

CONSERVATION ISSUES OF *LITSEA MONOPETALA* (ROXB.) PERSOON (LAURACEAE) IN PAKISTAN

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Abstract

Economically important especially medicinal plants are facing threats of habitat alteration, habitat degradation, unplanned urbanization, over exploitation and unsustainable use practices and these threats are mainly responsible for the current species extirpation. *Litsea monopetala* is economically important medicinal plant. In Pakistan it was previously reported from Salt Range only, since, no specific locality was mentioned in the literature, therefore, in the present study *L. monopetala* could not be located in Salt Range in spite of our repeated efforts. However, after four years of continuous field studies during 2015 to 2018, three new localities were discovered i.e. Aba Chena Najigram (district Swat), Shoprang and Char Tambo (district Buner). A total of 218 mature trees were found in 3 localities in 2015, 214 mature trees were found in 3 localities in 2016, 192 mature trees were found in 3 localities in 2017, whereas, 179 mature trees were found in 1 locality i.e. Shoprang in 2018. Whereas, no individuals were found in Aba Chena Najigram and Char Tambo during the year 2018. During the four years study in these 3 localities 1.84%, 10.28% and 6.77% decrease has been observed in its total population size, respectively. The main threats faced by the taxon were its habitat alteration, agricultural land extension, unsustainable logging and bark peeling. The bark of *Litsea monopetala* is sold in the local and national market for its medicinal properties by the local community. Following the IUCN Red List Categories and Criteria 2001, based on its extent of occurrence (EOO) of 293.77km², area of occupancy (AOO) of 20 km² and population size of 179 mature trees, the taxon is categorized as Critically Endangered (CR). Since, the taxon is found in the community owned lands adjacent to their cultivated fields therefore; it is recommended that awareness raising campaigns should be arranged for effective management of the taxon in its natural habitat.

Key words: *Litsea monopetala*, Lauraceae, Conservation status, Population size, Swat, Buner, Pakistan.

Introduction

A total of 308,312 vascular plant species have been described (Christenhusz & Byng, 2016), but this figure is far less than the estimated total of 450,000 (Pimm & Joppa, 2015), and we are still very far away from having any updated list of the world's flowering plants (Callmander *et al.*, 2005). On the other hand around 20,000 new species are published per decade (excluding new combinations) (Lindon *et al.*, 2015), and the exploration of the biodiversity rich unexplored areas are adding a great number of ca. 2,000 new species to the total each year (Christenhusz & Byng, 2016).

It is estimated that the rate of naturally occurring extinction is about one to five species per year, but the current rate of biodiversity loss is 1,000 times faster than the natural rate of extinction with literally dozens of species are going extinct every day (Chivian & Bernstein, 2008). According to Chen *et al.*, (2016) about 50,000 to 80,000 flowering plant taxa are utilized for medicinal purposes, and among these, about 15,000 taxa are threatened, facing extinction due to unsustainable use, over exploitation and habitat destruction. Plants in general and medicinal plants in particular are facing threats of extinction in the near future, mainly because of numerous anthropogenic pressures of various magnitudes (Leaky & Lewin, 1995).

The current land use pattern lead by habitat destruction, habitat alteration, and the rate at which these effects are happening, are alarming throughout the world (Alonso *et al.*, 2001). Among the most significant threats to biodiversity are the direct destruction and degradation of habitats (Newbold *et al.*, 2015). These effects are

further aggravated by population explosion especially in the developing countries. Population explosion is the ultimate cause of habitat loss, deforestation and climate change, all leading to the inevitable outcome of biodiversity loss (Abegao, 2019). These pressures are further exacerbated by unsustainable use and over exploitation by the local population.

Out of the total of 308,312 plant species described, only 33500 have been accessed through IUCN Red List Categories and Criteria (Christenhusz & Byng, 2016), of these, 123 are Extinct, 3027 are categorized as Critically Endangered, 5053 are categorized as Endangered, 6279 are categorized as Vulnerable, and 2420 are categorized as Data Deficient (Anon., 2019). But unfortunately, in this Red List, only 483 taxa are reported from Pakistan. Among which 04 are categorized as Critically Endangered, 03 are categorized as Endangered, 07 are categorized as Vulnerable, 21 are categorized as Data Deficient and the remaining 448 are categorized as Least Concern. Alam (2009) has reported 06 taxa as Critically Endangered and 02 taxa as Vulnerable from Gilgit-Baltistan. Similarly, Ali (2009) reported 12 taxa as Critically Endangered, 5 taxa as Endangered, 10 taxa as Data Deficient from district Chitral. Abbas (2009) reported 01 taxon as Critically Endangered and 03 taxa as Endangered from Sindh province. Majid (2015) reported 6 species as extinct, 3 Critically Endangered, 40 Endangered and 18 as vulnerable from Hazara region. Din (2016) reported 16 flowering plant species as Critically Endangered, 17 Endangered and 04 Vulnerable from district Shangla. These figures are just a tip of iceberg, and do not give a complete picture of the whole country.

The genus *Litsea* Lam. belongs to the family Lauraceae. It consists of about 200 species mainly distributed in tropical and subtropical Asia, few in Australia and South America (Mabberley, 2008). Kostermans (1978) reported two species of *Litsea* including *L. monopetala* from the Salt Range. Kostermans (1978) could not find any specimen of *L. monopetala* from Pakistan in various herbaria including BM, E, K, KUH, RAW. He included this species in Flora of Pakistan on the report of Parker (1918). *L. monopetala* is distributed in western outer Himalayas, India, Malaysia, Thailand and Myanmar (Kostermans, 1978). It is rather a rare species in Pakistan. Buner and Swat in Khyber Pakhtunkhawa seems to be its western most limits. This species is distinguished by broadly ovate or obovate to ovate oblong lamina, obtuse or apiculate apex, rounded base, tomentose beneath, lateral veins 6-13 pairs. *L. monopetala* is an evergreen small to medium size tree, c. 7m tall, with trunk diameter of 30-50 cm.

Litsea monopetala is locally known as “*Khadang*” while there are several vernacular names for its bark, the most common names are “*Maida Chob*” and “*Maida Sak*”. In folk medicine system it is considered as stomachache, stimulant, analgesic, antiseptic and as nerve tonic. It is also used for strengthening of bones. Leaves are used by the indigenous community as fodder for enhancing milk production in cattle.

Keeping in view the above mentioned scenario, the current studies were conducted for finding out conservation status, and conservation issues faced by *L. monopetala* for its effective conservation.

Materials and Methods

Extensive field investigations were conducted for four consecutive years i.e. during 2015 to 2018, from May to September, each year. Previously, *Litsea monopetala* was reported from only Salt Range (Kosterman, 1978). Therefore, random visits were made to Salt Range for finding out population of *L. monopetala*. All our exercise was futile as no population of this species was found in the Salt Range. We turned our attention to search other localities having similar altitudinal range and habitats. Different localities of districts Buner, Shangla and Swat having the same altitudinal range and similar ecological habitats were also searched for occurrence of the taxon. We successfully located 3 populations of *L. monopetala* in districts Buner and Swat. Specimens were collected from mature individual trees, pressed, properly dried, safely poisoned, mounted on herbarium sheets (standard size), and deposited in Swat University Herbarium (SWAT), for future reference. Conservation status was calculated by analyzing population size, Extent of Occurrence (EOO), Area of Occupancy (AOO) and the threats faced by *L. monopetala* as per IUCN Red List Categories and Criteria (Anon., 2001). For finding out the population size, all the mature individual trees were counted and tabulated accordingly. Juveniles and lopped individuals were also counted and tabulated. For calculating EOO and AOO, latitude and longitudes of all the mature individual trees were plotted on a georeferenced images acquired from Google Earth Pro

using the ArcGIS 10.5. Garmin GPS 2.3 was used for noting the altitude, latitude and longitude of the exact location of each individual. Polygon was created by joining all the outlying localities and its area was calculated as EOO. All the threats faced by *L. monopetala* were documented for each locality and habitat, and classified as per IUCN threat classification (Anon., 2001). Similarly, a grid with cell size of 2km x 2km was overlaid on the localities for calculating the AOO. Cuttings of 6 inches length with nodes, were dipped in IBA (indole-3-butyric acid) solution, at the ratio of 3:1, up to 4 inches bases for 10 minutes. The cuttings were then planted in soil. Fertilizer containing equal ratio of nitrogen and phosphorus were dissolved in water and applied to these cuttings once a day (Hartmann *et al.*, 2002).

Results and Discussion

As a result of four years of continuous field studies during 2015 to 2018, three new localities were discovered i.e. Aba Chena Najigram (district Swat), Shoprang and Char Tambo (district Buner). Since, no specific locality was mentioned in the literature, therefore, we could not find the taxon in Salt Range. A total of 218 mature trees were found in 3 localities in 2015, 214 mature trees were found in 3 localities in 2016, 192 mature trees were found in 3 localities in 2017, whereas, 179 mature trees were found in 1 locality i.e. Shoprang in 2018 (Fig. 1). Whereas, no individuals were found in Aba Chena Najigram and Char Tambo during the year 2018. During the four years study in 3 localities i.e. Aba Chena Najigram, Shoprang and Char Tambo, 1.84%, 10.28% and 6.77% decrease has been observed in its total population size, respectively (Table 1).

Threats: The most important threats faced by the taxon are its habitat alteration, habitat destruction and unsustainable use practices.

Habitat alteration: Local population residing in the known localities of *L. monopetala* are very poor and they depend on livestock rearing and agricultural practices for their subsistence. But due to the unprecedented human population growth in the area, their livelihood needs are not fulfilled. In order to fulfill their livelihood needs they have to find out alternate source of income. These people are compelled to clear the wild habitats and convert it to cultivable lands, as a result wild habitats have been altered (Fig. 2). The effects of habitat alteration on the reduction of population size of the taxon are irreversible.

Habitat destruction: Habitat destruction is considered as the basic cause of species extinction worldwide (Pimm & Raven, 2000). Forest cover has been removed by the local inhabitants for using the land for different purposes, this practice has accelerated soil erosion, which ultimately decreased water carrying and absorbing capacity and retarded growth of the juveniles. Some of the lopped individuals and juveniles of *L. monopetala* in wheat fields are evident in Fig. 3. As per information from the local population the plant was infrequently found in the vicinities some 20 years back.

Table 1. Population size, threats and number of individuals with their altitude, latitude and longitude during the years 2015-18.

S. No.	Locality	Altitude (m)	Latitude	Longitude	2015				2016				2017				2018			
					Mature trees	Bark peeled	Looped	Juveniles	Mature trees	Bark peeled	Looped	Juveniles	Mature trees	Bark peeled	Looped	Juveniles	Mature trees	Bark peeled	Looped	Juveniles
I.																				
Aba Chena Najigram (ACN)																				
1)	ACN 1	1113	34° 36.838'	72° 14.839'	1	1	1	--	1	1	1	--	1	1	1	--	1	1	--	
2)	ACN 2	1122	34° 36.816'	72° 14.828'	2	1	2	--	1	1	1	--	--	--	--	--	--	--	--	
3)	ACN 3	1150	34° 36.810'	72° 14.800'	1	--	--	--	1	--	--	--	--	--	--	--	--	--	--	
4)	ACN 4	1074	34° 36.777'	72° 14.870'	1	--	--	1	--	--	--	1	1	1	--	--	--	--	--	
5)	ACN 5	1119	34° 36.768'	72° 14.831'	1	--	--	--	1	--	--	--	--	--	--	--	--	--	--	
6)	ACN 6	1135	34° 36.882'	72° 14.801'	1	--	--	1	--	--	--	1	--	--	--	--	--	--	--	
7)	ACN 7	1100	34° 36.934'	72° 14.825'	1	--	--	1	--	--	--	1	1	1	--	--	--	--	--	
8)	ACN 8	1197	34° 36.760'	72° 14.745'	2	--	--	1	--	--	--	1	--	--	--	--	--	--	--	
9)	ACN 9	1075	34° 37.011'	72° 14.827'	1	1	1	--	1	1	--	--	--	1	--	--	--	--	--	
10)	ACN 10	1059	34° 37.014'	72° 14.839'	1	--	--	1	--	--	--	1	--	--	--	--	--	--	--	
11)	ACN 11	1075	34° 36.947'	72° 14.856'	1	--	--	--	1	--	--	--	--	--	--	--	--	--	--	
12)	ACN 12	1067	34° 36.896'	72° 14.882'	1	1	1	--	1	1	--	1	1	1	--	--	--	--	--	
13)	ACN 13	1131	34° 36.979'	72° 14.774'	1	--	--	--	1	--	--	--	--	--	--	--	--	--	--	
Total					15	4	5	5	11	4	5	6	4	4	4	4	4	4	00	
II.																				
Shoprang (Sh)																				
1)	Sh 1	955	34° 34.714'	72° 20.904'	13	2	11	4	12	4	9	5	12	4	12	5	12	3	10	
2)	Sh 2	931	34° 34.672'	72° 20.913'	13	3	10	3	11	2	9	4	10	10	10	4	10	4	9	
3)	Sh 3	932	34° 34.675'	72° 20.969'	11	4	11	4	12	4	10	3	9	4	9	4	9	3	9	
4)	Sh 4	917	34° 34.617'	72° 20.903'	11	2	9	5	13	3	10	4	12	3	10	4	11	3	10	
5)	Sh 5	909	34° 34.611'	72° 21.005'	7	2	7	2	7	2	6	3	8	2	7	3	8	2	7	
6)	Sh 6	908	34° 34.618'	72° 21.024'	10	3	8	4	12	4	11	4	12	4	10	5	9	3	9	
7)	Sh 7	914	34° 34.609'	72° 20.957'	9	1	7	3	8	2	8	3	8	3	7	4	9	3	8	
8)	Sh 8	909	34° 34.579'	72° 20.885'	14	4	12	5	12	4	11	5	12	3	11	4	11	4	11	
9)	Sh 9	906	34° 34.574'	72° 20.943'	8	2	7	--	8	2	7	1	7	3	7	2	7	3	6	
10)	Sh 10	903	34° 34.563'	72° 20.934'	8	--	8	3	8	2	8	1	7	2	7	2	7	3	7	
11)	Sh 11	931	34° 34.675'	72° 21.141'	16	5	13	7	18	6	14	5	15	4	14	5	15	4	14	
12)	Sh 12	924	34° 34.663'	72° 21.625'	13	3	13	3	12	3	12	2	11	3	11	3	11	3	10	
13)	Sh 13	913	34° 34.637'	72° 21.119'	12	3	12	--	12	3	12	1	12	3	12	2	11	2	11	
14)	Sh 14	902	34° 34.577'	72° 21.107'	10	2	7	2	10	2	8	2	11	2	8	--	10	2	8	
15)	Sh 15	891	34° 34.560'	72° 21.021'	7	2	6	1	7	2	4	--	7	2	4	--	6	1	5	
16)	Sh 16	884	34° 34.536'	72° 21.025'	6	1	6	--	6	1	6	1	5	--	5	--	5	1	5	
17)	Sh 17	874	34° 34.502'	72° 21.057'	6	2	6	1	6	2	6	1	6	2	6	--	5	2	5	
18)	Sh 18	868	34° 34.486'	72° 21.072'	8	2	6	2	8	3	6	2	7	2	5	--	7	2	6	
19)	Sh 19	871	34° 34.460'	72° 21.005'	10	--	10	--	10	1	9	1	9	1	9	1	9	1	7	
20)	Sh 20	858	34° 34.429'	72° 21.074'	8	3	7	2	7	2	7	2	7	3	6	2	7	3	6	
Total					200	46	176	51	199	54	173	50	187	53	170	50	179	52	163	
III.																				
Char Tambo (Char)																				
1)	Char 1	1511	34° 35.656'	72° 22.123'	1	1	1	--	--	--	--	--	--	--	--	--	--	--	--	
2)	Char 2	1519	34° 35.755'	72° 22.072'	1	--	1	--	1	1	1	--	1	1	1	--	--	--	--	
3)	Char 3	1521	34° 35.557'	72° 22.071'	1	1	1	--	1	1	1	--	--	--	--	--	--	--	--	
Total					3	2	3	--	2	1	2	--	1	1	1	--	00	00	00	
Grand Total					218	52	184	56	214	59	180	56	192	58	175	54	179	52	163	

ACN = Aba Chena Najigram, Sh = Shoprang, Char = Char Tambo. All these localities are indicated by respective abbreviations on the maps.

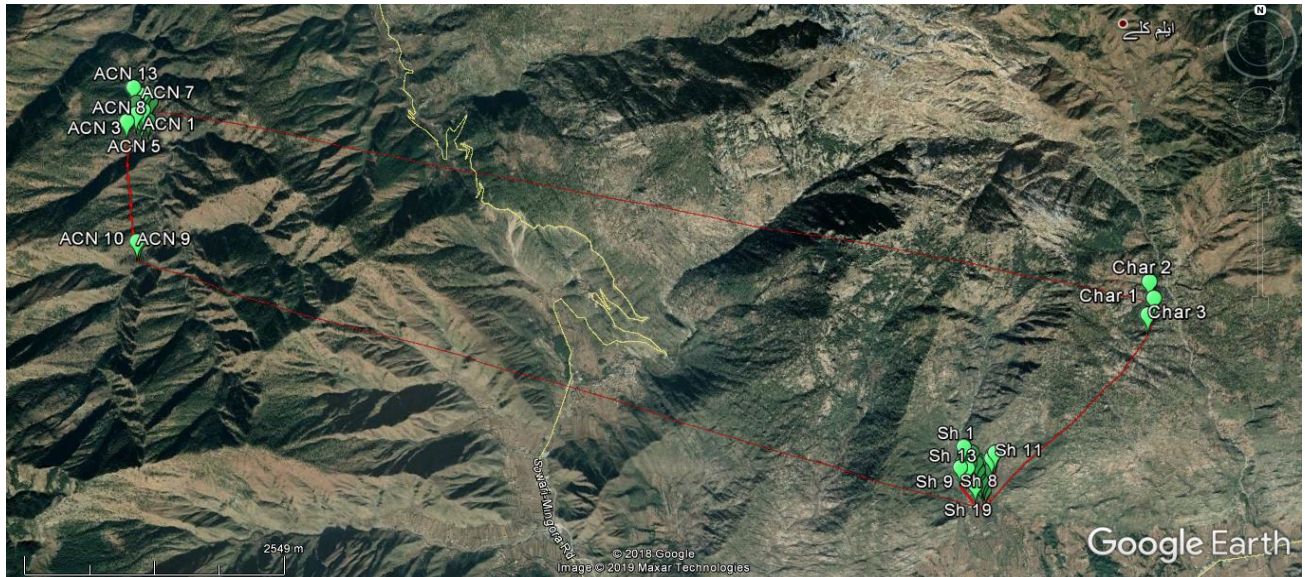


Fig. 1. Location map of *Litsea monopetala* from three habitats viz. Aba Chena Najigram (indicated on the map from ACN 1 to ACN 13), Char Tambo (indicated on the map from Char 1 to Char 3) and Shoprang (indicated on the map from ACN 1 to ACN 20) during the year 2016 to 2017.

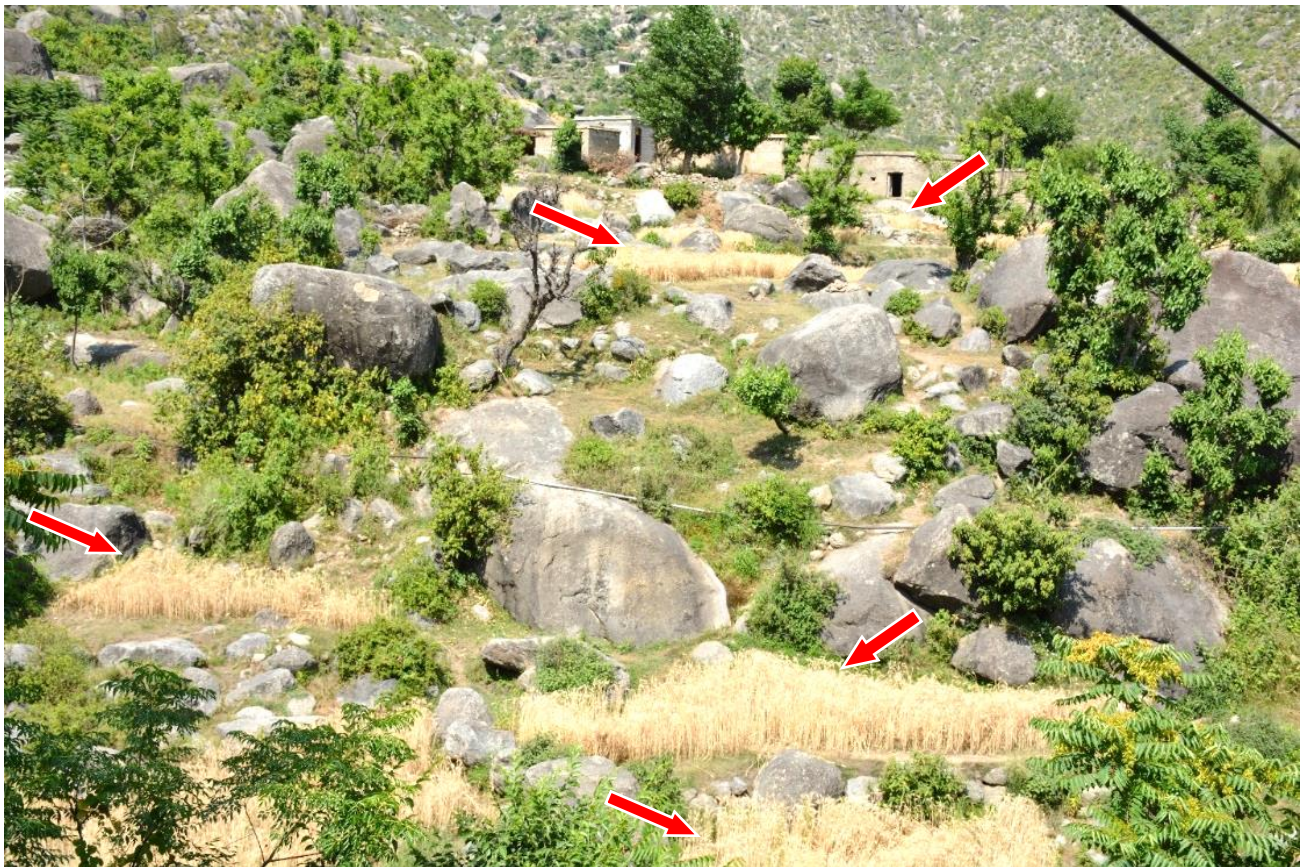


Fig. 2. Habitat has been converted into cultivated fields, where wheat crops are cultivated.

Medicinal uses: As per our field investigations and information obtained from local community the leaves and bark of *L. monopetala* are used for healing of bone cracks, relieving the pain during dislocation of bone joints, arthritis and other related problems. These uses are also reported by Puhua *et al.*, (2008) and Bhuniya *et al.*, (2010). Root is powdered and applied externally for pain,

bruises and swellings. Khare (2007) reported that its bark was analgesic because it contained Beta Sitosterol, Aporphine and Daphenine. The powdered drug is also used in the treatment of diarrhea, stomachache, dyspepsia, gastroenteritis, diabetes and edema (Mukul, 2007). Drug for the same use is also practiced in Chinese medicinal system (Kong *et al.*, 2015).



Fig. 3. Regenerated young tree after last year’s looping. Cultivated field with wheat is visible in the background.



Fig. 4. Peeling off of stem bark from mature individual.

Antioxidant activity has been reported by Arfan *et al.*, (2008) from the phenolic fractions of *L. monopetala*. Essential oils are reported from leaves, fruits, flowers and bark of *L. monopetala* (Wang *et al.*, 1999; Amer *et al.*, 2006; Choudhury *et al.*, 1996; 1997).

Bark is shade dried, powdered and used for the removal of intestinal parasites in cattle by the local community. According to Thompson & Geary (1995), and Watts *et al.*, (2010) saponins, tannins and alkaloids are reported from the bark of *L. monopetala* for removal of helminthic intestinal parasites in cattle. These medicinal uses have raised the demand for its extraction from the wild habitat. Since, its bark is used therefore, the whole tree is cut by the local people, because they are unaware of its sustainable bark collection (Figs. 4 & 5).

Lopping: It is generally believed by the local inhabitants that the leaves increase milk production in cattle therefore; the leaves are extensively lopped as a favorite fodder (Ahmad & Amin, 2005). In Aba China Najigram, during the years 2015, 2016 and 2017 a total of 33.33%, 45.45% and 100% individuals were lopped, respectively. Whereas, no individual was found in 2018 (Table 1). Therefore, the local population faced tremendous problem in providing fodder for cattle (Fig. 6). On other hand they either had to grow fodder species in their cultivated fields instead of cash crops or buy fodder from other areas, which is ultimately very costly.

Similarly, in Shoprang, during the years 2015, 2016, 2017 and 2018, a total of 88%, 86%, 90.9% and

91% individuals were lopped, respectively. Whereas, in Char Tambo, 100% of the individuals were lopped during the years 2015, 2016 and 2017 (Table 1). Since, the left over population of the taxon is now found on the cultivated field margins, whereas, the land is owned by the local community, it is, therefore, recommended that future conservation efforts should be planned by involving the local community by uplifting their understanding.

Past and present distribution: Kosterman (1978) and Ahmad *et al.*, (2002) reported *L. monopetala* from Salt Range. Similarly, Ahmad & Waseem (2004) placed this species under the category of CR (Critically Endangered) from the Salt Range, but did not mention any specific locality, population size, EOO and AOO. However, we could not find the taxon in Salt Range. Hence, very little is known about the historical distribution of the species in Pakistan (Ahmad & Amin, 2005).

The reasons for its depletion is the over extraction of its bark for commercial purposes and over exploitation of photosynthetic part of tree as fodder for cattle (Carter & Gronow, 1992; Pokharel, 1998).

Vegetative propagation: Seeds were collected from the wild population and were sown in soil during March 2018, but none of the seeds germinated. Although propagation through stem cuttings were successful by

using the rooting hormones i.e. indole-3-butyric acid (IBA) and the success propagation rate was 86.67 % (Table 2, Fig. 7).

Table 2. Percentage of successful cuttings.

S. No.	Total number of cuttings	Successful cuttings	Success % age
1.	150	130	86.67 %

Estimated economic potential: It is estimated that one mature tree of three years age has the potential to produce about 7kg of bark worth PKRs.2800 (@ PKRs. 400 kg⁻¹). Foliage of about 30kg worth PKRs. 1500 (@ PKRs. 50 kg⁻¹) may be obtained from a mature tree, to feed cattle as tonic. Wood of the tree is used for making furniture worth PKRs.1600 (@ PKRs.1600 ft⁻³) and as fuel wood worth PKRs. 400 (@ PKRs.15 kg⁻¹). It is estimated that about PKRs. 6300 may be obtained from a single mature tree of three years age. Whereas, the tree can be planted on the cultivated field margins i.e. without disturbing the fields. It can be easily inferred that if the tree is planted at the field margins, it can generate more monetary benefits as compared to other commercially used tree in three years. On the other hand, germplasm of the species should also be conserved (Table 3).



Fig. 5. (A) Bark of *L. monopetala* is sold in the local market; (B) Bark is peeled off and stored in unhygienic manner, directly exposed to various environmental hazards.



Fig. 6. Foliage of *Litsea monopetala* as fodder for livestock.



Fig. 7. Vegetative propagation through stem cuttings.

Table 3. Price and quantity of *L. monopetala* traded during the four years of study.

S. No.	Year	Price per Kg	Quantity (Kg)	Amount (Rs.)
1.	2015	300	500	150,000
2.	2016	320	420	134,400
3.	2017	350	550	192,500
4.	2018	400	480	192,000
Average			487.5	167,225

According to Ahmad & Amin (2005), the national demand of its bark is about 1500 tones, 90% (1350 tones) of which is fulfilled through its import from other neighboring countries, while only 10% (150 tones) is extracted at national level. The estimated import was worth Rs.67.5 million per year. But these figures are about 14 years old, which might be because of the fact that the taxon no longer exist in the Salt Range. And the current national demand is fulfilled by importing the bark. It is, therefore, recommended that genetic diversity of the taxon may be recovered in its whole range of distribution by involving the local community both directly and indirectly. This will ultimately improve livelihood of the marginalized communities.

Conservation status

During the year 2015 a total of three mature individuals were found in Char Tambo, indicated on the map as Char 1, Char 2 and Char 3 (Fig. 8A). Whereas, during the year 2016 this number was decreased and only two individuals were reported from Char Tambo, indicated as Char 2 and Char 3 on the map (Fig. 8B). Similarly, during the year 2017, this number was further decreased and only one mature individual was observed from the locality indicated as Char 2 (Fig. 8C), whereas, no individual was seen from the locality during the year 2018.

During the year 2015 a total of 15 individuals were observed from Aba Chena Najigram, indicated on the map from ACN 1 to ACN 13 (Fig. 9A). Whereas, during the year 2016, this number was decreased and a total of 11 individuals were found in Aba Chena Najigram (Fig. 9B). Similarly, during the year 2017 only 4 individuals were observed from the localities indicated as ACN 1, ACN 4, ACN 7 and ACN 13 (Fig. 9C), whereas, no individual was found in the locality during the year 2018.

Litsea monopetala is reported from 20 locations in Shoprang during the years 2015, 2016, 2017 and 2018 indicated on the map with Sh 1 to Sh 20 (Fig. 10).

EOO of the *L. monopetala* was of 293.77km² in 2015 which was less than 5000km² and according to the IUCN Red List Categories & Criteria (Anon., 2001) it should be categorized as Endangered (E). In 2018 the EOO was less than 100km² therefore, it should be categorized as Critically Endangered (CR). AOO of this species is only 20 km² which was less than 500km², its population size was 179 mature individual trees, which was less than 250 (Table 1). These results with low population size, continuous decline and extreme fluctuation suggests that the taxon be categorized as Critically Endangered as per the IUCN Red List Categories & Criteria (Anon., 2001).



Fig. 8. Population distribution in Char Tambo (Char), A: 2015; B: 2016; C: 2017.

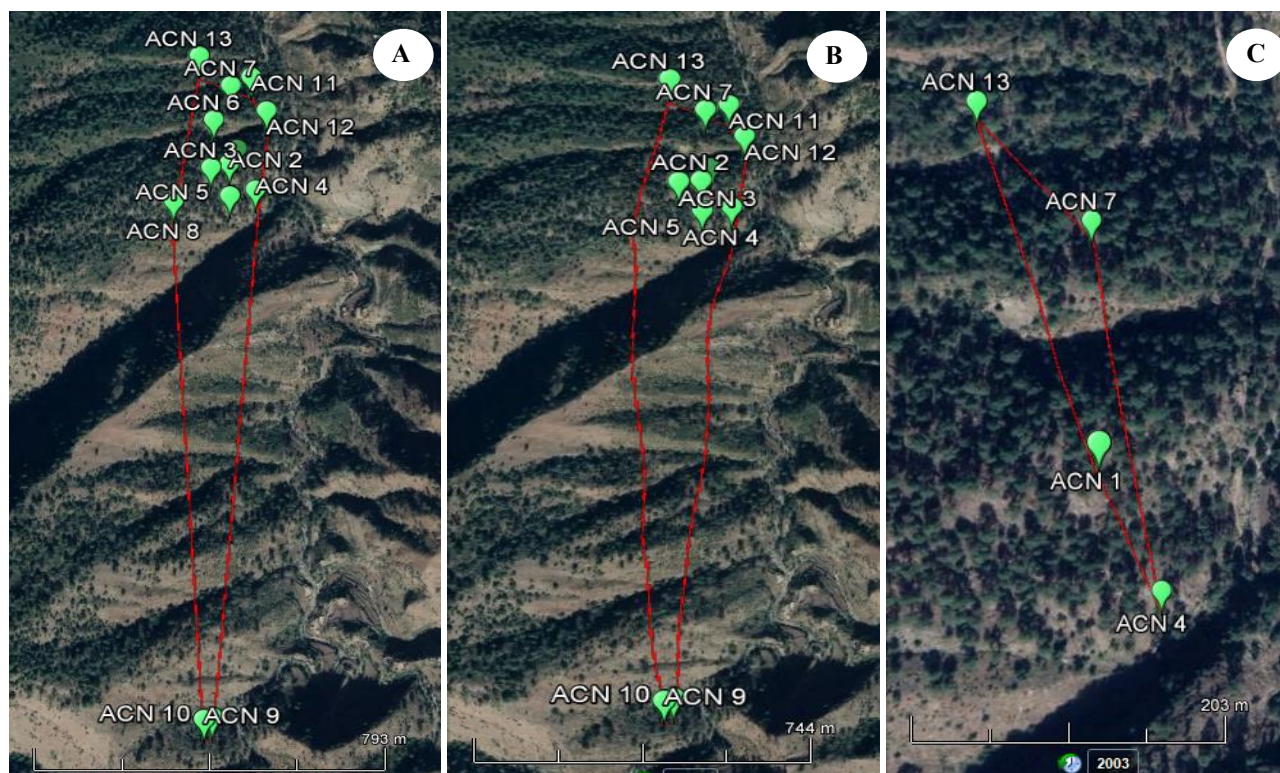


Fig. 9. Population distribution in Aba China Najigram (ACN), A: 2015; B: 2016; C: 2017.

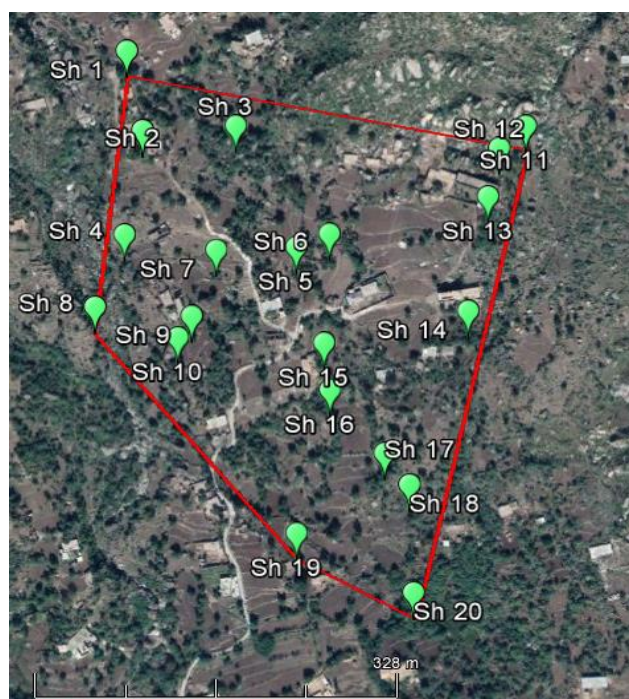


Fig. 10. Population distribution in Shoprang (Sh) from 20 locations during the years 2015 to 2018.

Plant resources found both in forests and other natural areas in and around human settlements serve many of the basic and secondary needs of rural and urban societies. These plant resources supply medicines, fuel, fodder for cattle and timber (Konwer *et al.*, 2001). Depletion of plant resources results in loss of self-sufficiency and economic opportunities for local people, which lead to poverty. Conservation of rare, threatened

and economically important medicinal plants are imperative, for providing subsidy to the poor communities. As a result of cultivation of *L. monopetala* on the cultivated field margins will provide additional income opportunity to the farmers. It will also contribute to country's economy through local production and trade.

Main reason of the genetic erosion of the species is over exploitation for its bark at commercial scale. Market survey shows that 90% of its bark demand is fulfilled through import, mainly from India and Sri Lanka while only 10% are extracted locally. Preliminary field observations show that as a cultivated crop *L. monopetala* has the potential to produce more in terms of economic values as compared to the conventional crops of subsistence agriculture, which may provide alternate livelihood opportunity to the poor community.

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