APPENDIX A

Survey Data

Table 1 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Doi Saket district (November 2011-October 2012).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Cool	*C. helena*	0/50	0/50	-	0	0	0
	E. eyriesi	0/17	0/17	-	0	0	0
	Th. scabra	0/50	0/50	-	0	0	0
	M. tuberculata	4/50	0/50	Parapleurolophocercous cercaria (4/50)	0	0	0
	Ta. granifera	8/50	0/50	Parapleurolophocercous cercaria (7/50) Xiphidiocercaria (1/50)	0	0	0
	B. siamensis siamensis	0/22	0/22	-	0	0	0
	F. doliaris	2/26	0/26	Distome cercaria (2/26)	0	0	0
	F. sumatrensis polygramma	1/22	0/22	Distome cercaria (1/22)	0	0	0
	F. martensi martensi	5/50	4/50	Xiphidiocercaria (1/50)	1-2 (1.5, 6)	8	1.5
	Total	20/337	4/337	Parapleurolophocercous cercaria (11/100) Xiphidiocercaria (2/100) Distome cercaria (3/48)	1-2 (1.5, 6)	8	1.5

Table 1 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Doi Saket district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Rainy	*C. helena*	0/50	0/50	-	0	0	0
	Ta. granifera	4/60	0/60	Parapleurolophocercous cercaria (4/60)	0	0	0
	M. tuberculata	0/50	0/50	-	0	0	0
	B. siamensis siamensis	0/30	0/30	-	0	0	0
	F. doliaris	56/60	52/60	Distome cercaria (4/60)	2-212 (10.9, 566)	86.7	10.9
	F. sumatrensis polygramma	40/40	40/40	-	1-73 (20.9, 835)	100	20.9
	F. martensi martensi	31/70	28/70	Distome cercaria (2/70) Xiphidiocercaria (1/70)	2-164 (44.8, 1,254)	40	44.8
	Total	131/360	120/360	Parapleurolophocercous cercaria (4/60) Xiphidiocercaria (1/70) Distome cercaria (6/130)	1-212 (22.1, 2,655)	33.3	22.1
Hot-dry	*C. helena*	0/50	0/50	-	0	0	0
	M. tuberculata	2/60	0/60	Young redia (2/60)	0	0	0
	Ta. granifera	3/60	0/60	Parapleurolophocercous cercaria (2/60)	0	0	0

Table 1 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Doi Saket district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Hot-dry	*Ta. granifera*	3/60	0/60	Young redia (1/60)	0	0	0
	F. doliaris	56/60	56/60	-	2-209 (40.4, 2,264)	93.3	40.4
	F. sumatrensis polygramma	24/24	24/24	-	1-64 (20.9, 501)	100	20.9
	F. martensi martensi	28/70	28/70	-	2-159 (44.8, 1,254)	40	44.8
	Total	113/324	108/324	Parapleurolophocercous cercaria (2/60) Young redia (3/120)	1-209 (33.2, 4,019)	33.3	37.2

Table 2 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Hang Dong district (November 2011-October 2012).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Cool	*L. rubiginosa*	6/30	0/30	Metacercaria unknown II (6/30)	0	0	0
	M. tuberculata	24/54	0/54	Parapleurolophocercous cercaria (12/54) Distome cercaria (12/54)	0	0	0
	Th. scabra	0/50	0/50	-	0	0	0
	B. siamensis siamensis	42/60	20/60	Xiphidiocercaria (12/60) Furcocercous cercaria (8/60) Gymnocephalus cercaria (2/60) Metacercaria unknown II (10/60)	1-7 (2.8, 56)	33.3	2.80
	F. doliaris	22/54	22/54	-	1-21 (7.2, 158)	40.7	7.2
	F. sumatrenss polygramma	10/20	10/20	-	1-5 (5, 50)	50.0	5.0
	F. martensi martensi	35/60	34/60	Xiphidiocercaria (3/60)	1-33 (4.7, 158)	56.7	4.7
	Total	139/328	86/328	Xiphidiocercaria (15/120) Furcocercous cercaria (8/60)	1-33 (4.9, 422)	26.2	4.9

Table 2 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Hang Dong district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Cool	Total	139/328	86/328	Gymnocephalus cercaria (2/60) Metacercaria unknown II (16/90) Parapleurolophocercous cercaria (12/54) Distome cercaria (12/54)	1-33 (4.9, 422)	26.2	4.9
Rainy	*C. helena*	0/30	0/30	-	0	0	0
	E. eyriesi	7/13	7/13	-	1-8 (3.3, 23)	53.9	3.3
	Ta. granifera	12/60	0/60	Parapleurolophocercous cercaria (12/60)	0	0	0
	B. siamensis siamensis	0/30	0/30	-	0	0	0
	F. doliaris	17/30	17/30	Xiphidiocercaria (3/30)	1-29 (11.6, 197)	56.7	11.6
	F. sumatrensis polygramma	8/19	8/19	-	1-67 (23.4, 187)	42.1	23.4
	F. martensi martensi	31/42	29/42	Distome cercaria (2/42)	5-43 (9.5, 276)	69.1	9.5
	Total	75/224	61/224	Parapleurolophocercous cercaria (12/60) Distome cercaria (2/42) Xiphidiocercaria (2/42)	1-67 (11.2, 683)	27.2	11.2

Table 2 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Hang Dong district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Hot-dry	*C. helena*	0/50	0/50	-	0	0	0
	M. tuberculata	16/60	0/60	Parapleurolophocercous cercaria (16/60)	0	0	0
	Ta. granifera	8/60	0/60	Parapleurolophocercous cercaria (7/60) Young redia (1/60)	0	0	0
	B. funiculata	0/30	0/30	-	0	0	0
	F. doliaris	43/70	43/70	-	5-97 (8.7, 376)	61.4	8.7
	F. sumatrensis polygramma	19/31	19/31	-	1-23 (9.7, 184)	61.3	9.7
	F. martensi martensi	32/50	30/50	Xiphidiocercaria (2/50)	1-37 (7.6, 227)	60.0	7.6
	Total	118/351	92/351	Parapleurolophocercous cercaria (23/120) Young redia (1/60) Xiphidiocercaria (2/50)	1-97 (8.6, 787)	26.2	8.6

Table 3 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Mae On district (November 2011-October 2012).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Cool	*L. rubiginosa*	0/60	0/60	-	0	0	0
	M. tuberculata	4/60	0/60	Young redia (2/60) Distome cercaria (2/60)	0	0	0
	Th. scabra	0/46	0/46	-	0	0	0
	Ta. granifera	4/60	0/60	Parapleurolophocercous cercaria (4/60)	0	0	0
	F. doliaris	28/71	28/71	-	4-37 (7.3, 204)	39.4	7.3
	F. martensi martensi	21/60	21/60	-	1-43 (15.1, 317)	35	15.1
	Total	57/357	49/357	Young redia (2/60) Distome cercaria (2/60) Parapleurolophocercous cercaria (4/60)	1-43 (10.6, 521)	13.7	10.6
Rainy	*C. helena*	0/60	0/60	-	0	0	0
	E. eyriesi	0/21	0/21	-	0	0	0
	M. tuberculata	34/60	0/60	Parapleurolophocercous cercaria (34/60)	0	0	0
	F. doliaris	27/42	27/42	Xiphidiocercaria (2/42)	3-44 (8, 216)	64.3	8
	F. sumatrensis polygramma	14/33	14/33	-	1-23 (8.2, 115)	42.4	8.2
	F. martensi martensi	29/53	29/53	-	5-61 (8.6, 248)	54.7	8.6

Table 3 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Mae On district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Rainy	Total	104/269	70/269	Parapleurolophocercous cercaria (34/60) Xiphidiocercaria (2/42)	1-61 (8.3, 579)	26.0	8.3
Hot-dry	*M. tuberculata*	16/60	0/60	Parapleurolophocercous cercaria (16/60)	0	0	0
	Ta. granifera	8/60	0/60	Parapleurolophocercous cercaria (8/60)	0	0	0
	A. housei	0/27	0/27	-	0	0	0
	B. siamensis siamensis	0/30	0/30	-	0	0	0
	F. doliaris	21/35	19/35	Distome cercaria (2/35)	1-63 (11.6, 221)	54.3	11.6
	F. sumatrensis polygramma	9/21	9/21	-	3-21 (14.1, 127)	42.86	14.1
	F. martensi martensi	18/47	15/47	Xiphidiocercaria (3/47)	2-34 (13.1, 197)	31.9	13.1
	Total	72/280	43/280	Parapleurolophocercous cercaria (24/120) Xiphidiocercaria (3/47) Distome cercaria (2/35)	1-63 (12.7, 545)	15.4	12.7

Table 4 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Mae Rim district (November 2011-October 2012).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Cool	*L. rubiginosa*	0/60	0/60	-	0	0	0
	M. tuberculata	20/36	0/36	Parapleurolophocercous cercaria (4/36) Distome cercaria (16/36)	0	0	0
	Th. scabra	5/20	0/20	Xiphidiocercaria (5/20)	0	0	0
	Ta. granifera	20/30	0/30	Parapleurolophocercous cercaria (9/30) Xiphidiocercaria (1/30) Distome cercaria (10/30) Young redia (1/30)	0	0	0
	B. funiculata	7/30	0/30	Xiphidiocercaria (7/30)	0	0	0
	F. doliaris	21/43	21/43	-	1-26 (16.6, 348)	48.8	16.6
	F. sumatrensis polygramma	7/23	7/23	-	7-16 (12.3, 86)	30.4	12.3
	F. martensi martensi	18/30	18/30	-	2-56 (10.8, 194)	60	10.8
	Total	98/272	46/272	Parapleurolophocercous cercaria (13/66) Distome cercaria (26/66)	1-56 (13.7, 628)	16.9	13.7

Table 4 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Mae Rim district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Cool	Total	98/272	46/272	Young redia (1/30) Xiphidiocercaria (13/80)	1-56 (13.7, 628)	16.9	13.7
Rainy	*C. helena*	0/30	0/30	-	0	0	0
	M. tuberculata	24/60	0/60	Parapleurolophocercous cercaria (24/60)	0	0	0
	Ta. granifera	31/60	0/60	Parapleurolophocercous cercaria (31/60)	0	0	0
	A. housei	0/19	0/19	-	0	0	0
	B. siamensis siamensis	0/30	0/30	-	0	0	0
	F. doliaris	31/53	31/53		3-42 (10.3, 318)	58.5	10.3
	F. sumatrensis polygramma	4/17	4/17	-	1-8 (9, 36)	23.5	9
	F. martensi martensi	27/62	27/62		1-53 (10.5, 284)	43.6	10.5
	Total	117/331	62/331	Parapleurolophocercous cercaria (55/120)	1-53 (10.3, 638)	18.7	10.3
Hot-dry	*C. helena*	0/30	0/30	-	0	0	0
	M. tuberculata	17/60	0/60	Parapleurolophocercous cercaria (17/60)	0	0	0
	Ta. granifera	23/60	0/60	Parapleurolophocercous cercaria (17/60) Distome cercaria (6/60)	0	0	0

Table 4 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Mae Rim district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Hot-dry	*B. siamensis siamensis*	0/30	0/30	-	0	0	0
	F. doliaris	36/74	32/74	Xiphidiocercaria (4/74)	1-96 (12.9, 412)	43.2	12.9
	F. sumatrensis polygramma	15/38	15/38	-	1-21 (8.5, 128)	39.5	8.5
	F. martensi martensi	39/54	38/54	Distome cercaria (1/54)	2-56 (12.6, 479)	70.4	12.6
	Total	130/346	85/346	Parapleurolophocercous c ercaria (34/120) Distome cercaria (7/114) Xiphidiocercaria (4/74)	1-96 (12.0, 1,019)	24.6	12.0

Table 5 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Mae Taeng district (November 2011-October 2012).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Cool	*C. helena*	4/32	0/32	Parapleurolophocercous cercaria (4/32)	0	0	0
	E. eyriesi	20/32	4/32	Distome cercaria (16/32)	2-17 (14, 56)	11.1	14.0
	A. housei	1/30	0/30	Parapleurolophocercous cercaria (1/30)	0	0	0
	M. tuberculata	42/80	0/80	Parapleurolophocercous cercaria (38/80) Pleurolophocercous cercaria (1/80) Metacercaria unknown I (3/80)	0	0	0
	Th. granifera	4/50	0/50	Parapleurolophocercous cercaria (3/50) Young redia (1/50)	0	0	0
	B. siamensis siamensis	1/50	0/50	Furcocercous cercaria (1/50)	0	0	0
	F. doliaris	52/57	52/57	-	3-129 (22.9, 1,190)	91.2	22.9
	F. sumatrensis polygramma	32/42	32/42	-	1-91 (10.0, 320)	76.2	10
	F. martensi martensi	28/43	26/43	Xiphidiocercaria (2/43)	1-63 (14.8, 385)	60.5	14.8
	Total	184/416	114/416	Parapleurolophocercous cercaria (46/192)	1-129 (17.1, 1,951)	27.4	17.1

Table 5 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Mae Taeng district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Cool	Total	184/416	114/416	Pleurolophocercous cercaria (1/80) Young redia (1/50) Xiphidiocercaria (2/43) Furcocercous cercaria (1/50) Distome cercaria (16/32) Metacercaria unknown I (3/80)	1-129 (17.1, 1,951)	27.4	17.1
Rainy	*C. helena*	0/50	0/50	-	0	0	0
	M. tuberculata	21/60	0/60	Parapleurolophocercous cercaria (19/60) Pleurolophocercous cercaria (2/60)	0	0	0
	Ta. granifera	41/60	0/60	Parapleurolophocercous cercaria (31/60) Distome cercaria (10/60)	0	0	0
	B. siamensis siamensis	1/50	0/50	Forcocercous cercaria (1/50)	0	0	0

Table 5 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Mae Taeng district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Rainy	*F. doliaris*	43/67	43/67	-	1-121 (12.2, 523)	64.2	12.2
	F. sumatrensis polygramma	23/44	23/44	-	3-41 (10.4, 239)	52.3	10.4
	F. martensi martensi	33/52	32/52	Distome cercaria (1/52)	2-67 (12.4, 396)	61.5	12.4
	Total	162/383	98/383	Parapleurolophocercous cercaria (50/120) Pleurolophocercous cercaria (2/60) Distome cercaria (11/112) Forcocercous cercaria (1/50)	1-96 (11.8, 1,158)	25.6	11.8
Hot-dry	*C. helena*	0/50	0/50	-	0	0	0
	E. eyriesi	12/27	7/27	Distome cercaria (5/27)	1-24 (12.4, 87)	25.9	12.4
	M. tuberculata	23/60	0/60	Parapleurolophocercous cercaria (20/60) Distome cercaria (3/60)	0	0	0
	Th. scabra	34/60	0/60	Parapleurolophocercous cercaria (34/60)	0	0	0
	A. housei	0/36	0/36	-	0	0	0

Table 5 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Mae Taeng district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Hot-dry	*B. siamensis siamensis*	7/34	0/34	Furcocercous cercaria (7/34)	0	0	0
	F. doliaris	54/78	54/78	-	2-87 (18.1, 975)	69.2	18.1
	F. sumatrensis polygramma	23/46	23/46	-	1-38 (14.8, 341)	50.0	14.8
	F. martensi martensi	53/64	50/64	Xiphidiocercaria (3/64)	1-76 (10.3, 513)	78.1	10.3
	Total	206/455	134/455	Parapleurolophocercous cercaria (54/120) Distome cercaria (8/87) Furcocercous cercaria (7/34) Xiphidiocercaria (3/64)	1-87 (14.3, 1,916)	29.5	14.3

Table 6 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Muang Chiang Mai district (November 2011-October 2012).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Cool	*M. tuberculata*	11/30	0/30	Parapleurolophocercous cercaria (11/30)	0	0	0
	Th. scabra	5/46	0/46	Parapleurolophocercous cercaria (3/46) Xiphidiocercaria (2/46)	0	0	0
	Ta. granifera	17/60	0/60	Parapleurolophocercous cercaria (17/60)	0	0	0
	B. funiculata	2/30	0/30	Xiphidiocercaria (2/30)	0	0	0
	F. doliaris	11/53	11/53	-	1-13 (19.4, 213)	20.8	19.4
	F. martensi martensi	5/27	3/27	Distome cercaria (1/27) Xiphidiocercaria (1/27)	2-57 (24.7, 74)	11.1	24.67
	Total	51/246	14/246	Parapleurolophocercous cercaria (31/136) Distome cercaria (1/27) Xiphidiocercaria (5/103)	1-57 (20.5, 287)	5.7	20.5

Table6 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Muang Chiang Mai district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Rainy	*C. helena*	0/44	0/44	-	0	0	0
	M. tuberculata	21/57	0/57	Parapleurolophocercous cercaria (21/57)	0	0	0
	Ta. granifera	42/60	0/60	Parapleurolophocercous cercaria (31/60) Distome cercaria (11/60)	0	0	0
	B. siamensis siamensis	2/38	0/38	Furcocercous cercaria (1/38) Xiphidiocercaria (1/38)	0	0	0
	F. doliaris	12/33	11/33	Xiphidiocercaria (1/33)	1-26 (11.6, 128)	33.3	11.6
	F. martensi martensi	23/46	23/46	-	1-32 (9.9, 228)	50	9.9
	Total	100/278	34/278	Parapleurolophocercous cercaria (52/117) Distome cercaria (11/60) Furcocercous cercaria (1/38) Xiphidiocercaria (2/71)	1-32 (10.5, 356)	12.2	10.5

Table 6 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Muang Chiang Mai district (November 2011-October 2012) (continued).

Seasonal	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Hot-dry	*C. helena*	0/60	0/60	-	0	0	0
	L. rubiginosa	0/60	0/60	-	0	0	0
	T. scabra	23/56	0/56	Parapleurolophocercous cercaria (17/56) Distome cercaria (6/56)	0	0	0
	M. tuberculata	34/63	0/63	Parapleurolophocercous cercaria (27/63) Distome cercaria (7/63)	0	0	0
	F. doliaris	16/43	16/43	-	2-54 (7.9, 127)	37.2	7.9
	F. sumatrensis polygramma	10/29	9/29	Xiphidiocercaria (1/29)	1-14 (7.4, 67)	31.0	7.4
	F. martensi martensi	13/40	12/40	Distome cercaria (1/40)	1-27 (8.0, 96)	30	8.0
	Total	96/351	37/351	Parapleurolophocercous cercaria (44/119) Distome cercaria (14/159) Xiphidiocercaria (1/29)	1- 54 (7.8, 290)	10.5	7.8

Table 7 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from San Kamphaeng district (November 2011-October 2012).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Cool	*C. helena*	0/60	0/60	-	0	0	0
	Th. scabra	32/44	0/44	Parapleurolophocercous cercaria (22/44) Young redia (6/44) Metacercaria unknown I (4/44)	0	0	0
	M. tuberculata	24/60	0/60	Parapleurolophocercous cercaria (24/60)	0	0	0
	Ta. granifera	7/50	0/50	Parapleurolophocercous cercaria (4/50) Distome cercaria (1/50) Young redia (2/50)	0	0	0
	B. funiculata	0/50	0/50	-	0	0	0
	F. doliaris	45/82	45/82	Xiphidiocercaria (1/82)	1-22 (2.8, 124)	54.9	2.8
	F. martensi martensi	5/50	5/50	-	1-4 (1.6, 8)	10.0	1.6
	Total	113/396	50/396	Parapleurolophocercous cercaria (50/154) Distome cercaria (1/50)	1-22 (2.6, 132)	12.6	2.6

Table 7 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from San Kamphaeng district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Cool	Total	113/396	50/396	Young redia (8/94) Xiphidiocercaria (1/82) Metacercaria unknown I (4/44)	1-22 (2.64, 132)	12.63	2.64
Rainy	*C. helena*	0/60	0/60	-	0	0	0
	M. tuberculata	31/60	0/60	Parapleurolophocercous cercaria (21/60) Distome cercaria (10/60)	0	0	0
	Ta. granifera	19/60	0/60	Parapleurolophocercous cercaria (19/60)	0	0	0
	A. housei	1/12	0/12	Parapleurolophocercous cercaria (1/12)	0	0	0
	B. funiculata	3/30	0/30	Furcocercous cercaria (3/30)	0	0	0
	F. doliaris	26/42	24/42	Xiphidiocercatia (2/42)	2-57 (11.5, 276)	57.1	11.5
	F. sumatrensis polygramma	7/22	6/22	Xiphidiocercatia (1/22)	1-14 (9.3, 56)	27.3	9.3
	F. martensi martensi	36/54	31/54	Xiphidiocercaria (5/54)	1-34 (11.2, 346)	57.4	11.2

Table 7 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from San Kamphaeng district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Rainy	Total	123/340	61/340	Parapleurolophocercous cercaria (41/132) Distome cercaria (10/60) Furcocercous cercaria (3/30) Xiphidiocercatia (8/118)	1-57 (11.1, 678)	17.9	11.1
Hot-dry	*C. helena*	0/60	0/60	-	0	0	0
	M. tuberculata	21/60	0/60	Parapleurolophocercous cercaria (20/60) Distome cercaria (1/60)	0	0	0
	Ta. granifera	41/60	0/60	Parapleurolophocercous cercaria (41/60)	0	0	0
	Th. scabra	13/60	0/60	Parapleurolophocercous cercaria (13/60)	0	0	0
	F. doliaris	44/63	44/63	-	1-41 (13.1, 578)	69.8	13.1
	F. sumatrensis polygramma	11/27	10/27	Xiphidiocercaria (1/27)	1-8 (6.4, 64)	30.0	6.4
	F. martensi martensi	28/47	26/47	Xiphidiocercaria (2/47)	1-28 (8.4, 217)	55.3	8.4

Table 7 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from San Kamphaeng district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Hot-dry	Total	158/377	80/377	Parapleurolophocercous cercaria (74/180) Distome cercaria (1/60) Xiphidiocercaria (3/74)	1-41 (10.7, 859)	21.2	10.7

Table 8 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from San Pa Tong district (November 2011-October 2012).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Cool	*L. rubiginosa*	0/60	0/60	-	0	0	0
	M. tuberculata	10/53	0/53	Parapleurolophocercous cercaria (7/53) Distome cercaria (3/53)	0	0	0
	Th. scabra	12/58	0/58	Parapleurolophocercous cercaria (12/58)	0	0	0
	Ta. granifera	24/60	0/60	Parapleurolophocercous cercaria (18/60) Distome cercaria (5/60) Young redia (1/60)	0	0	0
	B. funiculata	0/30	0/30	-	0	0	0
	F. doliaris	36/44	36/44	-	2-219 (9.1, 328)	81.8	9.1
	F. sumatrensis polygramma	17/31	17/31	-	1-12 (4.4, 74)	54.8	4.4
	F. martensi martensi	38/50	35/50	Xiphidiocercaria (3/50) Furcocercous cercaria (1/50)	1-30 (6.3, 220)	70	6.3
	Total	137/386	88/386	Parapleurolophocercous cercaria (37/171) Distome cercaria (8/113)	1-219 (7.1, 622)	22.8	7.1

Table 8 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from San Pa Tong district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Cool	Total	137/386	88/386	Young redia (1/60) Xiphidiocercaria (3/50) Furcocercous cercaria (1/50)	1-219 (7.1, 622)	22.8	7.1
Rainy	*L. rubiginosa*	0/60	0/60	-	0	0	0
	M. tuberculata	19/60	0/60	Parapleurolophocercous cercaria (19/60)	0	0	0
	Ta. granifera	31/60	0/60	Parapleurolophocercous cercaria (27/60) Distome cercaria (4/60)	0	0	0
	A. housei	0/12	0/12	-	0	0	0
	B. siamensis siamensis	3/60	0/60	Furcocercous cercaria (3/60)	0	0	0
	F. doliaris	58/86	55/86	Furcocercous cercaria (3/86)	1-72 (11.2, 617)	64.0	11.2
	F. sumatrensis polygramma	11/26	11/26	-	1-18 (10.3, 113)	42.3	10.3
	F. martensi martensi	39/65	37/65	Xiphidiocercaria (2/65)	1-54 (11.8, 438)	56.9	11.8
	Total	161/429	103/429	Parapleurolophocercous cercaria (46/120)	1-72 (11.3, 1,168)	24.0	11.3

Table 8 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from San Pa Tong district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Rainy	Total	161/429	103/429	Distome cercaria (4/60) Furcocercous cercaria (6/146) Xiphidiocercaria (2/65)	1-72 (11.3, 1,168)	24.0	11.3
Hot-dry	*C. helena*	0/60	0/60	0	0	0	0
	M. tuberculata	31/60	0/60	Parapleurolophocercous cercaria (31/60)	0	0	0
	Ta. granifera	23/58	0/58	Parapleurolophocercous cercaria (17/58) Distome cercaria (6/58)	0	0	0
	A. housei	2/14	0/14	Parapleurolophocercous cercaria (2/14)	0	0	0
	B. siamensis siamensis	0/60	0/60	-	0	0	0
	F. doliaris	23/48	20/48	Xiphidiocercaria (3/48)	1-43 (15.9, 318)	41.7	15.9
	F. sumatrensis polygramma	15/27	15/27	-	1-14 (7.6, 114)	55.6	7.6
	F. martensi martensi	44/52	42/52	Furcocercous cercaria (2/52)	2-107 (14.6, 612)	80.7	14.6

Table 8 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from San Pa Tong district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Hot-dry	Total	138/379	77/379	Parapleurolophocercous cercaria (50/132) Xiphidiocercaria (3/48) Distome cercaria (6/58) Furcocercous cercaria (2/52)	1-107 (13.6, 1,044)	20.3	13.6

Table 9 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Saraphi district (November 2011-October 2012).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Cool	*C. helena*	10/60	10/60	-	1-2 (1.2, 12)	16.7	1.2
	L. rubiginosa	2/60	0/60	Young redia (2/60)	0	0	0
	M. tuberculata	5/45	0/45	Pleurolophocercous cercaria (5/45)	0	0	0
	A. housei	5/40	0/40	Pleurolophocercous cercaria (5/40)	0	0	0
	B. funiculata	22/50	22/50	-	1-7 (3.0, 65)	44.0	3.0
	B. siamensis siamensis	25/30	0/30	Metacercaria unknown III (17/30) Gymnocercous cercaria (11/30) Monostome c ercaria (3/30) Furcocercous cercaria (1/30) Xiphidiocercaria (4/30)	0	0	0
	F. doliaris	16/34	16/34	-	1-15 (4.9, 79)	47.1	4.9
	F. sumatrensi polygramma	16/34	16/34	-	1-5 (2, 32)	47.1	2.0
	F. martensi martensi	8/48	8/48	-	1-14 (4.3, 34)	16.7	4.3
	Total	109/401	72/401	Young redia (2/60)	1-15 (3.1, 222)	18.0	3.1

Table 9 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Saraphi district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Cool	Total	109/401	72/401	Pleurolophocercous cercaria (10/85) Metacercaria unknownIII (17/30) Gymnocercous cercaria (11/30) Monostome cercaria (3/30) Furcocercous cercaria (1/30) Xiphidiocercaria (4/30)	1-15 (3.1, 222)	18.0	3.1
Rainy	*C. helena*	0/60	0/60	-	0	0	0
	L. rubiginosa	0/60	0/60	-	0	0	0
	M. tuberculata	42/60	0/60	Parapleurolophocercous cercaria (34/60) Distome cercaria (8/60)	0	0	0
	Ta. granifera	7/53	0/53	Pleurolophocercous cercaria (7/53)	0	0	0
	B. siamensis siamensis	14/60	0/60	Monostome cercaria (10/60) Furcocercous cercaria (4/60)	0	0	0

Table 9 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Saraphi district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Rainy	*F. doliaris*	31/44	31/44	-	1-78 (21.9, 678)	70.5	21.9
	F. sumatrensis polygramma	17/28	15/28	Xiphidiocercaria (2/28)	1-22 (7.8, 117)	53.6	7.8
	F. martensi martensi	39/77	39/77	-	1-102 (18.3, 714)	50.7	18.3
	Total	150/442	85/442	Parapleurolophocercous cercaria (34/60) Distome cercaria (8/60) Pleurolophocercous cercaria (7/53) Monostome cercaria (10/60) Furcocercous cercaria (4/60) Xiphidiocercaria (2/28)	1-102 (17.8, 1,509)	19.2	17.8
Hot-dry	*M. tuberculata*	37/60	0/60	Parapleurolophocercous cercaria (37/60)	0	0	0
	Ta. granifera	23/60	0/60	Parapleurolophocercous cercaria (23/60)	0	0	0
	B. funiculata	7/42	0/42	Futrcocercous cercaria (7/42)	0	0	0
	B. siamensi siamensis	4/30	0/30	Monostome cercaria (4/30)	0	0	0

Table 9 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from Saraphi district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Hot-dry	*F. doliaris*	33/52	33/52	-	1-84 (14.5, 479)	63.5	14.5
	F. sumatrensis polygramma	19/31	19/31	-	1-44 (10.2, 193)	61.3	10.7
	F. martensi martensi	29/55	28/55	Xiphidiocercaria (1/55)	1-38 (11.3, 317)	50.9	11.3
	Total	152/330	80/330	Parapleurolophocercous cercaria (60/120) Furcocercous cercaria (7/42) Monostome cercaria (4/30) Xiphidiocercaria (1/55)	1-84 (12.4, 989)	24.2	12.4

Table 10 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from San Sai district (November 2011-October 2012).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Cool	*M. tuberculata*	37/60	0/60	Parapleurolophocercous cercaria (30/60) Distome cercaria (7/60)	0	0	0
	Th. scabra	21/60	0/60	Parapleurolophocercous cercaria (21/60)	0	0	0
	Ta. granifera	33/60	0/60	Parapleurolophocercous cercaria (27/60) Xiphidiocercaria (6/60)	0	0	0
	B. siamensis siamensis	2/60	0/60	Furcocercous cercaria (2/60)	0	0	0
	F. doliaris	50/50	50/50	-	26-353 (131.0, 6,550)	100	131.0
	F. sumatrensis polygramma	20/20	20/20	-	17-26 (23.5, 470)	100	23.5
	F. martensi martensi	84/94	84/94	Furcocercous cercaria (1/94)	2-124 (32.0, 2,686)	89.4	32.0
	Total	247/404	154/404	Parapleurolophocercous cercaria (78/180) Distome cercaria (7/60) Xiphidiocercaria (6/60) Furcocercous cercaria (3/154)	2-353 (63.0, 9,706)	38.1	63.0

Table 10 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from San Sai district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Rainy	*C. helena*	0/60	0/60	-	0	0	0
	M. tuberculata	33/60	0/60	Parapleurolophocercous cercaria (30/60) Distome cercaria (3/60)	0	0	0
	Ta. granifera	21/60	0/60	Parapleurolophocercous cercaria (21/60)	0	0	0
	F. doliaris	98/102	98/102	-	1-114 (18.1, 1,769)	96.1	18.1
	F. sumatrensis polygramma	81/86	81/86	-	1-97 (11.4, 920)	94.2	11.4
	F. martensi martensi	69/74	67/74	Xiphidiocercaria (2/74)	1-78 (13.4, 897)	90.5	13.4
	Total	302/442	246/442	Parapleurolophocercous cercaria (51/120) Distome cercaria (3/60) Xiphidiocercaria (2/74)	1-114 (14.6, 3,586)	55.7	14.6
Hot-dry	*M. tuberculata*	28/60	0/60	Parapleurolophocercous cercaria (28/60)	0	0	0
	Ta. granifera	38/60	0/60	Parapleurolophocercous cercaria (33/60) Xiphidiocercaria (5/60)	0	0	0
	B. funiculata	0/30	0/30	-	0	0	0

Table 10 Survey of *Echinostoma* sp. metacercariae and other larval trematode in freshwater snail from San Sai district (November 2011-October 2012) (continued).

Season	Snail species	No. infected/ examined snail	*Echinostoma* spp. (No. infected/ examined snail)	Other larval trematode (No. infected/examined snail)	No. of *Echinostoma* sp. metacercariae isolated range (mean, total)	Prevalence of *Echinostoma* sp. (%)	Intensity of *Echinostoma* sp.
Hot-dry	*B. siamensis siamensis*	3/60	0/60	Furcocercous ceraria (3/60)	0	0	0
	F. doliaris	76/88	76/88	-	1-76 (16.0, 1,217)	86.4	16.0
	F. sumatrensis polygramma	80/83	80/83	-	1-85 (9.0, 720)	96.4	9.0
	F. martensi martensi	77/77	77/77	-	1-118 (13.0, 997)	100.0	13.0
	Total	302/458	233/458	Parapleurolophocercous cercaria (61/120) Xiphidiocercaria (5/60) Furcocercous ceraria (3/60)	1-118 (12.6, 2,934)	50.9	12.6

APPENDIX B

Characteristic features of the 37-collar-spined *Echinostoma* belonging to the '*revolutum*' group

Table 1 Characteristic features of the 37-collar-spined *Echinostoma* belonging to the '*revolutum*' group

Species	Adult worm morphology	1st intermediate host (snails)	2nd intermediate host (freshwater animals)	Definitive hosts	Gepgraphic distribution	Reference
E. revoltum	Testes slightly lobed. Cirrus sac well developed and elongate-oval. Eggs: 72.5 - 120 × 40 - 82.5 μm	*Filopaludina*	Gastropods *(Filopaludina*)	Birds, Mammals	Thailand (Chiang Mai)	(present study)
E. revolutum	Cirrus sac extending to middle of acetabulum. Testes smooth or slightly lobated. Eggs: 88-113×61-74 μm	*Lymnaea*	Gastropods, Bivalves, Fish, Tadpoles, Turtles	Birds, Mammals (including man)	Europe Asia North America	Kanev (1994) Chai *et al.* (2011) Toledo *et al*. (2009)
E. caproni	Two testes confluent/adjacent. Body broadest at just posterior to acetabulum Attenuated posterior end. Eggs: 117×75 μm	*Biomphalaria* *Bulinus*	Gastropods Tadpoles	Birds (chick, duck, pigeon) Mammals (mouse, rat, hamster)	Africa (Madagascar)	Maldonado (2003) Toledo *et al.* (2009)
E. trivolvis	Body slightly plump. Cirrus sac extending to middle of acetabulum. Testes smooth, oval, or slightly irregular in outline. Eggs: 90-130×60-70μm	*Helisoma* *Biomphalaria*	Gastropods, Mussels, Planarians, Tadpoles, Fish Amphibians, Turtles	Birds (pigeon, duck, chicken) Mammals (hamster, mouse, rat)	North America South America (Brazil)	Toledo *et al.* (2009) Kanev (1995)

Table 1 Characteristic features of the 37-collar-spined *Echinostoma* belonging to the '*revolutum*' group (continued)

Species	Adult worm morphology	1st intermediate host (snails)	2nd intermediate host (freshwater animals)	Definitive hosts	Gepgraphic distribution	References
E. paraensei	5 -11 of dorsal most collar spines smaller than others. Eggs: 104-122×74-86 μm	*Biomphalaria* *Physa*	Gastropods	Mammals (hamster, mouse, rat)	South America (Brazil)	Lie and Basch (1967) Toledo *et al.* (2009) Maldonado (2003)
E. friedi	Cirrus sac extending to anterior margin of acetabulum. Testes usually lobated Eggs: 83-117×54-76 μm	*Lymnaea, Radix* *Gyraulus,* *Biomphalaria* *Bulinus*	Gastropods	Bird, Mammals (mouse)	Europe (Spain)	Toledo *et al.* (2009) Toledo *et al.* (2000)
E. miyagawai	Very elongate body. Large head collar. Small ventral sucker. Testes indented and subglobular. Long cirrus sac extending to middle portion of cetabulum Eggs: 95×60 μm	*Planorbis* *Planorbarius* *Anisus* *Lymnaea*	Gastropods	Birds Mammals	Europe (Bulgaria, Czech Republic) Asia (Japan, Korea)	Kostadinova (2000) Toledo *et al.* (2009)
E. echinatum	Deeply lobed testes. Cirrus sac never extending to middle of acetabulum Eggs: 92-124×65-76 μm	*Anisus* *Biomphalaria*	Gastropods	Birds Mammals (including man)	Europe Asia (Celebes) South America (Brazil)	Kostadinova (2000) Sandground and Bonne (1940) Lie and Basch (1966)

Table 1 Characteristic features of the 37-collar-spined *Echinostoma* belonging to the '*revolutum*' group (continued)

Species	Adult worm morphology	1st intermediate host (snails)	2nd intermediate host (freshwater animals)	Definitive hosts	Gepgraphic distribution	References
E. parvocirrus	Small cirrus Eggs: 101-115×55-70 μm	*Biomphalaria*	Gastropods	Birds	West Indies (Guadeloupe)	Toledo *et al.* (2009) Nassi and Dupouy (1988)
E. luisreyi	Smaller oral lateral corner spines and larger aboral lateral corner spines. Dorsally situated excretory pore Eggs: 89-113×65-82 μm	*Physa*	Gastropods	Mammals (mouse, hamster)	South America (Brazil)	Toledo *et al.* (2009) Maldonado *et al.* (2003)
E. jurini	Cirrus sac extending to middle portion of acetabulum. Testes smooth or slightly irregular in outline. Eggs: 96-132×72-88 μm	*Viviparus*	Gastropods Molluscs Frogs	Mammals	Europe (Bulgaria, Czech Republic, Slovakia) Asia	Toledo *et al.* (2009) Kanev *et al.* (1995)

APPENDIX C

Worm Recovery

Table 1 The worm recovery of *Echinostoma revolutum* from chicks, experimentally infected with 50 metacercariae in each chick during 1-60 days post-infection.

Day after infection	Number of worm recovery										Total	Worm recovery rate (%)
	esophagus	crop	stomach		small intestine			caecum	large intestine	cloaca		
			proventiculus	gizzard	duodenum	jejunum	ilium					
1	0	0	0	0	0	0	6	0	0	0	6	12
2	0	0	0	0	0	20	0	0	0	0	20	40
3	0	0	0	0	0	2	12	0	0	0	14	28
4	0	0	0	0	0	0	20	0	0	0	20	40
5	0	0	0	0	0	0	23	0	0	0	23	46
6	0	0	0	0	0	0	5	0	0	0	5	10
7	0	0	0	0	0	0	35	0	0	0	35	70
8	0	0	0	0	0	3	9	1	0	0	12	24
9	0	0	0	0	0	0	15	0	0	0	15	30
10	0	0	0	0	0	2	10	0	0	0	12	24
11	0	0	0	0	0	5	12	0	0	0	17	34
12	0	0	0	0	0	7	9	0	0	0	16	32
13	0	0	0	0	0	3	5	0	0	0	8	16
14	0	0	0	0	0	0	16	0	0	0	16	32
15	0	0	0	0	0	0	7	2	0	0	9	18
16	0	0	0	0	0	2	15	0	0	0	17	34
17	0	0	0	0	0	0	25	2	0	0	27	54

Table 1 The worm recovery of *Echinostoma revolutum* from chicks, experimentally infected with 50 metacercariae in each chick during 1-60 days post-infection (continued).

Day after infection	Number of worm recovery										Total	Worm recovery rate (%)
	esophagus	crop	stomach		small intestine			caecum	large intestine	cloaca		
			proventiculus	gizzard	duodenum	jejunum	ilium					
18	0	0	0	0	0	0	2	0	0	0	2	4
19	0	0	0	0	0	0	12	0	0	0	12	24
20	0	0	0	0	0	0	1	0	0	0	1	2
21	0	0	0	0	0	5	5	0	0	0	10	20
22	0	0	0	0	0	7	2	0	0	0	9	18
23	0	0	0	0	0	0	14	0	0	0	14	28
24	0	0	0	0	0	22	3	0	0	0	25	50
25	0	0	0	0	0	0	6	0	0	0	6	12
26	0	0	0	0	0	1	4	0	0	0	5	10
27	0	0	0	0	0	4	8	0	0	0	12	24
28	0	0	0	0	0	0	3	0	0	0	3	6
29	0	0	0	0	0	11	6	0	0	0	17	34
30	0	0	0	0	0	1	12	1	0	0	14	28
31	0	0	0	0	0	0	7	0	0	0	7	14
32	0	0	0	0	0	3	7	0	0	0	10	20
33	0	0	0	0	0	2	7	0	0	0	9	18
34	0	0	0	0	0	1	2	0	0	0	3	6

Table 1 The worm recovery of *Echinostoma revolutum* from chicks, experimentally infected with 50 metacercariae in each chick during 1-60 days post-infection (continued).

Day after infection	Number of worm recovery										Total	Worm recovery rate (%)
	esophagus	crop	stomach		small intestine			caecum	large intestine	cloaca		
			proventiculus	gizzard	duodenum	jejunum	ilium					
35	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	1	2	0	0	0	3	6
37	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0

Table 1 The worm recovery of *Echinostoma revolutum* from chicks, experimentally infected with 50 metacercariae in each chick during 1-60 days post-infection (continued).

Day after infection	Number of worm recovery										Total	Worm recovery rate (%)
	esophagus	crop	stomach		small intestine			caecum	large intestine	cloaca		
			proventiculus	gizzard	duodenum	jejunum	ilium					
52	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*102*	*327*	*6*	*0*	*0*	*435*	*24.17*

APPENDIX D

Molecular Data

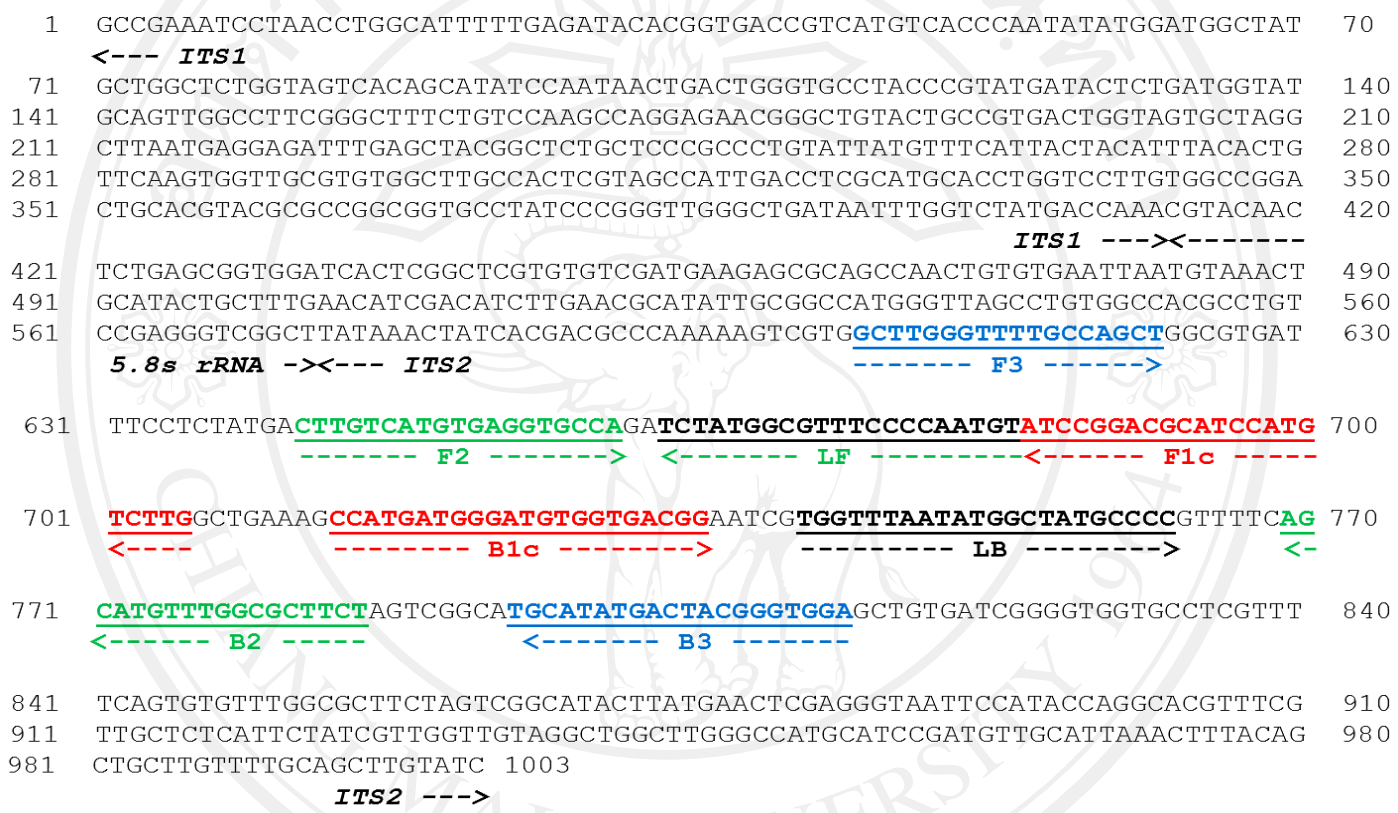

Figure 1 Location of the loop-mediated isothermal amplification forward (F3) and backward (B3) outer primers, internal forward (FIP: F1c+F2) and backward (BIP: B1c+B2) primers and of forward (LF) and backward (LB) loop primers within the respective sequences ITS2 of *E. revolutum*.

Table 1 Sequences of ITS2 of *Echinostoma revolutum* from various isolates in Southeast Asia.

Sequence name	Sequence	Length (bp)
E. revolutum THA (Fm)	GCTTATAAACTATCACGACGCCCAAAAAGTCGTGGCTTGGGTTTTGCCAGCTGGCGTGATTTCCTCTATGACTTGTCATGTGAGGTGCCAGATCTATGGCGTTTCCCCAATG TATCCGGATGCATCCATGTCCTGGTCGAATGCCATGATGGGATGTGGTGACGGAATCGTGGTTTAATATGGCTATGCCCCGTTTTCAGCATGTTTGGCGCTTCTAGTCGGCA TGCATATGACTACNGGTGGAGCTGTGATCGGGGTGGTACTTCGTTTTCAGTGTGTTTGGCGCTTCTAGTCGGCACACTTATGAACTCGAGGGTAATTCCATACCANGCACGT TTCGTTGCTTTCGTTCTATTATTGGTTTGTAGGCTGGCTTGNGCCATGCACCGATGTTGCATTGAACATTATAGCTGCTCGTTTTGCAGCTATTATC	433
E. revolutum THA (Fd)	GCTTATAAACTATCACGACGCCCAAAAAGTCGTGGCTTGGGTTTTGCCAGCTGGCGTGATTTCCTCTATGACTTGTCATGTGAGGTGCCAGATCTATGGCGTTTCCCCAATG TATCCGGATGCATCCATGTCCTGGTCGAATGCCATGATGGGATGTGGTGACGGAATCGTGGTTTAATATGGCTATGCCCCGTTTTCAGCATGTTTGGCGCTTCTAGTCGGCA TGCATATGACTACGGGTGGAGCTGTGATCGGGGTGGTACTTCGTTTTCAGTGTGTTTGGCGCTTCTAGTCGGCACACTTATGAACTCGAGGGTAATTCCATACCAGCACGTT TCGTTGCTTTCGTTCTATTATTGGTTGTAGGCTGGCTTGGCCATGCACCGATGTTGCATTGAACATTATAGCTGCTCGTTTTGCAGCTATTATC	430
E. revolutum THA (Fp)	GCTTATAAACTATCACGACGCCCAAAAAGTCGTGGCTTGGGTTTTGCCAGCTGGCGTGATTTCCTCTATGACTTGTCATGTGAGGTGCCAGATCTATGGCGTTTCCCCAATG TATCCGGATGCATCCATGTCCTGGTCGAATGCCATGATGGGATGTGGTGACGGAATCGTGGTTTAATATGGCTATGCCCCGTTTTCAGCATGTTTGGCGCTTCTAGTCGGCA TGCATATGACTACNGGTGGAGCTGTGATCGGGGTGGTACTTCGTTTTCAGTGTGTTTGGCGCTTCTAGTCGGCACACTTATGAACTCGAGGGTAATTCCATACCACGCACGT TTCGTTGCTTTCGTTCTATTATTGGTTGTAGGCTGGCTTGGCCATGCACCGATGTTGCATTGAACATTATAGCTGCTCGTTTTGCAGCTATTATC	431
E. revolutum THA (Bf)	GCTTATAAACTATCACGACGCCCAAAAAGTCGTGGCTTGGGTTTTGCCAGCTGGCGTGATTTCCTCTATGACTTGTCATGTGAGGTGCCAGATCTATGGCGTTTCCCCAATG TATCCGGATGCATCCATGTCCTGGTCGAATGCCATGATGGGATGTGGTGACGGAATCGTGGTTTAATATGGCTATGCCCCGTTTTCAGCATGTTTGGCGCTTCTAGTCGGCA TGCATATGACTACNGGTGGAGCTGTGATCGGGGTGGTACTTCGTTTTCAGTGTGTTTGGCGCTTCTAGTCGGCACACTTATGAACTCGAGGGTAATTCCATACCACGCACGT TTCGTTGCTTTCGTTCTATTATTGGTTGTAGGCTGGCTTGGGCCATGCACCGATGTTGCATTGAACATTATAGCTGCTCGTTTTGCAGCTATATC	431
E. revolutum THA (Bs)	GCTTATAAACTATCACGACGCCCAAAAAGTCGTGGCTTGGGTTTTGCCAGCTGGCGTGATTTCCTCTATGACTTGTCATGTGAGGTGCCAGATCTATGGCGTTTCCCCAATG TATCCGGATGCATCCATGTCCTGGTCGAATGCCATGATGGGATGTGGTGACGGAATCGTGGTTTAATATGGCTATGCCCCGTTTTCAGCATGTTTGGCGCTTCTAGTCGGCA TGCATATGACTACGGGTGGAGCTGTGATCGGGGTGGTACTTCGTTTTCAGTGTGTTTGGCGCTTCTAGTCGGCACACTTATGAACTCGAGGGTAATTCCATACCANGCACGT TTCGTTGCTTTCGTTCTATTATTGGTTTGTAGGCTGGCTTGGGCCATGCACCGATGTTGCATTGAACATTATAGCTGCCTCGTTTTGCAGCTATTATC	434
E. revolutum THA (Ch)	GCTTATAAACTATCACGACGCCCAAAAAGTCGTGGCTTGGGTTTTGCCAGCTGGCGTGATTTCCTCTATGACTTGTCATGTGAGGTGCCAGATCTATGGCGTTTCCCCAATG TATCCGGATGCATCCATGTCCTGGTCGAATGCCATGATGGGATGTGGTGACGGAATCGTGGTTTAATATGGCTATGCCCCGTTTTCAGCATGTTTGGCGCTTCTAGTCGGCA TGCATATGACTACNGGTGGAGCTGTGATCGGGGTGGTACTTCGTTTTCAGTGTGTTTGGCGCTTCTAGTCGGCACACTTATGAACTCGAGGGTAATTCCATACCAGCACGTT TCGTTGCTTTCGTTCTATTATTGGTTTGTAGGCTGGCTTGGCCATGCACCGATGTTGCATTGAACATTATAGCTGCTCGTTTTGCAGCTATATC	430
E. revolutum THA (Ee)	GCTTATAAACTATCACGACGCCCAAAAAGTCGTGGCTTGGGTTTTGCCAGCTGGCGTGATTTCCTCTATGACTTGTCATGTGAGGTGCCAGATCTATGGCGTTTCCCCAATG TATCCGGATGCATCCATGTCCTGGTCGAATGCCATGATGGGATGTGGTGACGGAATCGTGGTTTAATATGGCTATGCCCCGTTTTCAGCATGTTTGGCGCTTCTAGTCGGCA TGCATATGACTACNGGTGGAGCTGTGATCGGGGTGGTACTTCGTTTTCAGTGTGTTTGGCGCTTCTAGTCGGCACACTTATGAACTCGAGGGTAATTCCATACCACGCACGT TTCGTTGCTTTCGTTCTATTATTGGTTTGTAGGCTGGCTTGGCCATGCACCGATGTTGCATTGAACATTATAGCTGCTCGTTTTGCAGCTATTATC	432
E. revolutum LAO	GCTTATAAACTATCACGACGCCCAAAAAGTCGTGGCTTGGGTTTTGCCAGCTGGCGTGATTTCCTCTATGACTTGTCATGTGAGGTGCCAGATCTATGGCGTTTCCCCAATG TATCCGGATGCATCCATGTCCTGGTCGAATGCCATGATGGGATGTGGTGACGGAATCGTGGTTTAATATGGCTATGCCCCGTTTTCAGCATGTTTGGCGCTCCTAGTCGGCA TGCATATGACTACNGGTGGAGCTGTGATCGGGGTGGTACTTCGTTTTCAGTGTGTTTGGCGCTTCTAGTCGGCACACTTATGAACTCGAGGGTAATTCCATACCANGCACGT TTCGTTGCTTTCGTTCTGTTATTGGTTGTAGGCTGGCTTGGCCATGCACCGATGTTGCATTGAACATTATAGCTGCTCGTTTTGCAGCTATTATC	431
E. revolutum VNM	GCTTATAAACTATCACGACGCCCAAAAAGTCGTGGCTTGGGTTTTGCCAGCTGGCGTGATTTCCTCTATGACTTGTCATGTGAGGTGCCAGATCTATGGCGTTTCCCCAATG TATCCGGATGCATCCATGTCCTGGTTGAATGCCATGATGGGATGTGGTGACGGAATCGTGGTTTAATATGGCTATGCCCCGTTTTCAGCATGTTTGGCGCTCCTAGTCGGCA TGCATATGACTACGGGTGGAGCTGTGATCGGGGTGGTACCTCGTTTTCAGTGTGTTTGGCGCTTCTAGTCGGCACACTTATGAACTCGAGGGTAATTCCATACCAGCACGTT TCGTTGCTCTCATTCTGTTATTGGTTTGTAGGCTGGCTTGGCCATGCACCGATGTTGCATTGAACATTATAGCTGCTCGTTTTGCAGCTATTATC	431

Table 1 Sequences of ITS2 of *Echinostoma revolutum* from various isolates in Southeast Asia (continued).

Sequence name	Sequence	Length (bp)
E. revolutum CAM (K-1)	GCTTATAAACTATCACGACGCCCAAAAAGTCGTGGCTTGGGTTTTGCCAGCTGGCGTGATTTCCTCTATGACTTGTCATGTGAGGTGCCAGATCTATGGCGTTTCCCCAATG TATCCGGATGCATCCATGTCCTGGTTGAATGCCATGATGGGATGTGGTGACGGAATCGTGGTTTAATATGGCTATGCCCCGTTTTCAGCATGTTTGGCGCTCCTAGTCGGCA TGCATATGACTACGGGTGGAGCTGTGATCGGGGTGGTACTTCGTTTTCAGTGTGTGTGGCGCTTCTANTCGGCACACTTATGAACTCGAGGGTAATTCCATACCACACACGT TTCNTTGCTTTCANTCTATTATTGGNTGTACGCTGGNCNTGCGCCATGCACCGATGTTGCATTGAACATTATANCTGCTCGTTTTGCANCTANTATC	433
E. revolutum CAM (K-2)	GCTTATAAACTATCACGACGCCCAAAAAGTCGTGGCTTGGGTTTTGCCAGCTGGCGTGATTTCCTCTATGACTTGTCATGTGAGGTGCCAGATCTATGGCGTTTCCCCAATG TATCCGGATGCATCCATGTCCTGGTTGAATGCCATGATGGGATGTGGTGACGGAATCGTGGTTTAATATGGCTATGCCCCGTTTTCAGCATGTTTGGCGCTCCTAGTCGGCA TGCATATGACTACGGGTGGAGCTGTGATCGGGGTGGTACTTCGTTTTCAGTGTGTGTGGCGCTTCTAGTCGGCACACTTATGAACTCGAGGGTAATTCCATACCANACACGT TTCGTTGCTTTCATTCTATTATTGGTTGTACGCTGGCTTGAGCCATGCACCGATGTTGCATTGAACATTATAGCTGCTCGTTTTGCAGCTATTATC	432
E. revolutum CAM (K-3)	GCTTATAAACTATCACGACGCCCAAAAAGTCGTGGCTTGGGTTTTGCCAGCTGGCGTGATTTCCTCTATGACTTGTCATGTGAGGTGCCAGATCTATGGCGTTTCCCCAATG TATCCGGATGCATCCATGTCCTGGTTGAATGCCATGATGGGATGTGGTGACGGAATCGTGGTTTAATATGGCTATGCCCCGTTTTCAGCATGTTTGGCGCTCCTAGTCGGCA TGCATATGACTACGGGTGGAGCTGTGATCGGGGTGGTACTTCGTTTTCAGTGTGTGTGGCGCTTCTAGTCGGCACACTTATGAACTCGAGGGTAATTCCATACCAACACGTT TCGTTGCTTTCATTCTATTATTGGTTGTACGCTGGCTTGGCCATGCACCGATGTTGCATTGAACATTATAGCTGCTCGTTTTGCAGCTATTATC	430
E. revolutum CAM (K-4)	GCTTATAAACTATCACGACGCCCAAAAAGTCGTGGCTTGGGTTTTGCCAGCTGGCGTGATTTCCTCTATGACTTGTCATGTGAGGTGCCAGATCTATGGCGTTTCCCCAATG TATCCGGATGCATCCATGTCCTGGTTGAATGCCATGATGGGATGTGGTGACGGAATCGTGGTTTAATATGGCTATGCCCCGTTTTCAGCATGTTTGGCGCTCCTAGTCGGCA TGCATATGACTACGGGTGGAGCTGTGATCGGGGTGGTACTTCGTTTTCAGTGTGTGTGGCGCTTCTANTCGGCACACTTATGAACTCGAGGGTAATTCCATACCACACACGT TTCNTTGCTTTCATTCTATTATTGNTTGTACGCTGTCTTGCGCCATGCACCGATNTGCATTGAACNTATANCTGCTCGTTTTGCANCTATTATC	430
E. revolutum CAM (K-5)	GCTTATAAACTATCACGACGCCCAAAAAGTCGTGGCTTGGGTTTTGCCAGCTGGCGTGATTTCCTCTATGACTTGTCATGTGAGGTGCCAGATCTATGGCGTTTCCCCAATG TATCCGGATGCATCCATGTCCTGGTTGAATGCCATGATGGGATGTGGTGACGGAATCGTGGTTTAATATGGCTATGCCCCGTTTTCAGCATGTTTGGCGCTCCTAGTCGGCA TGCATATGACTACGGGTGGAGCTGTGATCGGGGTGGTACTTCGTTTTCAGTGTGTGTGGCGCTTCTAGTCGGCACACTTATGAACTCGAGGGTAATTCCATACCANACACGT TTCGTTGCTTTCATTCTATTATTGGTTGTACGCTGGCTTGGGCCATGCACCGATGTTGCATTGAACATTATAGCTGCTCGTTTTGCAGCTATTATC	432
E. revolutum CAM (K-6)	GCTTATAAACTATCACGACGCCCAAAAAGTCGTGGCTTGGGTTTTGCCAGCTGGCGTGATTTCCTCTATGACTTGTCATGTGAGGTGCCAGATCTATGGCGTTTCCCCAATG TATCCGGATGCATCCATGTCCTGGTTGAATGCCATGATGGGATGTGGTGACGGAATCGTGGTTTAATATGGCTATGCCCCGTTTTCAGCATGTTTGGCGCTCCTAGTCGGCA TGCATATGACTACNGGTGGAGCTGTGATCGGGGTGGTACTTCGTTTTCAGTGTGTGTGGCGCTTCTAGTCGGCACACTTATGAACTCGAGGGTAATTCCATACCAANACGTT TCGTTGCTTTCATTCTATTATTGGTTTGTACGCTGGCTTGGCCATGCACCGATGTTGCATTGAACATTATAGCTGCTCGTTTTGCAGCTATTATC	431
E. revolutum CAM (K-7)	GCTTATAAACTATCACGACGCCCAAAAAGTCGTGGCTTGGGTTTTGCCAGCTGGCGTGATTTCCTCTATGACTTGTCATGTGAGGTGCCAGATCTATGGCGTTTCCCCAATG TATCCGGATGCATCCATGTCCTGGTTGAATGCCATGATGGGATGTGGTGACGGAATCGTGGTTTAATATGGCTATGCCCCGTTTTCAGCATGTTTGGCGCTCCTAGTCGGCA TGCATATGACTACGGGTGGAGCTGTGATCGGGGTGGTACTTCGTTTTCAGTGTGTGTGGCGCTTCTAGTCGGCACACTTATGAACTCGAGGGTAATTCCATACCANACACGT TTCGTTGCTTTCATTCTATTATTGGTTGTACGCTGGCTTGGCCATGCACCGATGTTGCATTGAACATTATAGCTGCTCGTTTTGCAGCTATTATC	431
E. revolutum CAM (T-1)	GCTTATAAACTATCACGACGCCCAAAAAGTCGTGGCTTGGGTTTTGCCAGCTGGCGTGATTTCCTCTATGACTTGTCATGTGAGGTGCCAGATCTATGGCGTTTCCCCAATG TATCCGGATGCATCCATGTCCTGGTTGAATGCCATGATGGGATGTGGTGACGGAATCGTGGTTTAATATGGCTATGCCCCGTTTTCAGCATGTTTGGCGCTCCTAGTCGGCA TGCATATGACTACGGGTGGAGCTGTGATCGGGGTGGTACTTCGTTTTCAGTGTGTGTGGCGCTTCTAGTCGGCACACTTATGAACTCGAGGGTAATTCCATACCANGCACGT TTCGTTGCTTTCATTCTATTATTGGTTTGTACGCTGGCTTGGGCCATGCACCGATGTTGCATTGAACATTATAGCTGCTCGTTTTGCAGCTATTATC	433
E. revolutum CAM (T-2)	GCTTATAAACTATCACGACGCCCAAAAAGTCGTGGCTTGGGTTTTGCCAGCTGGCGTGATTTCCTCTATGACTTGTCATGTGAGGTGCCAGATCTATGGCGTTTCCCCAATG TATCCGGATGCATCCATGTCCTGGTTGAATGCCATGATGGGATGTGGTGACGGAATCGTGGTTTAATATGGCTATGCCCCGTTTTCAGCATGTTTGGCGCTCCTAGTCGGCA TGCATATGACTACGGGTGGAGCTGTGATCGGGGTGGTACTTCGTTTTCAGTGTGTGTGGCGCTTCTAGTCGGCACACTTATGAACTCGAGGGTAATTCCATACCANGCACGT TTCGTTGCTTTCATTCTATTATTGGTTGTANGCTGGCTTGNGCCATGCACCGATGTTGCATTGAACATTATAGCTGCTCGTTTTGCAGCTATATC	431

Table 2 Sequences of ND1 of *Echinostoma revolutum* from various isolates in Southeast Asia.

Sequence name	Sequence	Length (bp)
E. revolutum THA (Fm)	NNNNNTNNTGGTNTGCAGAGGTTTGCTGATCTTTTGAGTTGATTATAAAGTTTAAGTTTGTTTTTTTTTCAAAATCGTAGTTGATTATCTTGGGTAGGAGTTTATTTATTG GTTTTGTTGTCATGTGGTTATTGTGTGGTTTTGAGTTTGATGTATAGTGGTATTTTTAGGGATAAAGTTATGTTATGATTTTTGGTTATTACTAGAATTACGGGTTACAG ATTGTTGAGGGTTGGTTGGGGTTCTTATAATAAGTATGCTTTGTTAAGTTGTGTTCGATCAGCGTTCGGTTCTGTGAGATTTGAAGCTTGTTTTATGTGTGTTGTTATTA TGATCGCTATGGTTATGGGTTGTTATGGAGTGACTGGTGTTTTTTTATAGTCCTTGGTTTTTTTCTGTTGTTTTACCGTTGGTATATGGCTTATGATTGGTAGGAATTTTG TGTGAGTGTAATCGTACTCCATTGGATTATGCTGAAGCTGAAAGTGAATTAGTTTAGTGGTA	502
E. revolutum THA (Fd)	NNNANCTNCTGGCTATGCAGAGGTTTGCTGATCTTTTGANTTGATTATAAAGTTTAAGTTTGTTTTTTTTCAAAATCGTAGTTGATTATCTTGGGTAGGAGTTTATTTAT TGGTTTTGTTGTCATGTGGTTATTGTGTGGTTTTGAGCTTGATGTATAGTGGTATTTTTAGGGATAAAGTTATGTTATGATTTTTGGTTATTACTAGAATTACGGGTTAC AGATTGTTGAGGGTTGGTTGGGGTTCTTATAATAAGTATGCTTTGTTAAGTTGTGTTCGATCAGCGTTCGGTTCTGTGAGATTTGAAGCTTGTTTTATGTGTGTTGTTAT TATGATCGCTATGGTTATGGGTTGTTATGGAGTGACTGGTGTTTTTTTATAGTCCTTGGTTTTTTTCTGTTGTTTTACCGTTGGTATATGGCTTATGATTGGTAGGAATTT TGTGTGAGTGTAATCGTACTCCATTGGATTATGCTGAAGCTGAAAGTGAATTAGTTTAGTGGTA	504
E. revolutum THA (Fp)	NNNNTCTNNTGGTNTGCAGAGGTTTGCTGATCTTTTGAAGTTGATTATAAAGTTTAAGTTTGTTTTTTTTCAAAATCGTAGTTGATTATCTTGGGTAGGAGTTTATTTAT TGGTTTTGTTGTCATGTGGTTATTGTGTGGTTTTGAGCTTGATGTATAGTGGTATTTTTAGGGATAAAGTTATGTTATGATTTTTGGTTATTACTAGAATTACGGGTTAT AGATTGTTGAGGGTTGGTTGGGGTTCTTATAATAAGTATGCTTTGTTAAGTTGTGTTCGATCAGCGTTCGGTTCTGTGAGATTTGAAGCTTGTTTTATGTGTGTTGTTAT TATGATCGCTATGGTTATGGGTTGTTATGGAGTGACTGGTGTTTTTTTATAGTCCTTGGTTTTTTTCTGTTGTTTTACCGTTGGTATATGGCTTATGATTGGTAGGAATTT TGTGTGAGTGTAATCGTACTCCATTGGATTATGCTGAAGCTGAAAGTGAATTAGTTTAGTGGT	503
E. revolutum THA (Bf)	NNNNNTNNTGNGTNTGCAGAGGTTTGCTGATCTTTTGAAGTTGATTATAAAGTTTAAGTTTGTTTTTTTTCAAAATCGTAGTTGATTATCTTGGGTAGGAGTTTATTTAT TGGTTTTGTTGTCATGTGGTTATTGTGTGGTTTTGAGCTTGATGTATAGTGGTATTTTTAGGGATAAAGTTATGTTATGATTTTTGGTTATTACTAGAATTACGGGTTAT AGATTGTTGAGGGTTGGTTGGGGTTCTTATAATAAGTATGCTTTGTTAAGTTGTGTTCGATCAGCGTTCGGTTCTGTGAGATTTGAAGCTTGTTTTATGTGTGTTGTTAT TATGATCGCTATGGTTATGGGTTGTTATGGAGTGACTGGTGTTTTTTTATAGTCCTTGGTTTTTTTCTGTTGTTTTACCGTTGGTATATGGCTTATGATTGGTAGGAATTT TGTGTGAGTGTAATCGTACTCCATTGGATTATGCTGAAGCTGAAAGTGAATTAGTTTAGTGGTA	504
E. revolutum THA (Bs)	NNNNNTNNTNGTNTGCAGAGGTTTGCTGATCTTTTGAAGTTGATTATAAAGTTTAAGTTTGTTTTTTTTCAAAATCGTAGTTGATTATCTTGGGTAGGAGTTTATTTATT GGTTTTGTTGTCATGTGGTTATTGTGTGGTTTTGAGCTTGATGTATAGTGGTATTTTTAGGGATAAAGTTATGTTATGATTTTTGGTTATTACTAGAATTACGGGTTACA GATTGTTGAGGGTTGGTTGGGGTTCTTATAATAAGTATGCTTTGTTAAGTTGTGTTCGATCAGCGTTCGGTTCTGTGAGATTTGAAGCTTGTTTTATGTGTGTTGTTATT ATGATTGCTATGGTTATGGGTTGTTATGGAGTGACTGGTGTTTTTTTATAGTCCTTGGTTTTTTTCTGTTGTTTTACCGTTGGTATATGGCTTATGATTGGTAGGAATTTT GTGTGAGTGTAATCGTACTCCATTGGATTATGCTGAAGCTGAAAGTGAATTAGTTTAGTGGTA	503
E. revolutum THA (Ch)	NNNNCTNCTGGNTATGCAGAGGTTTGCTGATCTTTTGAGTTGATTATAAAGTTTAAGTTTGTTTTTTTTCAAAATCGTAGTTGATTATCTTGGGTAGGAGTTTATTTATT GGTTTTGTTGTCATGTGGTTATTGTGTGGTTTTGAGCTTGATGTATAGTGGTATTTTTAGGGATAAAGTTATGTTATGATTTTTGGTTATTACTAGAATTACGGGTTATA GATTGTTGAGGGTTGGTTGGGGTTCTTATAATAAGTATGCTTTGTTAAGTTGTGTTCGATCAGCGTTCGGTTCTGTGAGATTTGAAGCTTGTTTTATGTGTGTTGTTATT ATGATCGCTATGGTTATGGGTTGTTATGGAGTGACTGGTGTTTTTTTATAGTCCTTGGTTTTTTTCTGTTGTTTTACCGTTGGTATATGGCTTATGATTGGTAGGAATTTT GTGTGAGTGTAATCGTACTCCATTGGATTATGCTGAAGCTGAAAGTGAATTAGTTTAGTGGTA	503
E. revolutum THA (Ee)	GNNNANTNGTGGTAGATACATANGGGGCGTNCTTNAAGNNNGATAATTANTTNTNGNNNGTTNTTTTTGNAANNNNAANTGATTANCTTGNNNANGANTTTATTTATTATTGG TTTTGTTGTCATGTGGTTNTTGTGTGGTTTTGAGCTTGATGTATAGTGGTATTTTTAGGGATAAAGTTATGTTATGATTTTTGGTTATTACTAGAATTACGGGTTATAGA TTGTTGAGGGTTGGTTGGGGTTCTTATAATAAGTATGCTTTGTTAAGTTGTGTTCGATCAGCGTTCGGTTCTGTGAGATTTGAAGCTTGTTTTATGTGTGTTGTTATTAT GATCGCTATGGTTATGGGTTGTTATGGAGTGACTGGTGTTTTTTTATAGTCCTTGGTTTTTTTCTGTTGTTTTACCGTTGGTATATGGCTTATGATTGGTAGGAATTTTGT GTGAGTGTAATCGTACTCCATTGGATTATGCTGAAGCTGAAAGTGAATTAGTTNGTGGTA	500

Table 2 Sequences of ND1 of *Echinostoma revolutum* from various isolates in Southeast Asia (continued).

Sequence name	Sequence	Length (bp)
E. revolutum LAO	GATNNTAGTGGTAGATNCNTACGGGGCNTANTTNCAGANAGNNNATTAGTTANNGGTANNTTNNTTTTNNANNCNTNATTGATTATCTNGNNNANGAGNTTATTTATTGG TTTTGTTGTCATGTGGTTATTGTGTGGTTTTGAGCTTGATGTATAGTGGTATTTTTAGGGATAAAGTTATGTTATGATTTTTGGTTATTACTAGAATTACGGGTTATAGA TTGTTGAGGGTTGGTTGGGGTTCTTATAATAAGTATGCTTTGTTAAGTTGTGTTCGATCAGCGTTCGGTTCTGTGAGATTTGAAGCTTGTTTTATGTGTGTTGTTATTAT GATCGCTATGGTTATGGGTTGTTATGGAGTGACTGGTGTTTTTTATAGTCCTTGGTTTTTTTCTGTTGTTTTACCGTTGGTATATGGCTTATGATTGGTAGGAATTTTGT GTGAGTGTAATCGTACTCCATTGGATTATGCTGAAGCTGAAAGTGAATTAGTTAGTGGTA	500
E. revolutum VNM	NNNNNNGNTNNTGGTATGNANAGTTTGCTGATCTTTTGAANTGNTTNTAAAGTTTAAGTTTGTTTTTTTTCNAAATCNTANNTGATTGTCTTGGNTAGGAGTTNATNTGT TGGTTTTATTATCATGTGGTTATTGTGTGGTTTTANGTTTGATGTATAGAGGTGTTTTTAGGGATAAAGTTATGTTATGATTTTTGGTTGTTACTAGAATTACAGGTTAT AGATTGTTGAGGGTTGGTTGGGGTTCTTATAATAAGTATGCTTTGTTAAGCTGTGTTCGNTCAGCGTTCGGTTCTGTGAGATTTGAAGCTTGTTTTATGTGTGTTGTTAT TATGNTTGCTATGGTTATGGGTTGTTATGGNGTGACTGGTGTTTTTTTATAATCCATGATTTTTTTCTGTTGTTTTGCCGTTGGTGTATGGCTTGTGNTTGGTAGGAATTT TGTGTGAGTGTAATCGTACTCCGTTGGATTATGCTGANGCTGAAAGTGAATTAGTTAGTGGTA	503
E. revolutum CAM (K-1)	GNNANTNGTGGTAGNTANATTCGNGGGNGCNTAATANNNAGNNAATTANTTANNGGTAGNTNNNTTNNNAANNCNNNANTGATTATCTNGNNNANNAGTTTATTTATTGG TTTTGTTGTCATGTGGTTATTGTGTGGTTTTGAGCTTGATGTATAGTGGTATTTTTAGGGATAAAGTTATGTTATGATTTTTGGTTATTACTAGAATTACGGGTTATAGA TTGTTGAGGGTTGGTTGGGGTTCTTATAATAAGTATGCTTTGTTAAGTTGTGTTCGATCAGCGTTCGGTTCTGTGANATTTGAAGCTTGTTTTATGTGTGTTGTTATTAT GATCGCTATGGTTATGGGTTGTTATGGAGTGACTGGTGTTTTTTTATAGTCCTTGGTTTTTTTCTGTTGTTTTACCGTTGGTATATGGCTTATGATTGGTAGGAATTTTGT GTGAGTGTAATCGTACTCCATTGGATTATGCTGAAGCTGAAAGTGAATTAGTTAGTGGTA	500
E. revolutum CAM (K-2)	NNNNTNNNTTNNNTATGNNAGGTTTGCTGATCTTTTGANTTGATTATAAAGTTTAAGTTTGNTTTTTTTCAAAATCGTAGTTGATTATCTTGGGTAGGAGTTTATTTATT GGTTTTGTTGTCATGTGGTTATTGTGTGGTTTTGAGCTTGATGTATAGTGGTATTTTTAGGGATAAAGTTATGTTATGATTTTTGGTTATTACTAGAATTACGGGTTAYA GATTGTTGAGGGTTGGTTGGGGTTCTTATAATAAGTATGCTTTGTTAAGTTGTGTTCGATCAGCGTTCGGTTCTGTGAGATTTGAAGCTTGTTTTATGTGTGTTGTTATT ATGATYGCTATGGTTATGGGTTGTTATGGAGTGACTGGTGTTTTTTTATAGTCCTTGGTTTTTTTCTGTTGTTTTACCGTTGGTATATGGCTTATGATTGGTAGGAATTTT GTGTGAGTGTAATCGTACTCCATTGGATTATGCTGAAGCTGAAAGTGAATTAGTTAGTGGN	501
E. revolutum CAM (K-3)	NNNNNANCANNTCGANNTNCTTNGNNGCNNNNNWANNAGNNAGTNAATTAGTTNNNGNTANNTNCNTNNNNNNNCNNNNANANAGNNANTTANTTANTNNTNGNTACNTA NGNTTTNGTTNNCATGTGNNTNTNGTNNGNTTTNGANNTTGATGTATAGTGGTATTTTTAGGGATAAAGTTATGTTATGATTTTTGGTTATTACTAGAATTACGGGTTAY AGATTGTTGAGGGTTGGTTGGGGTTCTTATAATAAGTATGCTTTGTTAAGTTGTGTTCGATCAGCGTTCGGTTCTGTGAGATTTGAAGCTTGTTTTATGTGTGTTGTTAT TATGATCGCTATGGTTATGGGTTGTTATGGAGTGACTGGTGTTTTTTTATAGTCCTTGGTTTTTTTCTGTTGTTTTACCGTTGGTATATGGCTTATGATTGGTAGGAATTT TGTGTGAGTGTAATCGTACTCCATTGGATTATGCTGAAGCTGAAAGTGAATTAGNNAGCTGAATAAT	507
E. revolutum CAM (K-4)	NANGNTNGTGGTAGNTNCATACGNGGCNTACNNAATAGNNANNNAATTANTNANAGNTAGNTANNTTTTCANAATCGTAATTGATTATCTTGNGTANGAGNTTATTTATT GGTTTTGTTGTCATGTGGTTATTGTGTGGTTTTGAGCTTGATGTATAGTGGTATTTTTAGGGATAAAGTTATGTTATGATTTTTGGTTATTACTAGAATTACGGGTTATA GATTGTTGAGGGTTGGTTGGGGTTCTTATAATAAGTATGCTTTGTTAAGTTGTGTTCGATCAGCGTTCGGTTCTGTGAGATTTGAAGCTTGTTTTATGTGTGTTGTTATT ATGATCGCTATGGTTATGGGTTGTTATGGAGTGACTGGTGTTTTTTTATAGTCCTTGGTTTTTTTCTGTTGTTTTACCGTTGGTATATGGCTTATGATTGGTAGGAATTTT GTGTGAGTGTAATCGTACTCCATTGGATTATGCTGAAGCTGAAAGTGAATTANTTAGTGGTA	502
E. revolutum CAM (K-5)	CNNNNCTAGTGGTAGATNCATCGNGCCNTNCNTAATNNNAAGTNAATTANNNNNAGNTNGNTNNGTTNNNAANNCNNANANGANAANTANGTNNANGAANNTATTTATTG GTTTTGTTGTCATGTGNTTNTTGTGTGGTTNTGANCTTGATGTATAGTGGTATTTTTAGGGATAAAGTTATGTTATGATTTTTGGTTATTACTAGAATTACGGGTTAYAG ATTGTTGAGGGTTGGTTGGGGTTCTTATAATAAGTATGCTTTGTTAAGTTGTGTTCGATCAGCGTTCGGTTCTGTGAGATTTGAAGCTTGTTTTATGTGTGTTGTTATTA TGATYGCTATGGTTATGGGTTGTTATGGAGTGACTGGTGTTTTTTTATAGTCCTTGGTTTTTTTCTGTTGTTTTACCGTTGGTATATGGCTTATGATTGGTAGGAATTTTG TGTGAGTGTAATCGTACTCCATTGGATTATGCTGAAGCTGAAAGTGAATTAGTTAGTGGN	500

Table 2 Sequences of ND1 of *Echinostoma revolutum* from various isolates in Southeast Asia (continued).

Sequence name	Sequence	Length (bp)
E. revolutum CAM (K-6)	NNNCNNTAGTGGTNTNTAGANTNTTTNCTGATCNTTTNANTTGANNATNAANTTTAAGTTTGTTTTTTTTCAAATCGTAGTTGATTATCTTGGGTAGGAGTTTATTTATT GGTTTTGTTGTCATGTGGTTATTGTGTGGTTTTGAGCTTGATGTATAGTGGTATTTTTAGGGATAAAGTTATGTTATGATTTTTGGTTATTACTAGAATTACGGGTTATA GATTGTTGAGGGTTGGTTGGGGTTCTTATAATAAGTATGCTTTGTTAAGTTGTGTTCGATCAGCGTTCGGTTCTGTGAGATTTGAAGCTTGTTTTATGTGTGTTGTTATT ATGATCGCTATGGTTATGGGTTGTTATGGAGTGACTGGTGTTTTTTATAGTCCTTGGTTTTTTTCTGTTGTTTTACCGTTGGTATATGGCTTATGATTGGTAGGAATTTT GTGTGAGTGTAATCGTACTCCATTGGATTATGCTGAAGCTGAAAGTGAATTAGTTAGTGGN	501
E. revolutum CAM (K-7)	CCATNNNTNNTGGTANGTANAGGTTTGCTGATCTTTTGAAGTTGATTATNAAGTTTAAGTTTAGTTTTTTTTCAAANTCGTANTTGATTATCTTGGGTAGGAGTTTATTT ATTGGTTTTGTTGTCATGTGGTTATTGTGTGGTTTTGAGCTTGATGTATAGTGGTATTTTTAGGGATAAAGTTATGTTATGATTTTTGGTTATTACTAGAATTACGGGTT ATAGATTGTTGAGGGTTGGTTGGGGTTCTTATAATAAGTATGCTTTGTTAAGTTGTGTTCGATCAGCGTTCGGTTCTGTGAGATTTGAAGCTTGTTTTATGTGTGTTGTT ATTATGATCGCTATGGTTATGGGTTGTTATGGAGTGACTGGTGTTTTTTATAGTCCTTGGTTTTTTTCTGTTGTTTTACCGTTGGTATATGGCTTATGATTGGTAGGAAT TTTGTGTGAGTGTAATCGTACTCCATTGGATTATGCTGAAGCTGAAAGTGAATTAGTTAGTGGT	504
E. revolutum CAM (T-1)	CTTNGNTNGTGGTAGATNCNTNTNNGSNNTTCTTTTGNNTNGNTTATNANNTTTAAGNTNGTTTTTTTTCAAATCGTAGTTGATTATCTTGGGTAGGAGTTTATTTATTG GTTTTGTTGTCATGTGGTTATTGTGTGGTTTTGAGCTTGATGTATAGTGGTATTTTTAGGGATAAAGTTATGTTATGATTTTTGGTTATTACTAGAATTACGGGTTAYAG ATTGTTGAGGGTTGGTTGGGGTTCTTATAATAAGTATGCTTTGTTAAGTTGTGTTCGATCAGCGTTCGGTTCTGTGAGATTTGAAGCTTGTTTTATGTGTGTTGTTATTA TGATYGCTATGGTTATGGGTTGTTATGGAGTGACTGGTGTTTTTTTATAGTCCTTGGTTTTTTTCTGTTGTTTTACCGTTGGTATATGGCTTATGATTGGTAGGAATTTTG TGTGAGTGTAATCGTACTCCATTGGATTATGCTGAAGCTGAAAGTGAATTAGTTAGTGGTA	501
E. revolutum CAM (T-2)	NNNNNNTNGTNNTGGTANGNAGAGGTTTGCTGATCTTTTGANTTGATTATNAAGTTTAAGTTNGTTTTTNTTCAAATCGTAGTTGATTATCTTGGGTAGGAGTTTATTTA TTGGTTTTGTTGTCATGTGGTTATTGTGTGGTTTTGAGCTTGATGTATAGTGGTATTTTTAGGGATAAAGTTATGTTATGATTTTTGGTTATTACTAGAATTACGGGTTA TAGATTGTTGAGGGTTGGTTGGGGTTCTTATAATAAGTATGCTTTGTTAAGTTGTGTTCGATCAGCGTTCGGTTCTGTGAGATTTGAAGCTTGTTTTATGTGTGTTGTTA TTATGATCGCTATGGTTATGGGTTGTTATGGAGTGACTGGTGTTTTTTTATAGTCCTTGGTTTTTTTCTGTTGTTTTACCGTTGGTATATGGCTTATGATTGGTAGGAATT TTGTGTGAGTGTAATCGTACTCCATTGGATTATGCTGAAGCTGAAAGTGAATTAGTTAGTGGT	503

APPENDIX E

Reagent, Stains and Specimens Preparation

REAGENTS AND STAINS

1. 0.85% normal saline

Sodium chloride	8.5	g
Distelled water	1000	ml

2. 5% formalin

40% Formadehyde	5	ml
Distilled water	95	ml

3. Borax carmine (Grenacher's alcoholic)

Borax carmine	8	g
70% ethanol	200	ml

Boil for ½ hour, cool and make up to 200 ml

4. Acetocarmine solutuion (1%)

Carmine	1	g
Glacial acetic acid (45%)	100	ml
Ferric Chloride ($FeC_{l2} \cdot 6H_2O$) (10%) (Optional)	5	ml

Add carmine powder to boiling 45% glacial acetic acid, cool rapidly, and then filter into a dark glass. Staining can be intensified by adding ferric chloride ($FeC_{l2} \cdot 6H_2O$).

5. 2.5% Glutaraldehyde

50% glutaraldehyde	5.0	ml
0.1 M phosphate buffer pH 3	95	ml

6. 1% Osmium tetroxide

Stock solution (4% Osmium tetroxide)

Osmium tetroxide crystals	1.0	g
Distilled water	25	ml

Working solution (1% Osmium tetroxide)

4% Osmium tetroxide	1	part

0.1 M phosphate buffer	2	part
Distilled water	1	part

BUFFERS

1. 5x Tris Boric acid EDTA (TBE) buffer

Tris base	54	g
Boric acid	27.5	g
0.5 M EDTA (pH 8.0)	20	ml

add distilled water to 1,000 ml and autoclave

2. Phosphate buffer solution

Stock solution

(1) 0.2 M Sodium phosphate monobasic

$NaH_2PO_4H_2O$	27.6	g
Or $NaH_2PO_4 \cdot 2H_2O$	31.21	g
Distilled water	1,000	ml

(2) 0.2 M Sodium phosphate dibasic

$Na_2HPO_4 \cdot 2H_2O$	35.61	g
Or $Na_2HPO_4 \cdot 7H_2O$	53.65	g
Or $Na_2HPO_4 \cdot 12H_2O$	71.64	g
Distilled water	1,000	ml

Working solution

X ml (1)	Y ml (2)	pH
68.5	31.5	6.5
62.5	37. 5	6.6
56.5	43.5	6.7
51.0	49.0	6.8
45.0	55.0	6.9
39.0	61.0	7.0
33.0	67.0	7.1
28.0	72.0	7.2
23.0	77.0	7.3
19.0	81.0	7.4
16.0	84.0	7.5

The process of specimen preparation for permanent slide

Specimens

↓ Washing

0.85% normal saline

↓ Fixation

5% Formalin

↓ Washing

Tap water

↓ Dehydration

Ethanol series; 10%, 20%, 30%, 50%

↓

Borax carmine or Aceto camine ← 70% Ethanol

↓ Destaining (1% HCl in 70% Alcohol)

Ethanol series; 85%, 95%

↓

95% Ethanol : Butanol (2:1, 1:1, 1:2)

↓

Butanol

↓

Butanol : Xylene (2:1, 1:1, 1:2)

↓

Xylene

↓ mounting

Permount

The process of specimen preparation for SEM observation

Specimens

↓ Washing in o.1 M phosphate buffer

Primary fixation

(2.5% glutalraldehyde in 0.1 M phosphate buffer)

↓ Washing in o.1 M phosphate buffer

P0st fixation

(1% osmium tetroxide in 0.1 M phosphate buffer)

↓ Washing in o.1 M phosphate buffer

Dehydration in ethyl alcohol series;

10%, 20%, 30%, 50%, 70%, 85%, 95%, Absolute ethanol and Acetone

↓

Drying (Critical Point Drying) by CO_2

↓

Mounting and Coating

↓

SEM

CURRICULUM VITAE

Author's Name Kittichai Chantima

Date of Birth January 27, 1986

Place of Birth Phayao Province, Thailand

Education

2009-2014: Ph. D. in Biodiversity and Ethnobiology, Faculty of Science, Chiang Mai University, Chiang Mai, Thailand

2005-2009: B.Sc. (Hons) in Zoology, Faculty of Science, Chiang Mai University, Chiang Mai, Thailand

Scholarships

2009-2014: The Royal Golden Jubilee Ph.D. Program (Grant. No. PHD/0293/2550)

2005-2009: Research Professional Development Project under the Science Achievement Scholarship of Thailand (SAST)

Publications

Chantima K., Phuttachat K. and Wongsawad C. 2009. *In vitro* Effects of *Carica papaya* Linn. on the Death and the Tegumental Surface of the Trematode using Scanning Electron micrpscopy. *Journal of Microscopy Society of Thailand*. 23(1): 12-14.

Wongsawad P., **Chantima K.**, Yooyen T. and Wongsawad C. 2011. Effects of *Andrographis paniculata* (Burm) Wall. Ex Nees. Powder on Death and Tegumental Surface Chaning of *Stellantchasmus falcatus* (*in vitro*). *Journal of the Microscopy Society of Thailand*. 4(1): 1-3.

Buareal K., **Chantima K.** and Wongsawad C. 2011. Evaluation of the Efficacy of some Fruit Juices on the Digestion of Fish for Harvesting Trematode

Metacercariae. *Proceeding of the 37th Congress on Science and Technology of Thailand (STT 37). Bangkok, Thailand.* 1-4.

Chantima K and Wongsawad C. 2012. Collar Spines of *Echinostoma revolutum* (Froelich, 1802) Looss, 1899: Light and Scanning Electron Microscopic Studies. *Journal of the Microscopy Society of Thailand*. 5(1-2): 14-18.

Buddhachat K, **Chantima K**, Chomdej S and Wongsawad C. 2012. *In vitro* Effects of Some Thai Anthelmintic Plants on Mortality and Change of Tegumental Surface of *Stellantchasmus falcatus*. *Journal Bacteriology and Parasitolology*. 3(6): 146-148.

Chantima K, Chai JY and Wongsawad C. 2013. *Echinostoma revolutum*: Freshwater Snails as the Second Intermediate Hosts in Chiang Mai, Thailand. *Korean Journal of Parasitology*. 51(2): 183-189.

Chantima K., Rojanapaibul A., Anuntalabhochai S., Chai J.Y. and Wongsawad C. *Echinostoma revolutum*: Recovery and Fecundity in Experimental Chick and Notes on their Egg Development. *Tropical Biomedicine (Submitted).*

Chantima K., Jung B.K., Chai J.Y., Anuntalabhochai S. and Wongsawad C. Evaluation of Loop-Mediated Isothermal Amplification (LAMP) for Detection of *Echinostoma revolutum* (Trematoda: Echinostomatidae). *Experimental Parasitology (Submitted).*

Academic Conferences

Phuttachat K., **Chantima K.**, Teummee C. and Wongsawad C. 2008. *In vitro* Effects of some Thai Antihelminthic Plants on Tegumental Surface and Mortality of *Stellantchasmus falcatus* (Trematoda: Heterophyidae). The 22nd Biennial Conference of the Asian Association for Biology Education. November 21-24. Osaka, Japan. (Poster presentation)

Chantima K., Phuttachat K. and Wongsawad C. 2009. *In vitro* Effects of *Carica papaya* Linn. on the Death and the Tegumental Surface of the Trematode using Scanning Electron micrpscopy. 26th Annual Conference of the

Microscopy Society of Thailand. January 28-29. Chiang Mai, Thailand. (Poster presentation)

Chantima K. 2009. Epidemiology and Distribution of Metacercarial Trematodes in Cyprinoid fish from Mae Ngad Somboonchon Reservoir, Chiang Mai Province. The 4th Conference on Science and Technology for Youths. Mach 20-21. Bangkok International Trade and Exhibition Centre (BITEC), Bangkok, Thailand. (Poster presentation)

Wongsawad P., **Chantima K.**, Yooyen T., Wongsawad C. 2011. Effects of *Andrographis paniculata* (Burm) Wall. Ex Nees. Powder on Death and Tegumental Surface Chaning of *Stellantchasmus falcatus* (*in vitro*). 28th Annual Conference of the Microscopy Society of Thailand. January 5-7. Mae Fah Luang University, Chiang Rai, Thailand. (Poster presentation)

Buareal K., **Chantima K.**, Wongsawad C. and Chomdej S. 2011. Effect of Extracts from Ginger (*Zingber officinale* Roscoe.) on the Nematode, *Enterobius vermicularis* (*in vitro*). The 6th Conference on Science and Technology for Youths. Mach 18-19. Bangkok International Trade and Exhibition Centre (BITEC) Bangkok, Thailand. (Poster presentation)

Chantima K. and Wondsawad C. 2011. Identification and Redescription of *Echinostoma revolutum* from *Filopaludina* spp. Snails in Chiang Mai Province. The 1st Conference on Taxonomy and Systematics in Thailand. May 2-4. Faculty of Science, Naresuan University, Phitsanulok, Thailand. (Poster presentation)

Buareal K., **Chantima K.** and Wongsawad C. 2011. Evaluation of the Efficacy of some Fruit Juices on the Digestion of Fish for Harvesting Trematode Metacercariae. 37th Congress on Science and Technology of Thailand (STT 37). October 10-12. Centara Grand and Bangkok Convention Centre at Central World, Bangkok, Thailand. (Poster presentation)

Chantima K and Wongsawad C. 2012. Collar Spines of *Echinostoma revolutum* (Froelich, 1802) Looss, 1899: Light and Scanning Electron Microscopic studies. 29th Annual Conference of the Microscopy Society of Thailand. January 30- February 1. Phetchaburi, Thailand. (Poster presentation)

Chantima K and Wongsawad C. 2012. *Filopaludina* spp. (Gastropoda: Viviparidae): A New Second Molluscan Intermediate Host of *Echinostoma revolutum* in Chiang Mai Province. RGJ Ph.D. Congress XIII. April 6-8. Jomtien Palm Beach Hotel & Resort, Pattaya, Chonburi, Thailand. (Poster presentation)

Chantima K and Wongsawad C. 2012. Surface Morphology of Adult *Echinostoma revolutum* (Fröelich, 1802) Looss, 1899 (Digenea: Echinostomatidae). 38th Congress on Science and Technology of Thailand (STT 38). 17-19, October 2012, Empress Convention Hall, Chiang Mai, Thailand. (Poster presentation)

Chantima K., Chai J.Y. and Wongsawad C. 2013. Occurrence of *Echinostoma revolutum* metacercariae and other larval trematode infections in freshwater snails from Chiang Mai, Thailand. International Meeting on Emerging Diseases and Surveillance. 15–18, February 2013. Vienna, Austria. (Poster presentation)