

---

## Genetic diversity and phylogenetic relationships of hot spring cyanobacteria

---

*Panmuk Vacharapiyasophon\**, *Yuwadee Peerapornpisal*, *Prapun Triyasut*  
Chiang Mai University, Chiang Mai, Thailand,  
\*e-mail: panmuk@chiangmai.ac.th

A study of the genetic diversity and phylogenetic relationships of 16S ribosomal RNA (16S rDNA), 16S-23S internal transcribed spacer (16S-23S ITS), intergenic spacer of phycocyanin operon (PC-IGS) and DNA fingerprints of short and long tandem repeat repetitive sequences (STRR and LTRR) from 11 hot spring cyanobacterial isolates was conducted. It was found that the genetics of Thai hot spring cyanobacteria differ from cyanobacteria from other sources. Comparisons of 16S rDNA sequences with Genbank showed only *Synechococcus* spp. to have high similarities of 95-99 % to those in the database, whereas other genera showed similarities ranging between 83-95 %. For 16S-23S ITS, only 7 sequences were obtained with similarities ranging from 88 – 100 % to Genbank sequences. Five sequences were obtained from PC-IGS. Only two sequences, *Synechococcus* sp. SK 50 and *Synechococcus* sp. SK70, showed similarity with Genbank sequences. The phylogenetic relationship study showed that the phylogenetic trees of 16S rDNA and PC-IGS were related with the morphological classification. On the other hand, the tree from 16S-23S ITS showed an unclear grouping because this region has a high degree of variation. This marker may be suitable to classify cyanobacteria within the same genus. Cluster analysis of DNA fingerprints obtained from two primers specific to the short tandem repeats, STRR 1A and STRR 1B, distinguished hot spring cyanobacteria at the genus level. On the other hand, two primers specific to the long tandem repeat repetitive sequences, LTRR1 and LTRR2, were not suitable for generating DNA fingerprints in this group of cyanobacteria.

---

## Diversity of benthic diatoms in major rivers in Thailand and establishment of water quality indices

---

**Pongpan Leelahakriengkrai\* and Yuwadee Peerapornpisal**

Chiang Mai University, Chiang Mai, Thailand,

\*e-mail: bank\_2525@hotmail.com

A study on the diversity of benthic diatoms and water quality in major rivers of Thailand was carried out in March 2008 (dried season). It was found that the dominant species of benthic diatoms in the Ping River were *Gomphonema parvulum* (Kützing) Grunow, *Luticola mutica* (Kützing) D.G. Mann and *Nitzschia palea* (Kützing) W. Smith. *Gomphonema* sp 1, *Luticola* sp. 1 and *Nitzschia palea* (Kützing) W. Smith were dominant species in the Tha Chin River, *Encyonema mesianum* (Cholnoky) D.G. Mann, *Eunotia* sp. 1 and *Navicula radiosa* Kützing in the Chantaburi River, *Synedra ulna* (Nitzsch) Ehrenberg, *Cocconeis placentula* Ehrenberg and *Sellaphora pupula* (Kützing) Mereschkowsky in the Kwai River, *Rhopalodia gibba* (Ehrenberg) O. Müller, *Nitzschia clausii* Hantzsch and *Navicula symmetrica* Patrick in the Chi River and *Gomphonema clevei* Fricke. *Cymbella turgidula* Grunow and *Gomphonema* sp 2 were found to be dominant species in the Tapee River. Some physical and chemical factors were investigated for evaluating general water quality. The results indicated that the water quality based on trophic status and the water quality of most sampling sites were not clearly different and could be classified as clean-moderate water quality (oligotrophic-mesotrophic status). However, the water quality in some sampling sites was different, especially site 1 in the Tapee River which could be classified as clean water quality (oligotrophic status) and sites 4 and 5 in the Tha Chin River which could be classified as polluted water quality (eutrophic status).

---

## Research and development of algal products for restoration of soil and sustainable agricultural production

---

*Aparat Mahakhant\*, Suphansa Khantasopa, Watcharee Kunyalung and Narin Chansawang*

*Thailand Institute of Scientific and Technological Research (TISTR), Pathum Thani, Thailand, \*e-mail: aparat@tistr.or.th*

The four algal strains, *Nostoc* sp. TISTR 8290, *Nostoc muscorum* TISTR 9054, *Nostoc muscorum* TISTR 8871, and *Nostoc* sp. TISTR 8873, were selected as potential strains based on their rapid growth and high total polysaccharide production. The efficiency as soil conditioners of these algae was studied by comparison between the addition of algal biomass (AB) and extracellular polysaccharide (EPS). The findings indicated that addition of EPS produced faster and higher increases in microbial activities, total porosity, and water-stable aggregates and decreased bulk density than did addition of AB. *Nostoc muscorum* TISTR 9054 delivered the best results either with the addition of AB or EPS. These results showed statistical significant differences ( $p \leq 0.05$ ) with the control group in terms of organic matter, microbial activity, bulk density and total porosity of Lam Takhong soil, and organic matter and microbial activity of Thung Gula Ronghai soil. The survival of algae in developed soil conditioner products (granular, powder, sun-dried cells, hot oven-dried cells, including fresh cells in aluminium foil bags) could be detected up to the level of  $10^6$ - $10^7$  cells per gram or per millilitre after storage for 9 months.

---

## **Algae: alternative feedstocks for new renewable energy (NRE)**

---

### ***Aparat Mahakhant***

*Thailand Institute of Scientific and Technological Research, Pathum Thani, Thailand, e-mail: aparat@tistr.or.th*

While the global and domestic communities are concerned about the shortage of fossil fuel, biofuel has emerged among the options to solve this crisis. A number of crop plants such as cassava and palm have increasingly been used for biofuel production. But this alternative is not without obstacles. Competition between food crops and energy crops raises the global issue of food security. To avoid this problem, algae (including cyanobacteria) are considered as promising feedstocks for new renewable energy (NRE). The advantages of using algae as NRE are:

1) their much smaller foot-print (than plants) for biomass production owing to their higher growth rates and the ability to cultivate and harvest algae all year round,

2) the incorporation into NRE production of the energy-waste system for biomass production, e.g., flue gas and waste water. Therefore NRE production could be considered to be a green production system which reduces global warming,

3) obtaining valuable co-products (e.g. pigments) increases the cost effectiveness of using algae, and

4) various types of energy could be produced, e.g., hydrogen and bioethanol from high starch accumulating strains (*Nostoc* and *Oscillatoria*), biodiesel from high oil producing strains (*Botryococcus braunii* and many species of marine diatom) and gas/oil from high cellulose containing strains (*Lyngbya*).

Many developed countries are actively doing research on algae as NRE. Nevertheless, commercialization of biofuel from algae has not yet occurred. As for Thailand, abundant algal biodiversity and a geographical advantage results in a greater possibility to obtain potent algal strains that can be cultivated under optimal growth conditions. It is believed, therefore, that R&D on NRE from algae will bring great benefits to the country.

---

## **Algal response to herbivore exclusion and nutrient enrichment: insights into growth, reproduction and chemical defense**

---

*Jaruwan Mayakun<sup>1\*</sup>, Jeong Ha Kim<sup>2</sup>, Brian Edward Lapointe<sup>3</sup>  
and Anchana Prathep<sup>1</sup>*

*<sup>1</sup>Prince of Songkla University, Songkhla, Thailand,*

*\*e-mail: [jmayakun@hotmail.com](mailto:jmayakun@hotmail.com), <sup>2</sup>Sungkyunkwan University, Suwon, S. Korea, <sup>3</sup>Harbor Branch Oceanographic Institution, Inc. Ft. Pierce, FL*

Resource allocation is known to be important to algal fitness and it is adaptive to the environment. Here, we pose questions on how algae will respond and allocate their resources when they encounter herbivory and nutrient variation. The effects of herbivore exclusion and nutrient enrichment on algal resource allocation patterns (growth, reproduction and chemical defense) were experimentally tested in the subtidal zone. The experimental design comprised plots (50 x 50 cm<sup>2</sup>) of 2 dense macroalgae (*Turbinaria conoides* and *Halimeda macroloba*), 2 densities of herbivory and 2 nutrient levels. Cages (50 x 50 x 30 cm<sup>3</sup>) were used to exclude herbivores: uncaged plots and fully caged plots. Cages were covered with wire mesh (mesh size was 2 x 2 cm) and fixed on the dead coral substrate. To determine the effect of nutrients, 2 nutrients levels were manipulated: enriched and ambient levels. In the enriched plots, 60 g of Osmocote<sup>®</sup> slow-release fertilizer was placed in each plot. Reproductive output, biomass, and tissue nutrients (using C:N:P ratio) of algae in each plot were examined. To quantify chemical defense concentrations, tissues were analyzed using high performance liquid chromatograph (HPLC). This research will be completed in November 2008. We should be able to explain and get a better understanding of the effects of herbivores, nutrients and their interactions on resource allocation patterns of tropical algae in tropical coral reefs, where they are greatly disturbed.

---

## Species diversity and distribution of seaweed along the coastal shore of Chumporn Province, Thailand

---

**Bongkot Wichachucherd\***, *Supattra Pongparadon and Anchana Prathep*  
Prince of Songkla University, Songkhla, Thailand,  
\*e-mail: [wbongkot@yahoo.com](mailto:wbongkot@yahoo.com)

Seaweeds are important primary producers in marine ecosystems. Their rich diversity, abundance and wide distribution are due to their ability to adapt to changing environments. Seaweeds also are also a food source for human beings and aquaculture animals, a source of agar and other gels, and in aquarium tanks. The purpose of this project was to investigate the seaweed diversity in Chumporn Province along the coastal shores of the Remar and Phra Til Districts. Samples were collected in May 2007 along the beach during low tide; snorkeling was used when needed. The species distribution was investigated at the seaside site of King Mongkut's Institute of Technology Ladkrabang in July and October 2007. Three six hundred meter line transects were set up to assess the vertical distribution of seaweed from the shore. Thirty-two species of marine macroalgae were found. There were 2 species of cyanobacteria, 8 species of green algae, 13 species of brown algae and 9 species of red algae, reflecting that the full range of seaweed are well represented and distributed along the coastal shore out to 600 meters where the coral reef begins. The brown seaweeds, *Turbinaria* sp., *Sargassum* sp., *Padina* sp., *Lobophora* sp. and *Dictyota* sp, are more common in the deeper zone than the others. As indicated by the presence of many small young thalli, the seaweeds started growing up in July 2007 and reached their peak growth in October 2007. Therefore the percentage cover of seaweed was higher in October than in July 2007.

---

## Morphological variation in an adelphoparasite and in the agarophyte, *Gracilaria salicornia* (C. Agardh) Dawson

---

*Noppadol Kongkittayapun and Anong Chirapart*  
*Kasetsart University, Bangkok, Thailand*

*Gracilaria salicornia* and adelphoparasite specimens were collected from 11 sites in Chonburi (Ko Sichang, Ang Sila, Samaesan, Sri Racha harbor), Rayong (Ban Phe), Trat (Laem Sok, Laem Tien, Ao Cho), Prachuap Khiri Khan (Ta Mong Lai, Had Wanakorn), and Chumporn (Had Thung Wua Laen) Provinces. The sites could be grouped according to exposure, based on semi-exposed and sheltered conditions. Specimens of the adelphoparasite and *G. salicornia* were analyzed based on seven and eight morphological characters, respectively. The multivariate data sets were analyzed by canonical discriminant analysis in combination with a clustering procedure. For *G. salicornia*, sites clustered into two groups: 1) Laem Sok, Laem Tien, Ta Mong Lai, Had Thung Wua Laen, Ao Cho, Ang Sila, and Sri Racha harbor, (2) Ko Sichang, Had Wanakorn, Samaesan and Ban Phe. For the adelphoparasite specimens, sites could also be divided into two groups: (1) Samaesan, Laem Sok and Ao Cho, and (2) Had Thung Wua Laen, Ta Mong Lai and Had Wanakorn.

RAPD analysis was used to investigate molecular characteristics of the two plants. By screening twenty primers, twelve primers gave detectable polymorphisms. The UPGMA test gave identity values close to one for specimens of all sites. The results corresponded to those of discriminant analysis. This study showed close relationships occurred among specimens of *G. salicornia* as well as of the adelphoparasite growing in different habitats. On the other hand, their variation is thought to be caused by the changing external environments of the study sites.

---

## Yield, components and antimicrobial effects of polysaccharides extracted from some Thai species of brown seaweed

---

***Attachai Kantachumpoo\* and Anong Chirapart***

*Kasetsart University, Bangkok, Thailand, \*e-mail: g4662079@ku.ac.th*

Several brown seaweed species were collected from Chonburi, Rayong and Chumporn Provinces. Crude polysaccharides were extracted from dry material of *Colpomenia sinuosa*, *Hydroclathrus clathratus*, *Sargassum polycystum*, *Turbinaria conoides*, *Dictyota dichotoma*, *Padina australis* and *Padina minor*. The dry materials were extracted in distilled water at 100°C (E1) and in 2 mol/l of HCl solution at 75°C (E2). E1 gave the highest yields of  $1.97 \pm 1.15$  % w/w for *S. polycystum* from Rayong and of  $1.81 \pm 0.48$  % w/w for *C. sinuosa* from Chonburi. Total carbohydrate was high in the E1 of *P. minor* from Chumporn ( $55.95 \pm 0.72$  %) and of *P. australis* from Chonburi ( $51.94 \pm 0.08$  %). The highest sulfate content was  $18.10 \pm 0.25$  % obtained from the E1 of *H. clathratus* from Chonburi. However, higher yields were obtained from the E2. A maximum yield of  $19.69 \pm 0.23$  % (w/w) was obtained from *H. clathratus* from Chonburi. The highest carbohydrate yield of  $44.41 \pm 0.94$  % was obtained from the E2 of *P. minor* whereas the highest sulfate contents were from *C. sinuosa* ( $14.22 \pm 0.69$  %) and *H. clathratus* ( $13.82 \pm 0.18$  %).

The techniques, TLC and HPLC, were used for analysis of sugar composition of the E1 and E2 crude extracts using glucose, galactose, xylose, fucose and fructose as standards. The results showed fucose as the main component in all extracts. Both the E1 and E2 crude extracts were assayed for antimicrobial activity as well. At a concentration of 2 mg/ml crude extracts of *S. polycystum* from Chonburi showed activity against *Candida albicans* (E1 =  $0.122 \pm 0.004$  mm, E2 =  $0.123 \pm 0.003$  mm). E2 of *C. sinuosa* also showed activity ( $0.156 \pm 0.035$  mm).



---

## Seasonal variation in distribution, density, and life stages of *Halimeda macroloba* Decaisne at Tangkhen Bay, Phuket Province, Thailand

---

*Sutinnee Sinutok*<sup>1,\*</sup>, *Robert E. DeWreede*<sup>2</sup> and *Anchana Prathep*<sup>1</sup>

<sup>1</sup>Prince of Songkla University, Songkhla, Thailand, \*e-mail: [ssutinnee@gmail.com](mailto:ssutinnee@gmail.com), <sup>2</sup>The University of British Columbia, Vancouver, Canada

The genus *Halimeda*, a green alga (Chlorophyta), is widely distributed in tropical and sub-tropical marine environments. *Halimeda macroloba* Decaisne has several calcified segments, an erect and flat thallus, and a massive bulbous holdfast attached to the sandy bottom. The purposes of this project are to study the seasonal variation in distribution, density, and life stages of *H. macroloba* at Tangkhen Bay, Phuket Province, Thailand, and to investigate the relationships between sediment composition in the holdfast and in the study area, blade surface area and holdfast volume, and wave motion and blade and holdfast size. The results showed that there was seasonal variation in distribution, density, and life stages of *H. macroloba* resulting from wave action which contributes to asexual reproduction by vegetative fragmentation, rainfall which increases sedimentation, sediment composition of the substrate, and invasion of seagrasses. The life span of *H. macroloba* at Tangkhen Bay was 8-12 months. The sediment study showed that sediment accumulation in the holdfast of *H. macroloba* might be a process of sediment selection for the advantages of increasing holdfast strength (holdfast tenacity), nutrient uptake and decreasing desiccation. There was a positive relationship between holdfast volume and blade surface area in *H. macroloba*. However, there was no relationship between water velocity and both holdfast volume and blade surface area of *H. macroloba* at Thangkhen Bay. This might result from its flexible morphology which can reduce the drag force imposed on the algae by reconforming with flow.

---

**Effects of light, sediment and salinity on growth, pigments, agar production and reproduction in *Gracilaria fisheri* (B.M. Xia & I.A. Abbott) I.A. Abbott, J. Zhang & B.M. Xia at Koh Yor, Songkhla lagoon, Songkhla Province, Thailand**

---

*Chaloemphon Bunsom\** and *Anchana Prathep*

Prince of Songkla University, Songkhla, Thailand,

\*e-mail: c\_bunsom@hotmail.com

*Gracilaria fisheri* (B.M. Xia & I.A. Abbott) I.A. Abbott, J.Zhang & B.M. Xia is a red alga, distributed in the tropics. In Thailand, *G. fisheri* is known to be abundant in Pattani Bay and Songkhla Lagoon. At present, the population of *Gracilaria* spp. in Songkhla lagoon is declining because of development around the lake. This has changed the salinity and turbidity of the lake. The aim of this research is to study the effects of salinity and sediment on growth, pigment content, the amount of agar and reproduction of *Gracilaria fisheri*. The experiments will be set up to test the effects of salinity and sediment on *Gracilaria fisheri* under different conditions, derived from a preliminary survey of Songkhla lake during 2006 – 2007, in short-term (5 day) and long-term (30 day) responses. The algae will be cultivated at a temperature of 25°C, 3 levels of salinity (33, 25, 0 ppt.), 4 levels of light intensity (1000, 700, 400 and 150  $\mu\text{mol photons m}^{-2} \text{s}^{-1}$ ) and 3 levels of sediment (2.28, 0.67, 0 mg). Photosynthesis will be measured during the first 5 day experiment. Photosynthetic biomass, pigments and agar will be measured after the 30 day experiment.

---

## Use of *Ceriodaphnia cornuta* Sars as food for hybrid catfish and angel fish larvae

---

**Nukul Saengphan\***, Ramet Chusing and Phisamai Chaleoisak  
Suphanburi College of Agriculture and Technology, Suphanburi, Thailand  
\*e-mail: nukul\_sae@yahoo.com

This study aims to evaluate the potential of *Ceriodaphnia cornuta* Sars as food for hybrid catfish and angel fish larvae. One hundred hybrid catfish larvae of age 1-15 days old and 50 angel fish larvae of age 1-15 days old were reared in 24×12×12 inches aquarium tanks, and 30 angel fish larvae of age 16-30 days old were reared in concrete ponds of 1.0×1.0×0.3 meters. *Moina macrocopa* (Straus), *C. cornuta* and a mixture of *M. macrocopa* and *C. cornuta* were fed to hybrid cat fish and two age groups of angel fish 2 times a day for 15 days. *M. macrocopa* and *C. cornuta* used in this experiment were reared and harvested from outdoor ponds every day. Survival and growth of hybrid catfish fed with *M. macrocopa* was higher than of those fed the mix of *M. macrocopa* and *C. cornuta* and of *C. cornuta* ( $p < 0.05$ ). For angel fish of age 1-15 days old fed with all three diets, survival was less than 20% and growth was highly variable, whereas for angel fish of age 16-30 days old, survival did not differ significantly ( $p > 0.05$ ) among the *M. macrocopa*, the mix of *M. macrocopa* and *C. cornuta* and the *C. cornuta* food treatments. However, the growth of fish fed with *M. macrocopa* was higher than for any other group ( $p < 0.05$ ). This study indicated that *C. cornuta* can be used as fish larval food when there is a shortage of *M. macrocopa*.

---

## Cultures of *Diaphanosoma excisum* Sars and *Simocephalus heilongjiangensis* Shi & Shi in the laboratory

---

**Nukul Saengphan\***, Ramet Chusing and Phisamai Chaleoisak  
Suphanburi College of Agriculture and Technology, Suphanburi, Thailand,  
\*e-mail: nukul\_sae@yahoo.com

This study aims to culture two cladoceran species collected from Huay Khayeng: *Diaphanosoma excisum* Sars and *Simocephalus heilongjiangensis* Shi & Li. Live cladocera were transported from Huay Khayeng to the laboratory of the Suphanburi College of Agriculture and Technology. Four food types, *Chlorella* sp., rice bran, ami-ami and molasses waste water from the alcohol industry, at 5 concentrations, i.e., 100, 75, 50, 25, 5 and 0%, were introduced to both cladoceran species. Neonates of the experimental cladocera were reared individually in each of 100 ml plastic vessels containing 50 ml of food to record fecundity, time to first reproduction, number of clutches, clutch size and longevity. The results from previous experiments were used to modify laboratory cultures. A *Chlorella* sp. concentration of 5% was suitable for growth and reproduction of *D. excisum* and *S. heilongjiangensis*. Average time to first reproduction and the number of clutches of *D. excisum* and *S. heilongjiangensis* were  $3.75 \pm 0.5$  days and  $8.5 \pm 1.91$  clutches, and  $5.4 \pm 0.54$  days and  $6.0 \pm 0.70$  clutches, respectively. One female *D. excisum* and one female *S. heilongjiangensis* lived on average  $12.75 \pm 3.20$  and  $13.65 \pm 0.89$  days, and produced  $45.5 \pm 15.02$  and  $89 \pm 18.50$  neonates per female, respectively. The highest densities of *D. excisum* and *S. heilongjiangensis* in 50 ml containers were 11.50 and 34.64 individuals in day 3 and day 5 of culture, respectively. This study indicated that these two cladoceran species collected from Huay Khayeng can be successfully reared in the laboratory.

---

## Species diversity of ostracods in Srisaket Province

---

***Boonsong Kongsook\* and La-orsri Sanoamuang***

*Faculty of Science, Khon Kaen University, Thailand*

*\*e-mail: bookon@kku.ac.th*

A survey of species diversity of ostracods from Srisaket Province was conducted in winter (December 2006), summer (April 2007) and rainy (September 2007) seasons. Samples were collected from rice fields, ponds, swamps, reservoirs, canals, lakes and rivers using a 60  $\mu\text{m}$  mesh plankton net. In each location some water quality parameters (pH, water temperature and conductivity) were measured. Nitrate and Phosphate concentrations were measured by a Hach model DR/2400 Portable Spectrophotometer. Latitude and longitude were measured by a Sportrak GPS Receiver. Specimens were preserved in 70% alcohol and identified under compound and stereo microscopes. Images of identified species were taken using a Leo 1450VP scanning electron microscope. Eleven genera and 40 species of ostracods were identified. Species diversity of ostracods was negatively related to water conductivity with high statistical significance in the rainy season ( $p < 0.01$ ) and in the summer season ( $p < 0.05$ ). In contrast, temperature, pH, phosphate and nitrate did not correlate with species diversity in all seasons.

---

## The calanoid copepod family Pontellidae from Thai waters of the Andaman Sea

---

*Natthawadee Phukham\* and Sunan Patarajinda*

*Kasetsart University, Bangkok, Thailand, \*e-mail: natthaini@hotmail.com*

The diversity of marine calanoid copepods (Family Pontellidae) in Thai waters of the Andaman Sea was investigated from November 2005 to May 2007. Zooplankton samples from 142 stations were collected horizontally, vertically and obliquely with a plankton net with 330 µm mesh size. A total of thirty one species and five genera of calanoid copepods were found and twenty species were first records for Thai waters of the Andaman Sea, such as *Calanopia elliptica* (Dana), *C. minor* A. Scott, *Labidocera acuta* (Dana), *L. bengalensis* Krishnaswamy, *L. laevidentata* (Brady), *L. pectinata* Thompson & Scott, *Pontella danae* Giesbrecht, *P. diagonalis* Wilson, *P. fera* Dana, *P. investigatoris* Sewell, *P. spinipes* (Giesbrecht), *P. valida* Dana, *Pontellina morii* Fleming & Hulsemann, *P. plumata* (Dana), *Pontellopsis armata* (Giesbrecht), *P. inflatodigitata* Chen & Shen, *P. krameri* (Giesbrecht), *P. macronyx* A. Scott, *P. perspicax* (Dana) and *P. scotti* Sewell. Among these species, *Labidocera bengalensis* Krishnaswamy, *L. pectinata* Thompson & Scott, *Pontella danae* Giesbrecht, *P. diagonalis* Wilson, *P. fera* Dana, *P. investigatoris* Sewell, *P. spinipes* (Giesbrecht), *P. valida* Dana, *Pontellina morii* Fleming & Hulsemann, *Pontellopsis armata* (Giesbrecht), *P. krameri* (Giesbrecht) and *P. scotti* Sewell, were also first records for the Gulf of Thailand. Furthermore, six other unidentified species in the genera *Labidocera* (3 species) *Pontella* (2 species) and *Pontellopsis* (1 species) are potential new records in Thai waters.

---

## Species diversity and distribution of cladocerans in 5 Provinces in central, eastern and southern parts of Cambodia in comparison with Thailand

---

*Waraporn Mahasap\* and La-orsri Sanoamuang*

*Khon Kaen University, Thailand, \*e-mail: wara\_bank@hotmail.com*

The species diversity and distribution of cladocerans in 5 Provinces in central, eastern and southern parts of Cambodia were studied in June 2006. Qualitative samples (70 samples) were collected using a 60 micrometer mesh size net and preserved in 5% formaldehyde. Forty species from 25 genera were recorded, 38 species of which are new to Cambodia. According to the frequency of occurrence, the most common species were *Moina micrura* Kurz (60 % of sampled localities), followed by *Diaphanosoma excisum* Sars (57 % of sampled localities) and *Ceriodaphnia cornuta* Sars (47% of sampled localities), respectively. Rare species were *Bosmina meridionalis* (Sars), *Chydorus ventricosus* (Dadays), *Dunhevedia crassa* (King), *D. serrata* (Daday), *Kurzia brevilabris* Rajapaksa and Fernando, *Leydigia acanthoceriodes* (Fischer), *Nismirnovius eximius* (Kiser), *Pseudochydorus globosus* (Baird) and *Macrothrix sioli* (Smirnov). The majority of cladocerans recorded in this study were circumtropical species. The species diversity of cladocerans had a significant positive correlation with pH ( $r = 0.26$ ,  $p > 0.05$ ). To compare the species diversity of cladocerans between Thailand and Cambodia, the results of this study were compared with the early literature of Thailand. The species richness of the Cambodian cladocerans was less than that in Thailand because of fewer samples. The research will be continued in order to increase the knowledge of cladoceran fauna diversity of this country.

---

## Morphological and anatomical variation in the genus *Halimeda* Lamouroux (Chlorophyta, Caulerpales) in Thailand

---

**Supattra Pongparadon\* and Anchana Prathep**

Prince of Songkla University, Songkhla, Thailand

\*e-mail: supattra\_bobow@hotmail.com

The green calcified seaweed genus *Halimeda* (Chlorophyta, Caulerpales) is a common inhabitant of tropical and warm-temperate marine environments in reefs and lagoons. Morphological and anatomical variability within the Genus *Halimeda* could cause taxonomic problems. Specimens are often difficult to identify using identification keys and taxonomic descriptions. In Thailand, research on seaweed and especially *Halimeda* is very limited. Lewmanomont et al. (1995) reported that there were only five species of *Halimeda* found: *Halimeda macroloba* Decaisne, *H. discoidea* Decaisne, *H. incrassata* (J.Ellis) J.V. Lamouroux, *H. opuntia* (Linnaeus) J.V. Lamouroux and *H. velasquezii* Taylor. Although, *Halimeda* spp. are very common and are distributed throughout Thai waters, there have not been any studies on these algae. In addition, some *Halimeda* studies show different results. Thus, Verbruggen (2005) reported the known distribution of *H. incrassata* (J. Ellis) J.V. Lamouroux in the Atlantic. But this species has also been reported in the Indo-pacific. So, I will study the diversity, distribution and variation of the genus *Halimeda* in Thailand. Specimens will be collected from every site where the Genus *Halimeda* is found in Thailand. Part of the thallus will be preserved in ethanol (95%) or formaldehyde (5%), and 14 morphological characters and 28 anatomical characters will be examined using the morphometric method of Verbruggen (2005).