‘Bonsai’ Ornamental Pistachio

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Additional index words. *Pistacia chinensis*, *Pistacia integerrima*, Anacardiaceae, dwarfing gene

Chinese pistachio, *Pistacia chinensis* Bunge (Anacardiaceae Lindl.), is used widely as an ornamental tree in California due to its ability to exhibit good red fall foliage color in mild winter conditions. It is quite hardy with respect to cold and drought, but may be susceptible to the soil fungal pathogen (*Verticillium dahliae* Kleb.). *Pistacia integerrima* (Steward ex Brand) is resistant to verticillium wilt (Morgan et al., 1992), but lacks strong fall coloration as it is semideciduous under California mild winter conditions. Dwarf plants of many other plant species, such as dwarf peach [*Prunus persica* (L.) Batsch, Peach Group], have been described and are sold in the nursery trade. However, no dwarf species of pistachio have been reported in the literature.

Hybrid trees are excellent subjects for bonsai culture, as they require little if any pruning to maintain their dwarf growth habit. Most bonsai subjects are standard size individuals of tree or shrub species that can tolerate root constriction. The practice of bonsai was developed in China by A.D. 25–900 (Shen et al., 1991) and in Japan about A.D. 1185 (Marushima, 1989). Conventional bonsai uses careful pruning of tops and roots to keep the trees small. Dwarfing is obtained by root constriction, as bonsai subjects are grown in small containers to limit development of excessive new growth (Katakura et al., 1989; Shen et al., 1991). The success of traditional bonsai is dependent on the practitioner. Considerable skill is needed to keep the subject trees dwarf while concurrently producing a natural-looking subject. Most bonsai require careful watering and training.

Ornamental pistachio ‘Bonsai’ is the extremely dwarfed progeny from a hybrid between *P. chinensis* and *P. integerrima*. ‘Bonsai’ progenies require almost no training and grow well in hot, dry conditions. They develop excellent red-yellow fall color in low chilling environments (e.g., California) where other bonsai subjects will not develop significant fall leaf color before leaf abscission. It is expected that the dwarf hybrids will be moderately cold hardy (USDA zone 9); disease resistant; and tolerant of heat, direct sun, and moderately dry soils, as predicted from parental species characteristics.

Origin

‘Bonsai’ ornamental pistachio plants are F₁ seedling progeny from a closed cross of

a female *P. chinensis* (UCD16.9) and a male *P. integerrima* (UCD1.7). The crosses were made in 1991, 1993, and 2001. One-fourth of the progeny were observed to have the dwarfing genotype. These seedlings have been designated as ‘Bonsai’. The designation ‘Bonsai’ was given to the cross progeny by D.E.P. to indicate their extremely dwarf nature, especially the slow rate of growth and the diminutive size of the plant organs. The name suggests the characteristics expected in a conventional bonsai tree.

Description

Morphology. The dwarf progeny plants usually grow 5–10 cm tall during the first season after planting from seed, while the normal progeny grow 15–30 cm during the

first season. Leaves are compound paripinnate 2–5 cm long with 3–4 pairs of 1–2 cm opposite leaflets and a terminal leaflet. Normal progeny have paripinnate compound leaves 8–10 cm long with 3–4 cm leaflets. The dwarf trees grow very slowly and continue to exhibit small leaves and leaflets as well as highly compressed internodes. The trees are typically 10–20 cm tall after 5 years in 3.8-L pots, and have grown to ≈30 cm after 8 years without pruning. During the fall, the plants turn a range of colors from yellow-orange to orange-red [Yellow Orange 23 Group A-B to Orange Red 32 Group A (Royal Horticultural Society, 1966) or PANTONE® 14-1064 to PANTONE® 17-1464 (Eiseman and Herbert, 1990)], as do the standard size progeny. Variation in plant form (tree size and branch organization) and leaf characteristics (leaf size, leaflet size, and fall coloration) are observed among the dwarf progeny, since they are full sibs from parents of outcrossing species (Fig. 1).

Genetics. Chi square analysis (Table 1) of the ratio of dwarf to standard size hybrid progeny from three separate crosses indicates that the characteristic is inherited in a 1:3 ratio, typical for a single recessive gene, designated as *dw*. The dwarf selections are homozygous recessive for *dw*. The observed segregation ratio will occur only if the gene is present in both parents in a heterozygous condition, *dw:Dw*. A

Fig. 1. Three examples of 8-year-old ‘Bonsai’ ornamental pistachio in 3.8-L pots, showing variations in tree form and autumn coloration.

Received for publication 26 July 2002. Accepted for publication 21 Oct. 2002.

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Table 1. Chi square ratios and *P* values for the *dw* gene in a 1 dwarf : 3 normal expected ratio. Yates correction (Steel and Torrie, 1960) was applied.

Year	Observed <i>dw:Dw</i>	χ^2	<i>P</i> value
1991	5:13	0.00	1.0
1993	54:173	0.12	0.73
2001	268:837	0.29	0.59
Pooled χ^2	59:186	0.40	0.53
Heterogeneity χ^2		0.014	0.91

number of other *P. chinensis*, *P. integerrima*, and *P. chinensis* × *P. integerrima* cross combinations were made between 1991 and 2000. No dwarfing progeny were observed from any of these crosses. Since *Pistacia* L. sp. are dioecious (Joley, 1979; Zohary, 1952), a parent tree carrying the gene in a heterozygous condition cannot be self-pollinated to produce dwarf progeny. The dwarf trees have shown no evidence that they will flower; thus, the transmission of the dwarfing gene via a homozygous parent in natural populations is unlikely. The gene appears to be a regulatory gene for gibberellin synthesis. A spray application of gibberellic acid (GA₃) at 100 ppm to the dwarf plants in the spring promoted accelerated shoot growth and larger leaf and leaflet growth, approximating that of the normal seedlings.

Propagation and Culture

'Bonsai' pistachio trees are produced from seed of the controlled pollinated cross described above. Fruits are collected in the fall. Fruit with blue-green husks have viable seeds. After collection, the husks are removed and the seeds are dried at 25 to 35 °C. The seeds are germinated under the same conditions used to germinate pistachio rootstock seeds (Joley, 1979). Seeds are stratified (moist) for 6 weeks at 40 °C prior to planting. Germination is enhanced by soaking the seeds in water for 2–3 h prior to stratification. Seeds may be planted in flats with any standard sterilized potting soil mix. One of four seedlings will be dwarf and can be easily identified 8–12 weeks after planting. The dwarf seeds are transferred to 0.4–3.8 L containers for maintenance.

Availability

'Bonsai' will be distributed as seed, although seedling trees may be provided by prior arrangement. Questions concerning availability of 'Bonsai' pistachio should be directed to the Technology Transfer Center, Office of the Vice Chancellor for Research, Univ. of California, 508 Second St., Suite 202, Davis, CA 95616; telephone (530) 757-3432; or to Dr. Dan E. Parfitt, Dept. of Pomology,

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