Appendices

Appendix A

Table 1. Each ISSR marker scored as present (1) or absent (0) for each sample in Northern part of Thailand.

UBC 835

Fragment size (bp)	Lanes												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1500	0	0	0	0	1	0	0	0	0	0	1	0	0
1000	0	0	0	1	0	0	1	0	0	0	0	0	0
900	0	0	0	1	0	0	0	0	0	0	0	0	0
850	0	0	0	1	0	0	0	0	0	0	0	0	0
800	1	1	1	0	1	1	1	1	0	1	0	1	1
750	1	0	1	0	1	1	1	1	1	0	1	0	1
700	1	1	1	0	0	0	1	1	1	0	1	1	1
650	0	0	0	0	0	0	0	0	0	0	0	0	0
600	1	1	1	0	1	1	1	1	1	0	1	1	1
550	1	1	1	0	1	1	0	0	0	0	1	1	1
500	1	1	1	0	1	1	1	1	1	0	1	1	1
450	1	1	1	0	1	1	1	1	1	0	1	0	1
400	0	1	0	1	1	1	1	1	1	1	1	0	1
350	0	0	0	0	0	0	0	1	0	0	1	1	1
300	0	0	0	1	0	0	1	1	0	0	1	1	1
200	0	0	0	0	0	0	0	0	1	0	0	0	0

UBC 826

Fragment size (bp)	Lanes												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1500	0	1	1	0	0	0	1	1	0	0	0	0	0
1200	1	1	1	1	0	0	0	0	0	1	0	0	0
1000	1	1	0	1	0	1	1	1	0	1	1	0	0
900	0	1	0	0	1	0	0	0	0	1	0	0	1
800	0	0	0	0	0	0	0	1	1	1	0	1	1
700	0	0	1	0	0	0	1	0	1	0	1	0	0
650	0	0	0	1	0	0	1	1	0	1	0	0	0
600	0	0	0	1	0	0	0	1	0	1	0	0	1
500	1	0	0	1	0	0	0	0	0	0	0	0	1

UBC 809

Fragment size (bp)	Lanes												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1000	1	0	1	1	0	1	1	0	0	0	0	0	0
900	0	0	0	1	0	0	0	0	0	0	0	0	0
800	0	0	1	1	1	1	1	0	0	0	0	0	0
650	1	1	0	1	1	1	1	0	0	0	1	1	1
600	1	0	0	0	0	0	1	1	1	1	1	1	1
550	0	0	1	1	1	1	1	1	1	1	1	1	1
500	0	0	0	0	0	0	0	1	0	0	0	0	1

UCB 808

Fragment size (bp)	Lanes												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1200	0	0	0	1	0	0	1	0	0	1	0	0	0
1000	1	1	1	0	0	1	1	0	0	1	0	1	1
900	0	0	0	0	0	0	0	0	0	1	0	1	1
800	0	0	0	0	0	0	0	0	0	1	0	0	0
650	0	0	0	1	0	1	1	1	0	0	0	1	1
600	1	0	0	0	1	0	1	1	0	1	0	1	1
500	0	0	0	0	0	0	0	1	0	1	0	1	1
450	1	1	1	1	1	1	1	1	1	1	0	1	1
400	1	1	1	1	1	1	1	1	1	1	0	1	1

UBC 825

Fragment size (bp)	Lanes												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1750	1	1	0	0	0	0	0	0	0	0	0	0	1
850	1	1	1	1	1	1	1	1	1	1	1	1	1
600	1	1	1	1	1	1	1	1	1	1	1	1	1

UBC 827

Fragment size (bp)	Lanes												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1500	1	1	1	1	1	1	1	1	1	1	1	1	1
1100	1	1	1	1	1	1	1	1	1	1	1	1	1
1000	0	0	0	0	0	1	0	0	0	0	0	1	1
850	1	1	0	0	0	1	1	1	1	0	0	0	1
800	1	1	0	1	1	0	1	1	0	1	0	0	1
600	0	0	0	1	0	0	0	0	1	1	0	0	1
500	0	0	0	0	1	0	1	1	0	0	0	0	1

UBC 864

Fragment size (bp)	Lanes												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
2000	0	1	0	0	0	0	0	1	0	0	0	0	1
1500	1	0	0	0	0	0	1	0	0	0	0	0	0
1200	0	0	0	0	0	0	0	0	0	0	1	0	0
1000	1	1	1	1	0	1	1	1	0	0	0	0	0
700	1	1	0	0	0	0	0	0	0	0	0	0	1
650	0	0	0	1	0	0	0	0	0	0	1	0	0
480	0	0	1	0	0	0	1	0	0	0	0	0	0
380	0	0	1	0	0	0	1	0	0	0	0	0	0
300	0	0	0	0	1	0	0	0	1	1	0	0	0

UBC 807

Fragment size (bp)	Lanes												
	1	2	3	4	5	6	7	8	9	10	11	12	13
1000	0	0	1	1	0	0	0	0	0	1	1	0	0
850	0	0	0	0	0	0	0	0	0	0	0	1	0
750	0	1	1	1	1	0	1	1		0	0	1	1
620	1	0	0	0	0	1	0	0	0	0	0	1	1
480	0	0	0	0	0	0	0	0	0	0	0	0	0
400	1	1	0	0	1	1	0	0	0	1	1	0	1
320	1	0	0	0	0	1	1	1	1	0	0	0	0
300	0	1	0	0	0	0	0	0	0	0	0	0	0
280	0	0	1	1	0	1	1	1	1	0	0	0	0
220	0	1	0	0	1		1	1	1	1	1	1	1
150	0	0	1	1	0	0	0	0	0	0	0	1	0

UBC 857

Fragment size (bp)	Lanes												
	1	2	3	4	5	6	7	8	9	10	11	12	13
1700	1	1	0	0	0	0	0	0	0	0	0	0	0
1200	1	1	0	1	0	1	0	1	0	0	1	0	0
1000	1	1	1	1	1	1	1	1	1	1	1	1	1
650	1	1	1	1	1	1	1	1	1	1	1	1	1
400	1	0	0	0	0	1	0	0	0	0	0	0	0

UBC 880

Fragment size (bp)	Lanes												
	1	2	3	4	5	6	7	8	9	10	11	12	13
1700	0	1	1	1	0	0	1	1	0	1	0	0	1
1500	0	0	0	1	0	0	0	1	0	0	0	0	0
1200	0	0	1	0	1	0	1	1	0	0	0	0	1
1000	0	0	1	1	1	0	1	1	0	0	0	0	1
750	0	0	0	0	1	1	1	0	0	1	0	1	1
700	1	1	1	0	1	1	1	0	0	0	0	0	0
600	0	1	1	0	0	0	0	1	0	0	1	0	0
450	0	1	0	0	0	0	0	0	1	0	1	1	0
400	1	0	1	0	0	0	1	1	0	1	0	0	0

Table 2. Each ISSR marker scored as present (1) or absent (0) for each sample in Southern and Eastern part of Thailand.

UBC 835

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1000	1	1	1	1	1	1
900	1	1	1	0	0	0
700	1	1	1	1	1	1
620	1	1	1	1	1	1
300	1	1	1	1	1	1
270	1	1	1	1	1	1
230	1	1	1	1	1	1

UBC 826

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1500	1	1	0	1	0	0
1300	0	0	0	0	0	1
1050	0	0	0	0	0	1
1000	0	0	0	0	0	1
950	0	0	0	0	1	0
900	0	0	0	0	1	0
800	0	0	0	1	1	0
700	1	0	0	1	1	0
600	1	1	1	1	0	1
500	0	1	0	0	1	0
450	1	0	0	1	0	0
400	1	1	0	1	0	1

UBC 809

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
900	0	0	0	0	0	1
800	0	0	0	0	0	1
700	0	0	0	0	1	1
600	0	0	0	1	0	1
550	1	0	0	1	1	0
500	0	0	0	0	1	1
450	0	0	0	1	1	0
400	0	0	0	0	1	1
350	1	0	0	1	0	1
300	0	1	1	0	0	1
250	0	0	1	1	0	0
200	1	1	1	1	0	0

UBC 808

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1200	0	0	1	0	0	0
1000	0	1	1	0	0	0
900	0	0	1	0	0	0
800	0	0	1	0	0	0
700	1	0	1	0	1	0
600	0	0	0	0	1	0
550	0	0	0	0	0	1
500	0	1	1	0	1	1
450	1	0	1	1	0	0
400	0	0	1	0	1	0
350	0	0	0	0	1	0
300	0	0	1	0	1	1
250	1	0	0	0	1	1
200	0	0	0	0	0	1
150	1	1	0	1	1	0

UBC 825

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1000	1	0	0	1	1	0
800	1	0	1	0	0	0
700	0	1	0	1	1	0
600	0	0	1	1	1	1
500	1	1	1	1	1	1
450	0	1	0	1	0	0
400	0	0	1	0	1	1
350	1	0	0	1	1	0
300	0	0	1	1	1	0
250	0	0	0	1	0	0

UBC 827

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1200	0	0	0	1	0	0
1150	0	0	0	0	1	0
850	1	0	0	0	0	1
700	0	1	1	1	1	0
600	1	0	0	1	0	0
300	0	1	1	1	1	1

UBC 864

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1500	1	0	0	0	0	0
1250	1	0	0	1	1	0
1050	0	1	0	1	0	0
900	1	0	0	0	0	0
800	0	1	1	0	0	1
700	1	0	1	1	0	0
600	0	0	1	0	1	0
550	1	0	1	1	0	1
500	0	1	0	0	0	0
350	0	1	0	0	0	0
300	0	0	1	0	0	0

UBC 807

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1050	0	0	0	0	1	0
1100	0	0	0	0	0	0
850	1	0	0	0	1	1
700	1	1	1	0	1	0
650	0	0	1	0	0	0
600	0	0	1	0	0	0
500	0	0	0	1	0	0
400	0	1	1	0	0	0
350	0	0	1	0	0	0
300	0	0	1	0	0	0

UBC 857

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1500	0	0	1	1	1	1
1200	0	0	1	0	0	1
1000	0	0	0	0	0	1
850	1	1	1	0	1	1
600	0	0	0	0	1	0
500	1	1	1	1	1	0
280	1	0	1	1	1	1
250	1	1	1	0	1	1

UBC 880

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
2700	1	0	0	0	0	0
2400	1	0	0	0	0	0
1750	1	0	0	1	0	1
1500	1	0	0	0	0	0
1200	1	0	0	1	1	0
1000	0	0	1	0	1	0
800	1	1	0	0	0	0
700	1	0	0	0	0	0
500	1	0	0	0	1	0
400	0	1	0	0	0	0
300	1	0	0	0	1	1
250	0	0	0	1	0	1

Table 3. Each ISSR marker scored as present (1) or absent (0) for each sample in Northeastern part of Thailand.

UBC 835

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1000	1	1	1	1	1	1
700	1	1	0	0	1	1
600	1	1	1	1	1	1
400	1	1	1	1	1	1
300	1	1	1	1	1	1

UBC 826

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1700	0	1	1	1	0	0
1500	0	0	0	1	0	0
1300	1	1	1	0	1	0
1000	0	0	0	1	0	0
700	0	0	0	1	1	0
600	0	1	1	0	0	0
550	1	0	0	0	0	1

UBC 809

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
700	1	1	0	0	0	1
600	1	0	0	0	1	0
500	1	1	1	0	0	0
400	1	1	1	1	1	1
300	1	1	1	1	1	1
230	1	1	1	1	1	1

UBC 808

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1500	0	0	0	0	0	1
900	0	0	0	0	0	1
800	0	0	0	0	0	1
600	1	0	0	0	1	0
420	1	1	1	1	1	1
350	1	0	1	1	1	1
280	1	1	1	1	1	1
200	0	0	0	1	1	1
130	1	1	1	1	1	1

UBC 825

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1200	0	0	0	0	1	1
800	0	1	0	1	1	1
700	1	1	0	1	0	1
500	1	1	1	1	1	1
350	0	0	0	1	1	1
250	0	0	0	1	1	1

UBC 827

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1300	0	1	1	1	0	0
1000	0	0	0	0	1	0
970	1	0	0	1	0	1
720	1	1	1	1	0	1
600	0	1	1	1	1	1
500	0	1	1	1	0	1
350	0	1	1	1	1	1

UBC 864

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1850	0	1	0	0	0	0
1700	1	0	0	0	0	0
1250	0	1	0	0	1	0
1500	0	0	0	0	1	0
1200	1	1	1	1	1	0
1050	0	0	0	1	0	0
1000	0	1	1	1	0	0
900	1	1	1	1	0	1
800	1	1	0	1	1	1
700	1	0	0	0	0	0
600	0	1	0	0	0	0
550	0	1	1	1	1	0
500	0	0	1	0	1	1
480	0	0	0	1	0	0

UBC 807

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1100	0	0	1	0	0	0
1050	0	0	0	0	1	0
750	0	1	0	0	0	0
700	0	0	1	0	1	0
680	0	0	1	1	0	0
420	0	0	0	0	0	1
400	0	0	0	0	0	1
250	0	0	0	0	1	0
220	0	0	1	0	0	0
200	1	0	0	0	0	0
150	1	0	0	0	0	0

UBC 857

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1500	1	0	0	0	0	0
1200	1	1	1	0	1	1
800	1	1	1	1	1	1
700	0	1	1	1	0	0
550	1	1	1	0	1	1
500	1	1	0	1	1	1
350	1	1	1	0	0	0

UBC 880

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1700	1	1	1	1	0	1
1500	0	0	1	1	1	1
1200	1	0	0	1	1	1
700	0	0	0	0	1	0
650	1	0	0	1	0	1
240	0	1	1	0	0	0

Table 4. Each ISSR marker scored as present (1) or absent (0) for each sample in Central part of Thailand.

UBC 835

Fragment size (bp)	Lanes										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
900	0	1	1	1	0	0	1	1	1	1	0
800	1	1	1	1	1	1	1	1	1	1	1
700	1	1	1	1	1	1	1	1	1	1	1
600	1	1	1	1	1	1	1	1	1	1	1
400	1	1	1	1	1	1	1	1	1	1	1

UBC 826

Fragment size (bp)	Lanes										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
2250	1	1	0	0	0	0	0	0	0	0	0
1700	0	0	0	0	1	0	0	0	0	1	0
1500	0	0	1	0	0	0	0	0	1	0	0
1200	0	0	1	0	0	0	0	0	1	0	1
900	0	0	1	1	0	0	0	0	1	0	0
850	0	1	0	1	0	0	0	1	1	0	0
700	0	1	0	0	0	0	1	0	0	1	0
600	1	1	0	0	0	0	0	1	1	1	0
510	1	0	1	1	0	0	0	1	1	0	0
490	0	1	0	0	0	0	1	1	1	1	0
420	0	0	0	1	0	0	0	0	0	0	0
350	0	1	1		1	0	0	0	0	1	1
300	1	0	0	0	0	0	0	0	0	0	0

UBC 809

Fragment size (bp)	Lanes										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1150	0	0	1	1	1	0	0	0	0	0	0
900	0	0	0	0	1	0	0	0	0	0	0
650	1	0	0	1	0	1	1	1	0	0	0
550	1	1	1	1	0	1	1	1	0	0	0
500	1	1	1	0	0	0	1	0	0	0	0
350	1	0	1	1	1	1	1	1	1	1	1
320	1	0	1	1	1	1	0	0	1	0	0
250	1	1	1	1	1	1	1	1	1	1	1

UBC 808

Fragment size (bp)	Lanes										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
650	0	0	1	0	0	1	0	0	1	0	0
500	0	0	1	1	0	1	0	0	1	0	0
420	1	1	1	1	0	0	1	1	1	1	1
350	1	1	1	0	0	1	1	0	0	0	0
320	1	1	1	0	0	1	1	1	1	0	0
250	1	1	1	1	1	1	1	1	1	1	1
200	1	1	1	1	0	1	1	0	1	1	1
100	1	1	1	1	1	1	1	1	1	1	1

UBC 825

Fragment size (bp)	Lanes										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
700	0	0	1	1	1	1	1	0	1	0	0
600	0	0	0	0	1	0	1	1	0	0	1
500	1	1	1	1	1	1	1	1	1	1	1
400	0	0	0	0	0	0	0	1	1	1	1
250	0	0	0	0	0	0	0	1	1	1	1
200	0	0	1	0	1	0	0	0	0	0	0

UBC 827

Fragment size (bp)	Lanes										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1200	0	0	0	0	1	1	1	0	0	1	1
970	1	1	0	0	0	1	1	0	0	1	1
800	1	1	1	1	1	1	1	0	1	1	1
600	0	0	0	1	0	0	1	0	0	1	1
500	0	0	0	1	0	0	0	1	0	0	0
400	1	1	0	0	0	0	0	0	0	0	0
300	0	0	0	1	1	1	1	1	1	1	1

UBC 864

Fragment size (bp)	Lanes										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1500	0	0	1	0	0	1	1	1	0	0	0
1100	1	1	0	0	0	1	1	0	1	0	0
900	1	1	1	1	1	1	1	1	1	1	1
700	1	1	0	1	1	1	1	1	1	1	1
570	0	1	1	1	1	0	0	1	0	1	1
530	1	1	0	1	1	1	1	1	0	1	1
450	0	0	0	0	0	0	0	0	0	1	0

UBC 807

Fragment size (bp)	Lanes										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1000	0	1	0	0	0	0	1	0	0	0	0
670	0	0	0	1	0	0	0	0	0	1	1
600	1	0	0	0	0	0	0	0	0	0	0
500	0	1	0	1	0	0	0	0	0	0	0
400	1	1	0	1	0	1	0	0	0	1	0
350	0	0	0	0	0	0	0	1	1	0	1
320	0	0	0	0	1	0	1	0	0	0	1
270	0	0	1	1	0	0	0	0	0	0	0
200	0	1	1	1	0	0	0	0	1	1	1
180	0	0	0	0	0	0	0	0	0	1	0
150	0	0	0	0	0	0	1	0	0	0	0

UBC 857

Fragment size (bp)	Lanes										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1500	1	1	0	0	0	0	0	0	0	0	0
1200	1	1	1	1	1	1	0	0	1	1	1
900	1	1	1	1	1	1	1	1	1	1	1
800	0	1	1	1	1	1	1	0	0	0	1
530	1	1	1	1	1	0	1	0	0	1	1
500	1	1	1	1	1	1	1	1	1	1	1
370	1	1	1	0	1	1	0	0	0	1	0
300	1	1	1	1	1	1	1	1	1	1	1
200	1	1	0	0	0	0	0	0	1	0	0

UBC 880

Fragment size (bp)	Lanes										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
700	0	0	1	0	0	0	0	0	0	0	0
600	0	0	1	0	0	1	0	0	0	0	0
550	1	0	0	0	1	1	1	1	1	0	0
400	1	1	1	1	1	1	1	1	1	1	1
320	1	1	1	1	0	0	1	1	1	0	0
250	1	1	1	1	1	1	1	1	1	1	1
220	1	1	1	1	0	1	1	1	1	1	1
150	1	1	1	1	1	1	1	1	1	1	1

Table 5. Each HAT-RAPD marker scored as present (1) or absent (0) for each sample in Northern part ofThailand.

O 15

Fragment size (bp)	Lanes												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1200	1	1	1	1	1	1	1	1	1	1	1	1	1
900	1	1	1	1	1	1	1	1	1	1	1	1	1
550	1	1	1	1	1	1	1	1	1	1	1	1	1
400	0	0	0	0	0	0	0	0	0	0	0	0	1

O 16

Fragment size (bp)	Lanes												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1350	1	0	1	1	0	0	0	1	0	1	1	0	0
700	1	1	1	1	1	0	0	0	0	0	0	0	0
550	1	1	0	1	0	1	0	0	1	1	1	0	1
470	0	0	0	0	0	0	0	0	0	0	0	0	1
400	1	1	0	1	0	0	1	1	1	1	1	1	0
300	1	0	0	1	0	0	0	1	1	0	1	0	1
220	0	0	0	0	0	0	1	0	0	1	0	0	0

V 14

Fragment size (bp)	Lanes												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1300	1	1	1	1	1	1	1	1	1	1	1	1	1
700	0	1	1	1	1	1	1	1	1	1	1	1	1
600	0	1	1	1	1	1	1	1	1	1	1	1	1
480	1	1	1	1	1	1	1	1	1	1	1	1	1
370	0	0	0	0	0	0	0	0	0	0	1	0	1
290	0	0	0	0	0	0	0	0	0	0	1	0	1
230	1	1	1	1	1	1	1	1	1	1	1	1	1
170	1	1	1	1	1	1	1	1	1	1	1	1	1

V-15

Fragment size (bp)	Lanes												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
900	1	1	1	1	1	1	1	1	1	1	1	1	1
700	1	1	1	1	0	1	1	1	1	1	0	1	1
500	1	1	1	1	1	1	1	1	1	1	1	1	1
400	0	0	0	0	1	0	0	1	1	1	1	0	0
320	0	0	0	0	0	0	0	0	0	0	0	0	1

B-01

Fragment size (bp)	Lanes												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
550	0	0	0	0	1	0	0	0	0	1	0	0	0
460	1	1	1	1	1	1	1	1	1	1	1	1	1
380	0	0	1	1	0	0	1	1	0	0	0	0	0
330	1	1	1	1	1	1	1	1	1	1	1	1	1
280	1	1	1	1	1	1	1	1	1	1	1	1	1
220	0	1	1	1	1	1	1	1	1	1	0	1	0
160	1	1	1	1	1	1	1	1	1	1	1	1	1

Table 6. Each HAT-RAPD marker scored as present (1) or absent (0) for each sample in Southern and Eastern part of Thailand.

O 15

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1200	0	0	0	0	0	1
600	1	1	1	0	1	1
550	0	0	0	1	0	0
500	1	1	1	0	0	1
400	0	0	0	1	0	0
310	0	0	0	0	1	0
300	1	1	1	1	1	1
180	0	1	1	1	1	1
120	0	1	1	1	1	1

O 16

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
3000	0	0	1	1	0	0
2500	1	1	1	0	0	0
2000	1	0	1	1	1	0
1000	1	1	1	0	0	0
900	0	0	0	1	1	0
800	1	1	0	0	0	0
700	0	0	0	1	1	0
650	1	0	0	0	0	0
600	0	0	0	1	1	0
550	1	0	0	0	0	0
500	0	0	0	0	0	1
450	0	0	0	0	0	0
400	1	0	0	0	0	0
300	0	0	0	0	0	1
250	0	0	0	0	0	0
200	0	1	0	1	1	0

V 14

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
3000	0	0	0	0	0	1
2000	0	0	1	0	1	1
1000	0	0	0	0	1	1
900	1	0	0	0	0	0
800	0	0	0	0	0	1
750	0	0	0	0	0	0
700	0	0	0	0	1	1
650	0	0	0	0	0	0
600	0	1	1	1	1	0
550	0	0	0	0	0	1
500	1	1	0	1	1	0
450	0	0	1	0	0	0
400	1	1	0	1	1	0
350	0	0	1	1	0	1
300	1	1	0	0	1	1
250	0	0	0	1	0	1
200	1	1	0	0	0	1

V15

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
800	1	1	1	1	1	0
750	0	0	0	0	1	0
600	0	0	0	0	1	0
550	0	0	0	0	0	1
500	0	1	1	0	1	0
400	1	1	1	0	1	0
320	1	1	1	1	0	1
250	1	1	1	1	0	1
150	1	1	1	1	0	1

B01

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
900	0	0	0	0	0	1
600	0	0	0	0	0	1
450	0	0	1	1	1	0
400	1	1	1	0	0	0
350	1	1	1	0	0	1
300	0	1	0	1	1	0
250	1	0	1	1	1	1
200	0	1	1	0	0	0
150	0	1	1	1	1	1

Table 7. Each HAT-RAPD marker scored as present (1) or absent (0) for each sample in Northeastern part of Thailand.

O15

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
2000	0	1	0	0	0	0
1000	1	0	0	0	0	0
900	1	0	0	0	1	0
600	1	1	1	1	1	1
530	1	0	0	0	1	1
430	1	0	0	0	0	0
330	1	0	0	0	0	0
300	0	1	1	1	1	1
230	1	0	0	0	0	0
200	0	0	0	0	1	1
120	1	0	0	0	1	0

O16

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
2500	0	1	1	1	1	0
1350	1	1	0	0	0	1
1200	1	0	0	0	0	0
1000	1	1	1	1	1	1
900	1	1	1	1	1	1
700	1	1	1	1	1	0
600	1	1	1	1	1	0
500	1	0	1	1	1	0
370	1	1	0	1	0	1
320	1	1	1	1	1	1
230	0	0	0	0	0	1

V 14

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
650	0	0	0	0	0	1
530	0	0	1	1	1	1
420	1	0	0	0	0	0
390	1	1	1	1	1	1
330	1	1	1	1	1	1
230	1	1	1	1	1	0
200	1	0	1	1	1	1
170	0	1	1	1	1	1

V15

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
3000	0	0	0	0	0	1
2500	0	0	0	0	0	1
1500	0	0	0	0	0	1
1000	0	0	0	0	0	1
900	0	0	0	0	0	1
800	0	0	0	0	0	1
700	0	0	0	0	0	1
650	0	0	0	0	0	1
600	0	1	1	0	0	0
500	1	1	1	1	0	1
350	1	1	1	1	1	1
250	1	1	1	1	1	1
200	0	0	1	1	0	0
180	1	1	0	0	0	1

B01

Fragment size (bp)						
	1	**2**	**3**	**4**	**5**	**6**
900	0	0	0	0	0	1
600	1	0	0	1	0	0
500	0	0	0	0	0	0
470	0	1	0	0	0	0
450	1	0	0	0	0	0
400	0	0	0	0	0	1
320	1	1	1	1	1	1
270	1	1	1	1	1	1
200	1	1	0	0	0	0
170	1	1	1	1	1	0
100	1	0	0	0	0	0

Table 8. Each HAT-RAPD marker scored as present (1) or absent (0) for each sample in Central part of Thailand.

O15

Fragment size (bp)	Lanes										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
950	0	0	0	0	1	1	0	1	0	0	0
700	0	1	0	1	0	1	0	0	0	1	0
350	0	0	0	0	0	0	0	0	0	0	0
400	0	0	0	1	1	1	1	1	1	0	0
300	1	1	1	1	1	1	1	1	1	1	1
220	0	1	1	1	1	1	1	0	0	0	0
180	0	1	1	0	0	0	0	0	0	0	0

O16

Fragment size (bp)	Lanes										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1500	1	1	0	0	0	0	0	0	0	0	0
1000	1	0	0	1	0	0	0	0	1	0	1
850	1	1	1	0	0	1	1	0	0	1	1
700	0	0	0	0	1	0	0	0	0	0	0
530	0	0	0	1	0	0	0	0	1	0	0
480	1	1	0	0	0	1	1	0	0	1	1
300	1	1	1	1	0	0	0	1	1	0	0
220	1	1	1	1	0	0	0		1	0	0
100	0	0	0	0	0	1	1	0	1	0	1

V14

Fragment size (bp)	Lanes										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1000	0	0	0	0	0	0	0	0	0	1	0
700	0	1	0	0	0	0	0	0	0	0	0
500	0	0	0	1	1	1	1	0	0	0	0
400	1	1	1	1	1	1	1	1	1	1	1
350	1	0	1	1	1	1	1	1	1	0	1
200	1	1	1	1	0	0	0	1	1	1	1
150	0	1	0	0	0	0	0	0	0	0	0

V15

Fragment size (bp)	Lanes										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1200	0	0	0	0	0	0	0	0	0	1	0
800	0	0	0	0	1	0	0	1	0	0	0
600	1	1	0	1	1	0	0	1	0	0	0
500	1	1	1	1	1	0	0	1	1	1	0
400	0	0	0	0	1	0	0	1	1	0	0
310	0	0	1	1	0	1	1	0	1	0	1
270	0	1	1	0	0	0	0	0	0	0	0
230	1	1	1	1	0	1	1	0	1	1	1
170	1	0	1	1	0	1	1	0	0	0	0

B01

Fragment size (bp)	Lanes										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
600	0	0	0	0	0	0	0	1	0	0	0
500	0	1	1	0	1	1	0	1	0	1	0
350	1	1	1	1	1	1	1	1	1	1	1
250	1	1	1	1	1	1	1	1	1	1	1

Table 9. Each ISSR marker scored as present (1) or absent (0) for each character groups.

UBC 835

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1500	0	0	0	0	1	1
1000	0	0	0	1	0	0
700	0	1	0	0	0	0
500	0	1	0	0	0	0
400	0	1	0	1	0	1
330	1	0	0	1	0	1
300	0	1	1	1	1	1
220	1	1	0	0	1	0
200	1	0	0	0	0	0

UBC 826

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
700	0	1	0	0	1	0
600	1	0	0	0	1	1
530	0	0	0	1	0	0
500	1	1	0	1	0	0
400	1	1	1	1	1	1
350	0	0	1	1	0	1
200	0	0	0	1	0	0
100	0	0	0	0	0	1

UBC 809

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
600	0	0	1	1	0	1
500	0	0	1	1	1	1
400	1	1	1	1	1	1
350	1	1	1	1	0	1
230	1	1	1	1	1	1

UBC 808

Fragment size (bp)	Lanes					
	1	2	3	4	5	6
800	0	1	0	0	0	0
600	1	1	1	1	1	0
400	1	1	1	1	1	1
230	1	1	1	1	1	1
180	0	0	0	0	1	0
130	1	1	1	1	1	1

UBC 825

Fragment size (bp)	Lanes					
	1	2	3	4	5	6
1100	0	0	0	1	1	0
850	1	0	0	0	0	0
700	0	1	1	1	1	0
600	1	1	1	1	1	0
500	1	1	1	0	0	0
400	1	1	0	1	0	1
350	1	0	1	1	1	1
300	1	1	1	1	1	1
280	1	1	1	1	1	1
220	1	1	1	1	1	1
180	0	0	0	0	0	1

UBC 827

Fragment size (bp)	Lanes					
	1	2	3	4	5	6
1200	0	1	1	0	0	0
1050	0	1	1	1	1	1
900	1	0	1	1	1	0
850	1	0	1	0	0	1
700	0	1	1	1	1	0
550	1	1	1	1	1	1
500	0	0	0	0	1	1
490	0	1	1	1	1	0
280	1	0	1	0	1	0

UBC 864

Fragment size (bp)	Lanes					
	1	2	3	4	5	6
2700	1	0	0	1	0	0
1200	0	0	1	0	0	0
1150	0	1	0	0	0	0
1100	0	0	1	0	0	0
700	1	0	0	1	1	1
650	0	0	0	1	1	1
470	1	0	0	0	0	1
350	0	1	0	0	0	1
300	0	0	1	0	0	0

UBC 807

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1000	0	0	1	0	0	0
850	0	1	0	1	0	0
750	0	0	1	0	0	0
680	0	1	0	0	0	0
650	0	0	0	0	0	1
600	0	0	0	1	0	0
450	1	0	0	0	1	1
380	0	1	0	0	1	1
270	0	0	1	0	0	0
250	0	1	0	0	1	0
200	1	0	0	0	0	0
140	1	0	0	0	0	0

UBC 857

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
1700	0	0	0	0	0	1
1200	1	1	0	0	0	0
900	1	1	1	1	1	0
800	0	0	0	1	0	0
700	0	0	0	0	0	1
600	1	1	1	1	1	0
540	1	1	1	1	1	0
500	1	1	1	1	1	1
350	1	1	0	1	1	0
270	1		1	1	0	0
220	0	1	0	0	0	0
200	0	0	0	1	0	0

UBC 880

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
2850	1	0	0	0	0	0
2750	0	0	1	0	0	1
2600	0	1	0	0	0	0
2400	0	1	0	0	0	0
900	1	1	1	0	0	0
800	0	1	1	0	0	0
720	0	0	1	1	0	0
700	1	1	0	0	0	1
500	1	1	0	0	1	0
450	1	1	0	0	0	0
350	0	0	1	0	0	0

Table 10. Each HAT RAPD marker scored as present (1) or absent (0) for each character groups.

O15

Fragment size (bp)	Lanes					
	1	2	3	4	5	6
630	1	1	1	0	1	0
550	1	1	0	0	0	0
300	1	1	1	1	1	1
180	0	0	0	0	0	1
110	1	1	1	1	1	0

O16

Fragment size (bp)	Lanes					
	1	2	3	4	5	6
1050	0	1	1	1	0	0
950	0	0	0	0	1	0
800	0	1	1	1	1	1
700	0	1	1	0	0	0
500	1	0	0	0	0	0
400	1	1	1	1	0	1
330	1	0	0	0	1	1
300	1	0	0	1	0	0
250	1	1	1	0	0	0
220	1	1	1	1	1	1
180	0	1	1	1	1	0

V14

Fragment size (bp)	Lanes					
	1	2	3	4	5	6
600	0	0	1	0	0	1
330	1	1	1	1	1	1
280	1	1	1	1	1	1
160	1	1	1	1	1	1

V15

Fragment size (bp)	Lanes					
	1	2	3	4	5	6
2600	1	0	1	0	0	1
1300	1	0	1	1	0	1
900	1	0	1	1	1	1
800	1	0	1	1	1	1
600	0	1	1	0	1	0
520	0	0	0	0	0	1
500	1	1	1	1	1	1
370	0	0	0	0	0	1
330	1	1	1	1	1	1
230	1	1	1	1	1	1
170	1	1	1	1	1	1

B01

Fragment size (bp)	Lanes					
	1	**2**	**3**	**4**	**5**	**6**
600	0	0	0	0	0	1
280	0	1	0	0	1	0
330	1	1	1	1	1	1
280	1	1	1	1	1	1
170	1	1	1	1	1	1

Appendix B

SEQUENCE OF RIBUROSE-BIPHOSPHATE CARBOXYLASE (*rbcL*) AND INTERNAL TRANSCRIBED SPACER 2 (ITS2) REGION OF *Spirogyra* SUBJECTED FOR MULTIPLE ALIGNMENT

Sequences of *rbcL* gene of *Spirogyra* subjected for multiple alignment and analysis the phylogenetic relationships

Pattern 1 (*S. ellipsospora*)

AAAGGGTCTGCATTAAGCACGAGTAAGATTACAGACTTACATATTATACT
CCTGAGTATGAGACCAAAGAAACTGACATTTTAGCTGCTTTTCGTATGACT
CCTCAGCCTGGAGTACCACCAGAAGAGGCTGGTGCCGCTGTAGCAGCAGA
GTCTTCTACTGGAACATGGACTACTGTATGGACAGATGGACTGACTAGTTT
GGATCGTTACAAAGGAAGATGTTATGATATTGAACCTGTTGCTGGCGAAG
AAAATCAATACATTGCTTACGTAGCTTATCCTTTAGATCTATTTGAAGAAG
GTTCTGTTACCAACTTGTTTACTTCTATTGTAGGTAACGTATTTGGTTTCAA
AGCACTTCGTGCTTTACGTCTAGAAGATCTACGCATTCCTCCTGCATATTC
TAAAACTTTCCAAGGTCCTCCTCACGGAATTCAAGTAGAAAGAGACAAAC
TTAATAAGTATGGCCGTCCTTTGTTAGGTTGTACTATTAAACCTAAATTAG
GTTTATCTGCTAAAAACTACGGTAGAGCTGTATATGAGTGCCTTCGTGGTG
GACTTGGATTTTACAAAN

Pattern 2

AAAGGGGCCTGGAATTAAGCAGGTGTTAAGATTATAGACTTACATATTAC
ACTCCTGAATACGAAACCAAAGAAACTGATGTTTTAGCTGCATTTCGTAT
GACTCCTCAGCCTGGAGTACCACCTGAAGAAGCAGGTGCTGCTGTAGCAG
CTGAATCTTCTACTGGAACATGGACTACTGTTTGGACAGATGGACTTACTA
GTTTGGATCGTTATAAAGGAAGATGTTATGATATTGAACCTGTTGCTGGAG
AAGAAAATCAATACATCGCTTATGTAGCTTATCCTCTAGATCTATTTGAAG
AAGGTTCTGTTACTAACTTATTTACTTCTATTGTAGGTAACGTATTTGGTTT
CAAAGCACTTCGAGCTTTACGTCTAGAAGATCTACGTATTCCTCCTGCATA
TTCTAAAACTTTCCAAGGTCCTCCTCACGGAATTCAAGTAGAAAGAGACA
AACTAAATAAATATGGCCGTCCTTTATTAGGTTGTACTATTAAACCTAAAT
TAGGTTTATCTGCTAAAAACTATGGTAGAGCTGTATATGAATGTCTTCGTG
GTGGACTTGATTTTACAAA

Pattern 3 (*S. neglecta*)

AAGGGGGGGGTGGAGGAAGGGAAAGGATTACAGATTTACTATTATACTCC
TGACTATGGACCAAAGATACTGATATTTTATCTGCCTTTCGTGGACTCCTC
AACCTGGAGTACCCCCTTAAAAGGCAGGTGCAGCTGTTTCTACAGGAGTC
TTTCTACTGGAACATGGACTACTGTTTGGACAGATGGACTGACTAGTTTGG
ATCGTTACAAAGGAAGATGTTATGATATTGAACCCGTTGCTGGAGAAGAA
AATCAATACATTGCTTATGTAGCTTATCCTTTAGATCTATTTGAAGAAGGT
TCTGTTACTAACTTGTTTACTTCTATTGTAGGTAATGTATTTGGTTTCAAAG
CACTTCGAGCTTTACGTCTAGAAGATCTACGTATTCCTCCTGCATATTCTA
AAACTTTCCAAGGTCCTCCTCACGGAATTCAAGTAGAAAGAGATAAACTT
AATAAATATGGTCGTCCTTTGTTAGGTTGACTATTAAACCTAAATTAGGTT
TATCTGCTAAAACTACGGTAGAGCTGTTATGAGTGTCTTCGTGGTAACTTG
AATTTTAAAAA

Pattern 4

AAAGGGGGCCTGGAATTAAGCAGGTGTTAAGATTATAGACTTACATATTA
CACTCCTGAATACGAAACCAAAGAAACTGATGTTTTAGCTGCATTTCGTAT
GACTCATCAGCCTGGAGTACCACCTGAAGAAGCAGGTGCTGCTGTAGCAG
CTGAATCTTCTACTGGAACATGGACTACTGTTTGGACAGATGGACTTACTA
GTTTGGATCGTTATAAAGGAAGATGTTATGATATTGAACCTGTTGCTGGAG
AAGAAAATCAATACATCGCTTATGTAGCTTATCGTCTAGATCTATTTGAAG
AAGGTTCTGTTACTAACTTATTTACTTCTATTGTAGGTAACGTATTTGGTTT
CAAAGCACTTCGAGCTTTACGTCTAGAAGATCTACGTATTCCTCCTGCATA
TGCTAAAACTTTCCAAGGTCCTCCTCACGGAATTCAAGTAGAAAGAGACA
AACTAAATAAATATGGCCGTCCTTTATTAGGTTGTACTATTAAACCTAAAT
TAGGTTTATCTGCTAAAAACTATGGTAGAGCTGTATATGAATGTCTTCGTG
GTGGACTTGATTTTACAAA

Pattern 5

AAAGGGGCCTGGAATTAAGCAGGTGTTAAGATTATAGACTTACATATTAC
ACTCCTGAATACGAAACCAAAGAAACTGATGTTTTAGCTGCATTTCGTAT
GACTCCTCAGCCTGGAGTACCACCTGTAGAAGCAGGTGCTGCTGTAGCAG
CTGAATCTTCTACTGGAACATGGACTACTGTTTGGACAGATGGACTTACTA
GTTTGGATCGTTATAAAGGAAGATGTTATGATATTGAACCTGTTGCTGGAG
AAGAAAATCAATACATCGCTTATGTAGCTTATCCTCTAGATCTATTTGAAG
AAGGTTCTGTTACTAACTTTTTTACTTCTATTGTAGGTAACGTATTTGGTTT
CAAAGCACTTCGAGCTTTACGTCTAGAAGATCTACGTATTCCTCCTGCATA
TTCTAAAACTTTCCAAGGTCCTCCTCACGGAATTCAAGTAGAAAGAGACA
AACTAAATAAATATGGCCGTCCTTTATTAGGTTGTACTATTAAACCTAAAT
TAGGTTTATCTGCTAAAAACTATGGGTAGAGCTGTATATGAATGTCTTCGT
GGTGGACTTGATTTTACAAAA

Spirogyra ellipsospora **(DQ995997)**

AGAAGAGGCTGGTGCCGCTGTAGCAGCAGAGTCTTCTACTGGAACATGGA
CTACTGTATGGACAGATGGACTGACTAGTTTGGATCGTTATAAAGGAAGA
TGTTATGATATTGAACCTGTTGCTGGCGAAGAAAATCAATACATTGCTTAC
GTAGCTTATCCTTTAGATCTATTTGAAGAAGGTTCTGTTACCAACTTGTTTC
TTCTATTGTAGGTAACGTATTTGGTTTCAAAGCACTTCGTGCTTTACGTCTA
GAAGATCTACGTATTCCTCCTGCATATTCTAAAACCTTCCAAGGTCCTCCT
CACGGAATTCAAGTAGAAAGAGACAAACTTAATAAGTATGGCCGTCCTTT
GTTAGGTTGTACTATTAAACCTAAATTAGGATTATCTGCTAAAAACTACGG
TAGAGCTGTATATGAGTGCCTTCGTGGTGGTTTGGATTTTACAAAAGATGA
TGAAAACGTAAACTCTCAGCCATTTATGCGTTGGAGAGATCGTTTCTTGTT
TGTAGCAGAAGCTATATACAAAGCACAAGCAGAAACTGGAGAAATCAAA
GGACATTATTTGAATGCTACTGCTGGTACTTGTGAAGAAATGATGAAAAG
AGCAGAATATGCTAAAGAACTAGGCGTACCAATTATTATGCATGACTATT
TGACAGGTGGGTTTACAGCTAATACTAGCTTAGCTCATTATTGTCGCGATA
ATGGTCTTCTTCTACATATTCACCGTGCTATGCACGCAGTTATAGATAGAC
AGAAAAATCACGGTATACACTTTCGCGTATTAGCTAAAGCTTTACGTATGT

CTGGTGGAGACCATATTCACTCTGGTACTGTTGTGGGTAAACTTGAAGGA
GAACGTCAAGTAACACTTGGATTTGTAGATCTTCTTCGTGATGATTACATT
GAAAAAGACCGCAGTCGTGGTATTTACTTTACCCAAGATTGGGTATCTAT
GCCTGGTGTACTTCCAGTAGCTTCCGGAGGAATCCATGTTTGGCATATGCC
TGCACTTACAGAAATTTTTGGAGATGATTCTGTACTTCAATTTGGTGGAGG
AACCCTTGGACACCCATGGGGGAATGCACC

***Spirogyra ellipsospora* (DQ995996)**

AGAAGAGGCTGGTGCCGCTGTAGCAGCAGAGTCTTCTACTGGAACATGGA
CTACTGTATGGACAGATGGACTGACTAGTTTGGATCGTTATAAAGGAAGA
TGTTATGATATTGAACCTGTTGCTGGCGAAGAAAATCAATACATTGCTTAC
GTAGCTTATCCTTTAGATCTATTTGAAGAAGGTTCTGTTACCAACTTGTTTC
TTCTATTGTAGGTAACGTATTTGGTTTCAAAGCACTTCGTGCTTTACGTCTA
GAAGATCTACGTATTCCTCCTGCATATTCTAAAACCTTCCAAGGTCCTCCT
CACGGAATTCAAGTAGAAAGAGACAAACTTAATAAGTATGGCCGTCCTTT
GTTAGGTTGTACTATTAAACCTAAATTAGGATTATCTGCTAAAAACTACGG
TAGAGCTGTATATGAGTGCCTTCGTGGTGGTTTGGATTTTACAAAAGATGA
TGAAAACGTAAACTCTCAGCCATTTATGCGTTGGAGAGATCGTTTCTTGTT
TGTAGCAGAAGCTATATACAAAGCACAAGCAGAAACTGGAGAAATCAAA
GGACATTATTTGAATGCTACTGCTGGTACTTGTGAAGAAATGATGAAAAG
AGCAGAATATGCTAAAGAACTAGGCGTACCAATTATTATGCATGACTATT
TGACAGGTGGGTTTACAGCTAATACTAGCTTAGCTCATTATTGTCGCGATA
ATGGTCTTCTTCTACATATTCACCGTGCTATGCACGCAGTTATAGATAGAC
AGAAAAATCACGGTATACACTTTCGCGTATTAGCTAAAGCTTTACGTATGT
CTGGTGGAGACCATATTCACTCTGGTACTGTTGTGGGTAAACTTGAAGGA
GAACGTCAAGTAACACTTGGATTNGTAGATCTTCTTCGTGATGATTACATT
GAAAAAGACCGCAGTCGTGGTATTTACTTTACCCAAGATTGGGTATCTAT
GCCTGGTGTACTTCCAGTAGCTTCCGGAGGAATCCATGTTTGGCATATGCC
TGCACTTACAGAAATTTTTGGAGATGATTCTGTACTTCAATTTGGTGGAGG
AACCCTTGGACACCCATGGGGGAATGCACC

***Spirogyra* sp. (KC779222)**

GCTGGATTTAAAGCAGGGGTAAAAGATTACAGACTTACATATTATACTCC
TGAGTATGAGACCAAAGAAACTGACATTTTAGCTGCTTTTCGTATGACTCC
TCAGCCTGGAGTACCACCAGAAGAGGCTGGTGCCGCTGTAGCAGCAGAGT
CTTCTACTGGAACATGGACTACTGTATGGACAGATGGACTGACTAGTTTG
GATCGTTATAAAGGAAGATGTTATGATATTGAACCTGTTGCTGGCGAAGA
AAATCAATACATTGCTTACGTAGCTTATCCTTTAGATCTATTTGAAGAAGG
TTCTGTTACCAACTTGTTTACTTCTATTGTAGGTAACGTATTTGGTTTCAAA
GCACTTCGTGCTTTACGTCTAGAAGATCTACGTATTCCTCCTGCATATTCT
AAAACCTTCCAAGGTCCTCCTCACGGAATTCAAGTAGAAAGAGACAAACT
TAATAAGTATGGCCGTCCTTTGTTAGGTTGTACTATTAAACCTAAATTAGG
ATTATCTGCTAAAAACTACGGTAGAGCTGTATATGAGTGCCTTCGTGGTGG
TTTGGATTTTACAAAAGATGATGAAAACGTAAACTCTCAGCCATTTATGCG
TTGGAGAGATCGTTTCTTGTTTGTAGCAGAAGCTATATACAAAGCACAAG
CAGAAACTGGAGAAATCAAAGGACATTATTTGAATGCTACTGCTGGTACT
TGTGAAGAAATGATGAAAAGAGCAGAATATGCTAAAGAACTAGGCGTAC
CAATTATTATGCATGACTATTTGACAGGTGGGTTTACAGCTAATACTAGCT
TAGCTCATTATTGTCGCGATAATGGTCTTCTTCTACATATTCACCGTGCTAT
GCACGCAGTTATAGATAGACAGAAAAATCACGGTATACACTTTCGCGTAT
TAGCTAAAGCTTTACGTATGTCTGGTGGAGACCATATTCACTCTGGTACTG
TTGTGGGTAAACTTGAAGGAGAACGTCAAGTAACACTTGGATTTGTAGAT
CTTCTTCGTGATGATTACATTGAAAAAGACCGCAGTCGTGGTATTTACTTT
ACCCAAGATTGGGTATCTATGCCTGGTGTACTTCCAGTAGCTTCCGGAGG
AATCCATGTTTGGCATATGCCTGCACTTACAGAAATTTTTGGAGATGATTC
TGTACTTCAATTTGGTGGAGGAACCCTTGGACACCCATGGGGGAATGCAC
CTGGGGCAGTTGCAAATCGTGTAGCTTTGGAAGCTTGTGTACAAGCTCGT
AATGAAGGCCGTGACCTTGCTCGTGAAGGGAATGAGGTAATTCGTGAAGC
TTGTAAATGGAGTCCTGAGTTAGCTGCAGCATGTGAAGTAT

***Spirogyra* sp. (KC779220)**

GCTGGATTTAAAGCAGGGGTAAAAGATTATAGACTTACATATTACACTCC
TGAATACGAGACCAAAGAAACTGATGTTTTAGCTGCATTTCGTATGACTC
CTCAGCCTGGAGTACCACCTGAAGAAGCAGGTGCTGCTGTAGCAGCTGAG
TCTTCTACTGGAACATGGACTACTGTTTGGACAGATGGACTTACTAGTTTG
GATCGTTATAAAGGAAGATGTTATGATATTGAACCTGTTGCTGGAGAAGA
AAATCAATACATCGCTTATGTAGCTTATCCTCTAGATCTATTTGAAGAAGG
TTCTGTTACTAACTTATTTACTTCTATTGTAGGTAACGTATTTGGTTTCAAA
GCACTTCGAGCTTTACGTCTAGAAGATCTACGTATTCCTCCTGCATATTCT
AAAACTTTCCAAGGTCCTCCTCACGGAATTCAAGTAGAAAGAGACAAACT
AAATAAATATGGCCGTCCTCTATTAGGTTGTACTATTAAACCTAAGTTAGG
TTTATCTGCTAAAAACTATGGTAGAGCTGTATATGAATGTCTTCGTGGTGG
TTTAGATTTTACAAAAGATGATGAAAACGTAAACTCTCAACCATTTATGCG
TTGGAGAGACCGCTTCTTGTTTGTAGCGGAAGCTATCTACAAAGCACAAG
CAGAAACCGGAGAAATTAAAGGCCATTACTTAAATGCTACTGCTGGTACC
TGTGAAGAAATGCTAAAAAGAGCAGAATATGCTAAAGAGCTAGGTGTAC
CAATTATTATGCATGACTATTTGACAGGTGGTTTTACAGCGAACACTAGTT
TAGCTCATTATTGCCGTGACAATGGTCTTCTTTTACACATTCACCGTGCTA
TGCACGCAGTTATCGACAGACAGAAAAATCATGGTATTCACTTCCGTGTTT
TAGCTAAAGCTTTACGTATGTCTGGTGGAGACCACATTCACTCTGGTACTG
TTGTAGGTAAACTTGAAGGAGAACGTCAAGTAACACTTGGATTTGTAGAT
CTTCTTCGTGATGACTATATTGAAAAAGATCGTAGCCGTGGTATCTACTTT
ACTCAGGACTGGGTATCTATGCCTGGTGTACTGCCAGTAGCTTCTGGAGG
AATTCACGTTTGGCACATGCCTGCGCTTACAGAAATCTTTGGAGATGATTC
TGTACTTCAATTTGGTGGAGGAACTCTTGGACACCCATGGGGTAACGCAC
CTGGTGCAGCTGCAAACCGCGTAGCTTTAGAAGCTTGTGTACAAGCTCGT
AATGAAGGTCGTGATCTTGCTCGCGAAGGTAATGAAGTAATTCGTGAAGC
TTGC

***Spirogyra maxima* (KC779213)**

GCTGGATTTAAAGCAGGAGTAAAAGATTACAGACTTACATATTATACTCC
TGAATATGAGACCAAAGAAACTGATATTTTAGCTGCATTTCGCATGACTC
CTCAACCTGGAGTACCCCCAGAAGAAGCAGGTGCTGCAGTAGCAGCAGA
GTCTTCTACTGGGACATGGACTACTGTTTGGACAGATGGACTGACTAGTTT
GGATCGTTATAAAGGAAGATGTTATGATATTGAACCCGTTGCTGGAGAAG
AAAATCAATACATTGCTTATGTAGCTTATCCTCTAGATCTATTTGAAGAGG
GTTCTGTTACTAACTTGTTTACTTCTATTGTAGGTAATGTATTCGGTTTCAA
AGCACTTCGAGCTTTACGTCTAGAAGATCTACGTATTCCTCCTGCATATTC
TAAAACTTTCCAAGGTCCTCCTCACGGAATTCAAGTAGAAAGAGATAAAC
TGAATAAATATGGTCGTCCTTTGTTAGGTTGCACTATTAAACCAAAACTAG
GTTTATCTGCTAAAAACTACGGTAGAGCTGTATATGAGTGTCTTCGTGGTG
GTTTGGATTTTACAAAAGATGATGAAAATGTAAACTCTCAACCATTTATGC
GCTGGAGAGATCGCTTTTTGTTTGTAGCAGAAGCTATATACAAATCACAA
GCAGAAACCGGAGAAATCAAAGGACACTATTTGAATGCTACTGCTGGTAC
CTGTGAAGAAATGATGAAAAGAGCAGAATATGCTAAAGAATTAGGTGTA
CCCATTGTTATGCATGACTATTTAACAGGTGGTTTTACAGCTAACACTAGC
CTAGCTCATTATTGCCGTGATAACGGTCTACTTTTACATATTCACCGTGCA
ATGCACGCAGTTATCGATAGACAGAAAAATCATGGTATTCACTTCCGTGT
TTTAGCTAAAGCTTTACGTATGTCTGGTGGAGACCATATTCACTCTGGTAC
TGTTGTAGGTAAACTTGAAGGAGAACGTCAAGTAACACTTGGATTTGTAG
ATCTTCTTCGTGATGATTACATTGAAAAAGATCGCAGTCGTGGTATTTACT
TTACCCAAGACTGGGTATCTATGCCTGGTGTTCTTCCGGTAGCTTCTGGGG
GAATCCACGTTTGGCATATGCCTGCACTTACAGAAATTTTTGGAGATGATT
CCGTGCTTCAATTCGGTGGAGGCACCCTGGGACACCCATGGGGGAATGCA
CCTGGTGCAGTAGCAAACCGTGTAGCTTTGGAAGCTTGCGTACAAGCTCG
TAATGAAGGTCGTGATCTTGCTCGTGAAGGGAATGAAGTCCTTCGTGAAG
CTTGCAAATGGAGTCCAGAGTTAGCTGCGGCATGTGAAGTAT

***Spirogyra maxima* (KC779217)**

GCTGGATTTAAAGCAGGAGTAAAAGATTACAGACTTACATATTATACTCC
TGAATATGAGACCAAAGAAACTGATATTTTAGCTGCATTTCGCATGACTC
CTCAACCTGGAGTACCCCCAGAAGAAGCAGGTGCTGCAGTAGCAGCAGA
GTCTTCTACTGGGACATGGACTACTGTTTGGACAGATGGACTGACTAGTTT
GGATCGTTATAAAGGAAGATGTTATGATATTGAGCCCGTTGCTGGAGAAG
AAAATCAATACATTGCTTATGTAGCTTATCCTCTAGATCTATTTGAAGAGG
GTTCTGTTACTAACTTGTTTACTTCTATTGTAGGTAATGTATTCGGTTTCAA
AGCACTTCGAGCTTTACGTCTAGAAGATCTACGTATTCCTCCTGCATATTC
TAAAACTTTCCAAGGTCCTCCTCACGGAATTCAAGTAGAAAGAGATAAAC
TGAATAAATATGGTCGTCCTTTGTTAGGTTGCACTATTAAACCAAAACTAG
GTTTATCTGCTAAAAACTACGGTAGAGCTGTATATGAGTGTCTTCGTGGTG
GTTTGGATTTTACAAAAGATGATGAAAATGTAAACTCTCAACCATTTATGC
GCTGGAGAGATCGCTTTTTGTTTGTAGCAGAAGCTATATACAAATCACAA
GCAGAAACCGGAGAAATAAAAGGACACTATTTGAATGCTACTGCTGGTAC
CTGTGAAGAAATGATGAAAAGAGCAGAATATGCTAAAGAATTAGGTGTA
CCCATTGTTATGCATGACTATTTAACAGGTGGTTTTACAGCTAACACTAGC
CTAGCTCATTATTGCCGTGATAACGGTCTACTTTTACATATTCACCGTGCA
ATGCACGCAGTTATCGATAGACAGAAAAATCATGGTATTCACTTCCGTGT
TTTAGCTAAAGCTTTACGTATGTCTGGTGGAGACCATATTCACTCTGGTAC
TGTTGTAGGTAAACTTGAAGGAGAACGTCAAGTAACACTTGGATTTGTAG
ATCTTCTTCGTGATGATTACATTGAAAAAGATCGCAGTCGTGGTATTTACT
TTACCCAAGACTGGGTATCTATGCCTGGTGTTCTTCCAGTAGCTTCTGGGG
GAATCCACGTTTGGCATATGCCTGCACTTATAGAAATTTTTGGAGATGATT
CCGTGCTTCAATTCGGTGGAGGCACCCTGGGACACCCATGGGGGAATGCA
CCTGGTGCAGTAGCAAACCGTGTAGCTTTGGAAGCTTGCGTACAAGCTCG
TAATGAAGGTCGTGATCTTGCTCGTGAAGGAAATGAAGTCCTTCGTGAAG
CTTGCAAATGGAGTCCAGAGTTAGCTGCAGCATGTGAAGTAT

***Spirogyra* sp. (KC779219)**

GCTGGATTTAAAGCAGGGGTAAAAGATTATAGACTTACATATTACACTCC
TGAATACGAGACCAAAGAAACTGATATTTTAGCTGCATTTCGTATGACTC
CTCAGCCTGGAGTACCACCTGAAGAAGCAGGTGCTGCTGTAGCAGCTGAG
TCTTCTACTGGAACATGGACTACTGTTTGGACAGATGGACTTACTAGTTTG
GATCGTTATAAAGGAAGATGTTATGATATTGAACCTGTTGCTGGAGAAGA
AAATCAATACATCGCTTATGTAGCTTATCCTCTAGATCTATTTGAAGAAGG
TTCTGTTACTAACTTATTTACTTCTATCGTAGGTAACGTATTTGGTTTCAAA
GCACTTCGAGCTTTACGTCTAGAAGATCTACGTATTCCTCCTGCTTATTCT
AAAACTTTCCAAGGTCCTCCTCACGGAATTCAAGTAGAAAGAGACAAACT
AAATAAATATGGCCGTCCTTTATTAGGTTGTACTATTAAACCTAAGTTAGG
TTTATCTGCTAAAAACTATGGTAGAGCTGTATATGAATGTCTTCGTGGTGG
TTTAGATTTTACCAAAGATGATGAAAACGTAAACTCTCAACCATTTATGCG
TTGGAGAGACCGCTTCTTGTTTGTAGCAGAAGCTATCTACAAAGCACAAG
CAGAAACCGGAGAAATTAAAGGCCATTACTTAAATGCTACTGCTGGTACT
TGTGAAGAAATGCTAAAAAGAGCAGAATATGCTAAAGAGCTAGGTGTAC
CAATTATTATGCATGACTATTTGACAGGTGGTTTTACAGCAAACACTAGTT
TAGCTCATTATTGCCGTGACAATGGTCTTCTTTTACACATTCACCGTGCTA
TGCACGCAGTTATCGATAGACAGAAAAATCATGGTATTCACTTCCGTGTTT
TAGCTAAAGCTTTACGTATGTCTGGTGGAGACCATATTCACTCTGGTACTG
TTGTAGGTAAACTTGAAGGAGAACGTCAAGTAACCCTTGGATTTGTAGAT
CTTCTGCGTGATGACTATATTGAAAAAGATCGTAGCCGTGGTATCTACTTT
ACTCAAGACTGGGTATCTATGCCTGGTGTACTGCCAGTAGCTTCTGGAGG
AATTCACGTTTGGCACATGCCTGCGCTTACAGAAATCTTTGGAGATGATTC
TGTACTTCAATTTGGTGGAGGAACTCTTGGACACCCATGGGGTAACGCAC
CTGGTGCAGTTGCAAACCGCGTAGCTTTAGAAGCTTGTGTACAAGCTCGT
AATGAAGGTCGTGATCTTGCTCGCGAAGGTAATGAAGTAATTCGTGAAGC
TTGCAAG

Sequences of ITS 2 region of *Spirogyra* subjected for multiple alignment and analysis the phylogenetic relationships

Pattern 1 (*S. ellipsospora*)

ATCCACTGACTTATACTGTGAAACTGCGAATGGCACACCTTCTCATGTTAA
TCAGTTATAGTGTTATTTGATGGTACCTACTACTCGGATAGATCGTAGTAA
AATCTAGAGCTAATACGTGCGTAAATCCCGACTTCTGGAAGGCACGTATT
TATTAGATGGAAACGCCGACCGCCGGCTCTGGCCCGACTTACGCGGTGAA
TCATGATAACTTCACGAATCGGCATGGCCTTGTGCCGGCGATGTTAAACA
TACAAATTTCTGGGCTATCAACTTTCGATGGTAGGATAGAGGCCTACCAT
GGTGGTAACGGGTGACGGAGGATTAGGGTTCGATTCCGGAGAGGGAGCC
TGAGAAACGGCTACCACATCCAAGGAAGGCAGCAGGCGCGCAAATTACC
CAATCCTGACACAGGGAGGTAGTGACAATAAATAACAATACTAGGGCCTT
GTCAGGTCTGGTAATTGGAATGAGTACAATAGHTAAAACCCCTTAACGAA
AGGATCAATTGGAGGGGGCAAGTCTCTCTGGTGCCAGCAGCCGCGGTAAT
TCCAGCTCCAATAGCGTATATTTAAGTTGCTGCAGTTAAAAAGCTCGTAGT
TGGATTTCGGGTGGCGCCTGCCGGTCCGCCGTTTCGGTGTGCACTGGCAG
GACCCACCTTGTTGCTGATTCTATGGGTGGTGGTGCATGGCCGTTCTTAGT
TGGTGGGTTGCCTTGTCAGGTTGATTC

Pattern 2

ATAAACTGCTTTATACTGTGAAACTGCGAATGGCTCATTAAATCAGTTATA
GTTTATTTGATGGTACCTAGGTACCTACTACTCGGATAGATCGTAGTAAAA
TCTAGAGCTAATACGTGCGTAAATCCCGACTTCTGGAAGGCACGTATTTAT
TAGATGGAAACGCCGACCGCCGGCTCTGGCCCGACTTACGCGGTGAATCA
TGATAACTTCACGAATCGGCATGGCCTTGTGCCGGCGATGTTAAACATAC
AAATTTCTGGGCTATCAACTTTCGATGGTAGGATAGAGGCCTACCATGGT
GGTAACGGGTGACGGAGGATTAGGGTTCGATTCCGGAGAGGGAGCCTGA
GAAACGGCTACCACATCCAAGGAAGGCAGCAGGCGCGCAAATTACCCAA
TCCTGACACAGGGAGGTAGTGACAATAAATAACAATACTAGGGCCTTGTC
AGGTCTGGTAATTGGAATGAGTACAATAGHTAAAACCCCTTAACGAAAGG
ATCAATTGGAGGGGGCAAGTCTCTCTGGTGCCAGCAGCCGCGGTAATTCC
AGCTCCAATAGCGTATATTTAAGTTGCTGCAGTTAAAAAGCTCGTAGTTGG
ATTTCGGGTGGCGCCTGCCGGTCCGCCGTTTCGGTGTGCACTGGCAGGAC
CCACCTTGTTGCTGATTCTATGGGTGGTGGTGCATGGCCGTTCTTAGTTGG
TGGGTTGCCTTGTCAGGTTGATTC

Pattern 3 (*S. neglecta*)

ATCCACTGACTTATACTGTGAATCTGCGAATGGACACCTTCTCATGTTAAT
CAGTTATAGTGTTATTTGATGGTACCTACTACTCGGATAGATCGTAGTAGA
ATCTAGAGCTAATACGTGCGTAAATCCCGACTTCTGGAAGGCACGTATTG
ATTAGATGGGAACGCCGACCGCCGGCTCTGGCCCGACGTTACGCGGTGAA
TCATGATAACTTCACGAATCGcCATGGCCTTGTGCCGGCGATGTTTAAACA
TACAAATTTCTGGGCTATCAACTTTCGATGGTAGGATAGAGGCCCTACCAT
GGTGGTAACGGGTGACGGAGGATTAGGGTTCGATTCCGGAGAGGGAGCC
TGAGAAACGGCTACCACATCCAAGGAAGGCAGCAGGCGCGCAAATTACC
CAATCCTGACACAGGGAGGTAGTGACAAATAAATAACAATACTAGGGCCT
TGTCAGGTCTGGTAATTGGAATGAGTACAATAGHTAAAACCCCTTAACGA
AAGGATCAATTGGAGGGGGCAAGTCTCTCTGGTGCCAGCAGCCGCGGTAA
TTCCAGCTCCAATAGCGTATATTTAAGTTGCTGCAGTTAAAAAGCTCGTAG
TTGGATTTCGGGTGGCGCCTGCCGGTCCGCCGTTTCGGTGTGCACTGGCAG
GACCCACCTTGTTGCTGATTCTATGGGTGGTGGTGCATGGCCGTTCTTAGT
TGGTGGGTTGCCTTGTCAGGTTGATTC

Pattern 4

AAATCCACTGCTTTATACTGTGAGTAACTGCGAATGGCTCATTAAATCAGT
TATAGTTTATTTGATGGTACCTAGGTACCTACTACTCGGATAGATCGTAGT
TTAATCTAGAGCTAATACGTGCGTAAATCCCGACTTCTGGAAGGCACGTA
TTTATTAGATGGAAACGCCGACCGGGGGCTCTGGCCCGACTTACGCGGTG
AATCATGATAACTTCACGAATCGGCATGGCCTTGTGGCTCGACGGCGATG
TTAAACATACAAACCTCTATGGCTATCAACGGTCGATGGTAGGATAGAGG
CCTACCAAGGGTGGTAACGGGTGACGGAGGATTAGGGTTCGATTCCGGAG
AGGGAGCCTGAGAAACGGCTACCACATCCAAGGAAGGCAGCAGGCGCGC
AAATTACCCAATCCTGACACAGGGAGGTAGTGACAATAAATAACAATACT
AGGGCCTTGTCAGGTCTGGTAATTGGAATGAGTACAATAGHTAAAACCCC
TTAACGAAAGGATCAATTGGACGGCCAAGTCTCTCGGGTGCCAGCAGCGG
CGGTAATTCCAGCTCCAATAGCGTATATTTTGGAGTTGCTGCAGTTGGAAA
GCTCGTAGTTGGATTTCGGGTGGCGCCTGCCGGTCCGCCGTTTCGGTGTGC
ACTGGCAGGACCCACCTTGTTGCTGATTCTATGGGTGGTTGTGCATGGCCG
TTCTTAGTTGGTGGGTTGCCTTGTCAGGTTGATTC

Pattern 5

TTTATACTGTGATAACTGCGCAATGCCTCATTATATCAGTTATAGTTTATTT
GATGGTACCTAGGCTGCTCGGATACCCGTAGTAAATCTAGAGCTTATACG
TGCGTAAATCCCGACTTCTGGAAGGGACGTAGTTATTAGATTAAAGGCCG
ACCGGGCTCTGGCGGACTCGCGGTGAATCATGATAACTTCACGAATCGCA
TGGCCTTGTGCCGGCGATGTCTCATTCAAATTCCTGGCCTATCAACTTACG
ATGGTAGGATAGAGCCCTACCATGGTGGTAACGGGTGACGGAGGATTAGC
GTTCGATTGGGGAGAGGGAGCCTGATAAACGGCTACCACATCCAAGGAA
GGCAGCAGGCGCGCAAATTACCCAATCCTGACACAGGTAGGTAGTGACA
ATAAATAACAATACTGGGCCATTTCAGGTCTGGTAATTGGAATGAGTACA
ATCTAAGCCCTTTAACGAGGATCAATTGGAGGCCAAGTCTGGTGCCAGCA
GCCGCGTTAATTCCAGCTCCAATAGCGTATAGTTAAGTTGCTGCAGTTAAG
AAGCCGCGTAGTTGGATTTCGGGTGGCGCCTGCCGGTCCGGCGTTTGGGT
TGTGCACTGGCAGGACCCACCTTGTTGCCGGGGACGGGCTCCTGGGCGTC
ACTGTCCGGGACTCGGAGTCGGCGCTGTTACTTTGAGTAAATTAGAGTGTT
CAAAGCAGGCCTACGCTCTGAATACATTAGCATGGAATAACACGATAGGA
CTCTGGCCTATGCTGTTGGTCTGTAGGACCGGAGTAATGATTAAAAGGGA
CAGTCCCCGGCATTCGTATGTCATTGTCAGAGGTGTAATTCTTGGATTTAT
GAAAGAGGAACTACTGCGGGAAGCATTTGCCAAGGATGTTGTCATTATT

Appendix C

ECOLOGICAL AND BIOLOGICAL PARAMETERS OF EACH LACALITY WERE INVESTIGATED

Table. Ecological and Biological parameters of each locality were investigated.

Sites	Ecological parameters					Biological parameters			
	pH	**Cond.**	**TDS**	**Sal.**	**DO**	**Width**	**Length**	**Spiral**	**Granule**
N-1	7.04	476	253	0.2	6.8	55	110	9.5	106
N-2	6.18	353	188	0.2	8.8	45	131	10	118
N-3	4.73	118	63	0.1	10.6	40	95	6.5	74
N-4	5.88	251	133	0.1	9.7	45	100	7.5	82
N-5	5.57	307	165	0.2	7.8	82	263	11	86
N-6	6.68	266	141	0.1	9.1	53	180	7	72
N-7	8.31	461	98	0.1	10.5	55	120	11	124
N-8	6.68	315	167	0.2	11.2	52	110	9.5	115
N-9	7.19	334	198	0.1	9.5	44	123	8.5	90
N-10	7.26	197	152	0.5	8.6	52	159	9	74
N-11	7.47	287	179	0.1	9.8	47	104	8	82
N-12	6.43	295	156	0.1	8.6	49	180	6	50
N-13	7.38	279	185	0.1	8.6	48	164	7	57
M-1	7.26	197	152	0.5	8.1	79	225	16	60
M-2	8.10	361	296	0.3	10.4	50	115	7.5	62
M-3	7.53	448	257	0.2	6.6	60	120	11.5	132
M-4	8.71	367	388	0.2	6.9	43	188	5.5	118
M-5	7.23	379	407	0.5	7.2	45	108	11	115
M-6	7.14	198	361	0.2	8.0	56	206	9	56
M-7	6.79	578	230	0.1	8.1	55	120	12	145
M-8	7.09	499	376	0.3	9.0	41	161	7	240
M-9	7.37	225	335	0.4	9.4	48	172.5	8.5	58
M-10	8.28	256	321	0.2	10.4	60	120	6.5	52
M-11	8.31	254	153	0.1	11.0	42	110	7.5	84
E-1	8.79	434	236	0.6	8.1	51	100	10.5	136
E-2	9.04	415	220	0.7	7.1	50	122	9	78
E-3	7.16	510	272	0.6	5.5	47	118	12	154
S-1	6.58	489	415	0.5	8.3	70	181	8	125
S-2	7.52	491	671	0.4	6.1	56	110	11	116
S-3	7.54	351	214	0.5	10.3	48	104	9	86
NE-1	6.89	255	135	0.1	10.6	90	146	6	108
NE-2	7.69	286	152	0.1	9.96	45	114	8	88
NE-3	6.68	266	141	0.1	8.15	47	105	8.5	97
NE-4	4.09	113	206	0.5	8.9	40	85	5.5	68
NE-5	7.96	153	183	0.8	9.57	45	146	7.5	66
NE-6	7.29	752	398	0.4	10.13	55	124	7.5	75

CIRRICULUM VITAE

Name Mr. Pheravut Wongsawad

Date of birth 10 October 1963

Educational Background

1987	B.S. (Agriculture)	Chiang Mai University, Thailand
1993	M.S. (Biology)	Chiang Mai University, Thailand
1996	Certificate	Individual Training Course in Biotechnology Japanese International Cooperative Agency (JICA), Japan

Publications

Wongsawad C. and Wongsawad P. 2010. Molecular markers for Identification of *Stellantchasmus falcatus* and a Phylogenetic Study using the HAT-RAPD Method. Korean J Parasitol. 48 (4):303-307.

U-Kong W., Buddharak P., Wongsawad P. and Sanguansermsri M. 2010. *In Vitro* Culture Shoot Tip and Young leaf of *Jasminum sambac*. The Proceeding of The 22nd Annual Meeting of the Thai Society for Biotechnology "TSB2010 Biotechnology for Healthy Living" October 20-22, 2010. Prince of Songkla University, Trang Campus, Trang Province, Thailand.

Wongsawad P., Wongsawad C., Trisonthi C., Trisonthi P. and Inta A. 2011. Occurrence and Pollen Morphology of Some flower plants in Chiang Mai University Academic Center, Hariphunchai Campus, Lam Phun Province. Proceeding of the 28^{th} MST Annual conference, 5-7 January 2011, Chiangrai, Thailand.

Wongsawad P., Wongsawad C. and Noikong W. 2011. Pollen Morphology of Some Flowering Plants at Chiang Mai University Using Scanning Electron Microscopy. 37^{th}Congress on Science and Technology of Thailand. Thailand.

Wongsawad P. and Wongsawad C. 2011. Infection Dynamics and Molecular Identification of Metacercariae in Cyprinids from Chiang Mai and Sakon Nakhon Provinces. Southeast Asian J.Trop.Med.Publ Health. 42 (1): 74-78.

Takamiya T., Wongsawad P., Tajima N., Shioda N., Lu J. F., Wen C.L., Wu J.B., Handa T., Iijima H., Kitanaka S. and Yukawa T. 2011. Identification of *Dendrobium* Species Used for Herbal Medicines Based on Ribosomal DNA Internal Transcribed Spacer Sequence. Biol. Pharm. Bull. 34 (5):779-782.

Wongsawad P. and Peerapornpisal Y. 2012. Morphological Variation and Ecological Relevance of Green Algae, *Spirogyra* sp. in Northern Thailand Using Topology of Light and Scanning Electron Microscope. Proceeding of the 29^{th} MST Annual conference, 30 January – 1 February 2012, Cha-am, Thailand.

U-Kong W., Wongsawad P. and Buddharak P. 2012. Shoot Bud and Young Leaf Induction of *Jasminum* spp. in *in vitro* Culture. International Journal of Applied Agricultural Research. 7 (1): 17-26.

Wongsawd C., Wongsawad P., Sukontason K., Anuntaoabhochai S. and Chai J. Y. 2012. Epidemiology and Molecular Genotyping of *Fasciola gigantica* and Rumen flukes in The North and Northeast of Thailand Using HAT-RAPD PCR. JITMM (1): 9-16.

Wongsawad C. and Wongsawad P. 2012. *Ophisthorchis viverrini* and *Haplorchis taichui*: Development of a Multiplex PCR Assay for Their Detection and Differentiation Using Specific Primers Derived from HAT-RAPD. Experimental Parasitology. 132: 237

Wongsawad P., Peerapornpisal Y., Saenphet K. and Lamyong S. 2012. Variation and Ecology Relevance of Green algae, *Spirogyra* sp. on Northern Thailand Using Topology of Light and Scanning Electron Microscope. Journal of the Microscopy Society of Thailand. 5 (1-2): 1-4.

Wongsawad C., Wongsawad P., Anuntalabhochai S., Chai Jong-Yil and Sukontason K. 2013. Occurrence and molecular identification of liver and minute intestinal flukes metacercariae in freshwater fish from Fang-Mae Ai Agricultural Basin, Chiang Mai province, Thailand. Asian Biomedicine. 7 (1): 97-104.

Wongsawad P. and Peerapornpisal Y. 2013. Ecological Relevance and Physical Morphology of Green algae, *Spirogyra* sp. in Northern Thailand. Journal of Yala Rajabhat University. 8 (1): 1-8.

Pheravut Wongsawad and Yuwadee Peerapornpisal. 2014. Molecular identification and Phylogenetic relationship of green algae, *Spirogyra ellipsospora*

(Chlorophyta) using ISSR and rbcL markers. Saudi Journal of Biological Sciences. 21 (5): 505-510.

Pheravut Wongsawad and Yuwadee Peerapornpisal. 2014. Morphological and molecular profiling of Spirogyra from northeastern and northern Thailand using inter simple sequence repeat (ISSR) markers. Saudi Journal of Biological Sciences. (in press)

Pheravut Wongsawad, Yuwadee Peerapornpisal and Chalobol Wongsawad. 2015. Molecular Characterization of *Spirogyra* from Northern Thailand using Inter Simple Sequence Repeat (ISSR) Markers. Journal of Advances in Biology & Biotechnology. 2 (3): 144-153.