Osa pulchra (Rubiaceae)

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Osa pulchra, considered by some a "holy grail of showy tropical plants" (Knecht 2010), is a rare, handsome, small tree or large shrub in the gardenia or coffee family (Rubiaceae) from far eastern Costa Rica and adjacent western Panama. Possessing a habit similar to that of a coffee plant, with one or a few upright leaders and rather symmetrical, radial branches attached at right angles, its most striking features are the large, pendent, trumpet-shaped, fragrant, white flowers hanging along the spreading branches that belie its close connection to the better known *Portlandia grandiflora* and *Cubanola domingensis* (**Fig. 1**). We find it strange that a plant with such striking and attractive flowers could be unknown for so long in cultivation. Here we provide a well illustrated account and discussion of this rare and handsome plant, including its history, taxonomy, a description, distribution and ecology, and cultivation.

History

Donald Ray Simpson (1932–), American botanist, first named and described *Osa pulchra* as *Hintonia pulchra* in 1974, basing it on a collection that fellow American botanists William Carl Burger (1932–2022), then of the Field Museum in Chicago, and Ronald L. Liesner (1944–), presently of the Missouri Botanical Garden in St. Louis, had collected in January, 1970 near Rincón on the Osa Peninsula in Puntarenas Province, Costa Rica (*Burger and Liesner 7320*) (Simpson 1974). Burger and another American botanist, Robert G. Stolze (1927–2023), had actually made an earlier collection of this taxon from the same site in April, 1968 (*Burger and Stolze 5438*), which Simpson cited but not as a type.

A few years later, American botanist and entomologist Annette Aiello (1941–), presently at the Smithsonian Tropical Research Institute in Panama, in her studies of *Portlandia* and related genera, erected the new genus *Osa*, and transferred *Hintonia pulchra* to it, creating *O. pulchra* (Aiello 1979).

Osa pulchra is rare in the wild, known from only three localities, two in far eastern Costa Rica and one in adjacent, far western Panama. The original site where Burger and Liesner collected the type specimen of *Osa pulchra* in early 1970 is on the Pacific slope of Costa Rica in Puntarenas Province while the second site is on the Atlantic slope of Costa Rica in Baja Talamanca, Limón Province (*Valverde and Zúñiga 1382*, *1393* USJ). The third locality is on the Atlantic slope of Panama in Bocas del Toro near Changuinola. University of Panama botanists Reyes Carranza and

1. *Osa pulchra*, habit, with large, pendent, trumpet-shaped, white flowers, June, 2009. *HNT 81360*. © 2009 D. Hannon. All photos of *O. pulchra* taken in the Conservatory of The Huntington unless noted otherwise.

Fermín Hernández, while performing a botanical survey, first collected and documented *O. pulchra* at this Panamanian site in July, 2007 (Aiello et al. 2007).

Between the two Costa Rican sites, fewer than 30 plants of *Osa pulchra* were purportedly documented and natural reproduction was poor (Knecht 2010). Hannon (2007) speculated that the plants at the two Costa Rican sites possibly were planted and cultivated because they occur around human dwellings in secondary forest. Little is known of the Panamanian population, which might be the first report of a truly wild and natural population. Only a few plants were found there, and the construction of a dam on the Río Teribe in the Bonyic area might have since inundated them (Aiello pers. comm., Dec. 2023).

In September, 1996, co-author Dylan Hannon participated with Missouri Botanical Garden botanists Tom Croat and Barry Hammel on a trip to the Osa Peninsula. At the entrance to the old Estación BOSCOSA (now called Centro de Estudios y Empoderamiento Comunal Álvaro Wille Trejos. Fundación Neotrópica), near the historic, original site near Rincón, the group encountered a wall painted with a striking image of *O. pulchra* flowers (**Fig. 2**) Hannon exclaimed something to the effect of, "Is that a real flower??," to which Barry replied, "Yes, that is *Osa pulchra!*" At this small settlement were a few houses along the Quebrada Agua Buena, a few hundred meters west of the station. About six specimens of *O. pulchra* were encountered here, two of them apparently planted, growing in sunny as well as shaded positions. Hannon found one mature, ripe capsule (Hannon 2007). No seedlings were found, but ants were noted on the fruits and seeds. Upon his return to the U. S. A, at Rancho Santa Ana Botanic Garden (now California Botanic Garden) in Claremont, California, where he then worked as Plant Propagator, Dylan planted the seeds and was able to raise about 15 seedlings from about 40 seeds planted. A portion of these was distributed to The Huntington Library, Art Museum, and Botanical Gardens (The Huntington) in San Marino, California and other educational and research institutions. Over the years, Hannon hand-pollinated his plants and produced many seeds and seedlings, which were again widely distributed. In fact, at the time of this writing, nearly all the cultivated plants of *O. pulchra* outside of Mesoamerica originate from Hannon's 1996 collection of one capsule and subsequent seedlings. Because of Hannon's efforts, *O. pulchra* is now established in many botanical institutions and several private collections around the world with suitable growing conditions.

Taxonomy and Description

In the past, the genus *Osa* has been aligned in different subfamily and tribe arrangements or the subfamilies and tribes had different names. In its most current up-to-date alignment, *Osa* is in the family Rubiaceae, subfamily Cinchonoideae, tribe Chiococceae (Stevens 2001).

2. A painting of *Osa pulchra* graces a wall at the entrance to the old Estación BOSCOSA near the historic, original site near Rincón. © 1996 D. Hannon.

Osa pulchra (D. R. Simpson) Aiello, J. Arnold Arbor. 60(1): 116. 1979.

Hintonia pulchra D. R. Simpson, Phytologia 29(4): 277–280, Pl. 1. 1974. Type: Costa Rica. Puntarenas: "in forest near the airfield, about 5 km W of Rincón de Osa, Osa Peninsula, alt. 50–200 m, 8° 42' N, 83° 31' W," 9–12 January 1970, *Burger and Liesner 7320* (holotype F 1729029; isotypes CR 57914, MO 2262984, U 0006042, US 00130620) (**Fig. 3**).

Habit: evergreen, hermaphroditic, glabrous, large shrub to small tree, 2.5–6(–15) m tall, precociously flowering (at least in cultivation) as early as 0.5 m tall and less than two years in age (**Figs. 4–5**); at least when young the appearance is unusually similar to that of coffee (*Coffea arabica*), with a dominant. vertical, central leader, mostly unbranched, lateral branches horizontally spreading at right angles, and leaf appearance and arrangement.

Trunk: fluted; bark generally, thin, smooth but with a few rough or corky patches, tan (**Fig. 6**); stipules interpetiolate, 3–6 mm long, rounded to broadly triangular, convex, briefly connate around twig or stem at base, apex acuminate to somewhat attenuate, convex, persistent (**Fig. 7**).

3. Holotype of *Osa pulchra* at F. © 2024 Piero Delprete for the Field Museum (F).

4. Co-author Dylan Hannon provides scale for a plant of *Osa pulchra*. Note the dominant central leader at this stage of growth. *HNT 129353*. © 2023 D. R. Hodel.

5. *Osa pulchra*, habit. *HNT 129353*. © 2024 D. R. Hodel.

6. Bark of *Osa pulchra* is mostly smooth and tan. *HNT 81360*. © 2023 D. R. Hodel.

7. The interpetiolate stipules of *Osa pulchra* are rounded to broadly triangular, briefly connate around twig, and with an acuminate to attenuate apex. Note the short, winged petiole or leaf stalk. *HNT 129353*. © 2022 D. R. Hodel.

8. Leaves of *Osa pulchra* are simple, opposite, and glossy green. *HNT 129353*. © 2022 D. R. Hodel.

9. Leaves of *Osa pulchra* are opposite and distichous when spreading in the same plane. *HNT 81360*. © 2022 D. R. Hodel.

10. Leaf blades of *Osa pulchra* are elliptic to narrowly elliptic-oblong with an acuminate apex and 5–8 primary lateral veins on each side of midrib, these raised abaxially. *HNT 129353*. © 2022 D. R. Hodel.

11. The handsome and showy flowers of *Osa pulchra* are large, white, and pendent. *HNT 129353*. © 2023 D. R. Hodel.

12. The large, white, pendent flowers of *Osa pulchra* appear in distal portions of leafy lateral shoots. *HNT 129353*. © 2024 D. R. Hodel.

13. Flowers of *Osa pulchra* are large, white, and pendent. *HNT 129353*. © 2023 D. R. Hodel.

14. The flowers of *Osa pulchra* are typically one per leaf axil (two per node). *HNT 129353*. © 2024 D. R. Hodel.

Leaves: simple, opposite, sometimes spreading in same plane (distichous), sessile or leaves abruptly narrowed to a petiole-like base ("petiole" narrowly winged and then a "false petiole" 4–12 mm long) (**Fig. 7**), spreading to drooping, glabrous, glossy dark green (**Figs. 8–9**); blade (13–)16–20(–23.5) x (4–) 5.5–6.5(–8) cm, elliptic to narrowly elliptic-oblong, membranous (fresh) to chartaceous when dry, base broadly to narrowly cuneate and decurrent, apex acuminate, glossy green adaxially, somewhat paler abaxially; 5–8 primary lateral veins on each side of midrib, these distally curving, impressed adaxially, raised abaxially (**Fig. 10**).

Flowers: numerous and synchronous, protandrous, homostylous, 1 per axil (2 per node but sometimes one aborts) in distal portion of leafy lateral shoots, pendent, (**Figs. 11–14**), perfect, evening fragrant; **pedicel** 1–2.5 cm long, ebracteate; **calyx** deeply 5-lobed, lobes ascending to spreading, 25–40 × 1 mm, narrowly elliptic to linear, filiform (**Fig. 15**), or subulate, sometimes uneven, with secretory hairs adaxially; **corolla** trumpet-shaped, 5-ribbed, sharply angled with flat folds in bud, near white distally and transitioning to pale yellowish green toward the throat, texture like soft fine leather, 26.5–30 cm long, 6–8 mm wide at base and to about the middle, then abruptly flared to 11–14 cm wide at apex and there shallowly 5-lobed (**Figs. 16–19)**, the lobes 3.5–4 × 5–7 cm; **stamens** 5, included, nearly equal in length, loosely coalesced and held away from the corolla tube, reaching to the sinuses of corolla lobes (**Fig. 20**); filaments connate for proximal 1–3 mm and there adnate to proximal 1–3 mm of corolla, free portion ca. 18 cm long, portion enclosed in tube and throat (ca. 80% of length) (**Fig. 21**) with soft retrorse hairs ca. 1 mm long (**Fig. 22**); anthers 50–65 mm × 1 mm wide, linear (**Figs. 23–24**); pollen tricolporate, diffusely faveolate with echinate structures; **ovary** bilocular, turbinate, the placentae adnate to the septum for nearly its full length, ovules ca. 10 per locule, anatropous (**Fig. 25**); **style** to 1 cm longer or shorter than stamens, glabrous, stigma to 6 cm long, slightly thicker than style at base, expanding to over 2 mm wide distally, oblong, unlobed, base acute, apex rounded-obtuse, longitudinally and alternately 5-nerved and 5-ribbed, the ribs subulate, surface consisting of 2, rarely 3, narrow lines of papillae from the apex of the style down the outside, typically twisted several times around the style for a distance of 2–60 mm (**Fig. 26**).

Fruit: a durable, woody, 5-ribbed capsule, splitting partially along ribs from distal end, (3.2–)7–8 × 1.5–2 cm, ellipsoid-obovoid to obovoid (**Figs. 27–29**); fruiting pedicel 2.2 cm long, angled by continuation of capsule ribs; calyx lobes weakly persistent at distal end of fruit, ca. 3 × 0.15–0.2 mm; **seeds** (20–)40–60, attached horizontally, not imbricate, 6–6.5 × ca. 6 mm, 1.5–2.5 mm thick, irregularly circular or angled to elliptic or broadly elliptic, flattened but one surface convex and the other concave (shield-shaped), basipetally appressed, not winged, granular-roughened, reddish brown when dry (**Fig. 30**), testa mostly tuberculate but margins with small bumps or protrusions, aril present; embryo ca. 4.9 mm long, centered in abundant endosperm.

15. The calyx of *Osa pulchra* is deeply 5-lobed, with narrowly elliptic to linear sepals. *HNT 129353*. © 2023 D. R. Hodel.

16. The five-ribbed corolla of *Osa pulchra* is trumpet-shaped with the distal portion flared outward and five lobed. *HNT 129353*. © 2023 D. R. Hodel.

17. The corolla of *Osa pulchra* has a long, narrow throat before abruptly flaring outwards. *HNT 129353*. © 2024 D. R. Hodel.

18. The corolla of *Osa pulchra* is five-ribbed and -lobed distally. *HNT 129353*. © 2023 D. R. Hodel.

19. The corolla of Osa pulchra is distally flared and five-lobed. *HNT 129353*. © 2023 D. R. Hodel.

20. Part of the corolla of *Osa pulchra* was removed to show the stamens and style exserted from the narrow portion of the corolla tube. *HNT 129353*. © 2023 D. R. Hodel.

21. The narrow, tube-like base of the corolla of *Osa pulchra* shows the base of the stamens and style bunched together. *HNT 129353*. © 2022 D. R. Hodel.

22. The stamens of *Osa pulchra* have long filaments with short, retrorse hairs. *HNT 129353.* © 2022 D. R. Hodel.

23. Stamens and style of *Osa pulchra* are long and slender. Note the elongated anthers at the tip of the filaments, and the style (third from bottom on right). *HNT 129353*. © 2022 D. R. Hodel.

24. The style can exceed the elongated anthers in *Osa pulchra*. *HNT 129353*. © 2023 D. R. Hodel.

25. In this longitudinal view of the ovary of *Osa pulchra* the ovules (if fertilized, future seeds) are visible as well as the base of the style and filaments, the latter with small, retrorse hairs. *HNT 129353*. © 2023 D. R. Hodel.

26. The elongated stigma of *Osa pulchra* (third from left) tends to twist spirally. *HNT 129353*. © 2022 D. R. Hodel.

27. Immature fruits of Osa pulchra are green and prominently ribbed, the ribs terminating in the long, slender calyx lobes. *HNT 81360*. © 2024 D. R. Hodel.

28. Mature fruits of *Osa pulchra* are woody and split longitudinally. © 2022 D. R. Hodel.

29. The view of the seeds inside the fruit of *Osa pulchra* shows the attached aril. © 2022 D. R. Hodel.

30. Seeds of *Osa pulchra* are irregularly rounded, more or less flat, and brown. Note the attached and detached arils. © 2022 D. R. Hodel.

Distribution: COSTA RICA. Puntarenas: Osa Peninsula; Limon: Baja Talamanca (Fila Carbón). PANAMA. Bocas del Toro: Changuinola. 50–250 m elevation. *Osa pulchra* was originally known only from the population at the type locality on the Osa Peninsula but the landowner mostly destroyed the plants, and they were considered possibly extinct (Taylor 2021). However, two other populations were found relatively recently, both on the Atlantic slope, one in Costa Rica in Limón Province and a second in Bocas del Toro Province in adjacent Panama (Aiello et al. 2007, Ochoterena 2012).

Ecology: *Osa pulchra* occurs in wet, humid, evergreen, tropical, primary rain forest or secondary forest where it is a rare, understory component. At the type locality, the plants grow on moist, lateritic, reddish, clay soils in relatively high light, but as noted earlier the forest is somewhat disturbed here. In cultivation, fully shaded, understory light conditions have resulted in poor, stunted growth. Because of its large, trumpet-shaped, fragrant flowers, it is thought that sphingid (hawk) moths (Burger and Taylor 1993, Taylor 2021) or bats (Taylor 2014) pollinate it. Simpson (1974), noting that this species was similar to other shrubs and small trees well adapted to life in the heavily shaded, evergreen, tropical forest understory and, bearing extremely long, tubular

corollas that emit an evening fragrance, suggested that these species were well adapted to specialized pollinators of the lepidopteran order, which includes moths.

Phenology: Flowering mostly synchronous and intermittent from January to October, but mainly from March through September; fruiting January (Burger and Taylor 1993) to September.

Conservation Status: Zamora and Álvarez (2021) proposed Endangered (EN) for *Osa pulchra* under criteria B2ab(i,ii,iii). Major threats include deforestation and habitat disturbance and destruction due to various agricultural production models and illegal logging. Populations in the three known localities are very fragmented (40 to 100 km apart), patchily distributed within a narrow altitudinal gradient, and declining. Mean extent of occurrence: EOO = 11,044km2. Small occupancy: AOO = 24 km2. Populations occur on private land and in one protected reserve, which means protection is largely up to property owners. No regulations exist to protect this species nationally or internationally. It is cultivated and flowering in Costa Rica, Great Britain (London), U. S. A. (California, Hawaii, New York, North Carolina, Texas), and elsewhere around the world. Because it is a tropical plant, in non-tropical regions it must be grown in a climate-controlled greenhouse or similar structure.

Etymology: the genus name *Osa* is the name for the location where this species was first collected and documented, the Osa Peninsula. The name “osa” translates from Spanish to “female bear”. The specific epithet is from the Latin *pulcher*, meaning beautiful, alluding to the handsome appearance of this species.

Discussion: The description provided here is from Aiello (1979), Ochoterena (2012), Simpson (1974), Taylor (2014, 2021), which are based mostly on dried herbarium specimens. We have supplemented the description from fresh, living material cultivated in the Conservatory of The Huntington.

Osa pulchra is unique, striking, and readily distinguishable among Mesoamerican Rubiaceae by its woody habit with a central leader and radiating, mostly unbranched lateral branches; costate interpetiolate stipules; opposite leaves with elliptic to narrowly elliptic-oblong, thin, acuminate blades; large, pendent, showy, near-white, trumpet-shaped, synchronous, evening fragrant flowers with long, slender calyx lobes, and appearing along and towards the branch tips; woody, ribbed, ellipsoid-obovoid fruit capsules with persistent calyx lobes at the apex; and textured seeds with a fleshy and persistent aril (Ochoterena 2012, Taylor 2014, 2021). The size, shape, position, and color of its flowers resemble those of some species of nightshades (Solanaceae), especially in the genus *Brugmansia*.

When naming *Hintonia pulchra*, Simpson (1974) seemed keenly aware of the “exceptional” differences between this new species and the other members of the genus, including the longer

leaves, trumpet-shaped corolla, and especially the wingless seeds, which could be justification for proposing a new genus. Nonetheless, he continued on to discount these features, especially the wingless seeds, as insufficient to support establishment of a new genus, noting that he had found no taxonomic discussions of the value of the winged vs. wingless seed character as a criterion for establishing a new genus. Furthermore, he noted that leaf texture, shape, and size and the winged seed character were variable among species of *Hintonia*.

When establishing *Osa* and transferring *Hintonia pulchra* to it, Aiello (1979) distinguished *Osa* from *Hintonia* by the large, plump, wingless, non-imbricate seeds with a tuberculate testa and persistent aril (vs. smaller, flat, winged, imbricate seeds with a reticulate testa and lacking a persistent aril); very long, trumpet-shape corolla (vs. funnel-shape corolla); and long leaves with an attenuate apex (vs. short with an acute to acuminate apex).

Furthermore, Aiello (1979) noted that *Osa* was more closely related to *Portlandia*, a rather well known Jamaican genus of several species also with large, showy flowers, one of which, *P. grandiflora*, is widely cultivated. Indeed, both share the seeds with a tuberculate testa and a persistent aril. However, *Osa* can be distinguished from *Portlandia* by its long, narrow, membranous leaves (vs. broad and coriaceous); trumpet-shaped corolla (vs. funnel- or bell-shape); and large, basipetally appressed seeds (vs. smaller, horizontally appressed seeds). The most recent molecular analyses of tribe Chiococceae (Paudyal et al. 2018) place *Osa* in a sister-group relationship with the monotypic Mexican genus *Nernstia*. *Nernstia mexicana* from northeastern Mexico, is quite dissimilar in gross morphology (smaller, thicker leaves, proportionately shorter flowers, non-woody stems and branches, unribbed fruits) (**Figs. 31–33**) and is found in dry habitats.

Cultivation

Osa pulchra is an understory plant from wet, evergreen, tropical forests; thus, consistent, year-round environmental conditions of shade (2,700 to 10,700 lux), temperature (24 to 32 C [75 to 90 F] day, 15 to 21 C [59 to 70 F] night), and relative humidity (70% and above) are ideal for adequate growth. The root zone must be moist but well drained and not soggy. In subtropical and temperate regions, it should be grown in an environmentally controlled greenhouse under growing conditions just described. It is somewhat tolerant of conditions outside these suggested ranges and can sustain brief spells of cold (to 10 and even 7 C) if conditions are otherwise adequate. Because it can flower when small (about two feet tall) (**Fig. 34**), *O. pulchra* is a good candidate for smaller greenhouses and conservatory spaces.

31. *Nernstia mexicana* is a relative of *Osa pulchra*. Cultivated, *H. Ochoterena 153*. © 2023 D. Hannon.

32. Flowers and leaves of *Nernstia mexicana* are smaller than those of *Osa pulchra*. Cultivated, *H. Ochoterena 153*. © 2014 D. Hannon.

33. Unribbed fruits of *Nernstia mexicana* differ from the ribbed fruits of its close relative *Osa pulchra*. Cultivated, *H. Ochoterena 153*. © 2023 D. Hannon.

Propagation and Propagation History

Seed is the most satisfactory method of propagation of *Osa pulchra* (see below). Asexual propagation by cuttings is also possible but, because this species is plagiotropic and typically shows strong apical dominance like many conifers, using the horizontally spreading, lateral shoot tips usually results in rooted cuttings that continue to grow horizontally rather than upwards (Hannon 2007). Root systems in cutting-grown plants also tend to be weaker than in seed-grown plants, at least initially. Heading back the vertical central leader for cuttings, which would otherwise continue to grow upwards and define the plant's main architecture, typically leads to poor or awkward branching structure. However, if multiple leaders develop, this would be the most opportune material to use for cutting material.

When propagating from cuttings, consider using firm and semi-hardwood cuttings, rooting hormone, a coarse and well aerated and porous medium, bottom heat, and overhead mist for best results. The leaves should be clipped in half to reduce transpiration.

34. *Osa pulchra* makes a suitable container plant and flowers as a young specimen. © 2013 D. Hannon.

By all indications*, Osa pulchra* is strongly self-incompatible, despite the large anthers and stigmatic surfaces "hanging together" in the corolla tube giving ample opportunity for self-pollination; thus, hand pollination (discussed later), using two different, seed-grown individuals, is essential to obtain seeds (Hannon 2007). Even utilizing plants known to be genetically distinct, fertilization might be unsuccessful (**See Table 2**).

Once successfully pollinated, the capsules take 8 to 11 months to attain maturity. Mature capsules will split partially from the apex down, indicating the seeds are ready to extract and plant. Because the seeds have short viability—declining sharply after a few months—it is best to use fresh, fully mature seeds and plant them immediately upon removal from the capsule. The aril attached to the seed does not need to be removed. Prior to sowing, soak the seeds in clean water at room temperature for 12 hours.

A good sowing medium is something simple and basic such as peat (60 to 70%) and perlite (30 to 40%). To plant the seeds, place them flat on the surface or pre-moistened medium and cover them with 3 to 5 mm of medium. Carefully water well and keep under high humidity (80 to 90%). Place the planted container off the ground out of full sun in a warm location and maintain the temperature between 25 to 30 C (77 to 86 F). Germination should occur as early as three to four weeks or slightly longer.

Germination can be expected to occur unevenly over a period of weeks. Batches of seeds sown mid-March germinated primarily in May, continuing into July (**Table 1**). Knecht (2010) reported staggered germination over 30 to 75 days and, after two years, had only a 16% germination rate for 207 seeds. He reported that it took two months for the shoot to appear and an additional two months for the cotyledons to shed their seed coat. Hannon confirms that sprouted *Osa pulchra* seeds typically sit for some weeks with the cotyledons enveloped in the seed coat. An additional 4.5% of the 207 seeds germinated but declined and failed; out of 200 seeds distributed to botanical gardens and other institutions, the reported germination rate was only 10% overall (Knecht 2010). Based on multiple sowings over nearly 30 years by Hannon, germination rates have been higher than reported by Knecht (2010) in some cases, and lower in others. See Table below.

The most significant propagation event of material grown at The Huntington was probably a batch of seeds harvested between November, 2004 and January, 2005 (**Table 2**), which was from a reciprocal cross between two original plants from 1996 seed, designated clones G and F. Interestingly, the seeds of the reciprocal cross (using clone F as the pistillate parent) were smaller than the cross using clone G as the pistillate parent. Approximately 120 seeds were planted in

Table 1. *Osa pulchra* crosses of original clone B (= *HBG 81360*) and siblings of first generation ex HBG *81360* (= *HBG 122991*). The Huntington, San Marino, California. 2013–2014.

Pollination Date (2013, 2014)	Pistillate (female, seed-bearing) parent (clone)	Staminate (male, pollen-bearing) parent (clone)	Quantity of flowers pollinated	Results	Notes
30-Mar-14	*122991 B*	*81360*	2	2 fruits	
30-Mar-14	*122991 B*	*122991 B*	2	2 fruits	0% germination by 15-Aug-14
30-Mar-14	*122991 B*	*122991 B*	1	1 fruit fully formed, indehiscent	
30-Mar-14	*81360*	*122991 B*	2	2 fruits fully formed, 1 indehiscent, 1 dehiscent	90% germination by 15-Aug-14
30-Mar-14	*81360*	*122991 B*	2	2 fruits	6% germination by 15-Aug-14
23-Dec-13	*81360*	*122991 B*	1	1 fruit	5% germination by 15-Aug-14
23-Dec-13	*122991 C*	*81360*	unknown	unknown	0% germination by 15-Aug-14

January, 2005, resulting in about 100 seedlings (83% germination). Several dozens of these were distributed to an APGA conservatory meeting at New York Botanical Garden in 2006. These distributed plants, where extant, are potentially important in the genetic diversity of this introduction because both parent plants died a few years later. Of the original 1996 plants, only clone B is believed to have survived as a contributor to new generations of plants in the last 10 to 15 years.

While not all seed production at The Huntington has been formally recorded, the notes following Table 2 provide details for material that has been accessioned and pertain to plants and seeds that have been distributed at various times.

Table 2. *Osa pulchra* crosses of original clone (ex 1996 seed). Rancho Santa Ana Botanic Garden (2001) (now California Botanic Garden), Claremont, California and The Huntington (2004), San Marino, California.

Pollination Date (2001, 2004)	Pistillate (female, seed-bearing) parent (clone)	Staminate (male, pollen-bearing) parent (clone)	No. of flowers pollinated	Results	Notes
18-Jun-01	A	G	unknown	Failed	
18-Jun-01	G	A	2	Failed	
18-Jun-01	G	B	2	2 fruits	to: Waimea Arb. and Lyon Arb.
28-Jun-01	A	G	5	Failed	
28-Jun-01	G	A	1	Failed	
28-Jun-01	A	G	2	Failed	
5-Jul-01	A	E	1	Failed	
5-Jul-01	D	E	2	Failed	
5-Jul-01	E	A	2	Failed	
5-Jul-01	E	F	2	2 fruits	to: Waimea Arb. and Lyon Arb.
9-Oct-01	E	G	unknown	Failed	
9-Oct-01	D	G	unknown	Failed	
9-Oct-01	D	A	2	Failed	
9-Oct-01	A	D	unknown	Failed	
26-Mar-04	F	G	2	1 fruit	
26-Mar-04	G	F	8	4 fruits	
26-Mar-04	D	G	2	unknown	

DH 96300: single capsule collected September, 1996, near Estación BOSCOSA (see notes above). Ca. 40 seeds sown 20 October, 1996, germination in ca. 3 to 4 weeks, ca. 15 seedlings total (ca. 37% germination rate).

HBG 81360: six plants accessioned 1997–2003, all original plants from 1996 seed (= *DH 96300*). Only one (clone B) alive 2010, planted in the Rose Hills Conservatory November, 2005 and still growing 2024. Vouchered.

HBG 122991: seeds from reciprocal crosses of clones G and F. Widely distributed 2006 (see above). Three alive 2010 at The Huntington. All dead by 2014.

HBG 129353: seeds from cross of *81360* x *122991*. Hand-pollinated 30 March, 2014; harvested March, 2015; 60 sown 11 March, 2015; 35 5-cm rose pots 5 August, 2015. Two planted 2017 in the Rose Hills Conservatory, extant 2024. Note: one of these two has been subject to a deep shade environment and is about 1.2 m tall, rarely flowering, while the other, with more light, is about 4.6 m tall and is floriferous.

Grafting *Osa pulchra* on to rootstocks of related genera, like the more readily available *Portlandia* or perhaps even the much more distantly related *Coffea*, might be possible and provide better tolerance of or adaptability to environmental and horticultural conditions.

Hand-Pollination

The large and accessible flower parts of *Osa pulchra* make cross-pollination generally straightforward. A fake sable brush with fine bristles is recommended. Lightly brushing one's cheek to pick up oils is immensely helpful in accumulating pollen grains. Each flower provides a generous supply of pollen that can be dabbed up easily (**Figs. 35–36**). Moving to another plant/clone, the donor pollen should be carefully applied to the stigmatic surface of the receiving flower (**Fig. 37**). The greatest obstacle here is the anthers on the receiving flower, which must be moved aside or removed. All sides of the stigma should receive a generous swab of pollen. A month or two after successful pollination, the fruits may be almost fully formed and green; they will require an additional six to nine months to fully mature.

Potting Up and Growing On

Once the seedlings produce their first leaf pair above the cotyledons, remove them carefully from the germination bed or container and pot them up individually into clean, appropriately sized liner containers (**Fig. 38**). The medium for container growing should be similar to that used in germination: porous, well aerated and well drained yet holding sufficient water and nutrients and slow to break down. Maintain potted seedlings in partial shade. When the young plants are

35. The elongated anthers of *Osa pulchra* contain abundant pollen. *HNT 129353*. © 2023 D. R. Hodel.

36. Pick up pollen of *Osa pulchra* with the brush. HNT 129353. © 2023 D. R. Hodel.

37. Apply the pollen carefully to the stigmatic surface of a different clone of *Osa pulchra* from which the pollen was collected. *HNT 81360*. © 2023 D. R. Hodel.

38. A community pot of *Osa pulchra* seedlings ready for planting in individual liners or small pots. © 2013 D. Hannon.

39. This well grown seedling of *Osa pulchra* will soon be ready to shift up into a larger size pot. © 2013 D. Hannon.

firmly rooted and roots have filled the liner container, shift them up into the next appropriately larger container **(Fig. 39**). When the roots have filled out this larger container, typically a 3.8 ℓ (1-gallon), they are ready for planting out. They also make an acceptable container plant (**Fig. 34**).

Planting Location

Osa pulchra attain their fullest beauty and elegance when protected from the wind and sun. For maximum beauty and landscape impact, locate plantings in a wind-protected site with filtered

sun. It will perform well in just about any type of soil if it is well drained, holds nutrients, and is kept evenly moist.

Maintenance

Keep the root zone evenly moist. Apply a complete fertilizer, one with an N-P-K-Mg ratio of 2-1-3-1 or similar ratio following label directions. Maintaining five to eight cm of good quality mulch from the trunk out to at least two meters is beneficial.

Although plants of *Osa pulchra* tend to produce and maintain excellent structure, especially when young, with a strong, vertical, central leader with well spaced, horizontally spreading, lateral branches, sometimes this is not the case and multiple leaders might develop. If so, remove these to encourage just one central leader. Also, remove crowded, crossing, damaged, infested, or diseased branches. If lateral branches become too long, they can be headed back to a leaf axil or removed entirely. Although long-term experience growing and maintaining plants of *O. pulchra* is limited, it appears that plants 25 to 30 years old under cultivated conditions tend to lose their naturally desirable and excellent structure and become somewhat ill formed and lanky, with foliage only on the perimeter of the canopy and reduced flowering. Corrective, structural pruning is necessary at an early stage at the first indication of the plant transitioning from its naturally aesthetic structure to one that is less desirable.

Serious pests and disease problems have yet to be documented for *Osa pulchra* but the usual suspects are mites, scales, mealybugs, and aphids. The susceptibility of *O. pulchra* to a devastating, worldwide disease of coffee plants, coffee leaf rust, caused by the fungus *Hemileia vastatrix* is unknown. See Kawabata and Nakamoto (2021) for more information about this disease.

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