

A Review on *Geranium wallichianum* D-Don Ex-Sweet: An Endangered Medicinal Herb from Himalaya Region

Sabah Shaheen, Yamin Bibi, Mubashir Hussain, Muhammad Iqbal^{*}, Hafiza Saira, Irum Safdar, Hira Mehboob, Qura Tul Ain, Kiran Naseem and Sadaf Larai

Department of Botany, PMAS-Arid Agriculture University, Rawalpindi, Pakistan

^{*}Corresponding author: Muhammad Iqbal, Department of Botany, PMAS-Arid Agriculture University, Rawalpindi, Pakistan, Tel: 00923135338714; E-mail: mmiqballali@gmail.com

Received date: March 24, 2017; Accepted date: April 11, 2017; Published date: April 14, 2017

Copyright: © 2017 Shaheen S, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Abstract

Geranium wallichianum D. Don ex sweet belongs to Family Geraniaceae, distributed in Himalaya region of Pakistan. It is highly medicinal. It is native to Pakistan due to its restricted geographic ranges, specific habitats and anthropogenic activities more than 75% population has been reduced. Major threats are grazing of pasture, forest encroachment, soil-slope erosion, poverty, forest fire, illegal trade, habitat loss, invasive species and the lack of adequate training. In this review efforts are made to document the conservation status of important medicinal plant *G. wallichianum*. It is most threatened species and deserves special attention. Due to insufficient information, there is no organization strategy for conservation of this plant. With great ethnomedicinal value of this plant species draw the attention of the researchers to conserve it. Several conservation studies and efforts are making to conserve it, but comprehensive and long lasting conservation policies are necessary to ensure its conservation.

Keywords: Endemic plants; Ethno-medicinal; Endangered; *Ex-situ* & *In-situ* conservation

Introduction

Plants fulfill the basic needs of human with materials for existence, which is medicinal, economic and fodder values [1]. From a region plant species is lost, the knowledge enclosed in and also destroyed slowly until become disappear forever [2]. In Pakistan, more than 10% of the flora is endangered [3]. The data is limited on the conservation status of indigenous plant species; however, there is a lot of argument in the presented information. In Pakistan 709 plants are reported as threatened and endangered [4]. Among them about 580 are flowering plants [5]. In contrast, more recently reports represent only 21 flowering plants that are threatened in Pakistan [6]. Conservation of a plant species are initially hot problem [2]. Due to over harvesting, medicinal plant population are become severally reduced [7-9]. In Pakistan, more than 10% endangered flora is present [3]. In this review efforts are made to document the conservation status of important medicinal plant *G. wallichianum*. At local level this plant is used *G. wallichianum*, is most threatened species and need special attention. Overexploitation of plant resources combined with improper harvesting and post harvesting techniques are increases pressure on this plant.

Geographical distribution

In Pakistan its distribution is Swat, Murree hills, Baluchistan, Hazara, Chitral, Dir, Gilgit, Shogran valley and Lowari top. While in world distribution is East Asia-Himalayas from Nepal, Afghanistan to Bhutan [10]. It's very common in mountainous areas of Pakistan like Khyber Pakhtunkhwa, Azad Jammu Kashmir and Murree (Figure 1) [11].

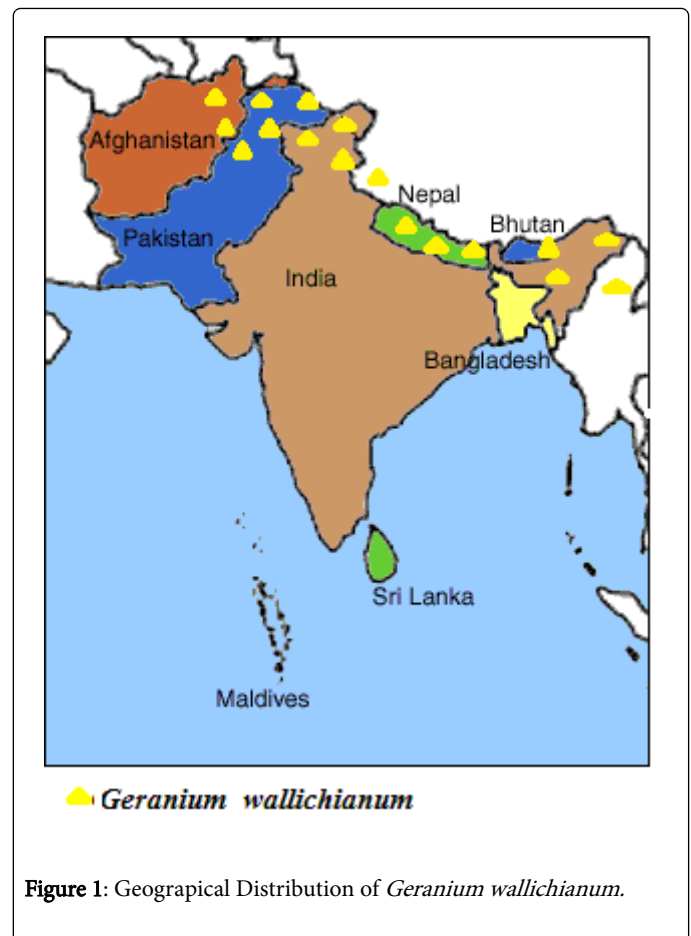


Figure 1: Geographical Distribution of *Geranium wallichianum*.

Occurrence

Commonly found in Forests, shrubberies and open slopes, 2400-3600 m [10]. It is found in moist damp places [12]. Indian Himalaya region the altitude range of *G. wallichianum* is 2500-4000 m [13]. In Azad Kashmir, its altitude range is 6000-8000 [12].

Taxonomy and morphology

Geranium wallichianum D. Don ex sweet usually named as "Shepherd's needles" and locally as "Ratanjot" [14]. It's commonly called Wallach cranes bill [15]. Its English name is Buxton's blue and in Tib it is known as Rus Jot [10]. It is also known as Sra zeal [16]. It is also called as mamekh [17]. It also known srazela [18]. It is also known as ratinloog and rattenjot [19].

Morphological and taxonomic features

Geranium wallichianum D. Don ex-sweet belongs to Family Geraniaceae. It comprises 5 genera and 750 species, it is worldwide in distribution but commonly in mild areas [15]. It comprises 4 genera and 26 native species in Pakistan [20]. There are two tribes in family i.e., Geraniaceae and Pelargonieae [21]. The length of plant is 45 cm or more. Stem ascending, adolescent and 1-4 ft. length. Leaves palmate partite, reniform, 5.5-7 cm wide, lamina pubescent-villous, 5-angled lobes rhomboid cuneate; stipules 0.9-1.4 cm in length, pubescent to lightly villous, widelance late, sometimes apex 2-fid. Size of Petiole is 7 cm, at the base of lamina dense villous. Peduncles 18.5 cm long, 2-

flowered, lance late, bracts 0.7-1.4 cm in length, appressed pubescent-glandular, Size of Sepals is 10-12 mm long, glandular hairy, elliptic ovate, awn 1 mm long; base villous 1.4-2 cm long Petals [13]. It is a perennial herb, blue-colored flowers ranges from 3-8.5 cm in diameter [22]. March to April is its flowering period [10]. It is observed that its flowering period is June to September [23]. It is reported that its flowering period is August-September [14].

Conservation status

G. wallichianum D. Don ex sweet is endemic to Pakistan [24]. In Kalam it is rare [25]. It is endangered in AJK [26]. In swat, it is rare [27]. It is rare in poonch valley [14]. In Dir Kohistan valley it is fall in most threatened species and need special attention [28]. It is near endemic in Nanda Devi [13].

Market value

G. wallichianum (Figure 2A) is commonly brought to the market as medicinal plant, from the mountain zone, mainly collected (2500-3100 m.) under *Picea smithiana* (Figure 2B) and *Abies pindrow* forest; a few species are collected from (sub-) alpine areas [29]. At altitude between 2,800-3,800 m, the vegetation is subalpine type represented by *G. wallichianum*. Mostly rhizome is sold at national and international market from 500-1000 Rs/kg (Figure 3) [30].



Figure 2: A: *G. wallichianum* B: *Picea smithiana*.

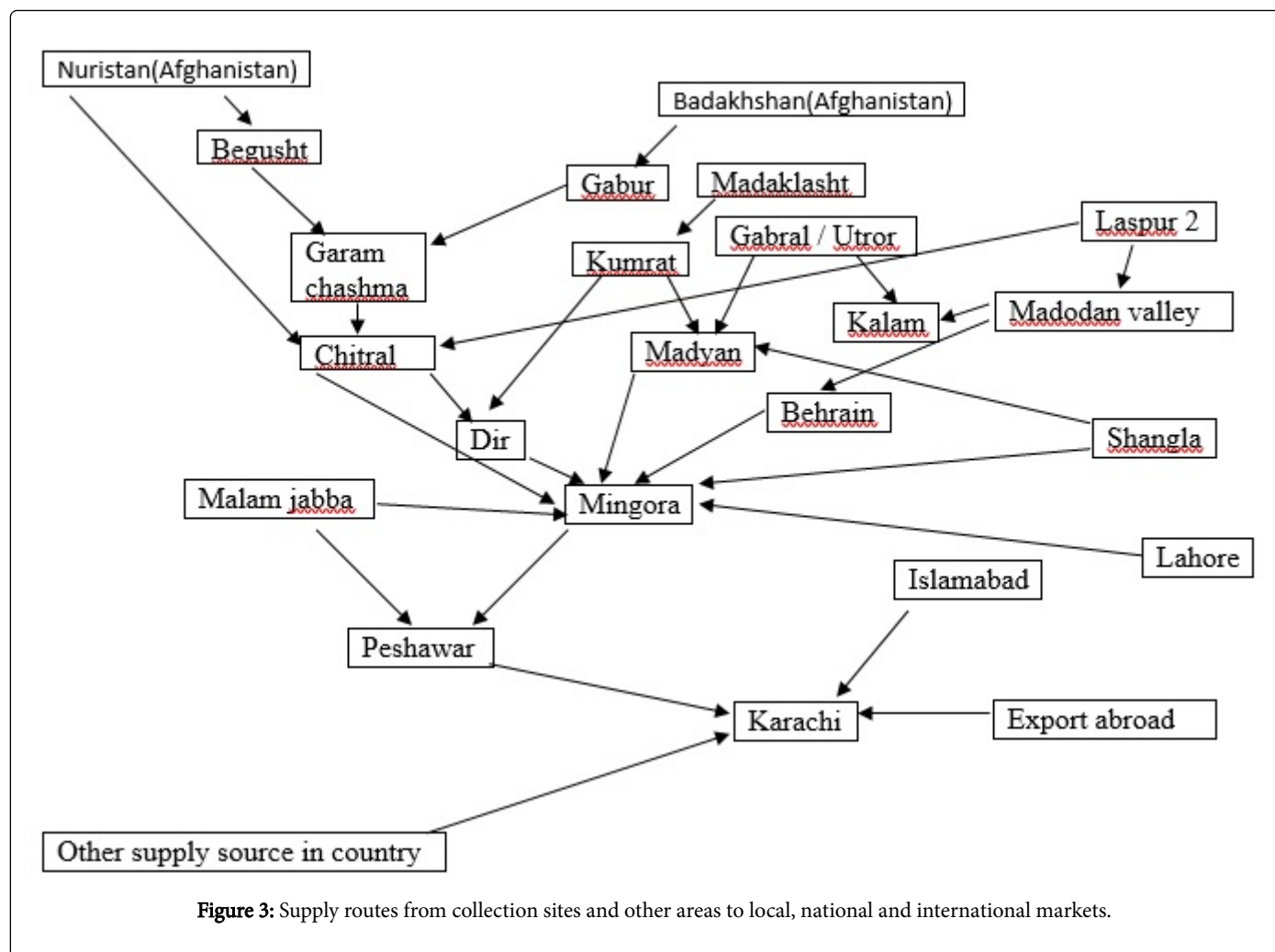


Figure 3: Supply routes from collection sites and other areas to local, national and international markets.

Ethanomedicinal uses

For primary health care 75-80% of the world's population are used herbal medicines because of superior traditional adequacy, better compatibility with human body and minor side effects.

In Pakistan, this species is endemic. More than 75% population is reduced. Unsustainable assembly of the rhizome and over exploitation is its main threats. As medicinal plant, there must be bane on the unsustainable collection and over exploitation of this species. Owing to over harvesting and extreme use of this plant, it needs to be conserved before it is vanish [24]. This plant need to be preserved before they disappear because of excessive commercial harvest and local uses. The major factors which take part in plant diversity loss found are grazing of pasture, forest encroachment, soil-slope erosion, collection of medicinal plant, agro-system threats, poverty, forest fire and invasive species intensify the environment. Further research is needed in extensive field conservation. Climate variations are strongly influences the dispersal and richness of plant variety margins of equally in latitude and altitude [38,39]. Deforestation, illegal trade, habitat loss, invasive species, growing demand for natural resources, industrial pollution, and the lack of adequate training are major threats of this plant [40]. Through illicit means collection of this plant continues from the forest (Table 1) [41,42].

Conservation strategies

The cultivation of *G. wallichianum*, *ex-situ* management is ignored in the past [43]. An *ex-situ* conservation effort was carried out by cultivating threatened and medicinally important plant species. *G. wallichianum* survived in the new habitat. Similar *ex-Situ* conservation effort was carried out by Ahmad [44]. An *ex-situ* conservation effort was made by cultivating medicinal plant *G. wallichianum* [17]. In 2002, an *ex-situ* conservation effort was made and plant is shifted from Swat to Tindodog for cultivation but it is failed [27]. The most effective route to conserve plants in their homeland and confirm use of plant resources sustainable, it is necessary to educate the people, give concept about sustainability and provide the chances for well settlement. In this way, the misuse of the native flora might be reduced. Excessive use of *G. wallichianum* and due to overgrazing plants gets threatened, endemic or vulnerable. Some steps are taken to reduce the negative effects of misuse and mismanagement of this plant like revolving greasing method introduced, cultivation increases, sustainable use, public awareness through media and stop illegal trade and don't up root the plant. *G. wallichianum* is an important plant with respect to its ethnobotanical importance. It is reduced more than 75% population it is listed as endangered plant. Few of the problems that arise during various conservation activities include; poverty, lack of education and awareness, lack of marketing opportunity, heavy human

and animal pressure on plant resources. Communities should be given exposure and awareness that they start working for the environment and all the plant biodiversity that needs to be protected. They can join institutions to support this purpose and play their role in conserving these massive endangered plant species. Furthermore, government

should ensure provision and promotion of advanced facilities for research and study in different aspects of plant conservation and should also promote and arrange courses, conferences, lectures and training courses at different levels for those already engaged in this field as well as general public.

| Ethanomedicinal Uses | Citations |
|--|-----------|
| Root is used in backache, sexual debility, joint pain, colic, jaundice, and kidney and spleen disorder. | [10] |
| In different assay the crude extracts and different fractions of rhizomes and leaves showed varied degree of antimicrobial activities and enzyme inhibitions | [11] |
| Root is used for astringent, ear & eye disorder and toothache. | [13] |
| In medicine its root and fruit is used. It may be Yellow, red, and brown in colour. It shows astringent property and used in toothache and eye infection. | [15] |
| Root is tonic and is used against jaundice and also effective to reduce blood pressure. | [16] |
| Pods of <i>Pistacia chinensis</i> with root decoction to treat cough and fever and urinary complaints. It also used for Fever, headache, analgesic and Respiratory disorder, Genital and sexual diseases. | [18] |
| For vision problem and blood purification its floral extract is used. <i>Daucuscarrota</i> with its root powder is used for jaundice, spleen problems and kidney. | [19] |
| The root stock is used in eye troubles and also in the cure of toothache. | [20] |
| The roots of the plant are used in mouth ulceration, dysentery, diarrhea, passive hemorrhage, and leucorrhoea. | [21] |
| <i>Geranium wallichianum</i> D. Don ex Sweet is usually used as tonic by women especially for physical fitness and other internal body complaints. | [23] |
| Root is used as astringent and clotting agent. | [26] |
| Whole plant is used for curing stomach acidity, gastric problems stomachache, arthritis, back pain and rheumatism. | [27] |
| The decoctions of the plant with hydrastine are used in disorders like gonorrhoea, leucorrhoea and diabetes. | [31] |
| Aqueous ethanolic extract obtaining from <i>G. wallichianum</i> showed antibacterial activity against <i>Staphylococcus aureus</i> . | [32] |
| The rhizomes of the plant are used to treat ulceration, dysentery, diarrhea, hemorrhage and leucorrhoea. | [33] |
| Crushed mixture of dried root is mixed with milk and sugar and is used in back pain, gout and also used in strengthening of the body muscles and bones. | [34] |
| Isolated for the first time from <i>Geranium wallichianum</i> compounds are identified as ursolic acid, β -sitosterol, stigma sterol, β -sitosterolgalactoside, herniarin, and 2, 4, 6-trihydroxyethylbenzoate which is highly used. | [35] |
| The roots are used in mouth ulceration. An efficient astringent which is given for chronic dysentery, diarrhea and leucorrhoea. | [36] |
| Leaves are effective for liver problem. | [37] |

Table 1: Medicinal uses of Ethanomedicinal plants.

Several conservation studies and efforts are made to conserve it, but a more comprehensive and multiple-approach conservation policies are required to ensure its conservation. Indirect methods like callogenesis and somatic embryogenesis can be applied for production of plantlets helping in establishment of large scale plant nurseries [45-47]. Ali et al. established a protocol for synthetic seed production by using artificial coating material (sodium alginate) and complexing agent (calcium chloride) [48]. This synthetic seed technology can also be very helpful for medicinal plants such as *G. wallichianum* species. These seeds can be stored and viable for comparatively longer period if provided suitable conditions. Germination of seeds can be enhanced by treating seeds with exogenous hormone like chemicals dissolved in water [49].

Long term monitoring programs and propagation studies may prove fruitful in conserving such critically endemic species. There recommendations are suggested for further research in future are biodiversity conservation awareness and information must be provided by people, anthropogenic activities should be avoided, for plant conservation protected area should be formed and afforestation plan should be introduced. Efforts must be made to ensure public participation in conservation programs and awareness through training or utilization of mass media coupled with permanent monitoring programs. Permanent monitoring programs should be developed and conservation strategies should be planned to maintain threatened species [50-53].

Conclusion

G. wallichianum is an important plant with respect to its ethno botanical importance. It is reduced more than 75% population it is listed as endangered plant. Number of factors is present for declining of their population. The plant is used to cure a wide range of disorders from simple toothache to complex illnesses of blood pressure and diabetes. Although the plant is recorded as endemic, due to insufficient information, there is no organization strategy for conservation of this plant. So, this plant need to conserve by long term monitoring, reducing man made pressure on plant resources, proper documentation is best method for its conservation. Proper conservation also demands of extinction actions and education about the significance of plants as well as planned cultivation initiatives.

References

1. Morgan WT (1981) Ethnobotany of the Turkana: Use of Plants by a Pastoral People and their Livestock in Kenya. *Journal of Economic Botany* 35: 96-130.
2. Cunningham AB (1996) Professional Ethics and Ethnobotanical Research. In: Alexiades MN, Sheldon JW (eds.) *Selected Guidelines for Ethnobotanical Research: A Field Manual* the New York. Botanical Garden Bronx, New York US, pp: 19-51.
3. Shinwari ZK, Gilani SS, Shoukat M (2002) Ethnobotanical resources and implications for curriculum. In: Shinwari ZK, Hamilton A, Khan AA (eds.) *Proceedings of Workshop on Curriculum Development in Applied Ethnobotany Nathiagali Abbottabad WWF and Pakistan*, pp: 34.
4. Chaudhri M, Qureshi R (1991) *Pakistan Endangered Flora II: A Checklist of rare and seriously threatened taxa of Pakistan* Pakistan System 5: 1-84.
5. Nasir YJ (1991) *Threatened Plants of Pakistan*. In: Ali SI, A Ghaffa (eds.) *Plant Life of South Asia: Proceedings of the International Symposium, Karachi*, pp: 229-234.
6. Ali H, Qaiser M (2010) Contribution to the Red List of Pakistan: A case study of *Astragalus gahiratensis* Ali (Fabaceae-Papilionoideae) Pakistan. *Journal of Botany* 42: 1523-1528.
7. Sher HZD, Khan A, Khan U, Hussain F (2005) In-situ conservation of some selected medicinal plants of Upper Swat. *Pakistan Acta Botanica Yunnanica* 27: 27-36.
8. Ahmad I, Hussain M, Ahmad MSA, Hameed M (2008) Spatio-temporal effects on association of plant species in soone valley of Pakistan Pakistan. *Journal of Botany* 40: 1865-1876.
9. Ahmad I, Ahmad MSA, Hussain M, Hameed M, Ashraf MY, et al. (2009) Spatio-temporal effects on species classification of medicinal plants in Soone valley of Pakistan International. *Journal of Agriculture Biology* 11: 64-68.
10. Ahmad M, Khan MA, Zafar M, Arshad M (2010) Use of chemotaxonomic markers for misidentified medicinal plants used in traditional medicines. *Journal of Medicinal Plants Research* 4: 1244-1252.
11. Ismail M, Hussain J, Khan A, Khan AL, Ali L, et al. (2012) Antibacterial Antifungal Cytotoxic Phytotoxic Insecticidal and Enzyme Inhibitory Activities of *Geranium wallichianum*. *Journal List Evidence Based Complement Alternative Medicine* 1: 113-118.
12. Khan MAM, Khan A, Hussain M, Mujtaba G (2014) Plant diversity and conservation status of Himalayan Region Poonch Valley Azad Kashmir (Pakistan) Pakistan. *Journal of Pharmaceutical Science* 127: 1215-1239.
13. Vikram SR (2014) Indigenous uses of medicinal and edible plants of Nanda Devi biosphere reserve-a review based on previous studies. *Global Journal of Research on medicinal Plants and indigenous medicine* 3: 57-66
14. Nadkarni KM (1976) *Indian Materia Medica* 3rd edn. Popular Book Prakashan; Bombay India: Depootapapeshwar Prakashan Panvel, pp: 1050.
15. Siva R (2007) Status of natural dyes and dye yielding plants in India *Current Science* 92: 10.
16. Razzaq A, Hadi F, Rashid A, Ibrar M, Ali U (2015) Exploration of Medicinal Plants and Their Conservation Status at Higher Altitude of District Shangla Khyber Pakhtunkhwa Pakistan American-Eurasian. *Journal of Agriculture and Environmental Science* 15: 328-331.
17. Shah GM (2007) *Plant and plant resources of siran valley*. Mansehra NWFP Pakistan PhD thesis, Quaid-i-Azam University Islamabad Pakistan, pp: 68.
18. Akhtar N, Rashid A, Murad W, Bergmeier E (2013) Diversity and use of ethno-medicinal plants in the region of Swat North Pakistan. *Journal of Ethnobiology and Ethnomedicine* 9: 25-27.
19. Chaudhary MI, Ahmed F, Maqbool M, Hussain T (2013) Ethnomedicinal Inventory of Flora of Maradori Valley District Forward Khahuta Azad Kashmir Pakistan American. *Journal of Research Communication* 1: 239-261.
20. Watt G (1972) In: *The Dictionary of Economic Products of India*. Vol 3. Cosmo Publications, New Delhi India, pp: 448-490.
21. Shinwari ZK, Gilani SS (2003) Swat profile. In: Medicinal and other useful plants of District Swat Pakistan ZK Shinwari, AA Khan, Nakaike T, Al-Aziz (eds.) *Communication Peshawar Pakistan*, pp: 9-17.
22. Council of Scientific and Industrial Research (1968) *The Wealth of India: A Dictionary of Indian Raw Materials and Industrial Products* New Delhi India: National Institute of Science Communication.
23. Qureshi RA, Ghufuran MA, Gilani SA, Yousaf Z, Abbas G, et al. (2009) Indigenous Medicinal Plants Used By Local Women in Southern Himalayan Regions of Pakistan Pakistan. *Journal of Botany* 41: 19-25.
24. Ullah A, Rashid A (2014) Conservation status of threatened medicinal plants of Mankial Valley Hindukush Range Pakistan International. *Journal of Biodiversity and Conservation* 6: 59-70.
25. Ali H, Ahmad H, Marwat KB, Yousaf M, Gul B, et al. (2012) Trade Potential and Conservation Issues of Medicinal Plants in District Swat Pakistan Pakistan. *Journal of Botany* 44: 1905-1912.
26. Ahmad SK, Qureshi AR, Hameed M, Ahmad F, Nawaz T (2012) Conservation Assessment and Medicinal Importance of some Plants Resources from Sharda Neelum Valley Azad Jammu and Kashmir Pakistan International. *Journal of Agriculture and Biology* 2: 12-389.
27. Hamyun MS, Khan A, Kim HY, Leechae IJ (2006) Traditional knowledge and ex-situ conservation of some threatened medicinal plants of swat kohistan Pakistan International. *Journal of botany* 38: 205-209.
28. Jan GE, Jan G, Hamayun M, Khan K, Khan K (2014) Diversity and conservation status of vascular plants of DirKohistan valley Khyber Pakhtunkhwa Province. *Journal of Biodiversity and Environmental Sciences* 5: 164-172.
29. Saqib ZR, Malik N, Shinwari MI, Shinwari ZK (2011) Species Richness Ethnobotanical Species Richness and Human Settlements along a Himalayan Altitudinal Gradient: Prioritizing Plant Conservation in Palas Valley Pakistan Pakistan. *Journal of Botany* 43: 129-133.
30. Sher H, Yousaf S (2014) Collection and marketing of high value pharmaceutically and therapeutically important plants from the Swat District Pakistan African. *Journal of Pharmacy and Pharmacology* 8: 507-513.
31. Nadkarni KM (1954) *Indian Materia Medica* 3rd Ed Popular Book Prakashan Bombay India Dhootapapeshwar Prakashan Panvel, pp: 1050.
32. Ahmad B, Ismail M, Iqbal Z, Chaudhry MI (2003) Biological Activities of *Geranium wallichianum* Asian. *Journal of Plant Sciences* 2: 971-973.
33. Zabta S, Ashiq AK, Toshiyuki N (2003) Medicinal and other useful plants of District Swat Pakistan WWF-Pakistan, pp: 68.
34. Gilani SAR, Qureshi A, Gilani SJ (2006) Indigenous Uses of Some Important Ethnomedicinal Herbs of Ayubia National Park Abbottabad Pakistan Ethnobotanical Leaflets 10: 285-293.
35. Ismail M, Ibrar M, Iqbal Z, Hussain J, Hussain H, et al. (2009) Chemical Constituents and Antioxidant Activity of *Geranium wallichianum* Records of Natural Products 3: 193-197.
36. Hazrat A, Nisar M, Shah J, Ahmad S (2011) Ethnobotanical Study of Some Elite Plants Belonging To Dir Kohistan Valley Khyber Pakhtunkhwa Pakistan Pakistan. *Journal of Botany* 43: 787-795.

37. Rana PK, Kumar P, Singhal VK, Rana JC (2014) Uses of Local Plant Biodiversity among the Tribal Communities of Pangri Valley of District Chambain Cold Desert Himalaya India. *The Scientific World Journal*, pp: 15.
38. Hickling RD, Roy B, Hill KJ, Fox R, Thomas CD (2006) The distributions of a wide range of taxonomic groups are expanding pole wards *Global Change Biology* 12: 450-455.
39. Tryjanowski P, Sparks HT, Profus P (2005) Uphill shift in the distribution of the white stork *Ciconia* Diversity and Distribution 11: 219-223.
40. Alam J, Ali SI (2009) Conservation Status of *Astragalusgilgitensis* Ali (Fabaceae): A Critically Endangered Species in the Gilgit District Pakistan *Phyton(Horn Austria)* 48: 211-225.
41. Chauhan RS (2004) Ecophysiology Agro-technology and Trade of an Endangered Medicinal herb. *Nardostachys jatamansi* DC .Ph D Thesis HNB Garhwal University Srinagar Garhwal.
42. Kala CP (2005) Indigenous use population density and conservation of threatened medicinal plants in protected areas of the Indian Himalaya *Conservation Biology* 19: 368-378.
43. Sher H, Ali H, Rehman S (2012) Identification And Conservation Of Important Plant Areas (Ipas) For The Distribution of Medicinal Aromatic And Economic Plants In The Hindukush-Himalaya Mountain Range Pakistan. *Journal of Botany* 44: 187-194.
44. Ahmad B, Ismail M, Iqbal Z, Chaudhry MI (2003) Biological Activities of *Geranium wallichianum* Asian. *Journal of Plant Sciences* 2: 971-973.
45. Iqbal M, Aamir A, Naima HN, Umair AK, Muhammad NAF, et al. (2016) Effect of Explants and Growth Regulators on the Expression of Callogenesis Somatic Embryogenesis and Plantlets Formation in Sugarcane (*Saccharum officinarum* L) *International. Journal of Biosciences* 9: 147-156.
46. Iqbal M, Raja NI, Asif S, Ilyas N, Hussain M, et al. (2016) In Vitro Study of Callogenesis and Regeneration Potential of Elite Wheat (*Triticum aestivum* L) Cultivars *American. Journal of Plant Sciences* 7: 2515-2526.
47. Hussain M, Raja NI, Iqbal M, Iftikhar A, Sadaf HM, et al. (2016) Plantlets regeneration via somatic embryogenesis from the nucellus tissues of Kinnow mandarin (*Citrus reticulata* L) *American. Journal of Plant Sciences* 7: 798-805.
48. Ali A, Muhammd I, Abdul M, Naima HN, Abdul R, (2013) In vitro conservation and production of vigorous and desiccate tolerant synthetic seed formation in sugarcane (*Saccharum officinarum* L) Conference paper published in proceedings of 47th annual conference of Pakistan Society of Sugar Technologists Rawalpindi Pakistan, pp: 9-10.
49. Iqbal M, Asif S, Ilyas N, Raja NI, Hussain M, et al. (2016) Effect of Plant Derived Smoke on Germination and Post Germination Expression of Wheat (*Triticum aestivum* L) *American. Journal of Plant Sciences* 7: 806-813.
50. Hussain M, Yamin B, Naveed IR, Muhammad I, Sumaira A, et al. (2016) A review of therapeutic potential of *Ajuga bracteosa*: A critically endangered plant from Himalaya. *Journal of Coastal Life and Medicine* 4: 918-924.
51. Tahir N, Bibi Y, Iqbal M, Hussain M, Laraib S, et al. (2016) Overview of *Dioscorea deltoidea* Wall Ex Griseb: An endangered medicinal plant from Himalaya region. *Journal of Biodiversity Environmental Sciences* 9: 13-24.
52. Iqbal M, Bibi Y, Raja NI, Ejaz M, Hussain M, et al. (2017) Review on Therapeutic and Pharmaceutically Important Medicinal Plant *Asparagus officinalis* L. *J Plant Biochem Physiol* 5: 180.
53. Hussain M, Raja NI, Akram A, Iftikhar A, Ashfaq D, et al. (2017) A status review on the pharmacological implications of *Artemisia absinthium*: A critically endangered Plant Asian Pacific. *Journal of Tropical Disease* 7: 185-192.