

Revision of the genus *Dasya* (Ceramiales, Rhodophyta) in Galicia (NW Spain) and the addition of a new alien species *Dasya sessilis* Yamada for the European Atlantic coasts

by

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Abstract

A revision of the genus *Dasya* in northwestern Iberian Peninsula is presented. Three species (*Dasya hutchinsiae*, *D. ocellata* and *D. sessilis*) are confirmed whilst other three (*Dasya corymbifera*, *D. punicea* and *D. rigidula*) are excluded from the Galician seaweeds flora. The alien species *Dasya sessilis* Yamada is a new record for the European Atlantic coasts. The study of the herbarium material reveals that *D. sessilis* was misidentified with other Dasyaceae species and that it has been collected on the Galician coasts for more than 16 years. Morphological and anatomical features of *D. sessilis* as well as its distribution and chronological data on the Galician coasts are provided. A comparison of the Iberian specimens with the Mediterranean and Asian plants is also included. *Dasya sessilis* was found growing on a wide range of substrata, from the lower intertidal to subtidal at moderate wave-exposed and sheltered areas. It is abundant in harbours and aquaculture areas together with other alien species such as *Heterosiphonia japonica* and *Undaria pinnatifida*. The comparative study between *D. sessilis* and similar European and Iberian Dasyaceae species is undertaken to prevent further misidentifications. *Dasya sessilis* is the largest *Dasya* species, with broader main axes (1-2 mm wide vs 200-500 μ m in *D. ocellata* and 500-600 μ m in *D. hutchinsiae*); pseudolaterals of *D. sessilis* are 3-5 times pseudodichotomously branched compared to 5-8 times in *D. hutchinsiae* and 4-5 times in *D. ocellata*; pseudolateral tips are broader in *D. sessilis* than in *D. ocellata*, but smaller than pseudolateral apices of *D. hutchinsiae*; tetrasporangial stichidium of *Dasya sessilis* has 6-7 periaxial cells (and 6-7 tetrasporangia) per fertile whorl vs. 4-5 in the rest of the native species; and tetrasporangial stichidia of *D. sessilis* are longer and cystocarps broader than those in *D. hutchinsiae*. The alien Dasyaceae species *Heterosiphonia japonica*, similar in size to *Dasya sessilis*, differs from it in main axes branching (alternate or distichous in *H. japonica* vs. spiral in *D. sessilis*), the number of periaxial cells in the vegetative axes (4 in *H. japonica* vs. 5 in *D. sessilis*), and color (pinkish red vs. deep red). Other distinctive characters are the tips of main axes (70-90 μ m wide in *H. japonica* vs. 100-130 μ m in

Resumen

Se presenta una revisión del género *Dasya* en el noroeste de la Península Ibérica que confirma la presencia de tres especies (*Dasya hutchinsiae*, *D. ocellata* y *D. sessilis*) y excluye la de otras tres (*Dasya corymbifera*, *D. punicea* y *D. rigidula*) de la flora bentónica marina gallega. La especie alóctona *Dasya sessilis* Yamada es nueva para el Atlántico europeo. El estudio de material de herbario revela que *D. sessilis* ha sido confundida con otras especies de Dasyaceae y que ha sido recolectada en la costa gallega desde hace más de 16 años. Se presentan las características morfológicas y anatómicas de *D. sessilis* así como su rango de distribución y la cronología de introducción en la costa gallega. Asimismo se lleva a cabo la comparación del material gallego de *D. sessilis* con especímenes mediterráneos y asiáticos. *Dasya sessilis* aparece sobre una gran variedad de sustratos, desde el intermareal inferior a infralitoral, en costas semiexpuestas a protegidas. Es además abundante en zonas portuarias y de cultivos marinos, donde aparece junto con otras especies introducidas tales como *Heterosiphonia japonica* y *Undaria pinnatifida*. Con el objetivo de facilitar futuras identificaciones se realiza un estudio comparado de *D. sessilis* y otras especies similares de Dasyaceae presentes en el Atlántico Ibérico y Europa. *Dasya sessilis* es la especie de *Dasya* más grande, con ejes principales anchos (1-2 mm frente a 200-500 μ m en *D. ocellata* y 500-600 μ m en *D. hutchinsiae*); pseudolaterales que se ramifican pseudodicotómicamente cada 3-5 veces frente a 5-8 veces en *D. hutchinsiae* y 4-5 veces en *D. ocellata*, y con ápices más anchos que en *D. ocellata* pero más estrechos que en *D. hutchinsiae*; estiquidios de los tetrasporocistes con 6-7 células periaxiales (y 6-7 tetrasporocistes) por segmento fértil frente a 4-5 en el resto de especies de *Dasya* europeas y son más largos y los cistocarpos más anchos que los de *D. hutchinsiae*. Otra Dasyaceae alóctona, *Heterosiphonia japonica*, también alcanza un gran tamaño, pero difiere de *Dasya sessilis* en la ramificación de ejes principales (alterna o dística en *H. japonica*, helicoidal en *D. sessilis*), el número de células periaxiales de los ejes vegetativos (4 en *H. japonica*, 5 en *D. sessilis*) y el color (rosado rojo frente a rojo oscuro). Otros caracteres de identificación de ambas especies son el ancho de los

D. sessilis), and the diameter of pseudolaterals at the base (broader in *H. japonica*).

Keywords: Alien species, Ceramiales, *Dasya hutchinsiae*, *Dasya ocellata*, *Dasya sessilis*, Dasyaceae, Galicia, *Heterosiphonia japonica*, Iberian Peninsula, Rhodophyta.

Introduction

Dasya sessilis Yamada (Dasyaceae, Ceramiales) is an introduced Asian species which has been previously reported from the European coast only in the Mediterranean Sea (Verlaque, 2002). It is present in the sheltered and shallow waters of the Thau Lagoon (France), where it was usually misidentified with other native European species of *Dasya*, like *D. hutchinsiae* Harvey. Similar confusions were already pointed out by Yamada (1928), who indicated misidentifications between *D. sessilis* and *D. punicea* (Zanardini) Meneghini ex Zanardini on the Japanese coasts. Here we report the discovery of this taxon for the Iberian Peninsula. Although its distribution is likely to be broader in the NE Atlantic, where it could be more common than expected in mariculture and harbour areas, so far it has been only detected in Galicia. As occurs with French materials, the Galician populations of *D. sessilis* were also confounded with other *Dasya* species, and a study of the herbarium material reveals a high number of wrong identifications of Dasyaceae species for more than 16 years. In this study we present a morphological and anatomical description of *Dasya sessilis*, its known distribution and chronological sequence of appearance in the Iberian Peninsula. Moreover, we present the comparative study between *D. sessilis* and similar Iberian Dasyaceae species to prevent further misidentifications. According to Bárbara & al. (2005), five *Dasya* species are reported for the benthic marine flora of Galicia: *D. corymbifera* J. Agardh, *D. hutchinsiae* Harvey in Hooker, *D. ocellata* (Grateloup) Harvey, *D. punicea* and *D. rigidula* (Kützinger) Ardissonne. Another alien Dasyaceae species common along the Atlantic Iberian Peninsula coasts is *Heterosiphonia japonica* Yendo which was formerly reported as *Dasysiphonia* sp. (Bárbara & al., 2003). Both alien species are similar in morphology and frequently occur together in the same habitats, like aquaculture and harbour areas.

Material and methods

For the morphological and anatomical study we used material of *Dasya* species and *Heterosiphonia*

ápices de ejes principales (70-90 µm en *H. japonica*, 100-130 µm en *D. sessilis*) y el diámetro de los pseudolaterales en su parte basal (más anchos en *H. japonica*).

Palabras clave: Ceramiales, *Dasya hutchinsiae*, *Dasya ocellata*, *Dasya sessilis*, Dasyaceae, especies alóctonas, Galicia, *Heterosiphonia japonica*, Península Ibérica, Rhodophyta.

japonica preserved in formaline seawater 4% and herbarium material (see Appendix) deposited in L, SANT, and the private herbaria of Bescansa (A Coruña) and Miranda (Santiago de Compostela).

Results and discussion

A. Dasyaceae in northwestern Iberian Peninsula

A.1. Description and reproduction of *Dasya sessilis* (Figs. 1-3)

Thalli 1-several erect axes, (3)5-25(28) cm high in tetrasporophytic plants and (5)6-13(18) cm high in gametophytic plants, terete, attached by a discoid rhizoidal holdfast; deep red color. Main axes composed of 5 periaxial cells, spirally branched to 4 orders, densely corticated throughout from apical parts, tapering gradually from 1,5-2 mm to 100-130 µm. Characteristic pseudolaterals 1,5-2 mm long, with (3)4 pseudodichotomies at narrow angle every (1)2-3(6) cells, a basal cell unbranched, (65)70-75(80) µm long, (40)45-65(75) µm wide, apical cells acute, 15-55 µm long, 15-20 µm wide. Aborted pseudolaterals usually three-celled, frequently with rounded apical cells at basal part of axes.

Cystocarps sessile, lateral or occasionally subapical on lateral branches, spirally arranged, urceolate, (65)700-810(850) µm long, (48)520-600(650) µm wide, with a prominent and flared neck to 250-350 µm in diameter. Pericarp 3-layered, carpostome (70)80-150(170) µm in diameter, carposporangia (30)38-63(70) µm long, (13)15-18(20) µm wide.

Spermatangial branches (200)300-520(650) µm long, (60)80-100(150) µm wide, lanceolate, sessile or borne on a 1-2-celled monosiphonous stalk; fertile segments (6)7-10(14), spermatangia ellipsoidal, 2-3 µm in diameter, tips monosiphonous, (6)9-11(12) cells long.

Tetrasporangial stichidia (350)400-900(950) µm long, (100)110-130(150) µm wide, with 6-7 periaxial cells, elongate, ovoid to cylindrical and pointing to monosiphonous tips, sessile or borne on 1-2-celled stalks on monosiphonous branches bases, rarely terminal in middle and upper parts of the plant. Cylin-

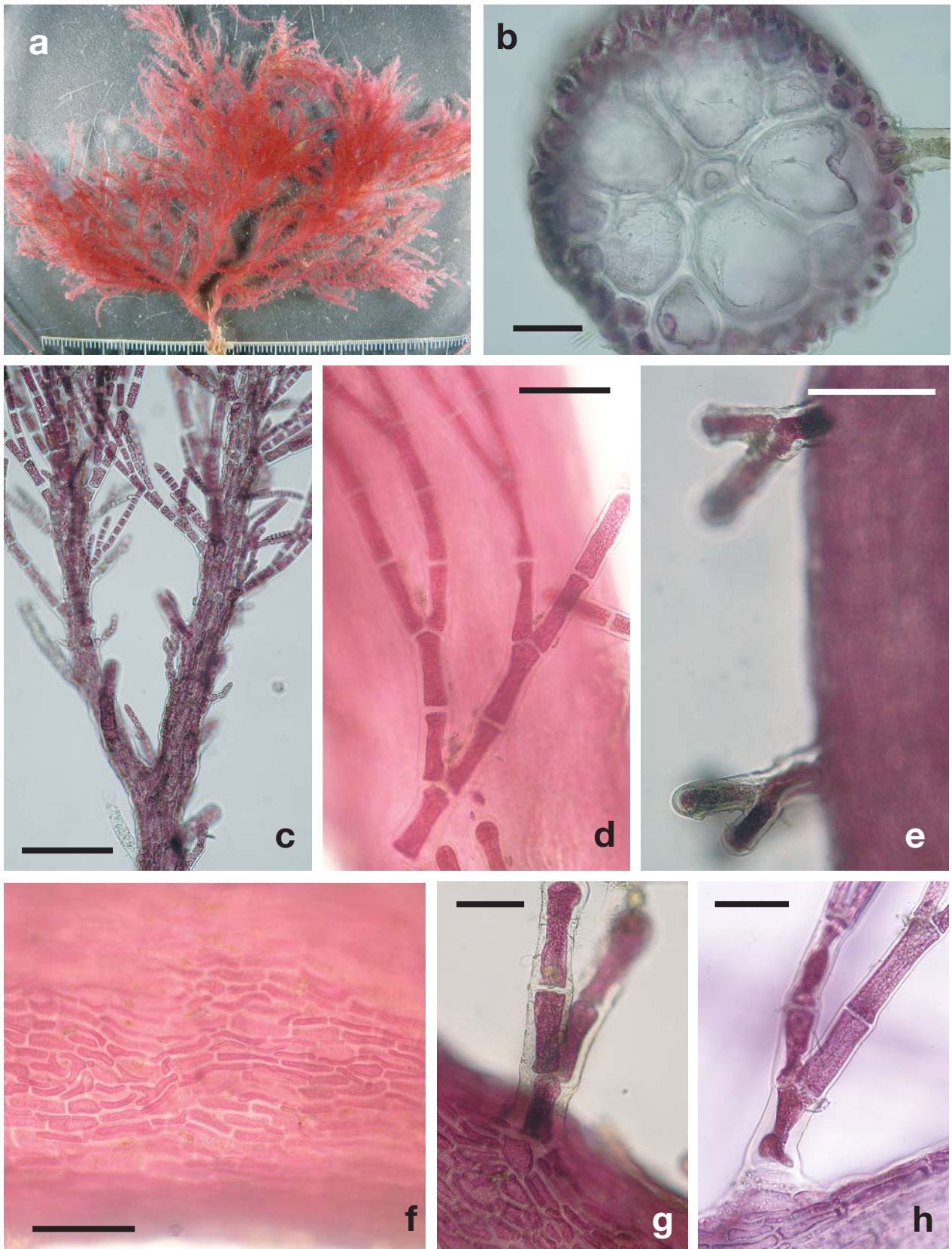


Fig. 1. *Dasya sessilis*: **a**, habit; **b**, transverse section of the axis showing 5 periaxial cells; **c**, apical part of the axis bearing pseudolaterals; **d**, pseudolateral pseudodichotomously branched at narrow angle; **e**, aborted pseudolaterals; **f**, detail of axis cortication; **g**, **h**, basal part of pseudolaterals. Scales: 100 μ m.

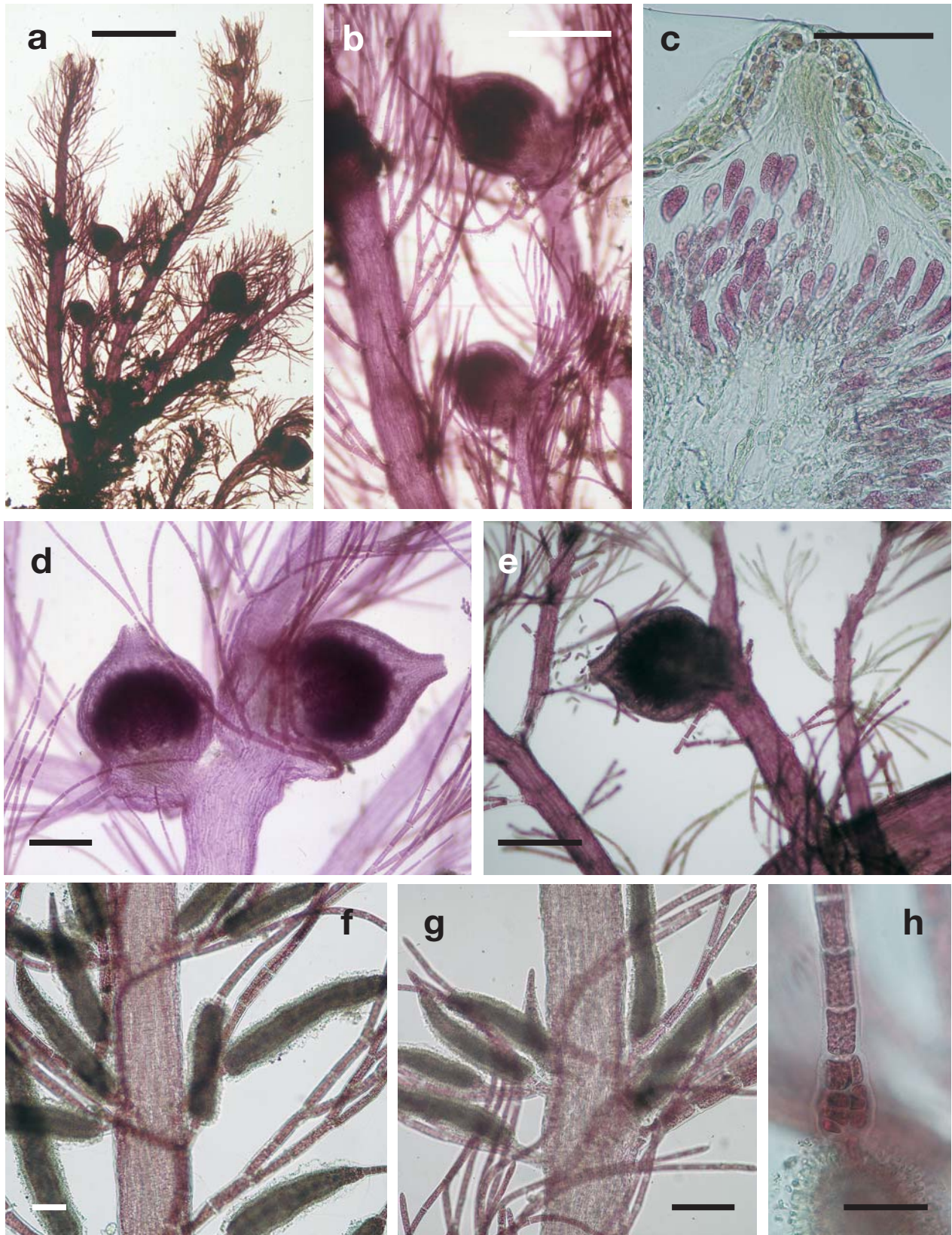


Fig. 2. *Dasya sessilis*: **a**, habit of female plant; **b**, lateral arrangement of sessile cystocarps; **c**, longitudinal section of cystocarp with elongate carposporangia and pericarp composed of 3 layers of cells; **d**, **e**, urceolate cystocarps with flared neck, **e**, carposporangia release (arrow); **f**, **g**, arrangement of spermatangial branches; **h**, monosiphonous tip of spermatangial branches. Scales: a = 2,5 mm; b, d, g = 500 µm; c, e, f, h = 100 µm.

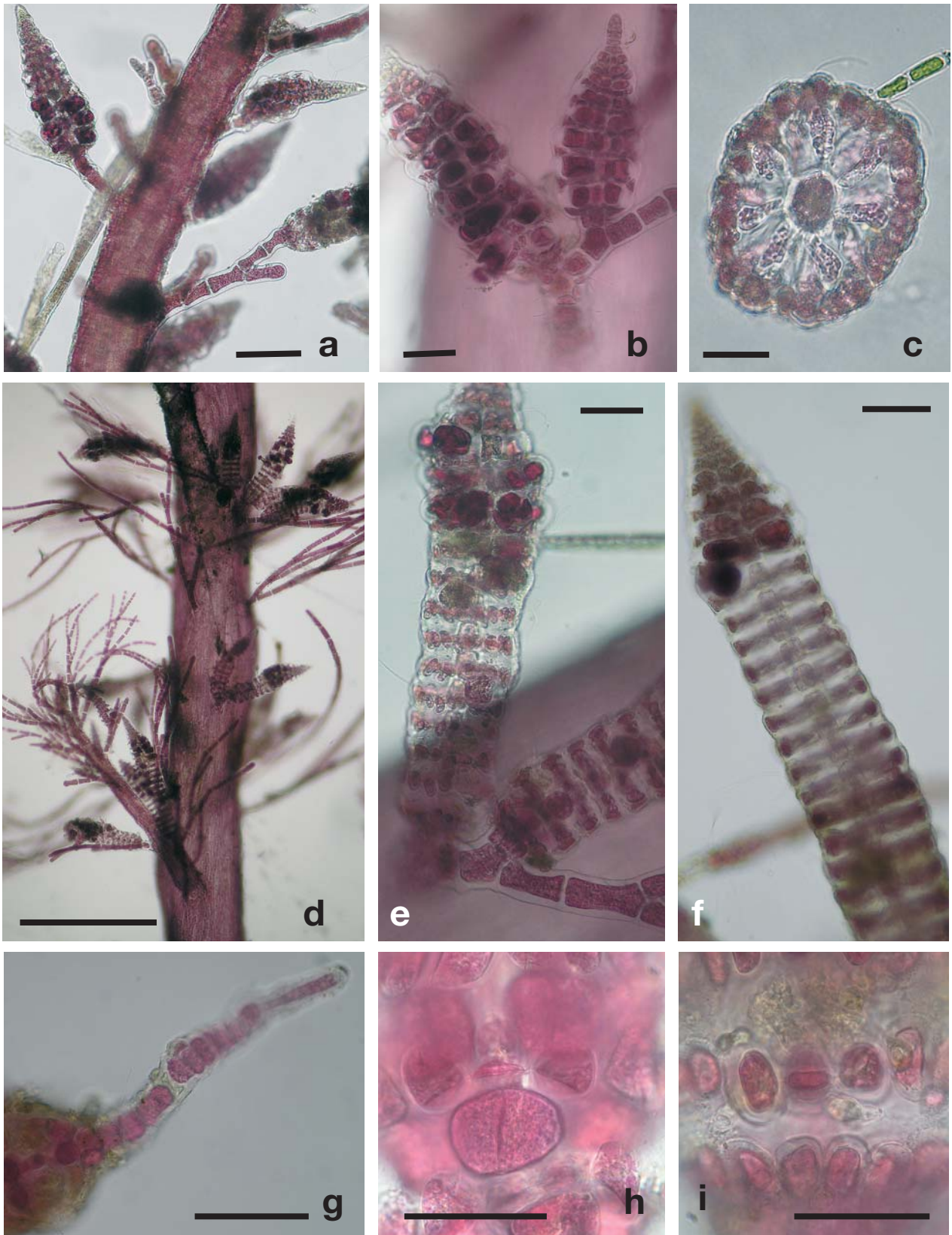


Fig. 3. *Dasya sessilis*: **a, b**, stalked tetrasporangial stichidia; **c**, transverse section of a tetrasporangial stichidium showing 7 periaxial cells; **d**, arrangement of tetrasporangial stichidia; **e**, stichidia born at pseudolateral base; **f**, elongate tetrasporangial stichidium with 20 segments; **g**, vegetative growth at the tip of tetrasporangial stichidium; **h, i**, detail of tetrasporangia stichidia showing tetrasporangia and 2-3 cover cells per periaxial cell. Scales: a-c, e-g = 100 μ m; d = 1000 μ m; h, i = 50 μ m.

dric and elongate stichidia with (13)14-25(27) fertile segments, ovoid stichidia with only 10-12 fertile segments, each fertile segment generating 6-7 tetrasporangia 35-45 µm in diameter. Tetrasporangia slightly covered with 2-3 cuboid cells (12)15-17(20) µm long, (9)10(11) µm wide; vegetative growth on tetrasporangial stichidia tips occasional.

Compared to previous descriptions of *Dasya sessilis* (Yamada, 1928; Verlaque, 2002), the Iberian material matches with the Asian and the Mediterranean ones despite some quantitative differences concerning reproductive structures such as the diameter of the cystocarps and the length of spermatangial branches and tetrasporangial stichidia (Table 1). As in the Mediterranean plants, the Atlantic tetrasporophytic plants were found almost all year round. However, sexual plants were found from March to October whereas the Mediterranean plants developed spermatangial branches and cystocarps from July to November. We also observed that the Atlantic plants reached their largest size in February and November.

A.2. Ecology and distribution of *Dasya sessilis*.

According to Verlaque (2002), *Dasya sessilis* is restricted in the Mediterranean Sea to rocky and hard substrata, between the water surface and 6-8 meters depth, on shallow and sheltered waters of the Thau Lagoon. Contrary to the Mediterranean plants, the Galician ones occur both sheltered and moderate wave-exposed areas, from lower intertidal to subtidal (to 16 meters depth) growing on a wide range of substrata (bedrock, mud and sand gravel, epizoic on *Mytilus* and *Balanus* as well as epiphytic on maërl beds). It is partic-

ularly abundant in harbours and aquaculture areas like the extensive mussel cultures which are widely distributed along the middle and central parts of the Rías (Figs. 4a, b, 5), where it usually coexists with other alien species such as *Heterosiphonia japonica* and *Undaria pinnatifida* (Harvey) Suringar.

In the Mediterranean Sea, *Dasya sessilis* was already reported from the Thau Lagoon in 1984, although as *D. hutchinsiae* and *Dasya* sp. According to Verlaque (2002) it was probably introduced in the 1970's along with massive importations of Japanese oyster [*Crassostrea gigas* (Thunberg)]. In Galicia, the vector by aquaculture is relevant since mussel cultures are widely spread along the Rías. As in the Mediterranean region, confusions between *Dasya sessilis* and *D. hutchinsiae*, *D. ocellata*, and *D. punicea* have occurred in Galicia during the last 16 years. During the revision of herbarium material we noted that the first collection of *D. sessilis* in the Iberian Peninsula was done in the Ría de Pontevedra (1989, as *D. hutchinsiae*, Fig. 4c). Since then the species has been regularly collected in Galicia: Ría de Ferrol (1990, as *D. ocellata*, Fig. 4d), Ría de Vigo and Ría de Arousa (1992, as *D. ocellata*, Figs. 4e, f), Ría de Betanzos (1996, as *D. punicea*), Ría de A Coruña (1997, as *D. punicea*, Fig. 4g), Corcubión (1998, as *D. hutchinsiae*), and San Ciprián (2005, as *D. sessilis*, Figs. 4h, 5), to cover at present the entire Galician coasts (Fig. 5).

A.3. Comparison of *Dasya sessilis* with similar European and Atlantic Iberian *Dasyaceae* species

Verlaque (2002) distinguishes *Dasya sessilis* from most other European *Dasya* species by the number of

Table 1. Comparison between Atlantic Iberian, Mediterranean and Asian specimens of *Dasya sessilis* based on: **1** = present study; **2** = Verlaque (2002); **3** = Yamada (1928).

	Galician plants (1)	Mediterranean plants (2)	Asian plants (3)
Length of pseudolateral (mm)	1.5-2	2-3	2-3
Pseudolateral branching	3-4 at intervals of (1)2-3(6) cells	4-5 at intervals (1)2 (3) cells	—
Diameter of pseudolateral basal cell (µm)	(40)45-65(75)	35-65	30
Diameter of cystocarp and neck (µm)	(480)520-600(650), 250-350	1005-1270, 262-463	—
Pericarp	3 layers of cells	3-5 layers of cells	—
Carposporangium (µm)	(30)38-63(70) × (13)15-18(20)	65-80 × 20-25	—
Length of spermatangial branch (µm)	(200)300-520(650)	Up to 900	—
Monosiphonous tip of spermatangial branch	(6)9-11(12) cells	Up to 15 cells	—
Tetrasporangial stichidium (µm)	Sessile and pedicellated, (350)400-900(950) × (100)110-130(150). Up to 27 fertile segments	Sessile and pedicellated, (297)1125-1575(1690) × 108-144. Up to 45 fertile segments.	sessile
Tetrasporangium (µm)	35-45	20-32	—



Fig. 4. Variability of *Dasya sessilis*: **a, b**, subtidal population growing on quays at Moaña harbour (Ría de Vigo); **c**, Ría de Pontevedra (1989, SANT-Algae 3021, as *D. hutchinsiae*); **d**, Ría de Ferrol (1990, SANT-Algae 469, as *D. ocellata*); **e**, Ría de Vigo (1994, SANT-Algae 8277, as *D. ocellata*); **f**, Ría de Arousa (1992, SANT-Algae 3856, as *D. ocellata*); **g**, Ría de A Coruña (1997, SANT-Algae 8431, as *D. punicea*); **h**, San Ciprián (2005, SANT-Algae 16052, as *D. sessilis*).



Fig. 5. Distribution of *D. sessilis* in northwestern Iberian Peninsula. For each locality the year of first collection is indicated.

periaxial cells and tetrasporangia per whorl in tetrasporangial stichidia (6-7 cells per fertile segment vs. 4-5 in the European species), with the exception of *Dasya baillouviana* (J.F. Gmel.) Mont., not present in the northwestern Iberian Peninsula coasts, which differs from *D. sessilis* in having stalked cystocarps and pseudolaterals spirally branched without a distinctive basal cell (Dixon & Irvine, 1970; Schleich & Abbott, 1989; De Jong, 1997; Ballantine & Aponte, 2004).

The re-examination of Atlantic collections showed that hitherto *D. sessilis* has been misidentified with other *Dasya* species, and also that only three species of the genus grow in northwestern Iberian Peninsula: *Dasya hutchinsiae*, *D. ocellata*, and *D. sessilis*. The taxonomic features to distinguish between these species, as well as their habitat in Galicia are given in the Table 2. *Dasya sessilis* is the largest *Dasya* species, with main axes 1-2 mm wide vs. 200-500 μm in *D. ocellata* (Fig. 6c) and 500-600 μm in *D. hutchinsiae* (Figs. 6e, f); pseudolaterals 3-5 times pseudodichotomously branched (5-8 times in *D. hutchinsiae* and 4-5 times in *D. ocellata*, cf. Figs. 6a, b), with tips broader than in *D. ocellata*, but narrower than in *D. hutchinsiae*; and tetrasporangial stichidia longer and cystocarps broader than those of *D. hutchinsiae*.

The ecology of all the Atlantic *Dasya* species is similar; all of them are epilithic, epizotic and epiphytic from lower intertidal to subtidal, although *Dasya ses-*

silis is more abundant at subtidal level (to 16 m depth). In similar habitats grow the introduced species *Heterosiphonia japonica* (to 18 m depth), and both alien species frequently occur together in aquaculture and harbours areas. *Heterosiphonia japonica* is also a large plant, reaching 30 cm in height (Figs. 6m, n), and therefore misidentifications are likely to occur in such areas. The main characters to separate both species are the main axes branching (spiral in *D. sessilis* but alternate or distichous in *H. japonica*), and the number of periaxial cells in vegetative axes, 5 in *D. sessilis* but 4 in *H. japonica* (Tab. 2). Other characters include the width of the main axes near the apex (100-130 μm in *D. sessilis*, 70-90 μm in *H. japonica*); color (deep red in *D. sessilis*, pinkish red *H. japonica*); shape of pseudolaterals, usually narrower at the base and broader at tips in *D. sessilis*. Further features exclusive of *H. japonica* are the presence of adventitious polysiphonous branches as well as axes less corticated than in *D. sessilis* (Figs. 6k, l).

B. Excluded species of *Dasya* from the Galician seaweeds flora

Dasya punicea was reported as a new record for Galicia from Ría de Arousa and Ría de Vigo by Veiga & al. (1998) and, subsequently, from Ría de A Coruña by Peña & Bárbara (2002). Afterwards Bárbara & al. (2004, fig. 4) described the spermatangial stichidia of *D. punicea* for the first time. However, the revision of these specimens and the rest of the Galician material of *D. punicea* revealed that they correspond to *D. sessilis*, and therefore *D. punicea* is excluded from the Galician seaweeds flora.

Dasya rigidula was reported from Ría de Arousa by Donze (1968) and from Ría de Muros-Noia by Otero-Schmitt (1993). Although Donze's material could not be found at the Nationaal Herbarium Nederland (L) (Prud'homme van Reine, *pers. comm.*), Otero-Schmitt's material (SANT-Algae 5167 as *D. rigidula*; figs. 6g, h) has vegetative axes 400-550 μm in diameter, corticated except in the apex, pseudolaterals tips to 30 μm in diameter, tetrasporangial stichidia 100-125 μm wide and tetrasporangia up to 60 μm in diameter. These measures do not match with published descriptions of *D. rigidula* (Taylor, 1979; Fredericq & Norris, 1986; Schneider & Searles, 1991; Afonso-Carrillo & Sansón, 1999; Ballantine & Aponte, 2004), which has pseudolaterals tips to 15 μm wide, tetrasporangial stichidia 30-60 μm in diameter, and tetrasporangia to 20 μm in diameter. On the contrary, the Galician materials match *D. hutchinsiae* descriptions. Moreover, the material of *Dasya rigidula* collected by

Table 2. Differentiation between northwestern Iberian Peninsula *Dasya* species and *Heterosiphonia japonica* based on herbarium material and the following references: **1** = Yamada (1928); **2** = Fredericq & Norris (1986); **3** = Schneider & Seafles (1991); **4** = Maggs & Hommersand (1993); **5** = Stegenga (1997); **6** = Maggs (1998); **7** = Afonso-Carrillo & Sansón (1999); **8** = Lein (1999); **9** = Choi (2001); **10** = Verlaque (2002); **11** = Bárbara & al. (2003); **12** = Bjærke & Ruess (2004); **13** = Ballantine & Aponete (2004); **14** = Bárbara & al. (2004); **15** = Present study.

	<i>Dasya hutchinsiae</i> (2, 4, 7, 13, 15) Fig. 6 d-j	<i>Dasya ocellata</i> (2, 3, 4, 6, 13, 15) Fig. 6 a-c	<i>Dasya sessilis</i> (1, 10, 14, 15) Figs. 1-4	<i>Heterosiphonia japonica</i> (5, 8, 9, 11, 12, 15) Fig. 6 k-n
Height	2-10(15) cm	(2)5-7 cm	(3)5-25(28) cm	Up to 30 cm
Main axis branching	4-5-order. Irregularly alternate to subdichotomous	0-3 order, lateral	Up to 4-order, spiral	3-5-order, alternate or distichous
Main axis diameter (base to apex)	500-600 µm to 200 µm	(190)200-500(600) µm to 50-70 µm	1000-2000 µm to 100-130 µm	450-1730 µm to 70-90 µm
Cortication	Throughout except at tips, thicker basally	Throughout except at tips, dense	Throughout, starting at apical parts, dense	Throughout, starting at apical parts
Color	Red to reddish-brown, brown or purple	Brownish to purplish-red.	Deep red	Pinkish-red
Pseudolateral branching	(4)5-8(9) order, Y-shaped to U-shaped, pseudodichotomously branched to divaricate from an immersed basal cell	4-5(7)-order, less than 45° angle. Dichotomously to pseudodichotomously branched from unbranched suprabasal cell, every 1-2(3) undivided segments	3-5-order, at narrow angle, dichotomously to pseudodichotomously branched every (1)2-3(6) undivided segments from an unbranched suprabasal cell (30)35-65(75) µm to (13)15-20 µm	1-2(3)-order, Y-shaped, pseudodichotomously branched in one plane from an unbranched suprabasal cell
Pseudolateral diameter (base to apex)	75 µm to 30 µm	40-56 µm to 10-16 µm		(60)70-85(100) µm to 10-15 µm
Tetrasporangial stichidium	Conical, lanceolate, ending in a 1-several sterile cells, stalked, 375-550 µm x 110 µm, 12-17(20) fertile segments, 5 periaxial cells and 5 tetrasporangia 35-50 µm, cover cells 2-3, covering less than 1/3 of tetrasporangium	Elongate tip acute, 1-4-celled stalk. 480-1350 µm x 95-120 µm, 15-35(45) fertile segments, 5 periaxial cells and 5 tetrasporangia (30)36-52 µm, cover cells 3, covering 1/3 of the tetrasporangium	Elongate, ovoid, to cylindrical with acute tip, sessile or with a 2-cell stalk, (29)7350-1575(1690) µm x (100)108-144(150) µm, (10)14-25(45) fertile segments, 6-7 periaxial cells and 6-7 tetrasporangia (20)32-35(45) µm, cover cells 2-3, scarcely covering the tetrasporangium	Lanceolate, ending in 2-3 sterile apical cells, sessile or with a 1-4-cell stalk, (300)650-850(1025) µm x (100)130-300(350) µm, (11)17-23(28) fertile segments, (4)5-7 periaxial cells and (4)5-7 tetrasporangia, 35-50(62) µm, cover cells 2-3, scarcely covering the tetrasporangium
Cystocarp	Sessile, urceolate, 525-800 µm x 450-525 µm, with a beak-like carpostome 125-175 µm long	Sessile, ovate-globose to slightly urceolate, 730 µm x 600 µm, carposporangia 25-33 µm x 12-14 µm	Sessile, urceolate, (650)700-810(850) µm x (480)650-1005(1270) µm, with a prominent neck (250)262-350(463) µm wide, 3-5 layers pericarp cells, carpostome (70)80-150(170) µm wide, carposporangia (30)38-70(80) µm x (13)15-20(25) µm	Sessile, spherical to obovately ostiolate, carposporangia spherical
Spermatangial branch	Conic-cylindrical, 200-375 µm x 30-40 µm	400-500 µm x 80-100 µm	Lanceolate, sessile or with a 1-3-cell stalk, (164)200-650(900) µm x (60)80-100(150) µm, to 14 fertile segments	Pedicellate
Ecology in the Galician coast	Epilithic, epizoic and epiphytic from lower intertidal to subtidal (4-6 m depth) at wave-exposed to sheltered coasts	Epilithic, epizoic and epiphytic from lower intertidal to subtidal (4 m depth) at moderate wave-exposed to sheltered coasts	Epilithic, epizoic and epiphytic, on maëri beds, from lower intertidal to subtidal (16 m depth) at moderate wave-exposed to sheltered coast	Epilithic, epizoic and epiphytic, on maëri beds, from lower intertidal to subtidal (18 m depth) at moderate wave-exposed to sheltered coast

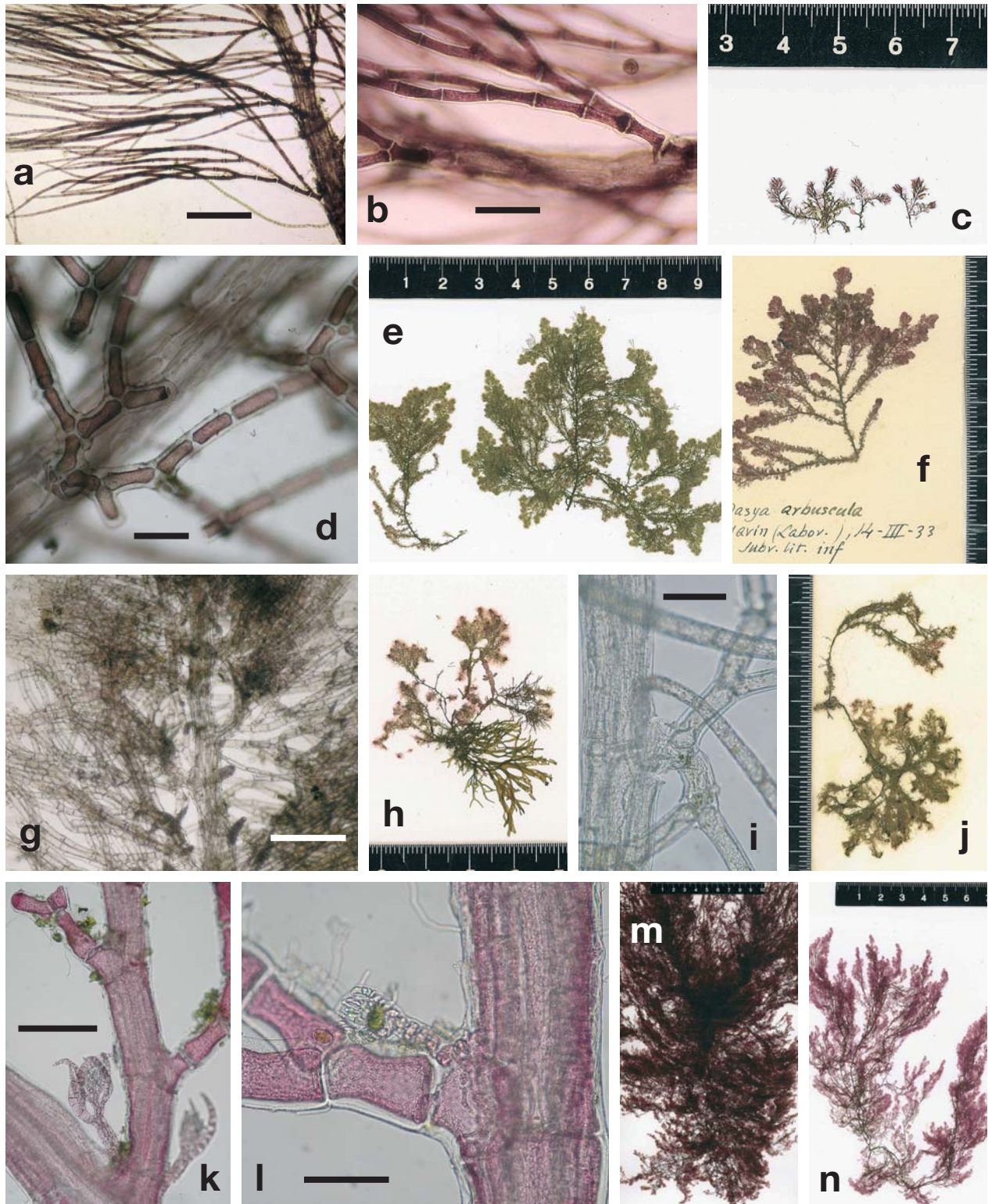


Fig. 6. a-c, *Dasya ocellata*: **a**, arrangement of pseudolaterals; **b**, pseudolaterals branched from a suprabasal cell; **c**, herbarium specimen (SANT-Algae 9205); **d-j, *D. hutchinsiae*:** **d**, pseudolateral branched from an immersed basal cell; **e**, herbarium specimen (SANT-Algae 16065); **f**, herbarium specimen (herb. Miranda); **g, h**, arrangement of pseudolaterals and the corresponding herbarium specimen (SANT-Algae 5167, as *D. rigidula*); **i, j**, pseudolateral branched from an immersed basal cell and the corresponding herbarium specimen (L-0194351, as *D. corymbifera*); **k-n, *Heterosiphonia japonica*:** **k**, arrangement of polysiphonous branches and pseudolaterals; **l**, branched pseudolateral from a suprabasal cell and adventitious polysiphonous branch; **m, n**, herbarium specimens (SANT-Algae 15715, 15768). Scales: a, b, d, i, l = 100 μ m; g, k = 500 μ m.

Donze could not be located, and thus we exclude this species from the Galician seaweeds flora.

Dasya corymbifera was reported from Ría de Vigo by Seoane-Camba (1957) and from Ría de Arousa by Donze (1968). Despite the fact that the herbarium material of Seoane-Camba was lost during a move from Cadiz to Barcelona, most Donze's specimens (L0194351-0194356, Fig. 6 j) were re-examined and, as in the previous case, they are *D. hutchinsiae*. All of them are vegetative specimens with axes not densely corticated, pseudolaterals with apical cells (10)15-25(30) µm wide, and branched basal cells (60)70(85) µm in diameter (Fig. 6 i), whereas *D. corymbifera* has pseudolaterals with apical cells 10 µm wide and unbranched basal cells up to 60 µm (Fredericq & Norris, 1986; Schlech & Abbott, 1989; Maggs & Hommersand, 1993; Ballantine & Aponte, 2004). As a result, we also exclude *D. corymbifera* from the Galician seaweeds flora.

Conclusions

From our study of the genus *Dasya* in northwestern Iberian Peninsula, we confirm the presence in the area of three species, *Dasya hutchinsiae*, *D. ocellata*, and *D. sessilis*, instead of the five formerly reported. The Galician material previously attributed to *D. punicea* is *D. sessilis*, whilst the herbarium material of *D. rigidula* and *D. corymbifera* are in fact *D. hutchinsiae*.

An important diagnostic feature to distinguish *D. sessilis* from native European *Dasya* species is the number of periaxial cells in each tetrasporangial stichidium (*D. sessilis* has 6-7 periaxial cells instead of 5). The alien Dasyaceae species *Heterosiphonia japonica* was also considered due to similarities with *D. sessilis* in vegetative morphology and ecology; it can be distinguished from *D. sessilis* by the alternate to distichous arrangement of its vegetative axes, which have 4 periaxial cells, its pinkish-red color, and wider pseudolaterals to the base.

Dasya sessilis collected in Galicia is a new record for the Atlantic European coasts. The Galician specimens match with descriptions of previous studies (Yamada, 1928; Verlaque, 2002), although there are some quantitative differences in reproductive structures such as the diameter of cystocarp and the length of spermatangial branch and tetrasporangial stichidium. In Galicia, *D. sessilis* grows on a wide range of substrata including maërl beds, from the lower intertidal to subtidal (-16 m depth) at moderate wave-exposed and sheltered areas. The species is specially abundant in harbours and aquaculture areas located in the middle and central parts of the Rías, together

with other alien species such as *Undaria pinnatifida* and *Heterosiphonia japonica*. In the northwest of the Iberian Peninsula *Dasya sessilis* was formerly collected from different Rías since 1989, although these records were misidentified as *Dasya hutchinsiae*, *D. ocellata* and *D. punicea*. Nowadays, *D. sessilis* is widely distributed along the Galician coast, although its distribution is surely wider along the NE Atlantic, where the species should be specially looked for in mariculture and harbour areas.

Appendix

Material of *Dasya hutchinsiae*

A Coruña: Fornos, Ortigueira ría, 29TNJ926407, 29-III-2002, SANT-Algae 16683. Between Punta Fornelos and Cariño beach, Ferrol ría, 29TNJ556133, 9-VII-1986, SANT-Algae 325. Punta de San Cristobal, Ferrol ría, 29TNJ568126, 31-I-1991, SANT-Algae 468. Santa Cristina, A Coruña ría, 29TNH509993, lower intertidal, 14-VI-1984, SANT-Algae 1485. San Amaro, A Coruña ría, 29TNJ491036, 26-II-1990, SANT-Algae 2016. North of Isla Castelo, A Coruña ría, 29TNJ530017, 20-II-1988, SANT-Algae 4829. Castillo de San Antón, A Coruña ría, 29TNJ497019, lower intertidal and sciophilic wall at intertidal, 13-V-1984, 14-VI-1984, 12-VII-1984, 26-I-1990, 20-III-1992, SANT-Algae 1265-1267, 4658, 4827. Oil quay breakwater, A Coruña harbour, 29TNJ499004, lower intertidal, on *Codium tomentosum* var. *micronatum* and *Sargassum muticum*, 16-X-2000, SANT-Algae 14060. Outer breakwater of Oza quay, A Coruña harbour, 29TNJ504002, lower intertidal, on *Corallina elongata* and *Codium fragile* subsp. *tomentosoides*, 16-X-2000, SANT-Algae 14077. San Amaro bay, A Coruña ría, 29TNJ491036, lower intertidal, on *Osmundea pinnatifida*, 27-I-1984, 13-VII-1984, 15-III-1987, SANT-Algae 4822, 4826, 4687. Torre de Hércules, A Coruña ría, 26-V-1990, SANT-Algae 4828. Lagoa bay, A Coruña ría, 29TNJ480038, middle intertidal, 22-VI-2002, SANT-Algae 15911. North of Isla Castelo, A Coruña ría, lower intertidal, 29TNJ530017, 6-V-1989, SANT-Algae 4823, as *Dasya ocellata*. Near Punta Liseiro, A Coruña ría, 29TNJ476024, lower intertidal, on *Corallina elongata* together with *Boergesenella thuyoides*, 10-IV-2005, SANT-Algae 15533. San Pedro islands, A Coruña ría, 29TNJ448030, 29TNJ452035, 22-VII-2005, 2-I-2006, SANT-Algae 16493, 16912. Isla Redonda (East), A Coruña, 29TNJ442023, lower and middle intertidal, 14-XI-2004, 11-IV-2005, SANT-Algae 16211, 16165. Barrañán beach, Arteixo, 29TNH358957, intertidal on sandy rock, 29-VIII-2003, SANT-Algae 15348. As Garzas, Malpica, 29TNH103963, lower intertidal, 27-IV-1998, SANT-Algae 10154. Barizo beach, Malpica, 29TNH102958, lower intertidal, 23-VI-2001, 23-VII-2005, SANT-Algae 16065, 16901. Sisarga Grande (Brance), Sisargas Islands, 29TNJ133004, middle intertidal, on *Corallina elongata* and sandy rocks, 26-III-1994, SANT-Algae 6902, SANT-Algae 6924. Muxía (West), 29TMH820712, 21-VIII-2005, SANT-Algae 16970. Santa Mariña harbour (East), 29TMH892824, rocks at lower intertidal, together with *Haraldia lenormandi*, 24-VIII-2005, SANT-Algae 16321. Camelle, Camariñas, 29TMH920818, 23-VIII-2005, SANT-Algae 16891. Camariñas, Lombo da Campa, Carnota, 29TMH894373, lower intertidal pool, on *Corallina elongata*, 22-IV-1989, SANT-Algae 5163. Punta Cantón, Louro, Muros-Noia ría, lower intertidal, on *Corallina elongata* and *Dictyota dichotoma*, 28-VII-1987, SANT-Algae 5167, as *Dasya rigidula*. Punta Insua, Carnota, 29TMH9035, lower intertidal, with *Stypocaulon scoparium* and *Corallina elongata*,

26-V-1990, SANT-Algae 5166. Punta Corna, Arousa ría, 29TNH047144, lower intertidal, 23-IV-1997, SANT-Algae 5613. Rúa Island, Arousa ría, 29TNH0511, sublittoral, beneath *Lamina-ria hyperborea* canopy, 26-VII-1964, 28-VII-1964, L-0194359, L-0194363, as *Dasya arbuscula*. Palmeira, Arousa ría, 4-VIII-1964, L-0194358, as *Dasya arbuscula*. **Lugo:** San Ciprián, Punta Furada (East), 29TPJ244399, lower intertidal, 25-IV-2005, SANT-Algae 16136. San Ciprián, Punta Besugueiro, 29TPJ247399, lower intertidal, 30-IX-2004, SANT-Algae 16303. San Ciprián, mouth of Lago Norte river 29TPJ231406, lower intertidal, on *Corallina elongata*, 7-IV-2005, SANT-Algae 15531, 15565. San Ciprián, Lago beach, 29TPJ227407, middle intertidal, on sand-covered rock, 10-II-2005, SANT-Algae 17184. Punta Riomar, Cangas de Foz, 29TPJ356317, on *Cystoseira tamariscifolia*, 5-IV-1993, SANT-Algae 6357. Punta del Castro, Barreiros, 29TPJ472249, lower intertidal, on sciophilic rocks, 20-III-2003, SANT-Algae 14439, 14480. **Pontevedra:** Punta Quilme, Arousa Island, Arousa ría, 29TNH098098, lower intertidal, 19-VIII-1997, SANT-Algae 5860, as *Dasya ocellata*. Punta Barbafeita, Arousa Island, Arousa ría, 29TNH089128, lower intertidal, 17-X-1997, SANT-Algae 9695. Punta Banqueira, Arousa ría, 29TNH106083, lower intertidal, on *Corallina elongata*, beneath *Himantalia elongata*, 30-III-1998, SANT-Algae 9973. San Vicente, Arousa ría, 4-5 mt depth beneath *Saccorbiza polyschides*, 1-VII-1963, 6-VIII-1964, L-0194353, 0194356, as *Dasya corymbifera*. Cabeza del moro, Arousa ría, 15-VII-1963, L-0194355, as *Dasya corymbifera*. Joidiro Pedregoso, Arousa ría, 15-VII-1963, L-0194354, as *Dasya corymbifera*. Palmeira, Arousa ría, 03-VIII-1964, L-0194352, as *Dasya corymbifera*. Centolleiras, Arousa ría, 12-VIII-1964, L-0194351. Punta de Paleiro, El Grove, *Himantalia* zone, 8-VIII-1964, L-0194365, 0194362, as *Dasya arbuscula*. La Lanzada, Arousa ría, 29TNH0900, *Himantalia* zone, 10-VIII-1964, 11-VIII-1964, L-0194364, 0194357, as *Dasya arbuscula*. San Vicente, Arousa ría, 29TNG0599, 2 m depth, *Himantalia* zone, 19-VII-1962, 5-VII-1963, L-0194360, 0194361, as *Dasya arbuscula*. Punta Placeres, Pontevedra ría, 29TNG263953, lower intertidal, 4-XI-1990, SANT-Algae 3272. Piedra Mouta, Marín, Pontevedra ría, 21-I-1933, Miranda's herbarium n° 182.1, as *Dasya arbuscula*. Marín Laboratory, Pontevedra ría, subtidal, 14-III-1933, Miranda's herbarium n°-112, as *Dasya arbuscula*. Piedra Mouta, Pontevedra, 4-6 mt depth, dredging, 21-I-1933, Miranda's herbarium n°-112, as *Dasya arbuscula*. Cabo Estay, Vigo ría, 29TNG152704, lower intertidal, on sandy rocks, 26-X-1996, SANT-Algae 3524. Vigo harbour near to Navales Patouro factory, Vigo ría, on *Balanus perforatus*, 17-III-1995, SANT-Algae 8077, as *D. ocellata*. Iberconsa, Vigo harbour, Vigo ría, 29TNG205759, on dock, 25-IV-1997, SANT-Algae 9204. Punta Sansón, Baiona, 5-IX-1914, Bescansa's herbarium.

Material of *Dasya ocellata*

A Coruña: Vispón point, Ferrol ría, 29TNJ592132, on *Cladophora*, 5-VII-1986, SANT-Algae 410. La Graña marina, Ferrol ría, 29TNJ599145, on *Codium fragile* subsp. *tomentosoides*, 10-VII-1986, SANT-Algae 408. Punta Leiras, Ferrol ría, 29TNJ605130, on *Cystoseira tamariscifolia*, 19-III-1988, SANT-Algae 409. Isla Castelo (North), A Coruña ría, 29TNJ530017, intertidal pool, on *Cladophora pellucida*, 22-IX-1990, SANT-Algae 4825. Oza marina, A Coruña ría, 29TNH501998, subtidal, on *Balanus*, 14-IV-1994, SANT-Algae 7345. Oza hospital, A Coruña ría, 29TNH502994, lower intertidal, sheltered, on *Mytilus*, 24-XII-1991, SANT-Algae 4527, as *Dasya butchinsiae*. El Pasaje, A Coruña ría, 29TNH523985, subtidal, on *Balanus*, 29-VII-1992, SANT-Algae 7338. Castillo de San Antón, A Coruña ría, 29TNJ497019, lower intertidal, 26-I-1990, SANT-Algae 4824.

Lugo: San Ciprián, Xove, inner part of Morás dock, 29TPJ239418, lower intertidal, sciophilic walls, 15-XI-2004, SANT-Algae 15610. San Ciprián, Punta Furada (East), 29TPJ244399, middle intertidal, 25-IV-2005, SANT-Algae 16130. **Pontevedra:** Placeres, Pontevedra ría, subtidal, shaded face of rocks, 11-II-1933, Miranda's herbarium n° 94. Punta Placeres, Pontevedra ría, 29TNG263953, on *Codium tomentosum*, 7-II-1989, SANT-Algae 3020. Vigo harbour, new dock next to fish quay, Vigo ría, on rocks, 13-VII-1995, SANT-Algae 825. Iberconsa, Vigo harbour, 29TNG205759, on quay rocks, 25-IV-1997, SANT-Algae 9205. Coia quay, Vigo harbour, 29TNG212758, on *Balanus*, 29-III-1994, SANT-Algae 8297. Patos beach, Carreira bay, Nigrán, 29TNG142672, middle intertidal, 18-III-2003, SANT-Algae 14831.

Material of *Dasya sessilis*

A Coruña: Nande bay, Ferrol ría, 29TNJ584124, on *Sargassum muticum*, 21-VIII-1990, SANT-Algae 469, as *Dasya ocellata*. Cirro beach, Betanzos ría, 29TNJ577040, drifted, 29-IX-1996, SANT-Algae 8457, as *Dasya punicea*. Casino marina, A Coruña ría, 29TNJ499025, subtidal (-7 m) on *Mytilus* and rock, 15-IV-1997, SANT-Algae 8431, as *Dasya punicea*. Dársena marina, A Coruña ría, 29TNJ490022, lower intertidal, on rock, *Balanus* and *Cystoseira baccata*, 13-XI-2000, 1-II-2002, SANT-Algae 14167, 14246, as *Dasya ocellata*. Oza quay, A Coruña harbour, 29TNJ499003, lower intertidal, on *Balanus* and *Mytilus*, 22-V-2001, SANT-Algae 14066, as *Dasya ocellata*. Batería quay, A Coruña harbour, 29TNJ487018, lower intertidal, on *Mytilus*, 22-V-2001, SANT-Algae 14209, as *Dasya ocellata*. Trasatlánticos quay, A Coruña harbour, 29TNJ489020, subtidal (-1 m) on *Codium vermilara*, 22-V-2001, SANT-Algae 14145, as *Dasya ocellata*. San Antón, A Coruña ría, 29TNJ497019, subtidal (-8 m), on *Mytilus* and *Balanus*, together with *Heterosiphonia japonica* and *Compsobambion thuyoides*, 8-II-2004, SANT-Algae 15077, as *Dasya punicea*. Arnela point, O Sardiñeiro bay, 29TMH814545, lower intertidal, 28-II-1998, SANT-Algae 9671, as *Dasya butchinsiae*. Punta Cambrona, Muros-Noia ría, 29TNH038366, lower intertidal, on rock, *Balanus* and *Mytilus*, 29-X-2004, SANT-Algae 15783. **Lugo:** San Ciprián, El Portiño (North), 29TPJ135921, subtidal (-3 m) on sandy rocks, 13-VII-2005, SANT-Algae 16052. **Pontevedra:** Piedra Seca lighthouse, Arousa Island, Arousa ría, 29TNH067110, subtidal (-15, -19 m), maërl bed and gravel, 22-IX-1995, 23-VI-1995, 23-I-1997, SANT-Algae 7426, 8739, 14965, as *Dasya ocellata* and *D. punicea*. Puerto point, Arousa Island, Arousa ría, 29TNH112128, lower intertidal, 10-I-1997, SANT-Algae 9263, as *Dasya punicea*. Naval beach, Arousa Island, Arousa ría, 29TNH103128, lower intertidal, on *Balanus* and *Mytilus*, 29-X-2004, SANT-Algae 15767. A Toxa Island, Arousa ría, 29TNH1204, middle intertidal, 27-VIII-1992, SANT-Algae 3856, as *Dasya ocellata*. A Toxa, O Grove, Arousa ría, 29TNH125032, lower intertidal, 27-III-1998, SANT-Algae 9840, as *Dasya punicea*. Islote Gorma, Arousa ría, 29TNH158144, 11-XI-2005, SANT-Algae 16503. Moreira point, O Grove, Arousa ría, 29TNH086039, maërl bed (-5 m) together with *Heterosiphonia japonica*, 4-VI-2004, SANT-Algae 15745. Negreiros de Tierra, O Grove, Arousa ría, 29TNH087052, dredging (-5 m), 4-VI-2004, SANT-Algae 15746. As Sinas point, Arousa ría, 29TNH144141, lower intertidal, sandy rocks 12-XII-1997, SANT-Algae 5978, as *Dasya punicea*. Vilaxoan, Arousa ría, 29TNH174157, subtidal (-3 m) on gravel and mud, 25-II-2005, SANT-Algae 15520. Malveira Island, Arousa ría, 29TNH163176, subtidal (-3 m) on gravel and mud, 25-II-2005, SANT-Algae 15521. Malveira Island, Arousa ría, 29TNH173177, subtidal (-3 m) on gravel and mud, 25-II-2005, SANT-Algae 15519. Placeres point, Pontevedra ría, 29TNG263953, lower intertidal on mud-covered rocks, 19-VIII-1989, 16-IX-1989, 16-X-1989, SANT-Algae 3021, 3017, 3018, as

Dasya ocellata and *D. hutchinsiae*. Outer dock, Bueu harbour, Pontevedra ría, 29TNG177864, dredging (-8 m) on gravel and maërl, 14-VI-2005, SANT-Algae 15759. Moaña harbour, Vigo ría, 29TNG233818, lower intertidal, on vertical quay walls, 17-XI-2004, 25-VIII-2005, SANT-Algae 15518, 16328. San Adrián point, Vigo ría, 29TNG287829, sand and mud-covered rocks, lower intertidal, 12-XI-1996, SANT-Algae 3589, as *Dasya punicea*. Ratas Island, Vigo ría, 29TNG195785, on sand-covered rocks, lower intertidal, 13-XI-1996, SANT-Algae 9264, as *Dasya punicea*. Vigo Marina, Vigo ría, 29TNG2377, experimental surfaces for fouling study, 11-V-1992, SANT-Algae 3460, as *Dasya ocellata*. Vigo harbour near to Industrias Navales Patouro, on *Balanus perforatus*, on dock rocks, 17-III-1995, SANT-Algae 8091, 8092, as *Dasya hutchinsiae*, as *Dasya ocellata*. Iberconsa, Vigo harbour, 29TNG205759, on rocks, 25-IV-1997, SANT-Algae 9199, 9200, as *Dasya punicea*. Coia externo dock, Vigo harbour, 29TNG212758, on *Balanus*, 29-III-1994, SANT-Algae 8271, 8318, as *Dasya ocellata*. Near Industrias Vulcano, Vigo harbour, 29TNG2477, on rocks, 15-VI-1995, SANT-Algae 8036, as *Dasya ocellata*. Bouzas quay, Vigo harbour, 29TNG206755, on *Gracilaria gracilis*, 17-II-1995, SANT-Algae 8231, as *Dasya ocellata*. Inner Coia dock, Vigo harbour, 29TNG212757, on rocks, 29-III-1994, 7-V-1997, SANT-Algae 8277, 9232, as *Dasya ocellata* and *D. punicea*. Arroas point, Vigo ría, 29TNG241804, subtidal (-9 m), dredging on gravel, 24-IX-2004, SANT-Algae 15717. Vigo harbour, new dock near fish quay, on rocks, 13-VII-1995, SANT-Algae 7825, as *Dasya ocellata*. Borna point, Vigo ría, 29TNG251807, subtidal (-2, -9 m) dredging on gravel, 24-IX-2004, SANT-Algae 15718. Domayo point, Vigo ría, 29TNG256809, subtidal (-2 m) dredging on gravel, 24-IX-2004, SANT-Algae 15719.

Material of *Heterosiphonia japonica*

A Coruña: A Muela del Segao, Ferrol ría, 29TNJ562115, subtidal (-5 m) epiphytic on *Cystoseira usneoides*, 1-IX-1998, SANT-Algae 11770, as *Dasyosiphonia* sp. San Martín point, Ferrol ría, 29TNJ578122, subtidal (-12 m) on sand-covered rocks, 10-IX-1998, SANT-Algae 11769, as *Dasyosiphonia* sp. Nande bay, Ferrol ría, 29TNJ584124, on *Gymnogongrus crenulatus*, 19-III-1988, SANT-Algae 411, as *Dasya hutchinsiae*. Leiras point, Ferrol ría, 29TNJ605130, on *Cystoseira tamariscifolia*, 19-III-1988, SANT-Algae 409, as *Dasya ocellata*. Laxe bay, Ferrol ría, 29TNJ582128, on *Corallina elongata* and on *Cystoseira* sp., 16-IV-1988, SANT-Algae 412, 413, as *Dasya hutchinsiae*. Santa Cristina Island, A Coruña ría, 29TNH508993, lower intertidal pool, 27-IV-1995, SANT-Algae 7419, as *Heterosiphonia crispella* var. *laxa*. Outer Santa Cristina Island, A Coruña ría, 29TNH509994, subtidal (-2 m) on *Balanus* and *Mytilus*, 23-II-2004, SANT-Algae 15094. San Antón castle, A Coruña ría, 29TNJ497019, lower intertidal, 5-XII-1994, SANT-Algae 7310, 7316, as *Dasya hutchinsiae* and *Heterosiphonia crispella* var. *laxa*. San Antón, A Coruña ría, 29TNJ497019, subtidal (-8 m), on *Mytilus* and *Balanus*, with *Compsothamnion thuyoides* and *Pterothamnion plumula*, 8-II-2004, SANT-Algae 15073. Casino Marina, A Coruña ría, 29TNJ499025, subtidal (-9-13 m) on *Mytilus* and rocks, 15-III-1997, 15-IV-1997, SANT-Algae 8425, 8434, as *Dasyosiphonia chejuensis*. Dársena, A Coruña harbour, 29TNJ488022, subtidal (-1 m) on *Mytilus*, 22-V-2001, SANT-Algae 14192, as *Dasyosiphonia* sp. Dársena Marine Club, A Coruña harbour, 29TNJ489022, lower intertidal, on *Cladophora rupestris*, 1-II-2002, SANT-Algae 14243, as *Dasyosiphonia* sp. Lagoa bay, A Coruña ría, 29TNJ480038, subtidal, on *Corallina officinalis*, 13-VII-2002, SANT-Algae 15898. Barrañán, Arteixo, 29TNH357958, subtidal (-2 m), 3-VIII-1998, SANT-Algae 13838, as *Dasyosiphonia* sp. Barrañán beach, Arteixo, 29TNH358957, middle intertidal, on sand-covered rock, 29-VIII-2003, SANT-Algae 15349. Cambrona

point, Muros-Noia ría, 29TNH038366, lower intertidal, on rocks, *Balanus* and *Mytilus*, 29-X-2004, SANT-Algae 15782. Fogareiro beach, Muros-Noia ría, 29TMH937335, subtidal (-4 m) dredging on maërl and gravel, 10-II-2006, SANT-Algae 17142. San Francisco bay, Muros-Noia ría, beneath *Laminaria hyperborea* canopy, subtidal (-9 m), 23-VIII-1988, SANT-Algae 5165, as *Dasya ocellata*. Insuela point, Arousa ría, 29TNH030131, on vertical rocks at lower intertidal, with *Undaria pinnatifida*, *Halurus flosculosus*, *Aglaothamnion tripinnatum* and *Rhodophyllis divaricata*, 23-I-2004, SANT-Algae 15024. Riveira, Arousa ría, 29TNH064144, subtidal (-11 m) dredging on maërl, 28-IV-2004, SANT-Algae 15714. Castro point, Arousa ría, 29TNH017096, subtidal (-10 m) dredging on maërl with *Ulva*, 22-VI-2005, SANT-Algae 15836. Rúa Island, Arousa ría, 29TNH050112, subtidal (-18 m) on gravel, 16-VI-1995, SANT-Algae 7396, as *Dasyosiphonia chejuensis*. Corna point, A Pobra do Caramiñal, Arousa ría, 29TNH047144, epiphytic on *Corallina elongata*, 23-IV-1997, SANT-Algae 9258 as *Dasyosiphonia chejuensis*. Tenencia Island, Arousa ría, 29TNH103164, 19-I-2005, SANT-Algae 17036. **Lugo:** Punta Furada (East), Cervo, 29TPJ244399, lower intertidal, 30-IX-2004, SANT-Algae 15459. Inner Morás dock, Xove, 29TPJ239418, lower intertidal on polychaetes, 15-XI-2004, SANT-Algae 15263. San Ciprián, Lago beach, 29TPJ227411, dredging (-5 m) on *Zostera marina* area, 12-VII-2005, SANT-Algae 16101. San Ciprián, inner Morás dock, 29TPJ239418, subtidal (-6 m) on rock, 13-VII-2005, SANT-Algae 16074. Toxido beach, Vivero ría, 29TPJ101440, subtidal (-4 m) with *Falkenbergia rufolanosa*, 10-IX-2002, SANT-Algae 13950, as *Dasyosiphonia* sp. **Pontevedra:** Piedra Seca Lighthouse, Arousa ría, 29TNH067110, subtidal (-10-19 m) on maërl and gravel, 23-VI-1995, 22-IX-1995, 6-III-1996, 9-V-1996, 23-I-1997, SANT-Algae 7425, 7445, 7450, 7580, 7690, 8724, 8789, as *Dasyosiphonia chejuensis*. Quilme point, Arousa Island, Arousa ría, 29TNH098098, lower intertidal, 19-VIII-1997, SANT-Algae 5860, as *Dasya ocellata*. Puerto point, Arousa Island, Arousa ría, 29TNH112128, rocks at lower intertidal, 10-I-1997, SANT-Algae 3694, as *Dasyosiphonia chejuensis*. Naval beach, Arousa Island, Arousa ría, 29TNH103128, lower intertidal, on *Balanus* and *Mytilus*, 29-X-2004, SANT-Algae 15768. Near Barbafeita point, Arousa Island, Arousa ría, 29TNH084128, dredging (-9 m) on maërl, 17-VI-2005, SANT-Algae 15831. Tragove, Arousa ría, 29TNH143082, lower intertidal, on sand-covered rocks, 23-I-1997, SANT-Algae 3728, as *Dasyosiphonia chejuensis*. Moreira point, O Grove, Arousa ría, 29TNH086039, on maërl (-5 m) with *Dasya sessilis*, 4-VI-2004, SANT-Algae 15744. A Toxa, O Grove, Arousa ría, 29TNH126058, lower intertidal, 30-I-1998, SANT-Algae 9404. Tulla beach, Pontevedra ría, 29TNG155876, subtidal (-9 m) dredging on maërl and gravel, 18-II-2005, SANT-Algae 15711. Loira point, Pontevedra ría, 29TNG208906, subtidal, (-10 m) dredging on maërl and gravel, 14-VI-2005, SANT-Algae 15764. Coia dock, Vigo harbour, 29TNG212758, on *Cystoseira baccata* and *Balanus*, 29-III-1994, SANT-Algae 8265, 8266, as *Dasyosiphonia chejuensis*. Near Industrias Navales Patouro, Vigo harbour, on *Balanus*, 25-VI-1994, 17-III-1995, SANT-Algae 8086, 8090, 8119, 8150, as *Dasyosiphonia chejuensis*. Iberconsa, Vigo harbour, Vigo ría, 29TNG205759, on quay rocks, 25-IV-1997, SANT-Algae 9202, as *Dasyosiphonia chejuensis*. Alcabre, Vigo harbour, 29TNG1975, on quay rocks, 27-IX-1995, SANT-Algae 7945, as *Dasyosiphonia chejuensis*. Leixón de Area milla, Vigo ría, 29TNG157775, subtidal (-16 m), dredging on maërl and gravel, 7-IX-2004, SANT-Algae 15712. Castros da Barra, Vigo ría, 29TNG138771, subtidal (-13 m), on maërl and gravel, 8-IX-2004, SANT-Algae 15522. Cangas bay, Vigo ría, 29TNG185769, subtidal (-17 m), dredging on gravel, 17-IX-2004, SANT-Algae 15713. Cangas bay, Vigo ría, 29TNG188777, subtidal (-10 m) dredging on maërl, epizoic on polychaete, 17-VIII-2004, SANT-Algae 15710. Rodeira, Vigo ría, 29TNG205783, 29TNG205784, subtidal (-4-6 m) on maërl, with *Kallymenia reni-*

formis, *Gracilaria multipartita* and *Sargassum muticum*, 17-III-2004, 18-V-2005, 7-VII-2005, 19-I-2006, SANT-Algae 15105, 15692, 15715, 16752, 16774, 17080, 17104.

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References

- Afonso-Carrillo, J. & Sansón, M. 1999. *Algas, hongos y fanerógamas marinas de las Islas Canarias. Clave analítica*. Universidad de La Laguna. La Laguna.
- Ballantine, D.L. & Aponte, N.E. 2004. *Dasya abbottiana* sp. nov. (Dasyaceae, Rhodophyta) from Puerto Rico, Caribbean Sea. *Cryptogamie Algologie* 25(4): 409-417.
- Bárbara, I., Cremades, J., Veiga, A.J. & López Rodríguez, M. C. 2003. *Dasysiphonia* sp. (Ceramiales, Dasyaceae) nuevo rodófito alóctono para la Península Ibérica. *Anales del Jardín Botánico de Madrid* 60(2): 440-443.
- Bárbara, I., Cremades, J. & Veiga, A.J. 2004. Floristic study of a maërl and gravel subtidal bed in the "Ría de Arousa" (Galicia, Spain). *Botanica Complutensis* 28: 27-37.
- Bárbara, I., Cremades, J., Calvo, S., López-Rodríguez, M.C. & Dosil, J. 2005. Checklist of the benthic marine and brackish Galician algae (NW Spain). *Anales del Jardín Botánico de Madrid* 62(1): 69-100.
- Bjærke, M.R. & Rueness, J. 2004. Effects of temperature and salinity on growth, reproduction and survival in the introduced red alga *Heterosiphonia japonica* (Ceramicales, Rhodophyta). *Botanica Marina* 47(5): 373-380.
- Choi, H-G. 2001. Morphology and reproduction of *Heterosiphonia pulchra* and *H. japonica* (Ceramicales, Rhodophyta). *Algae* 16(4): 387-409.
- De Jong, Y. 1997. Studies on Dasyaceae. 1. Reproductive structures of *Eupogodon planus* and *E. spinellus* (Ceramicales, Rhodophyta) from Corsica (Mediterranean). *Phycologia* 36(4): 281-292.
- Dixon, P.S. & Irvine, L.M. 1970. Miscellaneous notes on algal taxonomy and nomenclature III. *Botaniska Notiser* 123: 474-487.
- Donze, M. 1968. The algal vegetation of the Ría de Arosa (NW. Spain). *Blumea* 16: 159-192.
- Fredericq, S. & Norris, J.N. 1986. The structure and reproduction of *Dasya haitiana* sp. nov. (Dasyaceae, Rhodophyta) from the Caribbean Sea. *Phycologia* 25(2): 185-196.
- Lein, T.E. 1999. A newly immigrated red alga ("Dasysiphonia", Dasyaceae, Rhodophyta) to the Norwegian coast. *Sarsia* 84: 85-88.
- Maggs, C.A. 1998. Life history variation in *Dasya ocellata* (Dasyaceae, Rhodophyta). *Phycologia* 37(2): 100-105.
- Maggs, C.A. & Hommersand, M.H. 1993. *Seaweeds of the British Isles, Volume 1 Rhodophyta Part 3A Ceramicales*. The Natural History Museum. London.
- Otero-Schmitt, J. 1993. *Estudio de las fitocenosis bentónicas litorales en el tramo de costa comprendido entre Pta. Louro y Pta. Remedios (La Coruña-España)*. PhD Thesis. Universidad de Santiago de Compostela. Santiago de Compostela.
- Peña, V. & Bárbara, I. 2002. [2003] Caracterización florística y zonación de las algas bentónicas marinas del puerto de A Coruña (N.O. Península Ibérica). *Nova Acta Científica Compostelana* 12: 35-66.
- Schlech, K.E. & Abbott, I.A. 1989. Species of Dasyaceae (Rhodophyta) from Hawaii. *Pacific Science* 43(3): 332-351.
- Schneider, C.W. & Searles, R.B. 1991. *Seaweeds of the Southeastern United States. Cape Hatteras to Cape Canaveral*. Duke University Press. Durham.
- Seoane-Camba, J. 1957. Algas superiores de las rías bajas gallegas. *Investigación Pesquera* 8: 15-28.
- Stegenga, H. 1997. Een nieuwe Japanse invasie-vooral een systematisch probleem. *Het Zeepard* 57(5): 109-113.
- Taylor, W.R. 1979. *Marine algae of the eastern tropical and subtropical coasts of the Americas*. The University of Michigan Press. Ann Arbor.
- Veiga, A.J., Cremades, J. & Bárbara, I. 1998. Fragmenta Chorologica Occidentalia, Algae, 6283-6307. *Anales del Jardín Botánico de Madrid* 56(1): 121-123.
- Verlaque, M. 2002. Morphology and reproduction of *Dasya sessilis* (Ceramicales, Rhodophyta), an introduced Asian species thriving in Thau Lagoon (France, Mediterranean Sea). *Phycologia* 41(6): 612-618.
- Yamada, Y. 1928. Report of the biological survey of Mutsu Bay. 9. Marine algae of Mutsu Bay and adjacent waters. II. *Scientific reports of Tohoku Imperial University* 4(3): 497-534.

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