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## Natural regeneration status of *Terminalia chebula* Retz. in Hamirpur district of Himachal Pradesh

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### Abstract

The present study was confined to five natural populations of Harar (*Terminalia chebula* Retz) distributed in Hamirpur district of Himachal Pradesh. In every natural population 5 quadrats of 20 x 20 m (400 m<sup>2</sup>) size were laid down randomly to study the regeneration status along with percentage size class (girth class) occurrence of Harar trees. Most of the individuals in these populations were found to be almost of the same size producing flowers and fruits but no seedlings had been successfully established showing complete absence of natural regeneration of Harar (recruits, un-established or established) within its natural populations. However recruits of Harar were found in some agricultural fields of Naraina and recruits, un-established and established regeneration was found in grassland in the buffer zone of natural population in Pahlu.

**Keywords:** Populations, regeneration, individuals, recruits, grassland

### Introduction

Natural regeneration refers to the natural process by which plants replace or re-establish themselves. Natural regeneration is a power full tool for anyone wishing to re-establish vegetation on a property at minimum cost. There may be climatic, biological and physical constraints upon natural regeneration. Natural events such as fire, flood, wind, drought, temperature extremities and light conditions can affect the survival of seedlings. Some species require natural events to occur prior to germination. Other factors controlling natural regeneration are lack of light or water can prevent germination. Germination may fail to occur in a plant community during drought. The first heavy rains may initiate germination on a massive scale. This is true in the case of *Terminalia chebula*, a commercially important medicinal species. *Terminalia chebula* Retz commonly known as Harar belongs to family Combretaceae and is indigenous to India and Southeast Asia (Dymock *et al* 1976) [3]. It occurs in Indian forests and Agroforestry systems extending from sub-temperate to tropical region (Singh, 1982) [11]. In the Himalayas the tree is found in the outer Himalayas ascending up to 1500 m. In Himachal Pradesh it is distributed between an attitude of 800-1100 m in the districts of Sirmour, Hamirpur, Mandi, Kangra, Bilaspur and Una. *T chebula* occurs scattered in teak forest, deciduous forest and extends into forests of comparatively dry types. Harar has been traditionally used in Indian system of medicine Ayurveda. It is routinely used as household remedy throughout subcontinent for treating stomach colic of sucking infants and as a laxative for the old. Fruit pulp of *T chebula* is used in many of the standard preparations such as Triphala and Chayvanprash which are used as food supplement.

Natural regeneration of Harar is a problem as the nuts that contain seeds are enclosed in horny endocarp and germinate poorly. As the fruit of *T chebula* is a drupe with a hard endocarp it requires a long period of time for the seeds to germinate which is only possible with adequate soil moisture and humus. As the *Pinus gerardiana* is facing higher risk of extinction in Kinnaur region and therefore, categorized as Endangered in the Himalayan region (Sehgal and Sharma, 1989) [8] and also listed in Red Data Book (Dogra, 1964) [2]. A detailed perusal of literature indicated that the information on propagation, storage condition, biochemical attributes of seeds and nursery development of the species is available (Malik, 2007 [4]; Singh *et al.* 1992 [12]; Sharma, 2005 [10]; Malik *et al.* 2008 [5]; Malik and Shamet, 2008 [6]; Malik *et al.* 2009 [7]). Studying natural regeneration status within natural populations is an important aspect for commercialization of a species. Keeping in view the socio-economic importance of the species the present investigation was carried out in five natural populations distributed in district of Hamirpur, Himachal Pradesh.

## Materials and Methods

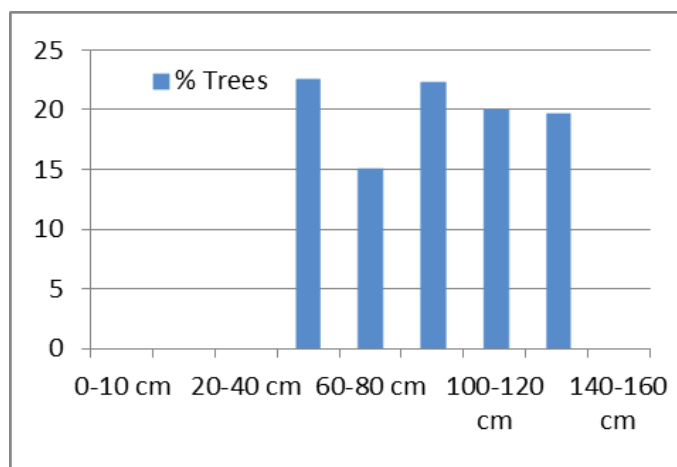
The present investigation was carried out at five sites namely Naraina, Kothi, Pahlu, Makar and Uled in Hamirpur district of Himachal Pradesh having natural populations of *T. chebula*. The physical description of natural populations is given in Table 1. To study the regeneration status along with percentage size class (girth class), occurrence of Harar trees in their natural populations was studied in five quadrats of 20 x 20 m (400 m<sup>2</sup>) size in each natural population covering approximately one to two per cent area in each population. In addition to these areas having natural populations, regeneration study was also carried out in the surrounding agricultural fields and grasslands due to poor regeneration of Harar in its natural population. The natural regeneration was measured on the basis of presence and absence of seedlings and saplings of Harar inside and buffer zone of natural population.

## Results and Discussions

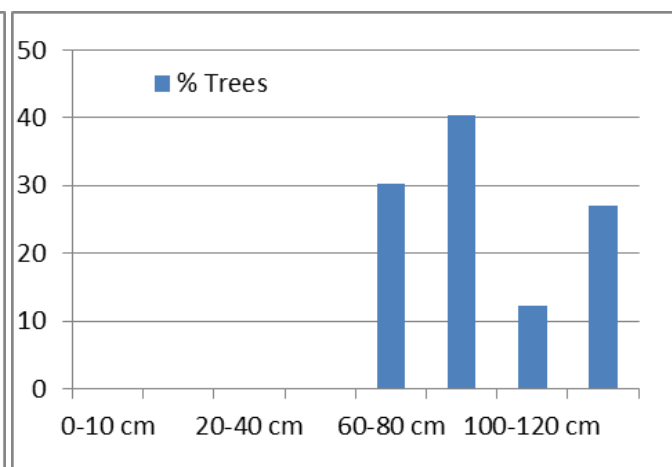
The life criteria of a species must be measured by its effectiveness in recruiting new individuals into the population of concerned species. The more effective this strategy the longer the population will be able to maintain itself in natural population. One method of measuring this success is to monitor the frequency and abundance of seedling establishment over a period of decades and to record the resultant increase or decrease in population size over time.

The perusal of data related to percentage girth class distribution of *T. chebula* trees in all of the five natural populations reflects final size class distribution reflecting a species whose regeneration is severely limited for some reason. The girth classes were >40 cm in Naraina, >60 cm in

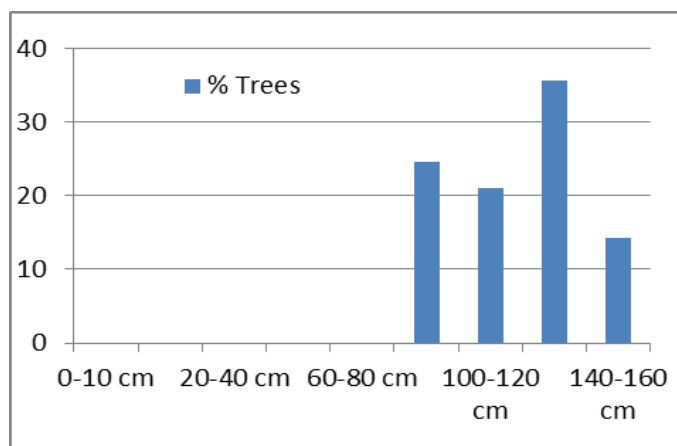
Kothi, >80 cm in Pahlu, >40 cm in Makar and >20 cm in Uled (Fig 1). Perusal of data (Fig 1) indicates that most of the individuals in these populations were of almost the same size producing flowers and fruits but no seedlings had been successfully established showing complete absence of natural regeneration of Harar (recruits, un-established or established) within its natural populations. However recruits of Harar were found in some agricultural fields of Naraina and recruits, un-established and established regeneration was found in grassland of natural population in Pahlu (Plates 1 & 2). The reasons for poor regeneration of Harar in natural regeneration were found to be having hard seed coat, the species being a strong light demander, complete burning of seedlings due to forest fires during summer and intensive removal of fruits for sale in the local markets. These results are supported by the findings of Talwar and Bhatnagar (2014) [14], Singh *et al* (2003) [13] and Chauhan *et al.* (2010) [1] who also reported absence of natural regeneration of Harar in its natural populations. The scanty/failure of natural regeneration of *Terminalia chebula* in Himachal Pradesh has also been reported by Sharma *et al.* (2016) [9]. The presence of seedlings of Harar in agriculture field at Naraina was due to cow dung applied in the field as manure because domestic animals also act as agents of digestion and dispersion of the seeds while grassland of natural population at Pahlu was found to be frequently used as resting place by shepherds for their livestock which lead to dispersion of seed in the grassland. In addition to this grassland was having southern aspect and not having any tree cover which helped seedlings of Harar to establish easily as it is a strong light demander.



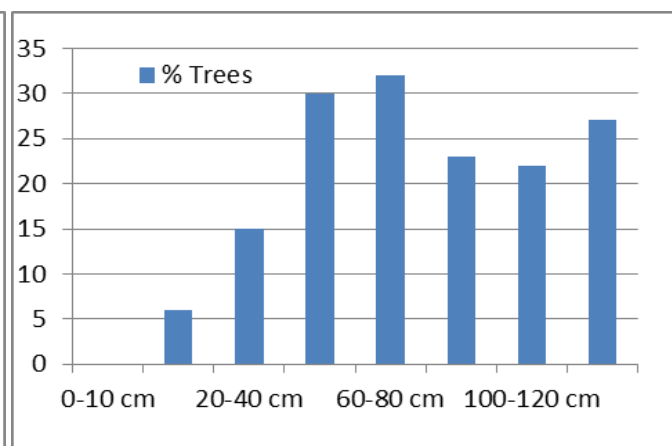
(a)



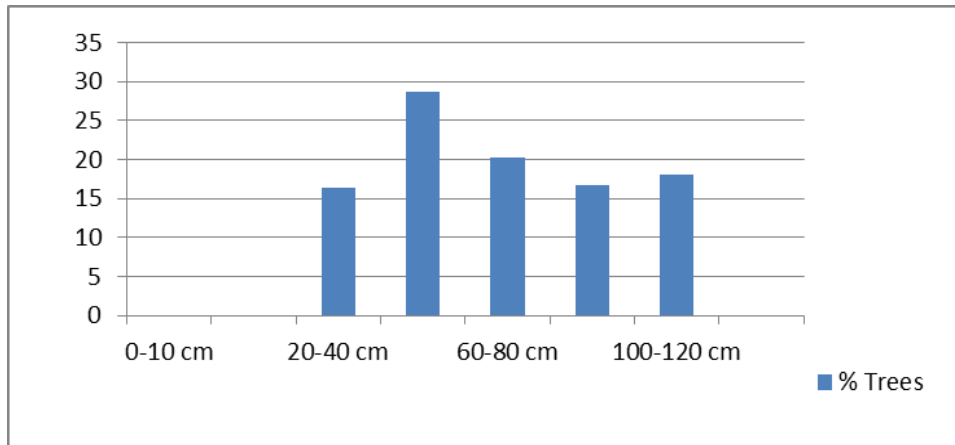
(b)



(c)



(d)



(e)

**Fig 1:** Girth class distribution of Harar trees at a) Naraina, b) Kothi, c) Pahlu, d) Makar, e) Uled**Table 1:** Physical description of sites/populations

Population	Population code	Altitude (m)	Latitude (N)	Longitude (E)
Naraina	NRN	478	31°36.396'	076°28.038'
Kothi	KTH	1189	31°33.700'	076°30.786'
Pahlu	PLU	375	31°36.231'	076°31.549'
Makar	MKR	375	31°35.178'	076°31.337'
Uled	ULD	375	31°34.414'	076°33.310'

**Plate 1:** Seedling of *Terminalia chebula* in agricultural field at Naraina**Plate 2:** Seedlings of *Terminalia chebula* in grassland at Pahlu

**Conclusion**

Complete absence of natural regeneration of Harar in its natural population confirms the urgency of propagation of the species with the help of artificial techniques, reduction of destructive harvesting methods such as hacking tree branches and lopping pressure, establishment of community-based pulp extraction enterprises near the forest ecosystem to help in returning back the seeds to the ecosystem enabling greater chances of regeneration by extracting the pulp and reusing the seeds for regeneration.

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