Traditional Medicinal Values of *Rubus ellipticus* with Biological Activities Observed from its Crude Extract: A Review

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(Received 1 February, 2021; Accepted 23 July, 2021)

**ABSTRACT**

This review article on *Rubus ellipticus* mainly systematically summarizes classification, morphology, distribution, traditional uses, phytochemical constituents and biological activities. *Rubus ellipticus* is commonly known as Yellow Himalayan Raspberry and has been used as a traditional medicine to cure for fever, diarrhoea, gastralgia, skin infection, joint pain, wound healing, diabetes, anti-fertility agent, analgesic, antiepileptic, as renal tonic, ulcer etc. Its phytochemicals analysis have revealed the presence of phenolic compounds, flavonoids, terpenoids and steroids. The crude extract shows biological activities such as antimicrobial, antioxidant, anti-inflammatory, wound healing, anti-diabetic, anticancer, antiulcerogenic etc.

**Key words:** Rubus, Flavonoids, Antimicrobial, Antioxidant, Phytochemicals.

**Introduction**

Plants are one of the major kingdom of natural living system on the earth which consists of leaves, stems, bark, roots, flowers, fruits, seeds etc. These may be in the form of trees, shrubs, herbs, climbers or creepers and have broad spectrum of uses in pharmaceuticals, food, textile and agriculture industries. Moreover, these maintain atmospheric oxygen level, water quality and carbon sequestration (Fernando, 2012; Usman *et al.*, 2014). These are also known to produce essential foods like carbohydrates, fats, proteins, minerals salts, organic acids, vitamins etc. which are required for human health care (Fernando, 2012). All over the World, ~3,00,000 plant species are present but only 21,000 plant species are known to have the high potential ability of Unani, Ayurveda and Siddha traditional medicines. According to World Health Organization more than 80% of the earth’s population depends on the natural plant products as traditional medicines for their primary healthcare needs (Prakash *et al.*, 2020; 2020a).

Medicinal plants are very important for the pharmaceutical industry, considering that they are a resource for the development of drugs such as
phytomedi-cines and phytopharmaceutics, and also as prototypes for the synthesis of new drugs (Cechinel and Yunes, 1998; Halvorsen et al., 2002; Yadav et al., 2022; Elisabetskiand Souza, 2004; Barreiro and Bolzani, 2009; Cragg et al. 2012; Slatnar et al., 2012; Mujeeb et al., 2014; Anand et al., 2019; Suntar, 2020). In recent years, there have been significant scientific advances involving chemical and pharmacological studies of medicinal plants, focusing on new compounds with therapeutic properties (Bendazzoli, 2000; Cechinel, 2002). The demands for medicinal plants are increasing all over the world due to the growing recognition that the medicinal plants have fewer side effects and are lesser toxic as compared to synthetic medicines pharmacologically active, cost effective and easier to use for human diseases (Niero et al., 2003). The plants particularly fruit berries are also gaining more attention to the researchers as they contain the best dietary sources of bioactive compounds (Heinrich, 2000; Koehn and Carter, 2005; De Souza, 2014).

The main objective of the present review is to report traditional medicinal values of \textit{R. ellipticus} and comparison of those medicinal values with suitable biological activity in support of traditional uses from the crude/phytochemicals isolated from its various parts.

**Classification, morphology and distribution**

**Classification**

\textit{R. ellipticus} is commonly known as Yellow Himalayan Raspberry (Maciel et al., 2002, Badhani, 2015)

**Morphology**

\textit{R. ellipticus} is a stout, weakly climbing, evergreen thorny shrub 1-3 m tall. Branchlets are pubescent and purplish brown or brownish with sparse, curved prickles and dense, purplish brown bristles or glandular hairs. Leaves are pinnate, digitate or pedate, with 3-7 dentate leaflets (Tutin et al., 1968). Flowering occurs during March to April, and the fruiting period is from April to May, when it produces aggregate golden-yellow fruits (Lu and Boufford, 2003). It is native from southern Asia and Southeast Asia, including southwestern India, China, Bhutan, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, and Vietnam (Lu et al., 2003; Ringmichon et al., 2013; Maity et al., 2004).

**Distribution**

The genus \textit{Rubus} includes over 750 species which is grows on slopes, in mountain valleys, sparse forests, and on roadsides at elevations between 300 and 2,600 m, where annual precipitation levels range from 2,000 to 6,500 mm (Corner and Beaman, 1996; Stratton, 1996; Graham and Woodhead, 2011). It is widely distributed across the globe from North Temperate Zone to the tropics (Southern hemisphere) (Heinrich, 2000; Koehn and Carter, 2005). It is native

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Plant/ Parts</th>
<th>To treat</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Whole plant</td>
<td>Reduce typhoid fevers and act as an astringent.</td>
<td>Patel et al., 2004</td>
</tr>
<tr>
<td>2.</td>
<td>Roots</td>
<td>Fever, diarrhea, gastric problems, wounds healing, antipyretics, fractured bones, headache, urinary tract infection.</td>
<td>Patel et al., 2004; Kirtikar and Basu, 2001</td>
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<tr>
<td>3.</td>
<td>Fruits</td>
<td>Fever, dysentery, gastralgia, wound healing, diabetes sore throats, colds, antifertility, antimicrobial, analgesic, epilepsy, ulcer, constipation.</td>
<td>Tutin et al., 1968; Maity et al., 2004; Vadivelan et al., 2009; Pandey and Bhatt, 2016; Dovydaitis, 2017</td>
</tr>
<tr>
<td>4.</td>
<td>Shoots</td>
<td>Stomach ache, diabetes, colic pains, hypothermia.</td>
<td>Rojas et al., 2002; Hazarika and Pongener, 2018</td>
</tr>
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<td>5.</td>
<td>Bark</td>
<td>Stomach ache, kidney tonic, renal tonic, cough, cold, blood disorders, and anti-diuretic, vaginal discharge, diabetes, and anti-diuretic.</td>
<td>Patel et al., 2004; Pandey and Bhatt, 2016; Wangchuk et al., 2017</td>
</tr>
<tr>
<td>6.</td>
<td>Aerial Parts</td>
<td>Hypothermia.</td>
<td>Patel et al., 2004</td>
</tr>
<tr>
<td>7.</td>
<td>Leaves</td>
<td>Fever, dysentery, stomach pain, diabetes, wound healing, ulcer and anti-fertility.</td>
<td>Sharma et al., 1983; Erdemoglu et al., 2003; Latha et al., 2015</td>
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</table>
to tropical and subtropical India (Nagata, 1995; Flynn and Lorence, 1998).

**Traditional medicinal uses**

In ancient Indian (Ayurveda), Greek, Chinese and American system, raspberry had been used for the treatment for wounds and diarrhea (Heywood and Moore, 1978; Castleman, 1991; Moon, 1991; Kim, 1996; Moerman, 1998; Otaiza and Arzola, 2001; Rojas Vera et al., 2002; Latha et al., 2015; Sasikumar et al., 2015). Traditionally different parts of plant are used to treat fever, diarrhoea, gastralgia, skin infection, joint pain, wound healing, diabetes, anti-fertility agent, analgesic, antiepileptic, as renal tonic, ulcer etc. (Table 1).

**Phytochemical constituents**

At least nineteen chemical constituents (Table 2) have been identified from different parts of *R. ellipticus* that includes 04 phenolic compounds (1-4),

![Fig. 1. Structures of identified phytochemicals from *R. ellipticus*](image-url)
Flavonoids and Triterpenoids have been isolated from the roots and fruits of *R. ellipticus*. Flavonoids contribute to plant pigmentation, while triterpenoids are a class of compounds with a molecular formula C_{30}H_{48}. The isolation and identification of these compounds are detailed below:

### Flavonoids

Flavonoids are known for their diverse functions, including plant pigmentation and antioxidant properties. From the roots and fruits of *R. ellipticus*, two flavonoid compounds (5 and 6) have been identified. Dried fruits extracted with methanol by soxhlet extraction method and compound (5) has been reported while compound (6) has been reported from roots by using methanol as a solvent (Vadivelan *et al.*, 2009; Sasikumar *et al.*, 2015).

### Triterpenoids

Triterpenoids are a class of chemical compounds that consist of three terpene units and have a molecular formula C_{30}H_{48}. Thirteen compounds (7-19) have been identified from the roots of plant by using methanol as a solvent (Wei *et al.*, 2009).

### Biological activities

Nineteen compounds have been isolated from the various parts of *R. ellipticus* so far but no biological activities have been reported on any isolated compound (Table 2). However, a wide range of biological activities has been carried out on crude extracted from various parts of *R. ellipticus* such as antimicrobial, antioxidant, anti-inflammatory, wound healing, anti-diabetic, anticancer, and antiulcerogenic (Table 3).

### Antimicrobial Activity

The extracts prepared by using hexane, ethyl acetate and methanol from the leaves of *R. ellipticus* showed...
<table>
<thead>
<tr>
<th>Plant part Used</th>
<th>Solvent used</th>
<th>Strains/ Test animals</th>
<th>Plant part</th>
<th>Solvent used</th>
<th>Strains/ Test animals</th>
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<tbody>
<tr>
<td><strong>Antimicrobial Activity</strong></td>
<td></td>
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<tr>
<td>Leaves</td>
<td>Hexane, ethyl acetate and methanol</td>
<td><strong>Bacteria:</strong> Staphylococcus aureus, Micrococcus luteus, Bacillus subtilis, Enterococcus faecalis, Staphylococcus epidermis and methicillin resistant Staphylococcus aureus. <strong>Gram negative:</strong> Klebsiella pneumoniae, Enterobacter aerogenes, Vibrio parahaemolyticus, Yersinia enterocolitica, Salmonella typhimurium, Shigella flexneri and Proteus vulgaris. <strong>Fungi:</strong> Aspergillus flavus, Trichophyton mentagrophytes, Trichophyton rubrum, Aspergillus niger, Scopulariopsis and Curvularia lunata</td>
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<td></td>
<td>Leaves</td>
<td>Ethanol</td>
<td><strong>Bacteria:</strong> Staphylococcus aureus, Staphylococcus epidermidis, Pseudomonas aeruginosa and E. coli <strong>Fungi:</strong> Candida kruzi and Trichoderma lignorum</td>
<td></td>
<td></td>
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<td></td>
<td>Fruit</td>
<td>Petroleum ether, chloroform, ethyl acetate, acetone, ethanol and water</td>
<td><strong>Bacteria:</strong> Bacillus cereus, Escherichia coli, Enterobacter aerogenes, Klebsiella pneumonia, Salmonella enterica typhimurium, Shigella flexneri, Staphylococcus aureus, Staphylococcus epidermidis, Streptococcus pyogenes <strong>Fungi:</strong> Candida albicans, Aspergillus flavus, Aspergillus parasiticus</td>
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<td><strong>Antioxidant Activity</strong></td>
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antimicrobial activity against the strains of *Staphylococcus aureus*, *Escherichia coli*, *Candida albicans*, *Candida tropicalis*, *Penicillium mmarneffi*, and *Trichophyton rubrum* by using well-diffusion method (Latha et al., 2015). Saklani et al. (2012) have reported that ethanolic fruits extract shown good activity against selected bacteria strain: *Bacillus cereus*, *E. coli*, *Enterobacter gergoviae*, *Klebsiella pneumonia*, *Salmonella enteritica*, *Shigella flexneri*, *S. aureus*, *Staphylococcus epidermidis*, *Streptococcus pyogenes* and fungal strain *i.e.* *C. albicans*, *Aspergillus flavus* and *Aspergillus parasiticus* by using well-diffusion method (Saklani et al., 2012). Ethanol leaves extracts of *R. ellipticus* shown significant activity against selective bacterial and fungal strain, *i.e.* *S. aureus*, *S. epidermidis*, *Pseudomonas aeruginosa*, *E. coli*; *Candida kruisi*, *Tricho-
derma lignorum (Prasanth and Chandran, 2017).

**Antioxidant Activity**

Methanolic leaves extracts of *R. ellipticus* shown in-vitro antioxidant activity by DPPH free radical scavenging (Subba et al., 2019) while Ahmad et al. (2015) also reported the similar activity from its fruit (Ahmad et al., 2015). Petroleum ether, ethanol and water have been used to extract the fruits of *R. ellipticus*. All the extracts i.e. petroleum ether, ethanol and water showed the antioxidant activity but ethanol extracts shown the best scavenging and reducing power activities as compared to petroleum ether and aqueous extracts (Sharma and Kumar, 2011) while methanol fruit extracts also given the similar in-vitro antioxidant activity (Sasikumar et al., 2015).

George et al. (2015) reported that methanolic extracts shown in-vivo antioxidant activity by effectively reduced DPPH, nitric oxide and Superoxide radical scavenging while the methanolic roots extracts also given strongest Superoxide radical scavenging (Vadivelan et al., 2009; George et al., 2015).

**Anti-inflammatory Activity**

Flavonoids result into anti-inflammatory activity. Vadivelan and his coworkers have studied that ethanolic extracts of roots of *R. ellipticus* gave the high anti-inflammatory activity by reducing the edema swelling of the rats (Vadivelan et al., 2009).

**Wound healing Activity**

This activity is shown by phenolic compounds. Leaves of *R. ellipticus* when extracted with methanol solvent have shown the wound healing activity (George et al., 2015).

**Anti-diabetic Activity**

Phenolic compounds are also responsible for anti-diabetic Activity. The dried powder of leaves of *R. ellipticus* has been extracted with methanol and it has been shown anti-diabetic activity by the inhibition of α-glucosidase (Latha et al., 2015).

**Anticancer Activity**

Triterpenoids generally cause for anticancer activity. Methanolic leaves extract of *R. ellipticus* has shown the anticancer activity. It was carried out on mice and there were be reduction of ascites and solid tumor (George et al., 2015).

**Antiulcerogenic Activity**

Ethanolic extracts of roots of *R. ellipticus* has been shown good antiulcerogenic activity by effectively reduced ulcer area and ulcerative lesions (Vadivelan et al., 2008). This activity is exhibited by phenolic compounds.

**Future Scope**

Traditionally different parts of *R. ellipticus* (whole part, roots, fruits, shoots, bark, aerial parts, and leaves) have been used to treat fever, diarrhea, gastralgia, skin infection, joint pain, wound healing, diabetes, anti-fertility agent, analgesic, antiepileptic, as renal tonic, ulcer etc. To prove the consistency of traditional uses, biological activities of leaves, roots and fruit are yet to be verified in the area of Fever, diarrhea, gastric problems, diabetes, and wounds healing. Similarly, the bark, aerial parts, shoots and whole plant of *R. ellipticus* has been used traditionally stomach ache, kidney tonic, renal tonic, cough, cold, blood disorders, kidney tonic, anti-diuretic, vaginal discharge, and diabetes but no significant study has been carried out on it.

Nineteen chemical compounds have been identified from *R. ellipticus* as yet but till now no activity has been carried out on the any compound isolated from this plant.

**Conclusion**

The traditional medicinal values of *R. ellipticus* have been compared with suitable biological activity in their support from the crude/phytochemicals extracted from various parts of the plant with different solvents. So far, 19 chemical constituents have been identified in its crude, out of which 04 are phenolic compounds, 02 are flavonoids, and 13 are triterpenoids. The crude has shown biological activities like effective antimicrobial (both bacterial and fungal), antioxidant (mainly due to the presence of phenolic compounds, flavonoids and terpenoids), anticancer (due to flavonoids, terpenoids), anti-inflammatory (due to flavonoids), antidiabetic (due to phenols and triterpenoids), wound healing and antiulcerogenic activities (due to phenolic compounds).

**Acknowledgments**

Authors would like to thank Maharishi Markan-
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