

CHAPTER 6

Conclusion and Recommendations

Samples were collected from different water bodies located in northern Thailand in the month of March 2009. Samples were collected using a plankton-net (10 µm pore size) while collection was acquired from aquatic plants and sediments within the water. Then, 13 sampling sites, which presented a high range of diversity of euglenoids, were selected for the collection of samples while the physico-chemical parameters were analyzed every month over a single year from April 2009 to March 2010. The results presented the diversity of 402 taxa of euglenoids belonging to 272 species, 108 varieties, and 22 forms. *Trachelomonas* (136 taxa) was recorded as being the highest in diversity and were followed by *Phacus* (64 taxa). Additionally, *Strombomonas* (58 taxa), *Euglena* (46 taxa), *Lepocinclis* (35 taxa), *Petalomonas* (14 taxa), and *Peranema* (10 taxa) were also observed in significant volume. Few representatives of *Anisonema* (6 taxa), *Euglenaria* (5 taxa), *Menoidium* (5 taxa), *Entosiphon* (4 taxa), *Heteronema* (4 taxa), *Notosolenus* (4 taxa), *Cryptoglena* (3 taxa), *Discoplastis* (2 taxa), *Monomorphina* (2 taxa), *Urceolus* (2 taxa), *Astasia* (1 taxon), *Eutreptia* (1 taxon), and *Rhabdomonas* (1 taxon) were found. Among them, 238 taxa were recorded for the first time in Thailand.

Furthermore, in terms of scientific records, five new species and one new variety of loricate euglenoid taxa were discovered, including *Strombomonas starmachii* Duangjan & Wołowski, *S. Chiangmaiensis* Duangjan, *Trachelomonas paucispinosa* (Prowse) Duangjan & Wołowski, *T. peerapornpisalii* Duangjan & Wołowski, *T. reticulato-spinifera* Duangjan, and *T. thailandicus* Duangjan & Wołowski.

In a comparison of euglenoid communities occurring in 4 types of water bodies (garden ponds, field ponds, ditches, fish ponds), *Trachelomonas* was the taxa that was shown to display the highest range of diversity, while it was mostly observed in garden ponds and

field ponds, whereas *Phacus* was frequently observed in fish ponds. *Strombomonas* was frequently found in ditches, whereas *Euglena* was observed in abundance and usually bloomed in fish-ponds. *Euglenaria* was present in limited diversity and abundance. A small amount of *Cryptoglena*, *Monomorphina*, *Eutreptia*, and *Discoplastis* was observed. However, several taxa belonging to the colorless groups were also recorded. The results showed that several water bodies, in which *Lotus* plants grew, usually contained taxa of the genus *Trachelomonas*. Besides, one of the notable characteristics of the water bodies was that they were always brown in color.

Euglenoids were found in water bodies whose water quality was classified into 5 trophic statuses by AARL-PC score. They ranged from clean-moderate (oligo-mesotrophic status) to highly polluted (hypereutrophic status).

Moreover, 32 taxa of euglenoids that occurred as the dominant species were selected to establish water quality assessment, which has come to be known as the “euglenoid index”. According to the euglenoid index, *Euglena agilis*, *Euglena ehrenbergii*, *Strombomonas scabra*, and *Strombomonas urceolata* indicated highly polluted waters. *Euglena granulata*, *Euglena haematodes*, *Euglenaria anabaena*, *Euglenaria caudata*, *Euglenaria clavata*, and *Phacus longicauda* var. *tortus* indicated polluted water. *Euglena chlorophoenicea*, *Euglena geniculata*, *Euglena hemichromata*, *Euglena proxima*, *Euglena sanguinea*, *Euglena splendens*, *Lepocinclis acus*, *Lepocinclis fusiformis*, *Phacus horridus*, *Phacus orbicularis* fo. *communis*, *Phacus salina*, *Phacus acuminatus*, *Phacus longicauda*, *Phacus triqueter*, *Strombomonas borystheniensis*, *Strombomonas ensifera*, *Strombomonas acuminata*, *Trachelomonas playfairiana*, *Trachelomonas mirabilis*, *Trachelomonas oblonga*, and *Trachelomonas volvocinopsis* indicated moderately-polluted water. *Euglena navicula* indicated moderate water quality. The number of euglenoid cells developing in the investigated water bodies is a potential indicator of pollution and is representative of *Euglena*, *Euglenaria*, which are good indicators of organic water pollution. Abundant development of one or more species of *Euglena* suggests a strong contamination by organic substances, whereas multi-species communities of euglenoids usually indicate moderately polluted water.

The euglenoid index presented a similar trophic status to AARL-PC (41%) and AARL-PP score (45%). However, it had a slightly lower trophic status than the AARL-PP score and a slightly higher trophic status than the AARL-PC score.

6.1 Recommendations

6.1.1 In this study, samples were collected from various types of water bodies, but not all water resources were covered. There are several water bodies that are considered of interest for the study of euglenoids, including carnivorous plants (Płachno *et al.*, 2012).

6.1.2 The collection of samples was done by three methods, including taking samples from open water with a plankton-net (10 µm pore size), taking samples from the sediment with a slime aspirator, and scraping samples from aquatic plants. These were all considered reliable methods for the collection of samples because they revealed high diversity and complete groups of euglenoids.

6.1.3 For the identification of euglenoids, fresh materials should be used because they can present reliable details and movement. However, some loricated groups, such as *Trachelomonas* and *Strombomonas*, should also be studied under a scanning electron microscope for lorica ultrastructure details.

6.1.4 This study focused only on sampling sites in northern Thailand. For elaboration of a proper index used to assess the degree of water pollution, samples should be collected from most areas of Thailand and should cover all trophic (oligotrophic to hypereutrophic) water bodies.

6.1.5 The euglenoid index can be used for the assessment of freshwater pollution if euglenoids occur as the dominant species, while the index should be applied together with an analysis of other groups of algae.