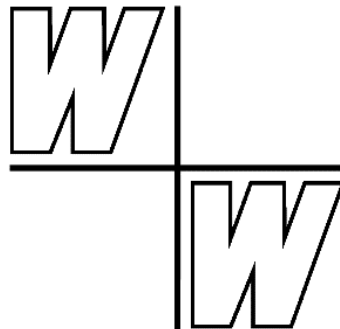


Data Collection on Intergeneric Hybrids and Basic Types: **ALGAE**

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<https://www.wort-und-wissen.org/artikel/data-collection-basic-types/>

“ALGAE”

algae = Algen

Systematics according to AlgaeBase: Guiry MD & Guiry GM (2014) AlgaeBase. World-wide electronic publication. National University of Ireland, Galway.
<https://www.algaebase.org/browse/taxonomy/?tc=accept&id=4586>

Summary

10 intergeneric hybrids, in 5 families (Fucales: Fucaceae; Laminariales: Agaraceae, Alariaceae, Laminariaceae, Lessoniaceae).

1 preliminary basic type:

Laminariales (provisional) (6 families) 38: 143. **9 IG (incl. 3 IF)**

Abbreviations:

° = taxa actually not accepted in the rank of a genus, e. g. *Cerasus*° (= *Prunus* p. p.)

10: 50 etc. The numbers behind the names of families etc. refer to extant genera and species

IS = interspecific hybrid. **IG** = intergeneric hybrid. **IST** = intersubtribal hybrid.

IT = intertribal hybrid. **ISF** = intersubfamilial hybrid. **IF** = interfamilial hybrid

EC = embryo culture or ovule culture

SO = somatic hybrid by cell fusion; normally these hybrids are asymmetric

AS = asymmetric hybrids, they do not equally express maternal and paternal features

HY = assumed intergeneric hybridogeneous origin of a taxon

nat. hyb. = natural hybrid **art. hyb.** = artificial hybrid

Colors within the crosses:

Red letters: intergeneric hybrids (incl. former IG).

Gray letters: hybridity unconfirmed or erroneous.

Green letters: notes on tribes, subfamilies etc. involved in the hybridization.

Yellow shaded: Notes concerning basic types.

Class
CHLOROPHYCEAE
green algae = Grünalgen

Only somatic intergeneric hybrids are known so far in green algae = SO

References on Chlorophyceae:

- Lee SY & Brown RM Jr (1987) Experimental cell fusion with selected Siphonocladalean algal cells. pp. 167–178 in Sowers AE (ed.) Cell fusion. Plenum Press: New York, USA; London, England, UK. **Cladophorales (Siphonocladales) SO**
- Guiry MD & Guiry GM (2014) AlgaeBase. World-wide electronic publication. National University of Ireland, Galway.
<https://www.algaebase.org/browse/taxonomy/?tc=accept&id=4586>
- Leible MB, Shoeman RL & Schweiger HG (1982) Ribulose 1 5 bis phosphate carboxylase EC-4.1.1.39 - a marker for chloroplast species specificity in *Acetabularia*. Biochimica et Biophysica Acta 699 (1), 60–66. **Dasycladales SO**
- Reddy CRK, Iima M & Fujita Y (1992) Induction of fast-growing and morphologically different strains through intergeneric protoplast fusions of *Ulva* and *Enteromorpha*. Chlorophyta. J. Applied Phycology 4 (1), 57–65. **Ulvales Enteromorpha × Ulva SO**
- Ohiwa T (1978) Behavior of cultured fusion products from *Zygnema extenua* and *Spirogyra gracilis* protoplasts. Protoplasma 97 (2–3), 185–200. **Zygnematales Spirogyra × Zygnema SO asymmetric**
- Ohiwa T (1980) Fine structure of degenerating nuclei in intergeneric fusion products from Zygnemataceae protoplasts. Protoplasma 102 (1–2), 77–96. **Zygnematales: Spirogyra × Zygnema SO asymmetric**
- Ohiwa T (1981) Intergeneric fusion of Zygnemataceae protoplasts. Bot. Magazine-Tokyo 94 (1035), 261–272. **Zygnematales: Spirogyra × Zygnema SO asymmetric**

Class
PHAEOPHYCEAE 265: 1500–2500
brown algae = Braunalgen

4 subclasses, 23 orders

Arrangement according to the order.

Ectocarpales 6 families (subclass Fucophycidae)

Ectocarpales: Ectocarpaceae 4–7

Montecinos AE et al. (2017) Hybridization between two cryptic filamentous brown seaweeds along the shore: analysing pre- and postzygotic barriers in populations of individuals with varying ploidy levels. *Mol. Ecol.* 26 (13), 3497–3512. doi: 10.1111/mec.14098. *Ectocarpus* **IS**

Fucales 9 families, 522 species (subclass Fucophycidae)

Fucales: Fucaceae 6: 23. 1 IG

IS: *Fucus* (Williams 1899, Scott & Hardy 1994, Coyer et al. 2002)

Ascophyllum 1, *Fucus* 15, *Hesperophycus* 1, *Pelvetia* 1, *Pelvetiopsis* 2, *Silvetia* 3

Fucus vesiculosus × *Ascophyllum nodosum* Williams 1899 (nat. hyb.), Kim et al. 1997 (art. hyb.; only up to embryos with a few cells)

Fucales: Sargassaceae 30: 541

Carpophyllum 6, *Halidrys* 2, *Sargassum* 358, ...

IS: *Carpophyllum angustifolium* × *C. maschalocarpum* Hodge et al. 2010

References on Fucales:

Coyer JA et al. (2002) Hybridization of the marine seaweeds, *Fucus serratus* and *Fucus evanescens* (Heterokontophyta: Phaeophyceae) in a 100-year-old zone of secondary contact. *Proc. R. Soc. Lond. Ser. B-Biol. Sci.* 269, 1829–1834.

Hodge FJ et al. (2010) Hybridization between the endemic brown algae *Carpophyllum maschalocarpum* and *Carpophyllum angustifolium* (Fucales): Genetic and morphological evidence (2010) *Phycological Research*.

<https://doi.org/10.1111/j.1440-1835.2010.00583.x>

Kim KY, O'Leary SJ & Garbary DJ (1997) Artificial hybridization between *Ascophyllum nodosum* and *Fucus vesiculosus* (Phaeophyceae) from Nova Scotia, Canada. *Canad. J. Bot.* 75, 1133–1136.

Scott GW & Hardy FG (1994) Observations of the occurrence of hybrids between 2 sympatric species of furoid algae. *Cryptogam. Algol.* 15, 297–305. *Fucus* **IS**

Williams KL (1899) New *Fucus* hybrids. *Ann. Bot. (London)* 13, 187–188. **IS**

Laminariales 7 families 38: 143. (6 IG + 3 IF) (subclass Fucophycidae)

7 families (The circumscription has recently been changed, see AlgaeBase 2025):

Agaraceae (= Costariaceae) 5: 11 *Agarum* 4, *Costaria* 2, *Dictyoneurum* (incl.

Dictyoneuropsis) 2, *Neoagarum* 2, *Thalassiophyllum* 1

Akkesiphycaceae 1: 1 *Akkesiphycus lubricum*

Alariaceae 7: 24 *Alaria* 17, *Eualaria* 1, *Lessoniopsis* 1 *littoralis*, *Orgyia* 1, *Pleurophycus* 1, *Undaria* 2, *Undariella* 1.

(Arthrothamnaceae see Laminariaceae)

Aureophycaceae 1: 1 *Aureophycus* 1

Chordaceae 1: 6 *Chorda* 6

Laminariaceae 15: 65 see below

Lessoniaceae 5: 32 *Ecklonia* 6, *Eckloniopsis* 1, *Egregia* 1, *Eisenia* 2, *Lessonia* 10, incertae sedis 3: 3

Attention: Druehl et al. 2005 write that in many putative hybrids of Laminariales only the DNA of one parental genome could be detected; exception: *Alaria* × *Lessoniopsis*.

Probably basic type **order Laminariales**. The order is well defined, but the subdivision is matter of debate. The order includes 38 genera and 143 species in 7 families. Of these, Agaraceae, Laminariaceae and Lessoniaceae are connected by interfamilial hybridization, thus connecting 30 genera and 108 species.

Laminariales: Agaraceae (= Costariaceae) 5: 11. 2 IF

Agarum 4, *Costaria* 2, *Dictyoneurum* (incl. *Dictyoneuropsis*) 2, *Neoagarum* 2, *Thalassiophyllum* 1.

Dictyoneuropsis[°] (= *Dictyoneurum*) *reticulatum* × *Dictyoneurum californicum* **IS** Lewis & Neushul 1995 → now interspecific hybrid

Dictyoneuropsis[°] (= *Dictyoneurum*) *reticulatum* × *Pelagophycus porra* **IF** Agaraceae × Laminariaceae (art. hyb.) Coyer et al. 1992

Dictyoneurum californicum × *Macrocystis* **IF** Agaraceae × Laminariaceae (art. hyb.) Lewis & Neushul 1995

Laminariales: Alariaceae 7: 24. 1 IG

Alaria 18, *Eualaria* 1, *Lessoniopsis* 1 (formerly Lessoniaceae), *Orgyia* 1, *Pleurophycus* 1, *Pterygophira* 1, *Undaria* (incl. *Undariopsis*) 2, *Undariella* 1

Alaria + *Laminaria* **IF**, not a sexual hybrid Tokida et al. 1958

Alaria × *Lessoniopsis* Liptack & Druehl 2001 (*A. marginata* × *L. littoralis*) (*Lessoniopsis* was formerly placed in the Lessoniaceae, and the hybrid was at that time classified as interfamilial) true hybrid

Undaria pinnatifida × *Undariopsis*[°] (= *Undaria*) *peterseniana* **IS** (gametophytes) Hwang et al. 2012

Laminariales: Laminariaceae 15: 65. 2 IG + 1 IF (+ 2 IF)

Arthrothamnus 2 (sometimes separated as own family Arthrothamnaceae), *Cymathere* 2, *Hedophyllum* 5, *Kjellmaniella* 1, *Laminaria* 29, *Macrocystis* 4, *Nereocystis* 1, *Pelagophycus* 1, *Polyschidia* 1, *Postelsia* 1, *Postelsiopsis* 1, *Pseudolessonia* 1, *Saccharina* 14, *Strptophyöpsis* 1, *Tauya* 1.

IS: *Macrocystis* Lewis et al. 1986, Lewis & Neushul 1994; *Saccharina* Li et al. 2016

Dictyoneurum californicum × *Macrocystis* IF Agaraceae × Laminariaceae (art. hyb.)
Lewis & Neushul 1995

Dictyoneurum (*Dictyoneuropsis*^o) *reticulatum* × *Pelagophycus porra* IF Agaraceae × Laminariaceae interfamilial (art. hyb.) Coyer et al. 1992

Laminaria digitata, saccharina × *Saccorhiza polyschides* probably erroneous Cosson 1987
(*Saccorhiza* is now placed in Phyllariaceae, order Tilopteridales)

Macrocystis pyrifera × *Nereocystis leutkeana* Sanbonsuga & Neushul 1978, 1979,
en.wikipedia 2025

Macrocystis × *Lessonia* IF Laminariaceae × Lessoniaceae Murua et al. 2020 (*M. pyrifera*
× *L. spicata*, nat. hyb.)

Macrocystis × *Pelagophycus porra* (nat. hyb.) Neushul 1962, Coyer & Zaugg-Haglund
1982, Coyer et al. 1992, Lewis & Neushul 1995

Laminariales: Lessoniaceae 5: 29. 3 IG (+ 1F)

Ecklonia 6, *Eckloniopsis* 1 *radicosa*, *Egregia* 2, *Eisenia* 2 *bicyclis, nipponica*, *Lessonia* 11.

IS: *Ecklonia* Shingo et al. 2021

Ecklonia cava, kurome × *Eckloniopsis radicosa* Migita 1985, Akita et al. 2021 (*E. cava* × *E. radicosa*)

Ecklonia cava, kurome, stolonifera × *Eisenia bicyclis* Migita 1984

Eckloniopsis radicosa × *Eisenia nipponica* Akita et al. 2021

Macrocystis × *Lessonia* IF Laminariaceae × Lessoniaceae Murua et al. 2020 (*M. pyrifera*
× *L. spicata*, nat. hyb.)

References on Laminariales:

- Akito S et al. (2021) Molecular evidence for naturally occurring intra- and inter-generic hybridization in the genus *Ecklonia* (Laminariales, Phaeophyceae). *Phycologia* 60 (2). <https://doi.org/10.1080/00318884.2021.1885246> e.g. *Ecklonia r.* × *Eisenia n.*
- .Cosson J (1987) Growth of sporophytes resulting from interspecific and intergeneric hybridization in Laminariales. [French] *Cryptogamie Algologie* 8, 61–72.
- Coyer JA, Engle JM & Zimmerman RC (1992) Discovery of a fertile *Pelagophycus* × *Macrocystis* (Phaeophyta) putative hybrid and subsequent production of F₂ sporophytes in the laboratory. *J. Phycol.* 28, 127–130.

- Coyer JA & Zaugg-Haglund AC (1982) A demographic study of the elk kelp, *Pelagophycus porra* (Laminariales, Lessoniaceae), with notes on *Pelagophycus* × *Macrocystis* hybrids. *Phycologia* 21, 399–407.
- Druehl LD, Collins JD, Lane CE & Saunders GW (2005) An evaluation of methods used to assess intergeneric hybridization in kelp using Pacific Laminariales (Phaeophyceae). *J. Phycol.* 41 (2), 250–262.
- Hwang EK, Gong YG & Park CS (2012) Cultivation of a hybrid of free-living gametophytes between *Undariopsis peterseniana* and *Undaria pinnatifida*: morphological aspects and cultivation period. *J. Applied Phycology* 24 (3), Special Issue SI, 401–408.
- Kim KY, O'Leary SJ & Garbary DJ (1997) Artificial hybridization between *Ascopyllum nodosum* and *Fucus vesiculosus* (Phaeophyceae) from Nova Scotia, Canada. *Canad. J. Bot.* 75, 1133–1136.
- Lane EC, Mayes C, Druehl D & Saunders QW (2006) A multi-gene molecular investigation of the kelp (Laminariales, Phaeophyceae) supports substantial taxonomic re-organization. *J. Phycol.* 42, 493–512.
- Lewis RJ et al. (1986) Interspecific hybridization of the species of *Macrocystis* in California. *Aquaculture* 57, 203–210.
<https://www.sciencedirect.com/science/article/abs/pii/0044848686901985>
- Lewis RJ & Neusul M (1994) Northern and southern hemisphere hybrids of *Macrocystis* (Phaeophyceae). *J. Phycol.* 30, 346–353. <https://doi.org/10.1111/j.0022-3646.1994.00346.x>
- Lewis RJ & Neushul M (1995) Intergeneric hybridization among five genera of the family Lessoniaceae (Phaeophyceae) and evidence for polyploidy in a fertile *Pelagophycus* × *Macrocystis* hybrid. *J. Phycol.* 31 (6), 1012–1017.
<http://bio.research.ucsc.edu/people/carr/publications/Nereo-lit/Nereo%20online%20PDFs/Lewis%201995.pdf>
- Li X et al. (2016) Breeding of an intraspecific kelp hybrid Dongfang no. 6 (*Saccharina japonica*, Phaeophyceae, Laminariales) for suitable processing products and evaluation of its culture performance. *J. Appl. Phycol* 28, 439–447 .
<https://doi.org/10.1007/s10811-015-0562-0>
- Liptack MK & Druehl LD (2000) Molecular evidence for an interfamilial laminarialean cross. *Europ. J. Phycology* 35, 135–142. *Alaria* × *Lessoniopsis*
- Migita S (1984) Intergeneric and interspecific hybridization between four species of *Eisenia* and *Ecklonia*. [Japanese] *Bull. Fac. Fish., Nagasaki Univ.* 56, 15–20.
- Migita S (1985) Life history and culture experiment of *Eckloniopsis radicata*, Phaeophyceae Laminariaceae. [Japanese] *Bull. Fac. Fish., Nagasaki Univ.* 58, 105–111.
- Murua P et al. (2020) Morphological, genotypic and metabolomic signatures confirm interfamilial hybridization between the ubiquitous kelps *Macrocystis* (Arthrothamnaceae) and *Lessonia* (Lessoniaceae). *Scientific Reports* 10 (1).
[Attention: *Macrocystis* is now part of Laminariaceae as defined today](#)

- Neushul M (1962) Possible intergeneric hybrids in giant kelps (Lessoniaceae). Amer. J. Bot. 49 (Suppl.), 672.
- Sanbonsuga Y & Neushul M (1978) Hybridization of *Macrocystis* (Phaeophyta) with other float bearing kelps. J. Phycology 14 (2), 214–224. *Macrocystis* × *Pelagophycus*
- Sanbonsuga Y & Neushul M (1979) Cultivation and hybridization of giant kelps (Phaeophyceae]. Proc. Int. Seaweed Symp. 9, 91–96.
- Saunders GW & Druehl LD (1993) Revision of the kelp family Alariaceae and the taxonomic affinities of *Lessoniopsis* Reinke (Laminariales, Phaeophyta). Fourteenth Internat. Seaweed Symposium, 689–697.
- Tokida J, Ohmi H & Imashima M (1958) A chimaera of *Alaria* and *Laminaria* found in nature. Nature 181, 923–924. *Not a sexual hybrid*.

Class

„Rhodophyceae“

red algae = Rotalgen

References on Rhodophyceae:

- Mizukami Y et al. (1995) Culture and development of electrically fused protoplasts from red marine-algae, *Porphyra yezoensis* and *P. suborbiculata*. Aquaculture 132, 361–367. *Porphyra interspecific, somatic hybrid*
- Mine I & Tatewaki M (1993) Life history of *Halosaccion yendoi* I. K. Lee (Palmariales Rhodophyta) and interspecific spermatium inoculation with *Palmaria* sp. from Hokkaido Japan. Japanese J. Phycology 41 (2), 123–130. *Palmariales Halosaccion* × *Palmaria* unsuccessful