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ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย



APPENDIX

ศูนย์วิทยทรัพยากร
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APPENDIX I
MORPHOMETRIC ANALYSIS

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จุฬาลงกรณ์มหาวิทยาลัย

APPENDIX I

SHELL MORPHOLOGY CHARACTERS FOR MORPHOMETRIC ANALYSIS OF *Mekongia* IN THAILAND

Shell Measurement Characters

1. Shell height (SH), maximal length of shell axis
2. Shell width (SW), maximal width of shell perpendicular to shell axis
3. Body whorl height (BH), length from suture, at junction of penultimate and body whorl
4. Body whorl width (BW), maximal diameter of first half-whorl of body whorl
5. Aperture height (AH), maximal length parallel to shell axis
6. Aperture width (AW), maximal width perpendicular to shell axis
7. Penultimate whorl height (PH), length from suture of penultimate whorl to apex
8. Apex height (SP), length from apex to suture of penultimate whorl

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จุฬาลงกรณ์มหาวิทยาลัย

Morphometric data (dimension in mm); SD = standard deviation, SE = standard error (dimension in mm)

Species	SH	SW	AH	AW	BW	SP	PH	SH/SW	SH/SP	SH/PH	SW/AW	AH/AW	AW/SP	BW/AW
<i>M. pongensis</i>														
mean	22.009	18.477	15.007	11.598	14.844	10.31	5.4219	1.1888	0.5461	1.0542	1.5931	1.2934	1.1327	1.28
SD	2.8275	1.9922	1.7154	1.1645	1.6718	1.4521	0.8282	0.0443	0.4582	0.8983	0.0472	0.0541	0.0746	0.0608
SE	0.3681	0.2594	0.2233	0.1516	0.2176	0.189	0.1078	0.0058	0.0597	0.117	0.0061	0.007	0.0097	0.0079
<i>M. tamarcki</i>														
mean	27.656	21.054	16.399	12.973	17.422	14.378	6.9629	1.311	0.4976	1.0276	1.6224	1.2671	0.9133	1.3419
SD	2.8296	1.7644	0.8819	0.9351	1.5124	2.0938	1.0613	0.0386	0.0755	0.1581	0.0458	0.0686	0.0798	0.0495
SE	0.6175	0.385	0.1925	0.204	0.33	0.4569	0.2316	0.0084	0.0165	0.0345	0.01	0.015	0.0174	0.0108
<i>M. sphaelicula cf. extensa</i>														
mean	24.169	17.606	14.247	10.652	15.736	13.398	6.1594	1.3739	0.2267	0.4922	1.6533	1.3389	0.7967	1.4794
SD	1.8867	1.2104	0.8432	0.7509	1.0316	1.2108	0.6359	0.0683	0.0206	0.0481	0.0624	0.0413	0.0435	0.0763
SE	0.4447	0.2853	0.1987	0.177	0.2432	0.2854	0.1499	0.0161	0.0049	0.0113	0.0147	0.0097	0.0103	0.018
<i>M. sphaelicula extensa</i>														
mean	24.582	17.555	13.597	10.467	15.423	13.697	6.7223	1.4005	1.0314	2.1086	1.6782	1.3014	0.7691	1.4741
SD	1.6003	0.9222	0.4397	0.5519	0.7664	1.3033	0.7304	0.0502	0.1021	0.2493	0.0381	0.0641	0.0518	0.0282
SE	0.3412	0.1966	0.0937	0.1177	0.1634	0.2779	0.1557	0.0107	0.0218	0.0531	0.0081	0.0137	0.011	0.006

Morphometric data (dimension in mm); SD = standard deviation, SE = standard error (Cont.)

Species	SH	SW	AH	AW	BW	SP	PH	SH/SW	SH/SP	SH/PH	SW/AW	AH/AW	AW/SP	BW/AW
<i>M. sphaericula sphaelicula</i>														
mean	28.786	22.544	17.998	13.674	19.283	14.834	7.4931	1.275	0.6556	1.293	1.6491	1.3169	0.9344	1.41
SD	3.1996	1.8543	1.4432	1.0143	1.749	2.1489	1.1429	0.0566	0.2332	0.4365	0.0657	0.0546	0.0999	0.0735
SE	0.3999	0.2318	0.1804	0.1268	0.2186	0.2686	0.1429	0.0071	0.0292	0.0546	0.0082	0.0068	0.0125	0.0092
<i>M. sphaericula spiralis</i>														
mean	30.481	27.007	21.685	15.897	21.905	13.782	7.5296	1.1274	0.5878	1.0965	1.7	1.3657	1.1661	1.3796
SD	1.9678	1.3326	1.0243	0.839	1.4532	1.5768	1.2939	0.0374	0.0783	0.2097	0.0582	0.0485	0.1292	0.0753
SE	0.4103	0.2779	0.2136	0.1749	0.303	0.3288	0.2698	0.0078	0.0163	0.0437	0.0121	0.0101	0.0269	0.0157
<i>M. swainsoni swainsoni</i>														
mean	24.617	19.599	15.9	11.98	15.888	11.762	5.9596	1.2577	1.0344	2.0492	1.639	1.3248	1.0244	1.3313
SD	2.3736	2.086	2.2338	1.4192	1.613	1.1767	0.6541	0.0586	0.1429	0.3247	0.0712	0.0711	0.1271	0.0838
SE	0.3426	0.3011	0.3224	0.2048	0.2328	0.1698	0.0944	0.0085	0.0206	0.0469	0.0103	0.0103	0.0183	0.0121
<i>M. swainsoni kmeriana</i>														
mean	23.725	19.348	14.628	11.533	16.036	11.843	6.444	1.2264	0.17	0.3124	1.678	1.268	0.976	1.3912
SD	1.2774	0.937	0.8032	0.6302	0.7252	0.7679	0.5542	0.0421	0.0115	0.03	0.0513	0.0359	0.0632	0.0475
SE	0.2555	0.1874	0.1606	0.126	0.145	0.1536	0.1108	0.0084	0.0023	0.006	0.0103	0.0072	0.0126	0.0095
<i>M. swainsoni braueri</i>														
mean	27.948	20.595	16.309	12.355	17.394	14.254	7.0308	1.3596	0.3532	0.716	1.668	1.3204	0.8696	1.408
SD	1.2118	0.8926	0.8018	0.5438	0.6275	0.9466	0.5386	0.0544	0.0238	0.0555	0.0477	0.0361	0.057	0.0441
SE	0.2424	0.1785	0.1604	0.1088	0.1255	0.1893	0.1077	0.0109	0.0048	0.0111	0.0095	0.0072	0.0114	0.0088

Morphological data of *M. pongensis* from Muaeng, Nakhon Phanom (NP)

Number	SH	SW	AH	AW	BH	BW	SP	PH
1	20.46	17.6	14.00	11.35	16.91	14.27	9.86	4.76
2	20.67	17.63	14.17	11.42	17.24	14.31	9.41	4.97
3	21.63	17.91	14.59	11.19	17.59	14.54	10.15	5.31
4	19.30	16.80	13.35	10.72	16.19	13.59	8.80	4.60
5	19.07	16.08	12.77	10.24	15.75	12.91	8.97	4.55
6	19.99	17.46	14.20	11.17	16.84	14.39	8.92	4.76
7	19.43	16.99	13.15	11.09	15.91	13.93	9.39	4.68
8	19.15	16.37	13.02	10.52	16.23	13.42	9.00	5.02
9	-	-	-	-	-	-	-	-
10	18.85	16.09	12.69	10.17	15.48	12.60	8.51	4.31
11	17.98	15.68	13.24	10.37	15.25	12.52	8.09	4.06
12	19.32	16.97	13.42	10.53	15.97	14.09	9.22	4.65
13	18.79	16.50	13.12	10.14	15.76	13.20	8.50	4.44
14	19.09	17.44	12.90	10.85	15.86	13.97	8.73	4.38
15	18.92	16.17	12.81	10.31	15.56	13.51	8.77	4.26
16	19.39	16.61	13.25	10.33	16.13	10.31	9.31	4.89
17	18.20	15.63	12.77	10.06	15.08	12.61	8.74	4.33
18	18.24	16.00	12.93	10.26	15.35	13.07	8.49	4.44
19	17.84	15.95	12.65	10.32	15.07	12.77	8.00	4.16
20	-	-	-	-	-	-	-	-
21	18.32	15.21	11.81	9.56	15.01	12.47	8.66	4.32
22	18.16	16.00	13.56	10.44	15.73	12.65	8.06	4.38
23	-	-	-	-	-	-	-	-
24	16.91	14.83	11.56	9.35	14.34	12.26	7.98	4.05
25	-	-	-	-	-	-	-	-

Morphological data of *M. swainsoni swainsoni* from Vat Bot, Phitsanulok (VB)

Number	SH	SW	AH	AW	BH	BW	SP	PH
1	29.09	23.99	20.27	15.89	24.17	19.33	13.24	6.95
2	30.94	23.99	20.89	14.68	24.83	18.88	13.87	6.42
3	24.62	20.11	18.02	12.96	20.90	15.22	10.72	5.57
4	28.42	23.27	17.79	13.78	23.38	18.86	13.79	7.04
5	27.97	22.57	19.28	13.19	23.17	18.31	12.45	6.06
6	27.83	22.42	18.93	13.30	23.36	18.18	12.80	6.51
7	25.80	21.45	16.47	12.81	21.31	16.74	12.71	6.14
8	25.72	20.51	16.75	12.87	21.64	17.27	12.48	7.04
9	26.72	21.29	18.64	14.09	22.10	17.23	12.25	6.37
10	26.02	21.07	17.74	13.00	21.88	17.61	11.86	6.56
11	24.61	20.57	17.60	12.54	20.99	16.80	11.09	5.71
12	27.10	22.52	19.25	13.49	22.93	17.88	12.46	6.62
13	25.20	21.70	17.13	13.27	21.00	16.71	11.29	5.71
14	25.05	20.01	16.14	12.30	21.22	16.35	11.81	6.69
15	24.34	20.07	17.74	13.27	21.06	15.42	10.69	5.63
16	24.41	19.93	17.13	12.37	21.45	16.23	10.68	6.23
17	25.02	20.76	16.86	12.55	20.89	17.24	11.59	5.91
18	-	-	-	-	-	-	-	-
19	24.53	20.12	17.62	12.34	20.58	16.09	10.72	5.09
20	24.52	20.81	17.85	13.38	21.00	17.17	10.71	5.35
21	25.19	21.48	17.14	12.78	21.29	16.57	11.30	5.93
22	24.93	19.93	17.83	13.64	20.91	15.79	11.24	5.81
23	24.09	20.72	17.87	13.00	21.34	15.95	10.38	5.90
24	25.97	20.09	16.36	12.22	20.77	16.05	12.60	5.88
25	29.09	23.99	20.27	15.89	24.17	19.33	13.24	6.95

Morphological data of *M. swainsoni swainsoni* from Tha Ruea, Ayutthaya (ST)

Number	SH	SW	AH	AW	BH	BW	SP	PH
1	28.22	20.997	16.77	12.42	22.96	17.22	13.94	7.18
2	24.21	19.79	16.13	11.75	20.18	16.07	11.21	5.67
3	24.35	18.54	14.88	10.95	19.17	15.45	12.20	5.81
4	27.23	19.66	14.58	11.44	20.56	16.75	14.44	6.84
5	26.21	19.61	14.41	11.43	20.65	16.26	14.10	7.01
6	24.85	19.50	13.73	11.22	19.82	16.69	13.13	7.00
7	24.15	18.51	14.50	11.01	19.89	15.58	12.25	6.56
8	23.91	18.09	13.72	10.87	19.12	14.72	11.99	5.87
9	23.24	17.71	13.43	10.41	18.32	14.63	12.16	5.88
10	23.40	18.12	13.43	10.60	18.50	14.69	11.58	5.55
11	26.40	19.79	15.73	11.82	21.05	16.40	12.96	6.41
12	23.44	18.33	14.33	10.41	18.80	15.21	11.40	5.52
13	21.64	17.78	13.62	10.48	17.45	14.04	10.57	5.00
14	23.63	16.64	13.76	9.50	19.37	14.54	12.05	6.52
15	21.82	18.07	14.84	11.55	18.16	14.00	9.92	5.01
16	23.11	17.45	15.08	10.92	18.58	14.63	11.32	5.32
17	21.51	17.85	13.01	11.44	17.47	13.81	10.30	5.15
18	23.69	18.44	14.27	10.98	18.94	14.64	11.74	5.97
19	23.16	17.81	13.81	10.71	18.53	14.78	11.42	5.45
20	20.55	15.59	12.01	9.75	16.46	12.61	10.98	5.35
21	21.10	16.63	12.28	10.57	16.97	13.71	11.13	5.78
22	21.82	17.86	13.46	10.60	17.65	14.15	10.75	5.28
23	21.33	16.70	13.46	11.20	17.34	13.65	10.72	5.15
24	21.03	15.84	13.15	9.74	17.00	13.21	10.56	5.04
25	19.52	16.07	13.51	9.53	16.15	13.29	9.02	4.62

Morphological data of *M. swainsoni braueri* from Bang Ban, Ayutthaya (BB)

Number	SH	SW	AH	AW	BH	BW	SP	PH
1	26.96	20.63	16.18	12.1	21.55	17.38	13.64	7.07
2	27.89	22.13	16.89	12.96	21.93	18.07	14.38	6.82
3	27.66	21.23	16.85	13.04	21.81	17.44	13.85	6.56
4	29.61	21.69	17.85	13.04	23.63	18.23	14.67	7.50
5	26.95	18.60	15.21	11.49	21.51	16.13	14.08	7.09
6	27.00	20.56	15.73	11.71	21.55	17.24	13.77	6.76
7	29.68	22.40	18.22	13.05	23.48	18.18	14.22	6.45
8	28.20	19.98	16.19	12.10	21.80	17.20	14.66	7.05
9	26.84	20.32	16.68	12.86	21.59	16.59	12.85	6.18
10	25.46	20.38	15.62	11.67	20.06	16.84	12.12	5.84
11	27.16	19.43	15.30	11.51	21.81	16.79	14.00	7.22
12	29.18	20.17	15.06	12.05	22.13	17.39	16.37	7.98
13	30.14	21.44	17.29	13.26	23.65	18.29	15.58	7.84
14	28.45	21.37	16.42	12.70	22.34	17.71	14.47	7.03
15	27.27	20.00	15.73	11.97	22.02	17.40	14.62	7.52
16	27.86	19.78	15.47	12.40	21.64	16.57	14.37	7.06
17	28.46	20.99	16.43	12.22	22.53	17.89	14.69	7.32
18	27.91	21.05	16.81	12.47	22.40	17.83	13.84	6.89
19	27.87	19.81	16.28	11.91	21.98	16.7	14.03	6.98
20	25.94	19.82	15.60	11.84	21.00	16.63	12.61	6.29
21	26.51	19.40	15.46	11.90	21.39	16.80	13.62	6.92
22	29.74	20.83	16.44	12.88	23.16	18.24	16.03	8.22
23	28.79	20.89	16.42	12.4	22.35	17.73	14.86	7.02
24	28.20	20.78	16.84	13.00	22.35	17.56	14.22	7.09
25	28.96	21.20	16.75	12.35	22.64	18.03	14.79	7.07

Morphological data of *M. swainsoni kmeriana* from Kabin Buri, Prachin Buri (KB)

Number	SH	SW	AH	AW	BH	BW	SP	PH
1	22.96	18.88	14.07	11.41	18.72	15.33	11.61	5.99
2	23.86	18.93	15.48	11.69	19.75	15.35	11.10	5.87
3	22.89	19.18	13.69	11.07	18.699	16.17	12.16	6.24
4	23.81	19.85	14.10	11.52	19.67	16.26	11.75	6.78
5	22.47	18.72	14.94	11.46	18.62	15.78	10.20	4.78
6	22.36	18.43	13.53	10.81	18.32	15.29	11.54	6.38
7	22.67	18.90	13.71	10.91	19.55	15.55	11.33	6.53
8	22.99	19.19	14.24	11.14	19.22	15.41	11.25	6.27
9	24.96	19.45	15.21	11.96	20.49	16.15	12.84	6.90
10	22.53	18.38	13.68	10.33	18.84	15.39	11.66	6.42
11	22.67	18.97	14.76	11.58	18.27	15.32	11.36	5.64
12	24.06	18.49	14.00	11.16	20.17	15.70	11.98	6.92
13	26.03	20.75	15.54	12.62	21.64	17.00	12.94	7.03
14	26.57	21.69	15.92	12.53	21.38	17.88	12.84	6.36
15	22.85	18.61	14.46	11.55	19.70	15.81	11.53	6.74
16	25.55	20.89	15.93	12.67	21.58	17.53	12.61	7.22
17	24.62	20.83	15.34	12.23	20.50	17.03	11.97	6.41
18	24.86	19.35	14.56	11.19	19.78	16.06	13.26	6.81
19	23.54	19.79	14.82	11.98	19.98	16.35	11.46	6.49
20	22.07	18.76	13.83	11.57	18.53	15.51	11.11	5.96
21	25.96	19.71	15.71	12.30	21.33	16.85	13.37	7.46
22	23.44	19.32	14.84	10.94	20.00	15.85	11.17	6.66
23	22.89	17.90	13.35	10.58	19.05	15.60	11.94	6.71
24	23.18	18.42	14.35	11.17	19.07	15.44	11.85	5.98
25	23.34	20.30	15.63	11.96	20.68	16.28	11.24	6.55

Morphological data of *M. lamarcki* from That U-then, Nakhon Phanom (TT)

Number	SH	SW	AH	AW	BH	BW	SP	PH
1	23.93	19.39	15.27	12.23	19.13	15.71	11.95	5.88
2	28.23	21.03	16.66	12.94	22.20	17.85	14.88	7.30
3	29.83	21.81	16.28	13.32	22.60	18.21	15.86	7.55
4	31.4	23.35	17.64	13.89	23.84	19.28	16.40	7.44
5	22.97	18.21	14.79	11.47	18.40	15.11	11.29	5.60
6	28.25	21.37	16.72	12.25	21.39	18.04	14.48	6.56
7	24.20	19.13	16.18	11.93	19.23	15.65	11.56	5.29
8	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-
10	30.44	22.95	16.41	14.19	23.43	18.64	15.92	8.61
11	-	-	-	-	-	-	-	-
12	25.19	19.68	16.78	12.08	19.94	16.40	12.14	5.67
13	27.33	20.71	16.72	12.45	21.23	17.41	14.05	6.71
14	25.09	20.13	15.76	12.53	19.99	16.22	12.24	5.93
15	32.47	23.81	17.12	14.16	23.26	20.06	18.23	9.06
16	30.08	22.55	17.31	13.72	23.38	18.56	15.78	8.02
17	28.57	22.45	16.72	13.84	22.29	18.36	17.58	7.25
18	24.88	18.94	15.48	11.98	19.50	15.50	12.36	6.32
19	-	-	-	-	-	-	-	-
20	26.04	19.22	15.71	12.45	20.99	15.90	13.68	7.38
21	30.78	22.81	18.60	14.21	23.83	18.78	15.27	6.98
22	23.76	18.16	15.31	11.73	18.84	15.24	11.54	5.65
23	28.38	21.76	16.84	13.21	21.92	17.75	14.78	6.90
24	29.28	21.88	16.05	13.46	22.53	17.85	15.98	7.97
25	29.68	22.80	16.02	14.39	22.95	19.34	15.96	8.15

Morphological data of *M. sphaericula extensa* from Sri Songkhram, Nakhon Phanom (MH)

Number	SH	SW	AH	AW	BH	BW	SP	PH
1	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-
3	24.54	18.37	15.10	11.13	18.95	15.98	13.37	6.24
4	-	-	-	-	-	-	-	-
5	28.08	18.70	14.86	10.97	20.87	17.22	16.60	7.77
6	24.56	18.18	14.37	11.03	18.45	15.86	13.93	6.16
7	26.65	20.09	15.50	11.98	20.74	17.58	14.64	7.04
8	24.88	18.61	14.83	11.40	19.56	15.88	13.30	6.25
9	26.25	16.48	14.66	11.03	20.09	16.92	14.88	6.80
10	24.28	17.92	14.46	10.58	18.43	15.42	13.24	5.97
11	25.80	18.35	14.88	11.59	19.87	15.82	13.93	6.34
12	24.96	18.09	14.62	11.11	19.54	16.24	13.91	6.56
13	25.27	18.61	15.20	10.97	19.63	16.58	13.73	6.31
14	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-
16	22.57	16.58	13.41	9.88	18.13	14.35	12.44	6.35
17	23.90	18.08	14.18	10.46	17.28	15.22	13.36	5.75
18	22.81	16.82	13.79	10.83	17.41	14.77	12.75	5.74
19	-	-	-	-	-	-	-	-
20	23.50	17.85	14.50	10.32	18.09	15.84	13.12	5.99
21	-	-	-	-	-	-	-	-
22	21.58	15.56	13.09	9.35	16.66	13.93	11.67	5.27
23	22.31	16.68	13.44	9.93	17.05	16.55	12.53	5.38
24	20.99	15.74	12.56	9.27	15.89	14.43	11.57	5.27
25	22.11	16.20	12.99	9.91	16.85	14.66	12.19	5.68

Morphological data of *M. sphaericula spiralis* from That Phanom, Nakhon Phanom (TP)

Number	SH	SW	AH	AW	BH	BW	SP	PH
1	32.68	27.66	22.61	15.74	27.59	22.77	15.37	8.74
2	28.03	26.33	22.04	15.87	24.70	20.64	11.09	5.87
3	31.22	26.60	21.17	15.63	25.69	22.97	14.84	7.75
4	30.46	26.43	21.47	15.86	25.64	22.35	14.11	8.05
5	30.30	27.33	21.22	16.78	25.99	22.6	13.97	7.16
6	31.04	26.84	22.36	15.78	26.15	20.73	13.08	5.86
7	30.92	27.93	22.12	15.30	27.22	23.68	14.97	9.12
8	29.54	26.35	21.38	15.41	26.05	20.91	12.88	7.70
9	25.03	23.13	19.18	14.18	21.48	17.88	10.10	5.16
10	32.94	27.61	22.88	17.49	27.67	23.09	15.25	7.96
11	-	-	-	-	-	-	-	-
10	26.87	24.98	20.14	14.67	23.92	19.46	10.36	5.21
13	34.10	29.62	23.74	16.88	29.33	24.09	15.69	8.91
14	30.66	26.73	20.87	15.96	26.54	22.12	14.44	8.95
15	31.67	26.90	22.12	16.35	27.12	23.14	15.22	8.94
16	30.51	28.48	22.12	16.65	25.59	21.22	12.67	6.02
17	29.74	26.35	21.71	15.95	26.14	21.14	13.81	7.74
18	32.16	28.92	22.96	17.05	27.97	24.06	15.34	9.69
19	32.19	27.69	22.05	15.98	26.66	21.89	14.51	6.88
20	-	-	-	-	-	-	-	-
21	30.22	27.36	21.56	15.42	26.34	22.37	13.92	7.73
22	29.58	27.10	21.36	16.12	25.40	21.05	12.40	6.29
23	31.46	28.28	22.30	16.98	26.44	22.25	13.94	7.29
24	29.58	25.90	19.90	14.73	25.09	21.67	14.21	7.90
25	30.17	26.63	21.50	14.84	26.62	21.74	14.81	8.26

Biography

Mr. Wachira Srikoom was born on the 30th of March, 1980 in Phetchabun Province. He received his Bachelor Degree of Science in Biology in 2001 from Naresuan University. He continued his graduate study for Master degree of science in Zoology, Department of Biology, Faculty of Science, Chulalongkorn University in 2002. He received a research grant for his master's thesis from BRT Program (Biodiversity Research and Training program) in 2003-2004.



ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย