

---

Q.)

(*Quercus brantii*)

( )

(*Q. libani*)

(*infectoria*)

...

*Q.*

*ilex*

*Q. canariensis* *Q. suber*

(Marañón et al., 2004)

Marañón et al., )

(2004 ; Castro, 1999

Jazirehi & Ebrahimi )

Dillon, )

(Rostaghi, 2003

*Pinus*

(1984 ; Winn, 1988

*Strubus*

Parker et al., )

*Q. rugosa*

(2006

*Q. laurina*

(Broncano et al., 1998)

(Gazala & Kubiske, 2004)

Khan et )

Miao, )

(al., 1999 ; Murali, 1997

(1995 ; Eriksson, 1999

(Karrfalt, 2004)

(Eriksson, 1999)

)

(

(Miao, 1995)

*Picea*

(Humara et al., 2002)

*sitchensis*

Navarro et (Chaisurisri et al., 1994)

al. (2006)

(2009)

(Alvaninejad et al., 2009)

Alvaninejad et al., )

(2008

(Akbari et al., 2001)

Archive of SID

(MTE )

(Souhani, 2007)

$$MTE = \sum_t (n/t) / \sum_n n$$

(Neophytou et al., 2007)

=n

=t

( )

( )

( )

( )

( )

( )

Broncano et )

(

Tilki et al., )

<sup>1</sup> Mean time of emergence

...

$$=H \left( \frac{V}{D^2} \right) =D \left( \frac{V}{H} \right)$$

( )

$$V = D^2 \times H \quad (SVI)$$

Kim) =%G

(et al., 1987

( )

( )

$$SVI = \%G \times \bar{H}$$

( )

( )

SPSS 16.0

( )

(PCA)

PC-ORD 4.17

( )

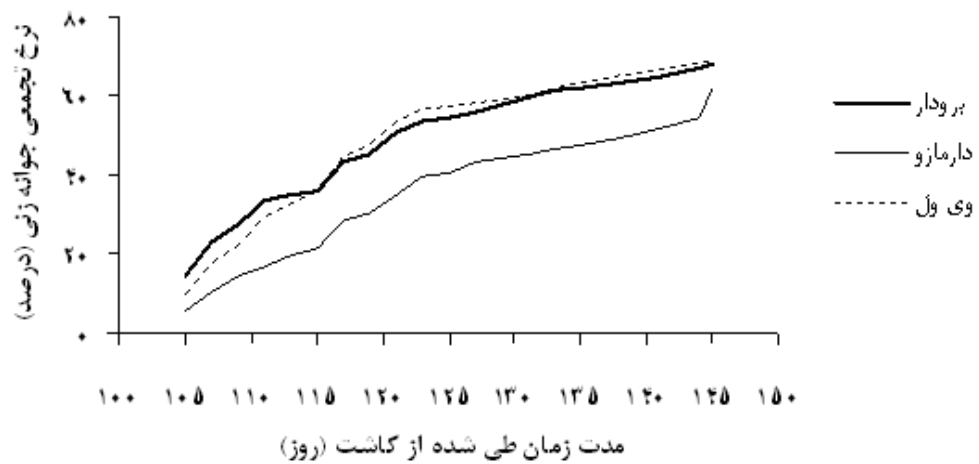
<sup>1</sup> Seedling vigor index

( )	( )	( )			
/	/	/	/	/	MST
/	/	/	/	/	F
/ **	/ **	/ **	/ **	/ ns	P
	ns	/	**	P	F
					= MST

/ a	/ a	/ a	( )
/ a	/ b	/ ab	( )
b	a	ab	
/ c	/ a	/ b	
/ a	/ b	/ b	( )

P	F	MST		P	F	MST	
/ ns	/			**	ch		( )
**	/	/	( )	**	ch		
/	/	/	( )	/	/		
**	/	/	( )	**	ch		( )
/	/	/	( )	**	/	/	( )
**	/	/	( )	ns	/		
ns	/	/		**	ch		( )
/	/	/		/	/		
ns	/	/		**	ch		
/ *	/	/	( )	**	ch		( )
				/	/	/	( )
				**	/	/	( )
	ns	/	*	/	**	ch	P
							F

/ a	/ b	/ b	( )
/ a	/ b	/ b	
/ a	/ c	/ b	( )
/ a	/ c	/ b	( )
/ a	/ a	/ a	
/ a	/ b	/ b	( )
/ a	/ b	/ b	
/ a	/ c	/ b	( )
/ a	/ b	/ b	( )
/ a	/ a	/ a	
/ a	/ b	/ b	( )
/ a	/ c	/ b	( )
/ a	/ b	/ b	( )
/ a	/ b	/ b	( )
/ a	/ a	/ a	
/ a	/ a	/ a	
/ ab	/ a	/ b	( )



---

( / ) ( / )  
( / ) ( / )  
( / )  
PCA -

( )

PCA

---

---

/	/	/	.
/	/	/	.
/	/	/	.
/	/	/	.
/	/	/	.
/	/	/	/
/	/	/	/

---

Archive of SID

( )

( / )

( / )  
PCA

( / )

( / )  
( / / )

( / )

PCA

( )

...

( )

( )

PCA

---

---

/	/	/	/
/	/	/	/
/	/	/	/
/	/	/	/
/	/	/	/
/	/	/	/
/	/	/	/

---

PCA

---

---

/	/	/	/
/	/	/	/
/	/	/	/
/	/	/	/
/	/	/	/
/	/	/	/
/	/	/	/

---

Turna, )

Eriksson (1999) Miao (1995)

(2004



---

( )

Schultz & Thompson (1992)

Bellari & Tani (1993) Abideen et al. (1993)

Karrfalt (2004)

(

Gomez

*Q. ilex*

(2004)

Parker et al. ( )

- Karrfalt (2004) (2006)

...

Alvaninejad et al. (2009)

- (Cicek & Tilki, 2007)

Akbari et )

(al., 2001

( )

(Armstrong & Westoby, 1993)

...

---

Khan et al. (1999) .

Archive of SID

<sup>1</sup> Outcrossing

---

## References

- Abideen, M.Z., Gopikumar, K. and Jamaludheen, V. 1993. Effect of seed charechter and its nutrient content on vigour of seedlings in *Pongamina pinnata* and *Tamarindas indica*. My forest. Vol. 29. 225-230.
- Akbari, H., Gudarzi, D. and Sohrabi, S.R. 2001. The study of the effect of moisture-temperature factor on germination of oak (*Quercus brantii*) seeds in Khoramabad, Lorestan province. Iranian Journal of Natural Resource. 54(3). 247-255.
- Alvaninejad, S., Tabari, M., Taghvae, M., Espahbodi, K. and Hamzpour, M. 2008. Effect of desiccation on germination and vigor of Manna Oak (*Quercus brantii* Lindl.) acorns. Iranian Journal of Forest and Poplar Research. Vol. 16(4). 574-582.
- Alvaninejad, S., Tabari, M., Taghvae, M., Espahbodi, K. and Hamzpour, M. 2009. Morphology and germination characteristics of *Quercus brantii* Lindl. Acorns in nursery. Iranian Journal of Forest and Poplar Research. Vol. 17(4). 523-533.
- Armstrong, D.P. and Westoby, M. 1993. Seedlings from large seeds tolerate defoliation better: a test using phylogenetically independent contrasts. Ecology. Vol. 74. 1092-1100.
- Bellari, C. and Tani, A. 1993. Influence of time of collection on the viability of seeds of *Alnus cordata*. Annual Academic Italian Science Forest. Vol. 42. 259-285.
- Broncano, M.J., Riba, M. and Retana, J. 1998. Seed germination and seedling performance of two Mediterranean tree species, holm oak (*Quercus ilex* L.) and Aleppo pine (*Pinus halepensis* Mill.): a multifactor experimental approach. Plant Ecology. Vol. 138. 17-26.
- Castro, J. 1999. Seed mass versus seedling performance in Scots pine: a maternally dependent trait. New Phytologist. Vol. 144. 153-161.
- Chaisurisri, K., Edwards, D.G.W. and El-kassaby, Y.A. 1994. Effects of seed size on seedling attributes in Sitka spruce. New forests. Vol. 8. 81-87.
- Cicek, E. and Tilki, F. 2007. Seed size effect on germination, survival and seedling growth of *Castanea sativa* Mill. Journal of biological science. Vol. 7(2). 438-441.
- Dillon, M.O. 1984. A systematic study of Flourensia (*Asteraceae*, *Heliantheae*). Fieldiana Botany. Vol. 16. 64-65.
- Eriksson, O. 1999. Seed size variation and its effect on germination and seedling performance in the clonal herb *Convallaria majalis*. Acta Oecologica. Vol. 20. 61-66.
- Gazala, R.M. and Kubiske, M.E. 2004. Influence of initial root length on physiological responses of cherrybark oak and shumard oak seedlings to field drought conditions. Forest Ecology and Management. Vol. 189. 295-305.
- Gomez, J.M. 2004. Bigger is not always better: Conflicting selective pressures on seed size in *Quercus ilex*. Evolution. Vol. 58. 71-80.
- Humara, J.M., Casares, A. and Majada, J. 2002. Effect of seed size and growing media water availability on early seedling growth in *Eucalyptus globulus*. Forest Ecology and Management. Vol. 167. 1-11.
- Jazirehi, M. H. and M. Ebrahimi Rostaghi, 2003. Silviculture in Zagros, University of Tehran press, 560 pp.
- Karrfalt, R.P., 2004. How acorn size influences seedling size and possible seed management choices. In: Riley, I.E. (Eds.), National Proceedings, Forest and Conservation Nursery Associations-2003, USDA Forest Service. RMRS-P-33, Fort Collins, CO, pp. 117-118.
- Khan, M.L., Bhuyan, P., Shankar, U., Singh, N.D. and Todaria, N.P. 1999. Seed germination and seedling fitness in *Mesua ferra* L. in relation to fruit size and seed number per fruit. Acta Oecologica. Vol. 20. 599-606.
- Kim, S.H., Choe, Z.R. and Kang, Y.H. 1987. Vigor determination in barely seed by multiple criteria. Korean Journal of Crop Science. Vol. 32 (4). 417-427.
- Marañón T., Villar R., Quero, J.L. and Pérez-Ramos, I.M. 2004. Análisis del crecimiento de plántulas de *Quercus suber* y *Q. canariensis*: experimentos de campoy de invernadero. Cuadernos de la Sociedad Espanola de Ciencias Forestales. Vol. 20. 87-92.

...

- 
- Miao, S. 1995. Acorn mass and seedling growth in *Quercus rubra* in response to elevated CO<sub>2</sub>. *Journal of Vegetation Science*. Vol. 6. 697-700 pp.
  - Murali, K.S. 1997. Pattern of seed size, germination and seed viability of tropical tree species in Southern India. *Biotropica*. Vol. 29. 271-279.
  - Navarro, F.B., Jimenez, M.N., Ripoll, M.A., Fernandez-Ondono, E., Gallego, E. and Simon, E.D. 2006. Direct sowing of holm oak acorns: effects of acorn size and soil treatment. *Annual Forest Science*. Vol. 63. 961-967.
  - Neophytou, Ch., Palli, G., Douvani, A. and Aravanopoulos, F.A., 2007. Morphological differentiation and hybridization between *Quercus alnifolia* Poech and *Quercus coccifera* L. (*Fagaceae*) in Cyprus. *Silvae Genetica*. Vol. 56. 271-276.
  - Parker, W.C., Noland, T.L. and Morneault, A.E. 2006. The effects of seed mass on germination, seedling emergence, and early seedling growth of eastern white pine (*Pinus strobus* L.). *New Forests*. Vol. 32. 33-49.
  - Schultz, R.C. and Thompson, J.R., 1992. Hardwood seedling root morphology and nursery practices. In: Branan, J., Moorhead, D. Proceedings, Southern Forest Nursery Association Conference, July, 20-30, Pine mountain, Georgia Forestry Commission and Southern Forest Nursery Association, pp. 31-53.
  - Souhani, M.M, 2007. Seed technology, 2<sup>nd</sup> Edition, Guilan university press, 287 pp.
  - Tilki, F., Yuksek, F.T. and Guner, S. 2009. The effect of undercutting on growth and morphology of 1+0 bareroot Sessile oak seedlings in relation to acorn size. *Australian Journal of Basic and Applied Sciences*. Vol. 3(4). 3900-3905.
  - Turna, I. 2004. Variation of morphological characters of oriental spruce (*Picea orientalis*) in Turkey. *Biologia Bratislava*. Vol. 59(4). 519-526.
  - Winn, A.A. 1988. Ecological and evolutionary consequences of seed size in *Prunella vulgaris*. *Ecology*. Vol. 69. 1537-1544.

Archive of SID

## Relation between seed morphological characteristics of three native oak species of *Zagros* with germination characteristics and seedling growth

R. Zolfaghari<sup>1\*</sup>, M. Nazari<sup>2</sup>, Kh. Karimi<sup>2</sup>, P. Fayyaz and S. Alvaninejad<sup>1</sup>

<sup>1</sup> Assistant Prof., Yasouj University, I.R. Iran

<sup>2</sup> M.Sc Student, Yasouj University, I.R. Iran

(Received: 30 October 2010, Accepted: 26 December 2011)

### Abstract

Conservation and development of *Zagros* oak forests requires collecting appropriate seeds for reforestation and afforestation plans. For this purpose, seeds of 60 trees of *Quercus brantii*, *infectoria* and *libani* (20 trees from each species) were collected from forests of *Baneh*, western Iran. After picking up 5 trees with distinct seed weight, the correlation between seed morphological characteristics and its growing traits like seed germination parameters and primary growth of seedling was investigated. The results showed that *Quercus libani* had larger seeds and seedlings compare to other species, but no significant differences in germination rate were observed between these three species. Also *Quercus infectoria* showed highest average time of germination. Regardless of species, primary growth of seedlings was affected by different seed morphological characteristics. So that, wider, more circular, bigger and heavier seeds produced larger seedlings. This correlation was higher in *Quercus brantii* and lower in *Q. infectoria*. But, there was no significant correlation between seed morphology and germination parameters in three oak species.

**Keywords:** *Quercus brantii*, *Quercus infectoria*, *Quercus libani*, Seed morphology, Germination, Seedling growth