

**Seed germination and growth performance in *Hardwickia binata*****\*Shital Deshmukh and Namdeo Ghanawat**

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**Received :** 18.10.2019; **Accepted :** 04.11.2019**ABSTRACT**

*Hardwickia binata* comes under the endemic biodiversity category and it is multipurpose tree species useful for agroforestry and dry land areas with medicinal, fodder, fuel, fibre, timber and manure utility / potential. It is essential to know more about its seed germination and growth. In present studies the attempts have been made to investigate seed germination and growth performance at three different places located in three different districts. The seed germination and growth performance experiments were carried out for one year on different treatments in nursery, laboratory and field for parameters viz. seed germination, seedling growth and survival rate in *H. binata*. The investigations revealed that seed germination and growth performance considerably varies with soil combination and locality or region. This study results may be useful in nursery and forestry management as well as conservation of *H. binata*.

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KEY WORDS : *Hardwickia binata*, Germination, Growth performance, Seedlings survival.**Introduction**

*Hardwickia binata* Roxb. is commonly known as 'Anjan' held as near threatened in Madhya Pradesh<sup>12</sup>, endangered<sup>4</sup>, endemic in India<sup>15</sup>. It is a multipurpose tree species for agroforestry in dryland areas<sup>5</sup>. Medicinal plant<sup>11</sup> with fodder, fuel wood, fibre, timber, manure<sup>6, 7</sup> and agricultural potentials<sup>6</sup>. *H. binata* provides excellent firewood, good charcoal, manure and also Nitrogen fixer, soil improver, inter-croper, timber production and bark yields a strong fibre largely employed for making ropes<sup>9</sup>. *H. binata* is found in the Satpuda mountain ranges and its offshoots in Nandurbar, Dhule, Jalgaon districts in Maharashtra state in India. It is species of dry and hot climatic locality and is found in the Southern Tropical Dry Deciduous Mixed Forest type. It grows in the various soil types ranging from murrumy to black cotton<sup>3</sup>. *H. binata* an excellent fodder tree in its initial growth was slow<sup>10</sup>. *H. binata* grows in a dry climate characterised by a long drought, scanty to moderate rainfall and intense heat during the hot season. In its natural range, the seedling was sensitive to drought while from the 2<sup>nd</sup> year onwards, it is immune to injury from frosts. Young shoots are sensitive to fire but recovery is good<sup>9</sup>. Seed

germination is very complex process but important event in the life cycle of plant<sup>13</sup>. In present studies attempts were made to investigate the effect and compare the responses of different treatments on seed germination and growth performance in *H. binata* at three different localities in Maharashtra.

**Materials and Methods****Study site:**

The experiments were conducted at Atpadi (Tal- Atpadi, Swatantrapur vasahat) located in Sangali district (17° 25' N latitude, 74° 56' E longitude and altitude 555 m above sea level), Dhule (Tal-Dhule, Borvihar area) located in Dhule district (20° 54' N latitude, 74° 46' E longitude and altitude 250 m above sea level), Jalgaon (Tal- Muktainagar, Muktainagar forest) located in Jalgaon district (21° 0' N latitude, 75° 33' E longitude and altitude 243 m above sea level) and Satara ( Tal- Satara, Yashavantrao Chavan Institute of Science) located in Satara district 17° 41' N latitude, 74° 0' E longitude and altitude 742m above sea level).

**Seed material:**Dried pods containing mature seeds of *Hardwickia*

**ACKNOWLEDGEMENTS :** The authors are thankful to Principal and Head, Department of Botany, Yashavantrao Chavan Institute of Science, Satara for providing the facilities and cooperation during the research work.

**TABLE-1: Seed germination and early seedling growth of *H. binata* in laboratory**

Sr. N.	D	DSS	NSS	NSG	GP %	RL (cm)	SL (cm)	SFW (g)	SDW (g)	SH (cm)	SB (cm)	SW (g)
1	S	25.7.2015	30	17	56.66	8.13	1.53	6.75	0.78	2.29	1	28
		11.9.2015	30	27	90	10.61	3.27	15.22	7.03			
2	D	25.7.2015	30	23	76.66	8.23	1.95	11.55	1.19	2.17	0.77	28.68
		11.9.2015	30	29	96.66	4.82	1.96	10.91	5.70			
3	J	25.7.2015	30	28	93.33	7.77	1.85	10.05	1.36	2.16	0.81	24.37
		11.9.2015	30	30	100	6.68	2.02	12.40	6.25			

D-Districts, S-Sangali, D-Dhule, J-Jalgaon, DSS-Date of seed sowing, NSS-Number of seed sowing, NSG- Number of seed germinated, GP-Germination percentage, RL-Root length, SL-Shoot length, SFW-Seedling fresh weight, SDW-Seedling dry weight, SH-Seed height, SB-Seed breadth, SW-Seed weight.

*binata* were collected from different localities viz. Sangali, Dhule and Jalgaon Districts in Maharashtra. These seeds were used in seed germination and seedling growth performance studies.

#### Seed treatment:

Seeds of *H. binata* were decontaminated with the help of 0.1% Mercuric chloride (HgCl<sub>2</sub>) for 2 minutes then rinsed and soaked in distilled water overnight.

#### Seed replications:

All treatments in the experiments were conducted in triplicate.

#### Studied characters:

- 1. Seed height (cm):** Height of 10 seeds of each locality was measured.
- 2. Seed breadth (cm):** Breadth of 10 seeds of each locality was measured.
- 3. Seed weight (g):** Weight of 100 seeds of each locality was measured.
- 4. Seed germination:** Mature, healthy and viable seeds

were used in all the experiments.

#### i. Seed germination and early seedling growth in laboratory:

In laboratory, seeds were placed in glass petriplates with 2 layers of moistened filter papers. Germination percentage was recorded on 1<sup>st</sup> day while growth parameters viz. root length, shoot length and fresh weight of seedlings were measured after 14<sup>th</sup> day.

#### ii. Seed germination and seedlings survival in field:

In field experiment, 100 seeds were sown equidistantly at the 2-5 cm soil depth in each replication. Germination percentage was recorded on 14<sup>th</sup> day while seedlings of each locality allowed to grow for 1 year and survival rate was recorded.

#### iii. Seed germination, seedling growth and survival of seedlings in nursery:

The experiment was conducted in polyhouse nursery with 9 different combinations of soil in different ratios were used for seed germination and seedlings performance study. Seed germination was recorded on

**TABLE-2: Seed germination and seedlings survival of *Hardwickia binata* in field experiments.**

S.N.	Districts	Germination %	Seedlings survival %
1	Sangali	47.66	00
2	Dhule	41.66	26.66
3	Jalgaon	00	00

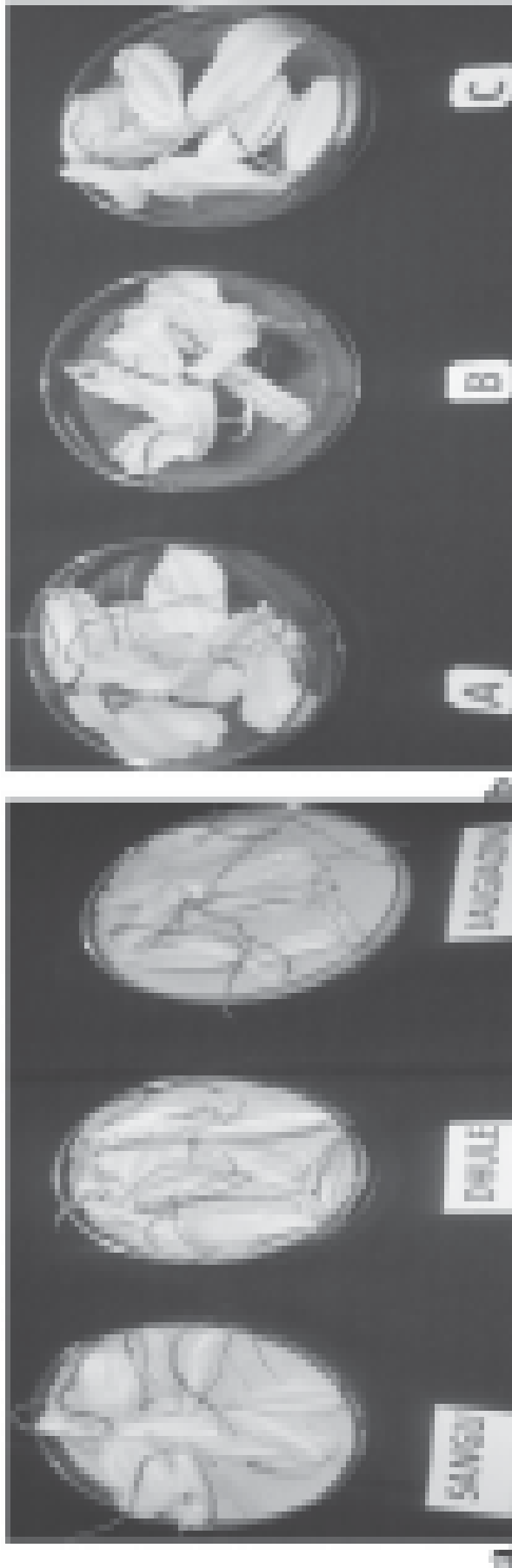


Fig. 1: a) Seed germination in July b) Seed germination in September c) Seedling length in July d) Seedling length in September e) Seed height

14<sup>th</sup> day while the growth performance and survival of seedlings were monitored and recorded at an interval of 1 month for 1 year.

## Results and Discussion

### Laboratory conditions- seed germination and early seedling growth:

The results of germination and early seedling growth presented in Table-1 and Fig.1 indicate that germination percentage was maximum in September than July. The rate of germination was highest in Jalgaon (100%) followed by Dhule (96.66%) and in Sangali (90%).

In July, root length, shoot length, seedling fresh weight and seedling dry weight were highest in Dhule as compared with Sangali and Jalgaon while in September, highest in Sangali as compared with Dhule and Jalgaon. In seed parameters seed height and breadth were found highest in Sangali than Dhule and Jalgaon while seed weight was observed maximum in Dhule than Sangali and Jalgaon. Seed germination study of *Stereospermum suaveolens* a number of seeds germinated in petridish containing filter paper had maximum seed germination when soaked in distilled water<sup>14</sup>.

**TABLE 3: Seed germination, seedling growth and seedling survival of *H. binata* at nursery technique**

S. N.	Soil combinations	Germination %			Seedling growth (cm)			Seedlings survival %		
		S	D	J	S	D	J	S	D	J
1	Pure Black	90	73.33	100	13.57 ±8.24	14.14 ±8.40	17.82 ±11.5	33.33	23.33	13.33
2	1Black: 1Red	86.66	73.33	86.66	14.90 ±7.19	14.20 ±5.91	14.23 ±6.92	33.33	26.66	26.66
3	1Black: 1FYM	96.66	93.33	93.33	13.81 ±5.31	13.54 ±5.39	14.25 ±7.04	46.66	16.66	13.33
4	1Black: 1VC	96.66	76.66	93.33	13.37 ±9.05	11.16 ±7.25	12.54 ±8.33	16.66	13.33	23.33
5	3Black: 1Red	96.66	80	86.66	15.32 ±8.79	15.26 ±8.28	11.29 ±6.48	26.66	13.33	6.66
6	Pure Red	93.33	93.33	93.33	13.99 ±6.46	15.15 ±6.44	13.82 ±6.33	43.33	50	13.33
7	1Red: 1FYM	83.33	100	76.66	14.21 ±8.07	11.80 ±3.92	12.05 ±4.09	30	43.33	13.33
8	1Red: 1VC	100	96.66	83.33	12.42 ±5.63	11.90 ±5.68	11.15 ±6.53	36.66	40	30
9	1Black: 3Red	83.33	96.66	93.33	12.61 ±6.06	13.50 ±5.02	12.53 ±5.25	13.33	43.33	40

S- Sangali, D- Dhule, J- Jalgaon, FYM-Farm yard manure, VC-Vermicompost

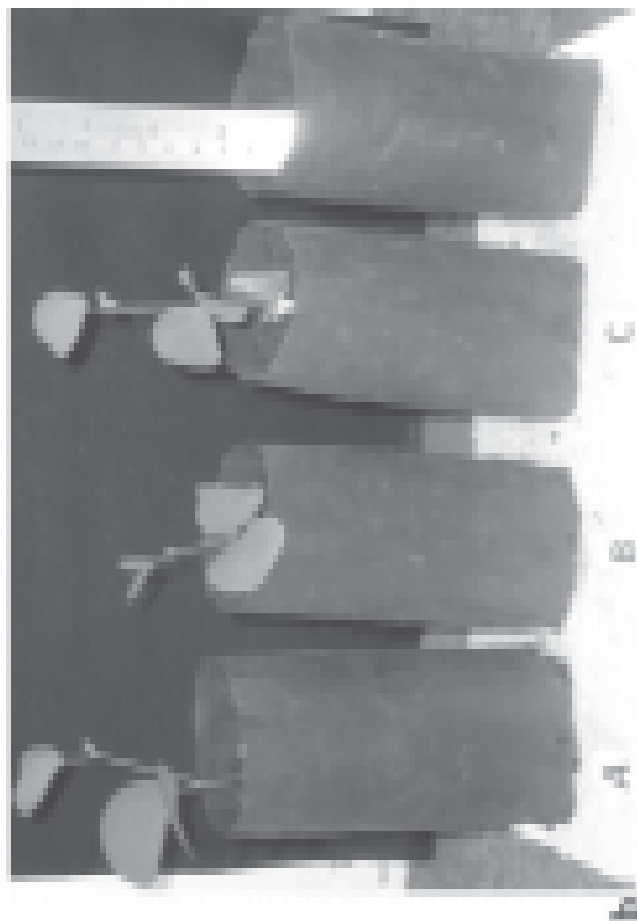
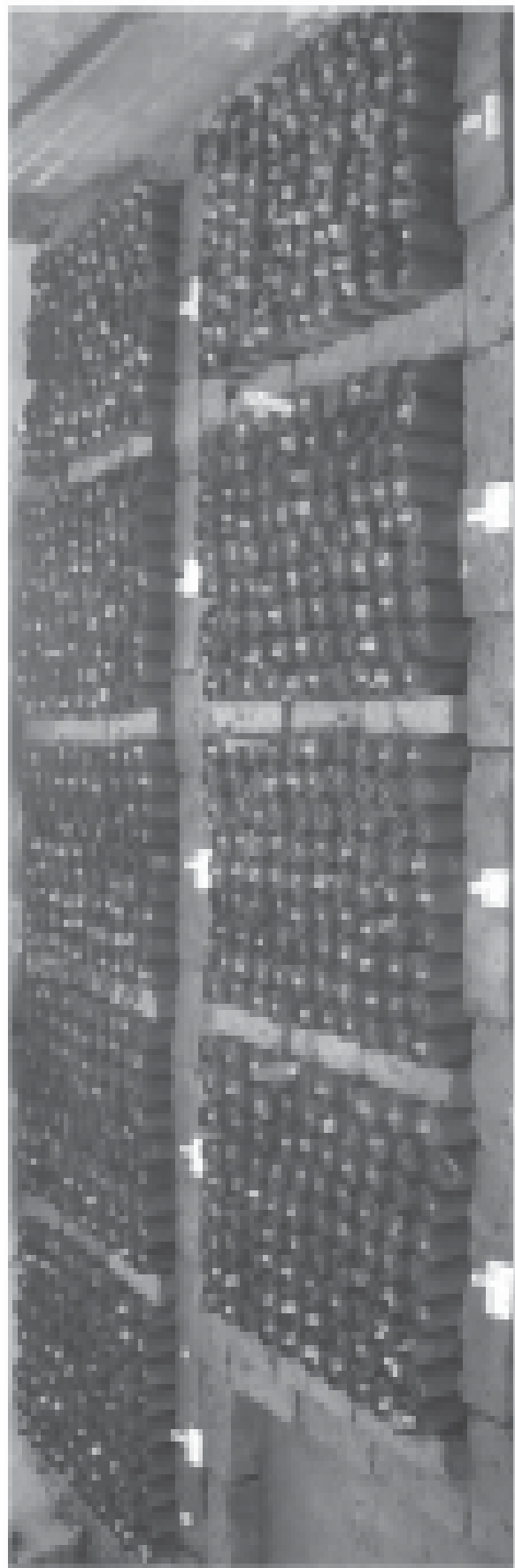


Fig. 2 : Depiction of Seedling growth of *Hardwickia binata*

### Field experiment- seed germination and seedlings survival:

The results are depicted in Table 2. Germination percentage was observed maximum in Sangali district (47.66 %) followed by Dhule (41.66 %) while no seed germination was observed in Jalgaon may be due to adverse effects of environmental conditions (very high rainfall) on seed germination. After germination seedlings of each locality allowed to grow for 1 year and seedling survival was observed after one year only in Dhule and no seedlings were observed in Sangali as well as Jalgaon Districts. Field seed germination studies in *H. binata* revealed that the extreme environmental conditions viz. very high rainfall for long period severely affected the seed germination. A variety of factors including environmental as well as endogenous affected the seed germination<sup>13</sup>. Similarly earlier studies reported that *H. binata* propagations through seeds are unreliable due to poor germination and death of young seedlings under natural environmental conditions<sup>2</sup>.

### Nursery Technique- seed germination, seedlings growth and survival of seedlings:

The results of germination percentage, seedling growth and survival percentage of *Hardwickia binata* at nursery stage are depicted in Table 3 and fig 2. The highest germination was found in pure black, 1red:1farm yard manure and 1red:1vermicompost while lowest germination was observed in 1black:1red combination of soil. In nursery technique, in all soil combinations there was highest germination in Sangali district. The seedling growth was maximum in Sangali with 1black:1red soil combination while lowest in Dhule and Jalgaon with 1red:1vc soil combinations. The seedling survival percentage was found highest in Sangali with pure red

soil while lowest survival was there in Jalgaon with 3black:1red soil combination. In earlier studies of *H. binata* reported that seed orientation and depth of sowing on germination placing the seeds with the embryo in a horizontal or inverted position gave early and higher germination, higher root and shoot length, greater dry matter production and vigour index<sup>7</sup>. The aphid attacks in the nursery can cause mortality<sup>9</sup>. *H. binata* is sensitive to frost when young but grows more frost hardy with age. Young shoots sensitive to fire but recovery is good. Seed germination after 14<sup>th</sup> day and soaking of seeds in cold water overnight. These results are similar with previous findings. *H. binata* seeds may start germinating in 10-15 days and soaking of seeds in cold water for 24 hours prior to sowing gives satisfactory results. Shading of nursery beds was necessary as exposure of tiny seedlings to hot sun results in large scale mortality in the dry localities. Growth and survival of seedlings was improved by mulching and shade<sup>6</sup>. *H. binata* showed good germination, seedling growth and biochemical constituents when seeds sown in soil having higher pH along with sand and farm yard manure mixture<sup>8</sup>. Raising high quality and large number of seedlings in a greenhouse play significant role for growth performance and adaptation of seedlings at field conditions<sup>1</sup>.

### Conclusion

The present investigation of *H. binata* revealed the effect of different treatments as well as environmental conditions on seed germination and seedling performance. The best results were obtained with a combination of 1red:1farmyard manure, 1red:1vermicompost and pure black soil. Thus this study would provide key useful information of nursery and forestry management as well as conservation of species.

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