

WILEY

Some Additions to the Genus *dodonaea* L. (Fam. Sapindaceae)

Author(s): Earl Edward Sherff

Source: *American Journal of Botany*, Vol. 32, No. 4 (Apr., 1945), pp. 202-214

Published by: Wiley

Stable URL: <https://www.jstor.org/stable/2437511>

Accessed: 30-12-2020 14:03 UTC

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at <https://about.jstor.org/terms>



JSTOR

Wiley is collaborating with JSTOR to digitize, preserve and extend access to *American Journal of Botany*

Earl Edward Sherff

DODONAEA sandwicensis sp. nov.—Nunc frutex 2–3 m. altus nunc arbor circ. 4–6 m. alta, caule usque ad 1.6 dm. crasso; ramis virgatis vel internodiis abbreviatis subflexuoso-tortuosis, inferne teretiusculis superne plus minusve angulatis, sub quoque folio costa elevata notatis, cortice rubro-fusco subgriseove glanduloso ceterum glabro. Folia alterna breviter vel moderate petiolata petiolo plerumque marginato et sub 1 cm. longo; lamina elliptica vel oblongo-lanceolata vel subrhomboidelanceolata vel parce oblanceolata spatulatave, apice rotundata obtusave (atque interdum emarginata) vel etiam acuta subacuminatave, basim versus in petiolum angustata, margine plerumque subrepanda et interdum plus minusve revoluta, membranacea vel supra subcoriacea, plerumque 4–8 cm. longa et 1–3 cm. lata (pro surculis sterilibus usque ad 1.5 dm. \times 6 cm.), sicca subpallida ac vix subnitida, nervo mediano valido subtus prominente convexo, nervis lateralibus subtilibus numerosis parallele oblique patentibus, paucis glandulis adpersa ceterum glabra. Flores dioici (hermaphroditum non visi) in thyrsis terminalibus axillaribusve stipitatis glabratis sub 5 cm. longis dispositi, longiuscule pedicellati; sepalis 4–6, plerumque linearilanceolatis vel oblongis, glabris vel margine sparsim hispidulis, 1-nervatis, 1–2 mm. longis, usque ad basim plerumque distinctis, in herbario rubro-atris. Florum masculinorum stamina circ. 9, antheris circ. 2 mm. longis filamentis 0.5–0.7 mm. longis vel rarius absentibus; ovario rudimentario superne setuloso; femineorum ovario (sicco) viridi-sucino, viscido ceterum glabrato, nitido, breviter stipitato, 2 stylis (siccis) atro-rubris, glabris, subtilibus, 5–9 (raro 12) mm. longis, apice vel rarissime usque ad basim distinctis, plerumque persistentibus etiam maturo fructu. Fructus subsemper 2-loculatus ac 2-alatus, alis sed non stylis inclusis usque ad 11 \times 11 mm. (rarissime 13 mm. longus et 18 mm. latus), omnino vinoso-ruber colore saepius in herbario persistente, glandulosus et interdum viscosus, aliter glabratus. Semen (normaliter unicum pro loculo) planum vel plano-convexum, ovatum, circ. 3 mm. longum.

Now a shrub 2–3 m. tall, now a tree about 4–6 m. tall, the trunk up to 1.6 dm. thick; branches virgate or with shortened internodes and then somewhat bent and twisted, somewhat terete below but more or less angulate above, marked under each leaf with a raised rib; the bark reddish-brown or grayish, glandular but otherwise glabrous. Leaves alternate, shortly or moderately petiolate, petiole commonly margined and under 1 cm. long; blade elliptic or oblong-lanceolate or subrhomboid-lanceolate or barely oblanceolate or spatulate, at apex rounded or obtuse (and at times emarginate) or even acute or subacuminate, toward base narrowed into a

petiole marginally as a rule subrepand and at times more or less revolute, membranaceous or on upper surface subcoriaceous, somewhat glandular but otherwise glabrous, commonly 4–8 cm. long and 1–3 cm. wide (for sterile shoots up to 1.5 dm. \times 6 cm.), in dry state subpallid and barely subglossy, the strong median nerve salient and convex beneath, the many delicate lateral nerves running parallel and spreading obliquely. Florets dioecious (hermaphroditic not observed), rather long-pedicellate, disposed in terminal or axillary thyrses, these stipitate, glabrate, under 5 cm. long; sepals 4–6, commonly linear-lanceolate or oblong, glabrous or at margin sparsely hispidulous, 1-nerved, 1–2 mm. long, commonly distinct almost to base, reddish-black when dry. Stamens of male florets about 9, their anthers about 2 mm. long, the filaments 0.5–0.7 mm. long or more rarely absent; ovary rudimentary, setulose above. Ovary of female florets greenish-amber when dry, viscid but otherwise glabrate, shining, shortly stipitate; the 2 styles blackish red (when dry), glabrous, delicate, 5–9 (rarely 12) mm. long, at apex or very rarely down to the base distinct, commonly persistent even on the mature fruit. Capsules nearly always 2-loculate and 2-alate, up to 11 \times 11 mm. including the wings but not the styles, or very rarely 13 mm. long and 18 mm. wide, entirely wine-red (the color more often persisting in the herbarium), glandular and at times viscid, otherwise glabrate. Seed (normally a single one to a locule) flat or flat-convex, ovate, about 3 mm. long.

Specimens examined:² HAWAIIAN ISLS.—*David Douglas* 4 (Kew, 2 sheets); *Gaudichaud* 276 (Voy. sur la Bonite), Aug., 1836 (Par.); *William Hillebrand* (Gray); *Hillebrand & John M. Lydgate* (Bish.); *Horace Mann & William T. Brigham* 719 (Bish.); *United States Exploring Expedition under Capt. Wilkes*, 1838–1842 (N.Y.; U.S.).

ISL. KAUA'I—*Otto Degener & Emilio Ordoñez* 12,621, open forest, alt. 3,000 ft., Milolii Trail, Kokee, Jan. 3, 1940 (Berl., Brit., Calif., Chi., Del., Gray, Kew, Mo., N.Y., Par., Phila., U.S., etc.); *Urbain Faurie* 276, Hanapepe, Dec., 1909 (Arn.,

² The following abbreviations are used for the depositories cited in this paper: Arn., Arnold Arboretum, Jamaica Plain; Berl., Berlin Botanical Garden; Bish., Bernice P. Bishop Museum, Honolulu; Brit., British Museum of Natural History, South Kensington; Calif., University of California, Berkeley; Chi., Chicago Natural History Museum (formerly Field Museum of Natural History), Chicago; Corn., Cornell University, Ithaca; Del., Delessert Herbarium, Geneva; Goth., Arboretum (Botanical Garden) of Gothenburg; Gray, Gray Herbarium of Harvard University, Cambridge; Kew, Royal Botanical Gardens, Kew; Minn., University of Minnesota, Minneapolis; Mo., Missouri Botanical Garden, St. Louis; N.Y., New York Botanical Garden; Par., Museum of Natural History, Paris; Phila., Academy of Natural Sciences, Philadelphia; U.S., United States National Museum, Washington, D. C.

¹ Received for publication December 21, 1944.

Par.); *Faurie* 277, alt. 1,000 m., Waimea, Feb., 1910 (Arn., Par.); *Charles N. Forbes* 279-K, Wahiwai Swamp, Aug., 1909 (Bish., Calif.); *F. Raymond Fosberg* 12,745, shrub 3 m. tall, in moist forest, Kanaloa Hululu Ranger Station, Kokee, Jan. 1, 1936 (Chi., etc.); *Albert S. Hitchcock* 15,542, vicin. of Kahloluamanu, Oct. 26, 1916 (U.S.); *J. August Kusche* 120, high plateau of Waimea, Halemanu to Koholuamanu, 1919 (Arn.); *Miss Marie Neal*, alt. 3,000–3,500 ft., Nualolo Trail, Aug. 14, 1936 (Bish.); *Miss Neal*, alt. 3,500–4,000 ft. Awaawapuhi Trail, Aug. 21, 1936 (Bish.); *Joseph F. Rock* 1,674, Halemanu, Feb. 14–26, 1909 (Gray); *Rock* 1,675, same place and date (Bish., N.Y.); *Rock* 2,178, same place and date (N.Y.); *Rock* 17,106, Kaholuamanu, Oct., 1916 (Bish.); *Harold St. John et alii* 10,713, Na Pali-Kona Forest Reservation, Kokee, Waimea, Dec. 26, 1930 (Bish., Calif.); *idem* 10,998, shrub in thicket along ridge, alt. 1,200 ft., Hanakapiai, Napali coast, Jan. 2, 1931 (Chi.); *St. John & F. R. Fosberg* 13,749, tree 15 ft. tall, in open koa forest, alt. 2,000 ft., Milolii ridge, Waimea, Dec. 27, 1933 (Bish., Chi.); *St. John & Fosberg* 13,772, shrub 8 ft. tall, in wet forest, alt. 3,200 ft., same place and date (Bish., Chi., etc.); *Carl Skottsberg* 994, near Kokee Station, Waimea, Oct. 28, 1922 (Bish., Goth.); *Truman G. Yuncker* 3,522, alt. 3,600 ft., near Forest Ranger's Station, Kokee, Jan. 20, 1933 (Yunck., U.S.).

ISL. OAHU—*Capt. Beechey* (Kew); *Degener* 11,155, in open woods, Wilhelmina Rise, Honolulu, Feb., 1923 (Chi., Gray); *Degener* 11,167, in rain-forest, Konahuanui above Pauoa Flats, Feb. 25, 1928 (Berl., Calif., Chi., Del., Gray, Kew, Par.); *Degener* 11,183, in wet forest, east slope of Palikea, Oct. 23, 1932 (Berl., Calif., Chi., Gray, Kew, Minn., N.Y., Par., Phila., U.S.); *Degener* 11,188, near summit, Kanehoa, July 5, 1931 (Chi.); *Degener & K. K. Park* 11,179, near forest, southeast side of Makua Valley near its head, Jan. 3, 1932 (Berl., Chi.); *Degener, Park, Takamoto, & Topping* 11,104, in rain-forest, C.C.C. Trail, Aiea, Feb. 16, 1936 (Berl., Chi., Kew, Par.); *Degener & Salucop* 11,194, moderately dry fills, ridge north-northeast of Kaala summit, Apr. 11, 1937 (Arn., Berl., Calif., Del., Gray, Kew, Minn., Mun., N.Y., Par., Phila., U.S.); *Degener, Salucop, & Arlantino* 11,530, in lower rain-forest, Aiea Ridge, Dec. 6, 1937 (Berl., Brit., Calif., Chi., Del., Gray, Kew, Minn., Mun., N.Y., Par., Phila., U.S., etc.); *C. N. Forbes*, ridge west of Kalihi, Oct. 3, 1908 (Bish., Calif., Mo.); *Forbes*, Palolo Valley ridges, Nov. 7, 1908 (Bish.); *Forbes*, "forest form," slopes of Kaala, Mokuleia, Apr. 26–May 16, 1912 (Bish., Chi., Mo., etc.); *Forbes* (With Dean Lake) 1,975-O, Waimano Ridge, Oct. 27–30, 1914 (Bish.); *Forbes & Rock*, Palolo Valley, Nov. 7, 1908 (Chi., Mo., U.S.); *F. R. Fosberg* 8,960, bush 2.5 m. tall, in wet forest, alt. 690 m., peak at head of Pauoa Flats, Oct. 30, 1932 (Chi., etc.); *Fosberg* 9,108, shrub 3 m. tall, in dry forest, alt. 750 m.,

east slope of Puu Kaala, Waianaueka, Jan. 8, 1933 (Chi., etc.); *Fosberg* 10,835, slender tree 5 m. tall, in moist forest, alt. 750 m., Puu Kawiwi-Puu Kaala ridge, Makaha-Waianae Kai, Mar. 31, 1935 (Chi.); *D. Wesley Garber* 121, Konahuanui Trail near Pauoa, Jan. 4, 1920 (Bish.); *Garber* 131, Mt. Konahuanui Trail above Pauoa, same date (Bish.); *Charles Guadichaud, Voy. sur la Bonite* (Gray); *William Hillebrand* 144, Nuuanu (Kew); *E. P. Hume* 211, tall shrub, alt. 1,200 ft., on wooded ridge, Puu Peahinau, Oct. 4, 1931 (Bish.); *Raymond Inafuku*, dry ridge, alt. 1,800 ft., Opaaula Gulch, Paalaa, Nov. 9, 1930 (Bish.); *Noel H. Krauss*, alt. 1,200–1,400 ft., Manoa-Palolo ridge, Nov. 19, 1933 (Bish., Chi.); *Kazuto Nitta* (*O. Degener distrib. no.*) 11,174, alt. 1,500 ft., Kipapa, Nov. 10, 1929 (Chi.); *A. M. Octavio*, Kipapa, Nov. 26, 1929 (Bish.); *Jules Remy* 567, exact locality not stated, 1851–1855 (type, Par.); *Olof H. Sellings* 3,656, east side of Waianae Mts., Sept. 25, 1938 (Goth.); *Carl Skottsberg* 266, alt. about 700 m., Palehua etc., Waianae Range, Aug. 25, 1922 (Bish., Goth.); *Skottsberg* 919, Palolo Valley, Koolau Range, Oct. 25, 1922 (Goth.); *Harold St. John* 10,032, shrub, alt. 1,200 ft., on wooded slope, south ridge of Kipapa Gulch, Waipio, Nov. 10, 1929 (Bish., Chi.); *St. John* 10,640, tree 20 ft. tall, on wooded ridge, alt. 1,800 ft., South Opaaula Gulch, Paalaa, Nov. 9, 1930 (Bish.); *St. John* 13,323, tree 20 ft. tall, trunk diam. 6 in., alt. 1,500 ft., in lower woods, ridge south of South Opaaula Gulch, Paalaa, Sept. 24, 1933 (Bish., Chi., etc.); *D. LeRoy Topping* 3,268, Mt. Olympus, Nov. 25, 1925 (Calif., N.Y.).

ISL. MOLOKAI.—*F. R. Fosberg* 13,403, tree 5 M. tall, edge of moist forest, alt. 600 m., Manawai-Kahananui ridge, Dec. 24, 1936 (Chi., etc.); *H. St. John & F. R. Fosberg* 12,866, tree 18 ft. tall, in rain-forest, alt. 2,400 ft., trail on ridge east of Mapulehu Valley, Dec. 29, 1932 (Bish., Chi., etc.).

WEST AND EAST MAUI.—*E. H. Bryan, Jr.*, 653, tree 4 m. tall, trunk diam. 10 cm., in lower forest, alt. 3,000 ft., Haelaau, native name *aalii*, Dec. 21, 1928 (Bish.); *C. N. Forbes* 476-M, Honokahau Drainage Basin, Sept. 25–Oct. 17, 1917 (Bish., Chi., etc.); *Forbes* 481-M, same place and date (Bish., Chi.); *A. S. Hitchcock* 14,802, alt. up to 5,000 ft., Puu Kukui, Sept. 24–26, 1916 (U.S.); *H. Mann & Wm. T. Brigham* 410, West Maui (Chi., Mo.); *Emilio Ordoñez* (*O. Degener distrib. no.*) 12,920, Waihee, Sept. 15, 1940 (Berl., Chi., Del., Kew, N.Y., Par., U.S.); *J. F. Rock* 8,614, tree 15–20 ft. tall, alt. 2,600–3,000 ft., in lower forest of Makawao, Oct. 18, 1910 (Chi., Gray, etc.).

ISL. HAWAII.—*Otto Kuntze* 23,064, alt. 1,400 m., June, 1904 (N.Y.).

This species has been confused with *Dodonaea viscosa* Jacq. In leaf-outline it sometimes faintly suggests var. *vulgaris* f. *repanda* (Schum. & Thonn.) Radlk. of that species, especially if the abnormally large leaves of sterile branches be examined. *D. sandwicensis* is rather easily separated

from the numerous previously described forms of *D. viscosa*, however, in having usually darker, also narrower and more distinct sepals; flowers seemingly always dioecious, not often hermaphroditic; the styles consistently two only, elongate and delicate, and more commonly persistent on the ripe capsules; fruits regularly 2-celled and 2-winged and usually retaining their red or claret color even after drying, not commonly 3-celled and 3-winged and commonly turning stramineous or brownish on drying.

Asa Gray (Bot. U. S. Explor. Exped. 1: 261. 1854) was perhaps the first to publish about this species, although he made no attempt to separate it from *D. viscosa*. He wrote: ". . . at the latter locality [*i.e.*, Honolulu, Isl. Oahu] also the (probably abnormal) form with elongated styles, some of them 5 or 6 lines in length! Similar specimens were gathered at Oahu by Gaudichaud in the Voyage of the Bonite." The elongate styles are now seen to be entirely normal for this species and to afford a rather striking diagnostic character. In young, numerously flowered, pistillate inflorescences they may even suggest tufts or locks of hair.

In foliage *D. sandwicensis* resembles occasionally *D. viscosa* var. *vulgaris* f. *Burmanniana* (DC.) Radlk. and the latter's counterpart in the Hawaiian flora, described below (see p. 209) as *Dodonaea eriocarpa* var. *glabrescens*.

DODONAEA SANDWICENSIS β *simulans* var. nov.—Folia elliptico-spathulata vel lanceolata, pallida, apice obtusa vel subacuta, saepius 3–5.5 cm. longa et 1–1.6 cm. lata, venis inferne manifestis. Fructus bialati, parvi, alis inclusis tantum 8–11 mm. lati et 6–8 mm. alti, sicci subbrunnei (forsitan capsula rubido-brunnea), extus interdum obsolete setulosi, stylo brevissimo vel absenti.

Leaves elliptic-spatulate or lanceolate, pale, apically obtuse or subacute, more often 3–5.5 cm. long and 1–1.6 cm. wide, veins conspicuous beneath. Fruits 2-winged, small, wings included only 8–11 mm. wide and 6–8 mm. tall, brownish when dry (or the capsule perhaps reddish-brown), sometimes obsoletely setulose on surface, style very short or lacking.

Specimens examined: Harold St. John et alii 12,538, alt. 2,200 ft., Maunahui, Kaunakakai, Isl. Molokai, Dec. 24, 1932 (type, Yunck.).

In its veiny leaves and 2-celled capsules and consequently 2-winged fruits, this variety suggests a small-leaved form of *D. sandwicensis* proper. However, its fruits do not exhibit the bright red color characteristic for fruits of *D. sandwicensis*, they are smaller, and they do not have long styles. They suggest in their diminutive size certain forms of *D. viscosa* Jacq. found in Florida of the United States, but are distinctive in the evident constancy of their 2-winged character.³ A few of the 26 fruits

³ One Florida form of *D. viscosa*, separated some years ago as *D. microcarpa* Small (Torreya 25:39. 1925) has small, 2-winged and 3-winged fruits.

found on the type have a few simple hairs sparsely placed (disregarding certain stellately clustered hyphal branches of some fungus observed in a few small areas), but these hairs will hardly suggest the larger-fruited *D. eriocarpa*.

DODONAEA ERIOCARPA SMITH in Rees Cyclop. 12: *Dodonaea* no. 6. 1809; *DODONAEA ERIOCARPA typica* var. nov.—Shrub, much branched, dioecious or at least in some of the varieties polygamous with staminate, pistillate, and hermaphrodite or perfect flowers on same plant; branchlets pubescent with short, stiff, slender, spreading, mostly simple hairs. Leaves narrowly to widely elliptic-lanceolate or -oblong or -oblanceolate, apically acuminate, basally narrowed into a short (\pm 1 cm.), supernally narrow-margined, hairy petiole; blade 2–4.5 (or even –8.5) cm. long and usually 8–18 mm. broad, short-hairy (often densely so at the minutely revolute slightly wavy but otherwise entire edges and on veins, particularly underneath), the hairs frequently branched at base as also on the petiole; upper surface of blade at least when dry appearing more or less coriaceous and irregularly viscid-glossy. Pistillate flowers (neither staminate nor hermaphrodite seen for var. *typica*) in panicles at ends of branchlets, pubescent. Sepals 5, narrowly ovate or rarely oblong-elliptic, apically somewhat acute, more or less bristly, later spreading or reflexed, about 1.5–2 mm. long. Pedicel filiform, \pm 5 mm. long. Ovary 1 mm. tall and subglobose or presently 2 mm. tall and 4-ridged, very shortly stipitate, densely pubescent with hairs mostly branched at base and more or less stellate. Style slender, 2–5 mm. long, glabrate, twisted, with four unequal, suberect, linear stigmata. Capsule turgid, 5–7 mm. tall, more or less appressed-pubescent and glandular-punctulate, 4- or sometimes 3-winged; the glistening, purplish wings more or less glandular-punctulate, up to 16 mm. long and 5 mm. broad, pubescent on their faces and especially so on their margin, leaving when flattened in pressing a basal sinus \pm 2 mm. deep and an apical sinus \pm 4 mm. deep. Seeds flattish-ovoid, about 1 mm. across.

Specimens examined: ISL. MOLOKAI.—Joseph F. Rock 6,169, plant about 6 feet tall, in company with *Acacia koaia* on dry, open slopes below Mapuloa, half-way between Kamoku and Kaunakakai, southeastern Molokai, Mar. 22, 1910 (Bish., Chi., Gray).

ISL. HAWAII.—Lucy M. Cranwell, O. Selling, & C. Skottsberg 3,204, on lava, along road near Huehue, North Kona, Sept. 11, 1938 (Goth.); Alfred Meebold (*Otto Degener distrib. no.*) 11,182, Huehue, North Kona (Chi., Deg.); Archibald Menzies, alt. 6,000 feet, "Hawaiian Isls." but doubtless from Hawaii (type collection, Kew); Jules Remy 570, Hawaii, 1851–1855 (Gray, N.Y., Par.); Shea & Stevens, North Kona, Jan., 1928 (Bish.).

The cosmopolitan species *Dodonaea viscosa* Jacq. is so highly polymorphic that it has been suspected

of including the principally Hawaiian *D. eriocarpa* described long ago by Sir James E. Smith. Benthams, at the conclusion of an extended study of *Dodonaea* (Fl. Austral. 1: 472. 1863) clearly had *D. eriocarpa* in mind when he mentioned "possibly one distinct Sandwich Island species." However, Hillebrand (Fl. Haw. Isls. 88. 1888) recognized *D. eriocarpa* as valid and retained it. We may note, too, that Radlkofer, in his classical study of *Dodonaea viscosa* Jacq. (Mart. Fl. Brasil. 13^{III}: 643. 1900), accepted a reduction to *D. viscosa*, by Benthams, of *D. spatulata* Smith but entirely omitted *D. eriocarpa*, thus impliedly recognizing the latter as valid.

Several years ago I made a study of much Hawaiian material of *Dodonaea* and described, in manuscript, various varieties and forms of *D. eriocarpa*. These have been withheld until a comparative study of many hundreds of specimens of *D. viscosa* from all quarters of the globe could be undertaken. This was recently done, thanks to the aid received in the lending of materials from various institutions. My conclusion that *D. eriocarpa* Smith is a valid species, known only from the Hawaiian Islands (where represented by several subordinate entities as well as by its var. *typica*), from Java, and from the Galapagos Islands is emphatic. It is true that *D. viscosa* exhibits certain forms elsewhere that simulate *D. eriocarpa* in one or another special characters, but the several combinations of characters as shown especially well in varieties or forms of *D. eriocarpa* in the Hawaiian Islands are not found.

Hillebrand (*loc. cit.*) seems to have been unfamiliar with many of these varieties and forms of *D. eriocarpa* and, in the absence of precise knowledge of the type itself, to have treated as mere variants of the species proper the several varieties that he himself had collected.

Fortunately, I have before me a specimen of the original material collected by Menzies, whose collection was cited by Smith in Rees' Cyclopaedia as the type basis for his *D. eriocarpa*. Only the above few specimens cited for var. *typica* match it. Numerous other specimens of *D. eriocarpa* had been labeled to the species in herbaria but these and certain additional ones are seen on further study to fall into fifteen additional, fairly well marked varieties. These are treated below. My foregoing description of the species proper, *i.e.*, var. *typica*, has been drawn in part perforce from the supplementary specimens cited, since the small Menzies branch is inadequately representative. It has ovaries but no mature fruits; and, as remarked originally by Smith himself, no anthers are present. Indeed, on none of the specimens examined for var. *typica* have stamens been observed and it may prove to be, as assumed by Smith, that the plants of var. *typica* are dioecious.

Key to Various Elements of *Dodonaea Eriocarpa* as Here Presented⁴

- a. Leaf-blades often 4-10 (or even -15) cm. long and 2-4.5 cm. broad, hispidulous beneath or at base
 - b. Leaf-blades hispidulous beneath, fruiting clusters dense, often subglobose, plant native to southern Hawaii and perhaps to West Maui
 - var. η *Hosakana*
 - b. Leaf-blades hispidulous at base, fruiting clusters loose and elongate, plant native of Java
 - var. θ *Waitziana*
- a. Leaf-blades shorter or narrower, or if not, then glabrate
 - b. Leaf-blades mostly oblanceolate to obovate or even broadly oblong
 - c. Leaf-blades distally (except for extreme apex) more often obtuse, rounded, or subtruncate, infrequently subacute
 - d. Fruits more often 2-winged; plant native of southeastern Molokai. var. λ *pallida*
 - d. Fruits mostly 3- or 4-winged; plants not known from Molokai
 - e. Leaves very thin, drying dark purplish-green, fruits large, \pm 2.5 cm. long and wide; plant native of Lanai. var. θ *oblonga*
 - e. Leaves otherwise, fruits smaller
 - f. Leaves small, blade commonly 2-3.5 cm. long and 1.3-2 cm. wide, fruits small, about 7-10 mm. wide (including wings); plant native of Lanai. var. ζ *lanaiensis*
 - f. Leaves and fruits larger
 - g. Leaves and fruits more or less conspicuously pubescent
 - var. ϵ *obtusior* and f. *galapagensis*
 - g. Leaves and fruits mostly glabrate or weakly pubescent
 - var. ι *Degeneri* and f. *decipiens*
 - c. Leaf-blades distally more often narrowed, from subacute to acuminate
 - d. Fruits large, capsule proper \pm 1.5 cm. long and \pm 1.2 cm. wide; plant native of Hawaii
 - var. γ *Forbesii*
 - d. Fruits smaller or at least with smaller capsules
 - e. Fruits more often 2-winged; plant native of southeastern Molokai
 - var. λ *pallida* f. *acuminatula*
 - e. Fruits infrequently 2-winged
 - f. Leaves more often glossy, chiefly somewhat elliptic-lanceolate; ovaries weakly or sparsely hispidulous. var. κ *glabrescens*
 - f. Leaves mostly lacking gloss, chiefly more dilated above middle; ovaries moderately to strongly hispidulous
 - g. Fruits very pubescent; styles very slender and 7-8 mm. long; plant native of Kauai, Oahu, and apparently Lanai
 - var. δ *waimeana*
 - g. Fruits weakly to moderately pubescent, styles shorter and stouter
 - h. Pubescence of ovaries strongly stellate
 - D. eriocarpa* sensu stricto,
 - i.e.*, var. *a typica*
 - h. Pubescence of ovaries not or but slightly stellate. var. ι *Degeneri* f. *decipiens*
 - b. Leaf-blades at most narrowly or a few moderately oblanceolate

⁴ Var. π *minor*, described on p. 212, from Java, is as yet too incompletely known to permit inclusion in this key.

- c. Leaves much crowded together, pedicels of pistillate flowers short, thickish, and not or but scarcely visible in the panicle; plant native of northern Hawaii.....var. β *confertior*
- c. Leaves comparatively less congested, pistillate inflorescence more open
- d. Mature fruits small, mostly under 12 mm. tall and (when flattened out) 15 mm. broad including wings
- e. Fruits usually very pubescent even on wings; most leaves strongly acuminate at apex; plant native of southeastern Molokai
var. ν *molokaiensis*
- e. Fruits glabrate; leaves subacuminate to obtuse at apex; plant native of Galapagos Islands.....var. μ *Vaccinioides*
- d. Mature fruits larger
- e. Leaves at most barely acuminate at apex; fruits and ultimate branchlets but weakly pubescent; plant common in East Maui and very rare in northwestern Hawaii
var. ξ *Hillebrandii*
- e. Leaves commonly very acuminate at apex
- f. Fruits very large, capsule proper \pm 1.5 cm. long and \pm 1.2 cm. wide; leaves glabrate or very slightly pubescent. .var. γ *Forbesii*
- f. Fruits smaller
- g. Ovaries slightly hispidulous
var. κ *glabrescens*
- g. Ovaries densely stellate-pubescent
D. eriocarpa sensu stricto,
i.e., var. α *typica*

DODONAEA ERIOCARPA β **confertior** var. nov.—Frutex \pm 1.5 m. altus, foliis confertis plerumque oblanceolatis, facile acuminatis, principalium lamina 3–5 cm. longa et saepius 1.2–1.8 cm. lata. Inflorescentiae compactae (floribus confertis ac breviter pedicellatis, tantum femineis visis) quam folia primum et plerumque etiam demum multo breviores. Fructus paulo minores alis usque ad 1.4 cm. longis et aegre vel etiam minime ciliatis, sinu apicali angustissimo.

Shrub \pm 1.5 meters tall, the crowded leaves commonly oblanceolate and easily acuminate, blade of principal ones 3–5 cm. long and more often 1.2–1.8 cm. wide. Inflorescences compact (flowers crowded and shortly pedicellate, only the pistillate seen), at first and commonly also at last much shorter than the leaves. Fruits a little smaller, wings up to 1.4 cm. long and weakly or even very slightly ciliate, apical sinus extremely narrow.

Specimens examined: Joseph F. Rock 8,334, shrub 5 feet tall, alt. 6,000 feet, Ahamoia (Ahumoa) Crater, Mauna Kea, Isl. Hawaii, June, 1910 (type, Gray: isotypes, Bish., Chi., Kew).

DODONAEA ERIOCARPA γ **Forbesii** var. nov.—Inflorescentia ramulique moderate patenti-hispidi. Folia oblongo-lanceolata vel pauca angustiora, utrinque (apice longe) acuminata supra fere glabrata infra marginibusque debiliter pubescentia, lamina 4–8 cm. longa et 0.8–2 cm. lata, petiolo gracili circ. 5–10 mm. longo. Fructus (soli maturi sicci rubro-brunnei vel purpurascetes visi) magni, nunc 3-saepius 2-alati, alis inclusis \pm 2.2 cm. longi et \pm 2 cm. lati, sparsim pubescentes, capsula ipsa

maxima \pm 1.5 cm. longa et \pm 1.2 cm. lata, alis 2–5 mm. latis.

Inflorescence and branchlets moderately spreading-hispid. Leaves oblong-lanceolate or a few narrower, at each end acuminate (at apex elongately so), above almost glabrate, underneath and on margins weakly pubescent, blade 4–8 cm. long and 0.8–2 cm. wide, petiole slender and about 5–10 mm. long. Fruits (only mature, dry, reddish-brown or purplish ones seen) large, now 3- more often 2-winged, \pm 2.2 cm. long including wings and \pm 2 cm. wide, wings 2–5 mm. wide.

Specimens examined (all from ISL HAWAII): Charles N. Forbes 247-H, Kanehaha, Kona, June 23, 1911 (type, Bish.: isotypes, Calif., Mo., N.Y., Par., U.S.); Horace Mann & William T. Brigham 410, Isl. Hawaii (Gray).

DODONAEA ERIOCARPA δ **waimeana** var. nov.—Folia saepius obovato-oblanceolata, apice acuminata, lamina plerumque 3–4.5 cm. longa et 1.2–1.9 cm. lata. Inflorescentiae femineae juvenes plerumque laxae, stylis gracilioribus et paulo longioribus (circ. 7–8 mm. longis). Fructus pubescentiores.

Leaves more often obovate-oblanceolate at apex acuminate, blade commonly 3–4.5 cm. long and 1.2–1.9 cm. wide. Young pistillate inflorescences commonly lax, styles more slender and a little longer (about 7–8 mm. long). Fruits more pubescent.

Specimens examined: ISL. KAUAI—Abbé Urbain Faurie 275, Waimea, Feb., 1910 (type, Par.); Amos A. Heller 2,846,⁵ on Kaholuamanu, above Waimea, Sept. 30, 1895 (Chi.); Heller (similarly) 2,846, same place, Oct. 1–8, 1895 (Calif., N.Y., U.S.); William Hillebrand, Kauai (Gray); Hillebrand 574, Kauai (Kew); Albert S. Hitchcock 15,559, Kaholuamanu to Waimea, Oct. 27, 1916 (U.S.); Joseph F. Rock 2,646, Kauai (Chi.); Rock 3,992, Kauai (Chi.); Rock 3,996, dry fore hills, Waimea, Feb., 1909 (Gray); Rock 3,997, Kauai (Chi.); Rock 4,000, Kauai (Bish.).

ISL. OAHU—Degener, Martinez, & Salucop 11,080, on moderately dry, open slope, plateau west of Kaumuku Gulch, Puuiki, Mar. 17, 1937 (Arn., Berl., Brit., Calif., Chi., 2 sheets, Del., Goth., Gray, Minn., Mo., Mun., N.Y., Par., Phila., U.S., U.V., etc.; a form with fruits mostly bialate, only very few trialate).

ISL. LANAI—Charles N. Forbes 508-L, Lanai, Sept., 1917 (Bish.; a small, staminate, small-leaved branch apparently belonging with this variety).

DODONAEA ERIOCARPA ϵ **obtusior** var. nov. et **obtusior** f. nov.—Folia plus minusve obovata (raro oblonge oblanceolata), supra interdum fere glabra; lamina nunc 2–3.5 cm. longa et \pm 1.5 cm. lata nunc ad 6 cm. longa et ad 3 cm. lata, apice obtuso vel saepius rotundo subtruncatove saepe abrupte mucronata vel apiculata; sepalis nunc ovatis nunc lanceolatis vel linearibus.

⁵ Elsewhere (Minn. Bot. Studs. 1: 849. 1897), Heller says of this plant: "On the bare slopes between the forks of the Waimea River, Kauai, is a very common plant . . . bushes vary in size from two to four feet, with ascending branches."

Leaves more or less obovate (rarely oblong-oblancoate), at times almost glabrous above; blade now 2–3.5 cm. long and \pm 1.5 cm. wide now up to 6 cm. long and to 3 cm. wide, often abruptly mucronate or apiculate at the obtuse or more frequently rounded or subtruncate tip; sepals now ovate now lanceolate or even linear.

Specimens examined: ISL. NIIHAU—*J. F. G. Stokes*, at foot of mountain on west side, Jan., 1912 (Arn., Bail., Bish., Calif., N.Y., U.S., 2 sheets).

ISL. KAUAI—*Otto Degener* 11,157 (see also under Isl. Hawaii), Kaulaula Ridge, dry region, June 13, 1926 (Berl., Chi., Deg.); *Degener & Emilio Ordoñez* 12,620, scrub at alt. 2,500 feet, Puehu Ridge, Waimea, Dec. 29, 1939 (Arn., Berl., Brit., Chi., Del., Goth., Gray, N.Y.); *Charles N. Forbes*, Waimea, Sept., 1909 (type, Bish.); *Forbes* 279-K, Wahiawa Swamp, Aug., 1909 (Bish., where one of three specimens approaches and Mo., where one of two specimens approaches or apparently is the var. *Waimeana*; U.S.); *Horace Mann & William T. Brigham* 410-a, alt. 1,500 ft., Waimea (Del., Mo., U.S.).

ISL. HAWAII—*Otto Degener* 11,157 (see also under Isl. Kauai), in dry region, 19 miles along main road from Waimea toward Kona, Aug. 18, 1926 (Berl., Chi., Deg.); *Mrs. Violet Oliveira Fosberg* 46, dry pasture lands, below Kamuela, South Kohala, Aug. 8, 1936 (Bish.); *United States Exploring Expedition under Capt. Wilkes*, Hawaii, 1838–1842 (U.S.).

The specimens by Mann & Brigham and by the U. S. Exploring Expedition have leaves less rounded at the tip than in the other material examined, but otherwise seem inseparable from var. *obtusior*. Forbes, under his no. 279-K, seems to have confused specimens of this variety with some of var. *waimeana*.

DODONAEA ERIOCARPA var. ϵ **OBTUSIOR** **galapagensis** f. nov.—Folia saepius obovata apice rotundata vel subtruncata (mucrone brevi), nervis lateralibus magis conspicuis, marginibus saepe irregulariter revolutis.

Leaves more often obovate and apically rounded or subtruncate (mucro short), lateral nerves more conspicuous, edges often irregularly revolute.

Specimens examined (all from ALBEMARLE ISL., GALAPAGOS ISLANDS): *R. E. Snodgrass & E. Heller* 244, alt. 3,000 feet, mountain east of Tagus Cove, Feb. 1, 1899 (Gray); *Snodgrass & Heller* 876, alt. 4,000 feet, Tagus Cove, June 15, 1899 (Gray, 2 sheets); *Snodgrass & Heller*, 904, alt. 2,100 feet or less, Tagus Cove, same date (Gray, 2 sheets); *Alban Stewart* 1,945, bushes 4–5 feet tall, abundant on lava beds above 2,000 feet, Tagus Cove, Mar. 27, 1906 (type, Gray: isotype, N.Y.); *Stewart* 1,946, small trees and bushes, alt. around 1,800 feet, Cowley Bay, Aug. 10, 1905–1906 (Gray).

The Galapagos specimens here cited are close to the typical form (*i.e.*, forma *obtusior*) of var. *obtusior* except as noted. Phytogeographically, the

occurrence in the Galapagos Islands of this forma and the var. *Vaccinioides* (see below) of an otherwise principally Hawaiian Island species is interesting. Robinson (Proc. Amer. Arts & Scs. 38: 4: 214. 1902) has already noted "on the whole rather slight traces of affinity between the flora of the Galapagos Islands and that of the Sandwich [*i.e.*, Hawaiian] Islands."

DODONAEA ERIOCARPA ζ **lanaiensis** var. nov.—Folia principalia obovata vel late elliptico-oblonga, minor, lamina sub 4 cm. longa et sub 2 cm. lata. Fructus parvi, plerumque 3- interdum 2-alati, alis inclusis plerumque 7–10 mm. lati, moderate hispiduli.

Principal leaves obovate or widely elliptic-oblong, smaller, blade under 4 cm. long and under 2 cm. wide. Fruits small, commonly 3- sometimes 2-winged, commonly 7–10 mm. wide including wings, moderately hispidulous.

Specimens examined (all from ISL. LANAI): *F. Raymond Fosberg* 12,520, low, spreading bush, on eroded slope, alt. 500 m., flats above head of Hawaialanui Gulch, Dec. 1, 1935 (type, Chi.: isotypes, several but undistributed as yet); *William Hillebrand*, Isl. Lanai (Gray); *George C. Munro*, Isl. Lanai (Bish.).

In the type collection the fruits are 2- and 3-alate, and under 1 cm. long and under 1.2 cm. wide including wings.

DODONAEA ERIOCARPA η **Hosakana** var. nov.—Demum arbor fruticosa \pm 2.4 m. alta. Folia nunc lanceolato-oblonga nunc oblanceolata nunc anguste obovata, majora, lamina saepe 4–10 (etiam –12) cm. longa et 2–4.5 cm. lata, apice nunc rotundata vel etiam subtruncata ac abrupte apiculata (pro typo) nunc obtusa vel etiam subacuminata; venis principalibus subtus saepe elevatis magis conspicuis. Paniculae multiflorae ad anthesin apertae et foliis longe superatae. Sepala minora sub 1.5 mm. longa, pro floribus masculinis plerumque angustiora etiam oblongo-linearia; antheris circ. 1.8 mm. longis, sparsim setulosis; pedicello gracillimo saepe \pm 1 cm. longo.

Finally a shrubby tree \pm 2.4 meters tall. Leaves now lanceolate-oblong now oblanceolate now narrowly obovate, larger, blade often 4–10 (even –12) cm. long and 2–4.5 cm. wide, at tip now rounded or even subtruncate and abruptly apiculate (for the type) now obtuse or even subacuminate; principal veins often salient beneath and more conspicuous. Panicles many-flowered, at anthesis open and much surpassed by the leaves. Sepals smaller, under 1.5 mm. long, for the staminate flowers commonly narrower even oblong-linear; anthers about 1.8 mm. long, sparsely setulose; pedicel very delicate, often \pm 1 cm. long.

Specimens examined (all from ISL. HAWAII):⁶ *Otto Degener* 11,159, in rocky pasture, Punaluu, July 25, 1926 (Berl., Chi., Deg.); *Degener* 11,160,

⁶ There seems some possibility that var. *Hosakana* occurs in at least one locality in West Maui. *Degener*, *Ordoñez*, & *Salucop* 12,490 is this variety and was said to

bushy tree about 8 feet tall, in *aa* lava desert, near Hanuapo, July 22, 1926 (Berl., Chi., Deg.); *Degener* 11,161, in *aa* lava flow, Isl. Hawaii, July 22, 1926 (Deg.); *Degener* 11,162, in Kau Desert, 25 miles along main road from Kilauea, July 22, 1926 (Berl., Chi., Deg.); *Degener* 11,171, not common, in arid region, *aa* lava *kipuka* two-thirds way from Waiohinu toward Kaalualu, Sept. 13, 1929 (Berl., Chi., Deg.); *Degener* 11,173, alt. 400 feet, in dry, rocky region, Milolii, Sept. 20, 1929 (Berl., Chi., Deg.); *Degener* 11,175, dry *aa* lava flow, Punaluu, Mar. 17, 1930 (Berl., Chi., Deg.); *Degener* 11,176, dry *aa* lava *kipuka*, between Honuapo and Hilea, Feb. 17, 1930 (Berl., Chi., Deg.); *Degener*, *Yasuma Iwasaki*, & *Yoshimasa Nitta* 3,906, "ripe capsules yellowish, never red as at Milolii," arid *aa* lava flow, between Hilea and Honuapo, Apr. 13, 1930 (Berl., Chi., Deg.); *Degener* & *Y. Nitta* 3,966, arid *aa* lava flow, between Hilea and Honuapo, May 7, 1930 (Berl., Chi., Deg.); *F. Raymond Fosberg* 10,143, bush 3 meters tall, on *aa* lava, alt. 230 meters, Volcano Road below Pahala, Aug. 31, 1933 (Chi., etc.); *Miss Marie C. Neal*, tree 8 feet tall, on *aa* flow, alt. \pm 300 feet, Punaluu, Kau, Aug. 8, 1929 (Chi.); *Clifford Nishina* (*Degener distrib. no.*) 11,185, Kona District (Arn., Chi.); *Joseph F. Rock* & *W. M. Giffard*, Kau and Kilauea, Apr., 1911 (Bish.); *Rock* & *Giffard* 8,781, alt. 1,000 feet, lava fields, Hilea, Kau, Apr., 1911 (type, Gray, a staminate and a pistillate branch on same sheet: isotypes, Bish., 3 sheets, Calif., Gray, N.Y., U.S.); *Rock* & *Giffard* (similarly) 8,781, Hilea, July, 1911 (Arn., Gray).

A variety usually recognizable at a glance by its large leaves. From notes accompanying herbarium specimens from the Bishop Museum, it is seen that some preliminary work had once been done toward segregating this variety by Mr. Edward Yataro Hosaka of that institution, and the variety thus may be named very appropriately in his honor.

DODONAEA ERIOCARPA θ **oblonga** var. nov.—*Ovarii* exceptis fere omnino glabrescens. Folia plerumque oblonga interdum obovata, apice obtusa vel subacuta, basi in petiolum brevum (\pm 5 mm.) cuneate angustata, membranaceissima, lamina \pm 7 cm. longa et \pm 3 cm. lata, sicca plus minusve atropureo-viridia. Flores masculini non visi. Styli breves (1–6 mm.), nunc cohaerentes nunc paene distincti. Fructus magni, demum 3 vel 4 alis inclusis \pm 2.5 cm. longi latique.

Almost entirely glabrescent except for ovaries. Leaves commonly oblong but sometimes obovate, apically obtuse or subacute, basally cuneate-narrowed into a short petiole (\pm 5 mm.), very thin; have come from northwest of Hopoi Camp, West Maui, July 28, 1939. It should be noted, however, that at the same place and on the same date the same collectors obtained a large suite of the very different var. *Degeneri*. Because of this fact, I have suspected an admixture of plants from Hawaii (var. *Hosakana*) among plants from West Maui (var. *Degeneri*) during the process of writing labels. In any event, the definite occurrence of var. *Hosakana* in West Maui is in need of confirmation.

blade \pm 7 cm. long and \pm 3 cm. wide, more or less dark purplish-green when dry. Staminate flowers not seen. Styles short (1–6 mm.), now cohering now almost distinct. Fruits large, finally \pm 2.5 cm. long and wide including the 3 or 4 wings.

Specimens examined (all from LANAI): *Charles N. Forbes* 18-L, mountains near Koele, June, 1913 (topotypes, Bish., Mo.); *Forbes* 90-L, same place and date (type, Bish.: isotypes, Calif., Mo., N.Y.); *Joseph F. Rock* 8,049, on open forehills of Mahana, July 27, 1910 (Chi., Gray).

DODONAEA ERIOCARPA ι **Degeneri** var. nov. et **Degeneri** f. nov.—Folia parva, moderate vel late oblanceolata, membranaceora, marginibus venisque hispidula alibi glabrata, supra saltem primum valdius viscida, lamina saepius 3–4 cm. longa et 0.8–1.4 cm. lata, apice plerumque acuta vel parce acuminata. Fructus numerosi sed laxe dispositi, plerumque multo minores, conspicue turgidi, omnino sparsim hispiduli, alis parvis saepius sub 7 mm. longis et 2 mm. latis.

Leaves small, moderately or broadly oblanceolate, thinner, on edges and veins hispidulous elsewhere glabrate, above more viscid at least at first; blade more often 3–4 cm. long and 0.8–1.4 cm. wide, at apex commonly acute or barely acuminate. Fruits numerous but loosely disposed, commonly much smaller, conspicuously turgid, sparsely hispidulous all over, the small wings more often under 7 mm. long and 2 mm. wide.

Specimens examined (all from WEST MAUI): *Otto Degener* 11,163, in arid region, Pohakea Gulch, July 11, 1927 (Berl., Chi., Deg.); *Degener*, *Emilio Ordoñez*, & *Felix Salucop* 12,488, extremely arid forehill, Ukumehame Gulch, Aug. 25, 1939 (Arn., Berl., Calif., Chi., Deg., Gray, Kew, Par.); *Degener*, *Ordoñez*, & *Salucop* 12,491, alt. 1,000 feet, on dryish, grassy ridge, Puu Lio northwest of Hopoi Camp, July 28, 1937 (type, Chi.: isotypes, Arn., Berl., Calif., Chi., Deg., Del., Flor., Gray, Kew, Minn., Mo., Mun., Mus.V., N.Y., Par., Phila., U.S., U.V., etc.); *Charles N. Forbes* 120-M, Hanaula, June, 1910 (Bail., Bish., Calif., Mo., N.Y., U.S.; a form approaching in larger size of fruit on certain specimens, but not otherwise, the var. *typica*); *Yoshimasa Nitta* (*Otto Degener distrib. no.*) 11,202, alt. about 1,200 feet, two gulches southeast of Ukumehame Gulch, May 10, 1937 (Berl., Chi., Deg.).

Named after Mr. Otto Degener, who very generously placed at my disposal his entire collections of the Hawaiian species of *Dodonaea*, and whose numerous specimens of this variety (most of them as yet undistributed to herbaria) have proved of the utmost help in drawing the description.

In well developed specimens, the leaves are thinner in texture, farther apart, and somewhat broader than in the var. *Hillebrandii* of East Maui.

DODONAEA ERIOCARPA var. ι **DEGENERI** **decipiens** f. nov.—Folia plerumque \pm dimidio majora, apice nunc rotunda nunc acuta vel conspicue acuminata, saepe longe graciliterque petiolata petiolo 1–3 cm.

longo. Fructus (quam pro f. *Degeneri*) plerumque majores.

Leaves commonly larger by a half more or less, at tip now rounded now acute or conspicuously acuminate, often elongately and slenderly petiolate, petiole 1–3 cm. long. Fruits commonly larger (than for f. *Degeneri*).

Specimens examined: ISL. KAUAI—*Degener & Ordoñez* 12,619, dryish valley side, alt. 500 feet, Hanapepe, Dec. 29, 1939 (Arn., Berl., Brit., Calif., Chi., Del., Flor., Gray, Kew, Minn., Mo., Mun., Mus.V., Par., Phila., U.S., U.V., etc.); *Jared G. Smith*, Mana, Mar. 10, 1908 (Mo.).

ISL. OAHU—*Degener* 11,177, not at all glutinous to touch, on arid slope, Koko Crater, Apr. 2, 1931 (Arn., Berl., Calif., Chi., Corn., Par.); *Degener & K. K. Park* 11,178, on hills east of Kawaihapai, dry, rocky region near sea level, Apr. 12, 1931 (Arn., Berl., Carn., Chi., Corn., Del., Gray, Kew, Minn., Mo., Mun., Mus.V., N.Y., Par., Phila., U.S., U.V., etc.); *Degener & K. K. Park* 11,187, on hill east of Kawaihapai, Apr. 11, 1931 (Chi.); *Degener & M. Takamoto* 11,103, dry, grassy region, middle Palawai Ridge, May 12, 1936 (Arn., Brit., Calif., Chi., Del., Gray, Kew, Minn., Mo., Mun., N.Y., Par., Phila., U.S., U.V.); *Degener, Topping, Martinez, & Salucop* 11,195, below forest, ridge directly north of Kaala summit, Mar. 26, 1937 (Arn., Berl., Brit., Calif., Chi., Gray, Kew, U.S.); *Degener, Topping, Whitney, & Martinez* 11,072, on grassy slope, Waimea Valley, Mar. 6, 1939 (Arn., Berl., Brit., Calif., Chi., 2 sheets; Del., Goth., Gray, Kew, Len., Minn., Mo., Mun., Mus.V., N.Y., Par., Phila., U.S., U.V.); *Charles N. Forbes (with Dean Lake)* 2,278-O, talus slopes near Kaena Point, Dec. 16, 1915 (Bish.); *Forbes* 2,506-O, Wailupe Valley, May 4, 1917 (type, Bish.); *F. Raymond Fosberg* 13,157, shrub 1.5 meters tall, on dry rocky slope, alt. 150 meters, on bluff above Kaena Point, May 31, 1936 (Chi., etc.); *F. R. Fosberg* 13,881, shrub 1 meter tall, alt. 100 meters, southwest side, on dry, steep slope, Diamond Head Crater, May 28, 1937 (Chi., etc.); *F. R. & V. O. Fosberg* 92, bush 2.5 meters tall, alt. 90 meters, on dry, bushy slope, east slope of Kalama Valley, Maunaloa, Mar. 7, 1937 (Chi., etc.); *Mrs. V. O. Fosberg* 91, bush 2 meters tall, on dry, bushy slope, east slope of Kalama Valley, Mar. 7, 1937 (Chi., etc.); *Mrs. Fosberg & J. M. Oliveira* 97, on dry brushy slope, alt. 150 meters, east slope of head of Kalama Valley, Mar. 7, 1937 (Chi.); *E. Y. Hosaka* 776, alt. 600 feet, on dry slope, south ridge, Kipapa Gulch, Waipio, Sept. 25, 1932 (Bish.); *E. P. Hume* 166, on open slope, alt. 450 meters, north ridge, Kaaawa, Apr. 12, 1931 (Bish., N.Y.; foliage faintly suggestive of *D. viscosa* var. *vulgaris* f. *repanda* (S. & T.) Radlk.); *V. Mac Caughey*, Keawaula, Kaena, Mar. 28, 1915 (native name, *a-alii*, Bish., Par., U.S.); *Jules Remy*, 569, Isl. Oahu, 1851–1855 (Par.); *D. LeRoy Topping* 2,821, Makua Valley, Aug. 24, 1924 (Arn., Chi.);

G. P. Wilder, Schofield Barracks, Feb. 14, 1934 (Bish.).

ISL. LANAI—*Albert S. Hitchcock* 14,687, on open lower plain, Sept. 21, 1916 (U.S.); *Emilio Ordoñez* (*O. Degener distrib. no.*) 12,846, July 14, 1940 (Arn., Berl., Calif., Chi., Del., Gray, Kew, Par.); *George C. Munro*, Isl. Lanai (Bish.).

ISL. MAUI—*Otto Degener* 11,164, north mauka of Ulupalakua, July 4, 1927 (Arn., Berl., Chi., Del., Gray, Kew, Par.); *C. N. Forbes* 1,808-M, Kanaio, East Maui, Mar. 2, 1920 (Bish., Chi., etc.); *Forbes* 2,009, Auwahi, south slope of Haleakala, East Maui, Mar. 18, 1920 (Bish., Chi., etc.); *Gerrit P. Wilder*, Isl. Maui, 1913 (Bish.).

ISL. HAWAII—*C. N. Forbes* 977-H, on *kipukas* in lava flow of 1823, at level of Kaewewai, June 28, 1915 (Bish.).

HAWAIIAN ISLS.—*Horace Mann & William T. Brigham* 532 (Bish.).

Through the forma *decipiens* the var. *Degeneri* approaches, at times closely, the more obovate-leaved forms of var. *glabrescens*.

DODONAEA ERIOCARPA κ **glabrescens** var. nov.—Folia membranacea, subnitida vel nitida, elliptico-lanceolata vel -oblanceolata, apice plus minusve elongate acuminata, margine paulum repanda, lamina plus minusve glabrescentia, saepius 6–10 cm. longa et 1.6–2.5 cm. lata, sicca brunnescenti-iridida costa mediana infertae straminea. Sepala ovata vel superne angustata. Ovaria debiliter hispidula, fructibus inflorescentiae ramulisque glabrescentibus.

Leaves membranaceous, subglossy or glossy, elliptic-lanceolate or -oblanceolate, at tip more or less elongately acuminate, at margin slightly repand; blade more or less glabrescent, more often 6–10 cm. long and 1.6–2.5 cm. wide, brownish-green (and the median rib straw-colored beneath) when dry. Sepals ovate or upwardly narrowed. Ovaries weakly hispidulous, fruits and branchlets of the inflorescence glabrescent.

Specimens examined: ISL. KAUAI—*Amos A. Heller* 2,871, on Kaholuamanu, above Waimea, Sept. 10–16, 1895 (Bish., N.Y.); *Heller* (similarly) 2,871, same place, Oct. 1–8, 1895 (Chi.); *Heller* (similarly) 2,871, same place, Oct. 11–16, 1895 (Arn., Calif., Mo., N.Y., Par., 2 sheets, Phila., U.S.).

ISL. OAHU—*Otto Degener* 12,390, on dryish forehill with *Santalum*, east slope of Kanehoa, June 17, 1939 (Arn., Berl., Brit., Calif., Chi., Corn., Del., Gray, Kew, Minn., Mo., Mun., Mus.V., N.Y., Par., Phila., U.S., U.V., etc.); *Degener, Ordoñez, & Foster* 12,340, in forest, Honouliuli Trail on southeast slope of Puu Hapapa, May 21, 1939 (Berl., Calif., Chi., Del., Gray, Kew, Minn., Mo., Mun., Par.); *Degener & Park* 11,180, southeast side of Makua Valley near its head, Jan. 3, 1932 (Berl., Calif., Chi., Corn., Del., Minn., Par., U.S.); *Degener & Salucop* 11,194, moderately dry forehills, ridge north northeast of Kaala summit, Apr. 11, 1937 (Berl., Calif., Chi., Del., Gray, Kew,

Mo., Mun., N.Y., Par., Phila., U.S., etc.); *F. Raymond Fosberg & Katherine Duker* 9,049, small tree 2.5 meters tall, in dry forest, alt. 480 meters, head of Makua Valley, Waianae Mts., Makua, Nov. 25, 1932 (type, Chi.); *Fosberg & Duker* 9,051, bush 2.5 meters tall, dry, bushy forest, alt. 475 meters, head of Makua Valley, same date (Chi.); *Olof H. Selling*, cult. in Kamehameha School garden, Honolulu, June 30, 1938 (Goth.); *St. John & Fosberg* 12,179, shrubs 10 feet tall, alt. 1,800 feet, east ridge of 2nd gulch east of Puu Kaupakuhale, northeast slope of Puu Kaala, Mokuleia, Oct. 23, 1932 (Chi.); *D. LeRoy Topping* 2,821, Makua Valley, Aug., 1924 (Calif.); *Topping* 3,166, Makua Valley, May 30, 1925 (Calif., Chi.); *Yuncker & Hosaka* 3,208, alt. 2,500 feet, gulch east of Puu Kaupakuhale, Mokuleia, Kamananui, Puu Kaala, Oct. 23, 1932 (U.S., Yunck.).

Heller (Minn. Bot. Studs. 1: 849. 1897) wrote: "This particular form . . . is a tree fifteen feet high, with slender, wide-spreading branches. The leaves are two to four inches long, elliptical-lanceolate, on short petioles, thin, shining, and with margins somewhat undulate. The young leaves are viscid." Heller referred his Kauai specimens hesitantly to *D. viscosa*, but the considerable proportion of 4-ate fruits and the stellate pubescence of many of the fruits even in old age (*e.g.*, *Fosberg & Duker* 9,051) on the Oahu specimens place the variety with *D. eriocarpa*. All of the Kauai specimens examined were staminate, but appeared identical in foliage with some of the Oahu specimens.⁷

DODONAEA ERIOCARPA λ **pallida** Degener & Sherff, var. nov. et f. **pallida** Deg. & Sherff f. nov.—Variatati *molokaiensis* affinis. Folia pallida, spatulata vel obovata, apice plus minusve rotundata et saepe mucronata (raro subtruncata etiam emarginata), basim versus in petiolum gracilem \pm 1.5 cm. longum angustata, glabrata, membranacea, lamina principalia 4–6.5 cm. longa et 1.3–2.7 cm. lata. Inflorescentia feminea subglabrescens, ferax, sepalis saepius lanceolatis, ovario plus minusve albidosetosus, stylo subintegro sub 5 mm. longo. Fructus fere glabrati, interdum 3-saepius 2-alata, alis magnis inclusis \pm 1.5 cm. lata et \pm 1 cm. alta.

Allied to var. *molokaiensis*. Leaves pale, spatulate or obovate, at apex more or less rounded and often mucronate (rarely subtruncate or even emarginate), toward base narrowed into a slender petiole \pm 1.5 cm. long, glabrate, membranaceous, principal ones with a blade 4–6.5 cm. long and 1.3–2.7 cm. wide. Pistillate inflorescence glabrate, prolific, sepals more often lanceolate, ovary more or less whitish-setose, style subtire and under 5 mm. long. Fruits almost glabrate, at times 3- more often 2-winged, the large wings included \pm 1.5 cm. wide and \pm 1 cm. tall.

Specimens examined (all from SOUTHEASTERN MOLOKAI): *Otto Degener* 11,166 *pro*

⁷ We may note, however, that the bialate-fruited *D. sandwicensis* has been collected in the same locality where Heller collected (see *Hitchcock* 15,542, p. 203).

parte, on arid, rocky slope, east part of Kaluaaha plateau, July 3, 1928 (type, Arn.: isotypes, Berl., Calif., Chi., Del., Kew, Minn., Mo., Mus.V., N.Y.).

The description has been based upon the large assortment of pistillate specimens examined. Staminate and monoecious and additional pistillate specimens were collected under the same number at the same place and date, but these have smaller and mostly acuminate or at least subacuminate leaves. They may be set off as:

DODONAEA ERIOCARPA var. λ **PALLIDA** f. **acuminatula** Deg. & Sherff, f. nov.—Folia paulo minora, apice plerumque acuta subacutave plus minusve acuminata.

Leaves a little smaller, at the commonly acute or subacute apex more or less acuminate.

Specimens examined (SOUTHEASTERN MOLOKAI): *Degener* 11,166 *pro parte*, on arid, rocky slope, east part of Kaluaaha plateau, July 3, 1928 (type, almost purely staminate, Chi.: pistillate isotype, Chi.; almost purely staminate isotypes, Brit., Carn., Corn., Flor., Gray, Kew, N.Y., Par., U.S.).

Hillebrand (Fl. Haw. Isls. 88. 1888) noted for *Dodonaea eriocarpa* that the plants were "polygamous with male, female and hermaphrodite flowers (the latter rare) on the same plant." On the labels for his no. 11,166, Degener had written: "dioecious but staminate plants occasionally with fertile flowers." Under the no. 11,166, Degener had sent me for study numerous specimens, these at once recognizable as being of three kinds. The first kind was exclusively pistillate and had broadly tipped leaves; it became the basis for var. *pallida* described above. The second kind, consisting of several branches, had nearly all the numerous flowers staminate, but here and there had been a pistillate flower that more or less completely matured a lone fruit; the leaves were somewhat smaller and more or less acuminate at the apex. This second kind, as also the third, similar to the second in leaves but exclusively pistillate, became the basis for f. *acuminatula*.

Through f. *acuminatula*, var. *pallida* approaches somewhat var. *molokaiensis* of the same region in Molokai, but that variety has considerably smaller and more remote leaves, also smaller and mostly more pubescent fruits.

DODONAEA ERIOCARPA μ **Vaccinioides** var. nov.—Folia glabrata vel glaberrima, petiolo gracillimo saepius 3–10 mm. longo, lamina 1.5–6 cm. longa et 0.5–2 cm. lata, nunc lineari-elliptica nunc oblanceolata vel etiam oblanceolato-oblonga, apice obtusa vel subacuminata et minute mucronata, margine integra vel obscure repanda. Inflorescentiae parvae et (saltem masculinae) numerosae, ramulis pedicellisque subtilibus debiliter pubescentibus; floribus fertilibus plerumque plus minusve hermaphroditis, sepalis pubescentibus oblongis vel oblongo-lanceolatis demum reflexis, stylo gracili circ. 4–5 mm. longo; antheris persistentibus; floribus masculinis sterilibusque saepe pendulis, sepalis ovatis ciliolatis sed dorso subglabris. Fructus raro

2- plerumque 3-alati, sub 1.1 cm. alti et 1.7 cm. lati, glabrati.

Leaves glabrate or very glabrous, the petiole very delicate and more often 3-10 mm. long; blade 1.5-6 cm. long and 0.5-2 cm. wide, now linear-elliptic now oblanceolate or even oblanceolate-oblong, at apex obtuse or subacuminate and minutely mucronate, the margin entire or obscurely repand. Inflorescences small and (at least the staminate) numerous, branchlets and pedicels slender and weakly pubescent; fertile flowers commonly more or less bisexual, their oblong or oblong-lanceolate sepals pubescent and finally reflexed, style slender and about 4-5 mm. long; anthers persistent; staminate and sterile flowers often pendulous, their sepals ovate and ciliate but dorsally glabrate. Fruits rarely 2- commonly 3-winged, under 1.1 cm. tall and 1.7 cm. wide, glabrate.

Specimens examined (all from GALAPAGOS ISLANDS): *G. Baur* 62, Cowley Bay, Albemarle Isl., Aug., 1891 (Gray); *Baur* 63, southern portion of Albemarle Isl., July, 1891 (Gray); *Alban Stewart* 1,942, occasional bushes on lava beds below 100 feet, Villamil, Albemarle Isl., Aug. 29, 1905-1906 (type, Gray: isotypes, Chi., N.Y.); *Stewart* 1,943, low bushes in disintegrated pumice near the shore, Cowley Bay, Albemarle Isl., Aug. 10, 1905-1906 (Chi., Gray, N.Y.); *Stewart* 1,944, occasional bushes 4-5 feet tall on basaltic lava, alt. 850 feet, James Bay, James Isl., Dec. 29, 1905-1906 (Chi., Gray, N.Y.).

The type collection from Villamil (*Stewart* 1,942) is almost entirely staminate, only a stray fruit occurring here and there, and most of the leaves are small, 2 to 3 cm. long and under 1 cm. wide. One sheet of material from Cowley Bay (*Stewart* 1,943, N.Y.) has leaves only slightly larger, but is rich in fruits. The rest of the cited material has considerably larger leaves and might indeed represent a good forma.⁸

DODONAEA ERIOCARPA *v.* **molokaiensis** Degener & Sherff var. nov.—Ramuli ultimi moderate vel conspicue patenti-hispiduli. Folia eis var. *Hillebrandii* subsimilia sed sicca pallidiora, lamina anguste moderateve lanceolata apice acuminata principalia 4-6 cm. longa et 0.7-1.7 cm. lata, gracilius longiusque petiolata (petiolo \pm 1.5 cm. longo), faciebus marginibusque glabrata vel debiliter brevissimeque hispidula. Florum feminorum sepala lineari-oblonga vel subovata, subsparsum pubescentes; ovariis dense glandulosis et moderate adpresso-hispidulis setulis simplicibus vel interdum stellatis; stylo debili, interdum \pm 7 mm. longo.

⁸ I have broadened the varietal description to include all the specimens, however, and have been deterred from making further segregations by the fact that Stewart apparently found both forms at Cowley Bay and construed them as identical, distributing them under the same number (1,943). They should be examined in the field. We may note here that the Galapagean flora offers numerous instances of modification into formae. Thus, for instance, Robinson and Greenman (*Amer. Jour. Soc.* 50:138. 1895) listed eight local formae of *Euphorbia viminea* Hook. f.

Fructus maturi plerumque minores, saepius sub 12 mm. alti et (in herbario planati) 15 mm. lati alis (plerumque 2 interdum 3 raro 4) inclusis, moderate vel dense pubescentes.

Ultimate branchlets moderately or conspicuously spreading-hispidulous. Leaves somewhat similar to those of var. *Hillebrandii* but paler in dry state, glabrate or weakly and very shortly hispidulous on surfaces and margins, more delicately and elongately petiolate (petiole \pm 1.5 cm. long), principal ones with a blade 4-6 cm. long and 0.7-1.7 cm. wide, narrowly or moderately lanceolate, the tip acuminate. Pistillate flowers: sepals linear-oblong or subovate, subsparingly pubescent; ovaries densely glandular and moderately appressed-hispidulous, their setulae simple or at times stellate; style slender, at times \pm 7 mm. long. Mature fruits commonly smaller, more often under 12 mm. tall and (when flattened in the herbarium) 15 mm. broad including the wings (these commonly 2 sometimes 3 rarely 4), moderately or densely pubescent.

Specimens examined (all from SOUTHEASTERN MOLOKAI): *Otto Degener* 11,165, in one of dry valleys between Kamalo and Kaunakakai, July 29, 1928 (type, Chi.: isotypes, Arn., Berl., Calif., Del., Flor., Gray, Kew, Par.); *Degener* 11,169, small tree, in second eastern gulch, arid region, Wawaia, June 27, 1928 (Arn., Berl., Chi., Kew, N.Y., Par., U.S., etc.).

DODONAEA ERIOCARPA ξ **Hillebrandii** var. nov.; J. F. Rock, *Indig. Trees Haw. Isls.* pl. 109. 1913.—Folia moderate vel anguste (interdum subrhomboid) oblanceolato-linearia, plerumque 3.5-5 (raro usque ad 6.5) cm. longa et 8-13 mm. lata, infra medium in petiolum brevem sensim angustata apice subacuminata acutave, tenuiora, demum plerumque glabrata. Ramuli moderate vel aegre pubescentes. Fructus demum aegrius pubescentes hispidulive; juvenes ovariaive plerumque densissime glandulosa sed irregulariter et tantum substellate pubescentia.

Leaves moderately or narrowly (sometimes subrhomboidally) oblanceolate-linear, commonly 3.5-5 rarely up to 6.5) cm. long and 8-13 mm. wide, gradually narrowed below middle into a short petiole, at apex subacuminate or acute, thinner, finally more often glabrate. Branchlets moderately or weakly pubescent. Fruits at last more weakly pubescent or hispidulous; young ones or ovaries usually very densely glandular but irregularly and only substellately pubescent.

Specimens examined: ISL. MAUI (probably East Maui only)—*H. M. Curran* 44, Isl. Maui, Apr., 1911 (U.S.); *Otto Degener* 2,320, in scrub vegetation, often fog-swept, hill mauka of Olinda, June 15, 1927 (Chi., N.Y.); *Degener* 2,321, within Haleakala, Aug. 16, 1927 (Berl., Chi., Mo., N.Y., Par., Phila., U.S.); *Degener* 2,322, aa lava plain, within Haleakala near Koolau Gap, Aug. 15, 1927 (Berl., Brit., Calif., Chi., Del., Gray, Kew, Minn., Mo., N.Y., Par., U.S.); *Degener* 2,326, dry aa lava, near Kaupo Gap, within Haleakala, Aug. 20, 1927 (Berl., Calif., Chi. (where numerous small

fruiting inflorescences are aggregated into a panicle 2.1 dm. wide and 1.7 dm. tall); Gray, Par.); *Degener* 11,168, within Haleakala, Jan. 20, 1928 (Chi., Kew, Par.); *Degener* 12,487, in scrub, outer slope of Haleakala below observatory, July 25, 1939 (Arn., Berl., Brit., Calif., Chi., Corn., Del., Flor., Gray, Kew, Minn. Mo., Mun., N.Y., Par., Phila., U.S., etc.); *Degener, Ordoñez, & Salucop* 12,489, aa lava plain at 6,000 feet alt., Kaupo Gap, Haleakala, Aug. 11, 1939 (Arn., Brit., Calif., Chi., Del., Gray, Minn., Mo., N.Y., Par., U.S.); *Degener & Henry Wiebke* 2,323, on dry aa lava, near Kaupo Gap in Haleakala Crater, Aug. 20, 1927 (N.Y., U.S.; also at Calif., but with collectors' no. changed to 2,326); *Abbé Urbain Faurie* 1,127, alt. 1,500 meters, Haleakala, Aug., 1909 (Arn.); *Faurie* 1,128, Haleakala, Aug., 1909 (Arn.); *Charles N. Forbes* 288-M, on Crater of Haleakala, Aug., 1910 (Arn., Bish., Calif., Chi., Mo., N.Y., Par., U.S.); *Forbes* 1,107-M, Kaupo Gap, Crater of Haleakala, Aug. 10, 1919 (Bish.); *Forbes* 1,108-M, Kaupo Gap, Aug. 10, 1919 (Bish., Par.); *Forbes* 2,172-M, Puu Ouli, south slope of Haleakala, Apr. 8, 1920 (Bish., Chi.); *F. Raymond Fosberg* 9,970, bush 1.5 meters tall, dry, brushy slope, alt. 2,275 meters, slopes of Haleakala between top of Halemanu Trail and end of road at Puu Nianaiu (Nianaiu), Aug. 23, 1933 (Chi., etc.); *Fosberg* 9,996, bush 1.5 meters tall, on lava bed, alt. 2,240 meters, Haleakala Crater floor, Halemanu Trail between Bottomless Pit and foot of pali, Aug. 23, 1933 (Chi., etc.); *William Hillebrand*, alt. 6,000–9,000 feet, Mt. Haleakala, *commun. anno* 1865 (type, Gray); *Hillebrand & Rev. John M. Lydgate*, Haleakala (Bish.); *Horace Mann & William T. Brigham* 239, Haleakala (Gray, Mo., U.S.); *Joseph F. Rock*, Haleakala, 1912 (Bish., Chi., etc.); *Harold St. John* 10,342, bush 5 feet tall, rocky slope, alt. 8,500 feet, Haleakala, Feb. 15, 1930 (Bish.).

ISL. HAWAII—*C. N. Forbes* 220-H, near summit of Hualalai, June 20, 1911 (Bish.); *Forbes* 754-H, Lava Flow of 1855 below Holealohu (Holealoha), June 7, 1915 (Mo.).

The type had been received at Harvard University in July, 1865, with the data as to habitat of collection but evidently without Hillebrand's determination. Later (Fl. Haw. Isls. 88. 1888); Hillebrand construed this material as a variant of *Dodonaea eriocarpa*: "Maui! Haleakala, 6,000–8,000 ft. (leaves mostly glabrate)." As noted in my description, however, the Haleakala material stands out from the var. *typica* in several respects. It apparently is best interpreted as merely another one of the extremely local varieties for which the Hawaiian Islands are so famous. Specimens of var. *Hillebrandii* sometimes are only with difficulty distinguishable from those of *D. viscosa* var. *spatulata* (Smith) Benth.

DODONAEA ERIOCARPA *o* **Waitziana** (Blume) comb. nov.; *Dodonaea Waitziana* Blume, Rumphia 3: 189. 1847; *Dodonaea viscosa* var. *Waitziana*

(Bl.) O. Ktze. Rev. Gen. 1: 143. 1891.

Blume's type had been collected "in sylvis montium ignivomorum Javae orientalis." From Blume's ample description we extract: "ramulis junioribus . . . racemisque subhirsutis . . . qua adeo ad *D. eriocarpam* Sm. ex insulis Sandwich proxime accedit . . . petiolis . . . dorso . . . puberulis." Blume described the leaves as 3–5.5 inches long and 0.5–1.33 inches wide, lanceolate, very acuminate, very rarely obtuse or retuse, etc. The three specimens now before me and cited below have leaves essentially as described by Blume, but vary from oblong- to elliptic-lanceolate. They suggest those of *D. viscosa* var. *vulgaris* f. *Schiedeana* (Schlecht.) Radlk. Otto Kuntze (*loc. cit.*) did indeed reduce Blume's species to varietal rank under *D. viscosa*. However, the stellate nature showing more or less definitely in the pubescence reveals a closer affinity with *D. eriocarpa* Sm., as implied by Blume, and accordingly I have renamed the plants *D. eriocarpa* var. *Waitziana*. A very few Hawaiian specimens of *D. eriocarpa* var. *Hosakana* (e.g., *Degener* 11,160) approach this variety in leaf-characters but differ sharply in their smaller, more compact, often subglobose clusters of usually smaller fruits.

Specimens examined (all from ISL. JAVA): *Otto Kuntze* 5,872, alt. \pm 5,000 feet, Wilis Mts., 1875 (N.Y.); *W. A. & C. B. Setchell*, Mt. Papandajan, Jan. 30, 1927 (Calif.); *C. G. J. van Steenis* 7,199, Pasoeroean (Arn.).

DODONAEA ERIOCARPA π **minor** var. nov.—Unicus ramulus sub 2 dm. longus plus minusve glabratus visus. Folia tenuiora, oblanceolata, apice attenuata acuminatave, infra medium in petiolum brevem (\pm 2 mm.) caespitoso-vel stellato-setulosum elongate attenuata, alibi subglabrata. Unica inflorescentia circ. 3.5 cm. longa et 2.5 cm. lata visa; vix ad anthesin, paniculata, masculina, axe ramulisque subtilibus setulosisque setulis simplicibus vel basi ramosis. Sepala ovata, apice breviter attenuata, extus sparsissime intus marginibusque conspicue hispidula, circ. 2 mm. longa, antheris paulo brevioribus.

A lone branchlet seen, this more or less glabrate and under 2 dm. long. Leaves thinner, oblanceolate, apically attenuate or acuminate, elongately narrowed below middle into a short (\pm 2 mm.), caespitose- or stellate-setulose petiole, elsewhere subglabrate. The solitary inflorescence about 3.5 cm. long and 2.5 cm. broad; this scarcely in flower, paniculate, staminate, its axis and branchlets delicate and setulose, the setulae simple or basally branched. Sepals ovate, at apex shortly attenuate, on outer surface very sparsely but on inner surface and margins conspicuously hispidulous, about 2 mm. long, slightly surpassing the anthers.

Specimens examined: *C. G. J. van Steenis* 10,881, alt. 2,100–2,200 meters, west side of Jang Plateau above Taman Hidoep, Besoeki, easternmost Java, July 14, 1938 (type, Arn.).

DODONAEA VISCOSA **minor** var. nov.—Folia valde

coriacea, oblanceolato-oblonga, infra in petiolum 0.5–3 cm. longum angustata, apicem versus obscure repando-marginata apice obtuso vel rotundato abrupte apiculata, lamina usque ad 8 cm. longa et ad 3 cm. lata. Sepala pro floribus femineis plerumque anguste lanceolata plus minusve 1-nervata, 2–3 mm. longa; pro floribus masculinis ovata et sub-3-nervata. Stylus 2-3-partitus, circ. 3–3.5 mm. longus. Capsulae maturae non visae; submaturae alis inclusis \pm 1.5 cm. latae.

Leaves very coriaceous, oblanceolate-oblong, narrowed below into a petiole 0.5–3 cm. long, obscurely repand-margined toward and abruptly mucronulate at the obtuse or rounded tip, blade up to 8 cm. long and to 3 cm. wide. Sepals of pistillate flowers commonly narrow-lanceolate, more or less 1-nerved, 2–3 mm. long; those of staminate flowers ovate and subtrinate. Style 2-3-parted, about 3–3.5 mm. long. Mature capsules not seen; submature ones \pm 1.5 cm. wide including wings.

Specimens examined: J. P. Chapin 903, tree 10 feet tall, trunk diameter 4 inches, flowers small and green, at upper edge of woods, alt. 600 feet, slope of mountain, Isl. Rapa, Austral Isls., Dec. 8, 1934 (type, N.Y.: isotype, Chi.; pistillate, subfruiting material); Chapin 909, tree 18 feet tall, trunk diameter 6 inches, flowers greenish, stamens yellow, often red on outer side, alt. 550 feet, bushy slope of mountain, Isl. Rapa, same date (N.Y.).

Of much smaller geographic range (hence the name *minor*) than the other known varieties of *D. viscosa*.⁹

Recently Forest Brown (Bish. Mus. Bull. 130: 164. 1935) described *D. viscosa* var. *Stokesiana* from the Austral Islands, among them Rapa. For that variety the leaf-petioles were described as short, \pm 2 mm. in length. Var. *minor* has much longer petioles. Of Brown's cited material of var. *Stokesiana*, a lone, numerous staminate-flowered specimen (Stokes 191) from Rurutu is before me. Its sepals average more nearly ovate and more distinctly 3-nerved than in the observed pistillate material of var. *rapensis*. Pistillate specimens of the two varieties should be compared when available.

In the type of var. *minor*, various straight or straightish, white hairs occur irregularly in the inflorescence, these sometimes clustered or stellately arranged. They appear now natural now almost as if derived by crystal-formation or by deposition from some foreign source.

DODONAEA STENOPTERA var. **Fauriei** (Lévl.) comb. nov.; \times *Dodonaea Fauriei* Lévl. in Fedde Repert. Spec. Nov. 10: 155. 1911.—*Dodonaea Fauriei* was described as a new hybrid, "*D. viscosa*

⁹ Mention may be made here of *Dodonaea Candolleana* var. *minor* Blume (Rumphia 3: 191. 1847), based on material from Java, etc. Blume's description was scanty, and under present war conditions there is little hope of consulting original specimens with a view to learning just what his var. *minor* was. I suspect, however, that it will be found to belong somewhere in *D. viscosa* or *D. eriocarpa*.

L. \times *D. stenoptera* Hillebr.," and was based on *Faurie* 299, Waianai [Waianae], westernmost Oahu, May, 1910. Specimens of the type collection (Bish., Par., etc.) are before me. They have many fruits, these immature and with mostly two but sometimes three very narrow wings, suggesting indeed *D. stenoptera* Hillebr., a species known only from southeastern Molokai. Lévillé clearly assumed that the narrowness of the fruiting wings was traceable to a *D. stenoptera* parentage while the fewness of these wings (mostly two, not four as in *D. stenoptera*) was traceable to a *D. viscosa* parentage (many Hawaiian specimens, most of them erroneously known to him as *D. viscosa*, having two-winged fruits). But since true *D. stenoptera* is known only from Molokai and, moreover, only from the far side of the island, there could have been little chance for it to produce a hybrid on Oahu. Rock (in Fedde Repert. Spec. Nov. 13: 352. 1914) called *D. Fauriei* Lévl. a "deformed specimen" of *D. viscosa* L. However, Fosberg collected an excellent suite of specimens in essentially the same locality on Oahu 23 years after *Faurie* had collected there, and the Fosberg plants show the same fruit characters as did the *Faurie* plants. There seems no reason, therefore, to regard the fruits as indicating any deformity. Rather do they appear to indicate a varietal rank for the Oahu material, under *D. stenoptera* Hillebr. In the *Faurie* plants, the material is pistillate, with here and there rudiments of stamens present. In the Fosberg plants, some of the pistillate flowers have a full complement of stamens, these in certain cases appearing as if functional.

Specimens examined: Abbé Urbain *Faurie* 299, Waianae, Isl. Oahu, 1910 (type coll., Bish., Par., etc.); F. R. Fosberg 9,494, tree 4 meters tall, both staminate and pistillate flowers on same tree, alt. 650 meters, in dry forest, Halona Valley, Waianae Mts., Lualualei, Isl. Oahu, May 12, 1933 (Chi., etc.).

DODONAEA STENOPTERA Hillebr. Haw. Isls. 88. 1888.—In the foregoing study of *D. stenoptera* var. *Fauriei*, an examination was made of all available specimens of the species proper, which for convenience of reference may be designated var. **typica** var. nov. It may be noted that Hillebrand studied *D. stenoptera* in considerable detail, describing even the seed-embryo. He termed it "a very distinct species." Rock (Indig. Trees Haw. Isls. 281. 1913) accepted *D. stenoptera* as a species and stated that it grew above Kamalo on Molokai. The following specimens have been studied by me:

Specimens examined (all from MOLOKAI): *Faurie* 274, alt. 1,000 meters, Kamalo, June, 1910 (Arn., Bish., Del., Par.); Charles N. Forbes 127-Mo, on ridges below Puu Kolekole, July, 1912 (Bish., Mo., N.Y.); William Hillebrand, alt. 1,500–2,000 feet, Kamalo (Gray, Kew); Albert S. Hitchcock 15,107 alt. about 4,000 feet, north of Kamalo,

Oct. 10, 1916 (Bish., U.S.); *Rock*, Kamalo, Feb., 1920 (Arn.).

In a forthcoming and considerably longer article upon *Dodonaea*, it is found necessary to use certain new names and new combinations. These are published at this time for the purpose of properly validating them:

DODONAEA VISCOSA var. **linearis** (Harv. & Sond.) comb. nov. et f. **linearis** f. nov.; *Dodonaea linearifolia* Linden Pl. Cub. num. 2,070 (annis 1841–1846) et apud Turcz. Bull. Mosc. 31¹: 407. 1858; *Dodonaea linearis* E. Mey. in Hb. Drège, Flora 26^{II}, Beigabe p. 179. 1843; *Dodonaea Thunbergiana* var. *linearis* Harv. & Sond. Fl. Cap. 1: 242, sub num. 2. 1859 & 1860.

DODONAEA VISCOSA var. **linearis** f. **angustifolia** (Benth.) comb. nov.; *Dodonaea angustifolia* L.f. Suppl. Pl. Syst. Veg. 218. 1781; *Dodonaea angustifolia* Swartz, Observ. Bot. 150. 1791; *Dodonaea viscosa* var. *angustifolia* Benth. Fl. Austral. 1: 476. 1863.

DODONAEA VISCOSA var. **linearis** f. **arizonica** (A. Nels.) comb. nov.; *Dodonaea arizonica* A. Nels. Amer. Jour. Bot. 21: 576. 1934.

DODONAEA VISCOSA var. **arborescens** (Cunn.) comb. nov. et f. **arborescens** f. nov.; *Dodonaea arborescens* Cunningham ex W. J. Hook. Jour. Bot. 1: 251. 1834 (as a syn. for *D. Aspleniifolia* var. β W. J. Hook. loc. cit.); *Dodonaea Aspleniifolia* var. *arborescens* (Cunn.) J. D. Hook. ex W. J. Hook. op. cit. 2: 415. 1840.

DODONAEA VISCOSA var. **arborescens** f. **spatulata** (Sm.) comb. nov.; *Dodonaea spatulata* J. E. Smith in Rees Encyclop. 12: no. 2. 1809; *Dodonaea viscosa* var. *spatulata* (Sm.) Benth. Fl. Austral. 1: 476. 1863; *Dodonaea viscosa* f. *arborea* Hert. Rev. S. Amer. Bot. 3: 168. 1936. *Nomen*; *Dodonaea arborea* Hert. op. cit. 5: 35. 1937.

DODONAEA VISCOSA var. **arborescens** f. **Ehrenbergii** (Schlecht.) comb. nov.; *Dodonaea Ehrenbergii* Schlecht. Linnæa 17: 639 (sphalm 739). 1843; *ibid.* 18: 36 (sphalm 52). 1844; *Dodonaea viscosa* var. *obovata* Hitchc. Report. Missouri Bot. Gard. 4: 73. 1893; *Dodonaea microcarya* Small, Torreyia 25: 38. 1925.

CHICAGO TEACHERS COLLEGE,
CHICAGO, ILLINOIS

THE PRODUCTION AND CHARACTERIZATION OF ULTRAVIOLET-INDUCED MUTATIONS IN *ASPERGILLUS TERREUS*. III. BIOCHEMICAL CHARACTERISTICS OF THE MUTATIONS¹

Lewis B. Lockwood, Kenneth B. Raper, Andrew J. Moyer, and Robert D. Coghill

PREVIOUS ANALYSES and descriptions of the effects of irradiation of conidia with ultraviolet light have dealt almost entirely with obvious gross morphological or cultural changes which are readily observable. The more difficult physiological and biochemical characterizations of light-induced variants have only recently been undertaken. Thus, Tatum and Beadle (1942) have obtained strains of *Neurospora* which had lost the ability to meet their own requirements of thiamin, thiazol, nicotinic acid, pantothenic acid, pyridoxin, methionine, lysine, arginine, leucine, and tryptophane. Raper, Coghill, and Hollaender (1945) have described two biochemical variants of *Aspergillus terreus*. One of these required an external source of thiamin for growth but was indistinguishable from the parent strain when an adequate supply of thiamin was present. The other strain had lost the ability to metabolize nitrates but made normal growth when ammonium ion was present.

While two of us (Moyer and Coghill, 1945) were engaged in a study of the production of itaconic acid from glucose, it became evident that a considerable portion of the glucose metabolized was converted into products other than itaconic acid. With the objective of obtaining mutant strains of

the fungus in which some of the enzyme systems were destroyed, irradiation experiments were conducted in cooperation with Dr. Alexander Hollaender of the National Institute of Health, Bethesda, Maryland. Data obtained in these experiments are presented by Hollaender, Raper, and Coghill (1945). It was hoped that the elimination of competing enzyme systems would result in the conversion of a larger percentage of the sugar to itaconic acid. Since no correlation of morphological characters with the physiological properties of *Aspergillus terreus* was known, it was necessary that both obvious morphological variants and strains which morphologically resembled the parent culture be selected for biochemical testing. Of the large number of cultures derived from irradiated conidia, a random selection of 217 strains was made for such examination.

CULTURE CONDITIONS AND ANALYTICAL METHODS.—A culture medium developed previously by one of us (A. J. M.) was used for the biochemical studies of all the strains of *A. terreus*. It had the following composition:

Glucose monohydrate (commercial).....	250	g.
NH ₄ NO ₃	2.47	g.
MgSO ₄ ·7H ₂ O	0.25	g.
KCl	0.1	g.
ZnSO ₄ ·7H ₂ O	0.0024	g.
HNO ₃ (sp. g. 1.42).....	1.60	ml.
Concentrated corn steep liquor.....	4.0	ml.
Distilled water to	1.0	liter

¹ Received for publication December 18, 1944.

The authors wish to express their grateful appreciation for analytical services to Morris Friedkin, Max D. Reeves, and Mrs. Lucille B. Czaplá of this laboratory.