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Morphological characterization of *Terminalia chebula* Retz. and Selection of Plus Tree from Kondagaon & Kanker Forest Stands of Chhattisgarh

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Abstract

Terminalia chebula Retz. Harad is high value medicinal tree and important component of Triphala which is used to treat so many ailments under Ayurvedic, Unani and Siddha system of medicine. The *T. chebula* trees are distributed very wide distribution in Chhattisgarh which comes under Dry Deciduous Tropical Forest of India. The dry fruit pulp is utilized for various preparations in herbal medicines. In Chhattisgarh the fruit is having lot of morphological variation in different forest stands. However, no agronomic or morphological research has been conducted on this species. Consequently, this research was conducted to identify the plus trees which are utilized to produce quality planting material in mass multiplication methods to supply farmers to plant this high value tree as a agroforestry tree and get extra income, there is very high demand of raw material which is dry fruit pulp. Forty four candidate plus trees were selected and mature fruits were collected for further statistical analysis of data. The morphological characters were considered using samples from 44 trees representing different populations Kondagaon and Kanker district of Chhattisgarh. The major morphological character fruit dry pulp weight which is sold in the market was recorded from Tatamari Keshkal Kondagaon Tree no 6(5.45 gm) maximum dry pulp followed by Tree no 5 (4.60 gm) maximum dry pulp was recorded whereas the, other plus tree from Kanker Distt. different sites were recorded Tirikdand, Charama (Kanker) Tree No 4(4.10 gm), Shingarbhat (Kanker) Tree No 7., (4.10gm) Botikanera, Kondagaon Tree No. 5 (4.9gm) followed by Tree No.6(4.3 gm). Remaining other CPT, the Length, breadth fresh weight and dry weight was recorded less as compared with the above identified trees and forest stands. The lowest pulp & seed weight, size in length and breadth was observed Singarbhat Kanker Tree no.2 (1.45gm) followed by Bailgaon, Pharsgaon Kondagaon Tree no.1(1.75gm). The selected plus tree would be utilized to multiply true to true type of plants through budding for mass multiplication and distributed as quality planting material. The smallest size of *Terminalia chebula* fruit fetches good prize in market as a BalHarad.

Keywords: Morphological characterization, *Terminalia chebula*

Introduction

T. chebulais commonly known as black myrobalans in English and Harad in Hindi. *Terminalia chebula* Tree is a native plant in India and Southeast Asia and is extensively cultivated in Taiwan. *T. chebula* belongs to the family Combretaceae and is found throughout India especially in deciduous forests and areas of light rainfall (Naik et al., 2004) [4]. Various parts of the plant have vital medicinal properties and are used extensively in indigenous and Ayurvedic system of medicine. *T. chebula* a medium to large deciduous tree, attaining a height of up to 30 m with wide spreading branches and a broad disk-shaped crown the bole 1.5 - 2.5 m diameter with round crown and spreading branches. (Chattopadhyay and Bhattacharya, 2007) [3]. The long ovate leaves are acute, in opposite pairs about 10 to 20 cm long. The flowers are dull white in spikes found at the end of the branches. The fruit scientifically known as drupe is hard and generally yellowish green in colour. Harad grows naturally in the sub-Himalayan tract from Sutlej eastwards ascending up to 1500 m elevation and also in deciduous forests of peninsular India. During the last five decades, apart from the chemistry of *T. chebula* compounds, considerable development has been achieved concerning the biological activity and medicinal applications of *T. chebula*.

It is now considered a valuable source of unique natural products for development of medicines against various diseases and also for the development of industrial products. It can grow in different environmental conditions. Soil supporting Harad vary widely in depth and composition. The mean maximum temperature in its habitat varies from 37°C to 48°C, absolute minimum temperature from 1°C to 15°C and annual rainfall from 750 to 3250 mm.

Material and Methods

A perspective survey was carried out during October 2020 within two district Kanker & Kondagaon these are 150 and 210 Km away from Indira Gandhi Agricultural University, Raipur towards Bastar region of Chhattisgarh. The time of sampling is selected in such a way that when fruits are mature and ready to fall down from tree 10 -30 fruits were collected from each tree and kept in poly bags to recorded data of different parameters. The length and breadth of fruit with digital caliper while fresh weight dry weight dry pulp and seed weight were recorded with digital balance. The fruit samples brought to laboratory oven dried in 80°C then dry weight and extracted pulp and seed weight data were recorded for further computation and statistically analysis. The height and diameter of sampled tree was recorded and trees are marked with white paint and numbered simultaneously the location of trees were recorded with the help of GPS so that the CPT would be find out as and when needed for further observations for research work. In natural populations, 10 trees were sampled from different forest stands in Kanker and Kondagaon district in different blocks of Chhattisgarh. In order to identify the variations within and between populations, a tree cluster of 2-3 trees were selected within a population, distance of at least 1 km was maintained between clusters.

Variables used for morphological characterization

Eight character of fruit namely 1. Length of fruit in mm, 2. Breadth of the fruit in mm, 3. Fresh weight of fruits in gm, 4. Dry weight of fruit in gm, 5. Dry pulp weight in gm, 6. Dry seed weight in gm 7. Shape of fruit, 8. Colour of fruit was recorded. The tree character was taken 1. Circumference of tree, 2. GPS location of individual tree was also recorded. The morphological parameters of fruits and tree assessed during the study were identified, measured and recorded

Morphological variation of *Terminalia chebula* in fruits

Variations were observed in circumference crown size height characters, I case of fruit characters of *T. chebula*. The within tree variation for fruit characters was not significant, while the between-trees it was observed significant variation. However shapes of fruits are observed Round shape, Long Shape and Small shape variation was clearly recorded. Whereas the colour of fruit were observed three type shades Pale green, Dark green and light green

Result and Discussion

The result of this experiment showed lot of variation in fruits of two districts Kanker two blocks Charama and Kanker. Similar variation are also recorded in Kondagaon district here the variation in fruit were observed all the three block Kondagaon, Pharsgaon and Keshkal. The result depicted in Table 1 showed that in Kanker dist. Two blocks total no. of 11 CPT sampled and the variation in fruit length was observed maximum Tree no. 6(41.48mm) at Shingarbhata followed by Bargani Tree no. 2(38.34mm) and minimum

recorded tree no.7 (22.13mm) at Shingarbhata. Whereas, breadth of fruit was observed maximum Tree no 4(25.25mm) in Tirkidand followed by tree no. 1 (23.20mm) Bargani and minimum found in tree no. 2 (14.69mm) at Shingarbhata. The fresh weight of fruit showed maximum in tree no. 4 (15.5gm) followed by Bargani tree no.1 (12.86gm) and minimum found in Shingarbhata tree no.2 (4.45gm). The dry weight of fruit was recorded maximum in Tree no. 4(6.6gm) Tirkidand followed by Tree no. 1(6.00gm) of Bargani and minimum was found in Tree no. 2(2.15gm) at Shingarbhata. The dry fruit pulp which is having merchantable value the maximum value observed in two trees of Tree no. 4 and Tree no 7 which was (4.10gm) Tirkidand and Shingarbhata respectively. However there was difference in fresh and dry weight of fruits but the seed weight of fruits of these tree differ tree no 4(2.5gm) and tree no. 7 (1.5gm). After analyzing the data it can be concluded that total sampled 11CPT of Kanker dist. Tree n. 7 of Tirkidand showed the superior fruit among other 11 CPT studied and can be selected as plus tree of these two blocks of Kanker. The analysis of colour and shape of fruit the maximum size of fruit was observed in round shape and pale green colour of fruit as compared with the long shape and light green fruit showed minimum size of fruit as BalHarad. Whereas the circumference of tree 150-175cm gave maximum pulp rate in fruit and 90-120 cm it was minimum size of fruit. The 33 CPT sampled from Kondagaon from three blocks in 5 sites. The result depicted in Table 2 shows that in fruit maximum length of fruit observed in tree no 10(46.88cm) Botikanera followed by tree no. 5 (43.20cm) Bailgaon and minimum Tree no. 4(28.72) Botikanera was recorded. In case of maximum breadth tree no. 5 (28.88cm) followed by tree no. 6(25.20) of Tatamari and minimum recorded in tree no.1 (17.64cm) Bailgaon. The maximum fresh weight of fruit found in tree no.5(16.55gm) followed by tree no. 5 (15.55) Tatamari and minimum was tree no. 1 (6.30gm). The maximum dry weight of fruit was observed in tree no.5 (8.85gm) Botikanera followed by tree no. tree no. 5(7.05gm) Tatamari and minimum tree no. 1(3.00gm) Bailgaon. The dry pulp weight of fruit was maximum recorded in tree no. 6(5.45gm) Tatamari followed by tree no. 5(4.90gm) Botikanera and minimum was tree no. 1 (1.75gm) Bailgaon. The dry seed weight was found maximum in tree no. 5(3.95gm) followed by tree no.2 (2.45gm) Tatamari and minimum was found in Tree no. 1(1.25gm) Bailgaon. However shape and colour of fruit showed that round shape and dusty green followed by round shape and pale green fruits are in big size, maximum pulp and small size of seed in fruit. The tree circumference 150cm shows big fruit followed by 140cm and minimum size of fruit was recorded in circumference 220cm of tree. The biggest fruit size can be obtained from the trees having circumference between 130to 150cm in this study. The overall 44 CPT sampled for different morphological character, like length, breadth, fresh weight, dry weight, dry fruit pulp, dry seed weight, shape & colour of fruit including circumference of tree. The computation and analysis of data of 44 CPT from different forest stands of 2 district and 8 sites total 8 trees showed the desirable character which are marked for plus trees are depicted in Table no 3 and marked as plus tree. In Kanker dist. Shingarbhata tree no. 7 and tree no.4 Tirkidand for maximum pulp weight and tree no 2 Shingarbhata for Bal hard small size of fruit were identified as plus trees. In case of Kondagaon district biggest dry fruit pulp tree no. 6 followed by tree no 5, tree no. 5 & 6 belongs to Tatamari and Botikanera respectively found maximum dry pulp fruits among 44CPT sampled and analyzed the data.

Whereas the smallest fruit called BalHarad tree No. 1 Bailgaon found. The colour and shape of fruit and circumference of tree did not do not showed significant results. The variability among size, shape, colour fresh and dry weight of fruit may due to its genetic variation. Sanjeewa *et al.* (2013) [7] also reported in his study that in *Terminalia chebula* tree within tree variation for fruit characters was not significant ($p>0.01$), while the between-trees variation was significant ($p< 0.01$) for fruit characters such as fruit shape and fruit size. Both between-and within-tree variations were significant ($p< 0.01$) in terms of leaf characters. A greater contribution of fruit characters namely, fruit diameter and the longitudinal section of fruit, to the PC suggests a relationship between clusters and fruit characters. This phenomenon indicated that it is possible to group the *T. chebula* trees according to their fruit shapes. Unique characters of each cluster are given. Similar results also obtained in this experiment. Said Muhammad (2012) also reported that the fruit are glabrous, ellipsoids ovoid drupes, yellow to orange brown in colour, encloses a single angle stone (Chattopadhyay and Bhattacharyya, 2007) [3]. *T. chebula* is of three types - actually these are the different stages of maturity of fruits (a) small Myrobalan- the immature fruit; (b) yellow Myrobalan- after development of seed, the mature stage of the fruit; (c) large Myrobalan- the fully matured fruit (Chattopadhyay and Bhattacharyya, 2007) [3].

The results of colour of fruits varied as reported by above author in our observation three types of colour was observed in Pale green, Dark green, Light green and Dusty green did not match as yellow this variation in color may be soil type environmental or genetic variation in this species in present investigation the observation is taken only on fruit maturity stage.

Similar variation in morphological characters of fruits have been previously reported for *Arachis* species (Chandran and Pandya, 2000) [2], Similar findings regarding too much variation in fruits of *Terminalia chebula* sampled in different forest stands and sites in present investigation as in case of *P. Emblica* Singh Bhupender *et al.* 2012 [1]. Navhale *et al.* (2011) [5] also reported that in morphological variation in *T. chebula* showed Significant variation was also noticed for fruit parameters *viz.*, weight of fresh fruit (6.32 to 10.42 g), diameter of fruit (0.98 to 1.84 cm), length of fruit (1.82 to 3.54 cm), weight of fruit pulp (3.58 to 7.32 g), weight of dry fruit (2.60 to 5.28 g), weight of seed (3.04 to 6.38 g), The variation in fruit characters *viz.*, fruit weight, fruit length, fruit width were also reported in Aonla by Pandey *et al.* (2008) [6]. The variation observed in this species could very well be exploited for identifying CPTs and also can be used in developing existing clonal orchards. Similar variation in fruit characters were found in this study

Table 1: The Morphological variation in *Terminalia chebula* at Charama & Kanker blocks Dist. Kanker

Tree No	CPT No	Site of trees	Length of fruit mm	Breadth of fruit mm	Fresh weight of fruit gm	Dry weight of Fruit gm	Dry Pulp weight gm	Dry Seed weight gm	Shape of Fruits	Colour	Circum. of tree cm
1	T1	Bargani, Nayapara) Charama	35.87	23.20	12.86	6.00	3.4	2.6	Round Shape	Pale Green	150 cm
2	T2	-do-	38.34	16.68	8.95	4.5	2.3	1.6	Long shape	Dark Green	145 cm
3	T3	Tirikdand, Charama	32.80	19.51	8.15	3.2	1.9	1.3	Round shape	Pale Green	152 cm
4	T4	-do-	36.50	25.25	15.5	6.6	4.1	2.5	Round Shape	Pale Green	150 cm
1	T5	Shingarbhata (Kanker)	33.75	22.11	9.80	9.0	2.25	2.05	Round shape	Light green	90 cm
2	T6	-do-	28.27	14.69	4.45	2.15	1.45	0.65	Long shape	Light green	90 cm
3	T7	-do-	36.57	18.79	8.20	4.10	2.35	1.55	Small shape	Dark green	110 cm
4	T8	-do-	31.13	21.99	9.75	5.15	3.3	1.85	Small shape	Light green	150 cm
5	T9	-do-	29.74	19.32	7.05	3.4	1.55	1.85	Round shape	Light green	90 cm
6	T10	-do-	41.48	23.69	12.75	6.05	3.35	2.65	Long shape	Light green	120 cm
7	T11	-do-	35.35	22.28	11.95	5.25	4.1	1.15	Small shape	Pale green	175 cm
8.	T12	-do-	22.13	18.13	5.50	5.40	3.25	2.15	Small round	Light green	175 cm
9	T13	-do-	30.42	18.29	6.90	4.10	2.4	2.15	Small Round	Light green	210 cm
10	T14	-do-	32.59	19.87	8.95	5.3	3.65	1.6	Round shape	Light green	210 cm
11	T15	-do-	28.56	20.18	7.65	4.30	2.55	1.75	Round shape	Light green	167 cm

Table 2: The Morphological variation in *Terminalia chebula* at Kondagaon, Pharsgaon & Keshkal blocks Dist. Kondagaon

Tree No	CPT No	Site of trees	Length of fruit mm	Breadth of fruit mm	Fresh weight of fruit gm	Dry weight of Fruit gm	Dry Pulp weight gm	Dry Seed weight gm	Shape of Fruits	Colour	Circum. of tree cm
1	T1	Botikanera, Kondagaon	33.86	21.42	9.70	5.90	2.85	2.25	Round Shape	Pale green	158 cm
2	T2	-do-	29.21	23.45	10.00	5.65	3.8	1.75	Round Shape	Pale green	130 cm
3	T3	-do-	34.30	21.27	10.25	6.45	4.2	2.2	Round Shape	Pale green	160 cm
4	T4	-do-	28.72	21.02	9.55	4.75	3.25	1.45	Round Shape	Pale green	160 cm
5	T5	-do-	36.64	28.88	16.55	8.85	4.9	3.95	Round Shape	Pale green	150 cm
6	T6	-do-	39.04	20.99	10.95	7.30	4.3	2.4	Round shape	Light green	130 cm
7	T7	-do-	38.30	20.27	9.35	5.65	3.70	1.95	Round Shape	Light green	105 cm
8	T8	-do-	37.23	17.50	7.30	3.80	1.90	1.9	Small shape	Pale green	130 cm
9	T9	-do-	36.44	20.26	9.65	5.85	3.7	2.15	Round Shape	Pale green	160 cm
10	T10	-do-	46.88	24.27	14.30	6.60	3.85	2.8	Long shape	Dark green	163 cm
1	T11	Bailgaon, Pharsgaon Kondagaon	28.73	17.64	6.30	3.00	1.75	1.25	Round shape	Dark green	220 cm
2	T12	-do-	31.98	16.62	6.50	3.60	2.05	1.55	Round shape	Dusty green	145 cm

3	T13	-do-	31.47	20.56	8.75	4.60	2.75	1.85	Round shape	Dark green	80 cm
4	T14	-do-	31.22	21.09	9.55	5.25	3.30	1.90	Round shape	Dark green	240 cm
5	T15	-do-	43.20	18.22	8.54	4.7	3.15	1.6	Round shape	Dark green	200 cm
6	T16	Aalor, Pharasgaon, Kondagaon	28.76	20.77	8.1	3.45	2.15	1.25	Round shape	Light green	260 cm
7	T17	-do-	28.73	18.16	6.70	6.1	2.35	1.55	Round shape	Green yellow	178 cm
8	T18	-do-	26.24	19.49	6.80	3.95	2.55	1.25	Round shape	Light green	210 cm
9	T19	-do-	34.55	20.58	9.55	4.15	2.35	1.75	Long shape	Dark green	204 cm
10	T20	-do-	32.67	21.20	9.05	7.00	2.25	1.55	Long shape	Light green	200 cm

Tree No	CPT No.	Site of trees	Length of fruit mm	Breadth of fruit mm	Fresh weight of fruit gm	Dry weight of Fruit gm	Dry Pulp weight gm	Dry Seed weight gm	Shape of Fruits	Colour	Circum of tree cm
1	T21	Batrali (Keshkal) Kondagaon	34.18	21.30	9.66	5.15	2.65	2.45	Long shape	Pale green	200 cm
2	T22	-do-	37.36	23.57	12.52	6.80	3.95	2.9	Small shape	Light green	135 cm
3	T23	-do-	31.59	19.89	8.40	4.90	2.85	2.05	Long shape	Dark green	150 cm
4	T24	-do-	39.90	21.65	11.80	6.75	3.45	2.65	Long shape	Dark green	80 cm
5	T25	Tatamari (Keshkal) Kondagaon	42.29	24.98	15.55	7.05	4.6	2.45	Round shape	Light green	140 cm
6	T26	-do-	35.46	25.20	14.85	6.95	5.45	1.45	Round shape	Dusty green	150cm
7	T27	-do-	37.52	23.40	12.10	11.05	3.0	3.2	Round shape	Light green	150cm
8	T28	-do-	38.55	21.93	10.15	5.10	1.85	3.25	Round shape	Light green	150 cm
9	T29	-do-	36.48	23.35	11.45	6.05	3.65	2.35	Round shape	Light green	185 cm

Table 3: Plus tree of *Terminaliachebula* selected from Kanker&Kondagaon Dist. of Chhattisgarh after analyzing the Data.

Tree No	Plus Trees	Site of trees	Length of fruit MM	Breadth of fruit MM	Fresh weight of fruit GM	Dry weight of Fruit GM	Dry Pulp weight GM	Dry Seed weight GM	Shape of Fruits	Colour	Circum. of tree cm
4	T4	Tirkidand, CharamaKanker	36.50	25.25	15.5	6.6	4.1	2.5	Round Shape	Pale Green	150 cm
7	T11	Shingarbhata, Kanker	35.35	22.28	11.95	5.25	4.1	1.15	Small shape	Pale green	175 cm
2	T6	*-do-	28.27	14.69	4.45	2.15	1.45	0.65	Long shape	Light green	90 cm
5	T20	Botikanera Kondagaon	36.64	28.88	16.55	8.85	4.9	3.95	Round Shape	Pale green	150 cm
6	T21	-do-	39.04	20.99	10.95	7.30	4.3	2.4	Round shape	Light green	130 cm
5	T39	Tatamari (Keshkal) Kondagaon	42.29	24.98	15.55	7.05	4.6	2.45	Round shape	Light green	140 cm
6	T40	-do-	35.46	25.20	14.85	6.95	5.45	1.45	Round shape	Dusty green	150 cm
1	T26	*Bailgaon, Pharsgaon Kondagaon	28.73	17.64	6.30	3.00	1.75	1.25	Round shape	Dark green	220 cm

Note: - * Small size of Harad fruit called BalHarad this also fetch high price in the Market

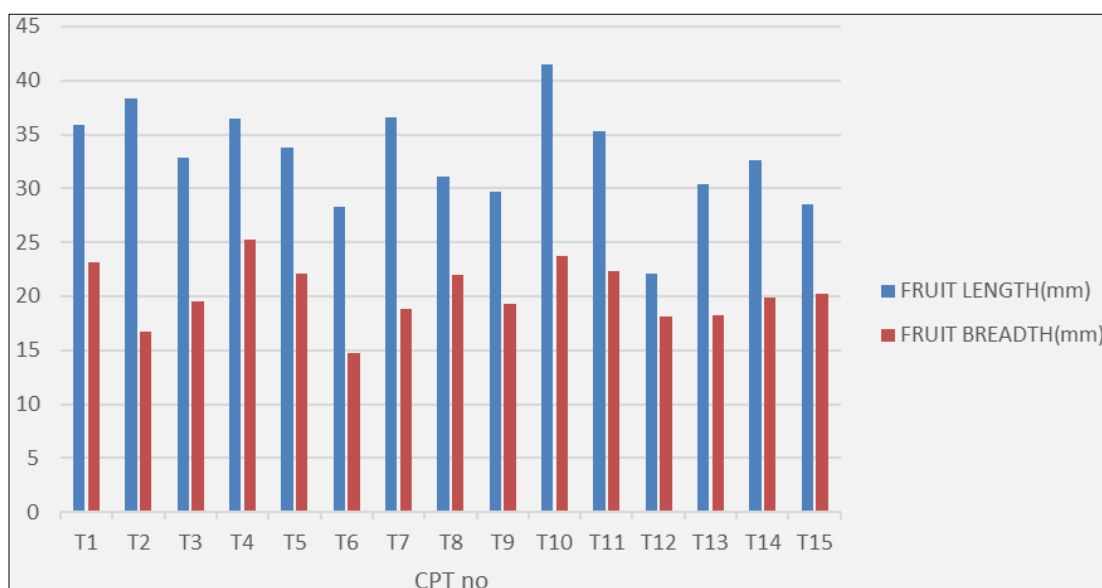


Fig 1: Variation of CPT (Candidate plus trees) with respect to fruit length & breadth at dist. Kanker {two blocks 1. Charama and 2. Kanker having three sites 1. Bargani, Nayapara) (Charama), 2. Tirikdand, (Charama), 3. Shingarbhata (Kanker)

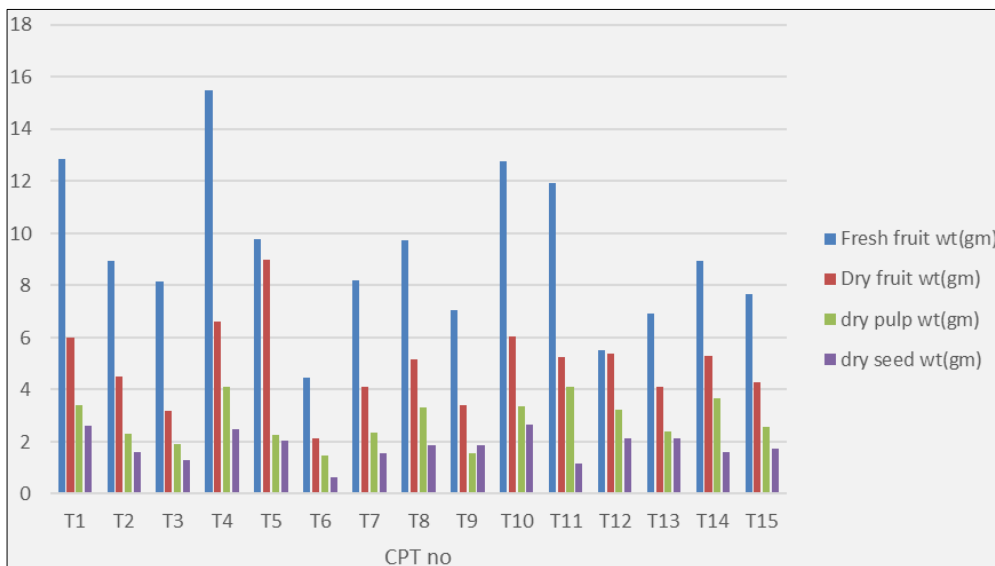


Fig 2: Variation of CPTs (Candidate plus trees) w.r.t. fresh & dry wt. of fruit and dry wt of pulp and seed at dist. Kanker {two blocks 1. Charama and 2. Kanker having three sites 1. Bargani, Nayapara) (Charama), 2. Tirikdand, (Charama), 3. Shingarbhata (Kanker)

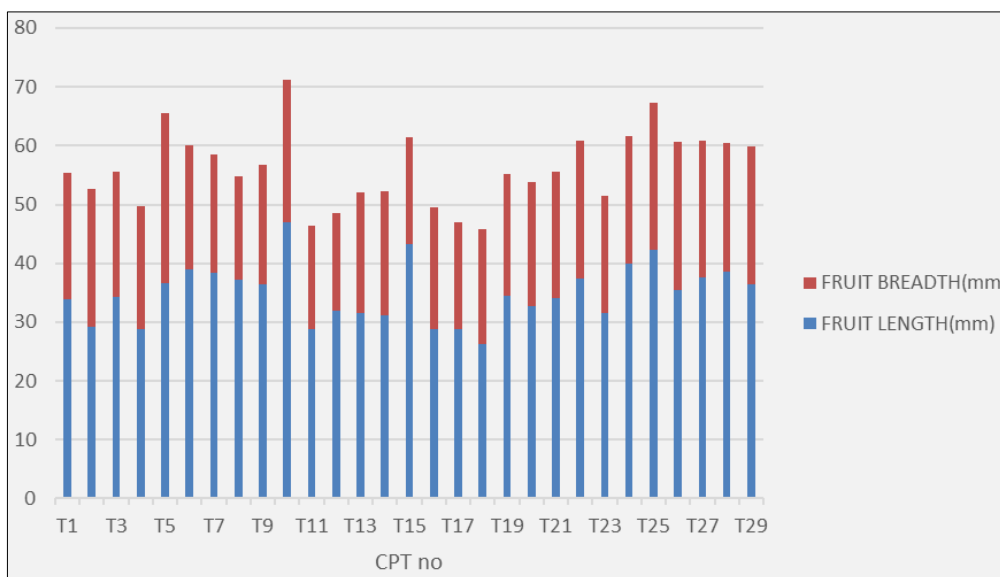


Fig 3: Variation of CPT (candidate plus trees)with respect to to fruit length & breadth atdist. Kondagaon{3 blocks 1. Kondagaon. 2 Pharsgaon 3 Keshkal with Five sites 1. Botikanera, (Kondagaon) 2. Bailgaon,(Pharsgaon) 3.Aalor, (Pharsgaon) 4. Batrali (Keshkal) 5. Tatamari (Keshkal)}

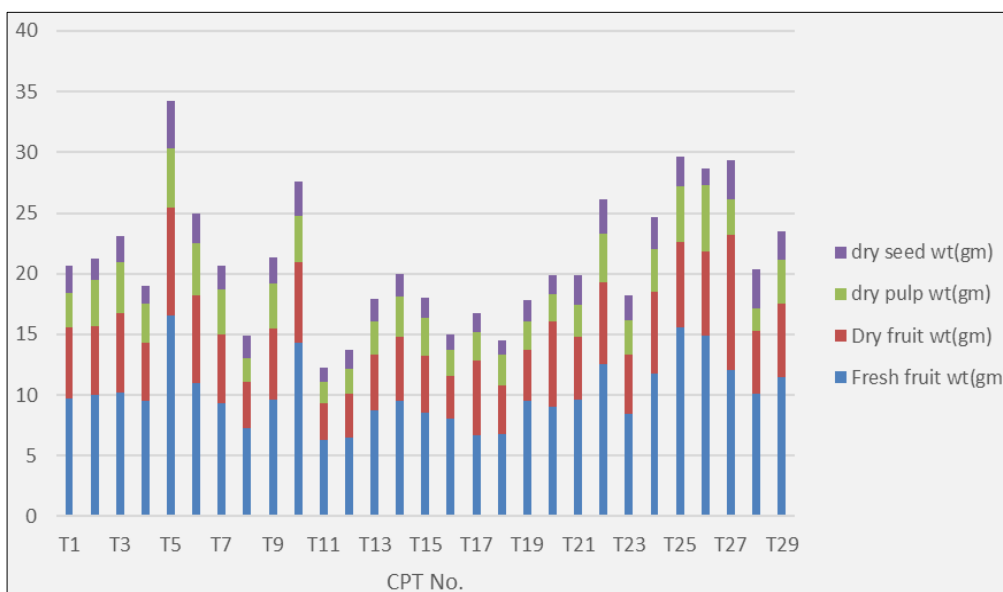


Fig 4: Variation of trees w.r.t. fresh & dry wt. of fruit and dry wt of pulp and seed atKondagaon {3 blocks 1. Kondagaon. 2 Pharsgaon 3 Keshkal with Five sites 1. Botikanera, (Kondagaon) 2. Bailgaon, (Pharsgaon) 3. Aalor, (Pharsgaon) 4. Batrali (Keshkal) 5. Tatamari (Keshkal)}

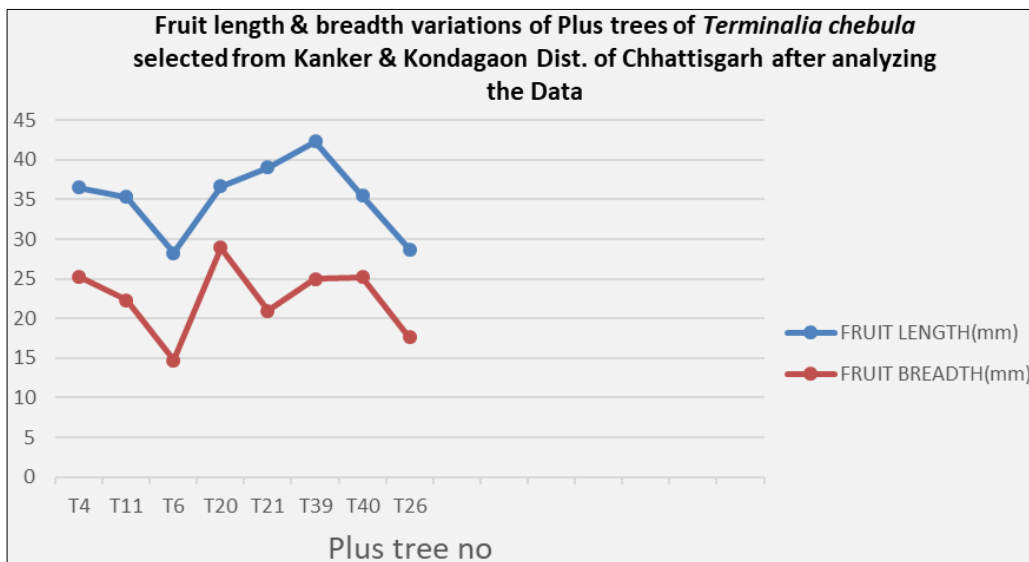


Fig 5: Plus trees of big fruit length and breadth in fruit Plus Trees 4,11,20,21,39,40, Plus Tree for Bal Harad Smallest length and breadth size of fruit Plus Tree 6 & 26

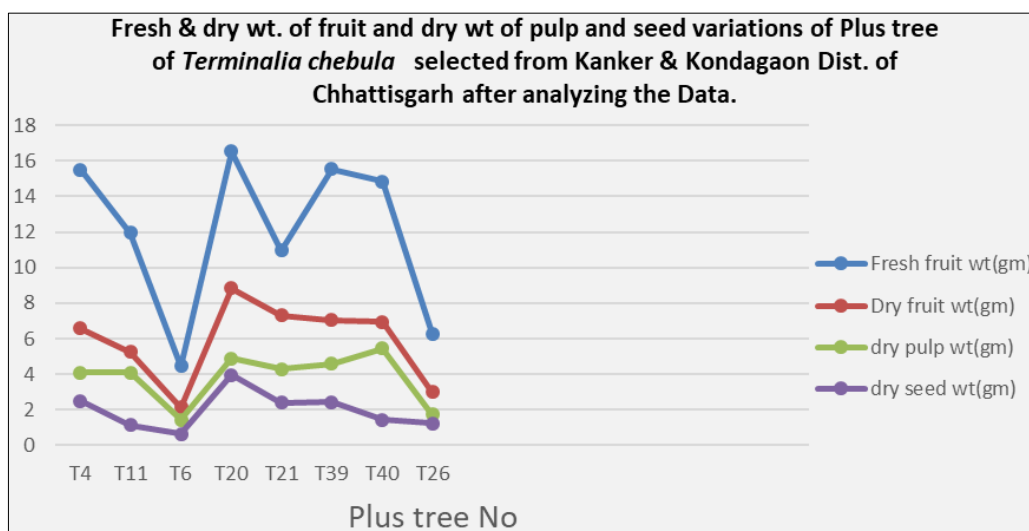


Fig 6: Plus trees of big fruit and dry pulp in fruit Plus Trees 4,11,20,21,39,40, Plus Tree for Bal Harad Smallest size of fruit Plus Tree 6 & 26



Fig 7: Morphological Variation in Harad *Terminalia chebula* of Kondagaon and Kanker district of Chhattisgarh RPF project



Fig 8: CPT selection collection of fruit from marked tree and observation taking by the Scholars



Fig 9: Data recording of various CPT



Fig 9: Samples drying in hot air oven



Fig 10: After oven drying of Harada fruits



Fig 11: Weighing of Harada fruits

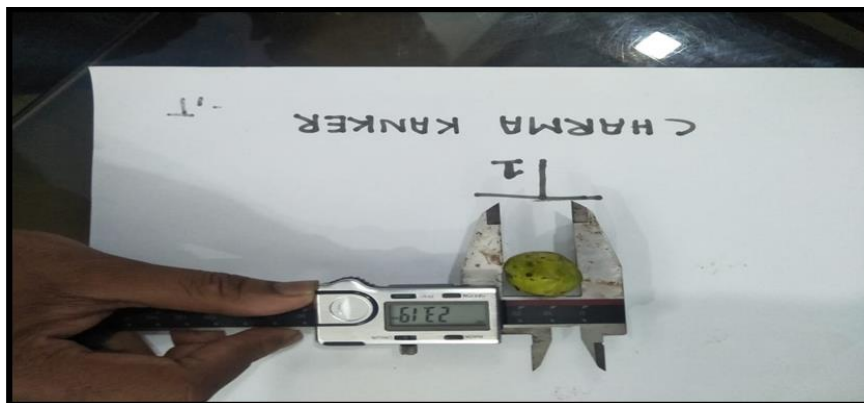


Fig 12: Width Measurement of Harada fruits



Fig 13: Location map plus tree Selection at Botikanera, Kondgaon



Fig 13: Location map plus tree Selection at Bargani, Charma

Conclusion

Being an economically important medicinal tree species, commercial cultivation of *T. chebula* could be promoted *ex-situ* as a conservation strategy. Six plus tree for big size of fruit and Two trees are small size of fruit which is called as BalHarad identified in this study through morphological characterization are useful to streamline the for further mass multiplication of quality planting material through budding true type seedlings will be produce for farmers of Chhattisgarh. Further, commercial cultivation of the species would reduce the threat on natural populations due to collection of seeds and its impacts on natural regeneration.

References

1. Bhupendra Singh, Uniyal AK, Rawat JSM, Rana DK. Estimation of genetic variability in *Phyllanthusemblica* L. - Towards a contribution in sustainable rural development Journal of Horticulture and Forestry. 2012; 4(5):92-95, Available online at <http://www.Academicjournals.org/JHF>
2. Chandran K, Pandya SM. Morphological characterization of *Arachis* species of section *Arachis*. Plant Genet. Resour. Newsl. 2000; 121:38-41.
3. Chattopadhyay RR, Bhattacharyya SK. Plant Review *Terminaliachebula*. Pharmacognos. Rev. 2007; 23:145-150.

4. Naik GH, Priyadarsini KI, Naik DB, Gangabhagirathi R, Mohan H. Studies on the Aqueous Extract of *Terminaliachebula* as a Potent Antioxidant and a Probable Radioprotector. *Photomed.* 2004; 11:530-538.
5. Navhale VC, Sonone NG, Jangam PS, Jadhav ST, Bhav SG. Genetic variability and selection of candidate plus trees in chebulicmyrobalan (*Terminaliachebula* Retz.) *Electronic Journal of Plant Breeding.* 2011; 2(1):157-163.
6. Pandey D, Shukla SK, Kumar A. Variability in Aonla (*Emblicaofficinalis*) accessions collected from Panna forest of Madhya Pradesh. *Indian J Agroforestry.* 2008; 10(1):73-77.
7. Sanjeeva TABD, Pushpakumara DKNG, Sangakkara UR. Morphological Characterization of *Terminaliachebula* Retz. in Sri Lanka Tropical Agricultural Research. 2013; 25(1):127-132.