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Ethnobotanical inventory and medicinal uses of some important woody plant species of Kotli, Azad Kashmir, Pakistan

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ABSTRACT

Objective: To document ethnobotanical informations of useful woody plant species in the region of Kotli, Azad Kashmir.

Methods: An ethnobotanical survey was conducted in Kotli. Data were collected by interview and semi structured questionnaire from selected local informants and traditional practitioners as well as by field assessment.

Results: The present study documented the ethnobotanical uses of 33 woody plant species. Most of the species have been used for dual purpose. Only 5 species are used for one purpose. Study revealed all species have medicinal value, among which 21 were used as fuel wood species, 16 as fodder species, 4 as timber wood species, 12 as edible fruit species, 6 as fence or hedge plant, 7 as ornamental species and 12 species had other uses.

Conclusions: Medicinal plants are still widely used for health care by locals of Kotli. Some species of woodlands seem to be vulnerable to overcollection and deforestation. As the young generation is diverted toward allopathic medicines, ethnobotanical knowledges of important medicinal plants are restricted to the old people only. It is suggested to close the forest of district Kotli for next two to three decades for the conservation of plant biodiversity.

1. Introduction

Ethnobotany is the study of relationship between plant, people and environment. In broader aspect, ethnobotany is the cultural study of how the people perceive the plants, give names, use and organize the information about the plants around them[1]. Plants are essential for human beings as they provide food, fuel, fodder, timber, fruit and medicines[2–4]. As compared to animals, plants are more important for us due to their diverse collection of biochemicals with a variety of potent biological activities[1–3,5–7]. In traditional healing systems, wild medicinal plants have been used for centuries[8]. Different modes of application has been adopted by local people to exploit the natural flora[9]. In many rural communities, use of wild flora for medicine and food is prevented since times[10]. The drugs which are obtained from plant are effective and have few side effects. This can be best explained by comparison between the synthetic drug aspirin and bark of important medicinal plant *Salix alba* (white willow). It is clear from different studies that aspirin causes many side effects

that can be avoided by using the extract of *Salix alba* bark[11,12]. Thus ethnobotanical knowledge is not only helpful for the conservation of biodiversity and traditional cultures but also useful in drug development and health care. Informations obtained from indigenous people can be used as a guideline for drug development under the assumption that a plant which has been widely used for longer period of time may have an allopathic application[5,13]. In spite of great importance of plants, very little work has been done on ethnobotanical enumeration of plants and only local health practitioner has knowledge about the medicinal plants[2,14,15]. Azad Jammu and Kashmir, Pakistan is one of the biodiversity hotspot because of the diversified habitats, such as lakes, rivers, streams, springs, nullahs, meadows, steep mountain slopes and roads, waste lands, cultivated fields, etc. The current research was conducted to document the ethnobotanical data on 33 useful woody species of Kotli District (Figure 1).

The population of the study area Kotli is 0.558 million according to census 1998. Its area is 1862 sq.km. The climate of area varies from subtropical to humid type with average monthly rainfall of 92.5 mm. The maximum rainfall occurs during July amounting to 277.2 mm, while the least rainfall occurs during November amounting to 15.1 mm. The hottest months of the year are June and July, with mean daily maximum temperature of 37.3 and

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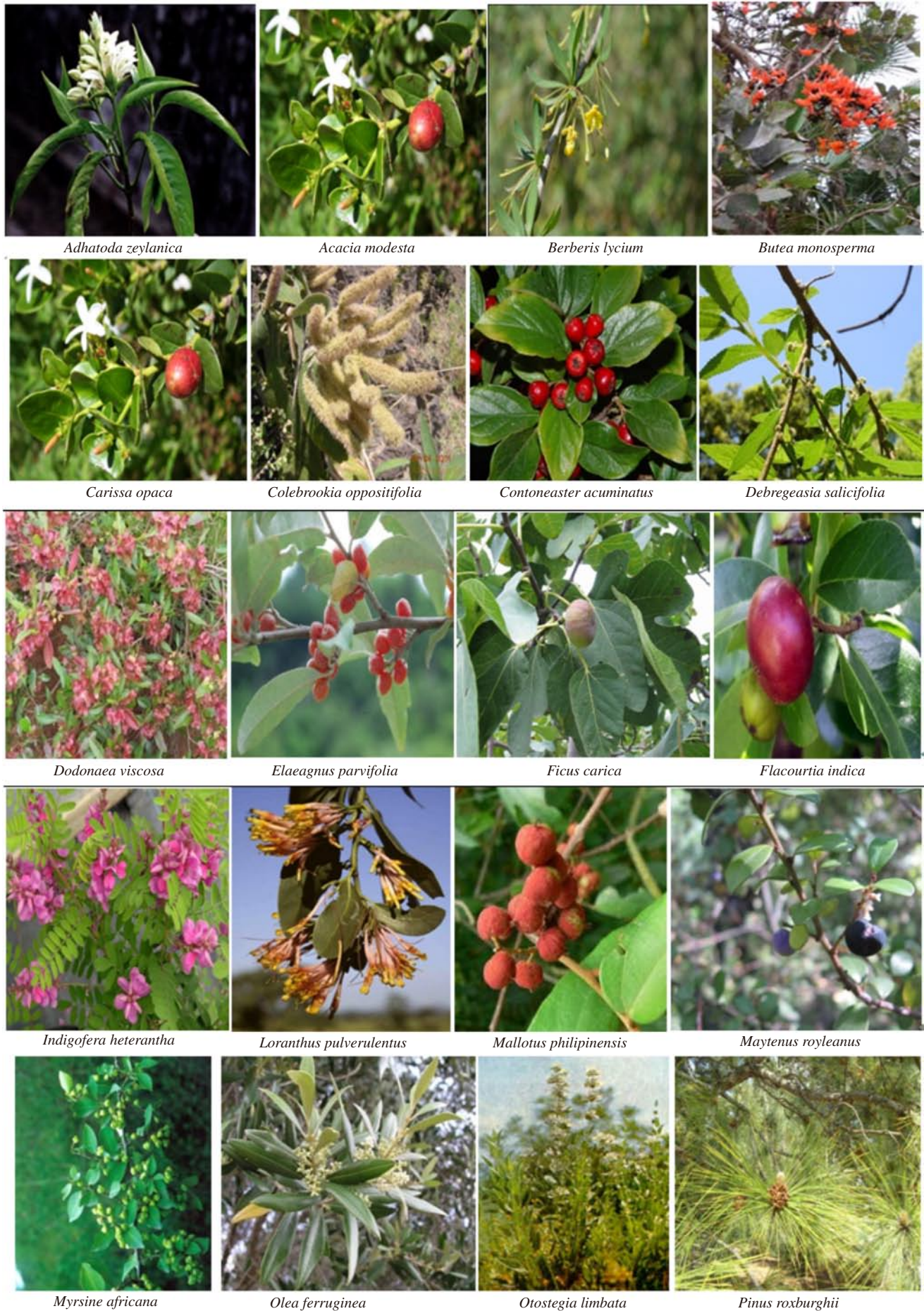


Figure 1. The 33 useful woody species of Kotli District.



Figure 1, continued. The 33 useful woody species of Kotli District.

Adhatoda zeylanica: *A. zeylanica*; *Acacia modesta*: *A. modesta*; *Berberis lycium*: *B. lycium*; *Butea monosperma*: *B. monosperma*; *Carissa opaca*: *C. opaca*; *Colebrookia oppositifolia*: *C. oppositifolia*; *Contoneaster acuminatus*: *C. acuminatus*; *Debregeasia salicifolia*: *D. salicifolia*; *Dodonaea viscosa*: *D. viscosa*; *Elaeagnus parvifolia*: *E. parvifolia*; *Ficus carica*: *F. carica*; *Flacourtia indica*: *F. indica*; *Indigofera heterantha*: *I. heterantha*; *Loranthus pulverulentus*: *L. pulverulentus*; *Mallotus philipinensis*: *M. philipinensis*; *Maytenus royleanus*: *M. royleanus*; *Myrsine africana*: *M. africana*; *Olea ferruginea*: *O. ferruginea*; *Otostegia limbata*: *O. limbata*; *Pinus roxburghii*: *P. roxburghii*; *Plectranthus rugosus*: *P. rugosus*; *Prunus persica*: *P. persica*; *Punica granatum*: *P. granatum*; *Quercus dlatata*: *Q. dlatata*; *Rabdopsia rugosa*: *R. rugosa*; *Rubus fruticosus*: *R. fruticosus*; *Rubus ellipticus*: *R. ellipticus*; *Rhus cotinus*: *R. cotinus*; *Rhynchosia hirta*: *R. hirta*; *Sarcococca saligna*: *S. saligna*; *Viburnum grandiflorum*: *V. grandiflorum*; *Woodfordia fruticosa*: *W. fruticosa*; *Zanthoxylum alatum*: *Z. alatum*; *Ziziphus mauritiana*: *Z. mauritiana*.

34.3 °C respectively, and minimum temperature of 19.7 and 17.9 °C respectively. The average maximum and minimum relative humidity received by the area is 79.8% and 34.3% respectively[16].

The ethnobotany of Hazar Nao forest, Malakand District, was reported by Murad *et al.*[17], and 90 plant species belonging to 56 families were found useful mostly as medicine, fuel, fodder, fruit, timber, agriculture and fencing. Similarly, in the present research it was observed that the local people of Kotli District is largely dependent for food and health on local flora.

2. Materials and methods

The study area lies in between longitude 73°6' to 74°7' E and latitude 33°20' to 33°40' N with altitude ranging from 460-1900 m. It is bounded on the western side by Rawalpindi (Pakistan), eastern side by Occupied Kashmir, northern side by Poonch District and southern side by Mirpur. Kotli District is divided into five tehsils viz. Kotli, Nikyal, Charhoi, Kohirata and Sehnsa.

Regular surveys were undertaken from September 2013 to August 2014 to document the traditional uses of important woody plant species of Kotli District. The plants, collected from different localities round the year were dried, preserved and identified with the help of Flora of Pakistan[18,19]. The ethnobotanical information was collected from knowledgeable local people and health practionaire by semi structured interview and questionnaire. The plants were classified into various ethnobotanical classes.

3. Results

Ethnobotanical information showed that most of the species were locally used for dual purposes (Table 1). All woody plant species have medicinal value, among which 21 were used as fuel wood species, 16 as fodder species, 4 as timber wood species, 12 as edible fruit species, 6 as fence or hedge plant, 7 as ornamental species, and 12 species had other uses. Four plant species were used for six different purposes, 2 plant species for four different purposes, 5 plant species for four different purposes, 4 plant species for three different uses, and 9 plant species for two different purpose. Only four species were used for one purpose. Ethnobotanical uses of plants along with family, common name and habit are given in Table 2 and Figure 2.

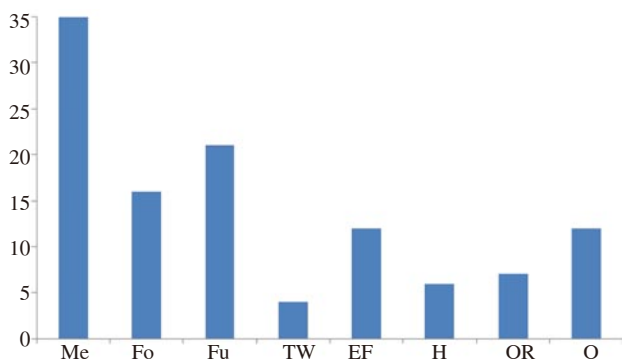


Figure 2. Ethnobotanical uses of different woody species of Kotli District, AJK. ME: Medicinal plants; FO: Fodder species; FU: Fuel wood species; TW: Timber yielding plants; H: Fencing/Hedge plants; OR: Ornamental; O: Other uses.

Table 1

Ethnobotanical classification of woody plant species of Kotli District, AJK.

Species	ME	FO	FU	TW	E	H	OR	O
<i>A. modesta</i> L./Sh-01	+	+	+	+	-	+	-	+
<i>A. zeylanica</i> Nees/Sh-02	+	+	-	-	-	-	-	-
<i>B. lycium</i> Royle/Sh-03	+	+	+	-	-	-	-	-
<i>B. monosperma</i> Lam./Sh-04	+	+	-	-	-	-	+	-
<i>C. opaca</i> Stapf ex Haines/Sh-05	+	-	+	-	+	-	-	-
<i>C. oppositifolia</i> Sm./Sh-06	+	-	+	-	-	-	-	-
<i>C. acuminatus</i> Linley/Sh-07	+	+	-	-	-	-	-	-
<i>D. salicifolia</i> (D.Don) Rendle/Sh-08	+	+	+	-	-	-	-	+
<i>D. viscosa</i> L. Jack/Sh-09	+	-	+	-	-	-	-	-
<i>E. parvifolia</i> Wall. ex Royle/Sh-10	+	-	+	-	-	-	-	-
<i>F. carica</i> Linn./Sh-11	+	+	+	-	+	-	+	+
<i>F. indica</i> (Brum.f) Merriu/Sh-02	+	+	+	-	-	-	-	-
<i>I. heterantha</i> Wall./Sh-13	+	+	+	-	+	-	+	+
<i>L. pulverulentus</i> Wall. in Roxb/Sh-14	+	-	-	-	-	-	-	-
<i>M. philipinensis</i> (Lam.) Muell/Sh-15	+	+	+	-	+	-	+	+
<i>M. royleanus</i> (Wall ex Lawson) cef./Sh-16	+	-	+	-	-	-	-	-
<i>M. africana</i> L./Sh-17	+	+	+	-	+	-	+	+
<i>N. indicum</i> Mill./Sh-18	+	-	-	-	-	-	+	+
<i>O. ferruginea</i> Royle/Sh-19	+	+	+	+	-	-	-	+
<i>O. limbata</i> (Bth) Boiss/Sh-20	+	+	+	-	-	-	-	-
<i>P. roxburghii</i> Sargent/Sh-21	+	-	+	+	-	-	-	+
<i>P. rugosus</i> Wall./Sh-22	+	-	-	-	-	-	-	-
<i>P. persica</i> (L) Bastch/Sh-23	+	-	-	-	+	-	-	-
<i>P. granatum</i> L./Sh-24	+	-	+	-	+	+	-	-
<i>Q. dlatata</i> Lind/Sh-25	+	-	+	+	-	-	-	-
<i>R. rugosa</i> (Wall. ex Benth.) H.Hara/Sh-26	+	-	-	-	-	-	-	+
<i>R. cotinus</i> L./Sh-27	+	-	+	-	-	-	-	-
<i>R. hirta</i> L./Sh-28	+	-	-	-	-	-	-	-
<i>R. ellipticus</i> Smith/Sh-29	+	-	-	-	+	+	-	-
<i>R. fruticosus</i> Wallich./Sh-30	+	+	-	-	+	+	-	-
<i>S. saligna</i> (D.Don) Muel/Sh-31	+	-	-	-	-	-	-	-
<i>V. grandiflorum</i> Wallich ex DC/Sh-32	+	-	-	-	+	-	-	+
<i>W. fruticosa</i> (L.) Kurz/Sh-33	+	+	+	-	-	-	+	-
<i>Z. alatum</i> Roxb./Sh-34	+	+	-	-	+	+	-	+
<i>Z. mauritiana</i> Lam./Sh-35	+	+	-	-	+	+	-	-

ME: Medicinal plants; FO: Fodder species; FU: Fuel wood species; TW: Timber yielding plants; H: Fencing/Hedge plants; OR: Ornamental; O: Other uses.

4. Discussion

Interaction between plant and humans is very strong and can never be separated as the dependence is obligate. The plant resources lead to the economical wealth of an area. The utility and use of plants create the importance of plant in that area[20]. In the same context when the woody plants of Kotli District were analyzed, it was observed that all the woody plant species recorded for their ethnobotanical uses were medicinally important. The promising species include *B. monosperma*, *B. lycium*, *F. indica*, *Nerium oleander*, *I. heterantha*. The the present findings are in accordance with the previous researches on the medicinal plants of Pakistan and Kashmir[5,8,20-22]. The medicinal plants are necessary for drug development and healthcare[5,23]. More than 50 000 registered hakims (herbal healers) are currently working in Pakistan[5]. Exploitation of medicinal plants by local folk, collectors and herbal drug dealers was increasing with increasing demand of pharmaceutical industry and non awareness of local inhabitants. This caused drastic decrease in the occurrences and products of medicinal plants. Grazing, browsing, deforestation and soil erosion were mainly responsible for reduction in the medicinal flora. It is therefore essential to have conservation strategies for these medicinal

Table 2

Ethnobotanical uses of woody plant species of District Kotli, AJK.

Family	Species	Habit	Common name	Ethnobotanical Uses
Acanthaceae	<i>A. zeylanica</i> Nees	Shrub	Bhaikar	Decoction of leaves is used for asthma, cough and fever. The plants are used as ingredient of numerous popular formulation including cough syrup used in combination with ginger and tulsi where its exert its effect as expectorant and antispasmodic. Leaves are used as fodder for horses.
Acanthaceae	<i>R. cotinus</i> L.	Shrub	Tilian	Extract or paste made from flower and leaves is used for anemia, skin diseases and blood purification. Dried plant is used as fuel wood.
Apocynaceae	<i>N. indicum</i> Mill.	Shrub	Kandira	The plant is ornamental due to beautiful flowers. The liquid extract in the branches or leaves are highly poisonous. Branches are used as Miswak (toothbrush).
Apocynaceae	<i>C. opaca</i> Stapf ex Haines	Shrub	Granda	Leaves are used as a fodder for goat and sheep. Stem and root is used as fuel. Fruit is edible and blood purifier.
Berberidaceae	<i>B. lycium</i> Royle	Shrub	Sumblu/komal	Root and stem barks are tonic. Decoction of root and stem barks are used against splenic trouble, as intestinal astringent, good for cough, chest and throat trouble and a good application to boils. The paste of root bark is externally applied on wounds and on bone fracture. Crushed bark is soaked in water and the resultant extract is taken early morning to treat diabetes, scabies, boils and pimples. The extract possesses cooling effect and seldom used in winter season. Fruits are edible. Leaves are used as fodder and dried branches for fuel.
Buxaceae	<i>S. saligna</i> (D.Don) Muel	Shrub	Nathrooni	Local peoples use the dried branches of the plant in the roof as suthra. Aqueous extract of leaf is used as antipyretic and calmativ.
Caprifoliaceae	<i>V. grandiflorum</i> Wallich ex DC	Shrub	Okloon	Leaves and fruits are given to cattle for constipation. Fruits are used to treat stomachache. Fruit is delicious and edible. Bark is used to make ropes.
Celastereae	<i>M. royleanus</i> (Wall ex Lawson) cef.	Shrub	Puthaki	Root extract is abortifacient. Leaves are palatable for goat and sheep. Dried plant is used as fuel.
Elaeagnaceae	<i>E. parvifolia</i> Wall. ex Royle	Shrub	Kankoli	Anti cancer and cardiac stimulant, Fruit is juicy, sweet and pleasant, used as a raw jam and preservative. The flowers are stimulant, cardiac and astringent. The seeds are used in curing cough and pulmonary infections. The wood is used as fuel.
Euphorbiaceae	<i>M. philippinensis</i> (Lam) Muell	Tree	Kamlila	The fruits are crushed and used orally to treat bloody diarrhoea. The leaves are used as "Koochan" to wash utensils. The leaves are used as fodder and branches for fuel.
Fabaceae	<i>B. monosperma</i> Lam.	Tree	Chichra	Root is useful in night blindness, helminthiasis, piles, ulcer and tumours. Flowers are useful in diarrhoea, astringent, diuretic, depurative, tonic, leprosy, skin diseases, gout, thirst, burning sensation. It is used for timber, medicine and dye. Leaves are used as fodder. This plant is important source of charchol. Due to leathery nature of leaves they are not usually taken by the cattles.
Fabaceae	<i>I. heterantha</i> Wall.	Shrub	Kanthi	Powdered leaves and flowers are used as vermifuge, shoot as fodder, branches as a rope, broom and fuel.
Fabaceae	<i>R. hirta</i>	Shrub	Lahr	Leaves are used as tonic and stomach disorder.
Fagaceae	<i>Q. dilatata</i> Lind	Tree	Rein	Galls produced on the tree are strongly astringent and are used in the treatment of chronic diarrhea, joint swelling and dysentery. Wood is very strong and durable. It is the most favorite and preferred fuel wood tree in the area that is used for construction and agricultural instruments.
Flacourtiaceae	<i>F. indica</i> (Brum.f) Merritt	Tree		Fruits are used as appetizing, diuretic, digestive, in jaundice and enlarged spleen. Barks are used for the treatment of intermittent fever. Roots are used in nephritic colic and gum is used in cholera. Branches and leaves are used as fodder and fuel wood.
Lamiaceae	<i>C. oppositifolia</i> Sm.	Shrub	Lansa	Leaves applied on wound and bruises and roots are used in epilepsy. Wood is used for fuel purpose.
Lamiaceae	<i>O. limbata</i> (Bth) Boiss	Shrub	Ghawareja	Leaves are boiled and the extract is taken orally against mouth ulcers and skin diseases.. The leaves are browsed by goats. Dry plant is used as fuel.
Lamiaceae	<i>P. rugosus</i> Wall.	Shrub	Safiad manja	It is used in fever.
Lamiaceae	<i>R. rugosa</i> (Wall. ex Benth.) H.Hara	Shrub		The leaves are grinded and eaten to relieve stomach pain. Extract of leaves is used as vermicide especially in children. Whole plant is used as insecticide.
Loranthaceae	<i>L. pulverulentus</i> Wall. in Roxb.	Shrub	Parwikh	Leaves juice is used for diabetes. Leaves powder is used for wound healing.
Lythraceae	<i>W. fruticoso</i> (L) Kurz	Shrub	Samu	Flowers are dried and powdered. This powder is used locally by females for abortion. These are also used in fewer amounts to ease menstrual flow. Leaves are used as fodder and Branches as fuel.
Mimosaceae	<i>A. modesta</i> L.	Tree	Phulahi	The gum is used as tonic and given in general weakness. Branches are used as tooth stick (Miswak) for teeth cleansing and tooth decay Wood is used for agricultural implements e.g. Hull, fuel, branches used for fencing fields and leaves are browsed by goats.
Moraceae	<i>F. carica</i> Linn.	Tree	Tosi	Fruits are eaten fresh or dried. Being laxative are used in constipation. Leaves are used as fresh fodder. Also used as fuel wood and in making various agricultural tools.
Myrsinaceae	<i>M. Africana</i> L.	Shrub	Gugal	Grinded fruits are anthelmintic and laxative. Leaves are used as blood purifier. Leaves are used as fodder and branches for fuel.
Oleaceae	<i>O. ferruginea</i> Royle	Tree	Kahu	Leaves are used in early days to make tea. It was especially used against cough, cold, flu and skin diseases. Young leaves are chewed to avoid toothache and mouth ulcers. Young branches are used as Miswak. The wood is extremely durable and is extensively used. Its elongated logs are used as guarders in roof thatching. The straight branches are used as handles for labour's tools. The leaves are used as fodder and dry branches are used for fuel. The wood yield more heat without smoke so its wood is especially used during extreme winter. The wood is also insect resistant.
Pinaceae	<i>P. roxburghii</i> Sargent	Tree	Chir	Juvenile apex of the stem is grinded and is used against bloody diarrhoea. Tuberculosis patients are advised to keep sitting under its shade for quick recovery. The wood of the plant is used for timber and fuel purpose. The resin obtained is used in soap industry. The seeds are edible. Dried leaves and logs are used in roof thatching. The heartwood is highly inflammable and its small pieces are used for ignition purpose at homes.
Punicaceae	<i>P. granatum</i> L.	Shrub	Droni	The seeds along with young fruits of <i>Z. alatum</i> , leaves of <i>M. longifolia</i> and green chillies are used to make "Chattni" which is a digestive stimulant. Its seeds are highly carminative. Extract of seeds have cooling effect and is especially used in summer. The rind of fruits is dried, powdered and mixed with sugar is used against diarrhoea for both humans and cattle. Branches are used for fuel and also for fencing the fields. Seeds are edible which are dried for making "Anar-dana" which is used as condiment.
Rhamanaceae	<i>Z. mauritiana</i> Lam.	Tree	Beri	Fruits are edible and used as digestive stimulant. Leaves are browsed by goats. The spiny branches are used as fencing the fields.
Rosaceae	<i>P. persica</i> (L) Bastch	Tree	Dandali	Fruits are used as antipyretic, killings of worms and jermis.
Rosaceae	<i>C. acuminatus</i> ILinley	Shrub		The stolons are used as an astringent. The wood is also used for fuel and construction purpose.
Rosaceae	<i>R. fruticosus</i> Wallich.	Shrub	Akhari	Fruit is edible, carminative and tonic. An infusion of leaves is taken to stay diarrhea and for some bleedings. The decoction of root is also useful against whooping cough in its spasmodic stage. Black berries fames and wine are taken for sore throat. Fruits are edible and have cooling effect. Spiny branches are used in fencing. Leaves are browsed by goats.
Rosaceae	<i>R. ellipticus</i> Smith	Shrub	Peela akra	Fruit is edible, carminative and tonic. It is used as hedge plant for bordering the field.
Rutaceae	<i>Z. alatum</i> Roxb.	Shrub	Timber	Young fruits are grinded with seeds of <i>P. granatum</i> , leaves of <i>M. longifolia</i> and green chillies to make "Chattni". Its fruits are highly carminative and also used against stomachache and dyspepsia. Young branches are used as "Miswak" just like toothbrush. Leaves are browsed by goats. Spiny branches are use as fence around fields. Straight branches are used as walking sticks.
Sapindaceae	<i>D. viscosa</i> L. Jack	Shrub	Sanatha	Leaves are used to heal wounds and cracked skin. The leaves are boiled in water and steam is inhaled to get relief from respiratory problems like cold, cough and asthma. Dried branches are used for fuel for producing heat without smoke.
Urticaceae	<i>D. salicifolia</i> (D.Don) Rendle	Shrub	Sandari	The fruits are grinded and are used against bloody diarrhoea. Leaves and branches are used as fodder. Wood is used for fuel purpose. Fiber obtained from stem bark are used for making ropes.

plants. Therefore, the preferred medicinal plants grow at high elevation where men and grazing animals could not reach easily. The increasing population has pressurized the medicinal plant which has dramatically decreased the species and population[5]. Most species in the present study have also been reported as medicinal by some other workers[5,21–24]. Deforestation, overgrazing and soil erosion were the main factor responsible for the reduction of medicinal plant in this

area. The local livestock grazed or browsed most of the medicinal plant. It is therefore essential to have conservation strategies for these medicinal plants[20,25–27]. It has been found that durgs obtained from plant are more cheaper efficient and safer as compared to synthetic products. With the advancement the peoples are diverted toward the allelopathic medicines so the ethnobotanical knowledge on useful medicinal plants are now restricted to the older people only[5,26].

People living around Kotli hills are poor and lack the basic facilities. They depend upon the forest for fuel wood. More than half of the woody plant species (21 species) are used for fuel wood. These include the *Q. dlatata*, *P. granatum*, *P. roxburghii*, *P. rugosus* and *Z. alatum*. The use of plants as fuel wood from adjoining areas has been reported by other workers[5,20,26,28–31]. Fuel wood is the major energy source for house hold that is used as fodder[32]. They have different palatability value. This indicates that due to poor vegetation and unsuitable agriculture conditions, most of the species reported in the present study have also been reported as fodder species by some other worker[5,20,30,33–35]. Sardar and Khan also conducted a similar work in the Shakargarh Area of Narowal District, Pakistan and the findings are also in accordance with the present results[36]. He reported that most of shrubby species were palatable and were heavily grazed by domestic and wild animals. Forests are badly destroyed by the local people due to overexploitation of important woody plant species for medicinal, fodder, fuel, timber and other uses.

People are not looking carefully to the local flora. The heavy exploitation of natural flora not only destroys the natural beauty but also changes the status of many species from vulnerable to endangered, such as *B. monosperma*, *Rhynchosia*, *Z. mauritiana*, *O. limbata* and *C. opaca*. Many other factors such as population explosion, poverty and insecure land tenure system are also responsible for species extinction. Therefore there is an urgent need to take steps for the conservation of natural flora.

The Kotli hills in Azad Kashmir are very rich in commercial and ethnomedicinal important plant species. The indigenous people have a lot of knowledge on the use of plants and how different plant species are used locally for curing diseases. Many important woody plant species are going to be critically endangered due to extensive deforestation. The local inhabitants depend on plants for the treatment of diseases but they are not familiar well with proper collection. Part to be used is stored and preserved by hakeems who are well aware of medicinal plant and their proper usage, so they must be engaged in the efforts of conservational and sustainable use of ethnomedicinal plant resources[37]. Deforestation is one of the serious threat to the forests of Kotli, so for proper conservation, it is necessary to increase the income of local people and provide them alternate sources of energy and timber. Woodland plants require specific habitat, therefore agro forestry systems should be perfected on *ex-situ* conservation for obtaining better results[38].

Conflict of interest statement

We declare that we have no conflict of interest.

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