
Species diversity of acetic acid bacteria at Khanom-Mu Ko Thale Tai National Park, Nakhon Si Thammarat Province

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During the course of study of the species diversity of acetic acid bacteria at Khanom-Mu Ko Thale Tai National Park, Nakhon Si Thammarat Province, one hundred and eighty-three strains were isolated from one hundred and seventy-nine collected samples. Seventy-nine strains were selected to analyze the 5' ends of 16S rDNA sequences for identification. In phylogenetic trees based on these sequences, seventy-one strains had their identification confirmed as acetic acid bacteria. A phylogenetic tree based on the sequences showed that nineteen strains should be classified into two new genera in the family *Acetobacteraceae*. The other fifty-two strains were assigned to six known species of three genera, *Acetobacter*, *Asaia* and *Gluconobacter*, based on 16S rRNA gene sequences, namely *A. tropicalis*, *As. bogorensis*, *As. lannensis*, *G. cerinus*, *G. frateurii* and *G. oxydans*. However, additional phenotypic and genetic characteristics have to be further characterized before proposing the new taxa, especially DNA-DNA hybridization compared with the type strains of closely related taxa.

Species diversity and collection of yeasts at Khanom-Mu Ko Thale Tai National Park

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The diversity of yeast in Khanom-Mu Ko Thale Tai National Park, Nakhon Si Thammarat Province, was investigated. One hundred and fifty-six yeast strains were isolated from sea water (63), plant materials in sea water (61), seaweeds (50), and water and soils of mangrove forest (15). The membrane filtration technique and the direct streaking and enrichment technique were used for isolation. Fifty-three strains were identified by using morphological characteristics and molecular techniques; 42 strains were ascomycetous yeasts and 8 strains were basidiomycetous yeasts. Based on D1/D2 domain of 26S rDNA sequence similarity and phylogeny, 35 strains were identified as 22 known species (13 genera), 17 strains were found to represent 13 new species (5 genera) and the remaining strain could not be identified by D1/D2 sequences. The ITS gene is required for identification of the latter strain. Morphological, physiological characteristics, chemotaxonomy and molecular taxonomy are required for describing the new species.

Endophytic fungi isolated from seagrasses and seaweeds from Had Khanom-Mu Ko Thale Tai National Park and their antimicrobial activity

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Endophytic fungi were isolated from seagrasses (*Enhalus acoroides*) and seaweeds (*Sargassum* sp.) from two sites in Had Khanom-Mu Ko Thale Tai National Park. Sixty-four isolates from four collections were obtained. Molecular identification of these endophytes will be carried out at a later stage of the project. The overall colonization and isolation rates were relatively low, and this is in concordance with other studies. Fermentation broths from selected fungal isolates (endophytes and fungi obtained from Year 1 of the project) were tested for antimicrobial activity by agar well diffusion. Twenty five out of 132 isolates (18.9%) showed antimicrobial activity against at least one pathogen. The results obtained from this study indicated that endophytic fungi can be isolated from seagrasses and seaweeds and that they are a good source of natural antimicrobial compounds.

Plankton diversity at Mu Ko Thale Tai, Nakhon Si Thammarat Province

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The present study aimed to examine plankton species diversity along Khanom Canal, Had Khanom, Mu Ko Thale Tai, Nakhon Si Thammarat Province. Sampling was carried out covering 15 stations starting from Cho Waterfall to Khanom Canal and around five islands of Mu Ko Thale Tai (Wang Nok, Wang Nai, Rap, Tan and Mudsum) during October 2006 and September 2007. A total of 184 phytoplankton taxa in three Divisions was recorded. The most diverse Division was Chromophyta, comprising of Class Bacillariophyceae with 41 genera (104 taxa), Class Dinophyceae 17 genera (51 taxa), and Class Dictyochophyceae 1 genus (2 taxa). Moreover, *Bacteriastrium* sp1, *Chaetoceros diversus* and *Chaetoceros lorenzianus* were the most frequently found taxa throughout the sampling periods. Based on density, *Bacteriastrium* sp1 dominated the phytoplankton of all stations sampled throughout the sampling periods (7.27×10^7 cells/l). This species had the highest density in March 2007 ($1.17 \times 10^6 \pm 2.21 \times 10^6$ cells/l) followed by October 2006 ($8.80 \times 10^5 \pm 1.28 \times 10^6$ cells/l) and September 2007 ($8.68 \times 10^5 \pm 6.24 \times 10^5$ cells/l). Moreover, 61 taxa in 11 phyla of zooplankton were recorded. Arthropoda was the most diverse phylum, comprising 24 taxa, of which nineteen were the members of the Copepoda. Based on density, nauplii of crustaceans dominated the zooplankton at all stations over the sampling period (1316.67-5293.02 ind./l). They showed the highest density in January ($5,297 \pm 8387$ ind./l), March ($4,662 \pm 6,315$ ind./l) and September 2007 ($3,437 \pm 4,279$ ind./l). Besides the nauplii of crustaceans, *Tintinnopsis orientalis* and *Codonellopsis ostenfeldi* also showed high densities at all times during the sampling periods.

The present status of marine sponges in Had Khanom-Mu Ko Thale Tai National Park, Nakhon Si Thammarat Province, southern Thailand

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The species diversity and distribution of demosponges dwelling in the coral reefs of Had Khanom–Mu Ko Thale Tai National Park, the southern Gulf of Thailand was investigated with field surveys undertaken at 14 sites in November 2006 and May 2007 using SCUBA and random observations. 47 species of demosponges from 10 orders, 24 families and 34 genera were recorded. The order Haplosclerida had the most species, with 15, followed by Poecilosclerida with 9 species and Dictyoceratida with 6 species. The massive sponge was the most dominant growth form of the study area. The most abundant and common sponges in this area were *Oceanapia sagittaria*, *Neopetrosia* sp. “blue”, *Xestospongia testudinaria* and *Haliclona (Gellius) cymaeformis*. Most species were common representatives of the Indo-Pacific fauna found throughout the Gulf of Thailand.

Species diversity of marine Ascidians dwelling in the coral reefs of the Khanom-South Islands, Nakhon Si Thammarat Province

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The species diversity and distribution of ascidians dwelling in the coral reefs of Had Khanom – Mu Ko Thale Tai National Park, Nakhon Si Thammarat Province, the southern Gulf of Thailand were investigated. The investigations were conducted at 12 sites in the Mu Ko Thale Tai area and were carried out by SCUBA diving during the daytime and random observation throughout the reefs. The results yielded 10 species of ascidians from 3 orders, 3 families and 5 genera. The genera were *Didemnum* (6), *Diplosoma* (1), *Eudistoma* (1), *Polycarpa* (1) and *Ascidia* (1).

Diversity study on Echinoderms in Khanom Beach – South Sea Islands National Park, Nakhon Si Thammarat Province

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Echinoderms of Had Khanom – Mu Ko Thale Tai National Park, Nakhon Si Thammarat Province, locating in the southern part of the Gulf of Thailand were studied at 12 sties namely, Ko Tan (4 sties), Ko Mudsum (2 sites), Ko Wang Nai (2 sites), Ko Wang Nok (2 sites) and Ko Rab (2 sites) in November, 2006 and May 2008. The investigations were carried out by SCUBA diving in the daytime and random searches throughout the reefs. The results yielded 24 species of Echinoderms from 5 class, 10 orders, 14 families and 20 genera. The most abundant Echinoderms in this area are : *Lamprometra palmate*, *Ophiothrix exigua*, *Holothuria (Metensiothuria) leucospilota*, and *Diadema setosum*. All observed species were commonly found in the Gulf of Thailand and the Indo-Pacific.

Species diversity of nudibranches at Had Khanom – Mu Ko Thale Tai National Park, Thailand

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The purpose of this study was to investigate the diversity and habitat ecology of nudibranches at Had Khanom-Mu Ko Thale Tai National Park. Nudibranches belong to the mollusk group (subclass Opisthobranchia), but have no shells protecting their soft bodies. Specimens were collected using the SCUBA diving technique. Then, the specimens were photographed and recorded by using a VDO camera before they were preserved in alcohol. Shapes, body colors, and color patterns of the nudibranches were used to identify to species level. The results showed that nudibranches could be found on coral colonies, coral reefs, and sand substrates between 1-15 m depth of water. At least 18 species of nudibranches were found at Had Khanom - Mu Ko Thale Tai National Park. The species included *Phyllidia elegans*, *Phyllidiella nigra*, *Phyllidia coelestis*, *Phyllidiella pustulosa*, *Fryeria picta*, *Chromodoris preciosa*, *Flabellina rubrolineata*, *Glossodoris atromarginata*, *Jorunna funebris*, *Glossodoris cincta*, *Dendrodoris denisoni*, *Platydorid dierythos*, *Armina* cf. *japonica*, *Bornella stellifer*, *Phyllodesmium magnum*, *Mexichromis multituberculata*, *Thecacera* sp., and *Facelina* sp. The dominant nudibranch species were in the Family Phyllidiidae. Five species were first records for Thailand: *Chromodoris preciosa*, *Glossodoris cincta*, *Dendrodoris denisoni*, *Platydorid dierythos*, and *Bornella stellifer*.

Relationships and associations of nudibranches with other organisms at Had Khanom – Mu Ko Thale Tai National Park, Thailand

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Nudibranches belong to the mollusk group but have no shell protecting the soft body. Due to the lack of a shell, nudibranches are prone to predators. However, they protect themselves by producing secondary metabolic compounds, which are used as a chemical defense. Some secondary metabolic compounds exhibit potent cytotoxic activities against cancer cells, such as secondary metabolic compounds in *Jorunna funebris* found at Had Khanom. However, little is known about the biology and ecology of these particular nudibranches in Thailand. At present, in Thailand, approximately 110 species of nudibranches have been found including those from a previous study at Had Khanom - Mu Ko Thale Tai National Park. The purpose of this study was to investigate the relationships and associations of nudibranches with other organisms including determining their food and habitats. Surveys were done by scuba diving. During the surveys, size, habitat, food, and behavior of nudibranches in each species were recorded. The results from the field surveys showed that most nudibranches found at Had Khanom - Mu Ko Thale Tai National Park were associated with either hydroids, sponges, sea pens, soft corals, or bryozoans depending on which were their food sources. However some which had conspicuous and contrasting color patterns tended to be found on sand and bare rocks, and were active during the day. These included nudibranches in the Family Phyllidiidae. The results from the surveys also showed that the dominant species was *Flabellina rubrolineata* followed by *Jorunna funebris*. This may be due to the high abundances of their food sources. *F. rubrolineata* fed on hydroids while *J. funebris* fed on blue sponges.

Species diversity and distribution of gorgonians at Had Khanom – Mu Ko Thale Tai National Park, Thailand

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The purpose of this study was to investigate the diversity and distribution of gorgonians at Had Khanom-Mu Ko Thale Tai National Park using the SCUBA diving technique. Samples were photographed and some were collected and preserved in 70% alcohol for further identification and for being reference specimens. Shapes and characteristics of colonies and sclerites of gorgonians were used to identify to genus level. Fifteen genera from 7 families of gorgonians were found. These included: Family Anthothelidae, *Solenocaulon*; Family Subergorgiidae, *Subergorgia*; Family Melithaeidae, *Melithaea*; Family Acanthogorgiidae, *Anthogorgia*; Family Plexauridae, *Euplexaura*, *Echinomuricea*, *Echinogorgia*, *Menella*, *Astrogorgia*; Family Gorgoniidae, *Rumphella*, *Pseudopterogorgia*; and Family Ellisellidae, *Ctenocella*, *Junceella*, *Dichotella* and *Verrucella*. The highest number of gorgonians, 15 genera, was found at Ko Rab, followed by 12 genera at Ko Tan and Ko Mut Sum. The genus *Subergorgia* showed the highest density (0.05 colony/m²), followed by *Ctenocella* and *Menella*. All gorgonians were usually found in 5 m depth of water or deeper, and were normally attached to rocks, dead corals, or rubble that lay beneath sand or silt substrates. Their distribution was clumped. Moreover, in this study, 3 genera, *Anthogorgia*, *Pseudopterogorgia*, and *Verrucella*, were found to be first records for Thai waters, and another 3 genera, *Solenocaulon*, *Astrogorgia*, and *Euplexaura*, were also first records for the Gulf of Thailand.

Organisms associated with the seagrass bed at Ko Tharai, Nakhon Si Thammarat Province

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Organisms associated with the seagrass bed at Ko Tharai, Nakhon Si Thammarat Province, were investigated. These included the groups that live in the sediment, on the bottom floor, in the water column, and on the seagrass. Three stations, *i.e.*, eastern, central, and western parts of the seagrass bed were sampled. The results showed that organisms found in the sediment of the seagrass bed were amphipods, polychaetes, and juveniles crabs, which used the seagrass bed for habitat and shelter. On the bottom of the seagrass bed, crabs (Diogenidae and Portunidae) were found. They used seagrass leaves to protect themselves from sunlight during low tide. Most organisms found in the water column were fishes. The most abundant fish groups were Leiognathidae and Siganidae while the economic fish groups were Lutjanidae, Lethrinidae, Serranidae and Sphyraenidae. Scatophagidae, Gobiidae, Syngnathidae, Sepiidae and Penaeidae were also recorded. The organisms associated with seagrass leaves were amphipods and copepods. These organisms also used seagrass leaves as habitat, shelter, and food sources.

Organisms associated with gorgonians at Mu Ko Thale Tai, Surat Thani and Nakhon Si Thammarat

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From a previous study of diversity and distribution of gorgonians at Had Khanom – Mu Ko Thale Tai National Park, it was found that the azooxanthallae gorgonians group, which do not require sunlight for survival, were the most abundant gorgonians, particularly in deeper areas where strong currents and greater turbidity occurred. In this study, the organisms associated with gorgonians were investigated. Three different genera were chosen as representatives of each colony shape, *i.e.* fan shape (genus *Verrucella*), bushy form (genus *Dichotella*), and sparse form (genus *Subergorgia*). The surveys were conducted at 3 water depths, *i.e.*, shallow water (< 5 m depth), mid-depth (5 – 10 m), and deep water (> 10 m depth), in 3 areas, Ko Tan, Ko Mat Sum, and Ko Rab, using the SCUBA diving technique. The results showed that more than 10 groups of animals were associated with gorgonians. Brittle stars (or snake stars), allied cowries, wing oysters, and delicate-looking shrimps were found on all colony shapes. In addition, hydroids, barnacles, algae, sponges, and bryozoa were found settled on gorgonian colonies. Moreover, flat worms, nudibranches, synatid sea cucumbers, and small fishes were recorded. However, in shallow water (< 5 m depth), *Subergorgia* was the only genus found, and brittle stars were the most abundant organisms on *Subergorgia*.

Diversity of reef fish in Had Khanom-Mu Ko Thale Tai National Park, Nakhon Si Thammarat

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Data collection for a reef fish study was conducted 3 times in February, May and July, 2007, around Had Khanom - Mu Ko Thale Tai National Park at 5 stations: Ko Wang Nai, Ko Wang Nok, Ko Rab, Ko Mud Sum and Ko Tan. Coral reefs of each island were located on reef flats on the leeward and windward sides and on reef slopes on the leeward and windward sides. 97 species of reef fish were recorded during the study period. The dominant fish families were Pomacentridae (23 species) and Labridae (14 species). Fish community diversity did not differ significantly ($p > 0.05$) between island or between windward and leeward sides of each island while species abundances and numbers on reef slopes and reef flats showed significant differences among all stations ($p < 0.05$). The number of species in the reef slope fish communities was higher than in the community of reef flat areas. On the other hand, the diversity index and evenness index of the reef flat were higher than for the reef slope. From this study it was obvious that there were two types of fish community: the fish community of reef flats and the fish community of reef slopes. However, data on fish populations in different seasons should be collected in order to get more information on fish community patterns.

Estimating population size and distribution of Indo-Pacific humpback dolphins at Khanom

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The population of Indo-Pacific humpback dolphins (*Sousa chinensis*) that inhabits the Khanom sea shore are in critical condition due to a high death rate. This project aimed to estimate the number of Indo-Pacific humpback dolphins by using a Photo-Identification technique. Digital Analysis and Recognition of Whale Images on Network (DARWIN) software was used to identify individual dolphins. All selected pictures were represented by 1 (present) and 0 (absent) in the MARK software. We collected dolphin dorsal fin pictures by boat survey. We went to Pra-Tub Cape pier and took a long tail boat from 7.00 a.m. to 1.00 p.m. We found that dolphins tended to be present in clear water (visibility > 1 m) with no waves (< 20 cm). All survey routes were recorded using a GPS Garmin 76 CSX. Dolphins were found most frequently from Racha Ferry to Kwaeng Pao Bay. We took more than 400 dorsal fin pictures during each survey by SLR digital camera with lenses 18-135 mm and 70-300 mm. We selected the best dorsal fin pictures, and cropped only dorsal fins in order to decrease the picture size of the database in the DARWIN software. Within the two months survey, we could identify 20 individual Indo-Pacific Humpback dolphins in the Khanom area.