COSTA RICAN NATURAL HISTORY

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Stemmadenia donnell-smithii (Huevos de Caballo, Cojones de Chancho)

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This widespread tree of the family Apocynaceae grows at low elevations from southern and eastern Mexico through Central America to Panama. Together with *S. obovata,* it is found commonly on the Pacific side of Costa Rica in a wide range of habitats including semievergreen and riparian forests, open forest and second-growth woodland, forest edge, and pasture. In the dry forests of Guanacaste, *S. donnell-smithii* (Rose) Woodson is restricted to riparian bottomlands, whereas *S. obovata* is more widely distributed in the deciduous forests. *Stemmadenia obovata* has smaller fruits and larger flowers and leaves than does *S. donnell-smithii,* but in other ways they are very similar. The trees of *S. donnell-smithii* are components of middle-level strata, reaching heights of about 20 m, though size and growth form vary with habitat. Among trees with equivalent dbh's, those in open habitats (second-growth woodland, pasture, edges, etc.) tend to be shorter and to have much broader crowns than those in forested areas. Leaves are lanceolate and opposite; inflorescences are terminal. The inflorescences, comprising one to five yellow flowers with tubular corollas 3–4 cm deep, generally produce a pair of large

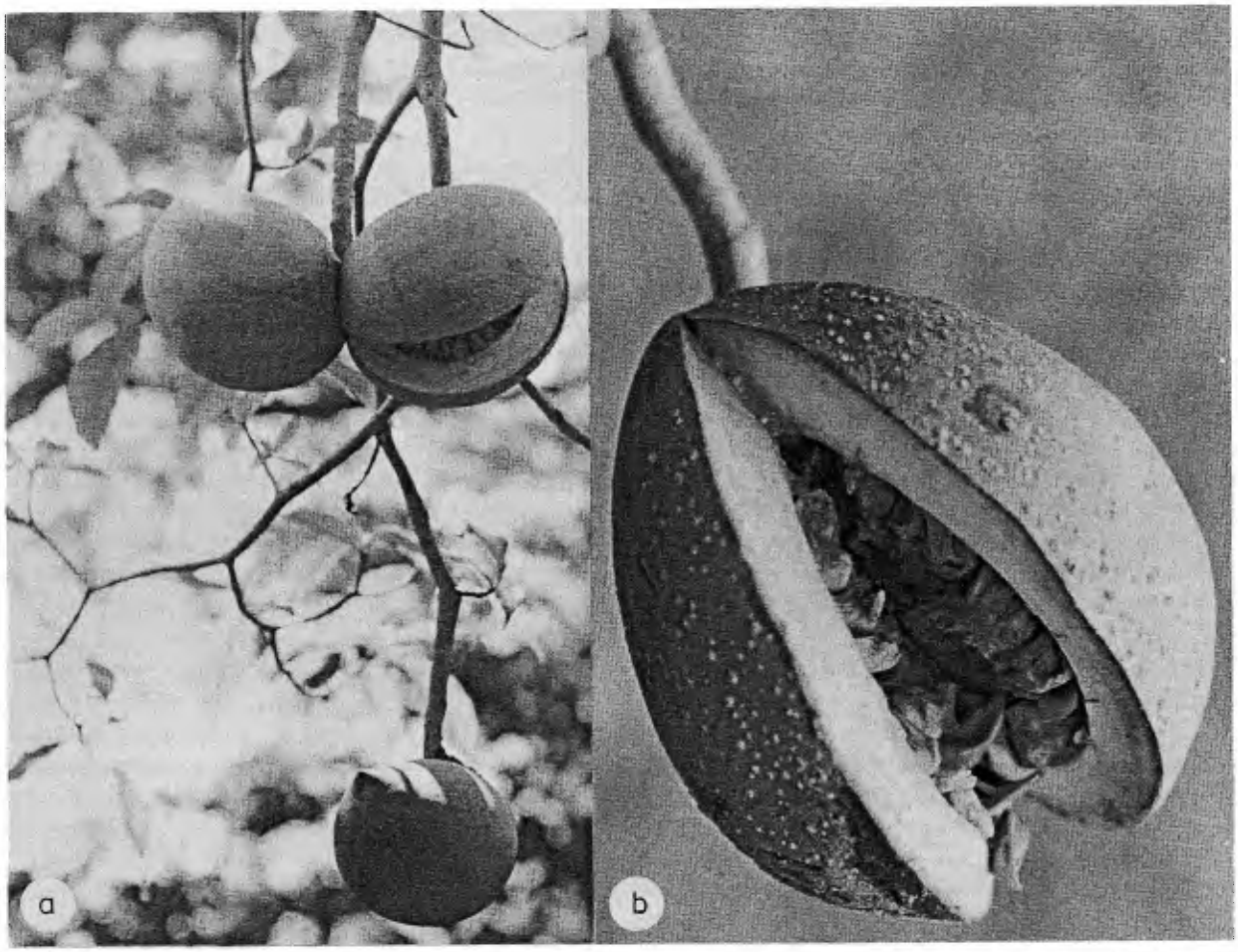

FIGURE 7.110. *Stemmadenia donnell-smithii. a,* Full-sized mature and nearly mature fruits on leafy branch; note that leaves are about the same length as the fruits (in contrast to the very similar *S. obovata,* which has leaves much larger than the fruits). *b,* Naturally opening fruit with arillate seeds inside. Finca Taboga, near Cañas, Guanacaste Province, Costa Rica (photos, M. S. Foster and R. W. McDiarmid).

ɔvoid fruits (fig. 7.110). All plant parts, when damaged, produce copious amounts of a sticky white latex.

Flowering phenology varies considerably both within and between sites. At Palmar Norte in southern Costa Rica, trees flower in March and April, at the end of the dry season and beginning of the wet season (Allen 1956). On the other hand, in Guanacaste Province in northwestern Costa Rica, flowering has been observed in March and April in the dry season and in June, July, and August in the wet season. Blooms probably are present at almost any time of the year (McDiarmid, Ricklefs, and Foster 1977). Fruit development is slow, requiring several months. In Palmar Norte the peak period of ripe fruit is in August–September. Ripe fruits have been observed in Guanacaste in March through September, though production peaks in the late dry season.

The fruits are large (7–10 cm long × 5–8 cm in diameter; 52–215 g, wet weight; $\bar{x} = 143$ g, $N = 20$), rounded, and covered with a thick (1–1.6 cm) greenish brown, woody husk (McDiarmid, Ricklefs, and Foster 1977) (fig. 7.110*a*). The latter forms the bulk of the fruit (77–88% wet weight). The thickness of the husk, together with its extrusion of latex when damaged, probably is effective in preventing damage to immature seeds by insects and may discourage some vertebrate predation. Parrots and white-faced capuchins, *Cebus capucinus*, are known to eat the fruits. When the fruits are ripe, they dehisce along the distal margin to reveal a tightly packed mass of fleshy, bright red orange arils, each almost completely enclosing a dark brown seed (fig. 7.110*b*). The aril is stringy, extremely oily, and highly nutritious (mean nutrient composition/g dry weight tissue = 7.9% ash, 63.9% lipid, 10.95% protein, 8.5% TCA-soluble carbohydrate, 8.3% structural carbohydrate). On a calorie/g ash-free dry weight basis, the greatest amount of energy is put into the aril for dispersal, followed by the seed for germination, and then the husk for protection. In terms of total expenditure, however, the plant channels the most calories into protection (husk), followed by germination (seed), and then dispersal (aril). Percentage of nutrient composition and caloric content of husks and seeds are relatively uniform, whereas the lipid, protein, and caloric content of the aril varies among fruits, habitats, and years. This variation may be important in allowing the plant to maintain protection and seed quality while maximizing seed production under varying environmental conditions (McDiarmid, Ricklefs, and Foster 1977).

Crop size varies with annual differences in the weather and also between habitats, the average number of fruits per tree increasing from forest to open forest to pasture. Mean crop size also is correlated directly with dbh. The average number of fruits opening per tree per day ranges from 0 to 10.3, both relative and absolute rates of opening increasing with increasing crop size and from forest to forest-edge to pasture. Thus, on a large tree with a sizable fruit crop, freshly opened fruits will be available during most of the fruiting season of the species.

Although the slit formed when the fruit dehisces may reach 10 cm in width, the seeds and aril nearly always are removed completely when the slit measures only 1–2 cm. Thus, use is restricted to those bird species with long, relatively narrow bills (e.g., some flycatchers, motmots) and those whose heads are small enough to be inserted at least partway into the fruit (e.g., honeycreepers, manakins). Feeding is restricted further to those birds large enough to perch on the fruit and feed (e.g., woodpeckers) and birds that hover-feed (e.g., some flycatchers, manakins). Twenty-two bird species were recorded using these fruits in Guanacaste.

Birds are the primary agents of seed dispersal for *S. donnell-smithii*. (There is little to no dispersal of seeds from fruits on the ground. Ants may harvest the aril, but usually the seeds remain. In the dry season, the unused aril shrivels and dries rapidly, whereas in the wet season the pulp rots and is inhabited by fly larvae.) Birds also seem to enhance seed germination by removing the aril, scarifying the seed coat, or both (McDiarmid, Ricklefs, and Foster 1977). In return, the aril of the fruit provides the birds with an estimated 16–25% of their daily energy expenditure as well as meeting a substantial portion of their requirement for nitrogen.

The peak of fruit ripening falls in the late dry season. Therefore fruit is most abundant when birds, especially insectivores facultatively using fruit, may experience a period of insect scarcity. This plus its occupancy of edge habitats, morphological characteristics, and relatively high nutrient quality support the idea that *Stemmadenia* has evolved to capture for seed dispersal the largest number of opportunistically frugivorous insectivores. Opportunistic use by these facultative frugivores has preadapted the tree to grow in second-growth habitats where insectivorous birds are common and probably accounts for the relative success of this species in disturbed habitats today.

A comparison of the flowering and fruiting phenologies and dispersal systems of the two species of *Stemmadenia* would be very interesting and could provide insight into the population dynamics of a plant and its pollination and dispersal systems in the contrasting deciduous and riparian forests of Guanacaste.

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Allen, P. H. 1956. *The rain forests of Golfo Dulce*. Gainesville: University of Florida Press.

McDiarmid, R. W.; Ricklefs, R. E.; and Foster, M. S. 1977. Dispersal of *Stemmadenia donnell-smithii* (Apocynaceae) by birds. *Biotropica* 9:9–25.