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Regeneration potential of Breeding hybrids (Family Vacciniaceae S.F.Gray) Depending on The Type of Explant

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Abstract

The paper presents the results of experimental studies concerning the effect of the explants type on the regenerative potential of breeding hybrids. It is shown that the regenerative potential of breeding hybrids depends on the type of explants and the hybrid combination. The apex of the sprout has the greatest regenerative potential

Keywords: breeding hybrids, regeneration potential, explant

Introduction

It is well known that the regeneration of plants in a sterile culture is in demand in breeding, as it reduces the time for obtaining marketable products from 20-25 years to 10-12. With its use, it is possible to obtain up to 500 thousand individuals per year from one hybrid seed, which makes it possible to create a hybrid fund, speed up the breeding process and overcome the sterility of distant hybrids in the shortest possible time.

The physiological state of the explant and it sage are of paramount importance in the regeneration processes occurring in cell and tissue culture. Thus, experimental studies of cereals and other crops indicate that in juvenile explant tissues, compared with mature ones, selective cells are only partially differentiated and not fully involved in special functions (Wenzier and Meins, 1986).

Studies by K.Rajasekaran et al. (1987) showed that the tissues of juvenile explants (immature embryo, young leaf, or inflorescence) contained high doses of in dolyl butyric acid and abscisic acid and possessed morphogenic ability, while mature parts of leaves that lacked morphogenic ability were characterized by a relatively low content of endogenous growth regulators. According to some authors (Hesemann and Schroder, 1982; Beaulieu and Bendich, 1985), as the age of the leaves from which the explant was isolated increases, disturbances in the content of nuclear DNA may occur, leading to a loss of the morphogenic ability of the explant.

It is generally recognized that different parts of the same plant have different morphogenesis abilities (Churikova et al., 1991). Explants selected from juvenile organs have a greater regenerative capacity compared to those from mature tissues (Hunter, 1979; Cheng, 1975]. Despite this, regenerating plants can be obtained from mature leaves, buds, roots, stems, and flower parts by organogenesis or somatic embryogenesis (Clod et al., 1990).

Thus, an analysis of the literature on the problem of the regenerative capacity of juvenile and mature explants suggests that there are two aspects of this problem. On the one hand, experimental material obtained by numerous researchers indicates a high re generative ability inherent in juvenile explants (Belonogova and Raldugina, 2006; Mundhara and Rashid, 2002; Wilhemova et al., 2004), on the other hand, mature (Purohit and Kukda, 2004; Rathore et al., 2004; Rathore et al., 2007). This convincesus that only experimentally it is possible to determine the morphogenic ability of one or another explant, regard less of its physiological tate, i.e. the degree of maturity.

The study of the regenerative ability of breeding hybrids, depending on the type of explant, will make it possible to determine an explants with a high regenerative ability, which gives the maximum yield of regenerating plants, and recommend it as the main one for in vitro culture.

Materials and Methods

The objects of the study were explants of sterile seedlings: epicotyl, hypocotyl, stem, root, cotyledons, apex of the seedling, leaves of regenerants (upper, middle, lower) breeding hybrids of four combinations: 1*) Vaccinium vitis-idaea* x *Oxycoccus palustris*, 2) *Vaccinium vitis-idaea* x *Oxycoccus macrocarpus* (var.Stivens), 3) *Vaccinium vitis-idaea* x *Vaccinium palustris*, 4) *Vaccinium vitis-idaea* x *Vaccinium uliginosum* selected by O.V. Morozov.

Sterile explants were planted on Anderson's medium containing the full norm of macro-and microsols, inositol, pyridoxine, indolylacetic acid, isopentenyladenine, adenine sulfate, sucrose, and agar. The flasks with the planted explants were placed on racks where the air temperature was 24°C, the illumination was 4000 lux, the relative humidity was 70%, and the photoperiod was 16 hours.

The repetition of experiments is three fold. Statistical data processing was carried out based on 10 explants per repeat. The experimental data are summarized in a Table. It contains arithmetic averages and their standard errors.

Results and Discussion

An analysis of the experimental material presented in the Table showed that different parts of the same hybrid have different regeneration potential. Each hybrid has a specific regenerative potential, depending on the type of explants and the combination of the hybrid. Thus, the hybrid combination *Vaccinium vitis-idaea* x *Oxycoccus palustris* obtained the largest number of regenerants per explant in the apex of the seedling, cotyledons, and medium leaves (5,2, and 2, respectively). In *V.vitis-idaea* x *O. macrocarpus* (var. Stivens), the largest number of re generants per explant was observed in the seedling apex, cotyledons, and hypocotyls (6,3, and 3, respectively).

The explants of the hybrid combination *V. vitis-idaea* x *V. uliginosum* have the least regenerative ability, with the exception of the apex of the seedling, which has a relatively high regenerative potential–4 regenerants per explant.

Explants of the hybrid combination *V.vitis-idaea* x *V. palustris* have the greatest regenerative ability, with the exception of the root, which has no regenerative potential at all. This pattern is typical for the roots of all the hybrids studied.

The lack of regenerative ability in these explants confirms the generally accepted fact that different parts of the same plant have different morphogenesis abilities. Thus, for some bulbous plants, a high regenerative ability of paired bulb scales was noted in comparison with other organs: leaf, stem, root (Halperin, 1986). Crocus has a high regenerative potential for ovaries (Fakhari and Evans, 1989), lilies for bulb scales (Churikova et al., 1991), common beans for young leaves (Kamal and Praven, 1991), gladioli for terminal renewal buds (Rumynin et al., 1990), in hybrid mountain ash–for apical buds (Suvorova et al., 1990).

All the studied combinations of hybrids have the maximum regeneration potential when using the seedling apex as an explant, which is important to take into account when regenerating hybrids in a sterile culture. This suggests an uneven content of endogenous phytohormones in different types of explants of the studied hybrids, on the one hand, and a genetic dependence of the regenerative potential, on the other.

Table 1. Regeneration potential of breeding hybrids depending on the type of explants

Explant	**Number of regenerants per explant, pcs.**			
	Vaccinium vitis-idaea x Oxycoccus palustris	*V. vitis-idaea x O.macrocarpus (var.Stivens)*	*V. vitis-idaea x V.palustris*	*V. vitis-idaea x V. uliginosum*
Epicotyle	1±0	1±1	2±1	0±0
Hypocotyl	1±0	3±1	4±1	1±0
Stem	0±0	1±0	3±2	0±0
Spine	0±0	0±0	0±0	0±0
Cotyledons	2±1	3±1	4±2	2±0
Apex of the sprout	5±1	6±1	7±1	4±0
Leaves:				
upper	0±0	2±1	1±0	1±0
middle	2±1	1±0	3±2	1±1
lower	1±1	0±0	1±0	0±0

Conclusion

Based on the results of experimental studies obtained to study the regenerative potential of breeding hybrids depending on the type of explant, an explants (seedling apex) with a high regenerative capacity with maximum yield of regenerating plants in a sterile culture was determined. This allows us to recommend the seedling apex as the main explant for the regeneration of the combinations of breeding hybrids studied by us.

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