ABSTRACT

The present investigation reveals the effect of sucrose and boric acid on in vitro pollen germination of a medicinal as well as dye yielding important plant Lawsonia inermis Linn. belonging to the family Lythraceae. It flowers almost throughout the year with a peak during June to August. Flowers open in the early morning (04.00 hrs.-06.00 hrs.) after which anther dehiscence take place. The pollen grains are 3- colporate. The maximum 92% pollen germination along with 1144 µm long pollen tube developed in 15% sucrose solution supplemented with 100 ppm boric acid. Pollen grains which were collected in the morning (06.00 hrs.- 7.00 hrs.) showed best results.

Key words: pollen germination, pollen tube, pollen viability.

INTRODUCTION

Germination is the first critical morphogenetic event in the pollen towards fulfilling its ultimate function of discharge of male gametes in the embryo sac. It is therefore important to understand the physiology and biochemistry of pollen germination. The stigma provides a suitable site for pollen germination. However studies on in vitro are not easily feasible because of the complications involving in pistillate tissue. It is possible to germinate pollen grains of a number of taxa using rather a simple nutrient medium and to achieve a reasonable length of tube growth. Our knowledge on physiology and biochemistry of pollen germination and tube growth comes largely from in vitro studies. Pollen grains, being the sexual reproductive unit and the carrier of male genetic material in higher plants, play a vital role in breeding programme and assists successful fruit-set. High crop yield generally depends on viable pollen grains. Pollen fertility and viability have a paramount importance in hybridization programme. Pollen performance in terms of germinating ability may have the relative importance upon not only fruit-set but also the flower-flower and flower-pollinator interaction. The present work is aimed to study the effect of sucrose and boric acid on in vitro pollen germination of Lawsonia inermis, a medicinally important plant [1,2,3] also having long traditional use as natural dye and cosmetic [4,5] belonging to the family Lythraceae. It is a native of Arabia and Persia and now being cultivated mainly in Hariana, Gujrat, Madhyaapradesh, Rajasthan and naturalized all over India [1,3].

MATERIALS AND METHODS

For the study of in vitro pollen germination, newly opened flowers were collected in the morning (6.00 hrs.-8.00 hrs.) and transferred to polythene bag. In vitro pollen germination was studied to know the effect of nutrients like sucrose and boric acid at different concentration individually as well as in combinations. The fresh pollen samples were sown on several grooved slides containing solution of sucrose and boric acid at different concentrations separately or in combinations. Slides were then kept in Petridishes lined with moist filter paper and examined under an Olympus microscope at low magnification (10x X 15x) at different time intervals to know the germination percentage and pollen tube length following the method of Shivanna and Rangaswamy [6]. A pollen grain was considered as germinated if pollen tube length atleast becomes twice greater than the diameter of the pollen grains [7].

RESULTS AND DISCUSSION

Studies on in vitro pollen germination at different time intervals after anthesis indicated that 72% germinating pollen with a mean of 858 µm long pollen tube development was observed in 15% sucrose solution (Table-1). Individually, 100 ppm boric acid showed 84% germination along with
897 μm long pollen tube (Table-2). The maximum 92% pollen germination along with 1144 μm long pollen tube developed after 3 hours in 15% sucrose solution supplemented with 100 ppm boric acid (Table-3, Fig-1). Though the effect of either sucrose or boric acid individually showed good results, but sucrose in combination with boric acid promoted pollen germination as well as tube development, because boron makes a complex with sugar and this sugar-borate complex is known to be capable of better translocation than non-borate, non-ionised sugar molecules [8,9].

The pronounced effect of sucrose and boric acid on increasing trend of germinating pollen might be reflected with the views of Johri and Vasil [10] and Shivanna and Johri [11] who stated that the externally supplied sucrose maintains the osmotic pressure and acts as a substrate for pollen metabolism. The role of boron has been confirmed in germinating pollen and growing pollen tubes in vascular plants [9,12]. The studies of Stanley and Loewus [13] indicated that boron is directly involved in pectin synthesis and thus indirectly involved in development of pollen tube membrane.
Scott [14] suggested that boron could exert a protective effect in preventing excessive polymerization of sugars at sites of sugar metabolism. In nature water, sugar, amino acids are supplied by the style to nourish the growing pollen tube. Boron is also provided by stigmas and styles, facilitates sugar uptake and has a role in pectin production in the pollen tube [15]. Boric acid is known to be crucial for pollen germination and tube growth and it is required at concentration of 100 ppm for most species [16]. Brewbaker and Kwack (1964) reported the induced role of Calcium and Boron on in vitro pollen germination [17]. Boron plays a role in flowering and fruiting process in pistachio [18] and its deficiency results in low pollen viability, poor pollen germination and reduced pollen tube growth [19]. Boron takes part in pollen germination and style tube formation and therefore has a vital function in fertilization of flowering crops. Boron added in the form of boric acid, is also essential for the in vitro culturing of pollen from most species; and it is well appreciated that elimination of boric acid from the culture medium often leads to tube bursting [20,21]. Wang et al. (2003) studied the effect of boron on the localization of pectins and callose in the wall of pollen tubes in Picea meyeri [22]. Acar et al. (2010) also reported the stimulatory effect of boron on in vitro pollen germination of Pistacia vera [21]. Thus, the present work gets supports from Vasil [23], Gupta et al. [7], Pal et al. [24], Mondal et al. [25], Bhattacharya et al. [26] and Bhattacharya and Mandal [27], Biswas et al. [28] and Acar et al. [21].

Fig.1. In vitro germinating pollen of Lawsonia inermis.

REFERENCES