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Diversity of green algae in Sri Nakhon Khuean Khan Park at Bang Kachao subdistrict, Phra Pradaeng district, Samut Prakan Province

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Abstract : Sri Nakhon Khuean Khan Park is a public space for recreation consists of small lake and old plantation but it is always threatened by wastewater from surrounding community and a salinity gradient in the dry season. This study aims to determine a diversity of green algae in Sri Nakhon Khuean Khan Park during November 2015 to March 2016. Five sampling stations were selected and data were collected monthly. The planktonic algae were collected from water surface for 10 liters by filtered through a plankton net (21 µm mesh size) into 1 liter. The precipitated pellets after centrifugation of water samples were used for algal identification. Twenty species, 11 genera and 6 families of green algae were recorded. Green algae in the genus *Scenedesmus*, *Tetradesmus*, *Desmodesmus* and *Tetraedron* were typically found in this study period. The water quality in Sri Nakhon Khuean Khan Park was classified to be in the meso-eutrophic status (moderately polluted) by using AARL-PP score.
Keywords : diversity, green algae, Sri Nakhon Khuean Khan Park

Introduction

Estuaries are a coastal ecosystem where there is a confluence of fresh and sea water, resulting in difference in salinity in this area. Estuaries are called “nurseries of the sea” because it has a lot of aquatic larvae, but it was constantly threatened by human activities such as ports, harbors, residential and other industrial developments. This leads to degraded area of estuarine and loss of ecosystem.

Algae are responsible for most of the primary production in estuarine ecosystem, because it uses light for photosynthesis and produce oxygen to the ecosystem (Wongrat, 2001). The algae and diatom can be used to indicate the water quality and trophic level (Dixit *et al.*, 1992; Kelly *et al.*, 1995; Palmer, 1969; Peerapornpisal *et al.*, 2007). Furthermore, algae benefit humans as food (*Caulerpa* sp., *Laminaria* sp., *Porphyra* sp.), industries (agar from *Gracilaria* sp. and *Gelidium* sp., carrageenan from *Chondrus* sp. and *Gigartina* sp., algin from *Macrocystis* sp.), agriculture (*Anabaena azollae* and *Nostoc* sp. nitrogen fixation species) and heavy metals adsorption (Peerapormpisal, 1999; Putijun, 2006).

Sri Nakhon Khuean Khan Park is a public area for community to relax, ride bicycle, or simply walk around but the main purpose is oxygen production for the nearby communities and neighborhoods. Park is about one-thousand and six hundred square meter, containing various aquatic plants, native plants and other plants that can grow in brackish water with several small lakes. However, a small canal connects the brackish water from outside park, so that aquatic organisms and algae in this area are affected by wastewater from community and salinity gradient (Tourism Authority of Thailand, 2016). This study aims to determine algae composition and water quality in Sri Nakhon Khuean Khan Park for five months.

Methodology

Sri Nakhon Khuean Khan Park located between 13° 39′– 13° 42′ N latitude and 100° 33′– 100° 34′ E longitude at Bang Kachao subdistrict, Phra Pradaeng district, Samut Prakan province. The park is an estuary ecosystem because it places near Chao Phraya River and gulf of Thailand so this area is affected by salinity gradient and wastewater from surrounding communities. In this study, five sampling sites were selected as the area of study that were covered both of the open and shaded area Sri Nakhon Khuean Khan Park.

Algae samples were collected from 5 sites in Sri Nakhon Khuean Khan Park using a plankton net. At each site, 10 L of water were collected and filtered through a plankton net (21 µm mesh size) into 1 liter per site Five milliliters of water samples were centrifuged at 3000 rpm for 5 min and extracted using dimethyl sulfoxide (DMSO) and kept in the dark for 12 hours. Then, chlorophyll a content in supernatant was measured using G10S UV-Vis spectrophotometer (Thermo Fisher Scientific, USA) with the absorbance at 664 and 648 nm, respectively follow by the equation of Chappelle and Kim (1992). All of water samples were examined with 3 replicates.

$$Chl_a \text{ (mg/ml)} = 12.25 \times A_{664} - 2.79 \times A_{648}$$

The remaining water samples after chlorophyll a content determination were added with 5-10 ml of 10 % of formalin solution for specimens preservation (Wongrat and Boonyapivat, 2003). The morphological characters of specimens were examined by light microscope (Olympus CH30, Japan) and microscope eyepiece camera (Dino-eye AM423X, Taiwan). Green algae were identified followed the keys and descriptions in a Thai phytoplankton book (Wongrat, 2001).

The water trophic level of Sri Nakhon Khuean Khan Park was studied using the dominant genera of microalgae or AARL-PP score method (Peerapornpisal *et al.*, 2007). The score of 3 dominant genera were averaged and compared with the standard score (1-10 score). The lower score indicated clean water and oligotrophic status. On the other hand, the higher score indicated polluted water and eutrophic status.

Results and discussion

Diversity of green algae at 5 sampling sites in Sri Nakhon Khuean Khan Park were observed from November 2015 to March 2016. Twenty species, 11 genera and 6 families of green algae were recorded (Table 1, Figure 1). Green algae in the genus *Scenedesmus*, *Tetradesmus*, *Desmodesmus* and *Tetraedron* were typically found in this study period. The water trophic level of Sri Nakhon Khuean Khan Park was classified to be in the meso-eutrophic status (moderately polluted) by using AARL-PP score. The average of chlorophyll-a content in November was 0.1040 mg/ml, December was 0.1673 mg/ml, January was 0.2473 mg/ml, February was 0.1953 mg/ml and March was 0.0947 mg/ml (Figure 2.).

Scenedesmus and *Tetraedron* were usually found in Sri Nakhon Khuean Khan Park during the period of study because they are normally found in brackish water. It was in accordance with the report of Khwaiphan (2005) in the study on diversity and abundance of microphytoplankton that found *Scenedesmus arcuatus*, *S. Quadricauda*, *Pediastrum duplex*, *P. obtusum* and *Tetraedron trigonum* in Bangpakong river mouth, Chachoengsao Province. Similarly, Boondao (2006) studied relationships between species composition and abundance of phytoplankton with those of zooplankton. *Coelastrum* sp., *P. duplex*, *Chodatella* sp., *S. arcuatus*, *S. quadricauda*, *Tetradesmus bernardii*, *Acutodesmus acuminatus*, *T. trigonum*, *T. gracile* and *Crucigenia quadrata* were reported. With genera *Scenedesmus* and *Tetraedron* were normally found in Maeklong estuary, Samut Songkhram Province.

The high chlorophyll a concentration was reported during the post-monsoon period in December and the low concentration was observed during the pre–monsoon season in February. It was in accordance with the reports of Thientaworn (1997), Horabun (1997) and George *et al*. (2012) which studied the phytoplankton productivity in river and estuary area. The productivity of water resources is increased during post-monsoon due to the running off may decrease a salinity gradient and increase the vertical area in water body. That will cause the improving of nutrient cycling in the aquatic ecosystems which it is suitable habitat for the growth of microalgae.

Conclusion

The water trophic level in Sri Nakhon Khuean Khan Park was classified to be in the meso-eutrophic status (moderate-polluted). Due to, the *Scenedesmus* are normally found in wastewater and can be used to indicate the water quality (Palmer and PA, 1997; Bruun, 2012). Moreover, *Tetraedron*, *Pediastrum*, *Chodatella*, *Coelastrum*, *Scenedesmus* and *Ankistrodesmus* are indicator of wastewater ponds (Landcare research, 2016).

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Table 1. List of green algae found in Sri Nakhon Khuean Khan Park

Division	Family	Genus	Species
Chlorophyta	Scenedesmaceae	*Coelastrum*	*Coelastrum* sp.
		Scenedesmus	*S. arcuatus* *S. quadricauda* *S. mangus*
		Tetradesmus	*T. incrassatulus* *T. bernardii* *T. dimorphus*
		Desmodesmus	*D. opoliensis* *D. bicaudatus* *D. denticulatus*
		Acutodesmus	*A. acuminatus*
	Hydrodictyaceae	*Pediastrum*	*P. obtusum* *P. duplex*
		Tetraedron	*T. constrictum* *T. gracile* *T. trigonum*
	Oocystaceae	*Chodatella*	*Chodatella* sp.
	Selenastraceae	*Ankistrodesmus*	*A. gracilis*
	Trebouxiophyceae	*Crucigenia*	*C. quadrata*
	Schroederiaceae	*Schroederia*	*S. setigera*

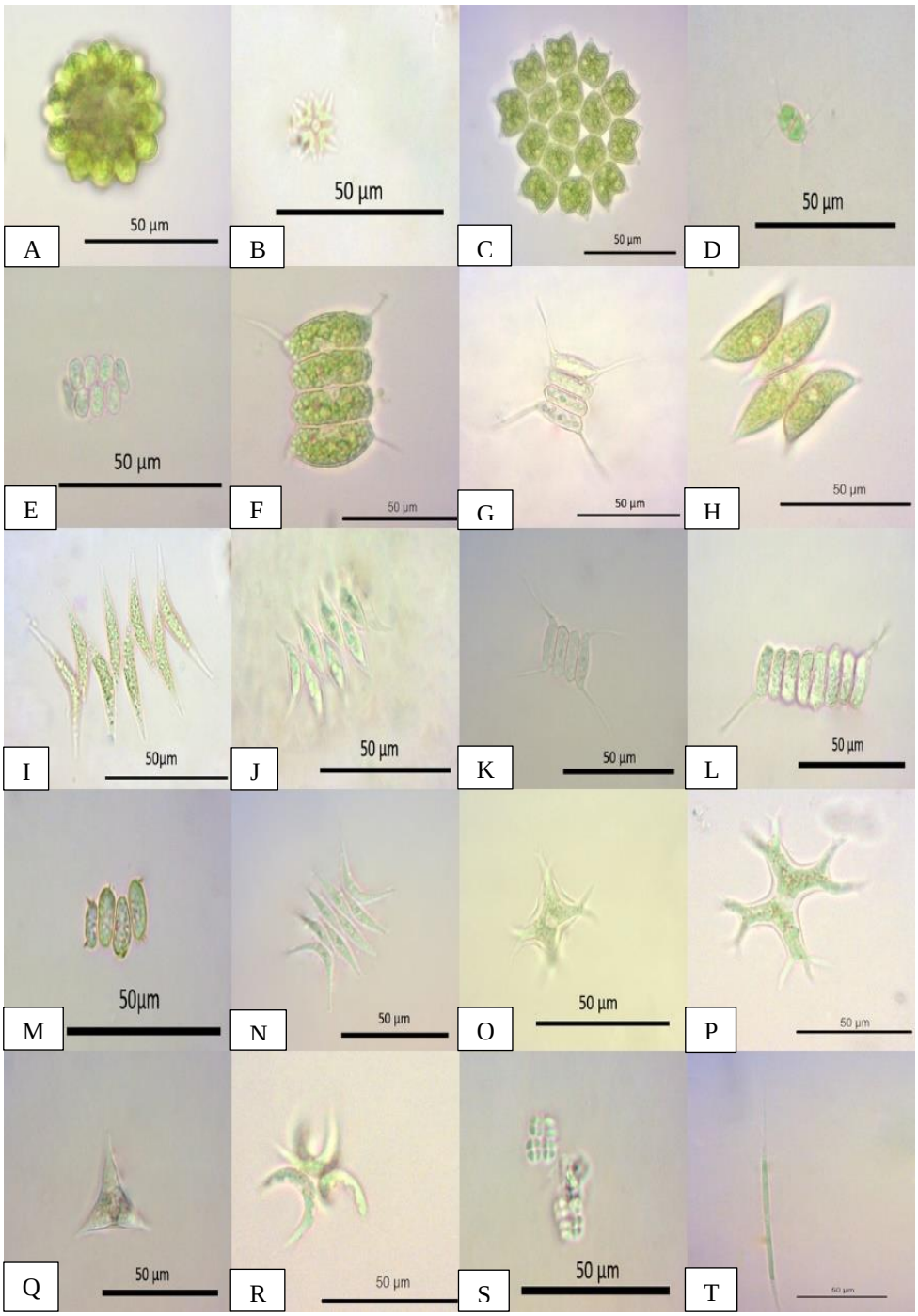

Figure 1. Green algae in Sri Nakhon Khuean Khan Park; (A) *Coelastrum* sp., (B) *P. obtusum*, (C) *P. duplex*, (D) *Chodatella* sp., (E) *S. arcuatus*, (F) *S. quadricauda*, (G) *S. mangus*, (H) *T. incrassatulus*, (I) *T. bernardii*, (J) *T. dimorphus*, (K) *D. opoliensis*, (L) *D. bicaudatus*, (M) *D. denticulatus*, (N) *A. acuminatus*, (O) *T. constrictum*, (P) *T. gracile*, (Q) *T. trigonum*, (R) *A. gracilis*, (S) *C. quadrata*, (T) *S. setigera*.

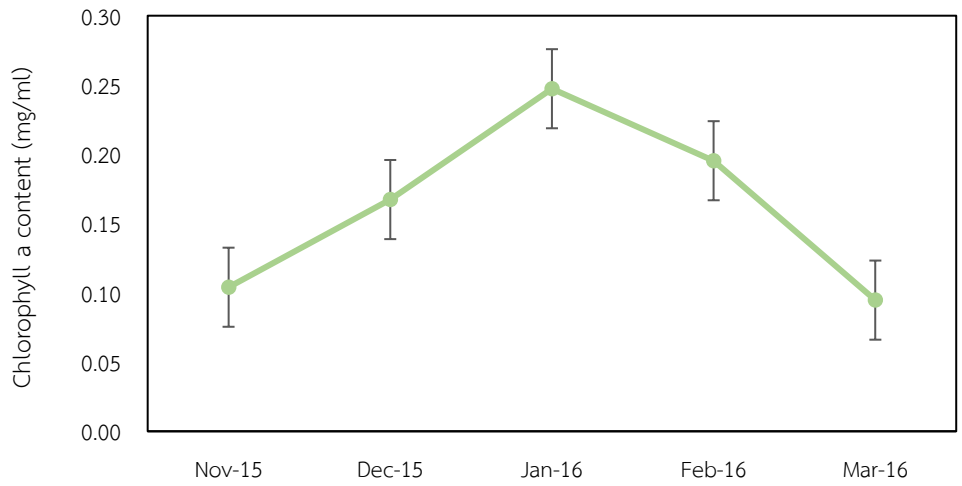

Figure 2. Chlorophyll a content (mg/ml) in Sri Nakhon Khuean Khan Park during November 2015 to March 2016 (0.16±0.06) (n=5)