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SEED GERMINATION AND SEEDLING GROWTH OF GUAIACUM SANCTUM, L.,

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INTRODUCTION

The native lignumvitae, *Guaiacum sanctum* L., has many desirable features as a small ornamental tree or shrub and was listed by Ruehle (4) as a potential ornamental plant for south Florida. It has evergreen compact foliage, abundant blue flowers usually in the spring and fall, clusters of opened fruits displaying bright red arils against an orange ovary wall, and a good natural growth form that can be modified by pruning. It has drought resistance and a broad tolerance to light conditions. It is also in need of conservation as it is facing extinction in the wild. Several specimens on the Florida keys and in Dade County yards have been under surveillance a number of years as a part of an ecology project.

In spite of very large seed crops, seedlings were found to be scarce under natural conditions and in yards. Casual attempts to germinate seeds were failures. These were followed without much success using the common techniques for breaking dormancy, such as temperature extremes, water soaking, and mechanical and acid scarification. A literature search revealed that Marreo (3), working with *Guaiacum officinale*, found that freshly harvested seeds germinated 9% in about 20 days. After one month of storage the figure rose to 20%, but in three months fell to 10%. These data on a second species supported the suspicion that a dormancy problem exists in this tropical genus.

Slow growth of seedlings under natural conditions also presents a horticultural problem. A series of experiments and tests were conducted over a two-year period to determine how to germinate a high percentage of the seeds and to increase the growth rate of seedlings.

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MATERIALS AND METHODS

Seeds falling from trees are covered by an aril, hence seed treatments were designed with and without arils. Since storage seemed to have an effect on germination of *G. officinale*, seed collections were dated and stored at room conditions so that the age of seeds in each experiment was known. Petri dishes with moistened filter paper were used for germination in the majority of tests. Twenty seeds were placed in each dish and sets of five gave 100 seeds per treatment in individual experiments. The dishes were kept under room conditions with a temperature range of 18-24° C. In some experiments testing was done in the greenhouse using a commercial mixture of equal parts of muck and sand. Seedlings were grown in a greenhouse and under a slat shed in the same soil mixture to which traces of soil from native habitats were added to insure the presence of mycorrhizal fungi.

In order to determine if water uptake was a problem, duplicate 100 seed lots were weighed and then placed in water. At intervals for 100 hours they were removed, blotted, reweighed, and returned to water and the results used to establish an imbibition curve.

Seed coat removal was done by scraping seeds carefully with a sharp knife. Scraping was done until the endosperm was exposed. Since scraping was a difficult operation, only 10 seeds per dish were used in these tests.

Gibberellic acid (K-salt—75%) was put into solution according to the method of Curtis and Cantlow (2) and used at 250, 500, 1000, and 2000 P.P.M. in water as a twenty-four hour

soak-treatment before placing the seeds in petri dishes or soil.

Results

Water uptake—Seeds began to imbibe and swell immediately after placement in water and gained approximately 40% in weight within 40 hours, with little additional uptake in the next 60 hours.

Aril effect—Seeds covered by their arils did not germinate under any of the treatments tried (Figure 1). Usually they would die and rot within the test period. Occasionally live seeds were found after the test. These were divided into two groups, one with the aril material present and the other washed free of all aril material. The latter group would give reasonable germination in about twenty days. The group with aril material would not germinate. Likewise, when the filter paper that had absorbed aril material during an initial test was used a second time with dearilled seed either no germination would occur in the test period or embryo growth would be seriously retarded.

Storage effect—Fresh seeds collected before falling, dearilled and washed in water averaged less than 2% germination over a period of 20 to 60 days. After one month storage about 5% would germinate, in two months 20%, in three 30%, in five to seven, 85%, and in twelve months about 60%. These data are approximate and derived from water control lots from experiments throughout the two year period. They also represent seeds from three separate flowering periods and several different trees.

Gibberellic acid effect—Figure 2 shows the results obtained when seeds that had been stored two months were used. Three month old seed did not germinate as well under the same GA treatment. The results were: water control 33%, 250 P.P.M.-58%, 500 P.P.M.-57%, 1000 P.P.M.-81% and 2000 P.P.M.-77%. Seeds fresher than two months were much less sensitive to G.A. With seeds of storage time greater

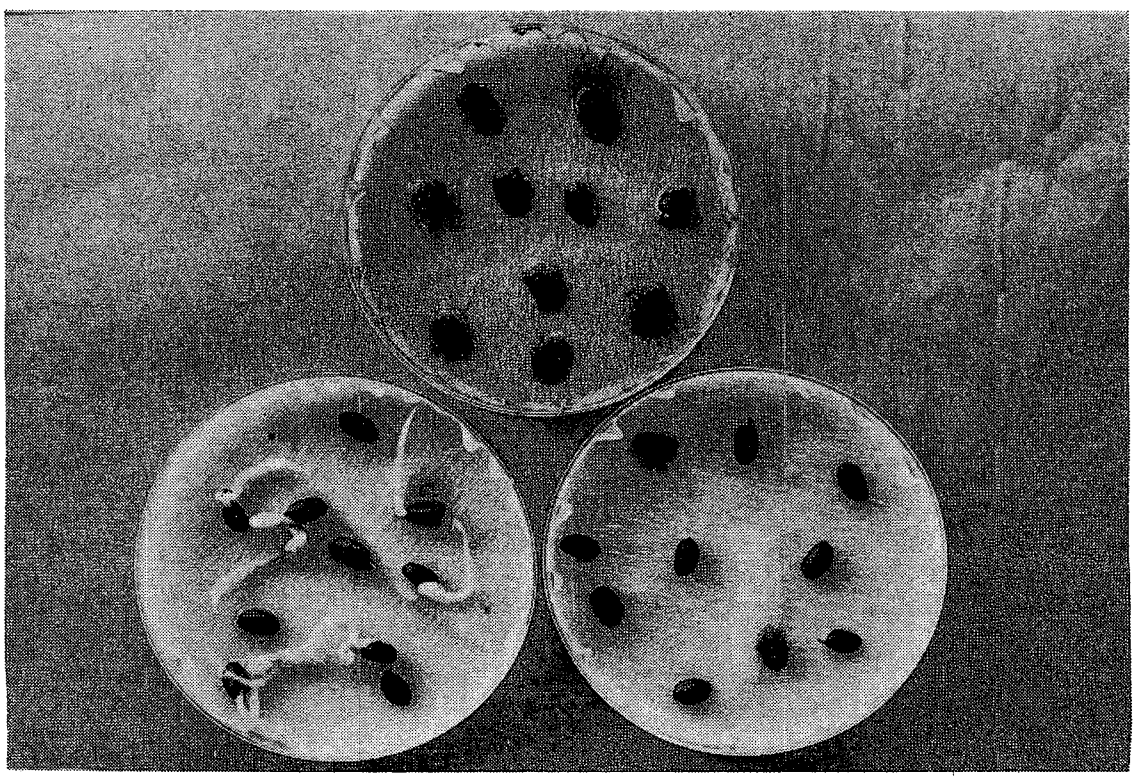

Fig. 1.—Top dish—seeds with decaying arils and no germination, bottom left—germinated de-arilled seeds treated with 1000 P.P.M. GA, bottom right—de-arilled water controls showing two seeds just beginning to germinate.

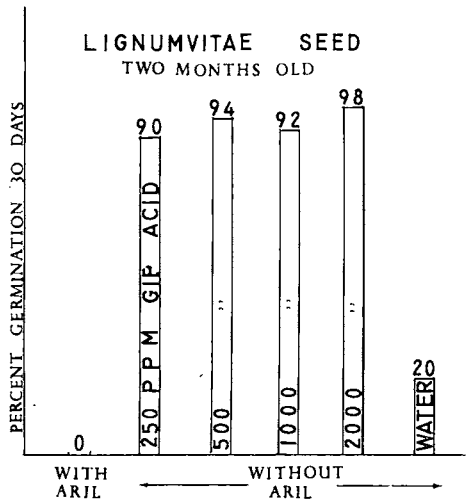

Fig. 2.—Results of one experiment using a 100 seed sample in each treatment.

than 3 months, the differences between contols and treatment became less and less.

Seed coat effect—Seeds that had been decoated before placing in petri dishes, would germinte nearly 100% in 2 to 5 days while controls with seed coats only nicked or intact would show no evidence of germination.

Discussion

The results indicate that germination inhibitors are present in the aril and seed coat. Water extracts of the aril have proved to be germination inhibitors of corn, Italian rye grass, radish, lettuce, peas, and cucumbers (1). Under natural conditions the aril usually deteriorates rapidly, especially under rainy conditions. The dry arils are also subject to infestation and destruction by larvae of the *Olethreutidae* family. In horticultural practice the aril should be removed and the seeds thoroughly washed before planting.

There is no problem with seed coat permeability to water. However, there appears to be one or more inhibitors associated with the seed coat of fresh seeds. This is readily demonstrated by the nearly 100% germination in a few days following seed coat removal from fresh seeds. The inhibitory effect dwindles with time under dry storage conditions. It also seems to disappear to a great extent in seeds under trees three or four months after seed drop. Many tropicals do not have a dormancy period. This one may be adapted to wet-dry tropical climate.

Gibberellic acid treatment is effective giving up to 98% germination especially after a few months dry storage (Figure 1). Variation of response to GA with different seed batches and storage times has been reported by Westra and Loomis (5) for a native grass species, *Uniola paniculata*. Similar trends were noted for lignumvitae.

Growth rates of seedlings were checked on two 100 seedling lots randomized into treatment and controls. Gibberellic acid in water at 500 P.P.M. was used at intervals as a treatment spray on the tops. One lot was first treated just as the cotyledons were falling and the other after a year's growth. In neither case was there any significant difference between treated and control plants. The best plants produced in eighteen months under greenhouse conditions averaged 60 cm. in height. It was concluded that G.A. at 500 P.P.M. was not a satisfactory growth acelerator for this species.

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