

香港紅潮品種

Red Tide Species in Hong Kong



漁農自然護理署
Agriculture, Fisheries and
Conservation Department

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Author 作者 Stanley, P.C. LAW 羅秉全

Editors 編輯 Dr. Jim, C. W. CHU 朱振華
Dr. Joanne, O. O. LEE 李安安
Brian, K. Y. YANG 楊健宇
Vivian, C. M. AU 區智敏
Fion, Y. K. LEE 李燕琼
Carrie, K.W. CHAN 陳嘉慧



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PREFACE 自序

To secure orderly and efficient production of fisheries products is one of the visions of the Agriculture, Fisheries and Conservation Department. The production of fisheries products relies on good water quality. The Aquaculture Environment Section is the team responsible for conducting regular water quality monitoring and also phytoplankton monitoring in fish culture zones.

Phytoplankton is the primary producers in aquatic food web. However, when there is a massive growth of toxic phytoplankton causing harmful algal bloom (HAB), some negative impacts may be created. Identification of toxic species is very important so that early warning can be issued to the mariculturists. It is also my major task in my career life in the Department.

I joined the Department in 1981. Since then, I have been mainly engaged in the research and study of marine phytoplankton. In 1982, the next year after I joined the Department, massive cultured fish loss due to harmful algal blooms was recorded in Hong Kong. After that, the Department started to develop a system for phytoplankton and HAB monitoring. I was occupied in assisting in the set-up of the system, including data collection of phytoplankton and red tides found in local waters; long-term water quality monitoring; provision of training and management for local mariculturists; and identification of marine phytoplankton and HAB species.

Over the years, with the hard-work of and assistance from all the colleagues I worked with, more than 800 species of phytoplankton were successfully identified in Hong Kong. AFCD has now the most extensive scientific database on marine phytoplankton and HABs in Hong Kong. Identification of phytoplankton was not easy but it is interesting and meaningful. This book introduces 79 red tide causative species and I would like to share my experience in phytoplankton identification to help readers identify the species.

Stanley, P.C. LAW

漁農自然護理署的其中一個職責，是確保漁產品可以有秩序和有效率地生產。要生產漁產品，實有賴良好的水質。負責定期於全港魚類養殖區進行水質監測和浮游植物監察工作的，便是水產養殖環境組。

浮游植物是海洋食物鏈中的基層初級生產者。不過，當浮游植物(特別是潛在有害物種)在海中大規模增長時，便會形成有害藻華(HAB)，從而造成負面影響。識別潛在有害物種對於向海魚養殖戶發出預警非常重要，這也是我職業生涯中的主要任務。

我在1981年加入漁農自然護理署。這些年來，我主要從事海洋浮游植物的識別和研究工作。在我加入本署後的翌年，即1982年，香港發生了因有害藻華而造成大量養殖魚類死亡的事故。自此以後，部門開始設立浮游植物和有害藻華的監察系統。在設立系統的過程中，我協助建立香港水域中發現的浮游植物和紅潮的數據收集系統、長期水質監測、為海魚養殖戶提供培訓和管理，以及鑑定海洋浮游植物和海洋生物物種。

多年來，憑着所有和我共事過的同事的辛勤工作和協助，香港成功鑑定了800多種浮游植物，並建立了內容充實的香港海洋浮游植物資料庫。鑑定浮游植物並不容易，但過程十分有趣，且饒具意義。本書介紹了79種本港引發紅潮的物種，希望藉此分享我在浮游植物識別方面的經驗，並幫助讀者識別物種。

羅秉全

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承蒙紅潮／有害藻華專家顧問小組提供寶貴的意見輔助本冊子的研究、紅潮相關資訊及論述工作，本人謹此致謝。本人在此鳴謝東京大學亞洲環境科學研究中心的福代康夫教授及其同儕提供專業意見，香港城市大學化學系歐慧婷博士協助環境掃描電子顯微鏡鑑定工作，以及香港政府化驗所中藥組曹秀清女士提供液相色譜－質譜聯用儀進行軟骨藻酸分析。同時，特別鳴謝王柏萱博士及胡紹燊教授，感謝他們為本書冊撰寫前言。藉此機會多謝所有向漁農自然護理署報告紅潮及提供紅潮資料和其他輔助鑑定的人士。最後，本人特別感謝漁農自然護理署署長梁肇輝博士以及上司朱振華博士、李安安博士對出版本書冊的支持。對於漁農自然護理署水產養殖環境組的伙伴：楊健宇先生、區智敏女士、李燕琮女士、陳嘉慧女士、張翠珊女士，本人十分感謝他們整理資料並協助書冊出版。同時，本人亦向翻譯組的同事致謝，感謝他們耐心協助校對。希望這書冊可幫助公眾認識香港引發紅潮的浮游植物。

FOREWORD 序

Phytoplankton, the microscopic drifting plants living in water, is the origin of productivity in all aquatic ecosystems. It converts inorganic carbon, nitrogen, phosphorus and sulphur compounds into carbohydrates, proteins and fats, making nutrients available for numerous aquatic animal species. The nutrients produced by phytoplankton pass along the food web, providing food for many aquatic and terrestrial species, including human. The photosynthetic activity of phytoplankton also converts carbon dioxide into oxygen, playing a significant role in replenishing aquatic and atmospheric oxygen.

Conversely, the proliferation of phytoplankton can lead to red tides or harmful algal blooms (HABs) in the aquatic environment. Most of the red tides are harmless. Yet some phytoplankton species may produce toxins that are harmful to the fish. Red tides may also kill fish indirectly by depleting oxygen in the water when phytoplankton decays. The Agriculture, Fisheries and Conservation Department (AFCD) has been monitoring phytoplankton and red tides in Hong Kong for more than 40 years, aiming at detecting potential toxic algae and development of red tides/ HABs with a view to providing early warnings to mariculturists and other concerned parties to minimise the impact of red tides/ HABs.

Phytoplankton identification is a unique combination of scientific and artisanal techniques. Identification of phytoplankton species is traditionally based on microscopic observation to differentiate various morphological features, which requires tremendous efforts and highly specialised skills to make the algal species discernible. A tiny and inconspicuous difference in one of the morphological features of two seemingly identical algal cells can yield two different taxonomic classifications. The author of this book, Mr Stanley LAW, has been working for AFCD on phytoplankton species identification for more than 30 years. With his exceptional technical skills and experience, over 800 phytoplankton species have been discovered and identified in Hong Kong waters and more than 80 red tide causative species, including toxic and non-toxic ones, have been recorded so far.

Over the past two years, Mr LAW and his teammates have collated the scientific information and statistical data from years of red tide records into this book, hoping to reveal and share the fruitful outcomes of their work. This publication first ever comprehensively documents and introduces the diversity of red tide causative phytoplankton in Hong Kong. It not only records their scientific facts and morphological characteristics but also unveils the fascinating microscopic world of the phytoplankton community in Hong Kong waters.

I am grateful to witness the birth of this book, as a reflection of some 30 years of work in the world of phytoplankton by our colleagues. We hope to pass on the knowledge to our future generations in order to safeguard the sustainable development of fisheries and marine ecological integrity.

Dr. LEUNG Siu Fai, JP

Director of Agriculture, Fisheries and Conservation

微小而隨水漂流的浮游植物，是所有水生生態系統生產力的根源。這些浮游植物把無機碳、氮、磷和硫化物轉化成碳水化合物、蛋白質和脂肪，為無數的水生動物提供營養。浮游植物製造的營養亦傳送到食物網中，為其他水生和陸上物種（包括人類）提供食物。透過光合作用，浮游植物又把二氧化碳轉化為氧氣，補充水中及大氣中的氧氣。相反，浮游植物一旦大量繁殖，便會導致紅潮或有害藻華的出現。大部分紅潮均屬無害，只有少數浮游植物可能產生對魚類有害的毒素。大量浮游植物死亡時亦會消耗水中的溶氧，間接令魚類死亡。漁農自然護理署在過去四十年一直監察本港浮游植物及紅潮的情況，目的是為了偵測潛在有毒藻類及紅潮的出現，以便向海魚養殖戶及其他相關人士發出預警，以減輕紅潮或有害藻華所帶來的影響。

浮游植物的鑑定，是一項融合科學與藝術的專門課題。傳統上，浮游植物的物種鑑定是基於在顯微鏡下觀察所得各種形態特徵，以分門別類。鑑定的過程甚費心思，且須具備高度專業技能，才能正確辨別不同的藻類品種。一些形態特徵的微小差異，可能使品種分類出現截然不同的結果。本書作者羅秉全先生過去三十多年來在漁農自然護理署工作，負責香港浮游植物物種的識別和研究。憑藉他傑出的技術和經驗，已在香港水域發現並鑑定了八百多種浮游植物及八十多種紅潮物種，當中包括有毒和無毒的紅潮物種。

羅先生和他的同事在過去兩年裏，整理了過去多年來的科學資料和本港紅潮的統計數據，把有關資料輯錄成此書冊，希望透過這本書冊，展示並分享他們工作所得的成果。本書冊全面記錄和介紹在香港引發紅潮的浮游植物品種，除形態特徵的描述外，本書冊亦展示了香港水域浮游植物群落微觀世界迷人的一面。

我十分高興見證這本反映着我們過去三十多年於浮游植物世界中工作的書冊誕生。我們希望當中的知識可薪火相傳，以保護漁業的可持續發展及海洋生態的完整性。

漁農自然護理署署長
梁肇輝博士, 太平紳士

FOREWORD 序

My whole career life was closely associated with red tides in Hong Kong. In the summer of 1971, the second year of my undergraduate study, a first unprecedented large scale red tide occurred in the southern beaches of Hong Kong. This red tide incident was a *Noctiluca* bloom and was studied by Professor Brian MORTON who later became the supervisor for my master study. My master and doctoral studies were on the ecology of some marine mollusks, totally unrelated to red tide. However, just before finishing my doctorate study, I applied for the post of Research Officer on Marine Pollution of the Hong Kong Agriculture, Fisheries and Conservation Department (AFCD). During the interview for the post, I realised that the post was tasked to look into red tide problems in Hong Kong. I confidently told the interviewing board that although I was not trained specifically on red tides, my basic training in research during my postgraduate years would be adequate for me to carry out research on red tides. And I did get the job finally when I completed my doctorate study.

I can still remember my first day at work. After reporting duty at the AFCD Headquarters, upon my arrival at my office in the Aberdeen Research Station, I was told to investigate a red tide outbreak at Po Toi O fish culture zone immediately. So I conducted my first red tide investigation wearing a skirt and high heel shoes. With the samples collected, I started my study on red tide causative organisms, the experience of which was really unforgettable. The causative organism was a naked dinoflagellate which, when fixed with Lugol, just appeared as dark brown to black blobs under the light microscope. The legacy from my predecessors was an album of black and white photos and the naked dinoflagellates species all appeared as black blobs of different sizes and shapes. Studying live samples under the microscope did not help as the cells either kept moving around at great speed or burst apart with the addition of glycerin to slow them down. Identification of the red tide causative organisms was really a great challenge to an amateur on red tide research like me.

As I was not getting any success, I started to work from the very basics. First I established an information collection system for phytoplankton and red tides in Hong Kong waters. All phytoplankton found in the water samples collected from the water quality monitoring programme were identified as far as possible and recorded with photos showing the identifying features. To improve recording, a higher magnification microscope with camera set up was acquired and colour photos of the fixed phytoplankton were taken. Toxicity tests were conducted on species suspected to be toxic and those confirmed toxic were recorded. Information of each red tides incident, including water colour, location, extent, causative organisms and the associated impacts were recorded onto a standard form. To enable collection of information of as many red tide incidents in Hong Kong as possible, a red tide reporting network involving government staff conducting routine duties around Hong Kong waters and mariculturists in all fish culture zones was established. All the above arrangements enable gradual but systematic accumulation of information on phytoplankton, especially the red tide organisms, in Hong Kong. However, the success of this information collection system in fact owes to the devotion and hard work of Stanley LAW who joined my research team in 1981.

Stanley took great interest in phytoplankton identification. He patiently took pictures of every phytoplankton species that appeared in the samples and tried to collect as much identification features for each as possible. He took the initiative to read up available literature on phytoplankton identification and kept himself continuously updated.

He attempted various measures to take pictures of live naked dinoflagellates. An accidental breakthrough occurred when he found that a disperser supposed to break and homogenise cells just immobilised the naked dinoflagellate cells. For those dinoflagellates with delicate cell walls, he found that the best way was to patiently wait and catch the moment when water just evaporated sufficiently to slow down the dinoflagellates and yet not enough to burst the cell. In order to take pictures of the phytoplankton with the identification features, he carefully rolled the cells around and took shots of each side from various visual depths. Over the years, he gradually upgraded the techniques used for microscopic photography from simple light to phase contrast, diffraction phase contrast and epifluorescence. Recently, he successfully introduced the Extended Depth of Focus (EDF) technique where images of the same phytoplankton species are captured in different depths of field and combined together by computer software to give a 3D image. This technique enables the taking of a single all-in-focus image of all the particular fine structures of any phytoplankton cell which greatly enhances identification precision. Stanley is also very keen to share his identification skill and over the years he has trained numerous colleagues and formed a strong phytoplankton identification team within the department. The editors: Dr. Jim CHU, Dr. Joanne LEE, Brian YANG, Vivian AU, Fion LEE and Carrie CHAN are all part of the team.

This book therefore is one of the achievements from Stanley's more than 30 years of toil and labour. With the information provided in this book, all workers on red tides in Hong Kong, even newcomers or amateurs do not have to go through what I went through when I first started to work on red tide and will be able to identify most of the red tide causative species in Hong Kong. It is hoped that this book will help promote research in red tide or harmful algal blooms in Hong Kong and find ways to solve the red tide problem in Hong Kong.

Dr. Patsy P. S. WONG

Former Senior Fisheries Officer of the Agriculture, Fisheries and Conservation Department

我的職業生涯與香港的紅潮有很密切的關係，1971年我在大學第二年的夏天，香港南區的海灘第一次出現史無前例的大規模紅潮。那次是夜光藻大量繁殖，由後來作我碩士研究導師的莫雅頓教授進行調研究。我的碩士及博士研究都是關於一些軟足類的生態，與紅潮全無關連。不過在臨近完成博士研究時，我申請應徵香港漁農自然護理署(漁護署)海洋污染研究主任的職位，在應徵面試時我才知道該職位是專責探究香港的紅潮問題，我還十分有自信的回應面試委員說，雖然我沒有紅潮方面的專門訓練，但我從學士後幾年研究工作所得到的基本技能，應足以讓我勝任研究紅潮的工作，最後在我完成博士研究工作後，我終獲聘擔任該職位。

我仍清楚記得第一天工作的情景，在漁護署總部報到後，我就前往我辦工的地點 — 香港仔研究所，甫到達就收到指示立刻要去調查在布袋澳魚類養殖區發生的紅潮，因此我是穿着裙子、高跟鞋進行人生第一次的紅潮調查。收集了一些樣本後，我便開始紅潮品種的鑽研，那經歷真的難忘。那次的紅潮是一裸甲藻藻華，那裸甲藻以魯哥氏液固定後在顯微鏡下呈現為深褐至黑色的圓粒。前任同事留下給我的是一本黑白藻類照片簿，而內裏所有的裸甲藻品種照片都是呈現為不同大小形狀的黑色粒子。用顯微鏡看活樣本也於事無補，因裸甲藻細胞不停地快速游動，又或在加上甘油去減低其游動速度時就爆裂。辨認紅潮品種對像我這樣的紅潮研究新手實在是一極大的挑戰。

由於各種嘗試都不得要領，我惟有從最基本着手。首先我設立一套香港水域浮游植物及紅潮資料收集系統。水質監察計劃所收集的水樣本內所有浮游植物都要盡量進行辨認，並用照片記錄其辨認特徵。為提高記錄效能，研究所購置了一部附有攝影機的放大倍數較高的顯微鏡。如有任何紅潮品種懷疑有毒性，就會進行毒性測試以確定並記錄其毒性。每宗紅潮個案的資料，包括水的顏色、地點、範圍、成因品種及關連的影響都用一指定的表格記錄下來。同時又成立一個紅潮報告網絡，以便能夠盡量收集在香港發生紅潮個案的資料，這網絡是由所有在香港水域執行例行公務的政府人員及所有養魚區的養魚戶組成的。藉着這些安排，有關香港浮游植物(特別是紅潮生物)的資料能逐漸並有系統地累積下來。不過，這個資料收集系統的成功其實全賴羅秉全先生的熱誠及努力，他於1981年加入我的研究團隊。

羅先生醉心於浮游植物品種辨認的工作，他很有耐性地為在水樣本裏出現的每一個浮游植物品種拍照，並嘗試盡錄每一個辨認特徵。他自發性地去鑽研有關浮游植物品種辨認的文獻，以至他在這方面的知識不斷得到更新。他又試用不同方法去拍攝活裸甲藻細胞，當時有一意外的突破，就是他發現原本買來破壁打碎細胞的儀器會使裸甲藻細胞停止游動。至於要在顯微鏡下拍攝那些細胞壁超薄的裸甲藻，他從無數試驗中得出的結論就是要耐心的等待，以捕捉那一刻當載物片上的水被蒸發足夠至細胞停止游動但未致令牠們爆裂。為了拍攝浮游植物的辨認特徵，他小心翼翼地​​在顯微鏡下滾動細胞，將細胞的每一邊用不同的焦距拍攝下來。多年來他逐漸改進顯微鏡的拍攝技術，從簡單光照、相位差、衍射相位差以至落射熒光。最近他更成功地引進焦點合成技術，就是將同一浮游植物細胞在不同焦距下的數個影像用電腦軟件合併成一個三維影像，這技術能將任何浮游植物細胞內全部特別微細的構件都清晰地顯示在同一幅影像裏，這就大大增加辨認的準確性。羅先生也十分熱心與人分享他的辨認技能，多年來他培訓了許多同事並在部門內成立了一支強勁的浮游植物辨認隊，而本書的幾位編輯朱振華、李安安、楊健宇、區智敏、李燕琮及陳嘉慧都是該隊的成員。

因此，這書是羅先生超過三十年艱辛耕耘的碩果之一，有了這本書提供的資料，在香港所有紅潮研究人員，就是新入行或是沒有受過正規訓練的，都能辨認大多數的香港紅潮品種，不用經歷我開始紅潮工作時所經歷的。冀盼這書能幫助推動紅潮或有害藻華的研究，並尋得方法以解決香港的紅潮問題。

漁農自然護理署前高級漁業主任
王柏萱博士

FOREWORD 序

In the last three decades, both the number and scale of Harmful Algal Blooms (HABs) have shown a significant increase globally. Cumulative evidence shows that a great diversity of phytoplankton can be causative species, and their toxic effects on human and marine biota have caused grave environmental and public health concerns both in Hong Kong and worldwide.

Since the first report of *Noctiluca scintillans* bloom in Hong Kong in 1971, HAB has attracted considerable public attention and scientific interest in the local community. The Hong Kong government has correspondingly introduced an extensive phytoplankton monitoring programme in local waters since 1975. This endeavor which has been continuing for the past 40 years has succeeded, and now provides us one of the most extensive scientific databases on marine phytoplankton and HABs in the world.

The author of this book, Stanley LAW of the Agriculture, Fisheries and Conservation Department (formerly the Agriculture and Fisheries Department), is one of the pioneers of the Hong Kong phytoplankton and HAB monitoring programme. I have had the privilege to work closely with Stanley for some 10 years in the 80's during the early stage of our careers. Stanley has placed tremendous efforts in developing keys for identification of marine phytoplankton and HAB species, especially the differentiation of toxic and non-toxic phytoplankton species. The description and systematic information on HAB species summarised in this book probably serves as the single most important guide for the general public, the scientific community in Hong Kong, and the Asian Pacific region in the many years to come. The contribution and dedication of Stanley LAW in this area are highly commendable.

Prof. Rudolf S.S. WU

Research Chair Professor
Department of Sciences and Environmental Studies,
The Education University of Hong Kong

過去三十年，有害藻華 / 紅潮的發生次數及規模於全球上都有着明顯的增加。累積數據顯示，多種浮游植物品種能引致有害藻華 / 紅潮，無論是在香港和世界各地，都可對人類和海洋生物造成影響而引致嚴重的環境和公眾健康問題。

自從香港於1971年首度記錄得由夜光藻引發的紅潮報告，有害藻華 / 紅潮引起了本地公眾廣泛關注及科學興趣。1975年，香港政府推行適用於本港水域的浮游植物監察計劃。這監察計劃至今成功地實行了40年，為我們提供了全球其中一個全面的海洋浮游植物和有害藻華 / 紅潮的科學數據庫。

本書作者 — 漁農自然護理署（前稱漁農處）的羅秉全先生，是香港浮游植物和有害藻華 / 紅潮監察計劃的先驅之一。早於80年代，我們的職業生涯的早期階段，我和羅先生一起緊密工作了大約10年。其間，羅先生致力建立海洋浮游植物和有害藻華 / 紅潮品種鑑別標識，尤其是在分辨有毒和無毒的浮游植物品種。這書冊提供了對有害藻華 / 紅潮品種的描述和有系統的資訊，可在往後日子作為公眾、香港和亞太地區的科研的參考指引。羅秉全先生的貢獻和奉獻精神值得高度讚揚。

香港教育大學科學與環境學系
研究講座教授
胡紹燊教授

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香港紅潮品種
Red Tide Species in Hong Kong

第一章
Chapter 1

Introduction
序言

Introduction

Microscopic algae are the primary producers that form the foundation of the aquatic food web. They are responsible for consuming most of the carbon dioxide in the ocean through photosynthesis and releasing most of the oxygen in the air we breathe.

There are over 800 microscopic algae recorded in Hong Kong waters in which 81 have been reported as red tide causative species and among them dinoflagellates are the highest in number of species and occurrence cases. Most of the red tide causative species are harmless and seldom cause large scale impact.

Microscopic identification of phytoplankton species is based on morphological and other visible features under a light microscope. The task is arduous since high degree of skill and experience is required to identify phytoplankton species in Hong Kong waters.

This booklet aims at disseminating red tide information and describing the red tide causative species that have been recorded in Hong Kong waters from 1975 to 2017. It incorporates photo profusion and text description and serves not only as a useful identification guide for students or those interested in phytoplankton identification, but also to arouse public awareness on red tide. Specifically, it attempts to act as a reference guide to review taxonomic history of various species by updating the valid name and retaining other names of the species in this publication.

序言

微藻類是水生食物網的基層初級生產者。他們在光合作用過程中消耗海洋中大部分二氧化碳，並釋放我們呼吸所需的氧氣。

根據記錄，香港水域的微藻類超過800種，當中有81個紅潮品種，而當中以甲藻的種類及發生的個案佔最多。大部份紅潮品種是無害，只有少量品種會造成大規模影響。

浮游植物的品種是根據光學顯微鏡下所顯示的形態或特徵來鑑定。這項工作是艱巨的，因為鑑定工作需要高度的技巧和豐富的經驗。

本書冊旨在傳達紅潮資訊和描述1975至2017年間於香港水域錄得的紅潮品種。書冊圖文並茂地介紹曾經在本港水域引發紅潮的品種，不僅能作為學生或有興趣識別浮游植物人士的鑑定指南，也可用以提高公眾對紅潮的認知。書冊亦在更新紅潮品種的有效名稱時保留品種的其他名稱，以便作為回顧不同品種分類歷史記錄的參考指南。

What are red tides / harmful algal blooms?

Red tides or algal blooms are natural phenomena of water discolouration caused by rapid multiplication of microscopic plankton to high levels of cell densities in water. Under favourable environmental conditions such as optimal light intensity, water temperature, salinity, nutrient level and geographic location, etc., microalgae can proliferate drastically and form red tides.

Harmful Algal Blooms (HABs) are the multiplication of toxic phytoplankton that may associate with negative impacts to the marine system, aquaculture industry or human health via mechanical damage to other organisms, production of toxins, or by other means.

甚麼是紅潮／有害藻華？

海洋中微小的浮游藻類迅速大量繁殖後引致海水變色，便會形成紅潮或藻華這種自然現象。在適當的環境條件下，例如合適的光度、水溫、鹽度、營養水平及地理位置等，微藻可大量繁殖而形成紅潮。

有害藻華(HABs)是有害的浮游植物大量繁殖，透過結構性的損害、產生毒素或其他方式為海洋系統、水產養殖或人類健康帶來有害的影響。

Occurrence of red tides in Hong Kong waters

The Agriculture, Fisheries and Conservation Department (AFCD) has started recording the occurrence of red tides since 1975. From 1975 to 2017, 932 red tide incidents were recorded in Hong Kong waters. Figure 1 shows the increasing numbers recorded in the early 1980s, with an exceptional high peak in 1988. Afterwards, the numbers of incidents decreased to about 20 incidents on average in the last decade.

Red tides occurred all year round in Hong Kong waters with a peak frequent record in March and with the least records in July over the past 40 years from 1975 to 2017. Figure 2 shows the monthly occurrence of red tides. The seasonal pattern shows that red tides are more likely to occur in spring whereas the relatively high water temperature in summer favours less red tide occurrence.

AFCD divides Hong Kong waters into six regions, namely West, South, Southeast, East, Northeast and Tolo Harbour for monitoring. Figure 3 shows the relative distribution of red tide occurrences in various water regions. The highest red tide occurrence (35.0%) was recorded in Tolo Harbour whereas the lowest (4.4%) was recorded in the eastern part of Hong Kong waters. The particularly high occurrence of red tide in Tolo Harbour might be related to the urbanisation between 1970s to 1980s, livestock and domestic sewage discharge as well as the topographic feature of Tolo Harbour which is a sheltered area with limited flushing by tidal currents compared with others water regions. The relatively low number of red tide in the eastern waters might be associated with a relatively open sea environment with less fluctuations of salinity and other environmental factors.

香港水域的紅潮

漁農自然護理署(漁護署)自1975年開始記錄在香港水域發生的紅潮。1975至2017年間，香港水域共錄得932宗紅潮個案。圖1顯示自八十年代起，紅潮個案有上升的趨勢，至1988年達高峯，隨後紅潮個案趨勢逐漸下降至過去十年平均每年約20宗。

在香港水域，一年四季都會發生紅潮。在1975至2017年的40多年間，記錄得最多和最少紅潮個案的月份分別是3月和7月。圖2顯示每月發生紅潮個案的數目。從季節性變化可見紅潮多發生在春季，而紅潮在水溫度相對較高的夏季則會較少發生。

漁護署把香港水域劃分為六個區域，包括西、南、東南、東、東北和吐露港區。圖3顯示紅潮在各個區域的相對分布頻率。吐露港錄得最多紅潮發生個案(35.0%)，而東部區域錄得的紅潮個案最少(4.4%)。從七十年代到八十年代，特別多紅潮個案發生於吐露港水域，相信與當時的新市鎮發展、牲畜及生活污水排放、地形特徵有關，吐露港是一遮蔽的水域，其沖刷力較其他區域弱。在東部水域相對較少的紅潮個案發生，可能與較開放的海洋環境以至較少鹽度轉變和受其他環境因素影響有關。

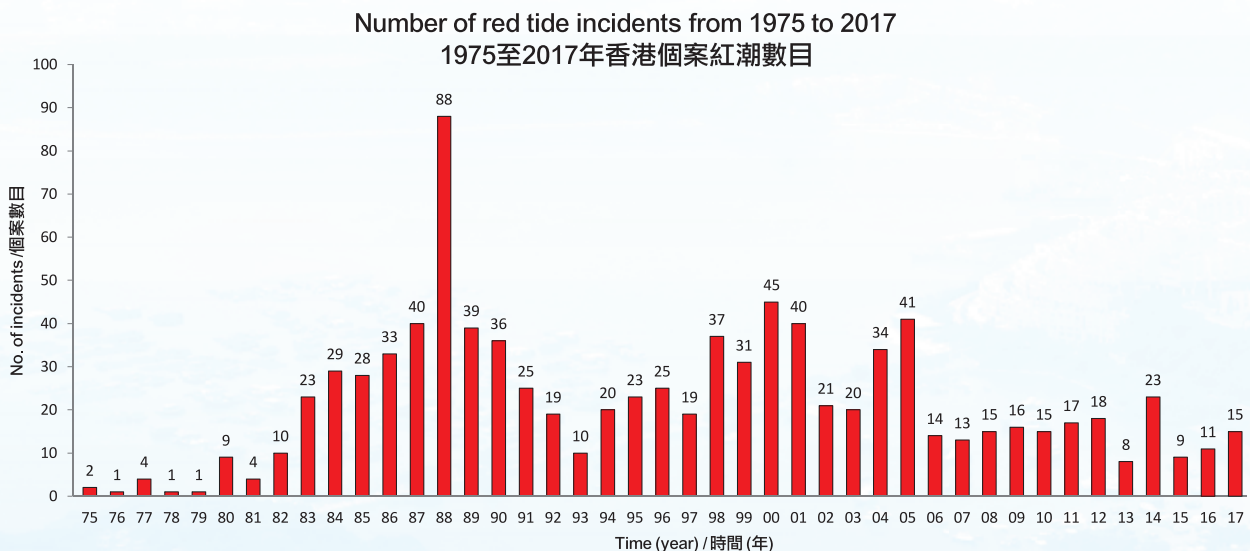


Figure 1. Annual occurrence of red tides from 1975 to 2017

圖1. 1975至2017年間每年發生紅潮個案的數目

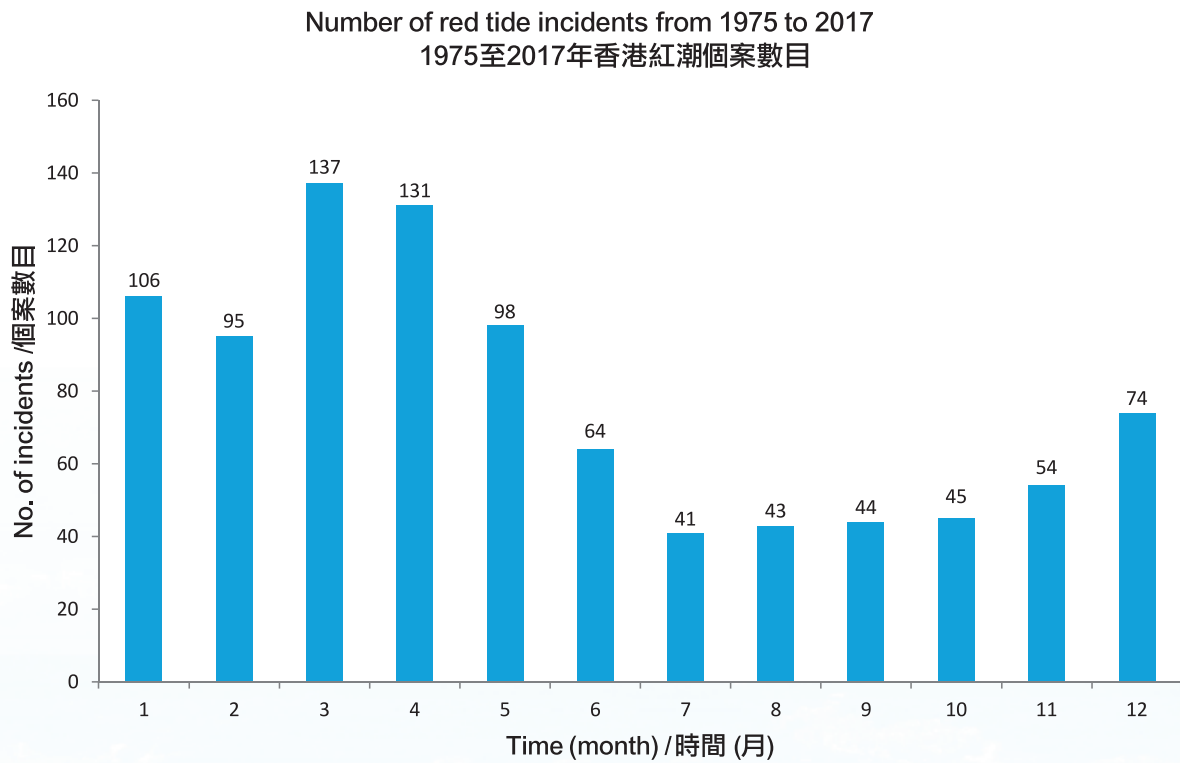


Figure 2. Monthly occurrence of red tides from 1975 to 2017
圖2. 1975至2017年間發生紅潮個案的月份分布

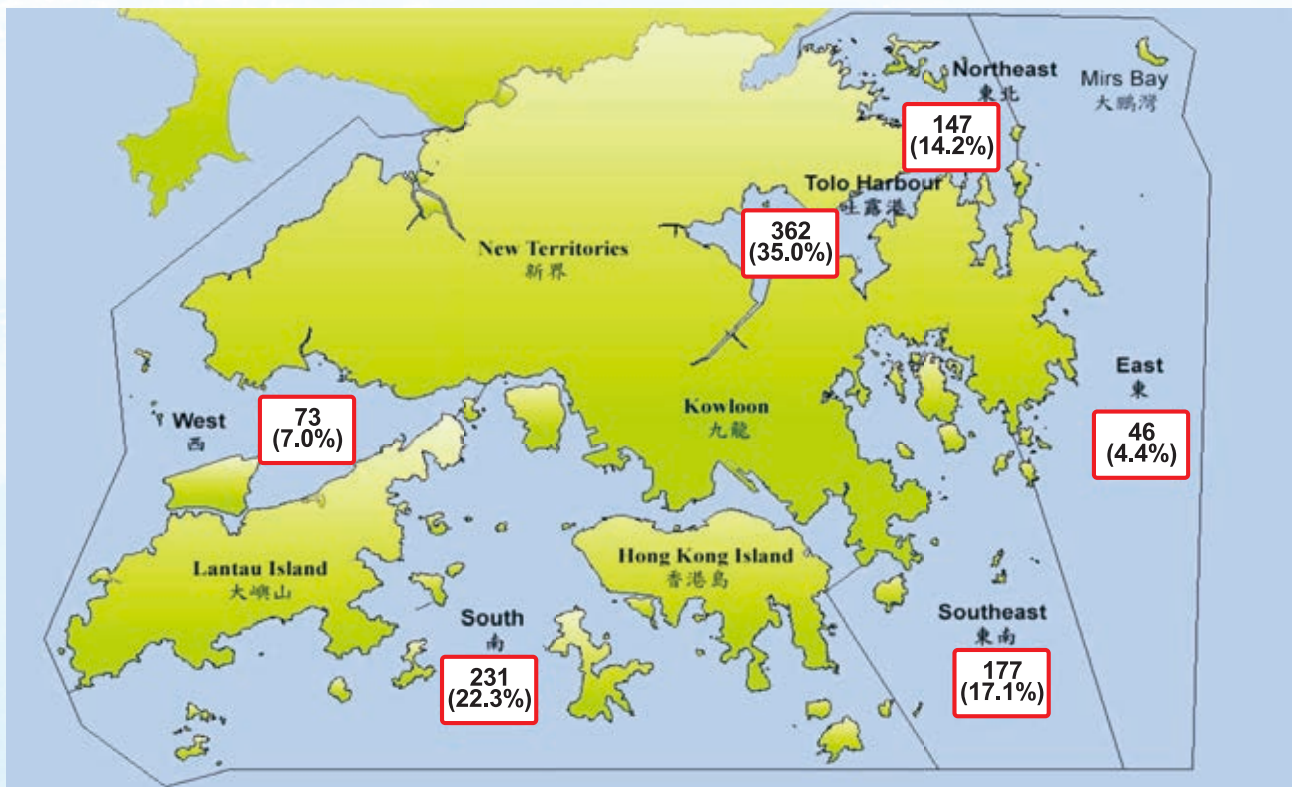


Figure 3. Regional distribution of red tide incidents in Hong Kong from 1975 to 2017
圖3. 1975年至2017年香港紅潮個案的水域分布

How many red tide species are found in Hong Kong?

There are over 300 aquatic organisms known to cause red tides all over the world of which only 81 have been recorded in Hong Kong. Among the 81 bloom forming species in Hong Kong, only 22 are toxic or potentially toxic algae.

The red tide organisms in Hong Kong are mainly classified into three groups, namely diatoms, dinoflagellates and others including Chlorophytes, Raphidophytes, Cyanophytes and Cryptophytes, etc.. According to our records, 643 red tide incidents were caused by dinoflagellates, accounting for 60.3% of the total number of red tide incidents while 185 incidents are caused by diatoms which accounted for 17.3%. The remaining 239 records (i.e. 22.4%) were caused by others.

香港有多少個紅潮品種？

全球有超過300個水生生物品種可導致紅潮，其中只有81種曾在本港引發紅潮，而在香港曾引發紅潮的81個品種中，只有22個品種是屬於有害或可能有害的藻類。

在香港引發紅潮的生物主要分為三類：硅藻、甲藻和其他物種(包括綠藻、針胞藻、藍綠藻及隱藻等)。根據記錄顯示，有643宗紅潮個案是由甲藻引起，佔總數的60.3%，185宗由硅藻引起，佔17.3%。由其他類別引起的，則有239宗，佔22.4%。

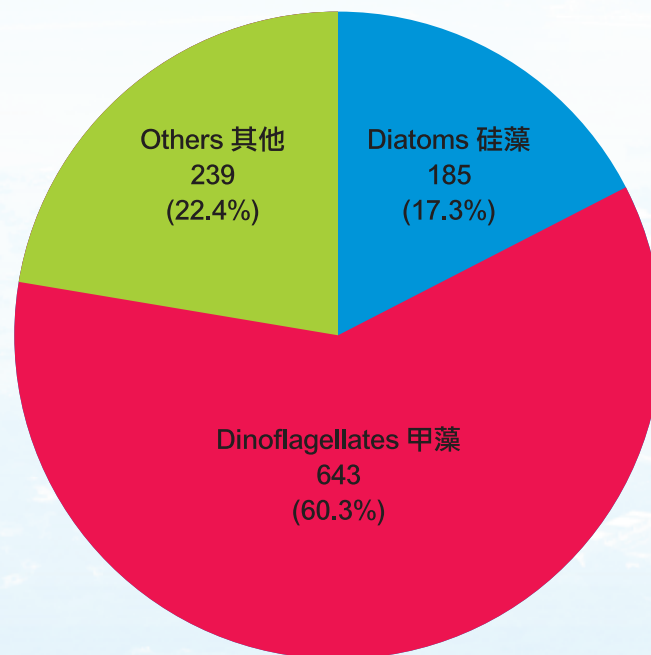


Figure 4. Percentage of red tide incidents caused by different phytoplankton groups
圖4. 由不同浮游植物組別導致的紅潮個案的百分比

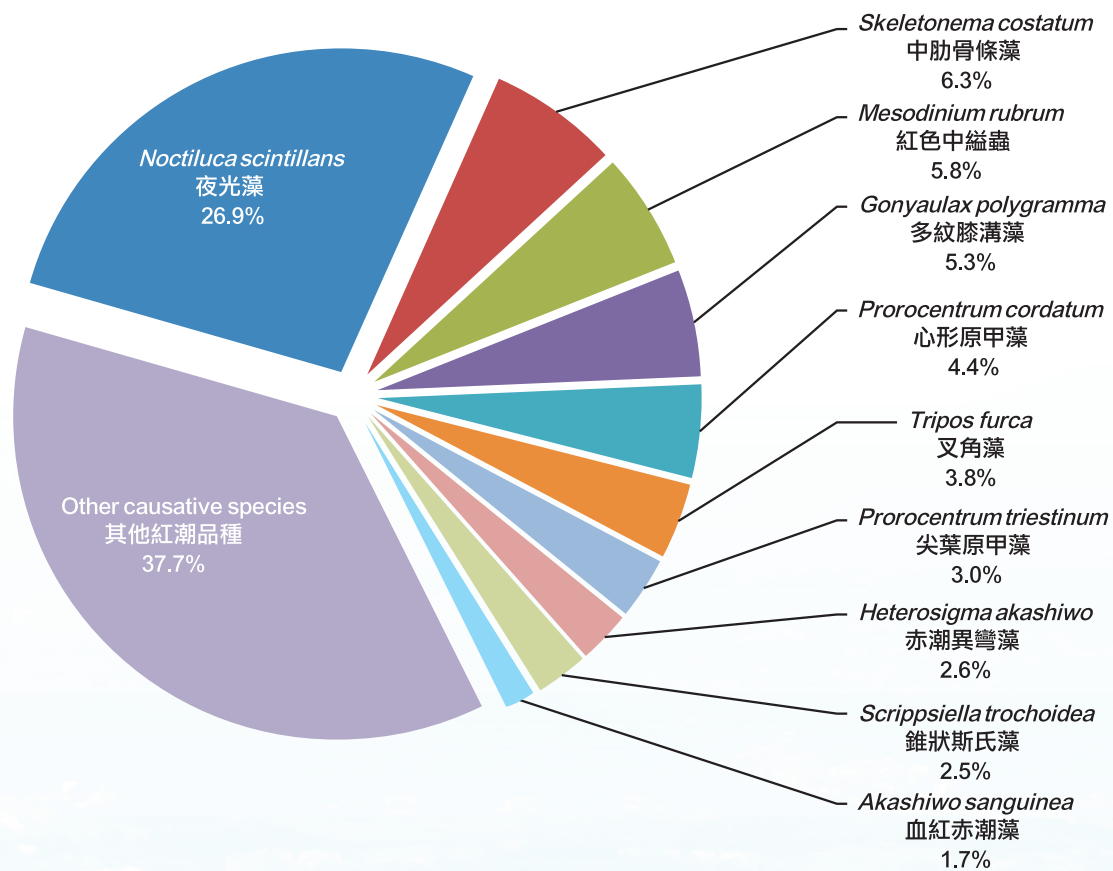


Figure 5. Percentage of red tide occurrence caused by different causative species
圖5. 香港不同紅潮品種引發紅潮次數的百分比

Noctiluca scintillans, which belongs to the dinoflagellate group, is the most common red tide causative species while *Skeletonema costatum*, a diatom, and *Mesodinium rubrum* which belongs to the others group are the second and third common red tide causative species in Hong Kong. They can occur as a single dominant species or co-dominate with other species in a red tide. In addition, they can occur in a wide range of Hong Kong waters. For instances, *Noctiluca scintillans* and *Mesodinium rubrum* are common and can be found in all regions of Hong Kong waters. Details of the regional distribution of diatoms, dinoflagellates and others are listed in Appendices I, II and III respectively. The text description of each causative species in this booklet will provide detailed information on the occurrence of its blooms. Other common red tide species are shown in Table 1 and Figure 5.

夜光藻(又稱夜光蟲)屬於甲藻，是本港最常見的紅潮品種，第二常見的是屬於硅藻的中肋骨條藻，而第三常見的是屬於其他類別的紅色中縊蟲。根據記錄顯示，它們可以單一品種或與其他品種共同引發紅潮，而且可見於香港大部分水域。舉例來說，在本港所有水域均曾發現夜光藻和紅色中縊蟲。硅藻、甲藻及其他類別的水域性分布載列於附錄一、二及三。本書以文字描述各紅潮品種引發紅潮次數的詳細資訊。其他常見的紅潮品種見表一和圖5。

Table 1. The occurrence and percentage of red tide caused by common red tide causative species in Hong Kong
表一 香港常見紅潮品種所引發的紅潮次數及其百分比

Red tide causative species 紅潮品種	Group 類別	Red tide occurrence 引發紅潮次數	Percentage of occurrence 引發次數的百分比
<i>Noctiluca scintillans</i> 夜光藻	Dinoflagellate 甲藻	287	26.9
<i>Skeletonema costatum</i> 中肋骨條藻	Diatom 矽藻	67	6.3
<i>Mesodinium rubrum</i> 紅色中縊蟲	Others 其他	62	5.8
<i>Gonyaulax polygramma</i> 多紋膝溝藻	Dinoflagellate 甲藻	56	5.3
<i>Prorocentrum cordatum</i> 心形原甲藻	Dinoflagellate 甲藻	47	4.4
<i>Tripos furca</i> 叉角藻	Dinoflagellate 甲藻	41	3.8
<i>Prorocentrum triestinum</i> 尖葉原甲藻	Dinoflagellate 甲藻	32	3.0
<i>Heterosigma akashiwo</i> 赤潮異彎藻	Others 其他	28	2.6
<i>Scrippsiella trochoidea</i> 錐狀斯氏藻	Dinoflagellate 甲藻	27	2.5
<i>Akashiwo sanguinea</i> 血紅赤潮藻	Dinoflagellate 甲藻	18	1.7
Other causative species 其他紅潮品種	Dinoflagellate, Diatom and Others 甲藻、矽藻及其他	402	37.7

More than 80% of red tide incidents recorded in Hong Kong waters were caused by harmless phytoplanktons, whereas the rest was formed by harmful or potential harmful algae (Figure 6). Among the potential harmful algal blooms, the extraordinary blooms of *Prorocentrum cordatum* (4.5%) occurred mainly in Tolo Harbour from 1986 to 2004. This might be highly associated with eutrophication within localised system. *Karlodinium veneficum*, *Prorocentrum rhathymum*, *Takayama pulchella* and *Trichodesmium thiebautii* each bloomed once (0.1%) in Hong Kong and no adverse impact was recorded during their blooms. Figure 7 and Table 2 summarise the potential harmful algal blooms recorded and their occurrences in Hong Kong waters since 1975.

Adverse impacts caused by harmful algae may include Amnesic Shellfish Poisoning (ASP), Paralytic Shellfish Poisoning (PSP), Neurotoxic Shellfish Poisoning (NSP), fish kill (FK) and shellfish mortality. Some harmful algae may produce microcystins, venerupin (hepatotoxin) and haemolytic toxins. Among these harmful algae, the highest occurrence in blooms in Hong Kong is fish kill species and the lowest is haemolytic toxin producing species, constituting 46.4% and 0.5% respectively (see Figure 7).

在香港記錄的紅潮個案中，超過百分之八十是無害品種所引發，有害或可能有害的藻類亦可引發紅潮，它們佔本港水域紅潮個案的17.5%。當中，心形原甲藻引發紅潮的次數最多(4.4%)，在1986至2004年間，這品種引發的紅潮主要集中在吐露港水域。這可能與該區水域變得適合藻類急速繁殖有密切關係。至於劇毒卡爾藻、慢原甲藻、美麗達卡藻及鐵氏束毛藻，則各只有一次引發紅潮的記錄，當中沒有嚴重影響的記錄。圖6和表二總結了自1975年起香港水域可能有害品種引發的紅潮記錄。

有害藻類可造成的影響包括可產生失憶性貝類中毒(ASP)、麻痹性貝類中毒(PSP)、神經性貝類中毒(NSP)、魚類死亡(FK)以及貝類死亡。此外，有些有害或可能有害品種可產生微藻毒素、蛤仔(肝臟)毒素或溶血毒素。當中，引發最多紅潮次數的是引致魚類死亡的品種，佔46.0%，而最少的則是產生溶血毒素的品種，佔0.5%(見圖7)。

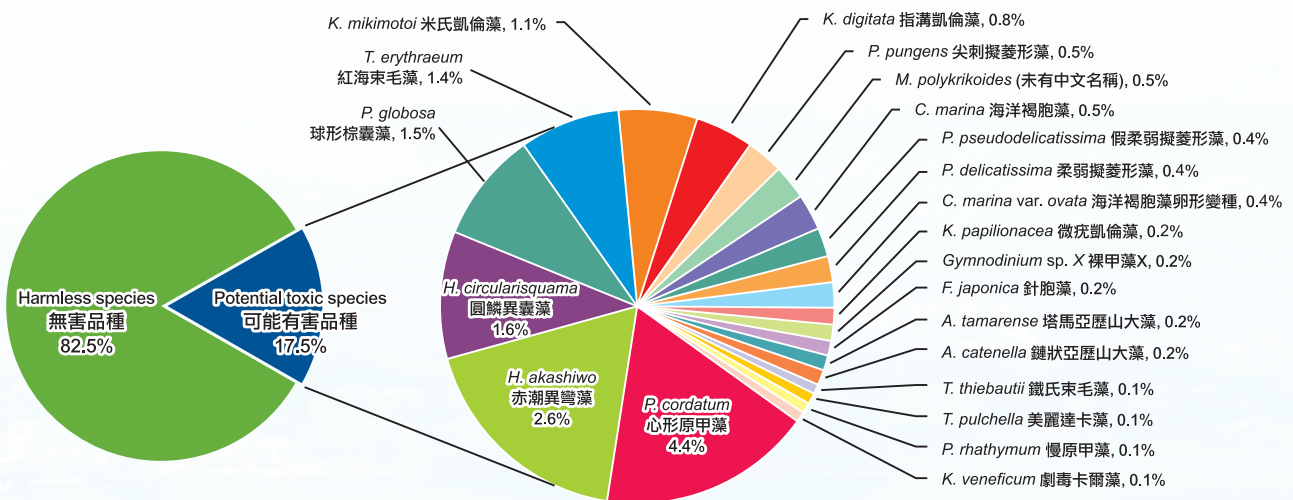


Figure 6. Occurrence of potential harmful algae in red tide incidents in Hong Kong (grouped by species)
圖6 可能有害藻類在香港紅潮個案出現的比率 (以物種分類)

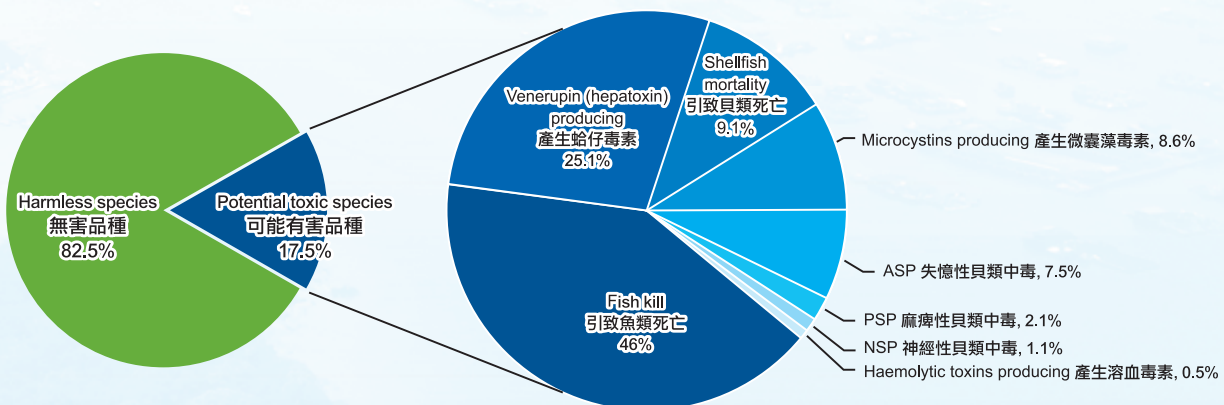


Figure 7. Occurrence of potential harmful algae in red tide incidents in Hong Kong (grouped by potential impacts)
圖7. 可能有害藻類在香港紅潮個案出現的比率 (以其潛在影響分類)

Table 2. Occurrence and percentage of potential harmful algal blooms recorded in Hong Kong
表二 在香港錄得的可能有害藻華的出現次數及其百分比

Potential impact 潛在影響	Potential harmful algal species 可能有害藻類品種	Red tide occurrence 紅潮出現次數	% of occurrence 出現百分比
Fish kill 引致魚類死亡	<i>Chattonella marina</i> 海洋褐胞藻	6	0.5%
	<i>Chattonella marina</i> var. <i>ovata</i> 海洋褐胞藻卵形變種	4	0.4%
	<i>Fibrocapsa japonica</i> 針胞藻	2	0.2%
	<i>Gymnodinium</i> sp. X 裸甲藻X	2	0.2%
	<i>Heterosigma akashiwo</i> 赤潮異彎藻	28	2.6%
	<i>Karenia digitata</i> 指溝凱倫藻	9	0.8%
	<i>Karenia mikimotoi</i> 米氏凱倫藻	12	1.1%
	<i>Karlodinium veneficum</i> 劇毒卡爾藻	1	0.1%
	<i>Margalofidinium polykrikoides</i> (未有中文名稱)	5	0.5%
	<i>Phaeocystis globosa</i> 球形棕囊藻	16	1.5%
	<i>Takayama pulchella</i> 美麗達卡藻	1	0.1%
Microcystins producing 產生微囊藻毒素	<i>Trichodesmium erythraeum</i> 紅海束毛藻	15	1.4%
	<i>Trichodesmium thiebautii</i> 鐵氏束毛藻	1	0.1%
Neurotoxic Shellfish Poisoning 神經性貝類中毒	<i>Karenia papilionacea</i> 微疣凱倫藻	2	0.2%
Paralytic Shellfish Poisoning 麻痺性貝類中毒	<i>Alexandrium catenella</i> 鏈狀亞歷山大藻	2	0.2%
	<i>Alexandrium tamarense</i> 塔馬亞歷山大藻	2	0.2%
Amnesic Shellfish Poisoning 失憶性貝類中毒	<i>Pseudo-nitzschia delicatissima</i> 柔弱擬菱形藻	4	0.4%
	<i>Pseudo-nitzschia pseudodelicatissima</i> 假柔弱擬菱形藻	4	0.4%
	<i>Pseudo-nitzschia pungens</i> 尖刺擬菱形藻	6	0.5%
Shellfish mortality 引致貝類死亡	<i>Heterocapsa circularisquama</i> 圓鱗異囊藻	17	1.6%
Venerupin (hepatotoxin) producing 產生蛤仔(肝臟)毒素	<i>Prorocentrum cordatum</i> 心形原甲藻	47	4.4%
Haemolytic toxins producing 產生溶血毒素	<i>Prorocentrum rathymum</i> 慢原甲藻	1	0.1%

What are the potential impacts of red tides?

Most red tides have no negative impacts to the aquaculture industry, human health or natural environment. Only a few algal species during their blooms are known to cause adverse impacts such as fish kills or seafood toxin contamination.

Some algal species may produce mucus/toxin that impairs the respiratory function of fish gills. For example, *Chattonella marina* and *Chattonella marina* var. *ovata* were associated with minor fish kills in local marine fish culture industry in 2001. Besides, massive algal biomass decays and consumes large amount of dissolved oxygen during decomposition by bacteria. The affected fish, especially those cultured in cages, may die of anoxia.

In addition, some algal species may produce toxins that can directly kill fish. For example, 9 fish culture zones in Tolo Harbour, Long Harbour and northeastern waters were affected by the bloom of *Karenia mikimotoi* in 2015, resulting substantial loss of cultured fish. Besides that, some algal species may produce toxins or biotoxins that may accumulate in shellfish or finfish. Shellfish poisoning may result if humans consume the contaminated seafood that has been exposed to harmful algal blooms. For example, *Alexandrium catenella* caused Paralytic Shellfish Poisoning (PSP) toxin contamination of local shellfish in 1989 in Hong Kong.

Discolouration of seawater during red tides or harmful algal blooms may place constraint on recreational activities at bathing beaches or water sport centres. Sometimes, offensive smell or extensive foams may also violate the natural aesthetics. Some algal species are suspected to produce microcystins that can cause skin or respiratory irritations during contact. If red tides are observed in gazetted beaches, red flags will be hoisted. Public should avoid swimming at such bathing beaches and seek medical advice if symptom appears after contacting the red tide.

紅潮可能造成甚麼影響？

大部分紅潮對水產養殖業、人類健康或自然生態環境並無負面影響。只有少數有害藻類在大量繁殖期間會導致不良影響，例如魚類死亡或毒素污染海產。

有些藻類可能會分泌一些黏液或毒素，阻礙魚鰓呼吸功能。例如，海洋褐胞藻和海洋褐胞藻卵形變種在2001年引發紅潮期間曾導致少量本地養殖海魚死亡。此外，在藻華／紅潮後期，海藻大量死亡而被細菌分解，分解過程消耗大量水中氧氣。受影響的魚類(尤其是網箱養殖的)可能會因而缺氧或窒息死亡。

此外，一些藻類品種可能產生毒素，可以直接殺死魚類。例如，於2015年，9個位於吐露港、大灘海及東北水域的魚類養殖區受米氏凱倫藻影響，引致大量養殖魚死亡。另外，一些藻類品種可產生毒素，毒素積聚於魚類或貝類體內。如果人類食用受污染的海產，可能會導致貝類中毒。例如，於1989年，鏈狀亞歷山大藻爆發，引致一些本地貝類受麻痺性貝類毒素污染。

紅潮／有害藻華的出現亦會令海水變色，可能會妨礙在沙灘或水上活動中心進行的康樂活動。有些紅潮／有害藻華可能形成比較大的泡沫或臭味，大大影響環境的美感。此外，有些藻類會產生微囊藻毒素，可能會刺激人類皮膚或呼吸道。如果在憲報公布的泳灘發現紅潮，泳灘職員會懸掛紅旗。市民應避免在紅潮出現的泳灘游泳，如果接觸紅潮後出現異常徵狀，應立即求醫。

Red tide management, reporting and investigation

Systematic reporting and recording of red tides was first established by AFCD in 1983. In view of the potential impacts of red tides/HABs on both the aquaculture industry and human health, AFCD also devised a red tide management strategy in 1983. It consisted of two programmes: an action programme comprising actions to be taken during a red tide event and a supportive programme comprising research and educational activities to collect further information and promote co-operation of fish farmers and the public during a red tide event.

Owing to the unprecedented fish kill, economic loss and ecological damage by a red tide incident caused by *Karenia digitata* in 1998, a red tide management framework was then established by the Government of the HKSAR in 1999 to further enhance red tide management to minimise the possible impacts of red tides or HABs on the aquaculture industry and human health in Hong Kong. A Red Tide Steering Group (RTSG) serves to oversee and provide guidance on the management and monitoring of red tides. A Red Tide Interdepartmental Working Group (RTIWG) serves to ensure better coordination in technical and operational matters during red tide/HAB events amongst various departments with AFCD acting as the coordinator. In addition, a Red Tide/HAB Expert Advisory Group (RTEAG), comprising non-government experts from tertiary institutions or professional associations is formed to provide advice on red tide/HAB management, scientific research and development. Figure 8 illustrates the organisational structure of the above management framework and its activities.

Various channels have been established for the exchange of red tide information between AFCD and the Mainland authorities concerned including the Ocean and Fisheries Environmental Monitoring Centre (the Administration of Ocean and Fisheries of Guangdong Province) and the South China Sea Branch of the State Oceanic Administration. This helps provide early clues and enables close monitoring of any development of a red tide at an early stage.

Red tide incidents are mainly reported through the Red Tide Information Network which comprises of various government departments, including the Environmental Protection Department (EPD), the Leisure and Cultural Services Department (LCSD), the Marine Department, the Government Flying Services, the Marine Division of Hong Kong Police Force and AFCD. Any sightings of seawater discolouration will be reported to AFCD. Mariculturists as well as members of the public can also report occurrences or suspected occurrences of red tides to AFCD.

Based on the information from the informant and investigation and analysis of the water samples collected, AFCD will assess the risk involved in each incident and disseminate the information received and findings to relevant departments including the Food and Environmental Hygiene Department (FEHD), EPD, the Water Supplies Department, the Department of Health (DH), the Hong Kong Observatory as well as LCSD for their appropriate follow-up actions.

Warnings are also given as appropriate to mariculturists in nearby fish culture zones, advising them to monitor the fish condition and water quality, especially dissolved oxygen, closely with a view to minimising possible loss.

To protect swimmers from possible effects of a red tide, the LCSD beach staff will hoist red flags, display notices at prominent locations, make regular announcements at the affected beach and disseminate information by press release to alert the general public or swimmers when red tide occurs at the beach. LCSD will also collect water samples and send them to AFCD for analysis, and continue to closely monitor the affected seawater area. Table 3 summarises the statistics of sighting reports received under the management framework during 1999-2017.

紅潮管理、報告及調查工作

自1983年起，漁護署開始有系統地報告和記錄紅潮的發生。鑑於紅潮／有害藻華對水產養殖業和人體健康有潛在影響，漁護署同年制訂了一套紅潮管理計劃。這計劃包括兩個方案：行動方案和支援方案。行動方案包括在紅潮發生期間所須採取的行動；支援方案的工作則包括研究和教育活動，以收集進一步的資料及促進在紅潮發生期間與養魚戶和公眾的合作。

鑑於1998年由指溝凱倫藻引起的紅潮曾導致大量養殖魚類死亡、經濟損失和生態破壞，香港特別行政區政府於1999年成立了紅潮管理框架，進一步加強紅潮管理，以減少紅潮／有害藻華對水產養殖業和人類健康可能造成的影響。紅潮督導委員會(RTSG)專責監督和指導紅潮的管理和監察事務，而漁護署於紅潮跨部門工作小組(RTIWG)中負責統籌工作，促進各部門之間在紅潮／有害藻華發生期間互相配合及採取適當行動。此外，還有紅潮／有害藻華專家顧問小組(RTEAG)，成員均來自專上院校或專業協會的非政府專家，他們會為紅潮／有害藻華的管理、科學研究和發展提供意見。圖8列出以上管理框架的組織架構及相關行動。

漁護署亦與內地有關部門，包括廣東省海洋與漁業環境監測預報中心(隸屬廣東省海洋與漁業廳)和國家海洋局南海分局互通紅潮資訊，這樣做有助通報早期跡象及容讓盡早密切監測紅潮的發生。

紅潮的個案主要通過紅潮資訊網絡作出報告。這網絡由有員工在海上執勤的不同政府部門組成，包括環境保護署(環保署)、康樂及文化事務署(康文署)、海事處、政府飛行服務隊、香港警務處水警總區和漁護署。養魚戶或市民如看見海水變色，亦可向漁護署報告。

根據報告者提供的資料，加上漁護署的調查和水樣本分析，漁護署會評估每宗個案的風險並將收集所得的資料及調查結果發放給有關部門，包括食物環境衛生署、環保署、水務署、衛生署、香港天文台及康文署，以便他們作出適切跟進。

此外，漁護署亦會向附近魚類養殖區的養魚戶發出預警，提醒他們密切監察魚類和水質情況(特別是水中溶氧量)，以減少損失。

為了減低紅潮對泳客可能造成的影響，如發現泳灘有紅潮出現，康文署泳灘職員會在泳灘懸掛紅旗、張貼告示、進行廣播及發放新聞公告，通知市民或泳客。康文署職員亦會在泳灘抽取海水樣本送往漁護署分析，並繼續密切留意海面情況。表三總結1999至2017年間管理框架下錄得的紅潮報告數據。

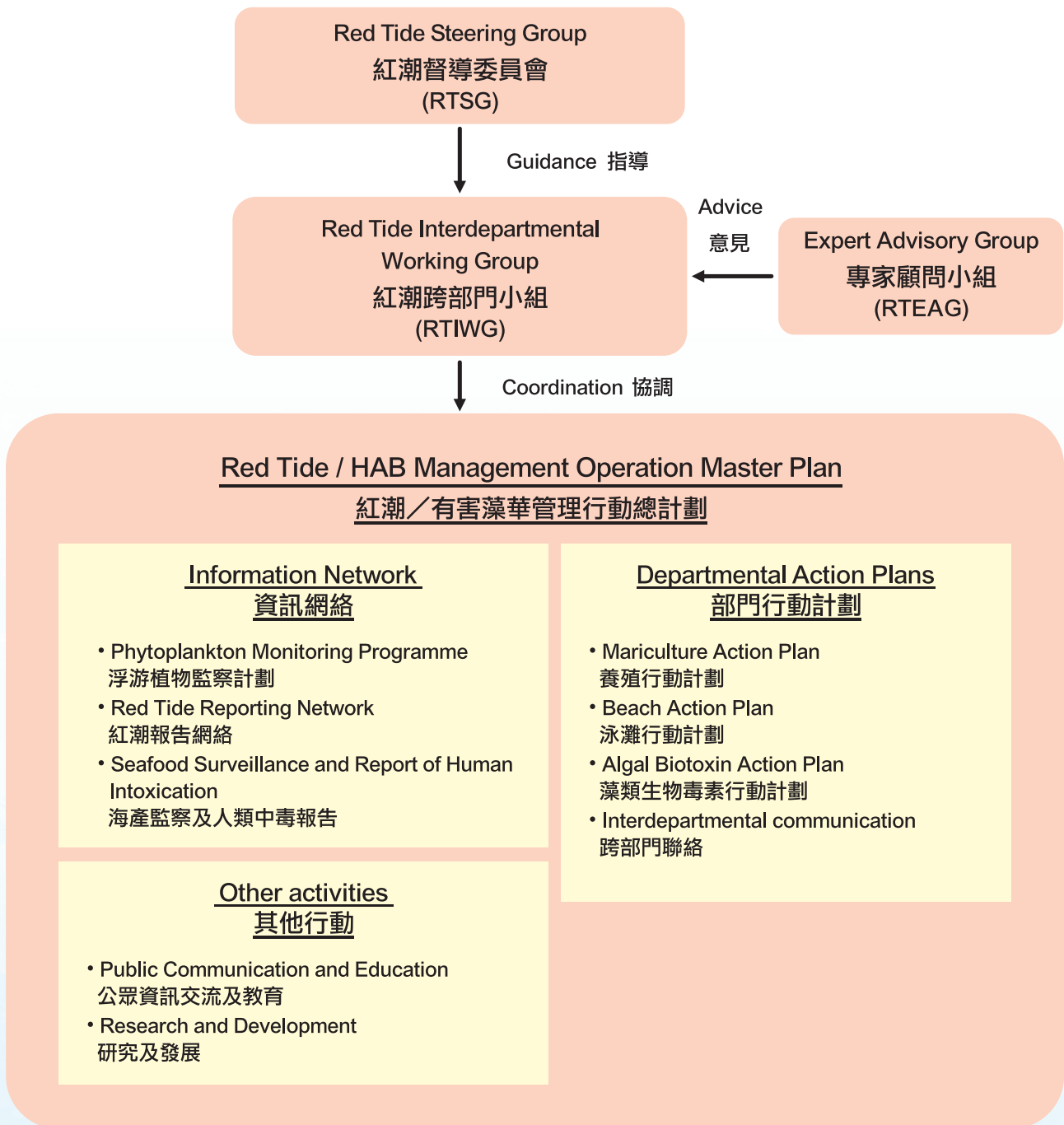


Figure 8. Red tide/ Harmful Algal Blooms (HAB) management framework
圖8. 紅潮／有害藻華管理框架

Table 3. The statistics of the management and monitoring of red tide/HAB programme from 1999 to 2017.
表三 1999至2017年紅潮／有害藻華監察及管理計劃的數據。

Year 年份	Number of sighting report received 收到報告數目	Reported by 報告來源					Causative species 引發品種			Location 發生地點			Potential impacts 潛在影響		
		AFCD 漁農自然 護理署	Other Depts 其他政府 部門	Mari- culturists 養魚戶	Public or others 公眾 或其他	Non - toxic species 無害品種	Potential harmful species 可能有害 品種	Fish culture zone 魚類 養殖區	Gazetted public beaches 憲報公布 的公眾 泳灘	Report of fish kills 魚類死亡 報告	Report of human intoxication 人類中毒 報告	Report of sickness from swimmers 泳客不適 報告			
1999	31	14	11	3	3	7	3	7	5	0	0	0			
2000	56	16	27	6	7	13	3	6	10	0	0	0			
2001	59	12	22	12	13	16	5	10	4	2	0	0			
2002	37	5	26	2	4	8	3	0	11	0	0	0			
2003	20	2	13	1	4	11	6	2	1	0	0	0			
2004	48	6	30	8	4	12	5	6	12	0	0	0			
2005	58	11	30	10	7	11	2	9	13	0	0	0			
2006	23	3	16	3	1	5	1	3	10	0	0	0			
2007	44	8	30	5	1	6	2	3	15	0	0	0			
2008	23	3	10	2	8	5	2	4	7	0	0	0			
2009	31	5	17	5	4	6	5	6	11	0	0	0			
2010	31	8	16	3	4	6	2	7	12	0	0	0			
2011	99	11	70	8	10	7	5	8	57	0	0	0			
2012	32	4	22	5	1	12	3	8	11	0	0	0			
2013	12	3	4	4	1	4	2	6	1	0	0	0			
2014	88	11	52	5	20	14	6	14	37	0	0	0			
2015	55	13	35	2	5	4	4	8	25	1	0	0			
2016	94	20	51	14	9	7	3	31	42	1	0	0			
2017	48	9	31	4	4	11	3	11	22	0	0	0			

Public communication and education

The latest situation of red tides is updated weekly through press release and the Hong Kong Red Tide Information Network (<https://www.afcd.gov.hk/english/fisheries/hkredtide/redtide.html>). To enhance public awareness of red tides, leaflets about red tides/HABs, their possible impacts on cultured fish, implication on seafood safety and beach goers are produced for distribution to the public and mariculturists or can be downloaded from the AFCD's webpage or the Hong Kong Red Tide Information Network.

AFCD has also published a bilingual booklet entitled "Harmful Marine Microalgae in Hong Kong". This publication is the second edition that aims at updating information and providing simple identification guides for toxic and potentially toxic marine microalgae found in Hong Kong waters.

公眾資訊交流及教育

漁護署會於香港紅潮資訊網絡(網址：https://www.afcd.gov.hk/tc_chi/fisheries/hkredtide/redtide.html)發放每周紅潮簡報及新聞稿，公布有關紅潮出現的個案及情況。為加強公眾對紅潮的認識，有關部門亦有將紅潮／有害藻華對養殖魚類、海產食用安全及泳客影響的資料編製成小冊子，以派發給公眾及養魚戶，並可於漁護署網頁或香港紅潮資訊網絡下載。

漁護署亦出版了一本名為《香港有害海洋微藻》的雙語書冊。這第二版書冊旨在更新資訊，並提供簡易指引以助鑑別香港水域有害和可能有害的海洋微藻。

Phytoplankton monitoring programme

AFCD has implemented a long term phytoplankton monitoring programme to detect the presence of toxic algae or development of harmful red tides in order to minimise the impact of red tides/ HABs on mariculture industries. AFCD conducts sampling weekly at 6 core fish culture zones, fortnightly at another 5 fish culture zones and 5 offshore stations, and once every 3 months from the remaining 15 fish culture zones to monitor the presence of harmful algae and development of red tides. Sampling frequency will be increased when harmful algal species or abnormally high phytoplankton population are detected. AFCD will alert the nearby marine fish farmers when a red tide is detected. Figure 9 shows the sampling stations of the phytoplankton monitoring programme.

Seawater samples are collected using a 500 ml water sampler and a small 20 μm mesh size conical nylon plankton net (Figures 10-11). The phytoplankton community including the potentially harmful algal species and the red tides causative species in the collected samples are scanned and identified under a light microscope (Figure 12), the most common tool for phytoplankton identification. AFCD examined more than 4,000 phytoplankton samples in 2017, and detected a total of 222 phytoplankton species. Of these, 121 species (55%) are diatoms and 74 species (33%) are dinoflagellates while 27 species (12%) belong to other phytoplankton group.

Currently, the most effective way to acquire the desirable information both for monitoring of potential algal bloom or during the bloom is identification and enumeration of the phytoplankton. As the movement of living cells would disturb the counting procedure, the samples are preserved or fixed by fixative (Imamura-Fukuyo, IF Staining Solution) that provides better preservation for both dinoflagellates and diatoms. In addition, this fixative can stain cells and flagella and the preserved samples allow genetic analysis.

Sometimes, staining the thecal plates of armoured dinoflagellates allows detailed examination of the plate structure by an epifluorescence microscope. A special stain, named CalcoFluor White, is used to stain the thecal plates and therefore the pore-pattern, plate arrangement or reticulation can be visualised under an epifluorescence microscope (Figure 13).

Figures 14-16 show several pictures of red tides.

浮游植物監察計劃

為減少紅潮對海魚養殖業的影響，漁護署已實施一項長期的浮游植物監察計劃，以監察有害藻類的出現或紅潮／有害藻華的形成。漁護署職員每周一次到6個主要的魚類養殖區，每兩周一次到另外5個魚類養殖區及5個離岸監察站，以及每三個月一次到餘下15個魚類養殖區採集海水樣本進行分析，以監察浮游植物的情況。如發現有害藻類或浮游植物異常增加，漁護署會加強採樣工作。如發現紅潮／有害藻華的出現，便會即時向養魚戶發出預警。圖9顯示浮游植物監察計劃取樣站的位置。

海水樣本會分別以一個500毫升採水樣器和一個20微米網眼的圓錐形尼龍浮游生物網來採集(圖10-11)。透過光學顯微鏡(最常用的浮游植物辨認工具)來分析和鑑定樣本中的浮游植物品種(圖12)，包括可能有害藻類品種和引發紅潮品種。2017年，漁護署共分析超過4000個浮游植物樣本，辨認共222種不同品種的微藻，其中121種為矽藻(55%)、74種為甲藻(33%)和27種為其他藻類(12%)。

現時鑑別和數算浮游植物是監察潛在藻華或正在發生的藻華的最有效方法，由於活細胞不停游動會妨礙數算，浮游植物樣本都會用固定劑(Imamura-Fukuyo染色劑)加以固定及保存。這固定劑可為甲藻和矽藻提供更佳的保存環境。此外，它能將細胞和鞭毛染色，這樣保存的樣本可作進一步的基因分析。

有時，將甲藻的殼片染色，就可以用熒光顯微鏡來詳細觀察殼片的建構。熒光增白劑(CalcoFluor White)是一種特別染料，最常用於把甲藻殼片染色，細胞經過染色後，透過熒光顯微鏡就可看見殼片的細孔形狀、殼片排列或網紋來進行分類(圖13)。

圖14-16顯示幾幅紅潮的圖片。

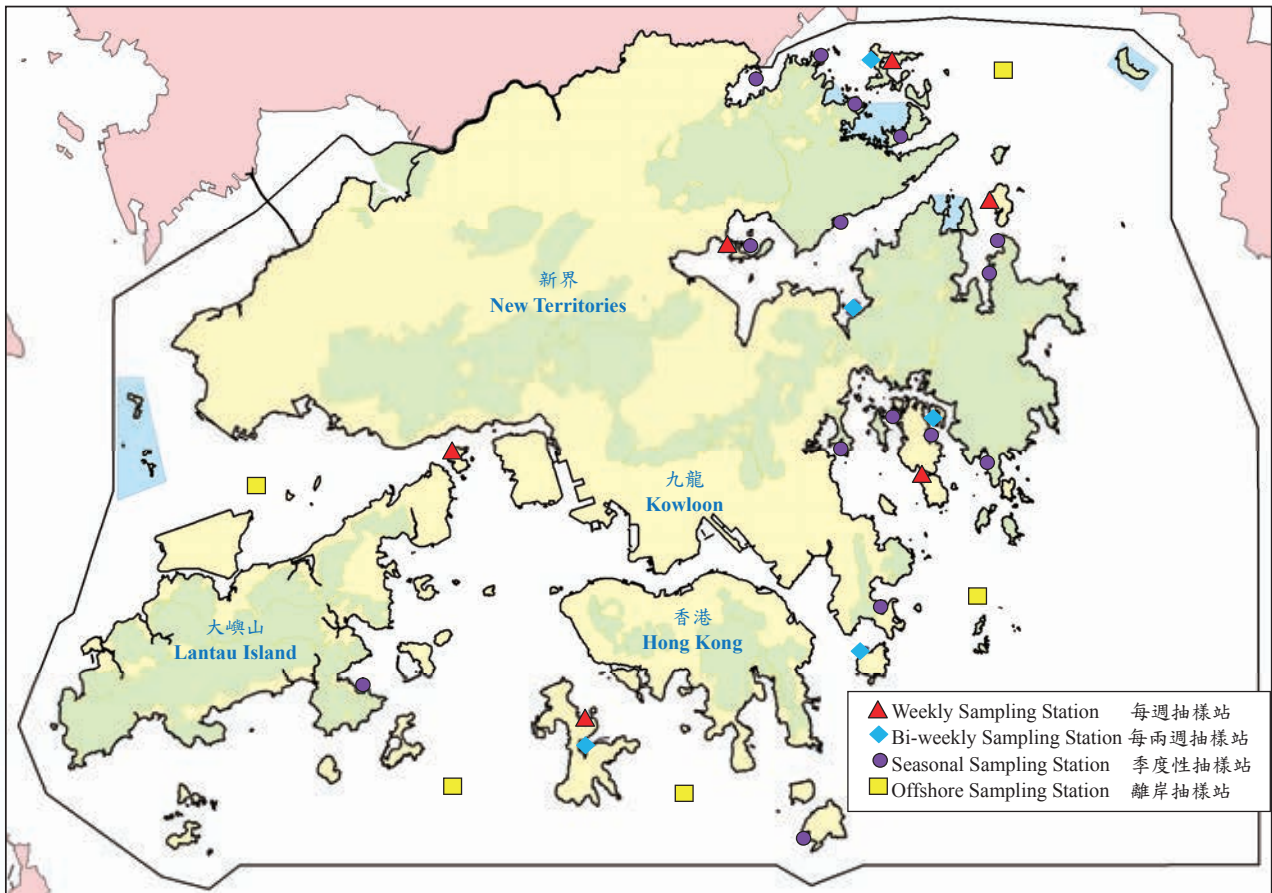


Figure 9. The location of sampling stations of the phytoplankton monitoring programme.
圖9. 浮游植物監察計劃採樣站的位置



Fig10. Collecting phytoplankton samples using a plankton net
圖10. 以浮游生物網收集浮游植物樣本



Fig 11. Collecting seawater sample using a sampler
圖11. 以取水樣器收集海水樣本



Fig 12. Fixed phytoplankton samples under a light microscope

圖12. 光學顯微鏡下以固定劑固定的浮游植物樣本

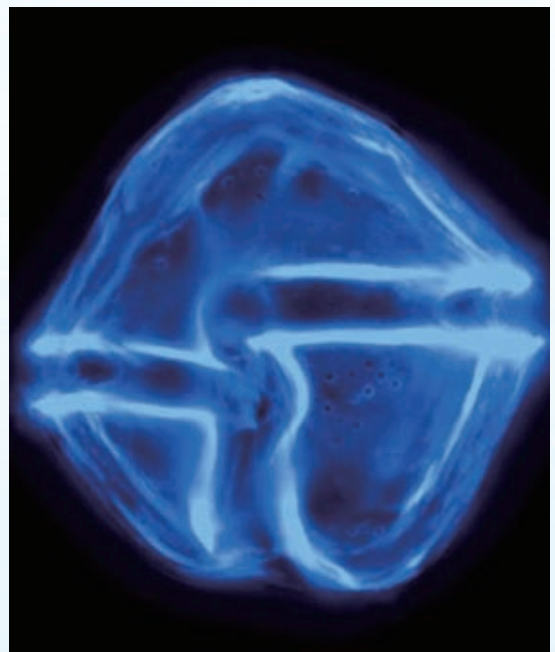


Fig 13. CalcoFluor White stained samples under an epifluorescence microscope.

圖13. 熒光顯微鏡下以熒光增白劑(CalcoFluor White) 染色的樣本



Fig 14. A red tide caused by
Polykrikos geminatum.
圖14. 寶石多溝藻引發的紅潮



Fig 15. A red tide caused by
Noctiluca scintillans
圖15. 夜光藻引發的紅潮



Fig 16. A red tide caused by
Prorocentrum micans
圖16. 海洋原甲藻引發的紅潮

第二章
Chapter 2

DIATOMS
矽藻



Morphology

Diatoms (Bacillariophyceae) are unicellular, eukaryotic organisms with yellow-brown chloroplast(s) and siliceous cell walls. The vast majority is photosynthetic and only less than ten species are obligatory heterotrophic. The cells may be solitary or colonial, and they are widely found in marine, fresh water habitats and even in soil. They can be planktonic or benthic. Diatom is commonly between 20 and 200 μm in diameter or length. The cell walls are composed of amorphous silica called frustules that consist of two valves fitted together by a cingulum. The taxonomy of diatom is often based on the shape and characteristics of the siliceous frustule.

Diatoms are traditionally divided into two groups based on valve symmetry: (1) the centric diatoms whose frustules are arranged basically in relation to a central point, an annule or a central areola and tend to appear radially symmetry, e.g. *Coscinodiscus* species; and (2) pennate diatoms whose frustules are more elongated and tend to appear bilaterally symmetry, e.g. *Pseudo-nitzschia* species.

When viewed under the light microscope, the silica shell can be presented in two ways. When the epivalve or hypovalve is the uppermost, the frustule is presented in "valve view"; on the contrary the frustules is in "girdle view" if the girdle bands are the uppermost. Figure 17 illustrates the morphology of diatoms.

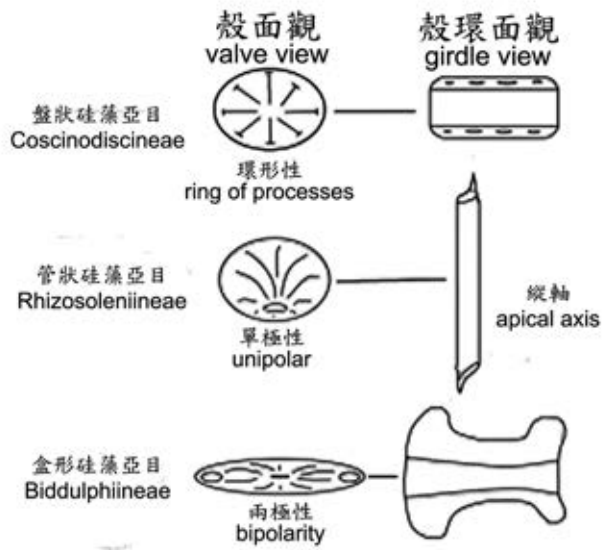
形態

矽藻（矽藻綱）又稱矽藻，是含有黃棕色葉綠體的單細胞生物，其細胞壁由矽質構成。絕大多數是光合自養性，只有少於十個品種是專性異養性。矽藻的直徑或長度通常介乎20至200微米不等，細胞能單獨或連結成群體出現。矽藻一般分布在淡水、海水的生境裏，浮游的、底棲的、甚或在泥土中生長。矽藻的細胞壁由無組織的矽質構成，分為上、下兩個半殼，由側帶連合，形成一個外殼稱為「殼面」。矽質「殼面」的形態和特色可作為分類命名的依據。

基於矽質殼面的對稱性，矽藻傳統上可分為兩大類：（1）圓心矽藻的殼面大多為圓形，紋理自中央一點向四周呈輻射狀排列為輻射形對稱，例如圓篩藻屬；以及（2）羽紋矽藻的殼面比較細長而且傾向兩側對稱，例如擬菱形藻屬。

在光學顯微鏡下觀察時，矽藻的矽質外殼會以「殼面觀」或「殼環面觀」方式呈現。「殼面觀」是在檢視時矽藻的上殼面或下殼面向上呈現；相反，「殼環面觀」則是在檢視時，矽藻以殼環面向上呈現。圖17顯示不同種類的矽藻的形態。

CENTRIC DIATOMS 圓心硅藻



PENNATE DIATOMS 羽紋硅藻

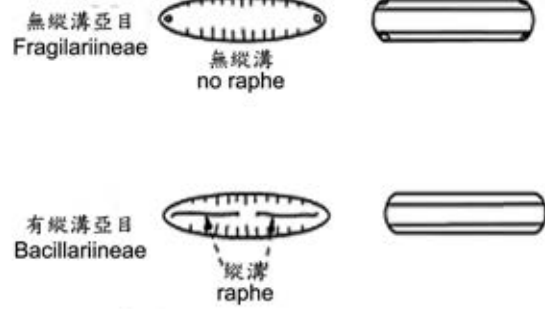


Figure 17. Morphology of centric and pennate diatoms (Source: Hasle and Syvertsen 1997)
圖17 圓心硅藻和羽紋硅藻的形態 (來源：Hasle and Syvertsen 1997)

Cerataulina pelagica

海洋角管藻

(Cleve) Hendey, 1937

Phylum: Ochrophyta

Class: Bacillariophyceae

Order: Hemiaulales

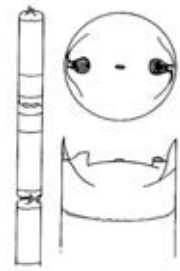
Family: Hemiaulaceae

門：褐胞藻門

綱：矽藻綱

目：半管藻目

科：半管藻科



Tomas et al., 1997

Synonyms 異名：

Zygoceros pelagica Cleve 1889, *Zygoceros pelagicum* Cleve 1889, *Cerataulus bergonii* Peragallo 1892 and *Cerataulina bergonii* (Peragallo) Schütt 1896

Description:

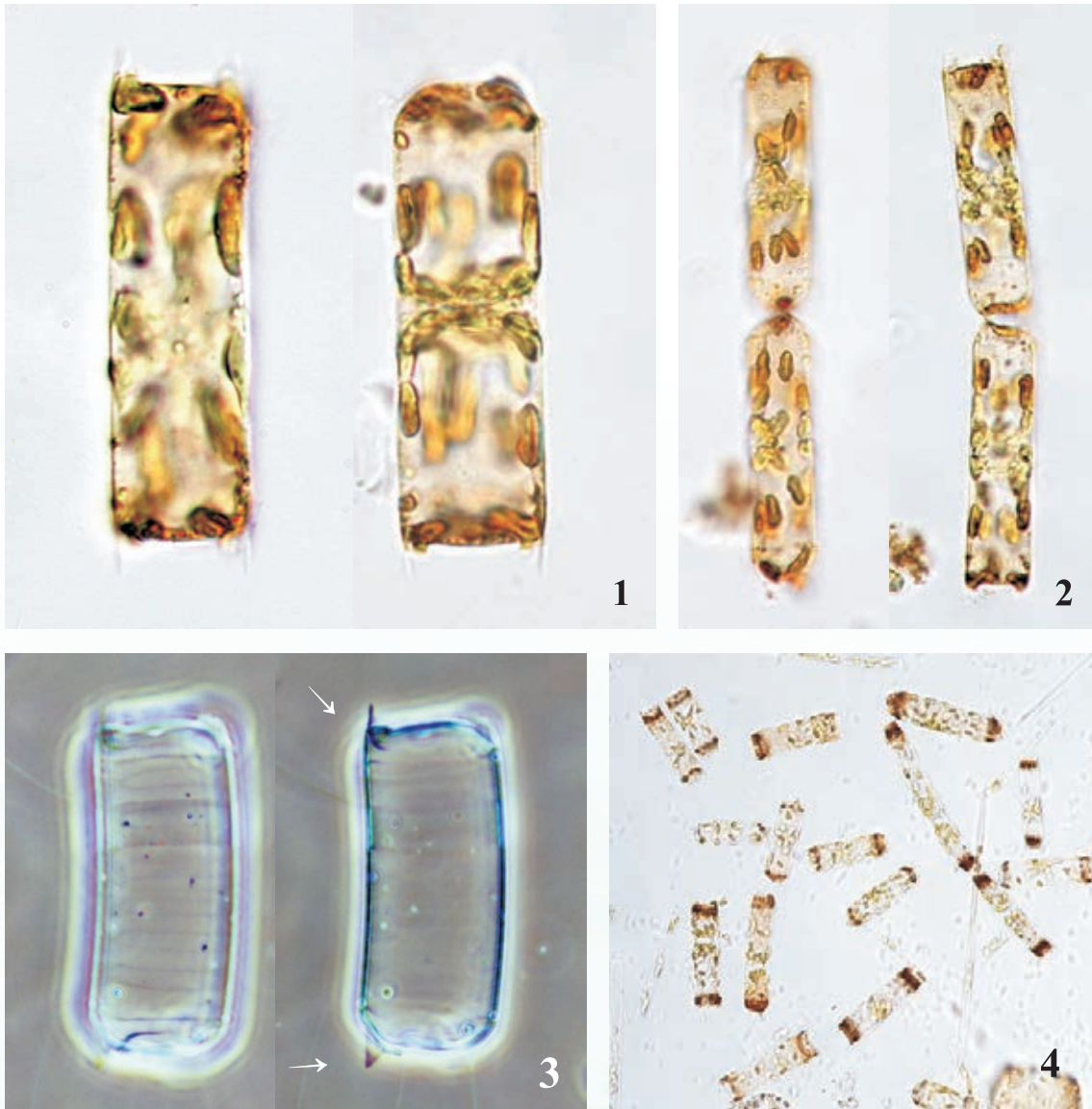
The cell of *Cerataulina pelagica* is cylindrical and it mostly occurs in chain form straightly or slightly twisted in girdle view. The cell size ranges from 7 - 56 μm in diameter. The valves are circular and have 2 prominent wings extending in the opposite direction. Each cell contains numerous disc-shaped chloroplasts.

描述：

海洋角管藻細胞從殼環面觀呈圓柱形，大多會串連成直條體或略作扭轉的鏈狀群，細胞直徑介乎7 - 56微米。殼面呈圓形，殼緣對邊有2個突起翼。細胞內有大量盤狀葉綠體。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1992	1	-
1998	1	-
2017	1	-
Total/總數：		3



Cerataulina pelagica. Figure 1: Cylindrical cell with many small disc-shaped chloroplasts. Figure 2: Cells twisted about the central axis of the chain. Figure 3: 2 short inconspicuous wing-like elevations on each valve (arrow); phase contrast photo. Figure 4. Red tide sample.

海洋角管藻。圖1：細胞呈圓柱形，有大量細小盤狀的葉綠體。圖2：細胞以中心軸略扭轉串連成條狀。圖3：殼邊有2個不明顯突起翼(箭咀); 相位差照片。圖4：紅潮樣本。

Ceratoneis closterium

新月蛾眉藻

Ehrenberg, 1839

Phylum: Ochrophyta 門：褐胞藻門
Class: Bacillariophyceae 綱：矽藻綱
Order: Fragilariales 目：脆杆藻目
Family: Fragilariaceae 科：脆杆藻科



Tomas et al., 1997

Synonyms 異名：

Nitzschia closterium (Ehrenberg) Smith 1853, *Nitzschiella closterium* (Ehrenberg) Rabenhorst 1864, *Nitzschia longissima* var. *closterium* (Ehrenberg) Van Heurck 1885, *Nitzschia curvirostris* var. *closterium* (Ehrenberg) De Toni 1892, *Nitzschiella longissima* var. *closterium* (Ehrenberg) Peragallo & Peragallo 1897-98, *Nitzschia curvirostris* var. *delicatissima* Lemmermann 1898, *Homoeocladia closterium* (Ehrenberg) Kuntze 1898, *Nitzschiella tenuirostris* Mereschkowsky 1901 and *Cylindrotheca closterium* (Ehrenberg) Reimann & Lewin 1964

Description:

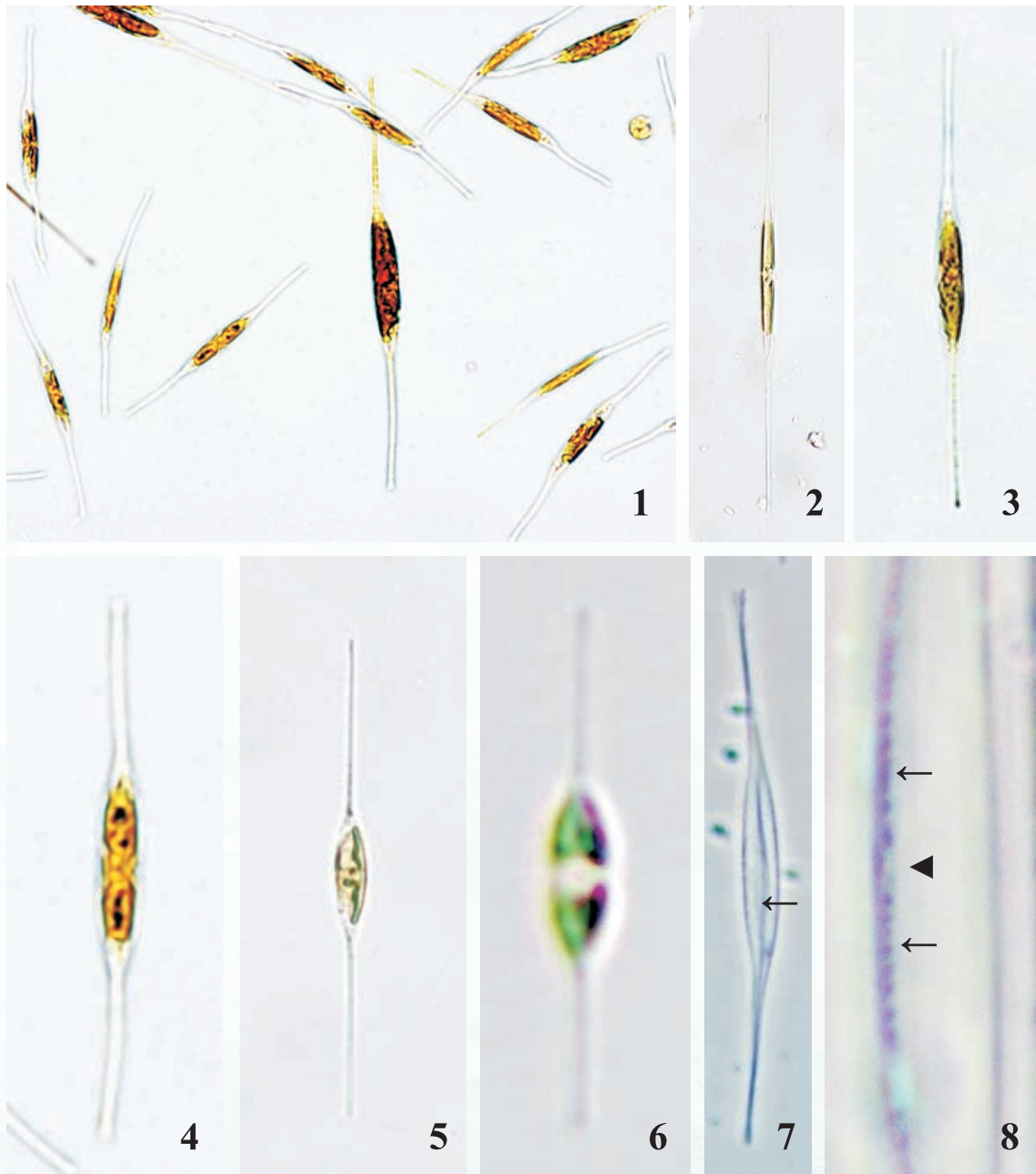
The cell of *Ceratoneis closterium* is spindle shaped with enlarged central part and long, straight or curved tapering ends. It is solitary and yellowish brown in colour. The cell size ranges from 12 - 400 μm in apical axis and 1.5 - 8 μm in transapical axis. In the central region of the cell, a large central interspace is present. It also contains 1 nucleus and 2 chloroplasts. The raphe, longitudinal slit along the axis or around the valve margin, is transversed by a series of fibulae. The number of fibulae in 10 μm are 12 - 25. Girdle bands are narrow and numerous.

描述：

新月蛾眉藻細胞呈紡錘狀，中央部分較大，兩端細長漸幼成直條形或彎曲形。新月蛾眉藻大多以單一細胞個體出現，呈黃褐色。細胞縱軸殼長為12 - 400 微米，切頂軸為1.5 - 8 微米。細胞中央部分有一大中央間隙，也有1個細胞核及2顆葉綠體。殼縫是沿着縱軸或殼邊附近的一縱長幼縫，在這縫內橫放着一連串的船骨點。每10微米船骨點數目為12 - 25。有多條狹小的殼環帶。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數:

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2004	1	<i>Prorocentrum cordatum</i> 心形原甲藻
Total/總數：		1



Ceratoneis closterium. Figures 1-6: Various sizes of spindle shaped cells with enlarged central part and long, straight or curved tapering ends. Figure 7: Acid cleaned frustule, valve with visible fibulae (arrow). Figure 8: Middle part of the valve showing large central interspace (arrow head) and fibulae (arrows); phase contrast photo.

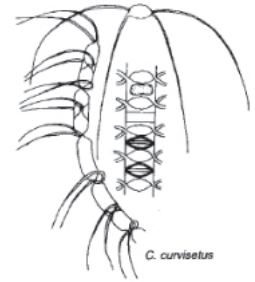
新月蛾眉藻。圖1-6：不同大小的紡錘狀細胞，中央部分較大，兩端漸幼成直條形或彎曲形。圖7：經酸洗的細胞殼，殼面可見船骨點（箭咀）。圖8：殼面中央部分，顯示大中央間隙（箭頭）及船骨點（箭咀）；相位差照片。

Chaetoceros curvisetus

旋鏈角毛藻

Cleve, 1889

Phylum: Ochrophyta 門：褐胞藻門
Class: Bacillariophyceae 綱：矽藻綱
Order: Chaetocerotales 目：角毛藻目
Family: Chaetocerotaceae 科：角毛藻科



Tomas et al., 1997

Description:

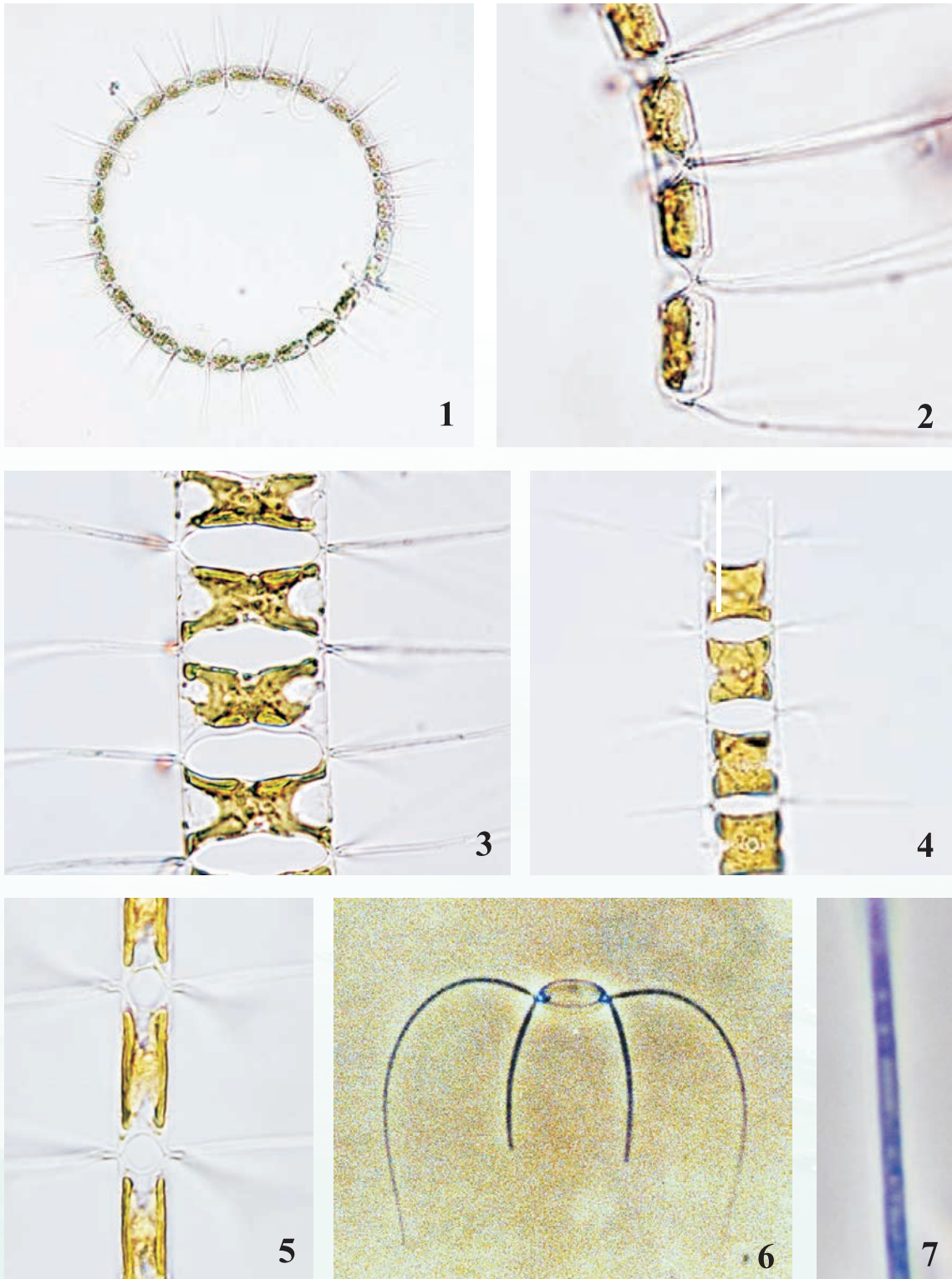
The cell of *Chaetoceros curvisetus* is rectangular and it mostly occurs in long chain and spirally curved form in girdle view. The apical axis of cell ranges from 7 - 30 μm . The valve surface is concave. The foramina are wide and elliptical. The intercalary and terminal setae are similar and they are long, thin with short basal part. The setae are circular in cross-section and they cross over at cell margin and curve or bend to the same direction, almost perpendicularly to the chain axis. The resting spores are spiny with broad convex primary valve and flat secondary valve. Each cell contains 1 chloroplast.

描述：

從殼環面觀，旋鏈角毛藻細胞為矩形，大多會串連成長鏈狀及呈螺旋彎曲狀，細胞殼長介乎 7 - 30 微米。殼面凹下。細胞之間的間隙大，呈橢圓形。內角毛與端角毛相約，幼長、基部短。角毛呈圓條狀，於細胞殼邊交叉生出，彎向同一方向，差不多與細胞鏈軸成直角。休止孢子雙殼有刺，初生殼寬闊突起而次生殼較扁平。每個細胞均有 1 顆葉綠體。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1991	1	-
1998	1	<i>Noctiluca scintillans</i> 夜光藻
2003	1	<i>Skeletonema costatum</i> 中肋骨條藻
Total/總數：	3	



Chaetoceros curvisetus. Figure 1: Many cells connected to make a spiral colony, narrow girdle view. Figure 2: Narrow girdle view showing the setae radiating outside. Figures 3-5: Chained cells in board girdle view, solitary chloroplast. Figure 6: Valve view; phase contrast photo. Figure 7: Intercalary seta; phase contrast photo.

旋鏈角毛藻。圖1：多個細胞串連成螺旋狀群體，窄殼環面觀。圖2：狹窄殼環面觀顯示放射性伸出的角毛。圖3-5：闊殼環面觀的細胞串連成鏈狀，內有單一顆葉綠體。圖6：殼面觀的相位差照片。圖7：內角毛的相位差照片。

Chaetoceros pseudocurvisetus

擬彎角毛藻

Mangin, 1910

Phylum: Ochrophyta

門：褐胞藻門

Class: Bacillariophyceae

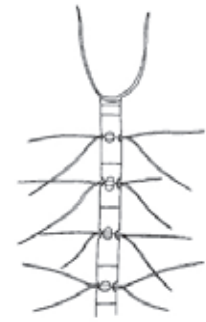
綱：矽藻綱

Order: Chaetocerotales

目：角毛藻目

Family: Chaetocerotaceae

科：角毛藻科



Tomas et al., 1997

Description:

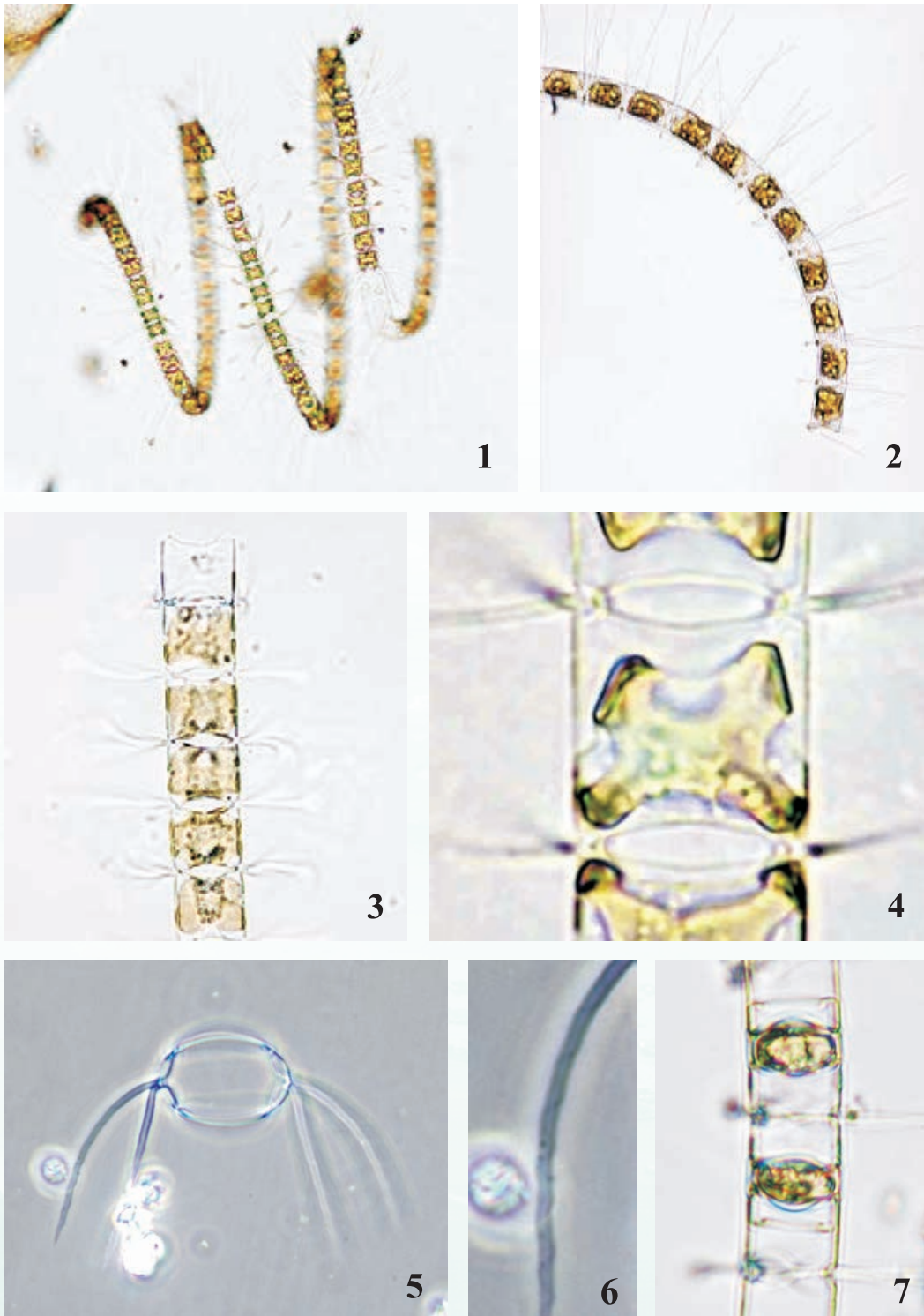
The cell of *Chaetoceros pseudocurvisetus* is rectangular and it mostly occurs in long and curved chain form in girdle view. The apical axis of cell ranges from 12 - 50 μm . The valve is broadly elliptical. The main foramen is widely elliptical with 2 small round foramina. The setae are similar, long thin with short basal part and are circular in cross-section. The intercalary setae cross over from the cell margin, bent curving round the chain axis while terminal setae are bent to align with the chain axis straightly. The valves of resting spores are convex with sheath and smooth. Each cell contains 1 chloroplast.

描述：

從殼環面觀，擬彎角毛藻細胞呈矩形，大多會串連成彎曲長鏈狀，細胞縱軸殼長介乎12 - 50微米。殼面寬闊呈橢圓形。主細胞間隙大，呈橢圓形及2個細小圓形的細胞間隙。角毛相約，幼長、基部短、呈圓條狀。內角毛與端角毛於細胞殼邊交叉生出，內角毛呈弧形圍着細胞鏈軸，而端角毛則彎向與細胞鏈軸成直線。休止孢子殼面平滑突起。每個細胞均有1顆葉綠體。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1996	1	-
2002	1	-
Total/總數：		2



Chaetoceros pseudocurvisetus. Figure 1: Many cells connected to make a spiral colony, board girdle view. Figure 2: Narrow girdle view showing the setae radiating outside. Figures 3-4: Chained cells in board girdle view, solitary chloroplast. Figure 5: Valve view; phase contrast photo. Figure 6: Intercalary seta; phase contrast photo. Figure 7: Resting spores.

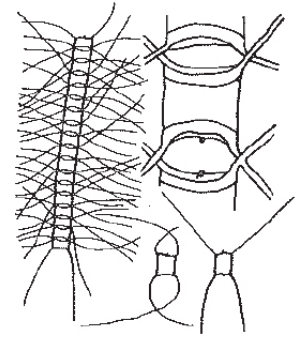
擬彎角毛藻。圖1：多個細胞串連成螺旋狀群體，闊殼環面觀。圖2：窄殼環面觀顯示角毛放射性伸出。圖3-4：闊殼環面觀顯示細胞串連成鏈狀，內有單一顆葉綠體。圖5：殼面觀的相位差照片。圖6：內角毛的相位差照片。圖7：休止孢子。

Chaetoceros salsugineum

角毛藻

Takano, 1983

Phylum: Ochrophyta	門：褐胞藻門
Class: Bacillariophyceae	綱：矽藻綱
Order: Chaetocerotales	目：角毛藻目
Family: Chaetocerotaceae	科：角毛藻科



Takano, 1983

Description:

The cell of *Chaetoceros salsugineum** is rectangular in girdle view and it may occur in solitary or in chain form. The apical axis of cell ranges from 3.5 - 6 μm . The valve is broadly elliptical to circular. The foramina are narrow. The setae are long and thin with short basal part and are circular in cross-section. The setae cross over at the cell margin. Intercalary and terminal setae are divergent to the chain axis. Each cell contains 1 chloroplast.

描述：

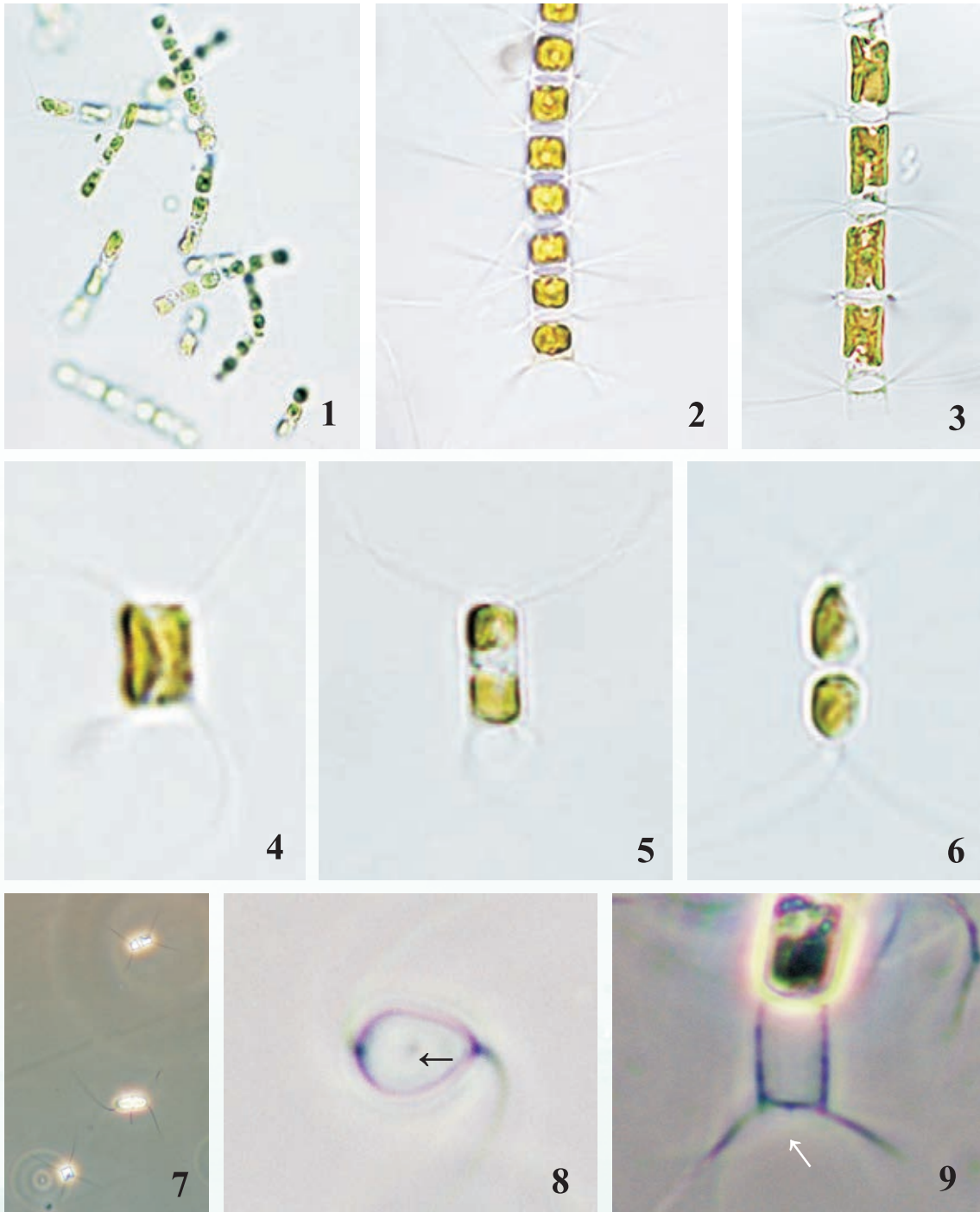
從殼環面觀，角毛藻*細胞呈矩形，以單獨個體或串連成鏈狀群體出現，細胞縱軸殼長介乎3.5 - 6微米。殼面寬闊呈橢圓形或圓形，細胞間隙狹小。角毛幼長、基部短、呈圓條狀，於細胞殼邊交叉生出，內角毛及端角毛分散開彎向細胞鏈軸。每個細胞均有1顆葉綠體。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2001	1	-
	1	<i>Skeletonema costatum</i> 中肋骨條藻
2010	1	-
2011	1	-
2017	2	-
Total/總數：	6	

* Previously, the specimen found in Hong Kong was named as *Chaetoceros* sp. 0105. Later based on the study findings and the morphology description, the specimen from Hong Kong resembled the species presented as *Chaetoceros salsugineum* by Takano (1983) and therefore it was renamed to *Chaetoceros salsugineum*.

* 以前在香港收集所得的樣本被命名為角毛藻屬0105。後來根據研究的結果及形態學的描繪，發現香港的樣本與Takano (1983) 所論述的角毛藻十分相似，因此將這品種重新命名為角毛藻。



Chaetoceros salsaugineum. Figures 1-3: Cells in chain form (frequently 3-10 cells). Figures 4-6: Solitary cells with 1 chloroplast; thin and curved setae. Figure 7: Phase contrast photo. Figures 8-9: Valve and girdle view showing the tiny process at the centre of valve face (arrows).

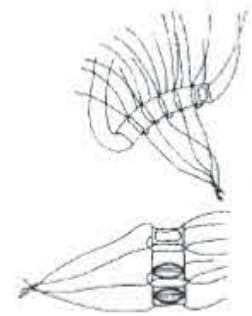
角毛藻。圖1-3：細胞串連成鏈狀群體（大多以3-10個細胞串連）。圖4-6：單一活細胞，有一顆葉綠體，幼長及彎曲的角毛。圖7：相位差照片。圖8-9：殼面及殼環面觀顯示位於殼面中央的細小突起物（箭咀）。

Chaetoceros socialis

聚生角毛藻

Lauder, 1864

Phylum: Ochrophyta	門：褐胞藻門
Class: Bacillariophyceae	綱：矽藻綱
Order: Chaetocerotales	目：角毛藻目
Family: Chaetocerotaceae	科：角毛藻科



Tomas et al., 1997

Synonyms 異名：

Chaetoceros radians Schütt 1895, *Chaetoceros socialis f. vernalis* Proshkina-Lavrenko 1953, *Chaetoceros socialis f. radians* (Schütt) Proshkina-Lavrenko 1963 and *Chaetoceros socialis var. radians* (Schütt) Tsarenko 2009

Description:

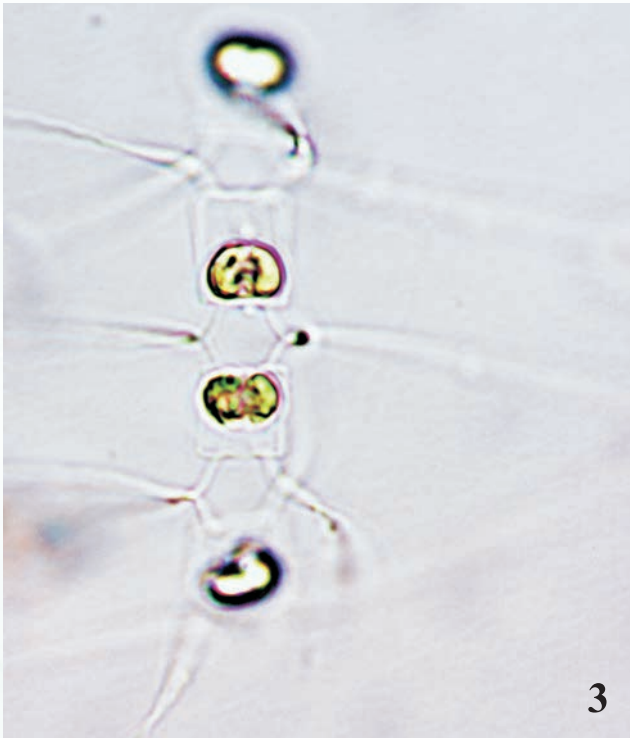
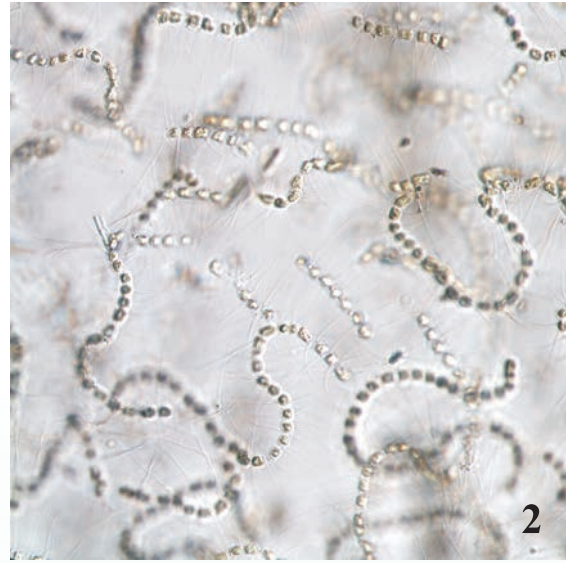
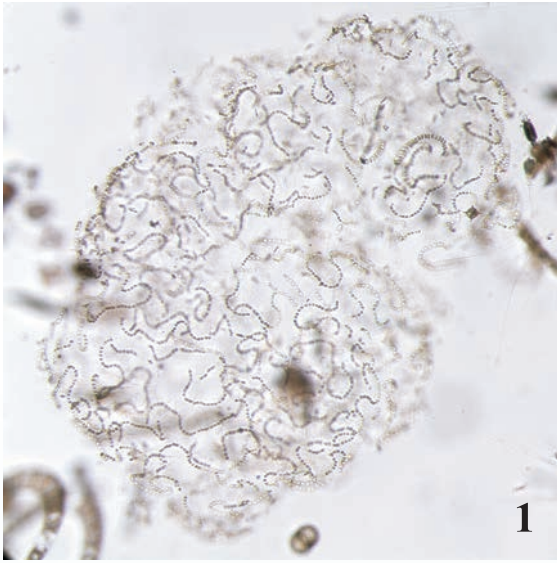
The cell of *Chaetoceros socialis* is rectangular in girdle view and occurs in chain form. The cells are mostly united in a colony and joined by long setae. The apical axis of cell ranges from 5 - 15 μm . The valve is flat and elliptical. It has 1 long seta and 3 short setae. They are thin with short basal part and circular in cross-section, cross over outside the cell margin. 3 short setae are directed towards one side of the chain and the long seta is directed to the opposite side. The resting spores of primary and secondary valves are convex. The primary valve bears spines in the central part while the secondary valve is smooth. Each cell contains 1 chloroplast.

描述：

從殼環面觀，聚生角毛藻細胞呈矩形，多串連成鏈狀，長的角毛互相連接而結集成群落。細胞縱軸殼長介乎5 - 15微米。殼面扁平，呈橢圓形。細胞有1條長角毛及3條短角毛，同屬幼長、基部短、圓條狀，由細胞殼邊交叉生出。3條短角毛於殼邊伸出，彎向細胞鏈軸的一邊，而較長的角毛則彎向細胞鏈軸的另一邊。休止孢子的初生殼及次生殼殼面突起，初生殼殼面中央有刺，而次生殼殼面則較為平滑。每個細胞均有1顆葉綠體。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2001	1	-
2004	1	-
2011	1	-
Total/總數：		3



Chaetoceros socialis. Figures 1-2: Cells united in short chains and form a spherical colony embedded in mucus. Figure 3: Chained cells in board girdle view showing rectangular in shape; hexagonal foramina; solitary chloroplast. Figure 4: Cell in valve view showing 3 short setae are directed towards one side and the long seta is directed to the opposite side; phase contrast photo.

聚生角毛藻。圖1-2：細胞串連成短鏈狀及被黏液包圍而結集成球形群落。圖3：殼環面觀，鏈狀細胞呈矩形，細胞間隙六角形，內有一顆葉綠體。圖4：殼面觀，3條短角毛於殼邊伸出，彎向細胞鏈軸同一方向，而較長的角毛則彎向細胞鏈軸的另一面；相位差照片。

Chaetoceros tenuissimus

細柔角毛藻

Meunier, 1913

Phylum: Ochrophyta

Class: Bacillariophyceae

Order: Chaetocerotales

Family: Chaetocerotaceae

門：褐胞藻門

綱：矽藻綱

目：角毛藻目

科：角毛藻科



Tomas et al., 1997

Synonyms 異名：

Chaetoceros simplex var *calcitrans* Paulsen 1905

Description:

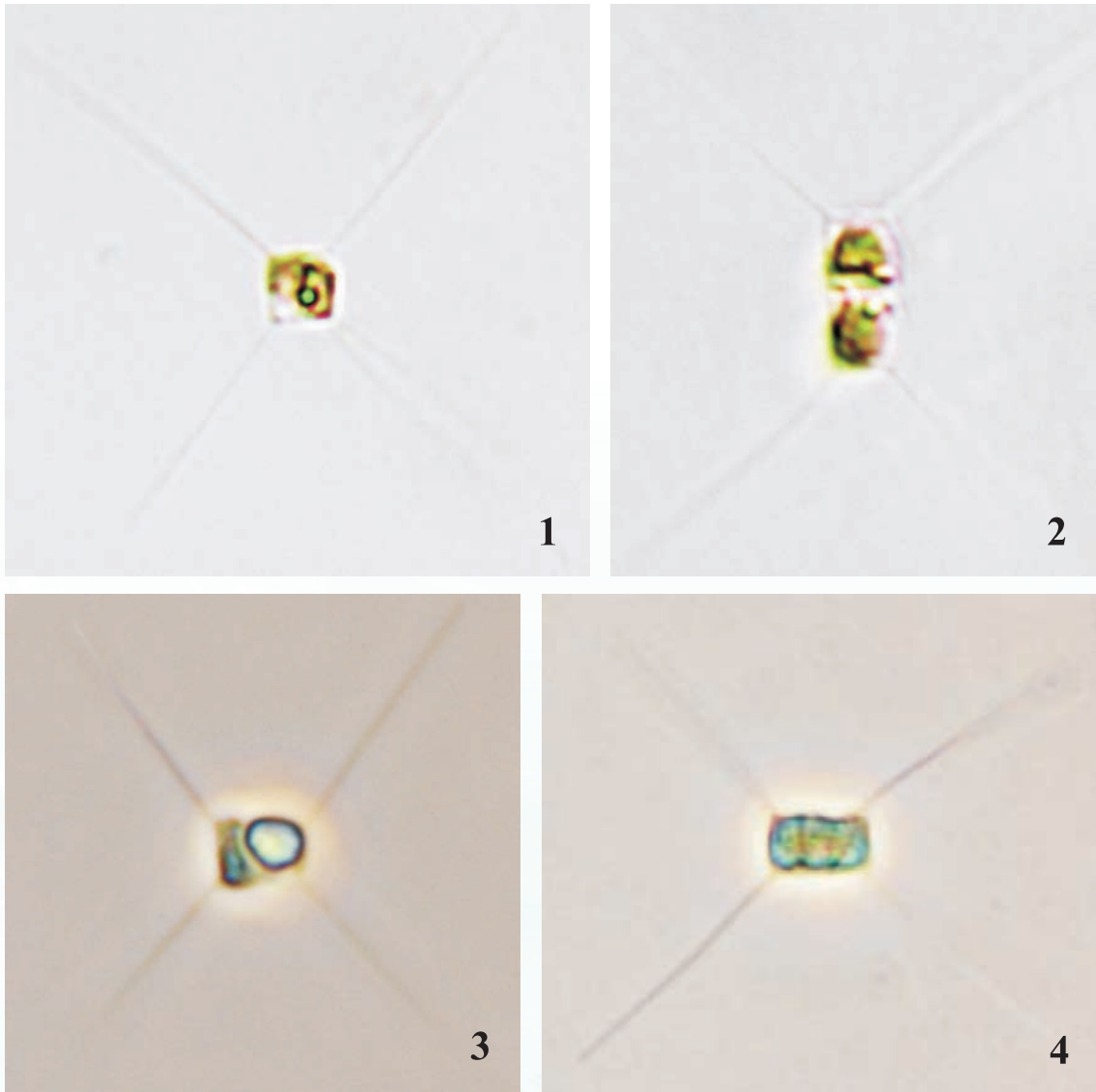
The cell of *Chaetoceros tenuissimus* is small and is square shaped in girdle view. The cell often occurs solitarily and sometimes in pairs. The apical axis of cell ranges 3 - 5 μm . The setae are straight and thin with short basal part and are circular in cross-section. The setae cross over at the cell margin and diverge at an angle of 45 degree to the apical axis. Each cell contains 1 chloroplast.

描述：

從殼環面觀，細柔角毛藻細胞細小呈正方形，常以單獨個體出現或偶有串連成對，細胞縱軸殼長介乎3 - 5微米。角毛幼細而直、基部短、圓條狀，於細胞殼邊交叉伸出，與細胞縱軸成45度角。每個細胞均有1顆葉綠體。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2001	1	<i>Skeletonema costatum</i> 中肋骨條藻、 <i>Thalassiosira pseudonana</i> 假微型海鏈藻
Total/總數：		1



Chaetoceros tenuissimus. Figure 1: Cell in girdle view showing square in shape; solitary chloroplast; setae are straight and thin with short basal part and diverge at an angle of 45 degree to the apical axis. Figure 2: Cell undergoes division. Figures 3-4: Various cells in girdle view; phase contrast photo.

細柔角毛藻。圖1：殼環面觀，細胞四方形；內有單一顆葉綠體；角毛幼細而直及基部短，於殼邊伸出，以45度角彎向細胞縱軸。圖2：細胞進行分裂狀態。圖3-4：不同細胞殼環面觀；相位差照片。

Conticribra weissflogii

威氏海鏈藻

(Grunow) Stachura-Suchoples & Williams, 2009

Phylum: Ochrophyta

門：褐胞藻門

Class: Bacillariophyceae

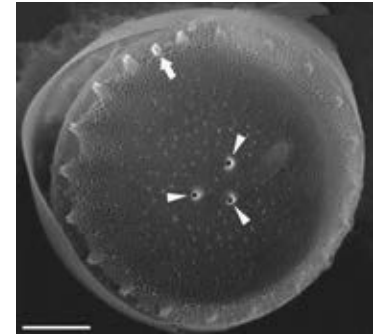
綱：矽藻綱

Order: Thalassiosirales

目：海鏈藻目

Family: Thalassiosiraceae

科：海鏈藻科



Li et al., 2013

Synonyms 異名：

Micropodiscus weissflogii Grunow 1882, *Eupodiscus weissflogii* Grunow 1882-1885, *Micropodiscus weissflogii* Grunow 1885, *Eupodiscus weissflogii* (Grunow) De Toni 1894, *Dimorphococcus fritschii* Crow 1923, *Thalassiosira fluviatilis* Hustedt 1926, *Coscinodiscus fluviatilis* (Hustedt) Cleve-Euler 1951 and *Thalassiosira weissflogii* (Grunow) Fryxell & Hasel 1977

Description:

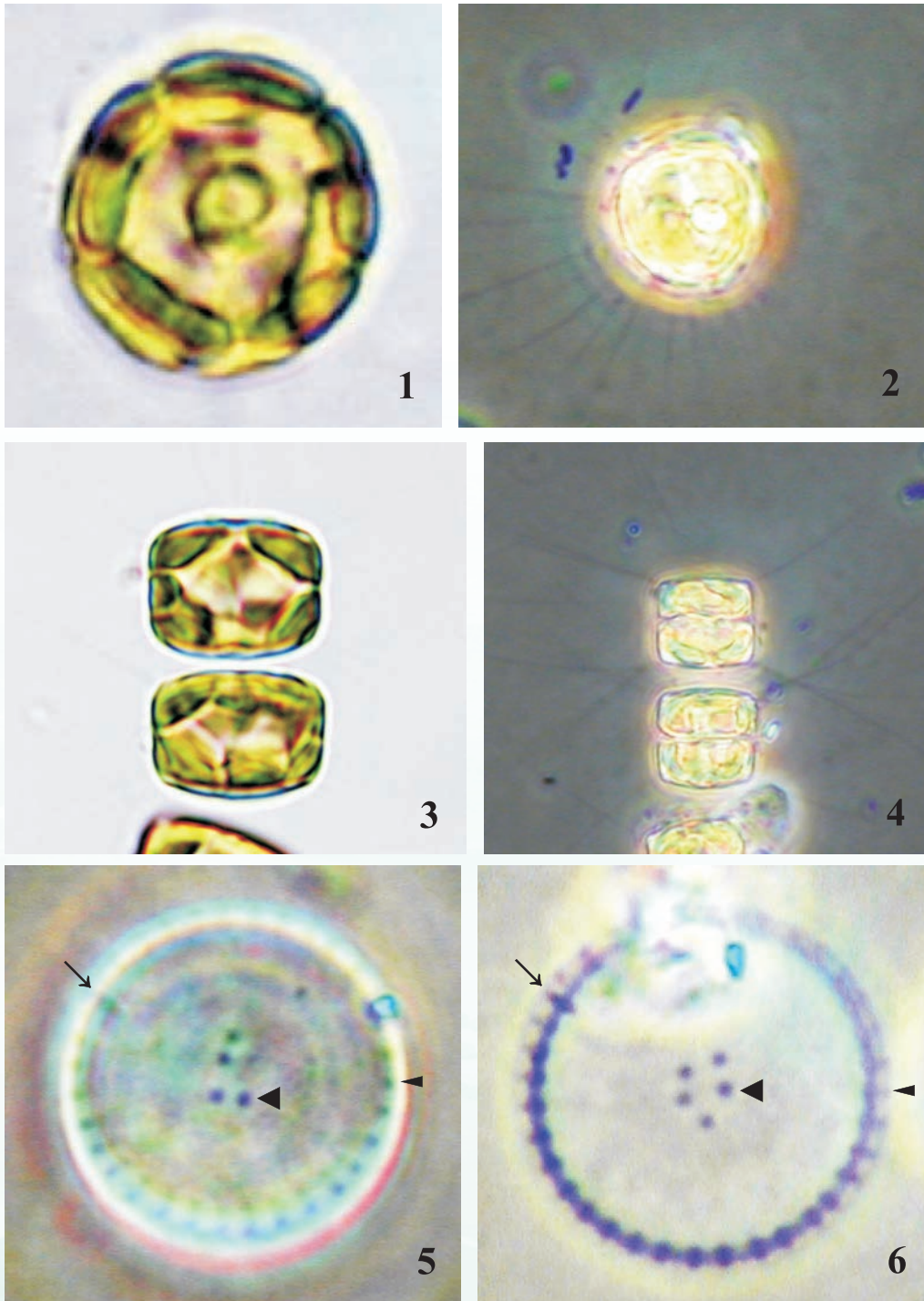
The cell of *Conticribra weissflogii* is round and flattened with short mantles in valve view. The areolae arrange in radial pattern. It occurs solitarily, or in loose chains joined by threads or valve to valve attachment. The cell size ranges from 5 - 55 μm in diameter. The valve bears a ring of marginal fultoportula with small external tubes, a single rimoportula replaces a marginal fultoportula and several central fultoportulae making a circular or irregular group near the valve centre. Smaller cells have a smaller number of central fultoportulae. This diatom is living in fresh and brackish waters in tropical and temperate estuaries.

描述：

從殼面觀，威氏海鏈藻細胞呈圓形、扁平、有狹窄的殼環邊，小孔呈放射形排列。細胞可以單獨個體出現，又或由線狀物串連或殼面與殼面相連成鬆散的鏈狀群體出現。細胞直徑介乎5 - 55微米。殼面有一圈有小管的邊緣支持突，有單一個唇形突代替了一邊緣支持突，數個中心支持突在近殼面中央位置特別明顯組成一組圓形或不規則的組別。較細小的細胞含有較少的中央支持突。這種矽藻生於熱帶和溫帶的淡水及半鹹水河口。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2002	1	-
2005	1	-
Total/總數：		2



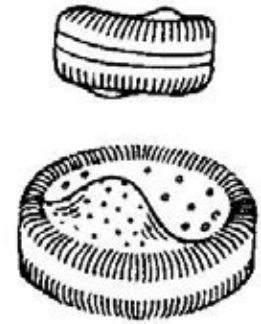
Conticribra weissflogii. Figures 1-2: Cell in valve view showing round shape and containing yellow-green chloroplasts. Figure 3: Cells in girdle view showing short cylindrical shape and the height is a little shorter than the diameter. Figure 4: Cells connected by mucilaginous thread to form a loose chain. Figures 5-6: Various cells in valve view showing 1 marginal rimoportula (arrow), a ring of marginal fuloportula with small external tubes (narrow arrow head) and 4-5 central fuloportulae (broad arrow head).

威氏海鏈藻。圖1-2：細胞呈圓形及含有黃綠色葉綠體。圖3：細胞殼環面觀呈短圓柱形及高度比圓周略短。圖4：細胞由膠質線狀物串連成鏈狀。圖5-6：不同細胞的殼面觀顯示1個殼邊緣唇形突（箭咀）、一圈附有小管的支持突（幼箭頭）及4-5個中央支持突（闊箭頭）。

Cyclotella choctawhatcheana 小環藻

Prasad, 1990

Phylum: Ochrophyta 門：褐胞藻門
Class: Bacillariophyceae 綱：矽藻綱
Order: Thalassiosirales 目：海鏈藻目
Family: Stephanodiscaceae 科：冠盤藻科



Proshkina- Lavrenko, 1955

Synonyms 異名：

Cyclotella caspia Grunow 1878 and *Cyclotella hakanssoniae* Wendker 1991

Description:

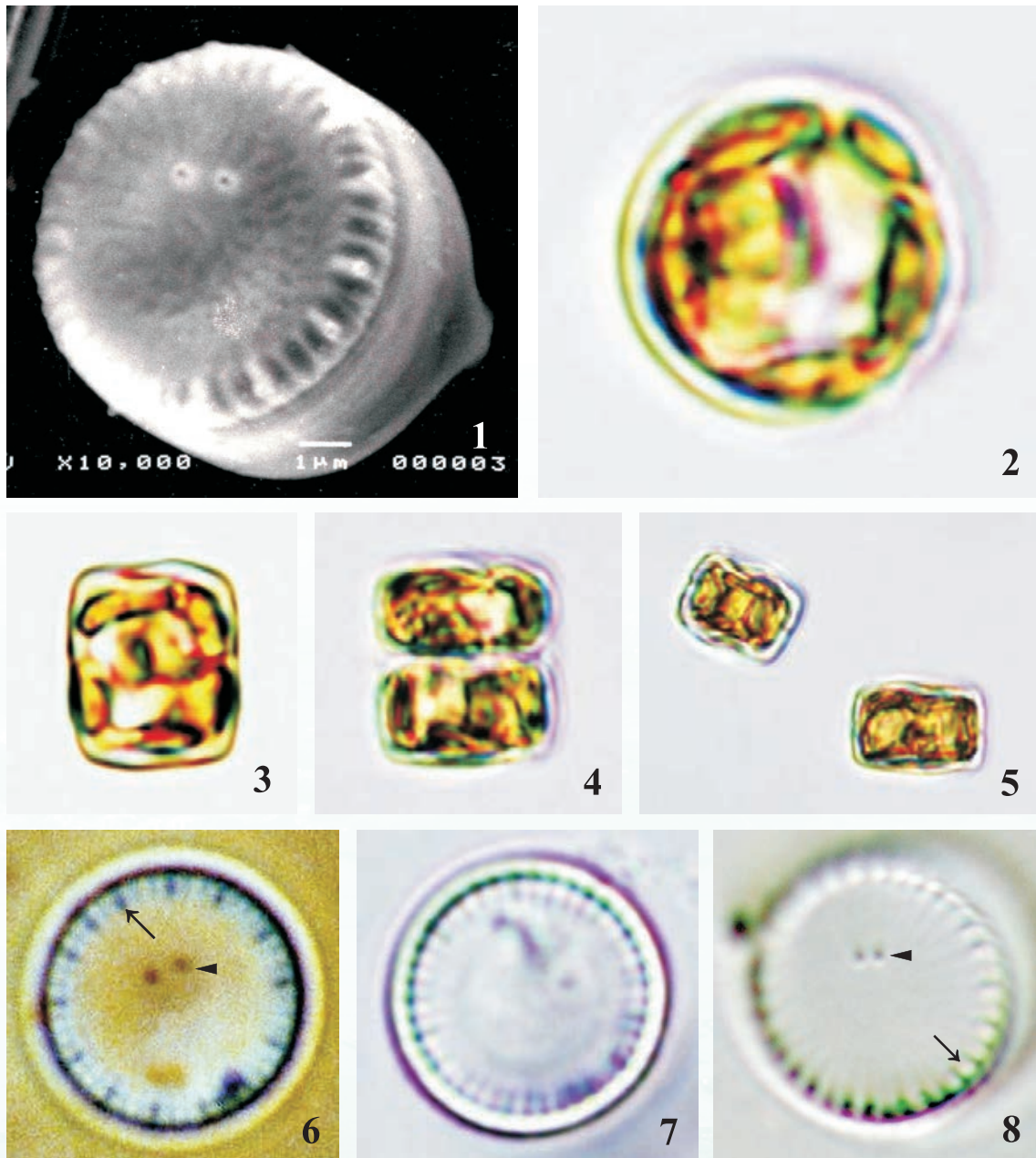
The cell of *Cyclotella choctawhatcheana* is disc-shaped in valve view and wave drum-shaped in girdle view. It usually occurs solitarily but also in linear chain form held together by mucilage. The margin zone of valve consists of 20 - 26 striae in 10 μm with equal length, radiating inward toward the centre. The marginal striae extend to the mantle edge. The diameter of cell ranges from 3.5 - 22 μm . The central area of cell is tangentially undulated. The valve bears a ring of marginal fultoportulae without external tubes, 2 central fultoportulae and 1 marginal rimoportula. The cell contains several disc-shaped chloroplasts.

描述：

從殼面觀，小環藻細胞呈圓盤形，從殼環面觀則呈波浪起伏鼓形。大多以單一細胞個體出現，但也有以黏液串連成直線鏈狀群體。殼面邊緣部分具有向中心伸展的放射形肋紋，每 10 微米有 20 - 26 條等長的肋紋，殼邊緣肋紋伸展至殼環邊。細胞直徑介乎 3.5 - 22 微米。細胞中央部分有波浪起伏形態。殼面有一圈沒有表面小管的殼邊緣支持突，2 個中央區支持突及 1 個殼邊緣唇形突。細胞內有幾顆圓盤狀葉綠體。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1988	1	-
2003	1	<i>Thalassiosira pseudonana</i> 假微型海鏈藻
Total/總數：		2



Cyclotella choctawhatcheeana. Figure 1: Cell in valve view showing disc-shaped and tangentially undulate in valve centre; scanning electron micrograph. Figure 2: Cell contains several disc-shaped chloroplasts. Figures 3-5: Cells in girdle view showing wave drum-shape. Figures 6-8: The valve bears a ring of marginal fultoportula (arrows) and 2 central fultoportulae (arrow head).

小環藻。圖1：殼面觀顯示細胞呈圓盤形，殼中心位置呈波浪起伏，掃描電子顯微鏡照片。圖2：細胞內含有幾顆盤狀葉綠體。圖3-5：殼環面觀顯示細胞呈波浪起伏鼓形。圖6-8：殼面有一圈殼邊緣支持突（箭咀）和2個中央區支持突（箭頭）。

Dactyliosolen fragilissimus

脆指管藻

(Bergon) Hasle, 1996

Phylum: Ochrophyta

Class: Bacillariophyceae

Order: Rhizosoleniales

Family: Rhizosoleniaceae

門：褐胞藻門

綱：矽藻綱

目：管狀矽藻目

科：根管藻科



Tomas et al., 1997

Synonyms 異名：

Rhizosolenia fragilissima Bergon 1903

Description:

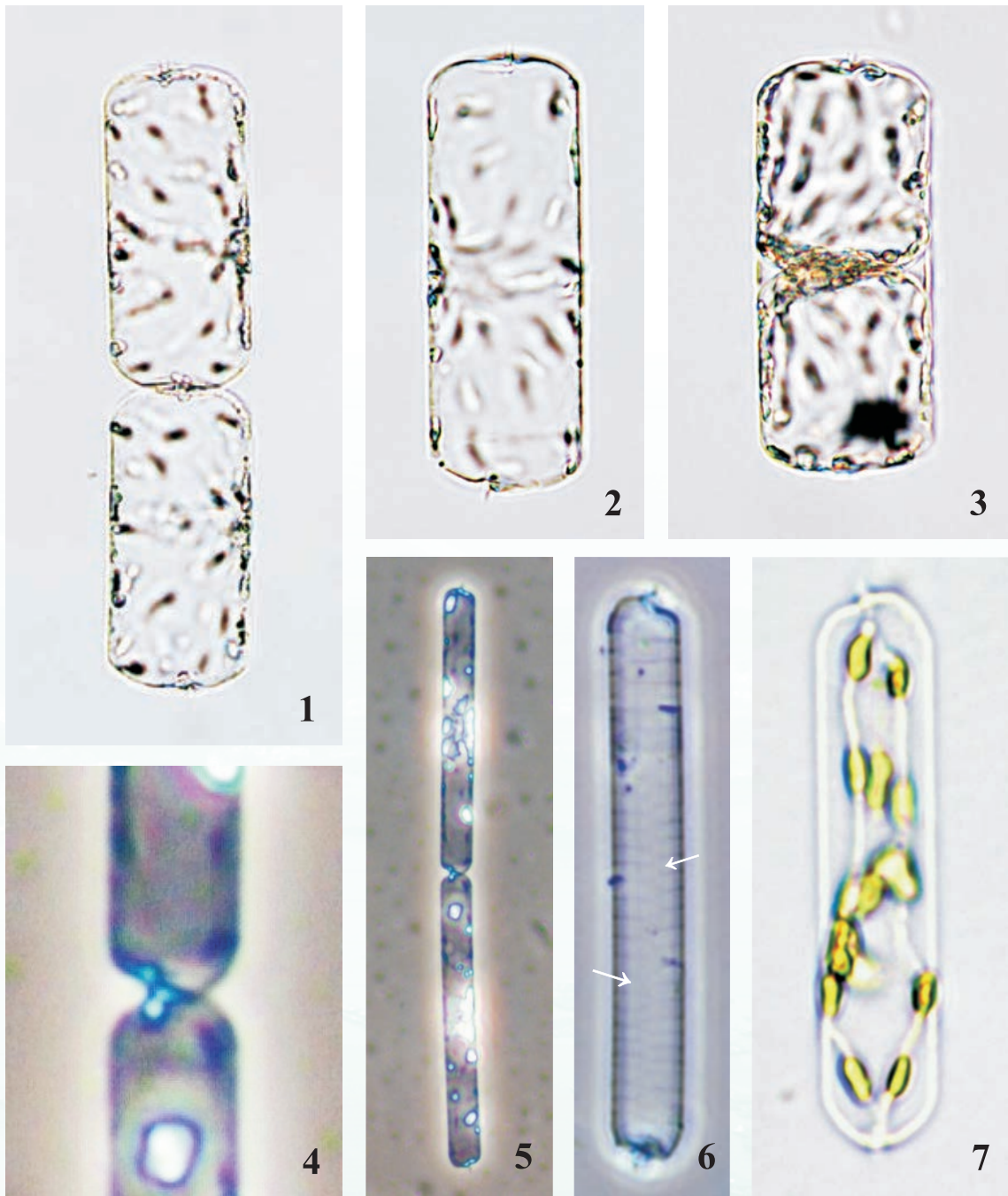
The cell of *Dactyliosolen fragilissimus* is cylindrical and the cells mostly occur in straight chain form in girdle view. The cell size ranges from 3 - 70 μm in diameter. The valve ends are round and connected by a short central spine that fits into a depression on the adjacent cell. Each cell contains numerous small plates-like chloroplasts and 1 nucleus near the cell wall. The cell is yellowish brown in colour with numerous girdle half bands .

描述：

從殼環面觀，脆指管藻細胞呈圓柱形，大多是串連成直條鏈狀群體，細胞直徑介乎3 - 70微米。殼面末端呈圓形，中央位置有小刺，小刺伸入毗連細胞凹陷處而連成鏈狀。每個細胞內有大量細小呈小盤狀的葉綠體及1個鄰近細胞壁的細胞核。細胞呈黃褐色及有大量殼環面半帶。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1988	1	-
	1	<i>Leptocylindrus minimus</i> 微小細柱藻
1989	1	<i>Leptocylindrus minimus</i> 微小細柱藻
1992	2	-
	1	<i>Leptocylindrus danicus</i> 丹麥細柱藻
1996	2	-
Total/總數：		8



Dactyliosolen fragilissimus. Figure 1: Cells united in chain. Figure 2: Girdle view. Figure 3: Cell undergoes division. Figures 4-5: Cells showing cylindrical shape with round ends and connected by a short central spine that fits into a depression on the adjacent cell. Figure 6: Acid cleaned frustule showing numerous distinct girdle half bands (arrows). Figure 7: Numerous small plate-like chloroplasts distributed along the cell wall.

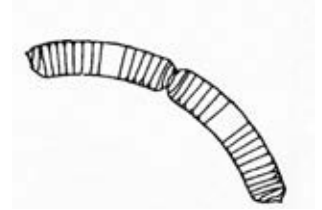
脆指管藻。圖1：細胞串連成鏈狀群體。圖2：殼環面觀。圖3：細胞進行分裂狀態。圖4-5：細胞呈圓柱形，兩末端呈圓形，細胞中央小刺伸入毗連細胞凹陷處而連成鏈狀。圖6：經酸洗後的細胞殼，顯示有大量明顯的半殼環紋（箭咀）。圖7：細胞內有大量呈小盤狀葉綠體，分布於細胞壁表面。

Dactyliosolen phuketensis

指管藻

(Sundström) Hasle, 1996

Phylum: Ochrophyta 門：褐胞藻門
Class: Bacillariophyceae 綱：矽藻綱
Order: Rhizosoleniales 目：管狀矽藻目
Family: Rhizosoleniaceae 科：根管藻科



Tomas et al., 1997

SYNONYMS 異名：

Rhizosolenia phuketensis Sundström 1980

DESCRIPTION:

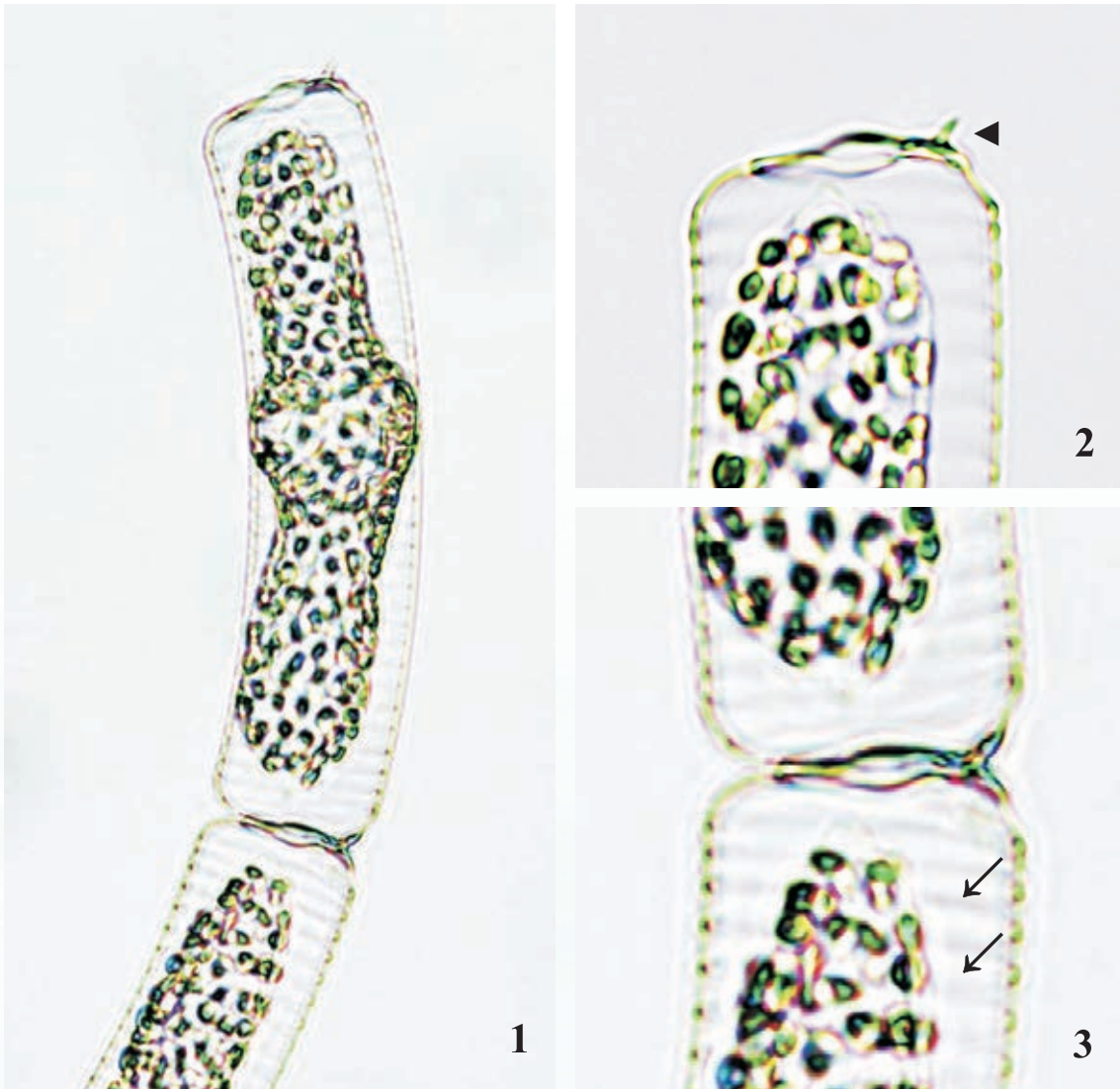
The cell of *Dactyliosolen phuketensis* is cylindrical and the cells mostly occur in curved or spiraling chain form in girdle view. The cell size ranges from 4.5 - 54 μm in diameter. Each cell contains numerous girdle bands. The external process tube is short and fits into a depression in the adjacent cell to form a chain. Each cell contains numerous small granule-like chloroplasts and 1 nucleus near cell wall. The cell is yellowish brown in colour.

描述：

從殼環面觀，指管藻細胞呈圓柱形，細胞大多是串連成彎狀或螺旋鏈狀。細胞直徑介乎4.5 - 54微米。每個細胞有大量殼環帶。外突出管短及伸入毗連細胞凹陷處而連成鏈狀。每個細胞內有大量呈顆粒狀的葉綠體及1個鄰近細胞壁的細胞核。細胞呈黃褐色。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2014	1	<i>Eucampia zodiacus</i> 浮動彎角藻、 <i>Guinardia delicatula</i> 柔弱幾內亞藻
Total/總數：		1



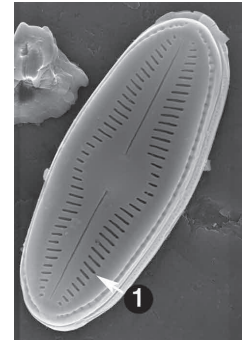
Dactyliosolen phuketensis. Figure 1: Curved cells united in a curved chain; cells in cylindrical shape with flat or slightly convex ends and connected by a short external spine that fits into a depression on the adjacent cell. Figure 2: Short external spine (arrow head) arising from the valve margin. Figure 3: Numerous distinct girdle half bands (arrows) and numerous small plate-like chloroplasts.

指管藻。圖1：細胞呈弧狀並串連成彎狀群體；細胞柱體形狀，有平或微凸末端，細胞外小刺伸入毗連細胞凹陷處而形成串連。圖2：短外小刺由殼面邊緣伸出（箭頭）。圖3：大量清晰的半殼環面帶（箭咀）及大量呈小盤狀葉綠體。

Diadesmis sp.
等半藻屬
Kützing, 1844

Phylum: Ochrophyta
Class: Bacillariophyceae
Order: Naviculales
Family: Diadesmidaceae

門：褐胞藻門
綱：矽藻綱
目：舟形藻目
科：等半藻科



University of Colorado Boulder

Description:

The cell of *Diadesmis* sp.* is small and it is mostly solitary or forms band-like colonies connected by their valve faces. The cell size ranges from 7 - 11 μm in apical axis. The valves are linear to lanceolate with bluntly round ends. The striae are composed of areolae elongated in the transapical direction. The raphe is present in the central part of the cell in valve view.

描述：

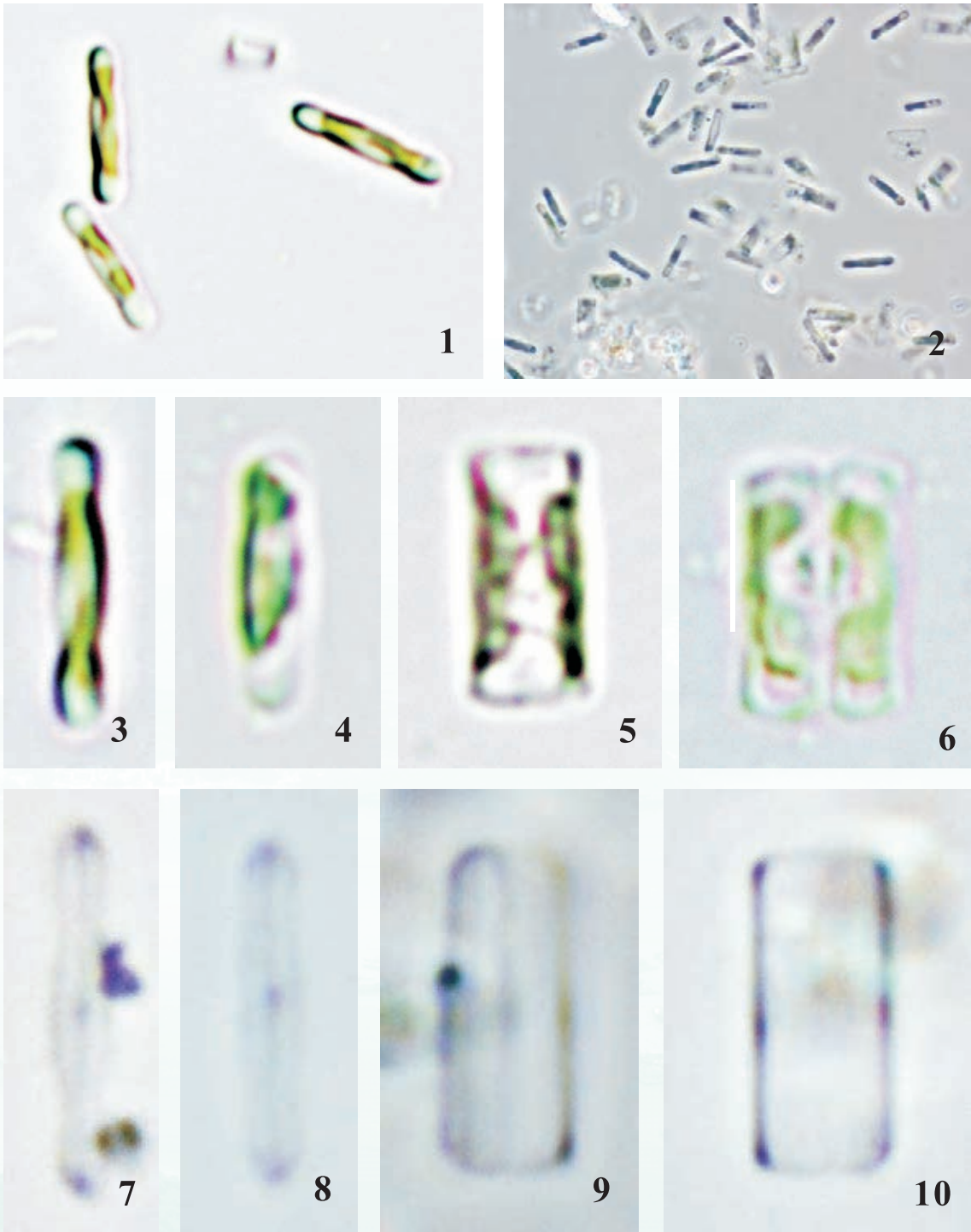
等半藻屬*細胞細小，大多以單獨個體出現或以殼面與殼面串連成帶狀群體，細胞縱軸殼長介乎7 - 11微米。殼面呈長線形或披針形，殼末端鈍圓。肋紋是由小孔沿橫軸方向排列而成。殼縫位於殼面中央位置。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2004	1	-
Total/總數：		1

* Previously, the specimen found in Hong Kong was named as *Navicula* sp. Later based on the study findings and the morphology description, the specimen from Hong Kong resembled the species presented as *Diadesmis* sp. by Kützing (1844) and therefore it was renamed to *Diadesmis* sp.

* 以前在香港收集所得的樣本被命名為舟形藻屬。後來根據研究的結果及形態學的描繪，發現香港的樣本與Kützing (1844) 所論述的等半藻屬十分相似，因此將這品種重新命名為等半藻屬。



Diadesmis sp. Figure 1: Live cells in valve view. Figure 2: Phase contrast photo. Figures 3-4: Various live cells in valve view. Figures 5-6: Various live cells in girdle view. Figures 7-8: Acid cleaned cells in valve view; phase contrast photo. Figures 9-10: Acid cleaned cells in girdle view; phase contrast photo.

等半藻屬。圖1：活體細胞的殼面觀。圖2：相位差照片。圖3-4：不同形狀活體細胞的殼面觀。圖5-6：不同形狀活體細胞的殼環面觀。圖7-8：經酸洗後細胞殼的殼面觀；相位差照片。圖9-10：經酸洗後細胞殼的殼環面觀；相位差照片。

Eucampia zodiacus

浮動彎角藻

Ehrenberg, 1839

Phylum: Ochrophyta

Class: Bacillariophyceae

Order: Hemiaulales

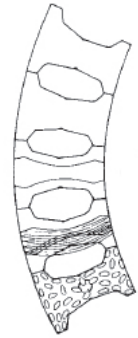
Family: Hemiaulaceae

門：褐胞藻門

綱：矽藻綱

目：半管藻目

科：半管藻科



Tomas et al., 1997

Synonyms 異名：

Eucampia britannica Smith 1853 and *Eucampia nodosa* Schmidt 1888

Description:

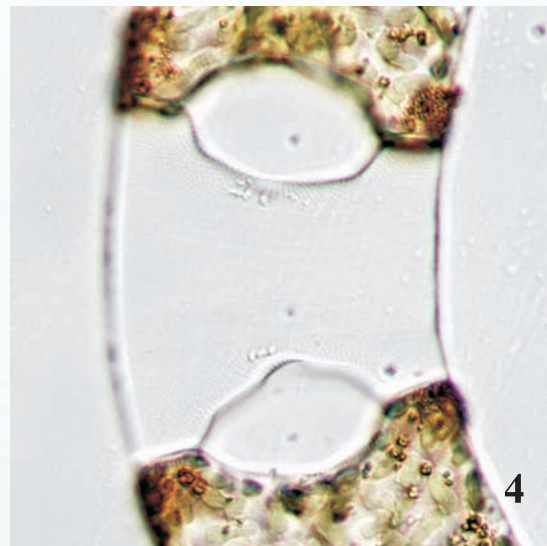
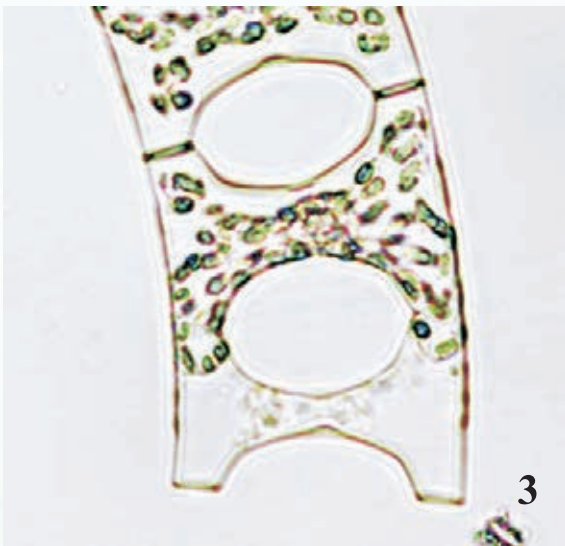
The cell of *Eucampia zodiacus* is flat and in trapezoid shape in girdle view. The valve face is concave with a small single depression located at the valve centre. The cell mostly occurs in helical chain form connected by two blunt processes with the adjacent cell. The aperture between adjacent cells is narrow and elliptical. The cell size ranges from 18 - 80 μm in apical axis. The cell contains numerous small elliptical chloroplasts and it is yellowish brown in colour.

描述：

從殼環面觀，浮動彎角藻細胞扁平，呈梯形。殼面凹陷，中心有一小凹處。細胞大多以螺旋鏈狀出現，細胞鏈是由細胞殼面兩端的鈍狀突起處，與毗連細胞的突起處互相串連而成的螺旋鏈狀。細胞間隙狹窄，呈橢圓形。細胞縱軸殼長介乎18 - 80微米。細胞內有大量細小橢圓形的葉綠體，細胞呈黃褐色。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1995	1	-
2002	1	-
2014	1	<i>Guinardia delicatula</i> 柔弱幾內亞藻、 <i>Dactyliosolen phuketensis</i> 指管藻
Total/總數：	3	



Eucampia zodiacus. Figures 1-2: Many cells connected to make a helical chain. Figures 3-4: Yellowish brown cell containing numerous small elliptical chloroplasts.

浮動彎角藻。圖1-2：多個細胞串連成螺旋鏈狀群體。圖3-4：啡黃色細胞內含大量橢圓形葉綠體。

Guinardia delicatula

柔弱幾內亞藻

(Cleve) Hasle, 1997

Phylum: Ochrophyta

門：褐胞藻門

Class: Bacillariophyceae

綱：矽藻綱

Order: Rhizosoleniales

目：管狀矽藻目

Family: Rhizosoleniaceae

科：根管藻科



Cupp, 1943

Synonyms 異名：

Rhizosolenia delicatula Cleve 1900

Description:

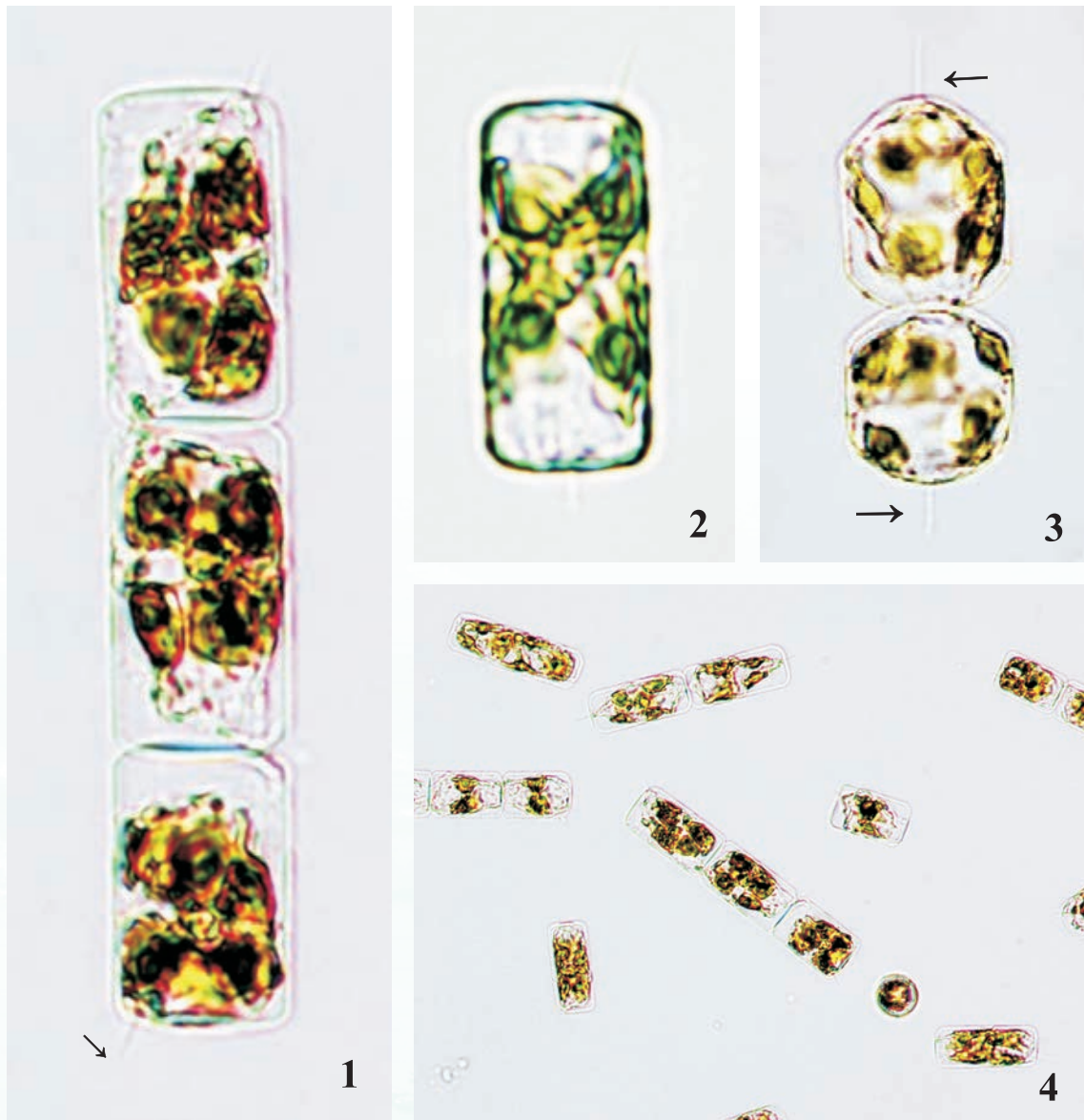
The cell of *Guinardia delicatula* is cylindrical with indistinct girdle bands. It mostly occurs in straight or slightly curved chain form without aperture between adjacent cells. The cell size ranges from 9 - 22 μm in diameter. The valve ends are flat and round and connected by a spine arising from the valve margin that fits into a depression on the adjacent cell. Each cell contains 2 - 8 large chloroplasts and they are usually present at the cell periphery.

描述：

柔弱幾內亞藻細胞呈圓柱形，表面有不明顯殼環帶。細胞大多是與毗連細胞互相串連成直條鏈狀或稍微彎曲狀群體，細胞與細胞之間沒有間隙。細胞直徑介乎9 - 22微米。殼面扁平，呈圓形，殼邊緣有小刺，小刺伸入鄰近細胞凹陷處而連成鏈狀。每個細胞內有2 - 8顆大型葉綠體，分布於細胞周邊表面。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1984	1	<i>Noctiluca scintillans</i> 夜光藻
2014	1	<i>Eucampia zodiacus</i> 浮動彎角藻、 <i>Dactyliosolen phuketensis</i> 指管藻
Total/總數：	2	

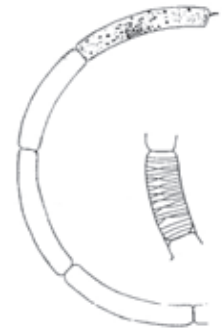


Guinardia delicatula. Figures 1-4: Cells are cylindrical, longer than their width, solitary or united in chains, valve ends are flat and connected by a spine (arrows) arising from the valve margin.

柔弱幾內亞藻。圖1-4：圓柱形細胞，長度大於闊度，單獨或串連成鏈狀，殼面扁平，細胞靠殼邊緣小刺（箭咀）相互連成鏈狀。

Guinardia striata
線紋幾內亞藻
(Stolterfoth) Hasle, 1996

Phylum: Ochrophyta 門：褐胞藻門
Class: Bacillariophyceae 綱：矽藻綱
Order: Rhizosoleniales 目：管狀矽藻目
Family: Rhizosoleniaceae 科：根管藻科



Tomas et al., 1997

Synonyms 異名：

Eucampia striata Stolterfoth 1879, *Rhizosolenia stolterfothii* Peragallo 1888 and *Pyxilla stephanos* Hensen 1974

Description:

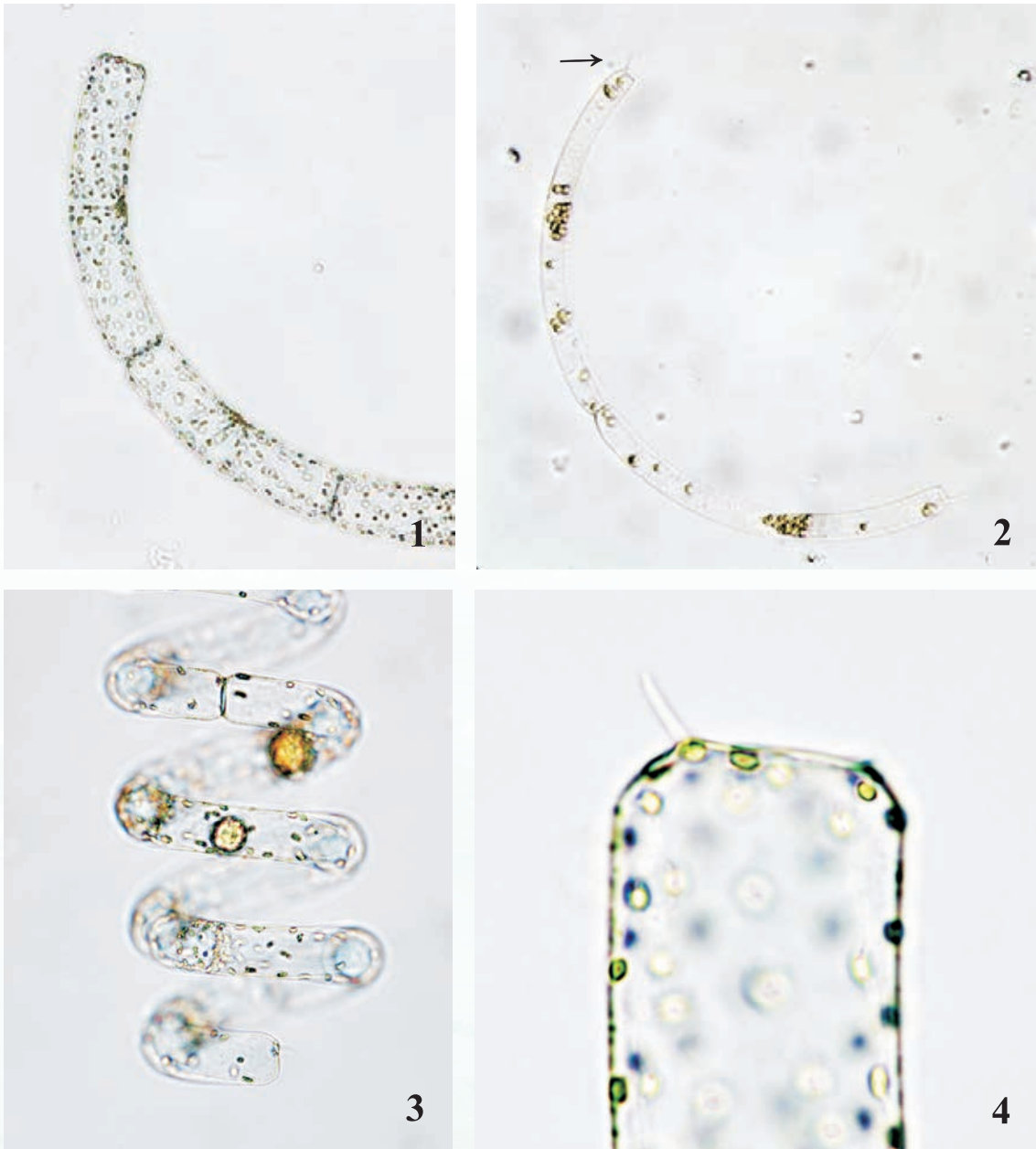
The cell of *Guinardia striata* is cylindrical with girdle bands. It occurs in long curved chain form and sometimes it may be in spiral shape without aperture between adjacent cells. The cell size ranges from 3 - 90 μm in diameter. The valve ends are flat and slightly round at the edges and they are connected by a stout spine arising from the valve margin that fits into a depression on the adjacent cell. Each cell contains numerous small elliptic chloroplasts and they are usually present at the cell periphery.

描述：

線紋幾內亞藻細胞呈圓柱形，表面有殼環帶。這種藻大多與毗連細胞相連成長而彎曲的鏈狀或間中呈螺旋形的鏈狀群體，細胞與細胞之間沒有間隙。細胞直徑介乎3 - 90微米。殼面扁平，殼邊緣略呈圓形，有粗短小刺，能伸入毗連細胞凹陷處而連成鏈狀。每個細胞內有大量細小橢圓形的葉綠體，葉綠體通常分布於細胞的周邊表面。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數:

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1991	1	<i>Leptocylindrus minimus</i> 微小細柱藻、 <i>Thalassiosira</i> sp. 海鏈藻
Total/總數：		1



Guinardia striata. Figures 1-2: Cells are cylindrical, longer than their width, solitary or united in curved chains, valve ends are flat and slightly round at the edges and connected by a stout spine (arrow) arising from the valve margin. Figure 3: Cells united at spiralling chains. Figure 4: Numerous small elliptic chloroplasts at the cell periphery.

線紋幾內亞藻。圖1-2：圓柱形細胞，長度大於闊度，單獨或串連成彎曲鏈狀群體，殼面扁平，邊緣略呈圓形及細胞靠殼邊緣粗短小刺（箭咀）相互串連。圖3：細胞串連成螺旋形鏈狀群體。圖4：細胞周邊表面有大量細小呈橢圓形的葉綠體。

Leptocylindrus danicus

丹麥細柱藻

Cleve, 1889

Phylum: Ochrophyta 門：褐胞藻門
Class: Bacillariophyceae 綱：矽藻綱
Order: Leptocylindrales 目：細柱藻目
Family: Leptocylindraceae 科：細柱藻科



Tomas et al., 1997

Description:

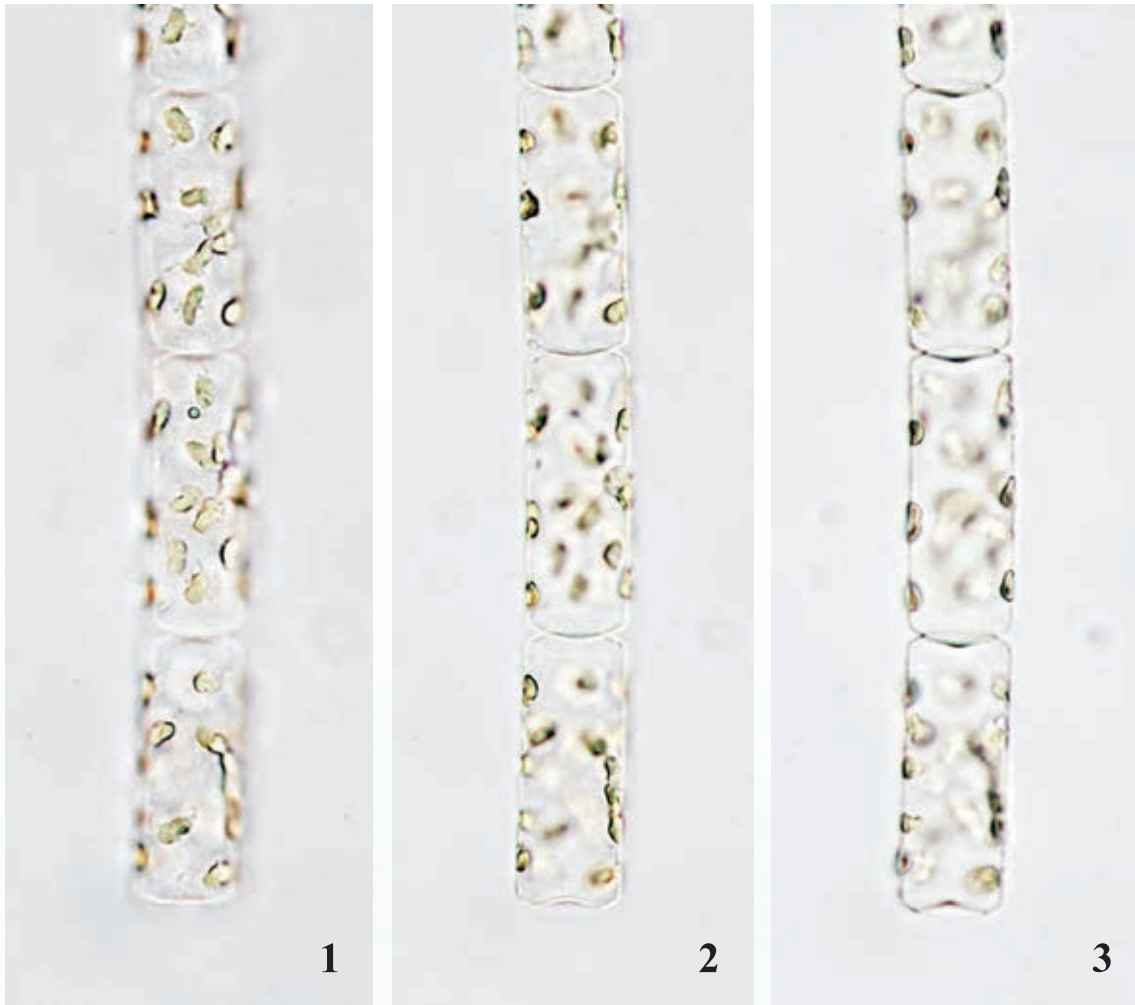
The cell of *Leptocylindrus danicus* is cylindrical and occurs in chain form connected by valve faces. The cell size ranges from 5 - 16 μm in diameter. One end of the valve is slightly convex and the adjacent valve end is slightly concave. The valve margin bears indistinct short spines between the valve face and the mantle. Each cell contains numerous small round plate-like chloroplasts.

描述：

丹麥細柱藻細胞呈圓柱形，大多是以殼面與毗連細胞的殼面互相串連成鏈狀群體，細胞直徑介乎 5 - 16 微米。細胞其中一端的殼面微微突起，而毗連的殼面則略為凹陷，殼面與殼邊緣之間有不明顯突起的短小刺。每個細胞內均有大量細小圓盤狀的葉綠體。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1986	1	<i>Teleaulax acuta</i> 尖尾全溝藻
1989	1	-
1992	1	<i>Dactyliosolen fragilissimus</i> 脆指管藻
2001	1	-
Total/總數：	4	



Leptocylindrus danicus. Figures 1-3: Same cells in girdle view in different focus showing cells united in chain, valve face slightly convex or concave, numerous small round plate-like chloroplasts.

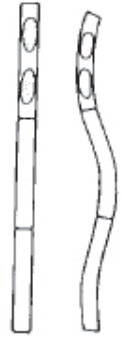
丹麥細柱藻。圖1-3：同一細胞在不同聚焦下的殼環面觀顯示細胞串連成鏈狀，殼面略為突起或凹陷，大量呈細小圓盤狀葉綠體。

Leptocylindrus minimus

微小細柱藻

Gran, 1915

Phylum: Ochrophyta 門：褐胞藻門
Class: Bacillariophyceae 綱：矽藻綱
Order: Leptocylindrales 目：細柱藻目
Family: Leptocylindraceae 科：細柱藻科



Tomas et al., 1997

Description:

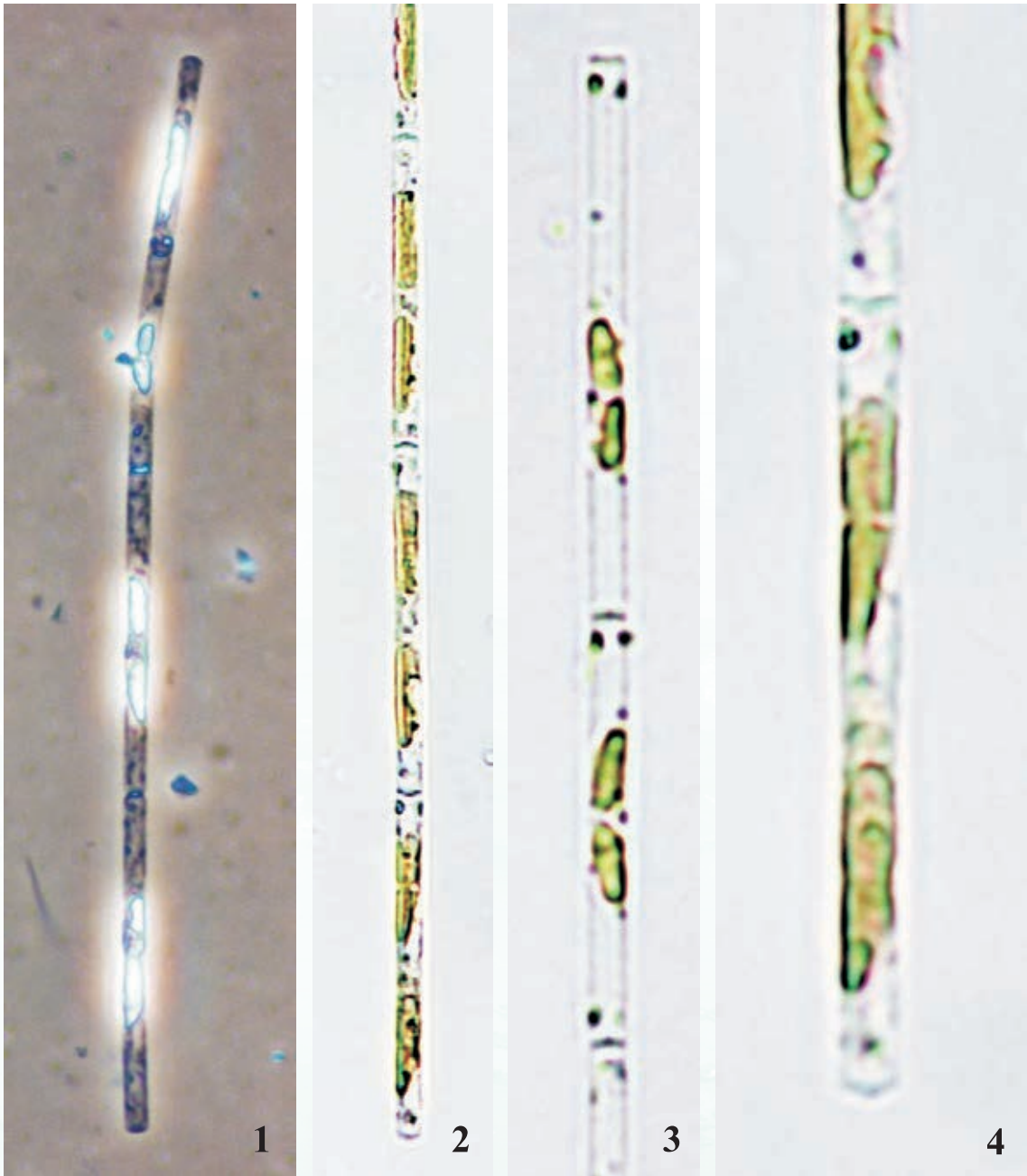
The cell of *Leptocylindrus minimus* is long, narrow, and cylindrical. It occurs in chain form straight or gently undulating chains connected by valve faces. The cell size ranges from 1.5 - 4.5 μm in diameter. The valve face is flat without spines. Each cell contains 1 or 2 elongated chloroplasts centrally and it is yellowish brown in colour.

描述：

微小細柱藻細胞呈狹長圓柱形，大多是以殼面與毗連殼面互相串連成直條或波浪形鏈狀群體。細胞直徑介乎1.5 - 4.5微米。殼面平滑沒有小刺。每個細胞的中央均有1顆或2顆長形黃褐色的葉綠體。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1984	1	<i>Noctiluca scintillans</i> 夜光藻
1988	1	<i>Pseudo-nitzschia pseudodelicatissima</i> 假柔弱擬菱形藻
	1	<i>Chaetoceros</i> sp. 角毛藻
	1	<i>Dactyliosolen fragilissimus</i> 脆指管藻
1989	1	<i>Dactyliosolen fragilissimus</i> 脆指管藻
1991	1	<i>Guinardia striata</i> 線紋幾內亞藻、 <i>Thalassiosira</i> sp. 海鏈藻
	1	-
1992	1	<i>Skeletonema costatum</i> 中肋骨條藻、 <i>Thalassiosira mala</i> 中肋海鏈藻
1996	1	-
1998	1	<i>Skeletonema costatum</i> 中肋骨條藻、 <i>Thalassiosira</i> sp. 海鏈藻
Total/總數：	10	



Leptocylindrus minimus. Figure 1: Cells are united in chain, phase contrast photo. Figures 2-4: Chain cells in girdle view showing long, narrow and cylindrical shape; flat valve face; 2 elongated chloroplasts located centrally.

微小細柱藻。圖1：細胞串連成鏈狀，相位差照片。圖2-4：鏈狀細胞於殼環面觀呈狹長圓柱形；殼面扁平；兩顆長形的葉綠體位於細胞中央。

Nitzschia incerta 菱形藻

(Grunow) Peragallo, 1903

Phylum: Ochrophyta 門：褐胞藻門
Class: Bacillariophyceae 綱：矽藻綱
Order: Bacillariales 目：有殼縫目
Family: Bacillariaceae 科：有殼縫科



Proshkina-Lavrenko A.I., 1955

Synonyms 異名：

Nitzschia reversa Smith 1853 and *Nitzschia lorenziana* var. *incerta* Grunow 1995

Description:

The cell of *Nitzschia incerta** is in spindle shape with enlarged central part and sharply tapering ends. The ends deflect in opposite directions and display in S-shape in girdle view. It mostly occurs solitarily. The apical and transapical axis are 70 - 200 μm and 4 - 8 μm respectively. The number of fibulae is 10 - 12 in 10 μm . The cell contains 1 nucleus and 2 chloroplasts in the central region of the cell.

描述：

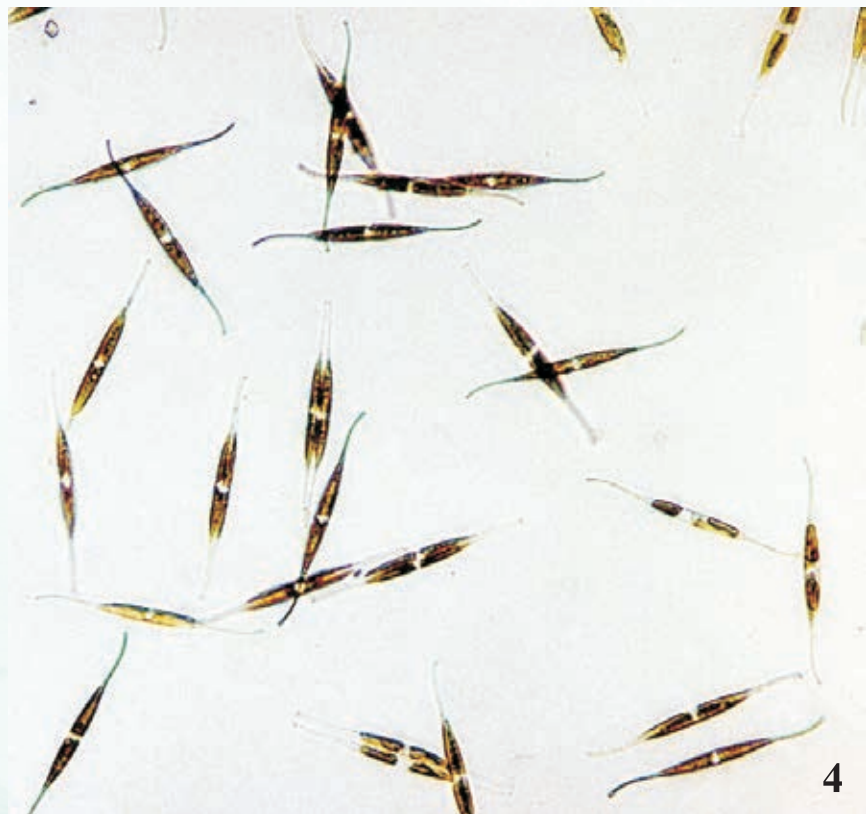
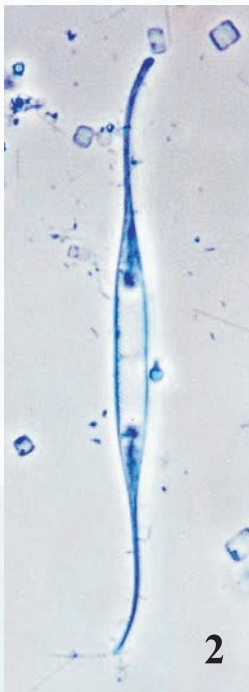
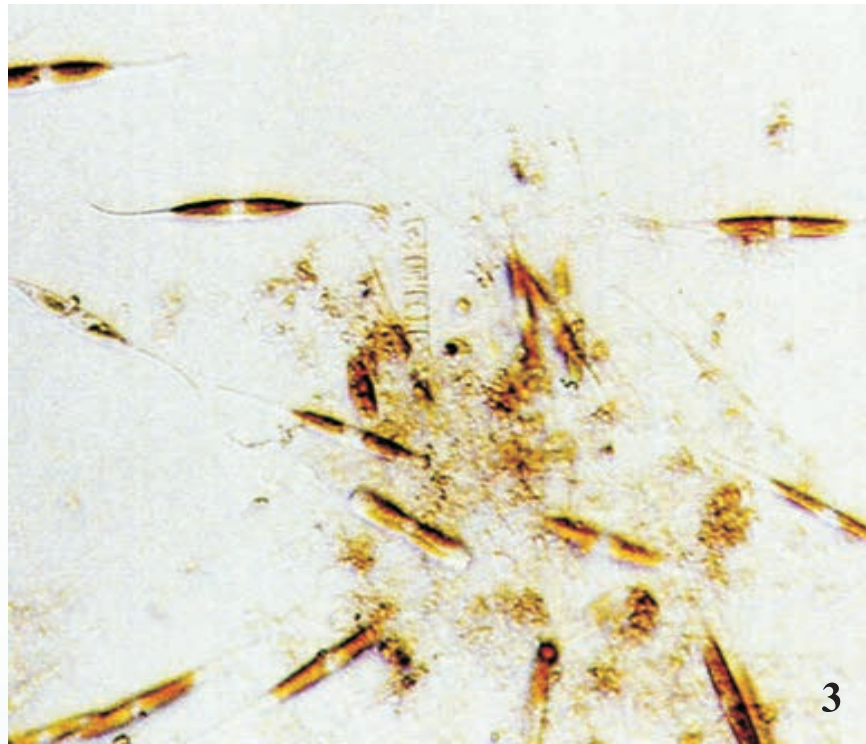
菱形藻*細胞呈紡錘狀，中央部分脹大，兩端急縮成尖細長條。兩末端彎向相反方向，以致殼環面觀呈S形。大多以單獨個體出現。縱軸為70 - 200微米，而切頂軸為4 - 8微米。每10微米船骨點的數目為10 - 12。細胞中央位置有1個細胞核及2顆葉綠體。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1988	1	<i>Tripes furca</i> 叉角藻
1999	1	<i>Leptocylindrus</i> sp. 細柱藻、 <i>Pseudo-nitzschia</i> sp. 擬菱形藻
Total/總數：		2

* Previously, the specimen found in Hong Kong was named as *Nitzschia longissima*. Later based on the study findings and the morphology description, the specimen from Hong Kong resembled the species presented as *Nitzschia incerta* by Peragallo (1903) and therefore it was renamed to *Nitzschia incerta*.

* 以前在香港收集所得的樣本被命名為長菱形藻。後來根據研究的結果及形態學的描繪，發現香港的樣本與Peragallo(1903)所論述的菱形藻十分相似，因此將這品種重新命名為菱形藻。



Nitzschia incerta. Figure 1: Cell in girdle view showing an S-shape, broadly in middle and sharply tapering ends. Figure 2: Girdle view, phase contrast photo. Figure 3: Live cells from red tide sample. Figure 4: Fixed cells.

菱形藻。圖1：殼環面觀呈S形，中央部分脹大，兩端急縮成條形。圖2：殼環面觀的相位差照片。圖3：紅潮樣本的活體細胞。圖4：以固定劑固定的細胞。

Pseudo-nitzschia delicatissima
柔弱擬菱形藻
(Cleve) Heiden, 1928

Phylum: Ochrophyta 門：褐胞藻門
Class: Bacillariophyceae 綱：矽藻綱
Order: Bacillariales 目：矽藻目
Family: Bacillariaceae 科：矽藻科



Tomas et al., 1997

Synonyms 異名：

Homoeocladia delicatissima (Cleve) Meunier 1910, *Nitzschia delicatissima* Cleve 1897 and *Nitzschia actydropbila* Hasle 1965

Description:

Pseudo-nitzschia delicatissima cell is elongate and symmetric, gently curved until some distance from the ends and pointed to the rounded ends in valve view. It is slightly sigmoid and straight cut ends in girdle view. The apical and transapical axis are 30 - 80 μm and 1.0 - 2.0 μm respectively. The cells overlap by 1/9 of the total cell length. A central interspace is present. The numbers of interstriae and fibulae in 10 μm are 34 - 41 and 19 - 26 respectively. There are 2 rows of poroids and 10 - 14 poroids in 1 μm .

Toxicity:

P. delicatissima is capable of producing domoic acid that causes Amnesic Shellfish Poisoning (ASP). Local cell cultures did not find to produce domoic acid.

描述：

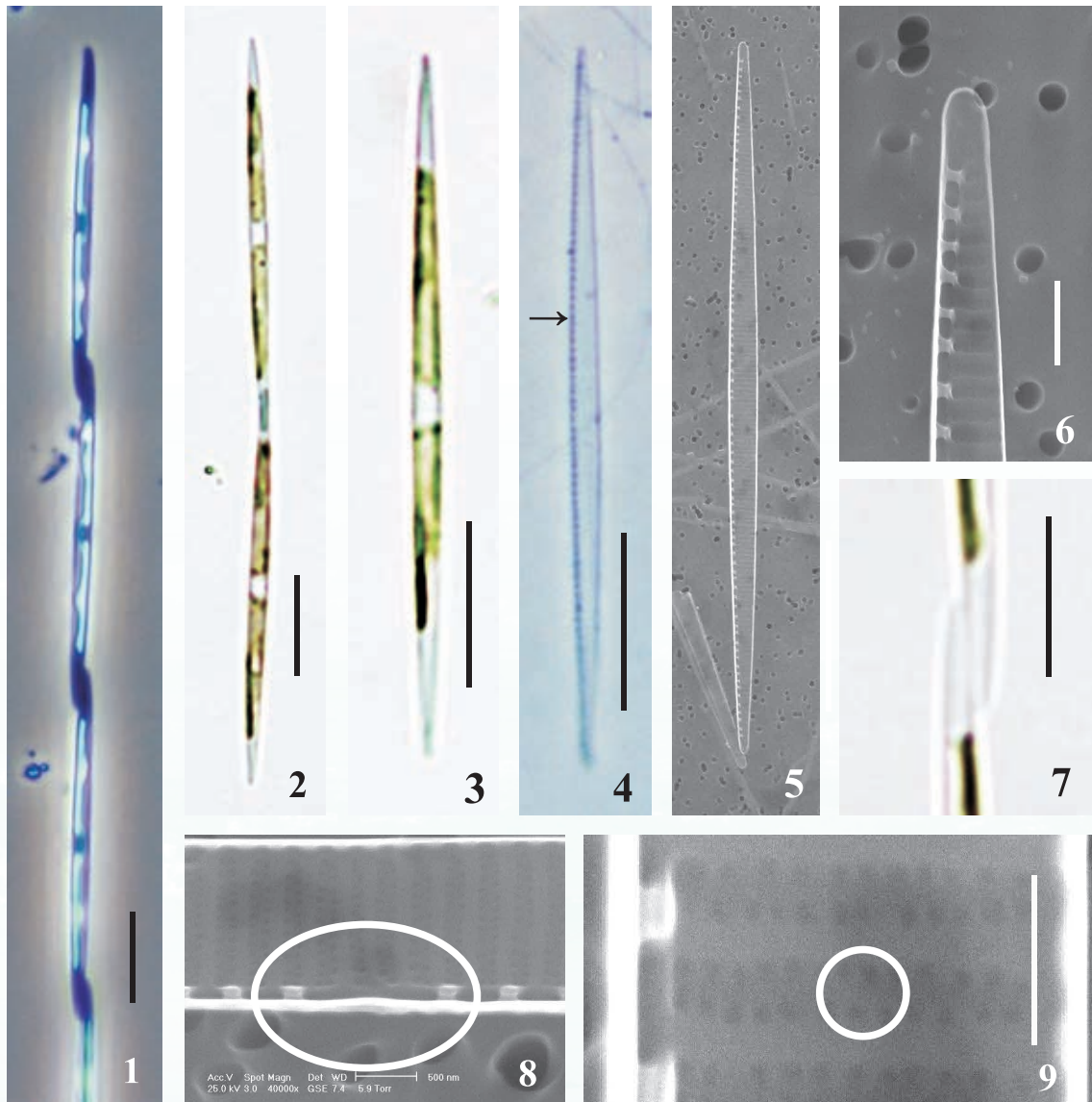
柔弱擬菱形藻的細胞殼面觀窄長且兩邊對稱，輕微彎曲至近末端，然後漸尖，末端鈍圓，殼環面觀細胞則略呈S形，末端為直切邊。縱軸及切頂軸分別介乎30 - 80微米及1.0 - 2.0微米，細胞交疊位置佔細胞總長度的九分之一，並有中央間隙。肋紋間及船骨點數目分別為每10微米34 - 41及19 - 26個。另有2排孔紋，孔紋數目為每1微米10 - 14個。

毒性：

柔弱擬菱形藻可產生引致失憶性貝類中毒的軟骨藻酸。香港培育的藻株並沒有產生軟骨藻酸。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2012	2	-
2014	1	-
	1	<i>Prorocentrum cordatum</i> 心形原甲藻、 <i>Pseudo-nitzschia pungens</i> 尖刺擬菱形藻、 <i>Skeletonema costatum</i> 中肋骨條藻
Total/總數：		4



Cultured cells of *Pseudo-nitzschia delicatissima*. Figure 1: Live cells in chain, girdle view, phase contrast photo. Figure 2: Live cells in chain, valve view. Figure 3: Live single cell, pointed ends, valve view. Figure 4: Acid cleaned frustule, valve with visible fibulae (arrows). Figure 5: Valve, SEM. Figure 6: Tip of the valve, SEM. Figure 7: Overlapping of cells, girdle view. Figure 8: Middle part of the valve showing large central interspace (oval). Figure 9: Middle part of the valve, 2 rows of poroids (circle), SEM.

Figures 1-4: scale bars = 10 μ m. Figure 6: scale bar = 1 μ m. Figure 7: scale bar = 5 μ m. Figures 8-9: scale bar = 500 nm.

柔弱擬菱形藻培植藻株。圖1：串連活細胞的殼環面觀，相位差照片。圖2：串連活細胞的殼面觀。圖3：活單細胞的殼面觀，呈兩端尖。圖4：經酸洗後的細胞殼，殼面可見船骨點（箭咀）。圖5：細胞殼面，掃描電子顯微鏡照片。圖6：殼面頂端顯示船骨點，掃描電子顯微鏡照片。圖7：細胞交疊處的殼環面觀。圖8：殼面中央部分顯示大中央間隙（橢圓）。圖9：殼面中央部分可見2排孔紋（圓圈），掃描電子顯微鏡照片。

圖1-4：比例尺=10微米；圖6：比例尺=1微米；圖7：比例尺=5微米；圖8-9：比例尺=500納米。

Pseudo-nitzschia pseudodelicatissima

假柔弱擬菱形藻

(Hasle) Hasle, 1993

Phylum: Ochrophyta

門：褐胞藻門

Class: Bacillariophyceae

綱：矽藻綱

Order: Bacillariales

目：矽藻目

Family: Bacillariaceae

科：矽藻科



Tomas et al., 1997

Synonyms 異名：

Nitzschia delicatula Hasle 1965 and *Nitzschia pseudodelicatissima* Hasle 1976

Description:

Pseudo-nitzschia pseudodelicatissima is straight and narrow in the middle part of body until some distance from the ends when observed in valve view. The ends are pointed in both valve and girdle view. The apical axis is 44 - 140 μm and transapical axis is 0.9 - 3.4 μm respectively. Central interspace is present. The cell overlaps 1/6 of the total cell length. The numbers of interstriae and fibulae in 10 μm are 29 - 46 and 14 - 26 respectively. The cell has 1 row of poroids with 4 - 6 poroids per μm , and the poroid hymen divides into 2 sectors.

Toxicity:

P. pseudodelicatissima is capable of producing domoic acid that causes Amnesic Shellfish Poisoning (ASP). Local cell cultures found to produce 0.0035 pg of domoic acid per cell.

描述：

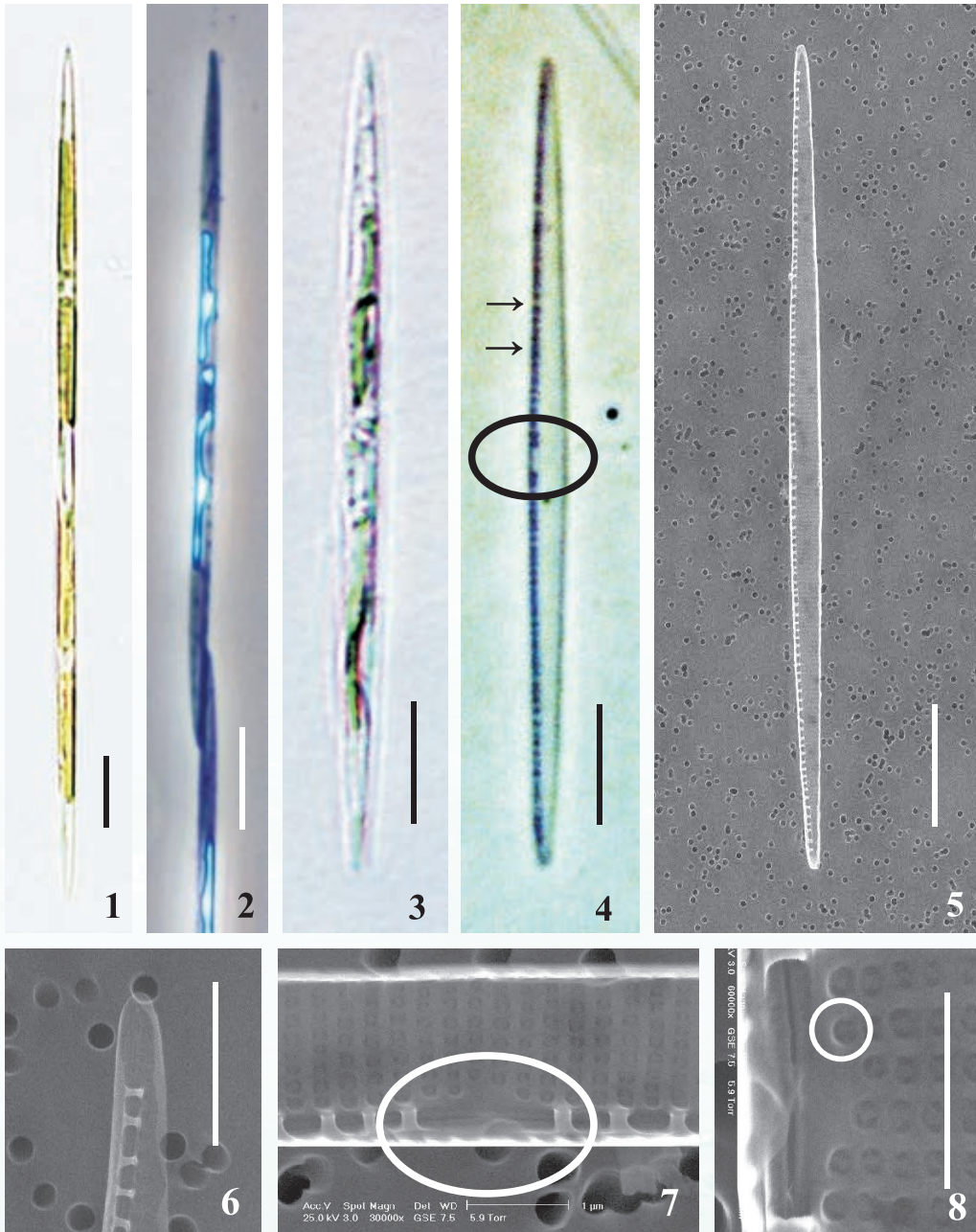
殼面觀的假柔弱擬菱形藻細胞形態筆直，中央窄至近兩端，兩端於殼面及殼環面觀均尖小。縱軸介乎44 - 140微米，切頂軸介乎0.9 - 3.4微米，有中央間隙。細胞交疊位置佔細胞總長度的六分之一。肋紋間及船骨點數目分別每10微米為29 - 46及14 - 26個。另有1排孔紋，孔紋數目為每1微米4 - 6個，孔紋膜將孔紋分為2部分。

毒性：

假柔弱擬菱形藻可產生引致失憶性貝類中毒的軟骨藻酸。本地培植的藻株每個細胞可產生0.0035微微克的軟骨藻酸。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1988	1	-
	1	<i>Leptocylindrus minimus</i> 微小細柱藻
	1	<i>Skeletonema costatum</i> 中肋骨條藻
1996	1	-
Total/總數：	4	



Cultured cells of *Pseudo-nitzschia pseudodelicatissima*. Figure 1: Live cells in chain, valve view. Figure 2: Live cells in chain, girdle view, phase contrast photo. Figure 3: Live cell in valve view. Figure 4: Acid cleaned frustule, valve with visible fibulae (arrow) and central interspace (oval). Figure 5: Valve, SEM. Figure 6: Tip of the valve, SEM. Figure 7: Middle part of the valve showing large central interspace (oval), one row of poroids, SEM. Figure 8: High magnification showing the hymen of poroids divides into 2 sectors(circle).

Figures 1-5: scale bars = 10 μm . Figure 6: scale bar = 2 μm . Figures 7-8: scale bar = 1 μm .

假柔弱擬菱形藻培養藻株。圖1：串連活細胞的殼面觀。圖2：串連活細胞的殼環面觀的相位差照片。圖3：活細胞的殼面觀。圖4：經酸洗後的細胞殼，殼面可見船骨點（箭咀）及中央間隙（橢圓）。圖5：殼面的掃描電子顯微鏡照片。圖6：殼面頂端的掃描電子顯微鏡照片。圖7：殼面中央部分的掃描電子顯微鏡照片，顯示大中央間隙（橢圓）及一排孔紋。圖8：高倍放大圖片，顯示孔紋膜分為2大部分（圓圈）。
圖1-5：比例尺=10微米；圖6：比例尺=2微米；圖7-8：比例尺=1微米。

Pseudo-nitzschia pungens

尖刺擬菱形藻

(Grunow ex Cleve) Hasle, 1993

Phylum: Ochrophyta	門：褐胞藻門
Class: Bacillariophyceae	綱：矽藻綱
Order: Bacillariales	目：矽藻目
Family: Bacillariaceae	科：矽藻科



Tomas et al., 1997

Synonyms 異名：

Nitzschia pungens Grunow ex Cleve 1897

Description:

Pseudo-nitzschia pungens is linear to lanceolate, symmetric along the apical axis and show pointed ends in valve and girdle views. The recorded ranges of apical axis and transapical axis are 74 - 174 μm and 1.8 - 6.5 μm respectively. The central interspace is absent. The numbers of interstriae and fibulae in 10 μm are 9 - 16 and 9 - 20 respectively. The cells overlap at about 1/4 of total cell length. The number of poroid rows is 2 and there are 2 - 4 poroids per μm .

Toxicity:

P. pungens is capable of producing domoic acid that causes Amnesic Shellfish Poisoning (ASP). Local cell cultures did not find to produce domoic acid.

描述：

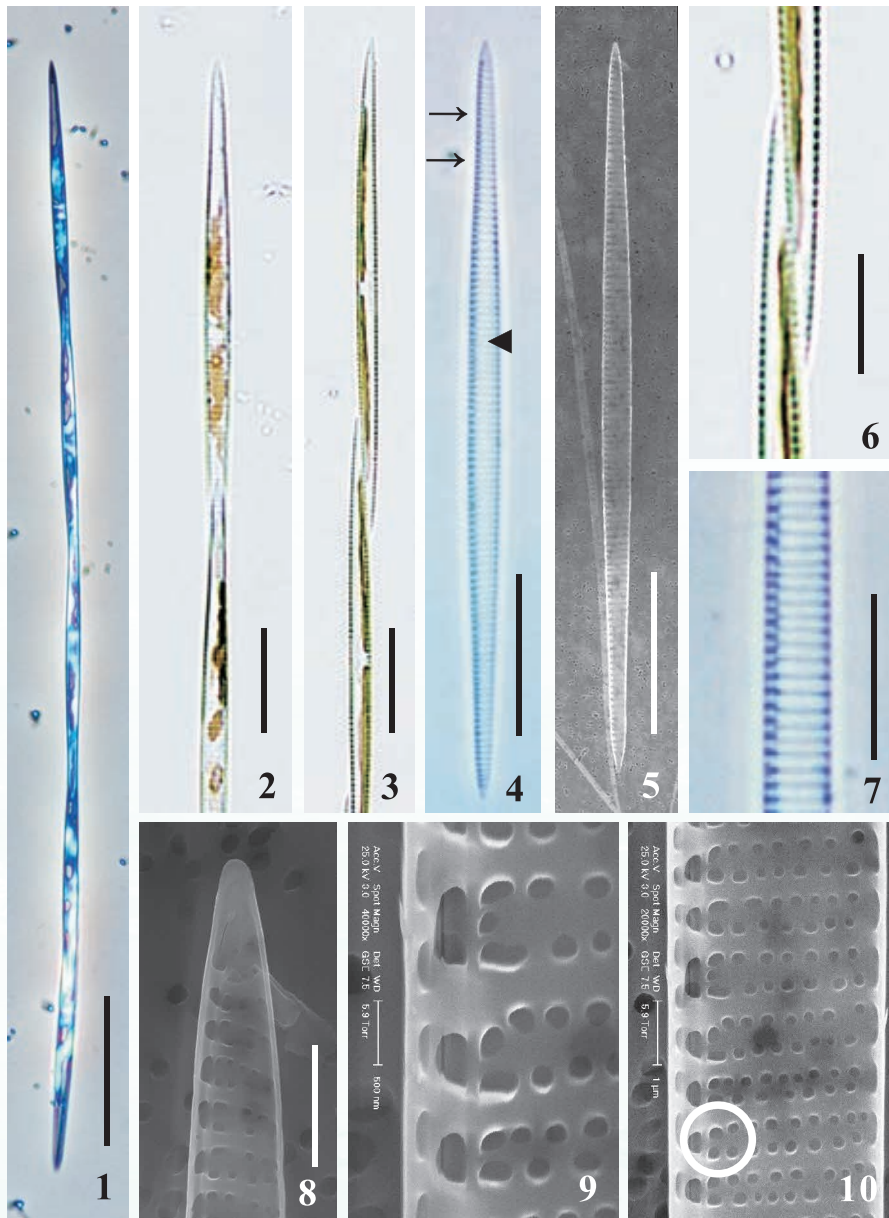
尖刺擬菱形藻於殼面觀及殼環面觀細胞呈長線形至披針形，殼沿縱軸對稱，兩端尖小。記錄顯示縱軸及切頂軸的大小分別介乎74 - 174微米及1.8 - 6.5微米，沒有中央間隙。肋紋間及船骨點數目分別為每10微米9 - 16及9 - 20個，細胞交疊位置約佔細胞總長度的四分之一。另有2排孔紋，孔紋數目為每1微米2 - 4個。

毒性：

尖刺擬菱形藻可產生引致失憶性貝類中毒的軟骨藻酸。香港培育的藻株並沒有產生軟骨藻酸。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1986	1	<i>Skeletonema costatum</i> 中肋骨條藻
1994	1	-
1995	1	-
2014	1	<i>Prorocentrum cordatum</i> 心形原甲藻、 <i>Pseudo-nitzschia delicatissima</i> 柔弱擬菱形藻、 <i>Skeletonema costatum</i> 中肋骨條藻
2015	1	-
2017	1	-
Total/總數：	6	



Cultured cells of *Pseudo-nitzschia pungens*. Figure 1: Live cells in chain, valve view, phase contrast photo. Figure 2: Live cells in chain, valve view. Figure 3: Live cells in chain, girdle view. Figure 4: Acid cleaned frustule with visible fibulae (arrows) and interstriae (arrow head). Figure 5: Valve, SEM. Figure 6: Overlapping of cells, girdle view. Figure 7: Middle part of the valve. Figure 8: Tip of the valve, SEM. Figure 9: Middle part of the valve showing no central interspace, SEM. Figure 10: Middle part of the valve, two rows of poroids (circle), SEM.

Figure 1: scale bar = 50 μm . Figures 2-5: scale bars = 20 μm . Figures 6-7: scale bars = 10 μm . Figure 8: scale bar = 2 μm . Figures 9-10: scale bars = 500 nm.

尖刺擬菱形藻培植藻株。圖1：串連細胞的殼面觀相位差照片。圖2：串連活細胞的殼面觀。圖3：串連活細胞的殼環面觀。圖4：經酸洗後的細胞殼，殼面可見船骨點（箭咀）及肋紋間（箭頭）。圖5：殼面的掃描電子顯微鏡照片。圖6：細胞交疊部分的殼環面觀。圖7：殼面中央部分。圖8：殼面頂端的掃描電子顯微鏡照片。圖9：殼面中央部分的掃描電子顯微鏡照片，顯示沒有中央間隙。圖10：殼面中央部分的掃描電子顯微鏡照片，可見2排孔紋（圓圈）。

圖1：比例尺=50微米；圖2-5：比例尺=20微米；圖6-7：比例尺=10微米；圖8：比例尺=2微米；圖9-10：比例尺=500納米。

Skeletonema costatum

中肋骨條藻

(Greville) Cleve, 1873

Phylum: Ochrophyta

Class: Bacillariophyceae

Order: Thalassiosirales

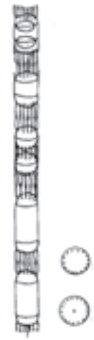
Family: Skeletonemaceae

門：褐胞藻門

綱：矽藻綱

目：海鏈藻目

科：骨條藻科



Tomas et al., 1997

Synonyms 異名：

Melosira costate Greville 1866

Description:

The cell of *Skeletonema costatum* is flat and convex in valve view. It is cylindrical in girdle view and occurs in long chain form. The cells are connected by numerous external tubes of marginal fultoportulae arising from the valve margin. The cell size ranges from 2 - 21 μm in diameter. 1 single rimoportula is located at the base of the connecting process. The aperture between adjacent cells is large and mostly larger than cell length. Each cell contains 1 - 2 chloroplasts and the nucleus is located at the centre of the cell.

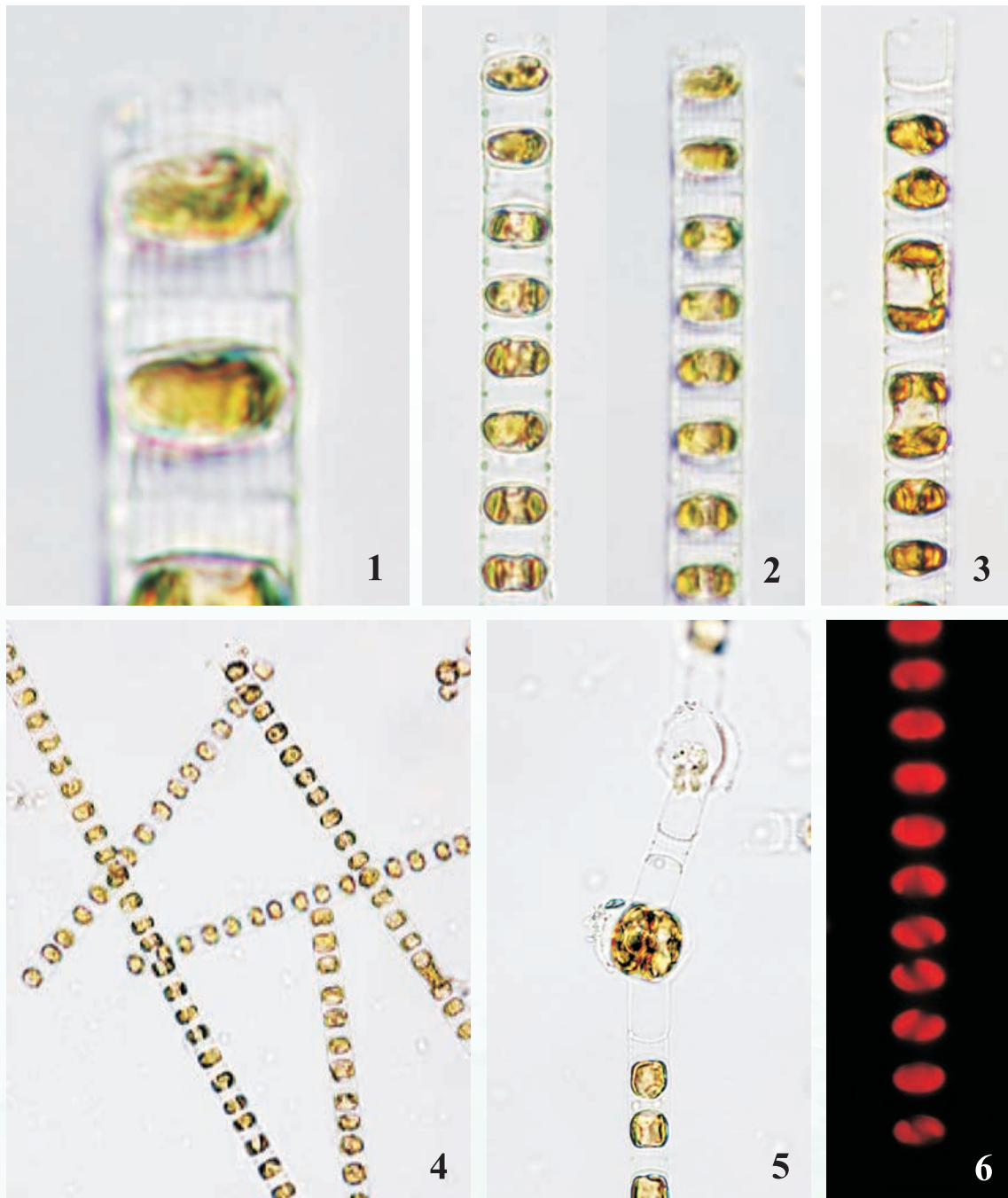
描述：

從殼面觀，中肋骨條藻細胞扁平、突起。而從殼環面觀，細胞則呈圓柱形，大多串連成長鏈狀，是由細胞殼面邊緣伸出的殼邊緣支持突的很多小管互相連繫而成的。細胞直徑介乎2 - 21微米。細胞殼面的連接支持突附近有1個唇形突。細胞間隙大，多數大過細胞本身的長度。每個細胞內有1 - 2顆葉綠體，而細胞核位於細胞的中央。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

From 1975 to 2017, 67 red tide incidents caused by *Skeletonema costatum* were recorded in Hong Kong waters. Refer to Appendix IV for detailed information.

由 1975 年至 2017 年間，香港水域共錄得 67 宗由中肋骨條藻引發的紅潮個案。有關資料詳情請參閱附錄四。



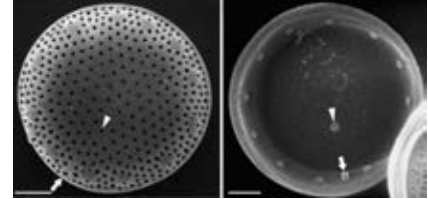
Skeletonema costatum. Figure 1: Cells united in chain and connected by numerous external tubes of marginal fultoportulae arising from the valve margin. Figure 2: Same chained cells in different focal planes. Figure 3: Fixed cells. Figure 4: Algal bloom cells from the field. Figure 5: Auxospore formation. Figure 6: Epifluorescent stained cells showing 1 or 2 autofluorescing chloroplasts.

中肋骨條藻。圖1：細胞串連成鏈狀的細胞，由細胞殼面邊緣的殼邊緣支持突的許多小管連繫而成。圖2：不同聚焦下的同一鏈狀細胞。圖3：以固定劑固定的細胞。圖4：來自紅潮現場的細胞。圖5：複大孢子的形成。圖6：經熒光染色的細胞，顯示有1個或2個自體熒光的葉綠體。

Thalassiosira mala 中肋海鏈藻

Takano, 1965

Phylum: Ochrophyta 門：褐胞藻門
Class: Bacillariophyceae 綱：矽藻綱
Order: Thalassiosirales 目：海鏈藻目
Family: Thalassiosiraceae 科：海鏈藻科



Li et al., 2013

Description:

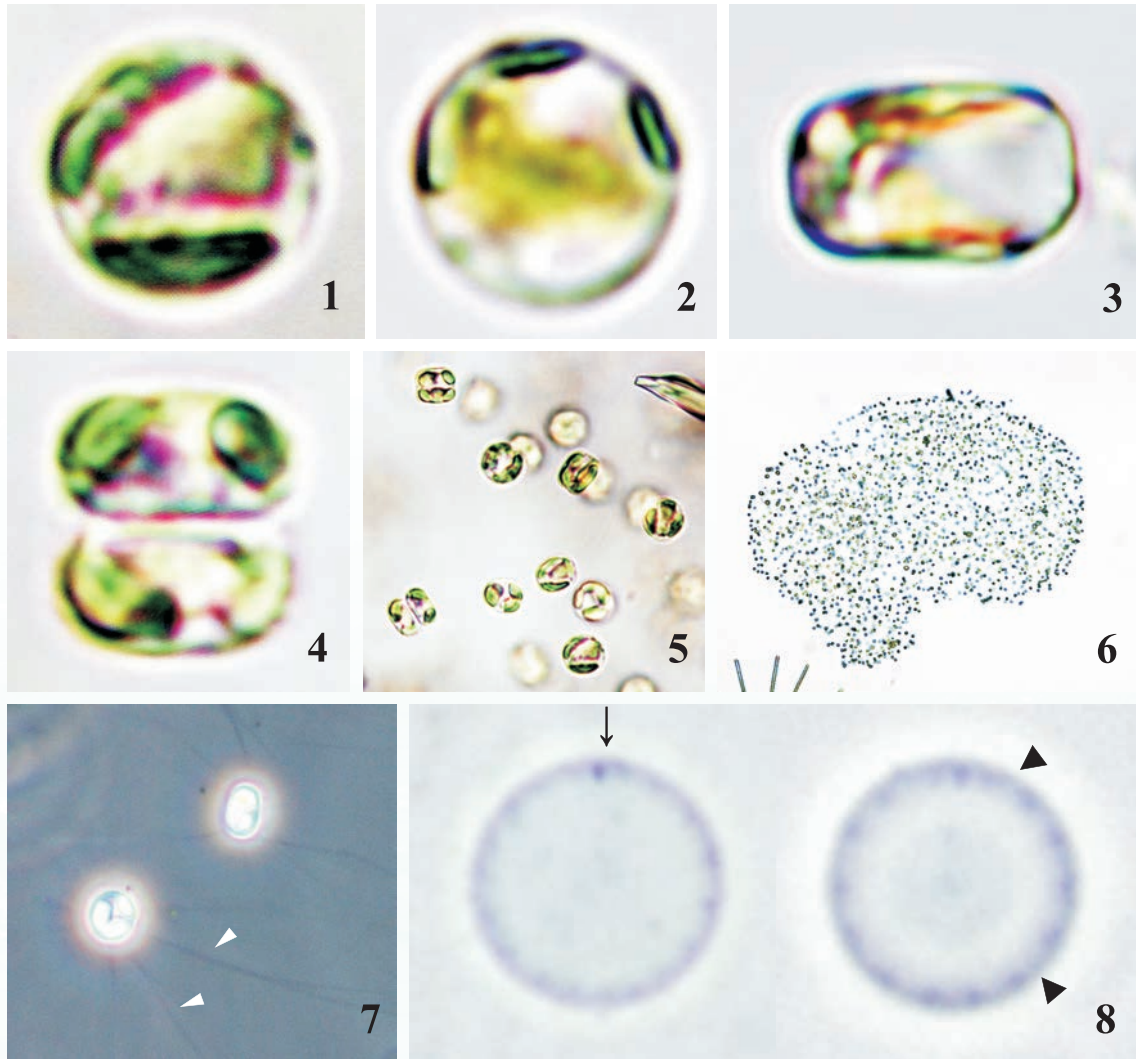
The cell of *Thalassiosira mala* is round and flattened. It occurs solitarily or is joined by threads or valve to valve connections forming loose chains or in dense mucilaginous colonies. Irregular areolae arrange in radial pattern and are composed of 2 - 16 pores. The cell size ranges from 4 - 10 μm in diameter. The valve bears a ring of marginal fultoportula with around 10 - 30 fultoportulae. 1 rimoportula with small tube occurs between 2 marginal fultoportulae. The rimoportula is larger than fultoportula.

描述：

中肋海鏈藻細胞呈圓形，殼面扁平。可以單一細胞個體出現或以線狀物串連成鏈狀、殼面與殼面相連而成鬆散的鏈狀群體，或以嵌埋於濃密膠質內的群體出現。殼面有不規則形的小孔呈放射形排列，有2 - 16個小孔。細胞直徑介乎4 - 10微米。殼面有一圈殼邊緣支持突，一圈大約有10 - 30個支持突。在2個殼邊緣支持突的中間，有1個有小管的唇形突。這唇形突較支持突大。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1985	1	<i>Prorocentrum triestinum</i> 尖葉原甲藻
1986	1	-
1989	1	-
1990	1	-
1991	1	-
1992	1	<i>Leptocylindrus minimus</i> 微小細柱藻、 <i>Skeletonema costatum</i> 中肋骨條藻
1996	1	<i>Heterocapsa circularisquama</i> 圓鱗異囊藻
2004	1	-
Total/總數：		8



Thalassiosira mala. Figures 1-2: Cells in valve view showing round in shape and each containing yellow-green chloroplasts. Figure 3: Cell in girdle view. Figure 4: Cell undergoes division. Figures 5-6: Cells embedded in formless mucilaginous masses. Figure 7: Cells connected by threads (narrow arrow heads). Figure 8: Same cell in different focal plane showing 1 marginal rimoportula (arrow) and a ring of marginal fultoportula (board arrow heads).

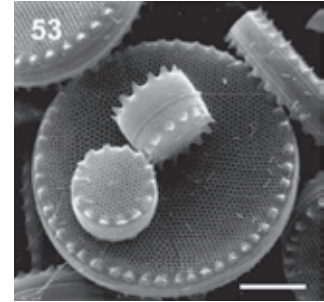
中肋海鏈藻。圖1-2：細胞的殼面觀顯示細胞呈圓形及每個細胞含有黃綠色的葉綠體。圖3：細胞的殼環面觀。圖4：細胞進行分裂。圖5-6：細胞嵌藏於無定形狀的膠質團內。圖7：細胞由線狀物（窄箭頭）串連。圖8：不同聚焦面下同一細胞所顯示的1個殼邊緣唇形突（箭咀）及一圈支持突（闊箭頭）。

Thalassiosira pseudonana

假微型海鏈藻

Hasle & Heimdal, 1970

Phylum: Ochrophyta	門：褐胞藻門
Class: Bacillariophyceae	綱：矽藻綱
Order: Thalassiosirales	目：海鏈藻目
Family: Thalassiosiraceae	科：海鏈藻科



Garcia & Odebrecht, 2009

Synonyms 異名：

Cyclotella nana Hustedt 1957

Description:

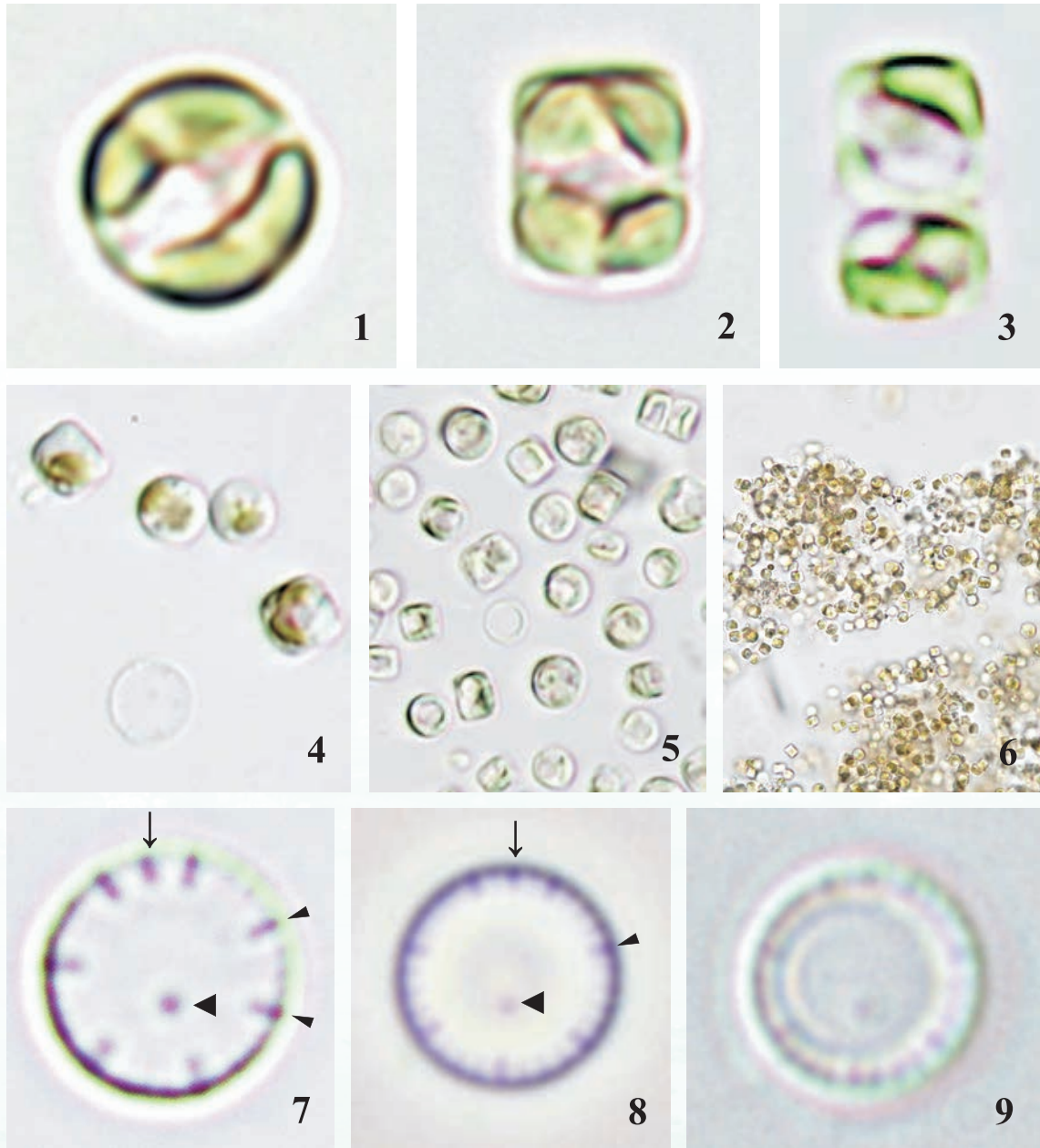
The cell of *Thalassiosira pseudonana* is round and flattened in valve view. It occurs solitarily, or is connected by valve to valve attachment forming loosely short chains or in dense mucilaginous colonies. Hexagonal areolae arrange in radial pattern. The cell size ranges from 3.5 - 9 μm in diameter. The valve bears a ring of marginal fultoportula around 4 - 7 fultoportulae with small external tubes. No central fultoportula is present and 1 eccentric fultoportula occurs. 1 rimoportula occurs between 2 marginal fultoportulae.

描述：

從殼面觀，假微型海鏈藻細胞呈圓形、扁平。細胞可以單獨個體出現、由殼面與殼面相連成鬆散短鏈狀群體、或以嵌埋於濃密膠質內的群體出現。殼面有六角形的小孔呈放射形排列。細胞直徑介乎 3.5 - 9 微米。殼面有一圈殼邊緣支持突，一圈大約有 4 - 7 個有小管的支持突。沒有中央支持突，但有 1 個偏心支持突。在 2 個殼邊緣支持突中間，有 1 個唇形突。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1989	1	-
1992	1	-
1996	1	<i>Chaetoceros</i> sp. 角毛藻
1997	1	-
1998	1	<i>Prorocentrum triestinum</i> 尖葉原甲藻
2001	1	<i>Chaetoceros tenuissimus</i> 細柔角毛藻、 <i>Skeletonema costatum</i> 中肋骨條藻
2003	1	<i>Cyclotella choctawhatcheeana</i> 小環藻
2012	1	-
2014	1	<i>Teleaulax acuta</i> 尖尾全溝藻
2017	1	-
Total/總數：		10



Thalassiosira pseudonana. Figure 1: Cell in valve view showing round shape and each containing yellow-green chloroplasts. Figure 2: Cylindrical in shape in girdle view. Figure 3: Cell undergoes division. Figures 4-5: Cells usually occur solitarily. Figure 6: Cells joined in dense mucilaginous colony. Figures 7-9: Various cells in valve view showing 1 marginal rimoportula (arrows), a ring of marginal fultoportula (narrow arrow heads) and 1 eccentric fultoportula (broad arrow heads).

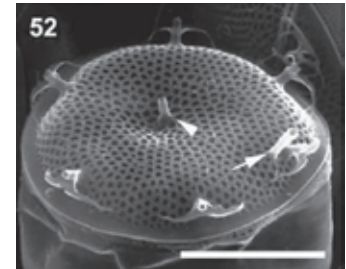
假微型海鏈藻。圖1：細胞的殼面觀顯示細胞呈圓形及每個細胞含有黃綠色葉綠體。圖2：殼環面觀顯示細胞呈圓柱體。圖3：細胞進行分裂。圖4-5：細胞通常以單獨個體出現。圖6：細胞嵌藏於膠質內成群體。圖7-9：多個細胞的殼面觀顯示1個殼邊緣唇形突（箭咀）、一圈支持突（窄箭頭）及1個中央支持突（闊箭頭）。

Thalassiosira tealata

特拉海鏈藻

Takano, 1980

Phylum: Ochrophyta	門：褐胞藻門
Class: Bacillariophyceae	綱：矽藻綱
Order: Thalassiosirales	目：海鏈藻目
Family: Thalassiosiraceae	科：海鏈藻科



Hoppenrath et al., 2007

Description:

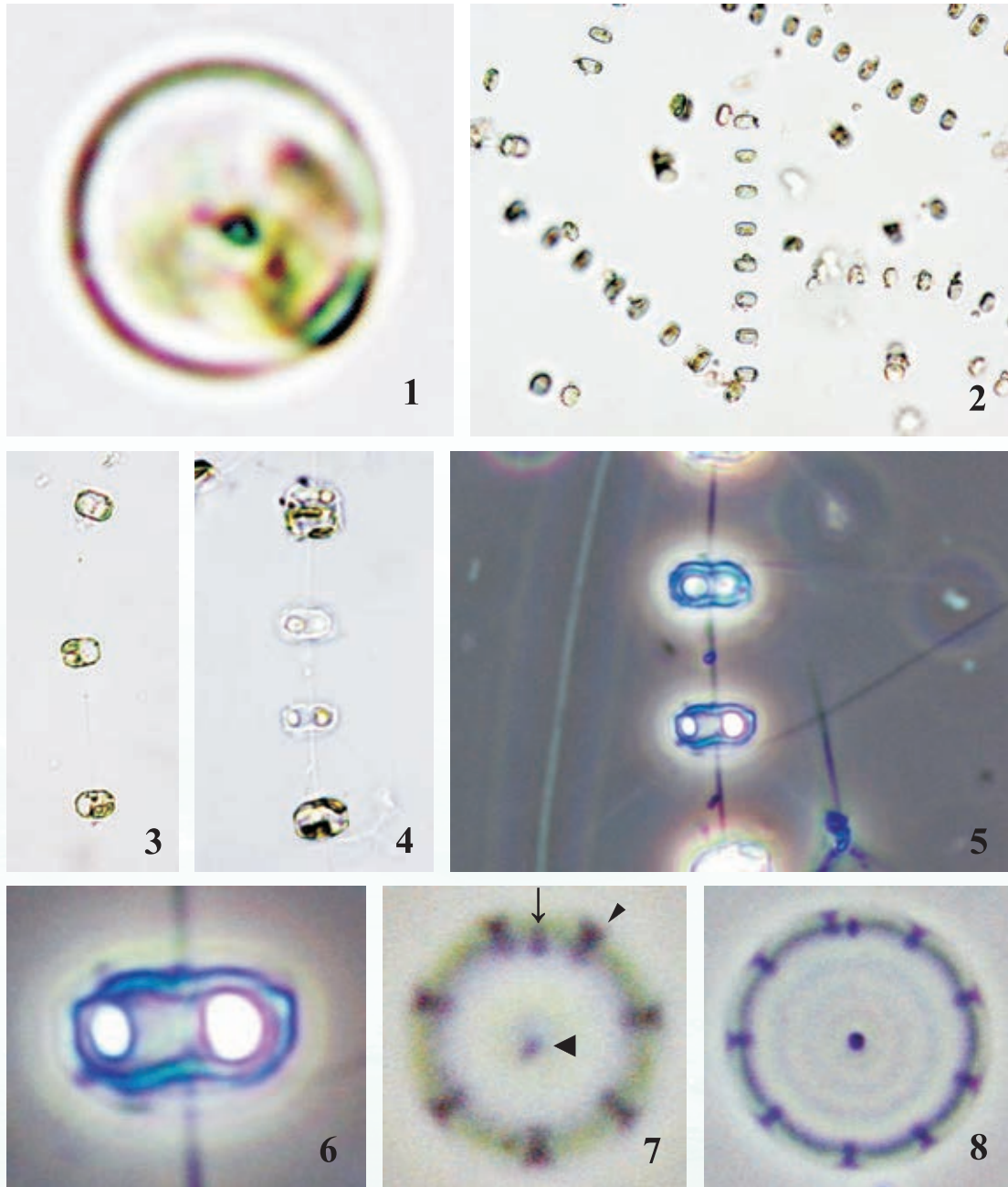
The cell of *Thalassiosira tealata* is round in valve view. It occurs solitarily or is joined by threads or valve to valve connections forming loosely chains. Hexagonal or loculate areolae arrange in fasciculated pattern. The cell size ranges from 6 - 10 μm in diameter. The valve bears a ring of marginal fultoportula around 6 - 10 fultoportulae with external tubes. A central and marginal fultoportulae are armoured with wings. 1 rimoportula with external tube occurs close to one marginal fultoportula.

描述：

從殼面觀，特拉海鏈藻細胞呈圓形。細胞可以單獨細胞個體出現，或以線狀物串連或殼面與殼面相連而成鬆散鏈狀群體出現。殼面有六角形或具隔室的小孔呈束狀排列。細胞直徑介乎6 - 10微米。殼面有一圈殼邊緣支持突，一圈大約有6 - 10個有小管的支持突。中央及殼邊緣支持突有翼狀物。1個有小管的唇形突出現於殼邊緣支持突的附近。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2008	1	-
2010	1	-
2017	1	-
Total/總數：		3



Thalassiosira tealata. Figure 1: Cell in valve view showing round in shape and containing yellow-green chloroplasts. Figure 2: Algal bloom cells from the field. Figures 3-4: Cells connected by mucilaginous thread to make a chain of cells fairly apart from each other. Figures 5-6: Cells in girdle view showing octagonal shape and valve centre is slightly concave. Figures 7-8: Cells in valve view showing 1 marginal rimoportula (arrow) with external tube located closer to 1 fultoportula; a ring of marginal fultoportula (narrow arrow head) is present on the valve margin, each fultoportula having a long external tube with 2 wings on the top; 1 central fultoportula (broad arrow head).

特拉海鏈藻。圖1：細胞的殼面觀顯示細胞呈圓形及含有黃綠色葉綠體。圖2：來自紅潮現場的細胞。圖3-4：細胞由膠質線狀物串連成鏈狀，細胞之間分隔相當距離。圖5-6：細胞的殼環面觀顯示細胞呈八角形及殼正面微凹。圖7-8：細胞的殼面觀顯示在殼邊緣支持突（窄箭頭）的附近有外小管的殼邊緣唇形突（箭咀）；而殼邊緣有一圈殼邊緣支持突（窄箭頭），每個支持突有一附有2個翼狀物於上方的長外小管；1個中央支持突（闊箭頭）。

Trieres mobiliensis

活動盒形藻

(Bailey) Ashworth & Theriot, 2013

Phylum: Ochrophyta

Class: Bacillariophyceae

Order: Triceratales

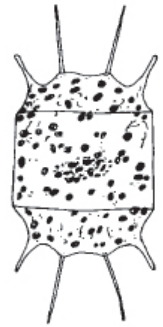
Family: Triceratiaceae

門：褐胞藻門

綱：矽藻綱

目：(未有中文名稱)

科：(未有中文名稱)



Cupp, 1943

Synonyms 異名：

Zygoceros mobiliensis Bailey 1851, *Biddulphia bailey* Smith 1856, *Biddulphia baileyi* Smith 1856, *Biddulphia mobiliensis* (Bailey) Grunow 1882, *Denticella mobiliensis* (Bailey) Grunow 1884, *Odontella mobiliensis* (Bailey) Grunow 1884 and *Odontella mobiliensis* (Bailey) Grunow 1884

Description:

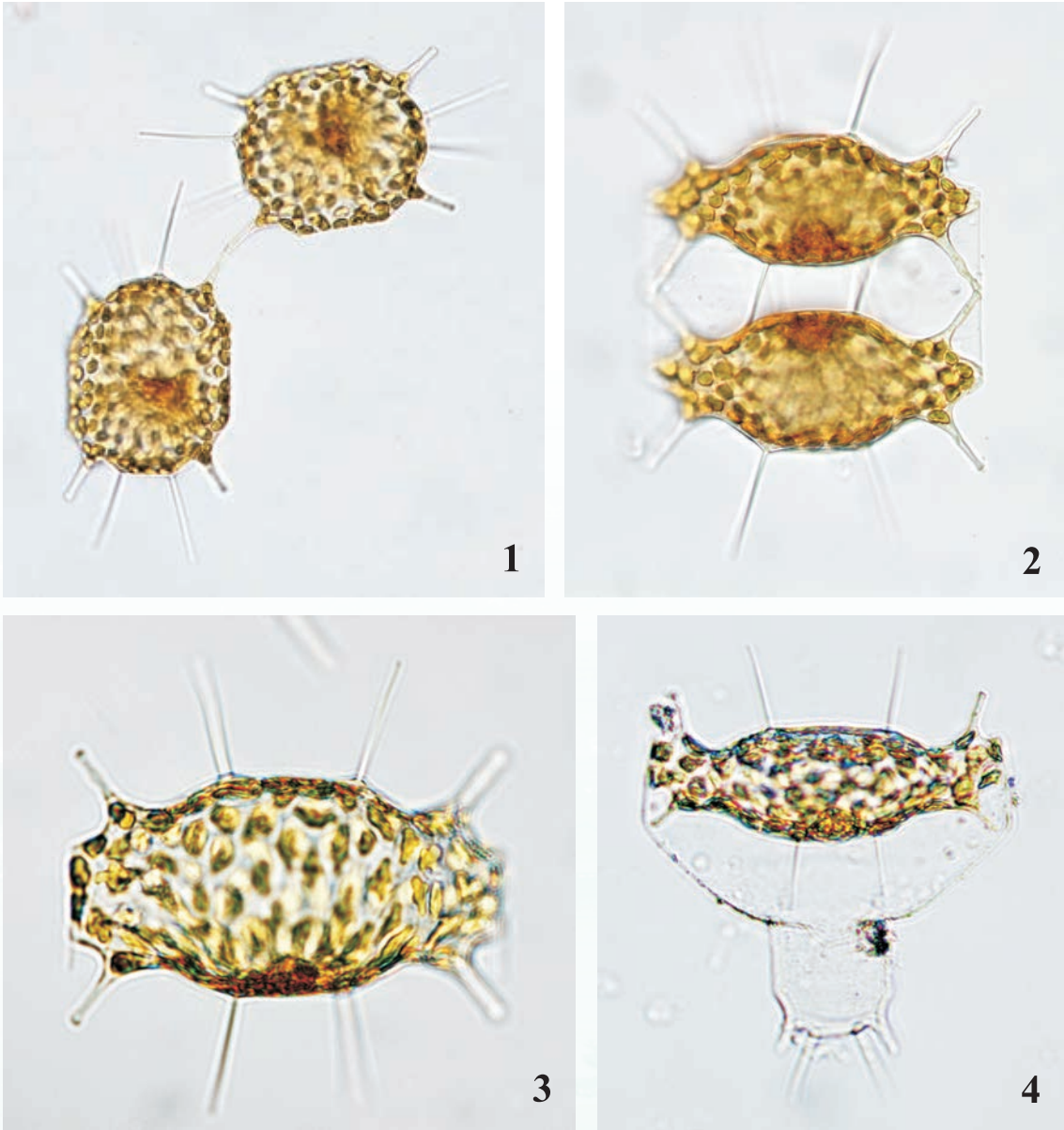
The cell of *Trieres mobiliensis* is oblong or roughly rectangular with long spines arising from the valve surface in girdle view. It mostly occurs solitarily and also in short chain form linked by spines crossing each other. The spines arising from corners of the valve are shorter than spines arising in valve centre with bluntly round tips. In valve view, the cell is elliptical to lanceolate. The cell size ranges from 45 - 200 μm in apical axis. Each cell contains numerous small granular chloroplasts lying on the cell periphery.

描述：

從殼環面觀，活動盒形藻細胞呈長橢圓形或大致長方形，長刺由殼面伸出。這種藻大多以單獨個體出現或偶有由細胞刺互相交叉而串連成短鏈狀。由殼面角邊伸出的細胞刺較由殼面中央位置伸出的細胞刺為短，且刺端較鈍圓。從殼面觀，細胞呈橢圓形或披針形。細胞縱軸長介乎45 - 200微米。細胞的周邊表面有大量細小顆粒狀的葉綠體。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數:

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1989	1	-
Total/總數：		1



Trieres mobiliensis. Figures 1-3: Various cells in girdle view showing an oblong or roughly rectangular shape; numerous small granular chloroplasts lying on the cell periphery. Figure 4: Auxospore formation.

活動盒形藻。圖1-3：不同細胞的殼環面觀顯示細胞呈長橢圓形或長方形；細胞周邊表面布滿大量細小顆粒狀的葉綠體。圖4：複大孢子的形成。

Trieres sinensis

中華盒形藻

(Greville) Ashworth & Theriot, 2013

Phylum: Ochrophyta

門：褐胞藻門

Class: Bacillariophyceae

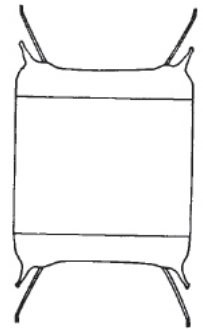
綱：矽藻綱

Order: Triceratiales

目：(未有中文名稱)

Family: Triceratiaceae

科：(未有中文名稱)



Tomas et al., 1997

Synonyms 異名：

Odontella sinensis Grunow 1884

Description:

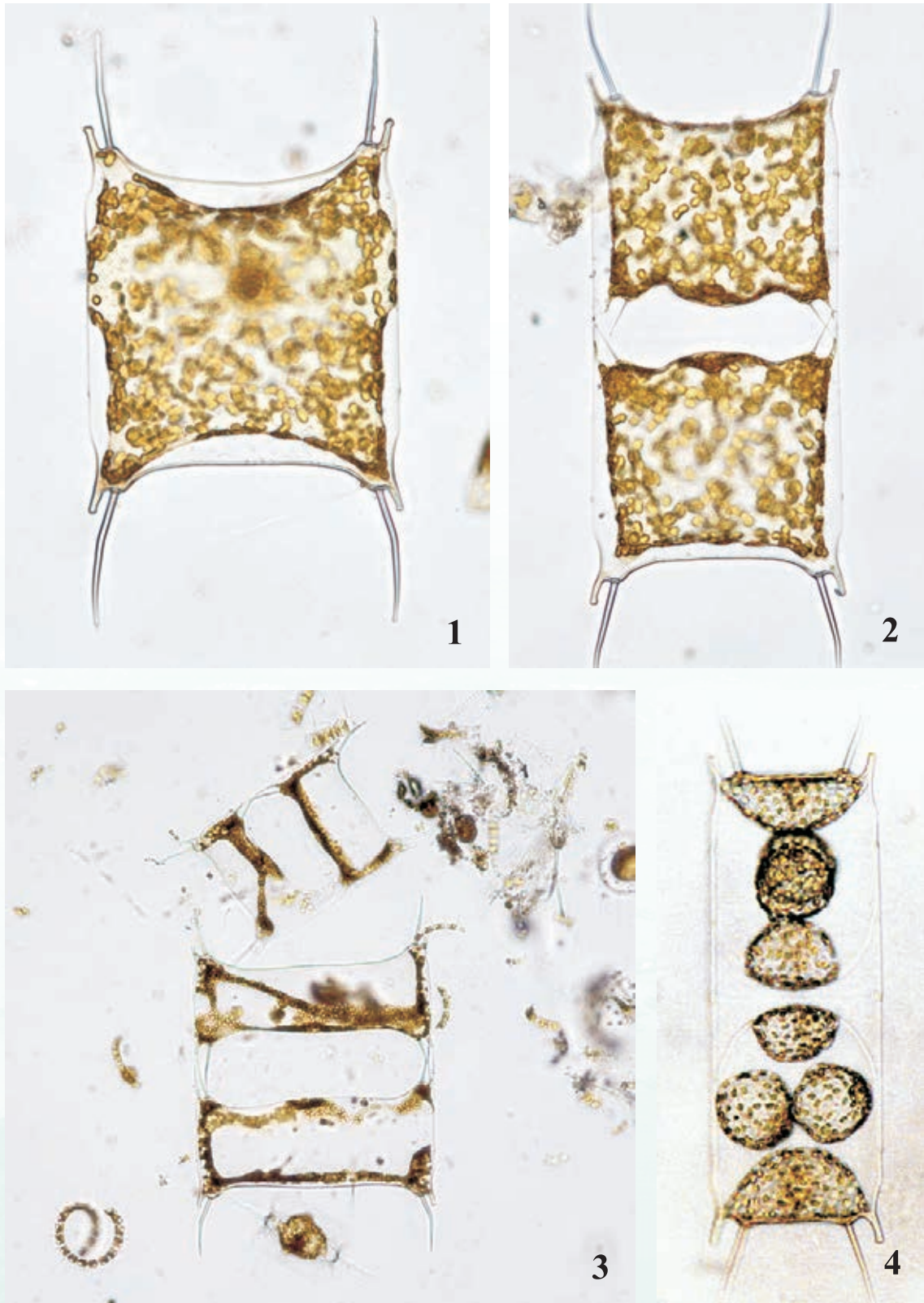
The cell of *Trieres sinensis* is rectangular or square with long spines arising from valve edges in girdle view. It mostly occurs solitarily and also in short chain form linked by the spines crossing each other. 1 long bent spine and 1 short blunt spine arise from the valve corners and they are nearly parallel to the cell axis. The valve face between spines is flat or concave. In valves view, the cell is narrowing lanceolate in shape. The cell size ranges from 90 - 325 μm in apical axis. The cell contains numerous small granular chloroplasts lying on the cell periphery.

描述：

從殼環面觀，中華盒形藻細胞呈矩形或正方形，長刺由殼邊緣伸出。這種藻大多以單獨個體出現或由細胞刺互相交叉而串連成短鏈狀。殼邊緣有1條微彎長刺及1條短鈍刺，刺伸出的方向與細胞軸心平行。刺與刺之間的殼面表面扁平或略凹。從殼面觀，細胞呈狹窄披針形。細胞縱軸長介乎90 - 325微米。細胞的周邊表面有大量細小顆粒狀的葉綠體。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1992	1	<i>Noctiluca scintillans</i> 夜光藻
Total/總數：	1	



Trieres sinensis. Figures 1-3: Various cells in girdle view showing a square or rectangular shape; numerous small granular chloroplasts lying on the cell periphery. Figure 4: Cell undergoes division.

中華盒形藻。圖1-3：不同細胞的殼環面觀顯示細胞可呈正方形或長方形；細胞周邊表面布滿大量細小顆粒狀的葉綠體。圖4：細胞進行分裂中。

第三章
Chapter 3

DINOFLAGELLATES

甲藻



Morphology

Dinoflagellates (Dinophyceae) are a group of microscopic, unicellular organisms that can swim freely by means of two flagella. The ribbon-like transverse flagellum lies in a groove-like structure around the equator of the organism, providing forward and rotational motion, while the longitudinal flagellum trails behind providing little propulsive force and mainly serving as a rudder. Conventionally, the side of the cell from which the flagella originate is named the ventral side. Dinoflagellates are basically round in shape and some species are chain-forming occasionally. Their size range is commonly between 5 - 2,000 μm in length or diameter. The vast majority of dinoflagellates species are marine, pelagic or benthic but some live in freshwater lakes, rivers and swamps/marshes.

Dinoflagellates are often divided into: 1) armoured dinoflagellates (possessing a theca or cellulose plates), and 2) naked dinoflagellates (without a theca). Figure 18 illustrates the morphology and cellular structure of dinoflagellate.

- 1) Armoured dinoflagellates: The cell wall of many dinoflagellates is divided into cellulosic plates known as theca. The taxonomy of these thecated dinoflagellates is mostly based on the number of plates, the arrangement, shape and structure of the theca e.g. *Alexandrium* spp.
- 2) Naked dinoflagellates: They have smooth and flexible cell walls and the taxonomy is mostly based on the shape and structure e.g. *Karenia* spp.

形態

甲藻（甲藻綱）是一組微小的單細胞生物，可自由游動，具有兩根鞭毛。橫鞭毛嵌藏於環繞細胞橫溝的槽狀結構內，提供前進推動力和旋轉力；縱鞭毛在後方拖曳，提供很少的推進動力，主要作方向舵。大部分甲藻呈圓型，有些品種間中可相連成鏈狀。甲藻的長度或直徑介乎5 - 2,000微米不等，大多數的品種是在海洋浮游的或底棲的生長，但亦可以在淡水湖、河流及沼澤／濕地生長。甲藻一般分為：（1）具有殼片甲藻（長有殼片或細胞甲片）和（2）不具殼片甲藻（沒有殼片）。圖18顯示甲藻的形態及細胞結構。

- 1) 具有殼片甲藻：許多甲藻的細胞壁由很多纖維素質甲片組成，稱為殼片。主要根據殼片的數目、排列方式、形狀及結構分類，例如亞歷山大藻屬。
- 2) 不具殼片甲藻：細胞壁平滑富彈性，主要根據形狀及結構分類，例如凱倫藻屬。

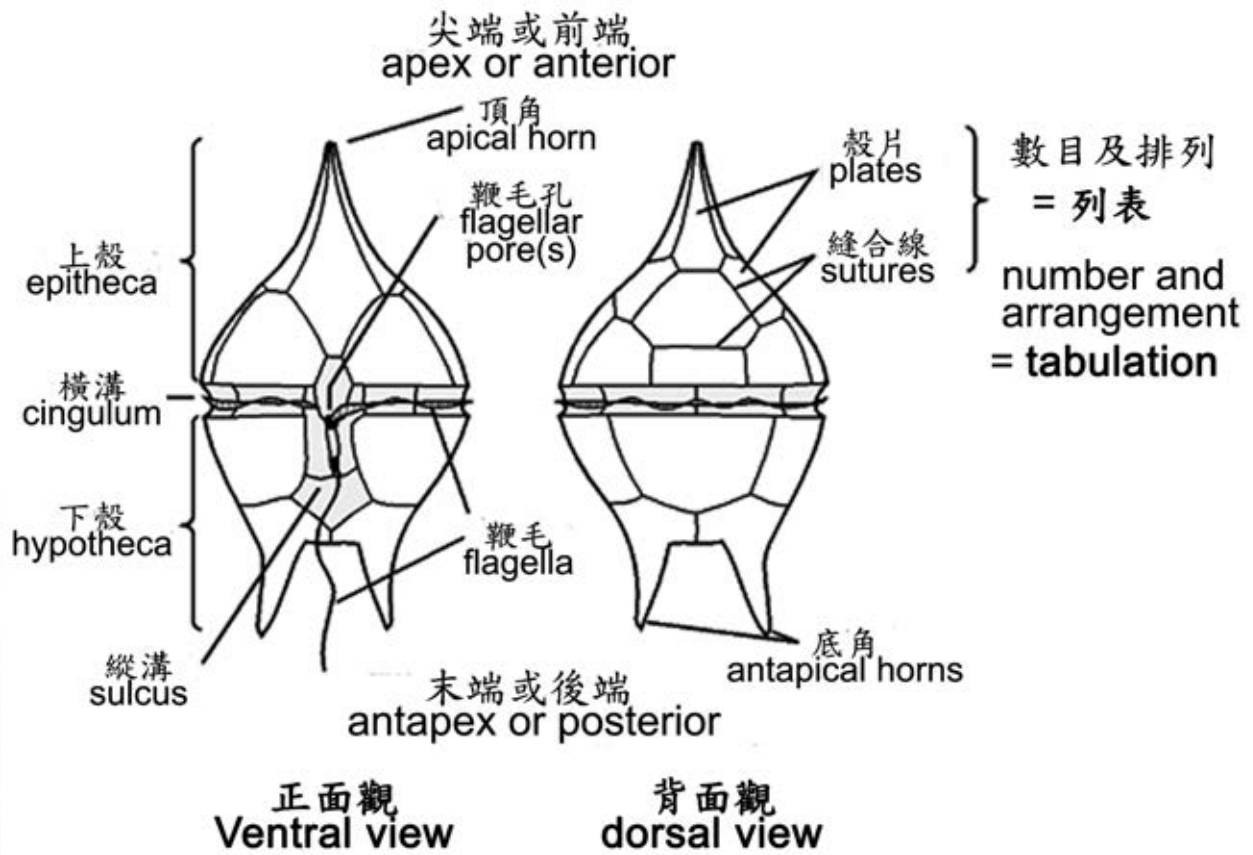


Figure 18. The morphology and cellular structure of dinoflagellate
圖18 甲藻的形態及細胞結構

Akashiwo sanguinea

血紅赤潮藻

(Hirasaka) Hansen & Moestrup, 2000

Phylum: Myzozoa

Class: Dinophyceae

Order: Gymnodiniales

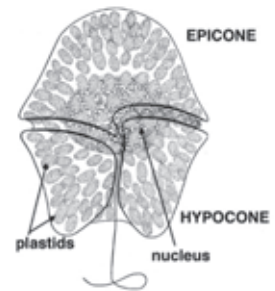
Family: Gymnodiniaceae

門：黏孢子門

綱：甲藻綱

目：裸甲藻目

科：裸甲藻科



Hulburt, 1957

Synonyms 異名：

Gymnodinium sanguineum Hirasaka 1922, *Gymnodinium sanguineum* Hirasaka 1924, *Gymnodinium splendens* Lebour 1925 and *Gymnodinium nelsonii* Martin 1929

Description:

Akashiwo sanguinea is an unarmoured species. The cell is large, solitary and variable in shape, roughly round to pentagonal. In ventral view, the epicone is bluntly round; the hypocone has 2 prominent posterior lobes and 1 incised sulcus. The cell is dorsoventrally flattened and the size ranges from 40 - 70 μm in length. The cingulum is nearly median and slightly descending. The apical groove is present and encircling the cell apex clockwise. The cell has a large number of yellowish brown chloroplasts radiating from the centre of the cell. 1 large nucleus is located at the centre of cell.

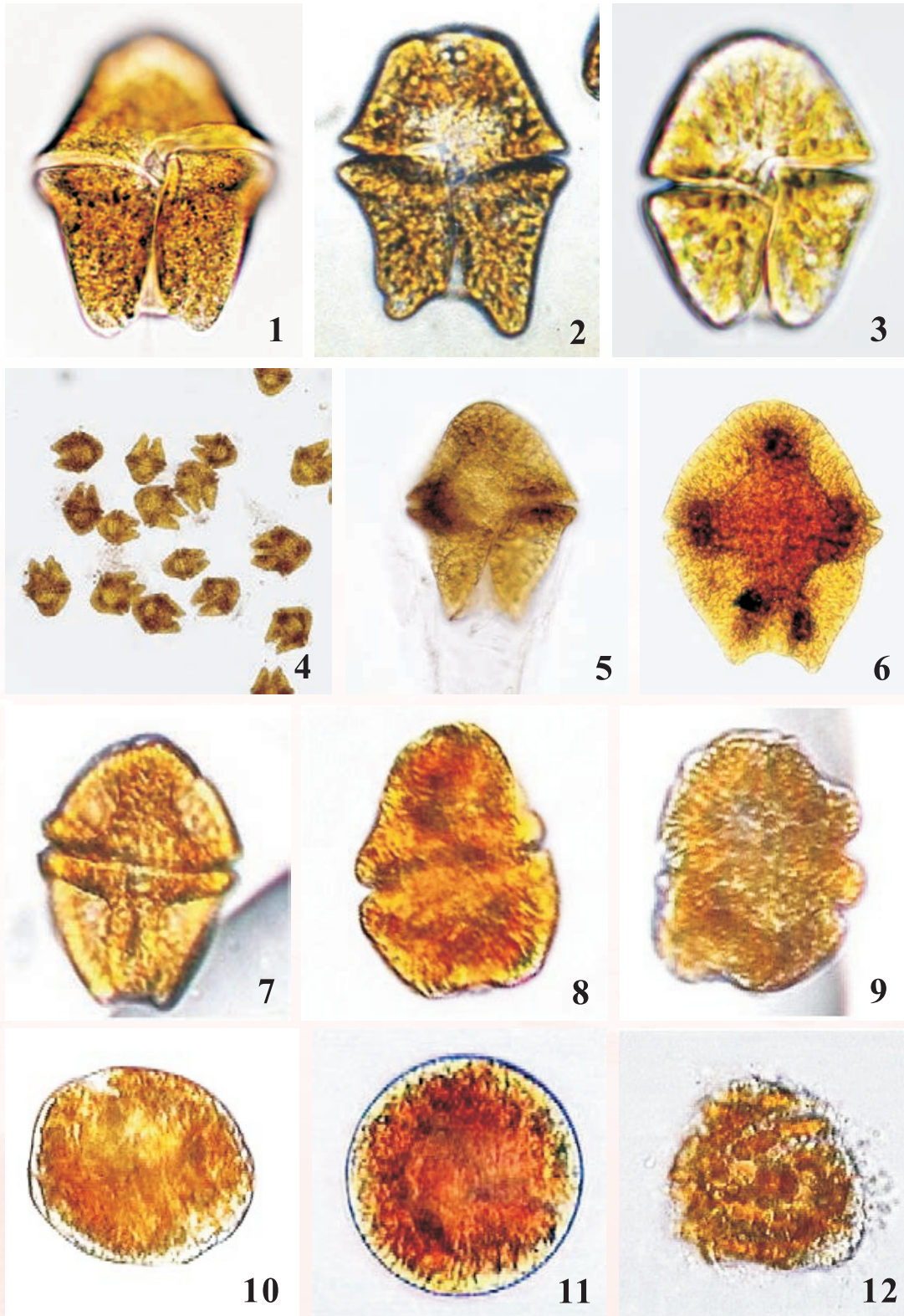
描述：

血紅赤潮藻是不具殼片藻類，細胞體大、單獨個體、體型多變或呈圓形至五邊形不等。細胞正面觀，上殼鈍圓，下殼有2塊明顯的後端圓形突出物及1條像切割的縱溝。細胞背腹略為扁平，體長介乎40 - 70微米。環溝接近中間位置，略向下移。頂槽順時針環繞着細胞頂端。細胞內有大量黃褐色葉綠體自細胞中央呈放射形排列。1個大細胞核位於細胞中央。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

From 1975 to 2017, 18 red tide incidents caused by *Akashiwo sanguinea* were recorded in Hong Kong waters. Refer to Appendix V for detailed information.

由1975年至2017年間，香港水域共錄得18宗由血紅赤潮藻引發的紅潮個案。有關資料詳情請參閱附錄五。



Akashiwo sanguinea. Figures 1-3: Live cells with various shapes. Figures 4-6: Fixed cells. Figures 7-12: This live cell was photographed in time series (approx. 1 hour) from healthy to round and then burst.

血紅赤潮藻。圖1-3：不同形狀的活體細胞。圖4-6：以固定劑固定的細胞。圖7-12：活細胞連續拍攝的照片（約一小時），細胞由健康狀態演變至圓形及至爆裂情況。

Alexandrium catenella

鏈狀亞歷山大藻

(Whedon & Kofoid) Balech, 1985

Phylum: Myzozoa

Class: Dinophyceae

Order: Gonyaulacales

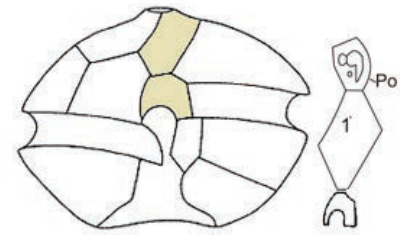
Family: Gonyaulacaceae

門：黏孢子門

綱：甲藻綱

目：膝溝藻目

科：膝溝藻科



Tomas et al., 1997

Synonyms 異名：

Gonyaulax catenella Whedon & Kofoid 1936, *Gonyaulax washingtonensis* Hsu 1967, *Protogonyaulax catenella* (Whedon & Kofoid) Taylor 1979, *Gessnerium catenellum* (Loeblich III & Loeblich) Taylor 1979 and *Gessnerium catenella* (Whedon & Kofoid) Taylor 1979

Description:

Alexandrium catenella occurs as a single cell or more often in short chains of 2, 4 or 8 cells. The cell is round in shape, size ranges of 20 - 42 μm in length, 22 - 44 μm in width, with a round apex and a slightly concave antapex. The width of the cell is slightly wider than its length and the cell surface is lightly porulated. The apical pore plate (Po) is broadly triangular with a larger anterior attachment pore (a.a.p.). The first apical plate directly connects to Po. The ventral pore (vp) is consistently absent. The apical pore plate houses the characteristic fishhook-shaped foramen. In chains, both anterior and posterior attachment pores are present. The nucleus is large and in U-shaped.

Toxicity:

A. catenella is a strong Paralytic Shellfish Poisoning (PSP) toxins producer and the toxicity of the Hong Kong strain is confirmed. The PSP toxins (C1 - C4 toxins, saxitoxins and gonyautoxins), transmitted via contaminated shellfish, can affect humans, other mammals and possibly fish.

描述：

鏈狀亞歷山大藻以單細胞出現，或較常是由2、4或8個細胞串連成短鏈狀，細胞為圓形，體長介乎20 - 42微米，闊介乎22 - 44微米，頂端偏圓而底部末端稍凹。細胞闊度稍大於長度及細胞表面有淺孔紋，頂孔甲(Po)呈闊三角形，有較大的前黏附孔(a.a.p.)。第一片頂甲片與頂孔甲(Po)相連接，一貫沒有腹孔(vp)。頂孔甲內是獨特的魚鉤形殼頂孔。當細胞串連成鏈狀時，前後黏附孔均清晰可見。細胞核大呈U形。

毒性：

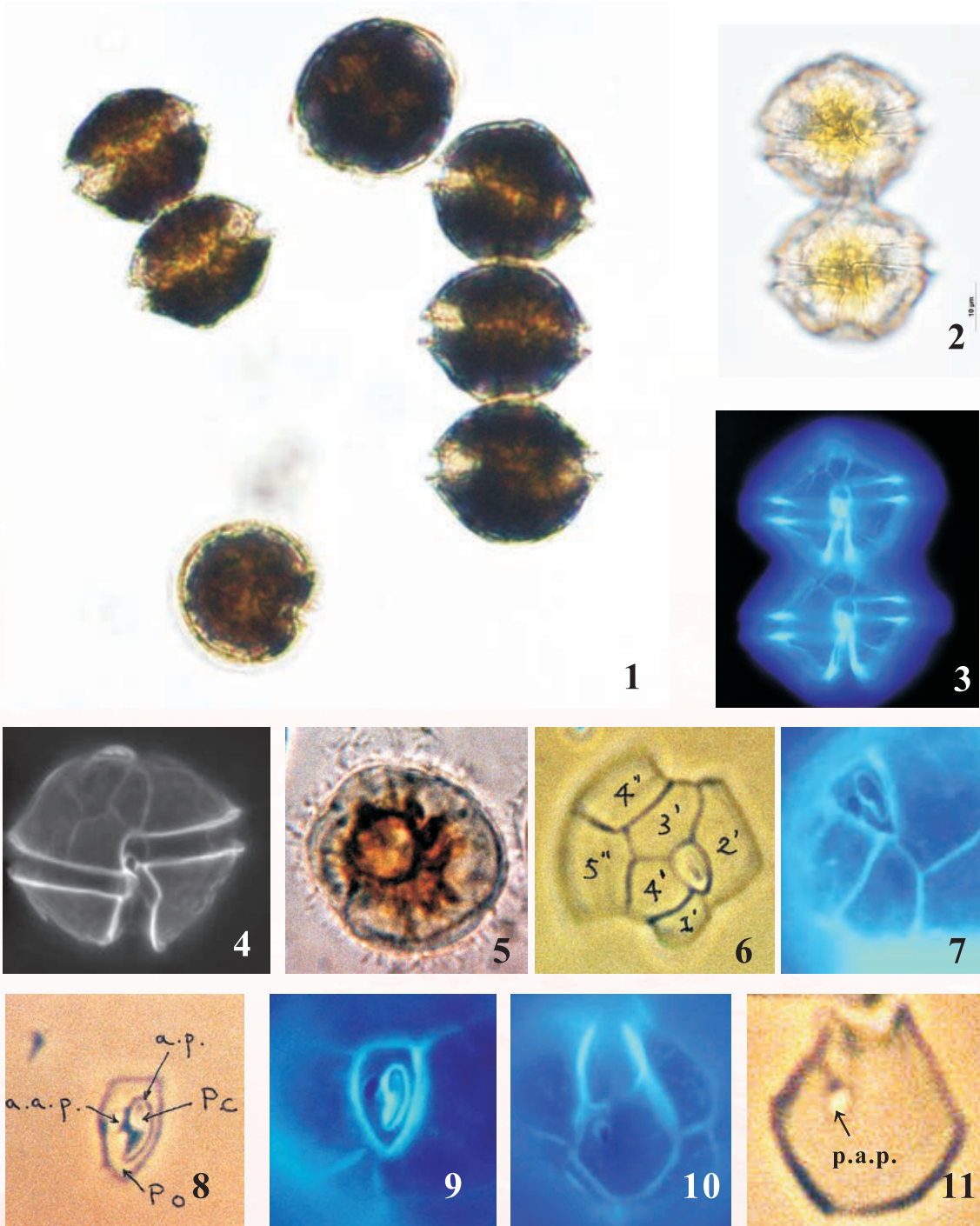
鏈狀亞歷山大藻可製造極強的麻痺性貝類毒素，香港的藻株已證實有毒性。麻痺性貝類毒素（C1 - C4毒素、蛤蚌毒素 / 石房蛤毒素及膝溝藻毒素）是透過受污染的貝類傳播，對人類和其他哺乳類動物均構成影響，並可能危害魚類。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1989 ¹	1	-
2011	1	-
Total/總數：	2	

1 In 1989, Paralytic Shellfish Poisoning (PSP) toxins exceeding the regulatory limit were detected from green mussel samples during this red tide bloom in south region of Hong Kong waters. The affected shellfish was then confiscated from market.

1989年於香港南面水域爆發的紅潮中，青口樣本被驗出超出限制的麻痺性貝類毒素，市場上的有關的貝類隨後被銷毀。



Alexandrium catenella. Figures 1-2: Fixed cells. Figure 3-4: Epifluorescent stained cells. Figure 5: Cyst. Figure 6: Epitheca showing the 1' plate without ventral pore (vp). Figure 7: Epifluorescent stained cell showing the apical pore plate (Po). Figures 8-9: The apical pore plate (Po) with an anterior attachment pore (a.a.p.). Figures 10-11: The posterior sulcal plate with a posterior attachment pore (p.a.p.).

鏈狀亞歷山大藻。圖1-2：以固定劑固定的細胞。圖3-4：熒光染色的細胞。圖5：包囊。圖6：上殼頂顯示第一片甲片沒有腹孔（vp）。圖7：熒光染色的細胞顯示細胞的頂孔甲（Po）。圖8-9：有前黏附孔（a.a.p.）的頂孔甲（Po）。圖10-11：有後黏附孔（p.a.p.）的後縱溝甲片。

Alexandrium tamarense

塔馬亞歷山大藻

(Lebour) Balech, 1995

Phylum: Myzozoa

Class: Dinophyceae

Order: Gonyaulacales

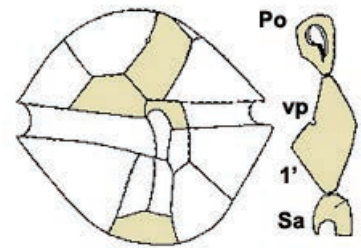
Family: Gonyaulacaceae

門：黏孢子門

綱：甲藻綱

目：膝溝藻目

科：膝溝藻科



Tomas et al., 1997

Synonyms 異名：

Gonyaulax tamarensis Lebour 1925, *Gonyaulax tamarensis* var. *excavate* Braarud 1945, *Gonyaulax excavata* (Braarud) Balech 1971, *Gessnerium tamarensis* (Lebour) Loeblich III & L. Loeblich 1979, *Protogonyaulax excavate* (Braarud) Taylor 1979, *Protogonyaulax tamarensis* (Lebour) Taylor 1979 and *Alexandrium excavatum* (Braarud) Balech & Tangen 1985

Description:

Alexandrium tamarense is small to medium in size, nearly spherical, its length is slightly longer than its width with cell size in the range of 22 - 51 μm in length, 17 - 50 μm in width. The cell occurs solitarily or in pairs, and less commonly in fours. Paired cells may contain an anterior attachment pore (a.a.p.) and a posterior attachment pore (p.a.p.). The thecal plates are thin and smooth. The first apical plate has 1 small ventral pore and directly connects to the apical pore plate (Po). Po houses 1 large fishhook-shaped foramen and 1 small round anterior attachment pore.

Toxicity:

A. tamarense is a paralytic shellfish poisoning (PSP) producer and the toxicity of the Hong Kong strain is confirmed. The PSP toxins (gonyautoxins, neosaxitoxin and saxitoxin), transmitted via contaminated shellfish, can affect humans or other mammals and possibly fish. No fish kill or harmful effects were recorded in Hong Kong.

描述：

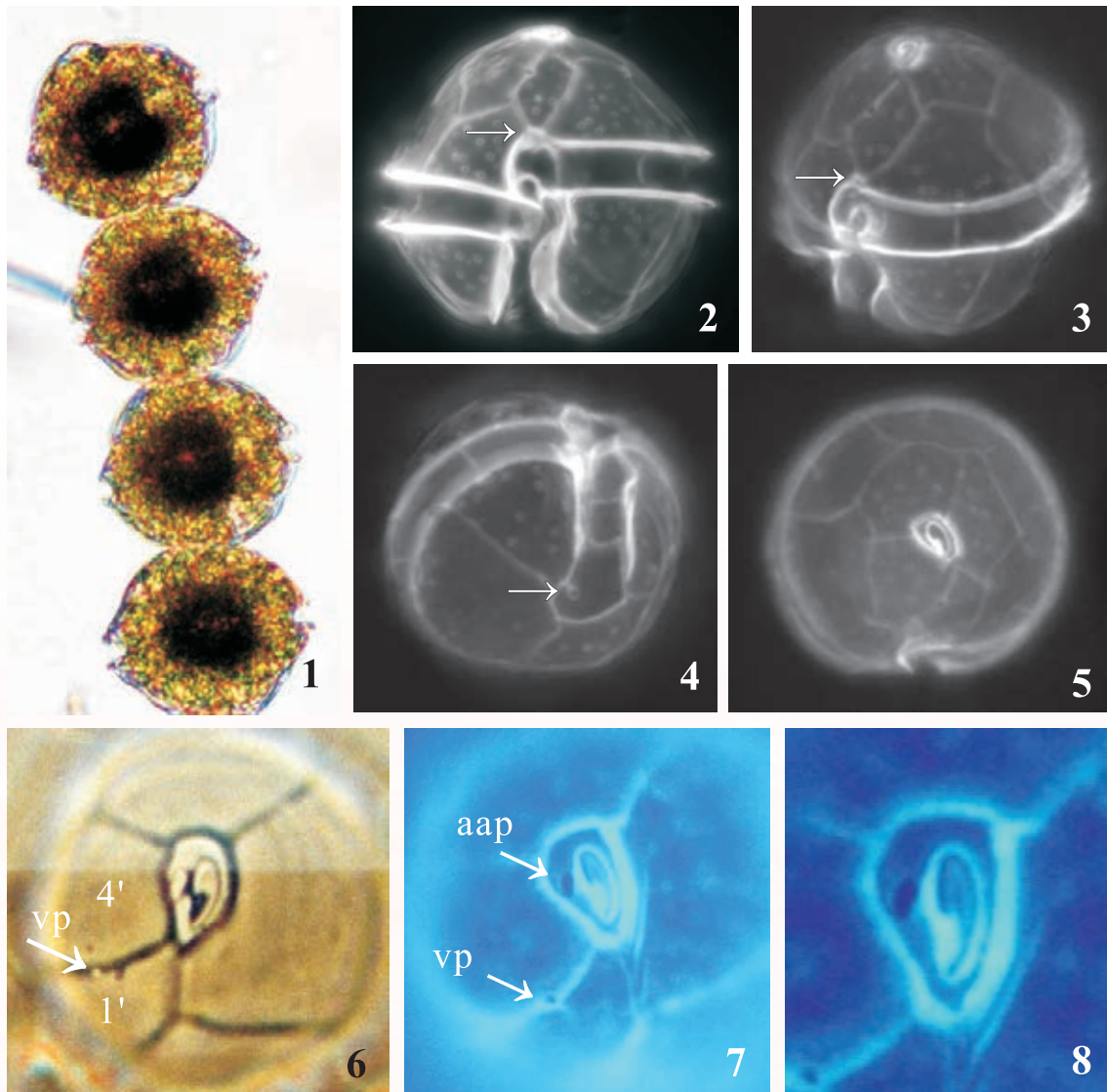
塔馬亞歷山大藻屬小至中型大小，細胞近球形，長度稍大於闊度，體長介乎22 - 51微米，闊介乎17 - 50微米。細胞以單獨個體或成對出現，亦偶有四個串連成鏈狀。成對細胞可能有前黏附孔(a.a.p.)及後黏附孔(p.a.p.)，殼片薄而平滑，第一片頂甲片有1小腹孔，直接與頂孔甲(Po)相連接。頂孔甲內有1寬大魚鉤形殼頂孔及1小圓形前連接孔。

毒性：

塔馬亞歷山大藻會產生麻痺性貝類毒素，香港藻株已證實有毒性。麻痺性貝類毒素(膝溝藻毒素、新蛤蚌毒素 / 新石房蛤毒素及蛤蚌毒素 / 石房蛤毒素)是透過受污染的貝類傳播，對人類或其他哺乳類動物均構成影響，並可能危害魚類。不過，在香港並沒有塔馬亞歷山大藻造成魚類死亡或其他有害影響的記錄。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1991	1	<i>Noctiluca scintillans</i> 夜光藻
1993	1	<i>Noctiluca scintillans</i> 夜光藻
Total/總數：	2	



Alexandrium tamarense. Figure 1: Fixed cells in chain form. Figures 2-3: Epifluorescent stained cells showing anterior sulcal plate with a “plica” (arrow). Figure 4: Antapical view showing the posterior sulcal plate with a posterior attachment pore (p.a.p.) (arrow). Figures 5-8: Apical view showing the apical pore plates with an anterior attachment pore (a.a.p.) and the 1' plate with ventral pore (vp).

塔馬亞歷山大藻。圖1：以固定劑固定的鏈狀細胞。圖2-3：熒光染色的細胞顯示有皺襞（箭咀）的前縱溝甲。圖4：底面觀顯示後縱溝甲片有後黏附孔（p.a.p.）（箭咀）。圖5-8：頂面觀顯示有前黏附孔（a.a.p.）的頂孔甲片以及有腹面孔（vp）的第一片甲片。

Cochlodinium convolutum

卷曲旋溝藻

Kofoid & Swezy, 1921

Phylum: Myzozoa

Class: Dinophyceae

Order: Gymnodiniales

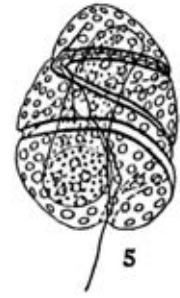
Family: Gymnodiniaceae

門：黏孢子門

綱：甲藻綱

目：裸甲藻目

科：裸甲藻科



Kofoid & Swezy, 1921

Description:

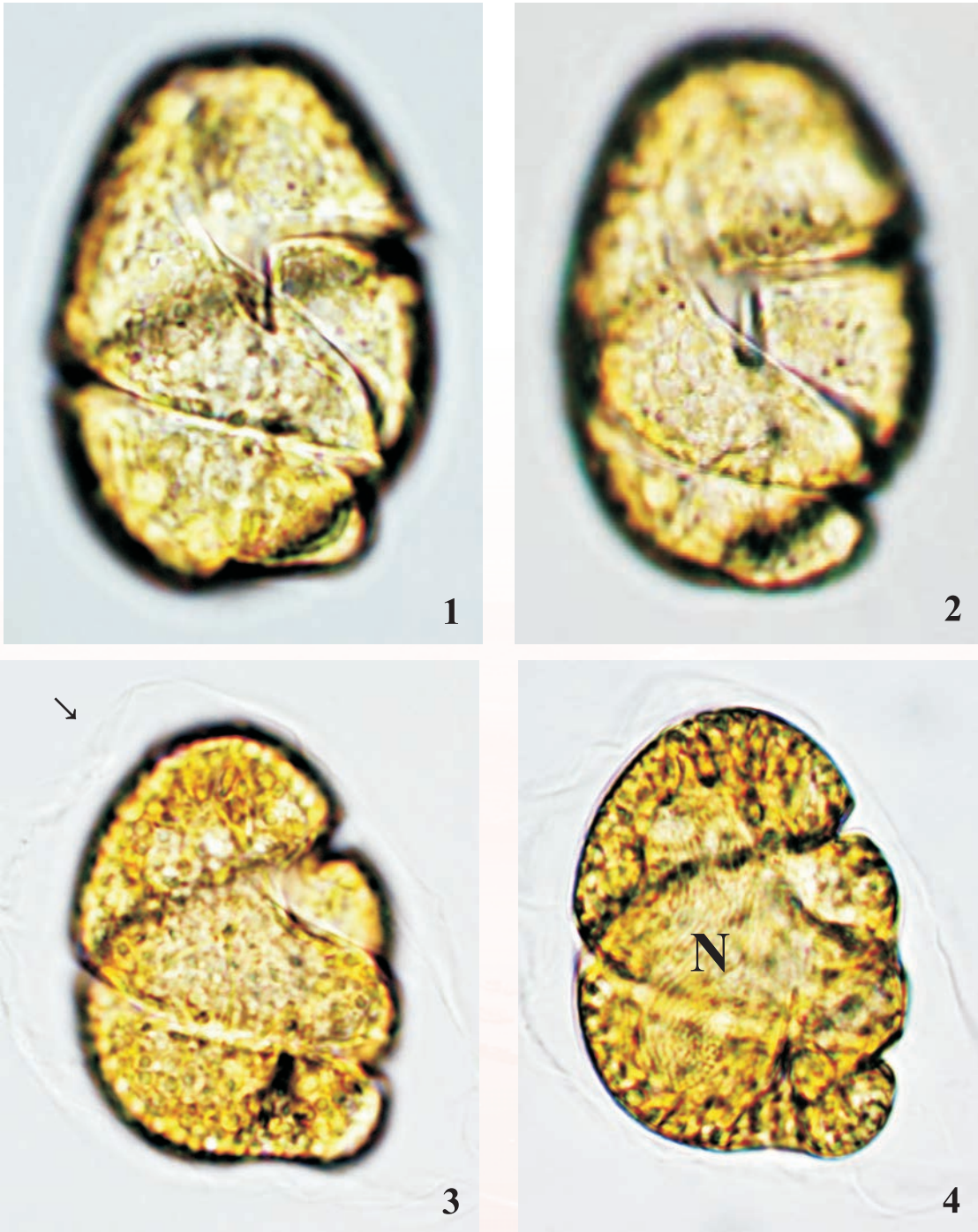
Cochlodinium convolutum is an unarmoured species without thecal plate. The cell is ovoid-shaped without eye spot. The epicone becomes slender toward the apex and the hypocone is wide and round. The girdle makes 1.5 turns around the cell. This species rarely forms a pair but mostly occurs solitarily. The cell size ranges from 40 - 70 μm in length and about 28 - 45 μm in width. A rectangular nuclear is located at the centre and the left ventral side of the cell.

描述：

卷曲旋溝藻是不具殼片甲藻，細胞呈橢圓形，沒有眼點。上殼漸向殼頂呈修長形狀，而下殼則闊及圓。殼環帶環繞細胞1.5周。這種藻很少成對出現，多以單獨個體出現。細胞體長介乎40 - 70微米，寬約28 - 45微米。細胞有一矩形細胞核位於細胞的中央偏左前方。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2017	1	<i>Noctiluca scintillans</i> 夜光藻
Total/總數：	1	



Cochlodinium convolutum. Figures 1-2: The same live solitary cell in ventral view at different focus plates showing the deep sulcus extending into the hypocone. Figure 3: Cell in right lateral view showing a hyaline membrane (arrow) around the cell. Figure 4: Nucleus (N) is located in the centre of the cell.

卷曲旋溝藻。圖1-2：同一細胞於不同焦距下的正面觀顯示深嵌的縱溝伸延至細胞上殼。圖3：細胞的右側面觀顯示有一透明膜（箭咀）包圍細胞。圖4：細胞核（N）位於細胞中心。

Gonyaulax polygramma

多紋膝溝藻

Stein, 1883

Phylum: Myzozoa

Class: Dinophyceae

Order: Gonyaulacales

Family: Gonyaulacaceae

門：黏孢子門

綱：甲藻綱

目：膝溝藻目

科：膝溝藻科



Tomas et al., 1997

Synonyms 異名：

Gonyaulax schuettii Lemmermann 1899

Description:

The cell of *Gonyaulax polygramma* is elongated and pentagonal in shape. It is medium-sized and mostly occurs solitarily. The cell size ranges from 29 - 75 μm in length and 26 - 56 μm in width. The epitheca bears an apical horn and 1 - 3 antapical spines are present at the end of truncated hypotheca. The theca plates between longitudinal ridges are reticulated with numerous pores. A large oval nucleus is located posteriorly.

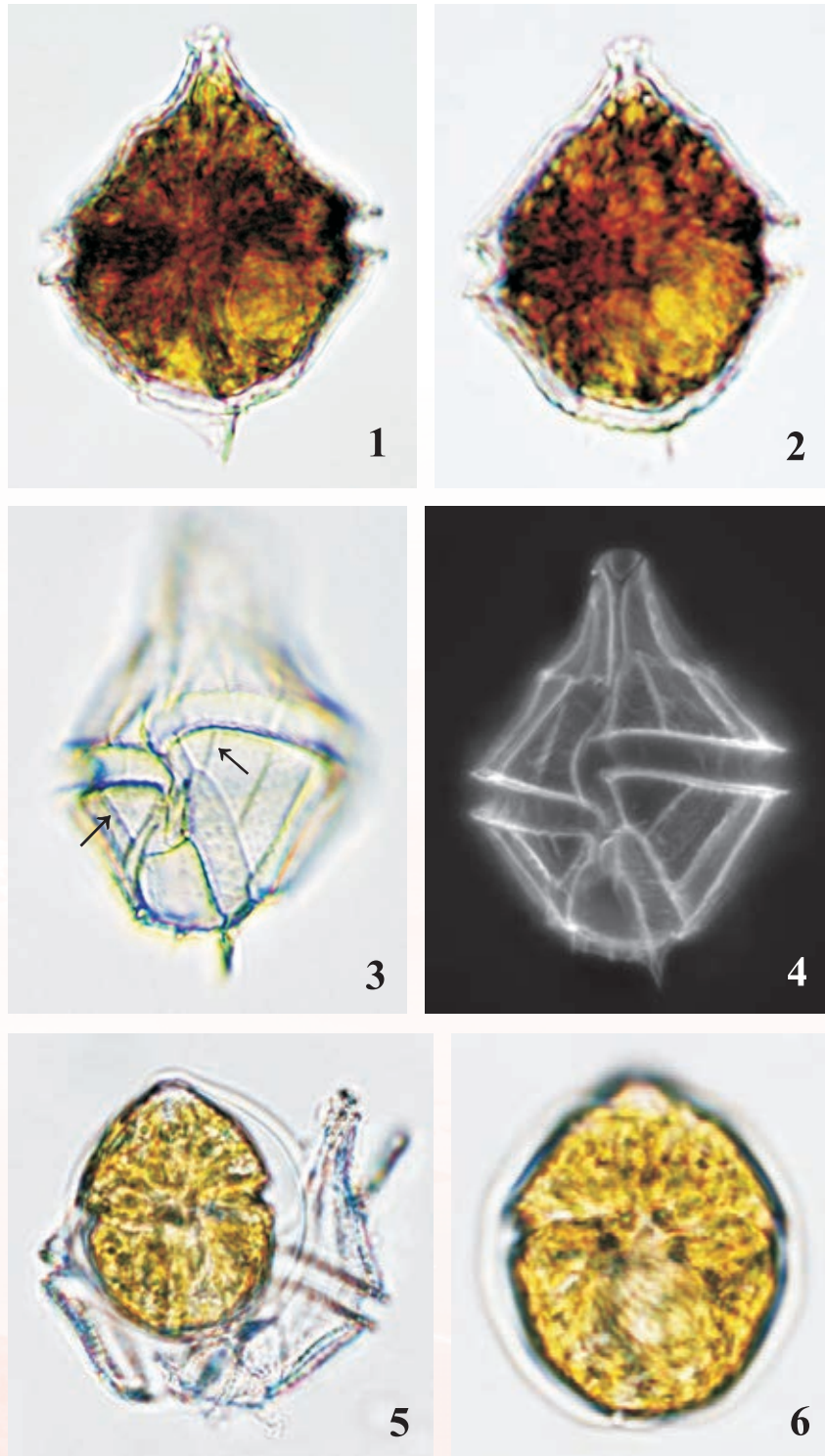
描述：

多紋膝溝藻細胞體長，呈五邊形。屬中型細胞、多以單獨個體出現。細胞長介乎29 - 75微米，闊介乎26 - 56微米。上殼有頂角，下殼呈鈍圓形，有1 - 3根底部短刺。在縱向條紋之間的殼片表面上布滿網狀小孔。細胞核大，呈卵形，位於細胞後端。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

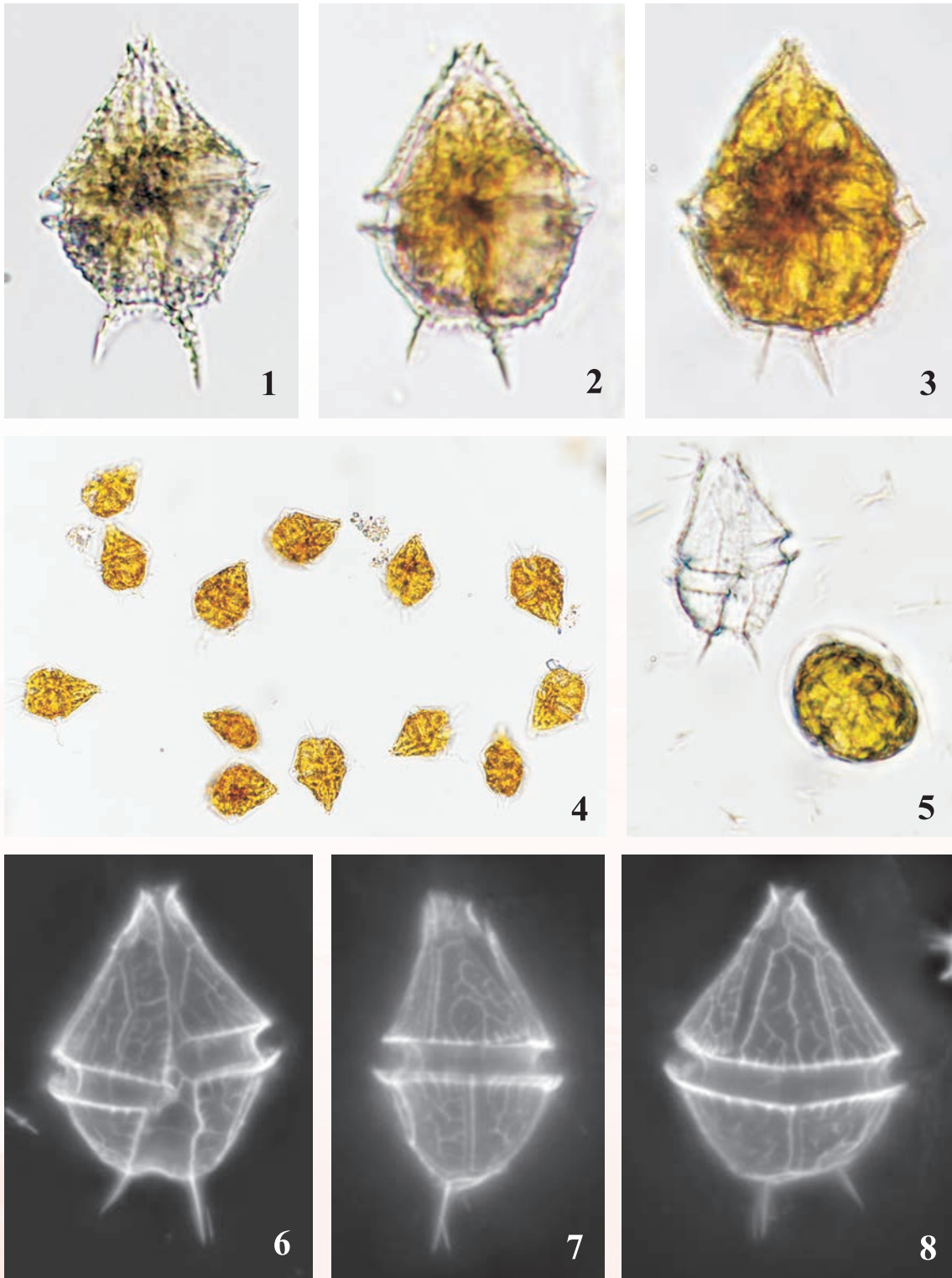
From 1975 to 2017, 56 red tide incidents caused by *Gonyaulax polygramma* were recorded in Hong Kong waters. Refer to Appendix VI for detailed information.

由1975年至2017年間，香港水域共錄得56宗由多紋膝溝藻引發的紅潮個案。有關資料詳情請參閱附錄六。



Gonyaulax polygramma. Figures 1-2: Fixed cells in ventral view showing nucleus located posteriorly with 1- 3 antapical spines at the end of hypotheca. Figure 3: Cingulum displaced 1.5 times the cingulum width; theca plates ornamented with longitudinal ridges (arrows), thecal reticulæ and numerous pores. Figure 4: Epifluorescent stained cell. Figures 5-6: Resting cysts.

多紋膝溝藻。圖1-2：以固定劑固定的細胞正面觀顯示細胞核位於細胞後端及下殼片有1-3條底端部尖刺。圖3：橫溝始末位移約為橫溝闊度的1.5倍；殼片有縱向條紋（箭咀）、殼網紋及大量小孔。圖4：熒光染色的細胞。圖5-6：休眠包囊。



Gonyaulax verior. Figures 1-3: Fixed cells in ventral view showing 2 antapical spines at the end of hypotheca. Figure 4: Red tide sample. Figure 5: Resting cysts. Figure 6: Epifluorescent stained cell in ventral view. Figure 7: Epifluorescent stained cell in left lateral view. Figure 8: Epifluorescent stained cell in dorsal view.

春膝溝藻。圖1-3：以固定劑固定的細胞正面觀顯示下殼片有2條底端部尖刺。圖4：紅潮樣本。圖5：休眠包囊。圖6：熒光染色的細胞正面觀。圖7：熒光染色的細胞左側面觀。圖8：熒光染色的細胞背面觀。

Gymnodinium impudicum

伊姆裸甲藻

(Fraga & Bravo) Hansen & Moestrup, 2000

Phylum: Myzozoa	門：黏孢子門
Class: Dinophyceae	綱：甲藻綱
Order: Gymnodiniales	目：裸甲藻目
Family: Gymnodiniaceae	科：裸甲藻科



Murray et al., 2007

Synonyms 異名：

Gyrodinium impudicum Fraga & Bravo 1995

Description:

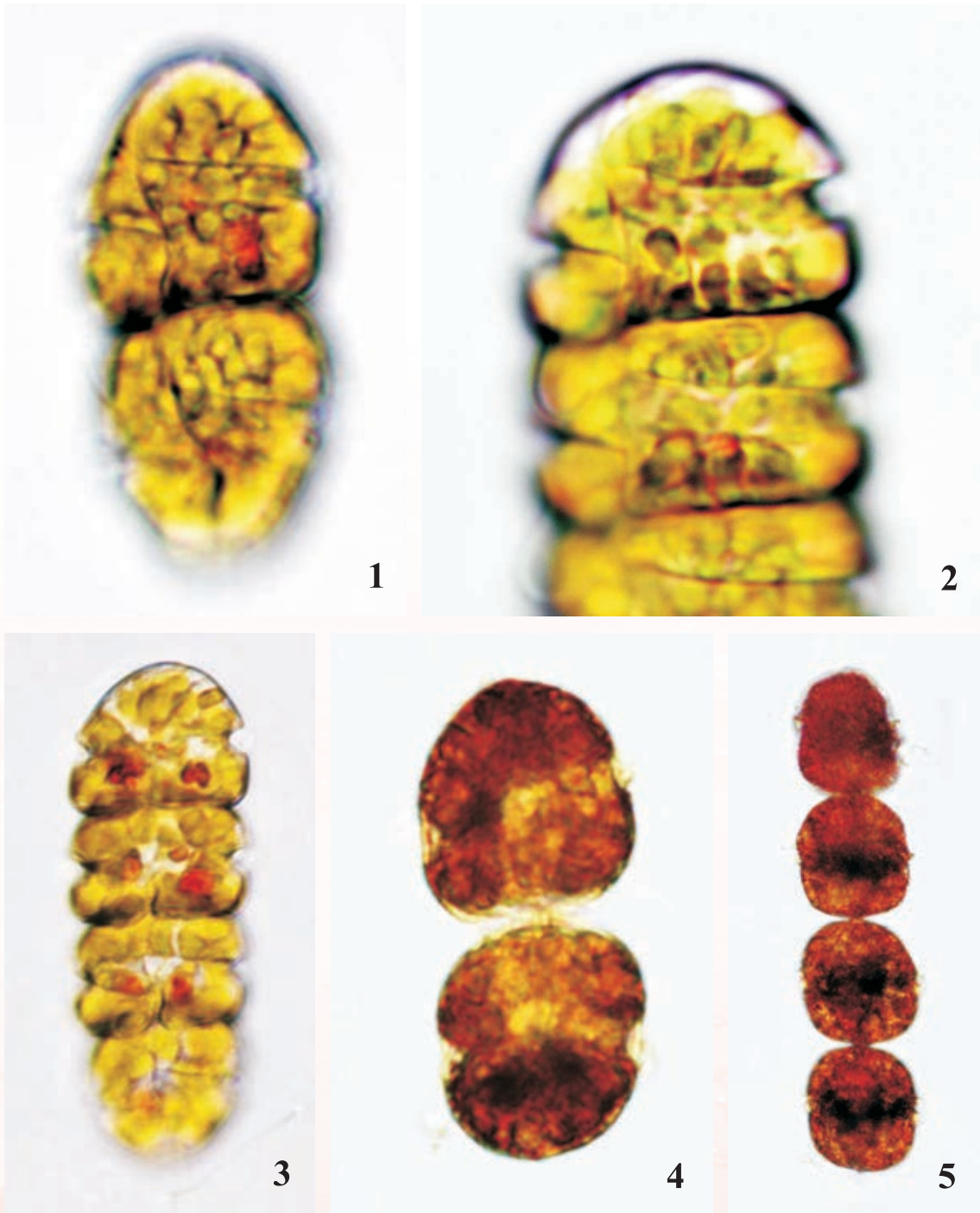
Gymnodinium impudicum is an unarmoured species and the cell is pear-shaped. It typically forms chains of 4 cells. The cell size ranges from 17 - 28 μm in length and 16 - 24 μm in width. The nucleus is located at the centre of cell, slightly displaced towards the hypocone in the anterior cell of a chain and towards the epicone in the posterior one. The cingulum is displaced by 1/3 - 1/4 of the total length of the cell. The sulcus is narrow, penetrating into the epicone as far as the apex and it turns anticlockwise when viewed from the apex to form an apical groove.

描述：

伊姆裸甲藻是不具殼片藻類，細胞呈梨形。通常以4個細胞串連成鏈狀出現。細胞長介乎17 - 28微米，闊介乎16 - 24微米。細胞核位於細胞中心位置，鏈狀起始細胞的細胞核傾向在下殼位置，而鏈狀末端細胞的細胞核傾向在上殼位置。橫溝截距約為細胞長度的1/3 - 1/4。縱溝較窄，延至上殼頂部及於細胞頂部逆時針方向形成頂槽。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2015	1	-
Total/總數：		1



Gymnodinium impudicum. Figure 1: Live cells in ventral view. Figure 2: Cingulum displaced by 1/3 to 1/4 of the total cell length. Figure 3: Live sample showing the cells occur in a short chain of 4 cells. Figures 4-5: Fixed cells.

伊姆裸甲藻。圖1：活細胞的正面觀。圖2：橫溝始末位移約為細胞長度的1/3-1/4。圖3：活體樣本顯示細胞以4個細胞串連成短鏈狀出現。圖4-5：以固定劑固定的細胞。

Gymnodinium simplex

簡單裸甲藻

(Lohmann) Kofoid & Swezy, 1921

Phylum: Myzozoa

Class: Dinophyceae

Order: Gymnodiniales

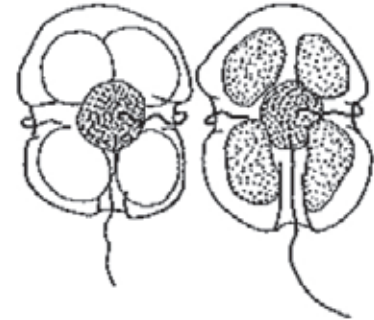
Family: Gymnodiniaceae

門：黏孢子門

綱：甲藻綱

目：裸甲藻目

科：裸甲藻科



Kofoid & Swezy, 1921

Synonyms 異名：

Protodinium simplex Lohmann 1908

Description:

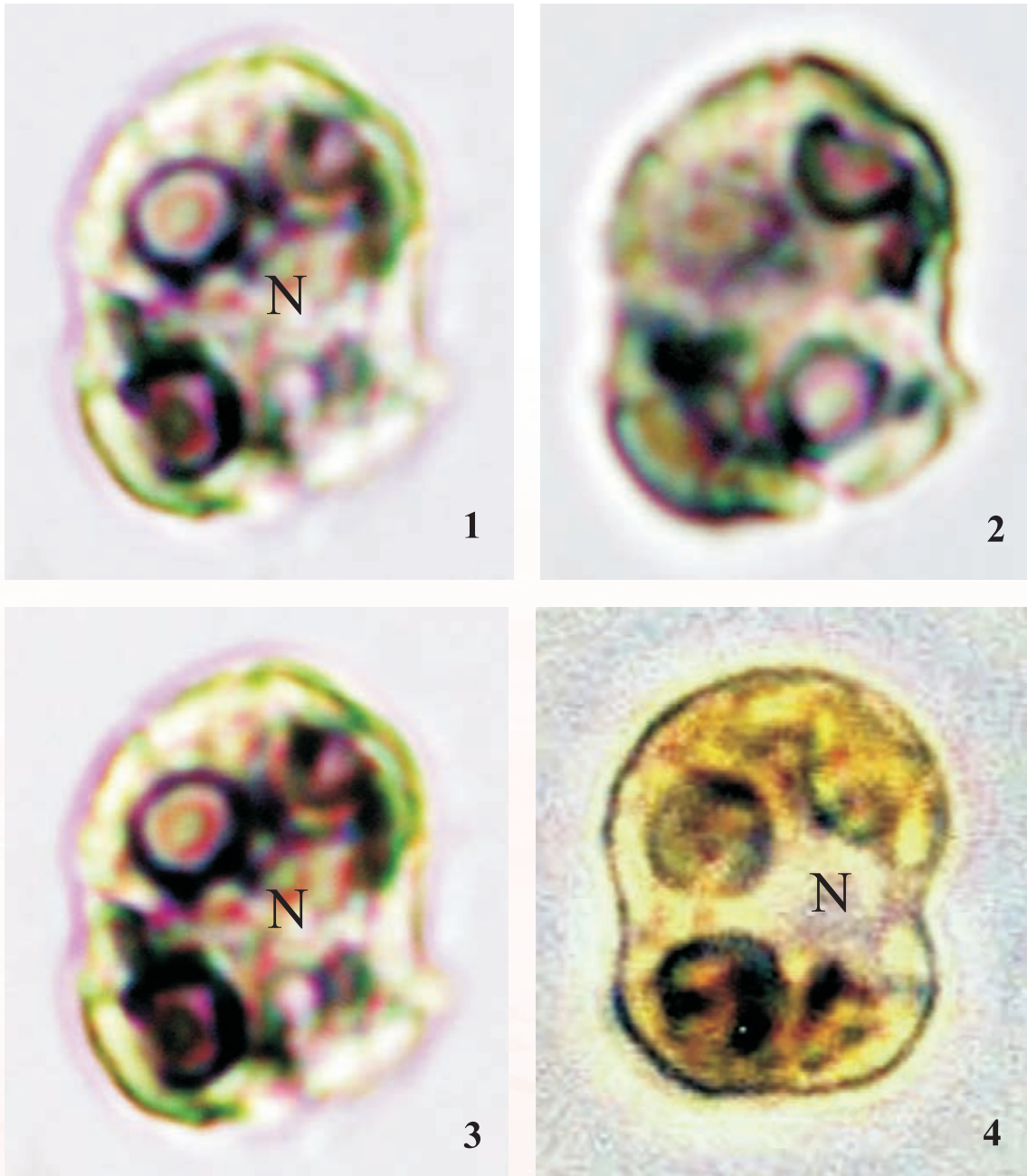
Gymnodinium simplex is an unarmoured species. The cell is small, oval, dorsoventrally flattened and occurs solitarily. The cell size ranges from 2 - 25 μm in length and 1.7 - 13 μm in width. The cingulum is wide and deeply incised and displaced in the middle part of the cell. Cell contains 4 irregular chloroplasts with 2 in epicone and 2 in hypocone. A round nucleus is located in the centre of the cell.

描述：

簡單裸甲藻是不具殼片藻類，細胞細小、呈卵形、背腹扁平、以單獨個體出現。細胞長介乎2 - 25微米，闊介乎1.7 - 13微米。橫溝寬闊，並深陷於細胞中間位置。細胞內有4個不規則形的葉綠體，2個在上殼內，2個在下殼內，細胞核呈圓形，位於細胞的中央。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1977	1	-
1981	2	-
1984	1	<i>Noctiluca scintillans</i> 夜光藻
Total/總數：	4	



Gymnodinium simplex. Figures 1-3: Fixed cell showing a round nucleus (N) located in the centre and 4 irregular chloroplasts with 2 in epicone and 2 in hypocone. Figure 4: Live cell in ventral view.

簡單裸甲藻。圖1-3：以固定劑固定的細胞顯示中心有一圓形細胞核（N）在細胞中央及4個不規則葉綠體，2個位於上殼及2個位於下殼。圖4：活細胞的正面觀。

Gymnodinium sp. X

裸甲藻X

Stein, 1878

Phylum: Myzozoa

門：黏孢子門

Class: Dinophyceae

綱：甲藻綱

Order: Gymnodiniales

目：裸甲藻目

Family: Gymnodiniaceae

科：裸甲藻科

Description:

Gymnodinium sp. X is an unarmoured species and the cell is small, round to oval, dorsoventrally flattened and occurs solitarily. The cell size ranges from 18 - 22 μm in length and 15 - 18 μm in width. The cingulum is wide and deeply incised and displaced in the middle part of the cell. The cell contains several chloroplasts at cell periphery and a large nucleus is located in the epicone.

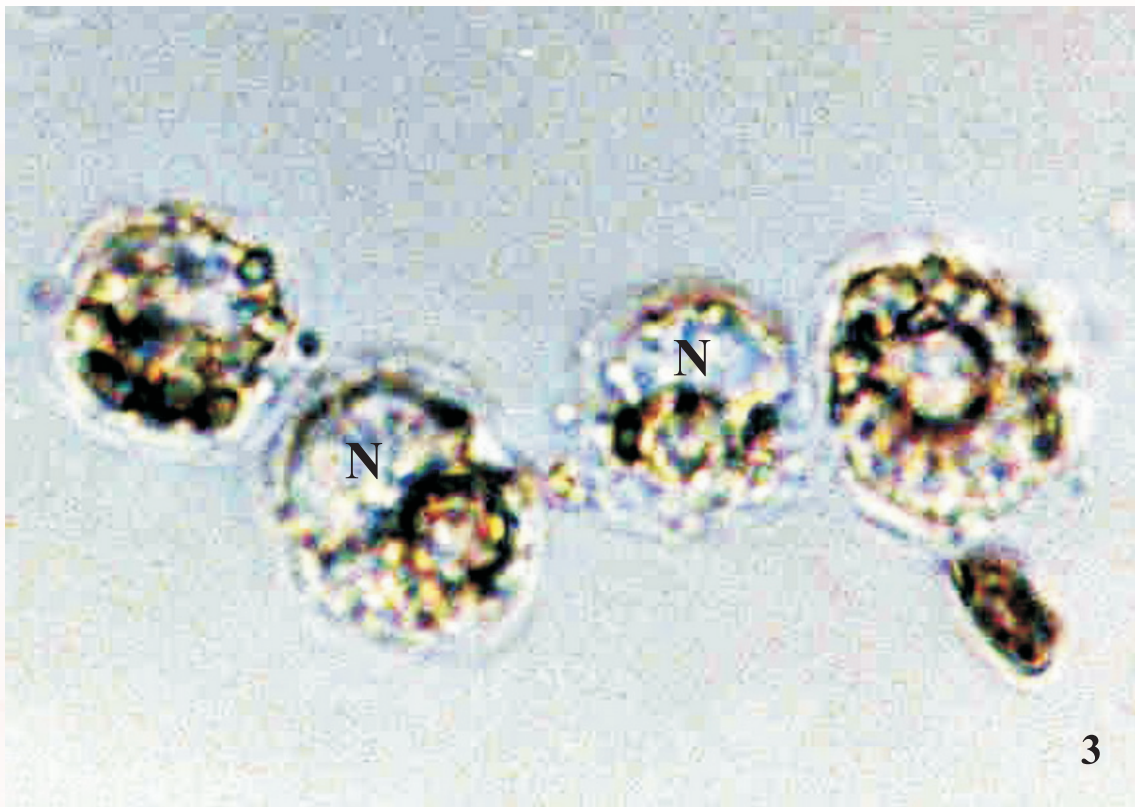
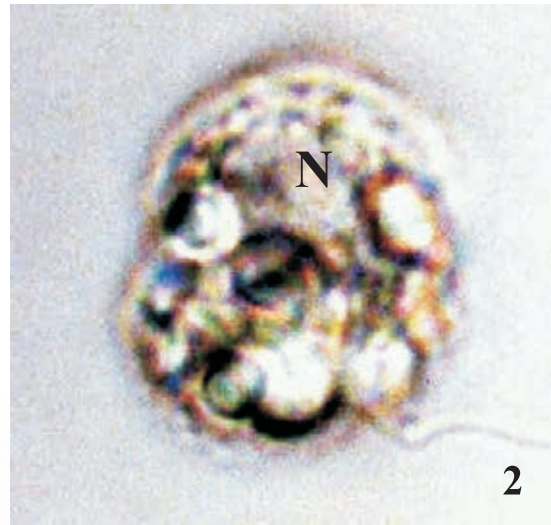
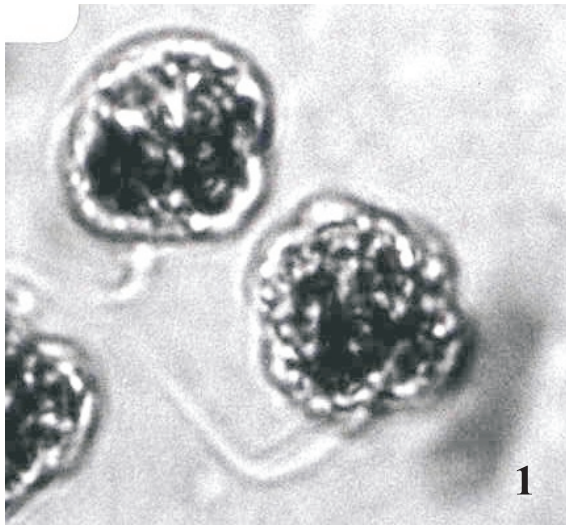
描述：

裸甲藻X是不具殼片藻類，細胞細小、呈圓形或卵形、背腹扁平，以單獨個體出現。細胞長介乎18 - 22微米，闊介乎15 - 18微米。橫溝寬闊，並深陷於細胞中間位置。細胞內有數個葉綠體，分布於細胞周邊表面，細胞核大，位於細胞的上殼。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1982 ¹	2	-
Total/總數：		2

¹ In 1982, culture fish loss was recorded in southeast region of Hong Kong waters during both blooms.
1982年，於香港東南面水域爆發的兩次紅潮均錄得有養殖魚類損失。



Gymnodinium sp. X. Figure 1: Live cells (black and white photo). Figures 2-3: Fixed cells showing a large nucleus (N) located in the epicone.

裸甲藻X：圖1：活細胞（黑白照片）。圖2-3：以固定劑固定的細胞顯示有一大細胞核（N）位於上殼。

Gyrodinium spirale

螺形環溝藻

(Bergh) Kofoid & Swezy, 1921

Phylum: Myzozoa

Class: Dinophyceae

Order: Gymnodiniales

Family: Gymnodiniaceae

門：黏孢子門

綱：甲藻綱

目：裸甲藻目

科：裸甲藻科



Kofoid & Swezy, 1921

Synonyms 異名：

Gymnodinium spirale Bergh 1881 and *Spirodinium spirale* Entz 1884

Description:

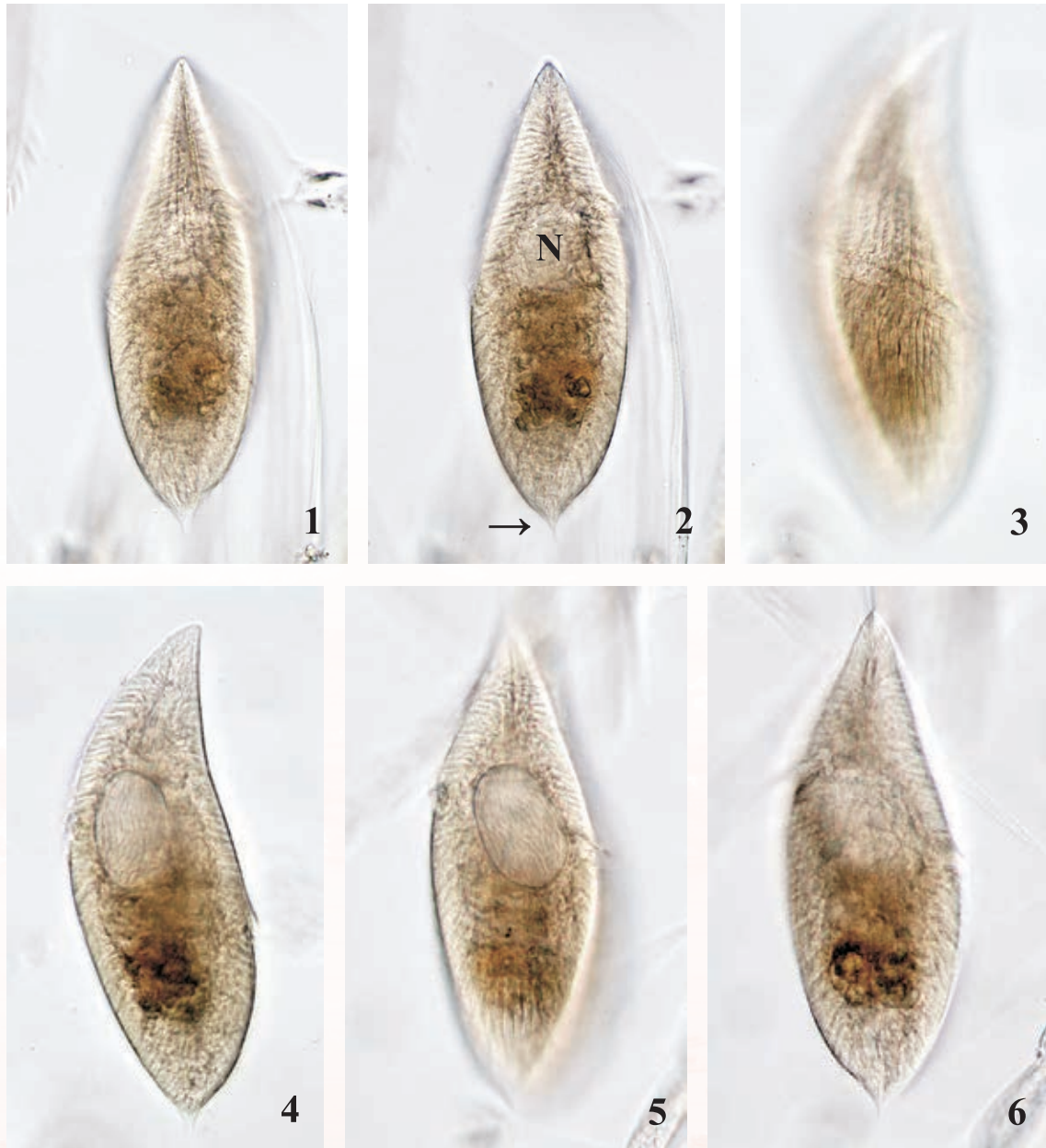
Gyrodinium spirale is an unarmoured species and the cell is elongated, slender or spindle-shaped. It mostly occurs in solitarily. The cell size ranges from 40 - 200 μm in length and 20 - 45 μm in width. The epicone is conical with slightly blunt apex, pointing to the right. The hypocone is broader than the epicone and bears with a small pointed antapical protrusion. The cingulum is narrow and displaced by up to 5 times of its width. The cell surface is covered with longitudinal ridges. Numerous trichocysts or mucocysts are situated at the cell margin. A round or ellipsoid nucleus is located at the centre of the cell.

描述：

螺形環溝藻是不具殼片藻類，細胞呈長形、纖長形或紡錘狀，大多以單獨個體出現。細胞長介乎40 - 200微米，闊介乎20 - 45微米。上殼部分呈錐形，尖端略鈍，彎向右邊，而下殼部分較上殼寬闊，下殼末端有小尖突出物。橫溝較窄，橫溝截距約為橫溝闊度的5倍。細胞表面布滿縱向條紋。細胞邊緣有大量棘絲胞或黏液泡。細胞核呈圓形或橢圓形，位於細胞的中心。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1998	1	-
Total/總數：		1



Gyrodinium spirale. Figures 1-2: The same fixed cell in ventral view at different focus plates showing the cell surface covered with longitudinal ridges, a small pointed antapical protrusion (arrow) and an ellipsoid nucleus (N) located in the centre of the cell. Figures 3-4: The same cell in lateral view in high and lower focus. Figures 5-6: The same cell in dorsal view in high and lower focus.

螺形環溝藻。圖1-2：以固定劑固定的同一細胞於不同焦距下的正面觀顯示細胞表面布滿縱向條紋、末端小尖突出物（箭咀）及位於細胞中心位置的一個橢圓形細胞核（N）。圖3-4：同一細胞於不同焦距下的橫向面觀。圖5-6：同一細胞於不同焦距下的背面觀。

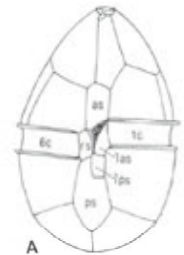
Heterocapsa circularisquama

圓鱗異囊藻

Horiguchi, 1995

Phylum: Myzozoa
Class: Dinophyceae
Order: Peridinales
Family: Peridiniaceae

門：黏孢子門
綱：甲藻綱
目：多甲藻目
科：多甲藻科



A
Horiguchi, 1995

Description:

Heterocapsa circularisquama is a small, solitary, armoured species. The cell is pear-shaped with conical epitheca and hemispherical hypotheca. The cell size ranges from 16 - 28.8 μm in length and 11.2 - 20 μm in width. The species is named for the diagnostic body scales with 6 radiating ridges on 1 circular basal plate. The thecal plates are thin. The cell has yellowish brown chromatophores and a deep girdle, comparatively shallow sulcus and sharp apex.

Toxicity:

Overseas research reported that *H. circularisquama* is a toxic species which causes mass mortality of shellfish. The toxicity of the Hong Kong strain is uncertain.

描述：

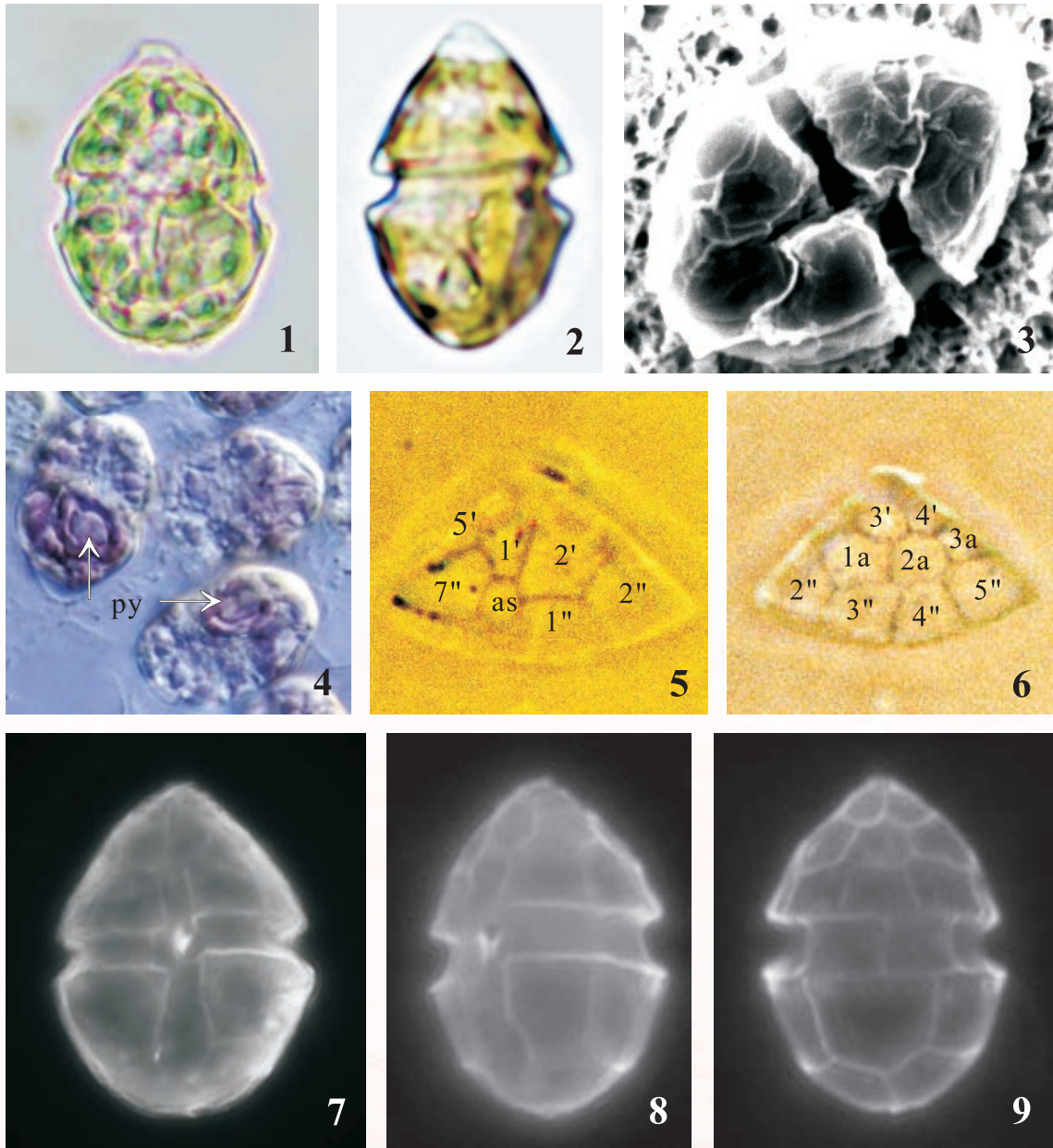
圓鱗異囊藻是細小的具殼片的甲藻，以單獨個體出現，細胞呈梨狀，上殼片呈錐形，下殼片半球形。細胞長介乎16 - 28.8微米，闊介乎11.2 - 20微米。圓鱗異囊藻的名字來自突出的藻體鱗片，這鱗片由1環形底板和6根放射條紋組成。殼片單薄。細胞有黃褐色的色素體和1條很深的殼環帶，縱溝相對較淺，頂部尖削。

毒性：

根據外國文獻記載，圓鱗異囊藻可導致大量貝類死亡。香港藻株的毒性尚未能確定。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1983	1	-
1986	1	-
1987	1	-
1990	2	-
1991	2	-
1993	1	-
1995	1	-
1996	1	-
	1	<i>Thalassiosira mala</i> 中肋海鏈藻
1997	1	-
1998	1	-
1999	1	-
2002	1	-
2004	1	-
2015	1	-
Total/總數：	17	



Heterocapsa circularisquama. Figure 1: Live cell in ventral view showing a small hyaline area at the apex. Figure 2: Live cell in dorsal view. Figure 3: Scanning electron micrograph. Figure 4: Cells showing a large pyrenoid (py). Figure 5: Epitheca in ventral view showing thecal plate arrangements and anterior sulcal plate (as). Figure 6: Epitheca in dorsal view. Figures 7-9: Epifluorescent stained cells.

圓鱗異囊藻。圖1：活細胞正面觀，顯示頂部有一細小的透明部分。圖2：活細胞背面觀。圖3：掃描電子顯微鏡圖片。圖4：細胞有一大澱粉核（py）。圖5：上殼片正面觀，顯示殼片排列方式及前縱溝甲（as）。圖6：上殼片背面觀。圖7-9：熒光染色的細胞。

Heterocapsa pygmaea

異囊藻

Lobelich, Schmidt & Sherley, 1981

Phylum: Myzozoa
Class: Dinophyceae
Order: Peridinales
Family: Peridiniaceae

門：黏孢子門
綱：甲藻綱
目：多甲藻目
科：多甲藻科



Iwataki, 2008

Description:

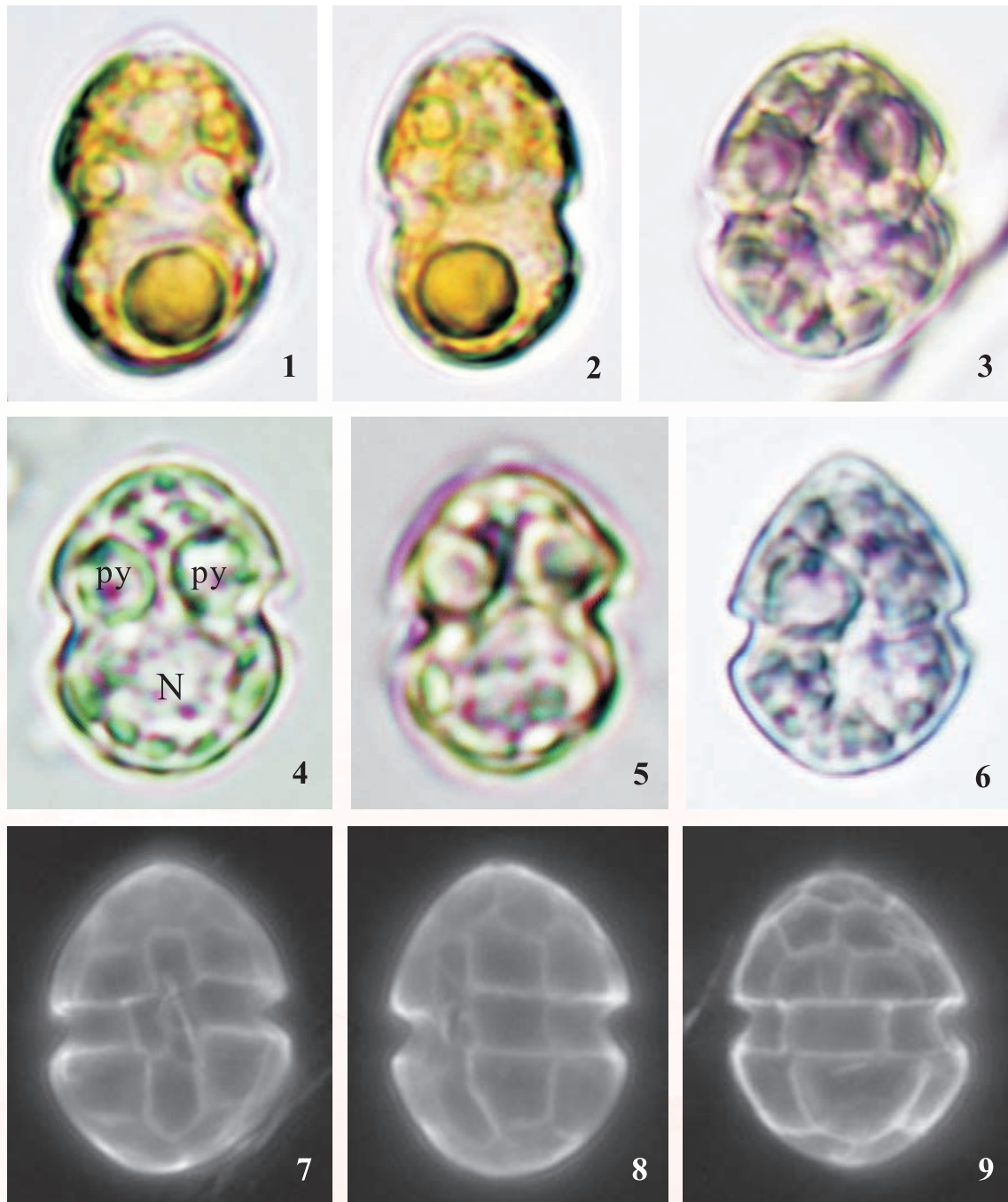
Heterocapsa pygmaea is a small, solitary, armoured species. The cell is ellipsoid with conical epitheca and round hypotheca. Both epitheca and hypotheca are equal in size. Size ranges from 9.8 - 18.4 μm in length and 6.1 - 10 μm in width. The cingulum is wide and well excavated. The sulcus is very conspicuous and fairly deep. The thecal plates are very thin. Nucleus is spherical and located posteriorly. Two pyrenoids are located in epitheca close to the cingulum and are above the nucleus.

描述：

異囊藻是細小、具殼片的甲藻，以單獨個體出現。細胞呈橢圓形，上殼部分呈錐形，下殼部分則呈圓形，兩部分大小均等。細胞長介乎9.8 - 18.4 微米，闊介乎6.1 - 10微米。橫溝寬闊、深陷，縱溝深而明顯。殼片單薄。細胞核呈圓形，位於細胞的後端。上殼部分，有2個澱粉核位於細胞核上面而接近橫溝位置。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2016	1	<i>Gonyaulax verior</i> 春膝溝藻
Total/總數：	1	



Heterocapsa pygmaea. Figure 1: Live cell in ventral view showing a small hyaline area at the apex. Figure 2: Same live cell in left lateral view. Figures 3-6: Fixed cells in ventral view showing 2 pyrenoids (py) located in the epicone and a nucleus (N) located in the hypcone. Figures 7-9: Epifluorescent stained cells.

異囊藻。圖1：活細胞正面觀顯示頂部有一細小的透明部分。圖2：同一個活細胞左側面觀。圖3-6：以固定劑固定的細胞正面觀顯示有兩個澱粉核（py）位於上殼位置，而細胞核（N）位於下殼位置。圖7-9：熒光染色的細胞。

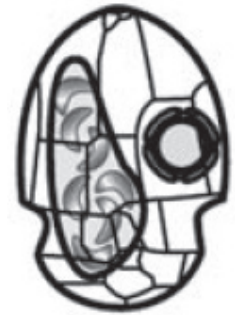
Heterocapsa rotundata

異囊藻

(Lohmann) Hansen, 1995

Phylum: Myzozoa
Class: Dinophyceae
Order: Peridinales
Family: Peridiniaceae

門：黏孢子門
綱：甲藻綱
目：多甲藻目
科：多甲藻科



Iwataki, 2008

Synonyms 異名：

Amphidinium rotundatum Lohmann 1908, *Gymnodinium minutum* Lebour 1925, *Massartia rotundata* (Lohmann) Schiller 1933, *Amphidinium pellucidum* Redeke 1935, *Amphidinium redekei* Conrad & Kufferath 1954, *Massartia rotundatum* var. *conradi* Kufferath 1954, *Katodinium rotundatum* (Lohmann) Loeblich III 1965 and *Katodinium minutum* Sournia 1973

Description:

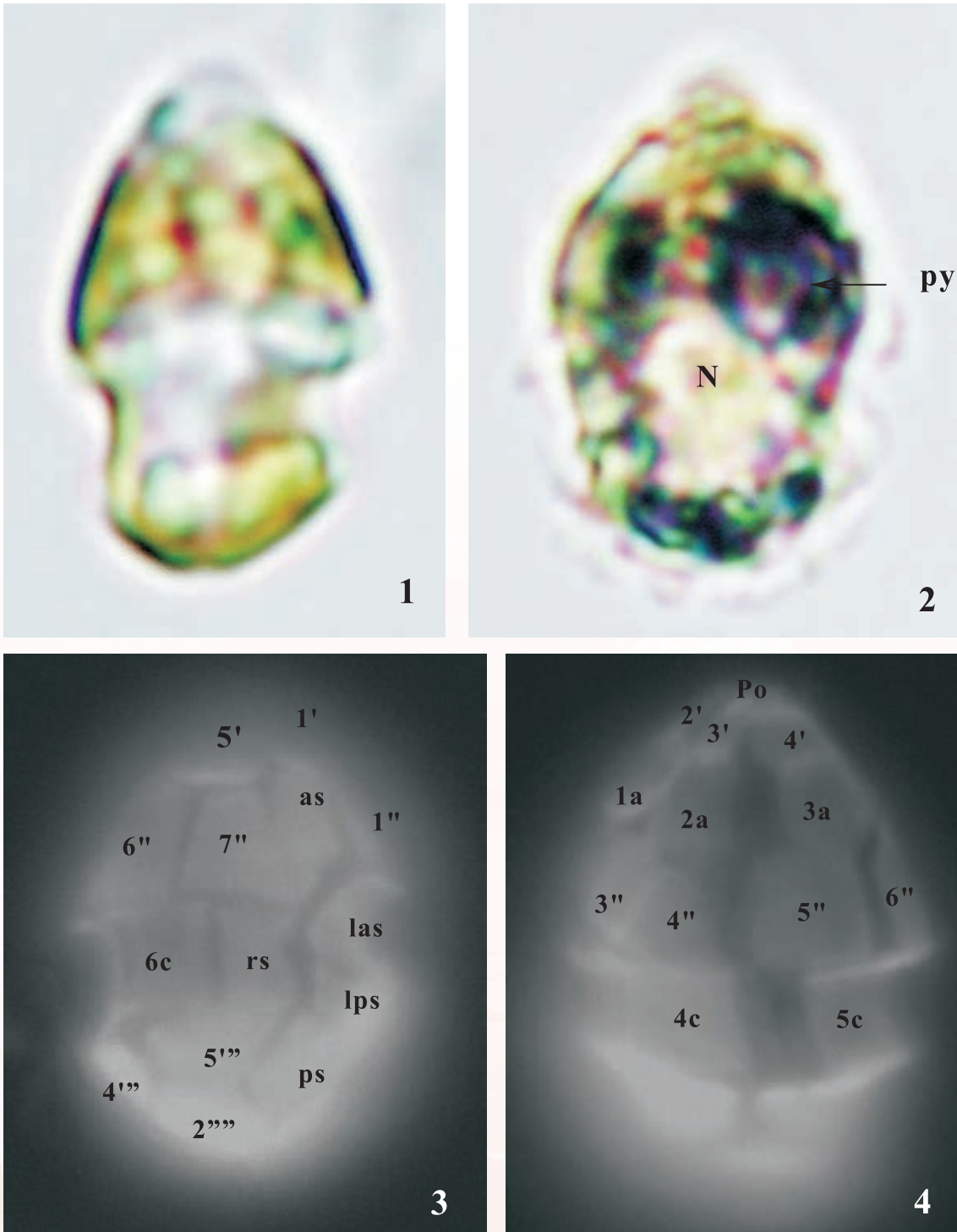
Heterocapsa rotundata is a small, solitary, armoured species. The cell is mushroom-shaped or has the arrowhead appearance with longer and broader epitheca than hypotheca. The cell size ranges from 9 - 15 μm in length and 6 - 12 μm in width. The thecal plates are thin. The cell contains yellowish brown chromatophores, large ellipsoid nucleus is located in the centre of the cell and 1 pyrenoid is located on the left side of the epicone.

描述：

異囊藻是細小、具殼片的甲藻，以單獨個體出現，細胞呈菇狀或與箭頭相似，即上殼部分較下殼長及寬闊。細胞長介乎9 - 15微米，闊介乎6 - 12微米。殼片單薄。細胞內含有黃褐色的色素體。細胞核大，呈橢圓形，位於細胞中央，有1個澱粉核位於上殼的左邊。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1997	1	-
2005	2	<i>Heterosigma akashiwo</i> 赤潮異彎藻、 <i>Plagioselmis prolunga</i> 伸長斜片藻
Total/總數：	3	



Heterocapsa rotundata. Figure 1: Live cell in ventral view showing the shape of a mushroom and a small hyaline area at the apex. Figure 2: Fixed cell in ventral view showing a large ellipsoid nucleus (N) located in the centre of the cell and a pyrenoid (py) located in the left epicone (arrow). Figures 3-4: Epifluorescent stained cells.

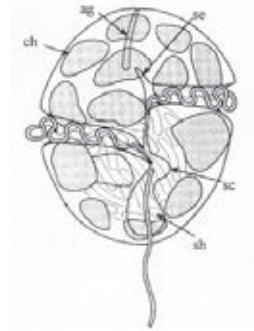
異囊藻。圖1：活細胞正面觀顯示細胞呈菇狀及頂部有一細小的透明部分。圖2：以固定劑固定的細胞正面觀顯示有一呈橢圓形大細胞核（N），位於細胞中央，而澱粉核位於左上殼位置（箭咀）。圖3-4：熒光染色的細胞。

Karenia digitata 指溝凱倫藻

Yang, Takayama, Matsuoka & Hodgkiss, 2001

Phylum: Myzozoa
Class: Dinophyceae
Order: Gymnodiniales
Family: Kareniaceae

門：黏孢子門
綱：甲藻綱
目：裸甲藻目
科：凱倫藻科



Yang et al., 2000

Description:

Karenia digitata is an unarmoured species without thecal plate. The cell is solitary, small, globular or ovoid, and almost circular but slightly flattened dorsoventrally. The cell size ranges from 10 - 26.3 μm in length and 10 - 23 μm in width. The epicone is hemispherical or broadly conical, the hypocone is round to hemispherical, and the antapex is not concave. The cell has a linear apical groove, which lies to the right of the sulcal axis. The nucleus is large, spherical to ovoid, and located in the centre of hypocone. Chloroplasts are yellowish green to yellowish brown and irregular in shape.

Toxicity:

K. digitata is a toxic species that can cause massive fish kill. The toxicity of the Hong Kong strain is confirmed.

描述：

指溝凱倫藻是不具殼片甲藻，以單獨個體出現，細胞細小，呈球狀或卵狀，背腹幾乎成圓形但稍為扁平，細胞長介乎10 - 26.3微米，闊介乎10 - 23微米。上殼為半球形或寬闊錐形，下殼圓形或半球形，末端不凹陷。細胞有一直頂槽，位於縱溝軸右側。細胞核大，呈球形或卵形，位於下殼中央位置。葉綠體為黃綠色或黃褐色，形狀不規則。

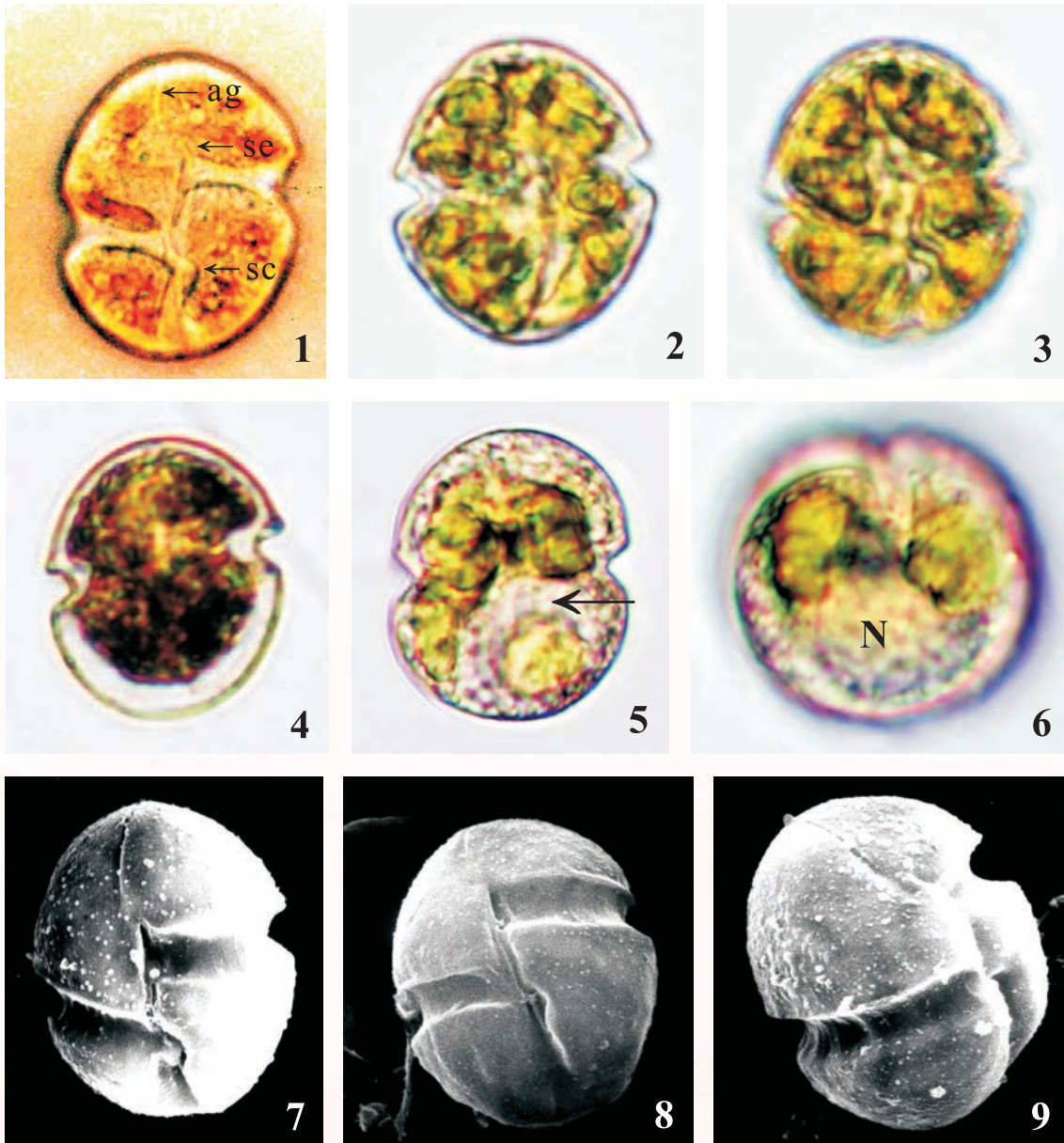
毒性：

指溝凱倫藻是有毒品種，可導致大量魚類死亡。香港的藻株已證實有毒。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1998 ¹	7	-
	1	<i>Prorocentrum cordatum</i> 心形原甲藻
2009	1	-
Total/總數：		9

1 In 1998, massive culture fish loss was recorded in several regions of Hong Kong waters during the blooms.
1998年，於香港多個水域爆發的紅潮均錄得有大量養殖魚類損失。



Karenia digitata. Figure 1: Live cell in ventral view; apical groove (ag); sulcal extension (se) on the epicone; sulcal curvature (sc) on the hypocone. Figures 2-5: Fixed cells in ventral view showing the nucleus located in the hypocone (arrow). Figure 6: Fixed cell in antapical view showing the nucleus (N). Figures 7-9: Scanning electron micrographs.

指溝凱倫藻。圖1：活細胞正面觀，可見上殼的頂槽（ag）及縱溝延伸（se）；下殼的縱溝彎曲度（sc）。圖2-5：以固定劑固定的細胞正面觀，顯示細胞核位於下殼（箭咀）。圖6：以固定劑固定的細胞底面觀，顯示細胞核（N）。圖7-9：掃描電子顯微鏡照片。

Karenia longicanalis

長溝凱倫藻

Yang, Hodgkiss & Hansen, 2001

Phylum: Myzozoa
Class: Dinophyceae
Order: Gymnodiniales
Family: Kareniaceae

門：黏孢子門
綱：甲藻綱
目：裸甲藻目
科：凱倫藻科



Yang et al., 2001

Description:

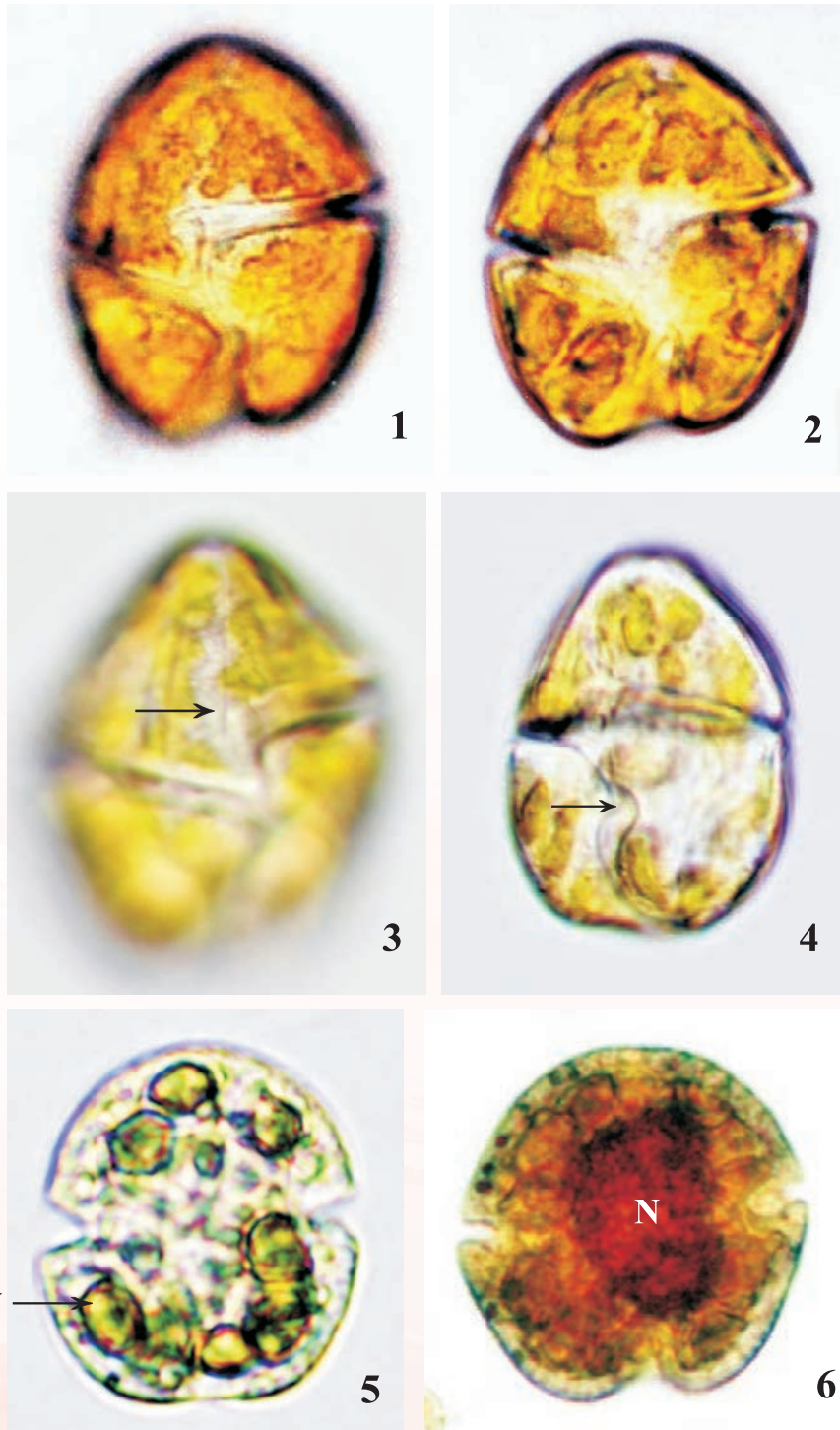
Karenia longicanalis is an unarmoured species without thecal plate. The cell is solitary, small, globular or ovoid, and almost circular but slightly flattened dorsoventrally. The cell size ranges from 17.5 - 35 μm in length and 10 - 22.5 μm in width. The epicone is hemispherical and the hypocone is hemispherical to slightly truncate with a concavity or indentation at the antapex. A straight apical groove lies to the right of the sulcal axis and extends about 2/3 down the dorsal side of the epicone. The nucleus is large, round, and located in the central part of cell. Chloroplasts are yellowish green, round in shape and each contains 1 pyrenoid.

描述：

長溝凱倫藻是不具殼片甲藻，以單獨個體出現，細胞細小，呈球狀或卵狀，背腹幾乎成圓形但稍為扁平。細胞長介乎17.5 - 35微米，闊介乎10 - 22.5微米。上殼呈半球形，下殼亦呈半球形但略鈍，末端有凹陷或凹槽。細胞有一直頂槽，位於縱溝軸右側，大約伸展至上殼背側約2/3位置。細胞核大，呈圓形，位於細胞中央。葉綠體黃綠色，呈圓形，每個葉綠體均含有1個澱粉核。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1998	1	-
Total/總數：		1



Karenia longicanalis. Figures 1-2: Live cell in ventral view in different focal planes. Figure 3: Live ventral view showing the straight apical groove (arrow) extended to the epicone. Figure 4: The left sulcal border has a distinct indentation (arrow). Figure 5: Numerous yellowish green chloroplasts and each with 1 pyrenoid (py). Figure 6: Fixed cell showing a large round nucleus (N) situated in the central part of the cell.

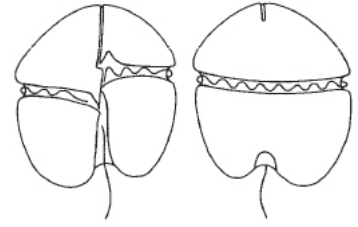
長溝凱倫藻。圖1-2：不同焦距下的活細胞正面觀。圖3：活細胞正面觀顯示直頂槽（箭咀）伸展至上殼。圖4：縱溝左側邊緣有一明顯凹槽（箭咀）。圖5：大量黃綠色葉綠體及每個葉綠體包含1個澱粉核（py）。圖6：以固定劑固定的細胞顯示有一大而呈橢圓形的細胞核（N）位於細胞中央。

Karenia mikimotoi 米氏凱倫藻

(Miyake & Kominami ex Oda) Hansen & Moestrup, 2000

Phylum: Myzozoa
Class: Dinophyceae
Order: Gymnodiniales
Family: Kareniaceae

門：黏孢子門
綱：甲藻綱
目：裸甲藻目
科：凱倫藻科



Tomas et al., 1997

Synonyms 異名：

Gymnodinium mikimotoi Miyake & Kominami ex Oda 1935, *Gyrodinium nagasakiense* Takayama & Adachi 1984 and *Gymnodinium nagasakiense* Takayama & Adachi 1985

Description:

Karenia mikimotoi is an unarmoured species without thecal plate. The cell is solitary with variable cell outlines, usually from ovate to almost round. The cell is dorsoventrally flattened and its size ranges from 18 - 40 μm in length and 14 - 35 μm in width. The girdle is wide with a descending spiral which is displaced about 1/5 of the cell length. The sulcus continues for a short distance onto the epicone where an apical groove extends in a straight line from near the sulcal intrusion across the apex and a short distance down on the dorsal side of the cell. The nucleus is ellipsoidal on the left side of the hypocone. The cell has oval chloroplasts with pyrenoids.

Toxicity:

K. mikimotoi is capable of producing both hemolytic and ichthyotoxins. It is known to associate with fish kill locally.

描述：

米氏凱倫藻是不具殼片甲藻，以單獨個體出現，外形多變，多為卵形至近圓形。細胞背腹扁平，細胞長介乎18 - 40微米，闊介乎14 - 35微米。殼環帶寬闊呈下行旋渦狀，而其橫溝截距約細胞長度的1/5。縱溝延伸入上殼少許，頂槽從縱溝伸入上殼處附近直線向上伸展，橫越頂部，再伸展至細胞背側少許。細胞核呈橢圓形，位於下殼左側。細胞有含澱粉核的橢圓形葉綠體。

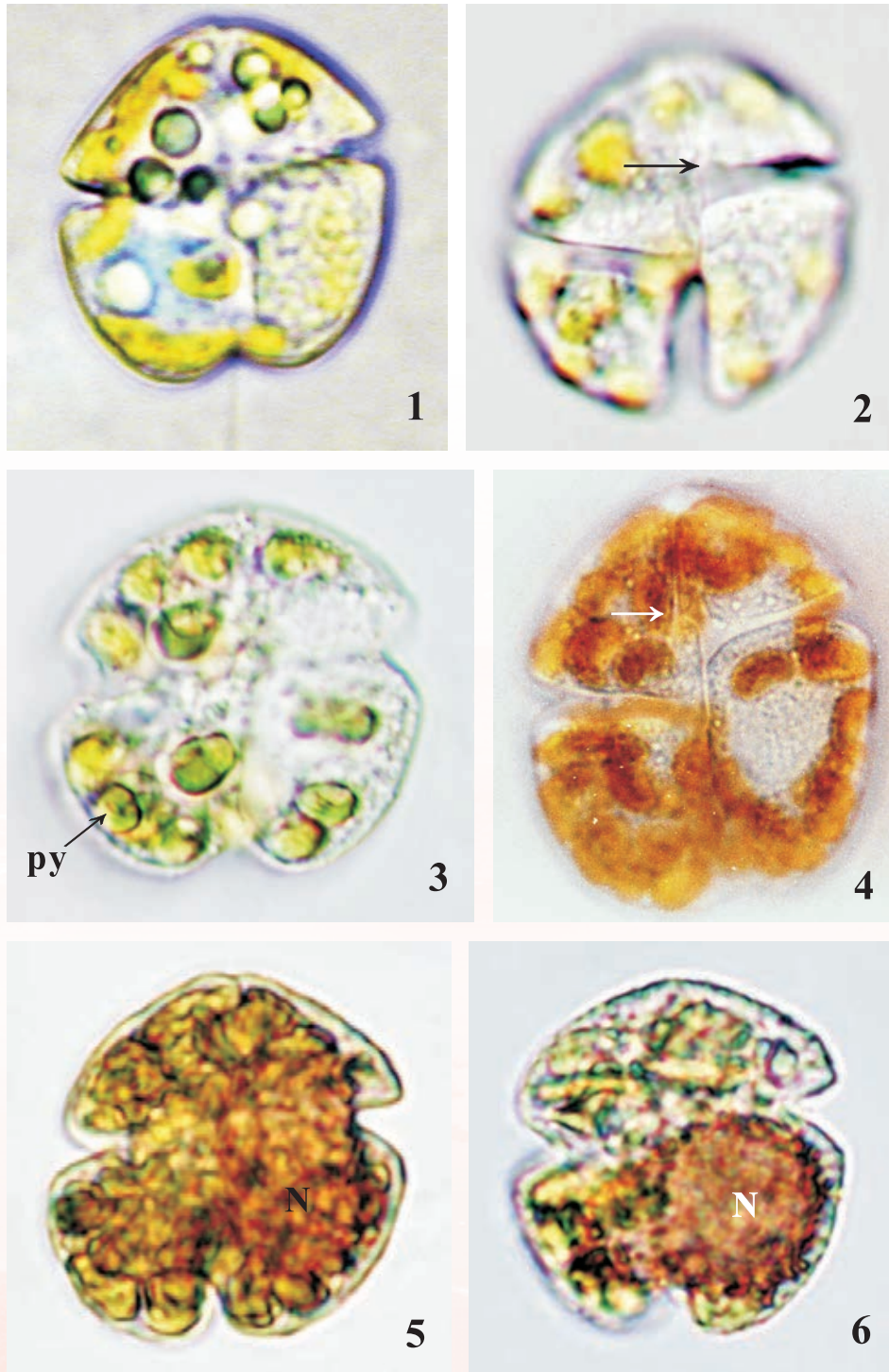
毒性：

米氏凱倫藻可產生溶血性毒素及魚毒素，本地藻株可引致魚類死亡。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

From 1975 to 2017, 12 red tide incidents caused by *Karenia mikimotoi* were recorded in Hong Kong waters. Refer to Appendix VII for detailed information.

由1975年至2017年間，香港水域共錄得12宗由米氏凱倫藻引發的紅潮個案。有關資料詳情請參閱附錄七。



Karenia mikimotoi. Figure 1: Live cultured cell. Figure 2: Same cell in ventral view in high focus showing the short anterior extension of the sulcus (arrow). Figure 3: Spherical chloroplast (arrow) with pyrenoid (py). Figure 4: Live ventral view showing the apical groove (arrow) extended to the epicone. Figures 5-6: Fixed cells showing a large ellipsoid nucleus (N) situated on the left side of the hypocone.

米氏凱倫藻。圖1：活培植藻株。圖2：同一細胞於不同焦距下的正面觀，顯示短小的縱溝前伸延（箭咀）。圖3：球狀葉綠體含澱粉核（py）。圖4：活細胞正面觀，顯示頂槽（箭咀）伸展至上殼。圖5-6：以固定劑固定的細胞，顯示細胞核（N）位於細胞下殼左側。

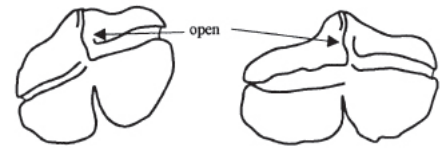
Karenia papilionacea

微疣凱倫藻

Haywood & Steidinger, 2004

Phylum: Myzozoa
Class: Dinophyceae
Order: Gymnodiniales
Family: Kareniaceae

門：黏孢子門
綱：甲藻綱
目：裸甲藻目
科：凱倫藻科



Haywood et al., 2004

Description:

Karenia papilionacea is an unarmoured species without thecal plate. The cell is solitary and elliptical in shape, moderately dorsoventrally compressed. The ventral is markedly concave and the dorsal is convex, and the cell size ranges from 18 - 32 μm in length, 18 - 48 μm in width. The cell has a pointed apical protrusion at the anterior end. The apical groove is short and extends to approximately the upper 1/3 of the dorsal epicone. The sulcus extends to the left of the apex and apical groove. The nucleus is spherical to slightly oval in shape located in the left hypocone. 1 red accumulation body is located on the right side of hypocone. Chloroplasts are peripheral, round to reniform in shape, and yellowish green in colour.

Toxicity:

Overseas research reported that *K. papilionacea* is capable of producing neurotoxic brevetoxins that causes neurotoxic shellfish poisoning (NSP) in humans or other mammals. The toxicity of the Hong Kong strain is uncertain.

描述：

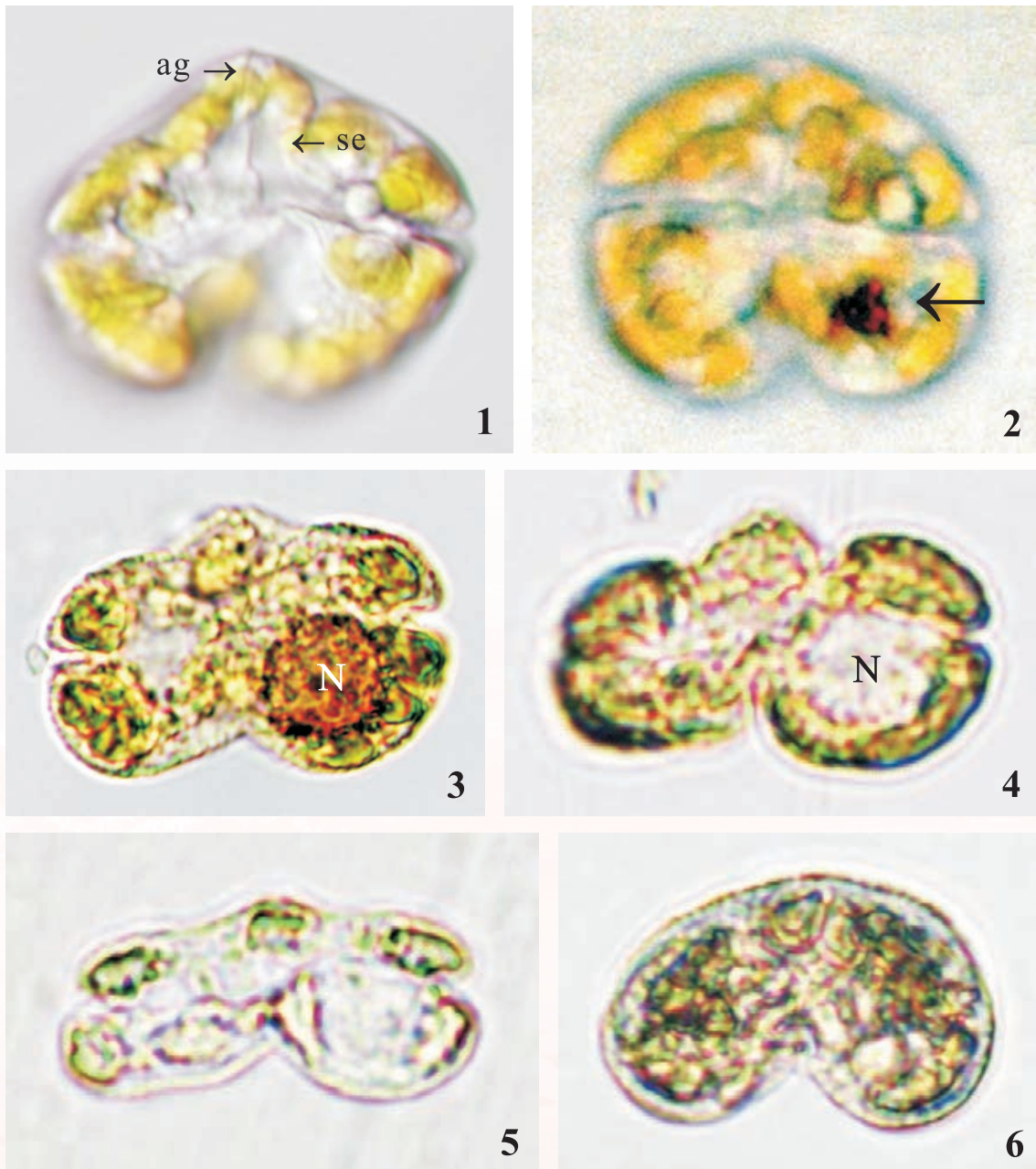
微疣凱倫藻是不具殼片甲藻，以單獨個體出現，細胞呈橢圓形，背腹略扁平，腹側顯著凹陷，背側凸出，細胞長介乎18 - 32微米，闊介乎18 - 48微米。細胞前端有尖削的頂突。頂槽很短，大約伸展至背側上殼1/3的位置。縱溝伸展至頂端及頂槽左方。細胞核呈球形或近卵圓形，位於下殼左方。下殼右方有1紅色體。黃綠色的葉綠體位於周邊，呈圓或腎形。

毒性：

根據外國文獻記載微疣凱倫藻可產生神經性雙鞭甲藻毒素，這毒素會導致人類或其他哺乳類動物發生神經性貝類中毒的情況。香港藻株的毒性尚未能確定。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2009	1	-
2016	1	<i>Karenia mikimotoi</i> 米氏凱倫藻
Total/總數：	2	



Karenia papilionacea. Figure 1: Live cell in ventral view showing yellowish green chloroplasts are peripheral and round to reniform in shape; apical groove (ag) and sulcus extension (se). Figure 2: Live cell in dorsal view showing the presence of red accumulation body on the right side of hypocone (arrow). Figures 3-4: Fixed cells in ventral view showing the spherical to slightly oval nucleus (N) located on the left side of hypocone. Figure 5: Wide cell in ventral view. Figure 6: Cell in apical view.

微疣凱倫藻。圖1：活細胞的正面觀，顯示位於周邊以及呈圓或腎形的黃綠色葉綠體、頂槽 (ag) 和縱溝伸延 (se)。圖2：活細胞的背面觀，顯示下殼右側有紅色體 (箭咀)。圖3-4：以固定劑固定的細胞正面觀，顯示球形或近卵圓形的細胞核 (N) 位於下殼左方。圖5：闊細胞正面觀。圖6：細胞頂面觀。

Karlodinium veneficum

劇毒卡爾藻

(Ballantine) Larsen, 2000

Phylum: Myzozoa

Class: Dinophyceae

Order: Gymnodiniales

Family: Kareniaceae

門：黏孢子門

綱：甲藻綱

目：裸甲藻目

科：凱倫藻科



Larsen, 2000

Synonyms 異名：

Gymnodinium veneficum Ballantine 1956, *Gymnodinium galatheanum* Braarud 1957, *Woloszynskia micra* Leadbeater & Dodge 1966, *Gymnodinium micrum* (Leadbeater & Dodge) Loeblich III 1970, *Gyrodinium galatheanum* (Baarud) Taylor 1992 and *Karlodinium micrum* (Leadbeater & Dodge) Larsen 2000

Description:

Karlodinium veneficum is an unarmoured species without thecal plate. The cell is solitary, small, and oval to round in shape and the size ranges from 8 - 18 μm in length, 7 - 14 μm in width. The apical groove is straight. The girdle is deeply incised, describing a descending spiral which is displaced almost from 1/7 to 1/3 of the cell length. The sulcus is strongly deflected in the inter-cingular region and extends into the epicone. The nucleus is large, round and located on the left side of hypocone or in the centre of the cell. The cell contains 2 - 8 goldenbrown chloroplasts, usually 4, equal number in epicone and hypocone.

Toxicity:

Overseas research reported that *K. veneficum* is capable of producing karlotoxins that cause mass mortality of fish. The toxicity of the Hong Kong strain is uncertain.

描述：

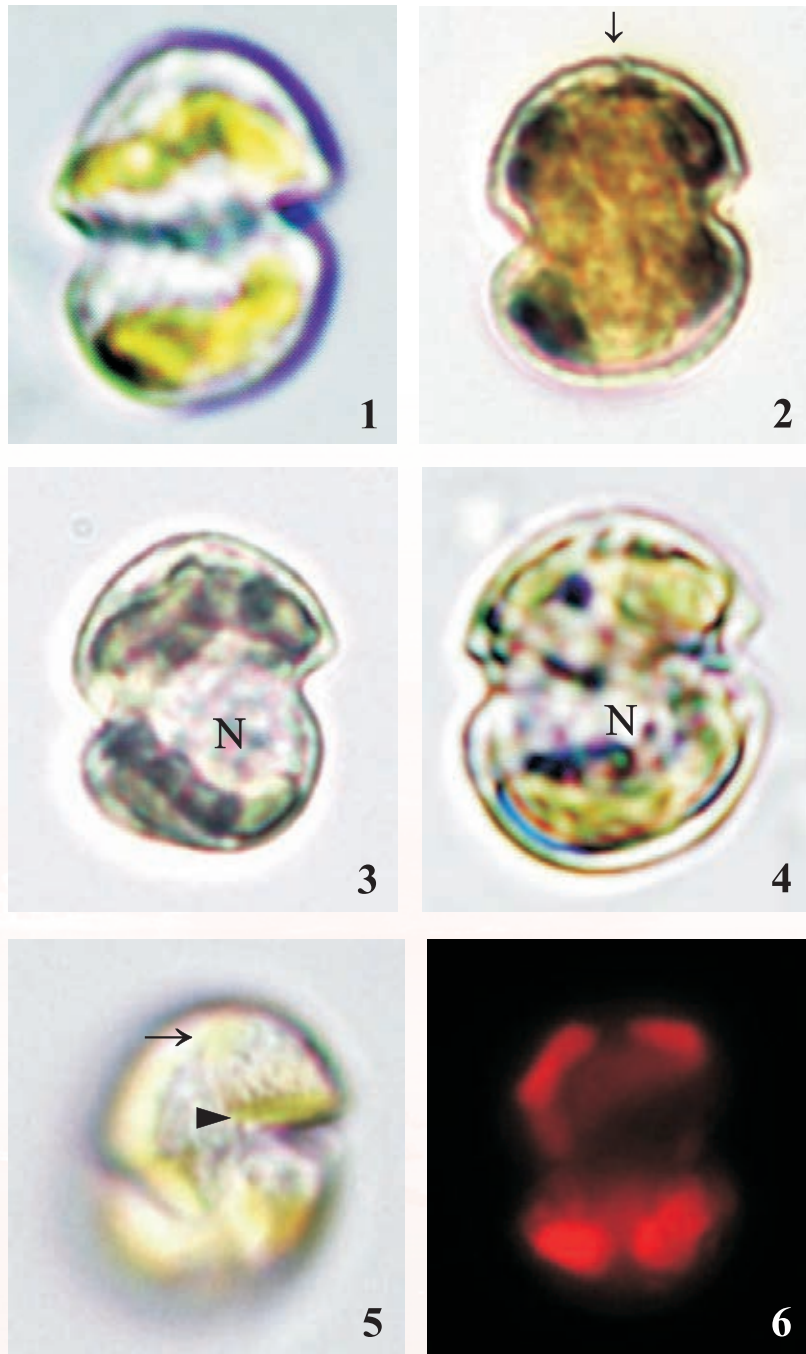
劇毒卡爾藻是不具殼片甲藻，以單獨個體出現，細胞細小呈橢圓或圓形，長介乎8 - 18微米，闊介乎7 - 14微米。頂槽畢直，殼環帶凹陷顯著，呈下行旋渦狀，其橫溝截距約細胞長度的1/7至1/3。縱溝在間橫溝區大幅偏斜，伸展至上殼。細胞核大而圓，位於下殼左邊或細胞中央。細胞有2 - 8顆金褐色葉綠體，通常是4顆，平均分布於上殼及下殼內。

毒性：

根據外國文獻記載劇毒卡爾藻可產生卡爾藻毒素 (karlotoxins) 毒素引致大量魚類死亡。香港藻株的毒性尚未能確定。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2003	1	-
Total/總數：		1



Karlodinium veneficum. Figure 1: Live cell in ventral view showing 4 golden brown chloroplasts. Figure 2: Fixed cell in ventral view showing the large chloroplasts; slight indentation at the apex caused by the apical groove (arrow). Figures 3-4: Nucleus (N) is large, round and located on the left side of the hypocone or in the centre. Figure 5: Cell in surface focus showing apical groove (arrow) and sulcal intrusion (arrow head); cingulum boarded, deeply excavated and displaced 3 times of its own width. Figure 6: Cell showing 4 large autofluorescent chloroplasts.

劇毒卡爾藻。圖1：活細胞的正面觀，顯示4個金褐色葉綠體。圖2：以固定劑固定的細胞正面觀顯示細胞內的大葉綠體，細胞頂端由頂槽造成的凹陷位置（箭咀）。圖3-4：細胞核（N）大而圓，位於細胞左下殼或中央位置。圖5：細胞殼面可見頂槽（箭咀）及縱溝侵入（箭頭）；橫溝坑紋深刻，上下位移達本身寬度3倍。圖6：細胞顯示4個大而自發熒光的葉綠體。

Levanderina fissa
旋紋環溝藻

Moestrup, Hakanen, Hansen, Daugbjerg & Ellegaard, 2014

Phylum: Myzozoa 門：黏孢子門
Class: Dinophyceae 綱：甲藻綱
Order: Gymnodiniales 目：裸甲藻目
Family: Gymnodiniaceae 科：裸甲藻科



Tomas et al., 1997

Synonyms 異名：

Gymnodinium fissa Levander 1894, *Spirodimun fissum* Lemmermann 1900, *Gyrodinium fissum* (Levander) Kofoid & Swezy 1921, *Gyrodinium pavillardii* Biecheler 1952, *Gyrodinium uncatenum* Hulburt 1957, *Gyrodinium instriatum* Freudenthal and Lee 1963, *Gymnodinium uncatenum* (Hulburt) Hallegraeff 2002 and *Gyrodinium instriatum* (Freudenthal and Lee) Coat 2002

Description:

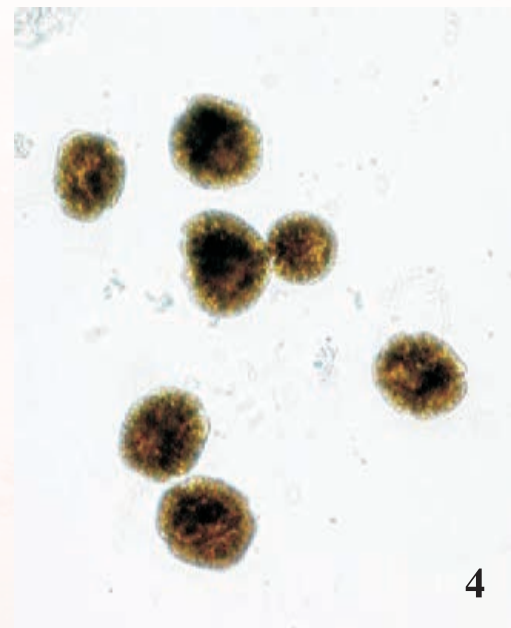
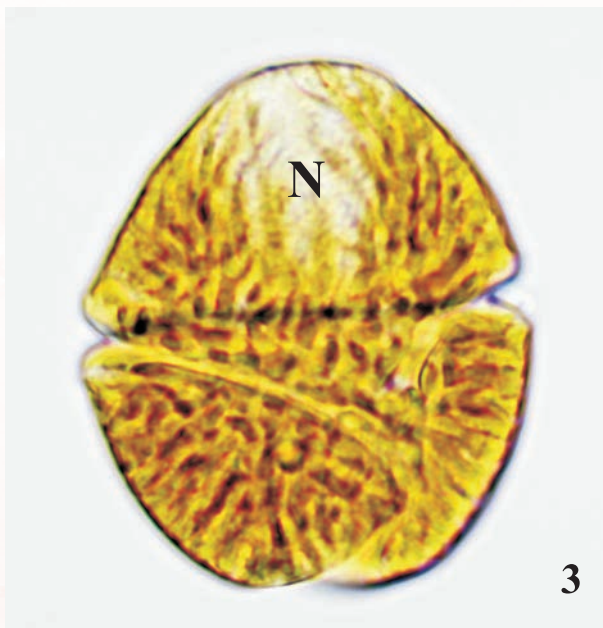
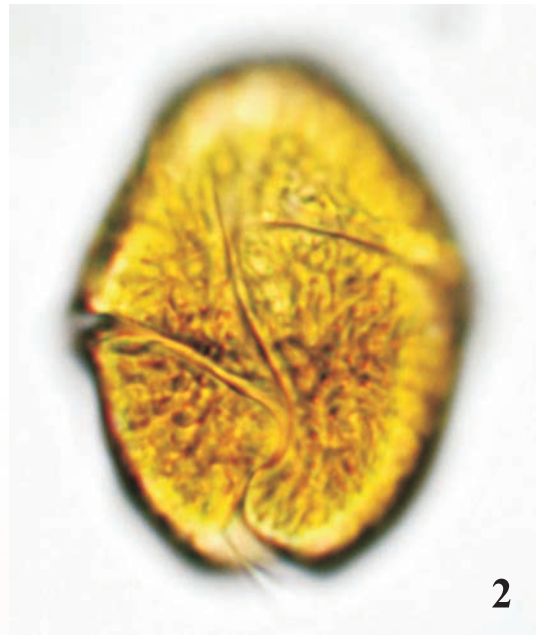
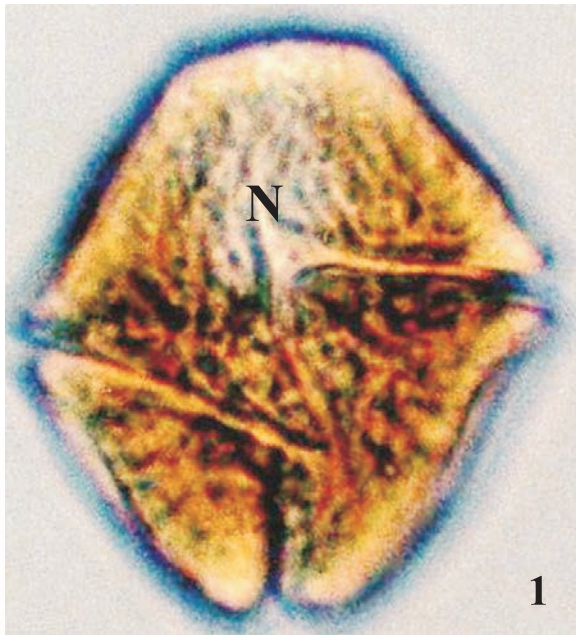
Levanderina fissa is an unarmoured species and the cell is round, oval to oblong, dorsoventrally flattened and occurs solitarily. The epicone is truncated conical and hypocone is cup-shaped and has 2 lobes at antapical. The cell size ranges from 40 - 70 μm in length. The cingulum is wide, deeply incised and displaced in the middle part of the cell and its end are displaced almost 1/3 of the cell length. The cell contains numerous discoidal, yellowish brown chloroplasts at cell periphery and a large oval nucleus is located in the epicone.

描述：

旋紋環溝藻是不具殼片藻類，細胞呈圓形、卵形或長橢圓形，背腹扁平，以單獨個體出現。上殼部分呈錐形，頂端截平，下殼部分呈杯形，底端分2裂片。細胞長介乎40 - 70微米。橫溝寬闊，並深陷於細胞中間位置，橫溝截距約為細胞長度的1/3。細胞內有大量呈盤形的黃褐色葉綠體，分布於細胞周邊表面，細胞核大，呈卵形，位於細胞的上殼。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1982	1	-
1983	1	-
1985	1	-
1998	1	-
2002	1	-
2004	1	-
Total/總數：	6	



Levanderina fissa. Figures 1-3: Live cell in ventral view showing cingulum displaced almost 1/3 of the cell length; large nucleus (N) located in the epicone and numerous discoidal, yellowish brown chloroplasts at the cell periphery. Figure 4: Fixed cells.

旋紋環溝藻。圖1-3：活細胞的正面觀顯示橫溝始末位移約為細胞長度的1/3；細胞核大，位於上殼部分及細胞內有大量呈盤形的黃褐色葉綠體，分布於細胞周邊表面。圖4：以固定劑固定的細胞。

Margalefidinium polykrikoides (未有中文名稱)

(Margalef) Gómez, Richlen & Anderson, 2017

Phylum: Myzozoa

門：黏孢子門

Class: Dinophyceae

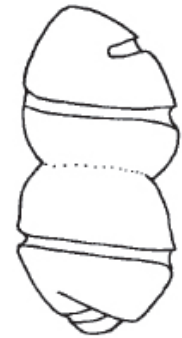
綱：甲藻綱

Order: Gymnodiniales

目：裸甲藻目

Family: Gymnodiniaceae

科：裸甲藻科



Tomas et al., 1997

Synonyms 異名：

Cochlodinium heterlobatum Silva 1967 and *Cochlodinium polykrikoides* Margalef 1961

Description:

Margalefidinium polykrikoides is an unarmoured species without thecal plate. The cell is small, more or less oval and slightly flattened dorsoventrally. The girdle makes 1.5 - 2.0 turns around the cell, is notched at the antapex. This species often forms short chains of no more than 8 cells and individual cell ranges from 28 - 40 μm in length, 20 - 30 μm in width. The apical groove is present. The epitheca is round and conical at the apex and the cingulum is deep and excavated, displaced at about 0.6 time of the cell length. The cells contain numerous rods or ellipsoid-shaped chloroplasts. The nucleus is situated anteriorly in the epitheca.

Toxicity:

Overseas research reported that *M. polykrikoides* is a toxic species and it associated with fish kill. The toxicity of the Hong Kong Strain is uncertain.

描述：

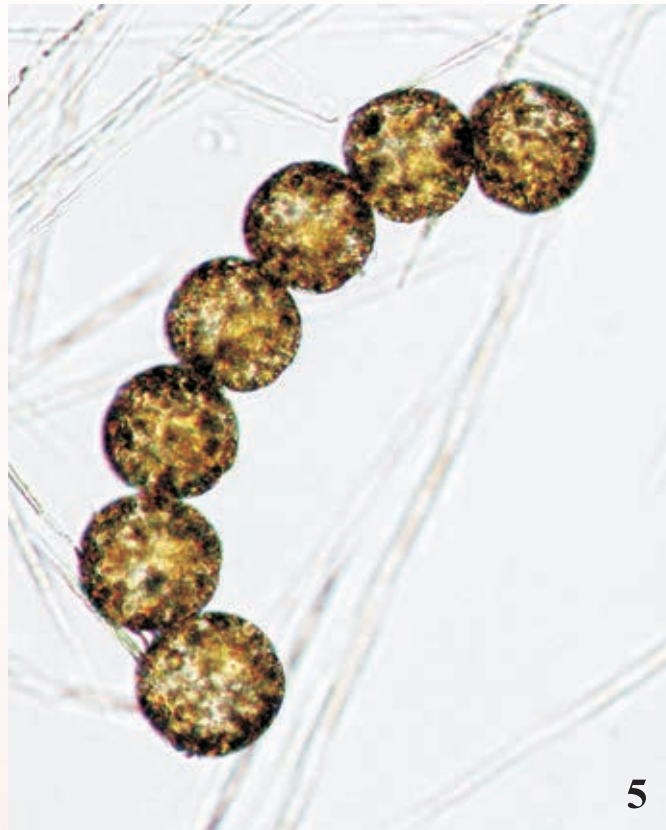
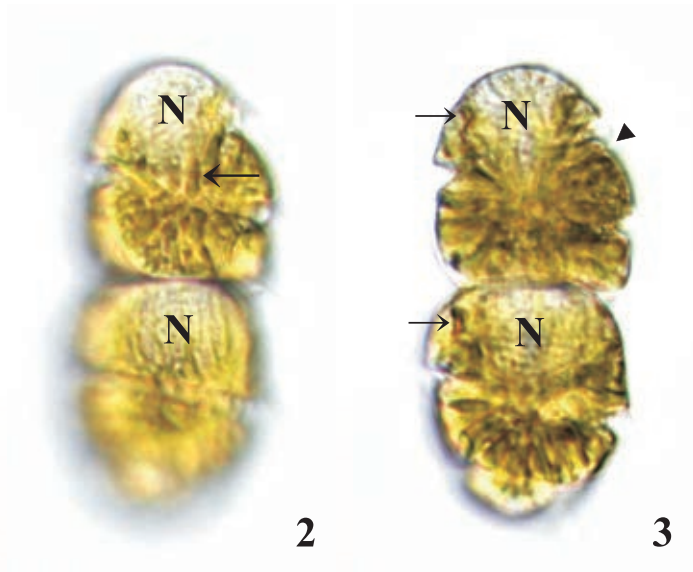
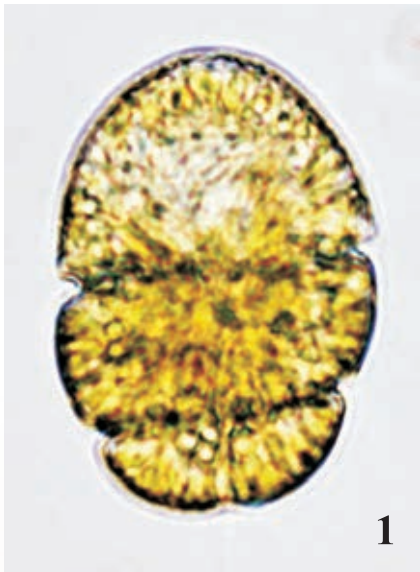
Margalefidinium polykrikoides 是不具殼片甲藻。細胞細小，大致呈卵形而背腹略為扁平。殼環帶環繞細胞1.5 - 2.0周，末端有凹槽。這種藻串連成短鏈狀，一般串連的細胞數目不超過8個，每個細胞長介乎28 - 40微米，闊介乎20 - 30微米，有頂槽，上殼片呈圓形但頂部呈錐形，橫溝深陷且闊，橫溝截距位於0.6倍細胞長度的位置。細胞內有無數桿狀形或橢圓形葉綠體。細胞核位於上殼片的前端位置。

毒性：

根據外國文獻記載，*M. polykrikoides* 與魚類死亡有關。香港的藻株疑有毒性，但尚未確定。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1984	2	<i>Mesodinium rubrum</i> 紅色中縊蟲、 <i>Noctiluca scintillans</i> 夜光藻
1998	2	-
2011	1	-
Total/總數：	5	



Margalefidinium polykrikoides. Figure 1: Live solitary cell in dorsal view. Figure 2: Surface view showing the chloroplasts in rod, ellipsoid-shape (arrow) and the nucleus (N) situated in the epicone. Figure 3: Live chained cells in dorsal view showing the position of sulcus (arrowhead) and red pigmented bodies (arrows) situated in the epicone. Figure 4: Live chained cells. Figure 5: Fixed cells.

Margalefidinium polykrikoides。圖1：單一活細胞背面觀。圖2：細胞表面顯示呈桿狀橢圓葉綠體（箭咀）及位於上殼的細胞核（N）。圖3：背面觀，串連成鏈狀的活細胞顯示縱溝位置（箭頭）及位於上殼的紅色眼點（箭咀）。圖4：串連成鏈狀的活細胞。圖5：以固定劑固定的細胞。

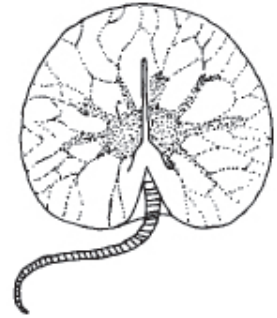
Noctiluca scintillans

夜光藻

(Macartney) Kofoid & Swezy, 1921

Phylum: Myzozoa
Class: Dinophyceae
Order: Noctilucida
Family: Noctilucaceae

門：黏孢子門
綱：甲藻綱
目：夜光藻目
科：夜光藻科



Tomas et al., 1997

Synonyms 異名：

Medusa marin Slabber 1771, *Medusa scintillans* Macartney 1810, *Noctiluca miliaris* Suriray 1816, *Mammaria scintillans* Ehrenberg 1834, *Noctiluca marina* Ehrenberg 1834, *Noctiluca punctate* Busch 1851, *Noctiluca omogenea* Giglioli 1870 and *Noctiluca pacifica* Giglioli 1870

Description:

Noctiluca scintillans is an unarmoured species. The cell is large, solitary and buoyant with a distinctively shaped nearly spherical. The cell size ranges from 100 - 2000 μm in diameter. The ventral groove is deep and wide and houses a flagellum, a tooth and a tentacle. The tentacle is striated and extends posteriorly. A large nucleus is located near ventral groove. Food vacuoles are present within cytoplasm and the chloroplast is absent. The cell is colourless. However, the cell appears pink or green in colour and has bioluminescence characteristic when photosynthetic symbionts are present in the cell.

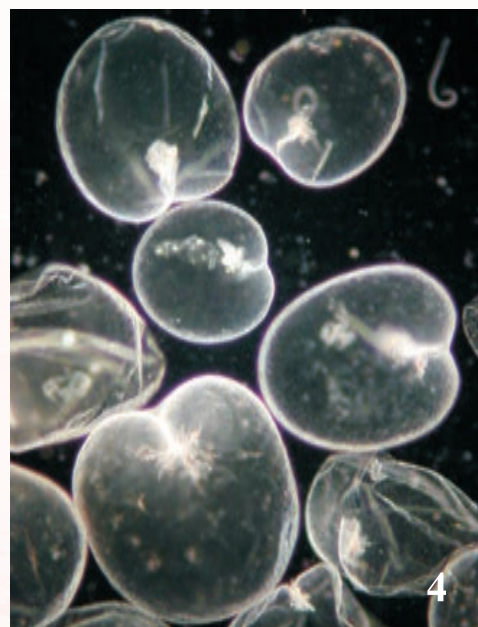
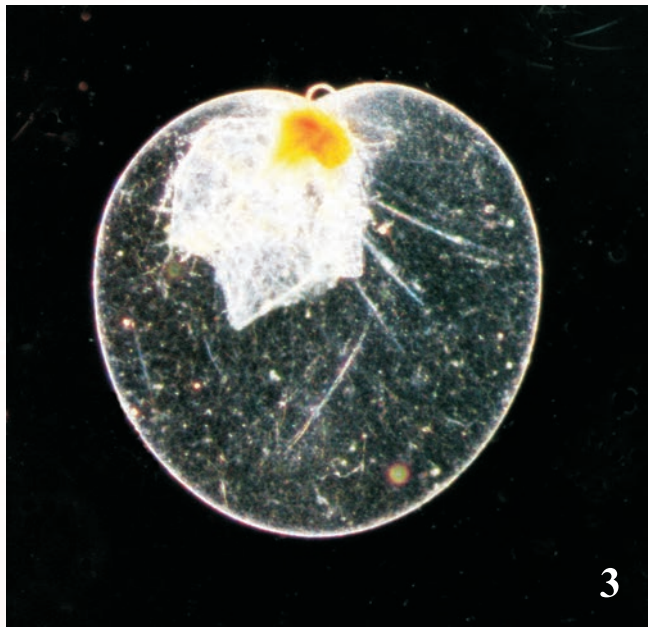
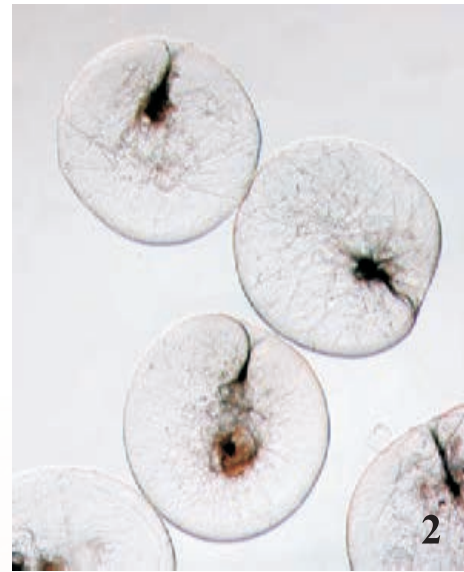
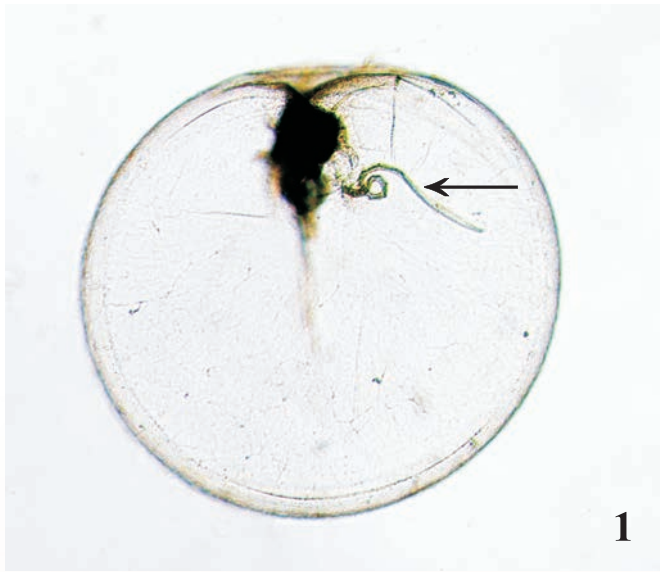
描述：

夜光藻(又稱夜光蟲)是不具殼片甲藻，細胞體大，單獨個體出現，呈獨特的近圓球形，浮游於水中。細胞直徑介乎100 - 2000微米。腹槽深陷而寬闊，藏有鞭毛、齒狀突及觸手。觸手表面有條紋，向後方伸出。細胞核大，位於腹槽附近，細胞質內有食物泡但沒有葉綠體。細胞本身並沒有顏色的，但當細胞內有光合成的共生體出現時，細胞會呈粉紅色或綠色並有生物熒光的特質。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

From 1975 to 2017, 287 red tide incidents caused by *Noctiluca scintillans* were recorded in Hong Kong waters. Refer to Appendix VIII for detailed information.

由 1975 年至 2017 年間，香港水域共錄得 287 宗由夜光藻引發的紅潮個案。有關資料詳情請參閱附錄八。



Noctiluca scintillans. Figures 1-2: Live cells in ventral view showing spherical in shape, large and colourless with a striated tentacle (arrow). Figures 3-4: Dark field micrographs.

夜光藻。圖1-2：活細胞的正面觀顯示細胞呈圓球形、體大及無色，細胞附有表面呈條紋的觸手（箭咀）。圖3-4：暗視野顯微鏡照片。

Peridinium quinquecorne

五刺多甲藻

Abé, 1927

Phylum: Myzozoa
Class: Dinophyceae
Order: Peridinales
Family: Peridiniaceae

門：黏孢子門
綱：甲藻綱
目：多甲藻目
科：多甲藻科



Abé, 1981

Synonyms 異名：

Protoperidinium quinquecorne (Abé) Balech 1974

Description:

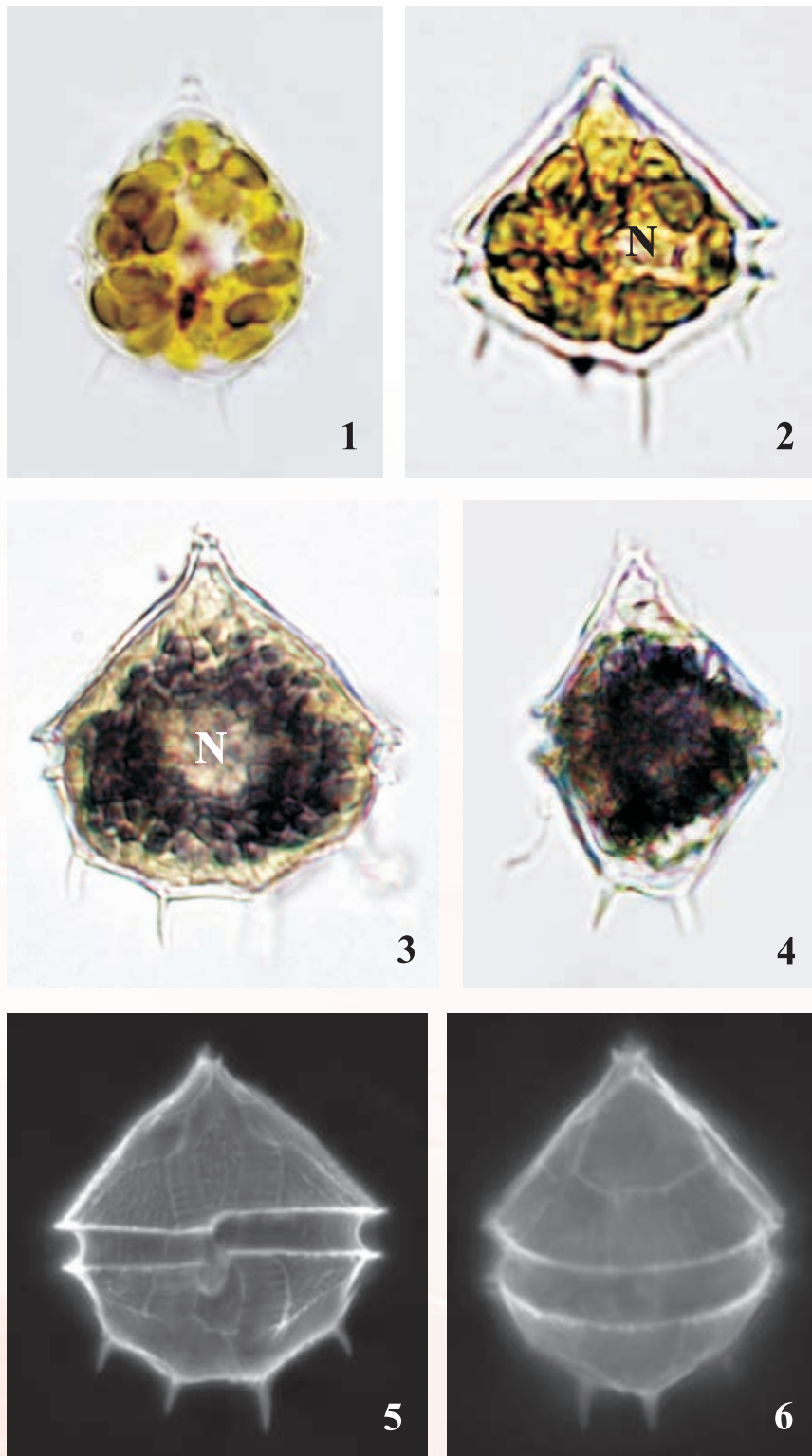
Peridinium quinquecorne is an armoured species. The cell is angular to ovoid with pointed apex and occurs solitarily. The epitheca is conical with an apical pore in the apical horn and hypotheca is round with four spines. The cell size ranges from 17.5 - 46 μm in length and 15 - 40 μm in width. The surface of thecal plates is smooth and has scattered pores. The cingulum is displaced in the middle part of the cell and formed by 5 plates. The cell contains numerous yellowish green, disc-shaped chloroplasts, 1 eyespot and a round nucleus is located at the centre.

描述：

五刺多甲藻是具殼片藻類，細胞呈多角形至卵形，有尖頂角，以單獨個體出現。上殼部分呈錐形，頂角有頂孔，下殼部分呈圓形，底部有4根小刺。細胞長介乎17.5 - 46微米，闊介乎15 - 40微米。殼片表面平滑及有零散小孔。橫溝由5片殼片組成，陷於細胞中間位置。細胞內有大量呈盤形的黃褐色葉綠體及1個眼點，細胞核呈圓形並位於細胞的中央。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2000	1	<i>Plagioselmis prolunga</i> 伸長斜片藻、 <i>Scrippsiella trochoidea</i> 錐狀斯氏藻
Total/總數：		1



Peridinium quinquecorne. Figure 1: Live cell in ventral view. Figures 2-3: Fixed cells in ventral view showing the nucleus (N) located in the centre with 4 antapical spines at the end of hypotheca. Figure 4: Cell in lateral view showing dorso-ventrally compressed. Figures 5-6: Epifluorescent stained cells.

五刺多甲藻。圖1：活細胞的正面觀。圖2-3：以固定劑固定的細胞正面觀顯示細胞核(N)位於細胞中央，底端有4根小刺。圖4：細胞的側面觀顯示背腹扁平。圖5-6：螢光染色的細胞。

Polykrikos geminatum

寶石多溝藻

(Schütt) Qiu, Huang, Liu, Zhang & Lin, 2013

Phylum: Myzozoa

Class: Dinophyceae

Order: Gymnodiniales

Family: Gymnodiniaceae

門：黏孢子門

綱：甲藻綱

目：裸甲藻目

科：裸甲藻科



Kofoid & Swezy, 1921



Schütt, 1895

Synonyms 異名：

Gymnodinium geminatum Schütt 1895, *Cochlodinium* c.f. *geminatum* Schütt 1896 and *Protopolykrikos distortus* Iwataki (unpublished)

Description:

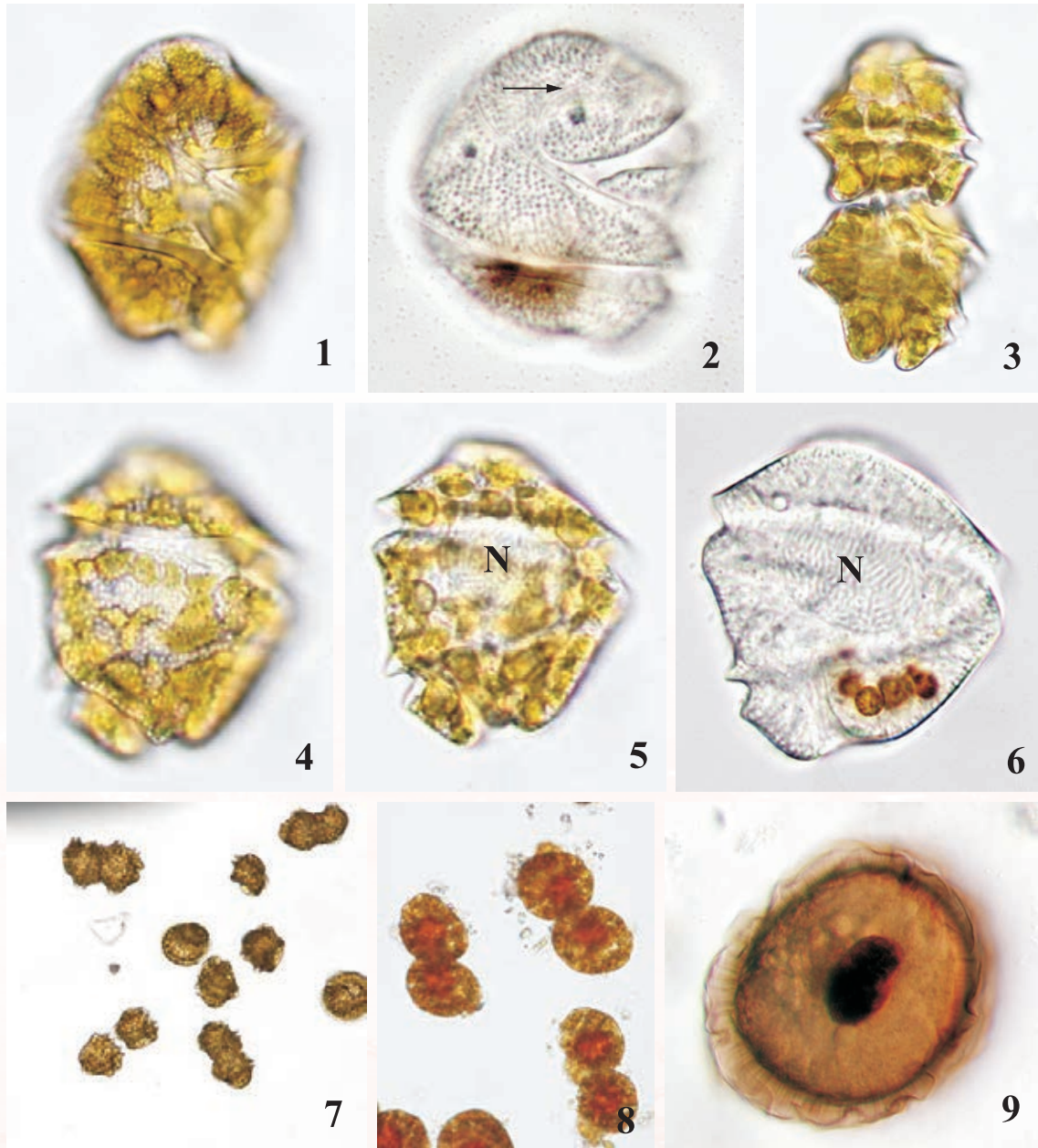
Polykrikos geminatum is an unarmoured species without thecal plate. The cell is irregularly spherical, or ovoid and slightly flattened dorsoventrally. The girdle makes 1.5 turns around the cell. This species often occurs solitarily or in short chains of 2 cells. The cell size ranges from 30 - 54 μm in length and 24 - 42 μm in width. Apical groove is hook-shaped; trichocyst located beneath the cell membrane and eyespot is absent. The cells contain numerous reticulated chloroplasts scattered throughout the cell periphery. A large spherical nucleus is located in the centre of cell.

描述：

寶石多溝藻是不具殼片甲藻。細胞大致呈不規則球形或卵形以及背腹略為扁平。殼環帶環繞細胞1.5周。這種藻常以單獨個體或由2個細胞串連成短鏈狀出現，每個細胞長介乎30 - 54微米，闊介乎24 - 42微米。頂槽呈鈎形，棘絲胞位於細胞膜之下，細胞沒有眼點。細胞內有無數網狀葉綠體，零散分布於細胞周邊。細胞核大，呈球形，位於細胞的中央。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2005	1	-
2006	1	-
2007	2	-
2009	1	-
2011	1	-
2012	1	-
2014	2	-
Total/總數：	9	



Polykrikos geminatum. Figure 1: Live cell in ventral view showing numerous reticulated chloroplasts scattered throughout the cell periphery. Figure 2: Live cell in ventral view showing hook-shaped apical groove (arrow) and without chloroplasts. Figure 3: Live chained cells in dorsal view. Figures 4-5: Same cell in dorsal view in different focal planes. Figure 6: A large nucleus (N) located centrally. Figure 7: Live red tide sample showing the cells often occur singly or in short chains of 2 cells. Figure 8: Fixed cells. Figure 9: Resting cyst.

寶石多溝藻。圖1：活細胞的正面觀顯示細胞內有無數網狀葉綠體，零散分布於細胞周邊。圖2：活細胞的正面觀顯示呈魚鉤形的頂槽（箭咀）及沒有葉綠體。圖3：呈鏈狀活細胞的背面觀。圖4-5：不同聚焦面下同一細胞的背面觀。圖6：一個大細胞核（N）位於細胞中央位置。圖7：活紅潮樣本顯示細胞以單獨個體或由2個細胞串連成短鏈狀出現。圖8：以固定劑固定的細胞。圖9：休眠包裹。

Prorocentrum balticum

波羅的海原甲藻

(Lohmann) Loeblich, 1970

Phylum: Myzozoa

Class: Dinophyceae

Order: Prorocentrales

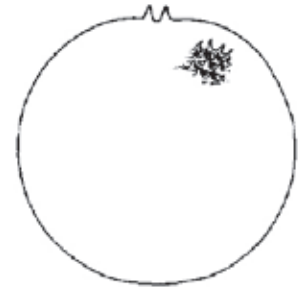
Family: Prorocentraceae

門：黏孢子門

綱：甲藻綱

目：原甲藻目

科：原甲藻科



Tomas et al., 1997

Synonyms 異名：

Exuviaella baltica Lohmann 1908, *Prorocentrum pomoideum* Bursa 1959 and *Exuviaella aequatorialis* Hasle 1960

Description:

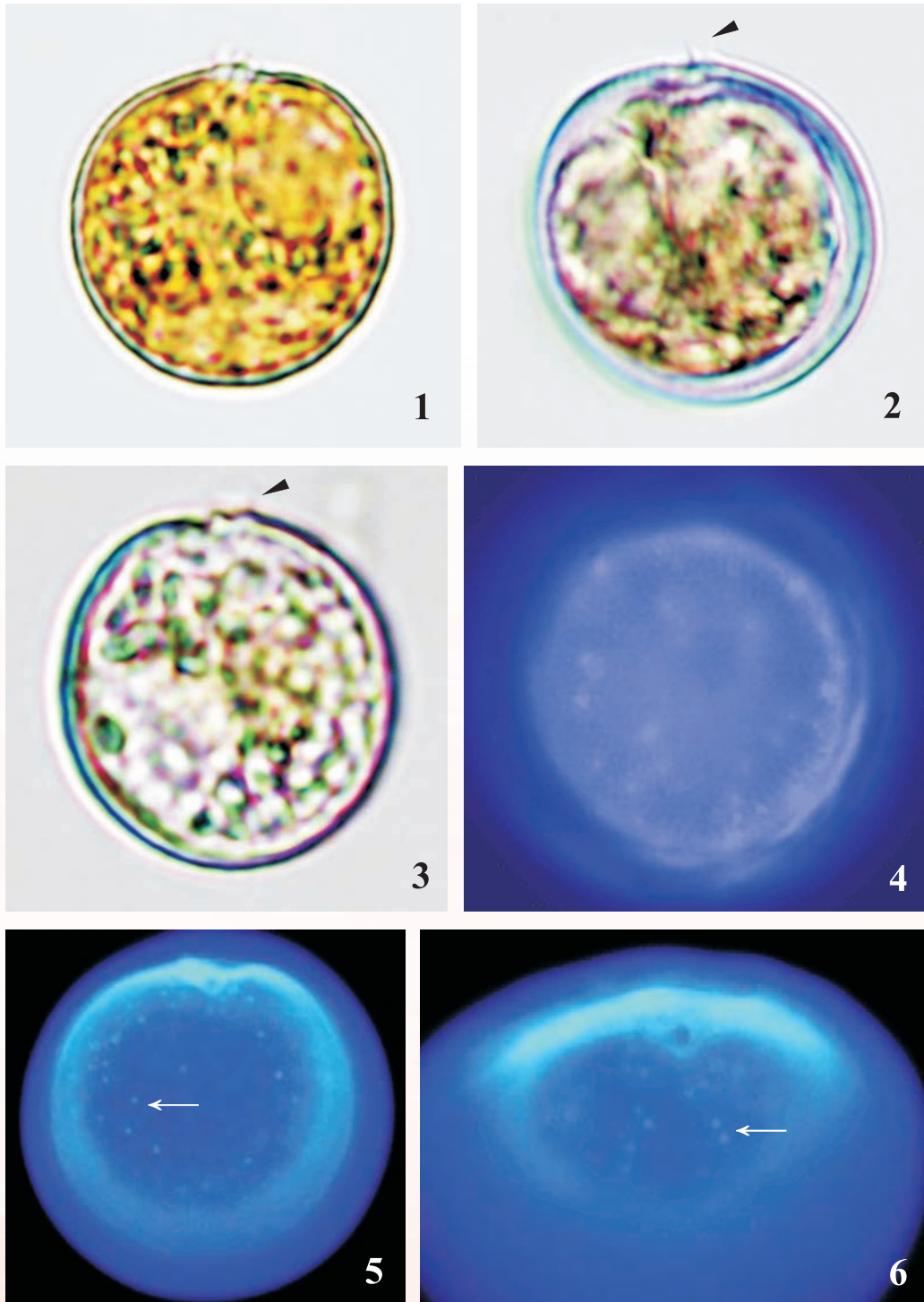
Prorocentrum balticum is a bivalvate armoured species. The cell is small, slightly laterally flattened, round or ovoid in shape and occurs solitarily. The cell bears 2 small apical spines in the periflagellar area. The cell size ranges from 9 - 22 μm in diameter. The surface of thecal plates is covered with small spines and a few scattered trichocyst pores. The cell contains several yellowish green chloroplasts and a round nucleus is located posteriorly.

描述：

波羅的海原甲藻是雙殼片甲藻，細胞細小，略為橫向扁平，呈圓形或卵形，多以單獨個體出現。圍鞭毛區有2條短小頂刺。細胞直徑介乎9 - 22微米。殼片表面布滿小刺及零散棘絲胞孔。細胞內有數個黃綠色的葉綠體，細胞核呈圓形，位於細胞的後端。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1999	1	<i>Gonyaulax polygramma</i> 多紋膝溝藻
2003	1	<i>Prorocentrum cordatum</i> 心形原甲藻
2005	1	<i>Noctiluca scintillans</i> 夜光藻
Total/總數：	3	



Prorocentrum balticum. Figure 1: Live cell in lateral view showing round or ovoid in shape. Figures 2-3: Fixed cells showing 2 small apical spines (arrow head) in the periflagellar area. Figures 4-6: Epifluorescent stained cells showing the surface of thecal plates covered with small spines (arrows) and a few scattered trichocyst pores.

波羅的海原甲藻。圖1：活細胞的側面觀顯示細胞呈圓形或卵形。圖2-3：以固定劑固定的細胞顯示圍鞭毛區有2條短小頂刺（箭頭）。圖4-6：熒光染色的細胞顯示殼片表面布滿小刺（箭咀）及零散棘絲胞孔。

Prorocentrum cordatum

心形原甲藻

(Ostenfeld) Dodge, 1975

Phylum: Myzozoa

Class: Dinophyceae

Order: Prorocentrales

Family: Prorocentraceae

門：黏孢子門

綱：甲藻綱

目：原甲藻目

科：原甲藻科



Tomas et al., 1997

Synonyms 異名：

Exuviaella cordata Ostenfeld 1902, *Exuviaella minima* Pavillard 1916, *Exuviaella pyriformis* Schiller 1928, *Prorocentrum triangulatum* Martin 1929, *Prorocentrum minimum* (Pavillard) Schiller 1933, *Exuviaella minima* Schiller 1933, *Exuviaella peisonis* Schiller 1955, *Exuviaella mariae-lebouriae* Parke & Ballantine 1957, *Exuviaella marie-lebouriae* Parke & Ballantine 1957, *Prorocentrum cordiformis* Bursa 1959, *Exuviaella pacifica* Kuz'mina 1960, *Prorocentrum mariae-lebourae* (Parke & Ballantine) Loeblich III 1970 and *Prorocentrum marie-lebouriae* (Parke & Ballantine) Loeblich III 1970

Description:

Prorocentrum cordatum is a bivalvate armoured species. The cell is small, laterally flattened, oval to heart-shaped and occurs solitarily. The anterior end is truncate with a small and shallow V-shaped depressed periflagellar area. A short spine is adjacent to the periflagellar area. The cell size ranges from 10 - 23 μm in length and 10 - 15 μm in width. The surface of thecal plates is covered with many small, short spines and scattered pores. The cell contains several yellow-brown chloroplasts and a broadly ellipsoidal nucleus is located posteriorly. 1 large pyrenoid and 2 pusules are present.

Toxicity:

Overseas research reported that *P. cordatum* is capable of producing venerupin (hepatotoxin) which causes shellfish poisoning resulting in gastrointestinal illnesses. The toxicity of the Hong Kong strain is uncertain.

描述：

心形原甲藻是雙殼片甲藻，細胞細小，略為橫向扁平，呈卵形至心形不等，以單獨個體出現。這種藻上殼前端部分截平，圍鞭毛區細小呈V形淺凹陷狀，圍鞭毛區鄰邊有一短刺。細胞長介乎10 - 23微米，闊介乎10 - 15微米。殼片表面布滿細小短刺及零散小孔。細胞內有數個黃褐色葉綠體，細胞核呈寬闊橢圓形，位於細胞的後端位置。細胞有1個大澱粉核及2個液泡。

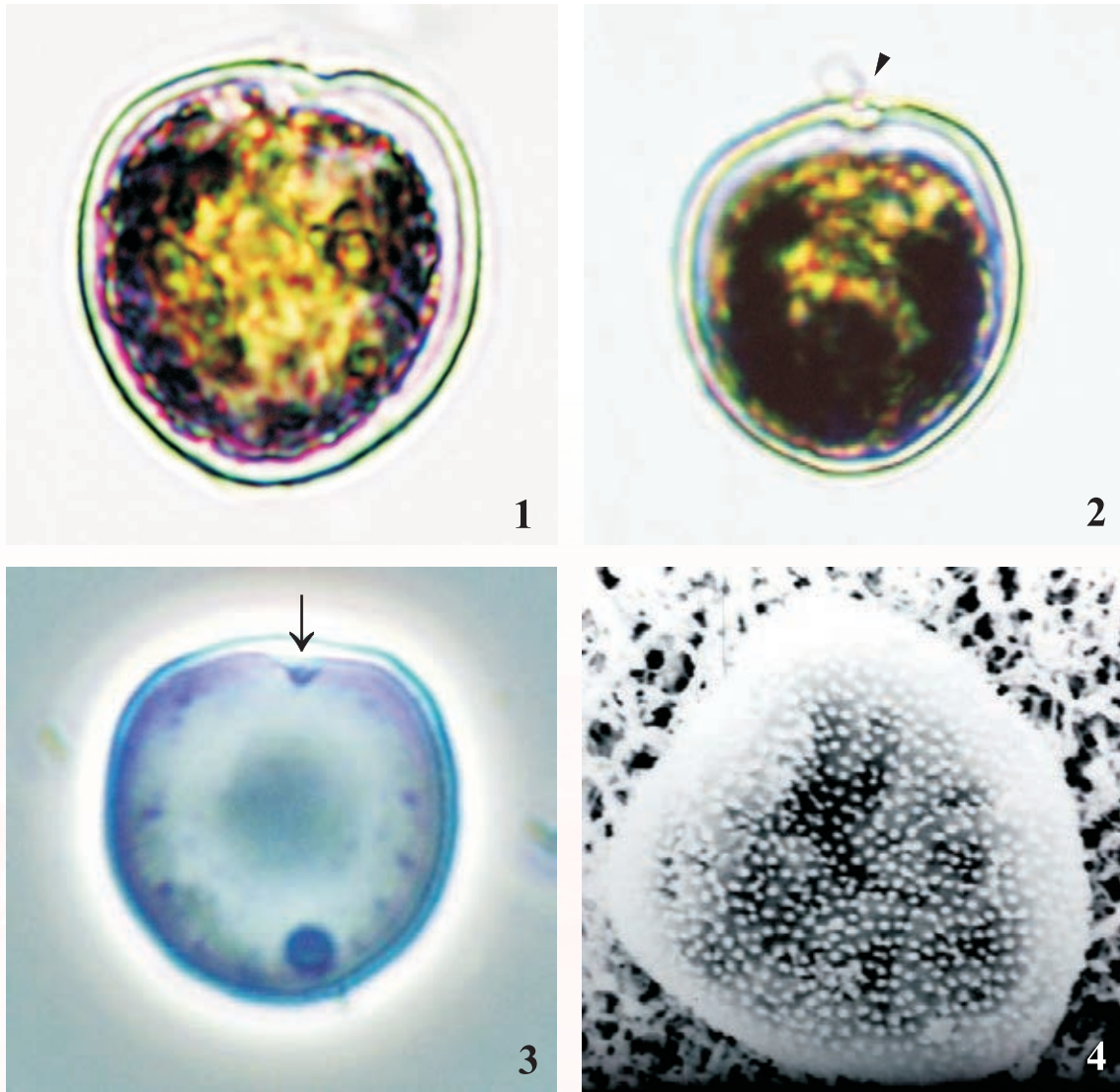
毒性：

根據外國文獻記載心形原甲藻可產生導致貝類中毒的蛤仔毒素(肝臟毒素)，令人類腸胃不適。香港藻株的毒性尚未能確定。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

From 1975 to 2017, 47 red tide incidents caused by *Prorocentrum cordatum* were recorded in Hong Kong waters. Refer to Appendix IX for detailed information.

由1975年至2017年間，香港水域共錄得47宗由心形原甲藻引發的紅潮個案。有關資料詳情請參閱附錄九。



Prorocentrum cordatum. Figures 1-2: Various cells in lateral view showing presence of a short apical spine (arrow head). Figure 3: Anterior end of right valve showing the V-shaped depression (arrow). Figure 4: Scanning electron micrograph showing thecal surface covered with numerous short spines.

心形原甲藻。圖1-2：不同細胞側面觀，可見短頂刺（箭頭）。圖3：右殼面前端可見V形凹陷（箭咀）。圖4：掃描電子顯微鏡圖片顯示殼片表面布滿短刺。

Prorocentrum dentatum

細齒原甲藻

Stein, 1883

Phylum: Myzozoa

Class: Dinophyceae

Order: Prorocentrales

Family: Prorocentraceae

門：黏孢子門

綱：甲藻綱

目：原甲藻目

科：原甲藻科



Tomas et al., 1997

Synonyms 異名：

Prorocentrum obtusidens Schiller 1928, *Prorocentrum veloi* Osorio-Tafall 1942 and *Prorocentrum monacense* Kufferath 1957

Description:

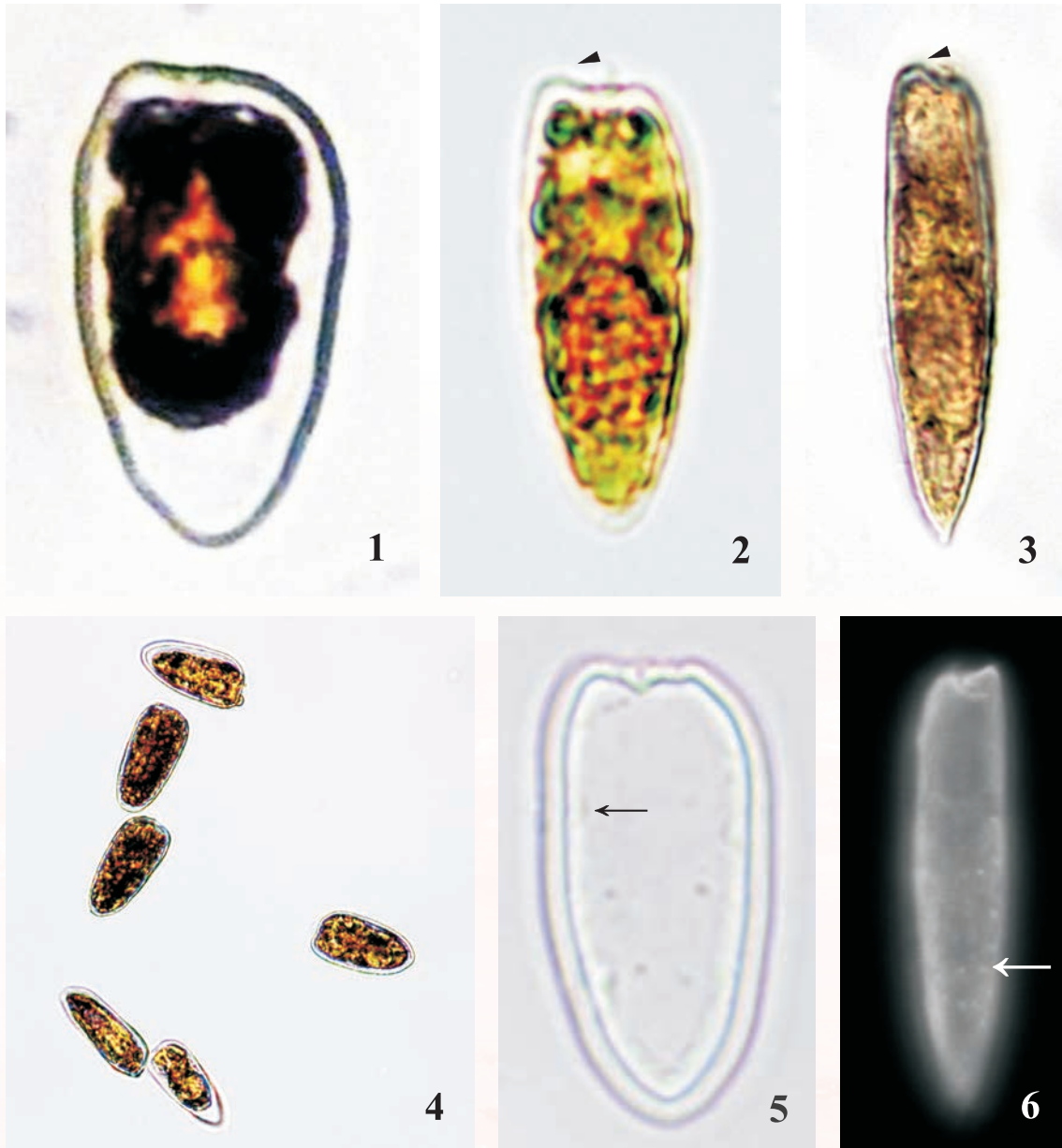
Prorocentrum dentatum is a bivalvate armoured species. The cell is laterally flattened, elongated and lanceolate to heart shape. It occurs solitarily or in chain form. This species is blunt or slightly pointed at the anterior with extension at one side without apical spine and tapered or slightly pointed at the posterior end. The cell size ranges from 15 - 60 μm in length and 9 - 20 μm in width. The surface of thecal plates is covered with small spines and trichocyst pores are around the valve margin. The cell contains several yellow-brown chloroplasts and a round nucleus is located posteriorly.

描述：

細齒原甲藻是雙殼片甲藻，細胞略為橫向扁平，呈長形、披針形或心形，以單獨個體出現或串連成鏈狀。這種藻上殼前端圓鈍或呈微尖狀而一邊則突出，沒有頂刺，下殼末端部分細長漸幼或呈微尖狀。細胞長介乎15 - 60微米，闊介乎9 - 20微米。殼片邊緣表面布滿小刺及沿殼片邊緣有棘絲胞孔。細胞內有數個黃褐色的葉綠體，細胞核呈圓形，位於細胞的後端。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1984	2	-
1985	1	<i>Prorocentrum triestinum</i> 尖葉原甲藻
1995	1	-
1998	2	-
	1	<i>Noctiluca scintillans</i> 夜光藻
	1	<i>Prorocentrum cordatum</i> 心形原甲藻
1999	1	<i>Prorocentrum cordatum</i> 心形原甲藻
2000	1	-
2001	1	-
2003	1	-
2004	1	-
2005	1	-
2008	1	-
Total/總數：	15	



Prorocentrum dentatum. Figures 1-4: Various cells in lateral view showing lanceolate or elongate in shape; blunt or slightly pointed at the anterior with extension (arrow heads) on one side without apical spine and tapered or slightly pointed at the posterior end. Figure 5: The trichocyst pores (arrow) scattered around the valve margin. Figure 6: Epifluorescent stained cell showing the trichocyst pores (arrow) scattered around the valve margin.

細齒原甲藻。圖1-4：不同細胞的側面觀顯示細胞呈披針形或長形；上殼前端的其中一端突起部分較鈍或呈微尖狀（箭頭），沒有頂刺，下殼末端部分細長漸幼或呈微尖狀。圖5：殼片邊緣表面布滿棘絲胞孔（箭咀）。圖6：熒光染色的細胞顯示殼片邊緣表面布滿棘絲胞孔（箭咀）。

Prorocentrum gracile

細長原甲藻

Schütt, 1895

Phylum: Myzozoa

門：黏孢子門

Class: Dinophyceae

綱：甲藻綱

Order: Prorocentrales

目：原甲藻目

Family: Prorocentraceae

科：原甲藻科



Tomas et al., 1997

Synonyms 異名：

Prorocentrum macrurus Athanassapoulos 1931, *Prorocentrum hentscheli* Schiller 1933, *Prorocentrum sigmoides* Böhm 1933 and *Prorocentrum diamantinae* Wood 1963

Description:

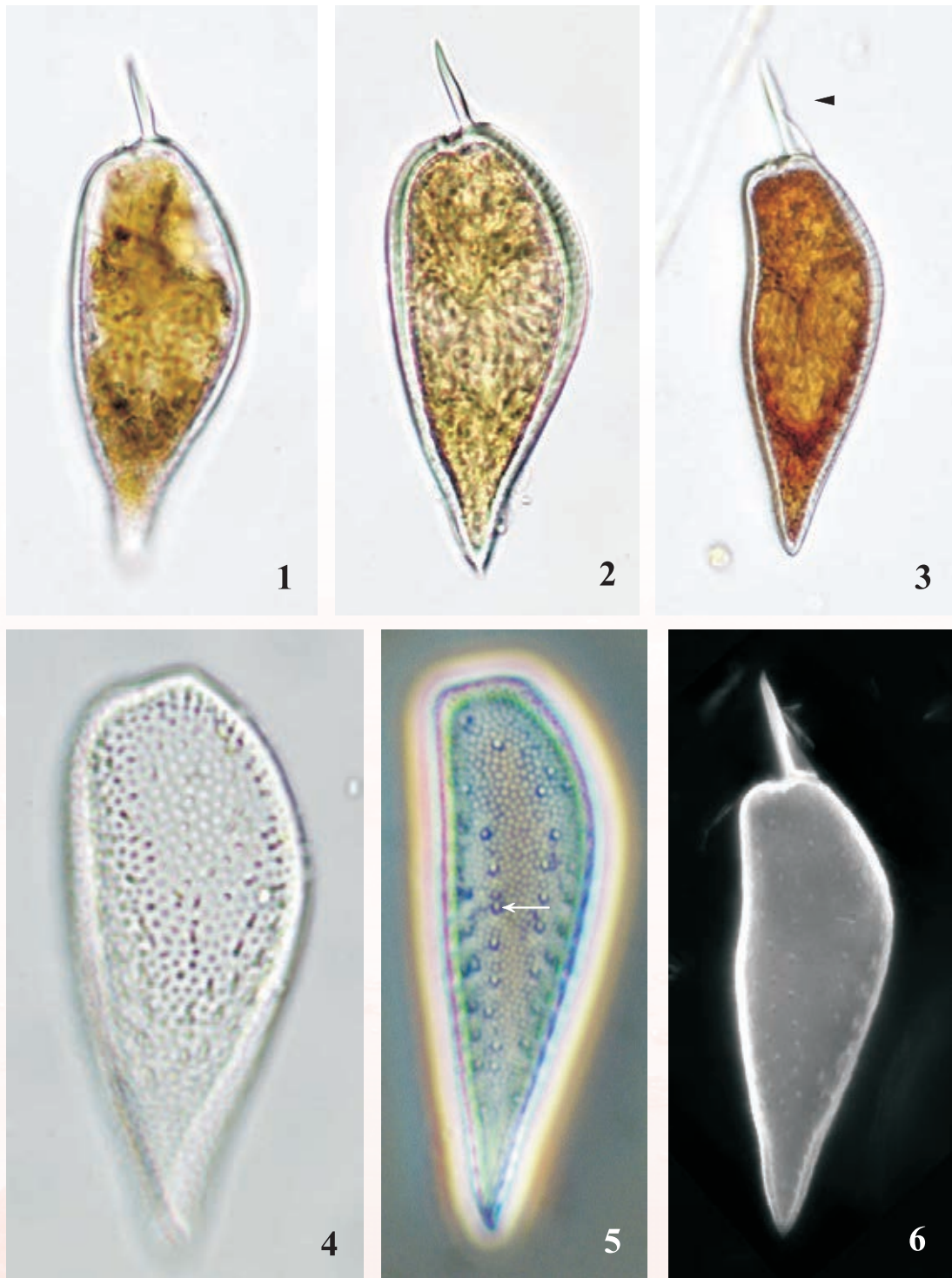
Prorocentrum gracile is a bivalvate armoured species. The cell is pointed or elongated to lanceolate and occurs solitarily. This species is round at the anterior with 1 long winged apical spine and pointed at the posterior end. The cell size ranges from 34 - 120 μm in length and 15 - 36 μm in width. The surface of thecal plates is covered with many shallow poroids and radially arranged trichocyst pores. The cell contains several yellow-brown chloroplasts and a V-shaped nucleus is located posteriorly.

描述：

細長原甲藻是雙殼片甲藻，細胞呈尖或拉長至披針形，以單獨個體出現。這種藻上殼前端部分呈圓形，有1根長翼狀頂刺，下殼末端部分尖細。細胞長介乎34 - 120微米，闊介乎15 - 36微米。殼片表面布滿淺小穴及呈放射形排列的棘絲胞孔。細胞內有數個黃褐色的葉綠體，細胞核呈V形，位於細胞的後端。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1980	1	-
1984	1	-
1985	1	-
1986	1	-
1988	2	-
	1	<i>Tripos furca</i> 叉角藻
	1	<i>Prorocentrum cordatum</i> 心形原甲藻
1990	3	-
	2	<i>Prorocentrum cordatum</i> 心形原甲藻
1997	1	<i>Karenia mikimotoi</i> 米氏凱倫藻、 <i>Prorocentrum cordatum</i> 心形原甲藻
	1	<i>Heterosigma akashiwo</i> 赤潮異彎藻、 <i>Prorocentrum triestinum</i> 尖葉原甲藻
2000	1	-
Total/總數：	16	



Prorocentrum gracile. Figure 1: Live cell in lateral view. Figures 2-3: Various cells in lateral view showing pointed or elongated to lanceolate in shape; round at the anterior with long winged apical spine (arrow head) and pointed at the posterior end. Figures 4-5: The surface of thecal plates covered with many shallow poroids and radially arranged trichocyst pores (arrow). Figure 6: Epifluorescent stained cell.

細長原甲藻。圖1：活細胞的側面觀。圖2-3：不同細胞的側面觀顯示呈尖或拉長至披針形；上殼前端部分呈圓形，有1根長翼狀頂刺（箭頭）及下殼末端部分尖細。圖4-5：殼片表面布滿淺小穴及呈放射形排列的棘絲胞孔（箭咀）。圖6：熒光染色的細胞。

Prorocentrum micans

海洋原甲藻

Ehrenberg, 1834

Phylum: Myzozoa

Class: Dinophyceae

Order: Prorocentrales

Family: Prorocentraceae

門：黏孢子門

綱：甲藻綱

目：原甲藻目

科：原甲藻科



Tomas et al., 1997

Synonyms 異名：

Prorocentrum schillerii Böhrn 1933, *Prorocentrum levantinoides* Bursa 1959, *Prorocentrum levantoides* Bursa 1959 and *Prorocentrum pacificum* Wood 1963

Description:

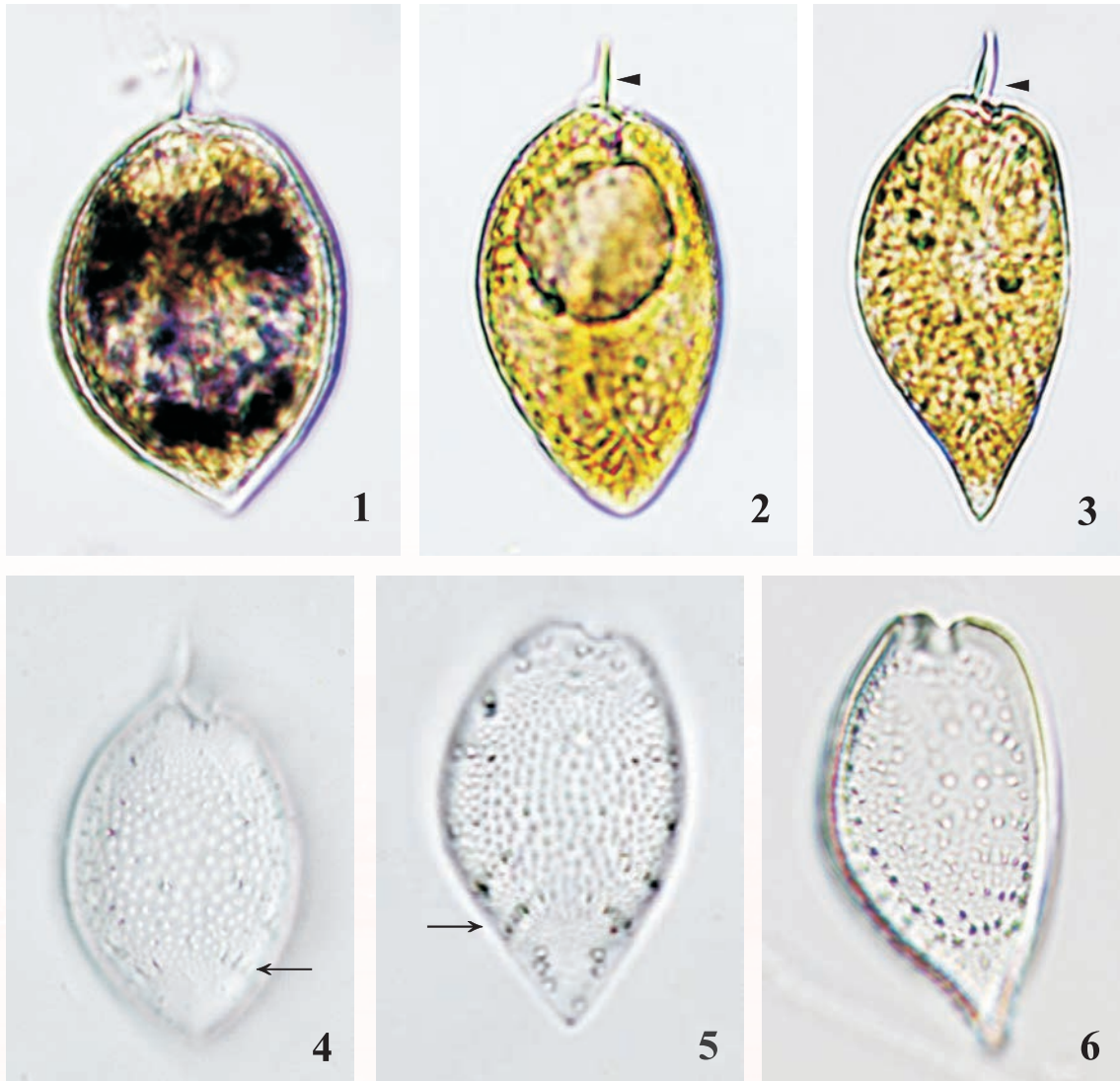
Prorocentrum micans is a bivalvate armoured species. The cell is medium-sized, laterally flattened, highly variable in shape from tear-drop to heart shape. It occurs solitarily. This species is round at the anterior with a winged apical spine and pointed at the posterior end. The cell size ranges from 15 - 80 μm in length and 15 - 50 μm in width. The surface of thecal plates is covered with shallow poroids and numerous radially arranged trichocyst pores. The intercalary band is smooth and wide. The cell contains several yellowish green chloroplasts and a V-shaped nucleus is located posteriorly.

描述：

海洋原甲藻是雙殼片甲藻，屬中型細胞，橫向略為扁平，外形多變可呈淚珠形至心形不等，以單獨個體出現。這種藻上殼前端部分呈圓形，有翼狀頂刺，下殼末端部分較尖。細胞長介乎15 - 80微米，闊介乎15 - 50微米。殼片表面布滿淺小穴及大量呈放射形排列的棘絲胞孔。中間帶平滑、寬闊。細胞內包有數個黃褐色的葉綠體，細胞核呈V形，位於細胞的後端。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1980	1	-
1982	1	<i>Noctiluca scintillans</i> 夜光藻
1983	1	-
1984	1	-
2004	6	-
	1	<i>Chattonella marina</i> 海洋褐胞藻
Total/總數：		11



Prorocentrum micans. Figures 1-3: Various cells in lateral view showing this species is highly variable in shape from tear-drop to heart shape; round at the anterior with a winged apical spine (arrow heads) and pointed at the posterior end. Figures 4-6: The surface of thecal plates covered with shallow poroids and numerous trichocyst pores (arrows) arranged radially.

海洋原甲藻。圖1-3：不同細胞的側面觀顯示此品種外形多變，可呈淚珠形至心形不等；上殼前端部分呈圓形，有翼狀頂刺（箭頭），下殼末端部分較尖。圖4-6：殼片表面布滿淺小穴及大量放射形排列的棘絲胞孔（箭咀）。

Prorocentrum rhathymum

慢原甲藻

Loeblich, Sherley & Schmidt, 1979

Phylum: Myzozoa

門：黏孢子門

Class: Dinophyceae

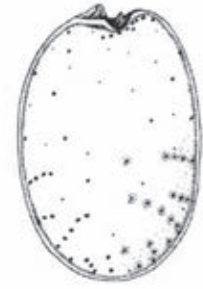
綱：甲藻綱

Order: Prorocentrales

目：原甲藻目

Family: Prorocentraceae

科：原甲藻科



Hoppenrath et al., 2013

Description:

Prorocentrum rhathymum is ovoid to oblong in valve view. Size ranges from 25 - 48 μm long, 18 - 32 μm wide. A winged apical spine is present at the periflagellar area. The thecal surface is smooth with trichocyst pores radially ranged. The pores are perpendicular to the cell periphery. The nucleus is located in the posterior part of the cell. Pyrenoid and marginal pores are absent.

Toxicity:

Overseas research reported that *P. rhathymum* is capable of producing haemolytic and fast-acting toxin (FAT). The toxicity of the Hong Kong strain is uncertain.

描述：

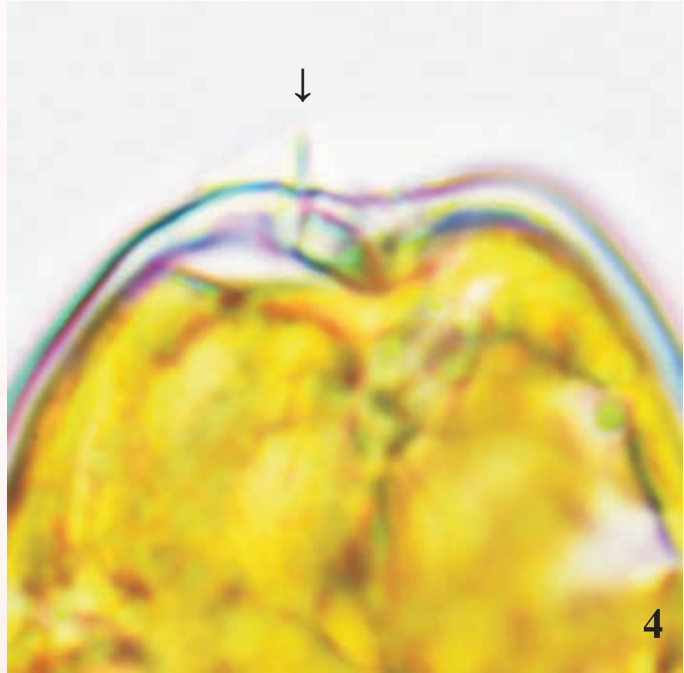
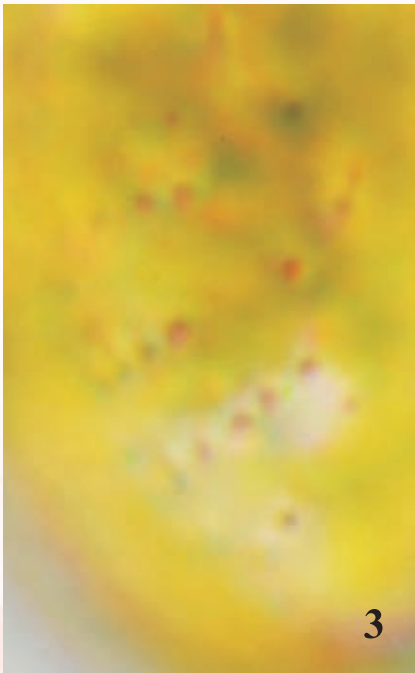
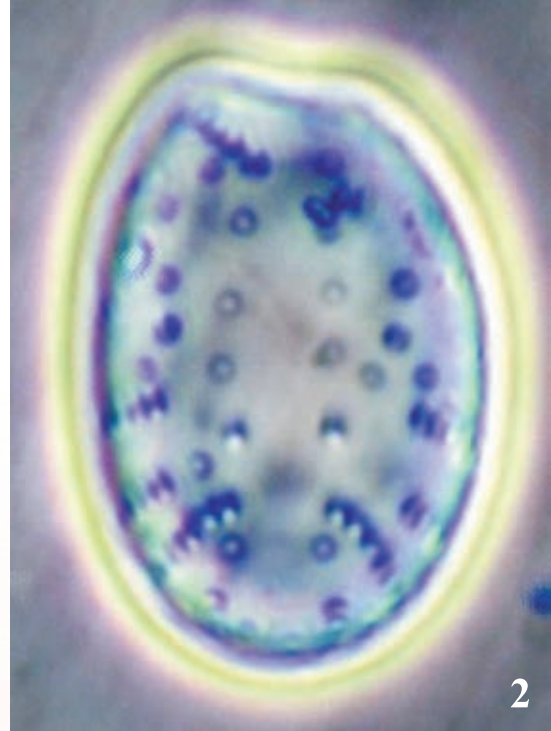
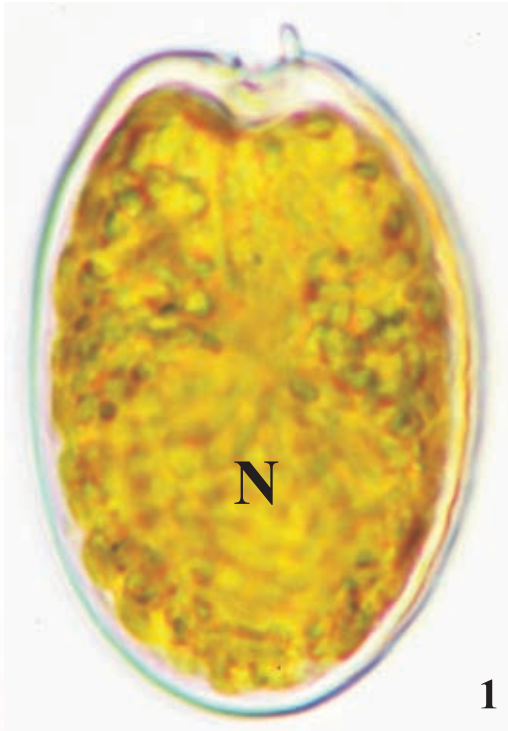
慢原甲藻的側面觀大致呈橢圓形至長方形，細胞體長25 - 48微米，寬18 - 32微米。圍鞭毛區有一翼狀頂刺。殼片表面平滑，有呈放射形排列的刺絲泡小孔，刺絲泡小孔與細胞邊緣成直角。細胞核位於細胞下方部份。細胞沒有澱粉核邊緣孔。

毒性：

根據外國文獻記載慢原甲藻可產生溶血毒素及快速反應毒素。香港藻株的毒性尚未能確定。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2017	1	<i>Akashiwo sanguinea</i> 血紅赤潮藻
Total/總數：		1



Prorocentrum rhathymum. Figure 1: Cells in valve view showing oval in shape; nucleus (N) located in the posterior part of the cell. Figures 2-3: Trichocyst pores radially arranged. Figure 4: Periflagellar area with well developed winged apical spine (arrow).

慢原甲藻。圖1：細胞側面觀顯示細胞呈橢圓形；細胞核(N)位於細胞的下方部份。圖2-3：刺絲泡小孔呈放射形排列。圖4：圍鞭毛區展示翼狀頂刺。

Prorocentrum triestinum

尖葉原甲藻

Schiller, 1918

Phylum: Myzozoa

Class: Dinophyceae

Order: Prorocentrales

Family: Prorocentraceae

門：黏孢子門

綱：甲藻綱

目：原甲藻目

科：原甲藻科



Tomas et al., 1997

Synonyms 異名：

Prorocentrum pyrenoideum Bursa 1959, *Prorocentrum redfieldii* Bursa 1959, *Prorocentrum setouti* Hada 1975 and *Prorocentrum setoutii* Hada 1975

Description:

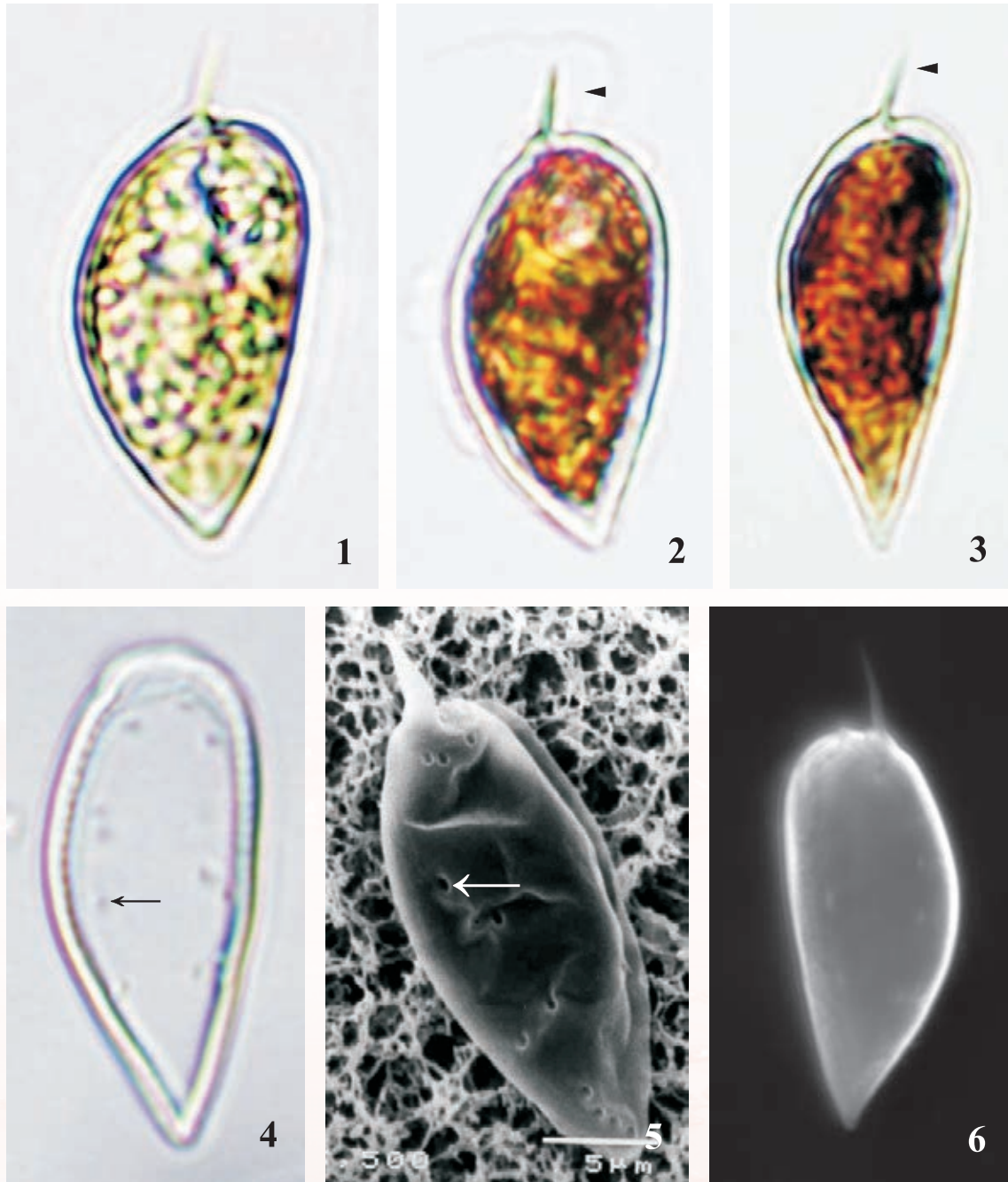
Prorocentrum triestinum is a bivalvate armoured species. The cell is small and elongated and it occurs solitarily. This species is round at the anterior with 1 narrow winged apical spine and pointed at the posterior end. The cell size ranges from 18 - 30 μm in length. The surface of thecal plates is smooth and has a few scattered trichocyst pores. The periflagellar area is a shallow depression. The cell contains several yellowish green chloroplasts and a round nucleus is located posteriorly.

描述：

尖葉原甲藻是雙殼片甲藻，細胞細小、呈長形、以單獨個體出現。這種藻上殼前端部分呈圓形，有1根狹窄翼狀頂刺，下殼末端部分尖細。細胞長介乎18 - 30微米。殼片表面平滑，有一些零散的棘絲胞孔。圍鞭毛區細小呈淺凹陷狀。細胞內有多個黃綠色的葉綠體，細胞核呈圓形，位於細胞的後端。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1983	1	-
1985	10	-
	1	<i>Prorocentrum dentatum</i> 細齒原甲藻
	1	<i>Thalassiosira mala</i> 中肋海鏈藻
1986	5	-
1987	3	-
1988	1	-
	2	<i>Prorocentrum cordatum</i> 心形原甲藻
1989	2	-
	1	<i>Prorocentrum cordatum</i> 心形原甲藻、 <i>Skeletonema costatum</i> 中肋骨條藻
1994	1	<i>Eutreptiella</i> sp. 異雙鞭裸藻、 <i>Noctiluca scintillans</i> 夜光藻
1997	1	<i>Heterosigma akashiwo</i> 赤潮異彎藻、 <i>Prorocentrum gracile</i> 細長原甲藻
1998	1	<i>Thalassiosira pseudonana</i> 假微型海鏈藻
2000	1	<i>Prorocentrum cordatum</i> 心形原甲藻
2001	1	<i>Prorocentrum cordatum</i> 心形原甲藻、 <i>Scrippsiella trochoidea</i> 錐狀斯氏藻
Total/總數：		32



Prorocentrum triestinum. Figure 1: Live cell in lateral view. Figures 2-3: Various cells in lateral view showing elongated in shape; round at the anterior with a narrow winged apical spine (arrow heads) and pointed at the posterior end. Figures 4-5: The surface of thecal plates is smooth with few scattered trichocyst pores (arrows). Figure 6: Epifluorescent stained cell.

尖葉原甲藻。圖1：活細胞的側面觀。圖2-3：不同細胞的側面觀顯示細胞呈長形；上殼前端部分呈圓形，有1根狹窄翼狀頂刺（箭頭）及下殼末端部分尖細。圖4-5：殼片表面平滑及有零散棘絲胞孔（箭咀）。圖6：熒光染色的細胞。

Protoperidinium depressum

扁平原多甲藻

(Bailey) Balech, 1974

Phylum: Myzozoa

Class: Dinophyceae

Order: Peridinales

Family: Protoperidiniaceae

門：黏孢子門

綱：甲藻綱

目：多甲藻目

科：原多甲藻科



Tomas et al., 1997

Synonyms 異名：

Peridinium depressum Bailey 1854, *Protoperidinium parallelum* Broch 1906 and *Protoperidinium parallelum* Paulsen 1907

Description:

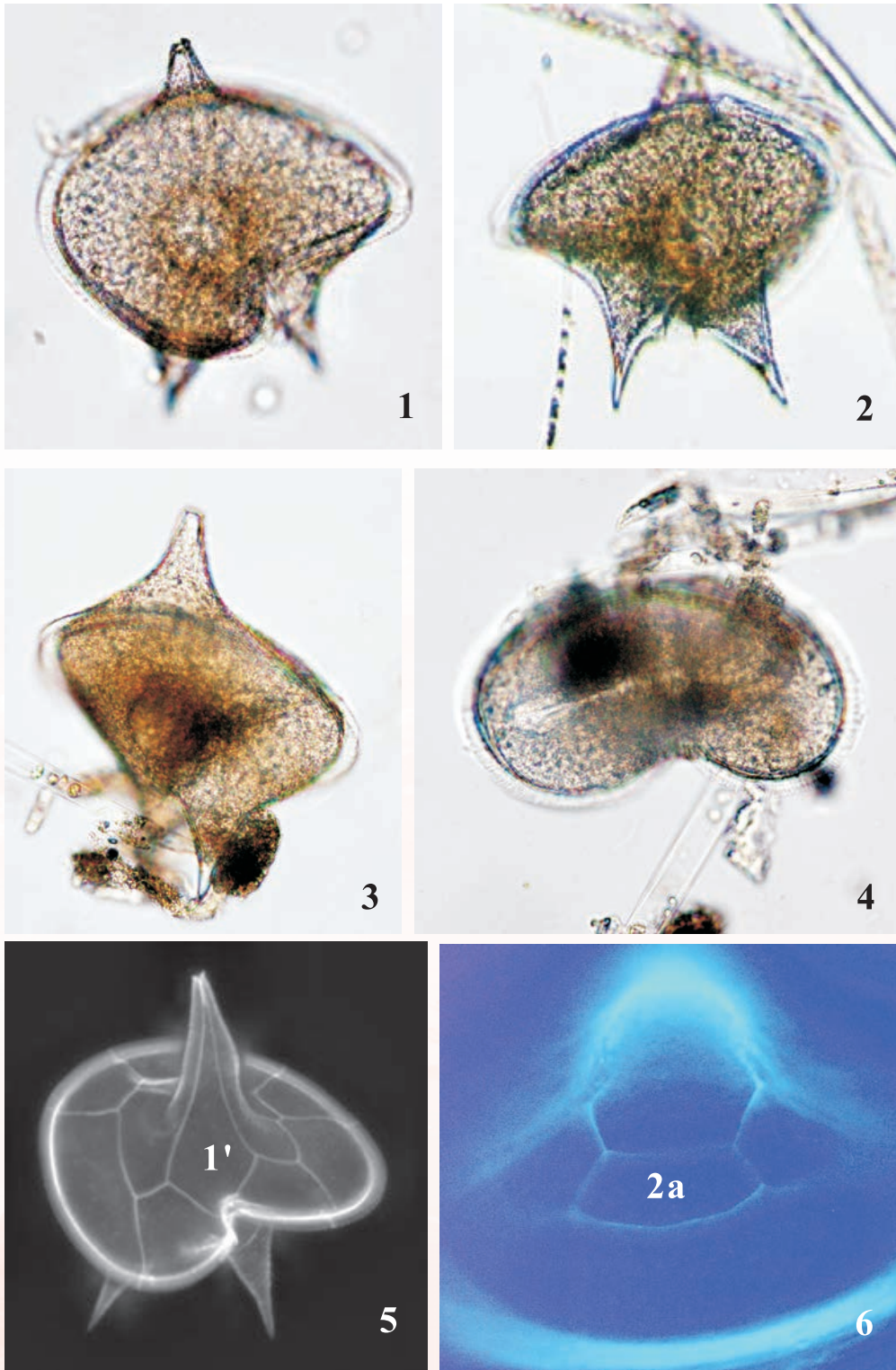
Protoperidinium depressum is an armoured species. The cell is large, elongated with a round or quadrangular body and it occurs solitarily. In ventral view, the epitheca is conical and has 1 long apical horn. The hypotheca has 2 long divergent antapical horns with shorter left antapical horn. The cell size ranges from 116 - 200 μm in length. The cingulum is narrow, left-handed with wide cingular lists. The sulcus is deep and forms a strong indentation of the the antapical margin between horns of hypotheca. The cell contains several yellowish brown chloroplasts and a nucleus is located at the centre of the cell.

描述：

扁平原多甲藻是具殼片藻類，細胞體大，呈長形，中間呈圓形或四邊形，以單獨個體出現。從正面觀，上殼部分呈錐形，有1長頂角，下殼末端部分有2個長而分叉的底角，左底角較右底角短。細胞長介乎116 - 200微米。橫溝窄，略左旋，有寬闊的橫溝翼。縱溝深，於下殼的底端邊緣兩個底角之間形成明顯凹槽。細胞內有數個黃褐色的葉綠體，細胞核位於細胞的中央。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1979	1	-
Total/總數：		1



Protoperidinium depressum. Figure 1: Anterior ventral view of the cell showing the epitheca is conical and has a long apical horn. Figure 2: Posterior dorsal view. Figure 3: Right lateral view. Figure 4: Apical view. Figures 5-6: Epifluorescent stained cells; plate configuration showing 1'=ortho & 2a=quadra.

扁平原多甲藻。圖1：細胞正面觀顯示上殼部分呈錐形及有長頂角。圖2：後背面觀。圖3：右側面觀。圖4：頂面觀。圖5-6：熒光染色的細胞；殼片排列顯示第一頂甲片（1'）呈直形而中間甲片（2a）是四邊形。

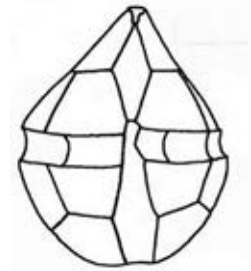
Scrippsiella trochoidea

錐狀斯氏藻

(Stein) Loeblich III, 1976

Phylum: Myzozoa
Class: Dinophyceae
Order: Peridinales
Family: peridiniaceae

門：黏孢子門
綱：甲藻綱
目：多甲藻目
科：多甲藻科



Tomas et al., 1997

Synonyms 異名：

Glenodinium trochoideum Stein 1883, *Glenodinium acuminatum* Jörgensen 1899, *Peridinium faeroense* Paulsen 1905, *Peridinium trochoideum* (Stein) Lemmermann 1910, *Scrippsiella faeroensis* (Paulsen) Balech & Soares 1966, *Scrippsiella faeroensis* (Paulsen) Balech & Soares 1967, *Scrippsiella faeronese* Dickensheets & Cox 1971 and *Calciodinellum faeroense* (Paulsen) Havskum 1991

Description:

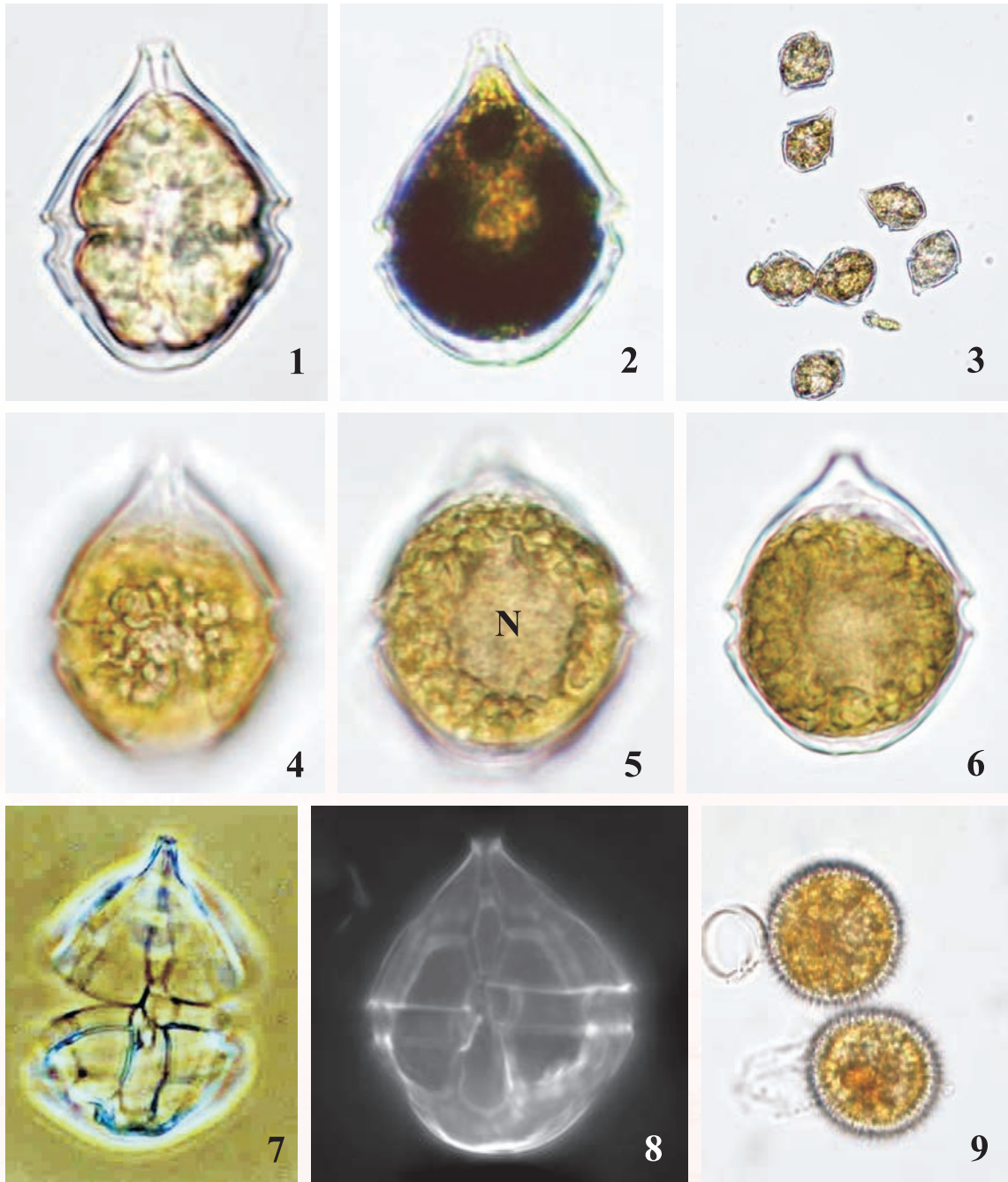
Scrippsiella trochoidea is an armoured species. The cell is solitary and pear-shaped. In ventral view, the epitheca is conical and has a short apical process; the hypotheca is round without spine or horn. The epitheca is slightly larger than the hypotheca. The cell size ranges from 16 - 43 μm in length. The cingulum is nearly excavated without cingular list. The sulcus is wide and excavated. The cell contains several yellowish brown chloroplasts and a nucleus is located at the centre of the cell.

描述：

錐狀斯氏藻是具殼片藻類，細胞呈梨形，以單獨個體出現。從正面觀，上殼部分呈錐形，有短突起頂端，下殼部分呈圓形，沒有刺或底角。上殼較下殼略大。細胞長介乎16 - 43微米。橫溝陷入，沒有橫溝翼。縱溝寬闊，深陷。細胞內有數個黃褐色的葉綠體，細胞核位於細胞的中央。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1988	1	<i>Karenia mikimotoi</i> 米氏凱倫藻
2000	10	-
	1	<i>Peridinium quinquecorne</i> 五刺多甲藻、 <i>Plagioselmis prolunga</i> 伸長斜片藻
2001	5	-
	1	<i>Skeletonema costatum</i> 中肋骨條藻、 <i>Thalassiosira</i> sp. 海鏈藻
	1	<i>Prorocentrum cordatum</i> 心形原甲藻
	1	<i>Prorocentrum cordatum</i> 心形原甲藻、 <i>Prorocentrum triestinum</i> 尖葉原甲藻
2003	1	-
2007	1	-
2010	2	-
2012	1	-
2013	1	-
2014	1	<i>Heterosigma akashiwo</i> 赤潮異彎藻
Total/總數：	27	



Scripsiella trochoidea. Figure 1: Live cell in ventral view showing the cell is pear-shaped; epitheca conical with a short apical process and hypotheca in round shape. Figure 2: Fixed cell in ventral view. Figure 3: Live red tide sample. Figures 4-6: Same cell in ventral view in different focal planes showing a large nucleus (N) located in the centre. Figure 7: Ventral view of theca plates; phase contrast. Figure 8: Epifluorescent stained cell. Figure 9: Resting cysts.

錐狀斯氏藻。圖1：活細胞的正面觀顯示細胞呈梨形；上殼部分呈錐形，有短突起頂端及下殼部分呈圓形。圖2：以固定劑固定的細胞正面觀。圖3：活紅潮樣本。圖4-6：不同聚焦下同一細胞的正面觀顯示一個大細胞核(N)位於細胞中央。圖7：殼片的正面觀；相位差照片。圖8：熒光染色的細胞。圖9：休眠包囊

Takayama pulchella

美麗達卡藻

(Larsen) de Salas, Bolch & Hallegraeff, 2003

Phylum: Myzozoa

Class: Dinophyceae

Order: Gymnodiniales

Family: Kareniaceae

門：黏孢子門

綱：甲藻綱

目：裸甲藻目

科：凱倫藻科



de Salas et al., 2003

Synonyms 異名：

Gymnodinium pulchellum Larsen 1994

Description:

Takayama pulchella is an unarmoured species without thecal plate. The cell is solitary and the cell outline is obovate and slightly dorsoventrally flattened. The cell size ranges from 13 - 27 μm in length and 12 - 25 μm in width. The apical groove is S-shaped sigmoid, encircling the cell apex anti-clockwisely. The epicone is hemispherical, and the hypocone is truncated and incised. In ventral view, a sharp finger-like sulcal intrusion extends shortly into the epicone. The sulcus is wider in the hypocone than the intercingular region. A large nucleus is ellipsoidal and located on the left side of the cell. The cell has several irregularly shaped chloroplasts with pyrenoids in the centre.

Toxicity:

Overseas research reported that *T. pulchella* is a toxic species which causes fish kill. The toxicity of the Hong Kong strain is uncertain.

描述：

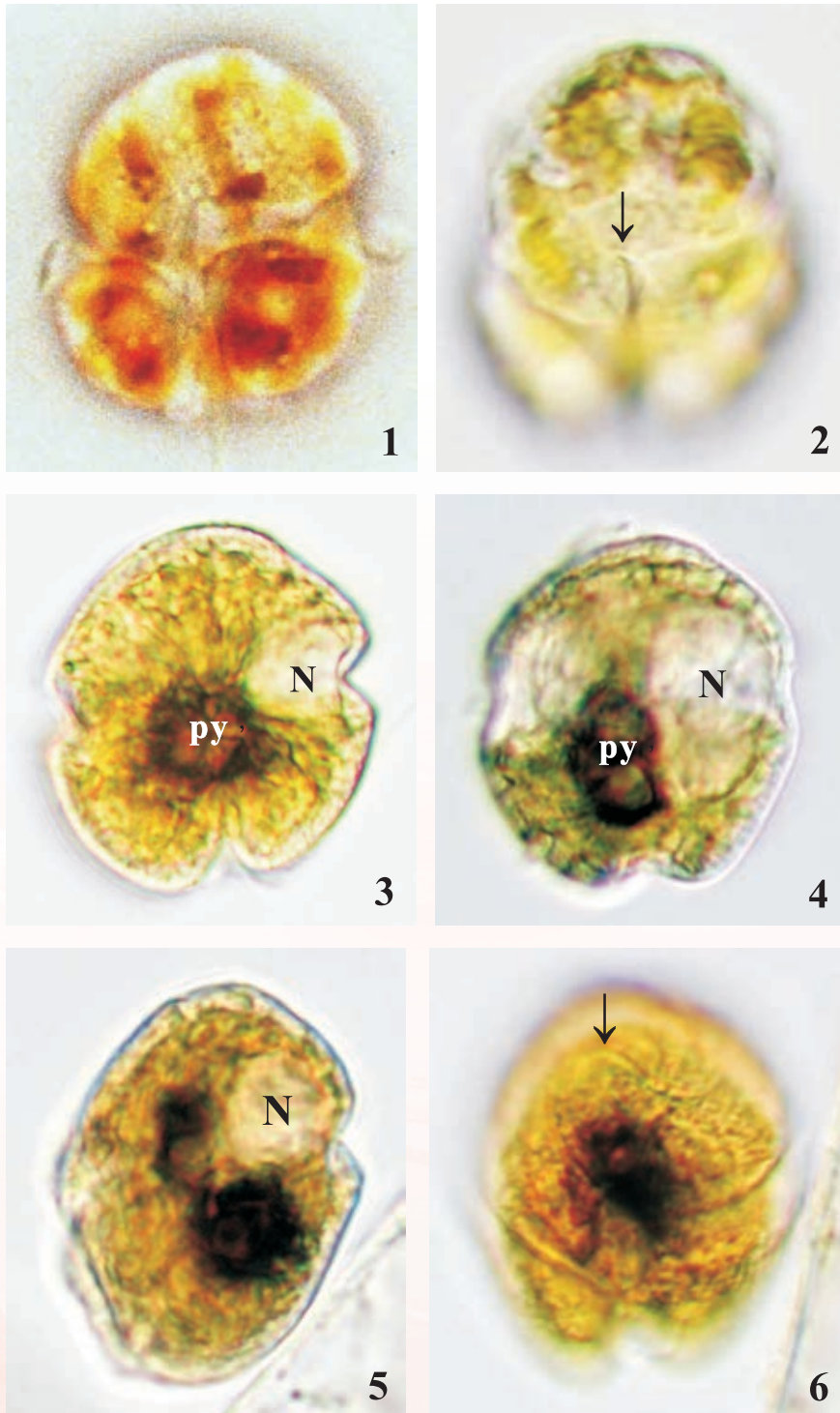
美麗達卡藻是不具殼片甲藻，以單獨個體出現，呈倒卵形，背腹略扁平，細胞長介乎13 - 27微米，闊介乎12 - 25微米。頂槽呈S形，以逆時針方向環繞細胞頂端。上殼為半球狀，下殼圓鈍及有坑槽，從正面觀可見一尖削的像手指的縱溝伸進上殼少許。縱溝於下殼段較橫溝區闊。細胞核頗大，呈橢圓形，位於細胞左側。細胞有數個不規則形的葉綠體，中央有澱粉核。

毒性：

根據外國文獻記載美麗達卡藻可導致魚類死亡。香港藻株的毒性尚未能確定。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2011	1	-
Total/總數：	1	



Takayama pulchella. Figures 1-2: Live cells in ventral view showing sharp finger-like sulcal intrusion extending into the epicone (arrow). Figures 3-4: Different fixed cells showing the pyrenoid (py) in the centre and the large, ellipsoidal nucleus (N) on the left side of the cell. Figure 5: Left lateral view showing the nucleus (N) close to the dorsal surface. Figure 6: S-shaped sigmoid apical groove encircling the cell apex (arrow).

美麗達卡藻。圖1-2：活細胞正面觀，顯示尖削的手指狀縱溝侵入至上殼（箭咀）。圖3-4：以固定劑固定的細胞，顯示細胞中央有澱粉核（py），大而呈橢球形細胞核（N）則位於細胞左側。圖5：細胞左側面觀顯示細胞核（N）接近細胞背側。圖6：S形頂槽環繞細胞頂端（箭咀）。

Tripos furca

叉角藻

(Ehrenberg) Gómez, 2013

Phylum: Myzozoa
Class: Dinophyceae
Order: Gonyaulacales
Family: Ceratiaceae

門：黏孢子門
綱：甲藻綱
目：膝溝藻目
科：角藻科



Tomas et al., 1997

Synonyms 異名：

Peridinium furca Ehrenberg 1834, *Ceratophorus furca* (Ehrenberg) Diesing 1850, *Ceratium furca* (Ehrenberg) Claparède & Lachmann 1859, *Biceratium furca* (Ehrenberg) Vanhoeffen 1897 and *Neoceratium furca* (Ehrenberg) Gómez, Moreiva & López-García 2010

Description:

Tripos furca is an armoured species. The cell is solitary, fork-like shaped and slightly dorsoventrally flattened with the widest at the cingulum area. The cell size ranges from 70 - 225 μm in length and 30 - 56 μm in width. The epitheca is tapering into the anterior horn and hypotheca is subtrapezoid with extending 2 antapical horns. The right antapical horn is shorter than the left one. The surface of theca plates is covered with reticulated ridges and pores. The cell contains numerous yellowish brown chloroplasts and a nucleus is located in the epicone.

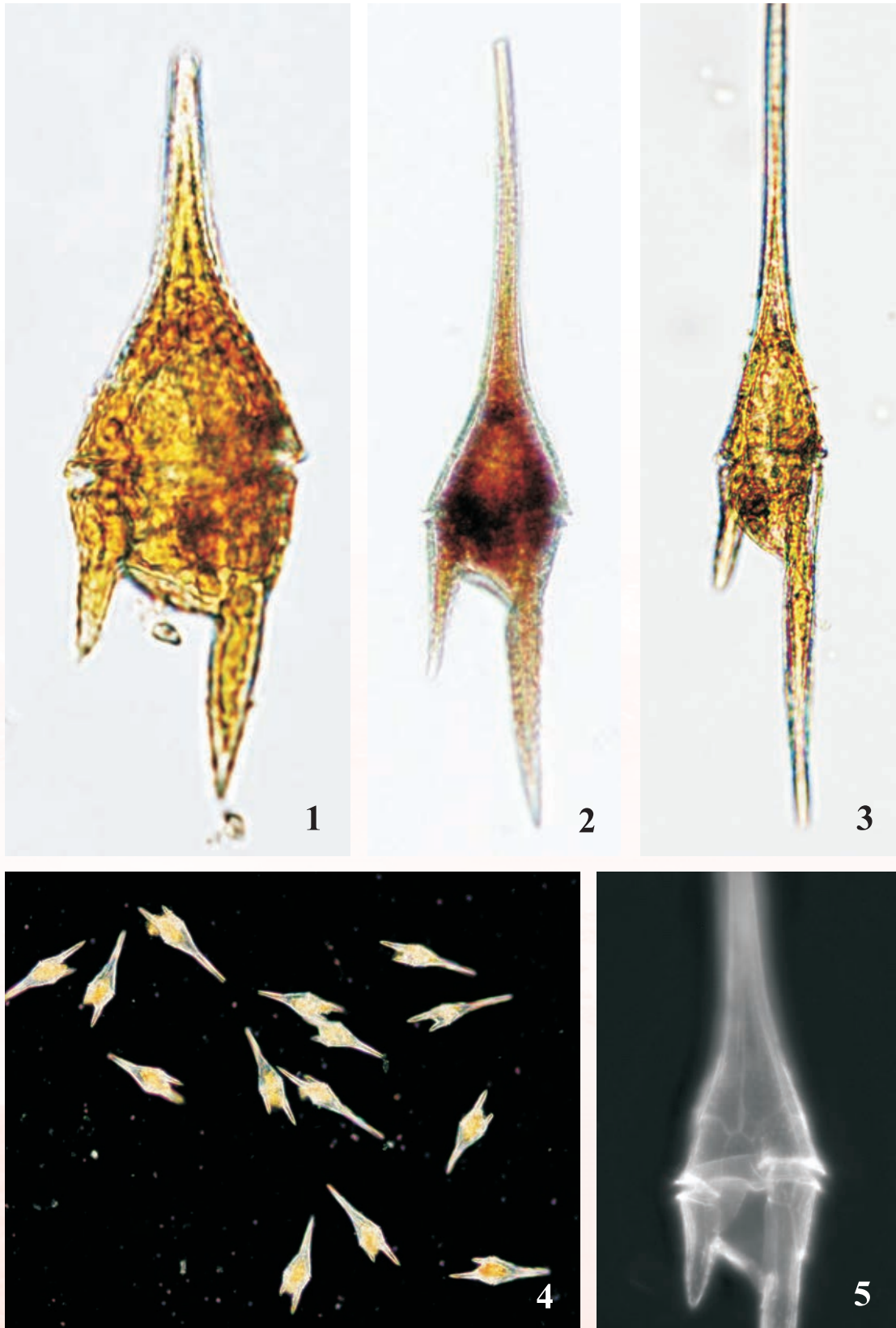
描述：

叉角藻是具殼片甲藻，細胞以單獨個體出現，呈叉狀，細胞背腹略為扁平，橫溝部位最寬闊。細胞長介乎70 - 225微米，闊介乎30 - 56微米。上殼部分向前端延伸漸變幼細，形成頂角，下殼部分呈倒梯形，兩個底角伸出，右底角較左底角短。殼片表面布滿網狀條紋及小孔。細胞內含有大量黃褐色的葉綠體，細胞核位於細胞的上殼。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

From 1975 to 2017, 41 red tide incidents caused by *Tripos furca* were recorded in Hong Kong waters. Refer to Appendix X for detailed information.

由1975年至2017年間，香港水域共錄得41宗由叉角藻引發的紅潮個案。有關資料詳情請參閱附錄十。



Tripos furca. Figures 1-3: Ventral view of various cells showing the different length of apical and antapical horns. Figure 4: Live cells, dark field micrograph. Figure 5: Ventral view of epifluorescent stained cell.

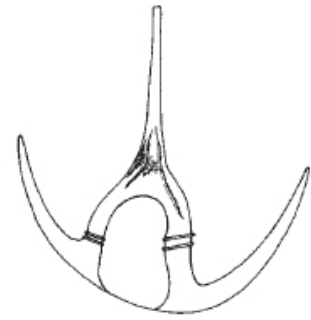
叉角藻。圖1-3：不同細胞的正面觀顯示不同長度的頂角及底角。圖4：活細胞，暗視野顯微照片。圖5：螢光染色細胞的正面觀。

Tripos muelleri
三角角藻

Bory de Saint-vincent, 1824

Phylum: Myzozoa
Class: Dinophyceae
Order: Gonyaulacales
Family: Ceratiaceae

門：黏孢子門
綱：甲藻綱
目：膝溝藻目
科：角藻科



Tomas et al., 1997

Synonyms 異名：

Cercaria tripos Müller 1776, *Ceratium tripos* (Müller) Nitzsch 1817, *Peridinium tripos* (Müller) Ehrenberg 1834, *Ceratophorus tripos* (Müller) Diesing 1850, *Euceratium tripos* Moses 1929, *Euceratium vultur* Moses 1929, *Ceratium schroederi* Nie 1936 and *Neoceratium tripos* (Müller) Gómez, Móreira & Lopez-Garcia 2010

Description:

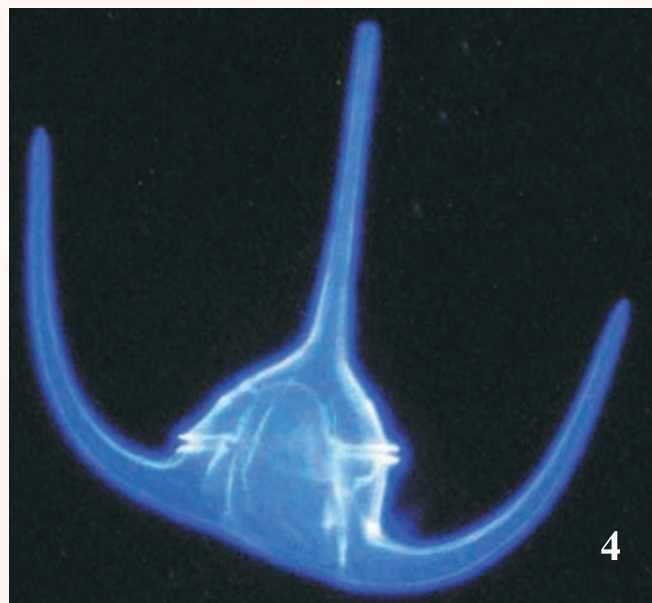
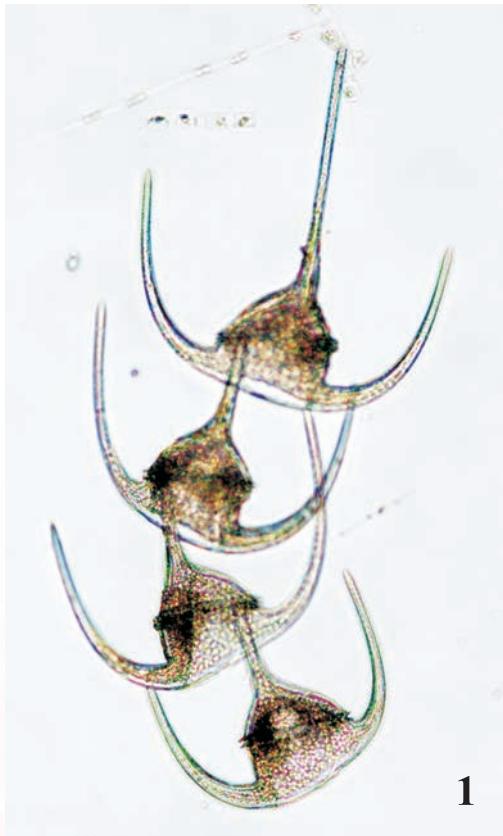
Tripos muelleri is an armoured species. The cell is nearly in triangular shape and occurs solitarily. The cell size ranges from 215 - 280 μm in length and 60 - 93 μm in width. The epitheca bears 1 long, straight and narrow apical horn and the 2 shorter hypothecal horns are curving bend almost parallel with the apical horn. The surface of theca plates is smooth. The cell contains numerous yellowish brown chloroplasts and a nucleus is located in the epicone.

描述：

三角角藻是具殼片甲藻，細胞呈三角形，以單獨個體出現。細胞長介乎215 - 280微米，闊介乎60 - 93微米。上殼部分有1個窄長而直的頂角，下殼部分的2個底角較短，彎向上伸出，差不多與頂角平衡。殼片表面平滑。細胞內含有大量黃褐色的葉綠體，細胞核位於細胞的上殼。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2012	1	<i>Chattonella marina</i> 海洋褐胞藻, <i>Tripos furca</i> 叉角藻
Total/總數：		1



Tripos muelleri. Figure 1: Dorsal view of chained cells. Figures 2-3: Ventral view of various cells. Figure 4: Epifluorescent stained cell.

三角角藻。圖1：串連成鏈狀的細胞之背面觀。圖2-3：不同細胞的正面觀。圖4：熒光染色的細胞。

第四章
Chapter 4

OTHERS
其他



Among the red tide causative species, there are other types of plankton which do not belong to diatoms or dinoflagellates and are collectively grouped to others. In Hong Kong, there are 17 red tide causative species grouped to “others” belonging to 10 classes comprising Raphidophyceae, Dictyochophyceae, Cryptophyceae, Euglenoidea, Cyanophyceae, Prymnesiophyceae, Chlorophyceae, Litostomatea, Chrysophyceae and Ebriophyceae.

In order to classify or identify plankton, the cell size and shape, motility, the number, shape and position of flagellum, and other morphological characteristics such as the position of nucleus as well as pigments distribution are common criteria used.

在引發紅潮的品種中，還有不屬於矽藻或甲藻的「其他」品種。本港記錄有17個紅潮品種屬「其他」品種，分別屬於10個綱，包括針胞藻綱、矽鞭藻綱、隱藻綱、裸藻綱、藍藻綱、定鞭藻綱、綠藻綱、葉口綱、金藻綱及Ebriophyceae (未有中文名稱)。

細胞的大小和形狀、活動性，以致鞭毛的數量、形狀和位置、細胞核以及色素的位置等形態特徵，均可作為分類或識別這些浮游生物的準則。



Chattonella marina 海洋褐胞藻

(Subrahmanyam) Hara & Chihara, 1982

Phylum: Ochrophyta 門：褐胞藻門
Class: Raphidophyceae 綱：針胞藻綱
Order: Chattonellales 目：褐胞藻目
Family: Chattonellaceae 科：褐胞藻科



Imai & Yamaguchi, 2012

Synonyms 異名：

Hornellia marina Subrahmanyam 1954

Description:

Chattonella marina is solitary, oblong or obovoid in shape with a tiny posterior tail. The cell is asymmetrical in lateral view and slightly flattened, and its size ranges from 30 - 70 μm in length and 12 - 33 μm in width. The 2 subequal flagella are approximately equal to the cell length and emerge from the bottom of an anterior depression. The teardrop-shaped nucleus is situated in the centre of the cell. Many green to yellowish brown, ellipsoid chloroplasts are arranged radially with 1 naked pyrenoid located on the inner pole of the chloroplasts. Electronic microscopy shows that electron-dense (osmiophilic) particles are present in the peripheral cytoplasm. Contractile vacuole, eyespot and mucocyst are absent.

Toxicity:

Overseas research reported that *C. marina* is capable of producing neurotoxic, hemolytic and haemagglutinating compounds, resulting in fish kills.

描述：

海洋褐胞藻以單獨個體出現，細胞呈長橢圓形或倒卵形，後端有小尖尾，細胞側面觀不對稱，略扁平，細胞長介乎30 - 70微米，闊介乎12 - 33微米。2條長度相約的鞭毛與細胞長度大致相同，由前端凹陷的底部伸出。淚珠形細胞核位於細胞中央，細胞內有很多綠色或黃褐色橢圓形的葉綠體呈放射形排列，葉綠體向內的一端有1個澱粉核。電子顯微鏡顯示周邊細胞質有電子致密(嗜鐵性)的粒子，沒有伸縮泡、眼點及黏液泡。

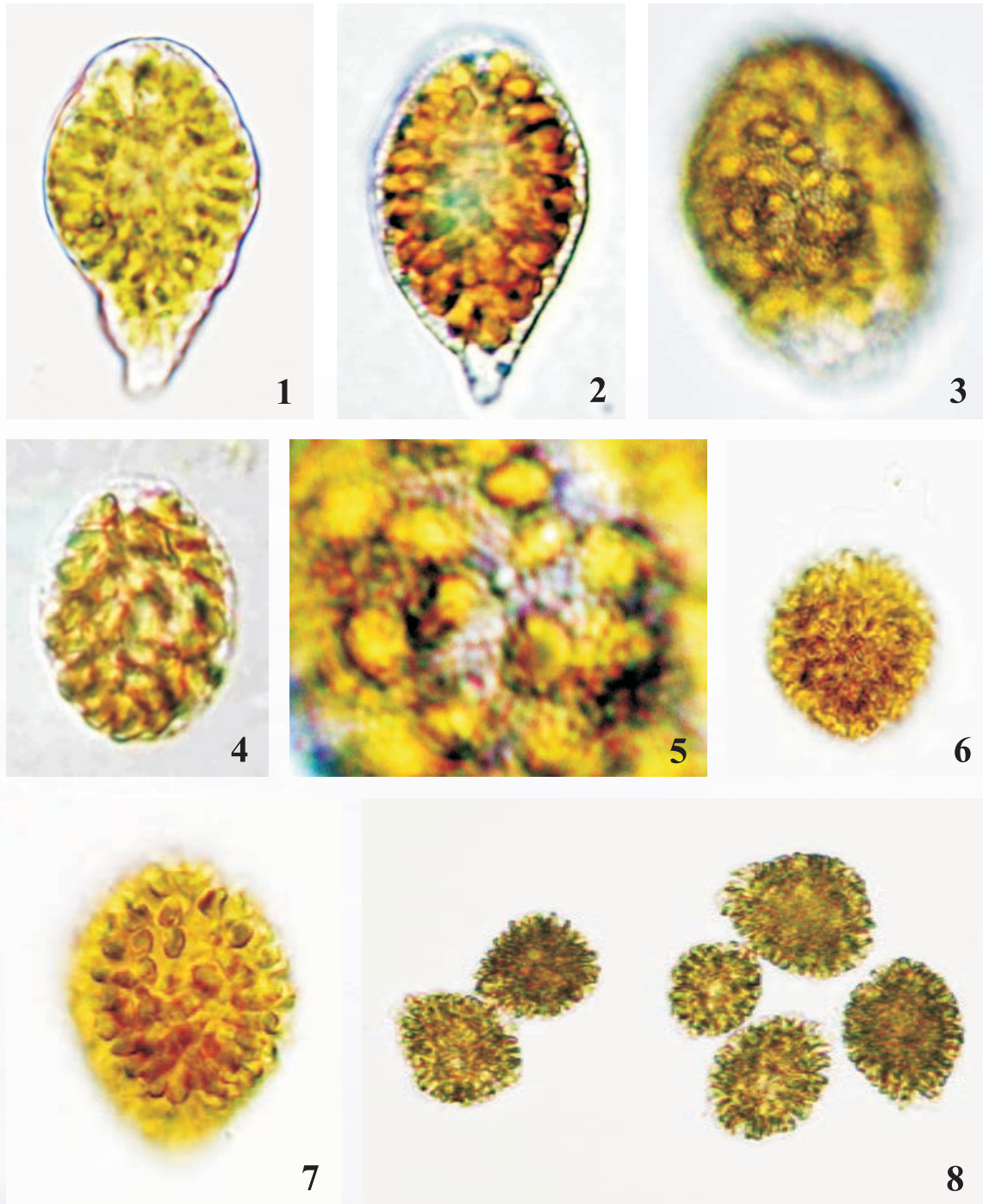
毒性：

根據外國文獻記載海洋褐胞藻可產生神經性、溶血性毒素和血凝複合物，可引致魚類死亡。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2001 ¹	2	<i>Chattonella marina</i> var. <i>ovata</i> 海洋褐胞藻卵形變種、 <i>Dictyocha octonaria</i> 硅鞭藻
2003	1	<i>Chattonella</i> sp. 0310 褐胞藻 0310
2004	1	<i>Prorocentrum micans</i> 海洋原甲藻
2012	1	<i>Tripos furca</i> 叉角藻、 <i>Tripos muelleri</i> 三角角藻
2014	1	<i>Chattonella</i> sp. 0310 褐胞藻 0310
Total/總數：	6	

¹ In 2001, culture fish loss was recorded in northeast region of Hong Kong waters during the blooms. 2001年，於香港東北面水域爆發的紅潮錄得有養殖魚類損失。



Chattonella marina. Figures 1-2: Live cells showing numerous green to yellowish-brown ellipsoid chloroplasts arranged radially; a tail-like protrusion at the posterior end. Figure 3: Live cultured cell. Figure 4: Cell starting to round off after ceasing to swim. Figure 5: Cell surface covered with numerous electron-dense (osmiophilic) particles. Figures 6-8: Fixed cells in various shapes.

海洋褐胞藻。圖1-2：活細胞布滿放射形排列的綠色或黃褐色橢圓形葉綠體；後端有尖尾狀突出物。圖3：活培養細胞。圖4：細胞停止游動後開始收縮成圓形。圖5：細胞表面布滿電子致密（嗜鐵性）粒子。圖6-8：以固定劑固定的不同形狀細胞。

Chattonella marina var. *ovata* 海洋褐胞藻卵形變種

(Hara & Chihara) Demura & Kawachi, 2009

Phylum: Ochrophyta 門：褐胞藻門
Class: Raphidophyceae 綱：針胞藻綱
Order: Chattonellales 目：褐胞藻目
Family: Chattonellaceae 科：褐胞藻科



Imai & Yamaguchi, 2012

Synonyms 異名：

Chattonella ovata Hara & Chihara 1994

Description:

Chattonella marina var. *ovata* is solitary, ovoid or obovoid, fairly flattened and the cell size ranges from 39 - 100 μm in length and 24 - 50 μm in width. The 2 subequal, heterodynamic flagella emerge from the bottom of an anterior depression in the cell. The cell contains numerous yellowish brown ellipsoid chloroplasts arranged radially with vacuoles among chloroplasts. 1 pyrenoid is located on the inner pole of the chloroplasts. Electron-dense (osmiophilic) particles are present in the peripheral cytoplasm. Contractile vacuole, eyespot and mucocyst are absent.

Toxicity:

Overseas research reported that *C. marina* var. *ovata* is capable of producing oxygen radicals and hydrogen peroxide compounds, resulting in fish kills.

描述：

海洋褐胞藻卵形變種以單獨個體出現，細胞頗為扁平，呈卵形或倒卵形，長介乎39 - 100微米，闊介乎24 - 50微米。2條長度相約但呈不同活動模式的鞭毛，由細胞前端凹陷的底部伸出。細胞有大量黃褐色橢圓形葉綠體呈放射形排列，當中含小泡。葉綠體內有1個澱粉核，周邊細胞質有電子致密(嗜鐵性)的粒子，沒有伸縮空泡、眼點及黏液泡。

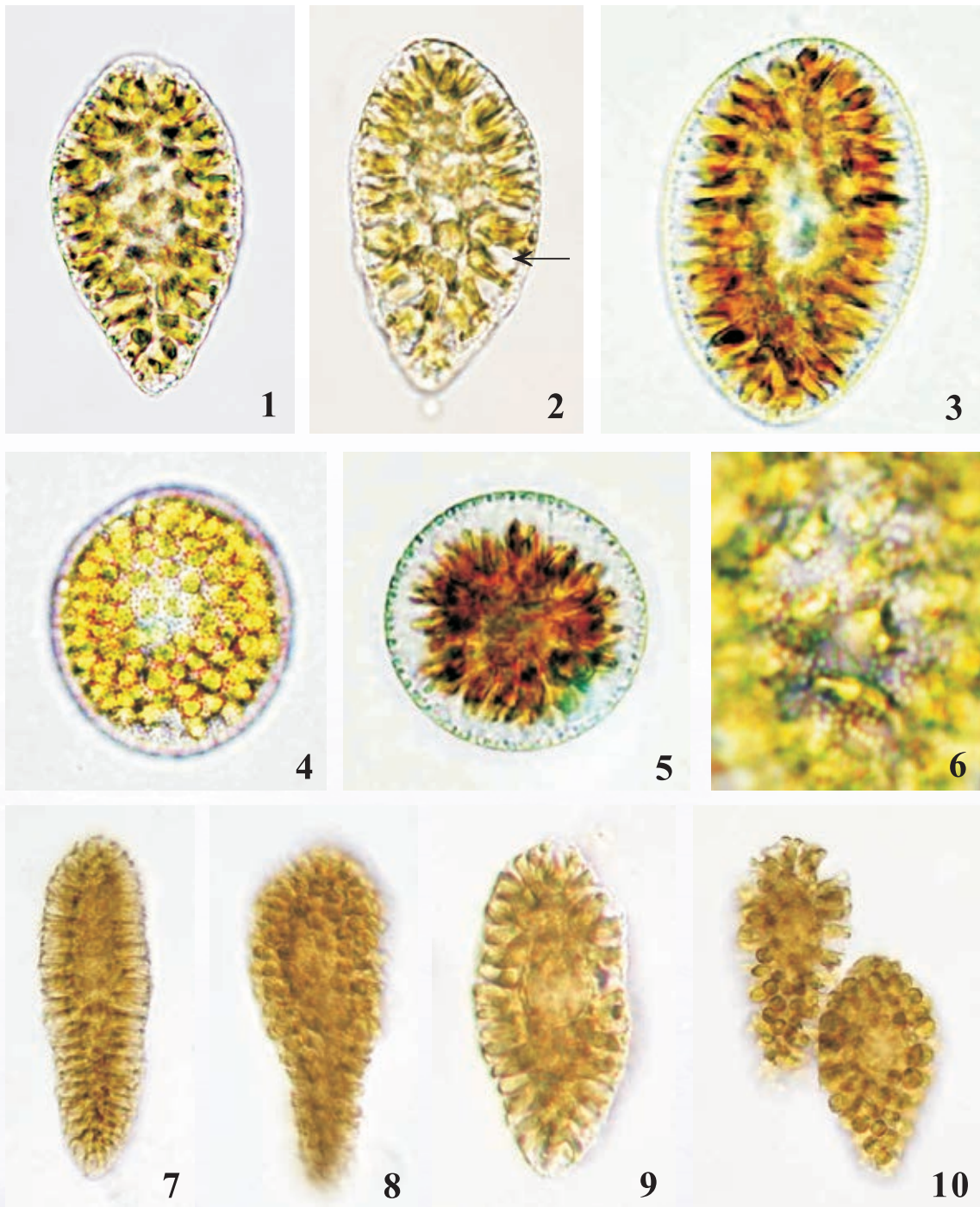
毒性：

根據外國文獻記載海洋褐胞藻卵形變種可產生氧自由基、過氧化氫複合物，可引致魚類死亡。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1991	1	-
2001 ¹	2	<i>Chattonella marina</i> 海洋褐胞藻、 <i>Dictyocha octonaria</i> 硅鞭藻
	1	<i>Dictyocha octonaria</i> 硅鞭藻
Total/總數：	4	

¹ In 2001, culture fish loss was recorded in southeast and northeast region of Hong Kong waters during the blooms. 2001年，於香港東南及東北水域爆發的紅潮錄得有養殖魚類損失。



Chattonella marina var. *ovata*. Figures 1-3: Live cells showing numerous yellowish-brown ellipsoid chloroplasts arranged radially; vacuoles located among chloroplasts (arrow); a large teardrop-shaped nucleus at the cell centre. Figures 4-5: Live cells starting to round off after ceasing to swim. Figure 6: Cell surface covered with numerous electron-dense (osmiophilic) particles. Figures 7-10: Fixed cells in various shapes.

海洋褐胞藻卵形變種。圖1-3：活體細胞布滿放射形排列的黃褐色橢圓形葉綠體；葉綠體當中含小泡（箭咀）；細胞中央有淚珠形大細胞核。圖4-5：活體細胞停止游動後開始收縮成圓形。圖6：細胞表面布滿電子致密（嗜鐵性）粒子。圖7-10：以固定劑固定的不同形狀細胞。

Chattonella sp. 0310

褐胞藻 0310

Biecheler, 1936

Phylum: Ochrophyta	門：褐胞藻門
Class: Raphidophyceae	綱：針胞藻綱
Order: Chattonellales	目：褐胞藻目
Family: Chattonellaceae	科：褐胞藻科

Description:

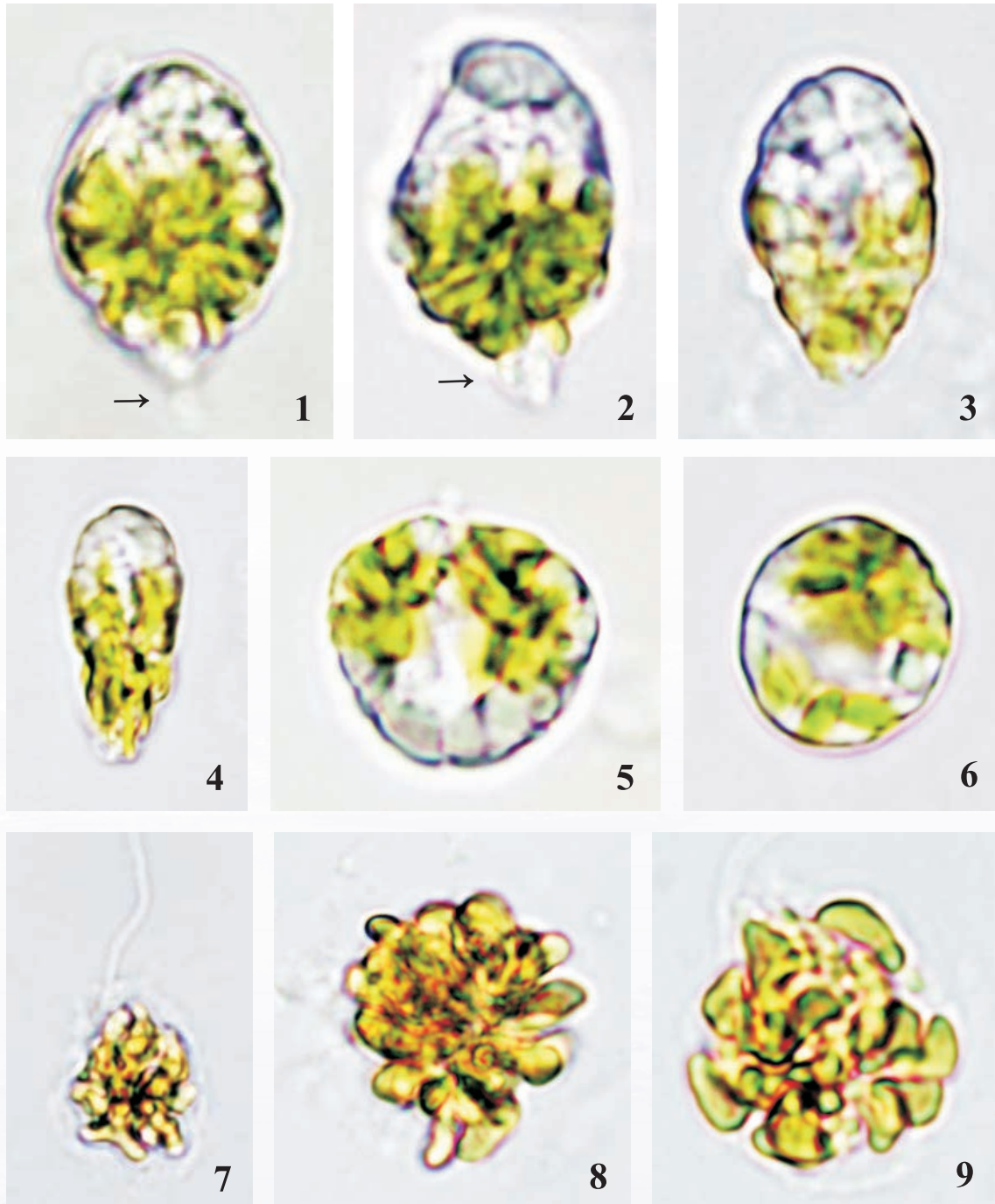
This species bloomed once in Hong Kong waters in October 2003. It has been identified to the genus level and is named as *Chattonella* sp. 0310. According to the findings, it belongs to the genus of *Chattonella*. It is solitary, highly variable in shape from pear-shape, oblong to ovoid with 2 flagella emerging subapically in depression and 1 tiny posterior tail. The cell size ranges from 18 - 24 μm in length and 10 - 14 μm in width. The cell contains many green to yellowish green ellipsoid chloroplasts and 1 naked pyrenoid. No electron-dense (osmiophilic) particle is present in the peripheral cytoplasm.

描述：

這品種只曾在2003年10月於香港水域引發過一次紅潮，並被確認至屬及被命名為褐胞藻0310。根據資料顯示，褐胞藻0310是褐胞藻屬的一種，以單獨個體出現，細胞形狀多變，梨形、長橢圓形或卵形不等，2條鞭毛從接近前端淺凹陷處伸出，細胞後端有1條細尖尾。細胞長介乎18-24微米，闊介乎10-14微米。細胞內有大量綠色至黃綠色橢圓形葉綠體及1個裸澱粉核，周邊細胞質沒有電子致密（嗜鐵性）的粒子。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2003	1	<i>Chattonella marina</i> 海洋褐胞藻
2014	1	<i>Chattonella marina</i> 海洋褐胞藻
Total/總數：	2	



Chattonella sp. 0310. Figures 1-4: Live cells in various shapes; numerous green to yellowish-green ellipsoid chloroplasts arranged radially; a tail-like hyaline protrusion (arrows) at the posterior end. Figures 5-6: Cells starting to round off after ceasing to swim. Figures 7-9: Fixed cells in various shapes.

褐胞藻0310。圖1-4：不同形狀的活細胞；細胞內含大量綠至黃綠色的橢圓形葉綠體，呈放射形排列；後端有透明尖尾狀突出物（箭咀）。圖5-6：細胞停止游動後會漸變至圓形。圖7-9：以固定劑固定的不同形狀細胞。

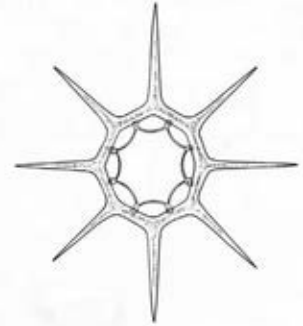
Dictyocha octonaria

硅鞭藻

Ehrenberg, 1839

Phylum: Ochrophyta
Class: Dictyochophyceae
Order: Dictyochales
Family: Dictyochaecae

門：褐胞藻門
綱：硅鞭藻綱
目：硅鞭藻目
科：硅鞭藻科



Tomas et al., 1997

Synonyms 異名：

Distephanus speculum var. *octarius* (Ehrenberg) Jörgensen 1899 and *Octactis octonaria* (Ehrenberg) Hovasse 1946

Description:

*Dictyocha octonaria** has different morphologies at different stages of its life cycle. One is a uninucleate, a silica skeleton-producing form, and followed by a multinucleate amoeba like stage and then a uninucleate naked stage. This species has several spines extruding from the basal ring skeleton at the stages of the skeleton-producing form and the uninucleate naked form. The number of spines is observed from 6-10 on each cell. The cell has only 1 long flagellum at the skeleton-producing stage. The cell bears 1 long flagellum which is known as mastigonemes and 1 very short vestigial smooth flagellum at the naked stage. The cell size ranges from 15 - 30 μm in diameter. The cell contains numerous chloroplasts at both stages.

描述：

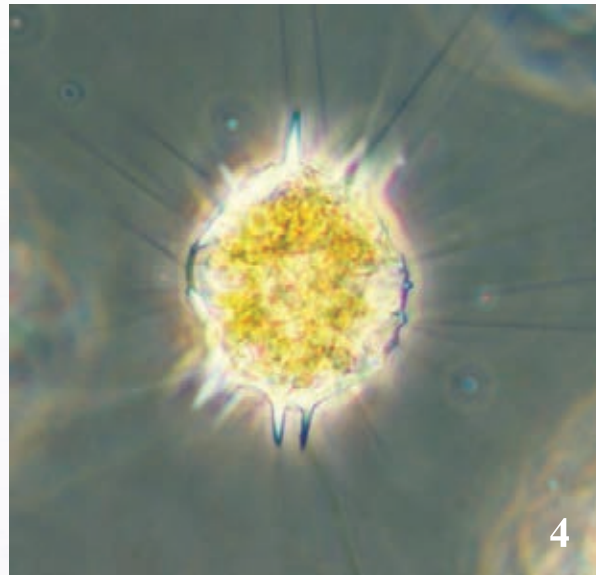
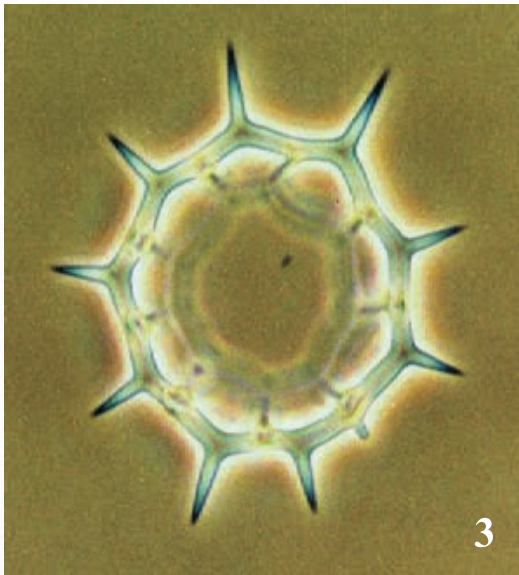
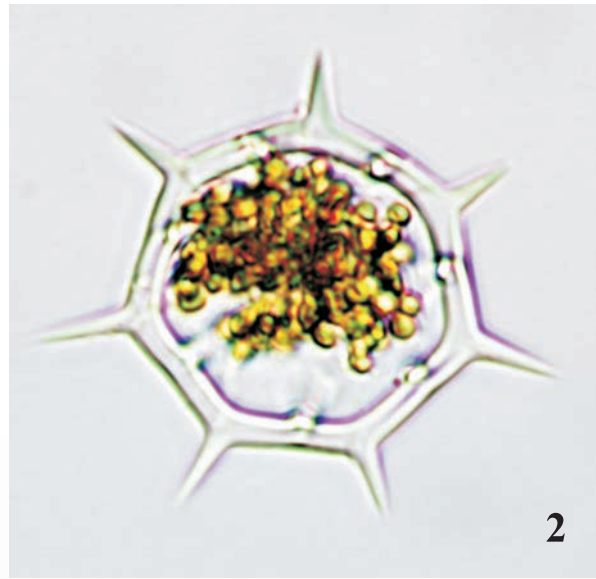
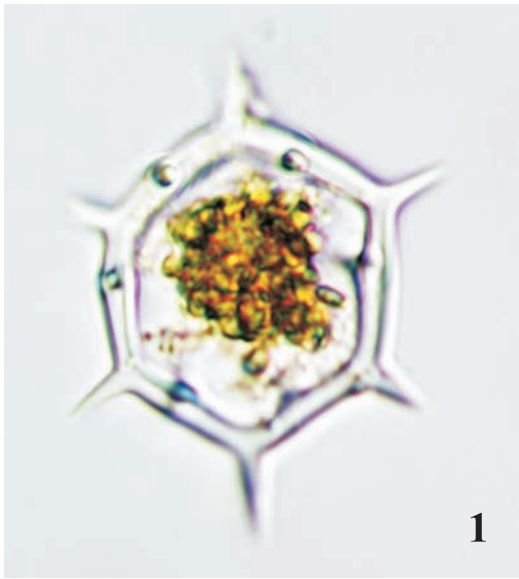
硅鞭藻在不同生命周期有不同的形態特徵。其一是單核有矽質骨骼支架的形態，隨之是多核細胞類似變形蟲的時期，然後是單核裸狀時期。這品種在骨骼支架形態及單核裸狀形態時，有數個頂棘從基層環伸出，每個細胞的頂棘數量介乎6-10個。在骨骼支架形態時期，細胞只具1條鞭毛，而在裸狀形態時期，細胞具1條稱為鞭茸毛的長鞭毛及1條極短小退化了的光滑鞭毛。細胞直徑介乎15 - 30微米。在這兩時期細胞內有大量葉綠體。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1992	1	-
2001	2	<i>Chattonella marina</i> 海洋褐胞藻、 <i>Chattonella marina</i> var. <i>ovata</i> 海洋褐胞藻卵形變種
	1	<i>Chattonella marina</i> var. <i>ovata</i> 海洋褐胞藻卵形變種
2006	1	<i>Noctiluca scintillans</i> 夜光藻
2012	1	-
2016	1	<i>Akashiwo sanguinea</i> 血紅赤潮藻、 <i>Noctiluca scintillans</i> 夜光藻
Total/總數：	7	

* Previously, the specimen found in Hong Kong was named as *Dictyocha speculum*. Later based on the study findings and the morphology description, the specimen found to resembles the species presented as *Octactis octonaria* by Tomas, C.R. (1997), Chang, F.H. (2015) and Chang, F.H. & Gall, M (2016) and therefore it is renamed to *Dictyocha octonaria*.

* 以前在香港收集所得的樣本被命名為六異刺硅鞭藻，後來根據研究的結果及形態學的描繪，發現本港的樣本與Tomas, C.R. (1997), Chang, F.H. (2015) 和 Chang, F.H. & Gall, M (2016) 所論述的硅鞭藻十分相似，因此將這品種重新命名為硅鞭藻。



Dictyocha octonaria. Figures 1-3: Various cells with different number of extruding spines. Figure 4: Live cell contains numerous chloroplasts; phase contrast.

矽鞭藻。圖1-3：不同細胞具有不同數目的頂棘。圖4：活體細胞內有大量葉綠體；相位差照片。

Dunaliella sp.

杜氏藻屬

Teodoresco, 1905

Phylum: Chlorophyta

Class: Chlorophyceae

Order: Volvocales

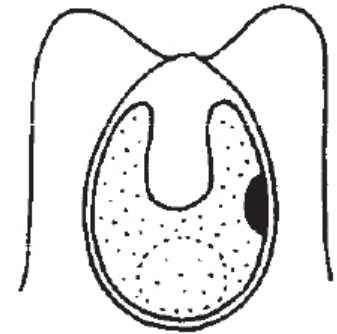
Family: Dunaliellaceae

門：綠藻門

綱：綠藻綱

目：團藻目

科：杜氏藻科



Tomas et al., 1997

Description:

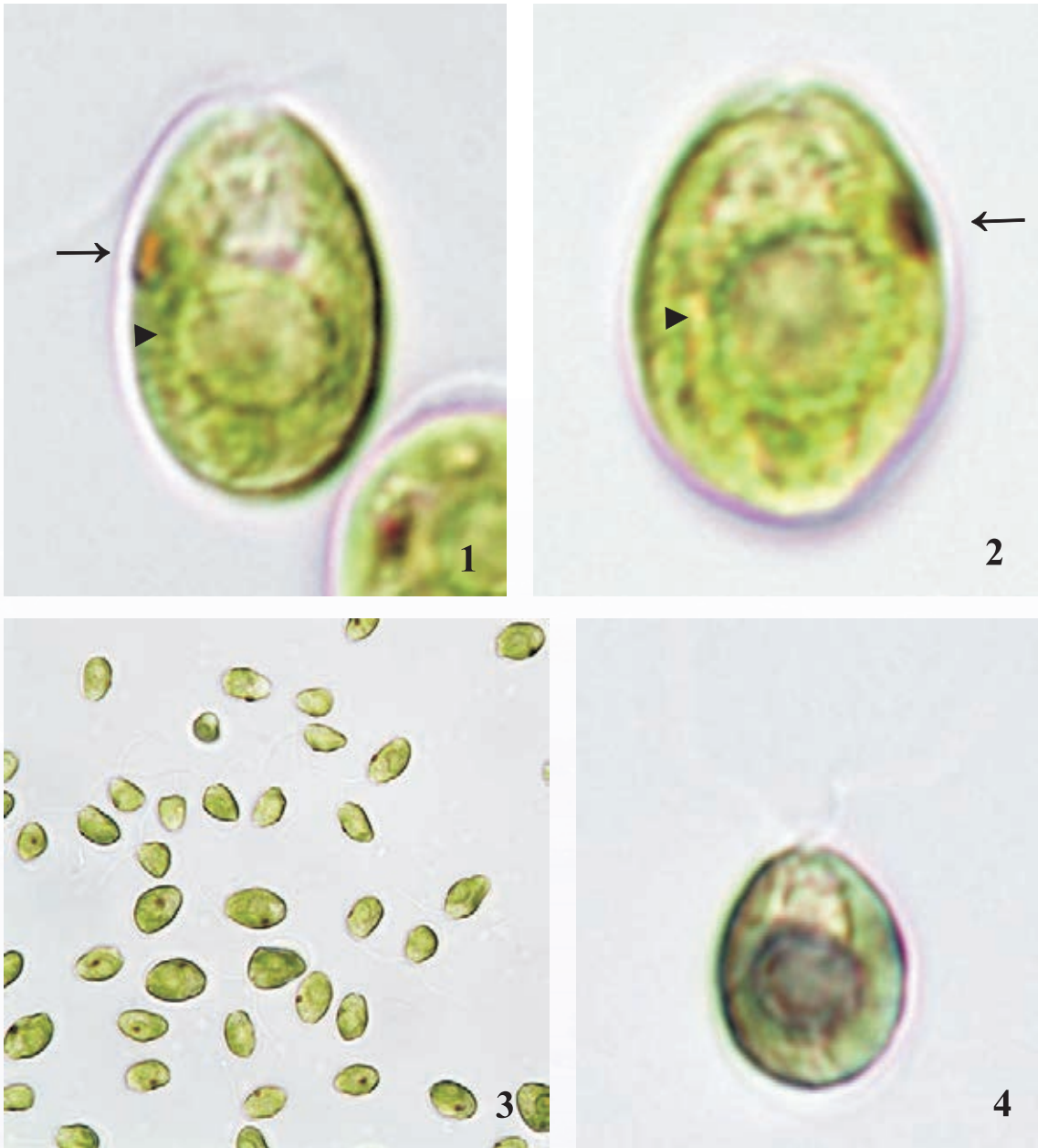
Dunaliella sp. is motile and unicellular. It is a rod to ovoid or spherical shaped green alga. The cell bears 2 flagella and is surrounded by a thick sheath without the cell wall. The length of flagella is almost equal to the cell length. The cell size ranges from 5 - 24 μm in length. The cell contains numerous cup-shaped chloroplasts, 1 eyespot and 1 large pyrenoid.

描述：

杜氏藻屬單細胞綠藻，能游動，細胞形狀呈棒形、卵形或球形不等。細胞具有2條鞭毛，細胞沒有細胞壁，由一層厚層膠質包圍着。鞭毛長度與細胞長度相約。細胞長度介乎5 - 24微米。內有大量呈杯形葉綠體、1顆眼點及1顆大澱粉核。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2012	2	-
Total/總數：		2



Dunaliella sp. Figures 1-2: Various live cells showing an eyespot (arrows) and a large pyrenoid (arrow heads). Figure 3: Live cells from red tide sample. Figure 4: Fixed cell.

杜氏藻屬。圖1-2：不同的活體細胞顯示具有眼點（箭咀）及大澱粉核（箭頭）。圖3：紅潮樣本的活體細胞。圖4：以固定劑固定的細胞。

Eutreptiella sp.
異雙鞭裸藻屬
da Cunha, 1914

Phylum: Euglenozoa
Class: Euglenoidea
Order: Eutreptiida
Family: Eutreptiaceae

門：眼蟲門
綱：裸藻綱
目：異雙鞭藻目
科：異雙鞭藻科



Tomas et al., 1997

Synonyms 異名：

Gymnastica Schiller 1925 and *Tetretreptia* McLachlan, Seguel & Fritz 1994

Description:

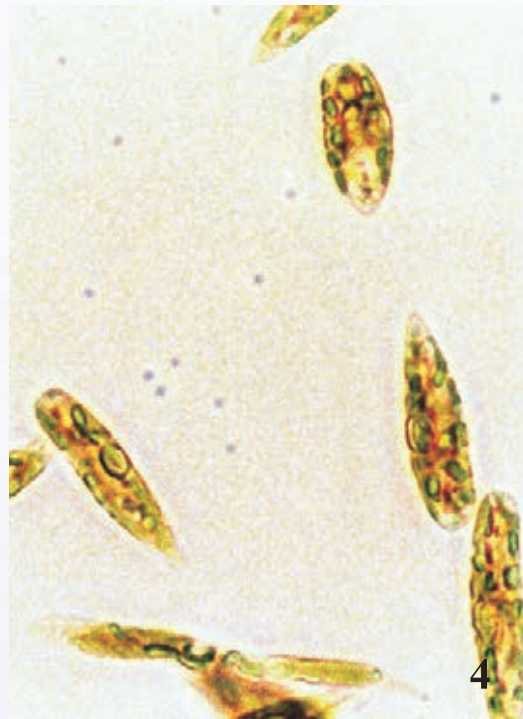
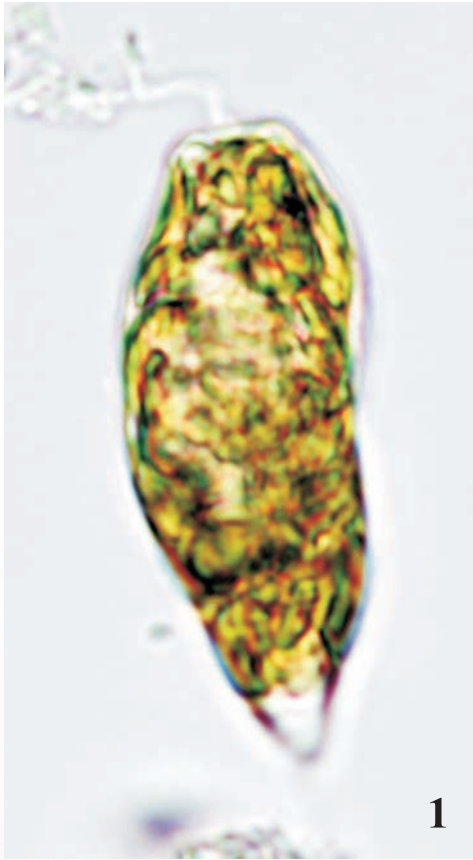
Eutreptiella sp. is ovoid to elongated, slightly flat in shape and occurs solitarily. 2 flagella with unequal length emerge from canal at the anterior end. The cell size ranges from 15 - 115 μm in length. The cell membrane is thin and distinctly striate. The cell contains numerous small disc-shaped chloroplasts and the cell is green. 1 red eyespot is present and a nucleus is located posteriorly of the cell.

描述：

異雙鞭裸藻屬的細胞呈卵形或長形，略為扁平，以單獨個體出現。具有2條不等長鞭毛，由前端溝處伸出。細胞長介乎15 - 115微米。細胞壁薄，有明顯條紋。細胞內有大量盤形葉綠體，呈綠色。細胞有1紅眼點，而細胞核則位於細胞的後端。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1987	1	-
1988	1	<i>Gonyaulax polygramma</i> 多紋膝溝藻、 <i>Noctiluca scintillans</i> 夜光藻
1994	1	<i>Noctiluca scintillans</i> 夜光藻
	1	<i>Noctiluca scintillans</i> 夜光藻、 <i>Prorocentrum triestinum</i> 尖葉原甲藻
Total/總數：	4	



Eutreptiella sp. Figures 1-2: Live cells showing numerous small green disc-shaped chloroplasts and a red eyespot located anteriorly of the cell (arrow). Figure 3: Cell membrane with distinct striate. Figure 4: Live cells in various shapes.

異雙鞭裸藻屬。圖1至2：活細胞前端含有大量細小綠色碟狀葉綠體及紅眼點（箭咀）。圖3：細胞壁有明顯條紋。圖4：活細胞呈多種形狀。

Fibrocapsa japonica 針胞藻

Toriumi and Takano, 1973

Phylum: Ochrophyta 門：褐胞藻門
Class: Raphidophyceae 綱：針胞藻綱
Order: Chattonellales 目：褐胞藻目
Family: Chattonellaceae 科：褐胞藻科



Tomas et al., 1997

Synonyms 異名：

Chattonella japonica (Toriumi and Takano) Loeblich III and Fine 1977

Description:

Fibrocapsa japonica is solitary, slightly flattened and ovoid in shape. The cell size ranges from 20 - 30 μm in length and 15 - 17 μm in width. The anterior flagellum is as long as the cell and the posterior flagellum is 1.2 times of the cell's length; both 2 flagella emerge from an anterior gullet. The nucleus is situated at the centre of the cell. Many discoidal, yellowish brown to golden brown chloroplasts are densely packed in the cell and 1 pyrenoid is present in each chloroplast. A number of rod-shaped mucocysts are concentrated at the posterior end of the cell. Contractile vacuole and eyespot are absent.

Toxicity:

Overseas research reported that *F. japonica* is capable of producing 5 neurotoxic compounds similar to brevetoxins which cause fish kill. The toxicity of the Hong Kong strain is uncertain.

描述：

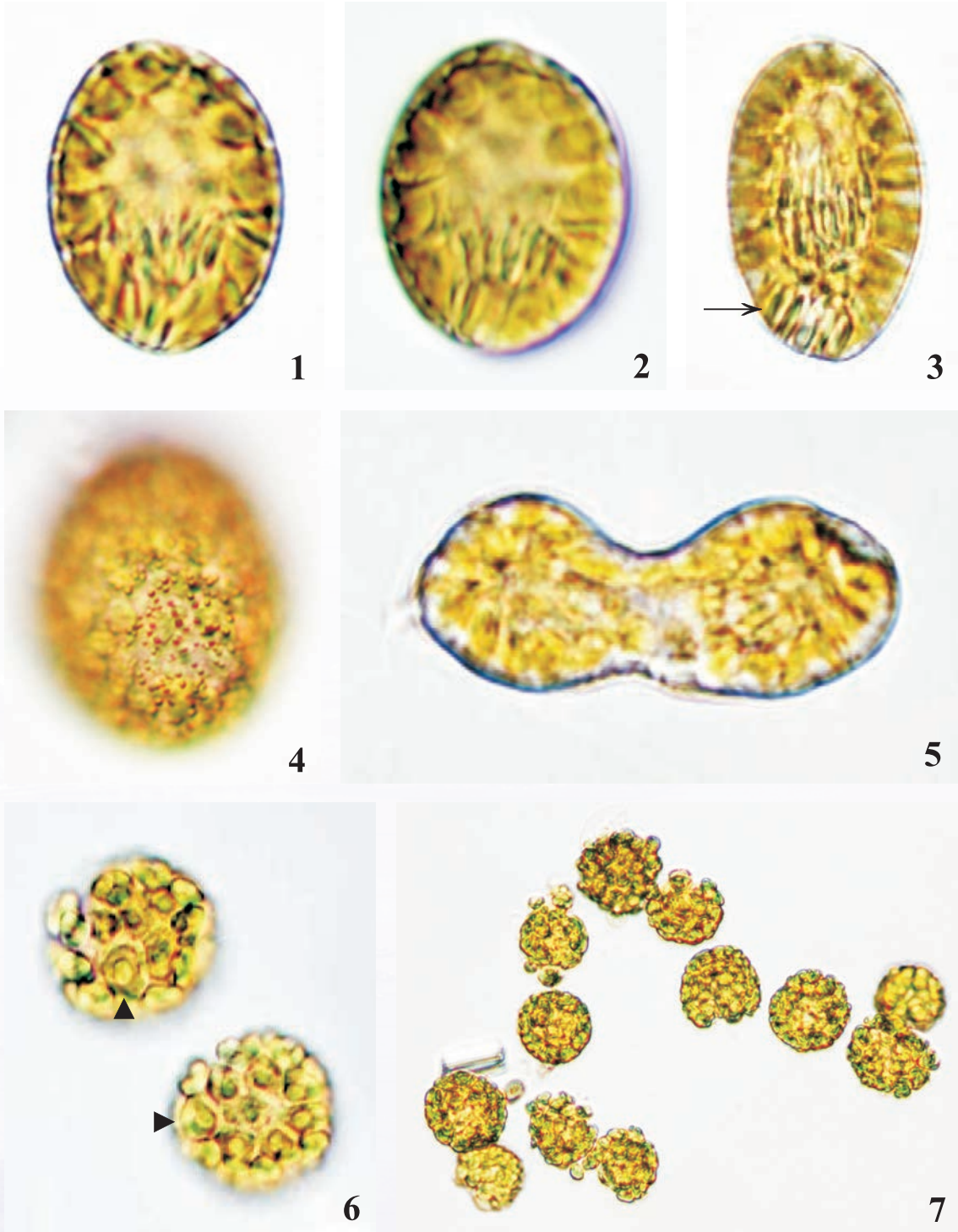
針胞藻是以單一細胞個體出現，細胞呈卵形、略為扁平，體長介乎20 - 30微米，闊介乎15 - 17微米。前鞭毛與細胞長度相同，後鞭毛是細胞長度的1.2倍，2根鞭毛均由細胞前端的小溝伸出。細胞核位於細胞中央，細胞內密布盤狀黃褐色或金褐色葉綠體，每顆葉綠體內有1個澱粉核。有多個桿狀黏液泡，密集排列在細胞後端，但沒有伸縮空泡及眼點。

毒性：

根據外國文獻記載針胞藻可產生5種神經毒素複合物，毒性作用與雙鞭甲藻毒素相似，能引致魚類死亡。香港藻株的毒性尚未能確定。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2008	2	-
Total/總數：		2



Fibrocapsa japonica. Figures 1-3: Live cells showing ovate or obovate shape with numerous discoidal, golden-brown chloroplasts; a number of rod-shaped mucocysts (arrow) concentrated at the posterior end of the cell. Figure 4: Many electron-dense particles scattered on the cell surface. Figure 5: Cell undergoes division. Figures 6-7: Fixed cells showing each chloroplast containing a pyrenoid (arrow haeds).

針胞藻。圖1-3：活細胞顯示卵形或倒卵形狀，布滿盤狀金褐色葉綠體；細胞後端有多個緊密排列的桿狀黏液泡（箭咀）。圖4：細胞表面有許多電子致密粒子。圖5：細胞正進行分裂。圖6-7：以固定劑固定的細胞，可見每顆葉綠體內含有一個澱粉核（箭頭）。

Haematococcus pluvialis

雨生紅球藻

Flotow, 1844

Phylum: Chlorophyta

Class: Chlorophyceae

Order: Volvocales

Family: Haematococcaceae

門：綠藻門

綱：綠藻綱

目：團藻目

科：紅球藻科



Hansgirg, 1886

Synonyms 異名：

Volvox lacustris Girod-Chantrons 1802, *Haematococcus lacustris* (Girod-Chantrons) Rostafinski 1875, *Sphaerella lacustris* (Girod-Chantrons) Wittrock 1883 and *Sphaerella pluvialis* (Flotow) Wittrock 1883

Description:

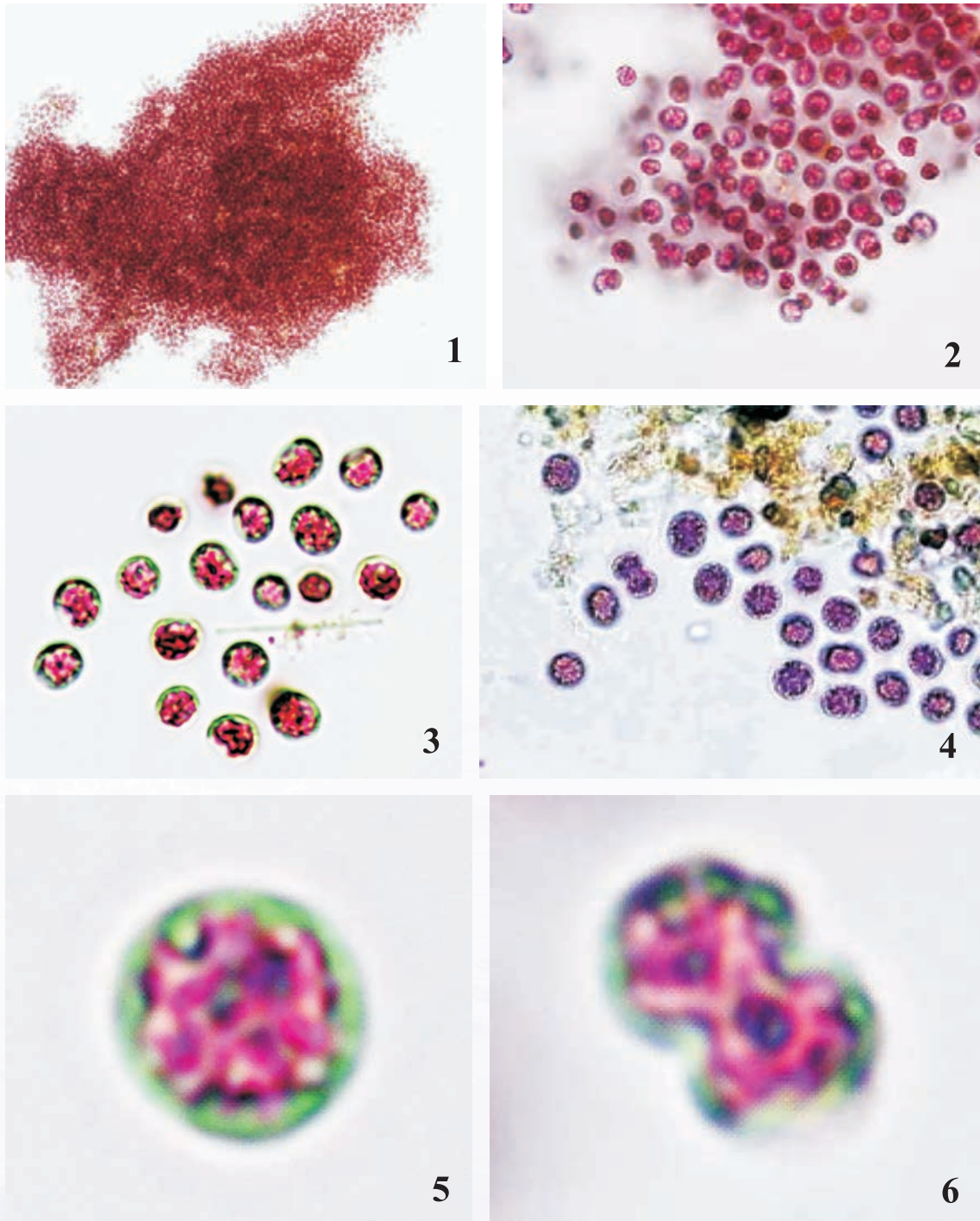
Haematococcus pluvialis is a freshwater species. It is a unicellular green alga with 2 flagella. A gelatinous sheath surround the alga. The cell has 2 types (green motile cell and red non-motile cell) of cell morphology depending on different environmental conditions. It is ellipsoid or spherical shaped. The cell size ranges from 3 - 6 μm in length. The cell contains a chloroplast, a pyrenoid eyespot and contractile vacuoles. Nucleus is located at the centre of the cell.

描述：

雨生紅球藻屬於淡水藻類，這種藻是單細胞綠藻，具有2條鞭毛，由一層凝膠質包圍着。細胞在不同環境條件下會有兩種不同的形態（能游動的綠色細胞及不能游動的紅色細胞）。細胞呈橢圓形或球形，細胞長介乎3 - 6微米。細胞內有葉綠體、澱粉核、伸縮空泡及眼點。細胞核位於細胞的中央。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2000	1	-
2004	3	-
2014	1	-
Total/總數：	5	



Haematococcus pluvialis. Figures 1-3: Live red non-motile cells . Figure 4: Fixed cells. Figure 5: Live single cell. Figure 6: Live single cell undergoes division.

雨生紅球藻。圖1-3：非動性紅色活細胞。圖4：以固定劑固定的細胞。圖5：活單細胞。圖6：活單細胞進行分裂。

Hermesinum adriaticum

亞得利亞海矽鞭藻

Zacharias, 1906

Phylum: Protozoa incertae sedis

Class: Ebriophyceae

Order: Ebriales

Family: Ebriopsidaceae



Tomas et al., 1997

Description:

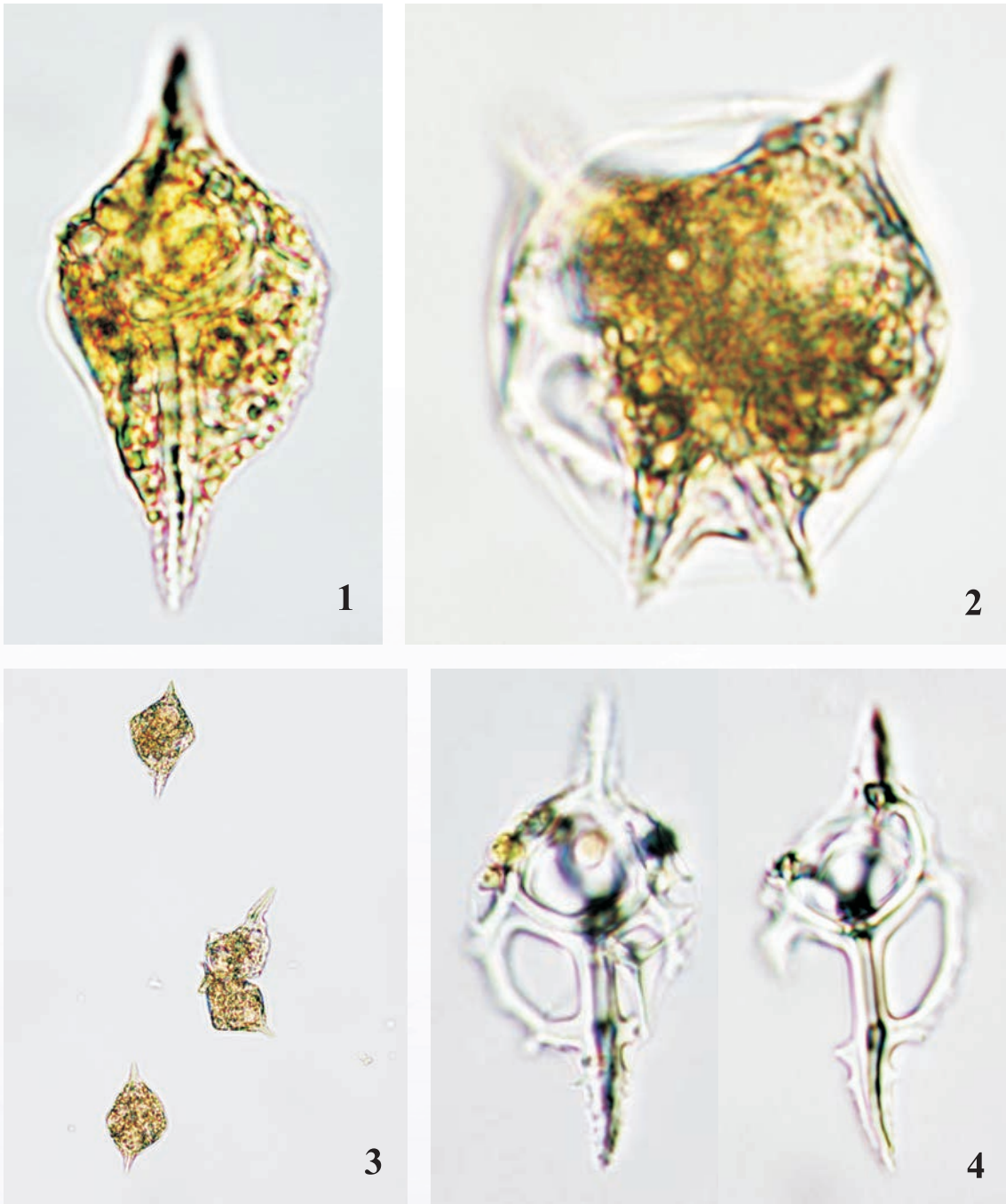
Hermesinum adriaticum is mostly rhomboid in shape and bears 4 primary branches to its internal siliceous skeleton in tetraaxial arrangement. The cell is surrounding the skeleton composed of solid elements with nucleus enclosed. The skeleton of this species is asymmetrical and the cell occurs solitarily. The cell size ranges from 45 - 50 μm in length. 2 unequal flagella are smooth, taper gradually, emerging from the cell at divergent angles.

描述：

亞得利亞海矽鞭藻細胞大多呈菱形，內在的矽質骨骼形態由4個主支架以四角軸心排列形成。細胞包圍着矽質骨骼，由圍繞着細胞核的固體物質組成。矽鞭藻的骨架並不對稱，這種藻主要以單獨個體出現。細胞長介乎45-50微米。有2條不等長的鞭毛由細胞伸出，鞭毛平滑，漸尖幼。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2000	1	-
Total/總數：		1



Hermesinum adriaticum. Figure 1: Live single cell . Figure 2: Cell undergoes division. Figure 3: Live cells in various shapes. Figure 4: Same siliceous skeleton in various angles.

亞得利亞海矽鞭藻。圖1：活單細胞。圖2：細胞進行分裂。圖3：活細胞呈不同形狀。圖4：不同角度的同一矽質骨骼。

Heterosigma akashiwo

赤潮異彎藻

(Hada) Hara & Chihara, 1987

Phylum: Ochrophyta

Class: Raphidophyceae

Order: Chattonellales

Family: Chattonellaceae

門：褐胞藻門

綱：針胞藻綱

目：褐胞藻目

科：褐胞藻科



Tomas et al., 1997

Synonyms 異名：

Olisthodiscus carterae Hulburt 1965, *Entomosigma akashiwo* Hada 1967, *Heterosigma inlandica* Hada 1968, *Chattonella inlandica* (Hada) Loeblich III & Fine 1977, *Chattonella akashiwo* (Hada) Loeblich III 1979 and *Heterosigma carterae* (Hullbert) Taylor 1992

Description:

Heterosigma akashiwo is solitary, small, potato-shaped, slightly dorsoventrally compressed. The cell size ranges from 8 - 25 μm in length and 6 - 15 μm in width. The 2 subequal, heterodynamic flagella emerge from an antero-lateral groove and exhibit a spirally swimming pattern. The cell contains numerous disc-shaped yellowish brown chloroplasts, each with 1 pyrenoid. A teardrop-shaped nucleus is situated in the centre of the cell. Contractile vacuole and eyespot are absent, while mucocysts are present along the cell periphery. The cell preserved in Lugol's solution often attains a characteristic raspberry shape.

Toxicity:

Overseas research reported that *H. akashiwo* might be capable of producing neurotoxins and causing fish kill by gill damage. The toxicity of the Hong Kong strain is uncertain.

描述：

赤潮異彎藻是以單獨個體出現，細胞細小，呈馬鈴薯形，細胞背腹略為扁平，長介乎8 - 25微米，闊介乎6 - 15微米。2根長度相約呈不同活動模式的鞭毛，由前側坑槽伸出，呈螺旋游動狀，細胞內部布滿盤狀黃褐色葉綠體，葉綠體內均有1個澱粉核。淚珠形細胞核位於細胞中央，沒有伸縮空泡及眼點，但沿細胞周邊有黏液泡。以魯哥氏液固定的細胞呈獨特的紅莓狀。

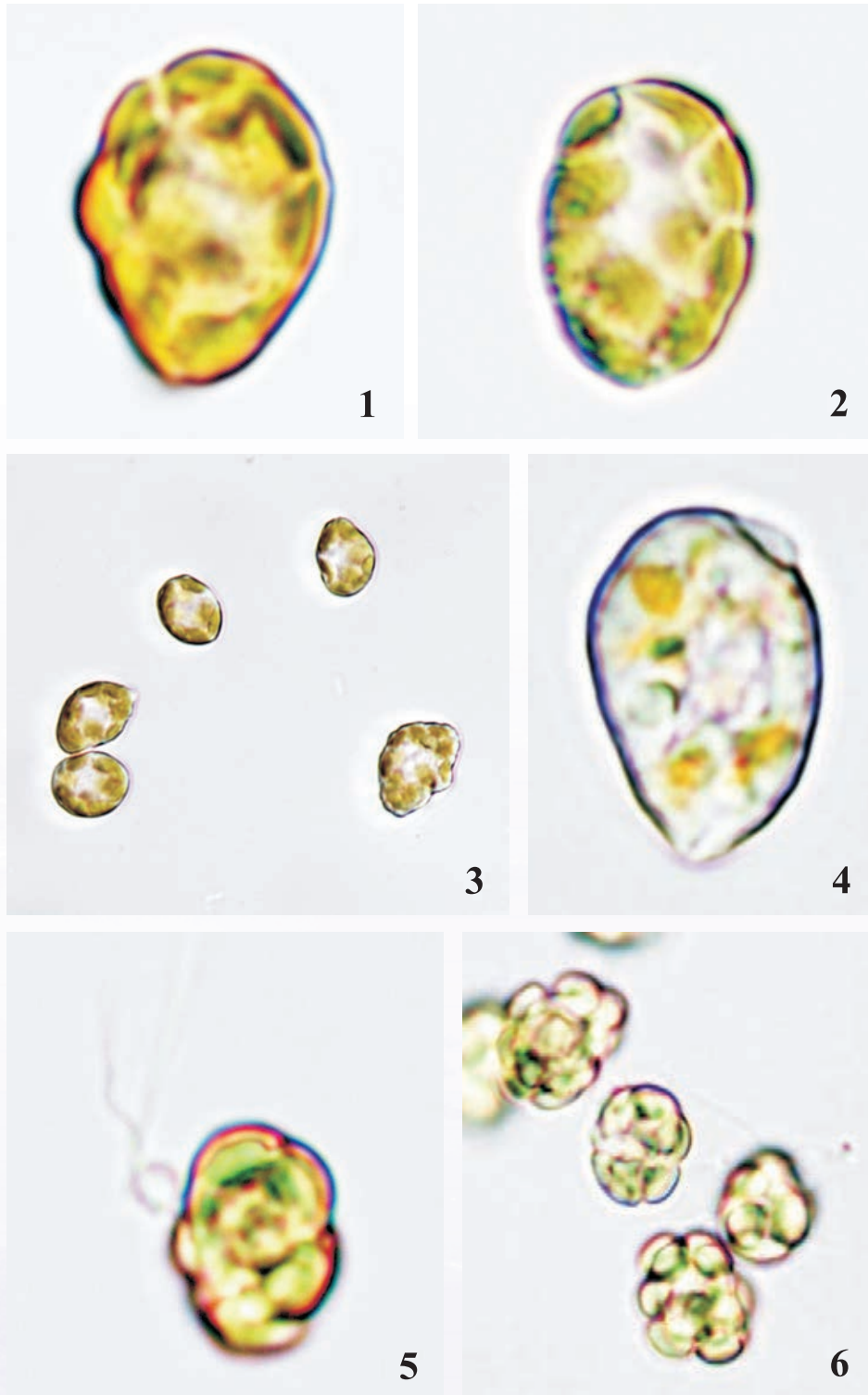
毒性：

根據外國文獻記載赤潮異彎藻可能產生神經毒素以及破壞魚鰓導致魚類死亡。香港藻株的毒性尚未能確定。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

From 1975 to 2017, 28 red tide incidents caused by *Heterosigma akashiwo* were recorded in Hong Kong waters. Refer to Appendix XI for detailed information.

1975 年至 2017 年間，香港水域共錄得 28 宗由赤潮異彎藻引發的紅潮個案。有關資料詳情請參閱附錄十一。



Heterosigma akashiwo. Figure 1: Live cell in lateral view showing slightly dorsoventrally compressed shape; numerous disc-shaped yellowish-brown chloroplasts, each with pyrenoid. Figure 2: Live cell in dorsal view. Figure 3: Live cultured cells. Figure 4: Aged cultured cell. Figures 5-6: Fixed cells.

赤潮異彎藻。圖1：活細胞側面觀顯示細胞背腹略為扁平並布滿盤狀黃褐色葉綠體；各有澱粉核。圖2：活細胞背面觀。圖3：活培植藻株。圖4：老化活細胞。圖5-6：以固定劑固定的細胞。

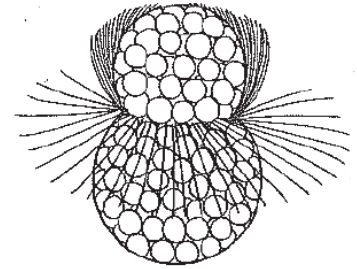
Mesodinium rubrum

紅色中縊蟲

Lohmann, 1908

Phylum: Ciliophora
Class: Litostomatea
Order: Cyclotrichiida
Family: Mesodiniidae

門: 纖毛門
綱: 葉口綱
目: 環毛目
科: 中縊科



Lohmann, 1908

Synonyms 異名:

Myrionecta rubra Lohmann 1908

Description:

Mesodinium rubrum is a ciliate and occurs solitarily. The cell size ranges from 15 - 70 μm in length. The cell is distinguished by 2-lobed round shape and many flagella are present in the centre of the cell. The anterior narrows apically and the posterior is broadly round. The cell is in brown or rusty red colour.

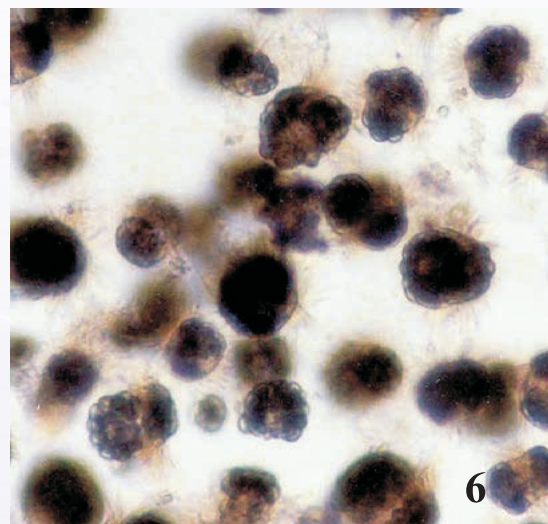
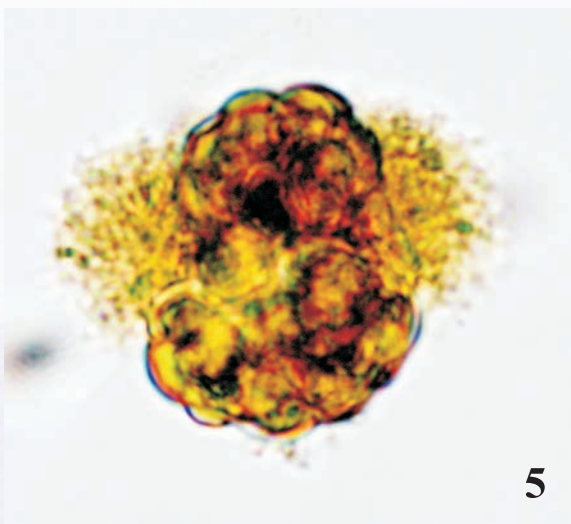
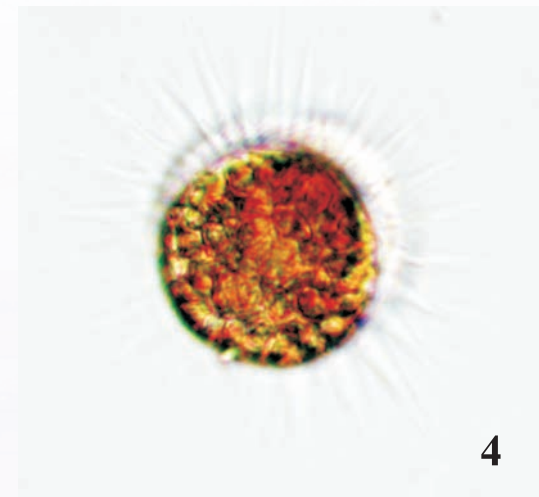
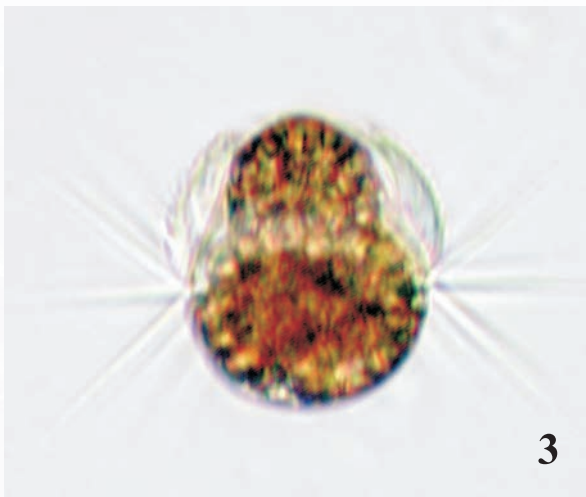
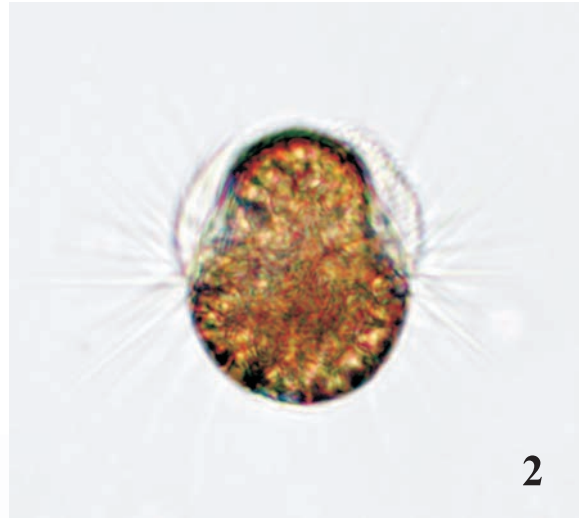
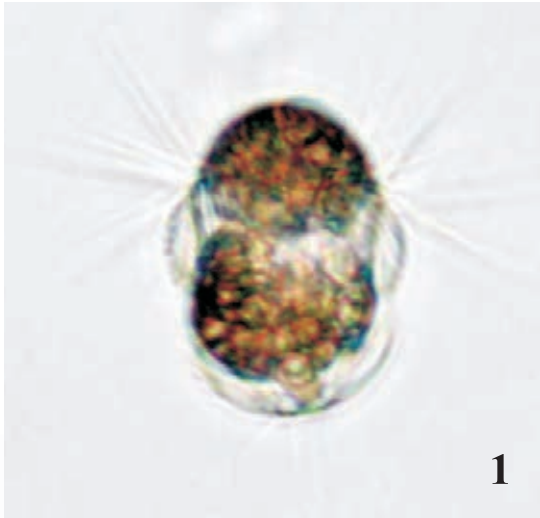
描述:

紅色中縊蟲屬纖毛蟲，以單獨個體出現。細胞長介乎15 - 70微米。細胞由2個圓球部分接合而成，大量纖毛從細胞中央接合處伸出。細胞上部略窄，下部較寬圓。細胞呈褐色或鐵銹紅色。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數:

From 1975 to 2017, 62 red tide incidents caused by *Mesodinium rubrum* were recorded in Hong Kong waters. Refer to Appendix XII for detailed information.

1975 年至 2017 年間，香港水域共錄得 62 宗由紅色中縊蟲引發的紅潮個案。有關資料詳情請參閱附錄十二。



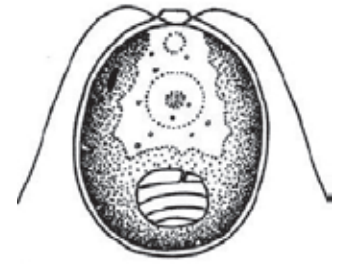
Mesodinium rubrum. Figures 1-3: Live cells in lateral view. Figure 4: Live cell in apical view. Figures 5-6: Fixed cells.

紅色中縊蟲。圖1-3：活細胞的側面觀。圖4：活細胞的頂面觀。圖5-6：以固定劑固定的細胞。

Microglena uva-maris
(未有中文名稱)

(Butcher) Demchenko, Mikhailyuk & Proschold, 2012

Phylum: Ochrophyta 門：褐胞藻門
Class: Chrysophyceae 綱：金藻綱
Order: Synurales 目：黃群藻目
Family: Mallomonadaceae 科：(未有中文名稱)



Demchenko et al., 2012

Synonyms 異名：

Chlamydomonas uva-maris Butcher 1959

Description:

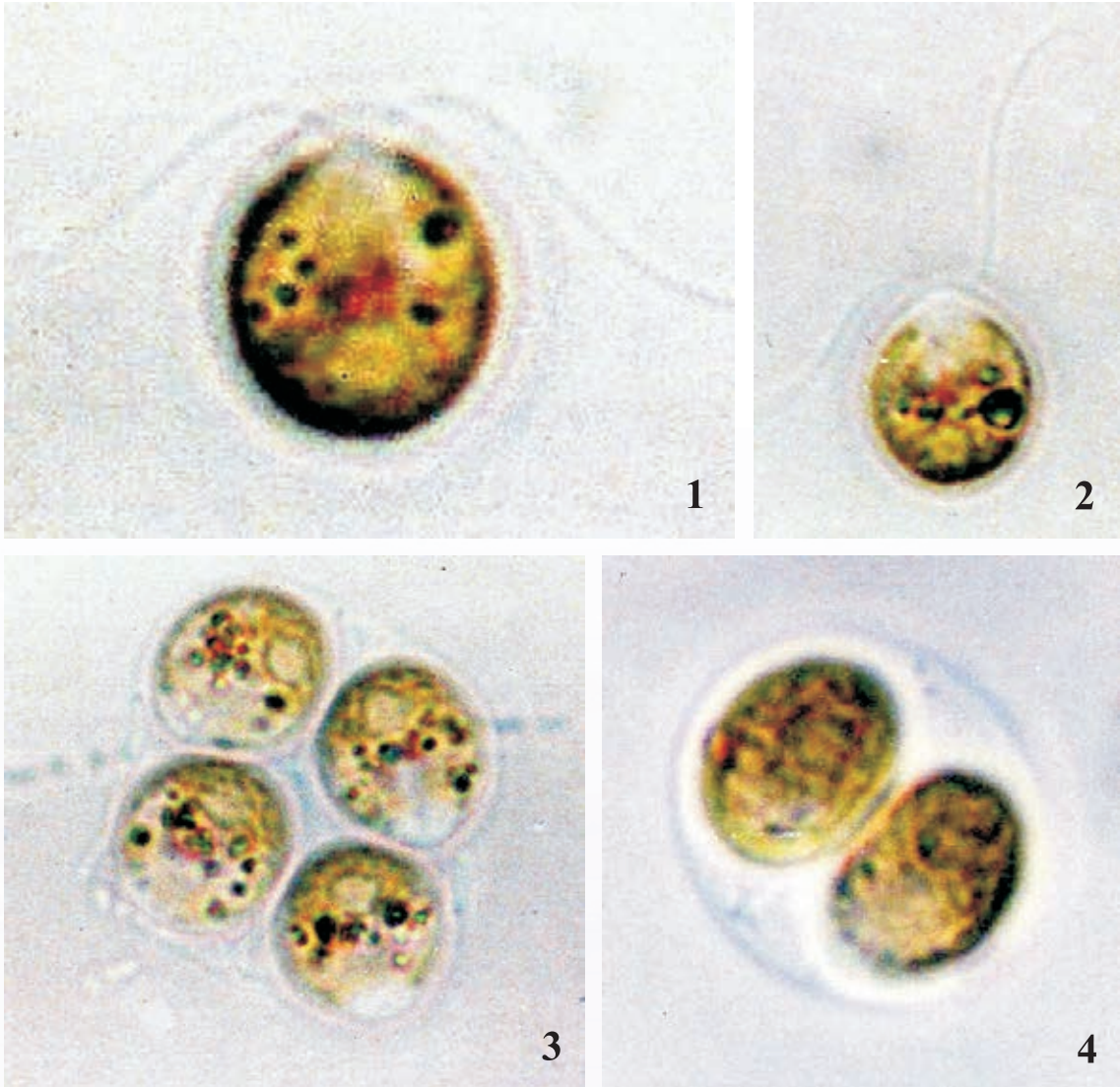
The cell of *Microglena uva-maris* is solitary, mostly round, radially symmetrical and dorsoventrally flattened. 2 equal flagella emerge at the anterior end and the cell is surrounded by a gelatinous sheath. The cell size ranges from 8 - 16 μm in length and 6 - 8 μm in width. The cell contains 1 single green chloroplast, 1 large red eyespot and a nucleus located at the centre of the cell.

描述：

Microglena uva-maris 屬以單一細胞個體出現，大多是圓形，呈放射性對稱，背腹扁平。2條等長鞭毛從前端伸出，細胞有一凝膠質層包圍着。細胞長介乎8 - 16微米，闊介乎6 - 8微米。細胞內有 1 個綠色葉綠體，1個大紅眼點，細胞核位於細胞的中央。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1994	1	<i>Thalassomonas</i> sp. 平藻
2004	1	-
Total/總數：	2	



Microglena uva-maris. Figures 1-2: Cells broadly ovoid with round posterior; 2 equal flagella emerge at the anterior end and the cell surrounded by a gelatinous sheath; a red eyespot is large and diffuse. Figure 3-4: Cysts.

Microglena uva-maris。圖1-2：細胞呈寬闊卵形，而細胞後端呈圓形；2條等長鞭毛從前端伸出，細胞有1膠質層包圍着；有1個大而擴散的紅眼點。圖3-4：孢囊。

Phaeocystis globosa

球形棕囊藻

Scherffel, 1899

Phylum: Haptophyta

Class: Prymnesiophyceae

Order: Phaeocystales

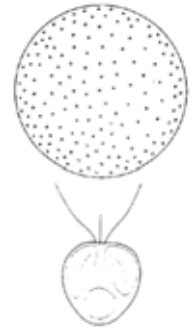
Family: Phaeocystaceae

門：定鞭藻門

綱：定鞭藻綱

目：棕囊藻目

科：棕囊藻科



Tomas et al., 1997

Description:

Phaeocystis globosa forms spherical, gelatinous colonies which can be up to 2 cm in diameter. Cells are distributed on the surface layer of the colony. The cell, embedded in mucilage, is around 3 - 9 μm . Each cell contains 2 parietal yellowish brown chloroplasts but usually lacks flagella and haptoneum. There are at least two different stages in its life cycle (colony-forming phase and one or more unicellular stage). The unicellular stage is a biflagellate with a very short haptoneum. The cell can produce thread-like material and the proximal part is arranged in pentagonal form.

Toxicity:

Overseas research reported that *P. globosa* is a foam-producing species that causes harmful effect to fish. It can generate mucilage which clogs fish gills. During blooms, the gelatinous colonies can also form huge mass of foams on beaches which reduces aesthetic and recreational values.

描述：

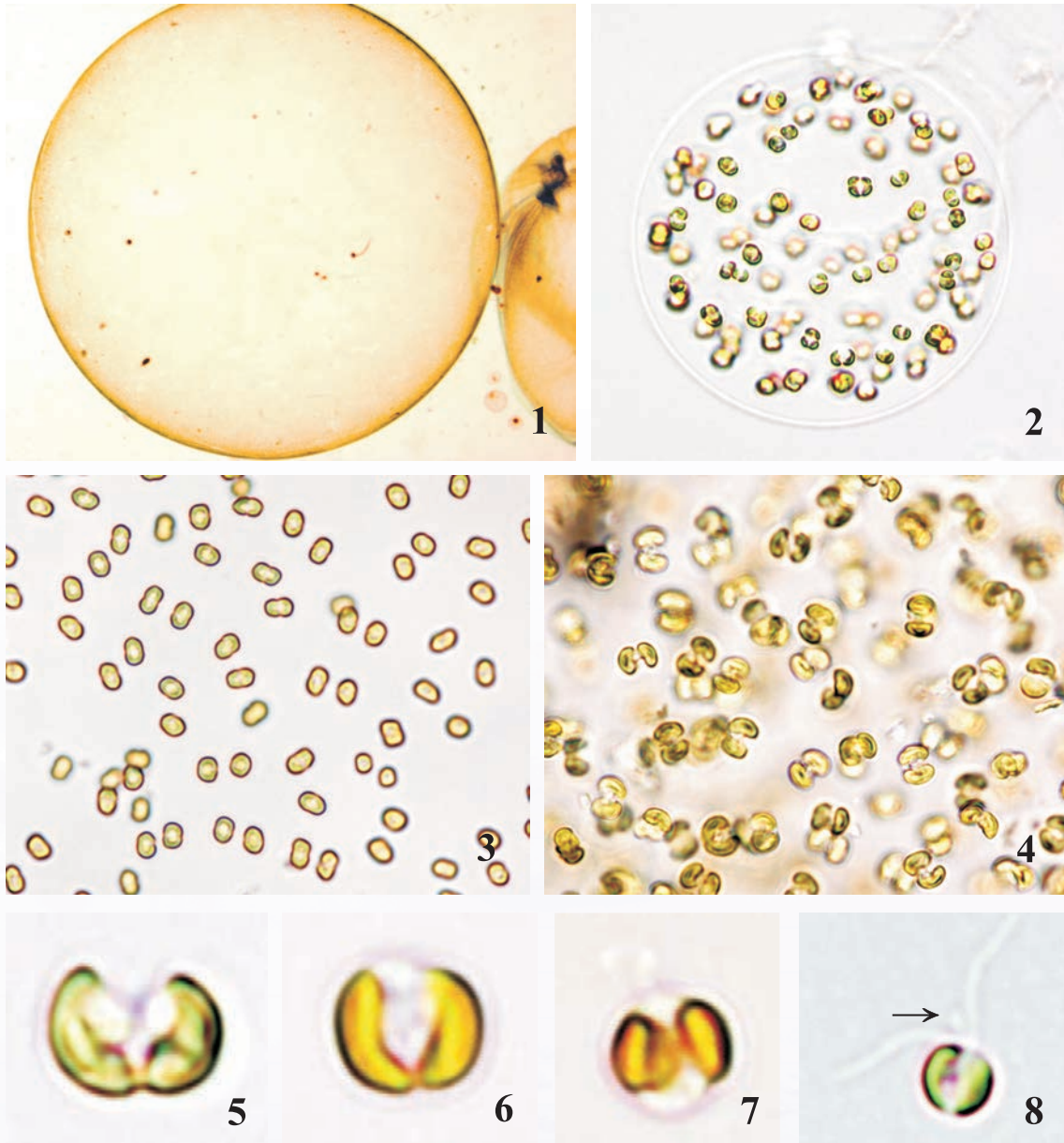
球形棕囊藻組成球凝狀膠質群落，直徑可達2厘米。細胞分布於群落表面，被黏液包圍，大小約3 - 9微米。每個細胞均有2個側生黃褐色葉綠體，但一般沒有鞭毛及定鞭毛。這種藻的生命周期最少有2個不同階段（群落形態及一個或多個單細胞形態）。在單細胞形態時有雙鞭毛和一根極短的定鞭毛，細胞可製造線狀物質，近側部分排列成五角形。

毒性：

根據外國文獻記載球形棕囊藻是可製造泡沫的藻類，對魚類有害，並可產生黏液，堵塞魚鰓造成危害。紅潮出現期間，膠質群落亦會在海灘產生大量泡沫，減低景觀及康樂價值。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2002	1	-
2004	1	-
2005	2	-
2006	2	-
2008	1	-
2009	2	-
2010	1	-
2011	1	-
2013	1	-
2014	1	-
2016	2	-
2017	1	-
Total/總數：		16



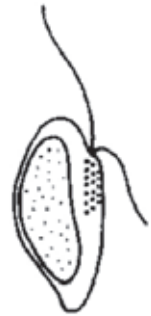
Phaeocystis globosa. Figure 1: Live spherical colony (8mm in diameter). Figure 2: Live cultured colony (95 μ m in diameter). Figure 3: Individual cells scatter on the surface of the colony. Figures 4-5: Fixed cells. Figures 6-7: Live non-motile cell showing 2 yellowish-brown chloroplasts and no flagellum. Figure 8: Live motile cell (zooid) showing 2 flagella and 1 heptonema (arrow).

球形棕囊藻。圖1：活球狀群落（直徑8毫米）。圖2：活培植群落（直徑95微米）。圖3：個別細胞散布於群落表面。圖4-5：以固定劑固定的細胞。圖6-7：非動性活細胞，顯示有2顆黃褐色葉綠體而沒有鞭毛。圖8：動性活細胞（游動個體），可見有2根鞭毛及1根定鞭毛（箭咀）。

Plagioselmis prolunga
伸長斜片藻

Butcher ex Novarino, Lucas & Morrall, 1994

Phylum: Cryptophyta 門：隱藻門
Class: Cryptophyceae 綱：隱藻綱
Order: Pyrenomonadales 目：隱藻目
Family: Geminigeraceae 科：隱藻科



Tomas et al., 1997

Synonyms 異名：

Plagioselmis punctata Butcher 1967

Description:

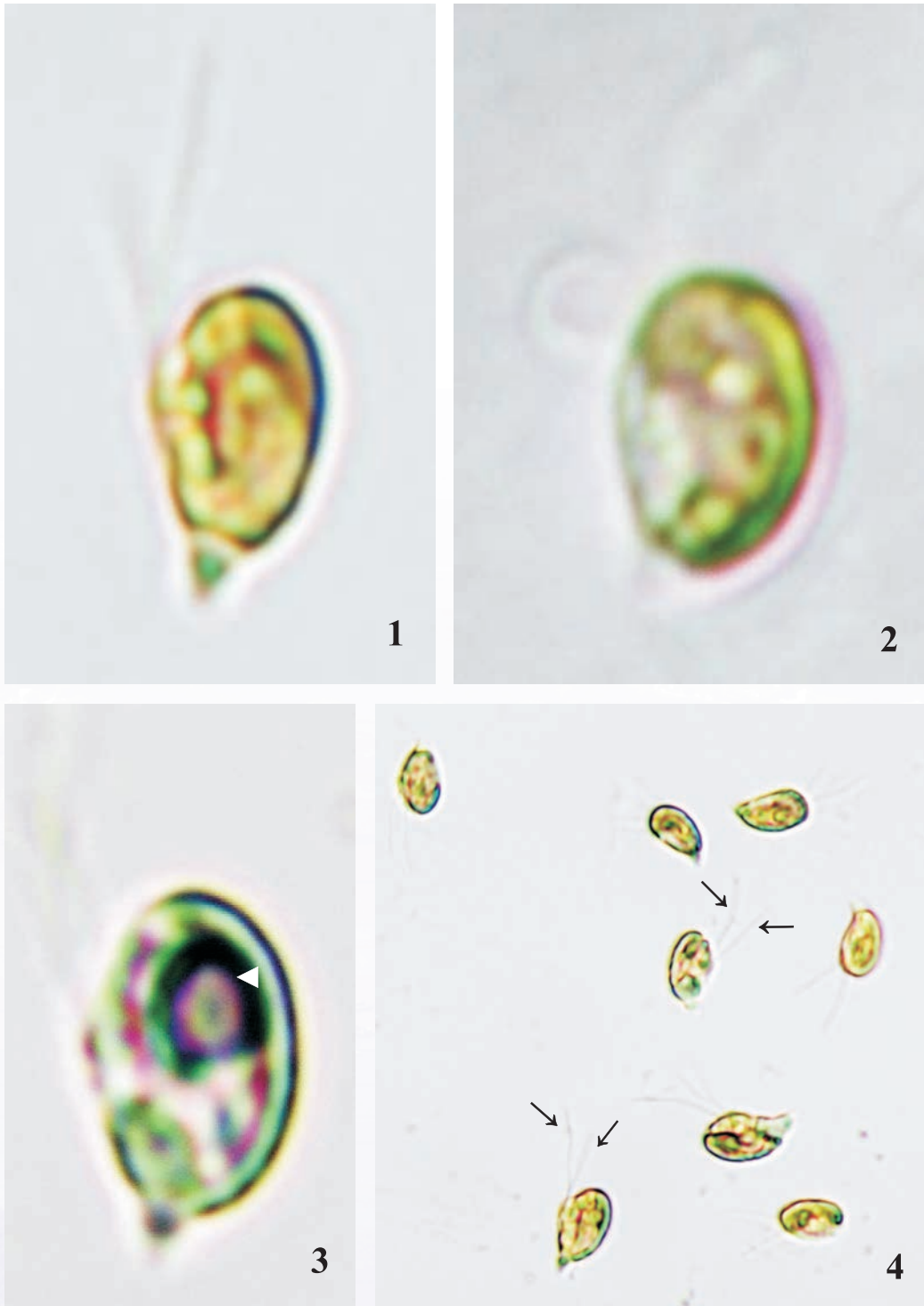
The cell of *Plagioselmis prolunga* is ovoid, flattened and teardrop-shaped with ventral furrow in lateral view. It is round at the anterior and tail-like at the posterior end and it occurs solitarily. The cell size ranges 5 - 10 μm in length and 3 - 5 μm in width. 2 subequal flagella emerge from a depression at the subapical end. A mid-ventral band is present. The surface of cell body is covered with large hexagonal plates while 1 sheet-like surface covers on the pointed and ventrally curved posterior tail.

描述：

伸長斜片藻的細胞呈卵形，略為扁平，細胞側面觀呈淚珠形，有明顯腹溝。細胞前端較圓，後端呈顯著的尖尾，細胞多以單獨個體出現。細胞長介乎5 - 10微米，闊介乎3 - 5微米。具有2條不等長的鞭毛，由接近前端槽處伸出。細胞有中央腹帶。細胞表面布滿大六角形殼片，而彎曲尖尾的表面則由1塊薄片所覆蓋。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1984	3	-
1985	1	-
1996	1	-
2000	1	-
	1	<i>Peridinium quinquecorne</i> 五刺多甲藻、 <i>Scrippsiella trochoidea</i> 錐狀斯氏藻
2002	1	-
2005	2	<i>Heterocapsa rotundata</i> 異囊藻、 <i>Heterosigma akashiwo</i> 赤潮異彎藻
2009	1	-
2017	1	-
Total/總數：		12



Plagioselmis prolonga. Figures 1-2: Various cells in lateral view showing teardrop-shape with a round anterior end and a tail-like posterior end. Figure 3: Fixed cell in lateral view showing a pyrenoid (arrow head) with a thin starch sheath. Figure 4: Fixed cells in various shape showing 2 subequal flagella (arrows) emerge from a depression at the subapical end.

伸長斜片藻。圖1-2：細胞的側面觀顯示細胞呈淚珠形，前端較圓及後端像長尾巴。圖3：以固定劑固定的細胞側面觀顯示細胞內有1個含有薄澱粉護鞘的澱粉核（箭頭）。圖4：以固定劑固定的不同形狀的細胞顯示細胞具有2條不等長的鞭毛（箭咀），由接近前端一凹處伸出。

Teleaulax acuta
尖尾全溝藻
(Butcher) Hill, 1991

Phylum: Cryptophyta 門：隱藻門
Class: Cryptophyceae 綱：隱藻綱
Order: Pyrenomonadales 目：隱藻目
Family: Geminigeraceae 科：隱藻科



Tomas et al., 1997

Synonyms 異名：

Cryptomonas acuta Butcher 1952

Description:

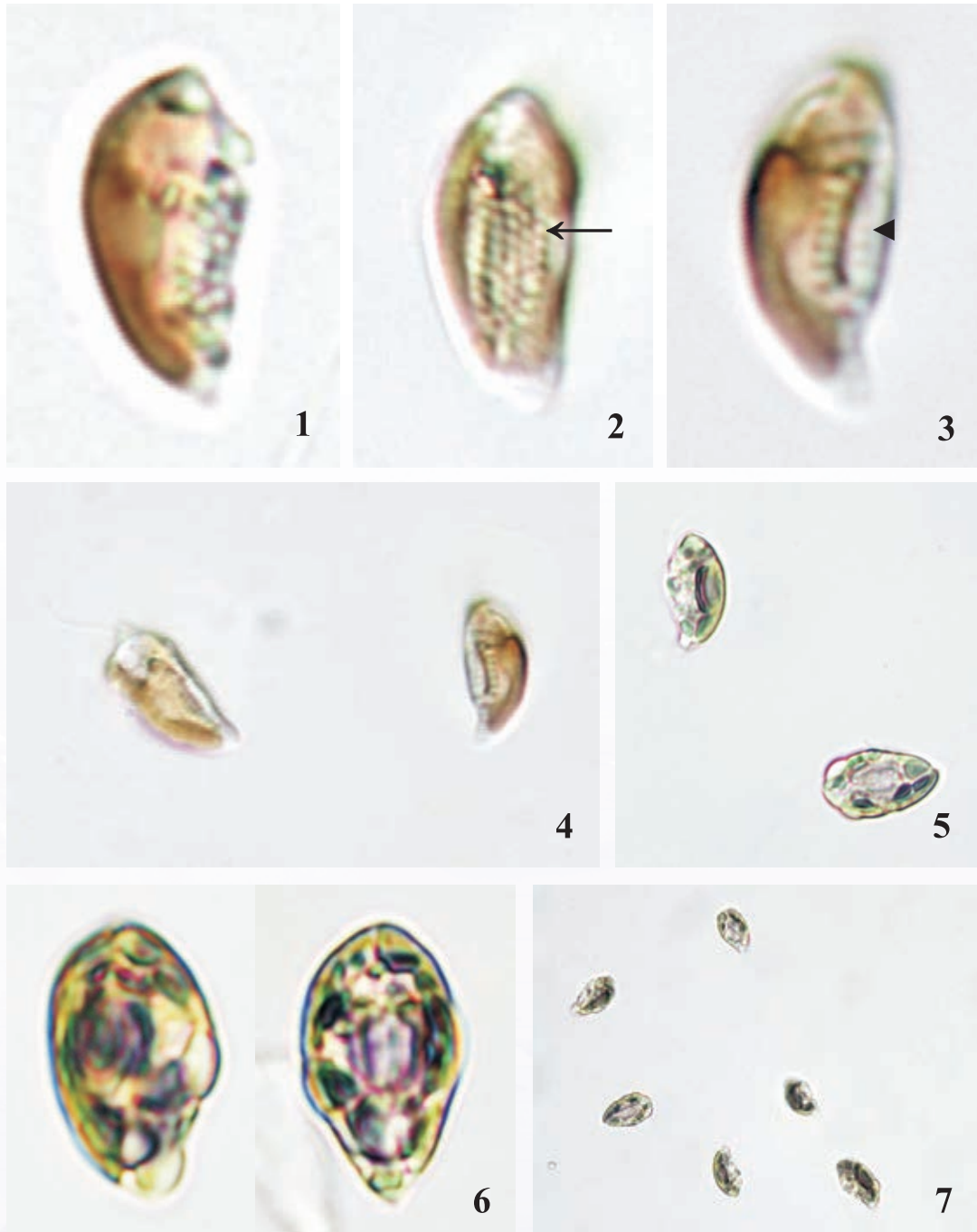
Teleaulax acuta is ovoid and asymmetrical but flattened in ventral view with an apical or subapical long furrow. It occurs solitarily. The anterior of the cell is rostrate and pointed at posterior. The cell size ranges from 12 - 16 μm in length. 2 flagella emerge from the upper end of a ventral furrow (depression at the apical end). 1 sheet-like periplast covers the entire cell surface including the posterior end. The cell contains 1 boat-shaped chloroplast, 1 central pyrenoid and 1 nucleus.

描述：

尖尾全溝藻的細胞呈卵形，不對稱，細胞的正面觀扁平，在前端或接近前端有長溝。多以單獨個體出現。細胞前端呈喙狀突起，後端是尖的。細胞長介乎12 - 16微米。2條鞭毛由腹溝上端末伸出(前端凹陷處)。細胞整個表面包括後端由1塊薄片所覆蓋。細胞內有1顆船形葉綠體、1個中央澱粉核及1個細胞核。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1983	1	-
1986	1	-
	1	<i>Leptocylindrus danicus</i> 丹麥細柱藻
1987	1	-
1997	1	-
2001	1	-
2004	1	-
2013	1	-
2014	1	<i>Thalassiosira pseudonana</i> 假微型海鏈藻
Total/總數：	9	



Teleaulax acuta. Figure 1: Live cell in lateral view showing the rostrate anterior and the pointed posterior. Figure 2: Live cell in ventral view showing 5 longitudinal rows of ejectosomes (arrow). Figure 3: Live cell in lateral-ventral view showing the long deep furrow extending for about half of the cell length (arrow head). Figure 4: Live cells with focus on cell surface. Figure 5: Fixed cells. Figure 6: The same fixed cell in different view showing the pyrenoid surrounded by starch sheath. Figure 7: Bloom cells from the field.

尖尾全溝藻。圖1：活細胞的側面觀顯示喙狀的前端及一尖的後端。圖2：活細胞的正面觀顯示細胞有5行縱向的彈射體（箭咀）。圖3：活細胞的側面觀顯示細胞有一長深溝，伸延至約細胞長度的一半（箭頭）。圖4：聚焦在細胞表面的活細胞的照片。圖5：兩個以固定劑固定的細胞。圖6：同一以固定劑固定的細胞以不同角度顯示的照片，可見細胞含有薄澱粉護鞘的澱粉核。圖7：在紅潮現場採集所得的細胞。

Trichodesmium erythraeum

紅海束毛藻

Ehrenberg ex Gomont, 1892

Phylum: Cyanobacteria

Class: Cyanophyceae

Order: Oscillatoriales

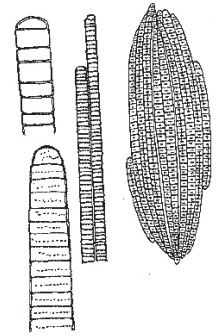
Family: Phormidiaceae

門：藍藻門

綱：藍藻綱

目：顫藻目

科：席藻科



Gomont, 1890

Synonyms 異名：

Oscillaria erythraea (Ehrenberg) Kützting 1843, *Trichodesmium ehrenbergii* Montagne 1844, *Trichodesmium hindsii* Montagne 1844, *Oscillatoria erythraea* (Ehrenberg) Geitler 1932 and *Skujaella erythraea* (Ehrenberg ex Gomont) Toni 1938

Description:

Trichodesmium erythraeum is a tropical filamentous alga with straight trichomes oriented parallel in bundles. The length of each trichome is around 60 - 750 μm ; the cell size ranges from 4.5 - 21 μm in length, 6 - 15 μm in width and its length is usually shorter than its width. The apical cell is hemispherical, conical or convex with calyptras at the end of the trichomes. The colony form appears red in colour.

Toxicity:

Overseas research reported that *T. erythraeum* is a toxic species which causes fish kill. It is also suspected to produce microcystins that might be a nuisance to swimmers. The toxicity of the Hong Kong strain is uncertain.

描述：

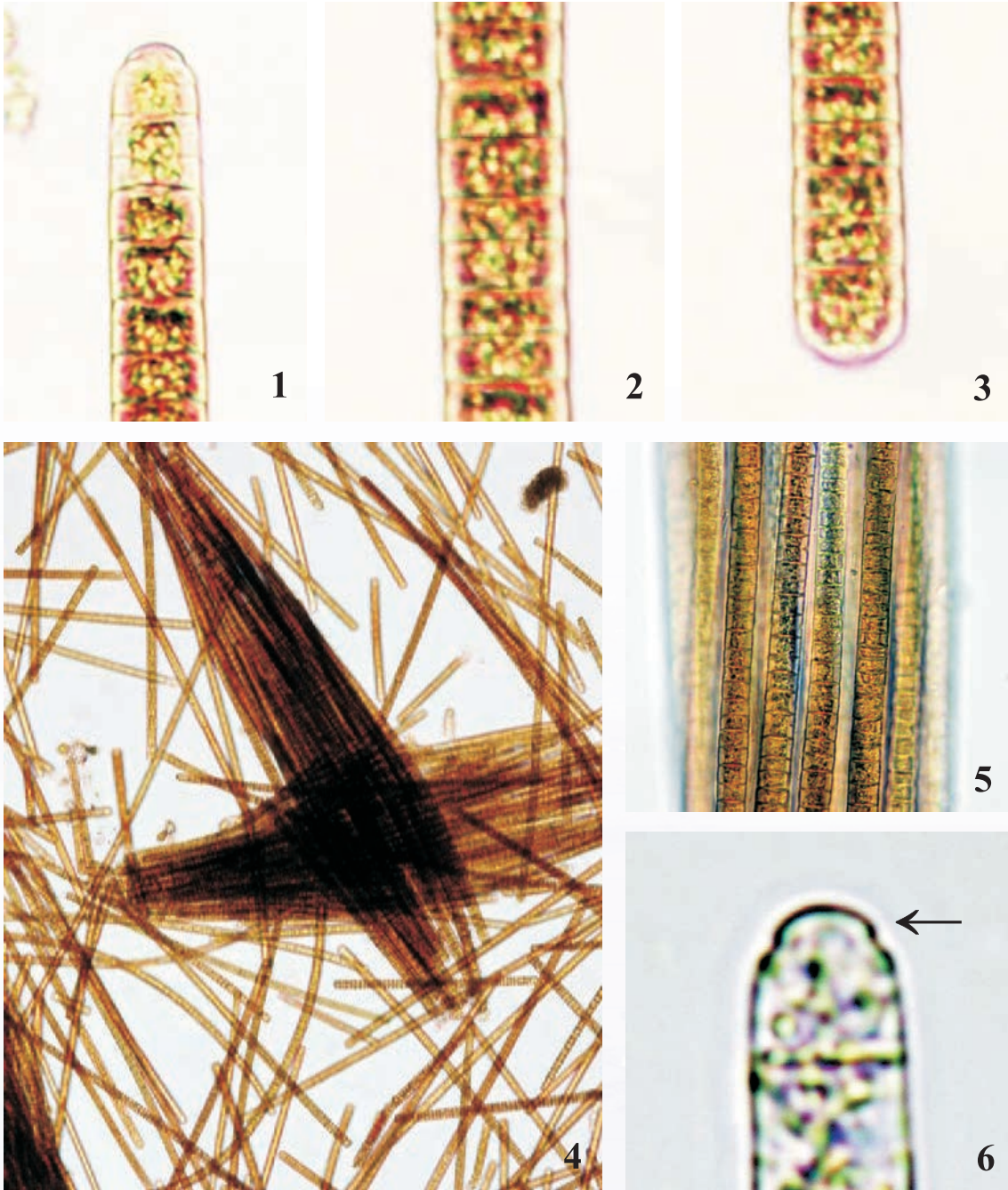
紅海束毛藻是熱帶絲狀藻，藻絲體直，平行排列成束狀。每條藻絲長介乎60 - 750微米；細胞長介乎4.5 - 21微米，闊介乎6 - 15微米，細胞長度一般比闊度略短。藻絲頂端細胞呈半球形、錐形或凸出的，藻絲末端有帽狀體，藻群呈紅色。

毒性：

根據外國文獻記載紅海束毛藻可導致魚類死亡，這種藻亦可能會產生微囊藻毒素，對游泳人士有害。香港藻株的毒性尚未能確定。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1980	1	<i>Noctiluca scintillans</i> 夜光藻
1984	1	-
2003	1	<i>Trichodesmium thiebautii</i> 鐵氏束毛藻
2004	8	-
2007	2	-
2009	1	-
2015	1	-
Total/總數：	15	



Trichodesmium erythraeum. Figures 1-3: Trichomes showing the width of individual cells are usually wider than their length. Figures 4-5: Trichomes are straight and oriented parallel in bundles. Figure 6: Apical cell is hemispherical, conical or convex with calyptra (arrow).

紅海束毛藻。圖1-3：藻絲顯示每個細胞一般闊度大於長度。圖4-5：藻絲體直，排列成束狀。圖6：頂細胞呈半球形、錐形或凸面，藻絲末端有帽狀體(箭咀)。

Trichodesmium thiebautii

鐵氏束毛藻

Gomont ex Gomont, 1890

Phylum: Cyanobacteria

Class: Cyanophyceae

Order: Oscillatoriales

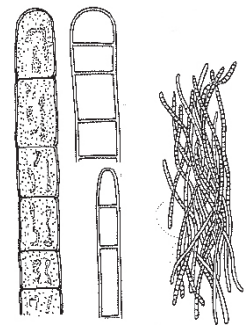
Family: Phormidiaceae

門：藍藻門

綱：藍藻綱

目：顫藻目

科：席藻科



Gomont, 1890

Synonyms 異名：

Oscillatoria thiebautii (Gomont ex Gomont) Geitler 1932 and *Skujaella thiebautii* (Gomont ex Gomont) Toni 1939

Description:

Trichodesmium thiebautii is a tropical filamentous alga. The colony form of *T. thiebautii* is highly variable, ranging from bundles of trichomes winded together, spherical to rope-like form with radiating trichomes. The trichome size ranges from 5 - 16 μm in diameter and the cell can be twice as long as in its width. The apical cell is round or flattened with or without calyptra at the end of the trichomes. Colonies are usually buoyant and about 1 - 3 mm in size. They usually appear golden brown in colour but can also vary from grey, brown to red.

Toxicity:

Overseas research reported that *T. thiebautii* can cause neurointoxication and may produce neurotoxin which has an impact similar to anatoxin-a. The toxicity of the Hong Kong strain is uncertain.

描述：

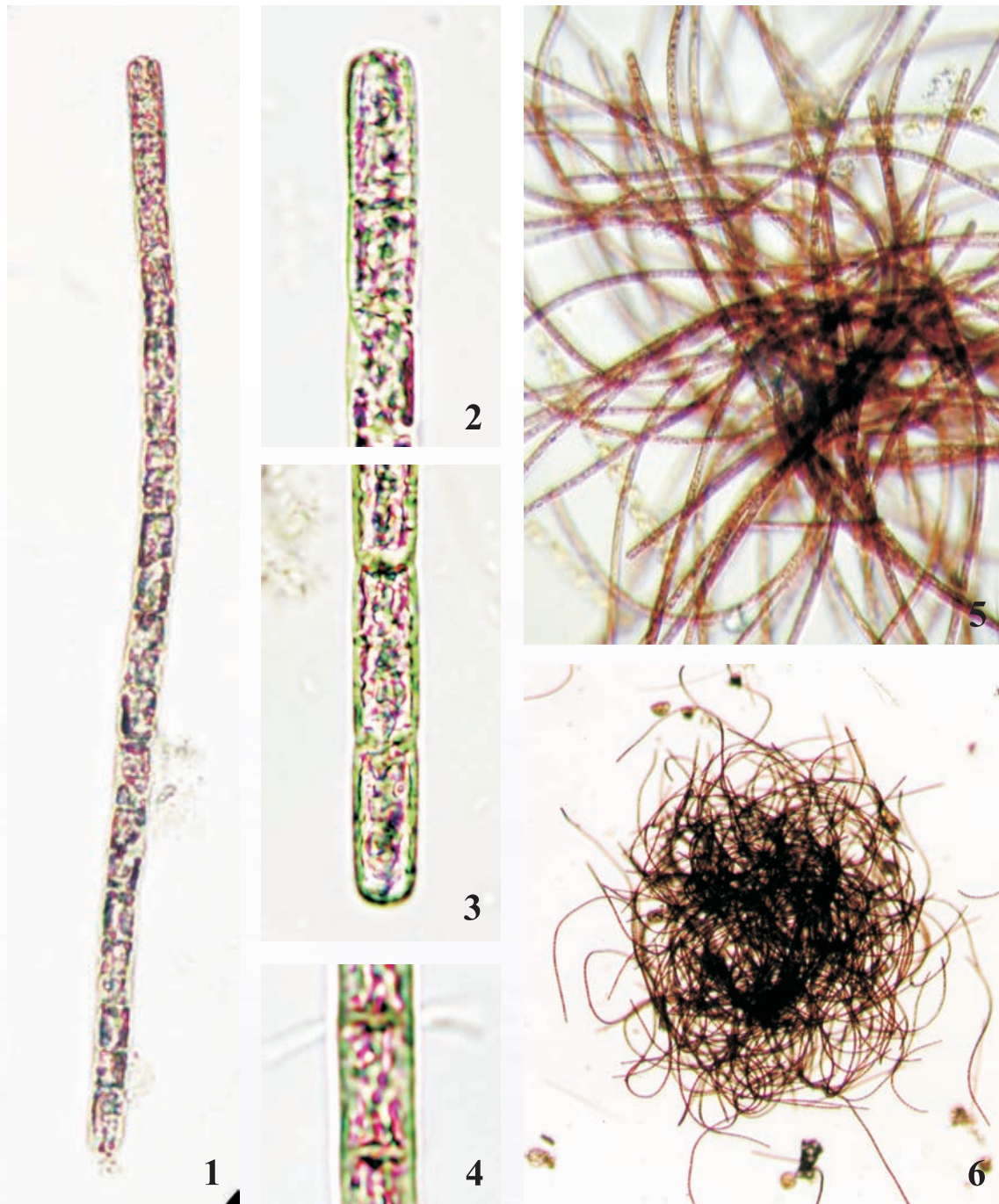
鐵氏束毛藻是熱帶絲狀藻，群落形態差異極大，藻絲束既可纏繞成群、或成球狀，亦可呈繩索狀附以伸展藻絲等。藻絲直徑介乎5 - 16微米，細胞長度可比闊度大兩倍。頂端細胞呈圓形或扁平，藻絲末端附有或沒有帽狀體。藻群落一般浮於水面，大小約1 - 3毫米，顏色以金褐色為主，但亦有不同顏色，例如灰、褐以至紅色的。

毒性：

根據外國文獻記載鐵氏束毛藻可引致神經中毒，這種藻會產生一種神經毒素，引起的症狀與魚腥藻毒素-a的相似。香港藻株的毒性尚未能確定。

Occurrence of bloom(s) in Hong Kong / 在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2003	1	<i>Trichodesmium erythraeum</i> 紅海束毛藻
Total/總數：		1



Trichodesmium thiebautii. Figure 1: Trichomes are slightly flexuous or well curled. Figures 2-3: Apical cells of trichomes are round or flattened without calyptras. Figure 4: Trichomes showing the length of individual cells usually longer than their width, and can be twice as long as their width. Figures 5-6: Trichomes forming radially arranged, spherical or rope-like colony, sometimes up to 3mm in size.

鐵氏束毛藻。圖1：藻絲微曲或深度彎曲。圖2-3：藻絲頂細胞呈圓形或扁平，藻絲末端沒有帽狀體。圖4：從藻絲可見細胞通常長而窄，長度可比闊度大兩倍。圖5-6：藻絲可形成輻射形排列、球形或繩索狀的群落，細胞群落有時可達3毫米大。

第五章
Chapter 5

Checklist / Index
覽表 / 索引



Checklist of Red Tide Causative Species from 1975 -2017 1975 至2017年紅潮品種一覽表

Red tide causative species 紅潮品種	Group 組別	Occurrence 引發次數	Percentage of occurrence H/M/L* 引發百分比 高/中/低*	Potential harmful algae Y/N 可能有害藻類 是/否	Caused fish kill Y/N 引致魚類死亡 有/否	Page 頁
<i>Akashiwo sanguinea</i> 血紅赤潮藻	Dinoflagellates 甲藻	18	M 中	N 否	N 否	96
<i>Alexandrium catenella</i> 鏈狀亞歷山大藻	Dinoflagellates 甲藻	2	L 低	Y 是	N 否	98
<i>Alexandrium tamarense</i> 塔馬亞歷山大藻	Dinoflagellates 甲藻	2	L 低	Y 是	N 否	100
<i>Cerataulina pelagica</i> 海洋角管藻	Diatoms 矽藻	3	L 低	N 否	N 否	38
<i>Ceratoneis closterium</i> 新月蛾眉藻	Diatoms 矽藻	1	L 低	N 否	N 否	40
<i>Chaetoceros curvisetus</i> 旋鏈角毛藻	Diatoms 矽藻	3	L 低	N 否	N 否	42
<i>Chaetoceros pseudocurvisetus</i> 擬彎角毛藻	Diatoms 矽藻	2	L 低	N 否	N 否	44
<i>Chaetoceros salsugineum</i> 角毛藻	Diatoms 矽藻	6	L 低	N 否	N 否	46
<i>Chaetoceros socialis</i> 聚生角毛藻	Diatoms 矽藻	3	L 低	N 否	N 否	48
<i>Chaetoceros tenuissimus</i> 細柔角毛藻	Diatoms 矽藻	1	L 低	N 否	N 否	50
<i>Chattonella marina</i> 海洋褐胞藻	Others 其他	6	L 低	Y 是	Y 有	170
<i>Chattonella marina</i> var. <i>ovata</i> 海洋褐胞藻卵形變種	Others 其他	4	L 低	Y 是	Y 有	172
<i>Chattonella</i> sp. 0310 褐胞藻 0310	Others 其他	2	L 低	N 否	N 否	174
<i>Cochlodinium convolutum</i> 卷曲旋溝藻	Dinoflagellates 甲藻	1	L 低	N 否	N 否	102
<i>Conticribra weissflogii</i> 威氏海鏈藻	Diatoms 矽藻	2	L 低	N 否	N 否	52
<i>Cyclotella choctawhatcheana</i> 小環藻	Diatoms 矽藻	2	L 低	N 否	N 否	54
<i>Dactyliosolen fragilissimus</i> 脆指管藻	Diatoms 矽藻	8	L 低	N 否	N 否	56

Checklist of Red Tide Causative Species from 1975 -2017 1975 至2017年紅潮品種一覽表

Red tide causative species 紅潮品種	Group 組別	Occurrence 引發次數	Percentage of occurrence H/M/L* 引發百分比 高/中/低*	Potential harmful algae Y/N 可能有害藻類 是/否	Caused fish kill Y/N 引致魚類死亡 有/否	Page 頁
<i>Dactyliosolen phuketensis</i> 指管藻	Diatoms 矽藻	1	L 低	N 否	N 否	58
<i>Diadsmis sp.</i> 等半藻屬	Diatoms 矽藻	1	L 低	N 否	N 否	60
<i>Dictyocha octonaria</i> 矽鞭藻	Others 其他	7	L 低	N 否	N 否	176
<i>Dunaliella sp.</i> 杜氏藻屬	Others 其他	2	L 低	N 否	N 否	178
<i>Eucampia zodiacus</i> 浮動彎角藻	Diatoms 矽藻	3	L 低	N 否	N 否	62
<i>Eutreptiella sp.</i> 異雙鞭裸藻屬	Others 其他	4	L 低	N 否	N 否	180
<i>Fibrocapsa japonica</i> 針胞藻	Others 其他	2	L 低	Y 是	N 否	182
<i>Gonyaulax polygramma</i> 多紋膝溝藻	Dinoflagellates 甲藻	56	M 中	N 否	N 否	104
<i>Gonyaulax verior</i> 春膝溝藻	Dinoflagellates 甲藻	1	L 低	N 否	N 否	106
<i>Guinardia delicatula</i> 柔弱幾內亞藻	Diatoms 矽藻	2	L 低	N 否	N 否	64
<i>Guinardia striata</i> 線紋幾內亞藻	Diatoms 矽藻	1	L 低	N 否	N 否	66
<i>Gymnodinium impudicum</i> 伊姆裸甲藻	Dinoflagellates 甲藻	1	L 低	N 否	N 否	108
<i>Gymnodinium simplex</i> 簡單裸甲藻	Dinoflagellates 甲藻	4	L 低	N 否	N 否	110
<i>Gymnodinium sp.X</i> 裸甲藻X	Dinoflagellates 甲藻	2	L 低	Y 是	Y 有	112
<i>Gyrodinium spirale</i> 螺形環溝藻	Dinoflagellates 甲藻	1	L 低	N 否	N 否	114
<i>Haematococcus pluvialis</i> 雨生紅球藻	Others 其他	5	L 低	N 否	N 否	184
<i>Hermesinium adriaticum</i> 亞得利亞海矽鞭藻	Others 其他	1	L 低	N 否	N 否	186

Checklist of Red Tide Causative Species from 1975 -2017 1975 至2017年紅潮品種一覽表

Red tide causative species 紅潮品種	Group 組別	Occurrence 引發次數	Percentage of occurrence H/M/L* 引發百分比 高/中/低*	Potential harmful algae Y/N 可能有害藻類 是/否	Caused fish kill Y/N 引致魚類死亡 有/否	Page 頁
<i>Heterocapsa circularisquama</i> 圓鱗異囊藻	Dinoflagellates 甲藻	17	M 中	Y 是	N 否	116
<i>Heterocapsa pygmaea</i> 異囊藻	Dinoflagellates 甲藻	1	L 低	N 否	N 否	118
<i>Heterocapsa rotundata</i> 異囊藻	Dinoflagellates 甲藻	3	L 低	N 否	N 否	120
<i>Heterosigma akashiwo</i> 赤潮異彎藻	Others 其他	28	M 中	Y 是	N 否	188
<i>Karenia digitata</i> 指溝凱倫藻	Dinoflagellates 甲藻	9	L 低	Y 是	Y 有	122
<i>Karenia longicanalis</i> 長溝凱倫藻	Dinoflagellates 甲藻	1	L 低	N 否	N 否	124
<i>Karenia mikimotoi</i> 米氏凱倫藻	Dinoflagellates 甲藻	12	M 中	Y 是	Y 有	126
<i>Karenia papilionacea</i> 微疣凱倫藻	Dinoflagellates 甲藻	2	L 低	Y 是	N 否	128
<i>Karlodinium veneficum</i> 劇毒卡爾藻	Dinoflagellates 甲藻	1	L 低	Y 是	N 否	130
<i>Leptocylindrus danicus</i> 丹麥細柱藻	Diatoms 硅藻	4	L 低	N 否	N 否	68
<i>Leptocylindrus minimus</i> 微小細柱藻	Diatoms 硅藻	10	L 低	N 否	N 否	70
<i>Levanderina fissa</i> 旋紋環溝藻	Dinoflagellates 甲藻	6	L 低	N 否	N 否	132
<i>Margalefidinium polykrikoides</i> (未有中文名稱)	Dinoflagellates 甲藻	5	L 低	Y 是	N 否	134
<i>Mesodinium rubrum</i> 紅色中縊蟲	Others 其他	62	M 中	N 否	N 否	190
<i>Microglena uva-maris</i> (未有中文名稱)	Others 其他	2	L 低	N 否	N 否	192
<i>Nitzschia incerta</i> 菱形藻	Diatoms 硅藻	2	L 低	N 否	N 否	72
<i>Noctiluca scintillans</i> 夜光藻	Dinoflagellates 甲藻	287	H 高	N 否	N 否	136

Checklist of Red Tide Causative Species from 1975 -2017 1975 至2017年紅潮品種一覽表

Red tide causative species 紅潮品種	Group 組別	Occurrence 引發次數	Percentage of occurrence H/M/L* 引發百分比 高/中/低*	Potential harmful algae Y/N 可能有害藻類 是/否	Caused fish kill Y/N 引致魚類死亡 有/否	Page 頁
<i>Peridinium quinquecorne</i> 五刺多甲藻	Dinoflagellates 甲藻	1	L 低	N 否	N 否	138
<i>Phaeocystis globosa</i> 球形棕囊藻	Others 其他	16	M 中	Y 是	N 否	194
<i>Plagioselmis prolunga</i> 伸長斜片藻	Others 其他	12	M 中	N 否	N 否	196
<i>Polykrikos geminatum</i> 寶石多溝藻	Dinoflagellates 甲藻	9	L 低	N 否	N 否	140
<i>Prorocentrum balticum</i> 波羅的海原甲藻	Dinoflagellates 甲藻	3	L 低	N 否	N 否	142
<i>Prorocentrum cordatum</i> 心形原甲藻	Dinoflagellates 甲藻	47	M 中	Y 是	N 否	144
<i>Prorocentrum dentatum</i> 細齒原甲藻	Dinoflagellates 甲藻	15	M 中	N 否	N 否	146
<i>Prorocentrum gracile</i> 細長原甲藻	Dinoflagellates 甲藻	16	M 中	N 否	N 否	148
<i>Prorocentrum micans</i> 海洋原甲藻	Dinoflagellates 甲藻	11	M 中	N 否	N 否	150
<i>Prorocentrum rhathymum</i> 慢原甲藻	Dinoflagellates 甲藻	1	L 低	Y 是	N 否	152
<i>Prorocentrum triestinum</i> 尖葉原甲藻	Dinoflagellates 甲藻	32	M 中	N 否	N 否	154
<i>Protoperidinium depressum</i> 扁平原多甲藻	Dinoflagellates 甲藻	1	L 低	N 否	N 否	156
<i>Pseudo-nitzschia delicatissima</i> 柔弱擬菱形藻	Diatoms 矽藻	4	L 低	Y 是	N 否	74
<i>Pseudo-nitzschia pseudodelicatissima</i> 假柔弱擬菱形藻	Diatoms 矽藻	4	L 低	Y 是	N 否	76
<i>Pseudo-nitzschia pungens</i> 尖刺擬菱形藻	Diatoms 矽藻	6	L 低	Y 是	N 否	78
<i>Scripsiella trochoidea</i> 錐狀斯氏藻	Dinoflagellates 甲藻	27	M 中	N 否	N 否	158
<i>Skeletonema costatum</i> 中肋骨條藻	Diatoms 矽藻	67	M 中	N 否	N 否	80

Checklist of Red Tide Causative Species from 1975 -2017 1975 至2017年紅潮品種一覽表

Red tide causative species 紅潮品種	Group 組別	Occurrence 引發次數	Percentage of occurrence H/M/L* 引發百分比 高/中/低*	Potential harmful algae Y/N 可能有害藻類 是/否	Caused fish kill Y/N 引致魚類死亡 有/否	Page 頁
<i>Takayama pulchella</i> 美麗達卡藻	Dinoflagellates 甲藻	1	L 低	Y 是	N 否	160
<i>Teleaulax acuta</i> 尖尾全溝藻	Others 其他	9	L 低	N 否	N 否	198
<i>Thalassiosira mala</i> 中肋海鏈藻	Diatoms 矽藻	8	L 低	N 否	N 否	82
<i>Thalassiosira pseudonana</i> 假微型海鏈藻	Diatoms 矽藻	10	L 低	N 否	N 否	84
<i>Thalassiosira tealata</i> 特拉海鏈藻	Diatoms 矽藻	3	L 低	N 否	N 否	86
<i>Trichodesmium erythraeum</i> 紅海束毛藻	Others 其他	15	M 中	Y 是	N 否	200
<i>Trichodesmium thiebautii</i> 鐵氏束毛藻	Others 其他	1	L 低	Y 是	N 否	202
<i>Trieres mobiliensis</i> 活動盒形藻	Diatoms 矽藻	1	L 低	N 否	N 否	88
<i>Trieres sinensis</i> 中華盒形藻	Diatoms 矽藻	1	L 低	N 否	N 否	90
<i>Tripes furca</i> 叉角藻	Dinoflagellates 甲藻	41	M 中	N 否	N 否	162
<i>Tripes nuelleri</i> 三角角藻	Dinoflagellates 甲藻	1	L 低	N 否	N 否	164

* H represents red tide occurrence more than 10% ; M represents red tide occurrence between 1 % and 10%; L represents red tide occurrence less than 1%

高代表紅潮引發次數百分比大於10%；中代表紅潮引發次數百分比介乎1%至10%之間；低代表紅潮引發次數百分比少於1%

Appendix 附錄

APPENDIX I 附錄一

Distribution of Diatoms in various water regions
硅藻在不同水域的分布

Red tide causative species 紅潮品種	West 西	South 南	Southeast 東南	East 東	Northeast 東北	Tolo Harbour 吐露港
<i>Cerataulina pelagica</i> 海洋角管藻		◆				◆
<i>Ceratoneis closterium</i> 新月蛾眉藻						◆
<i>Chaetoceros curvisetus</i> 旋鏈角毛藻		◆	◆			
<i>Chaetoceros pseudocurvisetus</i> 擬彎角毛藻		◆				◆
<i>Chaetoceros salsugineum</i> 角毛藻		◆	◆		◆	◆
<i>Chaetoceros socialis</i> 聚生角毛藻		◆				◆
<i>Chaetoceros tenuissimus</i> 細柔角毛藻					◆	
<i>Conticribra weissflogii</i> 威氏海鏈藻	◆					
<i>Cyclotella choctawhatcheana</i> 小環藻						◆
<i>Dactyliosolen fragilissimus</i> 脆指管藻			◆		◆	◆
<i>Dactyliosolen phuketensis</i> 指管藻		◆				
<i>Diadismis</i> sp. 等半藻屬	◆					
<i>Eucampia zodiacus</i> 浮動彎角藻	◆	◆				
<i>Guinardia delicatula</i> 柔弱幾內亞藻		◆				◆
<i>Guinardia striata</i> 線紋幾內亞藻						◆
<i>Leptocylindrus danicus</i> 丹麥細柱藻					◆	◆
<i>Leptocylindrus minimus</i> 微小細柱藻						◆
<i>Nitzschia incerta</i> 菱形藻		◆				◆
<i>Pseudo-nitzschia delicatissima</i> 柔弱擬菱形藻	◆	◆	◆			◆
<i>Pseudo-nitzschia pseudodelicatissima</i> 假柔弱擬菱形藻		◆				◆
<i>Pseudo-nitzschia pungens</i> 尖刺擬菱形藻	◆	◆	◆			◆
<i>Skeletonema costatum</i> 中肋骨條藻	◆	◆	◆	◆	◆	◆
<i>Thalassiosira mala</i> 中肋海鏈藻		◆				◆
<i>Thalassiosira pseudonana</i> 假微型海鏈藻	◆	◆			◆	◆
<i>Thalassiosira tealata</i> 特拉海鏈藻	◆	◆				
<i>Trieres mobiliensis</i> 活動盒形藻						◆
<i>Trieres sinensis</i> 中華盒形藻						◆

APPENDIX II 附錄二

Distribution of Dinoflagellates in various water regions
甲藻在不同水域的分布

Red tide causative species 紅潮品種	West 西	South 南	Southeast 東南	East 東	Northeast 東北	Tolo Harbour 吐露港
<i>Akashiwo sanguinea</i> 血紅赤潮藻	◆	◆	◆		◆	◆
<i>Alexandrium catenella</i> 鏈狀亞歷山大藻		◆			◆	
<i>Alexandrium tamarense</i> 塔馬亞歷山大藻			◆			
<i>Cochlodinium convolutum</i> 卷曲旋溝藻			◆			
<i>Gonyaulax polygramma</i> 多紋膝溝藻	◆	◆	◆	◆	◆	◆
<i>Gonyaulax verior</i> 春膝溝藻						◆
<i>Gymnodinium impudicum</i> 伊姆裸甲藻					◆	
<i>Gymnodinium simplex</i> 簡單裸甲藻						◆
<i>Gymnodinium sp.X</i> 裸甲藻X			◆			
<i>Gyrodinium spirale</i> 螺形環溝藻		◆				
<i>Heterocapsa circularisquama</i> 圓鱗異囊藻					◆	◆
<i>Heterocapsa pygmaea</i> 異囊藻						◆
<i>Heterocapsa rotundata</i> 異囊藻	◆					◆
<i>Karenia digitata</i> 指溝凱倫藻		◆	◆		◆	◆
<i>Karenia longicanalis</i> 長溝凱倫藻		◆				
<i>Karenia mikimotoi</i> 米氏凱倫藻		◆	◆		◆	◆
<i>Karenia papilionacea</i> 微疣凱倫藻			◆		◆	◆
<i>Karlodinium veneficum</i> 劇毒卡爾藻					◆	
<i>Levanderina fissa</i> 旋紋橫溝藻	◆	◆				
<i>Margalefidinium polykrikoides</i> (未有中文名稱)		◆	◆			◆
<i>Noctiluca scintillans</i> 夜光藻	◆	◆	◆	◆	◆	◆
<i>Peridinium quinquecorne</i> 五刺多甲藻						◆
<i>Polykrikos geminatum</i> 寶石多溝藻	◆	◆	◆			
<i>Prorocentrum balticum</i> 波羅的海原甲藻			◆		◆	◆
<i>Prorocentrum cordatum</i> 心形原甲藻	◆	◆	◆		◆	◆
<i>Prorocentrum dentatum</i> 細齒原甲藻		◆	◆		◆	◆
<i>Prorocentrum gracile</i> 細長原甲藻			◆		◆	◆
<i>Prorocentrum micans</i> 海洋原甲藻		◆	◆	◆	◆	◆
<i>Prorocentrum rathymum</i> 慢原甲藻		◆				
<i>Prorocentrum triestinum</i> 尖葉原甲藻						◆
<i>Protoperidinium depressum</i> 扁平原多甲藻						◆
<i>Scrippsiella trochoidea</i> 錐狀斯氏藻		◆	◆	◆	◆	◆
<i>Takayama pulchella</i> 美麗達卡藻						◆
<i>Tripos furca</i> 叉角藻			◆	◆	◆	◆
<i>Tripos muelleri</i> 三角角藻			◆			

APPENDIX III 附錄三

Distribution of Others in various water regions
其他組別在不同水域的分布

Red tide causative species 紅潮品種	West 西	South 南	Southeast 東南	East 東	Northeast 東北	Tolo Harbour 吐露港
<i>Chattonella marina</i> 海洋褐胞藻		◆	◆		◆	◆
<i>Chattonella marina</i> var. <i>ovata</i> 海洋褐胞藻卵形變種		◆	◆		◆	
<i>Chattonella</i> sp. 0310 褐胞藻 0310						◆
<i>Dictyocha octonaria</i> 硅鞭藻		◆	◆		◆	
<i>Dunaliella</i> sp. 杜氏藻屬						◆
<i>Eutreptiella</i> sp. 異雙鞭裸藻屬						◆
<i>Fibrocapsa japonica</i> 針胞藻		◆	◆			
<i>Haematococcus pluvialis</i> 雨生紅球藻						◆
<i>Hermesinium adriaticum</i> 亞得利亞海硅鞭藻					◆	
<i>Heterosigma akashiwo</i> 赤潮異彎藻	◆	◆	◆		◆	◆
<i>Mesodinium rubrum</i> 紅色中縊蟲	◆	◆	◆	◆	◆	◆
<i>Microglena uva-maris</i> (未有中文名稱)						◆
<i>Phaeocystis globosa</i> 球形棕囊藻	◆	◆	◆		◆	◆
<i>Plagioselmis prolunga</i> 伸長斜片藻						◆
<i>Teleaulax acuta</i> 尖尾全溝藻		◆				◆
<i>Trichodesmium erythraeum</i> 紅海束毛藻		◆	◆	◆		
<i>Trichodesmium thiebautii</i> 鐵氏束毛藻			◆			

APPENDIX IV 附錄四

Occurrence of *Skeletonema costatum* blooms in Hong Kong/
中肋骨條藻在香港引發紅潮次數：

Year/ 年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1985	1	-
1986	2	-
	1	<i>Pseudo-nitzschia pungens</i> 尖刺擬菱形藻
1987	8	-
1988	7	-
	1	<i>Gonyaulax polygramma</i> 多紋膝溝藻
	1	<i>Pseudo-nitzschia pseudodelicatissima</i> 假柔弱擬菱形藻
1989	6	-
	1	<i>Prorocentrum cordatum</i> 心形原甲藻、 <i>Prorocentrum triestinum</i> 尖葉原甲藻
1990	2	-
	1	<i>Noctiluca scintillans</i> 夜光藻
1991	1	-
	1	<i>Tripos furca</i> 叉角藻
1992	1	-
	1	<i>Leptocylindrus minimus</i> 微小細柱藻、 <i>Thalassiosira mala</i> 中肋海鏈藻
1995	2	-
1996	1	-
1998	1	-
	1	<i>Thalassiosira</i> sp. 海鏈藻
	1	<i>Leptocylindrus minimus</i> 微小細柱藻、 <i>Thalassiosira</i> sp. 海鏈藻
1999	1	-
2001	3	-
	1	<i>Scrippsiella trochoidea</i> 錐狀斯氏藻、 <i>Thalassiosira</i> sp. 海鏈藻
	1	<i>Chaetoceros salsugineum</i> 角毛藻
	3	<i>Thalassiosira</i> sp. 海鏈藻
	1	<i>Chaetoceros tenuissimus</i> 細柔角毛藻、 <i>Thalassiosira pseudonana</i> 假微型海鏈藻
2002	2	-
2003	1	<i>Chaetoceros curvisetus</i> 旋鏈角毛藻
2004	3	-
	1	<i>Thalassiosira</i> sp. 海鏈藻

APPENDIX IV (Continue) 附錄四 (續)

Occurrence of *Skeletonema costatum* blooms in Hong Kong/
中肋骨條藻在香港引發紅潮次數：

Year/ 年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2005	1	<i>Thalassiosira</i> sp. 海鏈藻
2006	2	-
2007	1	-
2008	2	-
2009	1	<i>Pseudo-nitzschia</i> spp. 擬菱形藻
2012	1	-
2014	1	<i>Prorocentrum cordatum</i> 心形原甲藻、 <i>Pseudo-nitzschia delicatissima</i> 柔弱擬菱形藻、 <i>Pseudo-nitzschia pungens</i> 尖刺擬菱形藻
Total/總數：		67

APPENDIX V 附錄五

Occurrence of *Akashiwo sanguinea* blooms in Hong Kong/
血紅赤潮藻在香港引發紅潮次數：

Year/ 年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1984	1	<i>Noctiluca scintillans</i> 夜光藻
1995	1	-
1998	1	-
2000	2	-
2001	1	-
2007	1	-
2010	1	-
2011	2	-
2012	1	-
2014	2	-
2016	1	-
	1	<i>Noctiluca scintillans</i> 夜光藻
	1	<i>Noctiluca scintillans</i> 夜光藻、 <i>Dictyocha octonaria</i> 硅鞭藻
2017	1	<i>Prorocentrum rathymum</i> 慢原甲藻
	1	<i>Tripos furca</i> 叉角藻
Total/總數：		18

APPENDIX VI 附錄六

Occurrence of *Gonyaulax polygramma* blooms in Hong Kong/
多紋膝溝藻在香港引發紅潮次數：

Year/ 年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1982	1	-
1986	1	-
1988	22	-
	1	<i>Tripos furca</i> 叉角藻
	1	<i>Prorocentrum cordatum</i> 心形原甲藻、 <i>Heterosigma akashiwo</i> 赤潮異彎藻
	1	<i>Prorocentrum cordatum</i> 心形原甲藻、 <i>Noctiluca scintillans</i> 夜光藻
	1	<i>Noctiluca scintillans</i> 夜光藻、 <i>Eutreptiella sp.</i> 異雙鞭裸藻
	1	<i>Prorocentrum cordatum</i> 心形原甲藻
	1	<i>Skeletonema costatum</i> 中肋骨條藻
	1	<i>Noctiluca scintillans</i> 夜光藻
1989	3	-
1990	1	-
1993	1	-
1994	2	-
1999	7	-
	1	<i>Prorocentrum balticum</i> 波羅的海原甲藻
2000	1	-
2001	1	-
2009	2	-
2011	1	-
2014	2	-
	1	<i>Prorocentrum cordatum</i> 心形原甲藻、 <i>Heterosigma akashiwo</i> 赤潮異彎藻
2015	1	-
2017	1	-
Total/總數：		56

APPENDIX VII 附錄七

Occurrence of *Karenia mikimotoi* blooms in Hong Kong/
米氏凱倫藻在香港引發紅潮次數：

Year/ 年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1980 ¹	1	-
1981 ²	1	-
1983 ³	1	-
1986	2	-
1988	1	<i>Scripsiella trochoidea</i> 錐狀斯氏藻
1997	1	<i>Prorocentrum cordatum</i> 心形原甲藻、 <i>Prorocentrum gracile</i> 細長原甲藻
2001	1	-
2003	1	-
2010	1	-
2015 ⁴	1	-
2016 ⁵	1	<i>Karenia papilionacea</i> 微疣凱倫藻
Total/ 總數：	12	

- 1 In 1980, culture fish loss was recorded in Tolo Harbour region of Hong Kong waters during the blooms.
1980年，於吐露港水域爆發的紅潮錄得有養殖魚類損失。
- 2 In 1981, culture fish loss was recorded in South region of Hong Kong waters during the blooms.
1981年，於南面水域爆發的紅潮錄得有養殖魚類損失。
- 3 In 1983, culture fish loss was recorded in Tolo Harbour region of Hong Kong waters during the blooms.
1983年，於吐露港水域爆發的紅潮錄得有養殖魚類損失。
- 4 In 2015, culture fish loss was recorded in Tolo Harbour region of Hong Kong waters during the blooms.
2015年，於吐露港水域爆發的紅潮錄得有養殖魚類損失。
- 5 In 2016, culture fish loss was recorded in Tolo Harbour and Northeast region of Hong Kong waters during the blooms.
2016年，於香港吐露港及東北水域爆發的紅潮錄得有養殖魚類損失。

APPENDIX VIII 附錄八

Occurrence of *Noctiluca scintillans* blooms in Hong Kong/
夜光藻在香港引發紅潮次數：

Year/ 年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1975	2	-
1976	1	-
1977	3	-
1980	1	<i>Trichodesmium erythraeum</i> 紅海束毛藻
	1	-
1982	1	<i>Prorocentrum micans</i> 海洋原甲藻
1983	6	-
1984	8	-
	1	<i>Guinardia delicatula</i> 柔弱幾內亞藻
	2	<i>Margalefidinium polykrikoides</i> (未有中文名稱)、 <i>Mesodinium rubrum</i> 紅色中縊蟲
	1	<i>Leptocylindrus minimus</i> 微小細柱藻
	1	<i>Gymnodinium simplex</i> 簡單裸甲藻
	1	<i>Akashiwo sanguinea</i> 血紅赤潮藻
1985	8	-
1986	7	-
1987	18	-
1988	18	-
	1	<i>Mesodinium rubrum</i> 紅色中縊蟲
	1	<i>Gonyaulax polygramma</i> 多紋膝溝藻、 <i>Prorocentrum cordatum</i> 心形原甲藻
	1	<i>Gonyaulax polygramma</i> 多紋膝溝藻、 <i>Eutreptiella</i> sp. 異雙鞭裸藻
	1	<i>Gonyaulax polygramma</i> 多紋膝溝藻
1989	8	-
1990	17	-
	1	<i>Skeletonema costatum</i> 中肋骨條藻
1991	9	-
	1	<i>Alexandrium tamarense</i> 塔馬亞歷山大藻
1992	5	-
	1	<i>Trieres sinensis</i> 中華盒形藻
1993	3	-
	1	<i>Alexandrium tamarense</i> 塔馬亞歷山大藻
	1	<i>Chaetoceros</i> sp. 角毛藻
1994	5	-
	1	<i>Eutreptiella</i> sp. 異雙鞭裸藻
	1	<i>Eutreptiella</i> sp. 異雙鞭裸藻、 <i>Prorocentrum triestinum</i> 尖葉原甲藻

APPENDIX VIII (Continue) 附錄八 (續)

Occurrence of *Noctiluca scintillans* blooms in Hong Kong/
夜光藻在香港引發紅潮次數：

Year/ 年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1995	12	-
1996	9	-
	1	<i>Trichodesmium</i> sp. 束毛藻
1997	9	-
1998	6	-
	1	<i>Prorocentrum dentatum</i> 細齒原甲藻
	1	<i>Chaetoceros</i> sp. 角毛藻、 <i>Prorocentrum cordatum</i> 心形原甲藻
	1	<i>Chaetoceros curvisetus</i> 旋鏈角毛藻
1999	5	-
2000	13	-
	1	<i>Trichodesmium</i> sp. 束毛藻
2001	10	-
2002	5	-
2003	3	-
2005	20	-
	1	<i>Prorocentrum balticum</i> 波羅的海原甲藻
2006	6	-
	1	<i>Dictyocha octonaria</i> 硅鞭藻
2007	3	-
2008	5	-
2009	4	-
2010	6	-
2011	5	-
2012	4	-
2013	3	-
2014	5	-
2015	2	-
2016	2	-
	1	<i>Akashiwo sanguinea</i> 血紅赤潮藻、 <i>Dictyocha octonaria</i> 硅鞭藻
	1	<i>Akashiwo sanguinea</i> 血紅赤潮藻
2017	2	-
	1	<i>Cochlodinium convolutum</i> 卷曲旋溝藻
Total/總數		287

APPENDIX IX 附錄九

Occurrence of *Prorocentrum cordatum* blooms in Hong Kong/
心形原甲藻在香港引發紅潮次數：

Year/ 年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1986	1	-
1988	2	-
	1	<i>Gonyaulax polygramma</i> 多紋膝溝藻、 <i>Heterosigma akashiwo</i> 赤潮異彎藻
	1	<i>Gonyaulax polygramma</i> 多紋膝溝藻、 <i>Noctiluca scintillans</i> 夜光藻
	1	<i>Gonyaulax polygramma</i> 多紋膝溝藻
	1	<i>Prorocentrum gracile</i> 細長原甲藻
	2	<i>Prorocentrum triestinum</i> 尖葉原甲藻
	1	<i>Tripes furca</i> 叉角藻
1989	2	-
	1	<i>Prorocentrum triestinum</i> 尖葉原甲藻、 <i>Skeletonema costatum</i> 中肋骨條藻
1990	2	-
	2	<i>Prorocentrum gracile</i> 細長原甲藻
1994	2	-
1995	2	-
1996	3	-
1997	1	-
	1	<i>Karenia mikimotoi</i> 米氏凱倫藻、 <i>Prorocentrum gracile</i> 細長原甲藻
1998	1	<i>Prorocentrum dentatum</i> 細齒原甲藻
	1	<i>Chaetoceros sp</i> 角毛藻、 <i>Noctiluca scintillans</i> 夜光藻
	1	<i>Karenia digitata</i> 指溝凱倫藻
1999	1	<i>Prorocentrum dentatum</i> 細齒原甲藻
2000	2	-
	1	<i>Prorocentrum triestinum</i> 尖葉原甲藻
2001	1	<i>Scrippsiella trochoidea</i> 錐狀斯氏藻
	1	<i>Scrippsiella trochoidea</i> 錐狀斯氏藻、 <i>Prorocentrum triestinum</i> 尖葉原甲藻
2002	3	-
2003	4	-
	1	<i>Prorocentrum balticum</i> 波羅的海原甲藻

APPENDIX IX (Continue) 附錄九 (續)

Occurrence of *Prorocentrum cordatum* blooms in Hong Kong/
心形原甲藻在香港引發紅潮次數：

Year/ 年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
2004	1	-
	1	<i>Ceratoneis closterium</i> 新月蛾眉藻
2014	1	<i>Heterosigma akashiwo</i> 赤潮異彎藻、 <i>Gonyaulax polygramma</i> 多紋膝溝藻
	1	<i>Pseudo-nitzschia delicatissima</i> 柔弱擬菱形藻、 <i>Pseudo-nitzschia pungens</i> 尖刺擬菱形藻、 <i>Skeletonema costatum</i> 中肋骨條藻
Total/總數：		47

APPENDIX X 附錄十

Occurrence of *Tripes furca* blooms in Hong Kong/
叉角藻在香港引發紅潮次數：

Year/ 年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1978	1	<i>Gymnodinium</i> sp. 裸甲藻
1983	3	-
1984	2	-
1985	1	-
1986	1	-
1987	2	-
1988	5	-
	1	<i>Gonyaulax polygramma</i> 多紋膝溝藻
	1	<i>Nitzschia incerta</i> 菱形藻
	1	<i>Prorocentrum gracile</i> 細長原甲藻
	1	<i>Prorocentrum cordatum</i> 心形原甲藻
	1	<i>Prorocentrum</i> sp. 原甲藻
1990	1	-
1991	1	<i>Skeletonema costatum</i> 中肋骨條藻
1994	2	-
1998	2	-
2000	1	-
2005	7	-
2006	2	-
2012	1	<i>Chattonella marina</i> 海洋褐胞藻、 <i>Tripes muelleri</i> 三角角藻
	1	-
2013	1	-
2016	1	-
2017	1	<i>Akashiwo sanguinea</i> 血紅赤潮藻
Total/總數：		41

APPENDIX XI 附錄十一

Occurrence of *Heterosigma akashiwo* blooms in Hong Kong/
赤潮異灣藻在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1987	2	-
1988	1	-
	1	<i>Gonyaulax polygramma</i> 多紋膝溝藻、 <i>Prorocentrum cordatum</i> 心形原甲藻
1989	2	-
1994	1	-
1995	1	-
1997	1	<i>Prorocentrum gracile</i> 細長原甲藻、 <i>Prorocentrum triestinum</i> 尖葉原甲藻
1999	3	-
2000	2	-
2001	1	-
2005	2	-
	2	<i>Heterocapsa rotundata</i> 異囊藻、 <i>Plagioselmis prolunga</i> 伸長斜片藻
2007	1	-
2009	1	-
2011	1	-
2012	1	-
2013	1	-
2014	2	-
	1	<i>Gonyaulax polygramma</i> 多紋膝溝藻、 <i>Prorocentrum cordatum</i> 心形原甲藻
	1	<i>Scripsiella trochoidea</i> 錐狀斯氏藻
Total/總數：		28

APPENDIX XII 附錄十二

Occurrence of *Mesodinium rubrum* blooms in Hong Kong/
紅色中縊蟲在香港引發紅潮次數：

Year/年份	No. of occurrence/引發次數	Species of codomination/共同引發品種
1983	5	-
1984	2	<i>Margalefidinium polykrikoides</i> (未有中文名稱)、 <i>Noctiluca scintillans</i> 夜光藻
	1	-
1985	1	-
1986	3	-
1987	3	-
1988	1	<i>Noctiluca scintillans</i> 夜光藻
1989	1	-
1991	2	-
1992	1	-
1997	2	-
1998	1	-
1999	9	-
2000	5	-
2001	2	-
2002	4	-
2003	2	-
2005	3	-
2007	2	-
2008	3	-
2009	1	-
2010	2	-
2011	1	-
2012	1	-
2014	1	-
2015	1	-
2016	1	-
2017	1	-
Total/總數：	62	

GLOSSARY 詞彙

Areolae: Perforation or pores on the valve of diatom.

孔: 矽藻細胞殼面的孔。

Amnesic Shellfish Poisoning (ASP): A potential life-threatening illness caused by consumption of contaminated shellfish that is fed on toxin (domoic acid) - producing diatoms (mainly pennates). It is characterised by gastrointestinal and neurological disorders, including loss of memory.

失憶性貝類中毒: 一種可能致命的疾病，源由是貝類攝食可產生軟骨藻酸毒素的矽藻(以羽紋矽藻為主)，人類進食這些受有毒藻類污染的貝類而導致中毒。典型病徵是腸胃不適及神經紊亂(包括失憶)。

Antapex: The posterior end of the cell.

末端: 細胞末端。

Antapical: The posterior part of the cell.

底端部: 細胞尾端部分。

Anterior attachment pore (a.a.p.): The pore located in the apical pore plate (Po). It can be a diagnostic character in *Alexandrium* spp.

前黏附孔 (a.a.p.): 位於頂孔甲，是亞歷山大藻其中一個分類特徵。

Apical: The anterior part of the cell.

頂部: 細胞頂端部分。

Apical axis: The long axis on the valve face of diatom.

縱軸殼長: 矽藻殼面的縱軸長度。

Apical pore plate (Po): The thecal plate located on the epitheca of many marine armoured dinoflagellates.

頂孔甲(Po): 在具殼片甲藻胞上殼的最頂端的殼片。

Basal part: The portion of the terminal seta closest to the valve face. Alternatively, it is the portion of an inner seta between its point of origin on valve face and its point of crossing with its sibling setae.

基部: 於端角毛與殼面最接近的部分。基部亦是內角毛與毗連細胞角毛的交叉點與殼面最接近的部分。

Cingulum: A horizontal or spiral groove on the cell surface of dinoflagellates which a flagellum lies on.

橫溝: 橫溝是在甲藻細胞表面一橫向或螺旋形的槽溝，鞭毛位於橫溝上。

Contractile vacuole: A rhythmically contracting vesicle, which fills in or expels fluid from the cell.

伸縮胞: 一個規律地收縮的泡囊，可注入或排出細胞液。

Cyanophyceae: A large and heterogeneous group of photosynthetic microorganisms formerly referred to as blue-green algae. Species may be unicellular or filamentous. Their photosynthetic mechanism is similar to that of algal and plant chloroplasts, but the cells are prokaryotic whereas the cells of algae and plants are eukaryotic.

藍藻綱: 大型多樣化光合微生物類群，前稱藍綠藻。藍藻綱品種可為單細胞或絲狀，其光合機制與藻類及植物葉綠體相似，但細胞為原核性，而藻類和植物的細胞均為真核性。

Diarrhetic Shellfish Poisoning (DSP): DSP is not life-threatening. It is an illness caused by eating shellfish that is fed on *Dinophysis* or *Prorocentrum* dinoflagellates which produce a suite of toxins, including okadaic acid, dinophysistoxins and pectenotoxins, resulting in gastrointestinal disorders.

下痢性貝類中毒：下痢性貝類中毒不會致命，這種中毒是由於食用曾攝食可產生多種毒素，包括大田軟海綿酸、鱈藻毒素及扇貝毒素的鱈藻或原甲藻等甲藻的貝類，導致腸胃不適。

Diatom: Diatom is a major group of eukaryotic algae with siliceous cell walls (called frustule) consisting two overlapping symmetrical parts. Most diatoms are unicellular, but some species can form colonies (e.g. chains of cells). There are two different groups of diatoms: the pennate which is pen-shaped and the centric which is cylindrical.

矽藻：矽藻是主要的真核藻類，有矽質細胞壁，由兩個對稱部分交疊而成。大部分矽藻均為單細胞，但有些品種會組成群落(例如串連成鏈狀)。矽藻分為兩類：筆狀的羽紋矽藻和圓筒形的橫紋矽藻。

Dinoflagellate: Dinoflagellate is unicellular protist with two flagella (transverse and longitudinal) of unequal lengths which allow it to swim in the water column. The transverse flagellum is located in a groove (cingulum) that divides the cell into two parts. The longitudinal flagellum is perpendicular to the transverse flagellum and extends towards the posterior. There are two types of dinoflagellates: armoured (with cellulose plates) and unarmoured (naked). Dinoflagellates can be heterotrophic, autotrophic, parasitic, or symbiotic.

甲藻：甲藻是單細胞原生物，有兩根長短不同的鞭毛，可在水體中游動。橫鞭毛位於細胞對分的槽溝中(橫溝)。縱鞭毛與橫鞭毛成直角，向後端伸展。甲藻分為兩類：具有殼片的甲藻(有細胞殼)和不具殼片的裸甲藻(無細胞殼)。甲藻可透過異養、自養、寄生或共生攝取營養。

Epicone: The portion of a dinoflagellate cell anterior to cingulum.

上殼：甲藻細胞橫溝以上的部分。

Epitheca: The portion of cell theca lying anterior to cingulum in dinoflagellates.

上殼片：甲藻細胞橫溝以上的殼片。

Eyespot: A pigmented, light-sensitive organelle.

眼點：一個含色素的感光細胞器。

Foramen: In a dinoflagellate, a relatively large comma-shaped cavity (or sometimes fishhook-shaped in some *Alexandrium* species) on the apical pore plate (Po). It is a diagnostic feature of the apical pore complex (APC). In diatoms, the passage through the constriction of the valve surface opposite the velum. Plural form is foramina.

孔：位於甲藻細胞殼面上的頂孔甲有一個比較大的逗號形空腔(在某些亞歷山大藻的品種或呈魚鈎狀)，這是頂孔甲的分辨特徵。如屬矽藻，孔是細胞殼面交接之間出現的空隙。名詞的複數是 Foramina。

Fultoportula (strutted process): A tubular process in the valve of some centric diatoms. The fultoportula consists of a tubular process surrounded by two or more satellite pores. The fultoportula appears either a tube or a pore in the valve wall externally.

支持突：一些圓心矽藻的殼面有管狀突起物。支持突有兩個或多個圍孔包圍着一個管狀突起物。在殼面外層，支持突呈管狀或小孔。

Furrow: A longitudinal depression, long trench or groove.
溝：一個縱向的凹陷處、長溝或槽。

Girdle band: The overlapping band that joins the two valves of a diatom frustule together.

殼環帶：矽藻上下兩個殼面相連接重疊的地方。

Girdle view: Looking at the valves of a diatom from the side.

殼環面觀：從矽藻兩個殼面的側面方向觀看矽藻細胞。

Haptonema: A flagellum-like structure in haptophytes which arises from the cell apex near the flagella and contains several microtubules. It facilitates cell attachment, feeding and avoidance responses.

定鞭毛：不等鞭毛類的鞭毛狀結構，由鞭毛附近的細胞頂端長出，內有數根微管。定鞭毛的作用是輔助細胞黏附、攝食或作出躲避反應。

Hypocone: The portion of a dinoflagellate cell posterior to cingulum.

下殼：甲藻細胞橫溝以下的部分。

Hypotheca: The portion of cell theca lying in the posterior part, below the cingulum.

下殼片：甲藻細胞橫溝以下的殼片。

Intercalary setae: Setae emerge from internal valves of cells that cross each other.

內角毛：由殼與殼之間的殼邊相互交叉伸出的角毛。

Interstriae: The non-perforate siliceous strip between two striae. Striae are single or multiple rows of areolates, pores or alveolus.

肋紋間：兩條肋紋之間的無孔矽質部分。肋紋由一排或多排網紋、小孔或窩泡組成。

Lanceolate: Leaf shaped or lance shaped and the broadest part is in the middle but it narrows with curved sides tapering to a pointed end.

披針狀：像柳葉狀或矛頭狀，中間最闊，兩邊彎曲向兩端漸漸收窄變幼成尖端。

Microalgae: Microscopic plant (single-celled or colonies of cells) comprises a diverse group of photosynthetic and heterotrophic protists which is commonly found in both freshwater and marine environments. There is a high diversity within the taxonomic classes, such as Bacillariophyceae, Ciliophora, Chlorophyceae, Cryptophyceae, Cyanophyceae, Dictyochophyceae, Dinophyceae, Raphidophyceae, Prymnesiophyceae, Euglenophyceae, Prasinophyceae, etc.

微藻：單細胞或群落的微生植物，包括多種的光合及異養原生物，常見於淡水及海洋環境。這分類群極多樣性，包括矽藻綱、纖毛蟲類、綠藻綱、隱藻綱、藍藻綱、矽鞭藻綱、甲藻綱、針胞藻綱、定鞭藻綱、裸藻綱及綠色鞭毛藻綱等。

Microcystin: A cyclic non-ribosomal peptide produced by cyanobacteria. It is a cyanotoxin and can be highly toxic to plants and animals, including humans. Their hepatotoxicity may cause serious damage to animal livers.

微囊藻毒素：由藍藻產生的非核糖體環肽，屬於藍藻毒素，可導致植物及動物包括人類劇烈中毒，尤其對動物肝臟造成極大危害。

Mucocyst: An ejectile organelle, a sac-like structure that releases mucous, or mucous threads through the cell pores.

黏液泡：囊狀結構的細胞器，透過細胞小孔釋出黏膜或黏液線體。

Neurotoxic Shellfish Poisoning (NSP): A non-fatal illness caused by consumption of shellfish that has accumulated brevetoxin and its derivatives. The major symptoms include tingling and/or numbness of lips, tongue, throat, hands and feet.

神經性貝類中毒：食用積聚了雙鞭甲藻毒素及衍生物的貝類而引起的非致命疾病，主要徵狀包括唇、舌、喉嚨及手腳刺痛及/或麻痺。

Paralytic Shellfish Poisoning (PSP): A life-threatening illness caused by consumption of shellfish which has been contaminated by saxitoxin and/or its derivatives. Neurological symptoms include tingling, numbness and burning sensation in lips and fingertips. In severe cases, respiratory paralysis may cause death within 24 hours.

麻痺性貝類中毒：足以致命的疾病，源自食用經蛤科毒素及/或其衍生物污染的貝類。神經系統病徵包括唇部及指頭刺痛、麻痺和熾熱感，如情況嚴重會出現呼吸停頓，可在24小時內致命。

Periflagellar area: Anterior end of the right valve with V-shaped or triangular depression in Procoenocentroids. It consists of plates or platelets around two pores (auxiliary pore and flagellar pore).

圍鞭毛區：原甲藻的右殼前端位置呈V形或三角形凹陷處，有兩個孔(輔助孔及鞭毛孔)的殼板或小板片。

Periplast: An outer layer surrounding the cell membrane.

薄膜：包圍着細胞膜的外層膜。

Poroid: Shallow surface depression of valve surface.

孔紋：殼面上較淺的凹陷處。

Posterior attachment pore (p.a.p.): The pore located in the posterior sulcal plate. It can be a diagnostic character in *Alexandrium* spp.

後黏附孔 (p.a.p.)：位於後縱溝甲，是亞歷山大藻其中一個分類特徵。

Precingular plate: In thecate species, the plate touching the cingulum in the epitheca.

前橫溝：在具殼片的藻類中，在上殼片接觸橫溝的殼片。

Pyrenoid: A protein organelle lying inside certain types of chloroplasts which is commonly associated with the formation of storage compounds.

澱粉核：位於葉綠體內的蛋白細胞器，一般與儲存化合物的形成有關連。

Prymnesiophyceae: A class of unicellular, flagellated algae with two smooth flagella and a haptonema. Haptonema is a filamentous appendage which may be short or long and whip-like. At least at some stages in their life cycle covered by calcareous plates (coccoliths) embedded in a gelatinous sheath.

定鞭藻綱：單細胞鞭毛藻其中一綱，長有兩根平滑的鞭毛和一「定鞭毛」。定鞭毛是絲狀附器，可長或短而呈鞭狀。定鞭藻在生命週期中某階段會藏於被膠質鞘包裹的鈣質甲片(鞭藻鱗片)內。

Raphidophyceae: A small group of eukaryotic algae that includes both marine and freshwater species. All raphidophytes are unicellular and possess a pair of flagella without the cell wall.

針胞藻綱：真核性藻內的一細小組別，有生長在海水和淡水的品種。所有針胞藻綱品種均為單細胞和有一對鞭毛，但無細胞壁。

Raphe: A slit crosses through the valve face of pennate diatom and usually positions along the apical axis of the cell. It enables the pennate diatom to move over substrates in aquatic environment.

殼縫：在羽紋矽藻殼面上的一個狹縫，通常位於縱軸上。殼縫使矽藻在水中固體表面滑行移動。

Reticulated: Surface ornamentation on thecal plates where raised straight lines or ridges cross one another creating a network pattern.

網狀紋：甲片表面上的花紋，由直線或縱向條紋縱橫交錯而成的網狀樣式。

Rimoportula (labiate process): A tubular process in the valve of some diatoms. It is characterised by a lip-shaped slit on the internal face of the valve. Rimoportula appears either a tube or a pore in the valve wall externally.

唇形突：一些矽藻殼面上的管狀突起物。主要特徵在於殼面內層有唇狀裂縫。在殼面外層，唇形突呈管狀或小孔。

Setae: Long and hollow extensions project outside from the valve margin of diatom. They can join frustules together to form chains and maintain buoyancy of diatoms in aquatic environment.

角毛：由矽藻殼邊向外伸出的長而中空的突出物，角毛會使矽藻殼相連成長鏈狀，可令矽藻在水中保持浮力。

Sigmoid: Curve and S-shaped.

S形：彎曲呈S字形。

Sulcus: A longitudinal furrow or depression on the ventral side of a dinoflagellate cell which lies on the longitudinal part of the flagellum. In the cated species, the sulcus is made up of sulcal platelets.

縱溝：甲藻細胞正面的一縱向坑紋或凹陷，位於鞭毛縱部。有甲殼品種的縱溝由縱溝小板組成。

Undulate: A wave-like surface margin.

波浪形：波浪形的表面邊。

Terminal setae: Setae emerge from the end valves of the chained cells.

端角毛：從串連成鏈狀的細胞末端殼邊伸出的角毛。

Transapical axis: The axis which is along the valve face and is perpendicular to the apical axis of diatom.

切頂軸：沿着殼面的軸，與殼面的縱軸成直角。

Trichocyst: A cytoplasmic ejectile organelle or channel on the surface of certain armoured dinoflagellate cells that releases filamentous or fibrillar threads.

棘絲胞：一些具殼片甲藻的殼面上的一個吐出器或排放管道，可釋放絲狀或纖維狀線體。

Trichome: A bundle of filament.

藻絲：一束絲狀群體。

Vacuole: A cytoplasmic membrane-bound cavity within a cell that functions in digestion, storage, secretion or excretion.

液胞：細胞內由細胞質膜包着的空腔，主要有消化、儲存、分泌或排泄的功能。

Valve mantle: The marginal part of a diatom valve that extends from the valve face and forms the edge of the valve.

殼套：硅藻殼面由殼邊延伸至轉彎的部分。

Valve view: Looking at a diatom frustule from the top or bottom of the cell.

殼面觀：從細胞的頂部或底部觀察硅藻的殼面。

Ventral pore (vp): It may be present at the juncture of the first apical plate (1') and an anterior intercalary or another apical plate on the epitheca. Sometimes the pore is in one of the apical plates or an intercalary. The presence of a ventral pore or its placement may be diagnostic character for certain species.

腹孔 (vp)：有些甲藻在第一頂板與其它頂板或前間插板之間有一腹孔，有些腹孔會位於第一頂板或前間插板內。它的出現及其位置是一些甲藻重要的分類特徵。

Venerupin (Hepatotoxin): A toxin that may impair liver functioning or cause gastrointestinal distress in humans through consumption of contaminated oysters or clams.

蛤仔毒素 (肝臟毒素)：這毒素可破壞肝臟功能或令腸胃不適，源自食用受蛤仔毒素污染的蠔或蜆。

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齊雨藻，1995，中國淡水藻志(四) 硅藻門中心綱。科學出版社，北京。

- 作者 : 羅秉全
Author Stanley P. C. LAW
- 編輯 : 朱振華、李安安、區智敏、楊健宇、李燕琮、陳嘉慧
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Author 作者	Stanley, P. C. LAW	羅秉全
Editors 編輯	Dr. Jim, C. W. CHU	朱振華
	Dr. Joanne, O. O. LEE	李安安
	Brian, K. Y. YANG	楊健宇
	Vivian, C. M. AU	區智敏
	Fion, Y. K. LEE	李燕琼
	Carrie, K. W. CHAN	陳嘉慧