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Breaking seed dormancy and determining cardinal temperatures for *Malva sylvestris* using nonlinear regression

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Abstract

This experiment was conducted to break dormancy of tall mallow (*Malva sylvestris*) seeds and estimate cardinal temperatures using non-linear regression. Scarification of seeds by concentrated sulphuric acid is the most effective method for breaking dormancy of tall mallow seeds. However, response to sulphuric acid treatment varied with seed storage. Treating freshly harvested seeds with sulphuric acid for 240 and 270 minutes resulted in the highest germination, while six months later, the highest germination was achieved with 120 minutes treatment. Different results were also obtained from scarification of fresh seeds and stored seeds by sandpaper. After finding out the best treatment for breaking dormancy, the seeds were placed under a range of temperatures between 5 and 40°C, and non-linear regression models used to determine cardinal temperatures. A dent-like model provided the best fit to the data and was used to estimate cardinal temperatures. Base, optimum and maximum temperatures were estimated as approximately 1, 23 to 34, and 42°C, respectively with this model. This is the first report on cardinal temperatures of tall mallow.

Introduction

The presence of Malpighian cells, which are tightly bundled to hydrophobic substances such as lignin and wax, causes the impermeability of seed coats to water and results in physical dormancy of seeds (Baskin, 2003; Smith *et al.*, 2003). It is known that species of 17 flowering plant families have seeds with physical dormancy (Gama-Arachchige *et al.*, 2010) and several types of specialised structures ('water gaps') have been found in 12 of the 17 families. Malvaceae is a large family which consists of at least 243 genera and comprises more than 4225 species. *Malva* is the typical genus of Malvaceae, comprising some 30 species including annual, biennial and perennial herbaceous plants (Khaleequr *et al.*, 2012). *M. sylvestris* is a medicinal plant but also an important invasive weed in southwest Iran. Most seeds of *Malva* remain impermeable during storage (Van Assche and Vandelook, 2006). It is also reported that seeds of this species usually require scarification to germinate. For example, Chauhan *et al.* (2006) reported low germination of *M. parviflora* seeds without scarification at harvest, but the germination percentage increased slowly as the days after harvest passed. It has also been reported that *M. neglecta* has a similar pattern of decline in dormancy (Makowski and Morrison, 1989).