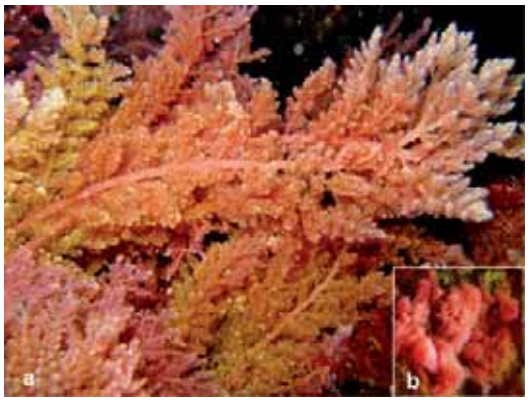
Asparagopsis taxiformis (Delile) Trevisan de Saint-Léon

Relevant synonyms
Fucus taxiformis Delile
Falkenbergia hillebrandii (Bornet) Falkenberg



a. Gametophyte.
b. Tetrasporophyte.

Photos a: S.Ruitton (Mediterranean, France); b: Littler & Littler, 2000 (S Pacific).

Short description

Asparagopsis taxiformis has a heteromorphic life history with alternation of erect gametophytes (*A. taxiformis*) and filamentous tetrasporophyte first regarded as a distinct species (*Falkenbergia hillebrandii*). Gametophytes: medium (to 30 cm high), erect, dark brown-red, fading to grey-red, much branched with cylindrical axis, 2 mm in diameter, bearing dense plumose branches on all sides; branches densely covered with indeterminate branchlets and short unbranched determinate ramuli; attachment by basal stolons and rhizoids; usually epilithic; structure uniaxial; monoecious or dioecious; cystocarps globular, stalked, 1-1.5 mm in diameter; spermatangial organs broadly clavate, stalked, 180-280 µm in diameter and 350-650 µm long. Tetrasporophyte ("*Falkenbergia*" phase) indistinguishable from that of *A. armata*: small (up to 2 cm high), filamentous, cotton-wool-like tufts, dense and much branched; filaments, 40-60 µm in diameter, with 3 periaxial cells around each axial cell; each periaxial cell cutting off inwardly a small spherical gland cell; tetrasporangia forming an irregular series, cruciately divided. The gametophytes of the Indo-Pacific taxon (see below) very robust with naked main axes below.

Distinguishing characteristics

Gametophytes: the thallus plumose, dark brown-red, fading to grey-red, usually epilithic, and the basal stolons and rhizoids without harpoon-like branches are distinctive; confusion possible with:
- *A. armata* Harvey: thallus smaller and less plumose, purplish-red in colour, with harpoon-like branches.

Tetrasporophyte: axes with 3 periaxial cells is distinctive of a *"Falkenbergia"* phase. Tetrasporophytic phases of *Asparagopsis* species are indistinguishable without fine morphological and genetic studies.

Biology / Ecology / Habitat

Subtidal communities; tetrasporophyte present all year round; gametophytes only in winter - early summer.

Distribution

Because the tetrasporophytic phases of the *Asparagopsis* species are indistinguishable, only the distribution of gametophytes (and tetrasporophytes if confirmed by molecular studies) is considered here. **Worldwide**: widespread in warmer seas; central western Atlantic, from Georgia (USA) to Brazil; eastern Atlantic, from Azores to Nigeria; Red Sea; Indian Ocean, widely distributed, from Iran to South Africa; western Pacific, Philippines, Sri Lanka, Vietnam, Japan, Taiwan, China; Papua New Guinea; Australia, New Zealand, New-Caledonia; eastern Pacific, California, Mexico, Panama, Chile; Pacific Islands, Fiji, Hawaiian Islands, French Polynesia, Easter Island. **Mediterranean**: described in 1813 from Alexandria, Egypt (Delile, 1813 and 1826, as *Fucus taxiformis*); successively recorded in Syria (Ardissone, 1883); Libya (De Toni, 1895; Bazairi *et al.*, 2013); Algeria (Feldmann and Feldmann, 1939b; Sartoretto *et al.,* 2008); Balearic Islands (Ballesteros and Rodriguez-Prieto, 1996); Lebanon (Lakkis and Novel-Lakkis, 2000); Spain, Andalusía (Báez *et al.*, 2001); Turkey (Aysel *et al.,* 2001); Italy, Sicily (Barone *et al.*, 2003), Liguria, Elba, Roma, Naples (Andreakis *et al.*, 2004); Tunisia (Andreakis *et al.*, 2004; Sartoretto *et al.*, 2008); France, La Ciotat (2005, S. Ruitton, unpublished data); Greece, south Aegean Sea, Rhodes Island and Saronikos Gulf (Tsiamis and Panayotidis, 2007b), Ionian and west Aegean Sea (Bardamaskos *et al.*, 2009; Tsiamis *et al.*, 2010, 2013), Chios Island (Katsanevakis and Tsiamis, 2009); Israel (Einav, 2007; Hoffman and Dubinsky, 2010); Croatia (Žuljević *et al.,* 2009); Albania (Katsanevakis *et al.*, 2011). The tetrasporophyte "*F. hillebrandii* (Bornet) Falkenberg" described from Elba (Ardissone, 1883, as *Polysiphonia hillebrandii* Bornet) may in fact represent the first report of *A. armata* in the Mediterranean (Ní Chualáin *et al.,* 2004).The scenario of the expansion of *A. taxiformis* resembles that of the *Caulerpa racemosa* complex. Two cryptic taxa coexist under the name of *A. taxiformis* in the Mediterranean Sea: a taxon described in 1813 from Alexandria and confined to the eastern Mediterranean Basin (Egypt, Lebanon, Syria and likely Libya) and another one, more recently introduced into the Mediterranean Sea, exhibiting an invasive behaviour in the western basin (Algeria, Balearic Islands, France, western Italy, Sicily, Tunisia) and the Adriatic Sea, Croatia (N. Andreakis, pers. com.). Recent molecular results showed that the first taxon appears to be of Atlantic provenance, via the Strait of Gibraltar, whereas the second taxon probably colonized the Mediterranean from Indo-Pacific (possible origin: Western Australia), most likely via the Suez Canal (Andreakis *et al.*, 2004, 2007; Ní Chualáin *et al.,* 2004). According to certain authors, the Atlantic taxon might be a native species (Verlaque, 1994; Cormaci *et al.,* 2004). The Mediterranean distribution of the two taxa appears to be closely related to their lower survival temperature (17 °C and 9-11 °C for the Atlantic and the Indo-Pacific taxon, respectively) (Ní Chualáin *et al.,* 2004).

Mode of introduction

Two distinct introductions: by shipping via Gibraltar, and via the Suez Canal.

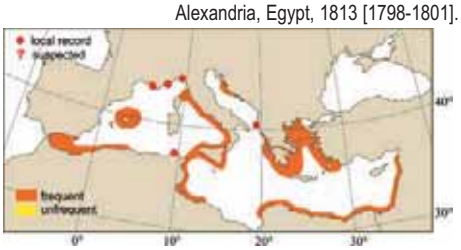
Establishment

Well established.

Importance to humans

The Indo-Pacific taxon is invasive and can become a nuisance.

1st Mediterranean record
Alexandria, Egypt, 1813 [1798-1801].



Key references

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