

**(*Brassica napus* cv. PF7045/91)**

\*

*haddadi@ut.ac.ir* : - \*  
( / / : / / : )

( / ) / / °C  
 % NLN-13 / - / mm  
 °C B<sub>5</sub> - mm °C  
 \* ( : ( ml ( ml  
 / ml  
 α = / α = /  
 % / % / ( % % ) a

*Brassica napus* L. :

Rape seed *Brassica napus*

(Doubled Haploid)

(Androgenesis)

- ( )  
 .( ) % -%  
 ( n = x = )

(Dunwell 1996)

( )

(Mass selection)

(Lichter 1982)

(Pedigree)

Keller *et al.* )

: (1987

Takahata *et al.* )

(Kuginuki *et al.* 1997) -

( )

	/ - / mm	Fan <i>et al.</i>	(1993, Li & Guan 2003)
% /		)	( <i>al.</i> 1988)
		(Polsoni <i>et al.</i> 1988)	
		(Fletcher <i>et al.</i> 1998)	
(Fletcher <i>et al.</i> 1998)		(Pechan & Keller 1988)	
		(	
	pH	-	(Pechan <i>et al.</i> 1991) (Takahata 1997)
	/ °C		
	ml		
	µm µm		(Huang <i>et al.</i> 1991)
rpm ( g)			
			(Takahata & Keller 1991)
Lichter ) NLN-13	ml	(1982	(Kott & Beversdorf 1990)
		(ABA)	
	/ ( × mm)		ABA
	/ ml	(Takahata 1997)	(Wakui <i>et al.</i> 1994)
	°C		
( rpm)			(Gland <i>et al.</i> 1988)
			°C
(Gamborg <i>et al.</i> 1968) B5			
% /	% (GA3)	/ mg l <sup>-1</sup>	
)		pH	
( cm			PF7045 / 91
°C			
	°C		
			PF
		/ cm	cm
		/ ) / h	
( :		( / ) / °C	(
	ml		

ml ( ( B ) )

( ( A ) ) / ml \* mm

(Activated Charcoal) % - SPSS

Gland *et al.* )

(1988) arcsin√x

%

/

(Zhao *et al.* 1996)

BAP B<sub>5</sub>

BAP B<sub>5</sub>

(Licher 1985, Swanson *et al.* 1987) ( ( A ) )

Fletcher *et al.* )

(1998) α = /

B<sub>5</sub> mm

/ ( )

α = /

a

mm (% % )

b %

( )

ABA /

ABA /

ABA

(Kawana & Ohkawa 1992)

ABA ( : )

Chinese Cabbage (

(Takahata *et al.* 1992) (

(Cotyledonary)

(Baillie *et al.* 1992)

( )

α = /

( )

( B )

b / (c )  
% / ( A )

% /

Keller *et al.* )

a

(1987, Huang *et al.* 1991

% /

( D )

/

(c )

NLN-13

ABA

% /

(Senaratna *et al.* 1991)

b

( C )

(Fletcher *et al.* 1998)

RAPD

(Zhang *et al.* 2003)

$\alpha = /$

(Wang *et al.* 2002)

( )

B

B5

( )

% /

B5

( g l<sup>-1</sup> )

a

(Li & Guan 2003)

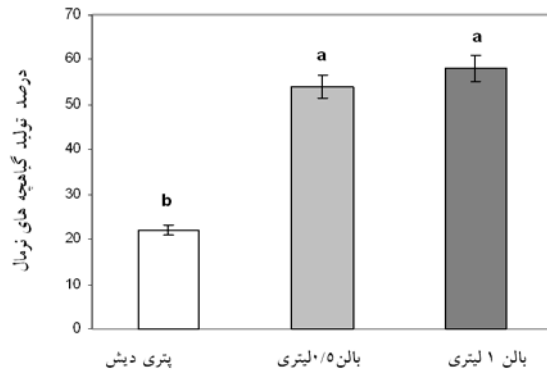
% /

-

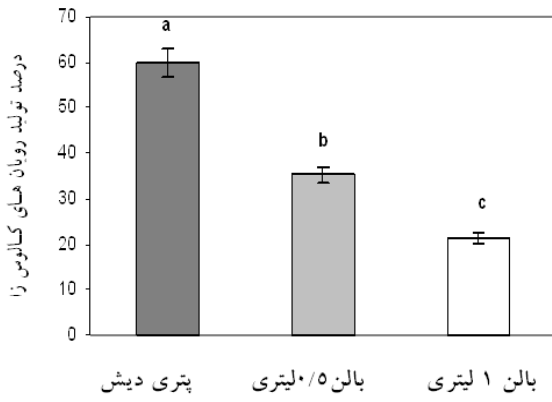
/ \*\* / \*\* / \*\*

/ / /

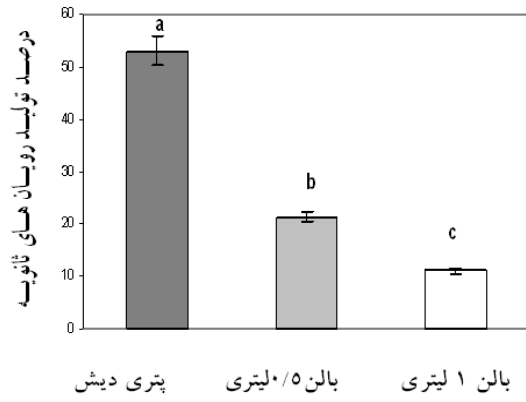
% / % / % / (C.V.)



(±SE)

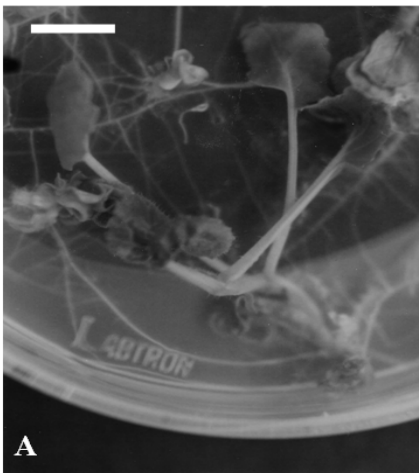


-B

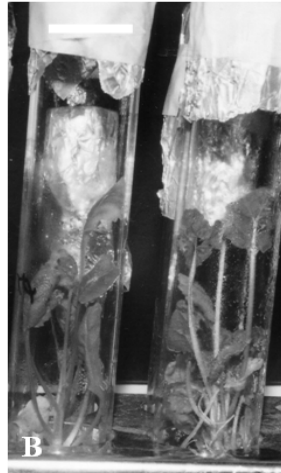


-A :

(±SE)



A



B



C

-B

- A -

.Bar = 1 cm .

-C



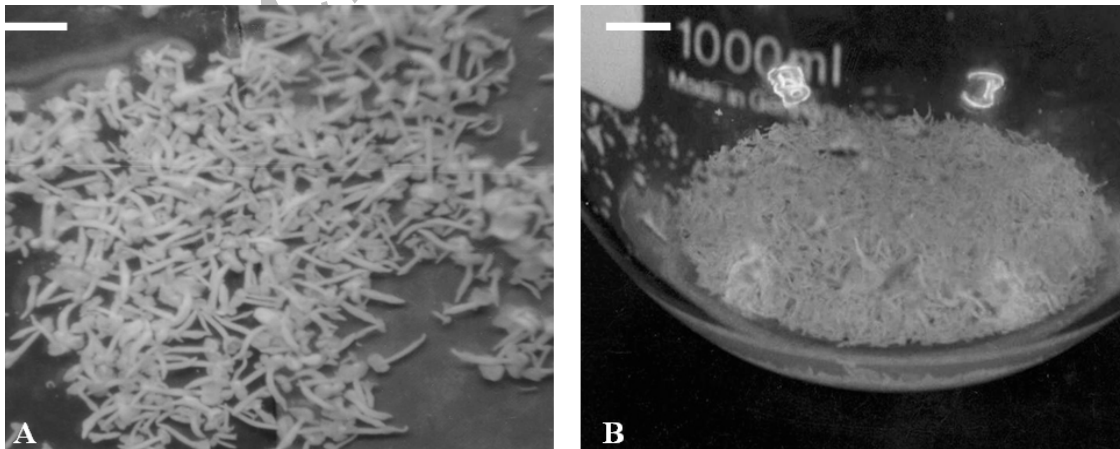
-A (*Brassica napus* L. cv. PF) -

-D

-C

-B

.5 cm (D) Bar = 1000  $\mu$ m (A - C) .



.Bar = 1 cm .

-B

-A -

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(*Brassica napus* L.)

- Baillie A. M.K., Epp D.J., Hutcheson D., Keller W.A. 1992: In vitro culture of isolated microspore and regeneration of plants in *Brassica campestris*. *Pl. Cell Rep.* **11**: 234-237.
- Dunwell J.M. 1996: Microspore culture. In: Mohan J. Sopory S.K., Veilleux R.E. (eds) In vitro Haploid production in higher plants. Vol. 1. Kluwer Academic Publishers. The Netherlands, Pp. 205 -216.
- Fan Z., Armstrong K.C., Keller W.A. 1988: Development of microspores in vivo and in vitro in *Brassica napus*. *Protoplasma* **147**: 191-199.
- Fletcher R., Coventry J., Kott L.S. 1998: Doubled haploid technology for spring and winter *Brassica napus*. *Technical Bulletin*, OAC Publication, Canada.
- Gamborg O.L., Miller R.A., Ojiwa K. 1968: Nutrient requirements of suspension culture of soybean root callus. *Exp. Cell Res.* **50**: 151-158.
- Gland A., Lichter R., Schweiger H.G. 1988: Genetic and exogenous factors affecting embryogenesis in isolated microspore culture of *Brassica napus*. *Pl. Physiol.* **132**: 613-617.
- Huang B., Swanson E.B., Baszczynski C.L., Macrae W.D., Bardour E., Armavil V., Wohe L., Arnoldo M., Rozakis S., Westcott M., Keats R.F., Kimble R. 1991: Application of microspore culture to canola improvement. In McGregor D.I. (ed) The Proceeding of 8<sup>th</sup> International Rapeseed Congres. Canada, Saskatoon, Pp.298-302.
- Kawana H., Ohkawa Y. 1992: Methods for high frequency leafing of microspore derived embryos. *Japan J. Breed.* **42**: 70-71.
- Keller W.A., Arnison P.G., Cardy B.K. 1987: Haploids from gametophytic cells recent development and future prospects. In Green C.E., Somers D.A., Nackett W.P., Biesbore D.D. (eds) Plant Tissue and Cell Culture. Allan R. Liss, New York, USA, Pp. 233-241.
- Kott L., Beversdorf W.D. 1990: Enhanced plant regeneration from microspore-derived embryos of *Brassica napus* by chilling, partial desiccation and age selection. *Pl. Cell Tissue Organ Cult.* **23**: 187-192.
- Kuginuki Y., Nakamura K., Hida K., Yoshikawa H. 1997: Varietal differences in embryogenic and regenerative ability in microspore culture of Chinese cabbage (*Brassica rapa* L. ssp. *Pekinensis*). *Breed Sci.* **47**: 341-346.
- Li X., Guan C. 2003: Studies of microspore culture and doubled haploid breeding on rapeseed, plant regeneration from microspore derived embryos of F1 hybrids between *Brassica napus* and *Brassica juncea*. *The Proceeding of The 11<sup>th</sup> International Rapeseed Congress*, Pp. 132.
- Licher R. 1985: From microspores to rape plants, a tentative way to low glucosinolate strains. In: Sorensen H. (ed) cruciferous crops: production, utilisation, description, vol. II. Nijhoff/Junk, Dordrecht Boston Lancaster, Pp. 68-277.
- Lichter R. 1982: Efficient yield of embryoids by culture of isolated microspore of different Brassicaceae species. *Pl. Breed.* **103**: 119-123.
- Pechan P.M., Keller W.A. 1988: Identification of potentially embryogenic microspores in *Brassica napus*. *Physiol. Pl.* **74**: 377-384.
- Pechan P.M., Bartels D., Brown D.C.W., Schell J. 1991: Messengers RNA and protein changes associated with induction of *Brassica* microspore embryogenesis. *Planta* **184**: 161-165.
- Polsoni L., Kott L.S., Beversdorf W.D. 1988: Large-scale microspore culture technique for mutation/selection studies in *Brassica napus*. *Can. J. Bot.* **66**: 1681-1685.
- Senaratna T., Kott L., Beversdorf D.W., McKersie D. 1991: Desiccation of microspore derived embryos of oilseed rape (*Brassica napus* L.). *Pl. Cell Rep.* **10**: 342-344.
- Swanson E.B., Coumans M.P., Ching Wu. S., Barsby L., Beversdorf W.D. 1987: Efficient isolation of microspores and the production of microspore-derived embryos from *Brassica napus*. *Pl. Cell Rep.* **6**: 94-97.
- Takahata Y., Keller W.A. 1991: High frequency embryogenesis and plant regeneration in isolated microspore culture of *Brassica oleracea* L. *Pl. Sci.* **74**: 235-242.
- Takahata Y., Wakui K., Kaizuma N. 1992: A dry artificial seed system for *Brassica* crops. *Acta Horti.* **1**: 317-322.
- Takahata Y., Brown D.C.W., Keller W.A., Kaizuma N. 1993: Dry artificial seeds and desiccation tolerance induction in microspore-derived embryos of broccoli. *Pl. Cell Tiss. Organ Cult.* **35**: 121-129.

- 
- Takahata Y. 1997: Microspore culture. In Kalia H.R., Gupta S.K. (eds) *Recent Advances in Oilseed Brassica*. Kayani Publishers, Ludhiana, Pp. 160-181.
- Wakui K., Takahata Y., Kaizuma N. 1994: Effect of abscisic acid and high osmoticum concentration on the induction of desiccation tolerance in microspore derived embryos of Chinese cabbage (*Brassica campestris* L.). *Breed. Sci.* **44**: 29-34.
- Wang X., Loh C., Yeoh H., Sun W. 2002: Drying rate and dehydrin synthesis associated with abscisic acid-induced dehydration tolerance in *Spathoglottis plicata* protocorms. *Exp. Bot.* **53**: 551-558.
- Zhang F., Aoki, S., Takahata Y. 2003: RAPD markers linked to microspore embryogenic ability in *Brassica* crops. *Euphytica* **131**: 207-2123.
- Zhao J.P., Simmonds D.H., William N. 1996: High frequency production of doubled haploid plants of *Brassica napus* cv. Topas derived from colchicines-induced microspore embryogenesis without heat shock. *Pl. Cell Rep.* **15**: 668-671.

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