

CHAPTER 5

DISCUSSION

5.1 Thai Trichoptera Database

The benefit of data compilation as Thai Trichoptera database is reveal whole picture of Trichoptera knowledge presently. Species occurrence, abundance and distribution range are able to apply for biodiversity, biomonitoring and conservation perspectives.

To date, only adult male Trichoptera specimens are able to be identified to species level using genitalia as primary key character. There are few species which have a species diagnostic character in both male and female such as *Macrostemum* spp. (wing color pattern) and *Oecetis* spp. (wing venation pattern) (Malicky, 2010b). Further study should focus on morphological characteristic of female which will be useful for population dynamic of each species, rare species in particular.

According to Trichoptera World Checklist in 2009, there have been recorded 13,573 species represent 47 families (Morse, 2011), the highest species richness biogeographical region were reported from Oriental region (4,865 species). In Indochina region, Thailand represented the highest species richness (1,004 species) may be because of Thailand is situated as a boundary of other subregions (Thapunya, 2004; Nuntakwang, 2005; Prommi, 2006) and also intensive and long period of time studies have been done in country. Since 1987, with continuously effort for and long periods of time study on Trichoptera of Assoc. Prof. Dr. Porntip Chantaramongkol and her graduate students and kindly support by Prof. Hans Malicky, it had been

invented 1,004 species with illustrate key available (Malicky, 2010b). As a result of illustrate key and species inventory, Trichoptera is one of well-known aquatic insect order in Thailand. Nevertheless knowledge on larval stage is still lacking, only 14 species had larval description. Regarding to using Trichoptera larva to assess lotic ecosystem health, species-specific responses may require for precise interpretation.

Among 28 families of Trichoptera in Thailand, family which have the highest number of species is Leptoceridae (216 species), followed by Hydroptilidae (126 species), Hydropsychidae (119 species) and Philopotamidae (100 species). Regarding to biotope type distribution, Philopotamidae, Hydropsychidae and Leptoceridae existed in all types. As a result from adult stage observation based on the idea of adult Trichoptera mostly came from nearby aquatic habitats (Chantaramongkol, 1983; Schmera, 2002 and Schmera and Kiss, 2004). However some studies gave the evidence on flight distance of Trichoptera far from the water sources (Malicky in Chantaramongkol, 1983; Urbanic, 2002).

A total of 12,633 recorded in Thai Trichoptera Database widely covered all part of country. In northern Thailand, found the most number of biodiversity studies, as a result of mountainous water body is ideal and suitable habitat for Trichoptera. In Doi Suthep-Pui and Doi Inthanon NPs recorded one third of whole country species inventory. However, in southern Thailand reported 215 species which 21 species were new to science (Prommi, 2006). This showed that observation in new area may possibly find more new species. In northeastern, western and eastern part still have few Trichoptera data existed.

Table 5.1 Summary of biotope type distribution in each families.

Family	Biotope types						
	I	II	III	IV	V	VI	VII
Rhyacophilidae	12	26	22	14			
Hydrobiosidae		2					
Ptilocolepidae			1				
Glossosomatidae	2	9	17	10			
Hydroptilidae		17	39	51	3		
Philopotamidae	11	53	67	47	1	2	20
Stenopsychidae			2	1			
Polycentropodidae	3	22	37	44	1	2	
Dipseudopsidae		2	4	5	2	1	
Psychomyiidae	1	20	38	35		7	
Xiphocentronidae		4	9	12		1	
Ecnomidae		4	21	39	13	8	
Arctopsychidae	3	1	2	2			
Hydropsychidae	8	59	105	85	2	14	5
Phryganeidae	1	1					
Phryganopsychidae		1					
Brachycentridae		3	6				
Limnacentropodidae	2	5	3	1			
Limnephilidae	4	5	2				
Goeridae	1	9	14	13		1	
Uenoidae	1		1				
Lepidostomatidae	9	19	23	10			
Leptoceridae	6	27	106	113	15	19	1
Sericostomatidae		1					
Helicopsychidae		1	4	6			
Odontoceridae	2	9	9	7		1	
Calamoceratidae	1	8	12	8			
Molannidae	2	1	3	1			
Total family	17	25	24	20	7	10	3

At stream reach section scale, species diversity more likely depend on the diverse of instream habitats and food sources. Mountainous stream showed higher species richness than head water and river. And stream that contain more diverse habitat patches (e.g. stream with waterfall) tend to hold higher species richness. Species inhabited in headwater streams in high altitude (e.g. Keaw Mae Pan) relatively differed from other may be as a result high degree of instream conditions stability (e.g. narrow temperature fluctuation annually and more habitat stability). In mid stream reach (more stream surface exposure, wider stream width and higher discharge) i.e. Wachiratarn and Mae Klang Sob Ab, number of species and individuals obvious peaked in June (generally before peaked discharge). In river (deep water, wide channel and large amount of discharge) an evident of swarming in dominant species was occurred. For example *Oestropsyche* sp. (Hydropsychidae) had numerous of biomass in Mae Kong river at Nakorn Phanom province (unpublished data) and were use for aqua-culture supplementary food.

Biotope type were defined to 7 types depend upon habitats types (stream, river, permanent and temporary standing water) and altitude (<500, 500-1,200, 1,200-1,700, >1,700 m asl) (table 5.1). The most species have been found in stream habitat, in particular at 1,700 - 500 m asl (represented 20 - 25 families) where stream have various types of habitats and food sources, high substrate stability, mildly disturbance and relative seasonal variability. Theoretically, this promote living organism adaptation and evolutionary successes to occupy the resources (particularly extreme conditions) in lotic ecosystem (Mackay and Wiggins, 1979; Vinson and Hawkins, 1998). While headstream in higher altitude have small variation in water temperature

whole year round, limitation of food sources and habitats, high stable physical conditions. This conditions promote endemism processes theoretically.

Using Trichoptera to monitor ecosystem alteration may have to concern biotope types and also seasonal variation. Thai Trichoptera Database provides the species-specific information which will support further research reliability.

For conservation perspective using case building behavior and adaptation to live in turbulent environments of Trichoptera may be interesting to gain public understanding and awareness of threatened in lotic ecosystem. Unfortunately, knowledge exist in Thailand may not enough to defined threatened species yet. The procedure to define the conservation status of Trichoptera have already been purposed and used in Europe (Nogradi and Uherkovich, 1999; Schmera, 2001; Schmera, 2004; Schmera and Kiss, 2004) and Australia (Threatened Species Unit, 2005). According to their historical population sizes, occurrence, and habitat specificity along with the experts' comments has allowed for comparison of species composition both geographically and temporally. It also has demonstrated the need for additional and continuous updating of information so as to ensure adequate evaluation of Trichoptera and associated habitats. Establishment of this initial Trichoptera database will serve as a data repository for future expansion to other locations throughout Thailand, and will allow for the evaluation of best research practices, the application of Trichoptera as bioindicator for water and habitat quality, and the long-term assessment of the conservation status of the species and their habitats.

5.2 Trichoptera in Doi Suthep-Pui and Doi Inthanon NPs

5.2.1 Physico-chemical parameters

Among all sampling site discharge, water and air temperature, pH, total dissolved solid, conductivity, nitrate nitrogen, ortho-phosphate and turbidity showed different significantly. This revealed the heterogeneity of lotic ecosystem base on physico-chemical aspect which depend on geomorphologic characters, watershed land use and human activities on stream reach.

In Doi Suthep-Pui, sampling sites represented good - excellence of habitat quality. Even though, sampling sites were located in national park, tourist activities and perturbation of stream structure were existed for example mildly channel modification such as moving streambed substrate and building small check dam. At Pa Lad stream reach showed dried out in April (during sampling period), in addition high value of TDS, conductivity, pH and nitrate nitrogen caused Pa Lad differed from others sampling sites. Moreover, there were the evidence of high degree of human activity to the stream for example number of trashes found instream and along banks. However, instream habitats and riparian forest condition still had good shaped (good habitat quality). For biodiversity conservation in lotic ecosystem not only physicochemical parameter but also habitat quality assessment may have to be more concerned. In all sampling sites are mountainous streams. The majority of threatened was channel and instream alteration which came from tourism purposes particular in Doi Suthep-Pui NP. Hence, education on nature of lives in stream ecosystem may need more effort for maintenance the functional ecosystem.

5.2.2 Trichoptera assemblages

At local scale biodiversity of Trichoptera in Doi Suthep-Pui and Doi Inthanon NPs were sampled and compared to former studies to reveal temporal changes. There were 256 species which identified to 137 species from five sampling sites in Doi Suthep-Pui NP and 187 species from six sampling sites in Doi Inthanon NP.

Combined data with former studies showed 328 species from both NPs comprised of 75 species represented only in Doi Suthep-Pui, 134 species represented only in Doi Inthanon and 119 species represent in both NPs (see table 4.2). Moreover there were 73 species which reported in former studies but not represented in present study. This may assume that they have long life cycle.

The grouped similarity of sampling sites based on species composition, the data showed likely relate to habitat features (stream and water+ steam) and distinctive elevation differences. According to the accretion species curve for Doi Suthep-Pui, the curve had reached asymptote, although most of sites were located only one side of the mountain. Meanwhile, the accretion species curve for Doi Inthanon showed that more collection should be conducted to reveal the complete biodiversity of the area. Given the high diversity of Trichoptera in these two NPs, there is considerable likelihood for the discovery of more new species in other areas of Thailand.

Doi Inthanon NP is a biodiversity hotspot and a well-known tourist attraction due to the impressive and unique forest. In particular, the high elevation streams support a unique habitat with cold year round water temperatures and dense, moisture riparian forests. This ecosystem is also home to potentially rare species such as *Nothopsyche muqua* MALICKY and CHANTARAMONGKOL 1989. This Trichoptera species has only been found in Doi Inthanon, at 1,200-1,300 m asl (Malicky and

Chantaronmongkol, 1993) and during the present study in Keaw Mae Pan upper (one specimen was identified at 2,071 m asl). These are the only reports of this species in Thailand. Similarly, during the present study, *Eubasilissa maclachlani* WHITE 1862, the largest Trichoptera in Thailand, was found in Siribhum (1,380 m asl) and in Keaw Mae Pan lower (2,050 m asl). Fourteen species only found in the highest elevation sampling site which will be considered for using as biomonitor for habitat quality changes in term of rising water temperature. From a conservation standpoint, rare species may serve a useful role as candidate flagship species (see Guiney & Oberhauser, 2008) helping to generate public awareness and appreciation of the need for habitat conservation of critical lotic ecosystems.