JOURNAL OF NATURAL REMEDIES
DOI: 10.18311/jnr/2025/46366
REVIEW ARTICLE

Pharmacological and Traditional Insights into *Callicarpa macrophylla:* A Comprehensive Review

Abdur Rahim, Grasav Gahlot, Vikash Jakhmola and Nidhi Gairola*

Uttaranchal Institute of Pharmaceutical Sciences, Uttaranchal University, Dehradun - 248007, Uttarakhand, India; nidhithapliyal28@gmail.com

Abstract

Priyangu, also called *Callicarpa macrophylla* Vahl., is a *Verbenaceae* family shrub that is extensively found throughout South and Southeast Asia, including India, Nepal, Bhutan and China. This plant is widely used to cure a variety of diseases, including cuts, wounds, rheumatism, diarrhoea, digestive issues and skin conditions. It is a key part of traditional medicine systems including *Ayurveda, Siddha* and *Unani*. Its traditional usage has been supported by modern pharmacological research that has established its antifungal, anti-inflammatory, antibacterial, and analgesic effects. The plant's medical efficacy is attributed to several significant phytoconstituents, including tannins, steroids, flavonoids and inorganic elements like iron and potassium. This review examines the traditional use, phytochemistry, and medicinal potential of *C. macrophylla*, emphasising the plant's value as a source of bioactive chemicals and its applicability to contemporary drug discovery.

Major Findings: *C. macrophylla* is a medicinal plant with antifungal, anti-inflammatory, antibacterial, and analgesic properties. Its bioactive compounds, like tannins and flavonoids, show potential for modern drug development.

Keywords: Antibacterial, Antifungal, Anti-inflammatory, *Callicarpa macrophylla,* Phytochemistry

1. Introduction

The use of medicinal plants is essential to human health care. Approximately 80% of people on the planet are dependent on traditional medicine, which is mostly derived from plants[1]. According to estimates from the World Health Organisation (WHO), approximately 80% of people living in undeveloped countries rely on traditional medicines, primarily plant-based pharmaceuticals, for their basic medical needs. *Ayurveda, Siddha, Amchi, Unani,* and *Tibetan* medicine all use roughly 1,200 plants[2]. *Callicarpa macrophylla* Vahl., or *Priyangu*, is a shrub. It is a member of the *Verbenaceae* family[3], which is also referred to as *Priyangu* in Hindi and Sanskrit[4]. It is dispersed throughout South East Asia, China, India, Nepal, Bhutan and Myanmar[5,6]. Across India, it is dispersed across Jammu and Kashmir, Himachal Pradesh, Uttar Pradesh, Bihar, Sikkim, West Bengal, Arunachal Pradesh, Assam, Meghalaya, Nagaland, Manipur, Mizoram, Tripura, and Andhra Pradesh up to an altitude of 1800 meters[7]. It is a well-known medicinal plant from the lower warm valleys of the Himalayas. In addition to the Ayurveda system, *C. macrophylla* is widely utilised in many traditional medical systems, such as *Sidha, homoeopathy,* and *Unani*[3]. This herb can cure a variety of ailments. The bark is used to treat cuts and wounds. Seeds and roots aid digestion, while leaves can be used to treat rheumatism. Additionally, fruits can be used to treat blisters and boils. Plant extracts exhibit anti-inflammatory, antifungal, and antibacterial properties[8,9]. The plant's stems were tested for antifungal activity[10]. The leaves are used to relieve gout and rheumatic pain. The leaves are decocted and used to treat diarrhoea, dysentery and bleeding. Leaf juice is used for stomach problems and headaches[11]. The herb has been utilised in *Ayurveda* and other traditional remedies to cure a variety of ailments and disorders, including tumours, polydipsia, diarrhoea, diabetes, dysentery, fever and blood purification. Flowers and

*Author for correspondence

Article Received on: 15.10.2024 Revised on: 29.11.2024 Accepted on: 06.12.2024

fruits are beneficial for rheumatoid arthritis, asthma, catarrh, anorexia, headache, nasty ulcers, flatulence, colic diarrhoea, dysentery, skin illness, burning feeling, excessive perspiration, diabetes, vomiting, fever and general weakness[12]. Yadav *et al*., recommend chewing the root to treat tongue rashes[6]. Plant extracts contain carbohydrates, steroids, flavonoids, glycosides and tannins, as well as inorganic elements such as potassium, phosphates, iron, and sulphate. Currently, around 25% of pharmaceuticals in the modern pharmacopeia are sourced from plants (phytomedicines), with many others being manufactured equivalents constructed on prototypes of plant-derived chemicals[13]. Its leaves have been shown to have anti-inflammatory, analgesic, and antipyretic properties[6,11] while its roots exhibit anti-inflammatory and analgesic benefits. *C. macrophylla* stems were tested for antifungal activity and the results were highly positive[6].

2. Parts Used

Root, bark, leaves, flowers, fruits.

3. Classification and Structure

3.1 Scientific Classification

The scientific classification of plants is given in Table 1.

3.2 Morphology

Callicarpa macrophylla Vahl is an officially recognised name. It was initially collected by A.F. Judd in 1928 with specimen BISH 71847, which was then placed at the Royal Botanical Garden at Kew. The little tree *C. macrophylla* is about 3–5mm tall. thickly covered with a brownish tomentum of stellate hairs on the stem and branches. The lamina of the leaves is oblong-lanceolate, only slightly spherical to oblong-lanceolate, apex, wedge-shaped, not sharp around at the base, rounded scallops or notches-toothed edge. It measures 10-35cm in length and 2-18cm in width. The petiole is 1-2 (-2.5) cm long and densely soft, woolly curved hairs, mature, lacking hair and full of wrinkles above or with many tiny hairs resembling stubbles. The inflorescence is star-shaped and hairy, with the main pedicel measuring between one and three centimetres, or somewhat longer than the petioles. Pedicels with small, slender flowers; pedicel speckled with glands, curled and about 1mm long. Calyx minutely 4-having teeth-like structures, 1-1.5mm long, gland-like outside, with coarse star-shaped hairs at the base, shiny inside. Corolla: violet, hairless inside, thinly hairy or almost glabrous outside with yellow glandular spots; lobes: 1-1.5mm long, obtuse or rounded; tube: 2-2.5mm long.

Anthers are egg-shaped 0.4-0.5mm expansive, secretory along the connecting and 0.7mm lengthy with filaments 4-6mm length. Stamens are exserted and placed close to the base of the corolla tube. The style is exserted, smooth having no hair or projections, 5-8mm long, and has a rounded head stigma. The ovary has the shape of a sphere or ball, is smooth and has no hair or projections, is highly gland-like, and is 0.5-1mm in circumference. Fruit is round, seamless, white, gland-like, smooth, has no hair or projections and with a diameter of around 2mm. *C. macrophylla* bears fruit from September to February and blossoms from May to August[15]. Fruits have a lovely aroma, especially after they have been somewhat bruised. They taste fairly sweet at first, then bitterish[16-18]. *C. macrophylla* fruits are edible[19,20].

Table 1. Scientific classification[14]

Kingdom	*Plantae*
Division	*Angiospermae*
Order	*Lamiales*
Family	*Verbanaceae*
Class	*Dicotyledons*
Genus	*Callicarpa*
Species	*macrophylla*

4. Name of *Callicarpa macrophylla* in Different Languages (Vernacular Names)

There are different names for *C. macrophylla* in different languages. It is called *Priyangu* or *Bastara* in Hindi, Perfumed Cherry in English and *Bonmala* in Assamese. Figure 1 enlist the names of *Callicarpa macrophylla* in different languages[16,21,22].

5. Distribution

Callicarpa macrophylla plant as seen in Figure 2 can be found in the upper Gangetic plains, West Bengal plains



Figure 1. Names *of Callicarpa macrophylla* in different languages.



Figure 2. *Callicarpa macrophylla.*

and the Eastern and Western Himalayan regions. The plant can be found in open and rejuvenated forest[17]. Up to an elevation of 1800 meters, it can be found in the Indian states of Himachal Pradesh, Jammu and Kashmir, Nagaland, Bihar, Uttar Pradesh, Sikkim, Mizoram, Arunachal Pradesh, Assam, West Bengal, Meghalaya, Manipur, Tripura, and Andhra Pradesh. Globally, *C. macrophylla* is found in Southeast Asia, Nepal, Bhutan, China, India, and Myanmar[5,23,24]. It grows in well-run-down soils that are both acidulent and alcalescent such as ammophilous, silty and swampy. The selected hardiness zone is mostly grown at Himalayan heights. It also grows in the wilderness, in a no man`s-land, edges of the road and wetlands[23].

6. Bio-active Compounds (Phytochemicals)

6.1 Leaf

6.1.1 Petroleum Ether Extract

Catechin, Coumarin, Phenols, Quinones, Saponins, Steroids, Tannins, Terpenoids and Reducing Sugar are present in petroleum ether extract and Anthraquinones. Flavonoids are not found in the petroleum ether extract of leaf[14,25,26]. From the petroleum ether extract of leaves, ursolic acid, βsitosterol, and 5,4'-dihydroxy 3'-7-3'-trimethoxy flavone have also been identified[27].

6.1.2 Ethanol Extract

Anthraquinones, Catechin, Coumarin, Phenols, Quinones, Saponins, Steroids, Terpenoids, Tannins and reducing sugar are found in the ethanol extract of leaves. Flavonoids are absent in the ethanol extract[14,25,26].

6.1.3 Methanol Extract

Anthraquinones, Catechin, Coumarin, Flavonoids, Phenols, Quinones, Saponins, Steroids, Tannins Terpenoids, and Reducing Sugar are found in the methanol extract of the leaf[14,25,26]. Calliterpenone and its monoacetate are also found in the methanol extract of the leaf[28].

6.2 Stem

6.2.1 Petroleum Ether Extract

Catechin, Coumarin, Phenols, Quinones, Saponins and Steroids are found in the petroleum ether extract of the stem and on the other hand Flavonoids, Anthraquinones, Terpenoids, reducing sugar, and Tannins are not found[14,25,26].

6.2.2 Ethanol Extract

Anthraquinones, Catechin, Coumarin, Phenols, Quinones, Saponins and Steroids are found in the ethanol extract of the stem while Flavonoids, Tannins, Terpenoids and reducing sugar are absent in the ethanol extract of stem[14,25,26].

6.2.3 Methanol Extract

In the methanol extract of the stem, the phytochemicals that are found are Anthraquinones, Catechin, Coumarin, Flavonoids, Phenols, Quinones, Saponins and Steroids while Tannins, reducing sugar and Terpenoids are not found in the methanol extract of stem[14,25,26].

6.2.4 Aqueous Extract

A water-based extract of the stem revealed the absence of alkaloids, steroids, proteins and amino acids and an abundance of glycosides, saponins, flavonoids, sugars and tannins[6].

6.3 Seed

6.3.1 Petroleum Ether Extract

In the petroleum ether extract of seed, the bio-active compounds that are absent are Anthraquinones, Catechin, Flavonoids, Phenols, Quinones, Saponins, Steroids, Tannins, Terpenoids, Reducing Sugar and while Coumarin is present in this extract[14,25,26].

6.3.2 Ethanol Extract

In the ethanol extract of seed, the bioactive compounds which are absent are Anthraquinones, Catechin, Flavonoids, Phenols, Quinones, Saponins, Tannins, Terpenoids, Reducing Sugar and while Coumarin and Steroids are present in this extract[14,25].

6.3.3 Methanol Extract

In the methanol extract of seed the bio active compounds which are absent are Anthraquinones, Catechin, Flavonoids, Phenols, Quinones, Saponins, Steroids, Tannins, Terpenoids, Reducing Sugar and while Coumarin is present in this extract[14,25,26].

6.4 Tests for Extracting Phytochemicals

By Reverse Phase High-Performance Liquid Chromatography (RP-HPLC) and High-Performance Thin Layer Chromatography (HPTLC), the two main growth stimulants of *C. macrophylla*, calliterpenone and calliterpenone monoacetate, may be reliably identified by ultraviolet spectroscopy[29]. By using silica gel, Sephadex LH-20 column chromatography, many plant components such as, betulinic acid, ursolic acid, α-amyrin, β-sitosterol, daucosterol, 2α,3α,19α trihydroxyurs-12-en-28-oic acid have been identified[30] (Table 2).

7. Medicinal Properties

Medicinal properties of *C. macrophylla* and its parts used given in Table 3.

7.1 Anti-bacterial Activity

7.1.1 Stem

Using Kirby Bauer agar disc diffusion assay procedures, the antibacterial activity of *C. macrophylla's* ethanol-based (SEE) and water-based (SAE) stem back extracts was investigated against a variety of gram-positive and gram-negative microorganisms, all of the bacterial strains showed modest growth inhibitory action against SEE, whereas SAE was remarkably inert except *Salmonella typhimurium*[6]. Crude stem extracts with solvents such as ethanol, methanol and petroleum ether demonstrated efficacy against Staphylococcus aureus, with methanol exhibiting the highest activity (22mm). All three crude extracts exhibited action against *Escherichia coli*, however the petroleum ether sample had the largest area of resistance (14mm). Petroleum ether (18mm) from *Bacillus subtilis* showed activity. Crude extracts of methanol and ethanol did not exhibit any action. The most active extracts against *Pseudomonas* (12mm) were methanol other than petroleum ether crude extract and ethanol[31].

7.1.2 Leaf

The antibacterial properties of *C. macrophylla* leaf methanol extract were investigated. The maximal zone of inhibition was 22mm against the *Bacillus cereus* bacterial strain, observed at the highest concentration of 350 µg/disc, whereas the highest dose of 2.5 mg/mL caused the greatest inhibition of cell growth which is 92%[32].

7.1.3 Seed

Only the crude seed extracts of methanol that is 9mm and petroleum ether that is 12mm showed efficacy against *S. aureus*. Crude ethanol extract, however, exhibited no action. Petroleum ether crude extract provided no effect in the *Pseudomonas* instance, however methanolic crude extract which is 15mm showed strong activity. Regarding *E. coli*, every crude extract exhibited action except for ethanol. The greatest activity is demonstrated by methanol which is 22mm over petroleum ether which is 12mm[31].

7.2 Anti-fungal Activity

7.2.1 Leaf

When assessed using the disc diffusion method with fluconazole as the standard medication, ethanolic leaf extracts at concentrations of 200 and 400 µg/disc showed strong antifungal efficacy against a variety of fungal strains, whereas water-based extracts had negligible antifungal activity[6]. All crude extracts, including methanol (8mm), ethanol (12mm) and petroleum (9mm) ether, exhibit efficacy against *A. fumigatous*. Petroleum ether failed to demonstrate any activity for *R. oryzae*, whereas crude extracts of methanol were 10mm and ethanol were 10mm. When it comes to *Aspergillus awamori*, ethanol which is 10mm and petroleum-based ether which is 9mm both exhibit action, while methanol does nothing[31]. By using the agar-well diffusion method, an aqueous extract of *C. macrophylla* leaves showed variable levels of antifungal activity against each of the six test fungi, which were *Aspergillus flavus, Cladosporium cladosporidies, Aspergillus niger*, *Drechslera halodes, Alternaria alternata* and *Fusarium moniliforme*[33].

7.2.2 Stem

The stem ethanolic extract demonstrated antifungal properties against six bacteria at concentrations of 200 µg/disc and 400 µg/disc. With *Giberella fujikoroi*, the biggest area of restriction of 17mm in diameter was seen but the water-based extract showed no antifungal activity[6]. Only the crude petroleum ether extract that is 9mm is active against *A. fumigatous*; both the methanol

Table 2. Phytochemicals present in *Callicarpa macrophylla*

Parts	P. Ether Extract		Ethanol Extract		Methanol Extract		References
	Present(+)	Absent(-)	Present(+)	Absent(-)	Present(+)	Absent(-)	
Leaf	Catechin, Coumarin, Phenols, Quinones, Saponins, Steroids, Tannins, Terpenoid, Reducing-Sugar	Anthraquinones, Flavonoids	Catechin, Coumarin, Phenols, Quinones, Saponins, Steroids, Tannins, Terpenoid, Reducing-Sugar Anthra-quinones	Flavonoids	Catechin, Coumarin, Phenols, Quinones, Saponins, Steroids, Tannins, Terpenoids, Reducing-Sugar, Anthra-quinones Calliterpenone	(-)	14,25,26,28
Stem	Catechin , Coumarin, Phenols, Quinones, Saponins , Steroids	Flavonoid, Anthra-quinones, Terpenois, Reducing-Sugar, Tannins	Catechin , Anthraquinones, Coumarin, Phenols, Quinones, Saponins , Steroids	Flavonoid, Terpenois, Reducing-Sugar, Tannins	Catechin , Anthraquinone, Coumarin, Phenols, Quinones, Saponins, Steroids, Flavonoid	Terpenois, Reducing-Sugar, Tannins	14,25,26
Seed	Coumarin	Catechin, Phenols, Quinones, Saponins, Steroids, Tannins, Terpenois, Reducing-Sugar, Anthra-quinones	Steroids , Coumarin	Catechin, Phenols, Quinones, Saponins, Tannins, Terpenois, Reducing-Sugar, Anthra-quinones	Coumarin	Catechin, Phenols, Quinones, Saponins, Steroids, Tannins, Terpenois, Reducing-Sugar, Anthra-quinones	14,25,26

and extracts of ethanol were inert. The highest area of resistance for *Rhizophous oryzae* was found in crude extracts of methanol which is 12mm and ethanol which is 12mm, but petroleum ether which is 9mm had notable action[31].

7.2.3 Seed

Each of the three crude seed extracts that are methanolic (9mm), ethanolic (12mm) and petroleum ether (9mm) show efficacy against *A. fumigatous*. Only crude extracts of ethanol (12mm) and methanol (9mm) exhibited action for *Rhizopus oryzae*; petroleum ether did not. Two natural extracts, ethanol (12mm) and petroleum (9mm) exhibit action in the case of *A. awamori*, although methanol did not[31].

7.3 Anti-diabetic Activity

Rats with resistance to insulin generated by dexamethasone and diabetes caused by streptozotocin showed significant medication-reliant antidiabetic

action when exposed to alcohol-extracted flower extract at doses of 100 and 200 mg/kg. Additionally, the extract was found to reduce hyperlipidaemia[34]. In rats given dexamethasone to generate diabetes, the antidiabetic potential of *C. macrophylla* flower extract was examined. Excipients were given dexamethasone. In the animals which were given *C. macrophylla* flower, blood sugar levels dropped gradually. The antidiabetic impact was contrasted to that of Glibenclamide 1 mg/kg p.o., leading to the finding that *C. macrophylla* has antidiabetic activity in the dexamethasone system[35,36].

7.4 Hepatoprotective Activity

In Albino rats, the extract's hepatoprotective properties against hepatotoxicity produced by carbon tetrachloride and paracetamol were investigated. For hepatoprotection, regular medication was used (Silymarin 25 mg/kg, b.w./p.o.). Beyond these measures, the plant extract's hepatoprotective qualities were also demonstrated by histological analyses and levels of bilirubin (both total and direct). It has been noted that *C. macrophylla* aerial parts hydroalcoholic extract has hepatoprotective properties[37]. Due to their potential to inhibit cytochrome P-450 aromatase, flavonoids found in the hydro-alcoholic extract of *C. macrophylla* aerial parts may contribute to its antihepatotoxicity[38].

7.5 Analgesic and Antipyretic Activity

Employing the Tail Immersion Model and the Brewer's Yeast-Induced Pyrexia Model, respectively, the pain-relieving and antipyretic properties of aqueous and ethanolic extracts of *C. macrophylla* leaves were assessed. Aqueous extract of leaves caused superior analgesia and has anti-pyretic capability than ethanolic extract when compared to conventional medicines. When combined with an antipyretic action, analgesia will determine its important role in infection-induced fever[6]. The analgesic activity of aqueous (200 mg/kg) and ethanolic (400 mg/kg) root extracts was assessed in albino rats by the tail immersion test. The analgesic effectiveness of the roots' aqueous extract is superior to that of its ethanolic extract[39]. It has been found that many flavonoids that were separated from plants for medicinal purposes have potent analgesic properties. A flavonoid component may be the cause of the analgesic effects of the ethanol-based, water-based extract of *C. macrophylla* Vahl's roots[40].

7.6 Anti-inflammatory Activity

Under the carrageenan-induced rat paw oedema technique, the ethanolic (200 mg/kg) and aqueous (400 mg/kg) leaf extracts demonstrated a medication-reliant anti-inflammatory effect with diclofenac sodium as the reference medication[11]. The option for an anti-inflammatory medication can be made based on the results, which indicated that the ethanol-based extract of *C. macrophylla* leaves had a better anti-inflammatory character than the water-based extract[41]. Greater anti-inflammatory potential is shown in ethanolic root extract compared to aqueous root extract. These very encouraging results confirm that the anti-inflammatory properties of *C. macrophylla* roots are on par with standards[39]. Moreover, early photochemical screening revealed the presence of carbohydrates, steroids, flavonoids and tannins in the ethanol-based and water-based extracts. One or more of the aforementioned phytoconstituent groups may be responsible for the anti-inflammatory action, which may result in suppression of the synthesis of prostaglandins, histamine, and serotonin[41].

7.7 Anti-arthritic Activity

Utilising models of human red blood cell membrane stabilisation and prevention of protein denaturation, the ethanolic extract of *C. macrophylla* flowers has anti-arthritic properties *in vitro*. The standard medication used was diclofenac sodium. Comparing the ethanolic extract of *C. macrophylla* at various doses to the usual medication, Diclofenac Sodium, showed significant anti-arthritic action, according to the results. The current study's findings indicate that the ethanolic extract of *C. macrophylla* flower exhibited anti-arthritic properties[42].

7.8 Anti-oxidant Activity

Studies show that its leaves and essential oils, which are abundant in chemicals like phyllocladene and β-selinene, have strong antioxidant properties that may be similar to those of common medications like Paracetamol and Ibuprofen[43].

8. Traditional Uses

The indigenous people of Sikkim, India, claim that the herb has a sour flavour and is effective against

Table 3. Medicinal properties of *C. macrophylla* and its parts used

S. No.	Medicinal Use	Parts Used	References
1	Anti-bacterial Activity	Stem, Leaf, Seed	6,31,32
2	Anti-fungal Activity	Stem, Leaf, Seed	6,32,33
3	Anti-diabetic Activity	Flower	34-36
4	Hepatoprotective Activity	Aerial Part	37,38
5	Analgesic and Antipyretic Activity	Leaf, Root	6,39,40
6	Anti-inflammatory Activity	Root, Leaf	11,39,41
7	Anti-arthritic Activity	Flower	42

a high body temperature, burning sensibility, perspiration and shigellosis because of its icy power. This medication is the most effective for treating blood-flowing disorders and lessening body odour[44]. Tribal Tripura people in Bangladesh utilise this plant as a restorative, neutraliser of 8oxins and therapy for cancer, eczema, arrhythmias, regular loose motions and frequent faeces[45]. The herb is utilised in a remedy along with other plants to cure skin conditions, helminthiasis and dysentery. It also helps to cleanse the blood and get rid of pollutants[46]. Roots can be used to treat pain from arthritis, gastrointestinal problems and pneumonitis[47,48]. The root fine grain is used in the northeast Indian Dibru-Saikhowa ecosphere area to treat aquaphobia[49]. Root fine grain has been utilised by the residents of Uttarakhand's Chamoli area to treat urinary symptoms and manage menstrual periods[50]. For curing a high body temperature, the Bangladeshi Chakma community utilises bark extract orally. It has been suggested that the roots' fragrant oil can help with digestive issues[51,52]. Leaves are utilised to alleviate digestive issues[48] and headaches in the Apatani of Ziro Valley Arunachal Pradesh, India[53]. Clean leaves brew can be utilised as a frequent gargle to help heal gum inflammation and ulcers[54]. The blossoms and fruits in Tamil Nadu, India are utilised for treating hyperglycemia[55]. Juice from its fruits is utilised for relieving fever in the United Kingdom and India[56]. It is said that the seeds can be utilised for curing gastrointestinal conditions and mouth disease[57].

9. Preclinical/Clinical Trial

The main focus of preclinical studies on *C. macrophylla* is on its pharmacological properties and possible uses in industries like medicine and agriculture. Because calliterpenone is a naturally occurring plant growth stimulant, it has been intensively explored for its potential to increase crop yields using environmentally friendly ways. *C. macrophylla* is the source of this molecule. The physiologically active components of the plant are highlighted in this study, despite its agricultural focus, as they could be useful for preclinical medical research[58]. Nevertheless, no direct preclinical studies focused only on *C. macrophylla* to treat illnesses were found.

10. *Priyangu* as *Ayurvedic* Medicine

Callicarpa macrophylla also known as *Priyangu* plays a vital role in the development of Ayurveda. *C. macrophylla* is used in the formulation of Ayurvedic medicine. Given below are examples of Ayurvedic medicine containing *C. macrophylla* as one of the ingredients.

10.1 *Devadarvarishta*

Conventional applications for *Devadarvarishta* include treating ailments of the skin, particularly those caused by hyperglycemia issues, gastrointestinal disorders, and problems in passing urine[59].

10.2 *Ushirasava*

Ayurvedic liquid *Ushirasava* is used to treat haemorrhoids, skin problems, helminthiasis, bleeding problems and inflammation ailments[60].

10.3 *Pippalyasava*

This *Vedic* medicine in liquid form is used to treat haemorrhoids, whooping, wheezing, Ischemia and bowel dysfunction[61].



Figure 3. Formulation on *Callicarpa macrophylla*.

10.4 Amroid Ointment

This is an exclusive *Ayurvedic* medication that helps with haemorrhoids, haematochezia and specific discomfort near the anal orifice[62].

11. Comparative Analysis with Other Related Species

The different biologically active elements in *C. macrophylla* have been highlighted by phytochemical investigations that have identified distinct diterpenoids in this plant, such as *macrophypene* compounds, which contrast from those identified in various *Callicarpa* species[63]. Three *Callicarpa* species were biochemically examined, and the results revealed that although they all have similar flavonoids and phenylethanoid glycosides, *C. macrophylla* had different secondary metabolite profiles, which might affect its ability to function as a medicine[64]. A comprehensive analysis of the flavonoid and phenol concentrations in seven *Callicarpa* species revealed that *Callicarpa rubella* had the highest antioxidant activity, whereas *C. macrophylla* had relatively little of these chemicals[65]. Furthermore, compared to comparable species, *C. macrophylla* exhibits significant antibacterial activity over *S. aureus*, which sets it apart from other species[66].

12. Future Scope

Callicarpa macrophylla has shown pharmacological qualities and the need for plant-based therapeutic medicines is expanding, therefore its potential in medical research is rather promising. Preclinical research and conventional medical use of the herb have both demonstrated its strong painkilling, inflammation-reducing reducing, and febrifuge properties. In light

of the increasing demand for natural remedies for ailments like persistent pain, inflammation and febrifuges particularly in light of worries about adverse effects and drug defiance, *C. macrophylla* may prove to be a suitable substitute. Its phytochemical components, such as tannins, terpenoids and flavonoids, have a variety of therapeutic benefits that call for more research and development of new drugs, especially for the treatment of aches and inflammation. Standardising *C. macrophylla* extracts into consistent formulations can also open up new pharmaceutical opportunities for treating conditions like joint pain, arthritis, and digestive problems, where inflammation plays a major role. This is especially relevant given the increasing demand for customised and alternative therapies. Furthermore, continuing developments in pharmacognosy and the biology of molecules may make it possible to pinpoint the precise processes and substances that are causing these effects, opening the door to the creation of innovative treatment possibilities. As the world's medical practices become more centralising, using *C. macrophylla* in conjunction with traditional treatments may improve the efficiency of care for a variety of illnesses. Its traditional applications in Traditional Chinese Medicine (TCM) also point to its potential for treating chronic illnesses understudied in modern medicine, such as blood disorders, irregular periods, and infections of the skin, in addition to symptoms of disease. *C. macrophylla* has the potential to become a major participant in the global herbal medicine industry by addressing unfulfilled medical requirements in developed as well as developing countries with additional clinical trials and toxicological investigations.

13. Research Gap

For *C. macrophylla* to fully achieve its potential medicinal uses, several crucial gaps in the existing research must be filled. First off, despite the plant's encouraging analgesic, anti-inflammatory and antipyretic activities in preclinical research, nothing is known about the fundamental biochemical pathways. The extent to which particular phytochemicals, including tannins and flavonoids, contribute to these effects is not well understood. Further comprehensive investigations into the biochemical processes implicated are necessary, with a particular emphasis on mediators of inflammation, immune-mediated responses and receptor relationships. Furthermore, the majority of research has concentrated on extracts instead of separating out and describing specific components that are bioactive, which makes it difficult to pinpoint the precise agents in charge of the pharmacological effects that have been seen.

A notable deficiency in current research is the absence of thorough toxicological assessments. Experimental investigations are being conducted on the lack of side effects, medication development and possible negative consequences in human models. The medical interpretation of *C. macrophylla* for therapeutic application is still unknown given the absence of such data. Additionally, there is a lack of consistency in the methods and extract formulation used in different research, which makes the results harder to repeat and compare. The last and most important gap is that there have never been any clinical studies involving humans. The use of *C. macrophylla* in advanced healthcare is still theoretical in the absence of human studies. To reach the full medicinal potential of the plant, these gaps must be filled by thorough, standardised study.

14. Discussion and Conclusion

The discussion makes it clear that *C. macrophylla* is an important herb with a wide range of medicinal uses, backed by its rich chemical compound profile and varied therapeutic characteristics. Its antidiabetic, analgesic, antibacterial, antifungal, anti-arthritic, and anti-inflammatory qualities have all been highlighted in recent research, which has further confirmed its potential. Its relevance in modern medicine was highlighted by a recent study that showed its increased potency against bacterial strains that are resistant to drugs.

Comparatively, more modern study highlights its bioactive constituents, like flavonoids and phenolics, and their mechanisms of action, while earlier articles mostly concentrated on its traditional medical benefits. This demonstrates how scientific knowledge has both evolved and remained consistent. Recent research provides a more in-depth understanding of

its molecular structure and therapeutic value, even if past research does support its antibacterial and anti-inflammatory qualities.

A more methodical and standardised approach to study is necessary to fully exploit *C. macrophylla's* therapeutic potential. In order to convert its theoretical potential into actual healthcare solutions, important gaps in our understanding of its bioavailability, toxicity profiles, and clinical applications still exist. The plant has great potential as a source of new phytochemicals to help with today's pharmacological problems. Future studies could lead to the creation of novel medications and treatments by filling in these information gaps.

15. Acknowledgement

Authors are thankful to Uttaranchal Institute of Pharmaceutical Sciences, Uttaranchal University, Arcadia Grant, Chandanwari, Premnagar, Dehradun, India for providing support for our work.

16. Author Contribution

Conceptualization - N.G. and V.J.; methodology - N.G, V.J, A.R, and G.G.; resources - N.G, V.J, A.R, and G.G ; writing-original draft preparation - N.G, A.R and G.G.; writing-review and editing - N.G., A.R G.G; visualization - V.J. and N.G.; supervision - N.G. and V.J.; project administration - N.G. All authors have read and agreed to the published version of the manuscript.

17. References

1. WHO, Regional Office for the Western Pacific, research guidelines for evaluating the safety and efficacy of herbal medicines. Manila, WHO, 1993.
2. Pushpangadan P. Role of traditional medicine in primary health care. Science for Health. Published by State Committee on Science, Technology and Environment, Govt. of Kerala, 1995.
3. Sharma AK, Negi KS, Bhandari DC, Shukla HY, Pareek SK. Influence of NPK and spacing on the growth and yield of herbage of *Callicarpa macrophylla* Vahl. *Priyangoo*: A less-known medicinal plant. Envis Bull. 2004; 12(1):38-40.
4. Pandey AS, Srivastava B, Wanjari M, Pandey NK, Jadhav AD. *Callicarpa macrophylla*: A review of its phytochemistry, pharmacology, folklore claims and ayurvedic studies. National Research Institute for Ayurveda-Siddha, Human Resource Development, Gwalior-474009 MP, India. Global J Res Med Plants Indigen Med. 2014. p. 91-100.
5. Billore KV, Yelne MB, Dennis TJ. Database on medicinal plants used in Ayurveda. Central Council for Research in Ayurveda and Siddha, New Delhi. 2005; 7:353-355.
6. Yadav VK, Satpathy S, Patra A. Pharmacognostical studies of *Callicarpa macrophylla* Vahl. stem. Int J Phytother Res. 2012; 2(1):35-41.
7. Kirtikar KR, Basu BD. Indian medicinal plants. 1st ed. Dehradun: International Book Distributors; 2006; 3:19-22.
8. Sumon S, Hoque MR, Paul S. Pharmacological activity investigation of *Callicarpa americana*. Department of Pharmacy, BRAC University, Dhaka, Bangladesh. J Med Plants Stud. 2019; 7(4):123-126.
9. Mishra J, Singh RD, Jadon VS, Gausain MP, Aradhana. Assessment of phenolic components and antioxidative activities of *Phaseolus vulgaris* L. Dept. of Biotechnology, Sardar Bhagwan Singh, PG Institute of Biomedical Science and Research, Dehradun, Uttrakhand, India. Int J of Integrative Biol. 2010. p. 26-33.
10. Kirtikar KR, Basu BD. Indian medicinal plants, International Book Distributers and Publisher Dehradun.2006; 3:1922.
11. Yadav V, Jayalakshmi S, Singla RK, Patra A, Khan S. Preliminary assessment of antiinflammatory activity of *Callicarpa macrophylla* Vahl. leaves extracts. a College of Pharmacy, Institute of Foreign Trade and Management, Lodhipur Rajput, Moradabad, Uttar Pradesh - 24001, India. Indo Glob J Pharm Sci. 2011; 1(3):219-222. https://doi.org/10.35652/IGJPS.2011.21
12. Sharma V, Kamal B, Srivastava N, Dobriyal KA, Jadon VS. Effects of additives in shoot multiplication and genetic validation in *Swertica chirayita* revealed through RAPD analysis. Department of Biotechnology, Sardar Bhagwan Singh Post Graduate Institute of Biomedical Sciences and Research, Balawala, Dehradun, India. Plant Tissue Cult Biotech. 2013; 23(1):11-19. https://doi.org/10.3329/ptcb.v23i1.15555
13. Arya A, Dubey SK, Lauthani A, Bahuguna A, Kumar R, Prakash O, Rawat DS. Phytochemical profile and antioxidant potential of extracts of *Callicarpa macrophylla* Vahl. from Uttarakhand Himalayan region. Int J Plant Based Pharm.2023; 3(2):131-140. https://doi.org/10.29228/ijpbp.25
14. Bansal V, Tiwari RC, Dikshit M, Sharma VB, Mittal B. A review of large leaf beautyberry (*Callicarpa macrophylla* Vahl.): Therapeutic indications. P.G. Dept. of Agad Tantra Evum Vidhi Vaidyaka, Uttarakhand Ayurved University, Rishikul Campus, Haridwar, Uttarakhand, India. World J Pharm Res. 2022; 430:10.
15. Leeratiwong C, Chantranothai P, Paton AJ. A synopsis of the genus *Callicarpa macrophylla* L. (*Lamiaceae*) in Thailand. Department of Biology, Faculty of Science, Prince

of Songkla University, Songkhla 90112, Thailand. Thai for Bull (Bot.) 2009; 37:36-58.
16. Chantranothai P, Leeratiwong C, Paton AJ: A synopsis of the genus *Callicarpa macrophylla* L. (*Lamiaceae*) in Thailand. Department of Biology, Faculty of Science, Prince of Songkla University, Songkhla 90112, Thailand. Thai for Bull (Bot.). 2009; 37:36-58.
17. Gupta AK, Tandon N, Sharma M. Quality standards of Indian medicinal plants, New Delhi. Indian Council for Medical Research. 2008; 5:134-141.
18. Mudgal V, Khanna KK, Hajra PK. Flora of Madhya Pradesh, Calcutta: Botanical Survey of India.1997; 2:365.
19. Dangol DR. Traditional uses of plants of commonland habitats in Western Chitwan, Nepal. Institute of Agriculture and Animal Science, Rampur, Chitwan, Nepal. J Inst Agric Anim Sci. 2008; 29:71-78.
20. Mehta PS, Negi KS, Ojha SN. Native plant genetic resources and traditional foods of Uttarakhand Himalaya for sustainable food security and livelihood. National Bureau of Plant Genetic Resources, Regional Station, Nainital, Uttrakhand. Indian J Nat Prod Resour. 2010; 1(1):89-96
21. Khare CP. Indian Medicinal Plants: An Illustrated Dictionary. New Delhi: Springer Inc.
22. Soni RK, Dixit V, Irchhaiya R, Alok S. *Callicarpa macrophylla*: A Review update on its botany, ethan botany, phytochemistry and pharmacology. Department of Pharmacognosy, Bundelkhand University, Jhansi - 284128, Uttar Pradesh, India. 2014; 1(2):87-94.
23. Wilfrid GS: Propagation of trees, shrubs, and conifers. Macmillan; 1963.
24. Shi Y, Wu C, Chen Y, Liu W, Feng F, Xie N: Comparative analysis of three Callicarpa herbs using high-performance liquid chromatography with diode array detector and electrospray ionization-Trap mass spectrometry method. Department of Natural Medicine Chemistry, China Pharmaceutical University, Nanjing, China. J Pharm Biomed Anal. 2013; 5(75):239-247. https://doi.org/10.1016/j.jpba.2012.11.038.
25. Olawuwo OS, Famuyide IM, McGaw LJ. Antibacterial and antibiofilm activity of selected medicinal plant leaf extracts against pathogens implicated in poultry diseases. Department of Paraclinical Sciences, University of Pretoria, Pretoria. South Africa Front Vet Sci. 2022; p. 9. https://doi.org/10.3389/fvets.2022.820304 PMid:35310417 PMCid: PMC8926311.
26. Gangola S, Joshi S, Kandpal N, Bhandari G, Gupta S, Jadon VS, Sharma V. Micropropagation and antimicrobial activity of *Callicarpa macrophylla* (*Priyangu*) against medically important pathogens. J Adv Zoo. 2023; 44(5).
27. Chaudhary A, Bhattacharya A, Mitra, SR, Adityachaudhary N. Phytochemical investigation on the leaves of *Callicarpa macrophylla* Vahl. J Indian Chem Soc.1978; 55:628-629.
28. Singh AK, Agrawal PK. 16α, 17-Isopropylideno-3-oxophyllocladane, a diterpenoid from *Callicarpa macrophylla*. Central Institute of Medicinal and Aromatic Plants, Lucknow 226 015, India. Phytochemistry.1994; 37:587-588. https://doi.org/10.1016/0031-9422(94)85106-9
29. Verma RK, Singh AK., Srivastava P, Shanker K, Kalra A, Gupta MM. Determination of novel plant growth promoting diterpenes in *Callicarpa macrophylla* by HPLC and HPTLC. J Liq Chromatogr Relat Technol. 2009. p. 32. https://doi.org/10.1080/10826070903188211
30. Pan P, Sun QS. Chemical constituents of *Callicarpa macrophylla* Vahl. Journal of Shenyang Pharmaceutical University. 2006; 9:003.
31. Gangola S, Joshi.S, Kandpal N, Bhandari.G, Gupta.S, Singh.V, Sharma.V. Micropropagation and antimicrobial activity of *Callicarpa macrophylla* (*Priyangu*) against medically important pathogens. School of Agriculture, Graphic Era Hill University, Uttarakhand. J Adv Zoo. 2023; 44(5):331.
32. Mona RI. Investigation of cytotoxic and antibacterial activity of methanol extract of *Callicarpa macrophylla* leaves. The Department of Pharmacy.BRAC University, Dhaka, Bangladesh.Project Report. 2016. p. 18-45.
33. Tripathi YC, Nishat A, Lokesh U. *In vitro* evaluation of antifungal activity of *Callicarpa macrophylla* Vahl leaves. Chemistry Division, Forest Research Institute, Dehradun, India. Org Med Chem Int J. 2017; 1(5):555571. https://doi.org/10.19080/OMCIJ.2017.01.555571
34. Patel SR. Evaluation of alcoholic extract of *Callicarpa macrophylla* flower for its antidiabetic activity. Rajiv Gandhi University of Health Sciences, Bangalore, India. Master Thesis. 2011. p. 55-119.
35. Patel SR, Puranik DS, Nagaraju B, Kumar HDH, Sumanth M, Kumar AKV and Ravi CM: Antidiabetic activity of *Callicarpa macrophylla* flower extract by dexamethasone-induced insulin resistance. Int Pharma Science. 2013; 3(1):70-83.
36. Kumar AKV, Patel SR, Puranik DS, Nagaraju B, Kumar HDH, Sumanth M, Ravi CM. Antidiabetic activity of *Callicarpa macrophylla* flower extract by Dexamethasone Induced Insulin resistance. Int Pharmsciencia. 2013; 3(1):70-83.
37. Patel R, Jawaid T. Hepatoprotective activity of aerial parts of plant extract of *Callicarpa macrophylla* in rats. Department of Pharmacology, Hygia Institute of Pharmaceutical Education and Research, Ghazipur (U.P.) India J Pharm Pharmacol Res. 2014;2(1):1-8.
38. Kukongviriyapan V, Janyacharoen T, Kukongviriyapan U, Laupattarakasaem P, Kanokmedhakul S, Chantaranothai P. Hepatoprotective and antioxidant activities of *Tetracera loureiri*. Phytother Res. 2003; 17:717-721. https://doi.org/10.1002/ptr.1138 PMid:12916065.

39. Yadav V, Jayalakshmi S, Singla RK, Patra A, Khan S: Assessment of anti-inflammatory and analgesic activities of *Callicarpa macrophylla* Vahl roots extracts. Webmed Central Pharmacol. 2012; 3(5):WMC003366.
40. Gülnur Toker G, Küpeli E, Memisoğlu M, Yesilada E. Flavonoids with antinociceptive and anti-inflammatory activities from the leaves of *Tilia argentea* (silver linden). Faculty of Pharmacy, Gazi University, Etiler, 06330 Ankara, Turkey. J Ethnopharmacol. 2004; 95(2-3):393-397. https://doi.org/10.1016/j.jep.2004.08.008 PMid:15507365.
41. Yadav V, Jayalakshmi S, Singla RK, Patra A. Preliminary assessment of the anti-inflammatory activity of *Callicarpa macrophylla* Vahl. leaves extract. College of Pharmacy, Institute of Foreign Trade and Management, Uttar Pradesh. India. Indo Global J Pharma Sci. 2011; 1(3):219-222. https://doi.org/10.35652/IGJPS.2011.21
42. Gupta SK, Gupta A, Gupta AK, Prakash D, Vedpal. *In vitro* anti-arthritic activity of ethanolic extract of *Callicarpa macrophylla* flower. Agra Public Pharmacy College, UP, India. Int Res J Pharm. 2013; 4(3):160-162. https://doi.org/10.7897/2230-8407.04332
43. Chandra M, Prakash O, Kumar R, Bachheti RK, Bhushan B, Kumar M, Pant AK. β-Selinene-rich essential oils from the parts of *Callicarpa macrophylla* and their antioxidant and pharmacological activities. Department of Chemistry, Graphic Era University, Dehradun, UK, India. Medicines. 2017; 4(3):52. https://doi.org/10.3390/medicines4030052 PMid:28930267 PMCid: PMC5622387
44. Panda AK. Medicinal plants of Sikkim in Ayurvedic practice. Regional Research Institute (Ay), Tadong, Gangtok, Sikkim. (*Ayurvedic*).
45. Rahmatullah M, Jahan R, Azam F. S, Hossan, S, Mollik MAH, Rahman T. Folk medicinal uses of *Verbenaceae* family plants in Bangladesh. Afr J Tradit Complement Altern Med. 2011; 8(5S). https://doi.org/10.4314/ajtcam.v8i5S.15 PMid:22754058 PMCid: PMC3252728.
46. Khare CP. Indian herbal remedies: Rational western therapy, Ayurvedic and other traditional usage, botany. Springer Science and Business Media; 2011.
47. Gautam TP. Indigenous uses of some medicinal plants in Panchthar district Nepal. Department of Botany, M.M.A.M. Campus, Tribhuvan University, Biratnagar, Nepal.Nepalese. J Biosci. 2011; 1:125-130.https://doi.org/10.3126/njbs.v1i0.7479
48. Rai MB. Medicinal plants of Tehrathum district, Eastern Nepal. Department of Botany, P. G. Campus, Biratnagar. Our Nature. 2003; 42-48. https://doi.org/10.3126/on.v1i1.304
49. Purkayastha J, Nath SC, Islam M. Ethnobotany of medicinal plants from Dibru-Saikhowa biosphere reserve of Northeast India. Division of Plant Sciences and Ecology, Regional Research Laboratory, Assam, India. Fitoterapia. 2005; 76(1):121-127. https://doi.org/10.1016/j.fitote.2004.10.012 PMid:15664476.
50. Dangwal LR, Rana CS, Sharma, A. Ethno-medicinal plants from transitional zone of Nanda Devi Biosphere Reserve, District Chamoli, Uttarakhand (India). Indian J Nat Prod Resour. 2011; 2(1):116-120.
51. Rahman MA., Uddin SB, Wilcock CC. Medicinal plants used by the Chakma tribe in Hill Tracts districts of Bangladesh. Indian J Tradit Knowle. 2007; 6(3):508-517.
52. Talapatra SK, Polley M, Talapatra B. Calliphyllin, a new diterpene from the leaves of *Callicarpa macrophylla*. J Indian Chem Soc. 1994; 71:527-532.
53. Kala CP. Ethnomedicinal botany of the Apatani in the Eastern Himalayan region of India. GB Pant Institute of Himalayan Environment and Development, Uttaranchal, India. J Ethnobiol Ethnomed. 2005; 1:11. https://doi.org/10.1186/1746-4269-1-11 PMid:16288657 PMCid:PMC1315349.
54. Arya KR. Agarwal SC. Folk therapy for eczema, bone fracture, boils sores and gingivitis in Taragtal province of Uttaranchal. Indian J Tradit Knowle. 2008; 7(3):443-445.
55. Jeyachandran R, Mahesh A. Enumeration of antidiabetic herbal flora of Tamil Nadu. Department of Plant Biology and Plant Biotechnology, St. Joseph's College, Tiruchirappalli, India. Res J Med Plant. 2007; 1:144-148.
56. Manandhar NP. An inventory of some vegetable drug resources of Makawanpur district Nepal. National Herbarium and Plant Laboratories, P.O. Box 3389, Kathmandu, Nepal. Fitoterapia.1995; 66:231-238.
57. Ahmad SA, Siddiqui SA, Zaman A. Chemical examination of *Callicarpa macrophylla*, *Lagerstromea lanceolata*, *Ficus palmata* and *Taxodium mucronatum*. J Indian Chem Soc.2014. 53(11):1165-1166.
58. Pandey P, Pandey SS, Awasthi A, Tripathi A, Singh HP, Singh AK, Tandon S, Kalra A. *Calliterpenone*, a natural plant growth promoter from a medicinal plant *Callicarpa macrophylla*, sustainably enhances the yield and productivity of crops. Microbial Technology Department, CSIR-Central Institute of Medicinal and Aromatic Plants, Lucknow, India. Front. Plant Sci. 2022; 13. https://doi.org/10.3389/fpls.2022.960717 PMid:36226284 PMCid: PMC9549104.
59. Goyal C, Sharma K, Joshi N. Literary review on *devdarvadyarrishta* w.s.r to its anti-diabetic potential. World J Pharm Life Sci. 2020. p. 87-94.
60. Khan T, Godbole H. *Ushirasava* Physicochemical standardization and quantitative estimation of some bioactives. Department of Pharmaceutical Chemistry and Quality Assurance, SVKM's Dr. Bhanuben Nanavati College of Pharmacy, Mumbai - India. Int J Pharm Sci Res. 2020. p. 2332-2341.
61. Sreedas E, Girish KJ. Clinical study on *Pippalyasava* and *Suranavataka* in *grahani roga* (irritable bowel syndrome). Department of *Kayachikitsa*, SDM College of Ayurveda and Hospital, Hassan, Karnataka, India. Int Ayurveda Med J. 2013; 1:1-6.

62. Dudhamal TS. Clinical efficacy of Amroid tablet and Amroid ointment in the management of *Arsha* (Hemorrhoids) - A single-arm open-label clinical trial. Department of Shalya Tantra, Institute of Teaching and Research in Ayurveda, Jamnagar, Gujarat, India. Asian Pac J Health Sci. 2022; 9(1):216-220. https://doi.org/10.21276/apjhs.2022.9.1.49
63. Du GX, Chen T, Wang G, Liu YB, Zheng L, Li CY, Wang WQ, Xuan LJ. Five undescribed abietane- Type diterpenes of *Callicarpa macrophylla*. School of Chinese Materia Medica, Nanjing University of Chinese Medicine, Nanjing 210023, People's Republic of China Fitoterapia. 2023; 170:105629. https://doi.org/10.1016/j.fitote.2023.105629 PMid:37524125.
64. Chen ML, Chang WQ, Zhou JL, Yin YH, Xia WR, Liu JQ, Liu LF, Xin GZ. Comparison of three officinal species of *Callicarpa* based on a biochemome profiling strategy with UHPLC-IT-MS and chemometrics analysis. China Pharmaceutical University, Jiangxi University of Traditional Chinese Medicine. J Pharm Biomed Anal. 2017. p. 666-674. https://doi.org/10.1016/j.jpba.2017.07.054 PMid:28800528.
65. Ning DS, Li DP, Huang S, Liu JL, Gu ZX, Yan XJ, Pan ZH. Determination of total flavonoids, total phenols, and antioxidant activity in aqueous extract of seven *Callicarpa* species. Guihaia 2016; 845-848.
66. Sharma KR, Rana K. Biological activities of some selected Nepalese medicinal plants and isolation of chemical constituents from *Callicarpa macrophylla*. Central Department of Chemistry, Tribhuvan University, Kirtipur, Kathmandu, Nepal. Int J Curr Pharm Res. 2020. p. 91-98. https://doi.org/10.22159/ijcpr.2020v12i3.38314