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*COMBRETUM INDICUM*LINN. A Comprehensive Pharmacological Review

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Abstract

CombretumIndicum also known as Madhumalti or Rangoon Creeper, belongs to the family Combretaceae which consists of over 600 species and 20 genera. This vining plant is found in both tropical and subtropical climates and is often found in the South-eastern part of Asia and the Philippines. In addition to its beautifying properties, it is also renowned for its many healing applications in both modern and alternative medicine practices. The pharmacological characteristics of the plant are affected by a variety of its phytochemicals, Including alkaloids, flavonoids, tannins, glycosides, saponins, steroids and phenolic compounds. Some of its leaves, flowers, fruits and roots have been used for the treatment of fever, rheumatism, nephritis, skin diseases, migraine, dysuria and many more. The potential usage of this plant as a medicinal tool has been supported by the presence of bioactive compounds found in the plant through phytochemical screening, such as quercetin, rutin, Quisqualis acid and several amino acids.Various pharmacological studies have shown that the plant possess multiple bioactivities such as immunomodulatory, anti-diabetic, anti-inflammatory, antioxidant, antibacterial, anthelmintic, analgesic, anti-dyslipidaemia and anti-asthmatic activities. Due to the wide range of therapeutic properties, the plant C. indicum is easily accessible and fast growing. This gives the plant great potential for further pharmacological studies and drug development.

Keyword: *CombretumIndicum*, Pharmacological activity , Antidiarrheal properties , Plant Profile Therapeutic implication etc.

I. Introduction :

CombretumIndicum-*Combretumindicum* is an ornamental, fast growing, beautiful, fragrant, perennial vine. It is the member of combretaceae family. Combretumindicum thrives in warm climates and prefers well-draining soil and ample sunlight.It holds significance in traditional herbal medicine practices, where extracts from its various parts are utilized for their medicinal properties. and commonly known as the Rangoon Creeper, is a tropical vine celebrated in traditional medicine across Asia. Its seeds, leaves, and roots are heavily utilized to treat intestinal parasites, respiratory issues like coughs and asthma, and skin conditions.

Plant Profile

CombretumIndicum is a woody, evergreen or semi-evergreen climbing shrub. It exhibits a vine-like growth habit, often climbing over structures or other plants for support. It can reach heights of up to 8 meters (26 feet) or more, showcasing its climbing ability. Its vine-like growth and ability to cover surfaces make it a popular choice for decorative purposes in landscaping.

Leaves: Leaves are simple, opposite or sub-opposite, meaning they grow in pairs along the stem, positioned across from each other or slightly staggered. The shape of the leaves is elliptic to ovate, with a pointed or rounded tip and a tapering base. They have entire margins (smooth edges). Typically, the leaves are 5-10 cm (2-4 inches) long and 2.5-5 cm (1-2 inches) wide leaves are smooth, glossy, and dark green in colour on the upper surface, while the underside may be lighter in shade.

Flowers: Flowers are arranged in terminal panicles (loose, branching clusters). The tubular flowers are fragrant and undergo a colour change as they age. They start as white, gradually turning pink, and finally deep red as they mature.5 Each flower is about 2-3 cm long and consists of a slender tube with five spreading lobes at the end.

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Stems: Stems are woody, often with tendrils aiding in climbing, and can be reddish-brown or greenish-brown in colour. Upon reaching maturity, the fruit exudes an almond-like flavour on the palate.

Fig.1 Combretumindicum

S.No.	Plant Part	Phytoconstituents
1	Leaves	Trigonelline, L-proline, L-asparagine, arjunolic acid, asiatic acid, oleanolic acid, benzyl-β-D-xylopyranosyl-(1″ → 6′)-β-D glucopyranoside, nudifloric acid, vanillin, gallic acid, and a sterol, β-sitosterol.
2	Flowers	Rutin, pelargonidin-3-glucoside and polyphenol
3	Seeds	Linoleic, oleic, palmitic, stearic, and arachidic acids, sterol, quisqualic acid
4	Roots	Alkaloids, polyphenols, fatty acids and carbohydrates.
5	Stem	Diphenylpropanoids, Kaempferol, arjunolic acid, dihydrocucurbitacin F

Table 1: *Important Phytoconstituents of Combretumindicum plant*

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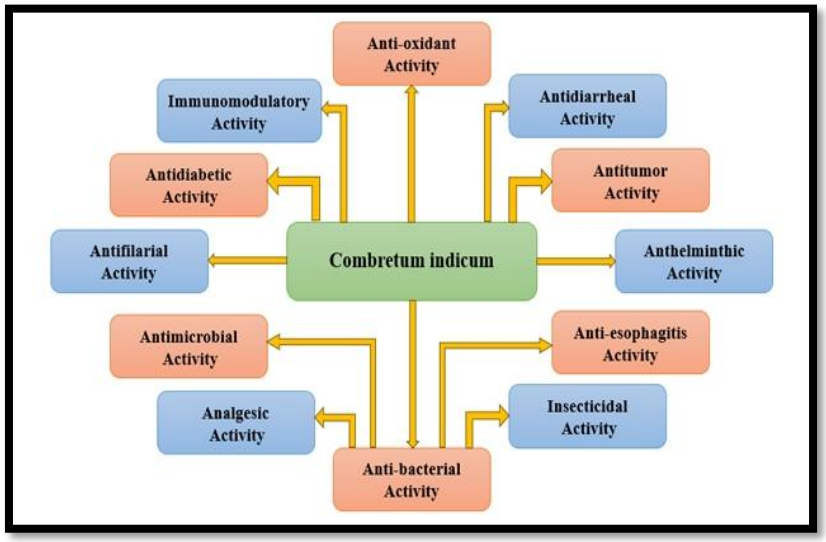

Fig. 2: Pharmacological Activities of Combretumindicum

1. Anti-oxidant Activity: A study was performed by Hossain Md. Abu Hanif et al to evaluate the antioxidant activity of methanolic extract of leaves of Combretumindicum. Anti-oxidant activity was assessed by DPPH radical scavenging assay and reducing power capacity assay. Ascorbic acid (AA) was used as standard. The results suggest that extracts from leaf exhibits a dose-dependent scavenging of DPPH with IC50 48.87 µg/ml while in standard AA showed an IC50 value of 21.14 µg/ml which indicate its potent antioxidant activity. In reducing power capacity assay, the extract was put on view moderate action in a dose dependent way.

Mechanism of Action: A number of researchers investigated that the presence of various polyphenolic compounds in the plants was the cause of their antioxidant actions. Polyphenolic compounds include flavonoids, tocopherols, tannins, and other organic acids. It has been well established that these compounds can exert synergistic effects on scavenging free radicals. Phenolic compounds have antioxidant activity by reacting with free radicals. Polyphenols function as antioxidants through two distinct pathways.

2. Antibacterial Activity: Kumar Manoj et al. examined the antibacterial activity of Combretumindicum Linn. flower extracts in methanolic, ethanolic, and aqueous forms against strains of gram-positive and gram-negative bacteria, including Micrococcus luteus, Bacillus subtilis, and Escherichia coli. The antibacterial activity of the extracts was assessed using the Agar well diffusion test method. In comparison to the ethanolic and aqueous extracts, the methanolic extract of Combretumindicum had the greatest effectiveness and the broadest inhibitory zone.3,20 Using three different solvents- methanol, ethyl acetate, and hexane Agarwal A et al. (2016) also found antibacterial activity in the dried aerial part of Combretumindicum. The broth dilution method was used to measure the antibacterial activity. When compared to ampicillin, which was used as a positive control, all extracts shown considerable action against the four pathogens Escherichia coli, Klebsiellapnemoniae, Staphylococcus aureus, and Staphylococcus pneumonia.

Mechanism of Action: Numerous studies have examined the potent antibacterial activity of polyphenols and alkaloids. Among the most abundant and varied classes of secondary metabolites, polyphenols' antioxidant properties serve as the foundation for their antibacterial actions. Bacterial cell membranes are bound by polyphenols in a concentration-dependent way that modifies the membrane's functional properties and inhibits the growth of the bacteria.

3. Anthelminthic Activity: The medication Combretumindicum L., also known locally as Eeshwarahoovu, is used by the folkloric people of Dakshina Kannada, District, Karnataka, to cure helminthiasis. In order to scientifically verify the folklore about the drug Combretumindicum L., an experimental investigation was conducted using adult Indian earth worms (Lumbricusterrestris L.). Albendazole suspension was used as the standard drug for comparison The investigation demonstrated

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the superior experimental efficacy of Combretumindicum L. over the standard drug in the experimental setting.

Mechanism of Action: An assessment was conducted on the anthelmintic activity of forty extracts derived from 10 plants that were utilised in Benin to treat small ruminant intestinal parasitosis. According to these findings, a number of substances, such as terpenes, flavonoids, alkaloids, and tannins, may be partially responsible for the biological activity that has been seen. Their mechanism of action is different. Tannins are polyphenolic substances that attach themselves to free proteins in worm guts. This can interfere with the worms' energy generation mechanism, causing paralysis and death. Moreover, tannins can strengthen the host's defences against intestinal parasites. Alkaloids can break down cell walls, proteins, and lipid content in worms, resulting in death. Flavonoids can cause proteins in the cuticle and intestine to clump together, which can paralyze the worm's muscles and eventually kill it.

4. Anti-filarial activity: Rastogi S et al. reported in vitro antifilarial activity of ethanolic and hydroethanolic extracts of the leaves and flowers of Combretumindicum on microfilariae (mf) and female adult worms of human lymphatic filariidBrugiamalayi. Antifilarial activity of the extracts was assessed using the motility and or 3-(4,5-dimethylthiazol-2-yl)-2,5 diphenyltetrazolium bromide (MTT)-reduction assays. It was discovered that the hydroalcoholic extract of flowers was found effective as it killed adult female worms (LC100: 62.5 µg/mL) and mf (LC100: 125 µg/mL). SI values recorded with respect to motility of female parasite and mf was more than 20.

5. Anti-tumor Activity: The methanolic extract derived from the aerial part of Combretumindicum exhibited notable anti-tumor activity when tested on Ehrlich ascites carcinoma cells. The entire extract demonstrated a significant impact on the viability of these carcinoma cells at all concentrations tested, displaying a dose-dependent response. Remarkably, the high concentration of the extract induced a cytotoxic effect comparable to that achieved by vincristine, a commonly utilized anticancer drug.

Mechanism of Action: Flavonoids can inhibit cell growth and act as an anticancer agent.

6. Anti-esophagitis Activity: The study reveals the efficacy of the alcoholic extract derived from Combretumindicum flowers in combating esophagitis through the inhibition of reactive oxygen species (ROS) and free radicals. This extract demonstrated the normalization of pH and total acidity in esophageal content, accompanied by an elevation in the levels of superoxide dismutase (SOD), catalase (CAT), and glutathione (GSH). Moreover, there was a reduction in thiobarbituric acid reactive substances (TBARS) and protein carbonyl (PC) concentration. The results of the statistical analysis using SAM further supported the protective effects of Combretumindicum flower extract on esophageal tissue. These beneficial actions are likely attributed to the higher content of phenols and flavonoids present in the extract.

7. In-vivo antidiabetic Activity: In a Long-Evans rat model, MdShaekhForid et al. examined the in vitro antioxidant and in vivo antidiabetic properties of Combretumindicum leaf extract (CILEx) using UPLC-QTOF/ESI-MS-based phytochemical profiling. The animals' lipid profiles, blood glucose levels, and pancreatic structures were assessed following a one-week intervention. The results indicated that CILEx has a very promising antioxidative impact. It was discovered that both CILEx doses increased high-density lipoprotein (HDL) and significantly ($p < 0.05$) decreased blood glucose, total cholesterol (TC), and low density lipoprotein (LDL). When compared to the diabetic control group, the pancreatic tissue topologies were significantly better.

8. Anti-microbial Activity: In the assessment of antimicrobial activity using the disk diffusion method, ethyl acetate extracts from various parts of Combretumindicum exhibited distinct profiles of bioactive compounds. Notably, the flower samples, both in their crude (102.24±0.48 mg GAE/g of tissue) and dry (83.75±0.47 mg GAE/g of tissue) forms, displayed the highest total polyphenolic content. Concurrently, the crude leaf extract (60.67±0.31 mg QE/g of tissue) and dry flower extract (54.27±0.20 mg QE/g of tissue) exhibited the highest total flavonoids content. Furthermore, when evaluating the antimicrobial efficacy, it was observed that the leaf extract displayed the maximum inhibitory zone against Staphylococcus aureus, while the flower extract exhibited the highest inhibitory zone against Escherichia coli. These findings underscore the differential bioactive substance distribution within the plant, emphasizing that the leaves and flowers of Combretumindicum contain high antimicrobial property compared to the stem.

9. Immunomodulatory Activity: The hydroalcoholic extract of Combretumindicum flowers demonstrated proven immunomodulatory activity, as evidenced by the carbon clearance test, cyclophosphamide-induced myelosuppression, Total

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Leukocyte Count (TLC), Differential Leukocyte Count (DLC), and Delayed Type Hypersensitivity (DTH). Administered orally at 100 mg/kg and 150 mg/kg, the Combretumindicum flower extract exhibited significant immunomodulatory effects, with Levamisole (50 mg/kg, po) as the standard drug. Comparative analysis against the control group induced by cyclophosphamide (50 mg/kg) further confirmed the higher dose of Combretumindicum flower extract's notable immunomodulatory activity.

10. Analgesic Activity: In wistar rats, KavitaKumari et al. assessed the analgesic effect of a hydroalcoholic extract of Combretumindicum Linn. leaves. Combretumindicum leaf hydroalcoholic extract (100 and 200 mg/kg p.o.) was found to have peripheral analgesic action when tested on experimentally induced pain models, such as the tail flick method with analgesiometer and the acetic acid-induced writhing effect in albino wistar rats of both sexes. In every treatment group, the plant extracts demonstrated dose-dependent analgesic effect; the outcomes were contrasted with those of the conventional medication, aspirin (20 mg/kg, p.o.). The hydroalcoholic extracts of Combretumindicum Linn. leaves (100, 200 mg/kg, p.o.) demonstrated considerable analgesic effectiveness against pain generated in an experimental setting, with the effects decreasing with dosage.

11. Antidiarrheal Activity: The petroleum ether extract of Combretumindicum L. leaves demonstrated significant dose dependent anti-diarrhoeal activity in albino Wistar rats. Administered orally at doses of 100 and 200 mg/kg, the extract exhibited efficacy against experimentally induced diarrhoea models, including castor-oil induced diarrhoea and charcoal-induced gastrointestinal motility test. Comparative analysis with standard drugs (Loperamide and Atropine sulphate) further supported the conclusion that the petroleum ether extracts possess noteworthy anti-diarrhoeal effects at both doses ($P<0.05$).

12. Insecticidal Activity: Ethanol extracts from thirty Chinese medicinal plants were tested for their insecticidal activity against Spodopteraexigua, as well as their contact toxicity and anti-feedant properties. Fruit from Combretumindicum was one of them. Eight Chinese medicinal plant preparations demonstrated potent insecticidal action. The plant extracts from Bruceajavanica (L.) Merr., Artemisia argyiLévl. et Vant., and Litseacubeba (Lour.) Pers. proved to be the most efficacious. Strong antifeedant effects were seen in the insect by three of the extracts. Extracts from Bidenspilosa, Carpesiumabrotanoides, Ecliptaprostrasta, F. thunbergii, Lonicera japonica, Saposhnikoviadivaricata, and Combretumindicum caused significant values of FDI (30 to 60%).

13.Anti-helmenthic :

Combretumindicum is said to be useful in treating ringworm, rickettsia, common cold, loose bowels as well as coughing. Seed is used for treatment of fever, diarrheal, boil, ulceristic conditions in Bangladesh is also common place. For those suffering from dropsy, the leaves and seeds act as anthelminthic tools. Young children are said to cough less after having steamed exposed to the leaves and seeds. Roots can be utilized as a treatment for parasitic worms and even as a remedy for diarrhoea. In addition, it may also be used to alleviate rheumatism.

II. Discussion

The ethnomedicinal profile of *Combretumindicum* underscores its diverse therapeutic potential across multiple physiological systems. This review highlights its prominent role in traditional medicine systems, particularly in South Asia, for treating infectious, gastrointestinal, and inflammatory disorders.

Antimicrobial and Antiparasitic Efficacy

The widespread traditional use of *C. indicum* as an anthelmintic agent is highly significant. The roots, leaves, and seeds are consistently utilized across different regions to expel parasitic worms, validating its classification as a potent anti-helminthic tool. Furthermore, reported activity against fungal pathogens like ringworm and intracellular bacteria such as *Rickettsia* suggests a broad-spectrum antimicrobial profile. These findings warrant rigorous in vitro screening to isolate the specific phytochemicals responsible for these disruptive properties against cellular pathogens.

Gastrointestinal and Respiratory Applications

Gastrointestinal distress, including diarrhoea and loose bowels, represents a primary therapeutic target for *C. indicum* roots and seeds. This antidiarrheal activity may be attributed to secondary metabolites that modulate intestinal motility or exhibit antisecretory properties. Simultaneously, the plant addresses respiratory ailments. Steam inhalation of leaves and seeds is documented to alleviate coughing in pediatric patients, while general preparations target the common cold. This dual efficacy in smooth muscle systems suggests

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potential antispasmodic or anti-inflammatory mechanisms that merit further pharmacological evaluation.

Tissue Repair and Analgesic Potential

Beyond internal systemic treatments, *C. indicum* demonstrates notable efficacy in dermatological and musculoskeletal care. The use of seed paste or extracts in Bangladesh to treat boils and ulceristic conditions indicates localized tissue-healing and antimicrobial properties. Additionally, root preparations are traditionally employed to alleviate rheumatism. This specific application strongly implies the presence of bioactive compounds capable of inhibiting inflammatory pathways or mitigating nociceptive pain signals.

III. Conclusion

In summary, *C. indicum* serves as a versatile pharmacological repository in traditional medicine. However, much of the current literature relies heavily on observational and ethnobotanical data. Future research must focus on:

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