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**Short Communication**

Craig W. Schneider, Michael J. Wynne and Gary W. Saunders

**On the nomenclatural reinstatement and lectotypification of *Spyridia americana* Durant (1850)**

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**\*Corresponding author: Craig W. Schneider**, Department of Biology, Trinity College, Hartford CT 06106, USA, email: cschneid@trincoll.edu

**Michael J. Wynne**, Department of Ecology and Evolutionary Biology and Herbarium, University of Michigan, Ann Arbor, MI 48109, USA

**Gary W. Saunders**, Centre for Environmental & Molecular Algal Research, Department of Biology, University of New Brunswick, Fredericton, New Brunswick E3B 5A3, Canada

**Abstract:** Southern New England and New York specimens of *Spyridia filamentosa* were sequenced for the mitochondrial COI-5P and chloroplastic *rbcL* genes and determined to be distinct from Mediterranean (type locality) specimens of the same taxon. A little-known species name, *S. americana* Durant, is applied to specimens collected from the northeastern coast of the United States.

**Keywords:** *Spyridia americana*; *Spyridia filamentosa*, New England, New York, Rhodophyta

**Abbreviations:**

COI-5P, 5' region of the cytochrome oxidase subunit 1 gene

*rbcL*, ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit gene

bp, base pair(s)

The red alga *Spyridia filamentosa* (Wulfen) Harvey (Callithamniaceae, Ceramiales), based on *Fucus filamentosus* Wulfen (1803), was described early in the phycological literature from its type locality in the Adriatic Sea and since then has been reported with a broad distribution in the world's oceans from temperate to tropical seas (Harvey 1853, Guiry and Guiry 2020). This near cosmopolitan distribution was based upon the morphological similarity of specimens from distant locations. However, beginning early in the 21<sup>st</sup> century, molecular investigations of isolates of *S. 'filamentosa'* began to challenge the reported global distribution. The findings of these studies from several wide-ranging locations led either to the reinstatement of taxa that over time had been subsumed under *S. filamentosa* (Zuccarello et al. 2004) or the realization that multiple cryptic species were residing under this epithet (Zuccarello et al. 2002, Conklin and Sherwood 2012, Freshwater et al. 2017).

The vegetative and reproductive morphology of *Spyridia filamentosa* was described in detail by Hommersand (1963); however, given that the material studied was taken from La Jolla, California, and specimens from there have yet to be sequenced, we cannot know for certain whether the Pacific material that Hommersand utilized actually represented *S. filamentosa*. Based upon the genetic studies cited above, other descriptions and reports of this species from the world's temperate to tropical seas (e.g., Børgesen 1917, 1930, 1945; Collins and Hervey 1917; Farlow 1881; Harvey 1853; Taylor 1928, 1930, 1942; Womersley and Cartledge 1975; Zheng et al. 2001) likewise may not represent true *S. filamentosa*. This uncertainty will remain until a sampling of isolates from throughout the world is molecularly compared against material from the type locality.

In 1850, Charles F. Durant published his little known exsiccata "*Algae and Corallines of the Bay & Harbor of New York, Illustrated with Nature Types*" and included as No. 160 a new species, *Spyridia americana*, from Red Hook in Brooklyn. Durant collected his specimens from

July–September on *Zostera* and rocks at and below the low-water mark at Red Hook or floating in most parts of the Bay. Scores of unbound separates of No. 160 found their way to the New York Botanical Garden (NY), some possibly donated by Durant’s daughter (Silva 2004), many stamped and unlabeled and still stored in an envelope of duplicates from the Herbarium of the Staten Island Institute of Arts and Sciences. Because Durant (1850) noted that this species was abundant at “Red Hook, after the July storm”, perhaps the bulk of these specimens were gathered in profusion on this occasion, but that is not explicitly stated.

Just three years after Durant’s (1850) publication, Harvey (1853, p. 205), in the red algal portion of *Nereis Boreali-Americana*, identified his material of *Spyridia* from Massachusetts to New York (including citation of Red Hook collections) and Key West, Florida as *S. filamentosa*, with no mention of Durant’s *S. americana* from New York Harbor. Durant produced and published only 50 copies of his exsiccata, and these were sold to local subscribers or by New York book sellers (Silva 2004). Apparently, a copy of Durant's book never made its way to Harvey in Dublin, Ireland. In *Nereis Boreali-Americana*, Harvey (1853) also described and illustrated a new variety of *S. filamentosa* from Key West with recurved axes and branches as *S. filamentosa* var. *refracta* Harvey. Farlow (1881) and all contemporary and subsequent northeastern North American workers (e.g., Harvey 1881; Kingsbury 1969; Martindale 1889; Mathieson and Dawes 2017; Sears 2002; Taylor 1957) followed Harvey’s (1853) use of *S. filamentosa* for the region without mentioning *S. americana*. Interestingly, Farlow (1881) included var. *refracta* in his flora of southern New England for specimens with recurved axes. Oddly, Taylor (1957) cited Durant’s exsiccata in his northeastern North American flora, yet never mentioned any of the few new genera and species described within its pages in his taxonomy (Silva 2004, Wynne 2013). Likewise, other than two species that have been

taxonomically clarified from Durant's work since Taylor (1957), Mathieson and Dawes (2017) did not include any of the specimens collected in New York Harbor by Durant.

In a genetic study of what is presently known as *Spyridia filamentosa*, Zuccarello et al. (2002) sampled widely from throughout its cosmopolitan range including the western Mediterranean Sea somewhat near Italy, but not its type locality in the Adriatic Sea. The Italian sample (from Isla Ischia off the west coast of Italy; Cox2, GenBank AF458721) sequenced by Zuccarello et al. (2002) joined a clade of *S. filamentosa* specimens from the subtropical western Atlantic (Puerto Rico). Zuccarello et al. (2002) considered a second Mediterranean isolate (Possidi, Greece; GenBank AF458728) as a possible anthropogenically introduced alien into the basin due to its position in a clade with isolates from throughout the Pacific but not the Indian Ocean. They also demonstrated great variation among specimens from throughout its purported range recognizing the great hidden diversity in what is presently known as *S. filamentosa*, yet never formally described new species within the complex. Some taxonomic studies within *Spyridia* have gone further. A recent monograph of the species of *Spyridia* with uncinata spines (Won et al. 2021) necessitated a reorganization of the existing four taxa in the group including the reinstatement of *S. aculeata* (Decaisne) Kützing, a species now found with a broader distribution than the species with which it formerly was synonymized, *S. hypnoides* (Bory) Papenfuss (Papenfuss 1968).

As part of the Saunders laboratory's efforts to barcode much of northern North America's red, green and brown macroalgae, we gathered material of *Spyridia filamentosa* from southern New England and New York for sequencing (CWS 09-41-3 [EC049], coll. C. Schneider, 24 Aug. 2009, Barn I. boat launch, Stonington, Connecticut, 41°20'13.9"N, 71°52'32.0"W) and *S. filamentosa* var. *refracta* (CWS 07-4-15 [EC078], coll. C. Schneider, 6 Oct. 2007, Siasconset Beach, Nantucket I., Massachusetts, 41°15'40.5"N, 69°57'43.6"W; CWS 09-54-2 [EC009], coll.

A. Kivela, 11 Oct. 2009, Navy Rd., Montauk, Long I., New York, 41°02'33.84"N, 71°58'36.36"W). Portions of these specimens were fast-dried and ground for DNA extraction and subjected to PCR amplification and sequencing of their COI-5P and *rbcL* markers as outlined in Saunders and McDevit (2012) and Saunders and Moore (2013). We were unable to locate a genetic sample of *S. filamentosa* from Italy in the Adriatic Sea (type locality); however, we had access to COI-5P data for an isolate from Corsica, France (PC0616101, GenBank MW570738) off the west coast of Italy. We successfully generated COI-5P for EC049 (GWS044418; GenBank MW770746) and EC078 (GenBank MW770747) and these two sequences were identical over the 664 base pairs (bp) available for comparison, but 3.8% (24 substitutions over 640 bp) divergent from the COI-5P sequence for the specimen from Corsica. This level of divergence is consistent with a single species in New England that is distinct from the Corsican entity (e.g., Saunders and McDonald 2010). We also generated a full length *rbcL* marker for EC078 (GenBank MW770750), and *rbcL*-3P for EC009 (GWS044417; GenBank MW770748) and EC049 (GWS044418; GenBank MW770749). These sequences were identical over the 834 bp available for comparison, consistent with all three belonging to a single species. In BLAST searches of GenBank, the full length *rbcL* marker for EC078 was 5.2% divergent from its closest matches, sequences from two specimens of *Spyridia hypnoides* (KU756102, KU756103). All of the data point to a single species in New England with COI-5P indicating a separate species from the Corsican entity. As we were not using Cox2 in our genetic analyses, we could not compare our sequences to the Isla Ischia sample (to the south of the Corsican sample) that Zuccarello et al. (2002) identified as *S. filamentosa*.

As material from northeastern North America had already been described by Durant (1850) as *S. americana*, we reinstate this epithet long lost in the phycological literature and herein designate the bound No. 160 specimen [NY02348236] (herbarium abbreviations follow

*Index Herbariorum*, <http://sweetgum.nybg.org/science/ih/>) in “*Algae and Corallines of the Bay & Harbor of New York...*” (bound NY herbarium copy) as the lectotype (Fig. 1a). All of the distributed copies of Durant’s exsiccata, including a second copy in the library of NY, represent isolectotypes of No. 160 within their pages. Scores of ‘unbound separates’ of Durant No. 160 in NY are likewise isolectotypes (Fig. 1b). Five additional specimens of Durant No. 160 not in NY have been discovered: MICH, WTU (2), PH (now housed at Drexel University), and Herb. CWS. These isolectotypes are either unbound separates or ones that remained in copies of Durant’s (1850) exsiccata when digitized (Macroalgal Herbarium Portal, <http://macroalgae.org/portal/index.php>).

The early Durant and recent material of *Spyridia americana* from southern New England and New York is morphologically similar to Mediterranean specimens. Descriptions of specimens identified as *S. filamentosa* from the northeastern United States (Farlow 1881; Taylor 1957; Mathieson and Dawes 2017) demonstrate how cryptic this delicate, feathery alternately branching species (Fig. 1a, b) is with specimens from the Mediterranean and other wide-ranging locations. Farlow (1881, pl. X, fig. 1, as *S. filamentosa*) was the first to report antheridia for *S. americana*, and he likewise illustrated cystocarps (pl. XII, fig. 2). *Spyridia americana* is locally common south of Cape Cod, Massachusetts, from midsummer through fall. Mathieson and Dawes (2017, as *S. filamentosa*) noted it as rare to the north of the Cape with drift specimens reported as far north as Nova Scotia, Canada. As shown above, our specimens first identified as *S. filamentosa* var. *refracta* from Massachusetts and New York were genetically identical to those representing *S. americana* in southern New England-NY. Whether material of this taxon from its type locality in Key West also represents *S. americana* awaits genetic analysis of specimens from that area.



The reinstatement of *Spyridia americana* for Northwest Atlantic specimens formerly identified as *S. filamentosa* and its var. *refracta* is similar to the action of Zuccarello et al. (2004). Based upon genetic and morphological evidence, they segregated specimens from the Northeast Atlantic out of the *S. 'filamentosa complex.'* In that study, *S. filamentosa* var. *griffithsiana* Smith was elevated to *S. griffithsiana* (Smith) Zuccarello, Prud'homme et Stegenga based on their collected evidence. Our study brings back the long-ignored binomial, *S. americana*, for distinct New England/New York, USA specimens, likewise utilizing genetic data.

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## Figure captions

**Figure 1:** (a) Lectotype of *Spyridia americana* Durant [NY02348236] in the bound herbarium copy of Durant's (1850) exsiccata, *Algae and corallines of the bay & harbor of New York...*, (b) non-bound islectotype on herbarium sheet [NY0266922]. Scale bars = 2 cm.

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