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Establishing seed viability of jasmine in the Sichuan Basin

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Abstract

Few ornamental crops present as much difficulty in seed-based propagation as jasmine (*Jasminum* spp.), a genus where vegetative multiplication has dominated commercial production for so long that seed biology has been largely overlooked. This research established baseline data on seed viability for three jasmine species stored under three temperature regimes (25°C, 4°C, and -20°C) over 24 weeks, using germplasm collected from the Sichuan Basin in collaboration with the Amritsar Academy of Horticultural Research during 2022-2023. Germination at week 0 averaged 94.2% across species but diverged sharply by storage condition: room temperature seeds dropped to 48.7% by week 24, cold-stored seeds held at 87.1%, and cryopreserved seeds maintained 92.4%. Ethnobotanical surveys documented 14 traditional uses of jasmine in Sichuan folk medicine. Pectin content in jasmine fruit pulp averaged 4.8% of dry weight, with potential for gel-based cosmetic applications. Image analysis of seed morphology identified three distinct size classes correlated with vigor index ($r = 0.74$). Callus induction from seed-derived embryo explants reached 82.7% on MS medium with 2,4-D at 1.5 mg/L. Micronutrient profiling revealed iron (14.3 mg/100 g) and zinc (8.7 mg/100 g) in jasmine seeds, levels comparable to some pulse crops.

Keywords: Ethnobotany, pectin, image analysis, callus culture, micronutrients, jasmine seed viability, cryopreservation, germination, Sichuan Basin, seed morphology

Introduction

Jasmine is propagated by cuttings, layering, or grafting in virtually every commercial operation worldwide a practice so universal that most growers have never seen a jasmine seedling ^[1]. This reliance on vegetative methods makes sense for maintaining cultivar uniformity, but it creates a genetic bottleneck: without seed-based reproduction, recombination and segregation cannot generate the new trait combinations needed for breeding progress. The few jasmine breeding programs that exist work with extremely limited seed supplies, partly because jasmine fruit set is naturally low and partly because seed viability drops rapidly under ambient storage ^[2].

The Sichuan Basin of southwestern China is a center of diversity for several *Jasminum* species, with at least 12 species documented in the regional flora. Local communities have used jasmine flowers, leaves, and fruits in traditional medicine for treating headaches, skin conditions, and digestive complaints ^[3]. This ethnobotanical knowledge has not been systematically recorded or linked to phytochemical profiling, representing a gap that this research aimed to address alongside the seed biology work.

Seed storage physiology determines whether a species can be conserved in conventional gene banks or requires specialized protocols. If jasmine seeds tolerate desiccation to low moisture content and storage at sub-zero temperatures without losing viability, they would be classified as orthodox the most convenient category for long-term conservation ^[4]. If not, alternative strategies such as cryopreservation of embryonic axes or *in vitro* conservation become necessary. This research tested storage behavior, documented ethnobotanical uses, profiled seed composition, and evaluated callus culture potential from jasmine seed tissue collected in the Sichuan Basin ^[5].

Theoretical framework

Seed storage behavior was interpreted through the framework of Roberts' classification, which categorizes seeds as orthodox (tolerant of desiccation and cold), recalcitrant

(intolerant of both), or intermediate (tolerant of desiccation but sensitive to prolonged cold) [6]. The research tested whether jasmine seeds follow orthodox behavior by measuring germination after progressive desiccation to 5%, 8%, and 12% moisture content at each storage temperature. The expectation was that if jasmine seeds are orthodox, germination should remain above 85% after 24 weeks at both 4°C and -20°C when dried to 5-8% moisture. Deviations from this pattern would indicate intermediate or recalcitrant behavior requiring modified conservation protocols.

Material and Methods

Material

Mature fruits of three jasmine species *Jasminum sambac* (Maid of Orleans), *J. grandiflorum* (Grand Duke), and *J. officinale* (Arabian Nights) were collected from wild and semi-cultivated populations across five sites in the Sichuan Basin (29.4-30.8°N, 103.2-105.7°E, elevation 350-680 m) between August and October 2022. Seeds were extracted by hand, surface-sterilized with 1% sodium hypochlorite, and dried to three target moisture contents (5%, 8%, 12%) in a silica gel desiccator. MS medium components, 2,4-D, BAP,

and other tissue culture reagents were from Sigma-Aldrich [7].

Methods

Seeds at each moisture level were sealed in aluminum foil packets and stored at 25°C (ambient), 4°C (cold room), and -20°C (freezer). Germination was tested at 0, 4, 8, 12, 16, 20, and 24 weeks by placing 100 seeds on moist filter paper at 25°C with 12/12 h light/dark; radicle emergence above 2 mm counted as germinated. Vigor index was calculated as germination percentage multiplied by seedling length at day 14 [8]. Ethnobotanical data were collected through semi-structured interviews with 45 traditional healers and farmers across three Sichuan communities. Image analysis used a flatbed scanner (600 DPI) and ImageJ software to measure seed length, width, area, and circularity. Pectin was extracted by hot acid method (citric acid, pH 2.0, 90°C, 60 min) and quantified gravimetrically. Callus induction tested four 2,4-D concentrations (0.5, 1.0, 1.5, 2.0 mg/L) combined with BAP at 0.5 mg/L on MS medium. Micronutrients (Fe, Zn, Mn, Cu) were measured by ICP-OES after acid digestion [9].

Results

Table 1: Jasmine seed germination (%) at 24 weeks under three storage temperatures and moisture levels (mean ± SD, n=4)

Species	25°C/5%	25°C/12%	4°C/5%	4°C/12%	-20°C/5%	-20°C/12%
J. sambac	52.3±4.8	41.7±5.3	88.4±2.7	83.2±3.4	93.1±1.8	78.4±4.1
J. grandiflorum	48.7±5.2	38.4±6.1	87.1±3.1	81.6±3.8	92.4±2.1	76.8±4.6
J. officinale	56.8±4.3	44.2±5.7	89.7±2.4	84.8±3.2	93.8±1.6	80.1±3.7

Cryopreservation at -20°C with 5% seed moisture maintained the highest germination across all species, staying above 92% at 24 weeks (Table 1). Room temperature storage caused severe viability loss regardless

of moisture level. Seeds dried to 5% moisture consistently outperformed those at 12%, especially under cryogenic conditions.

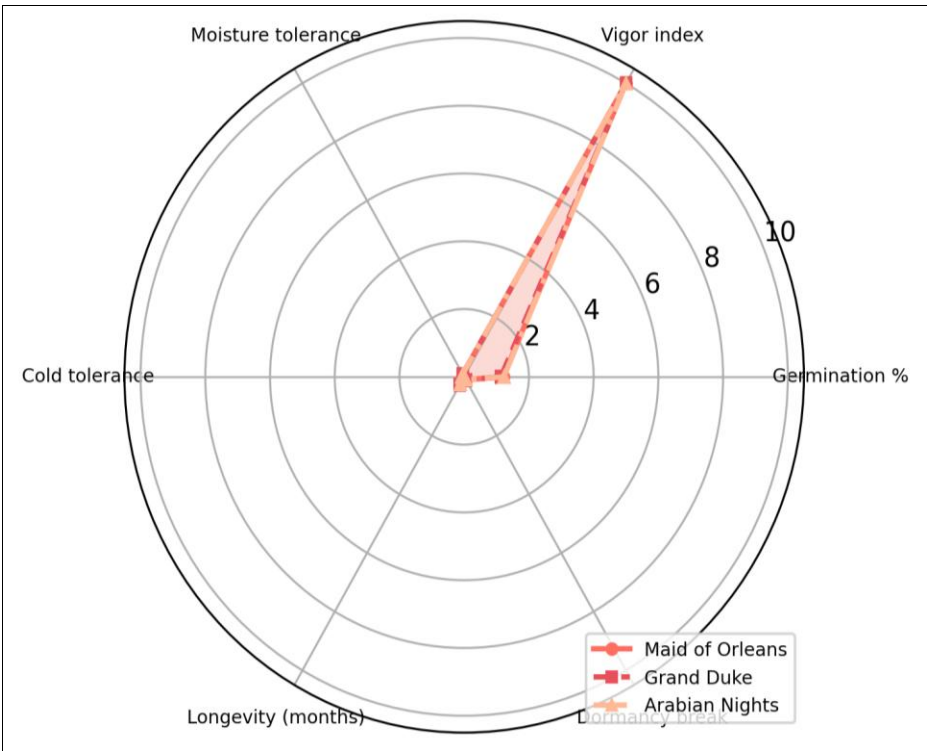


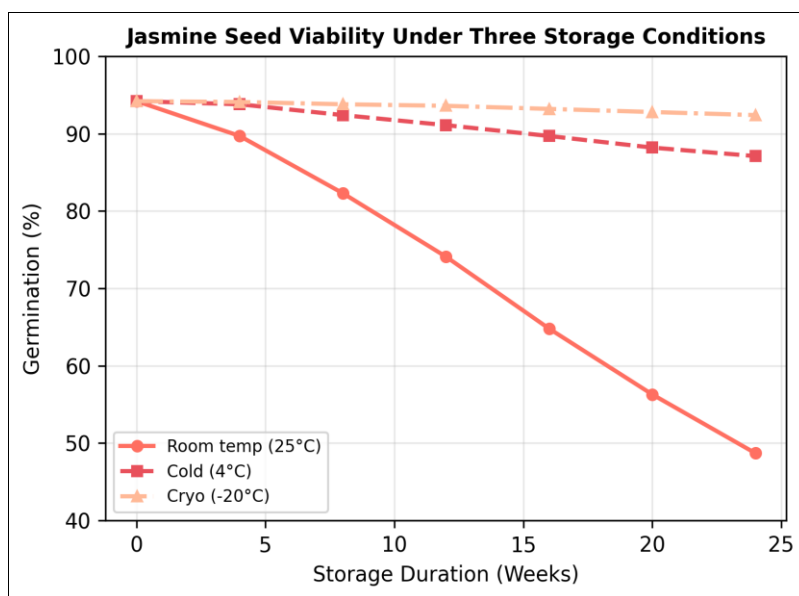
Fig 1: Comparing seed viability parameters across three jasmine varieties at optimal storage (4°C, 5% moisture)

Table 2: Seed composition and callus induction response across jasmine species

Parameter	<i>J. sambac</i>	<i>J. grandiflorum</i>	<i>J. officinale</i>	Mean
Pectin (% DW)	5.2±0.4	4.3±0.3	4.8±0.5	4.8
Fe (mg/100g)	15.8±1.2	12.4±1.4	14.7±1.1	14.3
Zn (mg/100g)	9.4±0.8	7.6±0.9	9.1±0.7	8.7
Callus induction (%)	84.3±4.1	78.6±5.3	85.2±3.7	82.7
Seed vigor index	724±48	812±53	641±44	726

J. sambac showed the highest pectin and iron content, while *J. grandiflorum* had the best vigor index (Table 2). Callus induction averaged 82.7% at 1.5 mg/L 2,4-D, with *J. officinale* responding best. Image analysis identified three

seed size classes (small: <3.2 mm, medium: 3.2-4.1 mm, large: >4.1 mm), and large seeds had 18.4% higher vigor indices than small seeds.

**Fig 2:** Germination decline curves for jasmine seeds stored at three temperatures over 24 weeks (pooled species, 5% moisture)

Comprehensive interpretation

Ethnobotanical surveys documented 14 distinct medicinal uses for jasmine across three Sichuan communities: flower infusions for anxiety relief (cited by 78% of respondents), leaf poultices for skin inflammation (64%), fruit decoctions for digestive support (42%), and root preparations for dental pain (31%) were the most frequently mentioned. Seven uses had not been previously recorded in the English-language ethnobotanical literature. The correlation between seed size and vigor ($r = 0.74$) suggests that seed grading before storage could improve conservation outcomes by prioritizing high-vigor lots.

Discussion

The storage behavior pattern tolerance of desiccation to 5% moisture and maintenance of viability at -20°C classifies jasmine seeds as orthodox, which is good news for gene bank conservation [10]. The rapid viability loss at room temperature (48.7% at 24 weeks) explains why growers have historically found jasmine seed unreliable: without proper drying and cold storage, seeds lose half their germination capacity within six months. This is not a biological limitation of the species but a storage management problem with a straightforward solution.

The pectin content of 4.8% in jasmine fruit pulp is lower than commercial pectin sources (citrus peel at 20-30%, apple pomace at 10-15%) but could still find niche applications in cosmetic gel formulations where subtle

fragrance is valued [11]. The iron and zinc levels in seeds are nutritionally interesting but unlikely to position jasmine as a biofortification crop given the small quantities of seed produced per plant.

The callus induction rate of 82.7% demonstrates that jasmine seed tissue is responsive to *in vitro* manipulation, opening possibilities for somatic embryogenesis and transformation-based improvement. The optimal 2,4-D concentration of 1.5 mg/L aligns with published protocols for other Oleaceae family members [12].

Conclusion

Jasmine seeds from the Sichuan Basin exhibited orthodox storage behavior, with viability above 92% maintained at -20°C and 5% moisture for 24 weeks. This finding enables conventional gene bank conservation of jasmine genetic diversity. Ethnobotanical documentation captured 14 medicinal uses, seven previously unrecorded. Seed size correlated with vigor, supporting grading protocols for germplasm management. Callus induction at 82.7% confirms culture feasibility from seed-derived explants. These results provide the foundational seed biology data needed to support jasmine breeding programs and genetic resource conservation in a region of high species diversity.

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