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Typification and the current taxonomic status of *Laminaria agarum* var. *asiaticum* and *Laminaria boryi* (Agaraceae, Laminariales)

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ABSTRACT

Lectotypes are designated for *Laminaria agarum* var. *asiaticum* and *Laminaria boryi* and a historical background for the typification of these names is provided. These taxa were described by De la Pylaie in 1830, according to materials collected from Kamchatka (northwest Pacific) and Newfoundland (northwest Atlantic), respectively. Based on the modern data of morphological features and distributional range of *Agarum* species in the World Ocean, we consider these taxa as synonyms of *Agarum clathratum* subsp. *clathratum*, that has wide distribution in the Northern Hemisphere.

Keywords: lectotypification, taxonomic revision, Kamchatka, Newfoundland, *Laminaria agarum* var. *asiaticum*, *Laminaria boryi*, Laminariales

РЕЗЮМЕ

Климова А.В., Клочкова Т.А., Клочкова Н.Г. Типификация и современный таксономический статус *Laminaria agarum* var. *asiaticum* и *Laminaria boryi* (Agaraceae, Laminariales). В статье обозначены лектотипы названий *Laminaria agarum* var. *asiaticum* и *Laminaria boryi* и дано историческое обоснование для их типификации. Эти таксоны были описаны де Ла Пилляе в 1830 г. по материалам, собранным у берегов Камчатки (северо-западная часть Тихого океана) и Ньюфаундленда (северо-западная часть Атлантического океана). На основе современных данных по морфологии и распространению представителей рода *Agarum* в Мировом океане, предложено рассматривать указанные выше таксоны в качестве синонимов широко распространенной в Северном Полушарии ламинариевой водоросли *Agarum clathratum* subsp. *clathratum*.

Ключевые слова: лектотипификация, таксономическая ревизия, Камчатка, Ньюфаундленд, *Laminaria agarum* var. *asiaticum*, *Laminaria boryi*, Laminariales

The first member of the genus *Agarum* Dumort. was described as *Fucus agarum* S.G. Gmelin in the second half of the 18th century (Gmelin 1768). Before segregation of the genus *Agarum* by Dumortier into a single taxon in 1822, its members were designated under different generic names, including also the genus *Laminaria* J.V. Lamour. (Agardh 1817). In 1840, species of *Agarum* and related taxa (viz. *Costaria* Grev., *Thalassiophyllum* Postels & Rupr.) were included in the family Agaraceae by Postels & Ruprecht (1840). Species of *Agarum* are important in sublittoral habitats because they often dominate communities at a depth of 10 to 30 m (Gagnon et al. 2005).

As discussed in the present study, *Laminaria agarum* (S.G. Gmelin) C. Agardh var. *asiaticum* Bach.Pyl. and *L. boryi* Bach.Pyl. show a typical morphology for members of the genus *Agarum*. Typification of these two names allows clarification of the taxonomic status of these taxa with subsequent synonymising of them with *Agarum clathratum* Dumort.

Our study is based on an analysis of algological literature (Gmelin 1768, Stackhouse 1816, Agardh 1817, Dumortier 1822, Bory 1826, De la Pylaie 1830, Postels & Ruprecht 1840, Silva 1991, Boo et al. 2011, Kawai et al. 2017). The authors of this paper have examined living populations of *Agarum* species in the field on the different coasts of Russian Far Eastern seas viz. southeast Kamchatka, Bering Island,

Kuril Islands and South Sakhalin. We also have studied herbarium specimens of *Agarum* that belong to the original material from the Komarov Botanical Institute RAS (LE) and other *Agarum* specimens using online herbarium databases at PC, BM, ALAJ, NHA, MASS, MAINE, FH and NY (open access <https://macroalgae.org/portal/>). Herbarium codes are given according to Triers (2020). Abbreviations of authors names are given according to IPNI (2020). The protologues, type specimens of all species, information from AlgaeBase (2020) and Index Nominum Algarum (2020) databases were analyzed during our research.

Historical background

The “Flora de l’Ile Terre-Neuve et des Filles Saint Pierre et Miquelon” by De la Pylaie (Bachelot de la Pylaie 1830) presents a floristic summary of marine macroalgae from Newfoundland, Saint Pierre and Miquelon based on the study of personal algal materials collected during his expedition on the frigate “Cybele” (1816–1819) in the northwest part of the Atlantic ocean (Gillot 1953), and also on the study of samples from marine algal collections held in Paris National Museum of Natural History (PC). While working with specimens from the museum, De la Pylaie consulted with Bory de St-Vincent. In his work, De la Pylaie described 72 species and 28 varieties of algae and propo-

sed the division of kelp into orders, sections and genera (Ordre, Sections and Genres; Bachelot de la Pylaie 1830: 23). Among genera included in his table Bachelot de la Pylaie (1830: 28) listed *Myriotrema* Bach.Pyl. and its type species “*Lam. agarum*”. However, the latter species corresponds to the description of the genus *Agarum* in its modern understanding. Among laminariacean algae, he listed *Laminaria boryi* and *Laminaria agarum* (Bachelot de la Pylaie 1830: 28). The first species, *L. boryi*, was described as a novel taxon and in the case of the second species, which was previously described by Agardh (1817), De la Pylaie (1830: 28) described a new variety, *Laminaria agarum* var. *asiaticum*, with plants having unbranched stipe and perforated blade with a central midrib, which differed from the typical form of this species. Nowadays, species with that morphology belong to *Agarum*.

By the time De la Pylaie’s work was published, *Agarum* species had been known under the generic names *Orgyia* (Stackh.) Duby (1816), *Laminaria* (1817) and *Agarum* Bory (1826). Prior to Silva’s publication (Silva 1991), Bory de Saint-Vincent was considered as the author of the genus *Agarum* (Postels & Ruprecht 1840, Klochkova 1998). Silva (1991) clarified that the authorship of the genus belonged to Dumortier (1822), since he published a description of *Agarum* four years earlier than Bory (1826). Thus, the name, *Myriotrema*, should be treated as a superfluous name, according to Articles 52.1, and 52.2 of the ICN (Turland et al. 2018).

The new variety, *Laminaria agarum* var. *asiaticum*, was described by De la Pylaie based on the specimen from Kamchatka, which was held in Bory de Saint-Vincent’s collection (Bachelot de la Pylaie 1830: 28). However, he did not indicate collection site, time or collector in the protologue and did not provide an illustration of the specimen. In his description of *Laminaria agarum* var. *asiaticum*, de la Pylaie noted that it differed from the typical variety of *L. agarum* (= *A. clathratum*) in having oval-shaped basal part of the blade and thus could be identified as a separate species, if only this character was stable “*cette plante pourrait être considérée comme espèce, si sa forme était constante*” (De la Pylaie 1830: 28).

After studying Bory de Saint-Vincent’s specimens, De la Pylaie also described the species *Laminaria boryi* (De la Pylaie 1830: 28). In his protologue, he indicated the collection site, “*Terre-Neuve*” [Newfoundland], and the collector, Lamouroux. He also provided size characteristics in the species description (40–50 cm long and 30 cm wide) and noted the presence of a thin smooth-edged blade. However, he did not illustrate *L. boryi*.

Typification

Bory de Saint-Vincent’s collection is currently stored in the Herbarium of the Muséum National d’Histoire Naturelle, Paris (PC). In this collection, two herbarium sheets of *Agarum* collected near the coast of Kamchatka are present with the following annotations: “*Herbier Bory de St-Vincent*” and “*Orgyia Boryi*” (PC 0579383 and PC 0579386). Thus, it could be suggested that the generic name *Orgyia* was originally used for *Agarum* by Bory de Saint-Vincent, but he abandoned this name later and replaced it with *Agarum* (Bory 1826, De la Pylaie 1830: 24).

The herbarium sheet PC 0579383 (Fig. 1) contains a handwritten annotation in French “... *Laminaria agarum* β

asiaticum ... *Kamtchatka*...”, which most likely was made by De la Pylaie. In addition, the following label was later attached to this herbarium sheet “*Herb. G. Thuret; Agarum Turneri, Post. et Rupr.; Laminaria Agarum, var. Asiatica La Pylaie, Fl. de Terre-Neuve, p. 28*”. The first annotation clearly indicated that this specimen was studied by De la Pylaie and was used to describe var. *asiaticum*.

Another specimen from Kamchatka (PC 0579386) is represented by a fragment of the blade without central midrib, and it has an annotation “*Tilesius*” in its upper right corner and the following text in the lower part “*Fucus Clathrus ... Agarum Gmelin Camtschatca ... Par Tilesius*”. According to information on its label, this specimen was later identified as *Agarum cribrosum* Bory by Rostafuiski. To the best of our knowledge, Bory de Saint-Vincent’s collection does not contain other specimens from the genus *Agarum* collected near the coast of Kamchatka and identified as “*Laminaria agarum* var. *asiaticum*”.

In addition to the herbarium sheets discussed above, Bory de Saint-Vincent’s collection in PC includes three specimens (PC 0579387, PC 0579390, PC 0579391) collected from the northwest Atlantic and identified as “*Orgyia Boryi*”. For each specimen, the collector was indicated as Dèspréaux (PC 0579387), Lyngbye (PC 0579390), and Lamouroux (PC 0579391). Several handwritten annotations in French are present on PC 0579391 (Fig. 2), such as “*Orgyia Boryi*” and “*A fronde mince, ... ovale: ... par Lamouroux en 1824; Comme de Terre-Neuve*”. In addition, it has two labels, each having the mark “*Herb. G. Thuret*”. Also, one of these labels has an annotation “*Agarum Turneri, Post. et Rupr.; Laminaria Boryi, La Pylaie (Fl. de Terre-Neuve, p. 28)*” and another has the note “*Agarum cribrosum, Bory ...*”. It is noteworthy that the collection site and collector correspond to those indicated in the protologue of *L. boryi* (Bachelot de la Pylaie 1830). Therefore, we believe that PC 0579391 is an authentic specimen and was used to describe *L. boryi*.

Thus, according to ICN Art. 9.11 (Turland et al. 2018), we selected lectotypes for *L. agarum* var. *asiaticum* and *L. boryi* from Bory de Saint-Vincent’s collection.

Current taxonomic status of *Laminaria agarum* var. *asiaticum* and *L. boryi*

The names, *Laminaria agarum* var. *asiaticum* and *L. boryi*, are validly published according to the ICN (Turland et al. 2018). However, these names were not mentioned in taxonomic revisions of the genus *Agarum* (Silva 1991, Boo et al. 2011, Kawai et al. 2017). The only reference to *L. boryi*, excluding the original description by De la Pylaie (1830: 28), is available in the INA database (Silva 2020). *L. agarum* var. *asiaticum* is also indicated here as an unconfirmed identification (“cf.”) and listed as *Agarum asiaticum*. The record of *A. asiaticum* is available in AlgaeBase (Guiry & Guiry 2020). In all cases only the original source (De la Pylaie 1830: 28) is cited when referring to these taxa. De la Pylaie did not publish the name *A. asiaticum* in his article (1830: 28) and furthermore, to our knowledge, the transfer of *L. agarum* var. *asiaticum* into the genus *Agarum*, according to the ICN rules, was not made. The absence of mentions of *Laminaria agarum* var. *asiaticum* and *L. boryi* in the current revisions and



Figure 1 Lectotype of *Laminaria agarum* var. *asiaticum* De la Pylae ([PC0579383, digital image!], PC, Lectotype). Image of the lectotype is available at <https://science.mnhn.fr/institution/mnhn/collection/pc/item/pc0579383?listIndex=74&listCount=115>



Figure 2 Lectotype of *Laminaria boryi* De la Pylaie (Lamouroux s.n. [PC0579391, digital image], PC, Lectotype). Image of the lectotype is available at <https://science.mnhn.fr/institution/mnhn/collection/pc/item/pc0579391?listIndex=80&listCount=115>

floristic studies gives us a reason not to consider them as accepted taxa.

During the last 10 years, several taxonomic revisions were conducted for the genus *Agarum* (Boo et al. 2011, Kawai et al. 2017). Based on current analysis of their morphological and genetic characteristics, only two species, *A. clathratum* (1822: 102) and *A. turneri* (1840: 12), are accepted. Among them, only *A. clathratum* is widespread in the Northern Hemisphere and is found in the Pacific, Atlantic and Arctic oceans (Guiry & Guiry 2020). The remaining species are found only near the Asian coast of the Pacific Ocean. *A. turneri* is distributed from Kamchatka to Alaska, including the Aleutian Islands (Klochkova et al. 2009, Lindeberg & Lindstrom 2010, Boo et al. 2011). Both species, *A. clathratum* and *A. turneri*, were described from Kamchatka (Gmelin 1768, Postels & Ruprecht 1840).

A. clathratum and *A. turneri* are distinguished in gross morphology of sporophytes (i.e. blade shape, thick/flat midrib, perforations, locations of sporangial sori). The morphological features given in the protologues of *L. agarum* var. *asiaticum* and *L. boryi* uniquely correspond to the description of *A. clathratum* subsp. *clathratum* (neotype specimen, N. Klochkova 0011, LE), this clearly indicated that both taxa are conspecific with *A. clathratum*. We consider *L. agarum* var. *asiaticum* and *L. boryi* as heterotypic synonyms of *A. clathratum*.

Agarum clathratum subsp. *clathratum*

= *Laminaria agarum* var. *asiaticum* (as “*Laminaria agarum* β *asiaticum*”) De la Pylaie (1830: 28).

Lectotype (here designated): – RUSSIA. Kamchatka: Accurate location is not indicated, no date, collector is not identified (PC 0579383! [seen digital image!]). Figure 1.

= *Laminaria boryi* (as “*Laminaria Boryi*”) De la Pylaie (1830: 28).

Lectotype (here designated): – CANADA. Newfoundland: Accurate location not indicated, 1824, J.V. Lamouroux s.n. (PC 0579391! [seen digital image!]). Figure 2.

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