Evaluation of *Pistacia integerrima*; an important plant

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**Abstract**

*Pistacia integerrima* is a typical therapeutic plant belongs to family Anacardiaceae and local to Japan, China and found in the Northern regions of Pakistan commonly called KakrraSingi (Urdu) and Shanai (Pushto). It is used ethnomedically for a number of diseases include fever, cough, asthma, vomiting, Ascaris, Anorexia, Allergy, viral infections, diarrhea, snake and scorpion biting sting. The different parts of the plant roots, leaves, stems, barks, Galls and fruits contains various bioactive compounds like amino acid, alkaloids, sterols, flavonoids, tannins, saponins, aromadendrene, Pistacinin, Pistacin, Dihydromalvic acid, Pistacienoic acid, sitosterol, resin, essential oils, caprylic acid, camphene, cineol, steral, dihydroqueretin and triterpenoids. Antimicrobial activity of chloroform and ethanol leaves extract from *Pistacia integerrima* reported in many research papers. The leave extract exhibited the fungi growth including *Aspergillus flavus*, *Dreschlera turcica* and *Fusarium verticillioides*. The plant is known to have many biological activities including antibacterial, antifungal, analgesic, antioxidant, phytotoxic, cytotoxicity and antiasthmatic. The current review will cover biological activities, phytochemical evaluation, ethnomedicinal uses, ethnobotanical uses and aim to serve as a base for additional investigation and exploitation. The current review shows a gap needed further investigations and isolations of new compound, and its biological activities.

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Introduction

*Pistacia integerrima* belong to family Anacardiaceae and a native dioecious tree to China, Japan, Pakistan, Afghanistan, and India (Pant and Samant, 2010). The different researcher goal medicinal flora like the development of therapeutic compounds (Elisabetsky, 1991).

There is some disease in the world which cause much death killing almost 40000 people, a disease like diarrhea cause huge mortality among children’s (Piddock et al., 1991). Bacteria like *Escherichia coli*, *Salmonella* spp. and *Staphylococcus aureus* are most common species which are pathogenic to children (Singh 1992). In recent years drug resistance to human pathogenic bacteria has been commonly reported from all over the world (Mulligen et al., 1992). Plant-based drugs are 120 worldwide and it is obtained from 95 plants.

About 250,000 flowering species and about 5000 flowers had pharmaceutical potential assessed. In East Asia, many plants are considered to have significant medicinal features i.e. anti-inflammatory, anti-bacterial and analgesic functions because they contain a large variety of phytochemical i.e. monoterpenoids, sesquiterpenoids, and curcuminoids (Tang, 1992).

It is found and mostly grows at an altitude of 900-2000m. *Pistacia integerrima* commonly called zebra wood but it has many vernacular names in Pakistan like Shania, Kakra, Khanjar, Thoak and India like Kakring, Kakra, Kakro, Kakkar, Singhi, kakarsinghi (Orwa et al., 2009). *Pistacia integerrima* is a well prominent due to Galls that present on the leaves and petioles. These galls are like animals horn shaped. The galls are the store house of various secondary metabolites so; it has importance in Indian traditional medicine systems (Chopra et al., 1986).

Plant description

**Synonyms**

*Pistacia integerrima* is synonyms of *Pistacia chinensis* subsp. *integerrima* (J. L. Stewart ex Brandis) Rech. f.

### Common names

- Latin name: *Pistacia integerrima*
- English name: Crab claw and zebra wood
- Urdu name: Kakarasingi
- Pashto name: Shanai
- Hindi name: Kakadasrngi
- Bengali name: Kankihasringi
- Kashmiri name: Kamaladina

Taxonomic position

Taxonomy of *Pistacia integerrima* is as Kingdom Plantae,

Division: Angiospermae

subdivision: Eudicots

Class: Rosides

Order: Sapindales

Family: Anacardiaceae

Scientific name: *Pistacia integerrima* (Bibi et al., 2011).

Habit and geographical distribution

*Pistacia integerrima* is native to Asia viz. Japan and China. It is also found in England, Myanmar, Nepal, Bhutan, India, Afghanistan and Pakistan. In Pakistan, it is mostly growing in the Temperate Himalayas Mountains. It is found 600-2500meters in altitudes from sea levels. It grows in a tropical climate (Sher et al., 2011).

Roots, stem, and leave

*Pistacia integerrima* is a deciduous multi-branched tree, having dark gray and blackish bark and grown upto 18meters. Leaves are 20-25cm in length, with or without terminal leaflet; leaflets are 4-5 pairs, lanceolate, coriaceous, pari or imparipinnate and base oblique. Leaves are a dark and green color which turns bright red in autumn (Sher et al., 2011).

Flower and fruit

Flowers are in lateral panicles, male compact pubescent, female lax and elongated. Plant wears the flowers and fruits in spring, which have large clusters of yellowish-brown colored fruit in winter.
Bracts ±1.2 mm long, lanceolate, apex pubescent, Bracteoles 2, linear, shorter, Sepals 4, less than anthers in length, linear, Stamens 5; anthers c. 1.8mm long, oblong, reddish, Styles 3-parted to almost the base; stigmas recurved, Drupe 5-6 mm broad, glabrous, dry, rugose, grayish-brown in color.

Seeds of the plant are with a membranous testa (Sher et al., 2011).

Methods
For the present review, information regarding the medicinal species was gathered via searching books and scientific databases including Elsevier, PubMed, springer and Google Scholar.

Phytochemistry
Isolated constituents: Plant mainly contains alkaloids, flavonoids, tannins, saponins and sterols in different parts including leaf, stem, bark, Galls and fruit. Following are method of isolation.

Phytochemical constituents
Phytochemical compounds also offer various health benefits and help in the treatment of various diseases.

The common phytochemicals are Amino acid, aromadendrene, Pistacinin, Pistacin, Dihydromalvic acid, Pistacienoic acid, Sitosterol, Resin, essential oils, aromadendrene, Caprylic acid, Camphene, Cineol, Sterals, dihydroqueretin and triterpenoids (Table 1).

Table 1. List of phytochemicals founds in various part of Pistacia integerrima.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Compounds</th>
<th>Plant parts</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Amino acid</td>
<td>Galls, Barks</td>
<td>(Bibi et al., 2011)</td>
</tr>
<tr>
<td>2</td>
<td>Saponin</td>
<td>Galls, Leaves</td>
<td>(Khan et al., 2012)</td>
</tr>
<tr>
<td>3</td>
<td>Tannins</td>
<td>Galls, Fruits</td>
<td>(Khan et al., 2012; Bibi et al., 2011)</td>
</tr>
<tr>
<td>4</td>
<td>Flavonoids</td>
<td>Galls, Fruits</td>
<td>(Jan et al., 2006)</td>
</tr>
<tr>
<td>5</td>
<td>Aromadendrene</td>
<td>Galls</td>
<td>(Sher et al., 2011)</td>
</tr>
<tr>
<td>6</td>
<td>Pistacinin</td>
<td>Galls</td>
<td>(Sher et al., 2011)</td>
</tr>
</tbody>
</table>

Health benefits

Ethnobotanical uses
Pistacia integerrima is an important plant and its various parts used ethnobotanically for various purposes like ornamental in various gardens, fuelwood, and fodder, medicinal purposes like coughing, appetite, asthma, vomiting, dysentery and dyseptic by (Orwa et al., 2009; Chopra et al., 1986; Abbasi et al., 2010). Furthermore, the leaves of Pistacia integerrima are used as food (Chopra et al., 1986). Stem resins are used for wounds healing (Abbasi et al., 2010). Barks of the Pistacia integerrima is boiled with water and used for jaundice problems (Aggarwal et al., 2006).

Table 2. Shows the Ethnobotanical importance of different parts of Pistacia integerrima.

<table>
<thead>
<tr>
<th>Part used</th>
<th>Ethnobotanical uses</th>
<th>Mode of administration</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roots</td>
<td>Fuel, charcoal is obtained</td>
<td>—</td>
<td>(Uddin et al., 2006 )</td>
</tr>
<tr>
<td>Stems</td>
<td>Stems Resin used as wound healer and backbone pains</td>
<td>Decoction</td>
<td>(Abbasi et al., 2010)</td>
</tr>
<tr>
<td>Wood</td>
<td>Construction purposes</td>
<td>—</td>
<td>(Jan et al., 2006)</td>
</tr>
<tr>
<td>Leaves</td>
<td>Fodder for animals, dyestuff</td>
<td>Decoction</td>
<td>(Ahmad et al., 2010)</td>
</tr>
<tr>
<td>Barks</td>
<td>Hepatitus, jaundice, Dyestuff,</td>
<td>Decoction</td>
<td>(Aggarwal et al., 2006)</td>
</tr>
<tr>
<td>Galls</td>
<td>Asthma, diarrhea, cough, fever, hepatitis, vomiting, appetite loss, nose bleeding, bites of snakes, scorpion sting.</td>
<td>Boiled in water or roasted with honey and take it orally</td>
<td>(Khan et al., 2012; Munir et al., 2006)</td>
</tr>
<tr>
<td>Fruits</td>
<td>Jaundice, hepatitis and edible</td>
<td>Orally</td>
<td>(Orwa et al., 2009)</td>
</tr>
</tbody>
</table>

The galls are used against liver disorder and hepatitis in Pakistan (Khan et al., 2012). Galls are mixed with other drugs and then used for scorpion and snake biting sting (Munir et al., 2006).

Fruits of Pistacia integerrima is edible and uses for liver disorder (Singh 1992; Orwa et al., 2009) Wood is used for construction purposes (Jan et al., 2006) as given in (Table 2).
Ethnomedicinal uses

*Pistacia integerrima* Galls are utilized as a part of customary drug to treat hacks, asthma, looseness of the bowels, diarrhea, fever, spewing, hunger misfortune, nose dying, wind nibbles and scorpion stings. The plant concentrates are utilized as a part of treating domesticated animals infections (Hussain et al., 2007; Islam et al., 2006; Ali et al., 2016; Shuaib et al., 2015).

Different items from *Pistacia integerrima* have huge pain-relieving and calming movement. Galls of *Pistacia integerrima* are brought with nectar for hack asthma and the runs in northern zones of Pakistan. Moreover, bothers are likewise utilized against hepatitis and another liver issue in Pakistan. Rankles in blend of different medications are likewise utilized against snake nibble and scorpion sting.

### Table 3. *Pistacia integerrima* activities.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Activities</th>
<th>Part involved</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Antibacterial activities</td>
<td>Leaf, Galls</td>
<td>Rahman et al., 2011; Ramachandra et al., 2010; Adusumalli et al., 2013; Shamim et al., 2010</td>
</tr>
<tr>
<td>2</td>
<td>Antifungal activities</td>
<td>Galls, Fruits</td>
<td>(Shirole et al., 2014; Ghias et al., 2011; Ramachandra et al., 2010)</td>
</tr>
<tr>
<td>3</td>
<td>Anticancer property</td>
<td>Galls</td>
<td>(Shirole et al., 2014)</td>
</tr>
<tr>
<td>4</td>
<td>Anti-inflammatory activities</td>
<td>Galls, Leaves</td>
<td>(Rizwan et al., 2013)</td>
</tr>
<tr>
<td>5</td>
<td>Antioxidant property</td>
<td>Galls</td>
<td>(Ramachandra et al., 2010)</td>
</tr>
<tr>
<td>6</td>
<td>Phytotoxic activities</td>
<td>Galls</td>
<td>(Shamim et al., 2010)</td>
</tr>
<tr>
<td>7</td>
<td>Antiasthmatic activities</td>
<td>Galls</td>
<td>(Shamim et al., 2010)</td>
</tr>
<tr>
<td>8</td>
<td>Phytochemical activities</td>
<td>Galls</td>
<td>(Ghias et al., 2011; Shuaib et al., 2016)</td>
</tr>
</tbody>
</table>

The bark of *Pistacia integerrima* is bubbled in water and concentrate is utilized for jaundice and hepatitis in a few districts of Pakistan. Stem gum is utilized as a part of wounds recuperating. Natural products are eatable and furthermore utilized against the liver issue. Other than customary restorative uses *Pistacia integerrima* stem and branches are utilized as fuel wood, development and elaborate wood in a few districts of Pakistan. Leaves of *Pistacia integerrima* are used as fodder for cattle (Islam et al., 2006; Sharifullah et al., 2016). In Pakistan, the Galls of *Pistacia chinensis* var. *Integerrima* are utilized for the treatment of hepatitis and liver. It has been accounted for to have depressant, pain relieving calming exercises and hyperuricemic impact issue (Hussain et al., 2007; Shuaib, M. 2016).

*Biological activities*

*Antibacterial activity*

Recently the world is paying more attention and importance to medicinal plants for their antimicrobial potential. These plants become more important when it comes to developing countries where one of the major causes of death is infectious diseases. These infectious diseases have built a need for the discovery of antimicrobial compounds. Thus the need for a new drug has made researchers to focus on medicinal plants and discover drugs against pathogens and disease-causing microbes. In doing so, many medicinal plants have been studied for their antimicrobial potential, but there still exist a large number of plants which needs to be explored and studied (Anonymous 2011). Several studies have proved that the foremost disease causing agents of both hospitals acquire and community infections are *Streptococcus pyogene* and *Staphylococcus aureus* (Shuaib et al., 2014). On the other hand, data obtained from the literature shows that around seventy percent of the bacterial flora has shown resistance to given antibiotics (Abbasi et al., 2009). These bacteria are the major cause of fatal diseases such as diarrhea, which is caused by intestinal infection, is the main reason for the infant death around the globe.
Excessive use of antibiotics has enabled pathogens to pose high resistance to antibiotics and other drugs. Infections like gonorrhea, wound infections, dermatitis, pneumonia, tuberculosis and many fungal infections are showing more resistance to the available drugs (Upadhye et al., 2010). This problem has further forced the scientist to look for new drugs and develop strong and effective antibiotics (Saghir et al., 2011).

In nutshell, bacterial resistance to several antibiotics has raised serious health issues because the number of effective drugs against these bacteria is very few (Upadhye et al., 2010). However, medicinal plants have still the potential to show strong and effective action against many bacteria. Ginger which is a common substance found regularly in our diet (Food and tea) is known to have strong antibacterial effects.

**Fig. 1.** Method of isolation (Yamin Babi et al., 2016).

**Antifungal activities**
Fungi are the most notorious infectious agents of plants. A variety of fungal genera is known to alter developmental stages of plants and cause diseases to various species of plants even after harvest. They affect plant organs with respect to organoleptic characteristics, limited shelf life and nutritional values (Anzana et al., 2013). They produce mycotoxins or allergens which are responsible for various allergic reactions and toxic abnormalities in consumers. Generally, synthetic fungicides are used against fungi but excessive use of fungicides poses health and environmental issues. This made researchers search for the alternate source of fungicide which are plants (Anzana et al., 2013). Many experiments have proved that plants extract have antifungal and antimicrobial properties (Anzana et al., 2013).

**Phytotoxic activity**
Natural products with phytotoxic activities can be used for the development of herbicides. Plants secondary metabolites (allelochemicals) are known to have allelopathic effects on other plants. Allelochemicals are released as exudates from plant’s tissues or by decomposition of dead organs into the environment. These chemicals inhibit or at least affect the growth of adjoining plants. A case study of Lemna revealed that its growth was inhibited by natural antitumor compounds. Moreover, it was also revealed that frond proliferation was also stimulated by some compounds which acted as growth stimulants. There is a hope that someday natural products will replace artificially synthesized herbicides and growth stimulators (Sebiomo et al., 2011). Weeds or unwanted plants have been one of the major causes of low crop yield throughout the world and Pakistan. Annual crop loss caused by weeds is greater than that of diseases and insects (Bibi et al., 2012). Weeds compete with crops for available resources and affect plant growth and yield. In an attempt to control weed by synthetic drugs resulted in health and environmental issues (Rauf et al., 2016). As a result, to control weeds, researchers have drifted their attention to other harmless and natural means (Hossein et al., 2011).
Anticancer property
Galls of *Pistacia integerrima* have anti-cancer property. The crude extract from *Pistacia integerrima* and its parts were tried for cytotoxic action against Michigan Cancer Foundation-7 human breast growth cell line. The crude extract of stem concentrate of this plant additionally displays the antitumour likewise the rough concentrate repressed Michigan Cancer Foundation-7 cell practicality in a measurement subordinate way; the poor poisonous quality (1.6%) at 10 μg/ml to direct harmfulness (55.4%) at 100 μg/ml. The IC50 values figured were 90.9 μg/ml. The ethyl acetic acid derivation and chloroform parts at a centralization of 200 μg/ml indicated ~100 and 97.4% restraint against Michigan Cancer Foundation-7 cell line. (Shirole et al., 2014).

![Fig. 2. The dried galls of *Pistacia integerrima* in the local markets.](image)

Anti-inflammatory activities
The leaves and galls of *Pistacia integerrima* have an anti-inflammatory property (Rizwan et al., 2013; Ahmad et al., 2013).

Anti-asthmatic activities
Explains the action of essential oil from the *Pistacia integerrima* for its anti-asthmatic activity (Bibi et al., 2011).

These essential oil were used for the inflammation frequently because it is absorbed in the skin tissue and work in quick sussesion. Antiasthmatic action separate nerves might be because of the film balancing out potential, concealment of immune response generation and restraint of antigen initiated histamine discharge.

Antioxidant property
*Pistacia integerrima* shows antioxidant properties. *Pistacia integerrima* bark indicated antioxidant properties nearly as strong as the standard medication ascorbic acid.

*Pistacia integerrima* leaves additionally demonstrated a high potential with the expectation of complimentary radical rummaging and cancer prevention agent movement. (Ramachandra et al., 2010; Izhar et al., 2011).

Pharmacological activities
*Pistacia integerrima* Galls were mostly used for various purposes like asthma, Bronchitis, chronic, fever, diarrhea, anthelmintic, antispasmodic, carminative and antiamoebic.

Economic value of *Pistacia integerrima*

The galls of *Pistacia integerrima* is exported to many countries from various parts of Pakistan like Dir valley, Swat valley to various local and international markets by (Shuaib et al., 2016; Hamayun et al., 2006).

Conclusion
This review concluded that *Pistacia integerrima* is multipurpose medicinal specie and a source of various bioactive compounds.
Currently there is very little work has been done on their phytochemical exploration and biological activities. Furthermore investigations are needed to explore its medicinal importance.

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