Medicinal importance and utilization of Rhododendron- A Review

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Abstract: Rhododendron arboreum is an evergreen shrub or small tree with a showy display of bright red flowers. Rhododendron is the national flower of Nepal and is known as (Laligurans) & the state tree of Uttarakhand. It is called ‘Burans, Bras, Buras or Barahke- phool’ in local dialect. Rhododendron arboreum is a wild plant species possesses high ecological importance and the flower of the species having unique medicinal and nutritional value. It is widely popular for the processed juice of its flowers which have gained market popularity as rhodojuice /sharbat. The paper highlighted medicinal value and potential of R. arboreum for bioprospecting by making value added products to improve the livelihood and employment opportunities of hill farmers.

Key words- Rhododendron, History, Medicinal uses, Juice preparation, Ornamental uses

Introduction

The genus Rhododendron (Greek Rhodon= rose and Dendron= tree) belongs to the family Ericaceae. Three major species (Rhododendron arboreum Smith, R. anthopogon D.Don and R. Campanulatum D.Don) have been reported from Western Himalayas (Prakash et al., 2007) however, R. arboreum Smith is the predominating species found in the hills of Uttarakhand state of India (Mehta et al., 2010). Leaves and flowers have got various medicinal uses such as treatment of illness, headache, diabetes, rheumatism etc. (Sharma et al., 2010). In the Indian Himalayan Region (IHR) over 675 wild edibles are known (Samant and Dhar, 1997) of which Rhododendron arboreum, commonly known as “Burans”, is amongst highly valued wild edible flower growing between 1500 and 2400 m asl. The genus forms dominant combination of forest types in the high altitudes (above 1500 m) of the Garhwal region having ecological significance and economic importance in addition to its graceful flowers. A total of 72 species, 20 subspecies and 19 varieties have been listed from India (Mao et al., 2001). The genus Rhododendron has long been regarded as a rich source of secondary metabolites such as phenols, phenolic acids, flavonoids, terpenoids, resins etc. The ethanol soluble portion of the flower of R. arboreum showed a- glucosidase inhibitor and potent diabetic activity (Sharma et al., 2010). Phenolic acids obtained from its leaves and twigs have shown anti-HIV activity (Kashiwada et al., 2001). Recently Verma et al. (2000) investigated the anti-inflammatory and antiseptic properties of flowers of R. arboreum.

The flowers of R.arboreum are deep scarlet in color, which comes in up to twenty blossoms in a single tree. The fresh flowers which are sweet-sour in taste are used to make a health promoting beverage i.e. squash by local inhabitants. Therefore Rhododendron squash fetches relatively higher prices and preferred for medicinal purposes by consumer in this region. However this squash has a slight bitter taste and consumers did not consuming it. This is the reason that Rhododendron squash has fewer takers beyond this region, despite its high nutritive value. Moreover, Rhododendron squash available in the market are not uniform in their organoleptic and quality attributes owing to arbitrary preparation practices adopted by individuals.

A few studies have been focused on phytochemical composition of Rhododendron (Prakash et al. 2007; Silies et al. 2010; Sharma et al. 2010; Verma et al; 2010). Until no attempt have been made to estimate the total phenolic content, total antioxidant capacity and other quality parameters.

Variations and Sub-Species

Dominant species=R. arboreum roseum- pink, R. arboreum album
Sub species=R. arboreum s. sp. Cinnamomeum- Orange, pale pink, bi-color (indumentums of a rusty or cinnamon)
R. arboreum s. sp. Campbellea- brown and woolly indumentums on the underside of the leaf.

Among all Indian rhododendron species, R. arboreum is widely distributed, occurring from western to eastern Himalayan region and other neighbouring countries (Giriraj et al., 2008). Apart from their worldwide aesthetic and ethnic uses, several species have commercial and medicinal values (Leach 1986). Rhododendron species with high levels of phenols, promising antioxidant and free radical scavenging activities may be utilized in the development of healthcare products (Dhan et al. 2007).
Antioxidants play a key role to scavenge free radicals and are associated with reduced risk of cancer and cardiovascular diseases (Wilkox et al., 2004). Among various attributes of functional foods, antioxidant property is considered the best, as it reduces the oxidation processes in the body (Krishnaih et al., 2007) and plays an important role in maintaining health by protecting against reactive oxygen species (Lan et al., 2007). R. arboreum is one of the most impressive rhododendron species, common in the western Himalayas in association with Quercus species, Myrica nagi, Neolitsea pallen, Alnus nepalensis, Viburnum mullaha and Pinus roxburghii. Still of having good medicinal value and tremendous potential for bioprospecting, the species not got much attention for its conservation and management in the western Himalaya.

History of Rhododendron

The genus Rhododendron belongs to the heather family, Ericaceae. Rhododendron is primarily a Northern Hemisphere genus, extending from North America across Europe and Asia to Japan and from the extreme north to the Equator. One mainly tropical section grows also south of the Equator in New Guinea, with a single species in Queensland, Australia. Rhododendrons do not occur in the wild anywhere in Africa, or in Central or a South America, though there is a considerable colony in one area in Jamaica, which is probably of garden origin. The first record of a rhododendron in cultivation in Britain is of R. hirsutum in 1650. The rampant R. ponticum, primarily from the Pontus Mountains and the Black Sea region, is also a native of Portugal and southern Spain. From Siberia came R. dauricum in 1780 and R. chrysanthum in 1796. R. luteum was introduced from the Caucasus in 1792 and R. caucasicum in 1803. R. camtschaticum came from Kamtschatka in 1799 and grows on both sides of the Bering Straits (Magor, 2008). Rhododendron arboreum was first species discovered and identified by specialist near Srinagar in 1796 (Milleville, 2002), but there is no authentic record of its introduction before 1817. R. campanulatum from Nepal followed in 1825, R. barbatum in 1829 and R. formosum from Assam in 1843 (Magor, 2008). Pioneer botanist Joseph D. Hooker (1817-1911) undertook a trip to Nepal but he could not see any Rhododendron blooming and continued his exploration in Northern India. He made extensive tour of the Sandakphur region and the Singallia range to the northwest of Darjeeling. His famous work, “The Rhododendrons of the Sikkim Himalaya,” (1849) is considered as the standard test for the study of Himalayan rhododendron.

Medicinal Uses

In Homeopathic Materia Medica, the tincture of dried leaves of Rhododendron arboreum has been used in gout and rheumatism (Skidel, 1980). Ayurvedic preparation “Asoka Arishta,” containing R. arboreum possesses oxytocic, estrogenic, and prostaglandin synthetase-inhibiting activity (Midlekoop and Labadie, 1983). The dried flowers of R. arboreum are supposedly highly efficacious in checking diarrhoea and blood dysentery (Laloo et al., 2006). The young leaves are said to be poisonous (causes intoxication in large quantities) as well as medicinal and applied on the forehead to alleviate headache (Watt, 1892). The fresh and dried corolla that is acid-sweet in nature is given when fish bones get stuck in the gullet (Pradhana and Lachungpa, 1990). The literature indicates limited potential of local or indigenous medicinal use of Rhododendron spp. (Foster and Duke 1990; Mabberley 1997). Medicinal uses of some Rhododendron species are presented in Table 1.

Commercial Uses

In hilly areas, the flowers of Rhododendron arboreum with sweet and sour taste are used in the preparation of squash, jams, jellies and local brew. It is a very common and pleasant drink, drunk once daily as refreshing appetizer and also to prevent high altitude sickness. Fresh petals are used to prepare chutney known as barah ki chutney. The juice of the leaves is spread over cots and beds to get rid of bed lice. Wood of the plant is used to make charcoal & fuel. The grained wood of R. arboreum is used for making ‘khukri’ handles, pack saddles, gift-boxes, gunstocks and posts (Paul et al., 2005). Flowers and leaves are fitted in long ropes made of munja grass and tied around the houses including temples as decorations (Chauhan, 1999).

Rhododendron Juice and Pickle Preparation

Rhododendron arboreum’s nectar is being brewed to make wine in Srinagar (SSCTT, 2007). The brewing technique is also found in the study area. Rhododendron juice business apparently flourished during the blooming season only. The briefing of making juice was done by trainee two years ago. However, they admitted that the preservation technology is lacking among them. The post harvest/preservation technique is effective practice with benefits of additional income generation to the local people. The juice extraction from rhododendron flower needed to attract national and international collaboration to raise the socio-economic status of the local communities (Taylor et al., 2002). The preparation and preservation of Rhododendron juice among TMJ people is mentioned below.

Plucking: At the time of flowering, when the flowers are matured fully, flowers are plucked from branches carefully. The collection is done in basket from the forest.

Grading: The anthers and stigma are removed and only petals are sorted out. These are then cleaned with water.

Grinding: The common grinder/ blenders used for juice extraction are used for grinding of petals. The extract obtained is filtered to obtain the concentrate form of juice.

Boiling: About 1300 ml water and 800 gm sugar is boiled on fire. When solution is about to boil about 1 litre of juice is measured and poured in mixture. At the same time 2gm of sodium bicarbonate is added. The mixture is boiled for about 25-30 minutes with constant stirring.

Preservation and packaging: For the purpose of preservation citric acid (25gm/ liter) is added before bottling. The bottles are cleaned and sterilized first then juice is poured and bottle is capped. To serve, mix the juice in water in the ratio of 1:3. Besides making juice Rhododendron can be also used for Chutney preparation. The corolla parts is used to make the the pulp of Rhododendron flowers it is boiled for 45 minutes and drained with strainer. In five kg
Table-1: Medicinal uses of some Rhododendron species

<table>
<thead>
<tr>
<th>Rhododendron Species</th>
<th>Parts used</th>
<th>Color of flower</th>
<th>Medicinal and other uses</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>R. anthopogon</em>: Sunpati</td>
<td>Leaves and flower</td>
<td>White or yellow tinged with pink</td>
<td>* Decoction of leaves is used in cold, cough and chronic bronchitis. Fragrant dried and powered flowers mixed with bland oil are used for massage over the entire body in post-delivery complications like fevers, cough and cold. Fragrant flowers are used to drink tea by local people. * The leaves are aromatic, their smoke is considered to have stimulant properties, administered as as enthine to produce sneezing.</td>
<td>Joshi and Joshi, 2001; Baral and Kurmi, 2006; SSCTS 2007</td>
</tr>
<tr>
<td><em>R. arboreum / R. puniceum</em>: Laligurans</td>
<td>Flower</td>
<td>Deep-crimson</td>
<td>* Curing dysentery and a paste made of flower for headache * Young leaves are applied for headache * Flowers used as appetizer, bark juice used for cough, pelmsmenstrual disorders. * Dried flowers fried in ghee used to check blood dysentery. * However the honey of wild bee is poisonous at the flowering time * Popularly use for juice preparation * About 5-10 flowers are eaten to take out fish bone from the throat.</td>
<td>Joshi and Joshi, 2001; Baral and Kurmi, 2006; Chaudhary et al., 2002; Indian Medicinal Plants</td>
</tr>
<tr>
<td>R. barbatum</td>
<td>Leaves and flowers</td>
<td>White mauve or lilac and spotted inside anteriorly with pink hurple petals</td>
<td>* It contains andromedotoxin — a substance that helps reduces blood pressure * Dried leaves snuffed to cure sinusitis; act as fish poison</td>
<td>(Joshi and Sharma, 2009)</td>
</tr>
<tr>
<td>R. campanulatum / Nilo Chimal</td>
<td>Leaves, twigs</td>
<td>White mauve or lilac and spotted inside anteriorly with pink hurple petals</td>
<td>* Leaves are mixed with tobacco to make medicinal snuff useful in colds and hemcrania, chronic rheumatism, syohills, and sciatics. * The dried twigs and wood are used as phthisis and chronic fevers.</td>
<td>Joshi and Joshi, 2001; Baral and Kurmi, 2006; SSCTS, 2007</td>
</tr>
<tr>
<td>R. cinnabarinum</td>
<td>Leaves</td>
<td>Orangerose, brick red or scarlet</td>
<td>* Poisonous to cattle; making flavoring agents, jam etc</td>
<td>Joshi and Joshi, 2001; SSCTS, 2007</td>
</tr>
<tr>
<td>R. falconeri :Korilanga</td>
<td>Tender roots and shoots</td>
<td>Piscicide</td>
<td></td>
<td>Baral and Kurmi, 2006</td>
</tr>
<tr>
<td><em>R. lepidotum</em>: Bhale sunpati</td>
<td>Bark and leaves</td>
<td>Pink, dull purple pale yellow, bright red</td>
<td>* Leaf decoction as insecticidal spray * Bark taken as tea is purgative * Leaf aromatic stimulant</td>
<td>Baral and Kurmi, 2006; SSCTS 2007</td>
</tr>
<tr>
<td><em>R. glaucophyllum</em>: Theki jhar.</td>
<td>Leaves</td>
<td>Red</td>
<td>* Bushy plant which is used as a pot cleaner. * In Milke dada region local people used them to clean the wooden plots used for yogurt preparation</td>
<td>Taylor et. al., 2002</td>
</tr>
<tr>
<td><em>R. setosum</em>: Jhuse sunpati</td>
<td>Pink</td>
<td></td>
<td>* Similar to <em>R. anthopogon</em> and use for making of aromatic oil, perfumery and cosmetics.</td>
<td>Baral and Kurmi, 2006; SSCTS 2007</td>
</tr>
<tr>
<td><em>R. thomsonii</em></td>
<td>Extract of plants</td>
<td>Red</td>
<td>* As natural insecticides</td>
<td>Baral and Kurmi, 2006</td>
</tr>
</tbody>
</table>

of pulp, 150 gm of salt is added, 200 gm of grated ginger, 20 gm of red chillies, 25 gm of crushed cardamom, 25 gm of crushed cinnamon, 25 gm of cumin, two gm of crushed *javitri* (mace), three gm of sodium benzoïd, two gm of crushed cloves, a little bit of vinegar and some crushed dry fruits is mixed well. This chutney is ready to serve.

Krishna et al. (2012) developed an improvised method for the preparation of Rhododendron squash, which otherwise had a narrow consumer’s acceptability, despite being rich in antioxidants due to faulty preparation procedure and to compare the superiority of the new method over existing preparation method by examining various antioxidants and total antioxidant capacity. Rhododendron petals were heated with water at 80 °C for 20 min and left for 3-hour (or 180 min) followed by filtration and addition of sugar with or without ginger juice. Leaving Rhododendron petals with water for 3-hour at room temperature following heating facilitated maximum recovery of anthocyanin in water. Rhododendron squashes, prepared through improvised method, were compared with a Rhododendron squash collected from the market (control) for their physico-chemical characteristics, antioxidants and sensory quality attributes. They found that the improvised Rhododendron squashes registered higher values for most of the parameters than the control.

Factors to be Considered for Preservation of Rhododendron

* The harvested flowers must be free from all visible evidence of diseases
* The fully bloomed flowers must be collected and Corolla should be separated from anthers, calyx and stamen
* Preservatives (Sodium bicarbonate, citric acid) must be added in proper amount.
* The bottle must be clean and washed with vinegar before packaging.

**Tourism product**

Beautiful *R. arboreum* forests such as on Milke Danda—arguably the largest rhododendron forest in the world (Milleville, 2002). Shrestha, 2009 found out Rhododendron as main tourist product (24%) in TMJ that shows importance of rhododendron for conservation and its sustainable utilization. The commodity can be promoted well thorough sound processing and packaging to the visitors. The visiting time for tourists is from April to the south of Milke Bhajhyang and Gufapokhari, May to the north of it. The plant starts blooming from February at lower elevation and finishes by May at higher elevations. Best bloom is to be captured during March and April at altitudes between 2,299m -3000m (IUCN, 2005).

**Ornamental Use**

During the period of bloom rhododendron has greatest ornamental value. Women decorate their hair; clusters are strung across a house entrance to welcome the guests. Informants also added that Rhododendron flower has been extensively used in Rhododendron festival to make garlands. Vestaas (2006) has studied climatic limits to predict the chances of survival for Nepalese Rhododendron species when they are grown in gardens located in temperate climates. This could assist in knowledge enrichment within a Nepalese institution. Further seeds and/or seedlings for sale, nursery management and rhododendron for landscaping can be flourished. Stimulate local economy, and help with reforestation. Rhododendrons are ideal for naturalistic, forest plantings and for massed spring color effects. Rhododendron logo and its picturesque view are also praised by many visitors and customers. Indirectly, rhododendron can be used for paintings and photographing. The popularity of rhododendron has attracted many painters. Henri Fantin-Latour painted Rhododendron in 1874 which has been placed to Colone Museum (Milleville, 2002).

**Other Uses**

*Rhododendron arboreum*’s wood is used to make Khukris’ handle, box and are as well used as common fire wood and occasionally converted to charcoal for blacksmith work. *Rhododendron falconeri* is used in making covers for fruit packaging, bamboo shoots’ canning etc. for distant marketing. *Rhododendron fulgens*’s leaves are used as wick for lighting fires by the local inhabitants. Stems of rhododendron is utilized to make agricultural implements such as knife stalk, knife knob, sickle, spade stalk, yoke pin, plough stick, poles, etc (Chaudhary et al., 2002). *Rhododendron hodgsonii*’s wood is used to make spoon and ladles and also handles of khuskri. Since the wood is hard, is a good fire wood and making wooden rods etc. Also the leaves of *R. hodgsonii* are used for packing apples and other temperate fruits (SSCST 2007).

**Conservation Issue and Strategies for Management**

Rhododendrons require specialized habitat conditions and specific plant associations to survive. The impact of the rhododendron species on other species has its significance to ecosystem processes, succession and forest management, thus rhododendron is considered a ‘Keystone element’ in the Himalayan context (Singh et al., 2003). It is a keystone element so that if disturbed may degrade habitats that threaten associated biodiversity (Singh et al., 2009). The degradation of rhododendron habitat is due to lack of appropriate policy, institutional and operational infrastructure. Restoration of rhododendrons and their conservation in nature promotes the existence of other biodiversity components (Singh et al., 2009). It is expected that information on phytosociological analysis and associated vegetation will be helpful to solve ecological problems such as, biological conservation and management. Improved efforts of protection with community participation and in situ and ex situ conservation methodologies need to be administered in order to conserve the species and ecosystems (Giriraj et al., 2008). Rhododendron is the only group of plants that has continuum in the aforesaid ecotone and beyond doubt maintains the biological sustenance in this fragile zone (Singh et al., 2009). Nutrient and water fluxes between the associated species are filtered and possibly impacted by these genera (Swank and Cossley, 1998). Maintaining viable population of wild edible species is a crucial factor in its conservation and this requires appropriate approaches/framework (Maikhuri et al., 2009; Negi et al., 2011) and conservation methods. Trees largely determine the architecture and microclimatic conditions of the forest and hence, the changes in tree community dynamics may strongly affect other forest species (Browkaw, 1985) and ecological processes in a stand (Singh and Singh, 1986; Kharkwal et al., 2005).

In many parts of the Himalaya, these resources are critical, especially for the poor, in securing subsistence needs in times of hardship and emergencies when quick cash is required or when casual food stores run out (Sundriyal et al., 2003; Maikhuri et al. 2004). Bioprospecting of *R. arboreum* open up wide scope for livelihood options to rural inhabitants of the region but at the same time also exerted anthropogenic pressure on the species since it is widely used for fodder, fuelwood and for preparation of agricultural equipments in the region. Therefore, sincere efforts are needed to promote its conservation through domestication and sustainable harvesting. Very little information is apparently available on the germination of rhododendrons. The rhododendron species are propagated by vegetative means as well as through seeds (Singh et al., 2009). The rate of vegetative propagation is very slow in many rhododendron species and seed germination in nature is also very poor (Singh et al., 2003, 2009). Research activities may mitigate the impasse to a certain degree by developing nurseries and their subsequent planting, but overall success depends on the conservation by the local inhabitants through sustainable harvesting and conservation. Picking of flowers from single tree should be amounts to about 60% only and the rest of the blooms are left out on the tree to mature into seeds for conservatives measures (Singh et al., 2003).

Nature is enriched with numerous plants which can be used for medicinal purpose. The wild edibles are gaining increased attention as potential food supplement or cheaper alternative of...
commercial fruits across the world. There is need to incorporate these plants in our diet. Therefore people should be encouraged develop/establish nurseries of these wild edibles. Efforts are required for value addition and create awareness about their high nutritive and medicinal value as a health food drink among hill farmers for solving malnutrition and for their employment generation activities on the other hand. Rhododendron has immense scope to improve the livelihood of hill farmer in Himalayan region.

References


