

Kappaphycus alvarezii

(Doty) Doty ex Silva 1996

Kappaphycus species are among the largest tropical red algae, with a high growth rate (can double in 15 to 30 days). Luckily, the plants only dispersal is by vegetative fragmentation, which appears to limit their expansion.

Division Rhodophyta
 Class Rhodophyceae
 Order Gigartinales
 Family Solieriaceae
 Genus *Kappaphycus*



IDENTIFYING FEATURES

DESCRIPTION

Algae tough, fleshy, firm; up to 2 m tall. Thalli coarse, with axes and branches 1 - 2 cm diameter; heavy, with major axes relatively straight, lacking secondary branches near apices. Frequently and irregularly branched, most branches primary, secondary branches intercalated between primary branches or mostly lacking.

Morphologically plastic: variable thalli forms, from gnarled forms with few small branches in shallow areas to large, intricately tangled, fleshy mats in deeper waters.

COLOR

Shiny green to yellow orange.

HABITAT

Reef flat and reef edge, 1 to 17 m deep. Loosely attached to broken coral, or unattached fragments floating in shallow and deep waters. Can form large, moving mats of unattached thalli.



STRUCTURAL

Thick-walled filaments that form a medullary core running from near the apices to the bases, becoming mixed with other cell types below and thus differing in cross-sectional appearance throughout; non-fibrillar cell wall material that is principally kappa-carrageenan. Tetrasporangia zonately divided, scattered in outer cortex. Spermatangia not conclusively demonstrated and cystocarps extremely rare.

DISTRIBUTION

HAWAI'I

Kane'ohē, O'ahu.

WORLDWIDE

Malaysia, Sulu sea, southern Philippines.

MECHANISM OF INTRODUCTION

Introduced to Kane'ohē Bay in 1974 for commercial cultivation.

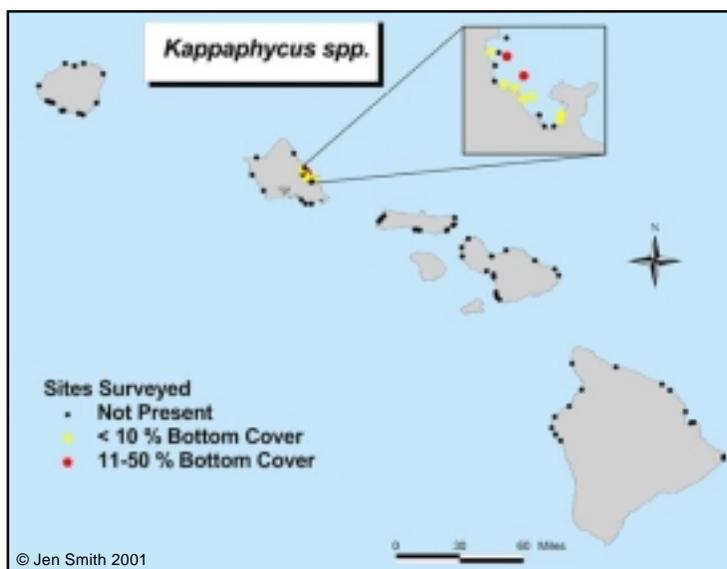
ECOLOGY/IMPACT

The two *Kappaphycus* species, *K. alvarezii* and *K. striatum*, are some of the largest tropical red algae, with extremely high growth rates, doubling in 15-30 days. Since their introduction in Kaneohe Bay in 1974, they have spread at the rate of 260 m/yr. The high growth rate, plastic morphology, and extremely successful vegetative regeneration make the two *Kappaphycus* species potentially destructive invasives in Hawaiian waters.

In Hawaii, *K. alvarezii* only reproduces by vegetative fragmentation. It has not been observed to reproduce sexually in cultivation or in the wild. Instead, at the tip of each branch is a cluster of apical cells potentially high in regenerative capabilities that are able to regenerate a new thallus after breaking off. A broken tip can grow into full-sized thalli in a short period of time.

This species has been highly successful at Kaneohe Bay, dominating the sandy spur and grooves on the reef flat. It inhabits barren sandy grooves where it does not appear to compete with native algal species. In other locations, *K. alvarezii* has been found to provide habitat for a diverse invertebrate population and reef fishes. This red alga was found to have a higher index of species diversity than neighboring reefs without the alien. It is highly grazed and can be found to be the primary food item in gut contents of common herbivorous fishes. The alga's large growth form can be detrimental to corals by shading or smothering, thus causing coral death.

The red alga's dispersal is thought to be constrained by size and weight, as it appears to become trapped in depressions and channels. The species is also constrained by high herbivory. *K. alvarezii* has managed to spread to neighboring reefs with supportive physical factors and



little grazing, where it is dominating the changing marine ecology.

K. alvarezii has been introduced throughout the warm tropics for commercial cultivation. It is a major producer of kappa-carrageenan, which is used for medicinal purposes and as a homogenizer in milk products, toothpaste and jellies.

REFERENCES

- Abbott, I.A., 1999. Marine Red Algae of the Hawaiian Islands. Bishop Museum Press, Honolulu, Hawai'i.
- Rodgers, S.K, and E.F. Cox, 1999. Rate of spread of introduced rhodophytes *Kappaphycus alvarezii*, *Kappaphycus striatum*, and *Gracilaria salicornia* and their current distributions in Kane'ohē Bay, O'ahu, Hawai'i. Pacific Science 53: 232-241.
- Russell, D.J. 1983. Ecology of the imported red seaweed *Eucheuma striatum* Schmitz on Coconut Island, O'ahu, Hawai'i. Pacific Science 37: 87-107.
- Woo, M.M.L., 2000. Ecological impacts interactions of the introduced red alga, *Kappaphycus striatum*, in Kane'ohē Bay, O'ahu, Masters Thesis, University of Hawai'i at Manoa, Honolulu, Hawai'i.

WEB PAGE

Marine Invasives in Hawai'i. <http://www.botany.hawaii.edu/Invasive/default.htm>

Ecological Success of Alien/Invasive Algae in Hawai'i. <http://www.botany.hawaii.edu/GradStud/smith/websites/ALIEN-HOME.htm>