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PHARMACOLOGICAL, PHARMACOGNOSTIC AND PHYTOCHEMICAL REVIEW OF  
*EMBELIA RIBES*

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**Abstract:**

India has a great wealth of various naturally occurring plant drugs which have great potential pharmacological activities. *Embelia ribes* is one amongst them. *Embelia ribes* has been proven to have great pharmacological potential with a great utility and usage as folklore medicine. A thorough review of its priorly determined activities will give an overview on the existing activities and gives an inspiration to explore the unexplored activities. Many activities are yet to be explored to determine the complete pharmacological profile of the plant. The reported activities so far are hepatoprotective, analgesic, amylase inhibitory activity, trypsin inhibition, anti bacterial activity, antioxidant activity, anti diabetic activity, anticonvulsant activity, adaptogenic activity, anti fertility activity, anti cancer activity, anti hyperlipidemic activity, anti fungal activity etc.

**Keywords:**

*Embelia ribes*, Embelin, Embelic acid, Potassium embelate, Phytochemistry.

**Introduction:**

*Embelia ribes* is one of the most significant plants in Indian traditional medicine. It is widely used plant in several ayurvedic preparations. It is used in treatment either alone or with the combination of other plants. It is traditionally used to treat ulcers, gastrointestinal disorders, acne vulgaris and possess strong adaptogenic action and cumulative adaptogenic property<sup>1-4</sup>. The plant parts like fruits, seeds, roots are widely used in ayurvedic preparations. Seeds form an ingredient in herbal preparations for treatment of liver ailments, leprosy, ringworm infections and other skin eruptions, gastrointestinal disorder<sup>5-9</sup>. Root extract is prescribed as contraceptive. The

liquid of boiled roots is taken by mothers to rectify the lactation problems<sup>10,11</sup> and whole plant is prescribed in anorexia, oedema, hepatitis, piles, diabetes, vitiligo<sup>12-14</sup>. The plant is not only traditionally believed to possess medical values but has already been reported scientifically for several activities like Hepatoprotective, Neuroprotective, Antibacterial, Antifungal, Analgesic, Hypoglycemic, Antioxidant, Anticancer, Anthelmintic, Anticonvulsant, Wound healing, Antifertility, Adaptogenic, Cardioprotective etc.

**Taxonomical classification:**

Kingdom : Plantae  
Phylum : Angiosperms  
Order : Ericales  
Family : Myrsinaceae  
Genus : *Embelia*  
Species : *ribes*



**Figure 1: Berries of *Embelia ribes***

**Synonyms:**

Sanskrit : Jantughna, Krmighna, Vella, Krmihara, Krmiripu  
Assamese : Vidang  
Bengali : Vidang  
Gujrati : Vavding, Vavading, Vayavadang  
Hindi : Vayavidanga, Bhabhiranga, Baberang  
Kannada : Vayuvilanga, Vayuvidanga  
Kashmiri : Babading  
Malayalam : Vizhalari, Vizalari  
Marathi : Vavading, Vavding  
Oriya : Bidanga, Vidanga  
Punjabi : Babrung, Vavaring

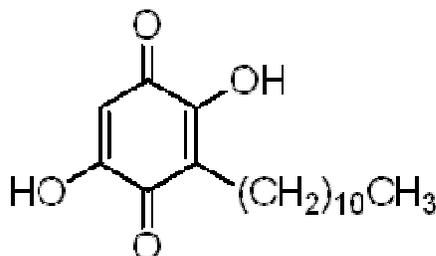
Tamil : Vayuvilangam, Vayuvidangam

Telugu : Vayuvidangalu

Urdu : Baobarang, Babrang

### PHYTOCHEMICAL CONSTITUENTS:

*Embelia ribes* berries contain several chemical constituents like embelic acid, volatile oil, fixed oil, resin, tannin, christembine (alkaloid)<sup>15</sup>, phenolic acids like caffeic acid, vanillic acid, chlorogenic acid, cinnamic acid, o-cumaric acid<sup>16</sup>. 4.33% of the embelin content is observed in the berries of *Embelia ribes*<sup>17</sup>. embelin is water insoluble, but forms a water soluble, violet colored complex, in alkaline medium<sup>18</sup>. Plant contains potassium embelate, 2, 5-dihydroxy,3-undecyl-1,4-benzoquinone, embelin, quercitol, fatty ingredients, vilangin<sup>16</sup>. Phytochemical investigation of the seeds revealed 3 new compounds identified as 3 - (4''-hydroxyoctadecanyloxy)-p-quinonyl-5-methylene-8-(10-pentanyloxy)-p-quinine (embelinol), n-pentacosanyl-n-nonadeca-7<sup>1</sup>-en-9<sup>1</sup>-alpha-ol-1<sup>1</sup>-oate (embeliaribyl ester) , 1,2,4,5-tetrahydroxy 3-undecanyl benzene (embeliol) and a known compound embelin.<sup>21</sup>



**Figure: 1 Structure of Embelin**

### PHARMACOLOGY STUDIES:

**Effect on Liver** :- Ethanolic extract of *Embelia ribes* administrated at 50 mg/100 gms body weight/day, 100 mg/100 gms body weight /day,200 mg/100gms body weight /day reported a dose dependant fall of 41% ( $p < 0.05$ ), 47% ( $p < 0.05$ ) and 66% ( $p < 0.01$ ) respectively in the serum SGPT levels as compared to elevated levels in the mice whose liver cell damage is included by paracetamol administered orally at 500 mg/kg body weight 48 hrs before .<sup>19</sup>

Embelin when administered orally at 25 mg/kg for 15 days shows minimal peroxidative damage in CCl<sub>4</sub> treated rats. When the results are compared with the standard drug silymarin the embelin treated rats have recorded significant values. Apart from minimal peroxidative damage an effective antioxidant property is observed<sup>20</sup>.

#### **Analgesic activity:**

Embelin has non-narcotic orally effective analgesic property which acts centrally. It has a different central site of action and is not antagonized by naloxone. It is more acceptable than morphine due to high oral efficacy, high therapeutic index and absence of abstinence syndrome<sup>22</sup>. Naloxone is known to antagonize mu ( $\mu$ )-receptor mediated activity associated with narcotic analgesics<sup>24</sup>. The mixed mu( $\mu$ ) and kappa( $\kappa$ ) agonists (such as EKC and bremazocine) and pure kappa( $\kappa$ ) agonist like U50, 488H caused significant displacement of potassium embelate. This indicates that potassium embelate has high affinity for mu( $\mu$ ) and kappa( $\kappa$ ) binding sites which may be involved in the modulation of potassium embelate induced analgesia in the rat brain<sup>23</sup>.

#### **$\alpha$ - amylase inhibitor activity:**

Ethanollic extract of the *Embelia ribes* seeds has shown pronounced % of  $\alpha$ -amylase inhibitory activity in-vitro i.e. 59.3% inhibition is observed when tested at concentration of 1mg / ml of the reaction mixture where as the active reference standard ( $\alpha$ -amylase inhibitor from *Phaseolus vulgaris*) has shown 59.4% inhibition.  $\alpha$  - amylase inhibitory activity of any plant material can be proven as an excellent tool for the treatment of obesity and diabetes<sup>25</sup>.

#### **Trypsin inhibition:**

Embelic acid is an inhibitor of trypsin and its values are comparable with potent trypsin inhibitors like phenyl methane, sulphonyl fluoride and soybean trypsin inhibitor<sup>26</sup>.

#### **Toxicology profile:**

Administration of embelin in female cyclic rats at 120 mg/kg body weight has reported no change in weight of liver, kidney and spleen but the net weight of adrenals increased considerably. Several pathological changes are observed by administration of embelin for 6 weeks. Adrenals showed hypertrophy, but spleen histological features remained unchanged<sup>27</sup>.

Anatomical evidence of ganglion cells degeneration in retinae of chicks administered orally with 1.25 g/kg dose of *Embelia ribes* has been reported. But at low dose of 0.25 g/kg visual deficit and retinotoxicity are not observed<sup>31</sup>.

Potassium embelate toxicology studies reported an ED<sub>50</sub> of 8.2 mg/kg. A very high dose of 2 g/kg administered in rats and mice has reported no mortality. The administration of potassium embelate for 10 weeks in mice and 24 weeks in monkeys did not produce significant toxicity symptoms. There is no effect on fertility. The drug and the F<sub>1</sub> animals revealed no change in their reproductive capacities. Necropsy examination, histopathological studies indicated that there is no effect on major organs proving it to be a safer drug<sup>28</sup>.

#### **Anthelmintic activity:**

*Embelia ribes* seed oil when administered at different doses like 10 mg/ml, 50 mg/ml and 100 mg/ml reported death of the worms (*Pheretima posthuma*). But response of worms to different doses altered in the time of paralysis parameter. Increase in dose reported a decreased time of paralysis. And the values are significant when compared with standard piperazine citrate (10 mg/ml)<sup>29</sup>.

*Embelia ribes* fruit extract in combination with *Veronica anthelmintica* seed extract administered at 1g / kg exerted a considerable decrease in the fecal eggs per gram (EPG) count in goats suffering from mixed gastrointestinal nematode infections<sup>33</sup>.

#### **Anti-bacterial activity:**

*Embelia ribes* at a concentration of 500 mg/50ml reported 12 mm diameter of zone of inhibition when compared to the standard drug nitrofurazone which has 22 mm diameter of zone of inhibition against test organism *Bacillus subtilis*. *Embelia ribes* did not produce any inhibitory / anti microbial activity against *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Escheresia coli*<sup>32</sup>. Ethanolic extract of *Embelia ribes* seeds show mild antibacterial property against *Staphylococcus aureus*, *Enterobacter aerogenes*, *klebsiella pneumoniae*. Acetone fraction of *Embelia ribes* seeds show mild antibacterial property against *Enterobacter aerogenes*, *Klebsiella pnemoniae*, the standard used is Amoxicillin.<sup>33</sup> Embelin, the principal constituent of the fruit of *Embelia ribes* is proved to have antibacterial property against both gram +ve and gram -ve bacteria, depending on the dose and bacteria test for the response alters. Even at very high doses (100 mg/disc) embelin did not exhibit any antibacterial property on

*Escherichia coli* and *Klebsiella pneumoniae*. At 25 mg/disc dose the zone of inhibition is not observed when experimented on *Streptococcus faegalis*, *Salmonella typhi* and *Vibrio cholerae* but, at high doses (50 mg/disc and 100 mg/disc) mild antibacterial property is observed on these organisms. At 100 mg/disc dose embelin reported more diameter of zone of inhibition than standard (kanamycin) used at 39 mg/disc when tested against *Staphylococcus aureus*, *Shigella flexneri* and *Shigella sonnei*. Same kind of response greater than standard (ciprofloxacin 5 mg/disc) is observed in *Pseudomonas aeruginosa* when embelin is used at high dose of 100 mg/disc considerable antibacterial property is shown against test organisms like *Streptococcus pyogenes*, *Salmonella typhi*, *Shigella boydii*, *Proteus mirabilis*. And very mild antibacterial activity has been reported. When tested against *Streptococcus faecalis* and *Vibrio cholerae*.<sup>34</sup>

#### **Antioxidant property:**

Aqueous extract of *Embelia ribes* administered orally at doses 100 mg/kg and 200 mg/kg body weight significantly decreased the levels of pancreatic superoxide dismutase, catalase and glutathione in the streptozotocin (at a dose of 40 mg/kg, intravenously as a single dose) induced diabetic rats. This antioxidant activity further protects the pancreatic  $\beta$ -cells against loss in streptozotocin induced diabetic rats<sup>35</sup>. Free radical scavenging activity of embelin was studied and found that embelin scavenges DPPH radical and inhibits hydroxyl radical induced lipid peroxidation and restores impaired Mn-superoxide dismutase in liver mitochondria of rat. Further studies on the kinetics and mechanism of reactions of embelin with hydroxyl, one-electron oxidizing, organo-haloperoxy and thiyl radicals using nano second pulse radiolysis technique suggests that embelin can act as a competitive antioxidant in physiological conditions.<sup>36</sup>

#### **Anti - diabetic activity:**

Aqueous extract of *Embelia ribes* fruits at doses 100 and 200 mg/kg orally fed for forty days produced significant ( $p < 0.01$ ) decrease in heart rate, systolic blood pressure, blood glucose, blood glycosylated haemoglobin, serum lactate dehydrogenase, creatine kinase and increase in blood glutathione levels in streptozotocin (administered at a dose of 40 mg/kg, intravenously single dose) induced diabetic rats. Gliclazide is used as standard in this study<sup>35</sup>.

Administration of ethanolic extract of *Embelia ribes* berries orally for 6 weeks at a dose of 100 mg/kg and 200 mg/kg significantly ( $p < 0.01$ ) reduced the levels of blood glucose, heart rate (HR) and systolic blood pressure (SBP) in streptozotocin induced diabetic Wistar albino rats. Gliclazide at a dose 25 mg/day is the standard used in this study<sup>37</sup>. Further studies revealed that ethanolic extract of *Embelia ribes* fruits significantly ( $p < 0.01$ ) reduced the pancreatic thiobarbituric acid-reactive substances (TBARS) in pancreatic tissue of diabetic rats<sup>38</sup>.

#### **Effect on CNS:**

*Embelia ribes* has shown a pronounced effect on CNS with anticonvulsant and adaptogenic activities.

#### **Anticonvulsant activity:**

Embelin i.p (intraperitoneal) administration at doses 2.5, 5 and 10 mg/kg body weight significantly inhibited seizures induced by electroshock and pentylenetetrazole in a dose dependent manner and the activity was comparable to phenytoin and diazepam. C.N.S depressant activity was revealed by significant decrease in locomotion. The observation suggests that embelin possess anticonvulsant activity against both grand mal and petit mal epilepsy<sup>42</sup>.

#### **Adaptogenic property:**

*Embelia ribes* is one of the ingredient of a composite Indian herbal preparation II (CIHP II) having strong adaptogenic action and cumulative adaptogenic property<sup>1-4</sup>.

#### **Effect on reproductive system:**

The root extract produced significant antifertility effect<sup>40, 41</sup>. Aqueous extract of *Embelia ribes* when administered from day 1 to day 7 of pregnancy at a daily dose of 100 mg /kg body wt reported 85% post coital antifertility<sup>43</sup>. Embelin isolated from seeds of *Embelia ribes* when administered at doses 50 and 100 mg /kg body weight reported 55.5% and 57.9% antifertility activity respectively in female albino rats<sup>44</sup>. Embelin administered at 100 mg/kg body weight to female albino rats does not increase or decrease any of the estrogen sensitive parameters like uterine weight, uterine protein uterine glycogen and uterine alkaline phosphates.<sup>45</sup>

Powdered berries of *Embelia ribes* administered orally 3 months at a dose of 100 mg /day to male bonnet monkeys adversely affected the quantity and quality of semen. Semen analysis includes parameters like volume, sperm count per ml, sperm motility (%). Circulating testosterone levels were also reduced. Luteinizing hormone

levels were not affected. Testicular biopsy revealed that spermatogenesis is not affected. Reduction in testosterone levels in circulation may be responsible for the reduced secretory activity of the accessory glands which results in decrease in volume of semen<sup>46</sup>.

A clinical trial of oral contraceptive *maswin* which contains *Embelia ribes* extract (1 tablet = 400 mg extract) was conducted on 48 fertile women (age 26-42) for 1 year covering 538 menstrual cycles. 1 tablet was taken each morning for 10 days beginning on the fifth day of menstruation. Total dosage was 10 tablets for 1 menstrual cycle. No pregnancies, side effects or toxic symptoms occurred. All the subjects expressed a sense of well being and were eager to continue usage of *maswin*. *Embelia ribes* antagonizes the effects of estrogen on the uterus. Uterus is not in the necessary condition to accept fertilized ovum, so pregnancy does not take place even though ovulation and fertilization have occurred<sup>47</sup>. Pippaliyadi vati an ayurvedic contraceptive containing equal parts of powdered seeds or fruit berries of *Embelia ribes*, fruit of *Piper longum* and borax powder was fed orally to two groups of pregnant rats: 2.5 times to one and five times to the other; the recommended dose for humans. The foetuses of mother feed with pippaliyadi had low birth weight and were smaller in length. The mother gained less weight during gestation.

Developmental defects of soft tissues and skeletons were analyzed. There were instances of herniation of the intestines into the umbilical cord in foetuses of mothers which are administered with pippaliyadi the control and gum acacia groups did show such herniation<sup>48</sup>. The combination of plant products *Embelia ribes*, borax and *Piper longum* has been found to be safe and effective as a female contraceptive and the results of phase-1 clinical trials are encouraging<sup>49</sup>.

Embelin extracted from *Embelia ribes*, berries when administered subcutaneously for 35 days at doses of 0.3, 0.4 and 0.5 mg/kg body weight altered the testicular histology and glycogen, gametogenic compound and accessory sex gland fructose. The compound is suggested to possess antiandrogenic activity.<sup>50</sup>

Administration of 50% ethanolic extracts of *Embelia ribes* at doses 75 mg/kg and 150 mg/kg increased the intensity of reaction for alkaline phosphatase in both uterine luminal and glandular epithelium. Intense positive reaction for alkaline phosphatase due to *Embelia ribes* extract has been correlated with its estrogenic mode of action<sup>51</sup>.

Subcutaneous administration of embelin extracted from seeds of *Embelia ribes* at a dose of 20 mg/kg body weight daily to male albino rats for 15 or 30 days revealed an inhibition of: (a) epididymal motile sperm count, (b) fertility parameters such as pregnancy attainment and litter size (c) the activities of the enzymes of glycolysis and energy metabolism. These changes were reversible, as seen after 15 and 30 days of recovery. The addition of embelin to epididymal sperm suspensions caused a dose and duration dependent inhibition of spermatozoal motility and the activities of the enzymes of carbohydrate metabolism. Light and scanning electron microscopy showed that both in vivo and in vitro treatment with the drug causes profound morphological changes in spermatozoa such as (a) decapitation of the spermatozoal head (b) discontinuity of the outer membranous sheath in the mid-piece and the tail region, and (c) alteration in the shape of the cytoplasmic droplet in the tail. These observations indicate the antispermatogenic effect of embelin.<sup>52</sup>

#### **Anti cancer property:**

Embelin is reported to decrease tumor size and inhibit the increase in activity of serum enzymes, viz. acid phosphatase,  $\tau$ -glutamyl transferase, lactate dehydrogenase, aldose, etc in rats with experimental fibrosarcoma. Embelin interferes with carbohydrate and amino acid metabolism in tumor bearing animals<sup>53</sup>.

Embelin 50 mg/kg/day in combination with curcumin 100 mg/kg/day prevented the induction of hepatic hyperplastic nodules, body weight loss, increase in the levels of hepatic diagnostic markers, and hypoproteinemia induced by N-nitrosodiethylamine in adult male Wistar rats<sup>54</sup>. The osteoclasts are responsible for the osteolysis observed in bone metastases of the tumor. RANKL (receptor activator for nuclear factor  $\kappa$ B ligand), a member of the TNF superfamily and an activator of the NF- $\kappa$ B signaling pathway, has emerged as a major mediator of bone loss, commonly associated with cancer and other chronic inflammatory diseases. Embelin has been reported to bind and inhibit XIAP protein and inhibit inflammatory pathways. The investigations whether embelin could inhibit osteoclastogenesis – associated bone loss induced by RANKL and by tumor cells in vitro reported that embelin suppressed the RANKL-induced differentiation of monocytes into osteoclasts. Thus, inhibitions of RANKL – induced NF- $\kappa$ B activation have great potential as therapeutic agents for osteoporosis and cancer - linked bone loss<sup>55</sup>.

Nuclear factor-kappaB (NF-kappaB) regulates several genes associated with inflammation, proliferation, carcinogenesis, and apoptosis. It was found that embelin inhibited tumor necrosis factor (TNF) alpha-induced NF-kappaB activation. Both inducible and constitutive NF-kappaB activation were abrogated by embelin. In addition, NF-kappaB activated by diverse stimuli such as interleukin-1beta, lipopolysaccharide, phorbol myristate acetate, okadaic acid, hydrogen peroxide, and cigarette smoke condensate also was suppressed. Embelin inhibited sequentially the TNFalpha-induced activation of the inhibitory subunit of NF-kappaBalpha (IkappaBalpha) kinase, IkappaBalpha phosphorylation, IkappaBalpha degradation, and P65 phosphorylation and nuclear translocation. Embelin also suppressed NF-kappaB-dependent reporter gene transcription induced by TNFalpha, TNF receptor-1 (TNFR1), TNFR1-associated death domain protein, TNFR-associated factor-2, NF-kappaB-inducing kinase, and IkappaBalpha kinase but not by P65. Furthermore, embelin down-regulated gene products involved in cell survival, proliferation, invasion, and metastasis of the tumor. This down-regulation was associated with enhanced apoptosis by cytokine and chemotherapeutic agents. Together, the results indicate that embelin is a novel NF-kappaB blocker and potential suppressor of tumorigenesis<sup>56</sup>.

In assessing the drug-induced cell toxicity, a fibrosarcoma cell line was exposed in vitro to increasing concentrations of embelin and simultaneously inoculated with [3H]-thymidine. The cells were examined for incorporation of the labeled thymidine in DNA, lipid peroxide and glutathione levels for regular intervals. A dose-dependent decrease in labeled thymidine uptake, lipid peroxide and glutathione levels was observed on embelin administration.<sup>57</sup>

#### **Antihyperlipidemic activity:**

Ethanollic extract of *Embelia ribes* administered orally at a dose of 200 mg/kg for 20 days reported significant ( $p < 0.01$ ) decrease in blood glucose level, serum total cholesterol and triglycerides and increase in HDL-cholesterol levels when compared to pathogenic diabetic rats which are induced by streptozotocin (at a dose of 40 mg/kg intravenously). The extract further lowered the liver and pancreas thiobarbituric acid-reactive substances (TBARS) values ( $p < 0.01$ ) when compared to TBARS values of liver and pancreas of the pathogenic diabetic rats<sup>58</sup>.

### **Antifungal activity:**

Antifungal activity evaluation of *Embelia ribes* using standard in vitro antifungal susceptibility was studied by test method NCCLS (The national committee for clinical laboratory standard M27-A2 Protocol). NCCLS method revealed that methanol extract of *Embelia ribes* and embelin had lowest MIC<sub>50</sub> range of 120 mg/L against *Candida albican* (MTCCno.183) and among four *Candida* species tested embelin had reported MIC<sub>50</sub> values below 700 mg/L. Solvent ether extract, petroleum ether extract, methanol extract and embelin reported to have MIC<sub>50</sub> in range of 300-700 mg/L against *Candida albica* (MTCCno.227) and *Candida parapsilosis* (MTCCno.1744). Petroleum ether extract shows lowest MIC<sub>50</sub> range of 250 mg/L against *Candida parapsilosis* (MTCCno.1744) and 360 mg/L against *Candida laurintis* (MTCC no. 2898) while water extract required higher MIC<sub>50</sub> value for all species. Thus the result shows that the percentage growth was increased with the decrease in the concentration of the plant extracts, except for the water extract<sup>59</sup>.

### **Cardio protective effect:**

Aqueous extract of *Embelia ribes* (100 mg/kg) pre-treatment orally for 40 days in isoprenolol (5.25 and 8.5 mg/kg: subcutaneously, for two consecutive days) induced acute myocardial infraction in albino rats significantly ( $p<0.01$ ) decreased the heart rate, systemic blood pressure, increased levels of serum lactate dehydrogenase, serum creatinine kinase and myocardial lipid peroxides and significantly increased the myocardial endogenous antioxidants (glutathione, superoxide dismutase and catalase) levels. These results are supported by the histopathological examination of rat's heart sections<sup>60</sup>.

### **Antihyperhomocysteinemic property:**

Antihyperhomocysteinemic property of *Embelia ribes* was evaluated in hyperhomocysteinemia induced adult male Wistar rats. Hyperhomocysteinemia was induced by methionine treatment (1 g/kg p.o) for 30 days. Administration of aqueous extract of *Embelia ribes* (100 and 200 mg/kg p.o) for 30 days to hyperhomocysteinemic rats significantly ( $p<0.01$ ) decreased the levels of homocysteine, LDH, total cholesterol, triglycerides, LDL-C and VDL-C and increased the HDL-C levels in serum. The results are comparable to the standard antihyperhomocysteinemic drug folic acid<sup>61</sup>.

### **Molluscicidal activity:**

Fruit powder of *Embelia ribes* in combination with *Azadirachta indica* and *Cedrus deodara* oil with synergists MGK-264, piperonyl butoxide (PB) in binary and tertiary combinations were used against the *Lymnaea acuminata*. It was observed that the toxic effects of these mixtures were time and dose-dependent. The binary and tertiary mixtures of plant-derived molluscicides with synergists were more toxic with respect to the single treatment of the plant-derived molluscicides<sup>62</sup>. The order of toxicity of various tertiary combinations against *Lymnaea acuminata* was *Lawsonia inermis* seed + *Cedrus deodara* + *Embelia ribes* > *Lawsonia inermis* seed + *Azadirachta indica* + *Embelia ribes* > *Lawsonia inermis* seed + *Polianthes tuberosa* + *Embelia ribes* > *Lawsonia inermis* seed + *Allium sativum* + *Embelia ribes*. The toxicity of tertiary combination (1:1:1) of *Lawsonia inermis* seed powder with *Cedrus deodora* oil and *Embelia ribes* fruit powder against *Lymnaea acuminata* was highest (24 hr LC<sub>50</sub> 14.80 mg/l) when compared to other combinations in this study.<sup>63</sup>

### **Wound healing property:**

Ethanol extract of *Embelia ribes* (30 mg/ml) and embelin both reported significant wound healing activity. In embelin treated groups (4 mg/ml of 0.2% sodium alginate gel), epithelialization of the incision wound was faster with a high rate of wound contraction. The tensile strength of the incision wound was significantly increased than the ethanol extract. Also in deed space model the weight of the granulation was increased indicating increase in collagenation. The histological examination of the granulation tissue of embelin treated group reported increased cross-linking of collagen fibres and absence of monocytes. The results are comparatively evaluated with standard skin ointment framycetin<sup>64</sup>.

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### **References:**

1. Handa et al, Fitoterapia, 1986, 57, pp 306.
2. Paranjpe, kulkarni, Current Research Medicinal and Aromatic plants, 1995, 17, pp 343.
3. Grover et al, Int.J.Pharmacogn, 1995, 17, pp 222.
4. Med Arom Plant Abrstr, 1995, 17, pp 222.

5. Sareena and Jain, *Med Surg*,1982, 22 (9), pp 28.
6. Gargye and Ram, *ibid*, 1983, 23(8), pp 41.
7. Kothavade et al, *Ind.J.Pharm.Sci.*1996, 58, pp 142.
8. Purohit et al, *J.sci Res plant Med*, 1985, 6(1-4), pp 39.
9. *Med Arom plant Abstr*, 1996, 18, pp 1148.
10. Satyavathi, *Ancient Sci life*, 1984, 3, pp 193.
11. Anderson, *Econ Bot*, 1986, 40, pp 442.
12. Ravishankar, *J Res Ayur siddha*, 1984, 5, pp 51.
13. *Med Arom plant Abstr*, 1996, 18, 3, pp 13348.
14. Tandon et al, *phytother Res*, 1996, 10, 263.
15. Henry G Greenish, *Materia medica*, Scientific publishers, India 1999, pp 121-122.
16. Shradda u.Nayak, V.K.Joshi, S.Maurya, U.P.Singh *AVU* 2009, 30, (2), pp 181-187.
17. S.Sudhakar Raja, K.P.Unnikrishnan, P.N.Ravindran, Indira balachandran, *Indian Journal of Pharmaceutical Sciences*, 2005, 67, (6).
18. Patel,R.B.Patel, M.R.,Pandya,S.S, Pundarikakshudu k and Banerjee.S, *Indian drugs*, 1997, 34, pp 590.
19. Nahid Tabassum, shyam S.Agarwal, *JK-Practitioner* 2003, 10 (1), pp 43-44.
20. Singh D,Singh R,Singh P,Gupta Rs, *Basic Clin Pharmacol Toxicol* ,2009.
21. Hoak, Alim, Siddiqui AW, *Pharmazie* 2005, 60 (1), pp 69-71.
22. Atal CK, Siddiqui MA, Zutshi U, Amla V, Johri Rk, Rao PG, Kour S, *J.Ethnopharmacol*, 1984, 11 (3), pp 309-317.
23. Uzutshi, R K Johri, C.K Atal, *Ind.Journal of Experimental Biology*, 1989, 27, pp 656-657.
24. DE Jalgon G & Palayo F, in *Medicinal chemistry advances*, edited by F G De Las Heras & S Vega (Pergamon press, Newyork) 1980, 191.
25. D.Prashanth, R.Padmaja, D.S.Samiulla, *Fitoterapia*, 2001, 72, pp 179-181.
26. *Med.Arom Plant Abstr*, 1995, 17, 119, 619.
27. Prakash, *Phytother Res*, 1994, 8, 257.

28. R.K.Joshi, S.K Dhar, G S Pahwa, S C Sharma, J L Kaul & U Zutshi, *Ind.J.of.Exp.biology*, 1990, 28, pp 213-217.
29. S.S Jalalpure, K.R.Alagawadi, C.S.Mahajanashetti, B.N.Shah, Salahuddin,Vijay singh and J.K.Patil, *Ind.J.of Pharmaceutical sciences*, 2007, 69 (1), pp 158-160.
30. Ijaz javed, muhammad shoaib akhtar, *Pakistan Journal of Pharmaceutical sciences*, 1990, 3 (2), pp 69-74.
31. Low G, Rogers LJ, Brumley SP, Ehrlich D, *Toxicol Appl Pharmacol*, 1985, 81 (2) , pp 220-30.
32. Umang H.Gajjar, Kapil M Khambolja, Rakesh K.Patel, *International Journal of Pharm Tech Research*, 2009, 1 (4), pp 1594-1597.
33. Tambekar, D.H, B.S.Khante, B,R.Chandak, A.S.Tltare, S.S.Boralkar and S.N.Aghadte, 2009, *Afr.J.Trad.Complementary and Alternative Medicines*, 6 (3), pp 228-232.
34. M.Chitra, C.S.Shyamala Devi, E.Sukumar, 2003, *Fitoterapia*, 74, pp 401-403
35. Uma Bandari, M Nazam Ansari, 2008, 46, pp 607-613.
36. Joshi R, Kamat JP, Mukaerjee T, 2007, *Chemical Biology Interact*, 167 (2), pp 125-134.
37. U.Bhandari, N.Jain, M.N.Ansari, K.K.Pillai, *Fitoterapia*, 2008, 79, pp 351-355.
38. Uma Bhandari, Neeti Jain and K.K.Pillai, *Experimental Diabetes Research*, 2007, 1-6.
39. Sowmya N.Madhavan, Ranjith Arimboor, C.Arumughan.
40. Satyavathi, *Ancient Sci.life*, 1984, 3, pp 193.
41. Anderson, *Econ Bot*, 1986, 40, pp 442.
42. Mahendran S, Thippeswamy BS, veerapur VP, Badami S, *Phytomedicine*, 2010, june .
43. Arora, R.B.GHATAK, N. & GUPTA,S.P., *J.Res.Indian.Med.*, 1971, 6, pp 107.
44. Mohana krishnaswamy & K.K.Purushothaman, *Ind.J.Exp.Biol.*, 1980, 18, pp 1359-1360.
45. Mohana krishnaswamy & K.K.Purushothaman, *Ind.J.Exp.Biol.*, 1980, 18, pp 638-639.
46. Tarala V.Purandare, S.D.Kholkute, Anjali Gurjar, Usha M.Joshi, B.Dattatreyamurthy, A.RSheth, X.R.Sheth, X.R.Swamy, S.Yayaraman & Safia R.Munshi., *Ind. J Exp. Biol*, 1979, 17, pp 935-936.
47. Shah NK 1971, *Curr.Med.Pract.*, 15 (2), pp 614-616.
48. Chaudhary MR, Chandrasekaran R, Mishra S, *J.Ethropharmacol*.2001, 74 (2), pp 189-193.

49. Sharma RS, Rajalakshmi M, Jeyaraj DA, J.Biosci., 2001, 26 (4), pp 391-405.
50. Agarwal S, Chauhan S, Mathur R, Andrologia, 1986, 18 (2), pp 125-32.
51. Mathur R, Acta Eur.Fertil., 1986, 17 (4), pp 297-300.
52. Gupta S, Sanyal SN, Kanwar U, Contraception, 1989, 39 (3), pp 307-320.
53. Chem. Abstr, 1995, 122, 177846.
54. M.sreepriya, geetha bali, Fitoterpia, 2005, 76, pp 549-555.
55. Retuer S, Prasad S, phromnoi K, kannappan R, yadav VR ,agarwal BB, 2010, Mol.Cancer.Res
56. Ahn KS, sethi G, aggarwal BB, 2007, Mol.Pharmacol., 71 (1), pp 209-219.
57. Chitra M,sukumar E, Devics, Oncology, 1995, 52 (1), pp 66-68.
58. Bhandari U, Kanojia R, Pillai KK , 2002, 3 (3), pp 159-162.
59. Sanjesh G Rathi, Vaidhun H Bhaskar, Bhuvan P Raval, Maulik P.suthar, Paras G Patel, 2009, Der Pharmacia Lettre, 1 (2), pp 115-120.
60. Uma Bhandari, M.N. Ansari, F Islam, Ind. J. Exp. Biol., 2008, 46, pp 35-40.
61. Uma Bhandari, M.N Ansari, F.Islam, C.D. Tripathi, Ind. J. Phamacol., 2008, 40 (4), pp 152-157.
62. Rao IG, Singh DK, Chemosphere, 2001, 44 (8), pp 1691-1695.
63. Amrita singh, D.K Singh, Ind. J. Exp. Biol. 2001, 39, pp 263-268.
64. Swamy HMK,Krishna V, Shankarmurthy K, Abdul rahiman B, Mankani KL, mahadeven KM,Harish BG, Raja naika H , J. Ethnopharmacol, 2007, 109 (3), pp 529-534.

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