

***Kappaphycus* spp.**

System: Marine

Kingdom	Phylum	Class	Order	Family
Plantae	Rhodophyta	Florideophyceae	Gigartinales	Solieriaceae

Common name guso (English), agar agar seru laut (English), red alga (English), eucheuman (English), cottonii (English), chilin-t' sai (English), eucheuma (English), kirinsai (English), agar agar pulau (English), agar agar besar (English), algae (English), algues rouges (French), agar-agar (English), agal agal besar (English), brown licorice (English), agal agal (English)

Synonym

Similar species *Kappaphycus alvarezii*, *Kappaphycus cottonii*, *Kappaphycus inermis*, *Kappaphycus interme*, *Kappaphycus procrusteanum*, *Kappaphycus striatum*

Summary *Kappaphycus* spp. are red algae species that have been introduced in various parts of the world for the purpose of harvesting the gelling agent kappa carrageenan, which is used in industrial gums and as a smoothening agent used in ice cream, toothpaste, jellies, medicines and paint. This species can regrow from fragments as small as 0.5cm making it an extremely difficult species to control.



[view this species on IUCN Red List](#)

Species Description

Kappaphycus spp. is a tough, fleshy, firm; algae that can grow up to 2m tall. The thalli are coarse, with axes and branches 1-2cm in diameter and heavy major axes that are relatively straight, but lacking secondary branches near the apices. These algae frequently and irregularly branch with most branches both primary and secondary branches intercalated between primary branches. The algae is shiny green to yellow orange (University of Hawai'i, UNDATED).

Notes

Woo *et al.* (1999) state that, "Results from various studies so far suggest that a combination of several characteristics of the algae allow for its success as an invader: phenotypic plasticity that allows for persistence in high and low wave energy environments, asexual reproduction through fragmentation which may increase dispersal capabilities, physiological adaptations which permit coalescence and attachment to substrate, and possible chemical and morphological characteristics which lead to low grazer preference." "Once established in an area, *Kappaphycus* spp. alga may be able to spread laterally but, does not appear to be able to spread long distances or between islands" (Smith *et al.* 2002).

Lifecycle Stages

The life cycle of *Kappaphycus* spp. are triphasic consisting of three independent life stages the carposporophyte (2N), tetrasporophyte (2N) and gametophyte (N) phases (Aska and Azanzab, 2002).

Uses

Granbom *et al.* (2004) states that, "The marine red alga *Kappaphycus alvarezii* is economically important due to the production of the gelling agent kappa carrageenan, which is used in industrial gums and other products." Tighe (1998) state that, "carrageen is a smoothing agent used in ice cream, toothpaste, jellies, medicines and paint."

Habitat Description

Kappaphycus spp. can be found on reef flats and reef edges anywhere from 1 to 17m deep. It is often loosely attached to broken coral. Unattached fragments can be found floating in shallow and deep waters. This species can form large, moving mats of unattached fragments (University of Hawai'i, UNDATED).

Reproduction

The University of Hawai'i (UNDATED) states that, "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." Smith *et al.* (2002) report the results of their study that showed that "*Kappaphycus spp.* regrew in the field from fragments as small as 0.5cm. This method of reproduction is most likely the primary mode of propagation for *Kappaphycus spp.*" They further observe that *Kappaphycus spp.* in Hawai'i have only recently been observed to reproduce sexually.

General Impacts

Kappaphycus spp. high growth rate, plastic morphology, and extremely successful vegetative regeneration makes them potentially destructive invasive species not just in Hawai'i but around the globe (University of Hawai'i, UNDATED). Conklin *et al.* (UNDATED) reports that *Kappaphycus spp.* is a serious danger to the coral reefs. Research has shown that *Kappaphycus spp.* have the ability to overgrow and kill coral. Woo *et al.* (1999) states that, "Observations have shown that the alga is able to coalesce into the tissue of the coral, providing a strong means for attachment, and thus allowing the alga to persist in high wave energy environments. The novel substrate and structure the algae provides may permit settlement of epiphytes previously absent, as well as shelter and protection for mesograzers." Woo (2001) documented fragments of *Kappaphycus spp.* weighing 0.05 g that were capable of net growth in the field, suggesting that fragments created by physical disturbance can be carried by waves and currents to new locations where they can possibly establish.

Management Info

There are few studies in relation to the management and control of *Kappaphycus spp.* Most of the documented effort ongoing are into the study of the basic biology of the species. Some authors have begun researching possible biological control agents of this species, but there is very little information regarding control of this species.

In a study conducted by Conklin *et al.* (UNDATED), the authors demonstrated that, "1) *Kappaphycus spp.* will regrow in plots after mechanical harvest unless further action is taken, 2) increases in nutrient availability lead to increased rates of regrowth, and 3) the enhancement of herbivore densities dramatically decreased the rate at which regrowth occurs. The results obtained with the urchins in the above experiment led to the addition of urchins to plots where *K. alvarezii* cover was approximately 60%. These plots showed that urchins in high densities could reduce invasive algal cover by almost 100% in 2-3 months."

Principal source: [Kappaphycus alvarezii \(The University of Hawai'i, UNDATED\)](#)

Compiler: National Biological Information Infrastructure (NBII) & IUCN/SSC Invasive Species Specialist Group (ISSG)

Review: Dr. Marit Ruge Bjaerke Section for Marine Biology and Limnology Department of Biology University of Oslo Norway

Publication date: 2005-05-16

ALIEN RANGE

[1] AMERICAN SAMOA
[1] FIJI
[1] INDONESIA
[5] KIRIBATI
[1] MALAYSIA
[1] SOUTH AFRICA
[4] VENEZUELA

[2] CHINA
[3] INDIA
[2] JAPAN
[1] MADAGASCAR
[3] MEXICO
[6] UNITED STATES
[1] VIET NAM

BIBLIOGRAPHY

39 references found for *Kappaphycus* spp.

Management information

[Barrios, J. 1999. La introducción de *Eucheuma denticulatum* y *Kappaphycus alvarezii* \(GIGARCALES, RHODOPHYTA\) en Venezuela: una revisión crítica. *Fontus* 4:135-153 \(1999\).](#)

Summary: Abstract available from: <http://www.costadevenezuela.org/invasionalgaroja.htm> [Accessed 17 August 2009]

Conklin, E.J., J. E. Smith, C. L. Hunter, and C. M. Smith. UNDATED. Developing a Research-Based Management Protocol for the Invasive Alien Alga, *Kappaphycus alvarezii*, in Hawaii. Hawaii Institute of Marine Biology.

Eswaran, K., P. V. Subba-Rao, and O. P. Mairh. 2001. Impact of ultraviolet-B radiation on a marine red alga *Kappaphycus alvarezii* (Solieriaceae, Rhodophyta). *Indian Journal of Marine Sciences*. 30 (2): 105-107.

[Hewitt, C.L, Campbell, M.L. and Gollasch, S. 2006. Alien Species in Aquaculture. Considerations for responsible use. IUCN, Gland, Switzerland and Cambridge, UK. viii + 32 pp.](#)

Summary: This publication aims to first provide decision makers and managers with information on the existing international and regional regulations that address the use of alien species in aquaculture, either directly or indirectly; and three examples of national responses to this issue (New Zealand, Australia and Chile).

Available from: <http://data.iucn.org/dbtw-wpd/edocs/2006-036.pdf> [Accessed 22 September 2008]

Paula, E. J., R. T. L. Pereira, and M. Ohno. 2002. Growth rate of the carrageenophyte *Kappaphycus alvarezii* (Rhodophyta, Gigartinales) introduced in subtropical waters of Sao Paulo State, Brazil. *Phycological Research* 50 (1): 1-9.

Perez, J. E., C. Alfonsi, M. Nirchio, C. Munoz, and J. A. Gomez. 2003. The Introduction of Exotic Species in Aquaculture: A Solution or Part of the Problem? *Interciencia* 28 (4): 234-238.

[Tewari, A. K. Eswaran, P. V. Subba Rao, B. Jha., 2006. Is *Kappaphycus alvarezii* heading towards marine bioinvasion? *Current Science*, VOL. 90, NO. 5, 10 MARCH 2006.](#)

[Correspondence Response: to Pereira, Neelam and X. N. Verlecar., 2005. Is Gulf of Mannar heading for marine bioinvasion? *Current Science*, VOL. 89, NO. 8, 25 OCTOBER 2005.](#)

Summary: Available from: <http://www.ias.ac.in/currensci/mar102006/619.pdf> [Accessed 3 July 2008]

[The Hindu, May 23, 2009. Tamil Nadu: Government prohibits alien seaweed cultivation report by C. Jaishanker](#)

Summary: Available from: <http://www.hindu.com/2009/05/23/stories/2009052361421000.htm> [Accessed 25 May 2009]

[University of Hawaii. UNDATED. *Kappaphycus alvarezii*. Marine Algae of Hawaii, University of Hawaii Botany Department.](#)

Summary: Available from: http://www.hawaii.edu/reefalgae/invasive_algae/rhodo/kappaphycus_alvarezii.htm [Accessed 24 January 2005]

General information

Aguilan, J. T., J. E. Broom, J. Hemmingson, F. M. Dayrit, M. N. E. Montano, M. C. A. Dancel, M. R. Ninonuevo, and R. H. Furneaux. 2003. Structural analysis of carrageenan from farmed varieties of Philippine seaweed. *Botanica Marina*. 46 (2): 179-192.

Aska, E. I. and Rhodora V. Azanzab, 2002. Advances in cultivation technology of commercial eucheumatoid species: a review with suggestions for future research. *Aquaculture Volume 206, Issues 3-4*, 22 Pages 257-277

Azanza, R. V., and T. T. Aliaza. 1999. In vitro carpospore release and germination in *Kappaphycus alvarezii* (Doty) Doty from Tawi-Tawi, Philippines. *Botanica Marina*. 42(3): 281-284.

Carlton, J. T. 2001. Introduced Species In U.S. Coastal Waters. Pew Oceans Commission.

[Chandrasekaran, S; N. Arun Nagendran, D. Pandiaraja, N. Krishnankutty and B. Kamalakannan., 2008. Bioinvasion of *Kappaphycus alvarezii* on corals in the Gulf of Mannar, India. *Research Article Current Science*, VOL. 94, NO. 9, 10 MAY 2008](#)

Summary: Available from: <http://www.ias.ac.in/currensci/may102008/1167.pdf> [Accessed 3 July 2008]

Chopin, T., G. Sharp, E. Belyea, R. Semple, and D. Jones. 1999. Open-water aquaculture of the red alga *Chondrus crispus* in Prince Edward Island, Canada. *Hydrobiologia*. 398-399 (0): 417-425.

Coles, S. L., P. R. Reath, P. A. Skelton, V. Bonito, R. C. DeFelice, and L. Basch. 2003. Introduced marine species in Pago Pago Harbor, Fagatele Bay and the National Park Coast, American Samoa. U.S. Fish and Wildlife Service.

Granbom, M., F. Chow, P. F. Lopes, M. C. Oliveira, P. Colepicolo, E. J. Paula, and M. Pedersen. 2004. Characterisation of nitrate reductase in the marine macroalga *Kappaphycus alvarezii* (Rhodophyta). *Aquatic Botany* 78 295-305.

[Guiry, M.D. & Nic Dhonncha, E., 2005. *Kappaphycus* spp. *AlgaeBase* version 3.0. World-wide electronic publication, National University of Ireland, Galway.](#)

Summary: AlgaeBase is a database of information on algae that includes terrestrial, marine and freshwater organisms.

AlgaeBase is available from: <http://www.algaebase.org>; *Kappaphycus* spp. information is available from:

http://www.algaebase.org/generadetail.lasso?genus_id=35125&-session=abv3:82D8C9F50c93138D10KiT39C8579 [Accessed 15 May 2005].

Global Invasive Species Database (GISD) 2024. Species profile *Kappaphycus* spp.. Available from: Pag. 3

<https://iucngisd.org/gisd/species.php?sc=738> [Accessed 23 December 2024]

- Hurtado, A. Q., and R. F. Agbayani. 2002. Deep-sea farming of *Kappaphycus* using the multiple raft, long-line method. *Botanica-Marina*. 45 (5): 438-444.
- Hurtado, A. Q., R. F. Agbayani, R. Sanares, and M. T. R Castro-Mallare. 2001. The seasonality and economic feasibility of cultivating *Kappaphycus alvarezii* in Panagatan Cays, Caluya, Antique, Philippines. *Aquaculture*. 199(3-4): 295-310.
- Jory, D., T. Cabrera, B. Polanco, R. Sanchez, J. Millan, J. Rosas, C. Alceste, E. Garcia, M. Useche, and R. Agudo. 1999. Aquaculture in Venezuela: perspectives. *Aquaculture Magazine* 25 (5).
- Larned, S. T. 1998. Nitrogen- versus phosphorus-limited growth and sources of nutrients for coral reef macroalgae. *Marine-Biology (Berlin)*. 132(3): 409-421.
- Luxton, D. M., and P. M. Luxton. 1999. Development of commercial *Kappaphycus* production in the Line Islands, Central Pacific. *Hydrobiologia* 398/399: 477-486.
- Mairh, O. P., S. T. Zodape, A. Tewari, and M. R Rajyaguru. 1995. Culture of marine red alga *Kappaphycus striatum* (Schmitz) Doty in the Saurashtra region, west coast of India. *Indian Journal of Marine Sciences*. 24 (1): 24-31.
- Munoz, J., Y. Pelegrin, and D. Robledo. 2004. Mariculture of *Kappaphycus alvarezii*, (Rhodophyta, Solieriaceae) color strains in tropical waters of Yucatan, Mexico. *Aquaculture* 239(1-4): 161-177.
- Ohno, M., D. B. Largo, and R. Ikumoto. 1994. Growth rate, carrageenan yield and gel properties of cultured kappa-carrageenan producing red alga *Kappaphycus alvarezii* (Doty) Doty in the subtropical waters of Shikoku, Japan. *Journal of Applied Phycology*. 6(1): 1-5.
- Ohno, M., H. Q. Nang, N. H. Dinh, and V. D. Tirt. 1995. On the growth of cultivated *Kappaphycus alvarezii* in Vietnam. *Japanese Journal of Phycology*. 43(1): 19-22.
- Ohno, M., M. Yano., and M. Hiraoka. 1999. Cultivation of carrageenophyte, the *Kappaphycus alvarezii* (Doty) Doty, in warm waters, Southern Japan. *Bulletin of Marine Sciences and Fisheries Kochi University*. (19): 37-42
- Pereira, Neelam and X. N. Verlecar., 2005. Is Gulf of Mannar heading for marine bioinvasion? *Current Science*, VOL. 89, NO. 8, 25 OCTOBER 2005
- Samonte, G. P. B., A. Q. Hurtado, and R. D. Caturao. 1993. Economic analysis of bottom line and raft monoline culture of *Kappaphycus alvarezii* var. *tambalang* in Western Visayas, Philippines. *Aquaculture*. 110(1): 1-11.
- Smith, J. E., C. L. Hunter, and C. M. Smith. 2002. Distribution and Reproductive Characteristics of Nonindigenous and Invasive Marine Algae in the Hawaiian Islands. *Pacific Science*, vol. 56, no. 3: 299-315
- Smith, J. E., E. J. Conklin, C. L. Hunter, and C. M. Smith. 2003. The impact of invasive algae on biodiversity and coral cover in Hawaii. Dept. of Botany University of Hawaii.
- Smith, J. E. UNDATED. Marine Algae Species of Concern. [Surialink, 2003. *Kappaphycus*](http://www.surialink.com/2003/Kappaphycus).
- Summary:** Available from: <http://www.surialink.com/HANDBOOK/Genera/reds/Kappaphycus/Kappaphycus.htm> [Accessed 24 January 2005]
- Terada, R., S. Kawaguchi, M. Masuda, and S. M. Phang. 2000. Taxonomic notes on marine algae from Malaysia: III. Seven species of Rhodophyceae. *Botanica Marina*. 2000; 43(4): 347-357.
- [Tighe, L. 1998. Strong alien seaweed may be killing Kaneohe Bay coral: A researcher brought the suspect seaweed from the Philippines. Star-Bulletin: Monday, July 27, 1998.](http://starbulletin.com/98/07/27/news/story5.html)
- Summary:** Available from: <http://starbulletin.com/98/07/27/news/story5.html> [Accessed 24 January 2005]
- Woo, M. 2001. Ecological Impacts and Interactions of the introduced red alga, *Kappaphycus striatum*, to Kaneohe Bay. Oahu. San Francisco Estuary Institute.
- Woo, M., C. Smith, and W. Smith. 1999. Ecological Interactions and Impacts of Invasive *Kappaphycus* spp., In Kaneohe Bay, A tropical reef. University of Hawaii, Honolulu.
- Wu, M., S. Mak, X. Zhang, and P. Y. Qian. 2003. The effect of co-cultivation on the pearl yield of *Pinctada martensi* (Dumker). *Aquaculture*. 221 (1-4): 347-356.