Study Progress on Tissue Culture of Maize Mature Embryo

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Abstract

It has been paid more and more attention on maize tissue culture as it is a basic work in maize genetic transformation, especially huge breakthrough has been made in maize tissue culture utilizing mature embryos as explants in the recent years. This paper reviewed the study progress on maize tissue culture and plant regeneration utilizing mature embryos as explants from callus induction, subculture, plant regeneration and browning reduction and so on.

1. Introduction

Maize (Zea mays L) is one of the most important feed, industrial materials and food crops in China. With the expanding population and limitation of land, more and more attention is paid for maize genetics and breeding technology. The major goals of maize breeding are high yield, good quality and extensive adaptability [1]. Genetically transformed maize plants have been obtained and have been commercialized in the past decades. Transgenic maize has been a main direction in the modern maize breeding in the recent years. However, an important basic work in maize transformation is establishment of a good genetic transformation recipient system. At present, a series of problem are to be solved for establishing such a genetic transformation recipient system such as low regeneration efficiency, strong genotype dependence, site inconsistency of regeneration cell with competent cell and insensitivity or abnormally high sensitivity to agrobacterium infection [2]. The first step for establishing a good genetic transformation recipient system is to establish a high efficient plant regeneration system. It has been a prerequisite for the utilization of genetic manipulation techniques in maize genetics and breeding.

More and more attention has been paid on study of maize tissue culture and great improvement has

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been made in the recent years. Green and Philips firstly reported callus induction from maize immature embryos and successfully obtained diploid regeneration plant. Afterwards, rapid progress has been made on maize tissue culture. Nowadays, maize immature embryos are used as explants more and more in maize tissue culture relative to other parts of maize\cite{3-5}. However, it has strong restriction of geography condition, growth period and development season when immature embryos used as explants for getting experiment materials. Immature embryos must be utilized during 9-12 days after pollination. Comparative to this, mature embryos are satisfactory explants for adapting maize genetic transformation because of that maize seeds are easily stored in large normal and can be conveniently obtained without time and quantity restriction.

A breakthrough is being on in the study of maize tissue culture with mature embryos used as explants. More and more papers reported tissue culture success of maize mature embryos. So the recent progress of maize tissue culture with mature embryos used as explants is reviewed in this article.

In the year of 2007, Xiang et al investigated some factors affecting maize mature embryos regeneration used maize elite in-bred line 178 as materials. The results showed that medium including 4.0 mg/L 2, 4-D was capable to producing primary callus. Among different concentrations of phytohormone, 2.0 mg/L 2, 4-D in combination of 0.2 mg/L BA and 10 mg/L silver nitrate produced the best results, which promoted the formation of embryogenic callus in the subculture medium. And 0.5 mg/L 6-BA had significantly increased the frequency of plant regeneration in the regeneration medium. The results showed maize elite inbred lines 178 had been successfully regenerated and the frequencies were 78 %. Xiang et al considered that an efficient maize regeneration system was developed using mature embryos. Using this system, the plantlets were regenerated from maize elite inbred lines 178, providing a powerful basis for genetic transformation of maize. Afterwards, Wang et al established an efficient transgenic acceptor system and developed some new methods on maize (\textit{Zea mays} L.) tissue culture, plant regeneration and genetic transformation with embryogenic callus initiated from mature embryos of three elite inbred lines CML295, CML304, and 18-599R. Tissue slice showed that the structure of callus formed from mature embryos was the same as those from immature embryos, being the type I embryogenic callus. The regeneration frequencies of the calli from mature embryos of CML295, CML304, and 18-599R were 68.6%, 75.4%, and 84.8%, respectively. The transgenic rates of embryogenic callus from mature embryos of the three inbred lines were similar to those from immature embryos. Wang’s conclusion is that using embryogenic callus from mature embryos as transgenic acceptors is efficient and available.

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References

