A REVIEW OF SEED GERMINATION DATA FROM THE GENUS IRIS BY RODIONENKO (1961)

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This review is intended to record for the general reader the experiments described by the Russian botanist, G. I. Rodionenko, relating to the problems of the germination of Iris seeds. While the bulk of his data, presented in a section on pages 135-144, does not directly involve aril species, there is reason to believe that the same mechanism(s) controlling seed dormancy exists in other species of the genus as we encounter in the aril group. It is felt that, although his data does not provide the definitive solution to the vexing problem of seed germination, it is worthwhile making this information available to a wider audience of readers. Neither the recent paper of Jorgensen in the Bulletin of the American Iris Society (October 1965) nor the extensive review of Kidd in the same publication (April 1966) provides any mention of this material. Our review, therefore, serves to complete the survey of literature on the subject.

A series of experiments utilizing fairly drastic pretreatment of seeds are described. One involving treatment with concentrated sulfuric acid for 3, 8 and 12 minutes, respectively, generally reduced germination percentages as compared with controls. One species, **I. pumila,** which is said to give very poor first year germination, did show a 20% increased germination rate. Plunging seeds in boiling water for 5 seconds generally decreased germination also, sometimes killing the seed outright. However, **I. halophila,** responded to this treatment with a 10% increase in germination. A third experiment involved high temperature as follows:

40° C for 8 hrs.
60° C for 6 hrs.
80° C for 1 hr.

Both wet and dry seed were treated with these conditions. The results showed either drastic reduction in germination or no change in the germination rate. The 80° C treatment usually killed the seed. Four species were given ultrasonic treatment of 2-4 minutes duration after the seed had been presoaked for 4 days. None showed increased rates over the controls. It may be mentioned that these kinds of procedures are generally effective in breaking dormancy in those seeds in which the seed coat exercises a determining role in germination. The generally poor results described here, therefore, suggest that in iris species the seed coat has little or no control over dormancy.

A related experiment was concerned with the amount of water taken up by the seeds. The experiment involved 10 species. For three species water absorption for whole seeds was compared with seeds which had the seed coat removed. The duration of the experiment was 10 days. Seeds of two species of arils, **I. elegantissima** and **I. hoogiana,** were included, although unfortunately the effect of removing the seed coat was not studied for these species. In two species which had the seed coats removed, the amount of water absorption was only slightly greater during the first 24-hour period as compared with the whole seed. In the third species of this group, **I. halophila,** however, the whole seed increased only 1.1 times by weight due to H_2O up-

take while the treated seed increased 1.4 times during the same period. This latter was the only species of the group to show a degree of water impermeability in the seed coat. **Iris hoogiana** showed an increase of 1.5 times dry weight in the first 24 hours while **I. elegantissima** increased 1.7 times during the same period. These data and similar values for other species clearly indicate that the seed coat is permeable to water. Most species seem to have absorbed their full water-holding capacity during the 10-day limit of the experiment. Water absorption is clearly not a significant aspect of the germination problems of iris seed because these data show that the seed coat is not an impermeable barrier.

Rodionenko records an experiment to test the effectiveness of embryo culture. The seeds used were sterilized with ethyl alcohol. Other procedures used were of the standard type. This technique was not perfected, however, because he reports only 5 germinations from 60 excised embryos, a very low percentage indeed. The seed used was apparently that of tall bearded garden hybrids.

Of more interest is an experiment involving **I. aphylla.** This species seems to have a dormancy as severe as that of the arils. Four-year old seed was sown in soil and kept in a greenhouse where the temperature varied from 4-25° C. After 2 years, no germination had occurred. [This result differs slightly from the senior author's own experience with some **I. aphylla** seed of unknown age. The seed was soaked in H_2O in the refrigerator for 6 weeks and then planted in soil and placed out of doors in November. After 4 weeks 3 out of 30 seeds had germinated. However, three months later no more seedlings had appeared.] The original 100 seeds were then removed from the soil, sterilized with 75% ethyl alcohol, and divided into 2 equal groups. One group was repotted and returned to the original conditions. The other half were treated by removal of a "small part of the endosperm in the region of the seed scar [hilum]." These seeds were placed on wet filter paper in sterile dishes and placed in the dark at 8-10° C. This second group gave 100% germination in six days, while the unaltered seed remained dormant during the period of the experiment. Unfortunately, the exact position and extent of the operation on the seed is not described or clearly illustrated. Rodionenko concluded from this experiment that the inhibition of germination was due to the lack of oxygen penetration to the embryos. He believes that the endosperm physically restricts the embryo and thus prevents its germination. This conclusion is not the only one, however, that can be drawn from these results. Much more precise experiments would be necessary to demonstrate an oxygen deficiency in ungerminated embryos and the mechanism by which oxygen is excluded during dormancy in the intact seed. More recent experiments of Jorgenson (1965) and of the present authors (unpublished) both indicate that the dormancy factor is of a biochemical nature.

Finally, some experiments are described relating to the effect of pretreatment with low temperatures. The chilling of dry seeds in general was not effective in giving better germination and in one species, **I. kaempfiri,** actually decreased the rate of germination over that of the controls. For three other species, **I. halophila, I. setosa** and **I. siberica,** better germination was obtained after chilling. A parallel series of seeds was placed in wet sand at 4-7° C. This latter treatment did increase the rate for **I. kaempfiri** and several other species. In the case of **I. halophila** and **I. setosa** the response was less dramatic than it was to dry cold but still better than that of the controls. Unfortunately, the conditions for the controls are not indicated.