

## Effects of Different Plant Growth Regulators and Minerals on Pollen Germination of “İstanbul” Medlar Variety

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**Abstract** – This study was carried out to examine the effects of some plant growth regulators and mineral substances on pollen germination and pollen tube length in the pollen of 'Istanbul' cultivar of medlar, which is one of the important minor fruit species. For this purpose potassium nitrate (50 ppm), thioure (50 ppm), benzyladenine (5ppm), gibberellic acid (10 ppm) and indole butyric acid (10 ppm) solutions were added germination medium (20% sucrose + 1% Agar-Agar + 5ppm H<sub>3</sub>BO<sub>3</sub>). Pollens were counted after 2h, 6h, 12h and 24 hours later after sowing. Pollen tube growth was measured by ocular micrometer after 24 hours later germination. Statistical analyses were performed by SPSS 22.0 version. The effects of chemicals on pollen germination and tube growth were found as statistically different according to plant growth regulators minerals substances. Pollen germination rate and pollen tube length were increased by incubation time. Potassium nitrate and gibberellic acid were determined as promoter while thioure and benzyladenine effected as inhibitory. The highest pollen germination rate and pollen tube length were obtained from the germination medium supplemented with gibberellic acid (26.25% and 100.28 µm respectively). Potassium Nitrate also increased the germination rate and pollen tube length as control (mean: 21.95% and 85.33 µm). Thioure (2.35%) and benzyladenine (2.80% effected as inhibitory in pollen germination and tube growth. Results close to the control group were obtained in the germination medium supplemented with indolebutyric acid (14.25% pollen germination rate and 36.31 µm pollen tube length). Recommended doses of gibberellic acid and potassium nitrate can be applied in the pollination period.

**Keywords** – Gibberellic Acid, Fruit Set, Pollen Germination, Pollen Tube Growth, Thioure

### I. INTRODUCTION

Optimal germination of pollen levels can vary, plant species and variety, environment nutrient content, humidity, pressure, pH status and ecology [1]. A mature pollen is in the same seed as it stores nutrients in its body and nutrients both *in vitro* and in germination of pollen *in vivo* used for [2], [3]. A mature pollen is in the same seed as it stores nutrients in its body and nutrients both *in vitro* and in germination of pollen *in vivo* used for. However, pollen nutrients contained in pollen tubes to reach the seed often not enough. For this reason, pollen tubes pass from a certain stage its subsequent development occurs in the stigma through the use of

nutrients is taking place. Sucrose of these substances.

In pollen germination. The first function of sugar is as a respiratory element. Its second task is osmoticis to control the pressure. many species. The pollen explodes when placed in water. Adding a certain amount of sugar, diffusion of water into pollen limits and tube fragmentation prevents. In addition, germination and boron, calcium, potassium for tube growth, Some, such as magnesium and gibberellic acid mineral substances and growth regulators required [4]. Among inorganic substances boron; pollen in the form of boric acid and borate very important in germination and tube growth has an effect. Pollen of many species boron. It is poor in

content. In nature this lack of stigma and high boron of style content is closed. Boron, germination as it increases the percentage and tube growth. It is also involved in the transport of sugar and explosion of pollen tubes

reduces [5]. Pollen of many species boron. It is poor in content. In nature this lack of stigma and high boron of style is closed with. Pollen grains other flower less calcium than they contain. calcium flower powder grass accelerates the growth of pollen tubes, make pollen tube straighter and harder provides. aluminum and calcium pollen germination and important role in the development of tube growth playing. Indole acetic acid, gibberellic acid, kinetin and naphthalene acetic acid flower powder germination most commonly used growth known as regulator [6].

In this study the effects some growth regulators and mineral substances on pollen germination and tube growth in medlar were investigated.

## II. MATERIALS AND METHOD

In this study 'İstanbul' medlar variety pollens' were used. Pollens were obtained from flowers at flowering stage in phenological stage. The flowers were brought to the laboratory as soon as they were picked. Anthers taken from flowers were placed in dark bottles by dehiscence them into the room temperature under the light. The 'agar in plate' method was used to establish pollen germination and pollen tube growth [7]. Germination medium was 20% sucrose + 1% Agar-Agar + 5ppm H<sub>3</sub>BO<sub>3</sub> which was obtained from previous study about medlar fertilization biology [8]. Some growth regulator and mineral substances to pollen germination. In order to examine the effects of determined as a result of the experiments, chemicals into the germination medium added.

- Potassium nitrate (KNO<sub>3</sub>) (50 ppm), thioure (50 ppm), benzyladenine (BA) (5ppm), Gibberellic acid (GA<sub>3</sub>) (10 ppm) and Indole butyric acid (IBA) (10 ppm).

Petri dishes was placed in in 21°C. 2h, 6h, 12h and 24 hours later pollen germination rate was determined and the pollen tube length was measured 24 hours later with ocular micrometer. Averages of germination results differences between multiple comparison test (P<0.05). Statistical analyzes with SPSS 22.0 package program made.

## III. RESULTS

Some growth regulators used pollens mineral substances effects on germination, different incubation duration examined at the end of the period. Pollen germination started 2 hours after sowing only in GA<sub>3</sub> added medium. All media and varieties used 24 hours after pollen germination for has increased markedly. Different Some growth regulator and mineral substances into the control medium after 24 hours. The effects on pollen germination were found to be statistically significant (p<0.05). Mean germinate rate was the highest in added GA<sub>3</sub> (26.25%). KNO<sub>3</sub> was found promoter as control group it was 21.95%. The lowest germination was obtained from Thioure with 2.35%. Similarly, BA was inhibitory (2.80%). IBA was closely to control group with 14.25%. (Table 1).

Table 1. Effects of Different Plant Growth Regulators and Minerals on Pollen Germination Rate İstanbul" Medlar Variety (%).

| İstanbul         | 2                        | 6            | 12           | 24            | Mean           |
|------------------|--------------------------|--------------|--------------|---------------|----------------|
|                  | hours                    | hours        | hours        | hours         |                |
| Control          | 0                        | 0.0          | 11.30        | 49.53         | <b>15.43c*</b> |
| GA <sub>3</sub>  | 1.1                      | 3.86         | 16.80        | 83.27         | <b>26.25a</b>  |
| KNO <sub>3</sub> | 0                        | 3.80         | 12.35        | 71.67         | <b>21.95b</b>  |
| Thioure          | 0                        | 1.23         | 2.90         | 5.30          | <b>2.35d</b>   |
| BA               | 0                        | 0            | 1.23         | 10.27         | <b>2.80d</b>   |
| IBA              | 0                        | 0.74         | 10.50        | 45.57         | <b>14.25c</b>  |
| <b>Mean</b>      | <b>0.18d<sup>y</sup></b> | <b>1.75c</b> | <b>9.18b</b> | <b>44.60a</b> |                |

\*Values within a column followed by different letters are significantly different (p<0.05). <sup>y</sup>Values within same row followed by different letters are significantly different (p<0.05).

24 hours after pollen sowing in all media used, varieties of pollen tube lengths have been measured. As seen as Table 2 different incubation and different plant growth regulators and minerals on pollen tube growth were statistically significant (p<0.05). The pollen tubes measured tallest at 24 hours for all medium. (137.61µm). GA<sub>3</sub> and KNO<sub>3</sub> were promoter for pollen tube length like pollen germination rate. The tallest pollen tubes were measured in GA<sub>3</sub> (100.28µm). The shortest pollen tubes were measured in added Thioure (19.09 µm). Also BA added medium was inhibitory as control 23.76 µm. Pollen tube lengths in the IBA added were close to the control group (36.31 µm).

Table 2. Effects of Different Plant Growth Regulators and Minerals on Pollen Tube Growth İstanbul" Medlar Variety (µm).

| İstanbul         | 2            | 6             | 12            | 24             | Mean           |
|------------------|--------------|---------------|---------------|----------------|----------------|
|                  | hours        | hours         | hours         | hours          |                |
| Control          | 0            | 0.0           | 55.28         | 100.14         | <b>38.86c*</b> |
| GA <sub>3</sub>  | 9.34         | 40.35         | 89.54         | 271.23         | <b>100.28a</b> |
| KNO <sub>3</sub> | 0            | 18.23         | 76.52         | 246.58         | <b>85.33b</b>  |
| Thiore           | 0            | 10.56         | 28.21         | 56.21          | <b>19.09e</b>  |
| BA               | 0            | 0             | 12.10         | 64.25          | <b>23.76d</b>  |
| IBA              | 0            | 9.16          | 48.85         | 87.23          | <b>36.31c</b>  |
| <b>Mean</b>      | <b>0.81d</b> | <b>13.05c</b> | <b>51.75b</b> | <b>137.61a</b> |                |

\*Values within a column followed by different letters are significantly different (p<0.05). <sup>†</sup>Values within same row followed by different letters are significantly different (p<0.05).

#### IV. DISCUSSION

Pollen germination rate and pollen tube length increased with incubation time for all germination medium media. Similarly, in strawberries, pollen germination rate and pollen tube length increased with incubation time [2]. In addition, in another study on cherries, the highest germination rate was obtained at the end of 24 hours for all varieties [9]. The effects of hormones are mostly pollen source. 'Tufts' 1 hour in their study with pollen finally germination begins and pollen with incubation time It was observed that germination increase. Different growth regulator and mineral substances, pollen germination and tube effects on growth, the variety used change according to the dose of use shows. For example, Jasmonic in strawberries acid pollen germination and grass tube while increasing its length, ethephon decreased it [10].

In a study conducted on pomegranates the hormone type and concentration depended on the cultivar. Although GA<sub>3</sub> decreases the rate in herbaceous flowers this effect was not in the same direction in functional male flowers. NAA reduces germination of all pollen [11]. In parallel with our study, in a study conducted in blackberries, potassium nitrate and gibberellic acid increased pollen germination and tube growth, while benzyl adenine decreased [12]. Likewise, in another study on cherries, potassium nitrate and while gibberellic acid is found as chemicals that have a positive effect on pollen germination and tube growth, inhibitory effects of thioure and benzyladenine have been observed [6].

#### V. CONCLUSION

Pollen germination and pollen tube growth are very important research material for morphological, physiological, biotechnological, ecological, biochemical and molecular studies. In conclusion;

used chemicals to pollen germination and although their effects on tube growth are different, all common point for chemicals and varieties; pollen with incubation time is an increase in germination. In our study, KNO<sub>3</sub> and GA<sub>3</sub>, pollen germination rate and pollen grass tubewhile increasing its length, thioure and BA detected as an inhibitor.

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