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POLLEN GERMINATION CAPACITY OF THREE MANGO CULTIVARS (*MANGIFERA INDICA* L., ANACARDIACEAE) FROM PAKISTAN

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Abstract

Pollen germination capacity and viability of 3-mango cultivars *viz*., Chaunsa, Dasheri and Langra were investigated up to 48 weeks. Pollen germination was standard by hanging drop technique in different concentration of sucrose solutions (5%-50%) with 1% agar and 0.001% boric acid. The stored conditions were refrigerator (4ºC), freezer (-20ºC, -30ºC), freeze drier (-60ºC), in vacuum over silica gel and in organic solvents (acetone, benzene, chloroform). Pollen stored at low temperature showed better germination percentage compared to pollen stored at 4ºC and fresh. Among three cultivars variety langra showed better pollen germination at all stored conditions except at -20ºC. Variety chaunsa and dasheri also showed good germination of pollen.

Introduction

Pollen grains may be bi-nucleate or tri-nucleate, the latter one lose viability very rapidly and could hardly germinate on artificial media. Pollen have considerable potential to achieve genetic transformation. There are some critical external factors which affect the maintenance of pollen germination capacity eg., relative humidity (RH) and temperature surrounding pollen. A successful system of *in vitro* pollen germination is a prerequisite for pollen research (Williams *et al.* 1982) and is important for testing the capacity and viability of pollen for controlled pollinations (Griffin 1982; Heslop- Harrison 1979b). The preservation of viable pollen for future study and for plant breeding is of considerable theoretical and practical value (Gill *et al*., 1992, King, 1961, Shivanna & Rangaswamy, 1992). Germination capacity of stored pollen can be maintained in hybridization and crops improvement programs. Fruit tree pollen are generally required to be stored for controlled crossing, either to achieve a desired breeding objective or to overcome a constrain involved in commercial fruit production (Ganeshan & Alexander, 1991). The pollen grains of different plant species required varying range of growth media like water, sugar solution, inorganic salts and vitamins for their successful germination (Iwanomy, 1971; Mehan & Malik, 1975; Amma & Kulkarni, 1979). In mango 10% sugar solution has been found to give maximum pollen germination, but highest pollen germination (28.2%) in *var*. Chaunsa has been recorded (Randhawa & Damodaran, 1961) with 25% sucrose solution at an incubation temperature of 30ºC. Popenoe (1917) reported 10-15% pollen germination with 25% sugar solution and 0.5% agar at 75-80°F, in the variety *Mulgoa*. He considered it unlikely that mango pollen could germinate below 60°F. The guava pollen required comparatively lower sugar concentration for optimum germination. The pollen germination capacity of almond was studied by Martinez-Gomez *et al*., (2001) and that of strawberry by Aslantus & Pirlak (2002). There are several reports on pollen germination and viability from different taxa (Nair & Singh, 1972; Vijay., 1972; Kapoor, 1976; Zeng-Yu-Wang *et al*., 2004, Khan & Perveen 2006a,b).

Vasil (1960) concluded that boron promotes absorption and metabolism of sugars by forming sugar borate complexes, increase oxygen uptake and is involved in the synthesis of pectic materials for the wall of the actively elongated pollen tubes. This is the first systemic study carried out on 3-mango cultivars *viz*., Chaunsa, Dasheri and Langra.

Material and Methods

Methodology: Pollen grains of 3-mango cultivars *viz.*, Chaunsa, Dasheri, and Langra were collected from cultivated fields and plants growing at Karachi University campus in large quantity during the peak of flowering period. Fresh pollen were systematically subjected to preliminary viability tests (Alexander, 1969). Pollen culture media were prepared using Brewbaker & Kwack (1963) techniques. Pollen grains equal to at least twice the diameter of pollen counted as germinated, burst pollen grains were not counted as germinated in different solutions. The viability of stored pollen was assessed in terms of percentage germination. The stored pollen were germinated in a humidity chamber. The germination was determined after 3-6hrs of incubation. The hanging drop practice was used for culturing pollen grains in liquid media. The culture was stored at room temperature.

The pollen grains slides were prepared for light microscope (LM) using Erdtman (1952) procedure. The pollen grains were mounted in unstained glycerin jelly and observations were made with a Nikon type-2 microscope. The measurements are based on 15 readings.

Results and Discussions

In the present investigation an attempt has been made to compare the germination capacity of 3-mango cultivars for up to 48 weeks in different storage conditions. The storage conditions are refrigerators (4ºC), Freezer (-20ºC, -30ºC), freeze drier (-60ºC), over silica gel in vacuum and in organic solvents (chloroform, acetone and benzene) at room temperature. All the 3-cultivars showed more or less equal germination percentage, however the viability period is different. Among the 3-cultivars langra showed better germination of 74% after 4 weeks of storage at (4ºC, -20ºC, -30ºC and -60ºC). After 24 weeks langra showed 60% germination at -30ºC (Fig. 2). At condition refrigerator (4ºC) the viability period decreases and after 48 weeks the germination percentage (29.7%) was noted in dasheri while at freezer (-20ºC) Dasheri showed better germination percentage (39.2%) after 48 weeks of storage (Fig. 3). At -30ºC the germination percentage was 32% as compared to langra which showed 40% germination. Chaunsa showed better germination (40%) in refrigerator after 48 weeks of storage as compared to other two varieties (Fig. 1). At freezer (-20ºC & -30ºC) chaunsa showed 32% germination after 48 weeks of storage. However at -30ºC it showed lower germination percentage (31%) while langra and dasheri showed 40% and 31% respectively. At freeze drier (-60ºC) langra showed 54.5% germination while chaunsa showed 49.1% germination percentage. During the study it is observed that *var.* Langra showed better germination at all conditions except at 4ºC where 30.9% germination was noted compared to 32% in chaunsa after 48 weeks (Figs. 1 & 2). Both freezer and freeze dried condition showed better results. The results showed that 10%-15% solutions are suitable for pollen germination of mango cultivars but some time 20% also showed better results..

Among organic solvents benzene showed some viability, the percentage observed was only 11.9% after 12 hrs of incubation and then no germination was noted. Both chloroform & acetone showed 4.8% and 5.3% germination after 6 hrs of incubation and then lost viability. Fresh pollen was also treated (1-24 hrs) in vacuum over silica gel, and then stored in refrigerator (4ºC) however this condition never seems to be effective and the germination percentage (2.2%) was only observed after 3 hrs of incubation and then lost viability.

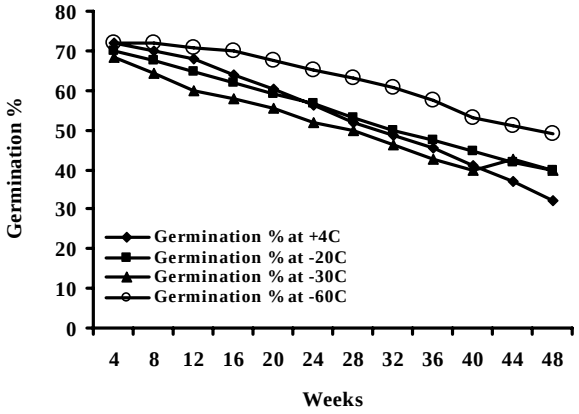

Fig. 1. Germination capacity of stored pollen of *Mangifera indica* L., var, Chaunsa (Anacardiaceae) at different temperature and humidity conditions in sucrose and boric acid solutions.

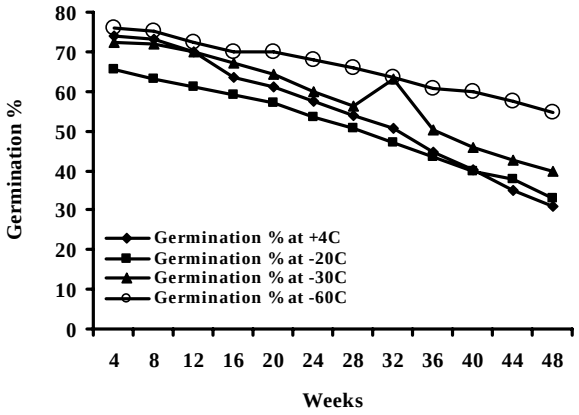

Fig. 2. Germination capacity of stored pollen of *Mangifera indica* L. var, Langra (Anacardiaceae) at different temperature and humidity conditions in sucrose and boric acid solutions.

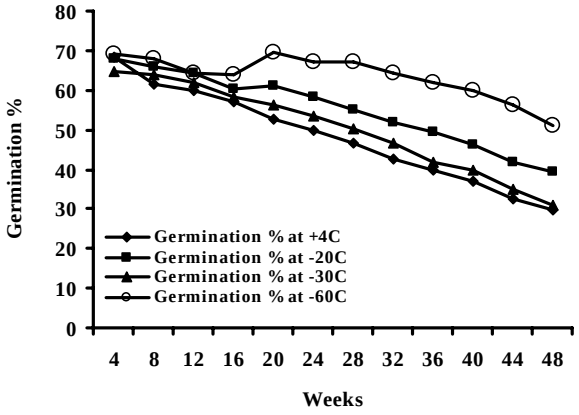

Fig. 3. Germination capacity of stored pollen of *Mangifera indica* L. var, Dasheri (Anacardiaceae) at different temperature and humidity conditions in sucrose and boric acid solutions.

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