

Some Rhodymeniales from Hawaii

ISABELLA A. ABBOTT

Hopkins Marine Station of Stanford University, Pacific Grove, California, U.S.A.

AND

MARK M. LITTLER

Department of Botany, University of Hawaii, Honolulu, Hawaii, U.S.A.

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Four species of poorly known Rhodymeniales (Rhodophyta) of wide but scattered distribution in the tropics are reported from Hawaii. These are *Chrysymenia okamurai* Yamada and Segawa, *Coelarthrum albertisii* (Piccone) Boergesen, *C. boergesenii* Weber van Bosse, and *Erythrocolon podagrica* (Harv. ex. J. Agardh in Grunow) J. Agardh ex Kylin. A new species of *Chrysymenia*, *C. glebosa* is described, and the status of *Cryptarachne* as a genus is evaluated.

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Introduction

Tropical members of the Rhodymeniales (Rhodophyta) are mostly referable to the Rhodymeniaceae, especially to the *Chrysymenia* group and the *Erythrocolon* group. The first is characterized (Kylin, 1956) as being partly to entirely hollow but without diaphragms and with gland (secretory) cells, and the second group as being hollow, with gland cells and with diaphragms. These algae possess essentially saccate thalli, morphologically distinct from the related and also partly saccate *Botryocladia* group in the lack of solid axes. In contrast, the commonest temperate water genera, *Rhodymenia* and *Faucea*, have a solid medulla, no diaphragms and no gland cells.

We report here for the first time five species from Hawaii, one as new to science: *Chrysymenia okamurai* Yamada et Segawa (1953), *C. glebosa* Abbott et Littler (new species), *Coelarthrum albertisii* (Picc.) Boergesen (1910), *C. boergesenii* Weber van Bosse (1928), and *Erythrocolon podagrica* (Harvey ex J. Agardh in Grunow) J. Agardh ex Kylin (1931).

In order to name some of the species in this paper, authentic material was obtained for comparison from the herbarium of Hokkaido University, Sapporo (*SAP*), the Weber van Bosse herbarium at Leiden (*L*), the W. R. Taylor (*WRT*) herbarium, and the University of California (*UC*) herbarium. We wish to thank the curators of these herbaria for the loan of

specimens. We are especially indebted to Professor Maxwell S. Doty of the University of Hawaii whose collections (both liquid-preserved and dried) were placed at our disposal. The senior author is happy to record the pleasure it was to serve as Dr. Doty's colleague at the University of Hawaii during the Spring Semester, 1968, when this research was conducted. His cooperation and that of the department was outstanding. We also acknowledge our gratitude to Donald P. Rogers of the University of Illinois for the Latin translations in reference to the nomenclature tangle shown by *Erythrocolon podagrica*.

Representatives of these species and the type specimen of *Chrysymenia glebosa* are being deposited in the Doty (*MSD*) herbarium. We also acknowledge the help of Charles F. Hastings in sharing his collections with us.

Chrysymenia

In 1931, Kylin elevated the subgenus *Cryptarachne* Harvey (1853) to generic rank, to include those species of *Chrysymenia*-like thalli that showed internal cortical rhizoids. These species are mostly Caribbean in distribution and include as the type species *Chrysymenia agardhii* Harvey (1853). Taylor (1960) accepted the circumscription of *Cryptarachne*, and listed *C. agardhii*, *C. dickiana*, and *C. planifrons* from the Caribbean area.

Okamura (1936), working with Japanese species, refused to recognize *Cryptarachne* as a

genus separate from *Chrysymenia* because his specimens showed both the presence and absence of internal rhizoids, and Yamada and Segawa (1953) followed this opinion. An examination of material used by Okamura (*SAP*) and Yamada and Segawa (*SAP*), and specimens used by Boergesen (*WRT*, *UC*) and Taylor (*WRT*) shows that the presence or absence of internal rhizoids is a very poor characteristic to distinguish these otherwise very closely related morphological entities. All specimens examined showed some parts of the thallus without, and other parts of the same thallus with, internal cortical rhizoids. Examination of material from Hawaii that might have been placed in either *Chrysymenia* or *Cryptarachne* showed similar variations. It therefore appears that Okamura was correct. Further attempts to recognize more than one genus will be de-

pendent on an analysis of other characteristics. We do not distinguish any at this time.

It should be noted in passing that Boergesen (1910, 1920) remarked that both *Chrysymenia ventricosa* (Lamour.) J. Agardh,¹ the species which Kylin (1931) chose as the type species of *Chrysymenia*, and *C. agardhii* Harvey, selected by Kylin (1931) as the type species of *Cryptarachne*, have internal rhizoidal filaments.

***Chrysymenia okamurai* Yamada et Segawa**
(Fig. 1-2)

(1963, p. 110, fig. 3); *Chrysymenia kairnbachii* of Okamura (1930, p. 96) not of Grunow. Okamura (1932, p. 77, pl. 288, fig. 1-8; 1936, p. 669).

¹Dr. Peter Dixon has called to our attention the fact that *Dumontia ventricosa* Lamouroux [Essai sur les genres de la famille des Thalassiophytes non articulées. MEM. MUS., Vol. 20. Paris, 1813], the basionym for this species is a *nomen nudum*.

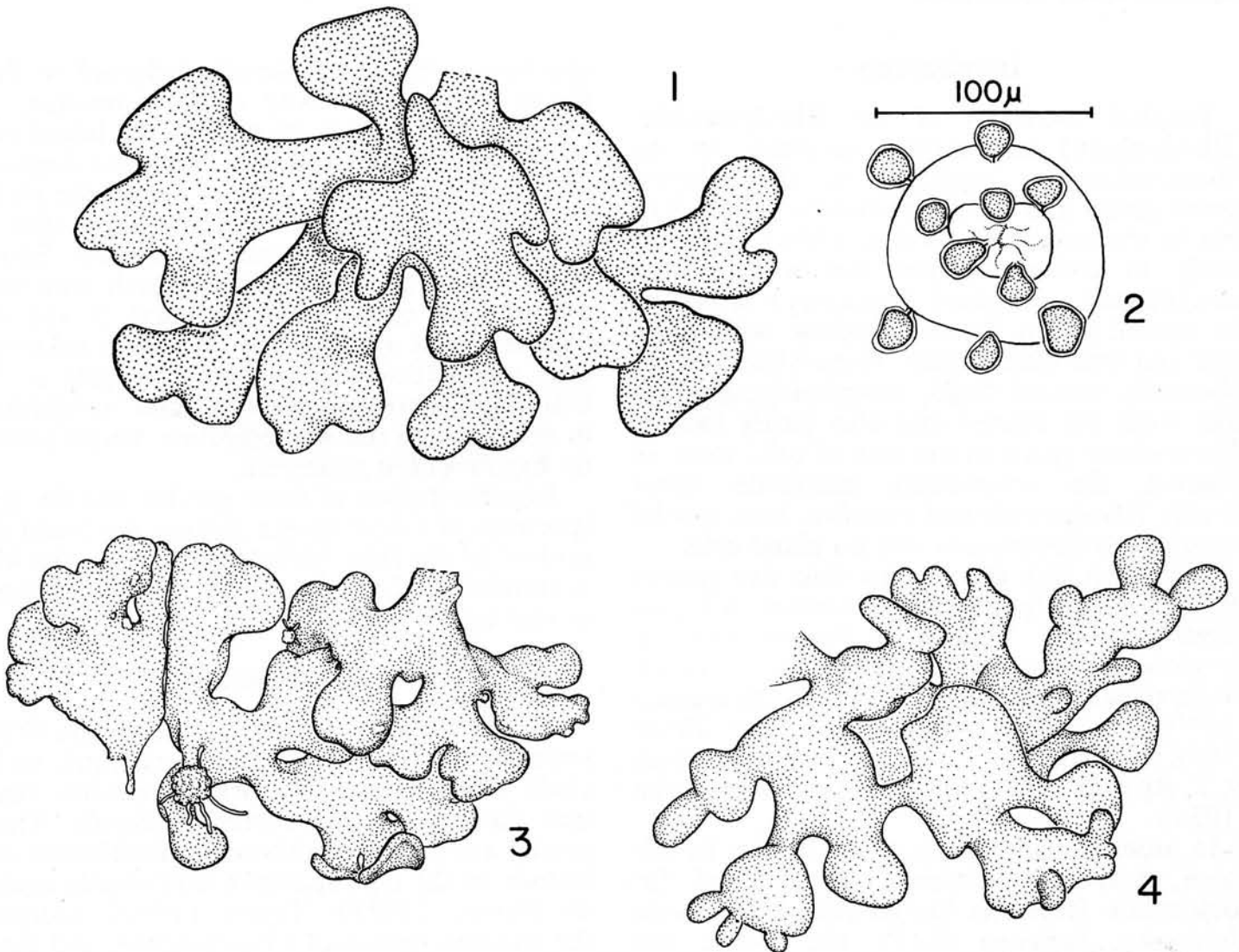


FIG. 1, 2. *Chrysymenia okamurai*. FIG. 1. Habit showing flattened blades of thallus (Doty 19539), $\times 1$. FIG. 2. Detail of arrangement of gland cells on inner cortical cells bordering hollow areas of thallus. FIG. 3. *Chrysymenia glebosa*; ventral view of a group of blades from one decumbent clump, all of which were attached to fleshy holdfast shown at bottom left (Abbott 4625); $\times 1\frac{1}{2}$. FIG. 4. *Coelarthrum boergesenii*; a creeping thallus with laterally anastomosing branches which are characteristic of the species (Doty 19537); $\times 1\frac{1}{2}$.

Thallus in partly repent, imbricate clumps, bladeliike segments 3 to 6 cm long, varying in width from less than 1 cm to more than 4 cm broad, irregularly dichotomously divided. Thallus surface soft, reddish brown in color. In section, locally hollow and mucilage-filled, but occasionally with solid parenchymatous portions and the older hollow portions of the thallus sometimes with internal cortical rhizoidal filaments traversing the medulla. Cortex 230 to 250 μ thick, of 2 to 4 layers of large cells and two layers of smaller cells toward the surface. Gland cells (Fig. 2) sessile on cells of the inner cortex, several to many to a cell. Tetrasporangia near the edges of the blades, in irregular sori, projecting beyond the adjoining surface cells. Cystocarps mostly on the dorsal surface, few but conspicuous.

HAWAIIAN DISTRIBUTION: Oahu Island: *Doty 14963*, Ala Moana Beach, leg. M. Kajimura, 20. XI. 1964; *Doty 19539*, washed in at Ewa Beach playground, Ewa, leg. M. S. Doty, 26. V. 1961; *Hastings 254*, Ewa Beach, leg. C. F. Hastings, 11. V. 1968; *Doty 13652*, washed in near mouth of Koloa stream, Laie, 25. XI. 1955, leg. M. S. Doty. Hawaii Island: *Abbott 4700*, Kiahoi Island off Puna, 14. VIII. 1945, leg. R. W. Hiatt.

OTHER DISTRIBUTION: Hachijo Island, Japan (type locality) and from Tosa, Kii, and Tzu peninsulas (central Japan). Lectotype: the specimen (*SAP*) on which fig. 2 of Okamura, 1930, pl. 288, is based. This is a tetrasporangial thallus.

The Hawaiian specimens are very similar to those from Japan. This species is twice the size of *C. glebosa* described below, and blades do not become conerescent nor do they show ventrally attached pegs.

***Chrysymenia glebosa* Abbott et Littler, sp. nov.**
(Fig. 3)

Thalli saxicolli decumbentes ex aliquote laminis applanatis, primum peltatis, deinde exstipitatis, a 3 cm quarum margines simplices ad incis et irregulares, constantes, orae laminarum contiguarum conerescentes. Thalli maturi ferruginei, superdicie inferiore obscuriore quam superioris quae nitorem metallicum caeruleam habet. Partes iuvenes ubique laxe filamentosae, partes vetustiores, autem, cauae quamquam compressae, cum aut sine rhizoideis interioribus. Glandicellulae sessiles $11 \times 15 \mu$, 1-4 in omni cellula quam oavum praetegit. Cystocarpi magni, emergentes, sine rhizoideis basalibus interioribus, tetrasporangia $23 \times 26-28\mu$, in soris irregularibus, cruciate divisa.

Thalli saxicolous, decumbent, consisting of several at first peltate and later estipitate flattened blades to 3 cm long, with simple to notched and irregular margins, the edges of adjacent ones conerescent. Mature thalli attached ventrally by means of peglike extensions of the thallus. When mature, thalli rusty-red (Ocher to Indian Red of Ridgway), the lower (ventral) surface darker than the upper (dorsal), and the upper surface with a bluish metallic sheen (rather like lavender over red). Transverse sections of young portions loosely filamentous throughout, but of older portions hollow although compressed, with or without internal rhizoids. Gland cells sessile, $11 \times 15\mu$, 1-4 to a cell bordering the cavity. Cystocarps large, emergent, mostly occurring on the upper (dorsal) surface of the thallus, without internal rhizoids basally; tetrasporangia cruciately divided, $23 \times 26-28\mu$, in irregular sori.

DISTRIBUTION: On northwest drain tubes of the War Memorial Natatorium at Waikiki, Hawaii. The holotype, *Abbott 4244* (*MSD*) leg. Mark M. Littler, 8.V.1968 consists of two thalli on one sheet, one cystocarpic and the other tetrasporangial of which we designate the tetrasporangial as the type specimen. Repeatedly collected from this locality, the only place where it has been found: *Abbott 4241*, 4621, 3.V.1968; 4625, 29.III.1968; *Hastings 224*, 29.III.1968; *Littler 537*, 3.XI.1966.

Chrysymenia glebosa is named for its clumping habit, in which the irregular bladeliike segments emerge from small cushions. This habit distinguishes it from *C. coelarthroides* Feldmann-Mazoyer (1941) and also from *C. procumbens* Weber van Bosse (1928). Both of

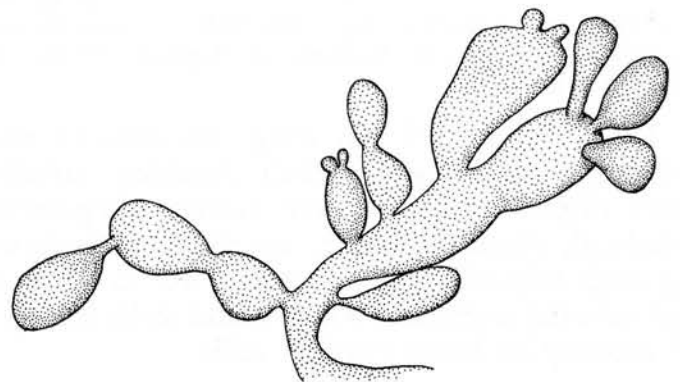


FIG. 5. *Erythrocolon podagrica*. Habit showing compressed and decumbent sausage-like segments of thallus, bearing spherical and erect segments (*Doty 17158*), $\times 1$.

the latter are small in stature, as is this new species, but neither has the clumping habit, nor the irregular margins of the Hawaiian species. Specimens on the type sheet (*L*) of *C. procumbens*, in fact, are like small isolated sacs of *Botryocladia*; the thallus of *C. coelarthroides*, as illustrated by Feldmann-Mazoyer (1941, fig. 1) arises from a definite central stipe, and is divided 3–4 times subdichotomously. Neither of these species has the small peglike secondary attachment organs of *C. glebosa*.

Coelarthrum

Coelarthrum albertisii (Piccone) Boergesen

BASIONYM: *Chylocladia albertisii* Piccone (1884). Boergesen (1910, p. 189-194, fig. 11, 12; 19-20, p. 404); Weber van Bosse (1928, p. 472, fig. 206).

Thalli erect, branches up to 6 cm high, reddish brown, with strong constrictions (internally represented by diaphragms) between adjoining segments; dichotomously divided; segments elongate-spherical, becoming rounder as they become shorter toward the upper ends of the thallus. Cortex of several layers of large cells, the innermost one bordering the cavity of smaller size and star-shaped, and bearing one or more gland cells.

HAWAIIAN DISTRIBUTION: Oahu Island: *Abbott 362*, drifting at Pearl Harbor, 12. I. 1944; *Abbott 2099*, Kawela Bay, cast ashore, 14. IX. 1961; *Abbott 2627*, Waimanalo Beach, cast ashore, 20. I. 1944, leg. Edna Fassoth.

OTHER DISTRIBUTION: Canary Islands (type locality), Guadeloupe, Virgin Islands, Bermuda, Indonesia.

Coelarthrum boergesenii Weber van Bosse

(1928, p. 473-474, fig. 207-208). *Coelarthrum coactum* Okamura et Segawa in Segawa (1936, p. 186, fig. 7).

Thalli up to 3.5 cm long, decumbent and creeping, with peglike discs forming attachment organs on the lower surface; segments spherical, rarely elongate, laterally anastomosing with adjoining thallus segments to form a mat several segments wide; gland cells attached directly to inner cortical cells.

HAWAIIAN DISTRIBUTION: Oahu Island: *Doty 19537*, Ewa Beach, cast ashore, 26. V. 1961; *R. T. Tsuda 1670*, same place, 2. VII. 1966; *G. T. Kraft 1176*, same place, 24. I. 1967;

Laysan Island, *R. T. Tsuda 592*, 6. XII. 1963. (All *MSD* herbarium.)

OTHER DISTRIBUTION: Indonesia (Saleyer, type locality); Arno, southern Marshall Islands; Miyake-jima, south central Japan.

The several collections of *Coelarthrum albertisii* from Hawaii and all of those specimens that we have examined from elsewhere are clearly erect thalli, whereas those that we recognize as *C. boergesenii* are creeping thalli and when best developed, matlike. This appears to be a constant and significant difference between these two species.

Coelarthrum boergesenii f. *minima* Weber van Bosse appears to be smaller (only 1.5 cm high) and with more spherical segments scarcely 3 mm wide, collected by the Siboga expedition from intertidal reefs rather than dredgings. We select the specimen from *Station 281*, eastern point of Timor Island as the lectotype of this form, and we choose the specimen from *Station 213* from the reef at Saleyer as the lectotype of the species. Both of these specimens are in Leiden (*L*).

Erythrocolon podagrica (Harvey ex J. Agardh in Grunow) J. Agardh ex Kylin (Fig. 5)

BASIONYM: *Chylocladia podagrica* Harvey ex J. Agardh in Grunow (1874). *Erythrocolon podagricum* (Harvey) J. Agardh. Yamada et Tanaka (1938, p. 78-79, fig. 10-11); Boergesen (1944, p. 18) as *Coelarthrum boergesenii*; Boergesen (1952, p. 38-39). *Chrysymenia podagrica* (Harv.) Svedelius. Weber van Bosse (1928), p. 171-172, fig. 204).

Thallus 3 to 5 cm high (the Hawaiian ones less than 3 cm), partly creeping. Segments of creeping portions vesicular but compressed, of the partly erect and free portions more spherical in shape and not compressed; branching somewhat dichotomous, but with segments produced irregularly here and there. Thalli essentially in one plane, some of the older portions anastomosing laterally with adjacent segments. In section, with one row of very large cells, followed on the outside by one or two irregular rows of small cells.

HAWAIIAN DISTRIBUTION: Hawaii Island: *Abbott 1534*, cystocarpic, Kiahoi Island off Puna, 14. VIII. 1945, leg. R. W. Hiatt; Oahu Island: *Abbott 1549*, Halona, 9. II. 1945; *Doty 17158*, Hanauma Bay, 26. XII. 1954, leg. M. Oguri; *Hastings 91*, Diamond Head below the Light-house, VI. 1967, leg. C. F. Hastings.

OTHER DISTRIBUTION: Tahiti (Friendly Islands, type locality); Tonga Islands; at 6 Siboga stations in Indonesia and New Guinea; Yonakuni Island (Ryukyus archipelago); Mauritius.

In habit resembling *Coelarthrum boergesenii* but a larger thallus with larger segments differing in cross section.

The rather cumbersome author citation in this binomial is due to several unusual circumstances. Grunow (1874) was first to publish Agardh's diagnosis of *Chylocladia podagrica*, based on an exiccata name of Harvey's "Friendly Islands Algae" which was a *nomen nudum*. He used *Erythrocolon*, attributing the name to J. Agardh, as a subgenus. In 1876, J. Agardh himself published *Erythrocolon* as a subgenus of *Chylocladia* and only raised it to genus rank in 1896 when he said (translated from the Latin): "In writing the *Epicrisis* [J. Agardh, 1876] I brought together as a peculiar subgenus under the cited name [*Erythrocolon*] with a question mark and certain species described by Harvey under the name *Chylocladia*, concerning which I even then said that they perhaps constitute an autonomous genus, which, however, since the fruits were unknown, could not be more certainly defined by me." In the 1896 paper, J. Agardh failed to use the binomial *Erythrocolon podagrica*, and it was only in 1931 that Kylin used this combination of names as genus and species. It should be noted that at no time was there any doubt as to which specimens were meant to bear the name, they being scarce enough not to add to the confusion. To our knowledge, there are only 12 specimens of this species that have been cited previously in the literature. We have examined all but the three lost in the Hamburg Museum bombings.

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