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Revision of *Oparanthus* (Compositae, Heliantheae, Coreopsidinae)

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The subtribe Petrobiinae of the Compositae, tribe Heliantheae, as recognized by Carlquist (1957), contains two genera: *Oparanthus* Sherff with two species in the South Pacific and *Petrobium* R. Br. with one species in the Atlantic. During recent investigations on the Petrobiinae as part of a re-evaluation of subtribal limits in the Heliantheae (Stuessy, in press), the relationships between these two genera have been examined, as well as affinities with genera of other subtribes. These comparisons suggest that *Oparanthus* and *Petrobium* are similar morphologically, and that they have a strong relationship with genera of the subtribe Coreopsidinae, especially *Bidens* L. In this paper the taxonomic history of *Oparanthus* is sketched, a commentary is presented on generic and subtribal relationships, and a taxonomic treatment is provided that includes two species that are restricted to the Tubuai Islands.

TAXONOMIC HISTORY

The taxonomic history of *Oparanthus* begins with the description of section *Quadrimeria* of *Chrysogonum* L. in the subtribe Melampodiinae. Forest Brown (1935), in one of his papers on the flora of southeastern Polynesia, described this new section of *Chrysogonum* which contained three new species from Rapa and the Marquesas Islands: *C. album*, *C. coriaceum*, and *C. rapense*. His rationale for inclusion of these new taxa within the genus stemmed from two

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63

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factors: the presence of sterile disc florets which has often been considered the most important character of the subtribe Melampodiinae (Hoffmann, 1890; Stuessy, 1973), and the existence of a diverse assemblage of taxa already in *Chrysogonum* that were distributed over the Pacific basin from the Philippines to Australia (Stuessy, ms. in prep.). These three new species differed from the rest of *Chrysogonum* in having woody stems and four-merous disc florets.

In a paper dealing with several genera of Compositae of south-eastern Polynesia, Sherff (1937a) elevated section *Quadrimeria* to generic status as *Oparanthus* with the simultaneous description of a new species, *O. intermedius*. He gave no reason for this hierarchical change except to note that (p. 12): "They [the first and last four cited specimens in his paper] had been determined by Dr. Elmer D. Merrill as *Chrysogonum rapense* F. Br. but with the exclamation in each case that they were 'neither *Chrysogonum* nor *Moonia*.'"

Oparanthus remained within the subtribe Melampodiinae until Carlquist (1957) suggested that the genus belonged to the monotypic *Petrobium* in the subtribe Petrobiinae. It is this taxonomic disposition that *Oparanthus* holds at the present time.

GENERIC AND SUBTRIBAL RELATIONSHIPS

Oparanthus is indeed similar to *Petrobium*. Both genera are shrubs of island habitats with oval to ovate leaves, four-merous disc florets, campanulate disc corollas, a two-awned pappus, and phyllaries and paleae containing brown-orange longitudinal striae. These features emphasize the close relationship of the two genera as well as a strong affinity with the subtribe Coreopsidinae. The last three characters, in fact, are diagnostic of this latter subtribe (Stuessy, 1973).

As detailed elsewhere (Stuessy, in press), the Petrobiinae seem unworthy of subtribal recognition. *Petrobium* and *Oparanthus* are regarded as belonging to the subtribe Coreopsidinae because they possess the diagnostic features mentioned above (Carlquist, 1966, also has suggested that *Oparanthus* is related to the Coreopsidinae). Due to their four-merous disc florets and oval to ovate leaves, however, the two genera are somewhat isolated from the other taxa of the subtribe. These two characters are not unknown in the Coreopsidinae, however, as the former occurs in *Moonia* Arn. (Stuessy, 1975) and in some species of *Coreopsis* (Smith, 1972), and the latter

is found in *Ericentrodea* Blake & Sherff and in some species of *Bidens* (Sherff, 1937b).

Oparanthus not only seems to be related to *Petrobium* and to belong clearly in the Coreopsidinae, but also the genus appears to be somewhat close to *Bidens*. This relationship has been suggested indirectly by E. E. Sherff, the well-known authority on *Bidens*, even though he himself described *Oparanthus* as new. In 1934, Degener and Sherff (in Sherff) first described *Bidens hivoana* from Hiva Oa in the Marquesas Islands. In 1935 Forest Brown described his three new species of *Chrysogonum*, including *C. album*, and among the paratypes of this new species is listed the type collection (Mumford & Adamson 469) of *Bidens hivoana*. When Sherff moved Brown's species of *Chrysogonum* to *Oparanthus* in 1937a he transferred *C. album* without any comment upon possible ties with *Bidens*, nor did he comment on any such relationship in his monograph on *Bidens* in that same year (1937b, p. 81). Although Sherff never mentioned the closeness of *Oparanthus* and *Bidens*, the fact that he included *B. hivoana* in the latter genus, while at the same time accepting a specimen of that taxon also as a species of *Oparanthus*, suggests a strong connection between the two genera. Whether the two species of *Oparanthus* recognized here should be moved into *Bidens* and with which species (in addition to *B. hivoana*) their affinities might lie are questions that must be examined further. Although apparently no species of *Bidens* occur in the Tubuai Islands, numerous species exist on other islands in the Pacific (Sherff, 1937b; Carlquist, 1966). Exactly how *Petrobium* of St. Helena in the Atlantic relates to *Bidens* also needs to be studied carefully.

TAXONOMIC TREATMENT

OPARANTHUS Sherff

Oparanthus Sherff, Occas. Papers B. P. Bishop Mus. 12(19):9. 1937. Lectotype species *Oparanthus rapensis* (F. Br.) Sherff

Chrysogonum L. sect. *Quadrimeria* F. Br. Bull. B. P. Bishop Mus. 130:341. 1935. Lectotype species *Chrysogonum rapense* F. Br.

Shrubs or trees. Leaves opposite, oval to broadly ovate, coarse to leathery. Capitula in cymose clusters. Receptacle convex. Involucre cupulate, biseriate; phyllaries coriaceous, ovate, with brown-orange longitudinal striae. Ray florets carpellate, fertile; ligules yellow to yellow-green with brown-orange longitudinal striae; pappus of 2-3 stout awns without barbs. Disc florets hermaphroditic, sterile; corollas yellow with brown-orange longitudinal striae; anthers brown, abaxially

ridged; style filiform; stigma undivided; ovary filiform; pappus absent or of 1-2 narrow awns. Paleae coriaceous. Chromosome number unknown.

KEY TO THE SPECIES

1. Leaves 0.3 mm. thick, coarse but not leathery, with secondary veins spaced 7-10 mm. apart and with reticulate tertiaries; heads 4-6 mm. tall; phyllaries 2-3 mm. long 1. *O. rapensis*
1. Leaves 1 mm. thick, very leathery, with secondary veins spaced 2-5 mm. apart and with the tertiaries paralleling the secondaries; heads 9-12 mm. tall; phyllaries 5-8 mm. long 2. *O. coriaceus*

1. **Oparanthus rapensis** (F. Br.) Sherff, Occas. Papers B. P. Bishop Mus. 12(19):11. 1937. Figures 1 and 4.

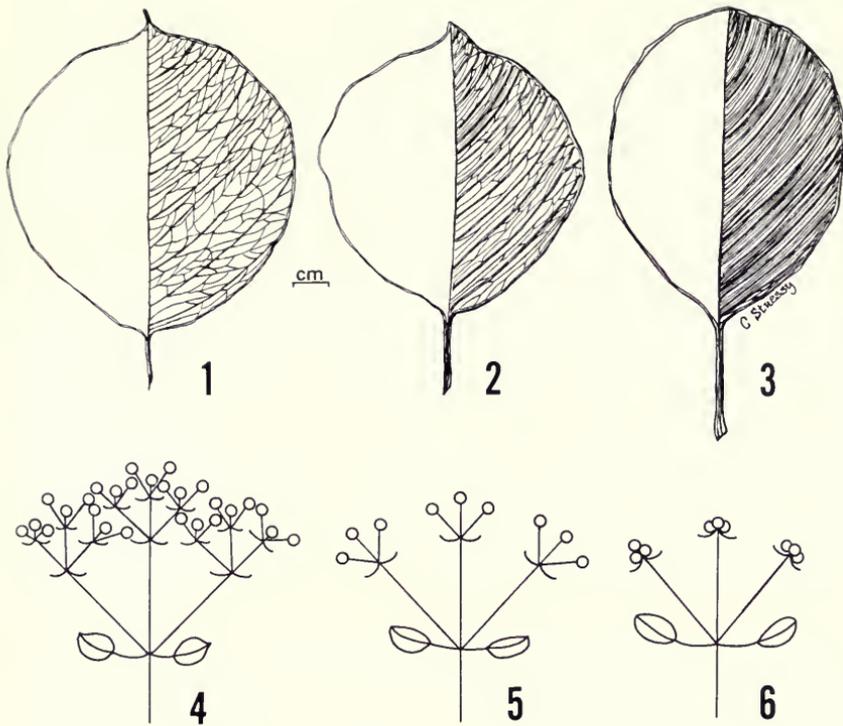
Chrysogonum rapense F. Br. Bull. B. P. Bishop Mus. 130:343. 1935. TYPE: FRENCH POLYNESIA: Tubuai Islands, Rapa, Maitua, "on talus with other trees and ferns" [from label], 180 m., 10 Oct. 1921, A. M. Stokes 337 (Holotype, BISH!).

Tree to 8 m. tall. Stems terete, somewhat swollen at the nodes, to 8 mm. diam. on upper branches, wrinkled when dry, glabrous. Leaves with petioles 3-9.5 cm. long, 1-2 mm. diam., at the base slightly expanded; blades oval, 6.7-13.7 cm. long, 7-14.5 cm. wide, at apex rounded to mucronate, at base rounded, with the margins entire, with both surfaces glabrous. Capitula 4-6 mm. tall, 5-8 mm. diam., subsessile or more often on peduncles to 1 cm. long. Receptacle 1 mm. diam. Phyllaries 6-10, ovate, coriaceous, 3-4.5 mm. long, 1.5-2.5 mm. wide, at apex rounded, glabrous. Ray florets 5-8; ligules 1.8 mm. long, deeply trifid; tube 1.5-2 mm. long, 0.3 mm. diam.; pappus of 2 awns to 1 mm. long; achenes flattened radially with a weak central adaxial carina (sometimes absent), 3-4 mm. long, 2.5-3 mm. wide, glabrous. Disc florets 8-15; throat of corolla narrowly campanulate, 0.5 mm. long, 0.5 mm. diam.; lobes narrowly ovate, 1.3 mm. long, 0.5 mm. wide, with a central midvein; tube 1.6 mm. long, 0.3 mm. diam.; anthers brown, 1.3 mm. long, with apical appendage tapered, with basal lobes obtuse; style 3 mm. long, 0.1 mm. diam.; ovary slender, 2-3 mm. long, 0.3-0.5 mm. diam.; pappus of 0-2 awns to 1 mm. long. Paleae lanceolate, 3 mm. long, 0.7 mm. wide.

Distribution.—Common in lower elevational forests and cliffs (50-300 m.) on Rapa Island of French Polynesia.

Flowering Dates.—Usually flowering in July, rarely in October and December.

Specimens Examined.—FRENCH POLYNESIA: Tubuai Islands: Rapa: wooded ravine, 8 Dec. 1934, *Chapin 907* (A, NY); SE slope of Mt. Ororangi, 6 July 1934, *Fosberg 11413* (A, BISH, GH); Mt. Tepiahu, 12 July 1934, *Fosberg 11501* (BISH); valley 2/5 mile E of Ahurei, 1 July 1934, *St. John & Fosberg 15264* (BISH,



FIGS. 1-6. Illustrations of leaves (figs. 1-3) and diagrams of capitulescences (figs. 4-6) of *Oparanthus rapensis* (figs. 1, 4) [Fosberg 11501, BISH], *O. rapensis* X *O. coriaceus* (= *O. intermedius*) (figs. 2, 5) [St. John, Maireau & Fosberg 15640, BISH], and *O. coriaceus* (figs. 3, 6) [St. John & Maireau 15517, GH]. Figures 1-3, same scale. The circles in Figures 4-6 represent individual heads.

GH, US); Maungaeae, E of Mangaoa Peak, 4 July 1934, *St. John & Maireau 15372* (BISH, GH); Peatuakaviri, W of Mt. Tautautu, 6 July 1934, *St. John & Maireau 15401* (BISH, GH, US); Morongoto, 15 July 1921, *Stokes & Brown 60* (BISH), 15 July 1921, *Stokes & Brown 76* (BISH); Pake, mountain side, 31 Oct. 1921, *Stokes & Brown 389* (BISH); dry cliffs above Maitua, 19 July 1934, *Zimmerman s.n.* (BISH).

2. *Oparanthus coriaceus* (F. Br.) Sherff, *Occas. Papers B. P. Bishop Mus.* 12(19):11. 1937. Figures 3 and 6.

Chrysogonum coriaceum F. Br. *Bull. B. P. Bishop Mus.*

130:344. 1935. TYPE: FRENCH POLYNESIA: Tubuai Islands, Rapa, 1922, *E. H. Quayle X* (Holotype, BISH!).

Oparanthus intermedius Sherff, Occas. Papers B. P. Bishop Mus. 12(19):10. 1937. TYPE: FRENCH POLYNESIA: Tubuai Islands, Rapa, Taratika, "east side of Mount Perahu, in thicket on steep ridge," 500 m., 21 July 1934, *H. St. John, J. Maireau & F. R. Fosberg 15640* (Holotype, BISH!; isotype, GH!). Figures 2 and 5.

Shrub to 3 m. tall. Stems terete, swollen at the nodes, 1 cm. diam. on upper branches, leathery when dry, glabrous. Leaves with petioles 2.5-4.5 cm. long, 1.5-2 mm. diam., at the base expanded; blades oval, 6.5-11 cm. long, 5-12 cm. wide, at apex boat-shaped and obtuse to rounded, at base rounded, with the margin entire to subserrulate, with both surfaces glabrous. Capitula 9-12 mm. tall, 6-10 mm. diam., sessile or on peduncles to 3 mm. long. Receptacle 2 mm. diam. Phyllaries ovate, coriaceous, 5-8 mm. long, 2-5 mm. wide, at apex obtuse, glabrous. Ray florets 5-8; ligules not observed; pappus of 2 or 3 stout awns 1.5-2 mm. long, with the central awn the shortest; achenes flattened radially, with a strong central adaxial carina, 3.6-4.2 mm. long, 1.7-2.9 mm. wide, glabrous. Disc florets 15-20; corollas not observed; ovary 5 mm. long, 0.6 mm. diam. ; pappus of 0-3 main awns to 2 mm. long. Paleae elliptic, 5 mm. long, 1.3 mm. wide.

Distribution.—Restricted to high elevations (350-500 m.) in mossy forests in the island of Rapa in French Polynesia.

Flowering Date.—July.

Brown (1935) mentioned the absence of both discoid and radiate corollas on his material of *Oparanthus coriaceus*, with the exception of one immature 5-lobed disc corolla. Sherff (1937a) stated "ray florets none" and noted the abundance of 4-lobed disc corollas. In material at my disposal for study, including the collection (*St. John & Maireau 15517*) cited by Sherff (1937a), I have seen neither mature ray nor even immature disc corollas. Because the outer series of achenes are clearly fertile and those in the center abortive, I prefer to designate the outer, fertile achenes as belonging to ray florets and those sterile ones of the center as disc florets. This same morphological pattern prevails in *O. rapensis*, in which both radiate and discoid corollas have been observed.

Oparanthus intermedius was described by Sherff in 1937a as being morphologically intermediate (hence the specific epithet) between *O. rapensis* and *O. coriaceus* in both floral and vegetative features. This has been corroborated in the present study (figs. 1-6). Only two collections of *O. intermedius* have been found: the type collection, and a vegetative fragment in a mixed collection with

O. coriaceus (Fosberg 11574, A). Because of the morphological intermediacy of *O. intermedius*, its rarity, and its occurrence in one population with *O. coriaceus*, one is tempted to regard the taxon as a hybrid between *O. rapensis* and *O. coriaceus*. Additional considerations support this hypothesis. The mountainous island of Rapa is relatively small, being only 20 miles in circumference, within which *O. coriaceus* is confined to elevations above 350 m. and *O. rapensis* below 300 m. It is possible, therefore, that two (and only two) species of this genus have evolved within the small confines of the island with *O. coriaceus* having speciated in isolation at higher elevations from a founder population of the more wide-spread *O. rapensis*. Recent disturbances, either natural or man-induced, may have facilitated intermixing and resultant interspecific hybridization.

Specimens Examined.—FRENCH POLYNESIA: Tubuai Islands: Rapa: Mitiperu, dense damp woods, 18 July 1934, Fosberg 11574 (A [in part], BISH); Kaimaru, S ridge of Mt. Perahu, thicket on steep mossy ridge, 13 July 1934, St. John & Maireau 15517 (BISH, GH).

EXCLUDED SPECIES

Oparanthus albus (F. Br.) Sherff, Occas. Papers B. P. Bishop Mus. 12(19):12. 1937. *Chrysogonum album* F. Br. Bull. B. P. Bishop Mus. 130:342. 1935. TYPE: FRENCH POLYNESIA: Marquesas Islands, Hiva Oa, Feani, 850 m., 15 Dec. 1921, F. & E. Brown 1088 (Holotype, BISH!). = *Bidens hivoana* Degener & Sherff in Sherff, Bot. Gaz. 96:143. 1934.

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