

Original Research Article

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## Studies on Germination Behaviour of Respective Seed Sources of *Azadirachta indica*

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### ABSTRACT

*Azadirachta indica* commonly known as neem belong to the family of Meliaceae. It is a valuable medicinal tropical tree species with many uses. Germination of neem seed is in the initial circumstance critical step in afforestation programmes or naturally conditions, Neem seed having short viability it's a kind of recalcitrant seeds so that is the problem in introducing neem to new locations. Fresh seeds germinate very soon, but within week's germination rates begin dropping off because seeds have low moisture content. This poses logistical difficulties for any tree-planting or improvement. Experiment was carried out at Nursery of Guru Ghasidas Central University Bilaspur Chhattisgarh, Germination percentage of among seed sources was recorded in Naryanpura gave maximum germination percentage (94.33%), where seed soaked with water, while minimum value of germination percentage was recorded from Dhamatari (85.89%). Where in the control there was no treatment recorded germination percentage in Bilaspur (91.00 %), while the minimum value of germination percentage was recorded from Dhamatari (83.00%). Seed sources of Bilaspur gave maximum Seedling vigor index (SVI) (3744.27) while minimum Seedling vigor index (SVI) was recorded from Bijapur (2885.74), Where in the control there was no treatment recorded highest Seedling vigor index (SVI) Bilaspur (3854.76), while minimum Seedling vigor index (SVI) was recorded from Pendra (2979.07), Seed sources of Bilaspur gave maximum Drupe weight (169.36g ), where lowest Drupe weight was recorded Balod (142.34g), Seed sources of Bilaspur gave maximum Drupe weight without pulp (60.46g ), where lowest Drupe weight without pulp was recorded Balod (52.41g), Seed sources of Bilaspur gave maximum Moisture content (16.91%), where lowest Moisture content was recorded Bemetera (13.51 %) was recorded Significant variations (CD=0.05).

#### Keywords

*Azadirachta indica*,  
Germination  
Percentage,  
Germination value,  
Mean germination  
time, Seedlings  
vigour index,  
Moisture content,  
Seed weight

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### Introduction

*Azadirachta indica* commonly known as neem belong to the family of Meliaceae. It is a valuable medicinal tropical tree species with

many uses. Germination of neem seed is in the initial circumstance critical step in afforestation programmes or naturally conditions seed quality at the physiological level includes seed viability. Neem seed

having short viability it's a kind of recalcitrant seeds so that is the problem in introducing neem to new locations. Fresh seeds germinate very soon, but within weeks germination rates begin dropping off because seeds have low moisture content. This poses logistical difficulties for any tree-planting or improvement. The viability of seed is simply its capacity for growth and development (Bewley & Black, 1978). Germination capacity is a measure of the ability of a population of seeds to germinate, or as Bewley & Black (1978) described it, "the maximum percentage of seeds that when germinating under favourable condition." Seeds of many tree species germinate readily when subjected to favourable conditions of moisture and temperature. But most of the species exhibit delayed germination due to some degree of seed dormancy. Rapid, uniform, early and complete germination are the pre-requisites for raising seedlings on large scale for any plantation programme. Seeds of most tree species are with a soft outer cover, the embryo of such seeds can be awakened rapidly when exposed to the warm moist environment and there is no need of any pre-treatment of these seeds before sowing (FAO, 1985). Seed germination has other utility also. Speed of germination has long been used as an indicator of vigour (AOSA, 1976). Seed vigour is an important factor determining seed quality in forest trees (Vlase and Voinesou, 1972). Seed vigour is one of the most important parameters in determining seed quality and it is the sum total of those properties of seed which determine the potential level of performance and activity of a non-dormant seed of a seed lot during germination and seedling emergence. Germination is the resumption of growth by the embryo plant which has lain dormant in the seed. This being as soon as the resting seed begins to imbibe moisture. Germination in the commonly accepted botanical use of the term occurs when the radical begins to

protrude beyond the seed coat (Toumey and Stevens, 1982) of all the quality measurements on seeds, none is more important than how well they will germinate. This information is the deciding factor on the value of the seedlot. The seed must be exposed to favourable environmental conditions before germinating. The favourable environmental conditions are an adequate supply of water, and adequate gas exchange, and suitable temperature and light. Temperature is one of the most important environmental factors affecting seed germination. It affects the germination percentage as well as the rate of germination and varies with different species.

## **Materials and Methods**

### **Study area**

The study of the germination behaviour of respective seed sources of *Azadirachta indica* was carried out from different seed sources of ten districts of Chhattisgarh India, and germination of the seed is performed in the nursery of Guru Ghasidas Central University Bilaspur Chhattisgarh, situated in 22. 12° North and 82. 13° East soil type of the site is sandy to loam. The average temperature of the area is 29.5°C, annual rainfall is about 58 cm,

Experiments were carried out using mature fresh seeds from yellow fruits (Neem seeds called as Drupe) which was collected during June to August 2020, which were collected from plantations at the district of Chhattisgarh, namely, Balod, Bilaspur, Bemetara, Bijapur, Dhamtari, Gariaband, Pendra, Kondagaon, Mahasamund, Narayanpur. Seeds were planted on the nursery raise bed having a proper mixture of soil: sand: organic manure at 2-5 cm (plant to plant) x 15-10 cm (row to row) spacing at 2.0-2.5 cm depth with three replication. Seed

germination was recorded daily to a minimum of 28 days or until there was no further germination. The weeding, cleaning and watering of raise bed were done manually when needed. The raised bed were arranged RBD design with three replication.

### **Seed pre-sowing treatment**

The experiment was carried out in the nursery of Department of Forestry, Faculty of Natural Resources, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh. The sample of three hundred seeds per seed sources (three replications of 100 seeds of each treatment) was taken for study. Onraise bed with two pre-sowing treatments was employed, as mentation below:

T<sub>1</sub> = Seeds without any treatment (control)  
T<sub>2</sub> = Seeds soaked in normal water for 12 hours

After each pre-treatment, the seeds were sown in a raised bed for germination test in the nursery and the following parameters were recorded as given below:

### **Germination percent (GP)**

Germination percent has recorded the percent of the sown seeds germinated at the completion of the test period, i.e., 28 days after sowing (ISTA, 1999). It was calculated by the following formula:

$$GP (\%) = \frac{\text{Total number of seed germinated}}{\text{Total number of seeds sown}} \times 100$$

### **Germination value (GV)**

Germination value was recorded is an index combining speed and completeness of seed germination. It was calculated as per the method given by Czabator (1962):

$$GV = PV \times MDG$$

Where, GV = Germination value  
PV = Peak value of germination and  
MDG = Mean daily germination

### **Mean germination time (MGT)**

Mean germination time was recorded the time taken to complete germination was determine as MGT in days according to Bonner (1983) and Dey (2012) as given in below:

Mean Germination Time =

$$\frac{\Sigma (\text{Daily germination} \times \text{Days})}{\text{Number of seed sown}}$$

Where, n = number of seed, which was germinated on day D, and D is number of days counted from the beginning of germination

### **Seedling vigor index (SVI)**

The seedlings vigour index was calculated as per the formula given by Abdul-Baki and Anderson, 1973. It reflexes the health of the seedling produced.

$$SVI = \text{Germination percentage} (\%) \times \text{Seedling length (cm)}$$

### **Drupe (Seed with pulp) weight**

Hundred droupe weight of three replicates (each of 100 randomly selected capsules) for each source was recorded up to two decimal points as per ISTA (1996) rules using an electrical pan balance.

### **Seed moisture content (%)**

It was determined as per ISTA rule, 1999. Three randomly drawn samples of seed in

each seed sources were measured for fresh weight by placing each sample in the metal container. Then the metal container was placed in a hot air oven at 60°C for 7 days and re-weight until a constant weight had reached with the help of electronic balance. The moisture content was calculated as per the following formula:

Moisture content (%) =

$$\frac{\text{Fresh seed weight} - \text{Dry seed weight}}{\text{Fresh seed weight}} \times 100$$

## Results and Discussion

Drupe (seed) data were recorded of ten seed sources which are Seed germination on daily basis have been furnished in Figure 1, germination value in figure 2, Mean germination time (days) in figure 3, seedling vigor index in figure 4, seed weight in figure 5, and moisture content of seed figure 6 respectively, before sowing seed two different treatment were performed (i.e. pre-treated water and control).

### Seed germination percentage

Pre-treated water Seed sources of Naryanpura gave maximum germination percentage (94.33%), which was followed by Bilaspur (93.35%) and Bametera (90.55%) (Fig 1) while minimum value of germination percentage was recorded from Dhamatari (85.89%). Where in the control there was no treatment recorded germination percentage Bilaspur (91.00 %), followed by balod (88.63 %) while the minimum value of germination percentage was recorded from Dhamatari (83.00%). The differences for seed parameters was recorded significant (p= 0.05) among all seed sources. The same trend of significant was also observed in the year of study and seed sources. The present observations of this study are close agreement with the findings of

Pandey *et al.*, (2002), Naidu *et al.*, (2001) in *Sapindus foliatus*; and Kumar *et al.*, (2003) in *Gmelina arborea*. Milberg *et al.*, (1996) opined about the larger variability in germination parameters if seed lots are in wider variation. Seeds of a single species differ in germination when seeds are collected from different places and this phenomenon may be associated with altitude (Holm, 1994; Vera, 1997).

### Germination value (GV)

In Fig. 2 seed sources of Bilaspurgave maximum germination value (6.05) which was followed by Balod (5.96) and Kondagaon (5.87) while minimum germination value was recorded from Demetara (4.00), were in the control there was no treatment recorded highest germination value Bilaspur (5.02), followed by balod (5.76) while minimum value of germination value was recorded from Bemetera (4.60). The differences for seed parameters was observed significant (p= 0.05) among all seed sources. The same trend of significant was also observed in the year of study and seed sources. Germination value is a further expression of germination energy and has been used as an integrated measure of seed quality in *Pinus roxburghii* (Roy *et al.*, 2004), *Acacia nilotica* (Ginwal and Gera, 2000);. Besides germination percentage, the variation in germination value among different pre-treatments in the different seed sources are well in conformity with the findings of Hossain (2001) in *Tectona grandis*; in *Albizia lebbek* (Mutha *et al.*, 2004).

### Mean germination time (MGT)

In Fig. 3, seed sources of Pendra gave maximum Mean germination time (20.59) which was followed by Bemetera (20.40) and Gariband (20.22) while minimum germination value was recorded from Bijapur (19.44),

Where in the control there was no treatment recorded highest Mean germination time Bemetera (21.24), followed by Kondagaon (21.23) and Mahasamuand (21.15) while minimum value of mean germination time was recorded from Naryanpur (20.34). The differences for seed parameters was significant ( $p= 0.05$ ) among all seed sources. The same trend of significant was also observed in the year of study and seed sources. This finding is justified the hypothesis that better germination will take lesser time (MGT) to germinate. This explanation could be on the basis that activities in seed embryo go faster resulting in the utilization of accumulated food material and early germination. Lepcha (2015) in *Swietenia mahagony*, Roy *et al.*, (2004) reported somewhat similar results in seeds of *Pinus roxburghii*.

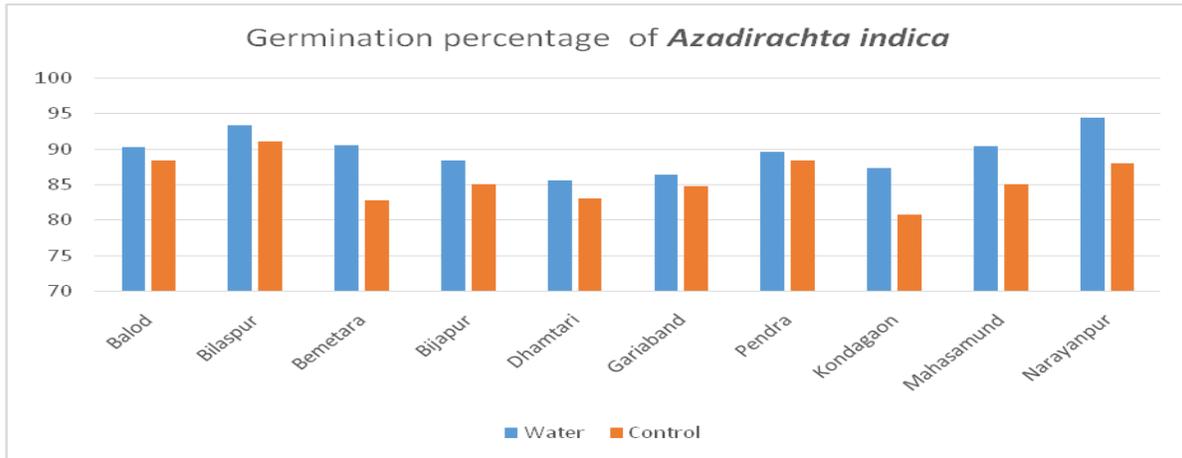
### Seedling vigor index (SVI)

In Fig. 4, seed sources of Bilaspur gave maximum Seedling vigor index (SVI) (3744.27) while minimum Seedling vigor index (SVI) was recorded from Bijapur (2885.74) which was followed by Pendra (2989.40), Where in the control there was no treatment recorded highest Seedling vigor index (SVI) Bilaspur (3854.76), while minimum Seedling vigor index (SVI) was recorded from Pendra (2979.07) which was followed by Gariaband (2985.46). The differences for seed parameters was noticed significant ( $p= 0.05$ ) among all seed sources. The same trend of significant was also observed in the year of study and seed sources.

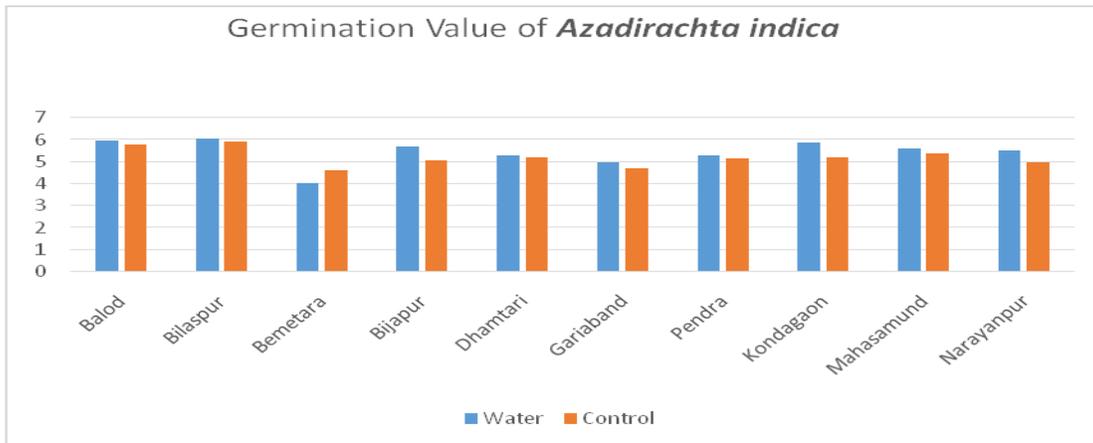
**Table.1** Geographic characteristics of seed sources of *Azadirachta indica*

S. No.	Name of seed source	District/ State	Latitude (N)	Longitude (E)	Altitude (msl)
1.	Balod	Balod, Chhattisgarh	20.73°	81.2°	326
2.	Bilaspur	Bilaspur, Chhattisgarh	22.09°	82.15°	208
3.	Bemetara	Bemetara, Chhattisgarh	21.70°	81.53°	282
4.	Bijapur	Bijapur, Chhattisgarh	18°47'30"	80°49'0"	303
5.	Dhamtari	Dhamtari, Chhattisgarh	20.71°	81.55°	319
6.	Gariaband	Gariaband, Chhattisgarh	20° 38' 0"	82° 4' 0"	340
7.	Pendra	Pendra Chhattisgarh	22.77°	81.95°	593
8.	Kondagaon	Kondagaon, Chhattisgarh	19.6°N	81.67°	596
9.	Mahasamund	Mahasamund, Chhattisgarh	21.11°	82.10°	321
10.	Narayanpur	Narayanpur, Chhattisgarh	19.7167°	81.2500°	540

**Fig.1** Germination percentage of *Azadirachta indica*



**Fig.2** Germination Value of *Azadirachta indica*



**Fig.3** Mean germination time (Days) of *Azadirachta indica*

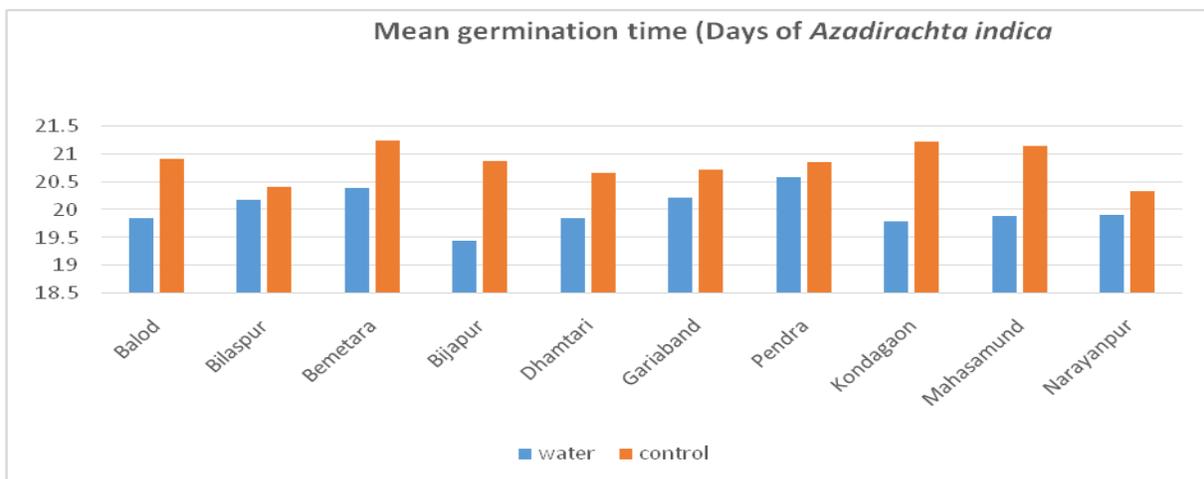


Fig.4 Seedlings vigour Index of *Azadirachta indica*

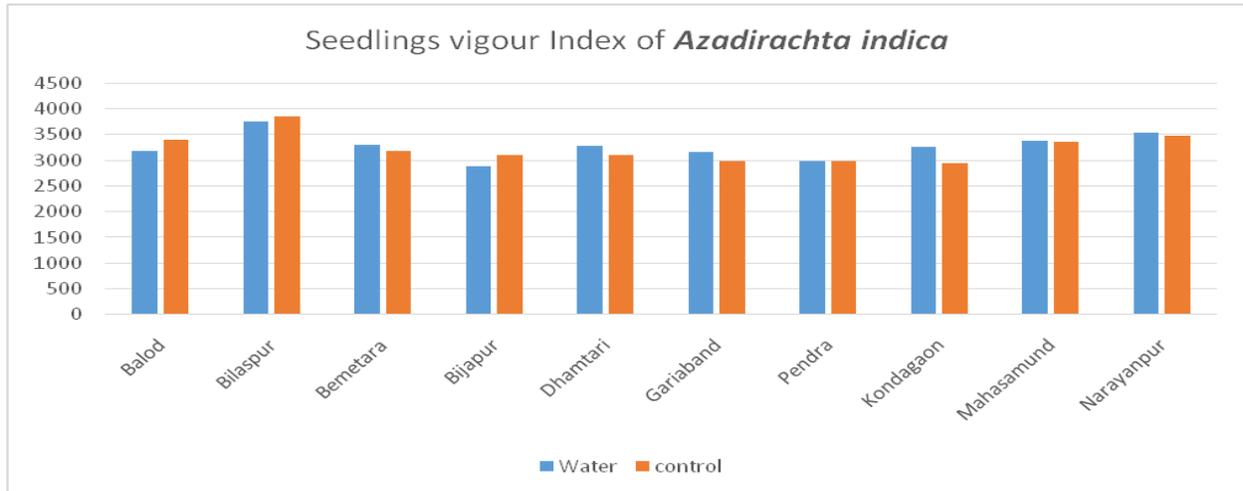


Fig.5 100 seed weight (g) with pulp

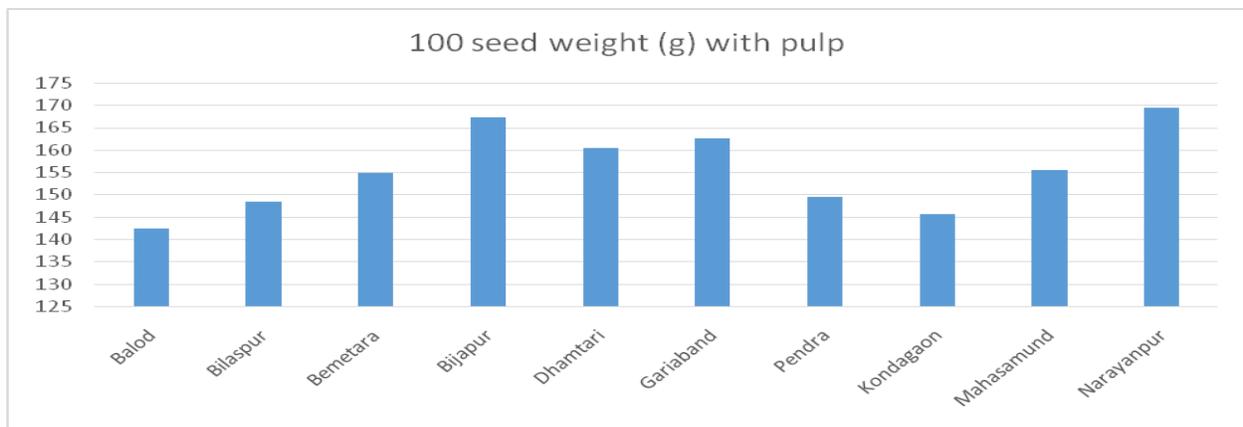
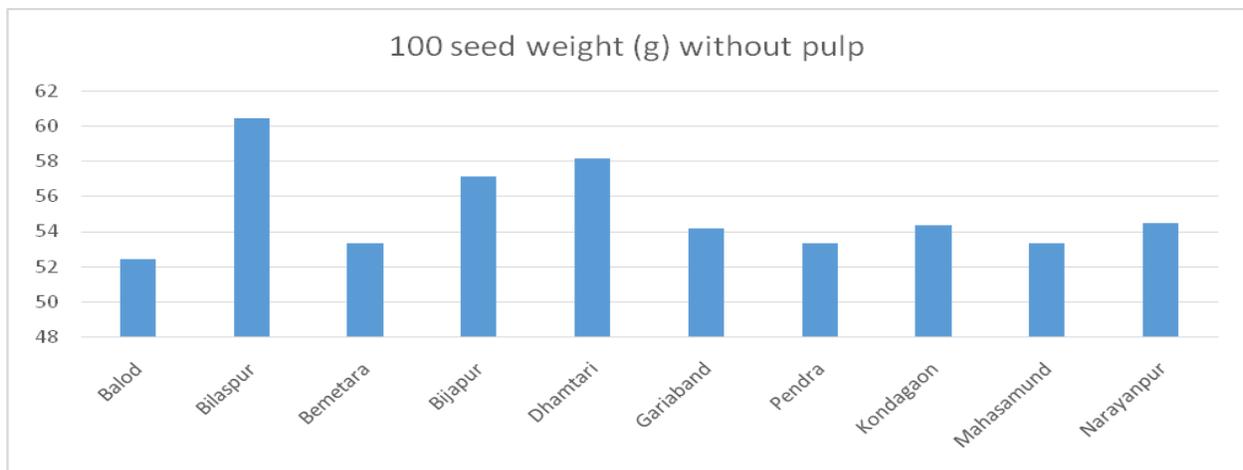
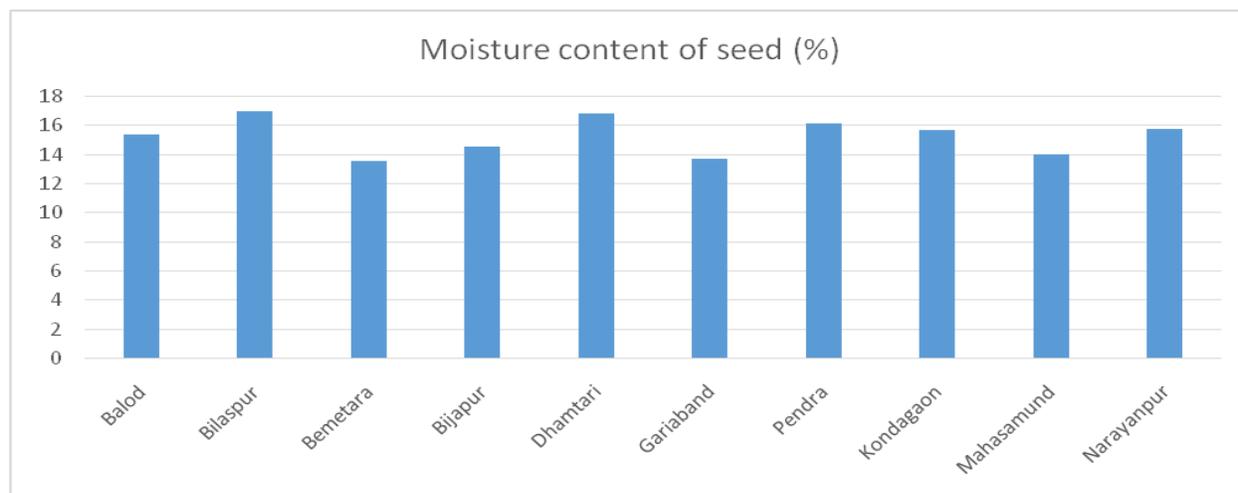


Fig.6 100 seed weight (g) without pulp



**Fig.7** Moisture content of seed (%)



### Drupe (Seed) weight (g) with pulp

In Fig. 5, seed sources of Bilaspur gave maximum Drupe weight (169.36g), which was followed by Dhamtari (167.38g), where lowest Drupe weight was recorded Balod (142.34g). The differences for seed parameters were significant ( $p= 0.05$ ) among all seed sources. This might be due to different environment at different geographic regions of each seed source and seasonal variables (Murali, 1997) (Table 1). Result of adaption to diverse environmental conditions throughout their range of distribution (Mathur *et al.*, 1984). Besides the age, vigour, crown structure and genotype of the mother plant, the locality factors of seed origin are important factors affecting seed traits (Salazar and Quesada, 1987). Such variations about the habitat have also been reported by Gera *et al.*, (2000) in *Dalbergia sissoo* Wang *et al.*, (1998) in *Pinus bungeana* (1998).

### Drupe (Seed) weight (g) without pulp

In Fig. 6, Seed sources of Bilaspur gave maximum Drupe weight without pulp (60.46g), which was followed by Dhamtari (58.15g), where lowest Drupe weight without pulp was recorded Balod (52.41g). The

differences for seed parameters were significant ( $p= 0.05$ ) among all seed sources. The same trend of significant was also observed in the year of study and seed sources.

### The moisture content of seed (%)

In Fig. 7, seed sources of Bilaspur gave maximum Moisture content (16.91%), which was closely followed by Dhamtari (16.81 %) and Pendra (16.12%), where lowest Moisture content was recorded Bemetara (13.51 %) which was closely followed by Gariaband (13.71 %). The differences for seed parameters was recorded significant ( $p= 0.05$ ) among all seed sources. This finding is a good agreement with the findings of Roberts (1973) who highlighted the variation in the moisture content of seed and altitude of seed source may be attributed to the environmental effects before, during and immediately after harvesting of seeds.

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