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**Seed Source Variation on Fruit and Seed Traits of
Zanthoxylum rhetsa- a Medicinal Tree under High
Exploitation in Central Western Ghats, India**

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Abstract

Zanthoxylum rhetsa is one of the important medicinal and spice trees which is being highly exploited in Central Western Ghats of India. It is a very hardy species with lot of variation. Even though it is one of the important Non Wood Forest Product (NWFP) of Western Ghats of Karnataka, India, no or little attention is given to this species as regard to its domestication, conservation and utilization of genetic diversity. Hence there is a need to know the seed source variation for fruit and seed traits, as it is basis for further studies on growth performance of the species and other related work. This research work has been taken into consideration based on the species economic importance in terms of its medicinal uses in the present context of global health care and other uses. Six different seed sources were selected for the study, based on the extensive survey in Uttara Kannada district of Karnataka, India. It was noticed from the survey that fruiting season varied in different localities. Based on seed availability at different time, seeds were collected to carry out the present investigation. Study revealed that the fruit length, fruit width, fruit test weight were 6.09 mm, 4.19 mm and 21.29 g respectively in Sirsi seed source which was found highest. Seed length, seed width and test weight and seed volume were 2.84 mm, 1.75 mm and 10.40 g, 0.037 mm³ respectively in Sirsi seed source which was found to be superior from rest of the seed sources. However Kumta seed source recorded the least for both fruit and seed parameters. Based on the result further studies on germination and growth performance from different seed sources could be studied. Further, plus trees for seed collection and multiplication could be identified.

Key-Words: NWFP, Seed source, Test weight, Conservation

Introduction

Zanthoxylum rhetsa is a medium-sized, deciduous, aromatic and medicinal tree commonly known as Triphal and is one of the important Non wood Forest Product (NWFP) of Karnataka (Gokhale, 2004). It has many medicinal and culinary uses. The fruit and stem bark are aromatic, stimulant, astringent, stomachic and digestive; prescribed in urinary diseases, dyspepsia, diarrhea and with honey in rheumatism (Rastogi & Mehrotra, 1990). Bark extract from *Z. rhetsa* has been shown to lessen abdominal contractions and diarrhea in mice (Rahman 2002). Other potential pharmaceutical applications include cancer treatment and anti-oxidant, anti-coagulant and anti-bacterial agents.

At the industrial level, species has been shown to contain high amounts of linalool (Morikawa and Burnette 2006) a compound used commercially as a precursor to vitamin E production and also in soaps, detergents and insecticides. Clearly, *Zanthoxylum* spp. has potential beyond traditional uses as spices and folk medicine.

Being one of the important NWFP species, over exploitation of the species is common in many region of Karnataka and in many localities it is critically endangered (Anonymous, 2001). Even though it has many economically important values, little or no attention is given to establish plantation or mass multiplication of the species. The main difficulty in establishing forest plantation of this species is its poor germination capacity of seeds. It also shows a poor recruitment in the wild. A uniform germination of seed with good vigour is necessary for the production of uniform planting stock which is a prerequisite for any successful domestication and large scale afforestation

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programme (Fenner and Thompson, 2005). For a successful promotion of large scale plantations, there is a need for carefully planned and well-directed provenance research (Sehgal and Chauhan, 1995). The most successful tree improvement programme is that in which proper seed sources and provenances are used (Zobel, 1984). For all these studies, preliminary studies on seed source variation for seed and fruit traits should be studied. Hence this study has been taken into consideration based on the species economic importance in terms of its medicinal uses in the present context of global health care and culinary uses, fewer studies on the species regard to its domestication, conservation and utilization of genetic diversity.

Material and Methods

Present investigation was carried out to know seed source variation for fruit and seed attributes of *Zanthoxylum rhetsa*. This study was carried out during 2011-2012 in Uttara Kannada district of Karnataka, India located in hilly zone (zone -9) of Karnataka state, in Central Western Ghats. The extensive survey was under taken across six different localities that spread over different taluks. It was noticed from the survey that fruiting season varied in different localities. Based on seed availability at different time, seeds were collected to carry out the present investigation.

The latitude ranges from 13° 55' and 15° 37' while mean rainfall ranged from 1450 to 3300 mm. The maximum mean temperature ranged between 31 degree Celsius to 37 degree Celsius and the minimum mean annual temperature ranged between 16 to 23 degree Celsius. To record the observations for fruit and seed parameters of *Zanthoxylum rhetsa*, matured fruits from approximately ten to fifteen plants of same dbh (diameter at breast height) from each seed source were collected during October to December. The selected trees were located minimum 100 meter apart to avoid narrowing down of genetic variation. The distance was maintained between two trees and the individual tree identity was also maintained.

The observations on different quantitative traits such as fruit and seed length, fruit and seed width, fruit and seed test weight and seed volume were recorded from a total of 100 fruits that were randomly selected from each seed source. The characters studied and techniques adopted to record the observation on fruits traits like fruit and seed length, (mm) by measuring from the tip of the fruit/seed to other end using digital caliper and it was expressed in millimeters. Fruit/seed width (mm) was taken at the middle of the fruit/seed across the fruit/seed length using digital caliper and it was expressed in millimeters. For measuring fruit/seed test weight (g) the weight of the fruit/seed were

recorded using electronic balance and expressed as gram.

Fruits were depulped manually and seeds containing stone were kept under sunlight for one or two days until its burst and break open, there after seeds were collected. The seed collected from each seed source were kept separately in separate gunny bag. The bags were labeled with, date of collection, locality and the information of the mother plant.

Seed Volume (mm³) is estimated by using the volumetric flask by taking 100 seeds. or beaker. Hence, the volumetric flask of 500 ml were taken and filled with 200 ml of water and subsequently put 100 seeds in to the volumetric flask and noted the increasing volume reading of the flask and finally calculated the seed volume separately from each seed source. Seed test weight (g) hundred seeds were taken from each source and measured for test weight using electrical balance, it was expressed in grams.

Results and Discussion

Variation for fruit traits

Fruits collected from different seed sources were subjected to study the different fruit traits.

Fruit test weight

The test weight showed significant variation among provenances and presented in Fig. 1. Significantly higher test weight was recorded in Sirsi (21.29 g), followed by Siddhapur (20.96 g) and Yellapur seed source (20.94 g). The least 100 fruit weight was recorded in Kumta (20.66 g), Bhatkal (20.77 g) and Karwar seed source (20.88g).

Fruit length

Data pertaining to the fruit length recorded from different geographical seed sources in fruit categories is furnished in Fig. 1. Fruit length showed significant variation among the different seed sources. It varied from 6.09 mm to 5.73 mm. significantly higher fruit length recorded from Sirsi (6.09 mm) compared to the other seed sources, followed by Siddhapur (5.99 mm) and Yellapur seed source (5.95 mm). The lower seed length was recorded in the seeds collected from Kumta (5.73 mm), Bhatkal (5.83 mm), Karwar (5.92).

Fruit diameter

Fruit collected from different geographic seed sources exhibited significant differences in their fruit diameter and were presented in Fig. 1.

Significant differences were observed between seed sources. Maximum fruit diameter was recorded in fruits collected from Sirsi (4.19 mm), followed by Siddhapur (4.13 mm) and Yellapur seed source (3.87 mm). The significantly Bhatkal (3.59 mm) and Karwar seed source (3.85 mm).

Variation for seed traits

Seeds collected from different seed sources were subjected to study the different seed traits.

Test weight

The test weight revealed that all the seed varied significantly from one another. Table 1. Significantly higher test weight was recorded in Sirsi (10.40 g), followed by Siddhapur (10.36 g) and Yellapur (10.33 g). The least seed weight was recorded in Kumta seed source (10.30g).

Seed Volume (mm³)

The data pertaining to the seed volume recorded in the seed collected from different geographical seed sources were furnished in Table 1. The seed volume showed highly significant variation among the different seed sources.

Significantly higher seed volume was recorded in Sirsi (0.037 mm³), followed by Siddhapur (0.034 mm³) and Yellapur (0.032 mm³). The least seed weight was recorded in Kumta seed source (0.030 mm³).

Seed length (mm)

The data pertaining to the seed length recorded in the seed collected from different geographical seed sources were furnished in Table 1. The seed length showed highly significant variation among the different seed sources.

The seed length showed significant differences and varied from 2.84 to 2.52 mm. Significantly higher seed length recorded from Sirsi (2.84 mm), followed by Siddhapur (2.75 mm) and Yellapur (2.73 mm). The least seed weight was recorded in Kumta (2.52 mm), Bhatkal (2.55 mm) and Karwar seed source (2.57 mm).

Seed diameter (mm)

Seed collected from different geographic seed sources exhibited significant differences in their seed width and are presented in Table 1.

Significant differences were observed between seed sources. Maximum seed diameter was recorded in seeds collected from Sirsi (1.75 mm), followed by Siddhapur (1.67 mm) and Yellapur (1.65 mm). The least seed weight was recorded in Kumta (1.51 mm), Bhatkal (1.5332 mm) and Karwar seed source (1.5331 mm).which were on par with each other.

In case of *Zanthoxylum rhetsa* fruit is the main economic part .The fruits contain an essential oil called "Mullilam Oil" which is obtained by steam-distillation of the dried ripe fruits. So fruit parameters are the main important one for elevation (Srimathi, 2001).The fruit traits from Sirsi seed source were found superior over the other followed by Siddhapur and Yellapur seed source and least was observed in Kumta seed source. The fruit from higher altitudinal seed source found superior over the other lower altitudinal area probably

due to more favourable factors. The pulp and weight of pulp were positively correlates with the fruit size and weight. So fruit size, weight, will positively correlate with each other. This is in line with the results reported by Jamaludheen *et al.* (1995) in *Lagestromia speciosa* and Kallaje (2000) in *Garcinia indica*.

Seed is a propogules which depict the growth and performance of a particular plant species. Seed polymorphism is a common feature for adaptation, which includes production of seeds of different size, weight, seed coat pattern *etc.* the significant differences in various seed morphological characteristics of *Zanthoxylum rhetsa* provenances is indicative of the possibility of selecting phenotypically superior plant with in the species for further improvement work. But environmental factors also play a role in changing the component of the seed size as the species grow in wide range of ecological conditions and hence, populations can be expected to experience markedly selection pressure on seed characteristics. The analysis of variance revealed significant differences for all the fruit/seed traits studied *viz.* fruit/seed length, fruit/seed diameter and 100 test weight. Statistical parameters for various seed traits showed significant differences among geographic sources.

This variation in seed traits may be due to fact that this species grows over a wide range of rainfall, temperature and soil type thus it was found that seed sources with higher seed length and width possessed higher seed weight. Good and viable seeds are always sinks (Srimathi, 2001). Hence seed weight can be used as one of the useful criteria for early selection of superior provenances. Thus seed size and weight are the two important traits considered for early selection of seed sources and improving seed production. Similar findings were made by Srivastava (1995) in *Bauhinia variegata* and Khalil, (1986) in *Picea glauca*. Hence it is evident from the data that seed sources from Sirsi,Siddhapur and Yellapur were found to be superior for seed traits and they excelled other seed sources. The result are in conformity with the results of Arya *et al.* (1992) in *Prosopis cineraria*; Arjunann *et al.* (1994) in *Pongamia pinnata*.

Conclusion

Based on our research inference Sirsi, seed source is highly influencing on fruit and seed character and it could be the superior seed source. For quoting superior seed source, other different criteria should be studied. This study only the basic one based on this influence of seed source variation on germination, viability, seed vigour, growth and development of seedlings and growth performance in the plantation should be studied for identification of suitable or best seed source. After

identification of suitable source seeds, plus trees from that region should be identified and further mass multiplication activities should be taken place..

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Table 1: Influence of seed source variation on seed parameters of *Zanthoxylum rhetsa*

Sl. No.	Seed sources	Seed length (mm)	Seed diameter (mm)	Test weight (g/100)	Seed volume (mm ³)
1	Karwar	2.57	1.53	10.32	0.031
2	Kumta	2.52	1.51	10.30	0.030
3	Bhatkal	2.55	1.53	10.31	0.031
4	Sirsi	2.84	1.75	10.40	0.037
5	Siddhapur	2.75	1.67	10.36	0.034
6	Yellapur	2.73	1.65	10.33	0.032
	Mean	2.66	1.61	10.33	0.032
	SEm ±	0.0090	0.00655	0.0033	0.000340
	CD @ 0.05	0.0252	0.01834	0.0094	0.000951

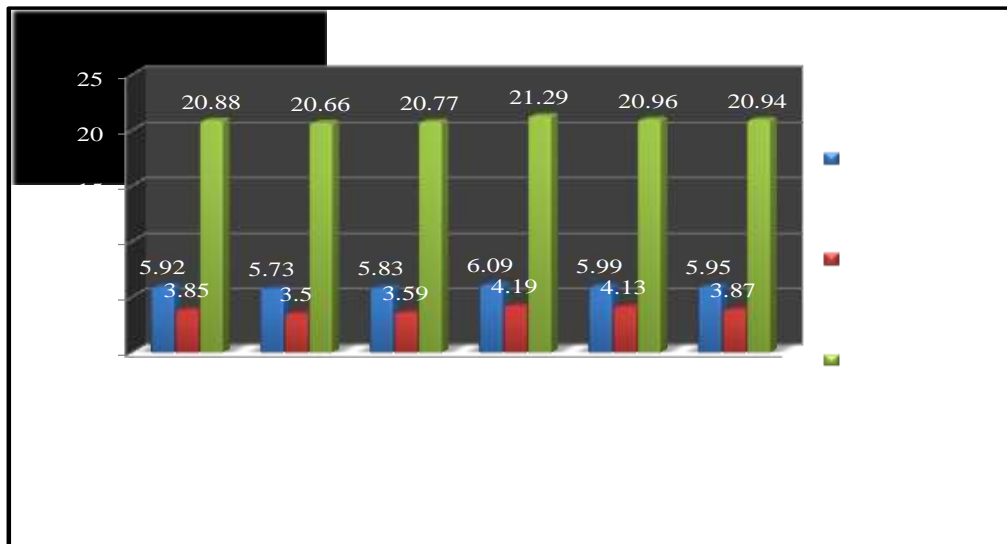


Fig. 1: Influence of seed source variation on fruit parameters of *Zanthoxylum rhetsa*

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