asthmatic properties when bound with zinc metal. Both antibacterial and anticancer properties against prostate cancer are demonstrated.

Geraniin:

Geraniin has cytoprotective, immunomodulatory, antioxidant, antibacterial, anticancer, and analgesic qualities. Both metabolic dysregulation and cardiovascular disease are treated with it

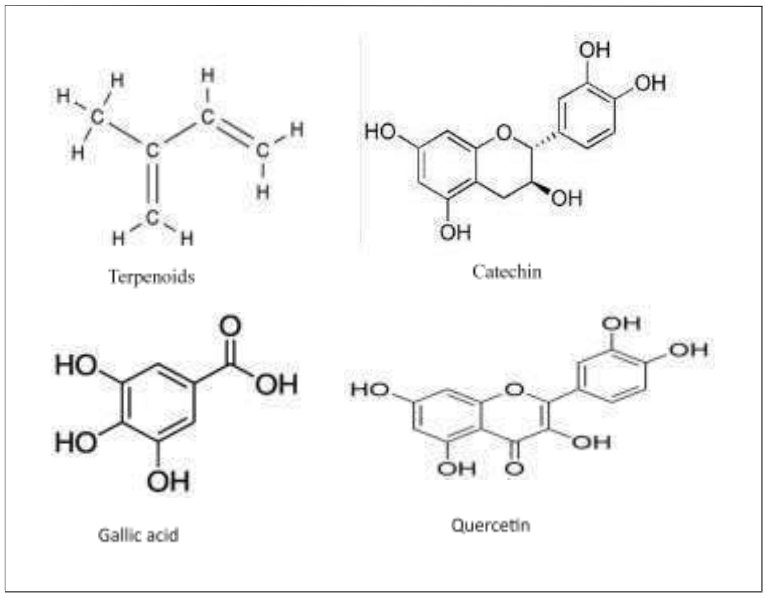

Fig.01: Chemical constituents of *terminalia* catappa L.

Description of the plant: -

Fig.No.02: Leaves of *terminalia* catappa L

Fig.No.03: *Terminalia* catappa L. tree

MATERIAL AND METHODS: -

MATERIAL:

Ternimalia catappa (Indian almond) young (green) and mature (red) leaves were gathered. Buy directly from farmers or from specialty stores or internet merchants like Amazon.in.

Variety: There are other varieties, such as "oxidized" or "fermented" leaves, which contain less oil and more tannin. Getting the extracts and fraction ready: Using n-butanol, chloroform, acetone, petroleum ether, and water, the air-dried powdered young (green) and mature (red) leaves of T. Catappa (5g) were extracted for 1218 hours using a mechanical shaker. A sonicator was used to concentrate the resulting extracts. After filtering the crude n-butanol, chloroform, acetone, petroleum ether, and aqueous extracts, the fractions were utilized for additional analysis.

Macroscopic Description:

The Terminalia catappa was the topic of macroscopic investigations that included the drug's organoleptic properties, such as its color, taste, odor, and size. These metrics were assessed in accordance with normal WHO guidelines and are thought to be helpful in crude drug quality control.

Microscopic Description:

Safranin and quick green were used to stain free hand transverse sections of the leaves. Afterwards, their unusual characteristics were examined with a

compound microscope (Lawrence & Mayo-LM-52-1602) and a phase contrast microscope (Lawrence & Mayo-LM-52-1802).

Powder characteristics: -

According to published procedures, a preliminary analysis of the powdered young and mature leaves using various chemical reagents and microscopical observation was conducted (Lyengar and Nayak, 2008; Iyengar 1997). A compound and phase contrast microscope was used to examine the properties of the powder. Initial phytochemical analysis: To identify the various phytoconstituents in the powered crude medication, qualitative chemical tests were conducted. Alkaloids' presence Standard qualitative techniques were used to test for flavonoids, cardiac glycosides, anthronal glycosides, phenols, saponins, sterols, triterpenoids, tannins, hydrolyzable tannins, carbohydrates, starch, and proteins.

Pharmacological Activities: -

Antimicrobial Activity: -

Both Gram-positive and Gram-negative bacteria are strongly inhibited by the methanoloic and chloroform extracts. Staphylococcus aureus and Escherichia coli are susceptible to the antibacterial effects of T. catappa root extract in chloroform.

Analgesic, modulatory, and anti-inflammatory properties:

Ethanolic leaf extracts of T. catappa exhibit an anti-inflammatory effect on 12-O-tetradecanoylphorbol-13-acetate (TPA)-induced ear edema in both acute and chronic animal models. The T. catappa distilled water active fraction, a novel fetal hemoglobin-inducing chemical that works in tandem with other substances and has been demonstrated to have a dual modulatory effect on intrinsic erythropoiesis, was isolated from T. catappa leaves. It has been demonstrated that tender leaf extract has anti-inflammatory and analgesic effects without disrupting the estrous cycle. Furthermore, the dosage does not cause drowsiness.

Antidiabetic Activity:

Now a days, Diabetes is more common problem found in both developed and developing countries. To overcome this problem medicinal plants with their antidiabetic potential have long been established. Fresh aqueous extract pf T. catappa leaves is proven to decrease the high blood glucose level in a dose-dependent manner. It also shows inhibitory activity on alpha-amylase as well as alpha-glucosidase enzymes, up to 54.04% and 73.2%, respectively. Extracts of dry leaves and fruits of T. Catappa are proven to help maintain cholesterol level. It is studied that chebulic acid presented in methanolic extract of T. catappa shows preventive effect diabetes mellitus condition.

Wound-healing Activity:

The loss or disruption of a live tissue's cellular and functional capacity is called a wound. The development of synthetic antimicrobial medicines to treat wounds was slowed down by medication toxicity and resistance. A number of plants with potent pharmacological properties might provide more healthful alternatives for wound care. It has been suggested that applying T. catappa ointment to a wound result in a 97% reduction in the wound area when compared to the control (81%) and the conventional medication, betadine ointment. The fact that T. catappa ointment causes epithelization more quickly indicates that the bark extracts have a significant wound-healing effect.

Antiaging activity:

T. catappa decreased the synthesis of Mmmp-1, -3, and -9 by blocking the activation of ERK, JNK, and p38. As a result, it can be used as an anti-aging agent.

Toxicological and safety profile:

Given the unpredictability of herbal product consumption, it is impossible to ignore the possibility of organ toxicity, including hepatotoxicity and nephrotoxicity. Toxicological profiles of plant extracts are essential for testing possible in vivo harm to living organisms and research into the most effective applications for them. These toxicity tests are generally crucial for assessing the degree of danger in biological systems. examined Terminalia catappa aqueous leaf extract's (TCA) oral toxicity in male wistar rats.

Anti-oxidant Activity:

An essential component of many foods is antioxidants. An important factor in aging-related phenomena is oxidative stress. At a concentration of 8.2 µg/mL, T. catappa leaf extracts exhibit potent antioxidative and free-radical scavenging activity using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay. The antioxidant properties of T. catappa L. methanolic extract have been investigated in relation to oxidative damage caused by hydrogen peroxide. Because of its antioxidant qualities, T. catappa extract is used to stop human fibroblasts from aging their skin due to oxidative stress. Through the use of phytochemical constituents like the reducing power assay, DPPH assay, and punicalin and nitric oxide assay, it has been discovered that T. catappa exhibits dose-dependent antioxidant properties.

Anti-inflammatory Activity:

Many medicinal plants have been used to treat inflammatory diseases since ancient times. It has been demonstrated that T. catappa has anti-inflammatory and anti-dysfunctional properties. Rats with colitis are treated with T. catappa stem bark extract (25, 50, and 100 mg/kg/day), which alters gene expression-regulated proteins and produces villin, ursolic acid, and numerous phytochemicals that have been shown to have anti-inflammatory properties.

Anticancer Activity:

According to an analysis of global cancer statistics, cancer accounts for 65% of all recorded deaths worldwide. "Tumor formation" is the term used to describe the damage caused by the growth and ongoing division of abnormal cells. It has been found that superficial CO3 leaf extracts of T. catappa can be used to control mutagenic activity. Additionally, it has been shown that oral administration of T. Catappa ethanol extract at doses of 50–200 mg/kg reduces tumor mass, lengthens patient life, and promotes peritoneal cell growth. Extracts from T. leaves. Punicalagin and tannin, two of catappa's main phytochemical constituents, are crucial for both cancer treatment and gene mutation control. T. Catappa extract has antimetastatic properties that help treat cervical cancer by blocking matrix metalloproteinase-9's mRNA level.

Hepatoprotective activity:

The majority of toxins that enter the body target the liver, which is the body's metabolic super achiever. It is essential for changing and getting rid of other chemicals and toxicants. The trustworthy liver-protective medications are clearly inadequate. The search for novel treatments has always been guided by conventional knowledge of medicinal plants. T. catappa reverses the activity of alanine aminotransferase (ALT) and inhibits the overexpression of the interleukin-6 (IL-6) gene in the liver of mice induced by chemokine 9C-C motif ligand 4 (CC14). Additionally, pretreatment with T. catappa effectively reduces histological changes in injured mice, such as hepatocyte swelling and the infiltration of multiple inflammatory cells.

Anti-fungal Activity:

Water was used to dissolve ground dried Indian almond leaves. The resulting activities against tilapia pathogens were measured using a range of concentrations of this solution. The findings showed that at 800 ppm, fish ectoparasites called trichodina were eliminated. At a concentration of 0.5 mg/ml Indian almond leaves upward, the growth of two strains of Aeromonas hydrophila was also inhibited. Additionally, this remedy can lessen fungal infections.

ACE inhibitory activity:

Brazilian plants' possible antihypertensive properties were assessed in vitro by their capacity to due to their widespread use as diuretics and/or antihypertensives. There were notable ACE inhibition rates in Terminalia catappa.

FEATURES SCOPE: -

Fishkeeping and Aquaculture:

This is the most common application, especially for shrimp from betta fish. and additional species of sort-water. They increase the health and survival rates of fish. Improve the coloration

Conventional medicine:

Throughout Asia and the tropics, traditional medicine has utilized the tree's parts, particularly its leaves, to treat conditions like diarrhea, dysentery, liver infections, inflammation, and skin disorders.

Reducing Stress:

By simulating their natural, dark habitats, the tannins' release darkens the water, giving fish that are apprehensive or anxious a sense of security and comfort.

Research on Pharmaceuticals:

Because of their rich phytochemical composition, extracts are being researched for their potential to create novel therapeutic agents that are anti-aging, anti-cancer, anti-diabetic, and antioxidant.

Synthesis of nanomaterials:

In green chemistry techniques, leaf extract is utilized as a bio-reducing agent to create nanoparticles.

Table 1: Ethnomedical uses T. catappa

Meditional uses	Extract [used]	Parts [used]	References
Antimicrobial	Chloroform and methanol	Roots	Pawar and Pal, 2002
Antimicrobial	Aqueous and methanol	Fruit	Nair and Chanda, 2008
Antibacterial	Aqueous	Leaves	Taganna et al. 2011
Anti-inflammatory	Ethanol	Leaves	Fan et al. 2004
Modulatory	Methanol	Leaves	Aimola et al. 2014
Analgesic	Ethanol	Leaves	Ratnasooriya et al. 2002
Wound healing	Chloroform	Leaves	Khan et al. 2013
Antidiabetic	Aqueous,	Fruit	Nagappa et al. 2003
Antidiabetic	methanol, and petroleum ether	Bark	Ahmed, 2005
Antioxidant	Aqueous and cold	Fruit	Liu et al. 1996
Anti-hepatotoxic	Aqueous	Leaves	Lin et al. 1997
Radical scavenging	Aqueous	Leaves	Lin et al. 2001
Antioxidant	Aqueous	Leaves	Lin et al. 2001
Hepato protective	Aqueous	Leaves	Gao et al. 2004
Antimoitochodrial	Chloroform	Leaves	Tang et al. 2004
Swelling	Aqueous	Leaves	Tang et al. 2004
Radical scavenging	Chloroform	Leaves	Tang et al. 2006
Activity	Chloroform	Leaves	Kinoshita et al. 2007
Hepato protective	Aqueous	Leaves	Ko et al. 2002
Hepato protective	CO2	Leaves	Chen et al. 2000
Anticancer	Aqueous	Cleaves	Yeh et al. 2012
Antimutagen	Ethanol	Leaves	Pandya et al. 2013
Anticancer	Ethanol	Leaves	Yang et al. 2010
Anticancer	Ethanol	Leaves	Wen et al. 2011
Anticancer	Aqueous	Leaves/seed	Lin et al. 2001
Anti-aging	Aqueous	Leaves	Lin et al. 2001

Neutritional value: -

Kernels:

The most concentrated source of fats, proteins, essential amina acids, and minerals.

Leaves:

Good for energy and nutrients, containing high levels of minerals like magnesium, phosphorus, iron, and potassium.

Flower:

Nectar from the flowers provides several essential amino acids, such as threonine, arginine, and lysine.

Evaluation Parameterse: -

1. Botanical Evaluation:

1. Scientific classification: Kingdom, family, genus, species.
2. Synonyms and common names: Local and vernacular name [e.g deshi badam]
3. Microscopic features: Anatomical details like trichomes, stomata, vascular bundles, etc
4. Morphological characteristics: Description of leaves, bark, fruits, and seeds.

2. Phytochemical Evaluation:

1. Extraction methods: solvent used (aqueous, ethanolic methanolic)
2. Qualitative phytochemical screening: presence of tannins, flavonoids, saponins, glycosides, alkaloids, etc
3. Quantitative estimation: determination of total phenolic and flavoid content

3. Pharmacological Evaluation:

1. In-vitro studies: Antioxidant, antimicrobial, anticancer, or enzyme inhibition tests
2. In-vivo studies: Animal models for hepatoprotective, anti-inflammatory
3. Toxocplogical studies: Acute and sub-chronic toxicity testing for safety evalution

4 Industrial formulation evaluation:

1. Cosmetic or pharmaceutical formulation: Use in creams, ointment, or capsules.
2. Stability and shelf-life studies: Assessment of extract or formulation stability.
3. Patent and commercialization status: Registered patents or marketed products.

CONCLUSION: -

This study emphasizes Terminala catappa L.'s pharmacological properties, phytochemical composition, and ethnomedical uses. Significant antibacterial, hepatoprotective, hypoglycemic, antioxidant, chemo preventive, ACE inhibitory, anti-inflammatory, antiparasitic, and antifungal properties have been shown by extensive research on the plant's major bioactive compound and its various parts. These pharmacological results highlight T's potential for therapeutic use. catappa. To completely clarify its effectiveness and safety in the prevention and treatment of human diseases, more thorough research is necessary, including clinical studies and mechanism-based assessments.

REFERENCE

1. Lin, C.C., Chen, Y.L., Lin, J.M., Ujiie, T.: Am J ChinMed, 25(2): 153–161(1997[2]
2. https://www.bing.com/search?q=Terminalia+catappa+family+common+names+distribution+traditional+uses&safeSearch=strict&form=METAWA
3. Shinde, V., Dhalwal, K., Mahadik, K.R.: Pharmacologyonline News Letter 2: 1-11 (2007)
4. Gilman, E.F., Watson, D.G.: "Terminalia catappa. Tropical-Almond1" Fact Sheet ST-626 (1994).
5. catappa leaves antifungal activity - Google Scholar https://share.google/ummMIBOZhRyuvvpik
6. A review on medicinal potential of Terminalia catappa July 2020 International Journal of Green Pharmacy 14
7. Wang X, Taufek NM, Arshad NM. Recent advances of Terminalia catappa and its application in fish culture: A review. Rev Aquac. 2024;16(4):1741-65.
8. Yakubu Y, Lee SY, Shaari K. Chemical profiles of Terminalia catappa Linn nut and Terminalia sub spathulata King fruit. Pertanika J Trop Agric Sci. 2021;44(4):795-8236.
9. Hamada SI, Kataoka T, Woo JT, Yamada A, Yoshida T, Nishimura T, et al. Immunosuppressive effects of gallic acid and chebulagic acid on CTL-mediated cytotoxicity. Biol Pharm Bull 1997; 20:1017-9.
10. Kinoshita S, Inoue Y, Nakama S, Ichiba T, Aniya Y. Antioxidant and hepatoprotective actions of medicinal herb, Terminalia catappa L. From Okinawa Island and its tannin corilagin. Phytomedicine 2007; 14:755-62.
11. Nagappa AN, Thakurdesai PA, Rao NV, Singh J. Antidiabetic activity of Terminalia catappa Linn fruits. J Ethnopharmacol 2003; 88:45-50.9.
12. Cunha LC, Silva ML, Furtado NA, Vinhólis AH, Martins CH, Filho AA, et al. Antibacterial activity of triterpene acids and semi-synthetic derivatives against oral pathogens. Z Naturforsch C J Biosci 2007; 62:668-72.

13. Yamada H, Wakamori S, Hirokane T, Ikeuchi K, Matsumoto S. Structural revisions in natural ellagitannins. Molecules 2018; 23:1901
14. Thomson LA, Evans B. Terminalia catappa (tropical almond). PIAS. 2016;2(2):1-20.
15. Tropical almond (Terminalia catappa): A holistic review PMChttps://pmc.ncbi.nlm.nih.gov/articles/PMC11750476/
16. As a library, NLM provides access to scientific literaturehttps://pmc.ncbi.nlm.nih.gov/articles/PMC7398001/
17. https://www.pharmatutor.org/articles/evaluation-crude-drugs-mono-polyherbal-formulation
18. https://pmc.ncbi.nlm.nih.gov/articles/PMC3614203/
19. Anand A, Divya N, Kotti P. An updated review of Terminalia catappa. Pharmacogn Rev. 2015;9(18):93.3. Mohale DS, Dewani AP, Chandewar AV, Khadse CD, Tripathi AS, Agrawal SS. Brief review on medicinal potential of Terminalia catappa. J Herb Med Toxicol. 2009;3(1):7-11.
20. Lee CY, Yang SF, Wang PH, Su CW, Hsu HF, Tsai HT, et al. Antimetastatic effects of Terminalia catappa leaf extracts on cervical cancer through the inhibition of matrix metalloprotein-9 and MAPK pathway. Environ toxicol 2019; 34:60-6
21. Anand AV, Divya N, Kotti PP. An updated review of Terminalia catappa. Pharmacogn Rev 2015; 9:93-8
22. https://www.researchgate.net/publication/281459614_An_updated_review_of_Terminalia_catappa
23. Ko TF, Weng YM, Chiou RY. Squalene content and antioxidant activity of Terminalia catappa leaves and seeds. J Agric Food Chem 2002; 50:5343-8.
24. Huang YH, Wu PY, Wen KC, Lin CY, Chiang HM. Protective effects and mechanisms of Terminalia catappa L. Methenolic extract on hydrogen-peroxide induced oxidative stress in human skin fibroblasts. BMC Complement Altern Med 2018; 18:266
25. Gao J, Tang X, Dou H, Fan Y, Zhao X, Xu Q. Hepatoprotective activity of Terminalia catappa L. Leaves and its.two triterpenoids. J Pharm Pharmacol2004; 56:1449-55
26. Abiodun OO, Rodríguez-Nogales A, Algieri F, Gomez-Caravaca AM, Segura-Carretero A, Utrilla MP, et al. Anti-inflammatory and immunomodulatory activity of an ethanolic extract from the stem bark of Terminalia catappa L. (Combretaceae): In vitro and in vivo evidences. J Ethnopharmacol 2016; 192:309-19.
27. Lee CY, Yang SF, Wang PH, Su CW, Hsu HF, Tsai HT, et al. Antimetastatic effects of Terminalia catappaL extracts on cervical cancer through the inhibition of matrix metalloprotein-9 and MAPK pathway. Environ Toxicol 2019; 34:60-6
28. Norazmir MN Jr, Ayub MY. Beneficial lipid-lowering effects of pink guava puree in high fat diet induced-. obese rats. Malays J Nutr 2010; 16:171-85
29. Trivedi N, Rawal UM. Hepatoprotective and toxicological evaluation of Andrographis paniculata on severe liver damage. Indian J Pharmacol 2000; 32:288-93.
30. Tang XH, Gao J, Dou H, Wang YP, Xu LZ, Zhu ZR, et al. Protective effect of the extract of Terminalia catappa leaves on acute liver injury induced by D-GalN in mice. Zhongguo Zhong Yao Za Zhi 2004; 29:1069-73.

HOW TO CITE: Suvarna Borade*, Ghule U. V., Dr. V. A. Kashid, Fiza Shaikh, Mayur Vare, Darshan Pagar, Pratik Pagar, Yash Gavande, Overview on the Recent in Pharmacological Profile of Terminalia Catappa, Int. J. Sci. R. Tech., 2025, 2 (11), 747-754. https://doi.org/10.5281/zenodo.17741044