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BIOCHEMICAL MARKERS FOR DROUGHT TOLERANCE IN TOMATO AND PHYLOGENETIC RELATIONSHIPS AMONG SOME TOMATO GERMPLASM.

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Abstract

Some tomato genotypes, which belong to different species of Lycopersicon, i.e., esculentum , pennellii , and chilense , and show differential phenotypic reactions against drought stress, were used in the present research to study the value of the using SDS-polyacrylamide gel electrophoresis and esterase isozymes analysis in detecting biochemical genetic markers to be used for accurate selection in tomato breeding programs of drought tolerance. SDS-PAGE electrophoresis revealed a unique band of 16.34 KDa which was associated with the tolerant genotype Edkawi (L. esculentum). In addition, a unique band of 68.36 KDa was found to be exclusively associated with the tolerant tomato LA1673 (L. esculentum var. cerasiforme). Furthermore, a band of 63.08 KDa was found to be useful in positive identification of tomato germplasm which are tolerant to drought. Esterase isozymes electrophoresis analysis showed bands which differed in pattern and intensity with the different tomato genotypes evaluated under water stress conditions. The two tomato genotypes LA1963(L. chilense) and LA716 (L.pennellii) which are known for high level of tolerance to drought revealed unique band pattern and intensity under water stress conditions, comparing to other evaluated tomato genotypes. These two lines had two activity zones for the esterase enzyme, i.e., Est-1 (very faint band) and Est-2 (very faint band) for LA 1963 (L. chilense) and Est-1 (faint band) and Est-3 (very faint band) for LA716 (L.pennellii). The susceptible tomato genotypes UCT5 and Super Marmande had more and darker bands than that expressed by the evaluated tolerant tomato genotypes, i.e., LA1963 (L. chilense), LA716 (L.pennellii) and Edkawi (L. esculentum). The highest similarity value (72.4%) was recorded between Peto 82 (susceptible) and UCT5 (susceptible), followed by the value (63.7%) which was recorded between LA 1953 L. esculentum var .cerasiforme (tolerant) and UC82B (tolerant). On the other hand, the lowest similarity value (11.6%) was recorded between Castle Rock , L. esculentum (susceptible) and LA 1963 L. chilense (tolerant) followed by the value (14.4%) which was recorded between Super Marmande, L .esculentum (susceptible) and LA1963 L. chilense (tolerant).

Introduction

Tomato is one of the most important vegetable crops in Egypt and all over the world. Water stress is expected to be a serious limiting factor for agriculture in the future in many parts of the world. Moisture stress during any stage of plant development will dramatically reduce quality and quantity of plant yield. Developing plants with genetic tolerance to drought stress will be an important approach to overcome this serious problem. Tomato germplasm LA 1963 (*L. chilense*) and LA716 (*L. pennellii*) are known for high level of resistance to drought (Rick,1973). Using biochemical genetic markers as an alternative selection for drought tolerance in tomato avoids the environmental effects on the expression of this trait and consequently the estimated heritability values will be more accurate (Orton,1982; Chen and Tabaeizadeh, 1992 b; Patel *et al.*, 2002). Biochemical genetic analysis using gel electrophoresis has been evaluating different quantitative characters (Cherry,1977; Ong, 1979; Kibenko *et al.*,1981; Kubis and Krzywanki, 1991; Chen and Tabaeizadeh,1992 a and b; Valpuesta *et al.*,1992;Chen et al.,1994; Bonnema *et al.*, 1995; Chakrabarti *et al.*, 1995; Liu *et al.*, 1995; Wei and Oconnell, 1996; El-Saka, 2006). In addition, biochemical genetic techniques were useful in studying genetic of drought and/or salinity stress in tomato (Martin *et al.*,1989; Plant *et al.*, 1991; Kahn *et al.*, 1993; Fooled and Chen,1997; El-Saka, 2006). Furthermore, the isozyme analysis proved to be useful in evaluating different quantitative characters and/or distinguishing between different genotypes with high accuracy (Tanksely and Rick, 1980; Tanksely *et al.*,1982; Al-jibouri and Adham, 1990; Lagrimini *et al.*, 1992; Foolad and Jones,1993; Patel *et al.*, 2002; El- Saka.2006). Moreover, phylogenetic relationships are of great value in breeding programs and germplasm preservation (Abdel-Tawab *et al.*, 2003, Abdel- Salam *et al.*, 2005; El-Saka, 2006).

The objectives of this research was to determine biochemical markers for drought tolerance in tomato which would be of great value in accurate selection in tomato breeding programs. Also, to identify Phylogenetic relationships among some tomato germplasm concerning drought tolerance which would be very useful in breeding tomato for drought tolerance and germplasm preservation protocols.

MATERAL AND METHODS

Biochemical Analysis

Samples for the purpose of biochemical genetic analysis were taken from the first fully expanded leaf at the top of the plants of some tomato genotypes which showed differential reactions against drought, Table A, during water-stress period after 69 days after transplanting. The tensiometer reading was 34(cb).

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