Germination of Paulownia Seeds in the Presence and Absence of Light[1]

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Stratification, gibberellic acid, and cold dry storage treatments reduced the light requirement of paulownia seeds for germination, with stratification at 4° C for 2 months proving most effective in both light and dark.

The seeds of *Paulownia tomentosa* (Thunb.) Siev. & Zncc. require long exposure to light for germination (*5*). Little germination occurs in the dark. A similar high light requirement was reported for paulownia seeds collected in Arkansas: The germinative capacity was 90 percent after 19 days of 8-hour illumination (*2*). Germination of paulownia seeds requires the action of phytochrome and is accomplished by illuminating them for a somewhat shorter time and allowing the P_{fr} (phytochrome—for red form) to continue acting in darkness until it disappears, or by giving the seeds a succession of brief illuminations alternating with several hours of darkness (*3*).

Temperature affects the effective length of the light period required for germination of some tree species. Low temperatures reduced the light requirement of *Tsuga canadensis* (L.) Carr. (*6*). The need for alight period in the germination of *Betula pubescens* Ehrh. was replaced by prechilling, seedcoat removal, or the use of an oxygen enriched atmosphere (*1*).

Our study began in 1974 and our objective was to examine the effects of low temperature storage, stratification, and gibberellic acid (GA_3) on the light requirement of *Paulownia tomentosa* seed germination.

Methods

Seeds were collected in September of 1974 from a single tree growing in the vicinity of Wolfe Creek Dam near Lake Cumberland in south-central Kentucky. Separate lots of seed randomly separated were subjected to the following treatments:

1. Untreated, fresh seed.
2. Fresh seed treated with GA_3
3. Seed stratified at 4° C for 2 months.
4. Seed stored dry at 4° C for 2 months.

Germination tests with fresh seeds began within 2 weeks of collection in September. The GA_3 treatment was applied to fresh seeds by soaking for a 1-hour period in a 100-parts per million solution. Dry seeds were stratified in a 1:1 moistened mixture of sand and peat moss. The seeds were stored in sealed glass vials. Seeds receiving the stratification and cold storage treatments were placed in a cold room maintained at 4° C.

Seeds were germinated under continuous light and in darkness in glass petri dishes on Whatman No. 1 filter paper moistened with distilled water. Each test consisted of 10 petri dishes each containing 25 seeds for a total of 250 seeds. Temperature during the germination period was maintained at approximately 70° F Seeds germinated in the light were illuminated with a fluorescent light source at 800 foot candles (42.31 $\mu w\, cm^{-2}$ at 660 nm) for a 12-hour photoperiod.

We defined germination as the emergence and development of the radicle to the point where a portion of the seed was lifted from the germination medium. Daily records were kept of germination. Initially, germination was observed over a 60-day period. Later, as major treatment differences became evident, most tests were concluded after 30 days.

Results

Figure 1 summarizes the effect of light on the cumulative germination of paulownia seeds. All three treatments enhanced germination. Stratified seeds and

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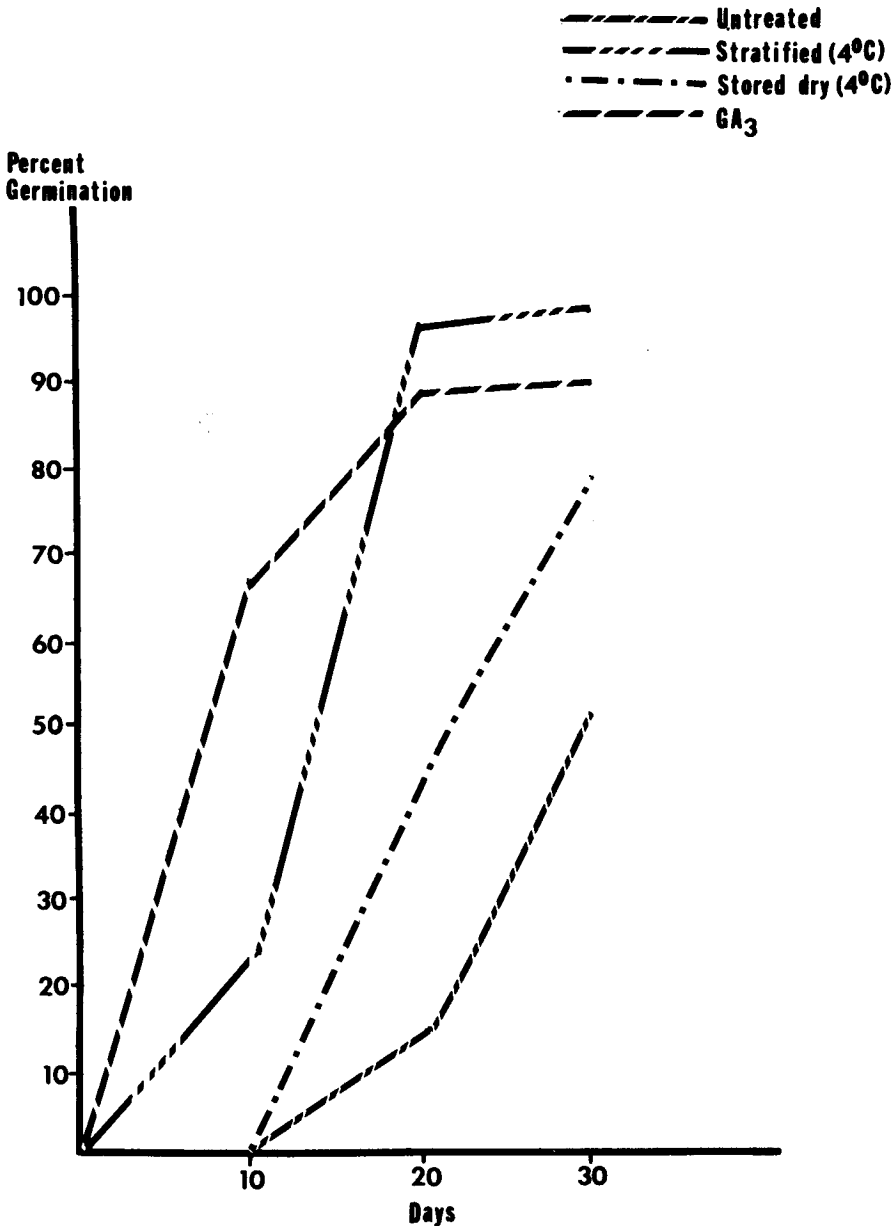

Figure 1.—*Effect of stratification, GA_3, and cold-dry storage treatments on the cumulative germination of paulownia seeds in the light.*

seeds treated with GA_3 began germinating sooner and germination was completed earlier than that of untreated seeds and those receiving the low temperature storage treatment. A maximum of 98 percent germination was recorded for stratified seeds germinated in the light after 20 days. GA_3-treated seeds germinated sooner than stratified seeds, but reached a maximum of 92 percent after 20 days. Germination of seeds receiving the dry cold storage treatment began after 10 days and increased linearly until the study was concluded in 30 days. Germination of untreated seeds also began after 10 days. They germinated slowly, but after 20 days, the rate began to accelerate.

Germination was lower in the dark for all treatments except stratified seeds (fig. 2). Maximum germination (98 percent) of seeds stratified at 4° C was completed in 10 days. The other treatments were far less effective in promoting the germination of paulownia seeds in the dark. Only 48 percent of the seeds treated with GA_3 had germinated after 30 days, but seeds treated with GA_3 germinated earlier than dry-storage seeds and untreated seeds. Germination of seeds receiving a dry, cold-storage treatment was delayed and significant germination did not occur until after 20 days. Untreated seeds also began to germinate

after 20 days in the dark; however, only 11 percent had germinated when the experiment was concluded after 30 days.

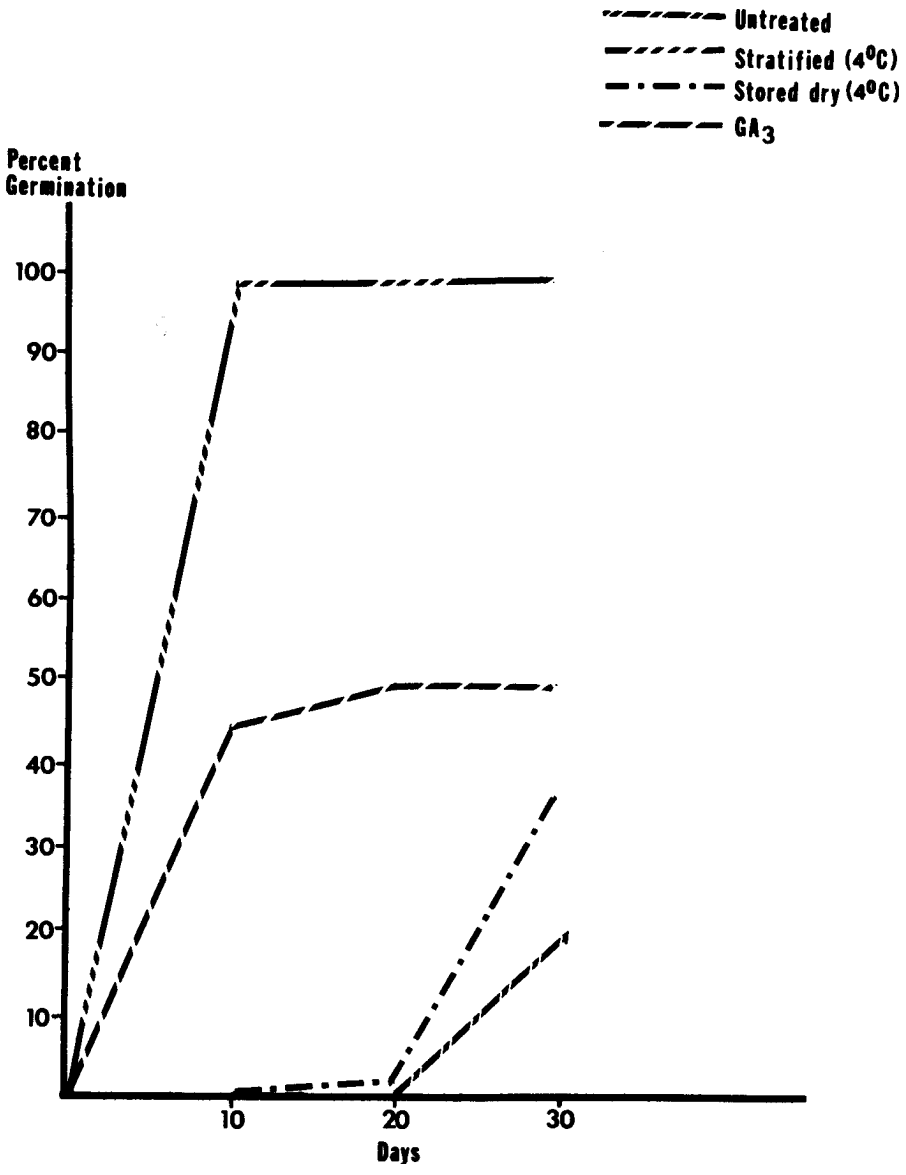

Figure 2.—*Effect of stratification, GA_3, and cold-dry storage treatments on the cululative germination of paulownia seeds in the dark.*

Implications

The results of this study suggest that paulownia seeds should be sown in the field in the fall months or should be stratified before sowing in the spring to obtain rapid, maximum germination. We have successfully stored paulownia seeds in stratification at 4° C for a period of 24 months without any sprouting occurring, or without loss of viability (*4*). Our experience also indicates that paulownia seeds can be stored dry at 4° C for long periods without loss of viability, but the germination of seeds stored dry is reduced and delayed compared with stratified seeds.

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