

Species Diversity of Marine Planktonic Diatoms around Chang Islands, Trat Province

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ABSTRACT

In March 2003, the marine planktonic diatoms were collected from 27 stations around Chang Islands, Trat Province in the Gulf of Thailand. Two types of the plankton net were used as filtering 100 litres of seawater through 20 µm mesh size and obliquely towing 70 µm mesh size at 2 meters above the seafloor. The diatoms was made by using light microscope (LM) and scanning electron microscope (SEM). The results showed that at least 70 genera and 140 species were identified under the Order of Biddulphiales (centric diatoms, including 38 genera and 93 species) and Bacillariales (pennate diatoms, including 32 genera and 47 species). From this study, species *Stictocyclus varicus* A. Mann was remarked as a first record in Thai's waters, and *Asteromphalus robustus* Castracane was remarked as a first record in the Gulf of Thailand.

Key words: Chang islands, gulf of Thailand, marine planktonic diatoms, centric diatoms, pennate diatoms.

INTRODUCTION

The diatoms are one of the most important phytoplankton as a primary producer of marine ecosystem. They are estimated to produce 20-25 % of the world total net primary production (Werner, 1977). They play a key role in mariculture and sea farming, for example *Chaetoceros calcitans* and *Skeletonema costatum* have been used for feeding larvae of marine organism. The suitable condition for each species of diatom is varied, and it can be used as an indicator of natural waters. For example in the coastal area in Peru, *Thalassiosira* and *Chaetoceros* can be found in an abundant area while *Rhizosolenia* and *Planktoniella* would be found in off shore areas which consider as in the low productive area.

(Wongrat, 1999) They were also used for evaluation of water quality and pollution. The earliest study of marine diatoms in Thailand was done by Ostefeld (1902) and Östrup (1904) around Chang Islands and the adjacent waters in Trat Province. The respectively previous study in the same areas was done by Wongrat *et al.* (2003) and Thongbor (2004).

Recently, Chang Islands have been promoted as tourist desination in Thailand, expecting income for the country, many development has been done in response to the government policy. This is the main cause of the environmental impact to the ecosystem so that data of species composition and their distribution of phytoplankton are very important.

The present study is the investigation of species composition and distribution of marine diatom around Chang Islands. The objective of this study was to identify marine planktonic diatom species and their distribution, and to investigate of species composition and distribution of marine diatoms around Chang Islands. This data can be used as the biodiversity database that will be benefit for monitoring of the environmental change.

MATERIALS AND METHODS

The samples of these plankton were

collected in March 2003 from 27 stations (Figure 1) by filtering 100 liters of seawater through 20 μm mesh size and obliquely towing 70 μm mesh size plankton net at 2 meters above the seafloor. The samples were identified by using light microscope (LM) and scanning electron microscope (SEM) and the documents of Allen and Cupp (1935), Hustedt (1959), Hendy (1964), Peragallo (1965), Simonsen (1974), Foged (1975), Jensen (1985) Dexiang *et al.* (1985), Sundström (1986), Ricard (1987), Round *et al.* (1990), Hasle and Syvertsen (1997), Wongrat (1999) and Lundholm and Moestrup (2003).

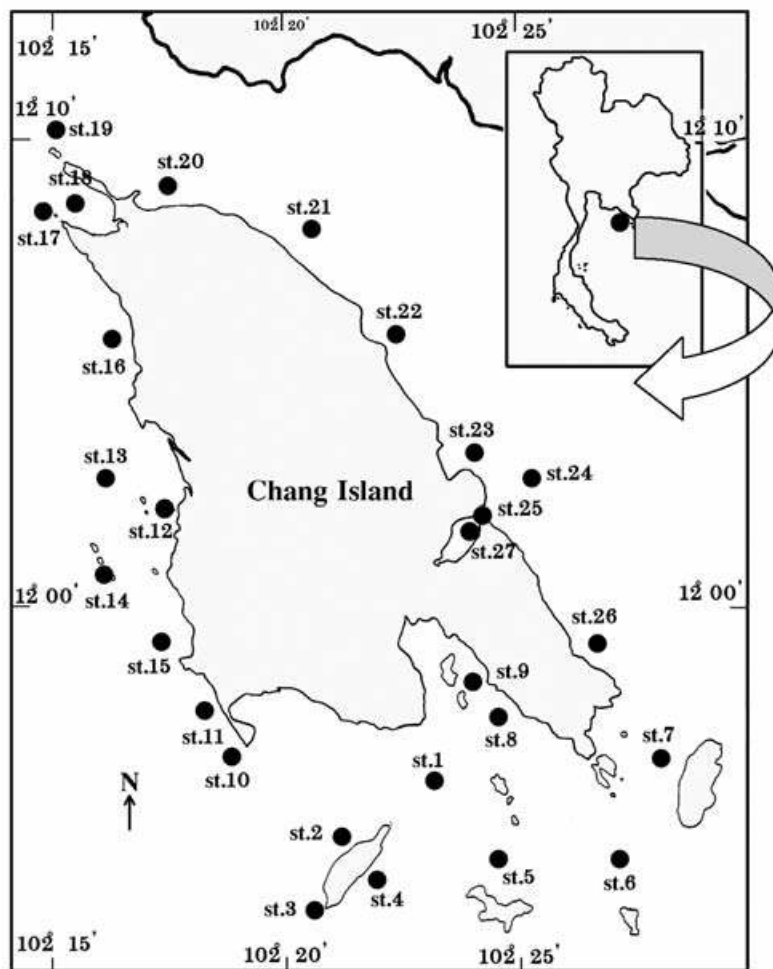


Figure 1 Study sites at Change Islands, Trat Province.

The distribution of marine planktonic diatoms will be considered as the species frequently found based on calculation of the percentage of station that found individuals of these species, as follow :

$$X = n/N \times 100$$

when, X = the percentage of station that found individuals species

n = the number of station that found individuals of the species;

N = the number of total station

The percentage of stations that found individuals of these species can be grouped into 3 levels; including common species (> 70 %), rare species (31-70 %) and very rare species (< 31 %).

RESULTS AND DISCUSSION

Identification

The marine planktonic diatoms (Division Chromophyta, Class Bacillariophyceae) in Chang Islands, Trat Province composed of 2 orders, 5 suborders, 26 families and at least 70 genera 140 species. At least 38 genera 93 species of centric diatoms (Order Biddulphiales) and at least 32 genera 47 species of pennate diatoms (Order Bacillariales) were identified. The most common genera in centric diatoms were *Chaetoceros*,

Coscinodiscus and *Rhizosolenia* that composed of 17, 11 and 9 species, respectively. From this study *Stictocyclus varicus* A. Mann was the first remarked as record found in Thailand while *Asteromphalus robustus* Castracane was the first species found in the Gulf of Thailand from this study. *Lyrella* and *Pleurosigma* were the most common genera in pennate diatoms composed of 4 species in both genera. Taxonomic list is showed in Table 1 and the illustration of some species are showed in Figure 2.

Occurrence of distribution

In this study, the highest and lowest number of species were reported at the station 18 and station 9 respectively, as showed in Figure 2. There were 42 common species distributed through the area at least 20 stations, 35 rare species frequently found between 9-19 stations and 64 very rare species frequently found in less than 9 stations as showed in Table 1. The common species most frequently found in every station were *Coscinodiscus gigas*, *Coscinodiscus* sp.1, *Dactyliosolen phuketensis*, *Hemiaulus membranaceus*, *Proboscia alata*, *Pseudosolenia calcar-avis*, *Rhizosolenia clevei* var. *communis*, *R. hyalina*, *Pleurosigma* sp.2, *Thalassionema frauenfeldii* and *T. nitzschoides*.

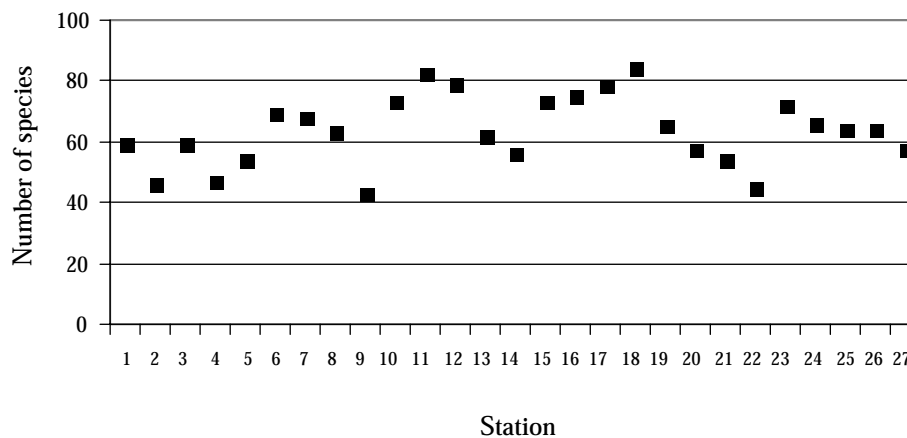


Figure 2 Number of species found in the study sites.

Table 1 Taxonomic list and distribution of marine planktonic diatoms at Chang Islands, Trat Province in March 2003.

No.	Marine planktonic diatoms	F	No.	Marine planktonic diatoms	F
Division Chromophyta			Suborder 2 Rhizosoleniineae		
Class Bacillariophyceae			Family 1 Rhizosoleniaceae		
Order 1 Biddulphiales (centric diatom)			32	<i>Dactyliosolen blavyanus</i> (H. Peragallo) Hasle ^A	rr
Suborder 1 Coscinodiscineae			33	<i>D. fragilissima</i> (Bergon) Hasle ^{A, B}	c
Family 1 Thalassiosiraceae			34	<i>D. phuketensis</i> (Sundström) Hasle ^A	c
1	<i>Cyclotella</i> sp. ^A	rr	35	<i>Guinardia cylindrus</i> (Cleve) Hasle ^{A, B}	c
2	<i>Detonula pumila</i> (Castracane) Schütt ^{A, B}	rr	36	<i>G. flaccida</i> (Castracane) H. Peragallo ^{A, B}	c
3	<i>Lauderia annulata</i> Cleve ^{A, B}	r	37	<i>G. striata</i> (Stolterfoh) Hasle ^{A, B}	c
4	<i>Porosira</i> sp. ^A	rr	38	<i>Proboscia alata</i> (Brightwell) Sundström ^{A, B}	c
5	<i>Skeletonema costatum</i> (Greville) Cleve ^{A, B}	rr	39	<i>Pseudosolenia calcar avis</i> (Schultze) Sundström ^{A, B}	c
6	<i>Thalassiosira</i> sp. ^A	c	40	<i>Rhizosolenia acuminata</i> (H. Peragallo) H. Peragallo ^{A, B}	c
Family 2 Melosiraceae			41	<i>R. bergonii</i> H. Peragallo ^{A, B}	c
7	<i>Paralia sulcata</i> (Ehrenberg) Cleve ^A	r	42	<i>R. clevei</i> Ostenfeld var. <i>clevei</i> Sundström ^{A, B}	c
Family 3 Leptocylindraceae			42.1	<i>R. clevei</i> Ostenfeld var. <i>communis</i> Sundström ^{A, B}	c
8	<i>Leptocylindrus danicus</i> Cleve ^{A, B}	rr	43	<i>R. hyalina</i> Ostenfeld ^{A, B}	c
Family 4 Coscinodiscaceae			44	<i>R. imbricata</i> Brightwell ^{A, B}	c
9	<i>Coscinodiscus asteromphalus</i> Ehrenberg ^A	rr	45	<i>R. pungens</i> Cleve-Euler ^A	r
10	<i>C. concinniformis</i> Simonsen ^A	rr	46	<i>R. robusta</i> Normann ^{A, B}	c
11	<i>C. concinnus</i> W. Smith ^A	r	47	<i>R. setigera</i> Brightwell ^{A, B}	r
12	<i>C. gigas</i> Ehrenberg ^A	c	48	<i>R. striata</i> Greville ^{A, B}	c
13	<i>C. janischii</i> A. Schmidt var. <i>arafurensis</i> Grunow ^{A, B}	r	Suborder 3 Biddulphiineae		
14	<i>C. jonesianus</i> (Greville) Ostenfeld ^A	rr	Family 1 Hemiaulaceae		
15	<i>C. nobilis</i> Grunow ^{A, B}	r	49	<i>Cerataulina bicornis</i> (Ehrenberg) Hasle ^{A, B}	r
16	<i>C. oculus iridis</i> Ehrenberg ^{A, B}	rr	50	<i>C. pelagica</i> (Cleve) Hendey ^{A, B}	r
17	<i>C. radiatus</i> Ehrenberg ^{A, B}	rr	51	<i>Climacodium frauenfeldianum</i> Grunow ^{A, B}	r
18	<i>Coscinodiscus</i> sp. 1 ^A	c	52	<i>Eucampia cornuta</i> (Cleve) Grunow ^{A, B}	r
19	<i>Coscinodiscus</i> sp. 2 ^A	rr	53	<i>E. zodiacus</i> Ehrenberg ^A	rr
20	<i>Palmeria hardmaniana</i> Greville ^A	rr	54	<i>Hemiaulus hauckii</i> Grunow ^A	r
21	<i>P. ostenfeldii</i> (Ostenfeld) von Stosch ^{A, B}	c	55	<i>H. indicus</i> Karsten ^A	c
Family 5 Hemidiscaceae			56	<i>H. membranaceus</i> Cleve ^A	c
22	<i>Actinocyclus normanii</i> (Gregory) Hustedt f. <i>normanii</i> Hasle ^A	r	57	<i>H. sinensis</i> Greville ^{A, B}	c
23	<i>A. octonarius</i> Ehrenberg ^A	rr	Family 2 Cymatosiraceae		
24	<i>Azpeitia nodulifera</i> (A. Schmidt) Fryxell & Sims in Fryxell <i>et. al.</i> ^A	c	58	<i>Cymatosira lorenziana</i> Grunow ^A	rr
25	<i>Pseudoguinardia recta</i> von Stosch ^{A, B}	c	Family 3 Biddulphiaceae		
Family 6 Stictocyclaceae			59	<i>Biddulphia pulchella</i> Gray ^A	rr
26	<i>Stictocyclus varicus</i> A. Mann ^A	rr	60	<i>Biddulphiopsis</i> sp. ^A	rr
Family 7 Asterolampraceae			61	<i>Isthmia enervis</i> Ehrenberg ^A	rr
27	<i>Asterolampra marylandica</i> Ehrenberg ^A	r	62	<i>Trigonium formosum</i> (Brightwell) Cleve ^A	rr
28	<i>Asteromphalus flabellatus</i> (Brébisson) Greville ^{A, B}	r	Family 4 Chaetoceraceae		
29	<i>A. robustus</i> Castracane ^A	r	63	<i>Bacteriastrum comosum</i> Pavillard ^A	c
30	<i>Asteromphalus</i> sp. ^A	rr	64	<i>B. delicatulum</i> Cleve ^A	c
Family 8 Heliopeltaceae			65	<i>B. elongatum</i> Cleve ^A	r
31	<i>Actinoptychus grundleri</i> A. Schmidt ^A	rr	66	<i>B. furcatum</i> Shadbolt ^{A, B}	c
			67	<i>B. hyalinum</i> Lauder ^{A, B}	c
			68	<i>B. minus</i> Karsten ^A	r

Table 1 (continued)

No.	Marine planktonic diatoms	F	No.	Marine planktonic diatoms	F
69	<i>Chaetoceros affinis</i> Lauder ^{A,B}	r		Family 6 Climacospheniaceae	
70	<i>C. coarctatus</i> Lauder ^{A,B}	c	103	<i>Climacosphenia moniligera</i> Ehrenberg ^A	rr
71	<i>C. compressus</i> Lauder ^{A,B}	c		Suborder 2 Bacillariineae	
72	<i>C. constrictus</i> Gran ^A	rr		Family 1 Lyrellaceae	
73	<i>C. curvisetus</i> Cleve ^A	rr	104	<i>Lyrella clavata</i> (Gregory) D.G. Mann ^{A,C}	rr
74	<i>C. denticulatum</i> Lauder ^A	r	105	<i>Lyrella</i> sp. 1 ^A	rr
75	<i>C. didymus</i> Ehrenberg ^{A,B}	rr	106	<i>Lyrella</i> sp. 2 ^A	rr
76	<i>C. diversus</i> Cleve ^{A,B}	c		Family 2 Berkeleyaceae	
77	<i>C. eibenii</i> Grunow ^A	rr	107	<i>Climaconeis lorenzii</i> Grunow ^A	rr
78	<i>C. lacinosus</i> Scüttht ^A	rr		Family 3 Naviculaceae	
79	<i>C. laevis</i> Leuduger-Fortmorel ^{A,B}	r	108	<i>Amphora</i> sp. 1 ^A	rr
80	<i>C. lorenzianus</i> Grunow ^{A,B}	r	109	<i>Amphora</i> sp. 2 ^A	rr
81	<i>C. messanensis</i> Castracane ^A	r	110	<i>Amphora</i> sp. 3 ^A	rr
82	<i>C. peruvianus</i> Brightwell ^{A,B}	r	111	<i>Diploneis</i> sp. ^A	rr
83	<i>C. pseudocurvisetus</i> Mangin ^A	r	112	<i>Donkinia</i> sp. ^A	rr
84	<i>C. tortissimus</i> Gran ^A	rr	113	<i>Gyrosigma</i> sp. ^A	rr
85	<i>Chaetoceros</i> sp. ^A	c	114	<i>Haslea gigantea</i> (Hustedt) Simonsen ^A	r
	Family 5 Lithodesmaceae		115	<i>H. wawriake</i> (Hustedt) Simonsen ^A	r
86	<i>Bellerochea horologicalis</i> von Stosch ^A	rr	116	<i>Meuniera membranacea</i> (Cleve) P.C. Silva ^{A,B}	c
87	<i>Bellerochea</i> sp. ^A	rr	117	<i>Navicula</i> sp. ^A	r
88	<i>Ditylum sol</i> Grunow ^{A,B}	c	118	<i>Pleurosigma</i> sp. 1 ^A	r
	Family 6 Eupodiscaceae		119	<i>Pleurosigma</i> sp. 2 ^A	c
89	<i>Lampriscus shadboltianum</i> Greville ^A	rr	120	<i>Pleurosigma</i> sp. 3 ^A	rr
90	<i>Odontella aurita</i> (Lyngbye) C. A. Agardh ^A	rr	121	<i>Pleurosigma</i> sp. 4 ^A	rr
91	<i>O. mobiliensis</i> (Bailey) Grunow ^{A,B}	c	122	<i>Trachyneis aspera</i> (Ehrenberg) Cleve ^A	c
92	<i>O. sinensis</i> (Greville) Grunow ^{A,B}	c	123	<i>T. olivaeformis</i> Chin et Cheng ^A	rr
93	<i>Triceratium favus</i> Ehrenberg ^A	r		Family 4 Bacillariaceae	
93.1	<i>T. favus</i> Ehrenberg f. <i>quadrata</i> Grunow ^A	rr	124	<i>Bacillaria paxillifer</i> (O.F. Müller) Hendy ^A	c
	Order 2 Bacillariales (pennate diatom)		125	<i>Cylindrotheca closterium</i> (Ehrenberg) W. Smith ^A	rr
	Suborder 1 Fragilariineae		126	<i>Nitzschia longissima</i> (Brébisson) Ralfs ^A	rr
	Family 1 Fragilariaceae		127	<i>N. sigma</i> (Kützing) W. Smith ^A	r
94	<i>Asterionellopsis glacialis</i> (Castracane) ^A Round ^A	rr	128	<i>Psammodictyon</i> sp. ^A	rr
95	<i>Bleakeleya notata</i> (Grunow) Round ^A	rr	129	<i>Pseudo-nitzschia pseudodelicatissima</i> (Hasle) Hasle ^A	r
	Family 2 Toxariaceae		130	<i>P. pungens</i> (Grunow ex Cleve) Hasle ^A	r
96	<i>Toxarium undulatum</i> (J.W. Bailey) Gregory ^A	rr		Family 5 Surirellaceae	
	Family 3 Thalassionemataceae		131	<i>Auricula complexa</i> (Gregory) Cleve ^A	rr
97	<i>Lioloma pacificum</i> (Cupp) Hasle ^A	rr	132	<i>Campylodiscus daemelianus</i> Grunow ^A	rr
98	<i>Thalassionema frauenfeldii</i> (Grunow) Hallegraeff ^{A,B}	c	133	<i>C. decorus</i> var. <i>pinnatus</i> Peragallo ^A	rr
99	<i>T. nitzschiioides</i> (Grunow) Mereschkowsky ^A	c	134	<i>C. echeneis</i> Ehrenberg ^A	rr
100	<i>Thalassiothrix longissima</i> Cleve & Grunow ^{A,B}	c	135	<i>Entomoneis</i> sp. ^A	c
	Family 4 Licmophoriaceae		136	<i>Petrodictyon gemma</i> (Ehrenberg) Mann ^A	rr
101	<i>Licmophora</i> sp. ^A	rr	137	<i>Surirella fastuosa</i> (Ehrenberg) Kützing ^A	r
	Family 5 Ardissonaceae		138	<i>Surirella</i> sp. ^A	rr
102	<i>Ardissonaea formosa</i> (Hantzsch) De Notaris ^A	rr	139	unidentified pennate diaatom 1 ^A	r
			140	unidentified pennate diaatom 2 ^A	rr

Remark F: The percentage of species frequently found, c: common species, r: rare species and rr: very rare species

A: species found in the present study, B: species found in Ostenfeld (1902) and C: species found in Östrup (1904)

Previous study of marine planktonic diatoms at Chang Islands and the adjacent waters was done by Ostensfeld (1902), rearrange with the total identification of 77 marine planktonic diatom species. It indicated that the number of species in this study was higher than the previous study (Table 1). According to his study the sample were collected by the plankton nets made from fine silk nets (no information about mesh size) but in this study collected by a smaller mesh size plankton nets (20 micrometer). In the other hand it was lower than its reported previous by Ostrup (1904)

that presented 274 marine diatoms species. They were mostly pennate diatom that usually exist in benthic form. At present, the name of some species found by Ostensfeld (1902) and Östrup (1904) were reclassified (Table 2). Similarly the recent paper by Thongbor (2004), studied on relationships between the quality of water and plankton distribution at Chang Islands, presented 152 marine planktonic diatoms species. The result of this study shows similar to her report. Because the sampling of both studies were done in the same area sites.

Table 2 The present and former scientific name of marine planktonic diatoms at Chang Islands, Trat province by Ostensfeld (1902) and Östrup (1904).

No.	Present	Former
	Order Biddulphiales	
1	<i>Azpeitia nodulifera</i> (Schmidt) Fryxell & Sims	<i>Coscinodiscus nodulifer</i> Janisch.
2	<i>Bacteriastrum furcatum</i> Shadbolt	<i>Bacteriastrum varians</i> Lauder
3	<i>Cerataulina bicornis</i> (Ehrenberg) Hasle	<i>Cerataulina compacta</i> Ostensfeld
4	<i>C. pelagica</i> (Cleve) Hendey	<i>C. bergonii</i> Peragallo
5	<i>Chaetoceros affinis</i> Lauder	<i>Chaetoceros ralfsii</i> Cleve
6	<i>Detonula pumila</i> (Castracane) Schütt	<i>Detonula delicatula</i> (Peragallo) Gran
7	<i>Guinardia cylindrus</i> (Cleve) Hasle	<i>Rhizosolenia cylindrus</i> Cleve
8	<i>G. striata</i> (Stolterfoh) Hasle	<i>R. stolterfohii</i> Peragallo
9	<i>Helicotheca tamesis</i> (Shrubsole) Ricard	<i>Streptothecca thamensis</i> Cleve
10	<i>Hemiaulus sinensis</i> Greville	<i>Hemiaulus heibergii</i> Cleve
11	<i>Leptocylindrus mediterraneus</i> (Peragallo) Hasle	<i>Dactyliosolen mediterraneus</i> Peragallo
12	<i>Odontella aurita</i> (Lyngbye) Agardh	<i>Biddulphia aurita</i> Lyngbye
13	<i>O. mobiliensis</i> (Bailey) Grunow	<i>B. mobiliensis</i> Bailey
14	<i>Proboscia alata</i> (Brightwell) Sundström	<i>R. alata</i> Brightwell
15	<i>Pseudoguinardia recta</i> von Stosch	<i>Lauderiopsis costata</i> Ostensfeld
16	<i>Pseudosolenia calcar avis</i> (Schultze) Sundström	<i>R. calcar avis</i> Schultze
17	<i>Rhizosolenia acuminata</i> (Peragallo) Peragallo	<i>R. temperei</i> Peragallo var. <i>acuminata</i> Peragallo
18	<i>R. bergonii</i> Peragallo	<i>R. amputata</i> Ostensfeld
19	<i>R. clevei</i> Ostensfeld var. <i>communis</i> Sundström	<i>R. styliformis</i> Brightwell
20	<i>R. imbricata</i> Brightwell	<i>R. shrubsolii</i> Cleve
21	<i>Thalassiosira eccentrica</i> (Ehrenberg) Cleve	<i>Coscinodiscus excentricus (eccentricus)</i> Ehrenberg
22	<i>T. leptopus</i> (Grunow, in Van Heurck) Hasle & Fryxell	<i>C. lineatus</i> Ehrenberg
	Order Bacillariales	
23	<i>Bacillaria paxillifera</i> (Müller) Hendey	<i>Bacillaria paradoxa</i> Gmelin
24	<i>Bleakeleya notata</i> (Grunow) Round	<i>Asterionella notata</i> Grunow
25	<i>Lyrella lyla</i> (Ehrenberg) Karajeva	<i>Navicula lyla</i> Ehrenberg
26	<i>Meuniera membranacea</i> (Cleve) Silva	<i>Navicula membranacea</i> Cleve
27	<i>Petrodictyon gemma</i> (Ehrenberg) Mann	<i>Surirella gemma</i> Ehrenberg
28	<i>Thalassionema frauenfeldii</i> (Grunow) Hallegraef	<i>Thalassiothrix frauenfeldii</i> Grunow in Cleve
29	<i>Toxarium hennedyanum</i> (Gregory) Pelletan	<i>Synedra hennedyana</i> Gregory

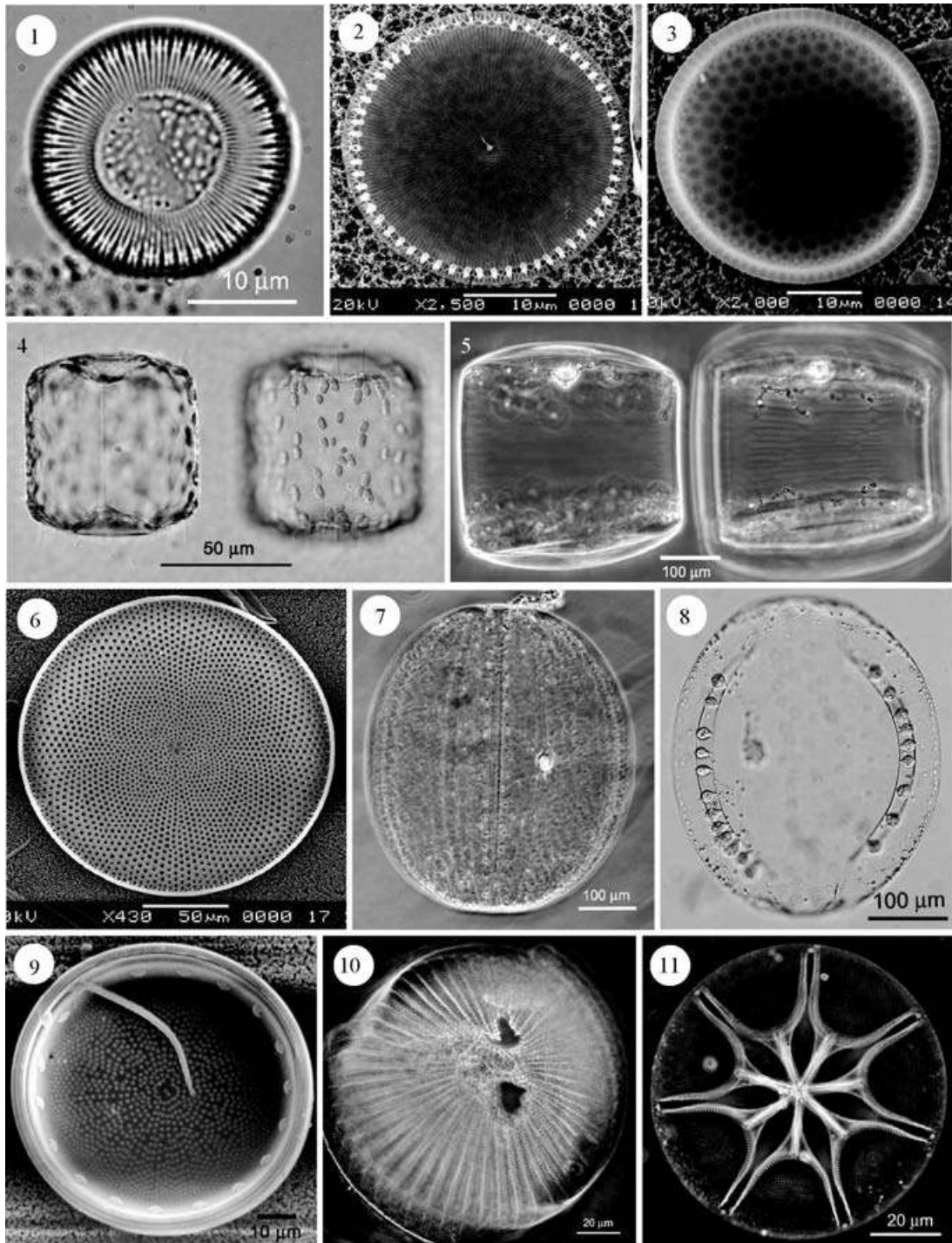


Figure 2 The illustration of some marine planktonic diatoms. (1) *Cyclotella* sp. (LM), (2) *Detonula pumila* (SEM), (3) *Thalassiosira* sp. (SEM), (4) *Lauderia annulata* (LM), (5) *Coscinodiscus concinniformis* (LM), (6) *C. asteromphalus* (SEM), (7) *Palmeria hardmaniana* (LM), (8) *P. ostenfeldii* (LM), (9) *Actinocyclus octonarius* (SEM), (10) *Stictocyclus varicus* (LM) and (11) *Asterolampra marylandica* (LM)

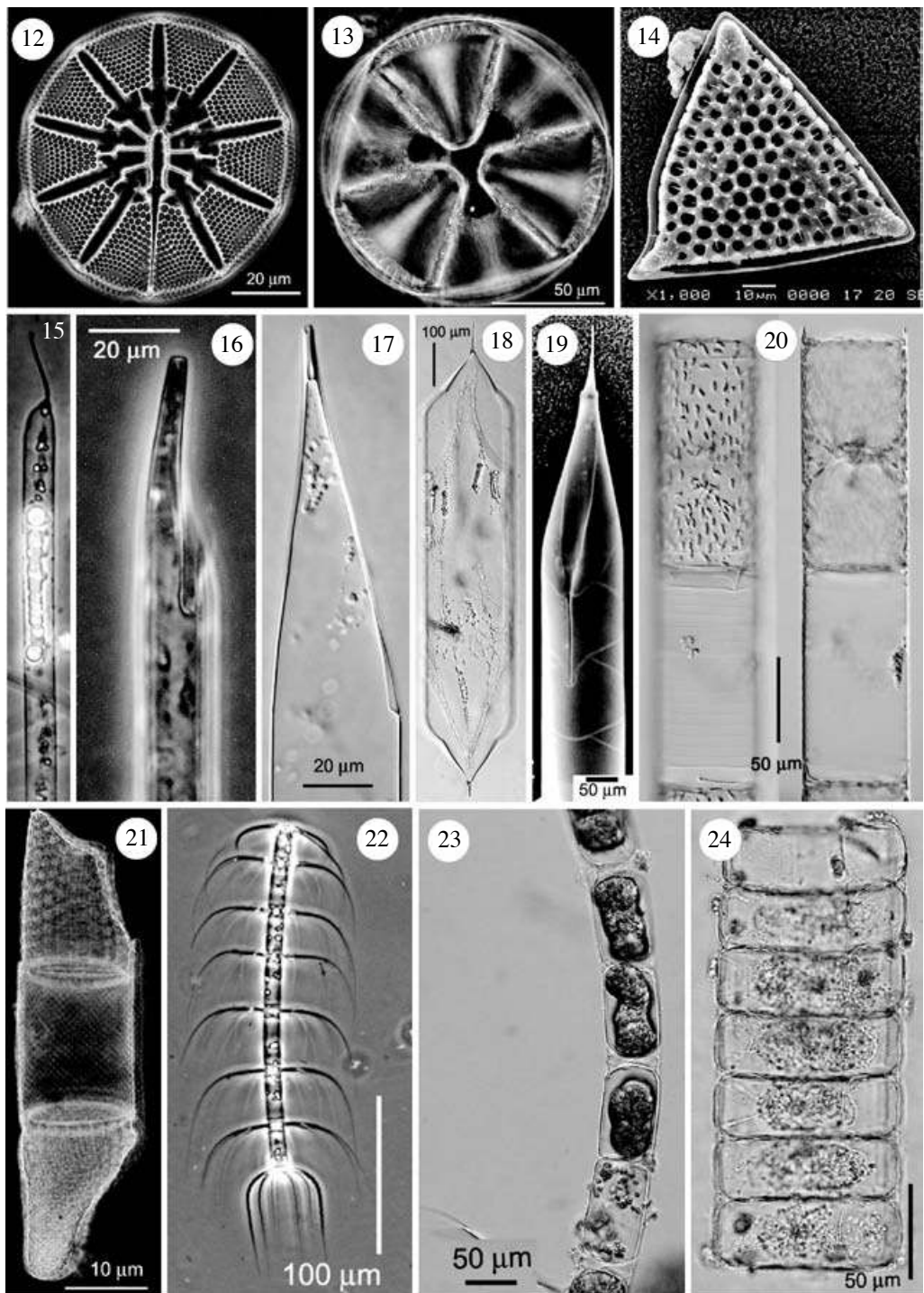


Figure 2 (continued) (12) *Asteromphalus robustus* (LM), (13) *Actinoptychus grundleri* (LM), (14) *Triceratium favus* (SEM), (15) *Guinardia cylindrus* (LM), (16) *Proboscia alata* (LM), (17) *Rhizosolenia bergonii* (LM), (18) *R. clevei* var. *clevei* (LM), (19) *R. clevei* var. *communis* (SEM), (20) *Cerataulina bicornis* (LM), (21) *Isthmia enervis* (LM), (22) *Bacteriastrium comosum* (LM), (23) *Bellerochea horologicalis* and (24) *Bellerochea* sp.

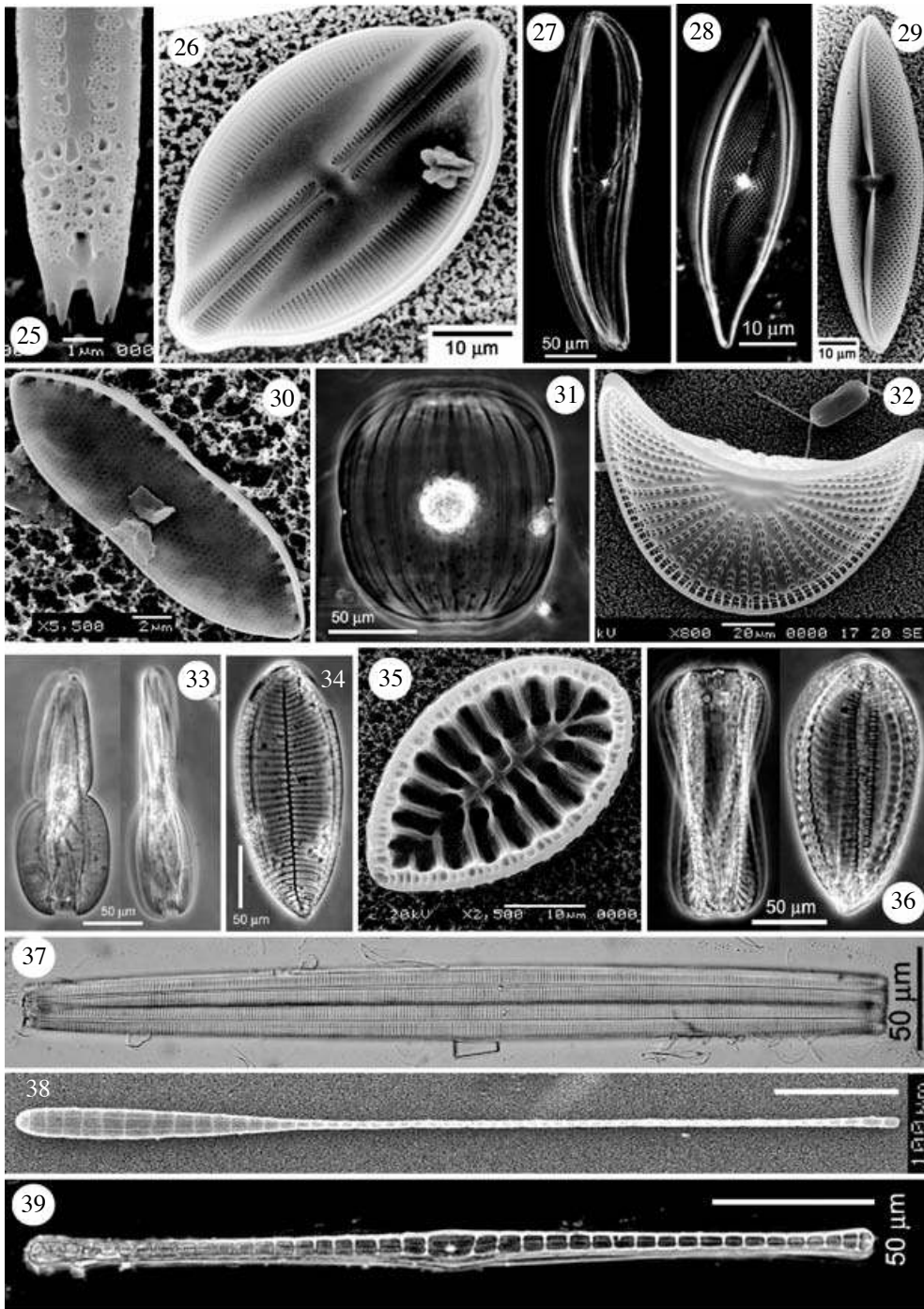


Figure 2 (continued) (25) *Lioloma pacificum* (SEM), (26) *Lyrella clavata* (SEM), (27) *Donkinia* sp. (LM), (28) *Pleurosigma* sp.1 (LM), (29) *Trachyneis olivaeformis* (SEM), (30) *Psammodictyon* sp. (SEM), (31) *Auricula complexa* (LM), (32) *Campylodiscus echeneis* (SEM), (33) *Entomoneis* sp. (LM), (34) *Petrodictyon gemma* (LM), (35) *Surirella fastuosa* (SEM), (36) *Surirella* sp. (LM), (37) *Ardissonea formosa* (LM), (38) *Climacosphenia moniligera* (SEM) and (39) *Climaconeis lorenzii* (LM)

CONCLUSION

The present study of marine planktonic diatoms at Chang Islands on March 2003 found 70 genera 140 species. *Stictocylus varicus* A. Mann was remarked as a first record in Thai waters while *Asteromphalus robustus* Castracane was the first record in the Gulf of Thailand. In this study, the highest and lowest number of species were reported at station 18 and station 9 respectively. There were 42 common species, 35 rare species and 64 very rare species. Eleven common species were frequently found at all station.

ACKNOWLEDGEMENTS

This project has been supported by the TRF/BIOTECT Special Program for Biodiversity Research and Training grant BRT T_ 147011, Plant Genetic Conservation Project Under the Royal Initiative of her Royal Princess Maha Chakri Sirindhorn and Naval Special Warfare Group, Royal Thai Fleet, Sattahip Naval Base, Royal Thai Navy.

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