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Review Article

Pharmacognostic Insights into Muntingia calabura with Emphasis on its Micromorphology, Phytochemistry, Traditional and Pharmacological Uses

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ABSTRACT

Muntingia calabura (Jamaican cherry) is a fast-growing tropical tree which is medicinal in multiple cultures. Overall pharmacognostic features of the plant including calcium oxalate crystals, anisocytic stomata and characteristic trichomes are reported in this review. The claimed antioxidant, anti-inflammatory, antidiabetic, antibacterial, anticancer and hepatoprotective roles of the plant are ascribed to the presence of high level of bioactive compounds through flavonoids such as quercetin and rutin, phenolics, saponins and tannins. Many in vitro and in vivo studies have also confirmed these pharmacological effects. Particle microscopy and physicochemical studies serve to verify the identification and quality control of this raw material. Although efficacy data in humans are scant, animal studies demonstrate a wide margin of safety. We are encouraged with the potential of M. calabura as herbal drugs because it has a wide traditional medicinal use and pharmacological activities. Its clinical uses need to be confirmed and expanded by further standardization, chemical isolation, mechanism analysis, and clinical trials.

INTRODUCTION

In this century, unparalleled medicinal inventions have been achieved to resolve incalculable diseases, including cancer and AIDS. However, the majority of research studies have been carried out worldwide to combat recently identified illnesses. As a result, we no longer remember our

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traditional medical systems, including Siddha, Ayurveda, and Unani [1].

Even though synthetic medications like steroids and antibiotics, and modern surgical techniques act more quickly and provide immediate relief, they can have fatal side effects. Additionally, taking antibiotics and various painkillers on a frequent basis might cause the liver to generate hazardous substances. Compared to humans today, ancient people lived longer due to their lifestyle, which was entirely reliant on the natural world. Herbal remedies, which are consumed as food rather than as medication or drugs, have historically been used to treat life-threatening illnesses. Because they stop the oxidative damage caused by free radicals, phytochemicals found in fruits and vegetables may lower the risk of a number of diseases [2].

The number of patients pursuing herbal and alternative therapies is rapidly increasing. The developing world is increasingly using herbal medications for primary healthcare, not just because they are less expensive but also because of their cultural acceptability, improved bodily compatibility, and low side effects [1,2].

The *Muntingia Calabura* (Jamaica cherry) is a member of the Muntingiacae family. Around the world, it is extensively cultivated in tropical and subtropical regions. The Jamaica cherry tree grows quickly and is modest. The plant has long been used to lessen stomach ulcer pain. the appearance of numerous infectious and non-infectious illness types. Its numerous pharmacological properties, including anti-inflammatory, antipyretic, antiulcer, anti-diabetic, anti-hypertensive, cardioprotective, antibacterial, insecticidal, and antioxidant properties, have been demonstrated [3].

This study intends to explore *Muntingia calabura*'s medicinal potential, emphasizing its therapeutic applications and prospects in contemporary healthcare, given its broad pharmacological profile and historic usage.

1. Plant Profile:

1.1. Vernacular name [4,5]:

English	Singapore cherry, Jamaican cherry
hindi	Singapore cherry
Brazil	Calabura
Indonesia	Kersen
Kannada	Gasagase Hannu
Tamil	Pachchai Pazham
Telugu	Pachchayi Pandu
Malayalam	Pazhampazham
Bengali	Tuti-fruti

1.2. Taxonomical classification [3]:

1. Kingdom- Plantae
2. Phylum- Spermatophyte
3. Subphylum- Angiospermae
4. Domain- Eukaryote
5. Class- Dicotyledonae
6. Order- Malvales
7. Family- Muntingiaceae
8. Genus- *Muntingia*
9. Species- *calabura*

1.3. Origin and Distribution [4]:

Southern Mexico, Central America, portions of tropical South America, and the Caribbean are the native habitats of *Muntingia calabura*. Since then, the plant has spread far and been naturalized in tropical areas including the Philippines, India, and Southeast Asia, where it is sometimes confused for native. Dr. David Fairchild collected seeds from a yellow-fruited cultivar that was first brought to Ceylon about 1912. Although cultivation has decreased, it was later grown in South Florida for its fruit and as a shade tree that grows quickly. The tree is utilized in reforestation when other species

fail because it grows well in a variety of settings, including contaminated metropolitan areas like Metro Manila. Its little fruits have no commercial value in Brazil, although they are marketed in Mexican markets. Because fruit bats consume the tree and make a mess around houses, it is occasionally regarded as a nuisance in Malaysia.

1.4. Morphological characteristics [3,6]:

Muntingia calabura is a fast-growing annual tree that can grow up to 12–15 m tall with spreading branches. It flowers all year long.

Leaves: The evergreen leaves of *Muntingia calabura* are oblong-ovate or lanceolate in form and range in length from 5 to 12.5 cm. In *Muntingia calabura*, the vascular supply extends to the leaf, its solitary stipule, the extra-axillary bud, and the supra-axillary peduncles. Each leaf trace is composed of a median and two lateral bundles, with a trilocular node. The two laterals separate from the axial stele and then travel in different directions through the cortex until they meet at the base of the median to produce the petiolar trace. While the other lateral does not branch and stipule production is suppressed on this side of the axis, one of the laterals releases a branch that creates the trace of a single stipule as it travels into the cortex. Therefore, the branching of the lateral trace bundle seems to be intrinsically related to the formation of stipules.

Bark: The thin, greyish-brown bark can be smooth or have little cracks in it.

Flowers: *Muntingia calabura* flowers have five green sepals, five white petals, and a number of prominent yellow stamens that only last for one day. The petals drop in the afternoon. The flowers are referred to as strawberry trees because they resemble strawberry blooms. Small to medium-sized bees, diurnal moths, butterflies, hoverflies, hummingbirds, and ants are drawn to the bloom due of its slightly pleasant scent. Although flowers are bisexual, there are significant differences in the size of the pistil and the quantity of stamens.

Fruits: Numerous tiny berries, about 1.5 cm in diameter, with a sweet, musky, fig-like flavor and, depending on the type, red or yellow, thin, smooth, and fragile skin and light-brown, soft, juicy flesh.

Seed: very small, whitish seed that is about 0.5 mm long.

1.5. Micromorphological characteristics:

1.5.1. Leaf Histology [7]:

Muntingia calabura leaves have parenchymatous, barrel-shaped epidermal cells with a thin cuticle. The lower epidermis is wavy and contains anisocytic stomata, but the upper epidermis has straight anticlinal walls. Two layers of palisade parenchyma and two layers of spongy mesophyll with collateral vascular bundles make up the lamina in the transverse section. Both surfaces have different trichomes (unicellular, stellate, and glandular) and crystals of calcium oxalate. With numerous layers of collenchyma and parenchyma, collateral vascular bundles, and an abundance of crystals and trichomes, the midrib and petiole have structural similarities.

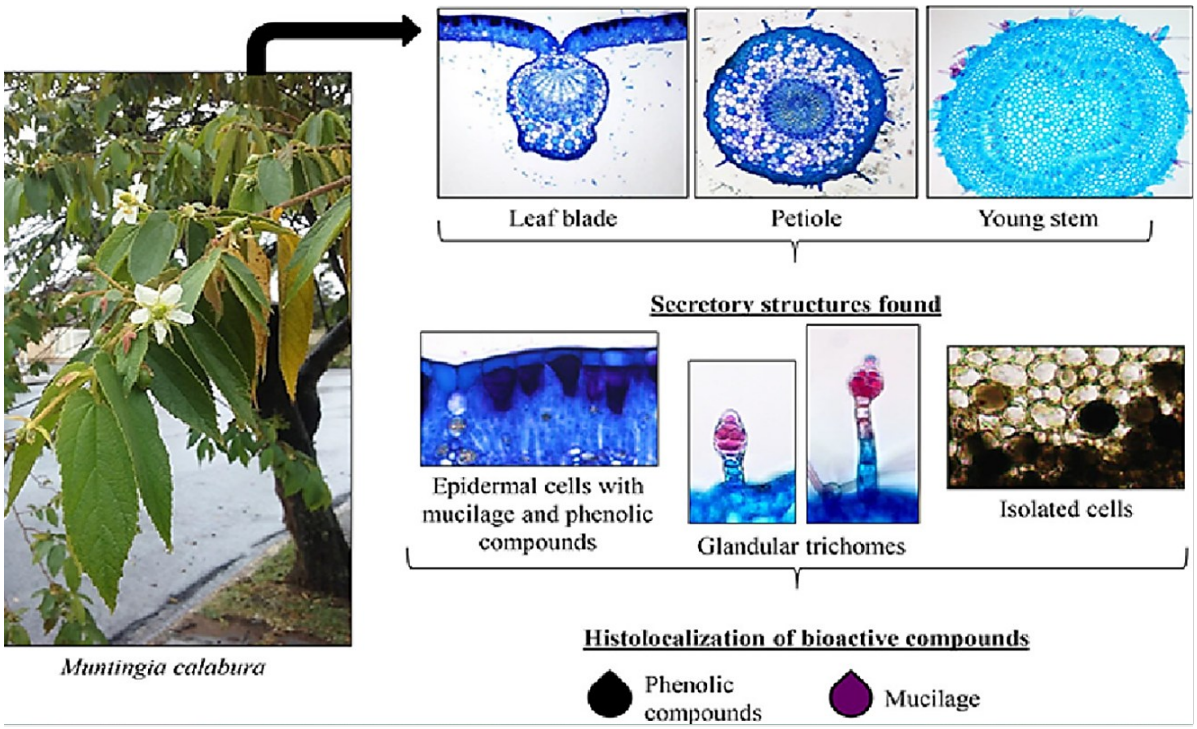

Fig. 1: Histological Characteristics of the Leaf, Petiole, and Stem of *Muntingia calabura* [7]

1.5.2. Stem Histology [8]:

A peripheral vascular system with a parenchymatous cortex and pith is visible in the stem of *Muntingia calabura*. Crystal druses of calcium oxalate are seen in the inner cortex. Both glandular and non-glandular trichomes, which are linked to the release of mucilage and phenolic chemicals, are abundant in the epidermis. These secretory structures are thought to be possible locations for bioactive chemical synthesis.

1.5.3. Root Histology [9]:

Muntingia calabura's root has typical dicotyledonous traits. It has a central vascular cylinder, an endodermis covering a fully formed pericycle, and a multilayered cortex made up of parenchymatous cells. Around the central pith, xylem and phloem alternate, forming a radial arrangement of the vascular tissues. Notably, the root's pharmacological qualities may be influenced by the large amounts of calcium oxalate crystals and starch grains found in the vascular and cortical areas.

1.5.4. Powder Microscopy of *Muntingia calabura* [10]:

Characteristics of *Muntingia calabura* powder include calcium oxalate crystals in large quantities in druse and cluster shapes, as well as pieces of parenchyma and epidermal cells. Anisocytic stomata, unicellular simple and multicellular glandular trichomes, and vascular components such as fibers and vessels with bordered pits are all visible. Additionally, remnants of palisade tissue and starch granules is observed both help to identify and authenticate the plant material.

2. Organoleptic properties of fruit [6,11]:

colour	Ple red, Red, Dark red (fresh) Dark purple (ripe)
Odour	Fruity and fragnant
Taste	Pleasant taste with mildly musky and slightly tangy flavour

3. Physicochemical parameters [11,12]:

Parameter	Typical Values
Moisture content	4-20% (w/w, in dried leaf/fruit powder)
Total ash value	1.8-2.5%
Acid-insoluble ash	0.5-1.5%
Water-soluble ash	3-5%
Alcohol-soluble extractive	14-15%
Water-soluble extractive	1.6-2.5%
Loss on drying (LOD)	2-3%
pH (1% w/v aqueous solution)	5.5-6.5
Foreign organic matter	Not more than 2%

4. Phytochemistry [3]:

Certain chemical compounds found in plants have therapeutic potential because they have a specific physiological effect on humans. The components are either inactive or therapeutically active. The structural components of plants, such as proteins, carbohydrates, and starches, are the inactive ingredients. Nonetheless, the inactive ingredients have medicinal applications. Secondary metabolites such as alkaloids, glycosides, volatile oils, tannins, flavonoids, sterols, and saponins constitute the active ingredients.

They are deposited in the cells and are referred to as secondary metabolites since they are produced from primary products that the plant is unable to repurpose. 56 substances, including furan derivatives, sesquiterpenoids, phenolic compounds, alcohols, and esters, were detected in the fruit extract. Squalene, triglycerides, a combination of palmitic acid, linoleic acid, and α-linolenic acid, as well as a mixture of stigmasterol and β-sitosterol, were all found in the dichloromethane extract of the plant's fruit.

Myrcene, thymol, α terpinol, linalool, geraniol, enrol, citronellol, eugenol, α lonone, β sitosterol, α amyrin, lupeol, α tocopherol, and β carotene are among the volatile chemicals found in the leaf's aqueous extract.

Ascorbic acid, Pyridoxinem, Niacin, Glucose, Fructose, Biotin, Thiamine, Kaempferol, Catechin, Quercetin, Riboflavin, Folic acid, Succinic acid, Malic acid, Cinnamic acid, Gallic acid, Pantothenic acid, and Ascorbic acid were all detected by the LC-MS analysis.

5. Traditional Uses [3]:

Muntingia calabura's various parts have been used to cure a variety of ailments. The flowers are used to treat lower extremity edema and as an antibacterial. When cooked or steeped in water, the leaves are used to treat colds and headaches, as well as to lessen gastric ulcers and prostate gland swelling. In addition to being used as a tonic and tranquilizer, flowers are also used as antispasmodics, anti-dyspeptics, and to cure headaches and colds. Apart from that, Malaysia has utilized *Muntingia calabura* roots as an abortifacient. Extracts from leaves, petals, and bark that have been cooked or soaked in water are used as antiseptics in Peru and to lessen stomach ulcers and prostate gland swelling in South America. It is also thought to relieve colds and headaches. Flowers are believed to be effective in treating headaches and cold symptoms in a few locations in the Philippines. In Colombia, the flowers' infusion is used as a tonic and sedative. In Mexico, the plant is also used to cure measles, stomachaches, and mouth pimples. Additionally, it has been reported to be beneficial as a tranquilizer and antispasmodic. In Vietnam, the plant's roots can also be used as an emmenagogue. The leaf infusion is used as a tea-like beverage, while the fruits are often cooked in tarts or turned into jam.

6. Pharmacological Activities:

- **Antioxidant Activity**: Because of phenolics and flavonoids like quercetin and gallic acid,

fruit extracts exhibit a notable reduction in lipid peroxidation and an increase in nitric oxide radical scavenging capacity [13].

- **Antimicrobial Activity**: Staphylococcus aureus and Escherichia coli were shown to be susceptible to the antibacterial properties of ethyl acetate and leaf aqueous extract [14].
- **Anti-inflammatory Activity:** Strong anti-inflammatory potential was demonstrated by the substantial inhibition of carrageenan-induced paw oedema in rats by methanol extract of leaves [15].
- **Anticancer Activity:** Through the action of flavonoids on the colon tissue, a methanolic extract of leaf extract had a cytotoxic impact against AOM-induced colon cancer, indicating potential anticancer characteristics [16].
- **Antidiabetic Activity:** Ethanol leaf extract demonstrated antidiabetic action by lowering blood glucose levels in mice with Alloxan-induced diabetes [17].
- **Analgesic and Antipyretic Effects:** The leaf's chloroform extract validated its traditional usage for fever and pain by lowering pyrexia and basal hot plate latency in rats using Eddy's hot plate [18].
- **Hepatoprotective Effects:** Hydroalcoholic extracts demonstrated hepatoprotective efficacy in rats by preventing liver damage caused by paracetamol [19].
- **Antiulcer activity:** In a rat model of ulcers caused by ethanol and indomethacin, methanolic leaf extract demonstrated dose-dependent inhibition [20].
- **Insecticidal activity:** It was discovered that ethanolic and hexane extracts of *Muntingia calabura*'s fruits and flowers were harmful to *Plutella xylostella* and diamondback moth larvae [21].
- **Antihypertensive activity:** The methanolic extract has a strong hypotensive effect in spontaneously hypertensive rats (SHR) [22].
- **Antidiabetic activity:** When M. calabura leaves are extracted using 50% ethanol, they can significantly reduce the difficulties associated with diabetes while also preventing the harmful side effects of synthetic anti-diabetic medications [23].
- **Cardioprotective activity:** Stem bark methanolic extract significantly reduced cardiac necrosis and serum biomarkers that indicated cardiac protection [24].

7. Toxicity and Safety Profile:

7.1. Acute Toxicity Studies [3]:

Rats were given oral doses of *M. calabura* leaf methanol extract at 300, 500, and 2000 mg/kg in an attempt to test for acute toxicity. The first 2-3 hours after administration of extract, percentage mortality observation starting from 24 h continued up to a period of 14 days. Results showed that there were no indications of toxicity or death, indicating that the extract was safe up to a dosage of 2000 mg/kg.

7.2. Sub chronic Toxicity Studies [25]:

In 90-day oral administration, *M. calabura* extracts did not significantly alter the haematological, biochemical, or histopathological parameters of treated rats in comparison to control.

7.3. Adverse Effects [26]:

There is no proof that *Muntingia calabura* is primarily responsible for any adverse drug reactions (ADRs). According to some research, however, further study is required to completely

comprehend its possible impacts and long-term safety.

8. Future Perspectives:

Although preclinical research is the majority of the current research on *Muntingia calabura*, it indicates remarkable therapeutic promise. Standardized extract formulations and long-term toxicity data are inadequate, and human clinical trials are scarce. Additionally, little is known about how its active ingredients work.

Its potential for therapeutic development is supported by the presence of important phytochemicals including rutin and quercetin, particularly for antibacterial, anti-inflammatory, and antioxidant uses. To confirm these effects and find more bioactive components, more pharmacological research is necessary.

Future research should concentrate on chemical isolation utilizing cutting-edge methods and thorough pharmacognostic profiling. To verify safety and effectiveness in humans, clinical trials are necessary. Its therapeutic effectiveness may be increased by investigating synergistic effects with other medications or botanicals.

CONCLUSION:

Muntingia calabura is a multipurpose medicinal plant that has a rich phytochemical profile and a variety of pharmacological actions, such as anti-inflammatory, anti-cancer, anti-microbial, and antioxidant properties. It has a lot of potential for therapeutic uses in contemporary medicine. Its current therapeutic application is limited by the absence of human clinical trials, standardized formulations, and long-term safety investigations, despite the abundance of preclinical data. To determine its efficacy and safety, future study should concentrate on mechanism-based investigations, human trials, and phytochemical standardization. *M. calabura* may prove to be a useful source for the creation of innovative natural drugs with the right validation.

REFERENCES

1. Hedge K, Anvitha DK, Munazza A, Shafa F, Fathima, Hafifa. Review on Emblica officinalis plant: its phytochemistry, morphology and uses. World J Pharm Res. 2024;13(23):1223–30.
2. Enioutina EY, Salis ER, Job KM, Gubarev MI, Krepkova LV, Sherwin CM. Herbal Medicines: challenges in the modern world. Part 5. status and current directions of complementary and alternative herbal medicine worldwide. Expert Rev Clin Pharmacol. 2017;10(3):327–38.
3. Upadhye M, Kuchekar M, Pujari R, Kadam S, Gunjal P. Muntingia calabura: A comprehensive review. J Pharm Biol Sci. 2021;9(2):81–7.
4. Sarojini S, Mounika B. Muntingia calabura (Jamaica Cherry): An overview. PharmaTutor. 2018;6(11):1–9.
5. Rao SK, Swamy RK, Kumar D, Singh AR, Bhat KG. J Cell Biol. 2019.
6. Saud B, Geetha KM, Dubey S, Singh PK, Shrivastava S, Singh D, et.al., Traditional, current and prospective therapeutic uses of Muntingia calabura: a comprehensive literature review. Res J Med Plant. 2023;17:9–22.
7. Lwin HH, Yadana AA. Investigation of morphological and histological characters, preliminary phytochemical examination and antimicrobial activity on leaves of Muntingia calabura. J Myanmar Acad Arts Sci. 2021;320–8.
8. Seixas DP, Palermo FH, Rodrigues TM. Leaf and stem anatomical traits of Muntingia calabura L. (Muntingiaceae) emphasizing the

production sites of bioactive compounds. Flora. 2021;1:151802.

9. Sowjanya M, Srinivasulu L, Lakshmi BKM, Venkatrayulu C, Sainath SBS. Phytochemical analysis and antimicrobial activity of Muntingia calabura. J Chem Health Risks. 2023;13(4):1–8.
10. Gapsari F, Putri TM, Rukmana W, Juliano H, Sulaiman AM, Dewi FG, et.al., Isolation and characterization of Muntingia calabura cellulose nanofibers. J Nat Fibers. 2023;20(1):2156018.
11. Indriati A, Hidayat DD, Andriansyah RC, Iwansyah AC, Surahman DN. Characterisation of physical, mechanical and colour properties of Muntingia calabura fruits. IOP Conf Ser Mater Sci Eng. 2020;462(1):012044.
12. Nur S, Aisyah AN, Nursamsiar N, Sami FJ, Fadri A, Khairi N, et.al., Standardization and GC-MS analysis of Kersen (Muntingia calabura L.) fruit ethanol extract as an herbal raw material. Bull Pharm Sci Assiut Univ. 2023;46(1):173–87.
13. Preethi K, Vijayalakshmi N, Shamna R, Sasikumar JM. In vitro antioxidant activity of extracts from fruits of Muntingia calabura Linn. from India. Pharmacogn J. 2010;2(14):11–8.
14. Zakaria ZA, Sufian AS, Ramasamy K, Ahmat N, Sulaiman MR, Arifah AK, et.al., In vitro antimicrobial activity of Muntingia calabura extracts and fractions. Afr J Microbiol Res. 2010;4(4):304–8.
15. Preethi K, Premasudha P, Keerthana K. Anti-inflammatory activity of Muntingia calabura fruits. Pharmacogn J. 2012;4(30):51–6.
16. Nasir NLM, Kamsani NE, Mohtarrudin N, Othman F, Tohid SFM, Zakaria ZA. Anticarcinogenic activity of Muntingia calabura leaves methanol extract against the azoxymethane-induced colon cancer in rats involved modulation of the colonic antioxidant system partly by flavonoids. Pharm Biol. 2017;55(1):2102–9.
17. Herlina H, Amriani A, Solihah I, Sintya R. Antidiabetic activity test of ethanolic Seri leaves (Muntingia calabura L.) extract in male rats induced by Alloxan. Sci Technol Indones. 2018;3(1):7–13.
18. Zakaria ZA, Kumar GH, Zaid SN, Ghani MA, Hassan MH, Hazalin NA, et.al., Analgesic and antipyretic actions of Muntingia calabura leaves chloroform extract in animal models. Adv Tradit Med. 2007;7(1):34–40.
19. Zakaria ZA, Mahmood ND, Mamat SS, Nasir N, Omar MH. Endogenous antioxidant and LOX-mediated systems contribute to the hepatoprotective activity of aqueous partition of methanol extract of Muntingia calabura L. leaves against paracetamol intoxication. Front Pharmacol. 2018;8:982.
20. Balan T, Sani MHM, Suppaiah V, Mohtarrudin N, Suhaili Z, Ahmad Z, et.al., Antiulcer activity of Muntingia calabura leaves involves the modulation of endogenous nitric oxide and nonprotein sulfhydryl compounds. Pharm Biol. 2014;52(4):410–8.
21. Bandeira GN, da Camara CA, de Moraes MM, Barros R, Muhammad S, Akhtar Y. Insecticidal activity of Muntingia calabura extracts against larvae and pupae of diamondback, Plutella xylostella (Lepidoptera, Plutellidae). J King Saud Univ Sci. 2013;25(1):83–9.
22. Shih CD. Activation of nitric oxide/cGMP/PKG signaling cascade mediates antihypertensive effects of Muntingia calabura in anesthetized spontaneously hypertensive rats. Am J Chin Med. 2009;37(6):1045–58.
23. Zolkeflee NK, Ramli NS, Azlan A, Abas F. In vitro anti-diabetic activities and UHPLC-ESI-MS/MS profile of Muntingia calabura leaves extract. Molecules. 2022;27(1):287.

24. Yemineni M, Kancharlapalli VR. Preclinical pharmacological profiling and cardioprotective activity for methanolic extracts of stem bark of Muntingia calabura L. against adrenaline-induced cardio-toxicity. Res J Pharm Technol. 2019;12(8):3773–80.
25. Nasir NL, Kamsani NE, Mohtarrudin N, Tohid SF, Zakaria ZA. Safety evaluation of orally-administered methanol extract of Muntingia calabura Linn. leaves: A sub-chronic toxicity study in Sprague Dawley rats. Pak J Pharm Sci. 2020;33(5):2009–16.
26. Busman H, Lestari RP, Rosa E, Arifiyanto AK. Ethanol extract repairs pancreatic cell damage, total coliforms, and lactic acid bacteria in hyperglycemic mice. J Pure Appl Microbiol. 2022;16(3):1943–52..

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