Regarding *Kallymenia* J.Agardh, 1842, *Euhymenia* Kützing *nom. illeg.* 1843, and the proposal of *Croisettea gen. nov.* (*Kallymeniaceae*, Rhodophyta)

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Saunders *et al.* (2017) proposed the reinstatement of *Euhymenia* Kützing (1843) as a genus to accommodate three species that in their molecular phylogenetic analysis were in a distinct clade in their multigene alignment trees. These three species were *E. requienii* (J.Agardh) Kützing, designated as "lectotype", together with *E. australis* (Womersley & R.E.Norris) G.W.Saunders and *E. tasmanica* (Harvey) G.W.Saunders.

In the *Index Nominum Genericorum* (Farr & Zijlstra, 2018) the entry appears as: "*Euhymenia* Kuetzing, Phycol. Gen. 400. 14-16 Sep 1843. ≡ *Kallymenia* J. G. Agardh 1842" The triple bar symbol "≡" denotes that these two generic names are homotypic synonyms, in other words, names with the same type.

Euhymenia originated with Kützing (1843: 400), and he assigned to this genus three species: *E. requienii* (J.Agardh) Kützing, *E. reniformis* (Turner) Kützing, and *E. lactuca* Kützing *nom. illeg.,* this last species being based on *Sphaerococcus lactuca* C.Agardh, *nom. illeg*. Kützing did not indicate a type for the genus. It is not clear why Kützing (1843) proposed the new name *Euhymenia* when he was aware of J. Agardh's *Kallymenia* validated in the previous year (J.Agardh 1842) with two of the same species (*K. reniformis* and *K. requienii*) that Kützing assigned to his *Euhymenia*. The explanation for Kützing's action later became apparent in Kützing's (1849) *Species algarum* where he has this entry:

> "492. EUHYMENIA. Kg. Phyc. Gener. p. 400.
> (Kallymenia *J. Ag.* non Calymenia *Nutt*.)"

It is now obvious that Kützing regarded J. Agardh's *Kallymenia* as too similar to the flowering-plant genus *Calymenia* [introduced by Persoon (1805), not Nuttall] placed by ING in the *Nyctaginaceae*, and thus he proposed a replacement name. This is the only plausible explanation for Kützing's introduction of *Euhymenia*. Kützing persisted in recognizing *Euhymenia* (Kützing 1845, 1847, 1849), and in Kützing (1867) 12 species of *Euhymenia* are recognised. Kützing's contemporaries and later workers, however, did not follow him in recognizing *Euhymenia*, although J. Agardh (1876: 222) recognized the name *Euhymenia* as a subgenus or section of *Kallymenia*, with three species but not any of the three species originally assigned to the genus *Euhymenia* by Kützing. Later, J. Agardh (1892: 65) recognized subgenus *Euhymenia* within *Kallymenia* and containing six species, including *K. requienii*. *Euhymenia* has long been regarded as congeneric with *Kallymenia* (e.g., Schmitz, 1889; Schmitz & Hauptfleisch, 1897; De Toni, 1897; Feldmann, 1942; Kylin, 1956; Schneider & Wynne, 2007). The fact is that *Euhymenia*, as it included the same two species as the valid and legitimate genus *Kallymenia* J.Agardh, must be regarded as a superfluous name and is thus illegitimate.

With his statement "*Bei jeder einzelnen Gattung habe ich die typische Species namentlich aufgeführt*", Schmitz (1889: 436) clearly designated the type or lectotype species of most red algal genera then recognized, and that included *Kallymenia reniformis* (Turner) J.Agardh (Schmitz 1889: 441, '*Callymenia'*). Although that lectotypification of *Kallymenia* has traditionally been accepted (e.g., Kylin, 1956; Norris, 1957; Irvine, 1983; Womersley, 1994), a contrary opinion was offered by Athanasiadis (2016: 649), who regarded *K. requienii* (J.Agardh) Kützing as the lectotype. Athanasiadis cited Montagne (1846: 112) as the source for this lectotypification citing Montagne's words "Icon Analyt. Nostra. t.10, fig. 4" which is of *Kallymenia requienii*. This clearly does not

accord with Art. 7.11 of the ICN (Turland *et al*., 2018), which states that "the term 'type' (typus) or an equivalent…" must be used to designate a lectotype.

A new generic name is thus proposed for *Euhymenia sensu* Saunders *et al*. (2017):

Croisettea M.J.Wynne, *gen. nov.*
Thallus a blade, membranous to tough consistency, ranging from broadly foliose to slightly lobed or deeply lobed, with strap-shaped branches (as in *C. australis*); stipitate at base; cortex of 2-3 layers of small cells at surface and one or two layers of elongated cells internal to outer cortex; medulla filamentous and laxly organized, consisting of a plexus of narrow filaments and stellate cells; non-procarpic; carpogonial-branches and subsidiary cells are elongate; carpogonial branch 2- or 3-celled; the supporting cell is variable, carpogonial branch system being monocarpogonial in *C. requienii* and *C. tasmanica*, but polycarpogonial in *C. australis*. Fusion cells, where observed, are conspicuous, deeply lobed, incorporating both the supporting and subsidiary cells and producing long connecting filaments. Auxiliary cell bearing up to 6 subsidiary cells; gonimoblast filament developing from the auxiliary cell or from the connecting filament near the site of fusion with auxiliary cell. Branched chains of carposporangia are formed. Tetrasporangia scattered in outer cortex.

The generic description is derived from information in Saunders *et al.* (2017, for *C. requienii*), Rodriguez-Prieto & Hommersand (2009, for *C. requienii*), and Womersley & Norris (1971, for *C. australis* and *C. tasmanica*).

Etymology: *Croisettea* formed from Cap Croisette, Marseille, France, the type locality for the type (*Rhodymenia* [*'Rhodomenia'*] *requienii* J. Agardh, 1841).

Type: ***Croisettea requienii*** (J.Agardh) M.J.Wynne, *comb. nov.*
Basionym: *Rhodymenia requienii* J.Agardh *Linnaea* 15: 12, 1841.
Representative DNA barcode: KJ0834090 (COI-5P). Saunders *et al.* (2017).
Homotypic synonyms: *Kallymenia requienii* (J.Agardh) J.Agardh, 1842.
Euhymenia requienii (J.Agardh) Kützing, 1843

The following two species are also representative of the genus:

Croisettea australis (Womersley & R.E.Norris) M.J.Wynne, *comb. nov.*
Basionym: *Cirrulicarpus australis* Womersley & R.E.Norris *Australian Journal of Botany* (Suppl. 2): 19, figs 39-43, 90, 1971.
Homotypic synonym: *Euhymenia australis* (Womersley & R.E.Norris) G.W.Saunders in G.W.Saunders *et al.,* 2017.

Croisettea tasmanica (Harvey) M.J.Wynne comb. nov.
Basionym: *Kallymenia tasmanica* Harvey Algae. Part III. *Flora tasmaniae*: 325, 1859.
Homotypic synonym: *Euhymenia tasmanica* (Harvey) G.W.Saunders (in Saunders et al. 2017).

According to Saunders *et al.* (2017) a total of ten genetic groups are apparent within the clade based on "*Kallymenia requienii*". A detailed account of the reproduction and anatomy of this species has been provided by Codomier (1972), whereas Rodríguez-Prieto & Vergés (2001) reported on its geographical distribution, habitat and phenology. Saunders *et al.* (2017) provided evidence that *Croisettea* (as *Euhymenia*) *tasmanica* was a "morphospecies" comprised of at least four genetic groups, apparently representing distinct species, but they considered that additional taxonomic work was required to sort these entities into discrete taxonomic units.

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Agardh, C.A. (1822-1823). *Species algarum*… Lundae [Lund]. Pp. [i-vii] + 169-398 (1822), 399-531 (1823).

Agardh, J.G. (1841). In historiam algarum symbolae. *Linnaea* 15: 1-50, 443-457.

Agardh, J.G. (1842). *Algae maris Mediterranei et Adriatici*, observationes in diagnosin specierum et dispositionem generum. pp. [i]-x, 1-164. Parisiis [Paris]: Apud Fortin, Masson et Cie.

Agardh, J.G. (1876). *Species genera et ordines algarum*. Volume 3. Part 1. Epicrisis systematis Floridearum. Pp. [ii*-iii*], [i]-[viï], [1]-724. Lipsiae [Leipzig]: C.W.K. Gleerup.

Agardh, J.G. (1892). Analecta algologica. *Acta Universitatis Lundensis* 28(6): 1-182, 3 pls.

Athanasiadis, A. (2016). *Phycologia Europaea Rhodophyta Vol. I*. pp. [i]-xxxxviii, 1-762. Thessaloniki: Published and distributed by the author.

Codomier, L. (1972 '1971'). Recherches sur les *Kallymenia* (Cryptonemiales, Kallymeniacées). I. Les espèces Méditerranéennes. *Vie et Milieu* 22A(1): 1-54, 28 figs.

De Toni, G.B. (1897). *Sylloge algarum omnium hucusque cognitarum. Vol. IV. Florideae. Sectio I*. pp. [i]-xx, [i]- lxi + [1]- 388. Patavii [Padua]: Sumptibus auctoris.

Farr, E.R. & Zijlstra, G. (eds.) (2018). Index Nominum Genericorum (Plantarum). [Online.] Available from http://botany.si.edu/ing [accessed 12 Sept. 2018].

Feldmann, J. (1942). Les *Kallymenia* (Rhodophycées, Cryptonemiales) des côtes d'Algérie. *Bulletin de la Société d'Histoire Naturelle de l'Afrique du Nord* 33: 7-14.

Harvey, W.H. (1859). Algae. Part III. Flora Tasmaniae. In: *The botany of the Antarctic voyage of H.M. discovery ships Erebus and Terror, in the years 1839-1843, under the command of Captain Sir James Clark Ross...Part III. Flora Tasmaniae. Monocotyledones and Acotyledones*. (Hooker, J.D. Eds) Vol. II, pp. 282-343. London: Lovell Reeve

Irvine, L.M. (1983). *Seaweeds of the British Isles. Volume 1. Rhodophyta. Part 2A. Cryptonemiales (sensu stricto), Palmariales, Rhodymeniales*. pp. [i]-xii, [1]-115. London: British Museum (Natural History).

Kützing, F.T. (1843). *Phycologia generalis* oder Anatomie, Physiologie und Systemkunde der Tange. Mit 80 farbig gedruckten Tafeln, gezeichnet und gravirt vom Verfasser. pp. [part 1]: [i]-xxxii, [1]-142, [part 2:] 143-458, 1, err.], pls 1-80. Leipzig: F.A. Brockhaus.

Kützing, F.T. (1845). *Phycologia germanica*, d. i. Deutschlands Algen in bündigen Beschreibungen. Nebst einer Anleitung zum Untersuchen und Bestimmen dieser Gewächse für Anfänger. pp. [i]-x, [1]-340 ['240']. Nordhausen: zu finden bei Wilh. Köhne.

Kützing, F.T. (1847). Diagnosen einiger neuen ausländischen Algenspecies, welche sich in der Sammlung des Herrn Kammerdirectors Klenze in Laubach befinden. *Flora, Regensburg* 30: 773-776.

Kützing, F.T. (1849). *Species algarum*. pp. [i]-vi, [1]-922. Lipsiae [Leipzig]: F.A. Brockhaus.

Kützing, F.T. (1867). *Tabulae phycologicae*; oder, Abbildungen der Tange. Vol. XVII pp. [i-iii], 1-30, 100 pls. Nordhausen: Gedruckt auf kosten des Verfassers (in commission bei W. Köhne).

Kylin, H. (1956). *Die Gattungen der Rhodophyceen*. pp. i-xv, 1-673, 458 figs. Lund: C.W.K. Gleerups.

Montagne, [J.F.] C. (1846). Flore d'Algérie. Ordo I. Phyceae Fries. In: *Exploration scientifique de l'Algérie pendant les années 1840, 1841, 1842...Sciences physiques. Botanique. Cryptogamie*. (Durieu De Maisonneuve, M.C. Eds) Vol. 1, pp. 1-197. Paris: Imprimerie Royale, publiée par ordre du Gouvernement et avec le concours d'une Commission Académique.

Norris, R.E. (1957). Morphological studies on the Kallymeniaceae. *University of California Publications in Botany* 28: 251-334, 25 figs., pls 28-40.

Persoon, C.H. (1805). *Synopsis plantarum, seu Enchiridium botanicum, complectens enumerationem systematicam specierum hucusque cognitarum / curante Dr. C.H. Persoon*. Pars Prima. Parisiis Lutetiorum: apud C.F. Cramerum et Tubingae, apud J.G. Cottam. xii + [ii] + 546 pp.

Rodríguez-Prieto, C. & Hommersand, M.H. (2009). Behavior of the nuclei in pre- and postfertilization stages in *Kallymenia* (Kallymeniaceae, Rhodophyta). *Phycologia* 48: 138-155.

Rodríguez-Prieto, C. & Vergés, A. (2001). Geographical distribution, habitat and reproductive phenology of the genus *Kallymenia* (Gigartinales, Rhodophyta) from Catalonia, Spain. *Botanica Marina* 44: 479-492, 16 figs., 2 tables.

Saunders, G.W., Huisman, J.M., Vergés, A., Kraft, G.T. & Le Gall, L. (2017). Phylogenetic analyses support the recognition of ten new genera, ten new species and 16 new combinations in the Kallymeniaceae (Gigartinales, Rhodophyta) *Cryptogamie, Algologie* 38: 79-132, 125 figs.

Schmitz, F. (1889). Systematische Übersicht der bisher bekannten Gattungen der Florideen. *Flora oder Allgemeine botanische Zeitung* 72: 435-456, pl. XXI.

Schmitz, F. & Hauptfleisch, P. (1897). Gigartinaceae. In: *Die natürlichen Pflanzenfamilien nebst ihren Gattungen und wichtigeren Arten insbesondere den Nutzpflanzen unter Mitwirkung zahlreicher hervorragender Fachgelehrten, Teil 1, Abteilung 2*. (Engler, A. & Prantl, K. Eds), pp. 352-366. Leipzig: verlag von Wilhelm Engelmann.

Schneider, C.W. & Wynne, M.J. (2007). A synoptic review of the classification of red algal genera a half a century after Kylin's "*Die Gattungen der Rhodophyceen*". *Botanica Marina* 50: 197-249.

Turland, N. J., Wiersema, J. H., Barrie, F. R., Greuter, W., Hawksworth, D. L., Herendeen, P. S., Knapp, S., Kusber, W.-H., Li, D.-Z., Marhold, K., May, T. W., McNeill, J., Monro, A. M., Prado, J., Price, M. J. & Smith, G. F. (editors.) (2018). *International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017*. Regnum Vegetabile 159. Glashütten: Koeltz Botanical Books.

Womersley, H.B.S. (1994). *The marine benthic flora of southern Australia - Part IIIA - Bangiophyceae and Florideophyceae (Acrochaetiales, Nemaliales, Gelidiales, Hildenbrandiales and Gigartinales sensu lato)*. pp. 1-508, 167 figs, 4 pls, 4 maps. Canberra: Australian Biological Resources Study.

Womersley, H.B.S. & Norris, R.E. (1971). The morphology and taxonomy of Australian Kallymeniaceae (Rhodophyta). *Australian Journal of Botany* (Suppl. 2): 1-62, 108 figs