

***Gelidiocolax* N.L.Gardner (*Pterocladophilaceae*, *Rhodophyta*), a genus new to Britain**

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Red algal parasites, found only on members of the phylum Rhodophyta, are generally small white or pinkish hemispherical lobed or unlobed pustules or clusters of minute blades often overlooked because of their inconspicuous nature, although a “good hand lens will easily reveal their presence” (Gardner 1927). They are generally taxonomically closely related to their hosts and are known from nine orders of the red algal class *Florideophyceae*: *Gelidiales*, *Ceramiales*, *Corallinales*, *Gigartinales*, *Gracilariales*, *Halymeniales*, *Palmariales*, *Plocamiales*, and *Rhodymeniales*. Some 120 species have been described worldwide (Preuss & al. 2017). Helpfully, many parasitic genera of algae were described with the suffix “-colax” (κολαξ m.: flatterer, Greek), but not all.

Genera reported from Britain and Ireland that include parasites are *Apoglossocolax*, *Asterocolax*, *Callocolax*, *Choreocolax*, *Coccotylus*, *Harveyella*, *Holmsella*, *Rhodophysema* and *Rhodymeniocolax*. The genera *Coccotylus* and *Rhodophysema* include the formerly parasitic genera *Ceratocolax* and *Halosacciocolax*, respectively (see Brodie & al. 2016).

The red algal genus *Gelidiocolax** N.L.Gardner (Gardner 1927a: 341) was described from Balboa Beach, Orange County, California with a single parasitic species, *Gelidiocolax microsphaericus* N.L.Gardner (as “*microsphaerica*”) found on *Gelidium pulchrum* N.L.Gardner (Gardner 1927b: 279, pls 50–53). The parasite was white, spherical and 175–225 µm in diameter, and Gardner (1927: 341) described cystocarps, spermatangia (as “antherozoids”) and tetrasporangia. The type is preserved as UC 296573.

Nine other species of the genus have since been described worldwide:

- *Gelidiocolax christiana*e Feldmann & G.Feldmann (Feldmann & Feldmann 1963: 567, figs 1–5, type locality “Cap du Troc, Banyuls-sur-Mer” [Pyrénées-Orientales, Mediterranean France])
- “*Gelidiocolax deformans*” Seoane-Camba, *nom. inval.* (Seoane-Camba 1982: 912, figs 1, 2; foto 1–4; intended type locality: Llanes, Asturias [Atlantic Spain])
- *Gelidiocolax desikacharyi* E.K.Ganesan (Ganesan 1973: 94, figs 1–10, 12–18, as “*desikachariae*”; type locality: Manzanillo, Isla de Margarita, Venezuela)
- *Gelidiocolax lyndae* R.E.Norris (Norris 1988: 349, figs 7–13, type locality: Shelly Beach, north of Uvongo, Natal, South Africa)
- *Gelidiocolax margaritoides* (M.T.Martin & Pocock) K.-C.Fan & Papenfuss (Fan & Papenfuss 1958[1959?]: 33), basionym: *Choreocolax margaritoides* M.T.Martin & Pocock, 1953: 50, fig. 1 c–e; pl. 19: figs c–e; type locality: Kleinemonde, near Port Alfred, Cape Province South Africa)

* The genus name *Gelidiocolax* is masculine as are all genus names ending in “-colax” (κολαξ, m.)

- *Gelidiocolax mammillatus* K.–C.Fan & Papenfuss (Fan & Papenfuss 1959: 34, figs. 3, 6, 7, 9, 10; type locality: Hanauma Bay, Oahu, Hawaiian Islands)
- *Gelidiocolax pustulatus* E.C.Oliveira & Yoneshigue (Yoneshigue & Oliveira Filho 1984: 441, figs 1–8, as “*pustulata*”; type locality: Ilhas de Cabo Frio, Espírito Santo State, Brazil)
- *Gelidiocolax suhriae* (M.T.Martin & Pocock) K.–C.Fan & Papenfuss (Fan & Papenfuss 1959: 33), basionym: *Choreocolax suhriae* M.T.Martin & Pocock 1953: 48, fig. 1 a, b; pl. 10: figs 1 a, b, type locality: Blaauwberg, Cape Town, South Africa)
- “*Gelidiocolax verruculatus*” Ouahi & Najim *nom. inval.* (in Ouahi 1993; intended type locality in Morocco)

Two of these names are nomenclaturally invalid: a type was not designated for “*Gelidiocolax deformans*” Seoane-Camba, and “*Gelidiocolax verruculatus*” Ouahi & Najim was either not effectively published (Preuss & al. 2017: 23 “unpublished doctoral thesis”) or if it were, it was not valid according to Benhissoune & al. (2002: 392, 403, 408) as it lacked “either a Latin diagnosis or ... type material”.

Abélard & Cabioch (1983: 1, pls I, II) reported, with some doubt, the South African species *Gelidiocolax margaritoides* from two localities in Brittany, where it was found on *Gelidium latifolium* (Greville) Bornet and *Gelidium pusillum* (Stackhouse) Le Jolis. At this time, *G. pusillum* was considered to include a range of gelidioid taxa now regarded as separate (e.g., Fredriksen & al. 1994), including *Gelidium pulchellum* (Turner) Kützinger and *Gelidium attenuatum* (Turner) Thuret ex Bornet (Brodie & al. 2016). *Gelidium latifolium* is currently regarded, perhaps incorrectly, as a synonym of *Gelidium spinosum* (S.G.Gmelin) P.C.Silva, originally described from “*Mare mediterraneum et anglicum*” (Gmelin 1768: 161, pl. 18: fig. 3), but for which a informative type does not exist although Gmelin’s illustration (pl. 18: fig. 3) does closely resemble NE Atlantic plants, and *Gelidium latifolium*, with a different morphology from Mediterranean plants, was described from England [Sidmouth, South Devon, as *Gelidium corneum* var. *latifolium* Greville (Greville 1830: 143), lectotype at E]. Similar plants, also under the name *Gelidiocolax margaritoides*, were later reported from Morocco (Cremades & Bárbara 1990), Spain (Bárbara & Cremades 1996) and Portugal (Cremades & al. 2002). “*Gelidiocolax deformans*” had earlier been described from Spain (Seoane-Camba 1982), where it occurs on *Gelidium sesquipedale* (Clemente) Thuret [now *Gelidium corneum* (Hudson) J.V.Lamouroux] and *Gelidium cantabrica* Seoane-Camba, a species closely related to *Gelidium corneum*. “*Gelidiocolax deformans*” is reported as forming fertile pustules at a smaller size than *Gelidiocolax margaritoides* (< 200 µm) and with larger tetrasporangia when mature. Unfortunately, *Gelidiocolax deformans* remains a nomenclaturally invalid name as no type has been designated.

Small, white or buff-coloured pustules (Figs 1–6) were found on *Gelidium pulchellum* in rock pools at Chimney Rocks, Penzance, Cornwall, England, on 6 March 2018 by one of us (DF). The pustules were generally bright white in reflected light and translucent or buff in transmitted light (cf. Figs 2–4), ranged from 150–250 µm in diameter and were fertile with tetrasporangia (Figs 9, 10) measuring 10–20 x 5–10 µm. The parasitic pustules were sometimes clustered in small groups (Fig. 3) but more often were solitary (Figs 1–4). Only tetrasporangial plants were found.

Additional plants were collected by DF at Portreath, Cornwall, 21 April 2018 (Figs 7–10), on what appeared to be worn plants of *Gelidium attenuatum* in rock pools (Figs 7, 8). The parasitic pustules

were again either solitary (Fig. 7) or clustered in a mass that seemed to be disrupting the host thallus causing irregular branching (Fig. 8). Only tetrasporangial plants were found.

These *Gelidiocolax* specimens seem to be identical to those described from the other side of the Channel (Santec and Beg-an-Fry, Brittany) by Abélard & Cabioch (1983: 1–3, pls I, II) and with photographs of *Gelidiocolax margaritoides* from Spain and Portugal kindly provided by Dr Ignacio Bárbara (and shown under this name on AlgaeBase; Guiry & Guiry 2020). Superficially, the English, French, Spanish, Portuguese and Moroccan plants all seem to represent the same species.

The question arises as to the identification of this little parasite as *Gelidiocolax margaritoides*, a species originally described growing on *Gelidium pinnatifidum* (J.Agardh) F.Schmitz, *nom illeg.* [now *Ptilophora pinnatifida* J.Agardh] from South Africa. This determination was first made by Abélard & Cabioch (1983) on the basis of the size of the thallus and of the tetrasporangia. However, the exact determination of the status of *Gelidiocolax* from the NE Atlantic can only be arrived at definitively by sequencing its genome and that of the various species of the genus, including the invalid species “*Gelidiocolax deformans*” described from Llanes, Asturias (Spain) parasitic on *Gelidium cantabricum* and *Gelidium corneum*, and which may be the correct name for all *Gelidiocolax* specimens in the area as the size range of the various pustules and their development seem too close to distinguish two entities on morphological grounds.

The status of the genus *Gelidiocolax* also requires further study as there may be no genetic basis for separating *Gelidiocolax* species from their host or from other genera, just as there was found to be no basis for separating *Halosacciocolax* from *Rhodophysema* (Clayden & Saunders 2010; Saunders & Clayden 2010) or *Ceratocolax* from *Coccotylus* (Le Gall & Saunders 2010).

Gelidiocolax is currently referred to the family *Pterocladophilaceae*, which is treated as a family of uncertain systematic position in the Florideophyceae (Athanasiadis 2016) containing only the parasitic genera *Pterocladophila*, *Holmsella* and *Gelidiocolax*, but this also requires further investigation. *Pterocladophila* K.–C.Fan & Papenfuss was described from *Pterocladia lucida* Lindauer (*Gelidiaceae*) from New Zealand.

Finally, even in Britain and Ireland with over two centuries of intense phycological activity, red algal parasites are rarely reported because of their inconspicuous nature (Fig. 1) and because they often resemble galls and other monstrosities. For example, *Rhodophysema lundii* (Edelstein) C.W.Schneider & M.J.Wynne, a tiny parasite of *Palmaria palmata* (Linnaeus) Weber & F.Mohr has been reported only from Britain and Ireland a handful of times (Irvine & Guiry 1983), but is actually quite common and widespread in more northern Atlantic and Arctic Oceans. Other such parasites likely have broader ranges than reported, again for the reasons outlined above.

Many thanks to Dr Ignacio Bárbara for helpful discussion and information.

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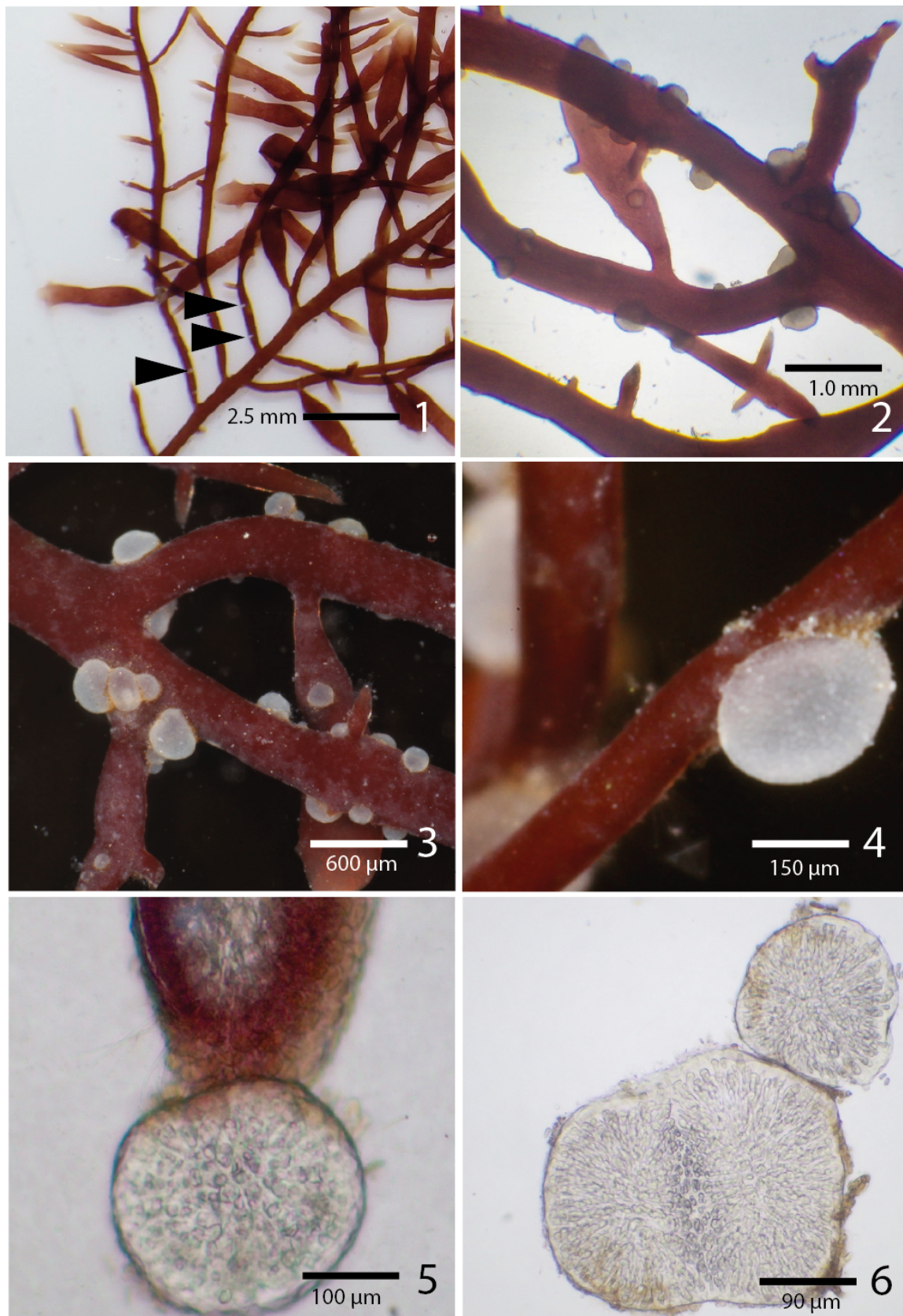
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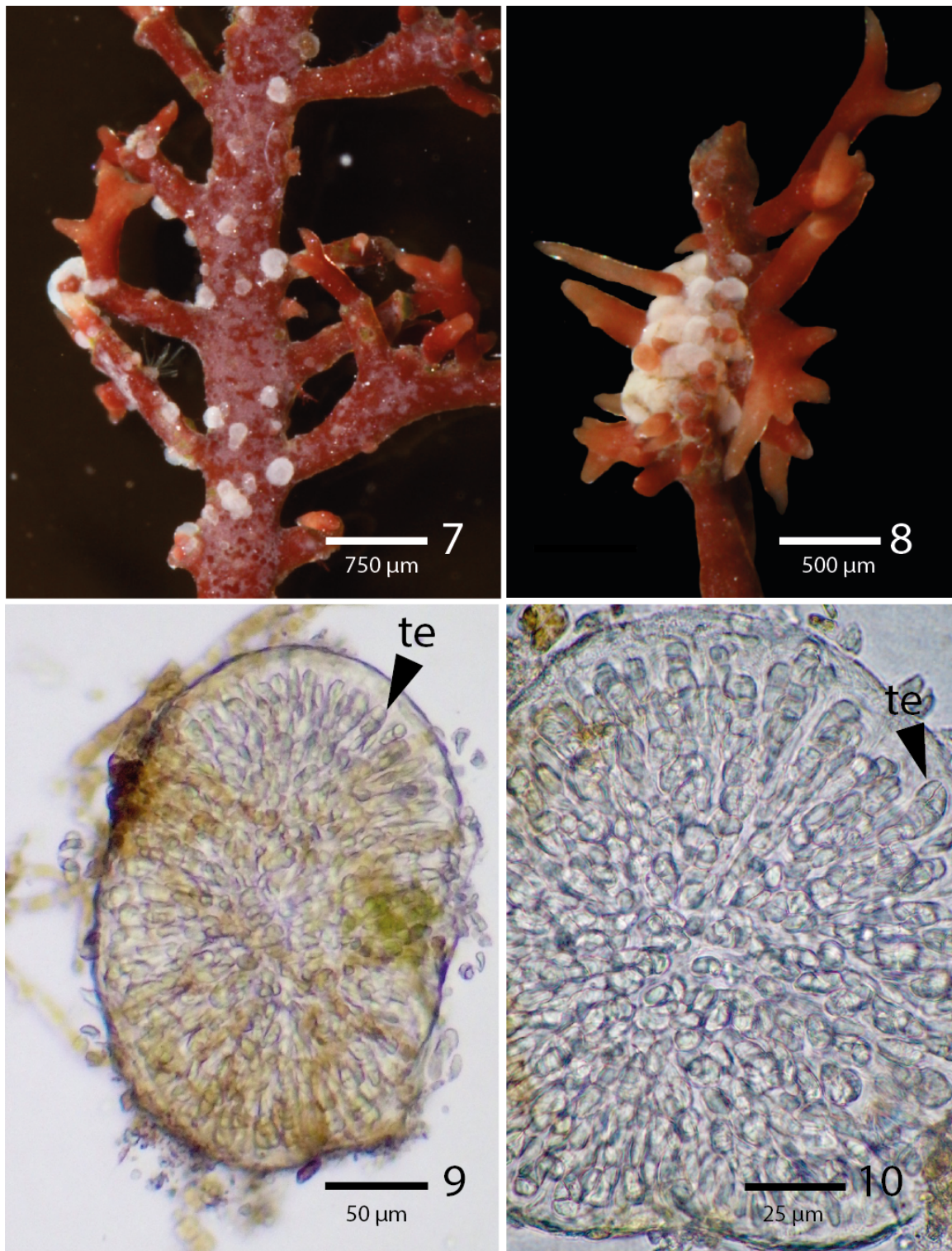
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Figs 1–6. *Gelidiocolax margaritoides* on *Gelidium pulchellum*. Chimney Rocks, Penzance, Cornwall, England, 6 March 2018. **Figs 1.** Inconspicuous pustules on host (arrows). **Figs 2–4** Close-up of pustules in transmitted and reflected light. **Figs 5, 6.** Tetrasporangial pustules in transmitted light.



Figs 7–9. *Gelidiocolax margaritoides* on *Gelidium* sp. Portreath, Cornwall, 21 April 2018. **Figs 7, 8.** Parasite in reflected light. **Figs 9, 10.** Tetrasporangial pustules in transmitted light (**te**: tetrasporangia).