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PRELIMINARY RESULTS OF PRIMING APPLICATIONS ON GERMINATION OF AGED ANATOLIAN BLACK PINE SEEDS

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Abstract: Anatolian black pine (*Pinus nigra* J.F. Arnold) seeds belong to the orthodox class and are very tolerant of drying and storage. The aging process is slower depending on time. Germination abilities decrease with aging Anatolian black pine seeds originate from Bursa-İnegöl-Boğazova and were harvested in 2006 and 2018. In this context, chitosan (0.25%, 0.50% 0.75%), humic acid (3%, 6%, 12%) and seaweed (0.30%, 0.60%, 1.20%) was used in the resarch. It was observed that the priming applications increased the germination percentage compared to the control groups depend on changing harvest year and aplication doses.
Keywords: Aging, Germination, *Pinus nigra,* Priming

INTRODUCTION

Anatolian black pine (*Pinus nigra* J.F. Arnold subsp. *pallasiana* (Lamb) Holmboe), Scots pine (*Pinus sylvestris* L.) and Turkish pine (*Pinus brutia* Ten.) are primary forest tree species with high ecological value and economic quality for Turkey (Boydak and Çalışkan, 2014; Ayan et al. 2021; Yer Çelik et al., 2023). Anatolian black pine is used extensively in afforestation works in Turkey, particularly in semi arid and antropogenic steppe region in Central Anatolia (Negiz et al., 2019). When all this information is evaluated, it can be said that the use of Anatolian black pine seeds in afforestation studies is important in terms of sustainability.

Typical orthodox seeds, when stored, age and gradually lose their viability (Roberts, 1973). The Anatolian black pine seeds that is one of these are tolerant of low temperature and drying, too. Furthermore, they are storaged long term in cold storage without not to much loss germination (Priestley, 1986).

Seed ageing during storage is a combination of several processes that eventually leads to loss of germinability (Copeland and McDonald, 1995). To improve yields from poor-quality which have low of germination and vigor pine seeds, it is necessary to discover pretreatments that increase seed vigor and germination. High-vigor seeds

germinate rapidly and uniformly regardless of growing conditions. Methods such as moist chilling, seed priming, magnetic field, and plant growth regulators are widely applied to improve vigor and germination in agriculture and forest tree seeds (Close and Wilson, 2002; Ayan et al., 2015; 2020).

Chitosan, obtained from chitin's deacetylation, is an organic polymer with a cationic character, which confers numerous physicochemical and biological properties, such as copolymerization, filmogenicity, biocompatibility, biodegradability, and also antibiotic properties (Kong et al., 2010; Nunes da Silva et al., 2014). In addition this, seaweed extract contains plant essential macro- and micronutrients, several plant growth regulators such as indole acetic acid (IAA), gibberellins, cytokinins, choline chloride and glycine betaine that are responsible for many physiological responses in plants which favourably affect yield and quality of several crops (Mondal et al. 2015; Layek et al. 2018; Dutta et al. 2019). It has been reported that humic substances (such as humic acide) promote germination, increase the rate of germination, root and shoot growth in seeds of various species, provided that they increase the enzymatic activities in the seed tissues during the germination process (Haciyusufoglu and Erkul,2015).

In this study, it was investigated whether the different priming materials and doses that were applied to the seed increased the germination capacity of Anatolian black pine seeds. Therefore, it is aimed that primed seeds germination percentage increase in this study.

MATERIAL AND METHOD

Material

Anatolian black pine seeds harvested in 2006 (PB-06) and 2018 (PB-18) were used as material. These seeds were storaged in at 4 C° after harvest. Then, they are primed with some materials such as humic acide (HA), chitosan (CHT) and seaweed (SW). After that, they were subjected to germination tests.

Method

0.25%, 0.50% and 0.75% chitosan solution, %3, %6, %12 humic acide solution and 0,30%, 0,60%, 1,20% seaweed solution were prepeared for seed priming. After this, germination test was started. In this experiment, 4 x100 seeds were tested for germination in order to investigate the effects of chitosan, seaweed and humic acid on the germination of aged larch seeds. Germination was carried out at 65% humidity and 21 °C in incubator. Total germination time was determined as 28 days. The germination rate was calculated by determining the total number of germinated seeds at the end of the germination period. In addition, root lengths of germinated seeds were determined. While measuring root lengths, care was taken to ensure that the radicle length was above 2 mm according to ISTA standards (ISTA, 2009).

RESULTS

Germination rates of aged Anatolian black pine seeds after priming with different materials are given in figure 1, 2, 3.

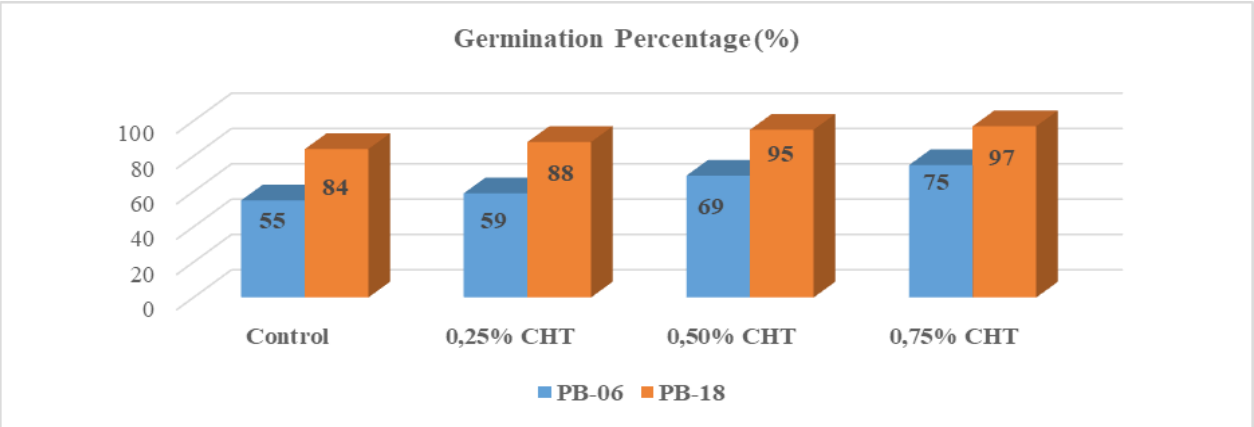

Figure 1. Germination percentage after seed priming with chitosan

According to figure 1, it is detected that seed germination percentage that was primed more upper than control seed generally. As application doses increased, germination percentage was raised.

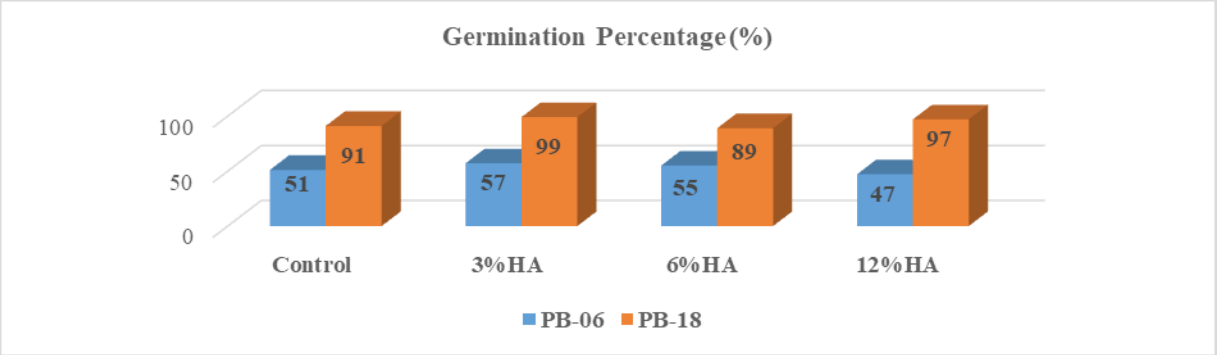

Figure 2. Germination percentage after seed priming with humic acide

The lowest humic asit dose (3% HA) application had increased to germination rate both PB-06 and PB-18 (Figure 2).

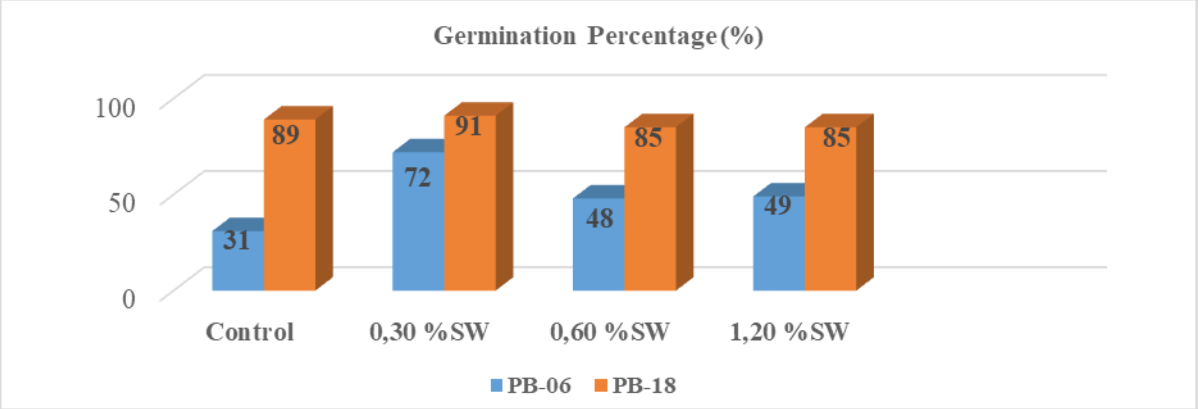

Figure 3. Germination percentage after seed priming with seaweed

Germination percentage was increased by 0,30% seawed priming application both PB-06 and PB-18 (Figure 3).

DISCUSSION AND CONCLUSION

In this study, Anatolian black pine seeds storaged long-term (15 years) and less-term (3 years) were subjected to priming with different materials to increase their germination percentage. When the seed germination is evaluated according to the harvest years, the germination percentage of less-term storage seeds is higher than long-term storage seeds for control groups. After priming, the germination percentage of both PB-06 and PB-18 differed depending on the priming material. For example, as the chitosan doses increased, the germination percentage of PB-06 and PB-18 seeds increased in comparison with the control. When the application doses were examined among themselves, the germination percentage decreased as the humic acid dose increased. It is seen that 3%HA application had the highest germination rate for both of them. After seaweed priming, germination rate; There was an inversely proportional relationship between germination percentage and dose amounts. Among the application doses, the highest germination percentage was obtained with 0.30% seaweed application.

Many researchers have stated that humic acids are effective on plant growth and development, have a positive effect on plant growth when applied in low amounts, and have ineffective or negative effects on growth when applied in excess (Chain and Aviad, 1990). In the study carried out in Şanlıurfa Harran Plain conditions in 2010 and 2011; applied humic acid to the seed before planting in wheat at 0, 1.25%, 2.5%, 5% and 10% levels. They reported that the highest grain yield was obtained from 5% and 10% seed applications (Öktem et. al, 2013). Also Hameed (2013), evidenced that seed priming with chitosan also induced an enhancement in anti-oxidant enzymes in wheat seeds, which possibly resulted in better seed performance in terms of germination and vigor. In another study, it was reported that seaweed extract applied to bean seeds positively affects seed germination and root and shoot development in later periods (El-Sheekh and El-Saied, 2000). According to the results of Yıldırım and Güvenç (2005), it can be recommended that the seeds be sown after being kept in seaweed extract or water for 24 hours in order to increase the seed germination rate and speed in leeks both under salt stress and under normal conditions.

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