



Evaluation of *Pistacia integririma*; an important plant

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Abstract

Pistacia integririma is a typical therapeutic plant belongs to family Anacardiaceae and local to Japan, China and found in the Northern regions of Pakistan commonly called KakraSingi (Urdu) and Shanai (Pushto). It is used ethnomedicinally 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, sterals, dihydroqueretin and triterpenoids. Antimicrobial activity of chloroform and ethanol leaves extract from *Pistacia integririma* 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. antiinflammatory, 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, Kakroi, 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

Pushto name: Shanai

Hindi name: Kakadasrangi

Bengali name: Kankihasringi

Panjabi name: Kakar, Kakarsingi

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*.

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

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

dyspeptic by (Orwa *et al.*, 2009; Chopra *et al.*, 1986; Abbasi *et al.*, 2010). Furthermore, the leaves of *Pistacia integerrima* are used as fodde (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*.

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

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 inablend of different medications are likewise utilized against snake nibble and scorpion sting.

Table 3. *Pistacia integerrima* activities.

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

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 gonorrhoea, 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.

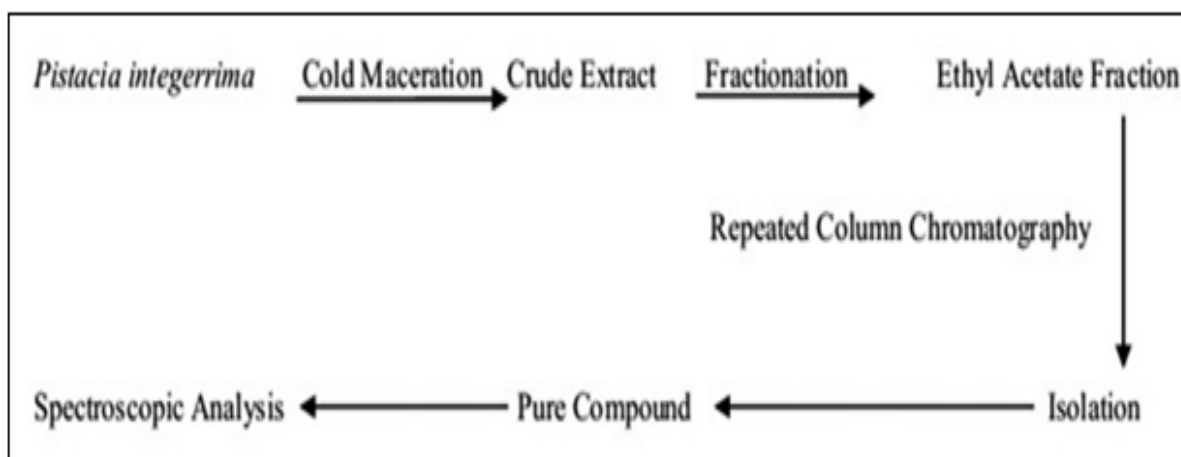


Fig. 1. Method of isolation (Yamin Babi *et al.*, 2016).

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 (Hosseini *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.

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 succession. 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 antiamebic.

Economic value of Pistacia integerrima

The galls of *Pistacia integerrima* are 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.

References

- Abbasi AM, Khan MA, Ahmad M, Zafar M, Khan H, Muhammad N, Sultana S.** 2009. Medicinal plants used for the treatment of jaundice and hepatitis based on socio-economic documentation. *African J. Biotech* **8**, 1643-1650.
- Abbasi AM, Khan MA, Ahmad M, Zafar M.** 2010. Herbal medicines used to cure various ailments by inhabitants of Abbottabad district, North West Frontier, Pakistan. *Ind. J. Trad. Know* **9**: 175-183.
- Adusumalli Y, Ranjit PM, Harish MS.** 2013. Antiasthmatic activity of aqueous extract of *Pistacia integerrima* Galls. *International Journal of Pharmacy and Pharmaceutical Sciences* **2**, 0975-1491.
- Aggarwal BB, Ichikawa H, Garodia P, Weerasinghe P, Sethi G, Bhatt ID, Pandey MK, Shishodia S, Nair MG.** 2006. From traditional Ayurvedic medicine to modern medicine: identification of therapeutic targets for suppression of inflammation and cancer. *Expert Opin. Ther. Targets* **10**, 87-118.
- Ahmad R, Pieters L, Rahman NU, Riaz M.** 2013. Antimicrobial and antioxidant activity of crude extracts of two medicinal plants *Pistacia integerrima* and *Debregeasia salicifolia*. *Inter. J. Pharmaceut. Sci* **18(1)**, 13-17.
- Ahmad S, Ali M, Ansari SH.** 2010. Phenolic constituents from galls of *Pistacia integerrima* Stewart. *Ind. J. Chem* **50B**, 115-118.
- Ali K, Shuaib M, Hussain Z, Sajjad W, Ali F, Fazil M.** 2016. Ethnobotanical assessment of the medicinal flora of Khyber agency, Pakistan. *Pak. J. Weed Sci. Res* **22(4)**, 607-616.
- Anonymous.** 2011. The Database on Medicinal Plants used in Ayurveda, Published by Central Council for Research in Ayurveda and Siddha, Govt. of India, New Delhi 169.
- Anzana P, Jesmin A, Md. Mehedi H, Nirupam B.** 2013. Study on the comparative antibacterial activity of *Polyalthia longifolia* (Debdaru) leaf extracts to some selective pathogenicbacterial strains **3(5)**, 17-24.
- Barkatullah Ibrar M, Muhammad N.** 2011. Evaluation of *Zanthoxylum armatum* DC for *in-vitro* and *in-vivo* pharmacological screening. *Afr. J. Pharma. Pharmacol* **5(14)**, 1718-1723.
- Bibi Y, Nisa S, Chaudhary MF, Zia M.** Antibacterial activity of some selected medicinal plants of Pakistan. *BMC Comp. Alt. Med* **11**, 52.
- Bibi Y, Sobia N, Chaudhary FM, Zia M.** 2011. Antibacterial activity of some selected medicinal plants of Pakistan. *BMC Complementary and Alternative Medicine* **11**:52.
- Bibi Y, Zia M, Qayyum A.** 2012. An overview of *Pistacia integerrima* a medicinal plants species: Ethnobotany, biological activities and Phytochemistry 2012.
- CDC.** 2005. Tuberculosis transmission in a homeless shelter population- New York, 2000–2003. *MMWR* **54**, 149–52.
- Chopra RN, Nayar SL, Chopra IC.** 1986. Glossary of Indian medicinal plants (Including the Supplement). Council of scientific and industrial research, New Delhi.1986.
- Dastagir G, Hussain F.** 2013. Phytotoxic and insecticidal activity of plants of family Zygophyllaceae and Euphorbiaceae. *Sarhad J. Agric* **29(1)**.
- Dellavalle PD, Cabrera A, Alem D, Larrañaga P, Ferreira F, Rizza MD.** 2011. Antifungal activity of medicinal plant extracts against phytopathogenic fungus *Alternaria* sp. *Chilean Journal of Agricultural Research* **71(2)**, 231-239.
- Doughari JH.** 2006. Antimicrobial Activity of *Tamarindus indica* Linn. *Tropical Journal of Pharmaceutical Research* **5 (2)**: 597-603.

- Elisabetsky E.** 1991. Sociopolitical, economical and ethical issues in medicinal plant research. *J Ethnopharmacol* **32**, 235–239.
- Fazli K, Zafar I, Zakiullah, Ayub K, Fazli N, Naveed M, Ali KJ, Shafiq KM.** 2012. Metal analysis, phytotoxic, insecticidal and cytotoxic activities of selected medicinal plants of Khyber Pakhtunkhwa. *Pak. J. Pharm. Sci.* **25**, 51-58.
- Ghias Uddin, Abdur R, Taj UR, Qaisar M.** 2011. Phytochemical Screening of *Pistacia chinensis* var. *integerrima*. *Middle-East Journal of Scientific Research* **7 (5)**, 707-711.
- Hamayun M, Khan SA, Sohn EY, Lee IJ.** 2006. Folk medicinal knowledge and conservation status of some economically valued medicinal plants of District Swat, Pakistan. *Journal of Ecology and application* **11(2)**.
- Hameed I, Hussain F, Zaman S, Bacha N, Khan AA.** 2013. Cytotoxicity and phytotoxicity of some selected medicinal plants of family Solanaceae. *Pak. J. Bot* **45(5)**, 1749-1754.
- Hossein Hosseinzadeha, Effat B, Mohammad MS.** 2011. Antinociceptive and Anti-inflammatory Effects of *Pistacia vera* Leaf Extract in Mice. *Iranian Journal of Pharmaceutical Research* **10(4)**, 821-828.
- Hussain F, Shah SM, Sher H.** 2007. Traditional resource evaluation of some plants of Mastuj, District Chitral, Pakistan. *Pak. J. Bot.* **39**, 339-354.
- Islam M, Ahmad H, Rashid A, Razzaq A, Akhtar N, Khan I.** 2006. Weeds and medicinal plants of Shawar Valley, district Swat. *Pak J. Weed Sci. Res* **12**: 83-88.
- Izhar A, Ikram I, Samar S, Khan I.** 2013. *In vitro* antioxidant activities of four medicinal plants on the basis of DPPH free radical scavenging. *Pak. J. Pharm. Sci.* **26(5)**, 949-952.
- Jan S, Khan MA, SirajUd-din, Murad W, Hussain M, Ghani A.** 2006. Herbal remedies used for gastrointestinal disorders in Kaghanvalley, NWFP, Pakistan. *Pak. J. Weed Sci. Res* **14**, 169-200.
- Kaur B, Singh S.** 2015. A review on gall karkatshringi. *J. Medi. P Res* **9**:636-640.
- Khan MA, Khan MA, Hussain M.** 2012. Medicinal Plants Used in Folk Recipes by the Inhabitants of Himalayan Region Poonch Valley Azad Kashmir (Pakistan). *J. Basic Appl. Sci* **8**, 35-45.
- Mulligen ME, Kauffman CA, Yu VL.** 1993. *American Journal of Medicine* **94**, 313-28.
- Munir M, Khan MA, Ahmed M, Bano A, Ahmed SN, Tariq K, Tabassum S, Mukhtar T, Ambreen M, Bashir S.** 2006. Foliar epidermal anatomy of some ethnobotanically important species of wild edible fruits of northern Pakistan. *J. Med. Plants Res* **5**, 5873- 5880.
- Orwa C, Mutua A, Kindt R, Jamnadass R, Simons A.** 2009. Agroforest tree database: a tree reference and selection guide version 4.0.
- Pant S, Samant SS.** 2010. Ethnobotanical observations in the Mornaulareserve forest of Kumoun, west Himalaya, India. *Ethnobotanical Leaflets* **14**, 193.
- Piddock KJV, Wise R.** 1991. *Journal of Antimicrobial chemotherapy* **23**, 475-83.
- Rahman S, Ismail M, Muhammad N, Ali F, Chisthi AK, Imran M.** 2011. Evaluation of the stem bark of *Pistacia integerrima* Stewart ex Brandis for its antimicrobial and phytotoxic activities. *Afr. J. Pharmac. Pharmacol* **5**, 1170-1174.
- Ramachandra YL, Ravi SBE, Sujana GPS, Sundar RS.** 2010. *In-vitro* antimicrobial activity of *Pistacia integerrima* leaf gall extracts. *Pharmacophore* **1(2)**, 149-154.
- Rauf A, Uddin G, Raza M.** 2016. Reversal of multidrug resistance in mouse lymphoma cells by extracts and flavonoids from *Pistacia integerrima*. *Asian Pac. J. Cancer. Prev.* **17**, 51-55.
- Rizwan A, Pieters L, Rahman NU, Riaz M.** 2013. Antimicrobial and Antioxidant Activity of Crude Extracts of Two Medicinal Plants *Pistacia integerrima* and *Debregeasia salicifolia*. *Int. J. Pharm. Sci. Rev. Res* **18(1)**, 03, 13-17.

- Saghir MGA, Porter DM.** 2011. Taxonomic Revision of the Genus *Pistacia* L. (Anacardiaceae). American Journal of Plant Sciences **3**, 12-32.
- Sebiomo Awofodu AD, AwosanyaAO, Awotona FE, Ajayi AJ.** 2011. Comparative studies of the antibacterial effect of some antibiotics and ginger (*Zingiber officinale*) on two pathogenic bacteria. Journal of Microbiology and Antimicrobials **3**, 18-22.
- Shah S, Siraj Ud Din, Rehmanullah Jamal Q.** 2013. Pharmacological evaluation of *Ziziphus nummularia* leaves for phytotoxic and molluscicidal bioassays. African Journal of Pharmacy and Pharmacology **7(45)**, 2887-2891.
- Shamim A, Ali M, Ansari SH.** 2011. Phenolic constituents from the galls of *Pistacia integerrima* Stewart. Indian journal of chemistry **50**:115-118.
- Shamim A, Mohammed A, Shahid H, Ansari, Faheem A.** 2010. Phytoconstituents from the galls of *Pistacia integerrima* Stewart. Journal of Saudi Chemical Society **14**, 409-412.
- Sharifullah, Shuaib M, Khan I, Ali S, Ali K, Kumar T.** 2016. Study of important medicinal plants of district Dir Upper, Pakistan. Pak. J. Weed Sci. Res **22(4)**, 595-606.
- Sher H, Elyemeni M, Hussain K, Sher H.** 2011. Ethnobotanical and economic observations of some plant resources from the northern parts of Pakistan. Ethnobot. Res. App **9**, 27-41.
- Shirole RL, Shirole NL, Kshatriya AA, Kulkarni R, Saraf MN.** 2014. Investigation into the mechanism of action of essential oil of *Pistacia integerrima* for its antiasthmatic activity. J Ethnopharmacol **153(3)**, 541-51.
- Shuaib M, Jang N, Ayub S, Rahman SU, Khan MT, Fazil M, Ali Z.** 2016. Export of Important Medicinal Plants to Local and International Market from District Dir, Khyber Pakhtunkhwa, Pakistan. American-Eurasian J. Agric. & Environ. Sci **16(1)**, 99-103.
- Shuaib M, Khan I, Sharifullah, Khan MT.** 2015. Study of Medicinal Plants of Lower Dir, Timergara, Tehsil Balambat, Khyber Paktunkhaw-Pakistan. American-Eurasian J. Agric. Environ. Sci. **15(10)**, 2088-2094.
- Shuaib M, Khan I, Sharifullah Khan R, Hashmatullah Mubarik S, Naz R.** 2014. Ethnobotanical studies of spring flora of Dir Lower, Khyber Pakhtunkhwa, Pakistan. Pak. J. Weed Sci. Res **20(1)**, 37-49.
- Shuaib M.** 2016. Ethno-Botanical Uses of Important Weed Species in DIR (Lower), Khyber, Paktunkhaw, Pakistan. American-Eurasian J. Agric. Environ. Sci. **16(2)**, 262-265.
- Singh M, Chaudhry MA, Yadava JNS, Sanyal SC.** 1992. J Antimicrobial Chemotherapy **29**, 159-68.
- Tang WG.** 1992. Eisenbrand. J Plant Research 401-415.
- Uddin G, Rauf A, Taj urRehman, Qaisar M.** 2006. Phytochemical screening of *Pistacia chinensis* var. *integerrima*. Middle-East J. Sci. Res **7**, 707-711.
- Upadhye AS, Rajopadhye AA.** 2010. Pharmacognostic and phytochemical evaluation of leaf galls of Kakadshringi used in Indian system of medicine. Journal of Scientific and Industrial Research 69 -70.