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Physiological properties of service tree (*Sorbus domestica* L.) seeds as affected by fruit size

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Materials and methods

Service tree fruits were collected from solitary tree in area of Vukomeričke gorice (Kravarsko) in autumn during 2011. 150 fruits were collected for analysis and were grouped on the basis of weight like small (5-10 g), medium large (11-15 g) and large (16-20 g). The length (mm) and width (mm) of fruits was measured using digital caliper and fruit weight was measured with laboratory balance "Sartorius" (accuracy 0.01 g). The seeds from fruits were separated manually with the help of little knife and number of full seeds in every fruit was determined. After drying the seeds on air-dry space the weight of each of 309 seeds, which were obtained from 150 fruits, was measured. The seeds were then used for stratification on 30.03.2012. The seeds were moistened before the stratification and placed on an absorbing filter paper before using them for stratification. Every seed was coded for recognition of its origin. The seeds were placed on moistened filter paper with covering of another layer of moistened filter paper to avoid draining problem. Stratification was carried out at temperature of 3°C and lasted in total for 120 days in accordance with rules of ISTA for overcoming seed dormancy from species of genus *Sorbus* L. The moistening of filter paper was continued as per need during the stratification time. After 120 days at the end of stratification period the weight of each seed was measured to calculate the percentage of water absorption. The daily monitoring of seeds was performed in order to determine the moment of seed shell bursting and radicle emergence till the length of 2 mm (*sensu stricto*) during entire stratification period. The increase in length after radicle cracking was taken on daily basis using digital caliper. The radicle length after 120 days of stratification is described in detail in current study. The Statistical analysis was performed with statistical package SAS 9.2.

Results

The descriptive statistical data for some morphological characteristics of service tree fruits with different weight is shown in table 1. Statistically significant differences were determined in length (mm) and width (mm) of fruits with different weight ($p < 0.0001$). Small fruits showed statistically significant difference ($p < 0.0001$) having highest fruit shape index (0.98) in comparison with medium large (0.94) and large (0.91) fruits, and thus can be concluded that small fruits have more round shape. Number of full seeds in fruit was statistically significantly ($p < 0.0001$) highest in large fruits (2.62 piece) in comparison with medium large (1.81 peace) and small (1.46 peace) fruits.

Statistically significant difference ($p < 0.0006$) was obtained in length of seed radicle from fruits with different weight after 120 days of stratification. Seeds from large fruits had statistically significant higher length of radicle (3.89 mm) than seed from small (2.88 mm) and medium large (3.27 mm) fruits. Considering the percentage of water absorption after 120 days of stratification no significant difference was obtained in seed from fruits with different weight ($p = 0.2896$). Weight of one air-dry seed was statistically significantly different considering fruit weight ($p < 0.0006$). It was noticed that seed weight increased with fruit weight. No statistically significant difference was obtained in mean germination time (MGT) from fruits with different weight even if seeds from large fruits germinated four days earlier than seeds from medium large fruits and 3 days earlier than seeds from small fruits. Mean germination time for seeds from all fruits was in average 107 days.

In the case of seeds from small fruits positive and statistically significant ($p < 0.05$) correlation was obtained between radicle length after 120 days of stratification and percentage of water absorption ($r = 0.46$). Negative and significant correlation ($r = -0.48$) was obtained between radicle length after 120 days of stratification and time needed for beginning of seed germination as well as between percentage of water absorption and seed weight in air-dry condition ($r = -0.32$). Positive and small ($r = 0.39$) but statistically significant ($p < 0.01$) correlation was obtained also between percentage of water absorption and time needed for beginning of seed germination.

For seeds from medium large fruits negative and significant ($r = -0.49$) correlation was obtained between length of radicle after 120 days of stratification and time needed for seed germination as well as between percentage of water absorption after 120 days of stratification and time needed for beginning of seed germination ($r = -0.33$). Difference was significant at $p < 0.01$. Although negative and small, but statistically significant ($p < 0.001$) correlation was obtained between percentage of water absorption after 120 days of stratification and seed weight in air-dry condition ($r = -0.32$).

For seeds from large fruits negative and high correlation was obtained between radicle length after 120 days of stratification and time needed for seed germination ($r = -0.79$). Correlation between percentage of water absorption and time needed for seed germination was negative and significant ($r = -0.45$). Differences were significant at $p < 0.001$. There is positive and small, but statistically significant ($p < 0.01$) correlation between radicle length after 120 days of stratification and percentage of water absorption after 120 days of stratification ($r = 0.29$), and negative and small between percentage of water absorption after 120 days of stratification and seed weight in air-dry condition ($r = -0.26$).

After 120 days of stratification at 3°C seed from large fruits (16-20 g) had highest percentage of germination (83.7 %). With the help of Hi-quadrat test statistically significant difference ($p < 0.001$) was obtained in germination of seeds from fruits with different weight wherein seed germination from large fruits was statistically significant higher than seed germination from medium large (59.4 %) and small (56.2 %) fruits show in figure 1. It can be concluded that laboratory seed germination of service tree increases with the size of fruits.

Conclusion

Statistically significant differences were achieved in length and width of service tree fruits with different weight. Small fruits had statistically significant higher fruit shape index (0.98) than medium large (0.94) and large (0.91) from which can be concluded that small fruits have

more roundish shape. Number of full seeds in fruit was statistically significant higher for large fruits (2.62 piece) than medium large (1.81 piece) and small (1.46 piece) fruits. Within all fruits positive and very high correlation was obtained between fruit length and width ($r=0.92$), fruit length and weight ($r=0.93$) and fruit width and weight ($r=0.98$). There is negative and statistically significant correlation between fruit weight and fruit shape index ($r=-0.47$). Statistically significant difference was obtained in length of seed radicle from fruits of different weight after 120 days of stratification. Seeds from large fruits had statistically significant bigger radicle length (3.89 mm) than seed from small (2.88 mm) and medium large (3.27 mm) fruits. Weight of air-dry seed increases with fruit weight. No statistically significant difference was found in mean germination time (MGT) from fruits of different weight although seed from bigger fruits has germinated 4 days earlier than seed from medium large fruits and 3 days earlier than seed from small fruits. Average time of seed germination for all fruits was 107 days. On seed from all fruits negative and significant correlation ($r=-0.66$) was found between radicle length after 120 days of stratification and time needed for beginning of germination. With increase of seed weight in air-dry condition percentage of water absorption statistically significantly decreases. After 120 days of stratification at 3°C, seed from large fruits (16-20 g) had highest percentage of germination (83.7%). Laboratory germination of service tree seed increases with fruit size.