

NOTES ON THE FLOWER, FRUIT, AND THE REPRODUCTIVE PHENOLOGY OF THE ELUSIVE *OTTOSCHULZIA RHODOXYLON*

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Abstract. We present a morphological description of the flower and fruit of *Ottoschulzia rhodoxylon* based on material collected at Hacienda La Esperanza Nature Reserve, Puerto Rico, cultivated material, as well as on data in herbarium specimens. Plants of *Ottoschulzia rhodoxylon* bear hermaphrodite flowers, and at least some appear to be fully functional. We also summarize phenological data for the species: flowering occur at the beginning of the rainy season, especially June; fruits develop further, until November.

Resumen. Se presenta una descripción morfológica de la flor y el fruto de *Ottoschulzia rhodoxylon*, con base en material recolectado en la Reserva Natural Hacienda La Esperanza, Puerto Rico, en material cultivado, así como de datos de especímenes de herbario. Las plantas de *Ottoschulzia rhodoxylon* producen flores hermafroditas, algunas de las cuales parecen completamente funcionales. También se resumen datos fenológicos para la especie: la floración ocurre a comienzo de la época de lluvias, especialmente en junio; los frutos se desarrollan posteriormente, hasta noviembre.

Keywords: floral morphology, Greater Antilles, Icacinaceae, *Ottoschulzia*, phenology

The genus *Ottoschulzia* (Icacinaceae sensu stricto, Kårehed, 2001; Lens et al., 2008) was established by Ignatz Urban (1912), and comprises four species of trees from the Greater Antilles (*O. cubensis* Urb. in Cuba, *O. domingensis* Urb. in Hispaniola, *O. rhodoxylon* Urb. in Hispaniola and Puerto Rico) and Southern Mexico-Guatemala (*O. pallida* Lundell). The Greater Antillean species were the first to be described and for a long time, the genus was considered endemic to that archipelago (Howard, 1942; Lundell, 1975). Urban described *Ottoschulzia rhodoxylon* in 1908 (originally as *Poraqueiba*) on the basis of sterile material, and described *O. domingensis* in 1912 with flowering material only (Urban, 1908, 1912). A later study on the Icacinaceae of the New World by Howard (1942) included a treatment for the three species of the genus that were known by then (i.e., the Antillean species). This valuable contribution includes detailed vegetative descriptions, vegetative keys, and agglutinated taxonomic knowledge

of the genus. Unfortunately, fertile specimens available at that time were sparse, and prevented the author from completing the morphological description of reproductive structures in *O. rhodoxylon* and *O. domingensis*. In 1982, Liogier published the first volume of his “Flora de la Española,” in which was included a treatment of the Icacinaceae from that island, and a description of the fruit of *O. domingensis* (Liogier, 1982). This left *O. rhodoxylon* as the least documented in the botanical literature. A century has elapsed since Urban’s description of *O. rhodoxylon* and very little has been reported regarding the reproductive characteristics of the species (U. S. Fish and Wildlife Service, 1994; Axelrod, 2011). It is striking, because at least a handful of specimens with flowers or fruits have been collected since Howard’s treatment of 1942. Furthermore, we have acquired additional understanding on the reproduction of the species, as the result of phenological observations carried out by us. Here we aim to summarize existing data on the flower, the

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fruit and the phenology of *O. rhodoxylon*. The information is of significance for the systematics of the taxon, but it is also important

for its conservation, because the species was designated as federally-endangered in 1990 (U. S. Fish and Wildlife Service, 1994).

MATERIALS AND METHODS

Phenology

Monthly phenological observations were carried out from December 2008 to November 2009 in trees occurring at the top of a limestone knoll or *mogote*, within the Hacienda La Esperanza Nature Reserve (HLENR). The area was classified by Ewel and Withmore (1973) as a subtropical moist forest. Additional observations were carried out throughout 2010 and until June of 2011. We also examined specimens in Herbaria GH, MAPR, SJ, UPR, and UPRRP to assess flower and fruit phenology.

Flower and Fruit Morphology

We examined flower material collected at HLENR in the Municipality of Manatí, Puerto Rico, flowers from cultivated material at UPR-Río Piedras Campus, specimens deposited in

the four major herbaria in Puerto Rico (MAPR, SJ, UPR, and UPRRP), as well as specimens at GH. We also examined material of the other three species in the genus deposited in these herbaria. The oldest herbarium specimens of *Ottoschulzia rhodoxylon* with fertile material examined date from 1940 (*L. E. Gregory 437*), and 1950 (*E. L. Little 13239*). Both were overlooked because they were originally misidentified and filed as *Maytenus laevigata* (Vahl) Grisebach ex Eggers. In the 1990's fertile material was collected (*Breckon 4245, 4272, 4280; Santiago 128a, 128b*) as part of field surveys on the species supported by the U. S. Fish and Wildlife Service (1994). Labels in specimens by Breckon include general descriptions of the flower.

RESULTS AND DISCUSSION

Phenology

The flowering period of *Ottoschulzia rhodoxylon* was short. Few buds and flowers occurred from April to May, but there was an explosive flowering in June. This pattern coincides with the beginning of the rainy season in Puerto Rico in May. We have found, as part of ongoing studies on the vegetation of HLENR, that many plant species of this moist karst initiate their reproduction at the beginning or during the rainy season (from May to December). No flowers were recorded in other months of the year at the reserve. Our observations are similar to data from herbarium specimens examined, in which buds and flowers were present in May, June, and July. An exception is a specimen with flowers and buds in December (*L. E. Gregory 437*).

Young fruits were observed in August at HLENR. Seedlings from previous years were observed in the reserve, indicating that recruiting is occurring at the site. The species has been collected in fruit elsewhere in Puerto Rico in March (*Liogier 34035*), July (*Proctor 39361*), September (*Axelrod 2949, Proctor 47167*), October (*Monseguir 240*), and November (*Monseguir 252*).

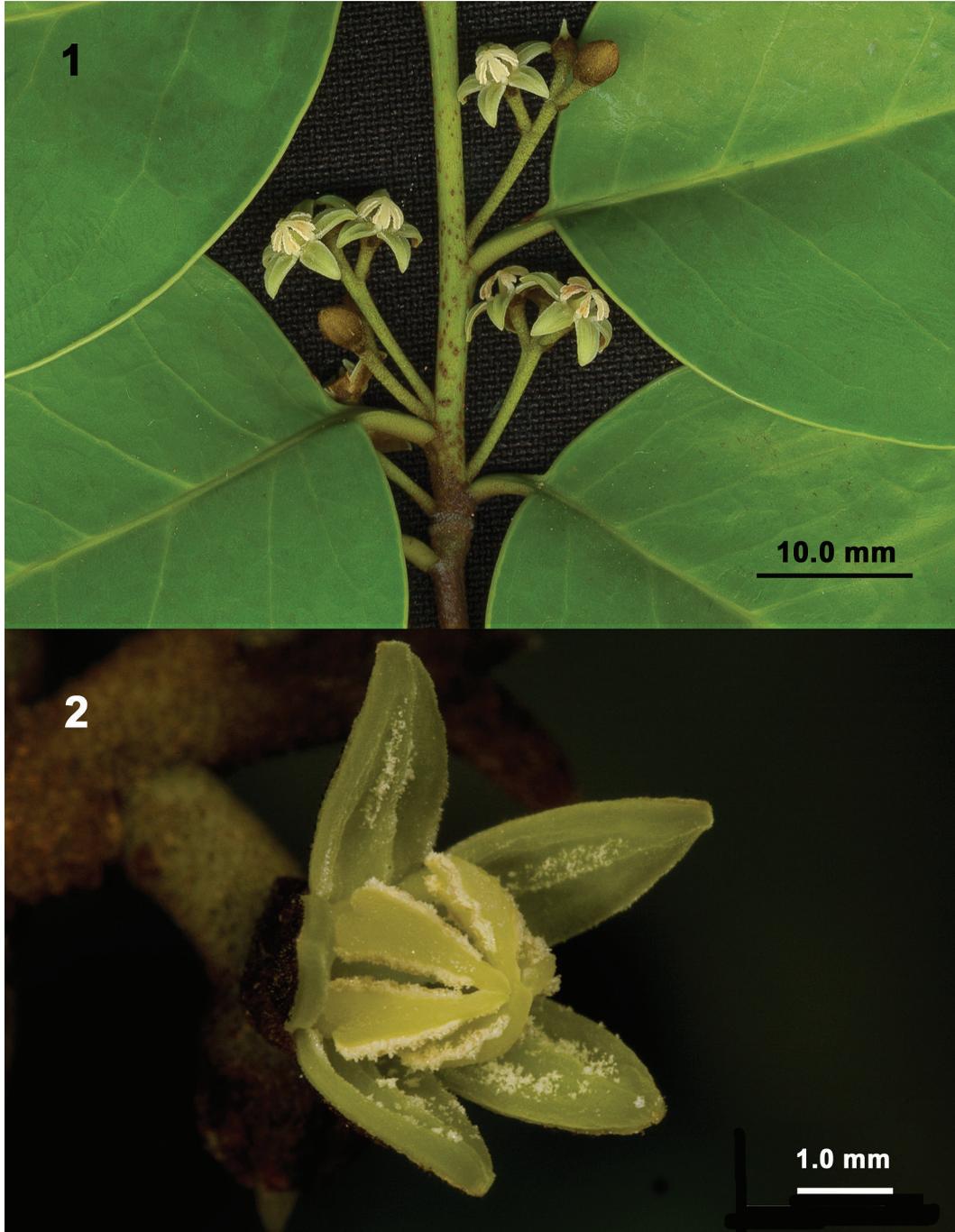
Flower and Fruit Morphology

Inflorescence reduced axillary panicle-like or raceme-like cyme, with 1–3 (–5) flowers (Figs. 1–2); the inflorescences finely pubescent, with reddish brown or chestnut brown short

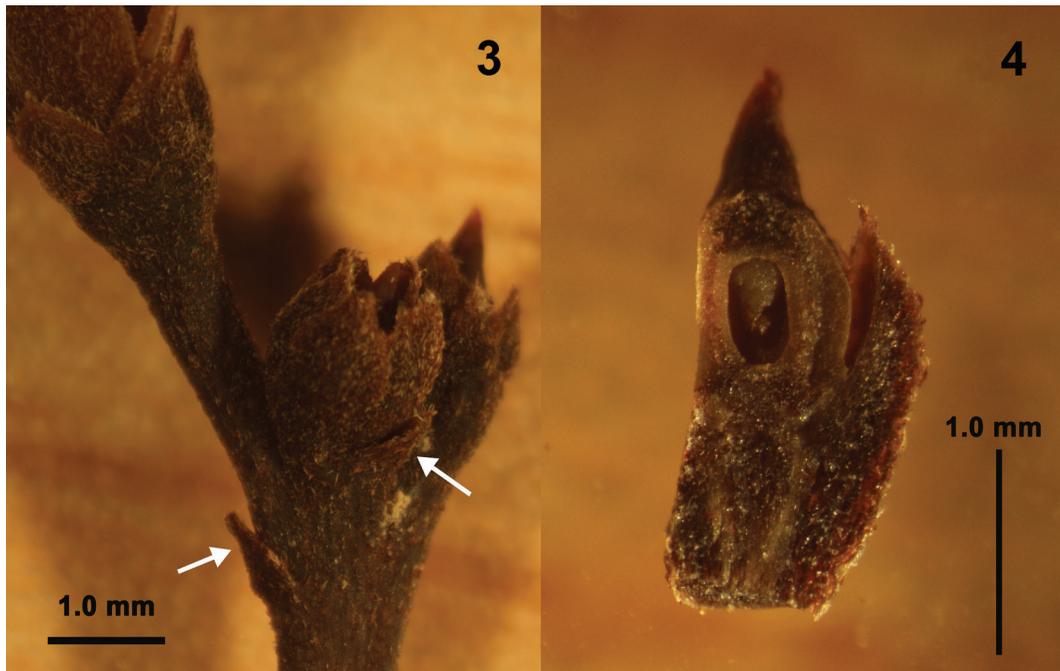
hairs; the peduncles 4.5–9.8 mm long; with small lanceolate-ovate bractlet at apex below each flower (Fig. 3). Pedicels short, 0.5–1 mm long, thick, articulate at base, flowers of inflorescences of 1–3(–5) flowers sometimes sessile. *Calyx* campanulate, 1–1.4 mm long, fleshy, strigose in the outer surface, with reddish or chestnut brown hairs, the inner surface glabrous; the 5 sepals slightly imbricate at base, deltoid to ovate-deltoid, 0.8–1. mm long, with obtuse apex, ciliate. *Corolla* with 5 lobules, fleshy, valvate, united at the base into a short tube (gamopetalous) 0.5–0.7 mm high, the tube glabrous. The petals ovate to narrowly ovate, 3 mm long, 1.5–1.8 mm on its widest part, reflexed, densely strigose-pubescent, with chestnut brown-colored malpighiaceous hairs on the outer surface, except on the short tube formed at the base of the corolla; petals glabrous inside, the inner surface with a prominent narrow keel, and two longitudinal furrows along sides of the keel (Fig. 2), the inner margin and the keel minutely papillate. *Stamens* 5, alternate with petals, borne at apex of corolla tube, 2–2.2 mm long; filaments 0.5 mm long, thick, 0.5 mm wide; anthers basifixed, sagittate, 1.8 mm long, tapering from base to the acute-acuminate apex, the anthers arching inward and overlapping at apex (Figs. 1–2), sparse minute papillate apically, with minute malpighiaceous hairs dorsally, dehiscent along lateral edges. Pistil with no disk, 1–2mm long; ovary ovate,

glabrous, smooth, thick and conical above, about 0.7–1.5 mm long, 1-loculate; ovule pendulous (Fig. 4). *Fruit* an ovoid drupe, up to 2.5 long and up to 2.2 cm in width, smooth, obscurely

apiculate, the peduncles usually short, thick; calyx persistent at base, the pericarp thin, the locule pubescent inside; 1-seeded, the seed up to 2 cm long.



FIGURES 1–2. *Ottoschulzia rhodoxylon*. 1, inflorescences; 2, flower, exhibiting a prominent narrow keel in the inner side of the petals, along two longitudinal furrows along sides of the keel. The flower also exhibits the anthers arching inward and overlapping at apex. Photograph 1 by Eugenio Santiago based on *E. Santiago 1911*; 2 by Alberto López based on *E. Santiago 1909*.



FIGURES 3–4. *Ottoschulzia rhodoxylon*. **3**, detail of an inflorescence with arrows showing the small bractlets below each flower; **4**, dissected pistil. The flower exhibits no disk, an ovate, glabrous, smooth, and thick ovary. The dissection exposes the 1-loculate condition of the pistil and a single, pendulous ovule. Photographs by Eugenio Santiago based on *E. Santiago 1910*.

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APPENDIX

Specimens Examined: PUERTO RICO. Municipality unspecified: Miraflores, 20 March 1971, *R. O. Woodbury s.n.* (UPR). Guajataca gorge, April 1985, *M. Vives s.n.* (UPR). Arecibo: Dominguito, 21 September 2003, *J. C. Trejo et al.* 2408 (UPR); 3 November 2003, *J. C. Trejo et al.* 2462 (UPR). Garrochales,

4 March 1993, *E. Santiago and R. O'Reilly 131* (UPRRP). Río Arriba, 28 July 1994, *F. Axelrod 8134* (MAPR, UPRRP); 5 August 1994, *F. Axelrod 8183* (UPRRP). Sabana Hoyos, 7 December 2002, *J. C. Trejo-Torres 2074* (UPRRP); 10 April 2003, *J. C. Trejo-Torres et al.* 2222 (GH, UPR). Bayamón: Barrio

- unspecified, 12 October 1958, *R. Woodbury s.n.* (UPR); 5 March 1989, *A. Gentry et al. 66097* (UPRRP). Hato Tejas, 14 September 1995, *G. R. Proctor et al. 50105* (SJ). Nevárez, January 1968, *R. O. Woodbury s.n.* (UPR). Sabana Seca, 7 February 1959, *R. O. Woodbury s.n.* (UPR); 9 June 1959, *R. O. Woodbury s.n.* (UPR). Cabo Rojo: Pedernales, 12 August 1993, *G. Rojas and E. Ventosa s.n.* (MAPR). Camuy: Piedra Gorda, 14 March 2004, *J. C. Trejo-Torres et al. 2566* (UPR). Puente, 12 November 2005, *F. Axelrod et al. 13239* (UPRRP); 27 January 2007, *G. J. Breckon 8126* (MAPR). Ciales: Cordillera, 27 October 2001, *J. A. Sustache et al. 688* (SJ). Frontón, 21 November 2003, *J. C. Trejo and G. Rosario 2473* (SJ, UPR). Dorado: Espinosa, 13 September 1995, *G. R. Proctor et al. 50099* (SJ). Higuillar, August 16 2006, *I. Morales s.n.* (MAPR, SJ). Maguayo, 21 March 1993, *G. R. Proctor 48697* (SJ). Río Lajas, 20 June 2003, *J. C. Trejo-Torres et al. 2276* (UPR). Fajardo: El Convento, 15 September 1981, *H. A. Liogier 32299* (UPR). Florida: Barrio unspecified, 11 June 2001, *J. A. Sustache and C. Trejo 633a* (SJ); November 2003, *T. A. Carlo et al. 107* (UPR). Isabela: Barrio unspecified, 19 September 1991, *Axelrod 2949* (UPRRP); June 25 2005, *A. Cubiñá and L. Laboy s.n.* (UPRRP). Coto, 23 September 1989, *G. R. Proctor 45939* (SJ); 1 May 1993, *E. Santiago et al. 128a and 128b* (MAPR); 6 May 1993, *G. J. Breckon and J. Vélez 4245* (MAPR, UPRRP); 9 June 1993, *G. J. Breckon and J. Vélez 4272* (GH, MAPR). Llanadas, 19 September 1991, *G. R. Proctor 47167* (SJ). Planas, 15 April 2004, *J. C. Trejo-Torres and A. García 2627* (UPR); 8 April 2009, *O. Monsegur 1051* (MAPR). Manatí: Coto Norte, 30 January 2007, *G. J. Breckon 8153* (MAPR). Tierras Nuevas [Poniente], 12 March 2009, *O. Monsegur 1038* (MAPR); 17 May 2009, *E. Santiago 1909* (UPR). Tierras Nuevas Saliente, 4 March 2001, *F. Axelrod 11531* (UPRRP); 17 September 2007, *G. J. Breckon 8325* (MAPR). Maricao: Maricao State Forest, January 1986, *R. Padrón s.n.* (UPR); 1 July 1993, *G. J. Breckon et al. 4280* (GH). Quebradillas: Guajataca Forest, 13 March 1983, *A. H. Liogier 34035* (UPR). San José, 14 October 2003, *J. C. Trejo-Torres and M. Caraballo 2441* (UPR). Terranova, 22 August 2009, *O. Monsegur 1087* (MAPR). Sabana Grande: Santana, 1 July 1993, *Breckon et al. 4280* (MAPR). San German: Maricao State Forest, 17 April 1986, *G. R. Proctor and R. Padrón 41551* (SJ). San Juan: Universidad, June 2011, *E. Santiago 1910* (UPR); 1 June 2012, *E. Santiago 1911* (UPR). Toa Alta: Barrio unspecified, 6 November 1965, *R. O. Woodbury s.n.* (UPR). Toa Baja: Barrio unspecified, 27 June 1950, *E. L. Little Jr. 13131* (GH). Candelaria, 15 March 1989, *G. R. Proctor and P. Ortiz 45393* (SJ); 27 March 1989, *G. R. Proctor 45453* (SJ). Media Luna, 2 December 1995, *G. J. Breckon 4640* (MAPR, UPRRP); 17 February 1996, *G. R. Proctor and C. González 50502* (SJ). Vega Alta: Sabana, 23 January 1994, *G. R. Proctor 49046* (SJ). Pugnado Afuera, 11 December 2009, *O. Monsegur 1091* (MAPR). Yauco: Barrio unspecified, 28 May 1941, *L. R. Holdridge 747* (UPR). Susua Alta, 11 October 1990, *R. García et al. 3246* (MAPR, UPR, UPRRP); 30 October 1990, *R. García 3271* (MAPR); 13 July 1991, *R. García 3533* (MAPR, UPR).