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THE IDENTITY OF THE GENUS NEOWAWRAEA (EUPHORBIACEAE)

W. JOHN HAYDEN

Hayden, W. John (Department of Biology, University of Richmond, Richmond, VA 23173). The identity of the genus *Neowawraea* (Euphorbiaceae). Brittonia 39: 268–277. 1987.—On the basis of newly acquired morphological evidence gathered in the course of floristic studies, the monotypic genus *Neowawraea* Rock is now recognized as a species of *Flueggea* Willd. and is renamed **F. neowawraea** W. J. Hayden. Taxonomic documentation presented for *F. neowawraea* includes an expanded morphological description, a map showing its widely scattered distribution in the Hawaiian Islands to which the species is endemic, and discussions of type specimens, common names, and its extreme rarity. The combination of flowers in pedicellate axillary clusters, the lobed staminate disk, pistillode, extrorse anthers, hemitropous ovules, and, especially, the smoothish dry seeds with a deep sub-hilar pit indicate placement in section *Flueggea* subsection *Flueggea.* The newly recognized species appears most closely related to *F. flexuosa* Muell. Arg.

The monotypic genus *Neowawraea* was established by Joseph Rock (1913) based on material collected from the rough 'a'a lava flows of Mauna Loa, Hawai'i. The rarity of this tree and the infrequency of reproductive material, especially pistillate flowers, on herbarium specimens have hitherto hampered efforts to establish its relationships. Most students of the Hawaiian flora (Neal, 1965; St. John, 1973; Fosberg & Herbst, 1975; Carlquist, 1980) have followed the lead of Sherff (1939) who transferred the sole species to *Drypetes* Vahl. Alternatively, Stone (1967) and Webster (1975) maintained generic status for *Neowawraea,* as did Hayden and Brandt (1984) in a comparative study of its wood anatomy since this tissue clearly shows *Neowawraea* to be distinct from *Drypetes* and suggests a relationship with tribe Phyllantheae. Similarly, Levin (1986a, 1986b, 1986c), on the basis of leaf architecture, has argued for the removal of *Neowawraea* from tribe Drypeteae, also noting much greater similarity with Phyllantheae, specifically with *Flueggea* Willd. and *Margaritaria* L. f.

The present resolution of the taxonomic position of *Neowawraea* was initiated by preparation of a treatment of this rare tree for the Bishop Museum's upcoming *Manual of the Flowering Plants of Hawai'i* (Wagner, Herbst & Sohmer, in prep.). In addition to the usual floristic information on distribution and abundance, study of virtually all known herbarium specimens and, especially, fluid-preserved pistillate flowers collected by amateur botanist Frank Mitchell, provided the basis for an enhanced understanding of the morphology of *Neowawraea* and, concomitantly, a better perspective on its relationships. Following a suggestion by Grady Webster (pers. comm.) that *Neowawraea* might prove to be a previously unrecognized element of *Flueggea,* several critical characters, especially ovular configuration and details of seed morphology (see discussion) were investigated, confirming the validity of this suggestion. Accordingly, this paper provides the requisite nomenclatural treatment and documentation of the morphology, distribution, and relationships of this rare and long-overlooked species of *Flueggea.*

Systematic Treatment

Flueggea neowawraea W. J. Hayden, nom. nov. (Fig. 1)

Neowawraea phyllanthoides Rock. The indigenous trees of the Hawaiian Islands, 245, pl. 92, 93. 1913. *Drypetes phyllanthoides* (Rock) Sherff, Field Mus. Nat. Hist., Bot. Ser. 17: 562. 1939. TYPE: UNITED STATES. HAWAI'I. South Kona, Kapu'a, *Rock 10030* (HOLOTYPE: BISH—500871!; ISOTYPES: CU!, F!, L!, MIN!, NY!, UC!, US!, WELT!).

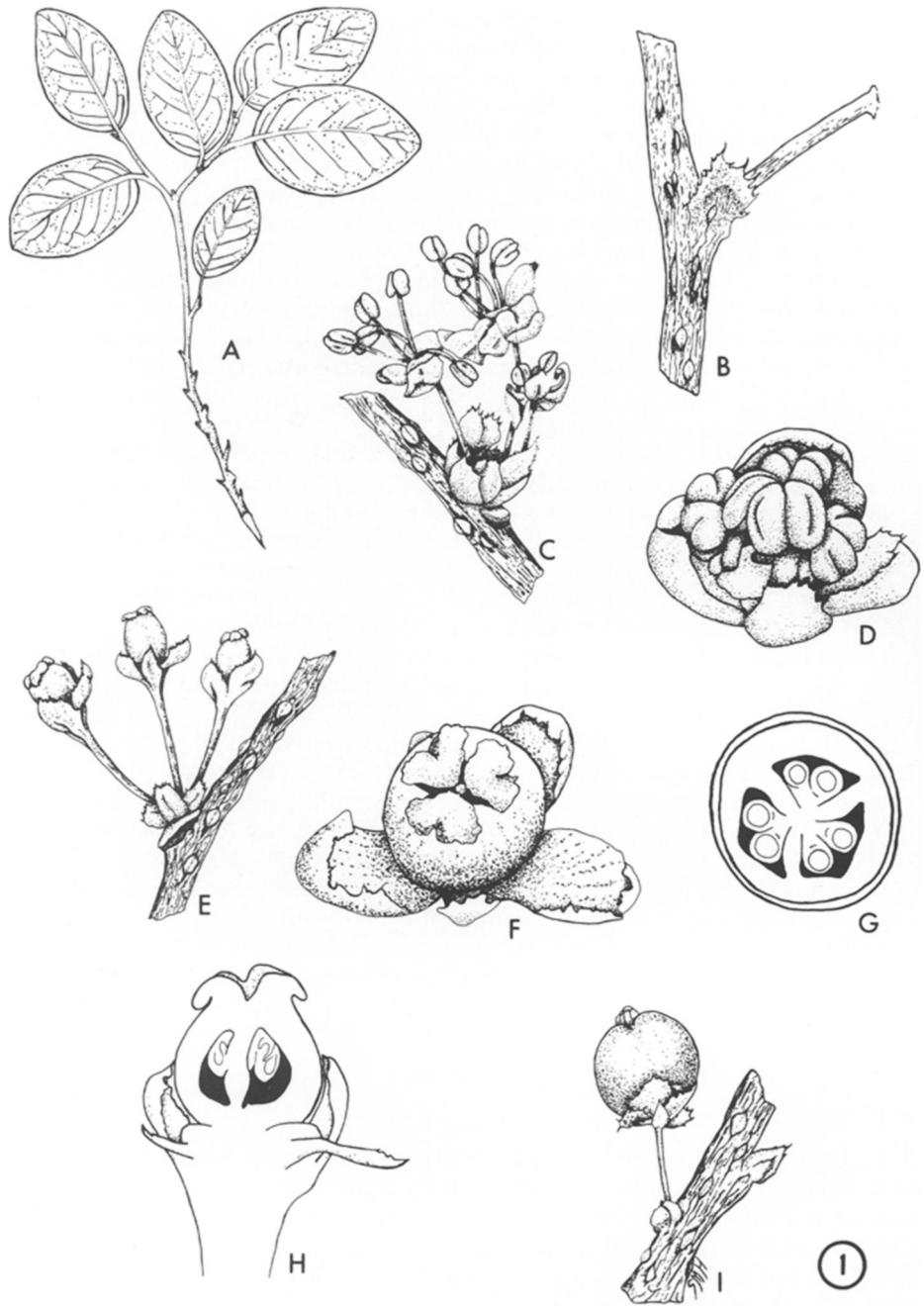


FIG. 1. *Flueggea neowawraea.* A. Leafy branch, *Degener 12341* (MIN), ×⅓. B. Stipule, *Judd s.n., 25 Nov 1930* (BISH), ×4. C. Staminate flower cluster, *Melville et al. 71/1042* (K), ×3. D. Staminate flower, *Melville et al. 71/1042* (K), ×6. E. Pistillate flower cluster, *Mitchell s.n.* (liquid collection—BISH), ×3. F. Pistillate flower, *Mitchell s.n.* (liquid collection—BISH), ×8. G. Pistillate flower, transverse section through ovary, *Mitchell s.n.* (liquid collection—BISH), ×8. H. Pistillate flower, longitudinal section, *Mitchell s.n.* (liquid collection—BISH), ×7. I. Fruit, *Russ s.n.* (BISH), ×4.

Large forest trees up to 30 m tall and 2 m DBH; bark light brown, rough, consisting of scales 0.5–2 cm in diam; sapwood reddish-brown; heartwood black; lenticels abundant, whitish, elliptic, oriented parallel with the axis, furrowed in the center, expanding laterally with age and becoming square to oblong; shoots glabrous. Leaves simple, alternate; blades thin, chartaceous, green above, glaucous below, but occasionally with reddish veins on both surfaces, ovate to elliptic, 4–14 cm long, 2–9 cm wide, frequently larger on stump shoots, pinnately veined, glabrous, apex acute, margins entire, bases truncate to rounded or oblique; petioles 0.5–2 cm long, glabrous; stipules deltate, 2–3 mm long, 2–3 mm wide, margins laciniate-ciliate. Flowers unisexual, in minutely bracted axillary clusters of 2–6; plants dioecious. Staminate flowers ± actinomorphic; pedicels 3–4 mm; sepals 5, green with brownish tips, free, unequal, 1.5–2 mm long, subspatulate, with ragged margins; petals absent; stamens (3) 5, inserted alternately with the somewhat irregular lobes of the floral disk, opposite the sepals; filaments short, 1–2 mm long; anthers 4-sporangiate, 2-loculed, extrorse, basifixed, 1–1.5 mm long; pistillode conic, projecting ca 0.3 mm above the disk. Pistillate flowers ± actinomorphic; pedicels 7–14 mm, dilated slightly apically; sepals 5, glabrous, 1–2.5 mm long, unequal, ranging from deltate and ascending with acute apices to spatulate and spreading with rounded upturned laciniate apices; petals absent; disk hypogynous, 0.3 mm high, projecting scarcely beyond perimeter of ovary; staminodes absent; ovary superior, unlobed, globose, 2.5–3 mm long, consisting of 3 (4) fused carpels, with 3 (4) locules, and axile, nearly apical placentas; stigmas 3 (4), sessile, bilobed; ovules 2 per locule, hemitropous, with an obturator covering the micropyle. Fruits baccate, reddish-brown to black, juicy, globose, 3–6 mm in diam, subtended by persistent sepals, pedicels 0.5–2 cm; pericarp ca 1 mm thick. Seeds slightly curved, 2–4 mm long, 1 mm wide, ± triangular in cross section, with flat radial faces and convex outer tangential face; micropyle apical; raphe ventral, extending to middle of seed; testa 2-layered, the outer layer consisting of large thin-walled cells forming a minutely reticulate surface, the inner layer consisting of palisade-like macrosclereids and enclosing a pit-like depression ca 0.5 mm deep located on the ventral surface below the hilum; embryo embedded in peripheral endosperm, with radical superior and cotyledons slightly bent.

Distribution: UNITED STATES. HAWAIIAN ISLANDS: NW Kaua'i. O'ahu, Wai'anae Range. Moloka'i(?). Maui, SW slope of Haleakala. Hawai'i, Kona Coast (Fig. 2). See also Appendix I.

Discussion

Nomenclature

Retention of Rock's specific epithet would result in a later homonym of *Flueggea phyllanthoides* Baillon, a name that probably applies to *F. virosa* subsp. *virosa* (Roxb. ex Willd.) Voight (Webster, 1984). In the absence of other available names, the epithet *neowawraea* was chosen to provide continuity with the original name of the plant and to maintain Rock's intended tribute to his countryman Heinrich Wawra, Ritter von Fernsee (1831–1887).

Types and noteworthy collections

Although fairly numerous and widely distributed in herbaria, Rock's collections of *F. neowawraea* are beset with a series of disconcerting inconsistencies. As recounted in his *Indigenous trees of the Hawaiian Islands* (1913), Rock collected the type specimen on July 15, 1912 near Kapu'a on the south Kona Coast of Hawai'i. Four trees were encountered, three were staminate and in flower, the

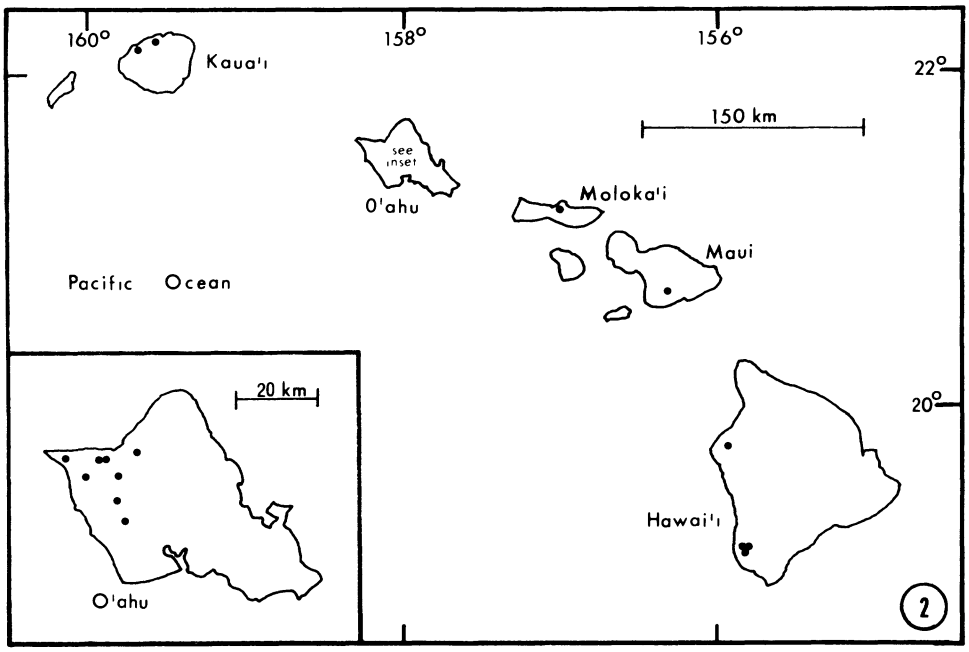
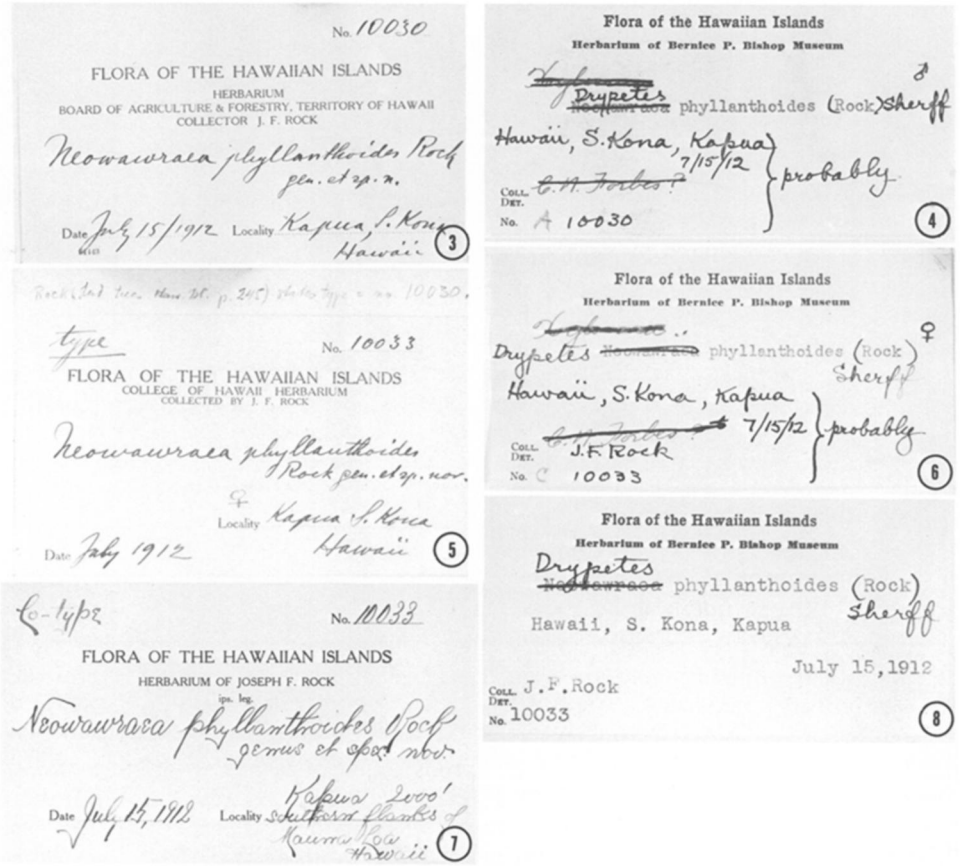


FIG. 2. Historical distribution of *Flueggea neowawraea* in the Hawaiian Islands based on herbarium specimen records.

fourth was pistillate bearing fruits. Specimens taken on that date include *Rock 10030* (staminate material) and *Rock 10033* (predominately pistillate); number *10030,* the only collection specifically mentioned in the text, was designated as the type (Rock, 1913). Rock's specimens originally were held at HAW, but were transferred to BISH in 1922, roughly coincident with his departure from the College of Hawai'i and the college's transition to university status (Chock, 1963; Sutton, 1974). Of 36 sheets attributed to Rock among the specimens examined, four bear complete data on handwritten labels (Figs. 3, 5, 7). Two of these specimens are at BISH, the holotype, a staminate specimen numbered *10030* (Fig. 3), and a pistillate specimen numbered *10033* (yet erroneously marked as the type) (Fig. 5). The other two specimens (at UC and GH) are labelled in a different handwriting; they are both marked as "cotypes" and bear the collection number *10033* (Fig. 7). While the UC "cotype" bears fruits and is thus typical of the vast majority of specimens attributed to *Rock 10033,* the GH specimen is clearly staminate, presumably a misnumbered duplicate of *Rock 10030,* and, thus, an isotype.

Further uncertainty surrounds additional putative isotypes and duplicates of *Rock 10033* which were distributed widely by BISH. Many of these specimens have identifications and label data entered at different times and with different handwriting and/or typescript. For example, many bear a provisional identification of "*Xylosma*" with "C. N. Forbes?" given as the collector; these data were subsequently crossed out (Figs. 4, 6). All the duplicate staminate specimens (numbered *10030*) and all of the specimens bearing mature fruits (numbered *10033*) bear either an "A," "B," or "C" in the space alloted for collection number. The "B" specimens of *10030* and *10033* bear collection data in typescript. "A" and "C" specimens, however, have this information appended, presumably by Sherff, in the same pen and handwriting by which the specimens were annotated as



FIGS. 3–8. Herbarium labels from specimens of *Flueggea neowawraea* attributable to J. F. Rock. 3. Holotype, *Rock 10030* (BISH). 4. Putative isotype, *Rock A10030* (NY). Most duplicates of this series have "J. F. Rock" included among the annotations. 5. Specimen erroneously labelled as "type," *Rock 10033* (BISH). 6. Putative collection of *Rock C10033* (NY). 7. So-called "cotype," labelled *Rock 10033*, but its staminate flowers suggest it is an isotype (i.e., *Rock 10030*) (GH). 8. Putative collection of *Rock 10033* (MIN).

Drypetes phyllanthoides (Rock) Sherff. Addition of the word "probably" (Figs. 4, 6) indicates that Sherff was uncertain in attributing these specimens to Rock and to the original discovery of the species. One series of specimens numbered *10033* lacks these letter designations; these bear all pertinent collection data in typescript (Fig. 8) but they also consist of sterile material only.

According to Warren L. Wagner (pers. comm.), Rock's typical procedure for numbering specimens was somewhat unusual and has often caused confusion. It was his practice to number duplicate specimens in series with the first number of the series ending in a zero, and subsequent replicates numbered successively up to the next increment of 10. Moreover, many of his specimens were never adequately labelled and were often mounted or distributed with partial information. It is not overly surprising, therefore, to encounter confusion in the numbering of Rock's specimens of *F. neowawraea* as well as uncertainty in attributing many of these specimens to Rock.

In summary, while the holotype (*Rock 10030* at BISH) seems perfectly adequate, the authenticity of many of the numerous putative isotypes and putative duplicates

of *Rock 10033* is somewhat in doubt. Nevertheless, this series of specimens remains important since, at 32 or more sheets, they represent over 25 percent of all the herbarium specimens of *F. neowawraea* that could be located after a prolonged search.

Common names

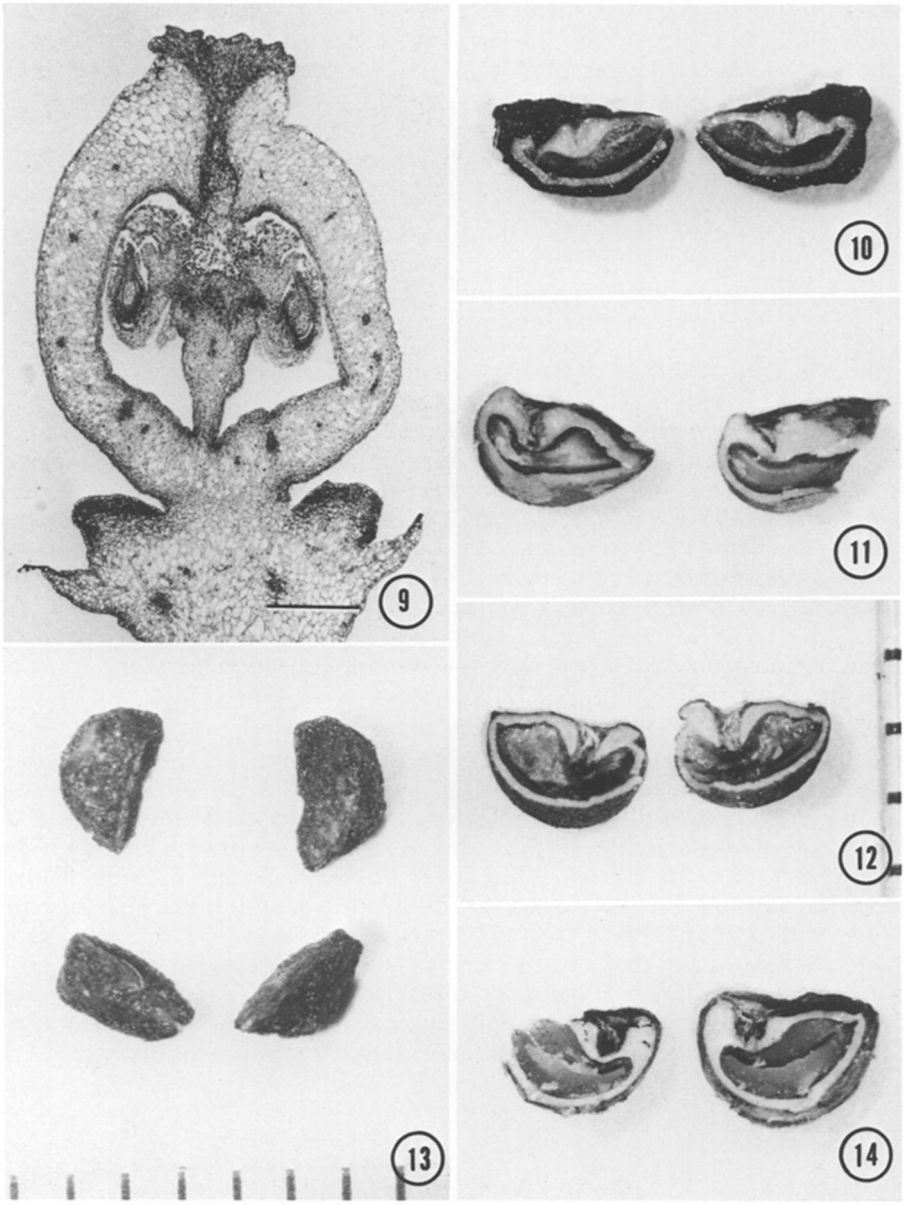
Three Hawaiian names have been attributed to *F. neowawraea,* but, as observed by Rock (1913), these should, perhaps, be viewed with some skepticism since the plant is so rare. Rock's informant gave the name Mehamehame, but this name, along with Hame, Hamehame, and Mehame, is generally applied to Hawaiian species of *Antidesma* (Rock, 1913; Pukui & Elbert, 1979). It is reasonable to assume that the informant failed to distinguish between *F. neowawraea* and *Antidesma,* since the plants resemble each other vegetatively. Other common names found on two herbarium labels, however, suggest some familiarity with the plant. The label on *Keppeler s.n.* contains the phrase "informant, Lohi'au, thinks more trees oceanward" and gives Kamehame as the local name. *Kame,* derived from the English word chamois (Pukui & Elbert, 1979), seems to suggest the recognition of a particular kind of "*Antidesma*" and, perhaps, refers to the glaucous abaxial leaf surface by which *F. neowawraea* can be distinguished from *Antidesma.* Similarly, the common name on labels of *Meebold s.n.,* Hamekapu'a, suggests a meaning of "the *Antidesma* from Kapu'a."

Morphology

The additional specimens accumulated since Rock's original discovery have prompted several differences between the amplified description presented above and Rock's original diagnosis. For example, Rock described the stipules as caducous; stipules are, however, generally prominent on herbarium specimens and are, apparently, only tardily dehiscent. Rock described male flowers as possessing three to four stamens, rarely five; the only herbarium specimens seen with male flowers at anthesis (*Melville et al. 71/1042, Rock 10030,* and *Lennox 50*) have stamens mostly five per flower. Rock also failed to mention the pistillode that, although smaller than those of many *Flueggea* species, is fairly prominent in male flowers. Two aspects of ovule and seed structure described by Rock could not be confirmed: specifically, neither an aril nor the occasional occurrence of four ovules per locule were observed in the material studied. Finally, Rock's characterization of the endosperm as scanty seems to underestimate the condition observed in this study.

Relationships

Drypetes differs from *F. neowawraea* in a number of respects, including its wholly intrastaminal disk, small or absent pistillode, and drupaceous or capsular fruits, as well as a series of wood (Hayden & Brandt, 1984) and leaf architectural (Levin, 1986a, 1986b, 1986c) features. There can be no question, therefore, in abandoning Sherff's assignment of the plant to *Drypetes.* On the other hand, classification in *Flueggea* is supported by many characters. First, the wood of *F. neowawraea* possesses "*Glochidion*-type" wood structure, a syndrome of features found frequently in tribe Phyllantheae. Placement in Phyllantheae is further supported by the combination of pedicellate apetalous flowers in axillary clusters, and, especially, the presence of hemitropous ovules (Fig. 9). Within Phyllantheae, the inconspicuous floral bracts, lobed staminate disk, extrorse anthers, pistillode of staminate flowers, seeds two per locule, and smoothish dry testa convincingly characterize the plant as a *Flueggea. Margaritaria,* a close relative of *Flueggea*



FIGS. 9–14. Ovules and seeds of species in *Flueggea* section *Flueggea* subsection *Flueggea*. 9. Hemitropous ovules of *F. neowawraea, Mitchell s.n.* (liquid collection—BISH) from longitudinal section of pistillate flower, bar = 0.5 mm. 10. Seeds of *F. neowawraea, Rock 10033* (UC), sagittal section, magnification as in 12. 11. Seeds of *F. virosa, King 5419* (US), sagittal section, magnification as in 12. 12. Seeds of *F. leucopyrus, Sohmer 8645* (US), sagittal section, scale in millimeters. 13. Seeds of *F. neowawraea, Rock 10033* (UC), lateral view above, ventral view below, scale in millimeters. 14. Seeds of *F. flexuosa, Whistler W3630* (US), sagittal section, magnification as in 12.

(Webster, 1979, 1984), can be eliminated from consideration by virtue of a series of diagnostic characters not found in *F. neowawraea*; specifically, *Margaritaria* consistently has 4-merous staminate flowers which lack a pistillode and papery thin capsular fruits bearing fleshy seeds with a distinctive bony sclerotesta. Within

Flueggea, the peculiar sub-hilar pit embedded in the inner layer of the testa (Figs. 10–14) is diagnostic for section *Flueggea* subsection *Flueggea* (Webster, 1984).

Of the three species in subsection *Flueggea, F. neowawraea* seems most closely related to *F. flexuosa.* Both species are large unarmed forest trees with relatively large evergreen leaves. Their general aspect contrasts sharply with other species of the genus many of which are thorny shrubs with small deciduous leaves and occur as elements of savanna or thorn scrub vegetation. *Flueggea flexuosa* occurs from the Philippines to eastern Melanesia and the other two species of subsection *Flueggea* occur from west Africa to southern New Guinea and Australia (Webster, 1984). *Flueggea neowawraea* thus provides another example of the strong Indo-Pacific derivation of the Hawaiian flora. *Flueggea neowawraea* differs from *F. flexuosa* in its prominent lenticels, smaller lobes of the staminate disk, and shorter, wider, more sessile stigmas.

Rarity

Herbarium labels routinely indicate that the trees sampled were in various states of senescence at the time of collection. Indeed, label notes on two specimens collected in the early 1950's from Makaleha Valley, O'ahu (*St. John 23829* and *Degener et al. 20686*) mention an abundance of dead trunks of *F. neowawraea* in the area. Most collections, however, note the existence of only one or two trees in any given location. Insect damage to the foliage is prominent on many herbarium specimens; presence of caterpillars in young fruits was noted on *Warshauer et al. 1672,* and geometrid larvae were noted in the collection data for *Gagne 497.* A specimen in cultivation at the State Forestry Nursery at Hilo was killed by black twig borers, *Xylosandrus compactus,* which reputedly are the main threat to the tree's continued survival. Fortunately, the tree is capable of regeneration from stump sprouts, a fact noted on a number of herbarium labels.

Available collections of *F. neowawraea* suggest a total of 10 to 12 populations on Kaua'i, O'ahu, Maui, and Hawai'i (Fig. 2). G. W. Russ collected one specimen from Moloka'i in 1931. However, according to a letter preserved at NY from C. S. Judd to O. Degener, this was taken from a small tree that had died sometime prior to 1939. No other specimens from Moloka'i have been seen, so the species must be presumed extinct on Moloka'i. One of the few known trees on Kaua'i was recently discovered to be leafless and presumed to be dead (T. W. Flynn, pers. comm.). The only specimens seen from Maui were all taken in the vicinity of Auwahi on the southwest slope of Haleakala; in recent years only two of the three trees from this population were known to remain alive (Linney, 1982). The largest extant populations of *F. neowawraea* occur on O'ahu in the Wai'anae Mountains and along the south Kona Coast of Hawai'i, but nowhere are more than 10 trees known to occur at a single site, and individuals tend to be highly dispersed (Linney, 1982). An herbarium specimen uncovered in the present study, *Hatheway 453* (G), apparently documents a previously unknown location for *F. neowawraea* on the island of Hawai'i, some 60 km north of its type locality.

The continued existence of *F. neowawraea* in the wild is clearly threatened by extremely low population densities and susceptibility to predation by insects. It is fervently hoped that improved knowledge of the morphology and relationships of the tree will stimulate additional studies of its biology leading to its eventual preservation.

Acknowledgments

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Appendix I

Specimens Examined

Hawai'i. Hu'ehu'e Ranch: 50 yds from belt road between Hu'ehu'e and Pu'uwa'awa'a, 2100 ft, 20 Nov 1950, *Hatheway 453* (G). S Kona: Honomalino, 19°11′N, 155°51′W, 2200 ft, 1 Jul 1968, *Webster et al. 14018* (DAV); Honomalino Farm, 1700 ft, 1 Jul 1968, *Herbst 1181* (BISH); Ho'omau Ranch, 2250 ft, 22 Jan 1978, *Warshauer et al. 1672* (BISH, HAW); Kapu'a, 15 Jul 1912, *Rock 10030* (BISH—holotype, CU, F, L, MIN, NY, UC, US, WELT), *10033* (BISH, F, GH, L, MIN, NY, UC, US, W, WELT); Aug 1915, *Rock & Copeland 12590* (BISH, L); 2000 ft, 27 Dec 1931, *St. John et al. 11354* (A, BISH, UC, US); about 1 mi S of Okoe boundary and 100 ft oceanward of Gov't road, Dec 1932, *Keppeler s.n.* (F); along Ku'u road within 2–3 mi of new tourist rest house, on left-hand side, 40 yds from road, 1000 ft, May 1932, *Meebold s.n.* (BISH, [duplicates distributed as *Degener 9097*: CU, G, MASS, MO, NY]).

Kaua'i. Limahuli Valley: SW end on Pali, 1400 ft, 12 Apr 1978, *Perlman 8* (BISH). Mahanaloa Valley: S side of gulch, above kukui zone, 660 m, 22 Aug 1970, *Gagne & Montgomery 533* (BISH). Pa'aiki Valley: Waimea, 2100 ft, Jul 1932, *Judd s.n.* (BISH); 2000 ft, Sep 1968, *Hobdy s.n.* (K).

Maui. Auwahi, SW slope of Haleakala: 18 Mar 1920, *Forbes 2020M* (BISH, L); 2700 ft, 6 May 1967, *Lennox 50* (BISH); 11 Nov 1967, *Herbst et al. 713* (BISH, HAW, LD); 29 Aug 1972, *Gillett 2522* (BISH).

MOLOKA'I. Waihi'i: near Kapuna, Jun 1931, *Russ s.n.* (BISH).

O'AHU. Wai'anae Mts.: Kamokunni (or Papaya) Gulch. Kamananui, 1700 ft, 17 Jul 1955, *St. John 25572A & 25572B* (both BISH). Kamokuiki Valley: between Pu'uiki and Pu'u Kama'ohanui, 12 Apr 1933, *Degener 9099* (NY); 13 Apr 1933, *Caum s.n.* (BISH); SSE of Pu'u Iki, W-facing slope of gulch, 500 m, 1 Mar 1970, *Gagne 497* (BISH). E Makaleha Valley: W branch, 1400 ft, 4 Jul 1950, *Degener et al. 20686* (BISH, BM, CU, F, G, GB, NY, US); 1400 ft, 4 Jul 1950, *Hatheway et al. 98* (BISH); Mokule'ia, in small side gulch, 30 Sep 1950, *Hatheway 395* (BISH); 1200 ft, 11 Jun 1952, *St. John 23829* (A, BISH, K, L); Pahole (Kukui'ula) Gulch, near head of rt. branch, 12 Apr 1936, *Fosberg 13064* (A, BISH, F, L, MO, NY, US, W). Kahanahaiki Valley: Piko Trail, 800–1000 ft, 3 Dec 1933, *Krauss s.n.* (F). Makua Valley: rt.-hand side below dike, Nov 1929, *Russ s.n.* (BISH); 11 Dec 1929, *Russ s.n.* (BISH, L); 25 Nov 1930, *Judd s.n.* (BISH); open forest on valley side, 600 m, 20 Apr 1932, *Christophersen 3654* (BISH); SE corner of Valley, 27 Sep 1932, *Degener & Judd 11010* (A, BISH, CU, F, G, MASS, MICH, MIN, MO, NY, PH); E slope above F & R Line, 25 May 1933, *Russ s.n.* (BISH). Pu'u Pane: in gulch above Puce Paue [sic], 1800 ft, 16 Nov 1971, *Melville et al. 71/1042* (K); Mokule'ia Forest Reserve, 5 mi S of Hale'iwa, 2000 ft, 11 Aug 1976, *Little 31046* (BISH). Pu'u Hapapa: SE slope, Honoliuli Trail, 21 May 1939, *Degener et al. 12341* (A, BISH, BM, CU, F, G, GH, MASS, MICH, MIN, MO, NY, US). Pohakea Pass, 12 May 1933, *Fosberg 9509* (A, BISH, CAS, F, L); steep gulch, 1800 ft, 12 May 1933, *St. John 13157* (BISH, F); 1800 ft, 12 May 1933, *Russ s.n.* (BISH).

BOOK REVIEW

Seeds of Continental United States Legumes (Fabaceae). By Richard L. Delorit and Charles R. Gunn. Agronomy Publications, P.O. Box 83, River Falls, WI 54022. ISBN 0-9616847-0-4. 1986. 134 pp. $32.00 (cloth), $28.00 (plastic spiral).

Agronomists, seed technologists, wildlife managers, beadworkers, botanical students of Leguminosae, and just plain people will derive pleasure and instruction in equal parts from this handsomely illustrated seed-book. Photographed in color against carefully chosen contrasting backgrounds are seeds (in few cases one-seeded propagules) of 220 sorts of bean, pea, and kindred. These are chosen to represent all tribes of Fabaceae occurring either native, or naturalized, or planted in continental United States, also all tribes, native or not, of the economically important tribe Phaseoleae, and in addition (despite the book's title) include one example taken from each tribe of the World's Legume flora not entering the foregoing categories. It thus provides an overview, though by no means exhaustive, of morphological variation in seed-form encountered in this immense plant family, always emphasizing those which enter into human diet and economics. The book opens with an essay on seed morphology and the special terminology used in description. Each photograph (four per page, often at different scales of enlargement, which may disorient the viewer at first glance) is accompanied by a few words describing the plant and its distribution, and random notes on virtues and liabilities. A phylogenetic conspectus in Appendix I indicates relationships which the alphabetical sequence of photographs deemphasizes. No key is attempted, but a multi-entry set of *guides* will aid the reader to match a seed in hand. It is hoped that some painful misspellings of Latin names (*Acacia toruosa* for *tortuosa, Bauhinia monarda* for *monandra, Errazurizia rotunda* for *rotundata*) and misattributions of authorship (*Senna occidentalis, Chamaecrista absus, Lablab purpureus*) will be corrected for a second printing. It was Katarine S. Bort, not a mythical Bortero, who first described the Velvetbean. But these small blemishes do not seriously detract from the value of this agreeable and unusual publication.—RUPERT C. BARNEBY, New York Botanical Garden.