

Studies of Marquesan Vascular Plants: Introduction

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This special issue of *Allertonia* presents a series of papers representing the first publications of the Flora of the Marquesas Islands project, a collaborative program primarily between the Smithsonian Institution and the National Tropical Botanical Garden intended to further knowledge of the flora of this remote archipelago. The project has multiple goals: 1) to increase scientific interaction among cooperating institutions and for these institutions to provide organization and personnel for further exploration of and research within the islands; 2) to create databases for specimens and literature; 3) to provide a framework to interact with Marquesan and other French Polynesian researchers, land-use planners, conservationists, and students in gaining knowledge of the flora and for preserving biodiversity of the Marquesas Islands; 4) to produce the first complete and fully illustrated *Vascular Flora of the Marquesas Islands*; and 5) to assist and collaborate on the Flora of French Polynesia project.

The Marquesas Islands are an isolated group of volcanic hot spot islands in the southeastern Pacific Ocean between the latitudes of 7° 53' and 10° 35' S and the longitudes of 138° 25' and 141° 27' W. They are one of the five archipelagos of French Polynesia, the others being the Austral (or Tubuai) Islands, Gambier Islands, Society Islands, and the Tuamotu Archipelago. The Marquesas Islands are further from any continent (4850 km from Mexico) than any other archipelago, but are less isolated than the Hawaiian Islands because they are situated at the eastern periphery of a series of archipelagoes. The nearest islands are the atolls of the Tuamotu Archipelago (480 km to the south) and the high islands of the Society Islands (1370 km to the southwest). The archipelago consists of 12 rugged, relatively small islands from Eiao (7° 53' S, 141° 27' W) at the northwestern end to Fatu Hiva (10° 35' S, 138° 35' W) at the southeastern end. Its axis is nearly parallel to the other archipelagoes of the eastern Pacific (Duncan & McDougall, 1974). The archipelago embodies roughly 6% of the area of the Hawaiian Archipelago; the larger of the Marquesan Islands are slightly smaller than the Hawaiian island of Lana'i (Wagner, 1991). Among the 12 Marquesas Islands three have peaks over 1220 m high. The radiometric ages of the Marquesan Islands range from 1.3 million years for Fatu Hiva to slightly over 6 million years for Eiao (Brousse et al., 1990).

The topography of the Marquesas Islands is extremely rugged and beautiful. There are essentially no developed coastal plains or coral reefs. All of the larger islands, except Ua Pou, appear to consist of half of an original volcano. Each of

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these islands has a prominent central ridge, except Hiva Oa and Nuku Hiva, both of which have elevated plateau regions. Beyond the steep slopes rising directly from the ocean the most striking features of the archipelago are the towering peaks of Ua Pou and the long narrow ridge of Fatu Hiva, which is so narrow and eroded in some places that it has holes through it several hundred meters from the summit (Wagner, 1991). The rugged topography has produced varied habitats on the larger islands ranging from dry on the leeward sides to mesic valleys and cloud covered summits. Rainfall, based on meager records, ranges roughly from 100 to over 280 cm per year.

The native flora consists of about 320 vascular plant species of which about 42% are endemic to the archipelago (Wagner, 1991). There are perhaps at least this many or more naturalized species. The relatively small size of the native flora reflects the small area of the islands, youth of the archipelago, and great distance from continental sources. As with other oceanic floras the pteridophyte component is rich due to the high dispersal ability of their spores. The Marquesas have one of the world's highest percentages of pteridophytes in its vascular flora—about 33% (Wagner, 1991). The monocot flora is, by contrast, relatively species-poor. Dicots make up the bulk of the flora with the Rubiaceae being the largest family with about 30 species, nearly half of which are in the genus *Psychotria* L. (D. H. Lorence & W. L. Wagner, unpubl.).

Overall the Marquesan flora is relatively poorly known. The only recent treatment of the flora is Forest and Elizabeth Brown's *Flora of Southeastern Polynesia* (Brown & Brown, 1931; Brown, 1931, 1935), which was essentially a report on the plants collected on the Bayard Dominick Expedition (1921–1922) by the Browns, on the Whitney Expedition (1921–1922) by E. H. Quayle, B. W. Jones, and R. Beck, and by the Pacific Entomological Survey (1929–1932). Earlier collections not then represented in the Bishop Museum herbarium were not included, except as they may have been recorded in the French Polynesian flora of Drake del Castillo (1892), as well as in his partially completed illustrated flora of the Pacific islands (1886–1892). Moreover, the work by F. Brown suffers from erratic writing, atypical typifications, and errors in identifications. Nevertheless, this three volume work has remained the *only* modern flora available for French Polynesia. The only other floristic accounts for the islands were those by Drake.

Starting with J. R. Forster and G. Forster on Captain Cook's second voyage on *H. M. S. Resolution* in April 1774 (Fosberg, 1993), a number of European visitors gathered plants in the Marquesas prior to the expeditions of the 20th century. Prominent among these were F. D. Bennett in 1835, L. M. A. Dupetit-Thouars in 1838 and 1842, R. B. Hinds and G. W. Barclay in 1840, J. B. Hombron and E. J. F. Guillou in 1836, G. H. von Langsdorff in 1804, T. Le Bastard in 1844, D. E. S. A. Jardin in 1854–1855, S.-R. Lenormand in 1857, P. Mercier in 1847, and P. A. L. Savatier in 1877.

This century the rate of exploration and collection of the flora has increased. The Bishop Museum has been prominently involved in study of the flora and fauna, especially insects, over most of this period. A number of expeditions visited the Marquesas Islands including the above-mentioned Bayard Dominick Expedition (1921–1922) where F. Brown and E. Brown made over 700 collections.

The American Museum of Natural History-sponsored Whitney Expedition (1921–1922) resulted in over 500 collections by W. B. Jones and E. H. Quayle, and the Pacific Entomological Survey (1929–1930), a collaboration between the Bishop Museum and Hawaiian Sugar Planters Association, resulted in over 750 collections by A. M. Adamson, and especially E. P. Mumford and the resident G. LeBronnec (Adamson, 1936). In 1960, 1963–1964, and 1974 Bryce Decker made the most extensive collections to date (about 2100), while conducting his Ph. D. research on the impact of human activity on the vegetation of the islands (Decker 1970, 1992). In 1977 Bishop Museum again sponsored an expedition to the Marquesas Islands. The collectors were B. H. Gagné, W. C. Gagné, and S. G. Montgomery. Most of the approximately 210 collections were made by B. Gagné. During the past two centuries a number of additional groups and individuals have made mostly small collections from the Marquesas Islands.

Three floristic projects have been initiated during the past half century, but none have resulted yet in a flora for these unique islands. The most comprehensive is the ongoing French project, *Flore de la Polynésie française*, which aims to produce a flora of all of French Polynesia. F. Hallé visited the archipelago in 1973, 1974, and 1975 making more than 220 collections. Jacques Florence, the principal investigator, is currently working on the first volume of this large project and has made six collecting trips (1982, 1984, 1986–1988, and 1990). Florence has published a number of new species resulting from his over 750 collections (Florence, 1985, 1986, 1990). He also has developed a database of information on species and collections from all of French Polynesia.

At the Smithsonian Institution Ray Fosberg and Marie-Hélène Sachet initiated floristic projects on the Society and Marquesas Islands. Although considerable collections were amassed only one fascicle of each flora was published, covering mostly the same angiosperm families (Grant et al., 1974; Sachet, 1975). The Marquesan treatments included the Apocynaceae, Asclepiadaceae, Epacridaceae, Ericaceae, Gentianaceae, Loganiaceae, Myrsinaceae, Oleaceae, Plumbaginaceae, Primulaceae, and Sapotaceae. They also published several preliminary papers (Fosberg, 1939; Fosberg & Sachet, 1966, 1975, 1981). Sachet visited the islands twice, once in 1963 making about 200 collections and again in 1974–1975. Royce Oliver made a trip there in 1975 a few months after Sachet arrived on her second trip and collected in preparation for the project over a several month period. In this trip they made nearly 500 collections. P. A. Schäfer and J.-C. Thibault also collected in 1975. Schäfer collected throughout the year, making at least 700 collections, while Thibault added another 150 or so collections, either separately or giving the specimens to Schäfer. All of these collections were identified and partially sorted at the Smithsonian, but never were distributed in Sachet's lifetime. Some of the more interesting new taxa were pulled out and published separately, such as the new genus *Lebronnecia* (Fosberg & Sachet, 1966).

In 1987 we initiated a new project on the flora of the Marquesas, utilizing the tremendous accumulation of specimens, amassed literature, and notes of Fosberg and Sachet. The project grew out of planning research agendas in the new positions both Wagner and Lorence started at the Smithsonian and National Tropical Botanical Garden respectively. The foundation for the flora will be detailed studies

for independent publication of all of the genera with more than a few species because of numerous taxonomic problems with most of these genera and a considerable number of new taxa. These papers will then form the basis for the flora treatments.

The primary publication that will result from the project will be a single volume *Vascular Flora of the Marquesas Islands* covering about 850 species of indigenous, naturalized, and cultivated plants of the archipelago and a specimen database of all collections. The coordinators and primary authors of the flora will be Warren L. Wagner and David H. Lorence. Currently nearly 8000 collections, including nearly all the collections made in the 20th century, and so far only a few of those made on the 18th and 19th century exploring expeditions, have been recorded in a database at the Smithsonian Institution funded by a Scholarly Studies Grant to Wagner.

At the outset of this project it was clear that more field work was needed before writing the flora. Field studies are needed both to resolve difficult taxonomic problems and to explore the many areas never collected or under collected botanically. In 1988 the first of what will be three or four proposed exploring and collecting expeditions took place. The Fatu Hiva Expedition to the Marquesas Islands was a joint, collaborative effort undertaken by the Bishop Museum, National [then Pacific] Tropical Botanical Garden (NTBG), Smithsonian Institution, and the Centre ORSTOM de Tahiti. Participants in the botanical phase of the expedition included David H. Lorence and Steven P. Perlman of the NTBG, Warren L. Wagner of the Smithsonian Institution, and Jacques Florence of ORSTOM. It was funded by a combination of private funds raised by Bishop Museum and the National Tropical Botanical Garden and a grant to Warren Wagner from the Smithsonian Institution Research Opportunity Fund. The 40 ft. research vessel *Aeolus*, owned and commanded by Edward H. Carus, Jr., sailed from Honolulu to the Marquesas where it was used as base of operations from June to September, 1988. Expedition members visited five of the islands: Hatutaa, Eiao, Nuku Hiva, Hiva Oa, and Fatu Hiva. During the expedition more than 2000 herbarium specimens (including duplicates) were collected, and eventually distributed to BISH, P, PAP, PTBG, US, and other herbaria (herbarium abbreviations according to *Index Herbariorum*, ed. 8, by Holmgren et al., 1990). Of the approximately 600 collections made during the Fatu Hiva Expedition, those from the three largest islands have yielded at least 10 new vascular plant species, of which eight are described in this issue of *Allertonia* (also see *Herbarium Pacificum News* 8(1): 6. 1989).

More recently the National Tropical Botanical Garden and Smithsonian Institution, in collaboration with Delegation for Environment and Research, Territory of French Polynesia, organized and funded a second botanical expedition to the Marquesas which took place during August and September, 1995. This endeavor was carried out under the auspices of a master cooperative agreement between the Territory and the Bishop Museum. During the 1995 expedition botanical collectors Steven P. Perlman and Kenneth R. Wood of NTBG, and Jean-Yves Meyer of the Delegation for Environment visited four of the islands: Hiva Oa, Tahuata, Fatu Hiva, and Nuku Hiva. Areas of high floristic diversity and those poorly known botanically were explored, and 513 numbered collections comprising 3000

to 4000 herbarium specimens were collected as well as seeds for propagation and material for DNA analysis and anatomical studies (Perlman et al., 1996). A preliminary examination of the specimens indicates that additional new taxa and new island records were collected. Seeds of a number of taxa have germinated successfully and are in cultivation at NTBG's Lawai Garden.

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