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MAINTENANCE OF POLLEN GERMINATION CAPACITY OF *MALUS PUMILA* L., (ROSACEAE)

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Abstract

Pollen germination of *Malus pumila* L., of the family Rosaceae was examined upto 48 weeks in a refrigerator (+4C), freezer (-20C, -30C) and freeze drier (-60C) using hanging drop technique in different concentration of sucrose and boric acid solution. Pollen stored at low temperature showed better germination percentage as compared to pollen stored at +4C and in fresh pollen. Freeze dried pollen (-60C) showed the highest germination percentage.

Introduction

Pollen storage is the efficient method to overcome barriers to hybridization between flowering plants at different times or growing in different regions. Various methods have been tried for successful storage of pollen of different taxa According to Amma & Kulkarn (1979) pollen grains of different plants require varying range of growth media like water, sugar solution, inorganic salts and vitamins for successful germination. Pollen stored at low temperature showed germination capacity better than pollen stored at high temperature (Stanley & Linskens 1974). Previously, number of workers have studied the viability of stored pollen such as Barnabás & Rajki (1976) stored *Zea mays* L., pollen at −196°C in liquid nitrogen. Liu & Lanzhou (1984) determined the germination, respiration and fertility of *Prunus persica* and *Malus pumila* pollen during storage in some organic solvents. Jain & Shivanna (1988) examined storage of pollen grains in organic solvents. Pinney & Polito (1990) reported germination of Olive pollen improved markedly in storage condition. Tyagi *et al.,* (1992) studied the germination of *Verticordia* pollen at different temperature. Ganeshan & Alexander (1996) examined the storage of different fruit pollen for commercial fruit production. Pressman *et al.,* (2002) studied the effect of heat stress on tomato pollen. Similarly, Khan & Perveen (2006a, b) studied the germination capacity of *Abelmoschus esculentus* L., and *Solanum melongena* L., pollen respectively. Perveen *et al.,* (2007) also examined germination capacity of *Carica papaya* pollen at different temperature. Present studies were carried out to examine the storage condition and viability of *Malus pumila*.

Materials and Methods

During the peak of flowering period of *Malus pumila* pollen were collected in large quantity from cultivated fields and green house. Fresh pollen were systematically subjected to preliminary viability tests. Pollen culture media were prepared according to standard method of Brewbaker & Kwack (1963). Pollen tube equal to at least twice the diameter of pollen grains were counted at the time of germination. The viability of stored pollen was assessed in terms of germination percentage. The stored pollen were germinated in humidity chamber in different sucrose solution ranging from 20-70% to which10% boric acid was added. For light microscopy pollen grains were mounted in unstained glycerin jelly and observations were made with a Nikon type-2 microscope.

Table 1. Germination capacity of stored pollen of *Malus pumilla* (Rosaceae) at different temperature and humidity conditions in sucrose and boric acid solutions.

Weeks	Germination % at +4°C	% Solutions	Germination % at - 20°C	% solutions	Germination % at -30°C	% Solutions	Germination % at -60°C	% Solutions
4	56.10	30	68.00	50	76.00	40	75.50	30
8	54.00	20	67.60	60	75.10	30	76.40	30
12	52.30	30	65.10	30	73.20	30	74.20	40
16	48.30	30	60.20	30	69.00	30	72.20	40
20	39.5 0	30	57.40	30	65.00	30	71.20	40
24	34.00	40	51.90	30	51.00	30	69.50	30
28	30.70	20	43.70	30	47.00	40	69.50	30
32	25.90	30	36.00	40	41.10	50	67.10	30
36	20.00	30	30.60	30	35.50	30	64.30	30
40	16.60	30	23.20	30	31.50	40	54.40	40
44	11.00	30	20.20	30	27.00	40	65.60	40
48	9.10	20	15.96	20	23.50	30	65.60	40

Results and Discussions

In the present investigation an attempt has been made to compare the efficiency of pollen storage in *Malus pumila* L. Pollen viability was examined up to 48 weeks in different storage conditions viz., refrigerator at (+4C), freezer (-20C-30C) and freeze drier (-60C). Pollen grains at room temperature showed 60% germination in sugar solution. Germination period was 12 hours. *Malus pumila* pollen showed good germination up to 20 weeks especially in freezer (-30^{o}C) and freeze dryer (-60^{o}C), 65.00% and 71.20 respectively. However, germination percentage at +4^{o}C and –20^{o}C was more or less similar (Table 1). It was observed that the viability rate decreased slowly and after 48 weeks in freeze dryer 65.60% germination was observed. At –20^{o}C and -30^{o}C pollen showed 15.96% and 23.50% germination after 48 weeks respectively, while the viability recorded 9.10% after 48 weeks at +4^{o}C condition. It is widely acknowledged that temperature and relative humidity of stored environment are the two important factors that profoundly influence the viability of stored pollen (Figs. 1 & 2).

According to Sanewski (1985) temperature had clear effect on pollen germination and showed the best results between 20°C and 30°C in Orchid pollen. Furthermore, he reported that the temperatures under 15°C and over 30°C reduced pollen germination and produced abnormal pollen tube development. Similar conditions also recorded in other species (Vasilakakis & Porlingis, 1985; Cohen *et al.*, 1989). However, during the present study, pollen showed good results between 30°C, 60°C. The influence of temperature and its fluctuations on the pollen germination of different cultivars of apple and pear were examined by Deckers & Porreye (1984). Similarly, Aslantus & Pirlak (2002) also reported that germination capacity of strawberry pollen increased at low temperature. Dantas *et al.,* (2005) examined the germination and development of pollen tube in apple.

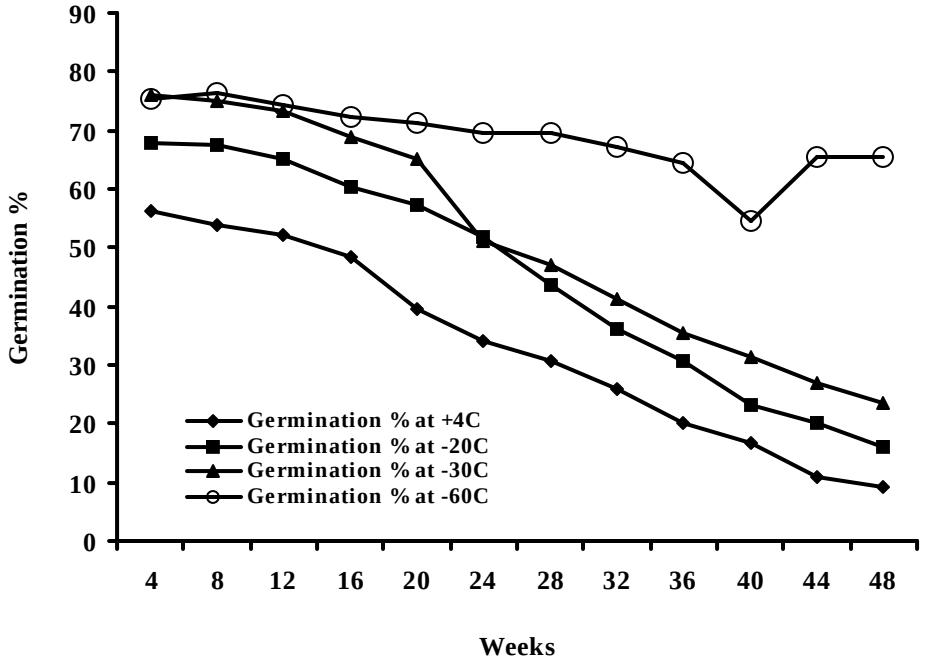

Fig. 1. Germination capacity of stored pollen of *Malus pumilla* (Rosaceae) at different temperature upto 48 weeks.

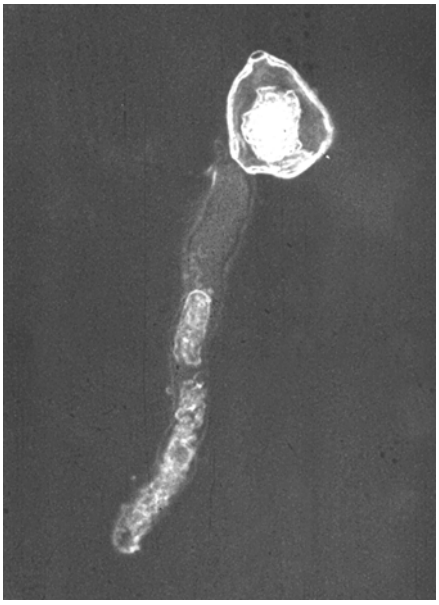

Fig. 2. *Malus pumila*: Germinating pollen (LM). Storage after 20 weeks at -20C (x 40).

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Reference

Alexander, M.P. 1996. Different staining of aborted and non-aborted pollen. *Stain Technology*, 44: 117-122.

Amma, M.S.P. and A.R. Kulkarn. 1979. Pollen storage in organic solvents. *J. Palyn*., 15:100-104.

Aslantus, R. and L. Pirlak. 2002. Storage of strawberry pollen. IV. *International Symposium on strawberry pollen*. (Eds.): M. Hietaranta, M.L Palonen & P. Parikka. *Acta Hortcul*ture, 2: 567.

Barnabás, B. and E. Rajki. 1976. Storage of maize (*Zea mays* L.) pollen at −196°C in liquid nitrogen. *Euphytica*, 25(1): 921-930

Brewbacker, J.L. and B.H. Kwack. 1963. The essential role of calcium ion in pollen tube growth. *Amer. J. Bot*., 50: 859-865.

Cohen, E., U. Lavi and P. Spiegel-Roy. 1989. Papaya pollen viability and storage. *Scientia Horticulturae,* pp. 317-324.

Dantas, A.C.De M., M.L. Peixoto, Rubens Onofre Nodari and M.P. Guerra. 2005. Germination of pollen and the development of pollen tubes in apple (*Malus* spp.). *Rev. Bras. Frutic.*, 27(3): 356-359.

Deckers, T. and W. Porreye. 1984. Influence of the temperature on pollen germination of different cultivars of apple and pear: trials *In vitro*. *Acta Hort*., (ISHS) 149:123-130.

Ganeshan, S. and M.P. Alexander. 1991. Cryogenic preservation of lemon (*Citrus lemon* Burm.) pollen. *Garten-bauwissenschaft*, 56: 228-230.

Jain, A and K.R. Shivanna. 1988. Storage of pollen grains in organic solvents: effect of organic solvents on leaching of phospholipids and its relationship to pollen viability. A*nnals* of *Botany,* 61: 325-330.

Khan, S.A. and A. Perveen. 2006a. Germination capacity of stored pollen of *Abelmoschus esculentus* L. (Malvaceae) and their maintenance. *Pak. J. Bot*., 38(2): 233-236

Khan, S.A. and A. Perveen. 2006b. Germination capacity of stored pollen of *Solanum melongena* L. (Solanaceae) and their maintenance. *Pak. J. Bot*., 38(4): 917-920.

Liu, W.L., Lanzhou and Z.X. Cao. 1984. Germination, respiration and fertility of pollen of *Prunus persica* and *Malus pumila* during storage in some organic solvents. *Acta Phytophysiologia Sinica*, 10(3): 277-284.

Perveen, A., S.A. Khan and R. Abid. 2007. Maintenance of pollen germination capacity of *carica papaya* l., (Caricaceae). *Pak. J. Bot*., 39(6): 1403-1406.

Pinney, K. and V.S. Polito. 1990. Olive pollen storage and *In vitro* germination. In: *International Symposium on olive growing.* (Eds.): L. Rallo, J.M. Caballero and R.S. Rscaba, *ISHS Acta Horticulture*, 1: 286.

Pressman, E., M.M. Peet and D.M. Pharr. 2002. The effect of heat stress on tomato pollen characteristics is associated with changes in carbohydrate concentration in the developing anthers. Annals of Botany, 90: 631-636.

Sanewski, G.M. 1985. *Custard apples: site selection*. North Moreton Region District Crop Summary. Queensland Department of Primary Industries, Mar. 85: 1 pp

Stanley, R.G. and H.F. Linskens. 1974. *Pollen biology, biochemistry and management*. Springer, Verlag. Berlin, Heidelberg, New York.

Tyagi, A, J.A. Considine and J. Mccomb. 1992. Germination of *Verticordia* pollen after stprageat different temperatures. *Australian J. of Botany*, 40(92): 151-155.

Vasilakakis, M. and I.C. Porlingis. 1985. Effects of temperature on pollen germination, pollen tube growth, effective pollination period and fruit set of pear. *Hort Science,* 20: 733-735.

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