

**Table S1.** Detailed taxonomic resources are used in the present study.

Subfamily	Subfamily	Genus	Species	GenBank accession number
Ingroup				
Hydropsychidae	Arctopsychinae	<i>Arctopsyche</i>	<i>Arctopsyche spinescens</i> Gui & Yang, 2001	ON859124
			<i>Arctopsyche</i> sp.	ON859111
		<i>Maesaipsyche</i>	<i>Maesaipsyche stengeli</i> Malicky, 1997*	OL677993
		<i>Parapsyche</i>	<i>Parapsyche difformis</i> (Banks, 1947)*	OL677995
			<i>Parapsyche elsis</i> Milne, 1936	ON859123
	Diplectroninae	<i>Diplectrona</i>	<i>Diplectrona albofasciata</i> (Ulmer, 1913)	ON859114
			<i>Diplectrona hexapetala</i> Sun, 2012*	OL678009
	Hydropsychinae	<i>Cheumatopsyche</i>	<i>Cheumatopsyche brevilineata</i> (Iwata, 1927)	ON859112
			<i>Cheumatopsyche campyla</i> Ross, 1938*	NC_036954
			<i>Cheumatopsyche charites</i> Malicky & Chantaramongkol, 1997*	OL678007
			<i>Cheumatopsyche infascia</i> Martynov, 1934	ON859113
			<i>Cheumatopsyche</i> sp.	ON859125
		<i>Hydromanicus</i>	<i>Hydromanicus huapingensis</i> (Li & Tian, 1990)	ON859115
			<i>Hydromanicus melli</i> (Ulmer, 1926)*	OL678021
			<i>Hydromanicus wulaianus</i> (Kobayashi, 1987)*	NC_036156
		<i>Hydropsyche</i>	<i>Hydropsyche cerva</i> (Li & Tian, 1990)	ON859117
			<i>Hydropsyche columnata</i> Martynov, 1931	ON859126
			<i>Hydropsyche formosana</i> Ulmer, 1911	ON859118
			<i>Hydropsyche fryeri</i> Ulmer, 1915*	NC_060325
			<i>Hydropsyche fukienensis</i> Schmid, 1965*	OL678022
			<i>Hydropsyche gautamittra</i> Schmid, 1961	ON859119
			<i>Hydropsyche orris</i> Ross, 1938*	NC_036951
			<i>Hydropsyche rhomboana</i> Martynov, 1909	ON859120

			<i>Hydropsyche simulans</i> Ross, 1938*	NC_036950
			<i>Hydropsyche simulata</i> Mosely, 1942	ON859121
			<i>Hydropsyche trifora</i> (Li & Tian, 1990)	ON859122
			<i>Hydropsyche pellucidula</i> (Curtis, 1834)*	NC_029246
			<i>Hydropsyche</i> sp.	ON859116
		<i>Potamyia</i>	<i>Potamyia chinensis</i> (Ulmer, 1915)	ON859128
			<i>Potamyia horvati</i> Malicky & Chantaramongkol, 1997	ON859129
	Macronematinae	<i>Macrostemum</i>	<i>Macrostemum floridum</i> (Navás, 1929)*	MT677867
			<i>Macrostemum radiatum</i> (McLachlan, 1872)	ON859127
Outgroup				
Philopotamidae	Chimarrinae	<i>Chimarra</i>	<i>Chimarra paramonorum</i> Hu, Sun & Wang, 2018*	OL678008
	Philopotaminae	<i>Dolophilodes</i>	<i>Dolophilodes bellatula</i> Sun & Malicky, 2002*	OL678011
		<i>Kisaura</i>	<i>Kisaura zhejiangensis</i> Hu, 2019*	OL678025
		<i>Wormaldia</i>	<i>Wormaldia unispina</i> Sun, 1998*	OL678056
Stenopsychidae	Stenopsychinae	<i>Stenopsyche</i>	<i>Stenopsyche angustata</i> Martynov, 1930*	NC_051529
			<i>Stenopsyche navasi</i> Ulmer, 1926*	OL678052
			<i>Stenopsyche tienmushanensis</i> Hwang, 1957*	MW201980
Psychomyiidae	Psychomyiinae	<i>Psychomyia</i>	<i>Psychomyia kalais</i> Malicky, 2004*	OL678047
Xiphocentronidae	Xiphocentroninae	<i>Abaria</i>	<i>Abaria</i> sp.*	OL677997

\* Published mitogenomes of Trichoptera.

**Table S2.** Collection information of the newly sequenced samples.

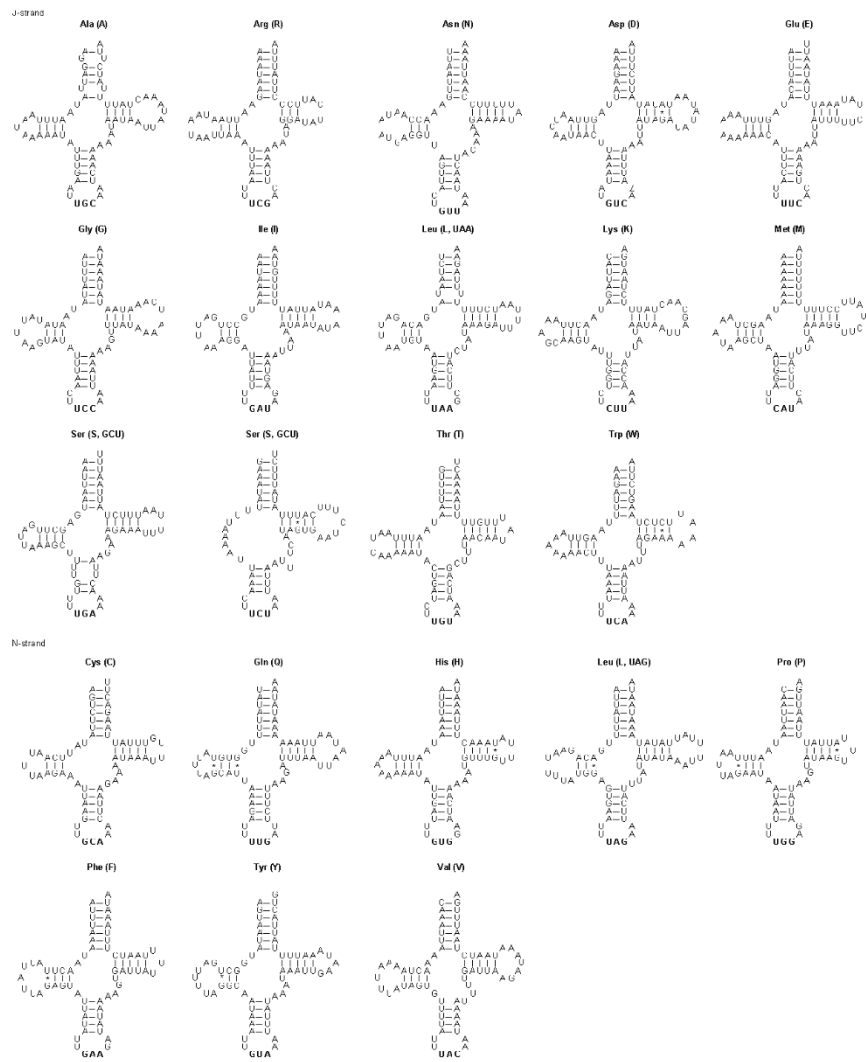
Subfamily	Species	Geographical locality	Longitude	Latitude	Elevation (m)	Collection date
Arctopsychinae	<i>Arctopsyche</i> sp.	Yunxi, Yunnan, China	101°59'59"E	23°37'1"N	1,624	13.VII.2021
	<i>Arctopsyche spinescens</i>	Menyuan, Qinghai, China	101°36'55"E	37°21'37"N	2,782	30.VI.2021
Diplectroninae	<i>Diplectrona albofasciata</i>	Mangshan, Hunan, China	112°55'39"E	24°58'48"N	731	02.IX.2020
	<i>Cheumatopsyche brevilineata</i>	Yueqing, Zhejiang, China	120°59'24"E	28°17'59"N	64	03-13.IV.2019
	<i>Cheumatopsyche infascia</i>	Mentougou, Beijing, China	115°50'21"E	40°1'57"N	408	01.XI.2020
	<i>Cheumatopsyche</i> sp.	Nanjing, Jiangsu, China	118°50'52"E	32°2'40"N	406	05.VI.2021
Hydropsychinae	<i>Hydromanicus huapingensis</i>	Huanping, Guanxi, China	109°54'38"N	25°36'5"N	612	19.V.2021
	<i>Hydropsyche cerva</i>	Zhaotong, Yunnan, China	103°1'28"E	26°47'14"N	738	23.XI.2019
	<i>Hydropsyche columnata</i>	Zhaotong, Yunnan, China	103°1'28"E	26°47'14"N	738	23.XI.2019
	<i>Hydropsyche formosana</i>	Wuyishan, Fujian, China	117°37'17"E	27°38'53"N	550	16.III.2020
	<i>Hydropsyche gautamittra</i>	Pingshan, Sichuan, China	103°45'58"E	28°41'8"N	368	19.XI.2019
	<i>Hydropsyche rhomboana</i>	Qilianshan, Qinghai, China	101°36'29"E	37°21'9"N	2,786	29.VII.2020
	<i>Hydropsyche simulate</i>	Shaoyang, Hunan, China	110°22'15"E	26°14'39"N	559	20.V.2021
	<i>Hydropsyche trifora</i>	Wuyishan, Fujian, China	117°37'17"E	27°38'53"N	550	16.III.2020
	<i>Hydropsyche</i> sp.	Shaoyang, Hunan, China	110°22'15"E	26°14'39"N	559	20.V.2021
	<i>Potamyia chinensis</i>	Yueqing, Zhejiang, China	120°59'24"E	28°17'59"N	64	03-13.IV.2019
	<i>Potamyia horvati</i>	Lincang, Yunnan, China	99°31'45"E	23°37'8"N	1,085	29.III.2020
	<i>Macrostemum radiatum</i>	Changde, Hunan, China	113°19'24"E	28°17'59"N	63	03-13.IV.2019
Macronematinae						

**Table S3.** PCR primers were used to sequence mtCOI genes of Trichoptera in this study.

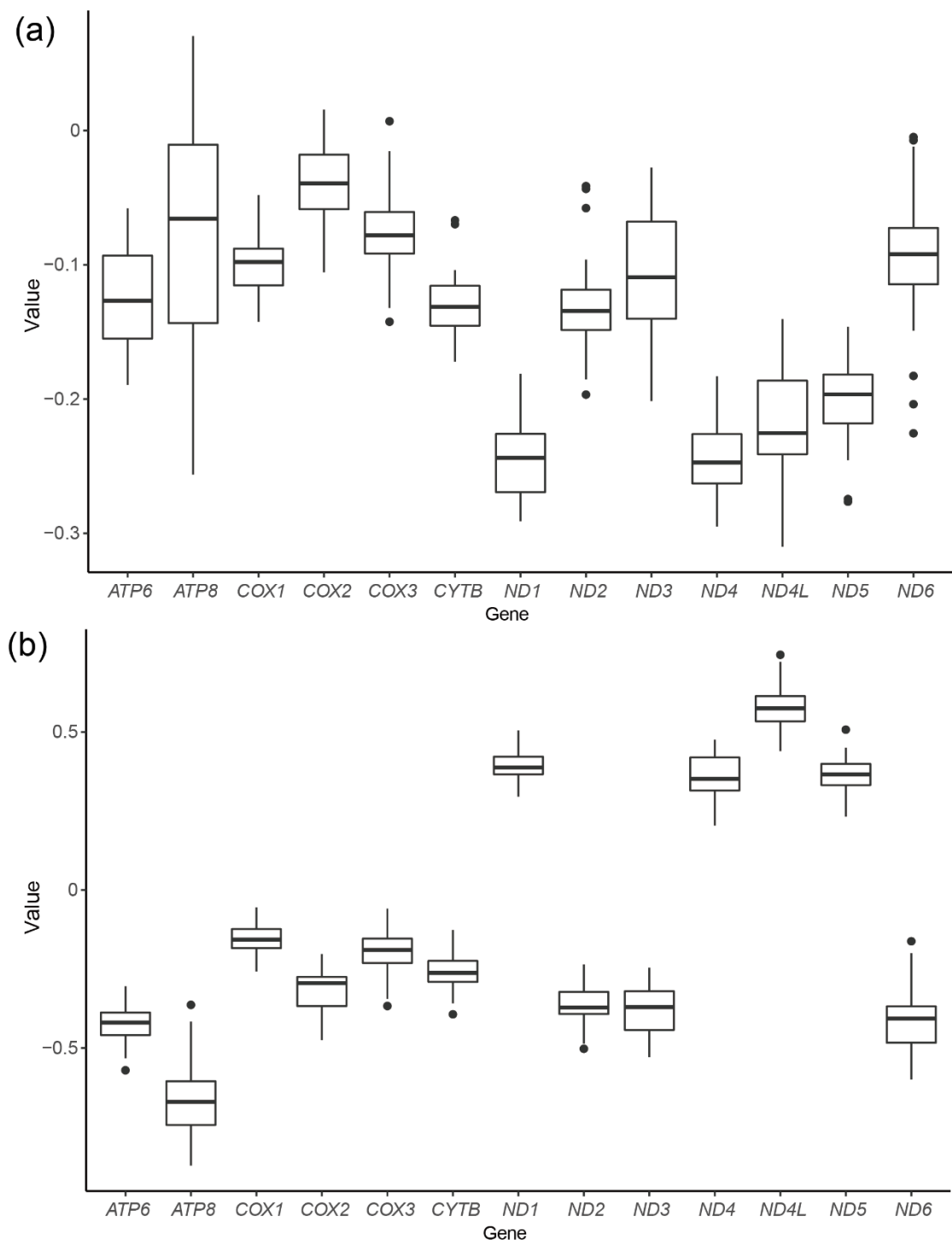
Primer	Sequence	Reference
LCO1490	GGTCAACAAATCATAAAGATATTGG	Folmer et al.1994
HCO2198	TAAACTTCAGGGTGACCAAAAAATCA	

**Table S4.** The length, nucleotide composition, and skewness of novel obtained hydropsychid mitogenomes.

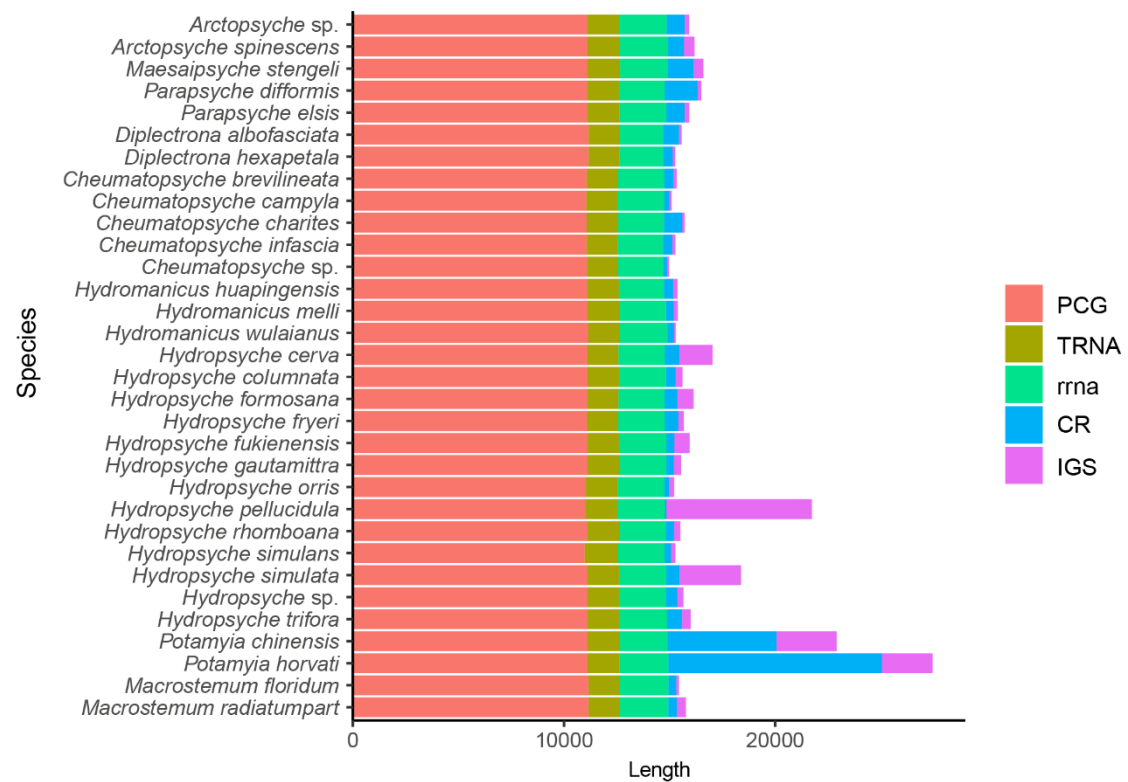
Species	length	A+T (%)	AT-Skew	GC-Skew
<i>Arctopsyche spinescens</i> Gui & Yang, 2001	16,175	79.24	0.0492	-0.3329
<i>Arctopsyche</i> sp.	15,923	81.42	-0.008	-0.2592
<i>Parapsyche elsis</i> Milne, 1936	15,931	73.09	0.0157	-0.3688
<i>Diplectrone albofasciata</i> (Ulmer, 1913)	15,566	72.92	0.0494	-0.3716
<i>Cheumatopsyche brevilineata</i> (Iwata, 1927)	15,330	79.1	0.0111	-0.3315
<i>Cheumatopsyche infascia</i> Martynov, 1934	15,275	78.99	0.0168	-0.3375
<i>Cheumatopsyche</i> sp.	14,974	80.41	-0.0097	-0.3003
<i>Hydromanicus huapingensis</i> (Li & Tian, 1990)	15,378	77.79	0.0318	-0.3511
<i>Hydropsyche cerva</i> (Li & Tian, 1990)	17,038	80.61	0.0195	-0.2988
<i>Hydropsyche columnata</i> Martynov, 1931	15,614	80.44	0.0226	-0.2874
<i>Hydropsyche formosana</i> Ulmer, 1911	16,139	82.35	0.0222	-0.2322
<i>Hydropsyche gautamittra</i> Schmid, 1961	15,545	81.54	0.0086	-0.2318
<i>Hydropsyche rhomboana</i> Martynov, 1909	15,507	77.7	0.0152	-0.3169
<i>Hydropsyche simulata</i> Mosely, 1942	18,380	81.51	0.0168	-0.279
<i>Hydropsyche trifora</i> (Li & Tian, 1990)	15,997	79.91	0.0274	-0.2941
<i>Hydropsyche</i> sp.	15,652	78.72	0.0333	-0.3129
<i>Potamyia chinensis</i> (Ulmer, 1915)	22,920	81.75	0.0368	-0.3808
<i>Potamyia horvati</i> Malicky & Chantaramongkol, 1997	27,450	85.4	0.0012	-0.3207
<i>Macrostemum radiatum</i> (McLachlan, 1872)	15,796	78.18	0.0098	-0.415



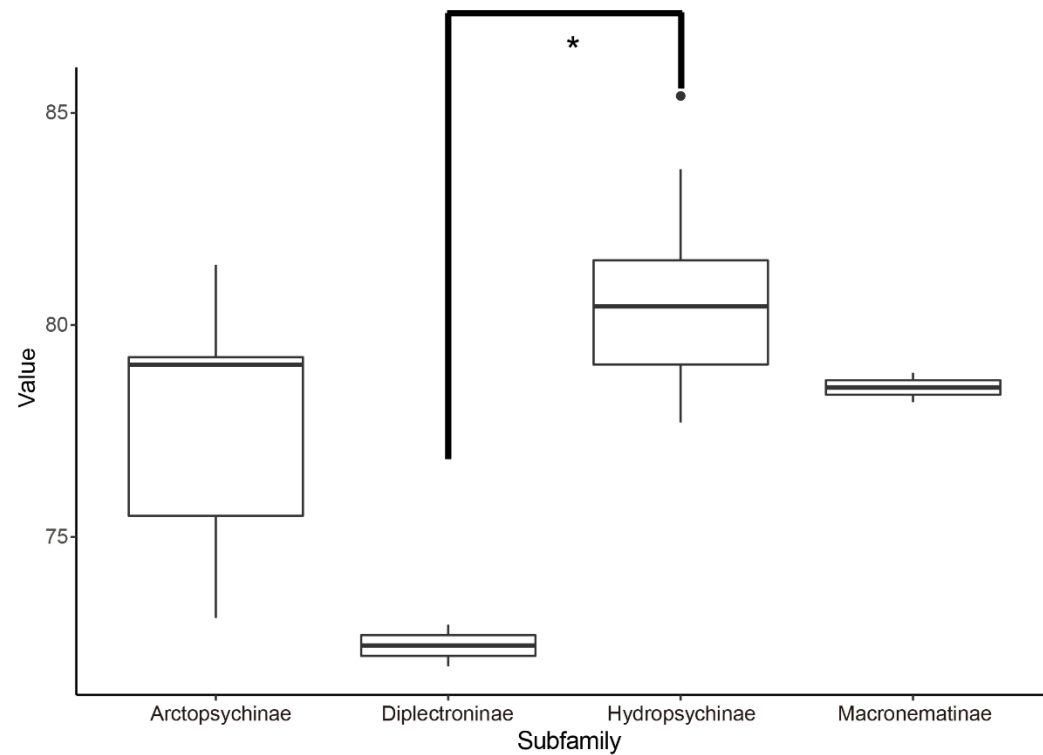
**Figure S1.** Putative secondary structures of the 22 tRNA genes identified in the mitogenome of *Hydropsyche cerva* Li & Tian, 1990.



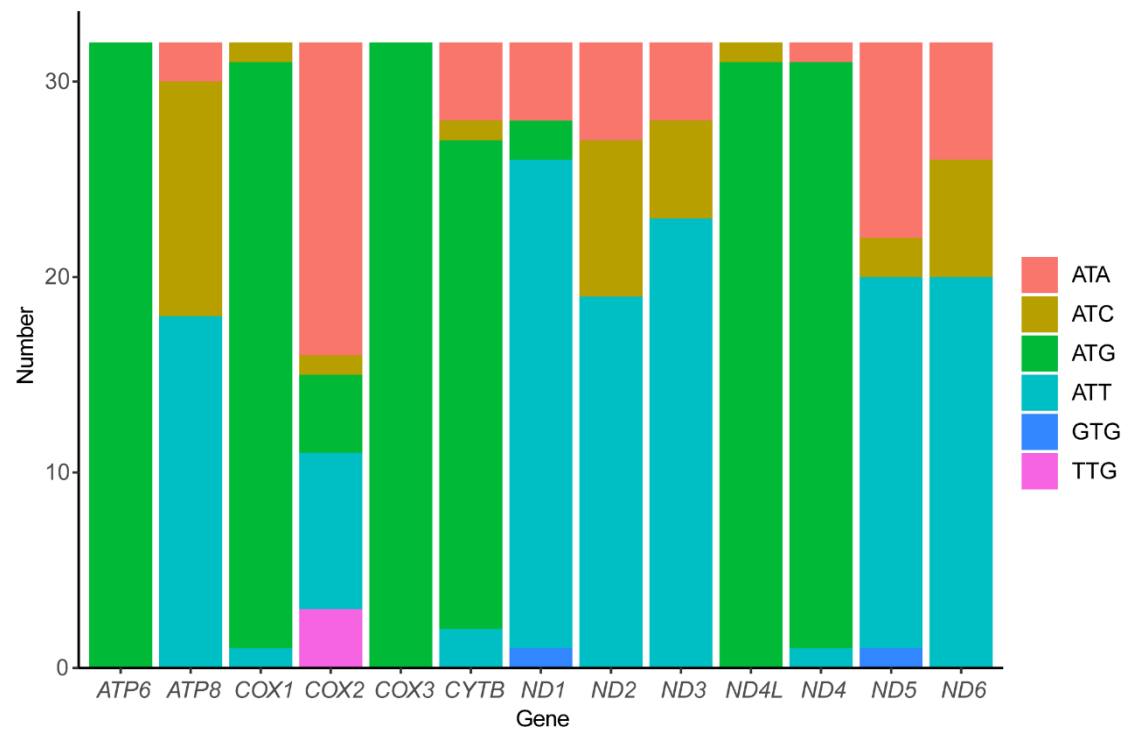
**Figure S2.** Box-and-whisker plots for nucleotide composition of each gene. (a) AT-skew; (b) GC-skew.



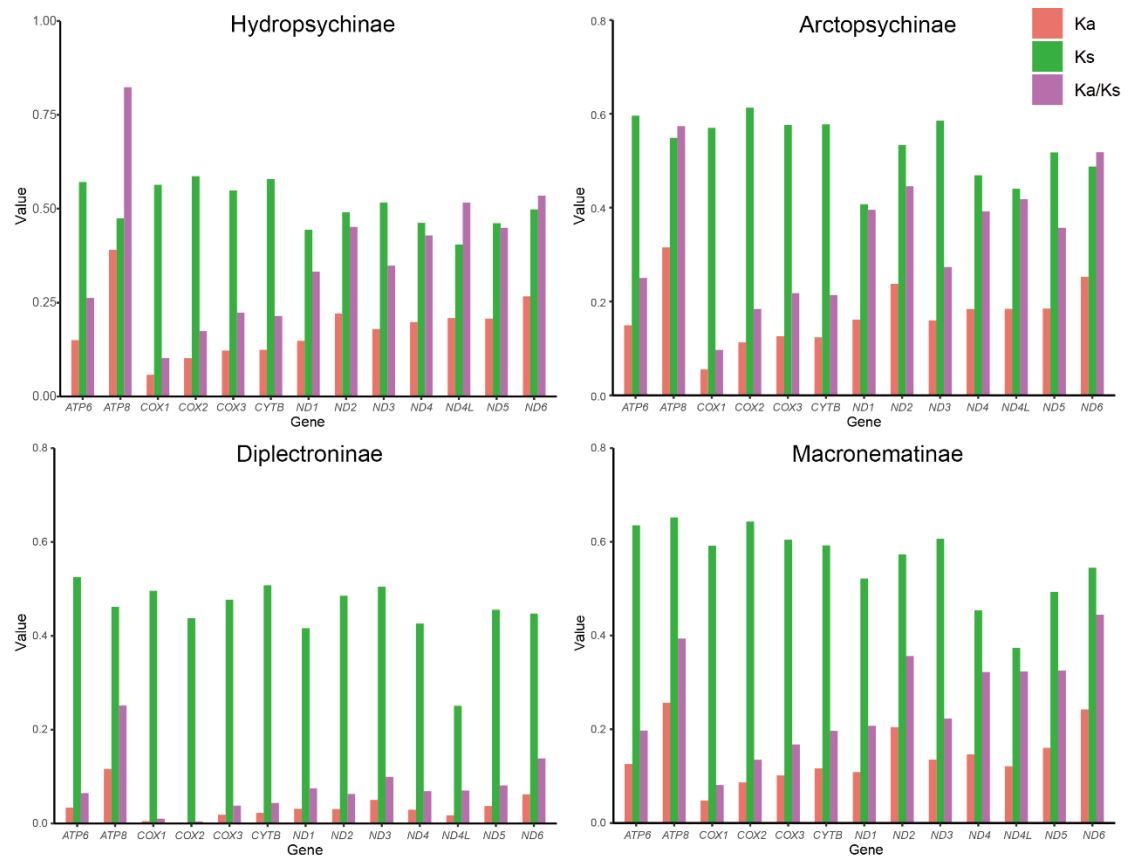
**Figure S3.** The length of protein-coding genes, transfer RNAs, ribosomal RNAs, and control regions among 32 hydropsychid mitogenomes.



**Figure S4.** A+T content of each subfamily. Asterisks indicate  $p$  values  $\leq 0.05$  (Wilcoxon rank sum test \*).

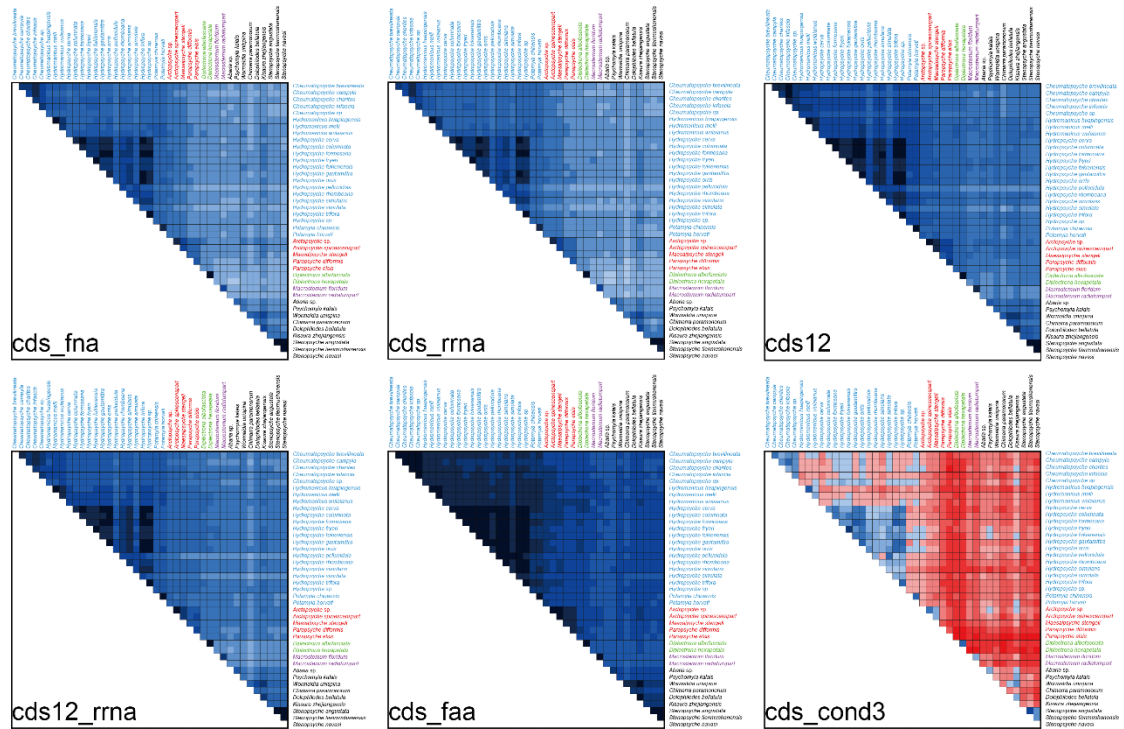


**Figure S5.** Start codons of protein-coding genes among hydropsychid mitogenomes.

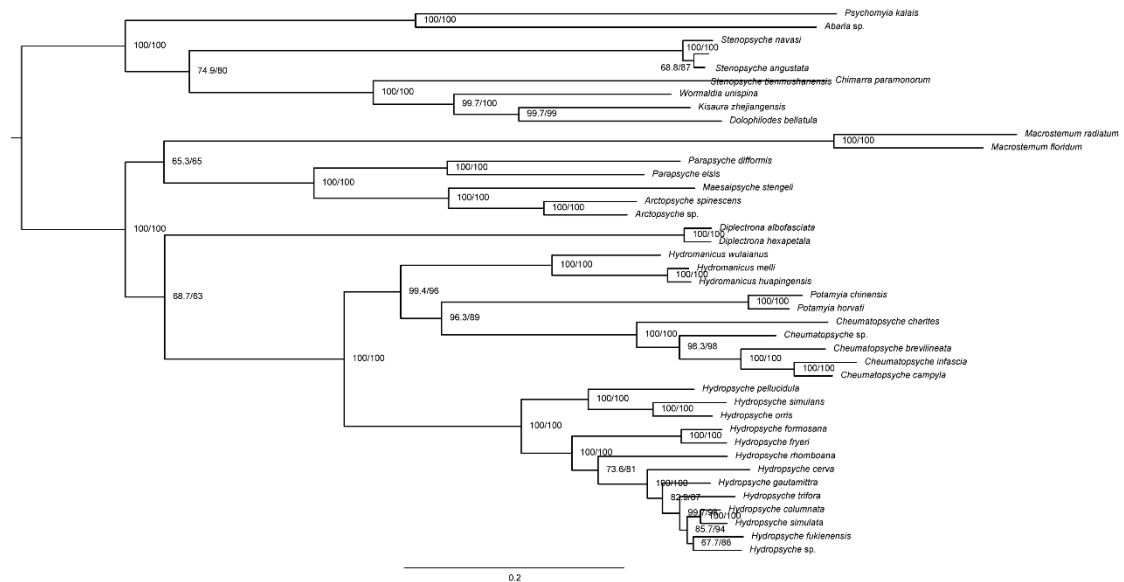


**Figure S6.** Evolution rate of each PCG of the mitogenomes of four subfamilies.

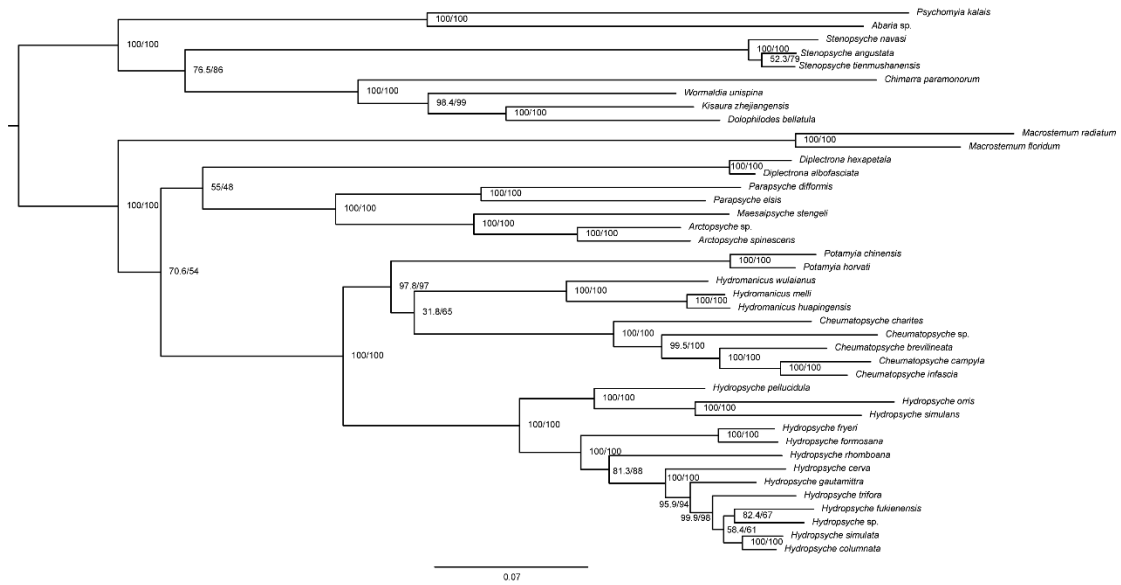




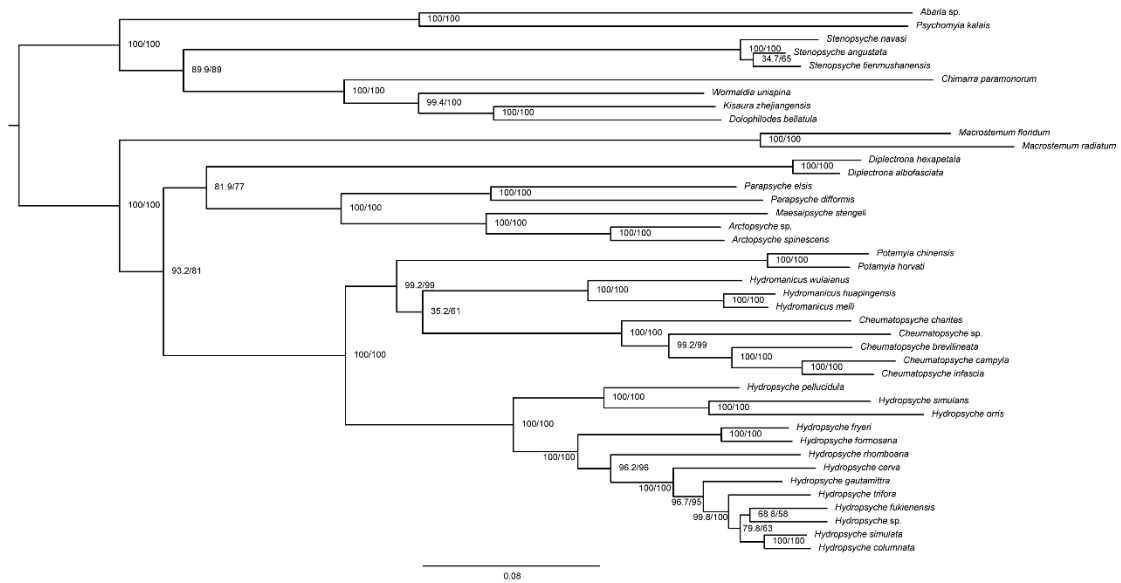
**Figure S7.** Heterogeneity of sequence composition of mitochondrial genomes for different datasets. The pairwise Aliscore values are represented by colored squares. The scores range from  $-1$ , indicating full random similarity (dark blue), to  $+1$ , indicating non-random similarity (bright orange).



**Figure S8.** ML phylogenomic tree of Hydropsychidae based on the analysis of PCG\_faa dataset with PMSF model in IQ-TREE. Node values represent SH-aLRT and UFBoot2, respectively.



**Figure S9.** ML phylogenomic tree of Hydropsychidae based on the analysis of PCG12\_fna dataset with partitioning model in IQ-TREE. Node values represent SH-aLRT and UFBoot2, respectively.



**Figure S10.** ML phylogenomic tree of Hydropsychidae based on the analysis of PCG12\_rna dataset with partitioning model in IQ-TREE. Node values represent SH-aLRT and UFBoot2, respectively.