بسم الله الرحمن الرحيم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

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MONA MAGHRABY

SURVEY AND EVALUATION OF *POPULUS* SPECIES CULTIVATED IN EGYPT

By

MOHAMED FATHY AHMED

B.Sc. Agric. Sc. (Horticulture), Fac. of Agric., Ain Shams Univ., 2006

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ABSTRACT

Mohamed Fathy Ahmed. Survey and Evaluation of *Populus* Species Cultivated in Egypt. Unpublished M.Sc. Thesis, Department of Horticulture, Faculty of Agriculture, Ain Shams University, 2020.

Populus is a fast growing tree that can occupy vast areas in forests and quick enough in reasonably short periods of times and thus attract big attention because of its ability of carbon sequestration and phytoremediation in addition to it being a wildlife habitat. *Populus* species are widely used as a source of wood, veneer, paper and as a source of bioenergy. This research study was divided into a survey study of *Populus* species naturally growing in some areas of Egypt and an *in vitro* experiment to fine-tune a suitable protocol to micropropagate *Populus alba* as an example of *Populus spp*. In the survey study, four locations were surveyed for types of *Populus*, i.e. Cairo, Giza, Qaliobia and Gharbia governorates. Site-survey results revealed that five species of *Populus* did exist, viz. *P. euramericana* female, *P. euramericana* male, *P. nigra*, *P. deltoides* and *P. alba*. Samples collected from each species were subjected to different morphological measurements, and to both chemical and genetic analysis too. LA of *Populus* species surveyed showed a notable variation that can be used to discriminate between species. Specifically, *P. nigra* varied among surveyed sites in LA where the ones found in Gharbia were significantly lower than both *P. nigra* found in Cairo and Giza which were similar in their LA. The genetic assessment of the surveyed species was carried out using molecular markers. Three different Inter-Simple Sequence Repeats (ISSR) primers were used (17899A, 17899B and HB13). ISSR primer markers yielded 67.52% polymorphic loci among the surveyed species as cluster analysis enabled separation on the basis of their genetic distances. Thus, genetic diversity was quite apparent between the surveyed species which could be used as a means to differentiate between them from each other. For instance, genetic traits confirmed variations amongst *P. nigra* in all three sites

where they were found and the same did apply for *P. euramericana* female in its two surveyed sites. As for the *in vitro* experiments, stem-node explants of *P. alba* were collected for direct organogenesis. They were first surface-sterilized under aseptic conditions using commercial bleach as 'clorox' (5.25% NaOCl) at 10, 20 and 30% + 0.1 g/l mercuric chloride ($HgCl_2$) for 10, 15, and 20 min and was compared to use of nano-silver solution at 0.5, 1 and 1.5 ml/100 ml sterilized distilled water for 25 min. Surface sterilized explants were cultered onto two media; Murashige and Skoog basal medium (MS) and woody plant medium (WPM) at ¼, ½, ¾ and full strength. For multiplication, established cultures were transferred individually to an MS medium at 3/4 strength containing BAP and 2-ip each at 0, 0.005, 0.015, 0.0375, 0.075 and 0.15 mg/l in combination with IAA at 0.1 mg/l, Kin at 0.1 mg/l or free of any growth regulator additives. As for rooting of microshoots coming out from the multiplication stage, an MS medium at ¾ strength was used supplemented with IBA and NAA at 0, 0.5, 1 and 1.5 mg/l in combination with application of activated charcoal at 0.00, 0.25, 0.50 and 0.75 g/l. For *ex vitro* acclimatization, rooted shoots resulting from *in vitro* rooting were acclimatized by culturing them in plastic pots individually filled beforehand with a mixture of peat moss : sand at (2 : 1 by volume) or peat moss : vermiculite at (1 : 1 by volume) and kept afterword's under a plastic tunnel inside a plastic house. Genetic analysis to establish fidelity of resultant *in vitro* shoots from 14 consequtive subcultures was carried out using an ISSR marker (HB13 primer) was performed. *Populus alba* could be successfully micropropagated through tissue culture by adopting the following protocol: Applying clorox (5.25% NaOCl) at 30% + 0.1 g/l $HgCl_2$ for 10 min or application of nano-silver at 1 ml/100 ml sterilized distilled water for 25 min as a sterilization agent have ensured high survival rate of initial explants. Use of an MS medium at only 3/4 strength was adequate enough for initial establishment of explants. The highest multiplication rate (number of shoots/ cluster) could be achieved by inclusion of BAP at 0.075 mg/l + Kin 0.1 mg/l. Adding NAA at 0.5

mg/l + AC 0.25 g/l to the *in vitro* rooting medium was appropriate to obtain best root number/ young rooted shoot. A mixture of peat moss: vermiculite (1:1) was suitable during *ex vitro* acclimatization to achieve high survival percentage. It is safe to undergo up to 14 subcultures during *in vitro* multiplication without any risk of genetic un-stability of the final produced plantlets as was substantiated by the genetic molecular marker assessment.

Key words: Egypt, Survey study, Woody trees, *Populus*, Morphology, Genetic diversity, ISSR, Tissue culture, Cytokinins, Auxins, Peat moss, Vermiculite, Genetic fidelity

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