

CHAPTER VI

GENERAL CONCLUSIONS

Cultured cells and genetic variation of *N. scintillans* in the inner gulf of Thailand

- ESM-culture medium and *Dunaliella* were appropriated to cultured pink *Noctiluca* but in the case of this study, we must culture the much of clones (more than 30 clones/stations) for testing ISSR primers. So it vary difficult to controlled the growth of cells were enough stable cells concentration in each clones.
- These 5 ISSR primers obtained from this study could potentially be used for screening genetic variation of *N. scintillans* but there was a problem about the maintenance of *N. scintillans* culture and the quantity of extracted DNA. Therefore, this study couldn't be continue.
- There was no genetic variation in COX I and 18s rRNA gene among *N. scintillans* samples used in this study.
- The complete sequence of ITS1 region could not be obtained. This might be the result of multiple copies of this region or the problem in the primer used in this study.

APPENDICES

APPENDIX I

Primers tested ISSR PCR

No.	primer	Sequence (5'-3')	No.	primer	Sequence (5'-3')
1	UBC809	(AG)8G	25	T8710	(CA)7YC
2	UBC811	(GA)8C	26	T8711	(CA)7YG
3	UBC827	(AC)8G	27	T8712	(GA)8AT
4	SAS1	(GIG)4C	28	T8713	(CT)8G
5	SAS3	(GAG)4C	29	T8714	(GT)6RG(CT)8T
6	814	(CT)8TG	30	T8715	(GA)6C
7	844A	(CT)8AC	31	T8716	(CA)6C
8	844B	(CT)8GC	32	T8717	(CA)6T
9	17898A	(CA)6AC	33	T8718	(GA)6T
10	17898B	(CA)6GT	34	UBC-813	(CT)8T
11	17899A	(CA)6AG	35	UBC-824	(CT)8G
12	HB12	(AC)3GC	36	UBC-845	(CT)8RG
13	HB13	(GAG)3GC	37	UBC-840	(GA)8YT
14	HB14	(CTC)3GC	38	UBC-848	(CA)8RG
15	HB15	(GIG)3GC	39	TL01	(CAG)5
16	T8701	(CT)8RA	40	TL02	(CAA)5
17	T8702	(AG)7YC	41	TL03	(GACA)4
18	T8703	(GT)6YR	42	TL04	(GATA)4
19	T8704	(GT)6AY	43	UBC812	(GA)8A
20	T8705	CAA(AG)5	44	UBC826	(AC)8C
21	T8706	GGGC(GA)8	45	UBC841	(GA)8YC
22	T8707	(GAG)4RC	46	UBC857	(AC)8YC
23	T8708	(GA)7RG	47	UBC818	(CA)8G
24	T8709	(GT)7YG	48	UBC868	(GAA)6

*Y= C/T; R= A/G

APPENDIX2

The result from BioEdit program of COX1 forward (COX_F2) sequence of *N. scintillans* in the inner gulf of Thailand (1-2PB, 3-4ASL and 5-6CPY). Asterisks symbols (*) expressed that all samples appear nitrogenous base (A, C, G, and T) identity.

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      ....|....| ....|....| ....|....| ....|....| ....|....|
                10         20         30         40         50
1PB      TTCGGTATAA TTAGTATTAT TATTAGTGGA GTTTCTCAAA AGATTGTATT
2PB      TTCGGTATAA TTAGTATTAT TATTAGTGGA GTTTCTCAAA AGATTGTATT
3ASL     TTCGGTATAA TTAGTATTAT TATTAGTGGA GTTTCTCAAA AGATTGTATT
4ASL     TTCGGTATAA TTAGTATTAT TATTAGTGGA GTTTCTCAAA AGATTGTATT
6CPY     TTCGGTATAA TTAGTATTAT TATTAGTGGA GTTTCTCAAA AGATTGTATT
5CPY     TTCGGTATAA TTAGTATTAT TATTAGTGGA GTTTCTCAAA AGATTGTATT
Clustal Co *****
      ....|....| ....|....| ....|....| ....|....| ....|....|
                60         70         80         90        100
1PB      CGGGCATCAA TCAATGATTT TTGCTATGAG CTGTATATGT ATTTTAGGCT
2PB      CGGGCATCAA TCAATGATTT TTGCTATGAG CTGTATATGT ATTTTAGGCT
3ASL     CGGGCATCAA TCAATGATTT TTGCTATGAG CTGTATATGT ATTTTAGGCT
4ASL     CGGGCATCAA TCAATGATTT TTGCTATGAG CTGTATATGT ATTTTAGGCT
6CPY     CGGGCATCAA TCAATGATTT TTGCTATGAG CTGTATATGT ATTTTAGGCT
5CPY     CGGGCATCAA TCAATGATTT TTGCTATGAG CTGTATATGT ATTTTAGGCT
Clustal Co *****
      ....|....| ....|....| ....|....| ....|....| ....|....|
                110        120        130        140        150
1PB      CTATTGTCTG GGGACATCAT ATGTACTGTTG TGGTCTTGA AACAGATACA
2PB      CTATTGTCTG GGGACATCAT ATGTACTGTTG TGGTCTTGA AACAGATACA
3ASL     CTATTGTCTG GGGACATCAT ATGTACTGTTG TGGTCTTGA AACAGATACA
4ASL     CTATTGTCTG GGGACATCAT ATGTACTGTTG TGGTCTTGA AACAGATACA
6CPY     CTATTGTCTG GGGACATCAT ATGTACTGTTG TGGTCTTGA AACAGATACA
5CPY     CTATTGTCTG GGGACATCAT ATGTACTGTTG TGGTCTTGA AACAGATACA
Clustal Co *****

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      ....|....| ....|....| ....|....| ....|....| ....|....|
            160           170           180           190           200
1PB      CGTGCTTATT TTACAGGTGT AACTATTTTA ATTTTCATTAC CAACAGGAAC
2PB      CGTGCTTATT TTACAGGTGT AACTATTTTA ATTTTCATTAC CAACAGGAAC
3ASL     CGTGCTTATT TTACAGGTGT AACTATTTTA ATTTTCATTAC CAACAGGAAC
4ASL     CGTGCTTATT TTACAGGTGT AACTATTTTA ATTTTCATTAC CAACAGGAAC
6CPY     CGTGCTTATT TTACAGGTGT AACTATTTTA ATTTTCATTAC CAACAGGAAC
5CPY     CGTGCTTATT TTACAGGTGT AACTATTTTA ATTTTCATTAC CAACAGGAAC
Clustal Co *****

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      ....|....| ....|....| ....|....| ....|....| ....|....|
            210           220           230           240           250
1PB      AAAAATCTTT AATTGGATTA GTACATACCT CGGTAATTCT TTATTACTCC
2PB      AAAAATCTTT AATTGGATTA GTACATACCT CGGTAATTCT TTATTACTCC
3ASL     AAAAATCTTT AATTGGATTA GTACATACCT CGGTAATTCT TTATTACTCC
4ASL     AAAAATCTTT AATTGGATTA GTACATACCT CGGTAATTCT TTATTACTCC
6CPY     AAAAATCTTT AATTGGATTA GTACATACCT CGGTAATTCT TTATTACTCC
5CPY     AAAAATCTTT AATTGGATTA GTACATACCT CGGTAATTCT TTATTACTCC
Clustal Co *****

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      ....|....| ....|....| ....|....| ....|....| ....|....|
            260           270           280           290           300
1PB      ATATGAGGAC TTCTTCAGCA CTTTTTGCGT CGCTTTTCCT TTTAATGTTT
2PB      ATATGAGGAC TTCTTCAGCA CTTTTTGCGT CGCTTTTCCT TTTAATGTTT
3ASL     ATATGAGGAC TTCTTCAGCA CTTTTTGCGT CGCTTTTCCT TTTAATGTTT
4ASL     ATATGAGGAC TTCTTCAGCA CTTTTTGCGT CGCTTTTCCT TTTAATGTTT
6CPY     ATATGAGGAC TTCTTCAGCA CTTTTTGCGT CGCTTTTCCT TTTAATGTTT
5CPY     ATATGAGGAC TTCTTCAGCA CTTTTTGCGT CGCTTTTCCT TTTAATGTTT
Clustal Co *****

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      ....|....| ....|....| ....|....| ....|....| ....|....|
            310           320           330           340           350
1PB      ACAATTGGAG GTTCTTCAGG TGTTATACTT GGAAATGCTG CTGTTGACCT
2PB      ACAATTGGAG GTTCTTCAGG TGTTATACTT GGAAATGCTG CTGTTGACCT
3ASL     ACAATTGGAG GTTCTTCAGG TGTTATACTT GGAAATGCTG CTGTTGACCT
4ASL     ACAATTGGAG GTTCTTCAGG TGTTATACTT GGAAATGCTG CTGTTGACCT
6CPY     ACAATTGGAG GTTCTTCAGG TGTTATACTT GGAAATGCTG CTGTTGACCT
5CPY     ACAATTGGAG GTTCTTCAGG TGTTATACTT GGAAATGCTG CTGTTGACCT
Clustal Co ***** ***** ***** ***** *****

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      ....|....| ....|.
            360
1PB      TGCATTACAT GATACA
2PB      TGCATTACAT GATACA
3ASL     TGCATTACAT GATACA
4ASL     TGCATTACAT GATACA
6CPY     TGCATTACAT GATACA
5CPY     TGCATTACAT GATACA
Clustal Co ***** *****

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APPENDIX3

The result from BioEdit program of ITS forward (ITS_F1) sequence of *N. scintillans* sample in the inner gulf of Thailand (1-2PB, 3-4ASL and 5-6CPY) and outing group from Philippine (11-12MB) and Indonesia (13-14ID). Asterisks symbols (*) expressed that all samples appear nitrogenous base (A, C, G, and T) identity. Green label showed the area of nucleotide sequences of samples were compared with *Pfiesteria-like dinoflagellate* position.

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      .....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
                10         20         30         40         50
5CPY_ITS_F  -----
6CPY_ITS_F  -----
12MB_ITS_F  -----
13ID_ITS_F  -----
3ASL_ITS_F  -----
11MB_ITS_F  -----
1PB_ITS_F   -----
14ID_ITS_F  -----
2PB_ITS_F   -----
4ASL_ITS_F  -----
Pfiesteria  TCAACCTGGT GATCCTGCCA GTAGTCATAT GCTTGTCTCA AAGATTAAGC
Clustal
      .....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
                60         70         80         90         100
5CPY_ITS_F  -----
6CPY_ITS_F  -----
12MB_ITS_F  -----
13ID_ITS_F  -----
3ASL_ITS_F  -----
11MB_ITS_F  -----
1PB_ITS_F   -----
14ID_ITS_F  -----
2PB_ITS_F   -----
4ASL_ITS_F  -----
Pfiesteria  CATGCATGTC TCAGCATAAA TTCCTGCACG GTAAGGCTGC GAATGGCTCA
Clustal

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      .....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
            110          120          130          140          150
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria TTAAAAACAGT TATAGTTTAT TTGATGGTCA TTCCTACATG GATAACTGTG
Clustal

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      .....|.....| .....|.....| .....|.....| .....|.....|
            160          170          180          190          200
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria GTAATTCTAG AGCTAATACA TGCACCCAAA CCCGACTCCG TGGAAGGGTT
Clustal

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      .....|.....| .....|.....| .....|.....| .....|.....|
            210          220          230          240          250
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria GTGTTTATTA GTTACAGAAC CAACCCAGGC TTGCCTGGTC TTGTGGTGAT
Clustal

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      .....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
                260      270      280      290      300
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria TCATAATAAC CGAACGAATC GCATGCCTTC GCGGCGATG GATCATTAA
Clustal

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      .....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
                310      320      330      340      350
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria GTTCTGACC TATCAGCTTT CGACGGTAGG ATATAGGCCT ACCGTGGCGA
Clustal

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      .....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
                360      370      380      390      400
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria CGACGGGTAA CGGAGAATTA GGGTTCGATT CCGGAGAGGG AGCCTGAGAA
Clustal

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      .....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
            410          420          430          440          450
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria ACGGCTACCA CATCTAAGGA AGGCAGCAGG CGCGCAAATT ACCCAATCCT
Clustal

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      .....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
            460          470          480          490          500
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria GACACAGGGA GGTAGTGACA AGAAATAACA ATACAGGGCA TCCATGTCTT
Clustal

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      .....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
            510          520          530          540          550
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria GTAATTGGAA TGAGTAGAAT TTAAATCCCT TTATGAGTAT CAATTGGAGG
Clustal

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      ....|....| ....|....| ....|....| ....|....| ....|....|
            560           570           580           590           600
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria GCAAGTCTGG TGCCAGCAGC CGCGGTAATT CCAGCTCCAA TAGCGTATAT
Clustal

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      ....|....| ....|....| ....|....| ....|....| ....|....|
            610           620           630           640           650
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria TAAAGTTGTT GCGGTAAAA AGCTCGTAGT TGGATTCTG CCGAGGACGA
Clustal

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      ....|....| ....|....| ....|....| ....|....| ....|....|
            660           670           680           690           700
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria CCGGTCCGCC CACTGGGTGT GCATCTGGCT CGGCCTGGGC ATCTTCTTGG
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          710          720          730          740          750
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria AGAACGTATC TGCACTTCAC TGTGTGGTGC GGTATCCAGG ACTTTTACTT
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          760          770          780          790          800
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria TGAGGAAATT AGAGTGTTC AAGCAGGCAC ACGCCTTGAA TACGTTAGCA
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          810          820          830          840          850
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria TGGAATAATA AGATAGGACC TTGGTCTAT TTTGTTGGTT TCTAGAACTG
Clustal

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      ....|....| ....|....| ....|....| ....|....| ....|....|
            860      870      880      890      900
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria AGGTAATGAT TAATAGGGAT AGTTGGGGGC ATTCGTATTT AACTGTCAGA
Clustal

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      ....|....| ....|....| ....|....| ....|....| ....|....|
            910      920      930      940      950
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria GGTGAAATTC TTGGATTTGT TAAAGACGGA CTA CTACTGCGAA AGCATTGCC
Clustal

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      ....|....| ....|....| ....|....| ....|....| ....|....|
            960      970      980      990      1000
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria AAGGATGTTT TCATTGATCA AGAACGAAAG TTAGGGGATC GAAGACGATC
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1010          1020          1030          1040          1050
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria AGTATACCGT CCTAGTCTTA ACCATAAACCC ATGCCGACTA GAGATTGGAG
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1060          1070          1080          1090          1100
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria GTCGTTATCT TTACGACTCC TTCAGCACCT TATGAGAAAT CAAAGTCTTT
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1110          1120          1130          1140          1150
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria GGGTTCCGGG GGGAGTATGG TCGCAAGGCT GAAACTTAAA GGAATTGACG
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1160          1170          1180          1190          1200
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria GAAGGGCACC ACCAGGAGTG GAGCCTGCGG CTTAATTTGA CTCAACACGG
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1210          1220          1230          1240          1250
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria GGAAACTTAC CAGGTCCAGA CATAGTAAGG ATTGACAGAT TGATAGCTCT
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1260          1270          1280          1290          1300
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria TTCTTGATTC TATGGGTGGT GGTGCATGGC CGTTCTTAGT TGGTGGAGTG
Clustal

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Continued

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1310      1320      1330      1340      1350
5CPY_ITS_F  -----|-----|-----|-----|-----|-----|-----|-----|
6CPY_ITS_F  -----|-----|-----|-----|-----|-----|-----|-----|
12MB_ITS_F  -----|-----|-----|-----|-----|-----|-----|-----|
13ID_ITS_F  -----|-----|-----|-----|-----|-----|-----|-----|
3ASL_ITS_F  -----|-----|-----|-----|-----|-----|-----|-----|
11MB_ITS_F  -----|-----|-----|-----|-----|-----|-----|-----|
1PB_ITS_F   -----|-----|-----|-----|-----|-----|-----|-----|
14ID_ITS_F  -----|-----|-----|-----|-----|-----|-----|-----|
2PB_ITS_F   -----|-----|-----|-----|-----|-----|-----|-----|
4ASL_ITS_F  -----|-----|-----|-----|-----|-----|-----|-----|
Pfiesteria ATTTGTCTGG TTAATTCGGT TAACGAACGA GACCTTAACC TGCTAAATAG
Clustal          ***** ** *****

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1360      1370      1380      1390      1400
5CPY_ITS_F  TGTCAAGTAT GATTCTTATT T----GATTA CTTCTTAAGG GGACTTTGTG
6CPY_ITS_F  TGTCAAGTAT GATTCTTATT T----GATTA CTTCTTAGAG GGACTTTGTG
12MB_ITS_F  TGTCAAGTAT GATTCTTATT T----GATTA CTTCTTAGAG GGACTTTGTG
13ID_ITS_F  TGTCAAGTAT GATTCTTATT T----GATTA CTTCTTAGAG GGACTTTGTG
3ASL_ITS_F  TGTCAAGTAT GATTCTTATT T----GATTA CTTCTTAGAG GGACTTTGTG
11MB_ITS_F  TGTCAAGTAT GATTCTTATT T----GATTA CTTCTTAGAG GGACTTTGTG
1PB_ITS_F   TGTCAAGTAT GATTCTTATT T----GATTA CTTCTTAGAG GGACTTTGTG
14ID_ITS_F  TGTCAAGTAT GATTCTTATT T----GATTA CTTCTTAGAG GGACTTTGTG
2PB_ITS_F   TGTCAAGTAT GATTCTTATT T----GATTA CTTCTTAGAG GGACTTTGTG
4ASL_ITS_F  TGTCAAGTAT GATTCTTATT T----GATTA CTTCTTAGAG GGACTTTGTG
Pfiesteria TTACAG-TGT AACTTCGGTT ACGTGGGCAA CTTCTTAGAG GGACTTTGTG
Clustal          * ** * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1410      1420      1430      1440      1450
5CPY_ITS_F  TGTCTAACCC AAGGAAGTTT GAGGCAATAA CAGGTCTGTG ATGCCCTTAG
6CPY_ITS_F  TGTCTAACCC AAGGAAGTTT GAGGCAATAA CAGGTCTGTG ATGCCCTTAG
12MB_ITS_F  TGTCTAACCC AAGGAAGTTT GAGGCAATAA CAGGTCTGTG ATGCCCTTAG
13ID_ITS_F  TGTCTAACCC AAGGAAGTTT GAGGCAATAA CAGGTCTGTG ATGCCCTTAG
3ASL_ITS_F  TGTCTAACCC AAGGAAGTTT GAGGCAATAA CAGGTCTGTG ATGCCCTTAG
11MB_ITS_F  TGTCTAACCC AAGGAAGTTT GAGGCAATAA CAGGTCTGTG ATGCCCTTAG
1PB_ITS_F   TGTCTAACCC AAGGAAGTTT GAGGCAATAA CAGGTCTGTG ATGCCCTTAG
14ID_ITS_F  TGTCTAACCC AAGGAAGTTT GAGGCAATAA CAGGTCTGTG ATGCCCTTAG
2PB_ITS_F   TGTCTAACCC AAGGAAGTTT GAGGCAATAA CAGGTCTGTG ATGCCCTTAG
4ASL_ITS_F  TGTCTAACCC AAGGAAGTTT GAGGCAATAA CAGGTCTGTG ATGCCCTTAG
Pfiesteria TGTCTAACCC AAGGAAGTTT GAGGCAATAA CAGGTCTGTG ATGCCCTTAG
Clustal          ***** * * * * * * * * * * * * * * * * * * * * * * *

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Continued

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1460          1470          1480          1490          1500
5CPY_ITS_F  ATGTTCTGGG CTGCACGGCG GCTACACTGA TGCATTCAAC GAGTTTATAA
6CPY_ITS_F  ATGTTCTGGG CTGCACGGCG GCTACACTGA TGCATTCAAC GAGTTTATAA
12MB_ITS_F  ATGTTCTGGG CTGCACGGCG GCTACACTGA TGCATTCAAC GAGTTTATAA
13ID_ITS_F  ATGTTCTGGG CTGCACGGCG GCTACACTGA TGCATTCAAC GAGTTTATAA
3ASL_ITS_F  ATGTTCTGGG CTGCACGGCG GCTACACTGA TGCATTCAAC GAGTTTATAA
11MB_ITS_F  ATGTTCTGGG CTGCACGGCG GCTACACTGA TGCATTCAAC GAGTTTATAA
1PB_ITS_F   ATGTTCTGGG CTGCACGGCG GCTACACTGA TGCATTCAAC GAGTTTATAA
14ID_ITS_F  ATGTTCTGGG CTGCACGGCG GCTACACTGA TGCATTCAAC GAGTTTATAA
2PB_ITS_F   ATGTTCTGGG CTGCACGGCG GCTACACTGA TGCATTCAAC GAGTTTATAA
4ASL_ITS_F  ATGTTCTGGG CTGCACGGCG GCTACACTGA TGCATTCAAC GAGTTTATAA
Pfiesteria ATGTTCTGGG CTGCACGGCG GCTACACTGA TGCATTCAAC GAGTTTATAA
Clustal     ***** *
.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1510          1520          1530          1540          1550
5CPY_ITS_F  CCTTGCCTGA AAAGGTTGGG TAATCTGC-- AATGTCATC GTGATGGGGA
6CPY_ITS_F  CCTTGCCTGA AAAGGTTGGG TAATCTGC-- AATGTCATC GTGATGGGGA
12MB_ITS_F  CCTTGCCTGA AAAGGTTGGG TAATCTGC-- AATGTCATC GTGATGGGGA
13ID_ITS_F  CCTTGCCTGA AAAGGTTGGG TAATCTGC-- AATGTCATC GTGATGGGGA
3ASL_ITS_F  CCTTGCCTGA AAAGGTTGGG TAATCTGC-- AATGTCATC GTGATGGGGA
11MB_ITS_F  CCTTGCCTGA AAAGGTTGGG TAATCTGC-- AATGTCATC GTGATGGGGA
1PB_ITS_F   CCTTGCCTGA AAAGGTTGGG TAATCTGC-- AATGTCATC GTGATGGGGA
14ID_ITS_F  CCTTGCCTGA AAAGGTTGGG TAATCTGC-- AATGTCATC GTGATGGGGA
2PB_ITS_F   CCTTGCCTGA AAAGGTTGGG TAATCTGC-- AATGTCATC GTGATGGGGA
4ASL_ITS_F  CCTTGCCTGA AAAGGTTGGG TAATCTGC-- AATGTCATC GTGATGGGGA
Pfiesteria CCTTGCCTGA AAAGGTTGGG TAATCTGC-- AATGTCATC GTGATGGGGA
Clustal     ***** *
.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1560          1570          1580          1590          1600
5CPY_ITS_F  TAGATTATTG CAATTATTAA TCTTCAACGA GGAATTCCTA GTAAGCGCGA
6CPY_ITS_F  TAGATTATTG CAATTATTAA TCTTCAACGA GGAATTCCTA GTAAGCGCGA
12MB_ITS_F  TAGATTATTG CAATTATTAA TCTTCAACGA GGAATTCCTA GTAAGCGCGA
13ID_ITS_F  TAGATTATTG CAATTATTAA TCTTCAACGA GGAATTCCTA GTAAGCGCGA
3ASL_ITS_F  TAGATTATTG CAATTATTAA TCTTCAACGA GGAATTCCTA GTAAGCGCGA
11MB_ITS_F  TAGATTATTG CAATTATTAA TCTTCAACGA GGAATTCCTA GTAAGCGCGA
1PB_ITS_F   TAGATTATTG CAATTATTAA TCTTCAACGA GGAATTCCTA GTAAGCGCGA
14ID_ITS_F  TAGATTATTG CAATTATTAA TCTTCAACGA GGAATTCCTA GTAAGCGCGA
2PB_ITS_F   TAGATTATTG CAATTATTAA TCTTCAACGA GGAATTCCTA GTAAGCGCGA
4ASL_ITS_F  TAGATTATTG CAATTATTAA TCTTCAACGA GGAATTCCTA GTAAGCGCGA
Pfiesteria TAGATTATTG CAATTATTAA TCTTCAACGA GGAATTCCTA GTAAGCGCGA
Clustal     ***** *

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Continued

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...|...| ...|...| ...|...| ...|...| ...|...|
          1610      1620      1630      1640      1650
5CPY_ITS_F  ATCATCAGCT CGTGCTGATT ACGTCCCTGC CCTTTGTACA CACCGCCCGT
6CPY_ITS_F  ATCATCAGCT CGTGCTGATT ACGTCCCTGC CCTTTGTACA CACCGCCCGT
12MB_ITS_F  ATCATCAGCT CGTGCTGATT ACGTCCCTGC CCTTTGTACA CACCGCCCGT
13ID_ITS_F  ATCATCAGCT CGTGCTGATT ACGTCCCTGC CCTTTGTACA CACCGCCCGT
3ASL_ITS_F  ATCATCAGCT CGTGCTGATT ACGTCCCTGC CCTTTGTACA CACCGCCCGT
11MB_ITS_F  ATCATCAGCT CGTGCTGATT ACGTCCCTGC CCTTTGTACA CACCGCCCGT
1PB_ITS_F   ATCATCAGCT CGTGCTGATT ACGTCCCTGC CCTTTGTACA CACCGCCCGT
14ID_ITS_F  ATCATCAGCT CGTGCTGATT ACGTCCCTGC CCTTTGTACA CACCGCCCGT
2PB_ITS_F   ATCATCAGCT CGTGCTGATT ACGTCCCTGC CCTTTGTACA CACCGCCCGT
4ASL_ITS_F  ATCATCAGCT CGTGCTGATT ACGTCCCTGC CCTTTGTACA CACCGCCCGT
Pfiesteria ATCATCAGCT CGTGCTGATT ACGTCCCTGC CCTTTGTACA CACCGCCCGT
Clustal     *****
...|...| ...|...| ...|...| ...|...| ...|...|
          1660      1670      1680      1690      1700
5CPY_ITS_F  CGCTCCTACC GATTGAGTGA TTCGGTGAAT AATTCGGAGA TTGAT-TTGT
6CPY_ITS_F  CGCTCCTACC GATTGAGTGA TTCGGTGAAT AATTCGGAGA TTGAT-TTGT
12MB_ITS_F  CGCTCCTACC GATTGAGTGA TTCGGTGAAT AATTCGGAGA TTGAT-TTGT
13ID_ITS_F  CGCTCCTACC GATTGAGTGA TTCGGTGAAT AATTCGGAGA TTGAT-TTGT
3ASL_ITS_F  CGCTCCTACC GATTGAGTGA TTCGGTGAAT AATTCGGAGA TTGAT-TTGT
11MB_ITS_F  CGCTCCTACC GATTGAGTGA TTCGGTGAAT AATTCGGAGA TTGAT-TTGT
1PB_ITS_F   CGCTCCTACC GATTGAGTGA TTCGGTGAAT AATTCGGAGA TTGAT-TTGT
14ID_ITS_F  CGCTCCTACC GATTGAGTGA TTCGGTGAAT AATTCGGAGA TTGAT-TTGT
2PB_ITS_F   CGCTCCTACC GATTGAGTGA TTCGGTGAAT AATTCGGAGA TTGAT-TTGT
4ASL_ITS_F  CGCTCCTACC GATTGAGTGA TTCGGTGAAT AATTCGGAGA TTGAT-TTGT
Pfiesteria CGCTCCTACC GATTGAGTGA TCCGGTGAAT AATTCGGACC GCAGCATTGT
Clustal     ***** * *****
...|...| ...|...| ...|...| ...|...| ...|...|
          1710      1720      1730      1740      1750
5CPY_ITS_F  TCTGCTTTGC AGAACATGTC TTTCGAA-GT TTAGTGAACC TCATCACTTA
6CPY_ITS_F  TCTGCTTTGC AGAACATGTC TTTCGAA-GT TTAGTGAACC TCATCACTTA
12MB_ITS_F  TCTGCTTTGC AGAACATGTC TTTCGAA-GT TTAGTGAACC TCATCACTTA
13ID_ITS_F  TCTGCTTTGC AGAACATGTC TTTCGAA-GT TTAGTGAACC TCATCACTTA
3ASL_ITS_F  TCTGCTTTGC AGAACATGTC TTTCGAA-GT TTAGTGAACC TCATCACTTA
11MB_ITS_F  TCTGCTTTGC AGAACATGTC TTTCGAA-GT TTAGTGAACC TCATCACTTA
1PB_ITS_F   TCTGCTTTGC AGAACATGTC TTTCGAA-GT TTAGTGAACC TCATCACTTA
14ID_ITS_F  TCTGCTTTGC AGAACATGTC TTTCGAA-GT TTAGTGAACC TCATCACTTA
2PB_ITS_F   TCTGCTTTGC AGAACATGTC TTTCGAA-GT TTAGTGAACC TCATCACTTA
4ASL_ITS_F  TCTGCTTTGC AGAACATGTC TTTCGAA-GT TTAGTGAACC TCATCACTTA
Pfiesteria TCAGCTT--C TCAACGTTGC AGTGGAAAGT TTAGTGAACC TTATCACTTA
Clustal     ** **** * **** * * * **** ** *****

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Continued


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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1760          1770          1780          1790          1800
5CPY_ITS_F  G-AGGAAGCA GAAGTCGTAA CAAGGTTTCC GTAGGTGAAC CTGCCG-AAG
6CPY_ITS_F  G-AGGAAGCA GAAGTCGTAA CAAGGTTTCC GTAGGTGAAC CTGCCGGAAG
12MB_ITS_F  G-AGGAAGCA GAAGTCGTAA CAAGGTTTCC GTAGGTGAAC CTGCCG-AAG
13ID_ITS_F  G-AGGAAGCA GAAGTCGTAA CAAGGTTTCC GTAGGTGAAC CTGCCG-AAG
3ASL_ITS_F  G-AGGAAGCA GAAGTCGTAA CAAGGTTTCC GTAGGTGAAC CTGCCG-AAG
11MB_ITS_F  GCAGGAAGCA GAAGTCGTAA CAAGGTTTCC GTAGGTGAAC CTGCCG-AAG
1PB_ITS_F   G-AGGAAGCA GAAGTCGTAA CAAGGTTTCC GTAGGTGAAC CTGCCG-AAG
14ID_ITS_F  G-AGGAAGCA GAAGTCGTAA CAAGGTTTCC GTAGGTGAAC CTGCCG-AAG
2PB_ITS_F   G-AGGAAGCA GAAGTCGTAA CAAGGTTTCC GTAGGTGAAC CTGCCG-AAG
4ASL_ITS_F  G-AGGAAGCA GAAGTCGTAA CAAGGTTTCC GTAGGTGAAC CTGCCG-AAG
Pfiesteria G-AGGAAGCA GAAGTCGTAA CAAGGTTTCC GTAGGTGAAC CTGCCG-AAG
Clustal     * ***** * ***** * ***** * ***** * ***** *
.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1810          1820          1830          1840          1850
5CPY_ITS_F  GATCATTAC AC--ATTCCA GCTTCATGTT T-----
6CPY_ITS_F  GATCATTAC AC--ATTCCA GCTTCATGTT T-----
12MB_ITS_F  GATCATTAC AC--ATTCCA GCTTCATGTT T-----
13ID_ITS_F  GATCATTAC AC--ATTCCA GCTTCATGTT T-----
3ASL_ITS_F  GATCATTAC AC--ATTCCA GCTTCATGTT T-----
11MB_ITS_F  GATCATTAC AC--ATTCCA GCTTCATGTT T-----
1PB_ITS_F   GATCATTAC AC--ATTCCA GCTTCATGTT T-----
14ID_ITS_F  GATCATTAC AC--ATTCCA GCTTCATGTT T-----
2PB_ITS_F   GATCATTAC AC--ATTCCA GCTTCATGTT T-----
4ASL_ITS_F  GATCATTAC AC--ATTCCA GCTTCATGTT T-----
Pfiesteria GATCATTGCG ACGCATCCAA GCATCTCACC ACCGTGAATT CTGGGTGTGA
Clustal     ***** * ** * * * * *
.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1860          1870          1880          1890          1900
5CPY_ITS_F  -----
6CPY_ITS_F  -----
12MB_ITS_F  -----
13ID_ITS_F  -----
3ASL_ITS_F  -----
11MB_ITS_F  -----
1PB_ITS_F   -----
14ID_ITS_F  -----
2PB_ITS_F   -----
4ASL_ITS_F  -----
Pfiesteria GGCTCTGTGT AGGGAGGTAT CGGTGCTCGT CGCCGAGATA TCCCTGTGCA
Clustal
Continued

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1910      1920      1930      1940      1950
5CPY_ITS_F  -----
6CPY_ITS_F  -----
12MB_ITS_F  -----
13ID_ITS_F  -----
3ASL_ITS_F  -----
11MB_ITS_F  -----
1PB_ITS_F   -----
14ID_ITS_F  -----
2PB_ITS_F   -----
4ASL_ITS_F  -----
Pfiesteria GCAGGCTCGA GGGCGGCTCA GTGCAGGATG GGTAGCATT T GCTTACCTCC
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1960      1970      1980      1990      2000
5CPY_ITS_F  -----
6CPY_ITS_F  -----
12MB_ITS_F  -----
13ID_ITS_F  -----
3ASL_ITS_F  -----
11MB_ITS_F  -----
1PB_ITS_F   -----
14ID_ITS_F  -----
2PB_ITS_F   -----
4ASL_ITS_F  -----
Pfiesteria TTTCTGTGTT GGTGCGCCACC CATTTCCTTA CCATATTTAC CGTCTCTTCC
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2010      2020      2030      2040      2050
5CPY_ITS_F  -----
6CPY_ITS_F  -----
12MB_ITS_F  -----
13ID_ITS_F  -----
3ASL_ITS_F  -----
11MB_ITS_F  -----
1PB_ITS_F   -----
14ID_ITS_F  -----
2PB_ITS_F   -----
4ASL_ITS_F  -----
Pfiesteria ATACTATCCC TTTGCTCGGG CTGTGGGGTG CTGTGTGTTC GCACACTCAT
Clustal

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Continued

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2060          2070          2080          2090          2100
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria CTCTCATCTC TGGCATTTC TTTTCTTACA ACTTTCAGCG ACGAATGTCT
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2110          2120          2130          2140          2150
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria CGGCTCGAAC AACGATGAAG GGCACAGCGA ACTGTGATAA GCATTGTGAA
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2160          2170          2180          2190          2200
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria TTGCAGATTT CCGCGAATCA ATAGAACTT GAACGTAAAA TGCGGTTTCG
Clustal

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Continued

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2210      2220      2230      2240      2250
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria GGATATCCCT GAAACCATGC CTGCTTCAGT GTCCCAACCT CTCCTTCCGG
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2260      2270      2280      2290      2300
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria TCGAACCTTT CGGTGACTGA TGTATTTCCG TGCTCCGAAG GTTCGGTCTC
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2310      2320      2330      2340      2350
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria GGTGTCGTTG TGTGTTAAGG TGCTTCGGCT CTCGTCGTCG CCCTTGACAC
Clustal

```

Continued

```

      ....|....| ....|....| ....|....| ....|....| ....|....|
            2360      2370      2380      2390      2400
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria ATCTAGGACA TGGAGATATC CCTGGCGGCT CTTTGGCGAC GAATCATGCT
Clustal

```

```

      ....|....| ....|....| ....|....| ....|....| ....|....|
            2410      2420      2430      2440      2450
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria CACCCATGCA TTTGCTCGCC TCCCGTCTTG GGGTTTTGTC TCCCACAGTC
Clustal

```

```

      ....|....| ....|....| ....|....| ....|....| ....|....|
            2460      2470      2480      2490      2500
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria TTCCTTAGCA CATTGTCACA CGACGATGGC TCTCAAGACA TGAAGTCAGG
Clustal

```

Continued


```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2510          2520          2530          2540          2550
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria TCAGCAAACC CGCTGAATTT AAGCATATAA GTAAGCGGAG GAAAAGAAAC
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....
          2560          2570          2580          2590
5CPY_ITS_F -----
6CPY_ITS_F -----
12MB_ITS_F -----
13ID_ITS_F -----
3ASL_ITS_F -----
11MB_ITS_F -----
1PB_ITS_F -----
14ID_ITS_F -----
2PB_ITS_F -----
4ASL_ITS_F -----
Pfiesteria TAAATAGGAT TCCCTTAGTA ATGGCGAATG AACAGGGAAA TCAC
Clustal

```

APPENDIX 4

The result from BioEdit program of ITS reverse (ITS_R2) sequence of *N. scintillans* sample in the inner gulf of Thailand (1-2PB, 3-4ASL and 5-6CPY) and outing group from Philippine (11-12MB) and Indonesia (13-14ID). Asterisks symbols (*) expressed that all samples appear nitrogenous base (A, C, G, and T) identity. Blue label showed the area of nucleotide sequences of samples were compared with *Pfiesteria-like dinoflagellate* position.

```

      .....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
                10         20         30         40         50
5CPY_ITS_R  -----
6CPY_ITS_R  -----
3ASL_ITS_R  -----
Pfiesteria  TCAACCTGGT GATCCTGCCA GTAGTCATAT GCTTGTCTCA AAGATTAAGC
Clustal

      .....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
                60         70         80         90         100
5CPY_ITS_R  -----
6CPY_ITS_R  -----
3ASL_ITS_R  -----
Pfiesteria  CATGCATGTC TCAGCATAAA TTCCTGCACG GTAAGGCTGC GAATGGCTCA
Clustal

      .....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
                110        120        130        140        150
5CPY_ITS_R  -----
6CPY_ITS_R  -----
3ASL_ITS_R  -----
Pfiesteria  TTAAAACAGT TATAGTTTAT TTGATGGTCA TTCCTACATG GATAACTGTG
Clustal

      .....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
                160        170        180        190        200
5CPY_ITS_R  -----
6CPY_ITS_R  -----
3ASL_ITS_R  -----
Pfiesteria  GTAATTCTAG AGCTAATACA TGCACCCAAA CCCGACTCCG TGGAAGGGTT
Clustal

```

Continued

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          210          220          230          240          250
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria GTGTTTATTA GTTACAGAAC CAACCCAGGC TTGCCTGGTC TTGTGGTGAT
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          260          270          280          290          300
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria TCATAATAAC CGAACGAATC GCATGCCTTC GCGGCGATG GATCATTTAA
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          310          320          330          340          350
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria GTTTCTGACC TATCAGCTTT CGACGGTAGG ATATAGGCCT ACCGTGGCGA
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          360          370          380          390          400
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria CGACGGGTAA CGGAGAATTA GGGTTCGATT CCGGAGAGGG AGCCTGAGAA
Clustal

```

Continued

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          410          420          430          440          450
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria ACGGCTACCA CATCTAAGGA AGGCAGCAGG CGCGCAAATT ACCCAATCCT
Clustal

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```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          460          470          480          490          500
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria GACACAGGGA GGTAGTGACA AGAAATAACA ATACAGGGCA TCCATGTCTT
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          510          520          530          540          550
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria GTAATTGGAA TGAGTAGAAT TTAAATCCCT TTATGAGTAT CAATTGGAGG
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          560          570          580          590          600
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria GCAAGTCTGG TGCCAGCAGC CGCGGTAATT CCAGCTCCAA TAGCGTATAT
Clustal

```

Continued

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          610          620          630          640          650
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria TAAAGTTGTT GCGGTTAAAA AGCTCGTAGT TGGATTTCTG CCGAGGACGA
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          660          670          680          690          700
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria CCGGTCCGCC CACTGGGTGT GCATCTGGCT CGGCCTGGGC ATCTTCTTGG
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          710          720          730          740          750
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria AGAACGTATC TGCACTTCAC TGTGTGGTGC GGTATCCAGG ACTTTTACTT
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          760          770          780          790          800
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria TGAGGAAATT AGAGTGTTTC AAGCAGGCAC ACGCCTTGAA TACGTTAGCA
Clustal

```

Continued


```

      .....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
                810          820          830          840          850
5CPY_ITS_R  -----
6CPY_ITS_R  -----
3ASL_ITS_R  -----
Pfiesteria TGGAAATAATA AGATAGGACC TTGGTCTAT TTTGTTGGTT TCTAGAACTG
Clustal

```

```

      .....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
                860          870          880          890          900
5CPY_ITS_R  -----
6CPY_ITS_R  -----
3ASL_ITS_R  -----
Pfiesteria AGGTAATGAT TAATAGGGAT AGTTGGGGGC ATTCGTATTT AACTGTCAGA
Clustal

```

```

      .....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
                910          920          930          940          950
5CPY_ITS_R  -----
6CPY_ITS_R  -----
3ASL_ITS_R  -----
Pfiesteria GGTGAAATTC TTGATTTGT TAAAGACGGA CTA CTACTGCGAA AGCATTTGCC
Clustal

```

```

      .....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
                960          970          980          990          1000
5CPY_ITS_R  -----
6CPY_ITS_R  -----
3ASL_ITS_R  -----
Pfiesteria AAGGATGTTT TCATTGATCA AGAACGAAAG TTAGGGGATC GAAGACGATC
Clustal

```

Continued

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1010          1020          1030          1040          1050
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria AGTATACCGT CCTAGTCTTA ACCATAAACC ATGCCGACTA GAGATTGGAG
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1060          1070          1080          1090          1100
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria GTCGTTATCT TTACGACTCC TTCAGCACCT TATGAGAAAT CAAAGTCTTT
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1110          1120          1130          1140          1150
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria GGGTTCGGG GGGAGTATGG TCGCAAGGCT GAAACTTAAA GGAATTGACG
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1160          1170          1180          1190          1200
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria GAAGGGCACC ACCAGGAGTG GAGCCTGCGG CTTAATTTGA CTCAACACGG
Clustal

```

Continued

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1210          1220          1230          1240          1250
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria GGAAACTTAC CAGGTCCAGA CATAGTAAGG ATTGACAGAT TGATAGCTCT
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1260          1270          1280          1290          1300
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria TTCTTGATTC TATGGGTGGT GGTGCATGGC CGTTCTTAGT TGGTGGAGTG
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1310          1320          1330          1340          1350
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria ATTTGTCTGG TTAATTCCGT TAACGAACGA GACCTTAACC TGCTAAATAG
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1360          1370          1380          1390          1400
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria TTACACTGTA ACTTCGGTTA CGTGGGCAAC TTCTTAGAGG GACTTTGTGT
Clustal

```

Continued

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1410          1420          1430          1440          1450
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria GTCTAACGCA AGGAAGTTTG AGGCAATAAC AGGTCTGTGA TGCCCTTAGA
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1460          1470          1480          1490          1500
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria TGTTCTGGGC TGCACGCGCG CTACACTGAT GCACTCAACG AGTTTACGAC
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1510          1520          1530          1540          1550
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria CTTGCCCGAT AGGGTTGGGT AATCTTTTTTA AAATGCATCG TGATGGGGAT
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1560          1570          1580          1590          1600
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria AGATTATTGC AATTATTAAT CTTCAACGAG GAATTCCTAG TAAGCACGAG
Clustal

```

Continued

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1610          1620          1630          1640          1650
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria TCATCAGCTC GTGCTGATTA CGTCCCTGCC CTTTGTACAC ACCGCCCGTC
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1660          1670          1680          1690          1700
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria GCTCCTACCG ATTGAGTGAT CCGGTGAATA ATTCGGACCG CAGCATTGTT
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1710          1720          1730          1740          1750
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria CAGCTTCTGA ACGTTGCAGT GGAAAGTTTA GTGAACCTTA TCACTTAGAG
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1760          1770          1780          1790          1800
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria GAAGGAGAAG TCGTAACAAG GTTTCCTAG GTGAACCTGC GGAAGGATCA
Clustal

```

Continued


```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1810      1820      1830      1840      1850
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria TTCGCACGCA TCCAAGCATC TCACCACCGT GAATTCTGGG TGTGAGGCTC
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1860      1870      1880      1890      1900
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria TGTGTAGGGA GGTATCGGTG CTCGTCGCCG AGATATCCCT GTGCAGCAGG
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1910      1920      1930      1940      1950
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria CTCGAGGGCG GCTCAGTGCA GGATGGGTAG CATTGCTTA CCTCCTTCT
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1960      1970      1980      1990      2000
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria GTGTTGGTCG CCACCCATTT CCCTACCATA TTTACCGTCT CTCCATACT
Clustal

```

Continued

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2010          2020          2030          2040          2050
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria ATCCCTTTGC TCGGGCTGTG GGGTGCTGTG TGTTGCACA CTCATCTCTC
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2060          2070          2080          2090          2100
5CPY_ITS_R -----GGA TTAGATTAAA C-ACAACTTC CAGTGATGGA TGTCTCGGCT
6CPY_ITS_R -----GGA TTAGATTAAA C-ACAACTTC CAGTGATGGA TGTCTCGGCT
3ASL_ITS_R -----GGA TTAGATTAAA C-ACAACTTC CAGTGATGGA TGTCTCGGCT
Pfiesteria ATCTCTGCGA TTTCATTTTC TTACAACTTT CAGCGACGAA TGTCTCGGCT
Clustal          * * * * *          * * * * * * * * * * * * * * * * * *

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2110          2120          2130          2140          2150
5CPY_ITS_R CGAACAACGA TGAA-----
6CPY_ITS_R CGAACAACGA TGAA-----
3ASL_ITS_R CGAACAACGA TGAA-----
Pfiesteria CGAACAACGA TGAAAGGGCAC AGCGAACTGT GATAAGCATT GTGAATTGCA
Clustal          * * * * * * * * * * * * * * * * * *

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2160          2170          2180          2190          2200
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria GATTTCCGCG AATCAATAGA AACTTGAACG TAAAATGCGG TTTCGGGATA
Clustal

```

Continued

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2210      2220      2230      2240      2250
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria TCCCTGAAAC CATGCCTGCT TCAGTGTCCC AACCTCTCCT TCCGGTCGAA
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2260      2270      2280      2290      2300
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria CCTTTCGGTG ACTGATGTAT TTCGGTGCTC CGAAGGTTCG GTCTCGGTGT
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2310      2320      2330      2340      2350
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria CGTTGTGTGT TAAGGTGCTT CGGCTCTCGT CGTCGCCCTT GACACATCTA
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2360      2370      2380      2390      2400
5CPY_ITS_R -----
6CPY_ITS_R -----
3ASL_ITS_R -----
Pfiesteria GGACATGGAG ATATCCCTGG CGGCTCTTTG GCGACGAATC ATGCTCACCC
Clustal

```

Continued

```

      .....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
            2410      2420      2430      2440      2450
5CPY_ITS_R  -----
6CPY_ITS_R  -----
3ASL_ITS_R  -----
Pfiesteria ATGCATTTGC TCGCCTCCCG TCTTGGGGTT TTGTCTCCCA CAGTCTTCCT
Clustal

```

```

      .....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
            2460      2470      2480      2490      2500
5CPY_ITS_R  -----
6CPY_ITS_R  -----
3ASL_ITS_R  -----
Pfiesteria TAGCACATTG TCACACGACG ATGGCTCTCA AGACATGAAG TCAGGTCAGC
Clustal

```

```

      .....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
            2510      2520      2530      2540      2550
5CPY_ITS_R  -----
6CPY_ITS_R  -----
3ASL_ITS_R  -----
Pfiesteria AAACCCGCTG AATTTAAGCA TATAAGTAAG CGGAGGAAAA GAAACTAAAT
Clustal

```

```

      .....|.....| .....|.....| .....|.....| .....|.....
            2560      2570      2580
5CPY_ITS_R  -----
6CPY_ITS_R  -----
3ASL_ITS_R  -----
Pfiesteria AGGATTCCT TAGTAATGGC GAATGAACAG GGAAATCAC
Clustal

```

APPENDIX 5

The result from BioEdit program of ITS forward (ITS_F3 and ITS_F4) sequence of *N. scintillans* sample in outing group from Philippine (10MB). Asterisks symbols (*) expressed that all samples appear nitrogenous base (A, C, G, and T) identity. Purple label showed the area of nucleotide sequences from ITS_F3 primer and yellow label showed the area of nucleotide sequences from ITS_F4 primer, the results were compared with *Pfiesteria-like dinoflagellate* position.

```

.....|.....|.....|.....|.....|.....|
      10      20      30      40      50
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria TCAACCTGGT GATCCTGCCA GTAGTCATAT GCTTGTCTCA AAGATTAAGC
Clustal

```

```

.....|.....|.....|.....|.....|.....|
      60      70      80      90     100
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria CATGCATGTC TCAGCATAAA TTCCTGCACG GTAAGGCTGC GAATGGCTCA
Clustal

```

```

.....|.....|.....|.....|.....|.....|
     110     120     130     140     150
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria TTAAAACAGT TATAGTTTAT TTGATGGTCA TTCCTACATG GATAACTGTG
Clustal

```

```

.....|.....|.....|.....|.....|.....|
     160     170     180     190     200
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria GTAATTCTAG AGCTAATACA TGCACCCAAA CCCGACTCCG TGGAAGGGTT
Clustal

```

```

.....|.....|.....|.....|.....|.....|
     210     220     230     240     250
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria GTGTTTATTA GTTACAGAAC CAACCCAGGC TTGCCTGGTC TTGTGGTGAT
Clustal

```

```

.....|.....|.....|.....|.....|.....|
     260     270     280     290     300
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria TCATAATAAC CGAACGAATC GCATGCCTTC GCGGCGATG GATCATTTAA
Clustal

```

Continued


```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          310          320          330          340          350
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria GTTTCTGACC TATCAGCTTT CGACGGTAGG ATATAGGCCT ACCGTGGCGA
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          360          370          380          390          400
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria CGACGGGTAA CGGAGAATTA GGGTTCGATT CCGGAGAGGG AGCCTGAGAA
Clustal Co

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          410          420          430          440          450
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria ACGGCTACCA CATCTAAGGA AGGCAGCAGG CGCGCAAATT ACCCAATCCT
Clustal Co

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          460          470          480          490          500
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria GACACAGGGA GGTAGTGACA AGAAATAACA ATACAGGGCA TCCATGTCTT
Clustal Co

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          510          520          530          540          550
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria GTAATTGGAA TGAGTAGAAT TTAAATCCCT TTATGAGTAT CAATTGGAGG
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          560          570          580          590          600
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria GCAAGTCTGG TGCCAGCAGC CGCGGTAATT CCAGCTCCAA TAGCGTATAT
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          610          620          630          640          650
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria TAAAGTTGTT GCGGTAAAA AGCTCGTAGT TGGATTTCTG CCGAGGACGA
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          660          670          680          690          700
11_MB_ITS -----
11_MB_ITS -----
Pfiesteria CCGGTCCGCC CACTGGGTGT GCATCTGGCT CGGCCTGGGC ATCTTCTTGG
Clustal Co

```

Continued

```

.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|
          710      720      730      740      750
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria AGAACGTATC TGCACTTCAC TGTGTGGTGC GGTATCCAGG ACTTTTACTT
Clustal

```

```

.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|
          760      770      780      790      800
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria TGAGGAAATT AGAGTGTTTC AAGCAGGCAC ACGCCTTGAA TACGTTAGCA
Clustal

```

```

.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|
          810      820      830      840      850
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria TGAATAATA AGATAGGACC TTGGTCTAT TTTGTTGGTT TCTAGAACTG
Clustal Co

```

```

.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|
          860      870      880      890      900
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria AGGTAATGAT TAATAGGGAT AGTTGGGGGC ATTCGTATTT AACTGTCAGA
Clustal

```

```

.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|
          910      920      930      940      950
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria GGTGAAATTC TTGATTTGT TAAAGACGGA CTA CTACTGCGAA AGCATTGCC
Clustal

```

```

.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|
          960      970      980      990     1000
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria AAGGATGTTT TCATTGATCA AGAACGAAAG TTAGGGGATC GAAGACGATC
Clustal

```

```

.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|
        1010     1020     1030     1040     1050
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria AGTATACCGT CCTAGTCTTA ACCATAAACC ATGCCGACTA GAGATTGGAG
Clustal

```

```

.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|
        1060     1070     1080     1090     1100
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria GTCGTTATCT TTACGACTCC TTCAGCACCT TATGAGAAAT CAAAGTCTTT
Clustal

```

Continued

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1110      1120      1130      1140      1150
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria GGGTTCCGGG GGGAGTATGG TCGCAAGGCT GAAACTTAAA GGAATTGACG
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1160      1170      1180      1190      1200
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria GAAGGGCACC ACCAGGAGTG GAGCCTGCGG CTTAATTTGA CTCAACACGG
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1210      1220      1230      1240      1250
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria GGAAACTTAC CAGGTCCAGA CATAGTAAGG ATTGACAGAT TGATAGCTCT
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1260      1270      1280      1290      1300
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria TTCTTGATTC TATGGGTGGT GGTGCATGGC CGTTCTTAGT TGGTGGAGTG
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1310      1320      1330      1340      1350
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria ATTTGTCTGG TTAATTCCGT TAACGAACGA GACCTTAACC TGCTAAATAG
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1360      1370      1380      1390      1400
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria TTACACTGTA ACTTCGGTTA CGTGGGCAAC TTCTTAGAGG GACTTTGTGT
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1410      1420      1430      1440      1450
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria GTCTAACGCA AGGAAGTTTG AGGCAATAAC AGGTCTGTGA TGCCCTTAGA
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1460      1470      1480      1490      1500
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria TGTTCTGGGC TGCACGCGCG CTACACTGAT GCACTCAACG AGTTTACGAC
Clustal

```

Continued

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1510      1520      1530      1540      1550
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria CTTGCCCGAT AGGGTTGGGT AATCTTTTAA AAATGCATCG TGATGGGGAT
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1560      1570      1580      1590      1600
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria AGATTATTGC AATTATTAAT CTTCAACGAG GAATTCCTAG TAAGCAGCAG
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1610      1620      1630      1640      1650
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria TCATCAGCTC GTGCTGATTA CGTCCCTGCC CTTTGTACAC ACCGCCCGTC
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1660      1670      1680      1690      1700
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria GCTCCTACCG ATTGAGTGAT CCGGTGAATA ATTCGGACCG CAGCATTGTT
Clustal

```

```

.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1710      1720      1730      1740      1750
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria CAGCTTCTGA ACGTTGCAGT GGAAAGTTTA GTGAACCTTA TCACTTAGAG
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1760      1770      1780      1790      1800
11_MB_ITS3 ----- -AGCGTACAA GGTTCGGTA GGTGAACCTG CGGAAGGATC
11_MB_ITS4 -----
Pfiesteria GAAGGAGAAG TCGTAACAAG GTTTCCGTAG GTGAACCTGC GGAAGGATCA
Clustal

```

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1810      1820      1830      1840      1850
11_MB_ITS3 ATTACACACAT TCCAG---CT TCATGTTTGT GCATGTTGCG T-TGTGGCCA
11_MB_ITS4 -----CCA TTCAG---CT TCATGTTTGT GCATGTTGCG T-TGTGGCCA
Pfiesteria TTCGCACGCA TCCAAGCATC TCACCACCGT GAATTCTGGG TGTGAGGCTC
Clustal          * **          ***          ** * **          * * * * *

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1860      1870      1880      1890      1900
11_MB_ITS3 TGTGGA-TGA CGTCTCATAAC GTCTT-----
11_MB_ITS4 TGTGGAATGA CGTCTCATAAC GTCTT-----
Pfiesteria TGTGTAGGGA GGTATCGGTG CTCGTCGCCG AGATATCCCT GTGCAGCAGG
Clustal **** * ** ** **          ** *

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Continued

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1910      1920      1930      1940      1950
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria CTCGAGGGCG GCTCAGTGCA GGATGGGTAG CATTGCTTA CCTCCTTCT
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          1960      1970      1980      1990      2000
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria GTGTTGGTCG CCACCCATTT CCCTACCATA TTTACCGTCT CTTCCATACT
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2010      2020      2030      2040      2050
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria ATCCCTTTCG TCGGGCTGTG GGGTGCTGTG TGTTGCACACA CTCATCTCTC
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2060      2070      2080      2090      2100
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria ATCTCTGGCA TTTCATTTTC TTACAACCTT CAGCGACGAA TGTCTCGGCT
Clustal Co

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2110      2120      2130      2140      2150
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria CGAACACGA TGAAGGGCAC AGCGAACTGT GATAAGCATT GTGAATTGCA
Clustal Co

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2160      2170      2180      2190      2200
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria GATTTCCGCG AATCAATAGA AACTTGAACG TAAAATGCGG TTTCGGGATA
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2210      2220      2230      2240      2250
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria TCCCTGAAAC CATGCCTGCT TCAGTGTCCC AACCTCTCCT TCCGGTCGAA
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2260      2270      2280      2290      2300
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria CCTTTCGGTG ACTGATGTAT TTCGGTGCTC CGAAGGTTTC GTCTCGGTGT
Clustal

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Continue


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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2310      2320      2330      2340      2350
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria CGTTGTGTGT TAAGGTGCTT CGGCTCTCGT CGTCGCCCTT GACACATCTA
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2360      2370      2380      2390      2400
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria GGACATGGAG ATATCCCTGG CGGCTCTTTG GCGACGAATC ATGCTCACCC
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2410      2420      2430      2440      2450
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria ATGCATTTGC TCGCCTCCCG TCTTGGGGTT TTGTCTCCCA CAGTCTTCTT
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2460      2470      2480      2490      2500
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria TAGCACATTG TCACACGACG ATGGCTCTCA AGACATGAAG TCAGGTCAGC
Clustal

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.....|.....| .....|.....| .....|.....| .....|.....| .....|.....|
          2510      2520      2530      2540      2550
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria AAACCCGCTG AATTTAAGCA TATAAGTAAG CGGAGGAAAA GAAACTAAAT
Clustal Co

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.....|.....| .....|.....| .....|.....| .....|.....|
          2560      2570      2580
11_MB_ITS3 -----
11_MB_ITS4 -----
Pfiesteria AGGATTCCTT TAGTAATGGC GAATGAACAG GGAAATCAC
Clustal

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