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Development of Inbred Lines for Hybrids Development in Bottle Gourd (Lagenaria siceraria M.) through Doubled Haploid Technique

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ABSTRACT

Monoecious and andromonecious nature in bottle gourd leads to higher levels of cross pollination. This mechanism favours wide diversity. Several varieties were evolved through selection from the native germplasm in bottle gourd. However, development of hybrids with high yield by using heterosis breeding is need of the hour. Conventional crop improvement strategies take longer time and require huge man power for the development of inbreds used as parents. Tissue culture techniques are being followed in vegetables to minimize the time taken for the development of inbred. Doubled haploids are developed through regeneration of haploid plants by using tissue culture protocols. Subsequently, these haploid plants are developed into homozygous conditions by doubling

of chromosomes. It is time saving process and minimizes the time and resources required for raising many generations. Several studies have been conducted in cucumber, squash and muskmelon. However, few regeneration protocols are available in bottle by using cotyledons as explant. So, there is an immediate need for standardization of haploid development protocols in bottle gourd as similar to other *Cucumis* species.

INTRODUCTION

Bottle gourd, *Lagenaria siceraria* M. is commonly known as bottle squash, calabash gourd, *Dodo* or *Lauki* and it is grown under tropical situations. It is highly suitable for year round production. In India, bottle gourd is cultivated in an area of 0.12 m ha, production is 1.43 m t and productivity are 122.1 q. ha^{-1} (Suchitra and Haribabu, 2007). The tender vegetable is rich in water, essential amino acids, sugar compounds and smaller amounts of Ca, P_2O_5 and Fe (Thamburaj and Narendra Singh, 2001). The cooked vegetable has cooling, diuretic, sedative and anti-bilious effect.

BREEDING STRATEGIES

Bottle gourd is an allogamous crop due to its andromonoecious nature and vast levels of genetic diversity (Singh *et al.,* 1996). It has higher levels of variations for morphological and yield characters (Arun Kumar and Sirohi, 2005). A large number of varieties have been developed in bottle gourd through direct selection from indigenous germplasm. In India, several local land races or local cultivars have established themselves based on selection by local growers in the past.

Hybrids development in bottle gourds is essential to increase the productivity of bottle gourd and meet out the consumer demands. In order to meet out the demand, new combinations of hybrids have to be evaluated in bottle gourd. It is highly suitable for development of hybrids due to its monoecious nature and higher amount of seeds per individual fruit. The demand of hybrids of bottle gourd is increasing because of earliness, uniformity and high yield (Tuan *et al.,* 2007). Several researchers involved in development of hybrids for enhancement of yield in bottle gourd (Singh and Kumar, 2002; Kushwaha and Ram, 2002; Arun Kumar and Sirohi, 2002).

Cultivated bottle gourd types are open pollinated and require adequate generations of selfing to obtain homozygosity to exploit heterotic vigour which is time consuming and laborious. Classical breeding approaches have been utilized to develop inbreds and evaluation which are cumbersome and laborious. So naturally it becomes difficult task and time requirement for the development of a new hybrid is also longer. There are few methods to isolate homozygous lines early in crop plants. So naturally hybrids development programmes with designed objectives will become easier in bottle gourd and can be generally applied in any hybrid development programme in bottle gourd. *In vitro* techniques have been utilized in vegetables to shorten the breeding cycles. Anther culture techniques became routine and popular to develop homozygosity to be used in hybrids development and genetic variability in major crop improvement programmes across the world. The androgenesis was observed in squash by Metwally *et al*., 1998 and muskmelon by Dryanovska, 1985.

DEVELOPMENT OF DOUBLE HAPLOIDS

Doubled haploid technique through culturing microspores in culture medium and subsequent regeneration of haploid plants then doubling will lead to homozygosity. It is effective and quick process compared to selfing for several generations. Applications of pre culture treatments to induce androgenesis have been studied by several groups (Immonen and Robinson, 2000; Pechan and Smykal, 2001). Effect of cold treatment (4°C) and heat shock treatment (32°C) of anthers of cucumber was done it was found that two days cold treatment showed higher percentage of somatic embryo induction (Kumar *et al.* 2003). Same results were observed in cucumber, when anthers were pre treated with cold (4°C) for two days (Song *et al*. 2007).

Pre-culture of anthers and maturation of somatic embryos were done to improve the efficiency in two cultivars of cucumis and ploidy level was confirmed (Kumar *et al.* 2003). Haploids were successfully generated in cucumber by culturing anthers in growing media added with 2,4-D, BA and NAA after pretreatment and percentage of embryogenesis was dependent upon genotype, growth regulators combination and concentrations (Song *et al*. 2007). Song *et al*. 2007 obtained 93 per cent di-haploids induction percentage in cucumber cv. Ningja and percentage was varied with genotype. But there are few protocols available for plant regeneration from cotyledon of this crop (Han *et al*. 2004). So, there is a need for standardization of successful and reproducible protocol for anther culture conditions, haploid synthesis and di-haploid production in bottle gourd. Still there is lot of scope to exploit heterotic vigour by utilizing inbred obtained from diverse cultivated types of bottle gourd.

CONCLUSION

Conventional breeding methods take longer time and need huge number of resources for the development of inbreds used as parents in heterosis breeding. Hence there is a need for standardization of viable protocols for development of haploids through *in vitro* techniques in bottle gourd.

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