PHYTOCHEMISTRY AND PHARMACOLOGICAL ACTIVITIES OF *EMBELIA RIBES* BURM F. -A POTENT MEDICINAL CLIMBER

Abstract

Natural bioactive substances have a wide range of biological applications, including analgesic, antibacterial, anticancer, and anti-inflammatory properties. Some natural products also have healing properties. The medicinal herb Embelia ribes belongs to the Myrsinaceae family and grows in hilly areas of India up to 1500 metres above sea level, from the outer Himalayas to the Western Ghats. A rare medicinal plant called 'Embelia ribes' Burm. f. has undergone extensive research on a variety of therapeutic properties. Herbal medicines have been used for healing since the dawn of recorded history. One of the most important medicinal herbs is Embelia ribes. This plant has various chemical components practically in every part of it, and it is used to treat a wide range of diseases. The berries of Embelia ribes Burm. F include a variety of chemical elements, such as embelin, volatile oil, fixed oil, resin, tannin, christembine, and phenolic acids, such as caffeic acid, vanillic acid, chlorogenic acid, cinnamic acid, and o-coumaric acid. These berries contain 4.33% of the embelin found in nature. This therapeutic plant, which is in grave risk of extinction, has been scientifically proven to have digestive, carminative, and laxative qualities. It has been demonstrated that the potent medicinal plant Embelia ribes has anthelminthic, antibacterial, antioxidant, diabetic, anticonvulsant, anti-cancer, and antihyperlipidemic, antifungal, antihyperhomocysteinemic, molluscidal, wound healing, antifertility, antihyperglycemic, antitumor and anti-inflammatory, chemotherapeutic, contraceptive, and anxiolytic properties the hepatoprotective and analgesic properties of Embelia ribes were also studied.

Keywords: *Embelia ribes*, pharmacognosy, phytochemistry, pharmacological activity, Phytoconstituents

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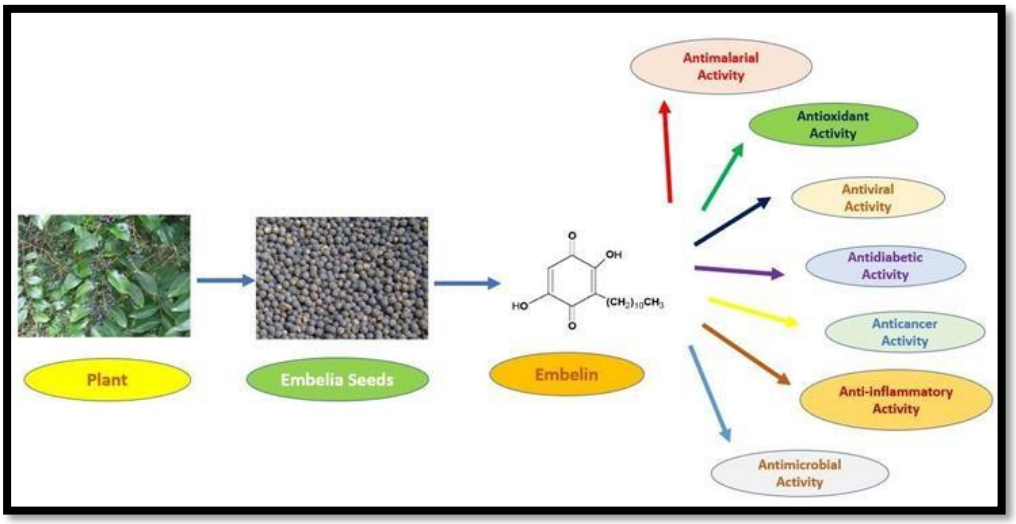
I. INTRODUCTION



Since ancient times, *Embelia ribes* Burm. f. has been utilized in Ayurvedic therapy., sometimes referred to as Vidanga or Baibidanga, is a major component in several formulations [1]. The ayurvedic texts Charakh Samhita, Sushurta Samhita, and Ashtanga hridayam mention Vidanga. According to certain accounts, vidanga is utilized in several medical systems, including Ayurveda, Unani (Baobarang), Siddha (Vaivilangam), Folk, Tibetan (Bydanga), and Homeopathy *(Embelia ribes).*

Botanists and numerous Ayurvedic practitioners have associated *Embelia ribes* Burm. f. to the plant vidanga. In 1966, when vidanga was first recognized as an official drug in the Indian Pharmacopoeia, its botanical origin was limited to the fruits of *E. ribes*. Since that time, it has been common knowledge that the dried berries of *E. ribes* fruits are the source of the psychoactive substance Vidanga (Myrsinaceae family). Despite being utilized in several medicinal systems, including Unani, Homeopathy, and others, *E. ribes* has not been proved [2].

Several additional languages have names for this plant, including Assamese, Marathi, Oriya, Bengali, Vavding in Gujarati, Vayavidanga in Hindi, Kannada, Babading in Kashmiri, Vizhalari in Malayalam, Babrung in Punjabi, Vayuvidangam in Tamil, Vayuvidangalu in Telugu, and Baobarang in Urdu [3]. *Embelia ribes* Burm. is also known by the names White-flowered *Embelia* and False Black Pepper. In the middle and lower Himalayas, Arunachal Pradesh, Assam, Bengal, Orissa, and Andhra Pradesh, semi-deciduous and deciduous woods at a height of 1,500 meters are home to *ribes* [4].

The vidanga shrub is a scrambling plant with climbing tendencies. The roots have a brownish-gray colour with reddish hairy roots. The mature stem is 45–72 cm in diameter and light grey with lenticels. Coriaceous leaves have a 1-0.8 cm petiole margin and are elliptic, lanceolate, alternate, whole-acuminate, and hairless. They are 2 to 4 centimeters broad and 6 to 14 centimeters long. Small, white or yellow blooms are pentamerous. The

fruits are smooth, juicy, wrinkled, rectangular to subglobose in form, 2.4–4 mm in diameter, tap with style, and are devoid of a calyx. The seeds are first red and subsequently transform into a faint black hue. A thin membrane covers the fragile pericarp of the seed, which, when peeled back, reveals a seed with a vibrantly coloured inside.

The seeds are hairy, with an endosperm that has been ruminated and a depressed base. Aromatic, astringent, and finishing with a hint of pungency. This plant's fruits, leaves, and roots have therapeutic qualities [5]. The whole plant is used to treat rheumatism, fever, lung and stomach issues, constipation, indigestion, fungal infections, mouth ulcers, sore throats, pneumonia, heart disease and obesity.

It can be used to treat tumors, ascites, bronchitis, jaundice, and mental health concerns [7]. The flavour of this fruit is bitter. According to Ayurvedic scriptures, *Embelia ribes* fruit has the finest krimighna (wormicidal) effects against illnesses [8]. Seeds have alterative, stimulative, antibacterial, antihelmintic, and antituberculosis effects [2]. The leaves can be used to treat pruritus, sore throats, mouth ulcers, adolescent skin problems, and leprosy due to their astringent, demulcent, and depurative characteristics [9]. The fruits of *Embelia ribes* contain the alkaloid christembine, whose chemical name is 2,5-dihydroxy-4-undecyl- 3,6- benzoquinone, the quinone derivative embelin (3-undecyl 2, 5-dihydroxy, 1,4-benzoquinone), and the volatile oil vilangin. The fruit contains significant levels of christembine, embelin, tannins and embelic acid [1].

Other compounds include vilangin, 2, 5-isobutylamine salts, quercitol, and volatile oil [11–14]. Embelin possessed antimicrobial and antiepileptic effects. *Embelia ribes* plant extract have potent anthelmintic, antioxidant, neuroprotective, antifertility, and antiestrogenic properties [17–20].

The big scandent shrub *Embelia ribes* Burm F. is a member of the Myrsinaceae family and grows all throughout India. It is sometimes referred to as Vidanga and fake black pepper. [21-25]

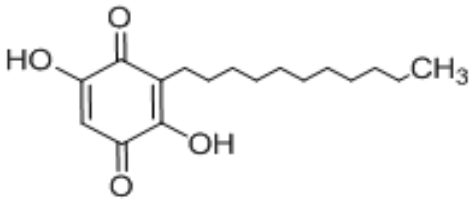
E. ribes thrives at 1,500 metres in the lower and central Himalayas, in the Indian states of Arunachal Pradesh, Assam, Bengal, Orissa, and Andhra Pradesh, as well as in semi-evergreen and deciduous forests. [26].

II. PHYTOCONSTITUENTS

1. **Phenolic compound:** derivatives of quinines Vilangin, Embelin, Embelinol, Embeliaribyl ester and Embeliol
2. **Flavonoid:** Quercitol
3. **Alkaloids**: Fruit includes christembine
4. **Steroids:** β-Sitosterol and daucosterol
5. **Additional components:** tannin, fatty compounds, resinoid and volatile oil, phenolic acids such as vanillic acid and cinnamic acid, o-coumaric acid, acid, caffeic acid, and chlorogenic acid.

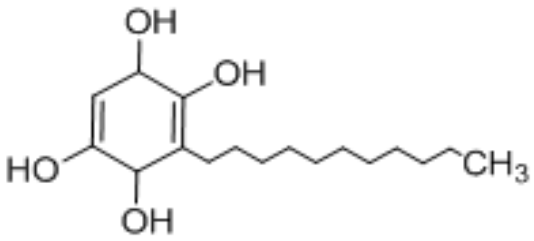
III. PHYTOCHEMISTRY

The active component embelin is contained in the mature fruits of *E. ribes* are the most economically useful plant constituent [27]



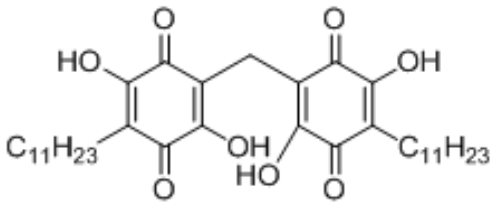
Embelin (2,5-dihydroxy-3-undecylcyclohexa-2,5-diene-1,4-dione)

Figure 1:



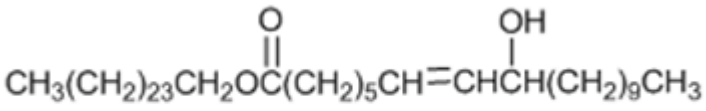
Embeliol (3-undecylcyclohexa-2,5-diene-1,2,4,5-tetraol)

Figure 2:



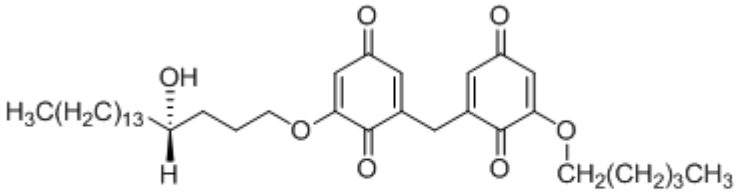
Vilangin (6,6'-methylenebis(2,5-dihydroxy-3-undecylcyclohexa-2,5-diene-1,4-dione)

Figure 3:



Embeliaribyl Ester (n-pentacosyl 9-hydroxynonadec-7-enoate)

Figure 4:



Embelinol ((*R*)-2-((3,6-dioxo-5-(pentyloxy)cyclohexa-1,4-dien-1-yl)methyl)-6-((4-hydroxyoctadecyl)oxy)cyclohexa-2,5-diene-1,4-dione)

Figure 5:

IV. CHEMICAL COMPOSITION

In addition to phenolic acids such as caffeic acid, vanillic acid, chlorogenic acid, cinnamic acid, and o-coumaric acid, *Embelia ribes* berries also include embelin, volatile oil, fixed oil, resin, tannin, and christembine. 4.33 percent of the *Embelia ribes* Burm. F. berries contain embelin. The plants also include methylenebis (2, 5-dihydroxy-4-undecyl-3-6-benzoquinone), embelin, quercitol, fatty components, and vilangin in addition to potassium embelate. *Embelia ribes* seeds included three more compounds: embelinol, embeliaribyl ester and embeliol [28]. Additionally, E. coli has a high carbohydrate content. Additionally, *E. ribes* seeds included Cr, K, Ca, Cu, Zn, and Mn.

Nitrogen-containing 3-alkyl-1, 4-benzoquinone derivatives include N-(3-carboxylpropyl)-5- amino-2-hydroxy-3-tridecyl-1, 4-benzoquinone, a rare 3-alkyl-1, 4-benzoquinone derivative and a derivative of gomphilactone. Using an ethanolic extract, the chemical 5,6-dihydroxy-7- tridecyl-3-[4-tridecyl-3-hydroxy-5-oxo 2-furylidene] was obtained. From the ancestry of *E. ribes*, 2-oxo-3(2H)-benzofuran. [28]

Using a qualitative analytical test, the presence of many phytoconstituents, including alkaloids, carbohydrates, saponins, phenolic compounds, proteins, oils and lipids and mucilage was determined in the aqueous and alcoholic extracts. *Embelia ribes* fruit powder [29] was subjected to a qualitative photochemical screening.

V. PHARMACOLOGY

On the basis of traditional and folkloric usage, *ribes* is being investigated scientifically to establish its capacity to heal and cure a number of diseases [30]. Several uses

of *Embelia* Table 2 lists the known pharmacological activities of *ribes* [31].

Activity/disease	Tested organism	Extract/salts	References
Analgesic activity	Rat	Embelin Embelindisalts Potassium embelate	16 17 18
Anthelmintic activity	Pheritima posthuman, haemonehus contortus, taenia canina, phamphistomum cervi	Aqueous and alcoholic extracts	19,20,21,22,23
Antianxiety activity	Rat	embelin	24,25,26
	Bacillus subtilis, staphylococcus aurens, Escherichia coli, pseudomonas aeruginosa Bacillus polymyxa and proteus vulgaris	Aqueous and ethanolic extracts Aryl substituted benzoxadiazine	27,28,29
Anthelmintic activity	Pheritima posthuman, haemonehus contortus, taenia canina, phamphistomum cervi	Aqueous and alcoholic extracts	19,20,21,22,23
Antianxiety activity	Rat	embelin	24,25,26
Antibacterial activity	Bacillus subtilis, staphylococcus aurens, Escherichia coli, pseudomonas aeruginosa Bacillus polymyxa and proteus vulgaris	Aqueous and ethanolic extracts Aryl substituted benzoxadiazine	27,28, 29
Anthelmintic activity	Pheritima posthuman, haemonehus contortus, taenia canina, phamphistomum	Aqueous and alcoholic extracts	19,20,21,22,23

	cervi		
Antianxiety activity	Rat	embelin	24,25,26
Antibacterial activity	Bacillus subtilis, staphylococcus aurens, Escherichia coli, pseudomonas aeruginosa Bacillus polymyxa and proteus vulgaris	Aqueous and ethanolic extracts Aryl substituted benzoxadiazine	27,28
Antinematodal activity	Goat	Seed oil	30
Anticancer activity	Fibrosarcoma cell line heLa cell line PC-3 xenograft modal HepG2 cells Wistar rats MCF-7 cancer cells Human leukaemic cells (K562) and Dalton's Lymphoma ascites Cells (DLA)	Embelin 5-O-ethylembelin, 5-O-methylembelin (derivatives) Embelin Embelin Embelin Embelin	32 33,34 35 36 37 38 39
Osteoporosis cancer-linkedbone loss		Breast cancer cells	Embelin
Anticonvulsant activity	Rat	Embelin	42
Antidepressant activity	Mice	Embelin	43
Antifertility activity	Male albino rats Male bonnet monkeys Rabbits Female Sprague-Dawley rats	Embelin *E. ribes* berries Embelin Embelin	44,45,46,47,48 49 50 51,52
Antifungal activity	Colletotricum Crassipes, Cladosporium , Armillaria mellea,	Seed extract Embelin	53 54,55,56

	Colletotricum capsica, Aspergillus niger, Rhizopus oryzae, Aspergillus terreus and Candida species		
Antigenotoxicity activity	Mouse bone marrow cells	Embelin	57
Antihistamic activity	Guinea pigs	Embelin	58
Antimitotic activity	Bengal gram seedsand germinating onions	2-hydroxy-5- substitited-3- undecylclohexa-2,5-diene-1,4-diones	59
Antioxidant and Neuroprotective activity	Rat Male wistar albinorats Peripheral blood human lymphocytes	Embelin Ethanolic extracts embelin	60,61 62,63 64
Cardioprotective activity	Rat	Aqueous and alcoholic extracts	65,66,67
Cosmetic agent	-	Embelin	68
Wound healing activity	Swiss albino rats	Ethanolic extracts, embelin	69,70
Nephroprotective activity	Albino rats	Ethanolic extracts, embelin	71,72
Nephroprotective activity	Albino rats	Ethanolic extracts, embelin	71,72
Antidiabetic activity	Wistar rats	Ethanolic extracts, embelin	73,74,75.76,77

Moreover, despite the fact that research has been conducted to investigate the various actions of *Embelia*. The majority of research on *ribes* has focused on cancer, diabetes, and infertility. This is due to *E. ribes* contains significant anticancer, antiglycemic, and antifertility properties (Fig 3). The bulk of these investigations utilized either the pure embelin component or aqueous- alcoholic extracts, according to additional research (Fig 2). Although experiments with various versions of the embelin molecule have been conducted.

1. **Analgesic activity:** Embelin is a centrally acting, non-narcotic analgesic taken orally. Its primary site of action varies from naloxone and is not hostile to it. Due of its great oral effectiveness, therapeutic index, and lack of abstinence syndrome, it is more bearable thanmorphine. Naloxone has been demonstrated to inhibit (U)-receptor-mediated activity in narcotic medications.

2. **Anthelminthic activity:** Different dosages of *Embelia ribes* seed oil, including 10 mg/ml, 50 mg/ml, and 100 mg/ml, killed the worms (Pheretima posthuma). However, the period of paralysis parameter varied across different dosages of worms. As the dose rose, it was noted that the duration of paralysis decreased. Compared to ordinary piperazine citrate (10 mg/ml), the outcomes are statistically significant. The combination of Embelia ribes fruit extract and Veronica anthelmintic a seed extract at 1g/kg significantly decreased the quantity of faecal eggs per gram in goats with mixed gastrointestinal nematode infections (EPG).

3. **Antianxiety activity:** Behavioral parameters from the elevated plus maze test, open field test, and light and dark test were used to evaluate the anxiolytic effect. In the raised plus maze, there were more entries and an increased proportion of open arm time. Embelin hasa potent anti-anxiety effect [97] that dose-dependently reduces the innate aversion to light and increases the time spent in the lighted region. The observed activity may be explained by the agonistic impact on the combination of GABA and benzodiazepine receptors [98].

4. **Anti-bacterial activity:** Compared to the traditional drug nitrofurazone, which has an inhibition zone of 22 mm diameter against Bacillus subtilis, *Embelia ribes* at a dosage of 500 mg/50ml demonstrated an inhibition zone of 12 mm. Against *Embelia ribes*, Pseudomonas aeruginosa, Staphylococcus aureus, and Escherichia coli shown no antibacterial or inhibitory action [99-100].

5. **Antinematodal activity:** On goats, the antinematodal action of the combination of Veronia anthemintica seed (Kali zeeri) and *Embelia ribes* fruit (Babrang) was examined. On the third, tenth, and fifteenth day, EPG (Egg per gram) counts were done in the faeces before and after treatment with the powder at dosages of 0.5, 1, and 2 g/kg body weight, as well as water and methanol extracts corresponding to 2 g/kg of the original powder. On the 15th day following treatment, data analysis demonstrated that 2 extract and 0.01 g/kg morantel tartrate are equally efficacious and safe for treating natural gastrointestinal nematodes in local goats [101].

6. **Ascaricidal properties:** Goats with gastrointestinal nematode infections are treated with seed oil extracted from *Embelia* vibrations (fruit) seeds [46].

7. **Anti-cancer activity:** In rats with experimental fibrosarcoma, embelin has been demonstrated to diminish tumor size and control the increase in activity of blood enzymes such as acid phosphatase, glutamyl transferase, lactate dehydrogenase, and aldose. Embelin inhibits the amino acid and glucose metabolism in animals with tumors. Together, 50 mg/kg/day of embelin and 100 mg/kg/day of curcumin reduced body weight loss, elevations in hepatic diagnostic markers, the development of N- nitroso diethylamine-induced hepatic hyperplastic nodules, and hypoproteinemia in adult male Wistar rats. Osteoclasts are responsible for the osteolysis observed in bone metastases caused by tumors. RANKL (receptor activator for nuclear factor k B ligand), amember of the TNF superfamily and activator of the signaling pathway, has been discovered as a critical mediator of bone loss, which is usually linked with cancer and other chronic

inflammatory illnesses. [102-103].

8. **Anticonvulsant activity:** Embelin i.p. at dosages of 2.5, 5, and 10 mg/kg body weight, (intraperitoneal) diagnosis decreased seizures induced by electroshock and pentylenetetrazole, with effects equivalent to phenytoin and diazepam. C.N. A considerable drop in motility was indicative of S's depressed effect. Embelin has anticonvulsant activity in both grand mal and petit mal epilepsy, according to the findings [105].

9. **Antidepressant activity:** To produce antidepressant effects, mice were given intraperitoneally with embelin 30 minutes prior to the beginning of experimental depression. Embelin has demonstrated therapeutic promise for the treatment of mental depression [104].

10. **Antifertility activity:** Using *Emelia ribes* Burm., the embelin was eradicated. Fruits administered subcutaneously for 35 days at dosages of 0.3, 0.4, and 0.5 mg/kg body weight altered the testicular histology, glycogen levels, gametogenic counts, and fructose content of the accessory sex gland. The chemical is considered to have anti- androgenic effects. This would result in a substantial increase in the number of couples utilizing family planning. Mentha arvensis, Daucus carota, Butea monosperma, and anti- implantation activities (leaves have anti-implantation effect). There are several references to plants with antifertility characteristics in India. [105].

11. **Antifungal activity:** NCCLS was utilised to evaluate the antifungal activity of *Embelia ribes* utilizing conventional in vitro antifungal susceptibility assays (The national committee for clinical laboratory standard M27-A2 Protocol). The methanol extract of *Embelia ribes* and embelin showed the lowest MIC50 range of 120 mg/L against Candida albican (MTCC no. 183) and the highest MIC50 range of 120 mg/L among the four Candida species tested [106].

12. **Antimitotic activity:** Embelin and Embelin derivatives have antimitotic properties [107].

13. **Antioxidant property:** The levels of glutathione, catalase, and pancreatic superoxide dismutase were dramatically decreased in streptozotocin-induced diabetic rats after oral administration of an aqueous extract of *Embelia ribes* at dosages of 100 mg/kg and 200 mg/kg body weight. It prevents the death of pancreatic cells in streptozotocin-induced diabetic rats by virtue of its antioxidant properties. [108].

14. **Cardio protective effect:** Extract of *E. ribes* decreased systemic blood pressure and heart rate considerably. Blood creatinine kinase, serum lactate dehydrogenase, and myocardial endogenous antioxidant levels may also rise [109].

15. **Wound healing property:** Both embelin and the ethanolic extract of *Embelia ribes* (30 mg/ml) were effective at treating wounds. Embelin-treated groups demonstrated faster epithelialization and wound constriction (4 mg/ml sodium alginate gel, 0.2% concentration). The incision site had considerably better tensile strength than the ethanol extract. The weight of the granulation increased in the deed space model, indicating a rise in collagenation. In the granulation tissue of the embelin-treated group, there were no monocytes and increased collagen fibre cross-linking. The outcomes are compared to

those of the well-known topical therapy for the skin, framycetin [110].

16. **Anti-diabetic activity:** The decoction of *Embelia ribes* fruits at doses of 100 and 200 mg/kg orally fed for forty days significantly decreased (p0.01) heart rate, systolic blood pressure, blood glucose, blood glycosylated hemoglobin, and serum lactate dehydrogenase in streptozotocin (40 mg/kg, intravenously single dose)-induced diabetic rats. Gliclazide is being used as a control in this study. It was shown that an ethanolic extract of *Embelia ribes* fruits considerably decreased pancreatic thiobarbituric acid reactive compounds (TBARS) in the pancreatic tissue of diabetic rats (p0.01) [111].

17. **Antihyperglycemic activity:** The treatment of diabetes mellitus using oral herbal medicines based on traditional medicine. Ayurveda utilized the anthelmintic properties of *Embelia ribes* burm (Myrtaceae), also known as vidanga. Ayurveda states that vidanga has a bitter taste. increasing digestive heat reduces gas and colic. A single research explored E. coli's capability. *E. ribes* Burm ethanolic extract to reduce cholesterol and function as an antioxidant in streptozotocin (40 mg/kg, IV, single injection)-induced diabetes, and the antihyperglycemic effect of *E. ribes* Burm. decoction in rats withdiabetes caused by glucose [112].

18. **Antihyperlipidemic activity:** Compared to streptozotocin-induced pathogenic diabetic rats (at a dose of 40 mg/kg intravenously), an ethanolic extract of *Embelia ribes* administered orally at a dose of 200 mg/kg for 20 days resulted in a significant (p0.01) reduction in blood glucose, serum total cholesterol, and triglycerides, as well as an increase in HDL-cholesterol levels. The extract also lowered thiobarbituric acid reactive compounds in the liver and pancreas. (TBARS) values (p0.01) werecompared to TBARS values in the liver and pancreas of pathogenic diabetic rats [113].

19. **Antihyperhomocysteinemic activity:** On adult male Wistar rats with hyperhomocysteinemia, *Embelia ribes* was evaluated for its anti-hyperhomocysteinemic action. 30 days of methionine treatment (1 g/kg p.o.) were employed to develop hyperhomocysteinemia. The treatment of 100 and 200 mg/kg p.o. of *Embelia ribes* aqueous extract to hyperhomocysteinemic rats for 30 days dramatically decreased homocysteine, LDH, total cholesterol, triglycerides, LDL-C, and VDL-C levels in blood while considerably boosting HDL-C levels (p0.01). The results are equivalent to those obtained with folic acid, the standard anti-hyperhomocysteinemic medication [114].

20. **Mollusicidal activity:** In addition to MGK-264 and piperonyl butoxide, *Embelia ribes* fruit powder was employed in binary and tertiary combinations with Azadirachta indica and Cedrus deodara oil against Lymnea acuminata (PB). It was observed that the time and dosage of certain mixes affected their toxicity. When combined in binary and tertiary treatments, plant-derived molluscicides with synergists produced more damage than when used alone. [115].

21. **Antiproliferative activity:** The biological activities of two 1, 4-benzoquinone derivatives, 5-O-ethylembelin (1) and 5-O- methyl embelin (2), were examined. Both marsupial kidney cekks exhibited antiproliferative activity when compared to a panel of human cancer cell lines (Ptk2). They inhibited HL-60 cells in the G (0)/G (1) phase of the cell cycle in a dose- and time-dependent manner. After six hours of exposure to 100

micro M of 1 or 2, the microtubule network in HeLa cells completely disintegrated, and the number of cells locked in the mitotic phase increased. After being treated to medicines 1 and 2 for 24 hours at a dose of 10 micro M each, HL-60 cells underwent apoptosis. This information implies that compounds 1 and 2 are promising new antimitotic and anticancer agents that target microtubular proteins. [116].

22. **Anti-spermatogenic activity:** Embelin, the active component of *Embelia ribes* Burm seeds, has allegedly been isolated. After daily subcutaneous treatment of 20 mg/kg body weight for 15 or 30 days, the medication decreased the number of motile sperm in the epididym, reproductive markers such as pregnancy success and litter size, and enzyme activities involved in glycolysis and energy metabolism in male albino rats. These modifications might be reversed between 15- and 30-days following recovery. Embelin reduced spermatozoal motility and glucose metabolism enzyme activity in a dose- and time-dependent manner when added to epididymal sperm suspensions. [117].

23. **Antitumor and anti-inflammatory activities**: Embelin, a benzoquinone derivative derived from plants, was discovered to exhibit anticancer properties and increase survival time in albino rats with methylcholanthrene-induced fibrosarcoma. Additionally, this medicine contains anti-inflammatory and pain-relieving qualities. The effects of cancer therapy on the amounts of DNA, RNA, and proteins in various organs were also investigated. [118]

24. **Chemotherapeutic activity:** Identifying the chemical components and molecular targets of ancient medicines is an attractive therapeutic objective. Embelin, a chemical obtained mostly from the *Embelia ribes* plant, has been found to have chemopreventive, anti-inflammatory, and apoptotic activities via an unknown mechanism. Considering that nuclear factor kappaB (NF-kappaB) controls many apoptosis-related genes, researchers hypothesised that NF-kappaB activation may facilitate embelin activity [119].

25. **Contraceptive activity:** In quest of traditionally therapeutic plants having contraceptive effects, plants were located and collected throughout India, the bulk of which were obtainedfrom Ayurvedic medicine vendors. The plants were air-dried, sliced, and treated with various organic solvents. Rats, mice, and hamsters were used to evaluate the herbs' contraceptive effects. 5-6 mice were administered 100-200 mg/kg oral dosages of 137 plants. Two to three extracts of each plant were administered to adult rats, and the results were encouraging enough to merit additional research. 14 plants have been identified as contraceptive. [120] It has been observed that Artabotrya odoratissimus Linn and *Embelia ribes* Burm exhibit intriguing biological features but pose severe risks.

26. **Anti-obesity activity**: Alcoholic extract of *E. ribes* decreased blood levels of leptin by 45 percent, insulin by 37 percent, glucose by 28 percent, total cholesterol by 18 percent, and triglycerides by 24 percent, while boosting HDL-C by 31 percent. In addition, the extract of *Embelia ribes* decreased myocardial lipid peroxidation and enhanced antioxidant levels in obese rats [121].

27. **Hepatoprotective activity:** A portion of *Embelia* in mice, exhibited hepatoprotective action. There is evidence linking paracetamol to hepatocellular injury. SGPT levels are

decreased dose-dependently in mice treated with extract .

VI. CONCLUSION

The Myrsinaceae family include the medicinal climber *Embelia ribes* Burm. f. This study utilised *Embelia ribes* Burm f. phytochemical analysis as a standardisation component. It is currently exceedingly difficult for Ayurveda, Siddha, and other Indian traditional medicinal systems to identify plants. Studies on the biological activity of *Embelia ribes* have revealed that it possesses a variety of therapeutic benefits, such as ascaricidal, antihelminthic, antibacterial, antioxidant, anti-diabetic, anticonvulsant, anticancer, and anti-hyperlipidemic qualities. *Embelia ribes* has been utilized for centuries. The ability to heal wounds and possess antifungal, molluscidal, obstetric, hyperglycemic, nematod, proliferative, spermatogenic, anticancer, and anti-inflammatory properties Contraception, hepatoprotective action, anxiolytics, antidepressants, antimitotics, cardioprotective effects, and obesity prevention, as well as additional research on isolated constituents.

Plants have been the source of medicine for centuries. Although health management methods are divided into two categories — traditional medicine and modern medicine — medicinal plants serve as their common foundation (78). Consequently, it is essential to precisely document the origins, effects, and applications of medicinal plants. In order to identify, categorize, and document plants, a comprehensive and well-organized ethnomedicinal research is necessary. In addition to advancing research and the development of novel medicines in the field of medicinal plants, this will preserve and disseminate traditional knowledge of herbal treatments.

According to the available data, *Embelia* due to its numerous therapeutic characteristics, is a crucial medicinal plant. The plants have demonstrated a variety of pharmacological effects, including wound healing, anticancer, cardiovascular, hypoglycemic, antioxidant, antibacterial, antidiabetic, and antifertility. In addition, it has been used as a cosmetic, an oral contraceptive, a blood purifier, and for oil pulling, all of which are currently the subject of active study. As a result, *E. ribes* is a promising candidate for the creation of new drugs.

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