

Study on Embryogenesis Response of Maize (*Zea mays* L.) Genotypes to Anther Culture

Khavari khorasani^{1*}, S., Moieni², A., Mousavi³, A. and Golbashy⁴, M.

Abstract

Haploid plants have an important role in plant breeding programmes and basic researches. In this study, 44 *Zea mays* L.) genotypes were evaluated for their response to embryogenesis via anther culture. Three experiments were conducted for understanding the effects of cold pre-treatments, kind of culture media, and the orientation of anthers on culture media for response to embryogenesis. The results of anther culture showed that embryo-like structures (ELSs) were obtained from genotypes DH5×DH7, ETH-M82, TWC605, SC709, A188, S61, K74/1 and LA12 (sweet corn). Plant regeneration was performed successfully. Analysis of variance for the first experiment showed significant differences between anther culture media and genotypes, but there was no significant differences between two cold pre-treatments (14 and 21 days). In the second experiment, the Yu-pei medium containing 90 g l⁻¹ was the best media for embryogenesis with 21.82 ELSs /100 cultured anthers. Cultivation of anthers by edges on medium in the third experiment was the best orientation for anther culture.

Keywords: Anther culture, Embryo-like structures (ELS), *Zea mays* L., Haploid plant

- Aulinger I. E. 2002. Combination of in vitro Androgenesis and Biolistic Transformation: An Approach for Breeding Transgenic Maize (*Zea mays* L.) Lines. PH.D Thesis, Swiss Federal Institute of Technology (ETH), Zurich, Switzerland.
- Barloy, D., and Beckert, M. 1993. Improvement of regeneration ability of androgenetic embryos by early anther transfer in maize. *Plant Cell, Tissue and Organ Culture*, 33: 45-50.
- Barnábas, B., Obert B., Kovacs G. 1999. Colchicine, an efficient genome-doubling agent for maize (*Zea mays* L.) microspores in anthero. *Plant Cell Reports*, 18:858-862.
- Buter, B., Pescitelli, S. M., Berger, K., Schmid, J. E., Stamp, P. 1993. Autoclaved and filter sterilized liquid media in Maize anther culture: significance of activated charcoal. *Plant Cell Reports*, 13:79-82.
- Buter, B. 1997. In vitro haploid production in higher plants. Kluwer Academic Publisher, Netherlands, 4: 37-71.
- Dieu, P., and Beckert, M. 1986. Further studies of androgenetic embryo production and plant regeneration from in vitro cultured anthers in Maize (*Zea mays* L.). *Maydica* XXXI. pp: 245-259.
- Fennel, A., and Hauptman, P. 1992. Selection of microspore derived embryogenic structure in Maize related to transformation by microinjection. *Botanica- Acta*, 105: 313-318.
- Gaillard, A., Vergne, P. and Beckert, M. 1991. Optimization of maize microspore isolation and culture conditions for reliable plant regeneration, *Plant Cell Reports*, 10: 55-58.
- Genovesi, A. D., and Collins, G. B. 1982. In vitro production of haploid plants of corn via anther culture. *Crop Science*, 22: 37-44.
- Hallauer, A. R., and Miranda, B. 1988. Quantitative Genetics in Maize Breeding. Iowa State Univ. Press.
- Hassan, L., Ahmad, S. D. and Okumus, A. 2001. The direct regeneration of Maize haploids through anther culture. *Journal of Biological Sciences*, 1: 900-901.
- Jahne, A. and Lorz, H. 1995. Cereal microspore culture. Review Article. *Plant Science*, 109: 1-12.
- Jardinaud, M. F. Souvire, A., Alibert, G. and Beckert, M. 1995a. UidA gene transfer and expression in maize microspores using the biolistic method. *Protoplasma*, 187: 138-143.
- Khavari Khorasani, S., Mansouri, N., Moieni, A., Mousavi, A., Karimzadeh, Gh. and Jalali, M. 2006. Study of callus induction and plant regeneration of maize genotypes (*Zea mays* L.) using immature embryo culture. *Pajouhesh & Sazandegi* No:73 pp: 43-49.
- Kuo, C. S., Sun, A. C., Wang, Y. Y., Gui, Y. L., Gu, S. R. and Miao, S. H. 1978. Studies on induction of pollen plants and androgenesis in maize. *Adaptive Botany Sinence* 20: 204-209.
- MacDonald, M. V. 1992. Donor plants growth factors affecting anther culture of maize and sweet corn (*Zea mays* L.). *Annals of Botany*, 70: 357 -363.
- Murashige, T. and Skoog, F. 1962. A revised medium for rapid growth and bioassays with tobacco tissue cultures.

1. Scientific Membrane of khorasan Razavi Agricultural Research and Natural Resources Institute Mashhad, Mashhad.

2. Associate Professor, Faculty of Agriculture, Tarbiat Modarres University, Tehran.

3. Scientific Membrane of National Institute of Genetic Engineering and Biotechnology- Iran, Tehran.

4. Ph.D. Student of NanoBioTechnology, University of Tehran, Tehran.

*: Corresponding author

- Phisiol Plant, 15: 473-497.
- Nageli, M., Schmid, J. E. Stamp, P. and Buter, B. 1999. Improved formation of regenerable callus in isolated microspore culture of Maize: Impact of carbohydrate, plating density and time of transfer. Plant Cell Report, 19: 177-184.
- Obert, B. and Barnábas, B. 2004. Colchicine induced embryogenesis in Maize. Plant Cell, Tissue and Organ Culture, 77: 283-285.
- Petolino, J. F. and Jones, A. M. 1986. Anther culture of elite genotypes of Maize. Crop Science, 26: 1072-1074.
- Pohelman, J. M., and Sleper, D. A. 1995. Breeding Field Crops. Chapter 17. Corn Breeding, pp: 317- 356. Iowa State University Press, U.S.A.
- Pretova, A., Ruijter, N. De., Van. Lammeren, A. and Schel, J. H. 1993. Structural observation during androgenesis of microspore culture of the 4C1 genotype of (Zea mays L.). Euphytica, 65: 61-69.
- Sainsington, S., Schmid, J. E., Stamp, P. and Buter, B. 1996. Colchicine mediated chromosome doubling during anther culture of Maize (Zea mays L.). Theoretical . Applied. Genetics. 92: 1017-1023.
- Shugar, L. 1998. Application of doubled-haploid systems. Hyland Seeds, W.G. Thomson and Sons Limited. Narin, Ontario, Canada.
- Ting, Y. C., Yu, M., and Wan, Z. Z. 1981. Improved anther culture of maize (Zea mays L.). Plant Science Letter, 23: 139-145.
- Tsay, H. S., Miao, S. H. and Widholm, J. M. 1986. Factors affecting haploid plants regeneration from maize anther culture. J. Plant Physiology, 126: 33-40.
- Wan, Y., and Widholm, J. M. 1993. Anther culture of maize. Plant Breeding Review, 11: 199-224.

To look at the figures and tables, please refer to the Persian text (pages: 35-46= 35-46).