

A revision of *Trimenia* Seem. (Trimeniaceae) in the Marquesas Islands with description of a new species, *Trimenia nukuhivensis*

Warren L. WAGNER

National Museum of Natural History,
Smithsonian Institution,
Department of Botany, MRC 166,
Washington, DC 20560-0166, U.S.A.
wagner.warren@nmnh.si.edu

David H. LORENCE

National Tropical Botanical Garden,
P.O. Box 340, Lawai, HI 96765, U.S.A.
lorence@ntbg.org

KEY WORDS
Trimenia,
basal Angiosperm,
Nuku Hiva,
Marquesas Islands,
French Polynesia,
dioecious.

MOTS CLÉS
Trimenia,
Angiosperme primitive,
Nuku Hiva,
Iles Marquises,
Polynésie française,
dioecious.

ABSTRACT

A new dioecious species, *Trimenia nukuhivensis* W.L. Wagner & Lorence, is described and illustrated. It is restricted to upper montane wet forest on the island of Nuku Hiva (Marquesas Islands in French Polynesia). *Trimenia nukuhivensis* differs from *T. marquesensis*, the only other species of this genus in the Marquesas Islands, by its glabrescent habit, larger lanceolate-elliptic leaf blades with widely spaced marginal serrations, longer petioles, fewer stamens in the staminate flowers, and darker purple fruit. The Marquesan species are most closely related to *T. weinmanniifolia* from Fiji and Samoa.

RÉSUMÉ

Révision de *Trimenia* Seem. (Trimeniaceae) aux Iles Marquises et description d'une nouvelle espèce, *Trimenia nukuhivensis*.

Une nouvelle espèce dioïque, *Trimenia nukuhivensis* W.L. Wagner & Lorence, est décrite et illustrée. Elle est restreinte aux forêts humides d'altitude de l'île de Nuku Hiva (Marquises, Polynésie française). Elle diffère de *T. marquesensis*, la seule autre espèce de ce genre dans les Iles Marquises, par sa glabrescence, des limbes foliaires elliptiques-lancéolés plus grands et à dents marginales plus espacées, des pétioles plus longs, les étamines des fleurs mâles en plus petit nombre, et des fruits pourpres plus foncés. Les espèces des Iles Marquises sont affines de *T. weinmanniifolia* des îles Fiji et Samoa.

Trimenia Seem. with eight species is the only genus in one of the basal angiosperm family Trimeniaceae, formerly included within Monimiaceae but less closely related to them than previously thought (ENDRESS & SAMPSON 1983). The flowers produce no nectar and the pollen is dry, characters not present in Monimiaceae; presumably wind is the primary means of pollination (ENDRESS & SAMPSON 1983; PHILIPSON 1986). The small succulent fruits are probably dispersed by birds. Oceanic islands generally have very few indigenous species of any basal angiosperm families. It is interesting then that *Trimenia* occurs primarily on islands; although most are continental islands of the southern Pacific basin such as New Caledonia, New Guinea, and the Moluccas, however, the genus also extends to southeastern Polynesia, where remarkably two species occur in the remote Marquesas Islands. As part of the *Vascular Flora of the Marquesas Islands* project, a collaboration primarily between the Smithsonian Institution and the National Tropical Botanical Garden (see LORENCE 1997), we have studied the roughly two dozen collections available of the genus from the Marquesas and have concluded that they represent two closely related species, each endemic to a single island of the archipelago. One of the species is new, *Trimenia nukuhivensis*, which is a small tree 3 or 4 m tall and occurs on the slopes above the isolated Toovii Plateau of the island of Nuku Hiva in montane rainforest at 790 to 960 m elevation. The other species, *T. marquesensis* F. Br., occurs on the younger Marquesan island of Hiva Oa, where it occurs in similar montane rainforest habitat. The Marquesan species are related to *T. weinmanniifolia* Seem., the only other member of the genus that inhabits oceanic islands (in Samoa and Fiji), and were included in it by RODENBURG (1971).

Until recently all of the collections of *Trimenia* from Nuku Hiva and Hiva Oa were considered to represent a single somewhat variable taxon. In 1935 BROWN described *T. marquesensis* from four collections made by MUMFORD and ADAMSON on the Pacific Entomological Survey in 1929 and 1930. BROWN's description was based on material representing the two species recognized by us; however, he cited only one pistillate collec-

tion of the new species described here. RODENBURG (1971) produced the only revision of the genus, in which he accepted only three species, *T. neocaledonica* Baker f., *T. papuana* Ridl., and *T. weinmanniifolia*. He delimited *T. weinmanniifolia* broadly in the Leiden taxonomic philosophy, subdividing it into three subspecies including *T. weinmanniifolia* subsp. *marquesensis*, and a new subspecies, *T. weinmanniifolia* subsp. *bougainvilleensis* Rodenburg from the Solomon Islands, in addition to the autonymic subspecies from Fiji and Samoa. SMITH (1978) was critical of RODENBURG's broad specific delimitation. After study of the literature and specimens we agree that specific status seems most appropriate since there are a series of morphological characteristics involving both vegetative and floral organs that differentiate *T. bougainvilleensis*, *T. marquesensis*, and *T. weinmanniifolia*, as well as a wide geographical separation of these taxa. SMITH (1981) maintained specific status for *T. weinmanniifolia*, restricting it to only the Fijian and Samoan populations. He also showed that *T. weinmanniifolia* is usually if not always dioecious rather than monoecious, as indicated by RODENBURG (1971).

In their detailed analyses of the structure and development of the flowers of several species of *Trimenia*, ENDRESS & SAMPSON (1983) extended the range of variation of the species they studied. They also showed that the characters used to differentiate the second genus of Trimeniaceae, *Piptocalyx* Oliv. ex Benth., were not decisive. In particular, they demonstrated that the tepals are not decussate but spiral as in *Trimenia*; and suggested that the species previously placed in *Piptocalyx* be transferred to *Trimenia*. PHILIPSON (1986) provided a thorough revision of the Malesian species. Although he confirmed RODENBURG's delimitation of *T. papuana*, he did not analyze the broad delimitation of *T. weinmanniifolia* but chose to maintain the conservative treatment of the Solomon Islands taxon at the subspecific level.

In this paper we provide a detailed treatment of the Marquesan species. We confirm a long series of differences from extra-Marquesan taxa, leading us to conclude that the Marquesan taxa are indeed distinct species from *T. weinmanniifo-*

lia and *T. bougainvilleensis*. We provide descriptions of both species, a key showing the diagnostic characters, and a discussion of the

relationship and delimitation of the Marquesan species and the related *T. weinmanniifolia* and *T. bougainvilleensis*.

Key to Marquesan *Trimenia*

- 1. Plants sparsely villous at least on young parts, otherwise glabrescent; leaf blade lanceolate-elliptic to sometimes oblong-elliptic, (7.5-)9.5-15 × (2.8-)3-6 cm, with marginal teeth 4-9 mm apart; petioles (2-)3-4 cm long; inflorescences 7.5-13(20.5) cm long; fertile stamens 14-17; anthers 2-2.5 mm long; berry ellipsoid, initially green, maturing dark reddish purple; pistillate flowers with 20-25 tepals **T. nukuhivensis**
- 1'. Plants densely villous; leaf blade elliptic, sometimes ovate-elliptic or oblong-elliptic, 5.5-11 × 2-4.8 cm, with marginal teeth 2.5-4 mm apart; petioles 1-2.3 cm long; inflorescences (3-)4-12 cm long; fertile stamens 18-23; anthers 1.6-1.8 mm long; berry globose, initially pale green, maturing pink; pistillate flowers with 16 tepals **T. marquesensis**

Trimenia nukuhivensis W.L. Wagner & Lorence, **sp. nov.**

Trimenia marquesensis auct.: BROWN (1935), pro parte (*Mumford & Adamson* 579).

Species *Trimeniae* *marquesensi* F. Br. *affinis*, *differt pubescentia parcius villosa cito glabrescens, foliorum majorum laminis lanceolato-ellipticis vel oblongo-ellipticis* (7.5-)9.5-15 × (2.8-)3-6 cm, *dentibus marginalis* 4-9 mm *distantibus; floribus masculis staminibus* 14-17, *antheris* 2-2.5 mm *longis*.

TYPUS.—*Lorence, Wagner, Florence & Perlman* 6107, Marquesas Islands, Nuku Hiva, Toovii region, trail along ridge from near l'Economie Rurale complex to Ooumu peak, 860-1080 m, fl. ♂, 17 July 1988 (holo-, PTBG-008522!; iso-, BISH!, Pl., PAP!, US!).

Dioecious small trees 3-10 m tall, new growth sparsely rufous villous, glabrescent, the trichomes antrorse; twigs glabrous, compressed, 4-7 mm diam., smooth or longitudinally wrinkled, drying dark brown. Leaves opposite, decussate; petioles (2-)3-4 cm, 1.5 mm diam., adaxially rufous villous when young, glabrate; lamina lanceolate-elliptic to sometimes oblong-elliptic, (7.5-)9.5-15 × (2.8-)3-6 cm, when fresh dark green, glossy, at first sparsely strigillose-puberulent, especially abaxially, soon glabrescent, base attenuate or acute, apex acute or short acuminate, costa yellowish-green or with pinkish tinge when fresh, adaxially canaliculate, abaxially pro-

minulous, secondary veins 12-20 on a side, prominent, tertiary veins uniting into 1-2 prominent irregular intersecondary veins, margins shallowly crenate-serrate, teeth thickened apically, 4-9 mm apart.

Inflorescences axillary, usually pleiochasial, branching to the first or rarely second degree, non-leafy or rarely leafy, 7.5-13(-20.5) cm long, 3.5-9(-14) cm wide, the axes sparsely rufous villous with antrorse trichomes, bracts on main axes ovate to oblong-ovate, 2-4 × 1.5 mm, ciliolate, fugaceous, the flowers arranged racemously. Flowers in bud ovoid-ellipsoid, 5-7 × 3-5 mm, the tepals brown, scarios, glandular-punctate, concave, the lower 1-2 pairs decussate; pedicels 0.5-2 mm, spreading to slightly recurved. Staminate flowers with 11-22 tepals, outer (lower) ones ovate to broadly ovate or elliptic-obovate, 2.2-3 mm, middle ones elliptic to oblanceolate, 3.2-4.8 mm, innermost ones spatulate to obovate or cucullate, 3-5 mm; stamens 14-17, 3-4 mm long, anthers linear, 2-2.5 mm, filament 0.4-0.5 mm, connective 0.4-0.6 mm, rudimentary pistil 0.4-0.5 mm. Pistillate flowers with 20-25 tepals, lower ones ovate, elliptic or broadly elliptic to obovate-elliptic, 2-3 mm, middle ones oblong-elliptic to obovate, 3.2-4.2 mm, innermost ones spatulate or cucullate, 3.2-4 mm, sterile stamens 15-24, 2-2.5 mm long, pistil 1 per flower, 1.8 mm, cylindrical, irregularly grooved.

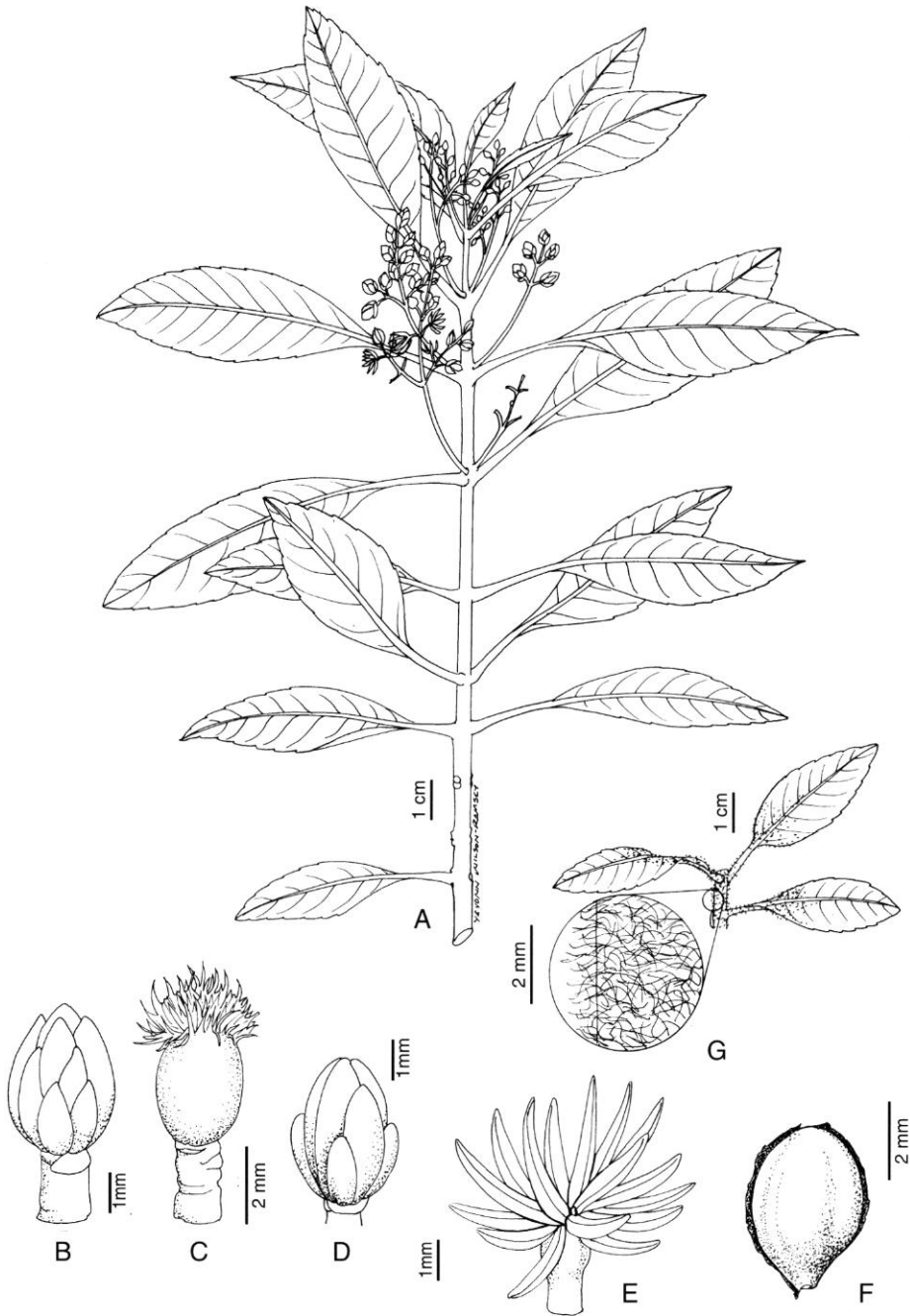


Fig. 1.—*Trimenia nukuhivensis*: A, habit; B, pistillate bud; C, pistillate flower; D, staminate bud; E, staminate flower; F, developing fruit. (Habit from Thibault 126; flowers from 35 mm slides by W.L. WAGNER of Lorence 6107, 6109).—*Trimenia marquesensis*: G, internode with inset showing trichomes. (Schäfer 5920).—Drawn by Yevonn WILSON-RAMSEY.

Fruit a berry, at maturity ellipsoid, 5 × 2.2 mm when fresh, initially green maturing dark reddish purple, immature seed ovoid, 4 × 2 mm.

PARATYPES.—**Nuku Hiva:** *Florence 4216*, Toovii, épaulement S du Mt. Ooumu, 835 m, 1 Dec. 1982, fl. ♂ (BISH [2], K, NY, P, US); *Florence 4305*, Toovii, épaulement au-dessus du réservoir, 960 m, 4 Dec. 1982, fl. ♀ (MO, US); *Florence 6792*, Toovii, épaulement SE du Mt. Tekao, 910 m, 28 May 1984, fl. ♂ (BISH, P); *Florence 6844*, Toovii, flanc N de l'épaulement SE du Mt. Ooumu, 945 m, 29 May 1984, fl. ♀, (BISH, K, P); *Florence 7449*, Toovii, épaulement S de la crête E du Mt. Tekao, 885 m, 5 Mar. 1986, fl. ♂ (BISH, K, P); *B. Gagné 1064*, Spur of Mt. Ooumu, Toovii Plateau, 875 m, 17 July 1977, fl. ♀ (BISH, US); *Gillett 2152*, Toovii Valley, 3 July 1970, fl. ♀ (BISH, US); *Gillett 2172*, slopes of Mt. Tapuaooa, 800-900 m, 10 July 1970, fl. ♀ (BISH, US); *Gillett 2179*, South slope of Mt. Tapuaooa, 10 July 1970, fl. ♂ (BISH, US); *Hallé 2078*, Plateau de Tovii, 2 Mar. 1973, fl. ♀ (US); *Lorence et al. 6109*, Toovii region, trail along ridge from near l'Économie Rurale complex to Ooumu peak, 860-1080 m, 17 July 1988, fl. ♀ (BISH, PAP, PTBG, US); *Mumford & Adamson 579*, Mt. Ooumu, 3500 ft, 10 Nov. 1929, fl. ♀ (BISH, NY); *Perlman 10115*, Toovii Plateau, trail up mountain peak, behind l'Économie Rurale toward Ooumu peak, 2620 ft, 16 July 1988, fl. ♂ (AD, BISH, E, F, K, MO, PAP, PTBG, US); *Thibault 126*, Toovii, 850 m, 9 July 1975, fl. ♂ (BISH, L, PTBG, US); *Wood & Meyer 6323*, Toovii, N of agriculture station, along drainage up to ridge, 2650 ft, 22 June 1997, fl. ♀ (BISH, L, P, PAP, PTBG, US).

DISTRIBUTION, HABITAT, AND PHENOLOGY.—*Trimenia nukuhivensis* is known only from the slopes northeast and west of Toovii Plateau, Nuku Hiva, which is the oldest large island of the archipelago, occurring in the vicinity of Mt. Ooumu to Mt. Tapueahu at 790-1080 m elevation. This new species occurs in montane wet forest with associates in the following genera: *Cheirodendron*, *Crossostylis*, *Cyrtandra*, *Fagraea*, *Freycinetia*, *Glochidion*, *Hernandia*, *Ilex*, *Metrosideros*, *Myrsine*, *Santalum*, *Weinmannia*, *Xylosma*, *Vaccinium*, and numerous Pteridophytes including *Cyathea*, *Dicranopteris*, *Histiopteris*, and *Nephrolepis*. Flowering at least in November, December, and March through July.

***Trimenia marquesensis* F. Br.**

Bernice P. Bishop Bull. 130: 82, fig. 14 (1935).—Type: *Adamson & Mumford 471*, Marquesas Islands, Hivaoa, Tenatinaci, Temetiu, 1086 m, 24 July 1929 (holo-, BISH-512502).

Dioecious shrubs or small trees (1-)3-8 m tall, the new growth densely antrorsely appressed to somewhat spreading villous, the trichomes rufous, fading to tan or yellowish with age; twigs 2.5-4 mm diam., villous or eventually glabrate, longitudinally wrinkled or weakly ribbed, drying dark brown. Leaves opposite, decussate; petioles 1-2.3 cm, 1.2-1.8 mm in diam., adaxially canaliculate, densely appressed villous; lamina elliptic, rarely ovate-elliptic or oblong-elliptic, 5.5-11 × 2-4.8 cm, when fresh shiny medium green, at first densely rufous villous, becoming paler with age, trichomes denser and persistent on abaxial surface and along costa, adaxially glabrescent, base cuneate to obtuse or sometimes rounded, apex acute or obtuse, rarely short-acuminate, tip thickened, costa and lateral veins yellow or greenish-yellow, costa adaxially shallowly canaliculate toward base, abaxially prominulous, secondary veins 13-17 on a side, prominulous, tertiary veins uniting to form an irregular intersecondary vein, margins shallowly serrate-crenate, teeth thickened apically, 2.5-4 mm apart.

Inflorescences axillary, usually pleiochasial and branching to the first or rarely second degree, occasionally unbranched and racemiform, non-leafy, (3-)4-12 cm long, (1.2-)4-8 cm wide, the axes moderately to densely rufous villous with antrorse trichomes, bracts on main axes narrowly oblong-ovate, 3.5-4 × 1-1.5 mm, ciliolate, fugaceous, the flowers arranged racemosely. Flowers in bud ovoid, 4-5 × 3-3.5 mm, the tepals brown, scarious, glandular-punctate toward apex, concave, the lower 1-2 pairs decussate; pedicels 0.8-3.2 mm, weakly to strongly recurved. Staminate flowers with 15-16 tepals, outer ones ovate-elliptic, 1.8-2.2 mm, middle ones ovate, oblong-ovate or becoming obovate, 3.3-4 mm, inner ones spatulate to cucullate, 4.2-6.5 mm; stamens 18-23, 2.5-2.9 mm, filament 0.6 mm, anther linear, 1.6-1.8 mm, connective 0.3 mm. Pistillate flowers with 16 tepals, outer ones ovate-elliptic, concave, 3-3.5 mm, middle ones ovate to obovate, 3.8-4.5 mm, inner ones spatulate to cucullate, 3.6-4 mm, 1.5-1.8 mm, sterile stamens 21, 1.5-1.8 mm long, pistil one or occasionally 2 per flower, ellipsoid, 2-2.2 × 1-1.3 mm. Fruit a berry, at maturity globose, 8-10 mm diam. when fresh, initially pale green, maturing pink, seed

3.4 × 2 mm, ovoid, tapering to stigma, slightly compressed, tan, with 8 irregular low ridges.

SPECIMENS EXAMINED.—**Hiva Oa:** *Adamson & Mumford 471*, Tenatinaci, crest of summit Mt. Temetiu, 3620 ft (NY); *Adamson & Mumford 1006*, Tepuna W of Temetiu, 3600 ft (NY); *Florence 9644*, Atuona, trail to Hanamenu, NW of Mt. Temetiu, 1165 m, 30 July 1988, fl. ♂ (BISH, P); *Lorence et al. 6237*, along old Atuona-Hanamenu trail, on high ridge leading to Mt. Feani, 1050-1150 m, 30 July 1988, fl. ♂ (BISH, PAP, PTBG, US); *Lorence et al. 6238*, Along old Atuona-Hanamenu trail, on high ridge leading to Mt. Feani, 1050-1150 m, 30 July 1988, fl. ♀ (BISH, MO, PTBG, US); *Mumford & Adamson 142*, N side of Mt. Temetiu, 1100 m, 23 Mar. 1929, fl. ♂ (BISH); *Mumford & Adamson 500*, Teipu, NW summit of Mt. Temetiu, 3400 ft, 3 Aug. 1929 (BISH, NY); *Mumford & Adamson HO 1006*, Tepuna (SW of Mt. Temetiu), 3500 ft, 27 Feb. 1930 (BISH); *Oliver & Schäfer 3150*, Feani ridge to upper slopes of dry side of island, 1050 m, 12 Feb. 1975, fl. ♀ (BISH, L, MO, P, PAP, US); *Perlman 10193*, Trail to Feani and Hanamenu, along ridge trail, 3700 ft, 30 July 1988 (BISH [fl. ♀], K, MO, P, PAP, PTBG [fl. ♂], US); *Perlman 10200*, Trail toward Hanamenu, 3200 ft, 3 August 1988, fl. ♀ (BISH, MO, P, PTBG, US); *Perlman & Meyer 14873*, Trail toward Hanamenu, from spring at Vaiumete and Vaiumioi W for 1.5 mi, on W side of summit crest, 3830 ft, 24 Aug. 1995, fl. ♂ (BISH, MO, P, PAP, PTBG, US); *Sachet & Decker 1153*, Atuona-Feani Trail, ridge crest and top of leeward side, 1200-1300 m, 24-26 Sep. 1963, fl. ♀ (BISH, CHR, L, MO, NSW, P, PAP, PTBG, US); *Schäfer 5920*, Montagnes NW du Temetiu, entre la haute vallée de Hanamenu et la crête de Temetiu, 900 m, 23 Oct. 1975, fl. (US).—**Tahuata:** *Wood 6549*, Haaiputeomo, near satellite dish, NE from Vaeiahu to summit ridge, 2500 ft, 14 July 1997, fl. ♀ (BISH, L, P, PAP, PTBG, US).

DISTRIBUTION, HABITAT, AND PHENOLOGY.—*Trimenia marquesensis* is known from Hiva Oa and the nearby Tahuata, islands which are younger than

Nuku Hiva, occurring in montane wet forest to low, windswept cloud forest in association with members of several genera including *Cheirodendron*, *Crossostylis*, *Cyathea*, *Freycinetia*, *Metrosideros*, *Psychotria*, *Reynoldsia*, and *Weinmannia*, with numerous epiphytes and a rich understory of Pteridophytes. It occurs at 900-1200 m on Hiva Oa from Mt. Feani to Temetiu, and at 760 m on Tahuata only from Haaiputeomo. Apparently flowering throughout the year.

Acknowledgments

We thank Yevonn WILSON-RAMSEY for preparing the illustration of *Trimenia nukuhivensis* and the Walcott Botanical Fund of the Smithsonian Institution for the funding for the illustration. We appreciate the assistance of Mike SISSON for databasing specimen information, and Jacques FLORENCE and two anonymous reviewers for comments that improved the manuscript.

REFERENCES

- BROWN F.B.H. 1935.—Flora of southeastern Polynesia. III. Dicotyledons. *Bernice P. Bishop Mus. Bull.* 130: 1-386.
- ENDRESS P.K. & SAMPSON F.B. 1983.—Floral structure and relationships of the Trimeniaceae (Laurales). *J. Arnold Arbor.* 64: 447-473.
- LORENCE D.H. (editor) 1997.—Botanical results of the 1988 Fatu Hiva Expedition to the Marquesas Islands. *Allertonia* 4: 221-306.
- PHILIPSON W.R. 1986.—Trimeniaceae. *Flora Malesiana* 10: 327-333.
- RODENBURG W.F. 1971.—A revision of the genus *Trimenia* (Trimeniaceae). *Blumea* 19: 3-15.
- SMITH A.C. 1978.—A precursor to a new flora of Fiji. *Allertonia* 1: 331-414. [*Trimenia marquesensis* is discussed on pp. 351-352, shown in figure 6C,D].
- SMITH A.C. 1981.—Trimeniaceae. *Flora Vitiensis Nova* 2: 102-104.

Manuscript received 13 November 1998;
revised version accepted 19 May 1999.