



Biodiversity and distribution of Trichoptera species along the Tapee River, Surat Thani Province, southern Thailand

PONGSAK LAUDEE^{1*} & TAENG ON PROMMI²

¹Faculty of Science and Industrial Technology, Prince of Songkla University, Surat Thani Campus, Surat Thani Province, 84100, Thailand

E-mail: p_laudee@yahoo.com

²Faculty of Liberal Arts and Science, Kasetsart University, Kamphaengsean Campus, Nakhon Pathom Province, 73140, Thailand

(*) corresponding author

Abstract

The Tapee River is one of the most important rivers in southern Thailand. The river crisscrosses from Khao Luang National Park, Nakhon Si Thammarat province to Surat Thani province and flows to the Thai Gulf. To study the biodiversity and distribution of Trichoptera species along the Tapee River, insects were collected by light trapping every 3 months from April 2004–February 2005. The results show that 105 species were found in 35 genera of 15 families. The most abundant families of Trichoptera in the Tapee River were Hydropsychidae, Leptoceridae, and Ecnomidae. The more widespread Trichoptera species included *Ecnomus atevalus* Malicky & Chantaramongkol, *Dipseudopsis knappi* Schmid & Denning, *D. robustior* Ulmer, *Aethaloptera sexpunctata* (Kolenati), *Amphipsyche meridiana* Ulmer, *Cheumatopsyche cognita* (Ulmer), *Macrostemum fenestratum* (Albarda), *Ceraclea idaia* Malicky & Chaibu, *Oecetis tripunctata* (Fabricius), and *Parasetodes respersellus* (Rambur). The upper Tapee River Trichoptera species included *Rhyacophila petersorum* Schmid & Denning, *R. tantichodoki* Malicky & Chantaramongkol, *Ugandatrichia kerdmuang* Malicky & Chantaramongkol, *Chimarra* spp., *Pseudoneureclipsis* spp., *Psychomyia* spp., *Cheumatopsyche charites* Malicky & Chantaramongkol, *Diplectrona* spp., *Hydropsyche* spp., *Hydromanicus inferior* Chantaramongkol & Malicky, *Goera* spp., *Ganonema fuscipenne* (Albarda), *Goerodes abruptum* Banks, and *Marilia* spp. The lower Tapee River Trichoptera species included *Ecnomus talenoi*, *E. paget*, *Polymorphanisus* spp., and *Oecetis bengalica*. The number of Trichoptera species was higher upstream and lower downstream.

Key words: Caddisflies, Tropical stream

Introduction

Thailand is one of the countries in the oriental region where the biodiversity is high. The biodiversity of aquatic insects in Thailand, especially caddisflies, has been intensively studied in last 2 decades. More than 900 species had been reported. The studies of Thai Trichoptera had been conducted mainly in northern Thailand. Most publications concerning the caddisflies in Thailand have been taxonomic (e.g., Malicky & Chantaramongkol 1999, Thapanya *et al.* 2004, Malicky & Prommi 2006). However, there have been some publications using caddisflies as bioindicators for environmental assessment and studies of caddisflies species along the Ping tributary, northern Thailand (Luadee *et al.* 2002, Luadee & Chantaramongkol 2002, Chaibu *et al.* 2002). Malicky & Chantaramongkol (1993) studied the altitudinal distribution of Trichoptera species in Doi Inthanon National Park, northern Thailand between 400–2300 m a.s.l.. The Trichoptera species were

correlated with altitudinal. The study of caddisflies in southern Thailand has been poor. Previous research emphasized discovery of new species and characterization of caddisfly larva (Prommi *et al.* 2006, Laudee 2008). There has been no research concerning biodiversity of caddisflies in the Tapee river ecosystem, which determined the subject of our investigation.

The Tapee River is the longest river in the southern part of Thailand. The river originates at Khao Luang National Park. The length is 230 km. The Tapee River drains 13 454 km² that includes a forested area of 4 072 km² and an agricultural area of 7 086 km² covering parts of Surat Thani, Nakhon Si Thammarat, and Krabi provinces. The floodplain of the Tapee River is divided into 3 main areas: floodplains of the upper Tapee River, the lower Tapee River and the Pumduang River.

Materials and methods

Samples of Trichoptera adults were collected overnight using a light trap apparatus consisting of a black ultraviolet light (15 W fluorescent, 12 v DC battery) suspended over a basin of weak detergent solution. A sample was taken at each location on 1 night every 3 months over 15 sites in Surat Thani Province from April 2004 - February 2005 (Fig. 1, Table 1). Specimens from the light traps were preserved in 70% ethanol for sorting and identification in the laboratory. The terminal part of the abdomens of male caddisfly specimens were cut and macerated in hot 10% KOH (60°C for 0.5–2 hrs) and rinsed in detergent solution for keying to species level under stereomicroscopy. The guide used for identifying specimens was the atlas by Malicky (2010). Trichoptera species were analyzed to understand their distribution along the Tapee River in Surat Thani Province.

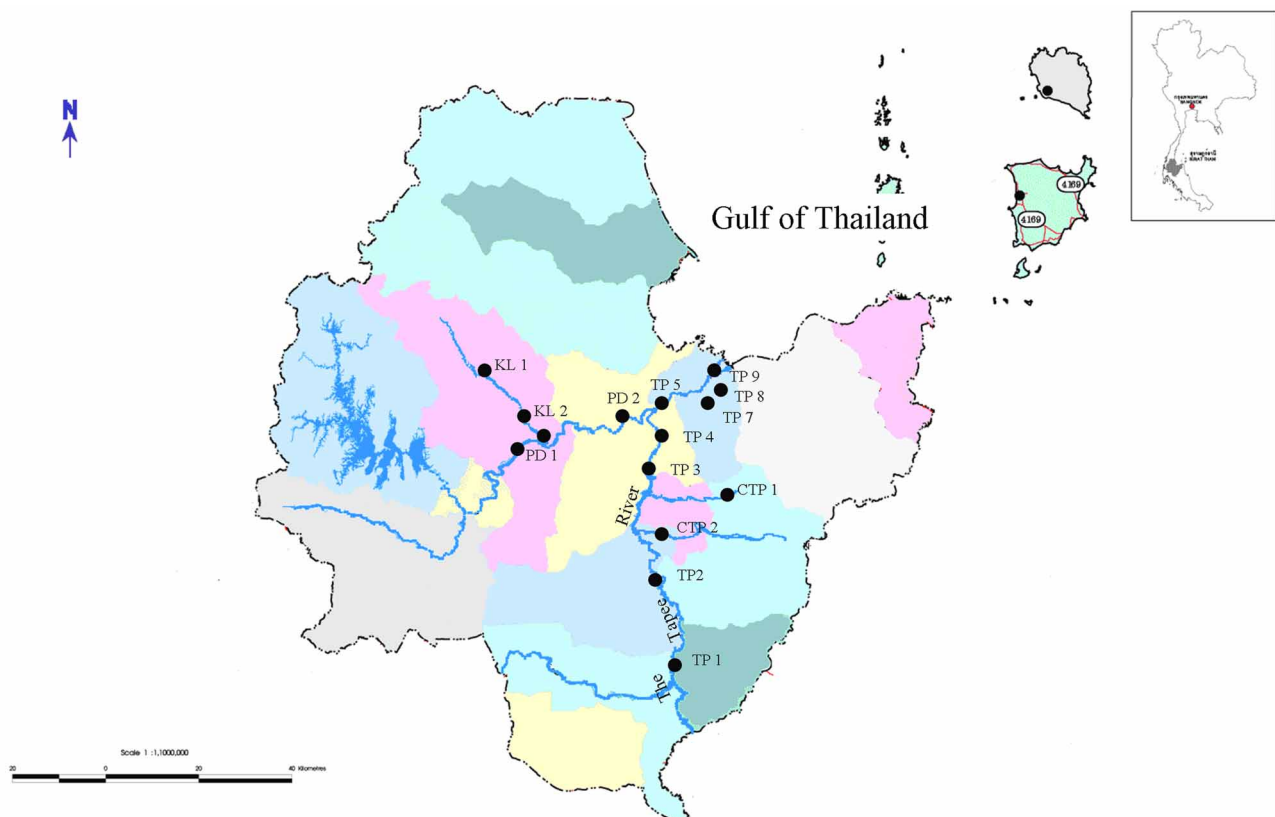


FIGURE 1. Map of the study sites in the lower Tapee River and Pumduang River, Surat Thani Province.

TABLE 1. Study sites of the Tapee River, Suart Thani Province

Site Code	Study Site Names	Altitude (m)	Coordinates	Description of Substrates
TP1	Phrasaeng Surat Thani province	12	08°33.644'N 99°15.639'E	Gravel and sand
TP2	Khian Sa Surat Thani province	10	08°50.693'N 99°13.053'E	Gravel and sand
TP3	Ban Tha Saton Surat Thani province	7	08°59.132'N 99°12.722'E	Gravel and sand
TP4	Ban Khao Hua Khwai Surat Thani province	7	09°04.346'N 99°13.279'E	Gravel and sand
TP5	Ban Tha Kham Surat Thani province	5	09°06.883'N 99°13.692'E	Gravel and sand
TP6	Ban Klong Noi Surat Thani province	5	09°07.729'N 99°15.760 'E	Gravel and sand
TP7	Ban Tagupe Surat Thani province	5	09°06.280'N 99°18.423'E	Sand and Clay
TP8	Ban Bang Yai Surat Thani province	5	09°07.128'N 99°19.839'E	Sand and Clay
TP9	Koh Lum Phu Surat Thani province	4	09°08.152'N 99°18.864'E	Sand and Clay
CTP1	Ban Lam Phun Surat Thani province	220	08°53.283'N 99°23.220'E	Bedrock, boulder, cobble, gravel and sand
CTP2	Ban Na San Surat Thani province	36	08°48.293'N 99°23.427'E	Gravel and sand
PD2	Ban Nam Rob Surat Thani province	13	09°05.008'N 99°10.239'E	Gravel and sand
PD1	Khiri Ratthanikhom Surat Thani province	12	09°01.681'N 99°58.363'E	Gravel and sand
KL1	Ban Yang Surat Thani province	23	09°12.254'N 99°57.285'E	Boulder, cobble and sand
KL2	Ban Yan Yao Surat Thani province	19	09°03.110'N 99°01.249'E	Gravel and sand

Results and discussions

The biodiversity of Trichoptera species along the lower Tapee River and Pumduang River, Surat Thani Province included 105 species in 35 genera of 15 families. The most abundant families of Trichoptera were Hydropsychidae, Leptoceridae, and Ecnomidae, respectively (Figure 2). Chaibu *et al.* (2002) found that the most abundant caddisfly families of the lower Ping River, northern Thailand, were Hydropsychidae, Leptoceridae and Philopotamidae. In the upper Ping River, Doi Chiang Dao watershed, the most abundant caddisfly families were Hydropsychidae, Philopotamidae, and Psychomyiidae (Luadee *et al.* 2002). The more widespread Trichoptera species along the study sites were *Ecnomus aktaion* Malicky & Chantaramongkol, *E. atevalus* Malicky & Chantaramongkol, *E. paget* Malicky & Chantaramongkol, *Dipseudopsis knappi* Schmid & Denning, *D. robustior* Ulmer, *Aethaloptera sexpunctata* (Kolenati), *Amphipsyche meridiana* Ulmer, *Cheumatopsyche*

cognita (Ulmer), *Macrostemum fenestratum* (Albarda), *Ceraclea idaia* Malicky & Chaibu, *Oecetis tripunctata* (Fabricius), *O. biramosa* Martynov, and *Parasetodes respersellus* (Rambur). The Trichoptera species found in the small streams of the lower Tapee River and Pumduang River (CTP1, CTP2, KL1, KL2) were *Rhyacophila petersorum* Schmid & Denning, *R. tantichodoki* Malicky & Chantaramongkol, *R. scissoides* Kimmins, *Ugandatrichia kerdmuang* Malicky & Chantaramongkol, *U. hongia* Oláh, *Chimarra argax* Malicky, *C. bimbltona* Malicky, *C. Chiangmaiensis* Chantaramongkol & Malicky, *C. monorum* Chantaramongkol & Malicky, *C. spinifera* Kimmins, *Gunungiella fiarafiazga* Malicky & Chantaramongkol, *Stenopsyche siamensis* Martynov, *Pseudoneureclipsis cheiron* Malicky & Sompong, *P. vali* Malicky & Chantaramongkol, *Psychomyia arthit* Malicky & Chantaramongkol, *P. adun* Malicky & Chantaramongkol, *P. Indra* Malicky & Chantaramongkol, *P. thienemanni* (Ulmer), *Paduniella semarangensis* Ulmer, *Tinodes sitto* Malicky & Chantaramongkol, *Ecnomus alkestis* Malicky & Chantaramongkol, *E. totiio* Malicky & Chantaramongkol, *E. venimar* Malicky & Chantaramongkol, *Dipseudopsis benardi* Navás, *D. varians* Ulmer, *Cheumatopsyche charites* Malicky & Chantaramongkol, *C. copia* Malicky & Chantaramongkol, *C. camena* Malicky, *C. tramota* Malicky & Chantaramongkol, *Diplectrona dulitensis* Kimmins, *D. gombak* Oláh, *Hydropsyche brontes* Malicky & Chantaramongkol, *H. dolosa* Banks, *H. doctersi* Ulmer, *H. pallipenne* Banks, *Hydromanicus inferior* Chantaramongkol & Malicky, *Macrostemum dohrni* (Ulmer), *M. hestia* Malicky & Chantaramongkol, *M. midas* Malicky & Chantaramongkol, *Potamyia aureipennis* (Ulmer), *P. phaidra* Malicky & Chantaramongkol, *Micrasema fortiso* Malicky & Chantaramongkol, *Goera solicur* Malicky & Chantaramongkol, *G. uniformis* Banks, *Ganonema fuscipenne* (Albarda), *Goerodes abruptum* Banks, *Leptocerus inthanonensis* Malicky & Chantaramongkol, *L. skamandrios* Malicky & Prommi, *Oecetis lotis* Malicky & Thapanya, *Marilia aerepe* Malicky & Chantaramongkol, and *M. sumatrana* Ulmer. The Trichoptera species found in the large river of the lower Tapee River and Pumduang River (TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, PD1, PD2) were *Ecnomus talenoi* Malicky & Chantaramongkol, *E. paget*, *E. votticius* Malicky & Chantaramongkol, *Cheumatopsyche banksi* Mosely, *Macrostemum dione* Malicky & Chantaramongkol, *Polymorphanus nigricornis* Walker and *Oecetis bengalica* Martynov (Table 2). The highest number of Trichoptera species was in the small streams and the lowest number of Trichoptera species was in large rivers. The dominant families of Trichoptera in the small streams were Rhyacophilidae, Hydroptilidae, Philopotamidae, Stenopsychidae, Polycentropodidae, Psychomyiidae, Ecnomidae, Dipseudopsidae, Hydropsychidae, Brachycentridae, Goeridae, Leptoceridae, Calamoceratidae, Lepidostomatidae and Odontoceridae. The functional feeding groups of Trichoptera in the small-stream sites of the Tapee River were varied, including predators, shredders, grazers and collectors. On the other hand, the Trichoptera species in the large Tapee River were Ecnomidae, Dipseudopsidae, Hydropsychidae and Leptoceridae. The functional feeding groups of Trichoptera in the large Tapee River were mainly grazers and collectors.

Vannote *et al.* (1997) introduced the River Continuum Concept (RCC). The RCC describes the adaptations of invertebrate communities in running water, reflecting shifts in the type and location of food resources along streams of a forested biome. The relative dominance of the general functional groups in small streams was shredders, grazers, collectors and predators, respectively. The dominant general functional groups in large rivers were collectors and predators, respectively.

The Tapee River is divided into 3 main areas, the upper Tapee River, lower Tapee River and the Pumduang River. This study was concentrated in the lower Tapee River and some study sites in the Pumduang River. Future research will survey the upper Tapee River and the Pumduang River.

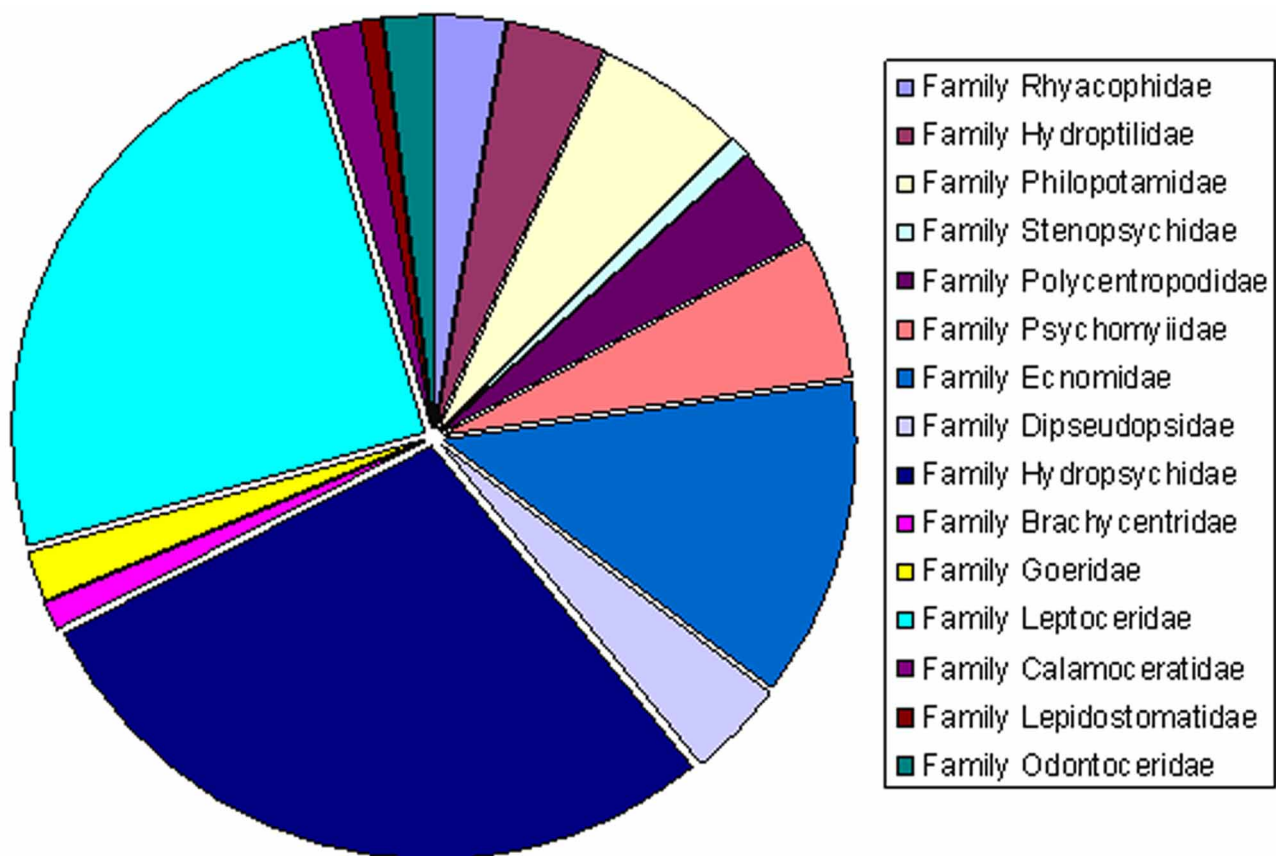


FIGURE 2. Percentage of Trichoptera families found in the Tapee River.

TABLE 2. Check list of Trichoptera species found in the Tapee River, Surat Thani Province, southern Thailand.

Study Sites	CTP1	CTP2	KL1	KL2	PD1	PD2	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9
Family Rhyacophilidae															
<i>Rhyacophila petosorum</i> Schmid and Denning 1971	+														
<i>Rhyacophila scissoides</i> Kimmins 1953	+														
<i>Rhyacophila tantichodoki</i> Malicky and Chantaramongkol 1993	+														
Family Hydroptilidae															
<i>Hydroptila portunus</i> Malicky and Chantaramongkol 2007			+		+										
<i>Hydroptila thuna</i> Olah 1989			+		+										
<i>Ugandatrichia kerdmuang</i> Malicky and Chantaramongkol 1991	+														
<i>Ugandatrichia hongae</i> Olah 1989	+														
Family Philopotamidae															
<i>Chimarra argax</i> Malicky 1989	+		+	+											
<i>Chimarra bimbltona</i> Malicky 1979	+														
<i>Chimarra Chiangmaiensis</i> Malicky and Chantaramongkol 1993			+												
<i>Chimarra monorum</i> Malicky and Chantaramongkol 1993	+														
<i>Chimarra spinifera</i> Kimmins 1957	+														
<i>Gunungiella fiarafiazga</i> Malicky and Chantaramongkol 1993	+														
Family Stenopsychidae															
<i>Stenopsyche siamensis</i> Martynov 1931	+														

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TABLE 2 (continued)

Study Sites	CTP1	CTP2	KL1	KL2	PD1	PD2	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9
Family Polypectropodidae															
<i>Nyctiophylax maath</i> Malicky and Chantaramongkol 1993								+							
<i>Pseudoneureclipsis cheiron</i> Malicky and Sommpong 2000	+														
<i>Pseudoneureclipsis vali</i> Malicky and Chantaramongkol 1993			+	+											
<i>Pseudoneureclipsis ulmeri</i> Malicky 2009				+											
Family Psychomyiidae															
<i>Psychomyia arthit</i> Malicky and Chantaramongkol 1993	+														
<i>Psychomyia adun</i> Malicky and Chantaramongkol 1993	+														
<i>Psychomyia indra</i> Malicky and Chantaramongkol 1993	+														
<i>Psychomyia thienemanni</i> (Ulmer 1951)			+	+											
<i>Paduniella semarangensis</i> Ulmer 1913			+												
<i>Tinodes sitto</i> Malicky and Chantaramongkol 1993	+														
Family Ecnomidae															
<i>Ecnomus aktaion</i> Malicky and Chantaramongkol 1997		+	+	+	+	+	+	+	+	+	+				
<i>Ecnomus alkestis</i> Malicky and Chantaramongkol 1997	+														
<i>Ecnomus atevalus</i> Malicky and Chantaramongkol 1993			+	+	+	+		+		+	+		+	+	
<i>Ecnomus cincibitus</i> Malicky and Chantaramongkol 1993			+			+									
<i>Ecnomus digitatus</i> Mosely 1932															+
<i>Ecnomus paget</i> Malicky and Chantaramongkol 1997						+			+	+	+	+	+		+
<i>Ecnomus puro</i> Malicky and Chantaramongkol 1993		+	+	+	+										
<i>Ecnomus sela</i> Malicky 2009			+	+	+						+				
<i>Ecnomus talenoi</i> Malicky and Chantaramongkol 1993										+	+				
<i>Ecnomus totio</i> Malicky and Chantaramongkol 1993	+														
<i>Ecnomus venimar</i> Malicky and Chantaramongkol 1993	+														
<i>Ecnomus volovicus</i> Malicky and Chantaramongkol 1993			+	+											
<i>Ecnomus votticius</i> Malicky and Chantaramongkol 1993										+			+	+	+
Family Dipseudopsidae															
<i>Dipseudopsis benardi</i> Navas 1930			+	+											
<i>Dipseudopsis knappi</i> Schmid and Denning 1979					+	+	+	+	+	+	+	+			
<i>Dipseudopsis robustior</i> Ulmer 1929			+	+	+	+	+	+	+	+	+	+	+	+	
<i>Dipseudopsis varians</i> Ulmer 1929			+	+											
Family Hydropsychidae															
<i>Aethaloptera sexpunctata</i> (Kolenati 1859)		+			+		+	+	+	+		+			
<i>Amphipsyche meridiana</i> Ulmer 1909	+	+		+	+	+	+	+	+	+	+	+			
<i>Cheumatopsyche angusta</i> Ulmer 1930				+											
<i>Cheumatopsyche banksi</i> Mosely 1942							+	+		+					
<i>Cheumatopsyche charites</i> Malicky and Chantaramongkol 1997	+														
<i>Cheumatopsyche copia</i> Malicky and Chantaramongkol 1997	+														
<i>Cheumatopsyche camena</i> Malicky 1997			+												
<i>Cheumatopsyche charites</i> Malicky and Chantaramongkol 1997	+	+					+	+							
<i>Cheumatopsyche cognita</i> (Ulmer 1951)	+	+	+	+	+	+	+	+			+				
<i>Cheumatopsyche tramota</i> Malicky and Chantaramongkol 1997	+														
<i>Diplectrona dulitensis</i> Kimmins 1955	+														

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TABLE 2 (continued)

Study Sites	CTP1	CTP2	KL1	KL2	PD1	PD2	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9
<i>Diplectrona gombak</i> Olah 1993	+														
<i>Hydropsyche brontes</i> Malicky and Chantaramongkol 2000	+														
<i>Hydropsyche camillus</i> Malicky and Chantaramongkol 2000	+	+													
<i>Hydropsyche dolosa</i> Banks 1939	+		+												
<i>Hydropsyche doctersi</i> Ulmer 1951	+														
<i>Hydropsyche pallipenne</i> Banks 1939	+														
<i>Hydromanicus inferior</i> Chantaramongkol and Malicky 1995	+														
<i>Macrostemum dione</i> Malicky and Chantaramongkol 1998								+	+				+		
<i>Macrostemum dohrni</i> (Ulmer 1905)	+														
<i>Macrostemum fenestratum</i> (Albarda 1887)	+	+		+			+		+				+	+	
<i>Macrostemum floridum</i> Navas 1929			+	+											
<i>Macrostemum hestia</i> Malicky and Chantaramongkol 1998	+														
<i>Macrostemum midas</i> Malicky and Chantaramongkol 1998	+														
<i>Polymorphanisus nigrirornis</i> Walker 1852							+								
<i>Polymorphanisus muluensis</i> Barnard 1980						+	+	+			+				
<i>Potamyia aureipennis</i> Ulmer 1930	+	+													
<i>Potamyia alleni</i> Malicky and Chantaramongkol 1997				+		+									
<i>Potamyia flavata</i> Banks 1934		+													
<i>Potamyia phaidra</i> Malicky and Chantaramongkol 1997	+														
Family Brachycentridae															
<i>Micrasema fortiso</i> Malicky and Chantaramongkol 1992	+														
Family Goeridae															
<i>Goera solicur</i> Malicky and Chantaramongkol 1992	+														
<i>Goera uniformis</i> Banks 1931	+														
Family Leptoceridae															
<i>Ceraclea egeria</i> Malicky & Chaibu 2000						+									
<i>Ceraclea harpalyke</i> Malicky and Changthong 2002							+								
<i>Ceraclea hersilia</i> Malicky and Changthong 2002							+								
<i>Ceraclea idaia</i> Malicky and Chaibu 2002		+			+	+	+	+	+	+	+				+
<i>Leptocerus ciconiae</i> Malicky 1993		+						+							
<i>Leptocerus dirghachuka</i> Schmid 1987	+	+	+	+	+										
<i>Leptocerus inthanonensis</i> Malicky and Chantaramongkol 1991	+														
<i>Leptocerus lampunensis</i> Malicky and Chantaramongkol 1991			+	+	+		+								
<i>Leptocerus skamandrios</i> Malicky and Prommi 2006	+														
<i>Oecetis asmada</i> Malicky 1979				+											
<i>Oecetis bengalica</i> Martynov 1936												+			
<i>Oecetis biramosa</i> Martynov 1936		+			+						+	+	+	+	
Family Leptoceridae															
<i>Oecetis empusa</i> Malicky and Chaibu 2000			+	+	+										
<i>Oecetis jacobsoni</i> Ulmer 1930															+
<i>Oecetis laodike</i> Malicky and Cheunbarn 2005		+	+		+								+		
<i>Oecetis lotis</i> Malicky and Thapanya 2004	+		+												
<i>Oecetis meghadouta</i> Schmid 1958					+	+				+	+	+	+	+	+

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TABLE 2 (continued)

Study Sites	CTP1	CTP2	KL1	KL2	PD1	PD2	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9
<i>Oecetis meleagros</i> Malicky and Thani 2005			+	+	+										
<i>Oecetis tripunctata</i> (Fabricius 1793)		+	+	+	+	+	+	+	+	+	+		+		
<i>Parasetodes respersellus</i> (Rambur 1842)			+	+	+	+	+	+	+	+	+	+	+		+
<i>Setodes argentiguttatus</i> Gordon and Schmid 1987	+		+												
<i>Setodes gangaya</i> Gordon and Schmid 1987					+			+							
<i>Setodes isis</i> Malicky and Nawvong 2004	+														
<i>Setodes thoneti</i> Malicky and Chantaramongkol 2006	+														
<i>Trichosetodes pales</i> Malicky and Chaibu 2006				+											
<i>Triplectides indica</i> Walker 1852													+		
Family Calamoceratidae															
<i>Anisocentropus brevipennis</i> Ulmer 1906							+								
<i>Ganonema fuscipennis</i> Albarda 1881	+	+													
Family Lepidostomatidae															
<i>Goerodes abruptum</i> Banks 1931	+														
Family Odontoceridae															
<i>Marilia aerope</i> Malicky and Chantaramongkol 1996	+														
<i>Marilia sumatrana</i> Ulmer 1951	+														

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References

- Chaibu, P., Chantaramongkol, P. & Malicky, H. (2002) The caddisflies (Trichoptera) of the River Ping, northern Thailand, with particular reference to domestic pollution (Studies on Trichoptera in Thailand. Nr. 31). *In*: Mey W. (Ed.), *Proceedings of the 10th International Symposium on Trichoptera, Nova Supplementa Entomologica*, Kelttern, 15, 331–342.
- Laudee, P. (2008) Larval morphology and diagnosis of the giant microcaddisfly, *Ugandatrichia* spp. (Hydroptilidae: Trichoptera) in Thailand. *Zootaxa*, 1825, 29–39.
- Laudee, P. & Chantaramongkol, P. (2002) Comparison of *Stenopsyche siamensis* larvae morphology using scanning electron microscopy as a measure of ecotoxicity. *In*: Mey W. (Ed.), *Proceedings of the 10th International Symposium on Trichoptera, Nova Supplementa Entomologica*, Kelttern, 435–438.
- Laudee, P., Chantaramongkol, P. & Prapamontol, T. (2002) Sublethal effects of organophosphorus and carbamate pesticides on cholinesterase activity of *Stenopsyche siamensis* (Trichoptera: Stenopsychidae). *Verhandlungen des Internationalen Verein Limnologie*, 28, 1849–1852.
- Laudee, P., Chantaramongkol, P., Prapamontol, T. & McQuillan, P.B. (2002) Diversity of aquatic insects from Doi Chiang Dao Watershed, Chiang Mai Province, and their use for environmental bioassessment. *Proceedings of the 6th BRT Annual Conference 2002*, 276–285.
- Malicky, H. (2010) *Atlas of Southeast Asian Trichoptera*. Biology Department, Faculty of Science, Chiang Mai University, Chiang Mai, 346 pp.

- Malicky, H. & Chantaramongkol, P. (1999) A preliminary survey of the caddisflies (Trichoptera) of Thailand. Study no. 26 on caddisflies of Thailand. *In*: Malicky H., Chantaramongkol P. (Eds.), *Proceedings of the 9th International Symposium on Trichoptera*, Chiang Mai University, Chiang Mai, pp. 205–216.
- Malicky, H. & Chantaramongkol, P. (1995) The altitudinal distribution of Trichoptera species in Mae Klang catchment on Doi Inthanon northern Thailand: Stream zonation and cool- and warm-adapted groups. (Studies on caddisflies of Thailand, No. 16). *Revue d'Hydrobiologie Tropicale*, 26 (4), 279–291.
- Malicky, H. & Prommi, T. (2006) Beschreibungen einiger Köcherfliegen aus Süd-Thailand (Trichoptera) (Arbeit Nr. 42 über thailändische Köcherfliegen). *Linzer biologische Beiträge*, 38 (2), 1591–1608.
- Prommi, T., Permkam, S. & Sites, R.W. (2006) Description of the larva and pupa of *Potamyia phaidra* Malicky and Chantaramongkol 1997 (Trichoptera: Hydropsychidae) from southern Thailand. *Zootaxa*, 1357, 21–29.
- Thapanya, D., Chantaramongkol, P. & Malicky, H. (2004) An updated survey of caddisflies (Trichoptera, Insecta) from Doi Suthep-Pui and Doi Inthanon National Parks, Chiangmai Province, Thailand. *Journal of Natural History, Chulalongkorn University*, 4, 21–40.
- Vannote, R.L., Minshall, G.W., Cummins, K.W., Sedell, J.R. & Cushing, C.E. (1980) The river continuum concept. *Canadian Journal of Fisheries and Aquatic Science*, 37 (1), 130–137.