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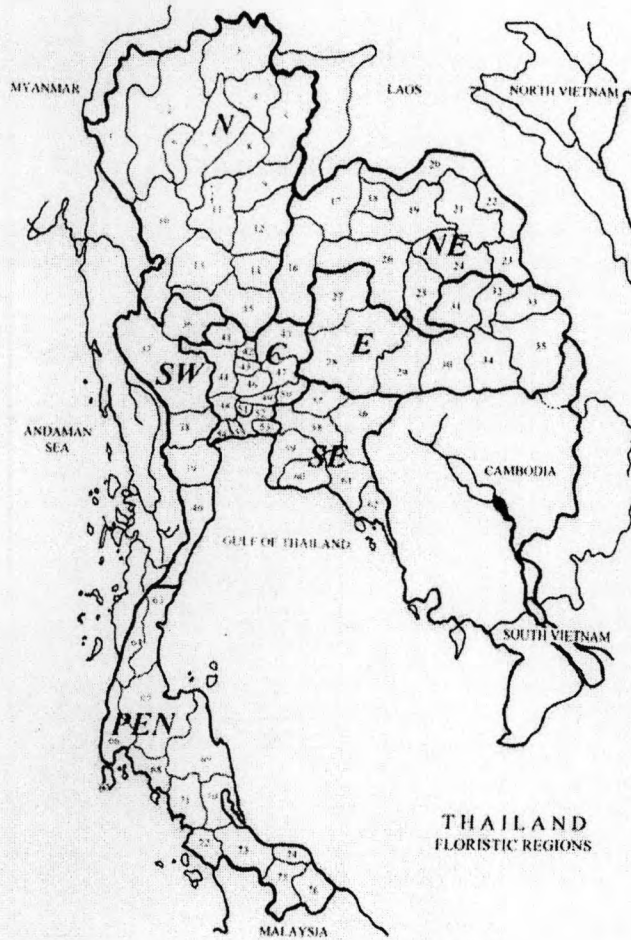
APPENDICES

APPENDIX A

The floristic regions and provincial map of Thailand

The floristic regions and provincial map of Thailand

FLORISTIC REGIONS AND PROVINCES OF THAILAND



- | | | |
|------|----------------------|--|
| I. | N (NORTHERN) | 39 Phetchaburi |
| | 1 Mae Hong Son | 40 Prachuap Khiri Khan |
| | 2 Chiang Mai | V. C (CENTRAL) |
| | 3 Chiang Rai | 41 Chai Nat |
| | 4 Phayao | 42 Sing Buri |
| | 5 Nan | 43 Lop Buri |
| | 6 Lamphun | 44 Suphan Buri |
| | 7 Lampang | 45 Ang Thong |
| | 8 Phrae | 46 Phra Nakhon Si Ayutthaya |
| | 9 Uttaradit | 47 Saraburi |
| | 10 Tak | 48 Nakhon Pathom |
| | 11 Sukhothai | 49 Pathum Thani |
| | 12 Phitsanulok | 50 Nakhon Nayok |
| | 13 Kamphaeng Phet | 51 Nonthaburi |
| | 14 Phichit | 52 Krung Thep Maha Nakhon
(Bangkok) |
| | 15 Nakhon Sawan | 53 Samut Prakan |
| II. | NE (NORTH-EASTERN) | 54 Samut Songkhram |
| | 16 Phetchabun | 55 Samut Sakhon |
| | 17 Loei | VI. SE (SOUTH-EASTERN) |
| | 18 Nong Bua Lam Phu | 56 Sa Kaeo |
| | 19 Udon Thani | 57 Prachin Buri |
| | 20 Nong Khai | 58 Chachoengsao |
| | 21 Sakon Nakhon | 59 Chon Buri |
| | 22 Nakhon Phanom | 60 Rayong |
| | 23 Mukdahan | 61 Chanthaburi |
| | 24 Kalasin | 62 Trat |
| | 25 Maha Sarakham | VII. PEN (PENINSULAR) |
| | 26 Khon Kaen | 63 Chumphon |
| III. | E (EASTERN) | 64 Ranong |
| | 27 Chaiyaphum | 65 Surat Thani |
| | 28 Nakhon Ratchasima | 66 Phangnga |
| | 29 Buri Ram | 67 Phuket |
| | 30 Surin | 68 Krabi |
| | 31 Roi Et | 69 Nakhon Si Thammarat |
| | 32 Yasothorn | 70 Phatthalung |
| | 33 Amnat Charoen | 71 Trang |
| | 34 Si Sa Ket | 72 Satun |
| | 35 Ubon Ratchathani | 73 Songkhla |
| IV. | SW (SOUTH-WESTERN) | 74 Pattani |
| | 36 Uthai Thani | 75 Yala |
| | 37 Kanchanaburi | 76 Narathiwat |
| | 38 Ratchaburi | |

APPENDIX B

Specimens examined in anatomical study

Specimens examined in anatomical study

Species	Localities	Voucher
Subtribe Ischaeminae		
1. <i>Apluda mutica</i>	Sattahip, Chon Buri	<i>P. Traiperm</i> 152
	Khun Tan, Lampang	<i>P. Traiperm</i> 321
2. <i>Ischaemum hirtum</i>	Nam Nao, Phetchabun	<i>P. Traiperm</i> 171
3. <i>I. hubbardii</i>	Doi Inthanon, Chiang Mai	<i>P. Traiperm</i> 308
4. <i>I. muticum</i>	Muang, Songkhla	<i>P. Traiperm</i> 138
	Tarutao, Satun	<i>P. Traiperm</i> 199
5. <i>I. rugosum</i>	Muang, Khon Kaen	<i>P. Traiperm</i> 127
	Klang, Rayong	<i>P. Traiperm</i> 293
6. <i>I. tenuifolium</i>	Warin Chamrap, Ubon Ratchathani	<i>P. Traiperm</i> 233
	Makham, Chanthaburi	<i>P. Traiperm</i> 287
7. <i>I. sp.1</i>	Khao Soi Dao, Chanthaburi	<i>P. Traiperm</i> 327
8. <i>Kerriochloa siamensis</i>	Warin Chamrap, Ubon Ratchathani	<i>P. Traiperm</i> 235
9. <i>Sehima nervosum</i>	Nam Nao, Phetchabun	<i>P. Traiperm</i> 170
	Khun Tan, Lampang	<i>P. Traiperm</i> 323
10. <i>Thelepogon elegans</i>	Muang, Saraburi	<i>P. Traiperm</i> 276
Subtribe Rottboelliinae		
11. <i>Eremochloa attenuata</i>	Phu Kradueng, Loei	<i>P. Traiperm</i> 162
12. <i>E. bimaculata</i>	Muang, Roi-Et	<i>P. Traiperm</i> 116
13. <i>E. lanceolata</i>	Pha Taem, Ubon Ratchathani	<i>P. Traiperm</i> 242
14. <i>Hackelochloa granularis</i>	Hot, Chiang Mai	<i>P. Traiperm</i> 303
15. <i>H. porifera</i>	Mae Rim, Chiang Mai	<i>P. Traiperm</i> 311
16. <i>Hemarthria compressa</i>	Phu Khiao, Chaiyaphum	<i>P. Traiperm</i> 187
17. <i>H. pratensis</i>	Phu Kradueng, Loei	<i>P. Traiperm</i> 158
18. <i>Mnesithea cancellata</i>	Phu Kradueng, Loei	<i>P. Traiperm</i> 161
	Phu Khiao, Chaiyaphum	<i>P. Traiperm</i> 183
19. <i>M. glandulosa</i>	Muang Phatthalung	<i>P. Traiperm</i> 139
20. <i>M. laevis</i>	Chom Thong, Chiang Mai	<i>P. Traiperm</i> 307
21. <i>M. mollicoma</i>	Muang, Song Khla	<i>P. Traiperm</i> 131
22. <i>M. sp.1</i>	Mae Soaw, Chiang Mai	<i>P. Traiperm</i> 347
23. <i>Ophiuros exaltatus</i>	Phu Khiao, Chaiyaphum	<i>P. Traiperm</i> 186
24. <i>Phacelurus zea</i>	Phu Khiao, Chaiyaphum	<i>P. Traiperm</i> 222
25. <i>Rottboellia cochinchinensis</i>	Muang, Song Khla	<i>P. Traiperm</i> 133

APPENDIX C

Specimens examined in molecular study

Taxa sampled	Voucher	Locality	GenBank accession no.	
			trnL-F	ITS
1. <i>Apluda mutica</i>	<i>P. Traiperm</i> 152	Satthahip, Chon Buri		
2. <i>Ischaemum barbatum</i> 1	<i>P. Traiperm</i> 140	Thale Noi, Phatthalung		
3. <i>Ischaemum barbatum</i> 2	<i>P. Traiperm</i> 206	Phu Phan, Sakon Nakhon		
4. <i>Ischaemum barbatum</i> 3	<i>P. Traiperm</i> 215	Bung Khla, Nong Khai		
5. <i>Ischaemum barbatum</i> 4	<i>P. Traiperm</i> 351	Muang, Trat		
6. <i>I. hirtum</i>	<i>P. Traiperm</i> 171	Nam Nao, Phetchabun		
7. <i>I. hubbardii</i>	<i>P. Traiperm</i> 308	Chom Thong, Chiang Mai		
8. <i>I. indicum</i> 1	<i>P. Traiperm</i> 159	Phu Kradueng, Loei		
9. <i>I. indicum</i> 2	<i>P. Traiperm</i> 195	Phu Ruea, Loei		
10. <i>I. indicum</i> 3	<i>P. Traiperm</i> 277	Sarika waterfalls, Nakhon Nayok		
11. <i>I. indicum</i> 4	<i>P. Traiperm</i> 330	Khao Luang National Park, Sukhothai		
12. <i>I. rugosum</i>	<i>P. Traiperm</i> 212	Nam Phong, Khon Kaen		
13. <i>I. tenuifolium</i>	<i>P. Traiperm</i> 233	Warin Chamrap, Ubon Ratchathani		
14. <i>I. timorensis</i>	<i>P. Traiperm</i> 254	Sirindhorn, Ubon Ratchathani		
15. <i>I. sp.1</i>	<i>P. Traiperm</i> 327	Pong Nam Ron, Chanthaburi		
16. <i>I. sp.2</i>	<i>P. Traiperm</i> 149	Ngao, Ranong		
17. <i>Kerriochloa siamensis</i>	<i>P. Traiperm</i> 235	Warin Chamrap, Ubon Ratchathani		
18. <i>Sehima nervosum</i>	<i>P. Traiperm</i> 300	Hot, Chiang Mai		
19. <i>Thelepogon elegans</i>	<i>P. Traiperm</i> 276	Muang, Saraburi		
20. <i>Eremochloa attenuata</i>	<i>P. Traiperm</i> 162	Phu Kradueng, Loei		
21. <i>E. bimaculata</i>	<i>P. Traiperm</i> 116	Muang, Roi Et		
22. <i>E. ciliaris</i>	<i>P. Traiperm</i> 204	Phu Phan, Sakon Nakhon		
23. <i>E. ciliatifolia</i>	<i>P. Traiperm</i> 163	Phu Kradueng, Loei		
24. <i>E. eriopoda</i>	<i>P. Traiperm</i> 237	Warin Chamrap, Ubon Ratchathani		
25. <i>E. lanceolata</i>	<i>P. Traiperm</i> 242	Khong Chiam, Ubon Ratchathani		
26. <i>E. maxwellii</i>	<i>P. Traiperm</i> 232	Warin Chamrap, Ubon Ratchathani		
27. <i>E. sp.1</i>	<i>P. Traiperm</i> 125	Phu Ta Ka, Khon Kaen		
28. <i>Hackelochloa granularis</i>	<i>P. Traiperm</i> 299	Hot, Chiang Mai		
29. <i>H. porifera</i>	<i>P. Traiperm</i> 311	Mae Rim, Chiang Mai		
30. <i>Hemarthria compressa</i>	<i>P. Traiperm</i> 214	Phimai, Nakhon Ratchasima		
31. <i>H. pratensis</i>	<i>P. Traiperm</i> 158	Phu Kradueng, Loei		
32. <i>M. cancellata</i>	<i>P. Traiperm</i> 205	Phu Phan, Sakon Nakhon		
33. <i>Mnesithea glandulosa</i>	<i>P. Traiperm</i> 274	Muang, Saraburi		
34. <i>M. helferi</i>	<i>P. Traiperm</i> 132	Hat Yai, Songkhla		
35. <i>M. laevis</i>	<i>P. Traiperm</i> 307	Chom Thong, Chiang Mai		
36. <i>M. mollicoma</i>	<i>P. Traiperm</i> 280	Nam Nao, Phetchabun		
37. <i>M. striata</i>	<i>P. Traiperm</i> 325	Khun Tan, Lampang		
38. <i>M. striata</i> var. <i>pubescens</i>	<i>P. Traiperm</i> 314	Mae Rim, Chiang Mai		
39. <i>M. sp.1</i>	<i>P. Traiperm</i> 347	Mae Saow, Chiang Mai		
40. <i>Ophiuros exaltata</i>	<i>P. Traiperm</i> 176	Nam Nao, Phetchabun		
41. <i>Phacelurus zea</i>	<i>P. Traiperm</i> 222	Khon San, Chaiyaphum		
42. <i>Rottboellia cochinchinensis</i>	<i>P. Traiperm</i> 133	Hat Yai, Songkhla		
43. <i>Centotheca lappacea</i>	<i>C. Jaroenchai</i> 77	Phu Ruea, Loei		
44. <i>Eragrostis biflora</i>			DQ655879	DQ655824

APPENDIX D

Paraffin Method adapted from Thammathaworn (1995)

PARAFFIN METHOD ADAPTED FROM THAMMATHAWORN (1995)

Outline Paraffin Method

1. Fixation (FAA 70%) and Cutting specimens
2. Suctioning (24 hours)
3. Washing (alcohol 50% 3 times)
4. Dehydration (TBA series)
5. Infiltration
6. Embedding
7. Microtoming
8. Affixing section to slide
9. Prestaining and Staining
10. Mounting and Label

1. Fixation (FAA70%) and Cutting specimens

Prepare FAA70% using formalin 5% v/v, glacial acetic acid 5% v/v and 70%ethyl alcohol 90% v/v, mix well. Pour FAA 70% in up to the $\frac{3}{4}$ make in a vial (small glass bottle) with a secure lid (called fixative vial). Then wash fresh specimens with tap water and then cut them into pieces, 1 cm. high, with a razor blade then immediately put the specimens into a fixative vial (now called specimen vial).

2. Suctioning

This step ensures that the fixative and chemical substances in the next steps get into every cell of the specimen (especially a problem for plant cells which have a lot of air space and a lumen, e.g. aquatic plants). Place the specimen vial into the dessicator, which is connected to a vacuum pump. Suction at 25 in Hg Vac for about 30-60 minutes, until there are no more the air bubbles moving from the specimens, then keep the specimen vial at room temperature for at least 24 hours before moving to the next step.

3. Washing

Rinse the specimens down with ethyl alcohol 50% for 3 times. Pouring fixative out into the "Used FAA" container then fill the vial with 50% alcohol, close the lid and gently move the vial around and pour the alcohol out, then fill the vial with 50% alcohol and leave the specimens in the alcohol for about 10 minutes. Repeat the washing 3 times.

4. Dehydration (Tertiary Butyl Alcohol (TBA) series)

2.1 Prepare the TBA grade I, II, III, IV and V as follows:

	TBA Grade (ml)				
	I	II	III	IV	V
Distilled water	50	30	15	0	0
Ethyl alcohol 95%	40	50	50	45	0
Tertiary Butyl Alcohol	10	20	35	55	75
Ethyl alcohol 100%	0	0	0	0	25
Total percentage of alcohol	50	70	85	95	100

2.2 Rinse the specimens with the TBA series using the same method as used for washing. Leave the specimens in each TBA grade for 24 hours. Then rinse the specimens with absolute TBA and leave in absolute TBA for 24 hours then repeat the rinse with absolute TBA 3 times to ensure all water is removed and that the wax will be able to infiltrate the specimens.

5. Infiltration

5.1 Prepare the hot air oven at 56°C then leave the paraffin wax (Paramat, pastillated, melting point 56°C) in a beaker in the hot air oven to melt the wax.

5.2 Prepare a mixture of absolute TBA: paraffin oil (TBA: Oil) = 1:1 v/v.

5.3 Rinse the specimens with the TBA: Oil mixture and then leave the specimens in the mixture for about 1 hour at room temperature.

5.4 Pour the melted wax (from the hot air oven) into a cleaned vial (wax vial) and fill to about $\frac{3}{4}$ make in a vial and leave the wax to set at room temperature.

5.5 Take the specimens from the TBA: Oil mixture and place on top of the wax vial and cover it with some the same mixture then leave the wax vial in the hot air oven for 24 hours.

5.6 Repeat this step for each vial each time, pour the melted wax and mixture off into the "Used paraffin" paper container then quickly replace with pure fresh melted wax and then leave the vial in the oven for 24 hours.

5.7 Repeat step 6, 2 times.

6. Embedding

6.1 Prepare embedding paper base moulds (for specimens whose depth is more than 5 mm) or stainless steel base molds (for specimens whose depth is less than or equal to 5 mm). Place these and the plastic holder molds into the hot air oven.

6.2 Pour the melted wax into the base mould which is kept warm on the hotplate then take a specimen from the vial and put into the base mold containing melted wax.

6.3 Move the base mould from the hotplate to the table and then set the specimens upright (for transverse section cutting) using warm needles to manipulate them then put the plastic warm holder mould on top of the base mould to form a set and pour the melted wax on top until the set is full then leave at room temperature without moving the mold to let the wax set. After the wax in the paper base mold is set, take the paper off and trim the wax into a "cubic block", which the specimens are in the center. For specimen whose depth is more than 5 mm, as unable to put the holder mold on top of the paper base mold, prepare the "block without specimens" (make the block using the set of stainless steel base mold and plastic holder without specimen in the wax) then stick the "block without specimen" together with the "cubic block" using a hot spatula touching each surface of the blocks to melt the wax and then press them to form one piece.

6.4 Trim the blocks into a trapezium shape.

6.5 Keep the blocks in refrigerator at least 15 minutes.

7. Microtoming

Cut the blocks on a sliding microtome with disposable blades, 10-15 μm thickness, set the clearance angle to 5°-10°. The thin pieces with specimens produced by cutting the block are called "sections or ribbons".

8. Affixing section to slide

8.1 Melt 0.25 g of gelatin powder with 200 ml hot water in a beaker, then add 300 ml tap water and then put the beaker on the drying plate (50°C).

8.2 Put the section in the warm gelatin solution, keep the shiny surface up and then leave for a minute to extend the section.

8.3 Lift the section using a cleaned, twin frosted microscope slide and using needles arrange the position of the section on the slide as desired. Then leave the slide to stand beside the drying plate, to drain the solution, for a few minutes.

8.4 Keep the dry slides into the microscope slide case for 20 days (up to 5 months).

9. Prestaining and Staining

As the stain (toluidine blue) is water based, it is necessary to remove the embedding wax from the sections before staining.

9.1 Prepare toluidine blue stain using toluidine blue 0.5 g in tap water 100 ml, stir well, filter, paper then keep in bottle.

9.2 Prepare a Coplin's staining jar with solution of each step as follows:
(Transferring the slides to other solutions in each step in the fume hood)

Step	Solutions	Time in solution
1	Absolute Xylene	10 mins
2	Absolute Xylene:Absolute alcohol = 1:1	3-5 mins
3	Absolute ether:Absolute alcohol = 1:1	3-5 mins
4	Absolute alcohol	3-5 mins
5	Alcohol 95%	3 mins-4 hrs
6	Alcohol 70%	up-down 3 times
7	Alcohol 50%	up-down 3 times
8	Alcohol 30%	up-down 3 times
9	Toluidine blue	2 hours
10	Wash with tap water in beaker	up-down 3 times
11	Alcohol 30%	up-down 3 times
12	Alcohol 50%	up-down 3 times
13	Alcohol 70%	up-down 3 times
14	Alcohol 95%	up-down 3 times
15	Absolute alcohol	up-down 3 times
16	Absolute Xylene:Absolute alcohol = 1:1	3-5 mins
17	Absolute Xylene	3-15 mins

10. Mounting and Label

The slides can then be mounted permanently in DPX mountant for microscopy. Label slides with plant name, plant organ (leaf, scape), collector and collector number, transverse section, toluidine blue.

APPENDIX E
Molecular protocols and data matrix

MOLECULAR PROTOCOLS

Nina Rønsted 29.4.03

Isolation of total cellular DNA for long term storage

References: Saghai-Marroof et al. (1984). PNAS 81: 8014-8018; Doyle & Doyle (1987).

Phytochemical Bulletin 19: 11-15; Palmer et al. (1989). Annals of the Missouri Botanical Garden 75: 1180-1206.

1. Preheat 10 ml of isolation buffer containing 40 μ l of beta-mercaptoethanol in a 50 ml plastic centrifuge tube in a 65 °C water bath. Preheat mortar and pestle as well.

2. Grind 0.3 g of silica or freeze dried or 0.2 g of herbarium leaf material in a mortar. Add the buffer and grind until a uniform slurry is obtained. Return the slurry to the centrifuge tube and leave at 65 °C for 10 minutes as above.

3. Add 10 ml SEVAG to each tube. Mix gently and open cap slightly to release gas. Leave the tubes on their side on a shaker for 1 hour ($\frac{1}{2}$ -1 $\frac{1}{2}$).

4. Spin at 8000 rpm at 25°C for 10 minutes (Beckman J2-MC centrifuge). Ideally the aqueous (top) phase will be clear and colourless.

5. Transfer aqueous phase containing DNA with a pipette to a 50 ml centrifuge tube. An aliquot of 300 μ l can be taken off for QIA quick column cleaning at this stage. Dispose SEVAG and plant debris in waste container.

If long term storage is not needed. Amounts may be reduced or the centrifuge tube with DNA may be stored in a freeze for an unknown time.

Further cleaning for inclusion in the Kew DNA bank:

6. Add 2/3 volume of -20 °C isopropanol (herbarium sample) or 2 volume of -20 °C EtOH (Fresh, freeze, silica dried sample). Put in -20 °C freeze, for at least 24 hours to precipitate DNA.

7. Spin at 3000 rpm for 5 minutes, pour off liquid and add 3 ml of 70% ethanol, dislodge pellet to facilitate washing (Harrier 15/80 MSE centrifuge, Sanyo).

8. Spin down DNA at 3000 rpm for 3 minutes, pour off liquid and leave tube on its side overnight to allow alcohol to evaporate.

9. Resuspend DNA in 3 ml 1.5 mg/ml CsCl – EtBr solution. Cover samples in foil to keep dark (EtBr degrades in sunlight). Shake until pellet dissolves (min 24 hours).

10. Pour DNA into ultra centrifuge rotor tube. Add CsCl – EtBr until total weight is 8.04-8.06 g (this weight ensures a minimum of air between sample and lids in the ultra centrifuge used at Jodrell, Which is important to avoid damage to tubes and rotor at the high speed used).

11. Spin at 45000 rpm (at least 14 hours) or 58000 for 5 hours (Beckman Ultracentrifuge XL-80).

12. Please tubes with sample on ultra violet light box. Remove 600 µl of solution above band. Take of 1200 µl of the band and transfer to transparent tubes. (If it is not possible to see the band, the 1200 µl is taken off at the same level as the band in the other sample. The rest of the sample is saved until the final gel check of DNA has shown that the level taken off did contain the DNA). At this stage sample can be left in a dark place until further clean up.

13. Add an equal volume of CsCl satisfied butanol, shake and leave tubes on the side for 15 minutes to remove EtBr. Shake tubes gently occasionally.

14. Rinse a 5 litre beaker and fill to 2 litres with milli-Q water (4 litre for 20 or more sample s). Rinse 800 ml beaker and fill to 200 ml with milli-Q water.

15. Cut dialysis tubing into 10 cm strips and rinse in 800 ml beaker.

16. Clamp lower end of each piece of tubing and pipette samples (lower layer) into tubings. Clamp top end of tubings, avoiding air bubbles in the sample.

17. Place samples in the 5 ml beaker making sure the samples are kept under stirred water. The samples are left 2-4 houes.

18. The samples are then concentrated by transferring to a tray and adding sugar (purity unimportant). Leave samples for 20-40 min depending on how much samples need to be concentrated (to obtain about 1 ml).

19. Rinse out 5 litre breaker and add 25 ml dialysis buffer and 2 litre milli-Q water (or 50 ml and 4 litre water for 20 samples or more). Put samples into water and leave for 4 hours to overnight ensuring that they are kept under stirred water.

20. Repeat step 19 again.

21. Transfer samples into 1.5 ml eppendorf tubes. Check DNA levels on gel and store at -20 °C or 80 °C for long term storage (at least up to 10 year).

Isolation buffer: (2 x CTAB): 100 mM Tris-HCL, pH 8, 1.4 M NaCL, 20 mM EDTA, 2% CTAB (hexadecyltrimethylammonium bromide), 2% PVP.

Silica: Sigma S4883, 28-200 M

SEVAG: 24:1 chloroform:isoamylalcohol

SSC satisfied BuOH: 1:1. BuOH:sodium citrate (0.15 molar NaCL & 0.015 molar sodium citrate)

Dialysis buffer 80X: 10mM Trizma® base, 1mM EDTA, pH adjusted to 8 by HCL.

Dialysis tuning: Cellulose membrane. Sigma cat.no. D-9277

CsCl (cesium chloride) and EtBr (ethidium bromide) are considered possible carcinogens and should be handled with gloves, disposable pipettes and tubes.

QIAquick purification of total DNA

Reference: QIAGEN QIAquick Spin Handbook 01/99 page 20-21. QIAquick PCR purification kit (250) QIAGEN Cat. No. 28106

1. Insert QIAquick columns into a vacuum manifold.
2. Add 750 μ l Buffer PB and 150 μ l of the total DNA and apply vacuum.
3. Repeat loading until all of the total DNA is passed through the column, always making sure to use
4. 5:1 volumes of Buffer PB to DNA extract.
5. Wash with 750 μ l Buffer PE.
6. Switch vacuum off and transfer columns to the provided 2 ml collection tubes. Spin at 13.000 rpm for about 1 min to remove residual EtOH (PE Buffer).
7. Cut lids of sterilized 1.5 ml eppendorf tubes and place the QIAquick column into the tubes. Add 50 μ l (or less depending on concentration of DNA) Buffer NE directly on the membrane of the columns and leave for 30 min to dissolve DNA in the elution buffer.
8. Spin 1 min at 13.000 rpm, cap tubes and store at -20 °C after checking DNA levels on gel.

Making an agarose gel

1. Tape sides of gel tray to hold the gel while setting, and place well forming combs.
2. Dissolve 1.g agarose in 100 ml TBE buffer in microwave for 1.5 min with loose lid. Shake gently after one min.
3. Let cool until not smoking. Add 4 μ l EtBr and shake gently.
4. Pour into gel tray and leave for 20 min to set.
5. Place gel in eletrophoresis tray and cover with TBE buffer.

TBE buffer: 216 g Trizma® base, 110 g Boric acid, 16.6 g EDTA in 2 L Milli-Q water.

EtBr solution: 1 g EtBr in 100 ml water. Wrap in foil and stir for hours. Carcinogenic!

Gel check of DNA levels

1. Spot 5 μ l of blue loading dye for each DNA sample on s strip of parafilm.
2. Mix 5 μ l of DNA with the spot of dye and load the mix into a well on the gel.
A standard can be loaded for reference.
3. Run for 10-20 min at 80 A.
4. View gel under UV light and photograph for later reference.

Loading dye: 40 g sucrose in 100 ml Milli-Q water, add 0.025 g bromophenol blue and stir to obtain a deep dark blue colour.

QUICK COLUMN CLEAN PROTOCOL**Materials needed:**

- 3 Types of Buffer:
1. PB Buffer (alters pH)
 2. PE Buffer (washing buffer) (NT3)
 3. EB Buffer (eludes DNA through filter) (NE)
 - 300 μ l of extracted sample in Eppendorf tubes
 - column tubes: pink in white(by blue "pig")

1. PB Buffer: For this buffer there has to be a ratio 5 : 1 (5 parts of PB buffer to 1 part of DNA) = 750 μ l PB : 150 μ l DNA sample)

Number pink and white column tubes (each separately) with the sample numbers (1 to ...)

Line up **pink** tubes onto pig; open levers underneath them (from horizontal to vertical position);

Transfer 750 μ l PB buffer and 150 μ l (using P1000 and P200 pipette accordingly) **of the sample** into pink column tube (=total of 900 μ l). Mix well (by absorbing and releasing solution in tube with pipette).

(For transfer of buffer into all tubes, the same pipette tip can be used, but for transfer of sample a new pipette tip has to be used for each sample).

Turn on switch on wall and let solution run through column (approx. 1-2 min.).

Repeat above with second lot of sample (another 150 μ l). Keep Eppendorf tubes, as they are needed again later.

2. PE Buffer

After second lot of sample with PB buffer has run through column. **Add 750 μ l of PE buffer** to column (again, one pipette tip to used for all samples) and let run through column.

Then remove pink tubes from pig, close them and attach white lower tube part to it and put into small centrifuge (balancing sample equally in centrifuge). Let it spin approx. 1 min. (looking at your watch, as time switch on centrifuge has to be switch on to run, but does not stop at appropriate time; after a minute, press stop button and wait until green light comes on before opening centrifuge.)

Take out tubes from centrifuge and discard white lower tube with percipient into waste glass on desk.

3. EB Buffer

Put pink, column tubes into respective Eppendorf tubes. Cut off lid of Eppendorf tubes, but **keep!** **Add 50 μ l of EB buffer right into centre of white filter** at bottom of each pink column tube.

Change pipette tip after each sample.

Then close lids and let it sit for 1 minute for buffer to elude through filter. Then out both, pink column tubes inside Eppendorfs, into small centrifuge and spin for 1 min.

Stop centrifuge, and now you should have sample (approx. 48 μ l) in Eppendorf tubes.

Discard of pink column tubes into waste glass, or waste bin. Finished!

4. Run gel to check DNA content of samples.

	91	100	110	120	130	140	150	160	170	180
Apl.mut.26233	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAATAGAACCCAAAGGAAAAGGA	----	TAGGTGCAGAG					
Isc.bar.26363	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-CTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Isc.bar.26364	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-CTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Isc.bar.26365	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-CTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Isc.bar.26366	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-CTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Isc.hir.26249	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	----	TAGGTGCAGAG					
Isc.hub.26250	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-CTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Isc.ind.26367	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-CTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Isc.ind.26368	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	----	TAGGTGCAGAG					
Isc.ind.26369	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Isc.ind.26370	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Isc.rug.26372	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Isc.ten.26373	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Isc.tim.26374	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Isc.sp1.26251	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-CTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Isc.sp2.26375	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Ker.sia.26252	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Seh.ner.26239	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTG-----CAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
The.ete.26240	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Mne.can.26346	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GCGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Mne.gla.26347	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GCGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Mne.he1.26348	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GCGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Mne.mol.26349	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GCGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Mne.str.26350	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GCGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Mne.stp.26351	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GCGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Mne.sp1.26244	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GCGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Ere.att.26352	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Ere.bim.26353	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Ere.cil.26354	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Ere.cit.26355	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Ere.eri.26356	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Ere.jan.26357	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Ere.max.26358	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Ere.sp1.26245	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GCGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Hac.gra.26234	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Hac.por.26235	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Hem.com.26247	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Hem.pra.26248	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Mne.lae.26236	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GCGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Oph.exa.26237	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Pha.zea.26238	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Rot.coc.26253	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						
Ere.bif.	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAATGAAAAGGA	AGGGATAGGTGCAGAG						
Cen.lap.26376	TGGGCAATCCTGAGCCAAATCCCTTTTTT	-GAAAAAACAA	-GTGGTTCTCAAAC TAGAACCCAAAGGAAAAGGA	AGGGATAGGTGCAGAG						

	181	190	200	210	220	230	240	250	260	270
Apl.mut.26233	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Isc.bar.26363	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Isc.bar.26364	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Isc.bar.26365	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Isc.bar.26366	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Isc.hir.26249	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Isc.hub.26250	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Isc.ind.26367	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Isc.ind.26368	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Isc.ind.26369	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Isc.ind.26370	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Isc.rug.26372	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Isc.ten.26373	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Isc.tim.26374	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Isc.sp1.26251	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Isc.sp2.26375	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Ker.sia.26252	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Seh.ner.26239	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
The.ele.26240	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Mne.can.26346	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Mne.gla.26347	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Mne.hel.26348	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Mne.mol.26349	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Mne.str.26350	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Mne.stp.26351	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Mne.sp1.26244	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Ere.att.26352	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Ere.bim.26353	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Ere.cil.26354	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Ere.cit.26355	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Ere.eri.26356	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Ere.lan.26357	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Ere.max.26358	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Ere.sp1.26245	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Hac.gra.26234	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Hac.por.26235	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Hem.com.26247	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Hem.pra.26248	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Mne.lae.26236	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Oph.exa.26237	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pha.zea.26238	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rot.coc.26253	ACTCAATGGAAGCTGTTCTAACGGAATCGAAGTAATAACG	-----	-----	-----	-----	-----	-----	-----	-----	-----
Era.bif.	ACTCAATGGAAGCTATTCTAACGGAATCGAGGTG- TAATTACGTTGTGTTGGTAATGAAACTCCCTCTAAATTTGAGAAAAGAGGGGGCTTTA	-----	-----	-----	-----	-----	-----	-----	-----	-----
Gen.lap.26376	ACTCAATGGAAGCTGTTCTAACGGAATCAAGGT- -AATTACGTTGTGTTGGTAGTGGAACTCCCTCAAATTTAGAGAAAAGAGGGGGCTTTT	-----	-----	-----	-----	-----	-----	-----	-----	-----

	631	640	650	660	670	680	690	700	710	720
Apl.mut.26233	CCTCTATCCCC	-----	-----	AAATAAAAAGCCC	ATTTTACTTCCTAACTATTG	----	TACCAACCTCTATTTTT	CATTAATGG	-T	
Isc.bar.26363	CCTCTATCCCC	---	AAACCCCTCTTTT	-----	-----	ATTCCCTAACC	ATAGTTGTTATCCT	-TTTTTCTTTT	ATCAATGGGT	
Isc.bar.26364	CCTCTATCCCC	---	AAACCCCTCTTTT	-----	-----	ATTCCCTAACC	ATAGTTGTTATCCT	-TTTTTCTTTT	ATCAATGGGT	
Isc.bar.26365	????????	????	????	????	????	????	????	????	????	????
Isc.bar.26366	CCTCTATCCCC	---	AAACCCCTCTTTT	-----	-----	ATTCCCTAACC	ATAGTTGTTATCCT	-TTTTTCTTTT	ATCAATGGGT	
Isc.hlr.26249	CCTCTATCCCC	---	AAACCCCTCTTTT	-----	-----	ATTCCCTAACC	ATAGTTGTTATCCT	-TTTTTCTTTT	ATCAATGGGT	
Isc.hub.26250	CCTCTATCCCC	---	AAACCCCTCTTTT	-----	-----	ATTCCCTAACC	ATAGTTGTTATCCT	-TTTTTCTTTT	ATCAATGGGT	
Isc.ind.26367	CCTCTATCCCC	---	AAACCCCTCTTTT	-----	-----	ATTCCCTAACC	ATAGTTGTTATCCT	-TTTTTCTTTT	ATCAATGGGT	
Isc.ind.26368	????????	????	????	????	????	????	????	????	????	????
Isc.ind.26369	CCTCTATCCCC	---	AAACCCCTCTTTT	-----	-----	ATTCCCTAACC	ATAGTTGTTATCCT	-TTTTTCTTTT	ATCAATGGGT	
Isc.ind.26370	CCTCTATCCCC	---	AAACCCCTCTTTT	-----	-----	ATTCCCTAACC	ATAGTTGTTATCCT	-TTTTTCTTTT	ATCAATGGGT	
Isc.rug.26372	????????	????	????	????	????	????	????	????	????	????
Isc.ten.26373	CCTCTATCCCC	---	AAACCCCTCTTTT	-----	-----	ATTCCCTAACC	ATAGTTGTTATCCT	-TTTTTCTTTT	ATCAATGGGT	
Isc.tim.26374	CCTCTATCCCC	---	AAACCCCTCTTTT	-----	-----	ATTCCCTAACC	ATAGTTGTTATCCT	-TTTTTCTTTT	ATCAATGGGT	
Isc.sp1.26251	CCTCTATCCCC	---	AAACCCCTCTTTT	-----	-----	ATTCCCTAACC	ATAGTTGTTATCCT	-TTTTTCTTTT	ATCAATGGGT	
Isc.sp2.26375	CCTCTATCCCC	---	AAACCCCTCTTTT	-----	-----	ATTCCCTAACC	ATAGTTGTTATCCT	-TTTTTCTTTT	ATCAATGGGT	
Ker.sia.26252	????????	????	????	????	????	????	????	????	????	????
Seh.ner.26239	CCTCTATCCCC	---	AAACCCCTCTTTT	-----	-----	ATTCCCTAACC	ATAGTTGTTATCCT	-TTTTTCTTTT	ATCAATGGGT	
The.ele.26240	CCTCTATCCCC	---	AAACCCCTCTTTT	-----	-----	ATTCCCTAACC	ATAGTTGTTATCCT	-TTTTTCTTTT	ATCAATGGGT	
Mne.can.26346	CCTCTATCCCC	-----	-----	AAATAAAAAGCCC	ATTTTACTTCCTAACTATTG	----	TACCAACCTCTATTTTT	CATTAATGG	-T	
Mne.gla.26347	CCTCTATCCCC	-----	-----	AAATAAAAAGCCC	ATTTTACTTCCTAACTATTG	----	TACCAACCTCTATTTTT	CATTAATGG	-T	
Mne.hel.26348	CCTCTATCCCC	-----	-----	AAATAAAAAGCCC	ATTTTACTTCCTAACTATTG	----	TACCAACCTCTATTTTT	CATTAATGG	-T	
Mne.mol.26349	CCTCTATCCCC	-----	-----	AAATAAAAAGCCC	ATTTTACTTCCTAACTATTG	----	TACCAACCTCTATTTTT	CATTAATGG	-T	
Mne.str.26350	CCTCTATCCCC	-----	-----	AAATAAAAAGCCC	ATTTTACTTCCTAACTATTG	----	TACCAACCTCTATTTTT	CATTAATGG	-T	
Mne.stp.26351	CCTCTATCCCC	-----	-----	AAATAAAAAGCCC	ATTTTACTTCCTAACTATTG	----	TACCAACCTCTATTTTT	CATTAATGG	-T	
Mne.sp1.26244	CCTCTATCCCC	-----	-----	AAATAAAAAGCCC	ATTTTACTTCCTAACTATTG	----	TACCAACCTCTATTTTT	CATTAATGG	-T	
Ere.att.26352	CCTCTATCCCC	-----	-----	AAATAAAAAGCCC	ATTTTACTTCCTAACTATTG	----	TACCAACCTCTATTTTT	CATTAATGG	-T	
Ere.bim.26353	CCTCTATCCCC	-----	-----	AAATAAAAAGCCC	ATTTTACTTCCTAACTATTG	----	TACCAACCTCTATTTTT	CATTAATGG	-T	
Ere.cil.26354	CCTCTATCCCC	-----	-----	AAATAAAAAGCCC	ATTTTACTTCCTAACTATTG	----	TACCAACCTCTATTTTT	CATTAATGG	-T	
Ere.cit.26355	CCTCTATCCCC	-----	-----	AAATAAAAAGCCC	ATTTTACTTCCTAACTATTG	----	TACCAACCTCTATTTTT	CATTAATGG	-T	
Ere.eri.26356	CCTCTATCCCC	-----	-----	AAATAAAAAGCCC	ATTTTACTTCCTAACTATTG	----	TACCAACCTCTATTTTT	CATTAATGG	-T	
Ere.lan.26357	CCTCTATCCCC	-----	-----	AAATAAAAAGCCC	ATTTTACTTCCTAACTATTG	----	TACCAACCTCTATTTTT	CATTAATGG	-T	
Ere.max.26358	CCTCTATCCCC	-----	-----	AAATAAAAAGCCC	ATTTTACTTCCTAACTATTG	----	TACCAACCTCTATTTTT	CATTAATGG	-T	
Ere.sp1.26245	CCTCTATCCCC	-----	-----	AAATAAAAAGCCC	ATTTTACTTCCTAACTATTG	----	TACCAACCTCTATTTTT	CATTAATGG	-T	
Hac.gra.26234	CCTCTATCCCC	-----	-----	AAATAAAAAGCCC	ATTTTACTTCCTAACTATTG	----	TACCAACCTCTATTTTT	CATTAATGG	-T	
Hac.por.26235	CCTCTATCCCC	-----	-----	AAATAAAAAGCCC	ATTTTACTTCCTAACTATTG	----	TACCAACCTCTATTTTT	CATTAATGG	-T	
Hem.com.26247	CCTCTATCCCC	---	AAACCCCTCTTTT	-----	-----	ATTCCCTAACC	ATAGTTGTTATCCC	-TTTTT	CTTTTATCAATGGGT	
Hem.pra.26248	CCTCTATCCCC	---	AAACCCCTCTTTT	-----	-----	ATTCCCTAACC	ATAGTTGTTATCCC	-TTTTT	CTTTTATCAATGGGT	
Mne.jae.26236	CCTCTATCCCC	---	AAACCCCTCTTTT	-----	-----	ATTCCCTAACC	ATAGTTGTTATCCT	-TTTTT	CTTTTATCAATGGGT	
Oph.exa.26237	CCTCTATCCCC	---	AAACCCCTCTTTT	-----	-----	ATTCCCTAACC	ATAGTTGTTATCCT	-TTTTT	CTTTTATCAATGGGT	
Pha.zea.26238	CCTCTATCCCC	---	AAACCCCTCTTTT	-----	-----	ATTCCCTAACC	ATAGTTGTTATCCT	-TTTTT	CTTTTATCAATGGGT	
Rot.coc.26253	CCTCTATCCCC	---	AAACCCCTCTTTT	-----	-----	ATTCCCTAACC	ATAGTTGTTATCCT	-TTTTT	CTTTTATCAATGGGT	
Era.bif.	????????	????	????	????	????	????	????	????	????	????
Gen.Jap.26376	CCTCTATCCCC	AAACCAACCA	ACCTTCTTTT	????	????	????	????	????	????	????

Apl.mut.26233
Isc.bar.26363
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Isc.rug.26372
Isc.ten.26373
Isc.tim.26374
Isc.sp1.26251
Isc.sp2.26375
Ker.sla.26252
Sch.ner.26239
The.ele.26240
Mne.can.26346
Mne.gla.26347
Mne.hel.26348
Mne.mol.26349
Mne.str.26350
Mne.stp.26351
Mne.sp1.26244
Ere.att.26352
Ere.blm.26353
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Ere.jan.26357
Ere.max.26358
Ere.sp1.26245
Hac.gra.26234
Hac.por.26235
Hem.com.26247
Hem.pra.26248
Mne.jae.26236
Oph.axa.26237
Pha.zea.26238
Rot.coc.26253
Era.blf.
Cen.lap.26376

811 820 830 840 850 860 870 880 890 900

TCTTTGGATCTTATCCCATTTCATACAAATGAACATATTATAGTATAGGCAAGTAATCCC-----
TAAATAGAT---GATTTCTTTTTTTTTAT

TAAATAGAT---GATTTCTTTTTTTTT-AT

TAAATAGAT---GATTTCTTTTTTTTT-AT

TAAATAGAT---GATTTCTTTTTTTTTAT

TAAATAGAT---GATTTCTTTTTTTTT-AT

TAAATAGAT---GATTTCTTTTTTTTT-AT

TAAATAGAT---GATTTCTTTTTTTTT-AT

TAAATAGAT---GATTTCTTTTTTTTT-AT

TAAATAGAT---GATTTCTTTTTTTTT-AT

TAAATAGAT---GATTTCTTTTTTTTT-AT

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TAAATAGAT---GATTTCTTTTTTTTT-AT

TAAATAGAT---GATTTCTTTTTTTTT-AT

TAAATAGAT---GATTTCTTTTTTTTT-AT

TAAATA-----GATTTCTTTTTTT-

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Apl.mut.26233
 Isc.bar.26363
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 Isc.hlr.26249
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 Isc.ten.26373
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 Ker.sia.26252
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 The.fie.26240
 Mne.can.26346
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 Mne.sp1.26244
 Ere.att.26352
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 Hac.gra.26234
 Hac.por.26235
 Hem.com.26247
 Hem.pra.26248
 Mne.lae.26236
 Ophexa.26237
 Pha.zea.26238
 Rot.coc.26253
 Era.bif.
 Cen.lap.26376

901	910	920	930	940	950	960	970	980	990
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TTATTTT	-----	-----	-----	ATTAGAGTA	----	TGGCAAGGAATCTCGATTATTAATTCGATTTTTTTA	-----	-----	-----
TTATTTT	-----	-----	-----	ATTAGAGTA	----	TGGCAAGGAATCTCGATTATTAATTCGATTTTTTTA	-----	-----	-----
TTATTTT	-----	-----	-----	ATTAGAGTA	----	TGGCA	-----	CTCGATTATTAATTCGATTTTTTTA	-----
TTATTTT	-----	-----	-----	ATTAGAGTA	----	TGGCAAGGAATCTCGATTATTAATTCGATTTTTTTA	-----	-----	-----
TTATTTT	-----	-----	-----	ATTAGAGTAGAGTAT	-----	TGGCAAGGAATCTCGATTATTAATTCGATTTTTTTA	-----	-----	-----
TTATTTT	-----	-----	-----	ATTAGAGTA	----	TGGCAAGGAATCTCGATTATTAATTCGATTTTTTTA	-----	-----	-----
TTATTTT	-----	-----	-----	ATTAGAGTAGAGTAT	-----	TGGCAAGGAATCTCGATTATTAATTCGATTTTTTTA	-----	-----	-----
TTATTTT	-----	-----	-----	ATTAGAGTAGAGTAT	-----	TGGCAAGGAATCTCGATTATTAATTCGATTTTTTTA	-----	-----	-----
TTCTTTTT	ATTTTTTTA	TTTTTTTTT	TTTTTTTTT	TTTTTTTTT	TTTT	ATTAGAGTAGAGTAT	-----	TGGCAAGGAATCTCGATTATTAATTCGATTTTTTTA	-----
TTATTTT	-----	-----	-----	ATTAGAGTAGAGTAT	-----	TGGCAAGGAATCTCGATTATTAATTCGATTTTTTTA	-----	-----	-----
TTATTTT	-----	-----	-----	ATTAGAGTAGAGTAT	-----	TGGCAAGGAATCTCGATTATTAATTCGATTTTTTTA	-----	-----	-----
????????	TTTTTTTTT	-----	-----	ATTAGAGTAGAGTAT	-----	TGGCAAGGAATCTCGATTATTAATTCGATTTTTTTA	-----	-----	-----
TTCTTTTT	-----	-----	-----	ATTATTAGAGTAGAGTAT	-----	TGGCAAGGAATCTCGATTATTAATTCGATTTTTTTA	-----	-----	-----
TTCTTTTT	TTTTTTTTT	-----	-----	ATT	----	AGAGTA	----	TGGCAAGGAATCTCGATTATTAATTCGATTTTTTTA	-----
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TTCTTTTT	TTTTTTT	ATTATC	-----	-----	ATTATTAGAGTA	----	TGGCAAGGAATCTCGATTATTAATTCGATTTTTTTA	-----	-----
TTCTTTTT	TTTTTTT	ATTATC	-----	-----	ATTATTAGAGTA	----	TGGCAAGGAATCTCGATTATTAATTCGATTTTTTTA	-----	-----
TTCTTT	TTTTTTT	TTTTTTTTT	TTTT	ATT	----	ATTATTAGAGTA	----	TGGCAAGGAATCTCGATTATTAATTCGATTTTTTTA	-----
TTCTTTTT	TTTTTTT	TTTTTTTTT	TTTT	ATT	----	ATTATTAGAGTAGAGTAT	-----	TGGCAAGGAATCTCGATTATTAATTCGATTTTTTTA	-----
TTCTTTTT	TTTTTTT	TTTTTTTTT	TTTT	ATT	----	ATTATTAGAGTAGAGTAT	-----	TGGCAAGGAATCTCGATTATTAATTCGATTTTTTTA	-----
-----	-----	-----	-----	-----	-----	ATTAGAGTA	----	TGGCAAGGAATCTCGATTATTAATTCGATTTTTTTA	-----
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Apl.mut.26233
Isc.bar.26363
Isc.bar.26364
Isc.bar.26365
Isc.bar.26366
Isc.hlr.26249
Isc.hub.26250
Isc.ind.26367
Isc.ind.26368
Isc.ind.26369
Isc.ind.26370
Isc.rug.26372
Isc.ten.26373
Isc.tlm.26374
Isc.sp1.26251
Isc.sp2.26375
Ker.sia.26252
Seh.ner.26239
The.efe.26240
Mne.can.26346
Mne.gla.26347
Mne.hel.26348
Mne.mol.26349
Mne.str.26350
Mne.stp.26351
Mne.sp1.26244
Ere.att.26352
Ere.bim.26353
Ere.cil.26354
Ere.ctc.26355
Ere.erl.26356
Ere.jan.26357
Ere.max.26358
Ere.sp1.26245
Hac.gra.26234
Hac.por.26235
Hem.com.26247
Hem.pra.26248
Mne.lae.26236
Oph.exa.26237
Pha.zea.26238
Rot.coc.26253
Era.bif.
Cer.lap.26376

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1081          1090          1100          1110          1120          1130          1140          1150          1160          1170
TCTTTTTT--AGTCCCTTTAATTGCATAGATACAAGTACGTACTCTACTAGGATGATGCACAATAAATGGTCAGGATAGCTCAGTTGGT
TGATTTTTT-AGTCCCTTTAATTGCATAGATGCAAATA---C-TT-TACTAAGATGATGCACAAGAAAGGGTCAGGATAGCTCAGTTGGT
TGATTTTTT-AGTCCCTTTAATTGCATAGATGCAAATA---C-TT-TACTAAGATGATGCACAAGAAAGGGTCAGGATAGCTCAGTTGGT
TGATTTTTT-AGTCCCTTTAATTGCATAGATGCAAATA---C-TT-TACTAAGATGATGCACAAGAAAGGGTCAGGATAGCTCAGTTGGT
TGATTTTTT-AGTCCCTTTAATTGCATAGATGCAAATA---C-TT-TACTAAGATGATGCACAAGAAAGGGTCAGGATAGCTCAGTTGGT
TGATTTTTT-AGTCCCTTTAATTGCATAGATGCAAATA---C-TT-TACTAAGATGATGCACAAGAAAGGGTCAGGATAGCTCAGTTGGT
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TGATTTTTT-AGTCCCTTTAATTGCATAGATGCAAATA---C-TT-TACTAAGATGATGCACAAGAAAGGGTCAGGATAGCTCAGTTGGT
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	1351	1360	1370	1380	1390	1400	1410	1420	1430	1440			
Apl.mut.26233	GGGCC	TCGGCCC	GGCAC	AGGCCCC	CGAGCCCC	CC	GGGGGG	GGAGGGG	CCGCA	AACAGAACCT-ACGG			
Isc.bar.26363	GGGCC	CCGGCCC	GGCACAA						A-	CAGAACCC-ACGG			
Isc.bar.26364	GGGCC	TCGGCCC	GGCACAA						A-	CAGAACCC-ACGG			
Isc.bar.26365	GGGCC	TCGGCCC	GGCACAA						A-	CAGAACCC-ACGG			
Isc.bar.26366	GGGCC	CCGGCCC	GGCACAA						A-	CAGAACCC-ACGG			
Isc.hir.26249	GGGCC	TCGGCCC	GGCACAA						AAC	AGAACCA-ACGG			
Isc.hub.26250	GGGCC	TCGGCCC	GGCACAA						A-	CAGAACCC-ACGG			
Isc.ind.26367	GGGCC	CCGGCCC	GGCACAA						A-	CAGAACCC-ACGG			
Isc.ind.26368	GGGCC	TCGGCCC	GGCACAA						AAC	AGAACCA-ACGG			
Isc.ind.26369	GGGCC	TCGGCCC	GGCACAA						AAC	AGAACCA-ACGG			
Isc.ind.26370	GGGCC	TCGGCCC	GGCACAA						AAC	AGAACCA-ACGG			
Isc.rug.26372	GGGCC	CCGGCCC	GGCACAA						A-	CAGAACCC-ACGG			
Isc.ten.26373	GGGCC	TCGGCCC	GGCACAGG	CCCCGAG	-CTCCGT	-CC-	GGGG	GGAGGGG	CCGCA	AACAGAACCC-ACGG			
Isc.tim.26374	GGGCC	TCGGCCC	GGCACAA						AAC	AGAACCA-ACGG			
Isc.sp1.26251	GGGCC	TCGGCCC	GGCACAA						A-	CAGAACCC-ACGG			
Isc.sp2.26375	GGGCC	TCGGCCC	GGCACAA						AAC	AGAACCA-ACGG			
Ker.sia.26252	GGGCC	TCGGCCC	GGCACAGG	CCCCGAG	-CTCC	-TTCCC	GGGG	GGAGGGG	CCGCA	AACAGAACCC-ACGG			
Seh.ner.26239	GGGCC	CCGGCCC	GGCACAGG	CCCCGAG	-CCCCGT	CTCCGAC	GGGG	GGAGGGG	CCGCC	CACAGAACCC-ACGG			
The.le.26240	GGGCT	TCGGT	CCGGC	CAAGGCC	CCCTAG	-CTTCGG	CGA	AGGGG	CCGCA	AAAAGAACCC-ACGG			
Mne.can.26346	GGGCT	TCGGCCC	GGCACAGG	CCCCGAG	-CTTCGG		CGG	AGGGG	CCGCA	AACAGAACCC-ACGG			
Mne.gla.26347	GGGCT	TCGGCCC	GGCACAGG	CCCCGAG	-CTTCGG		CGA	AGGGG	CCGCA	AACAGAACCC-ACGG			
Mne.he1.26348	GGGCT	TCGGCCT	TGGC	CAAGGCC	CCCCGAG	-CTTCGG	CGG	AGGGG	CCGCA	AACAGAACCC-ACGG			
Mne.mol.26349	GGGCT	TCGGCCT	TGGC	CAAGGCC	CCCCGAG	-CTTCGG	CGG	AGGGG	CCGCA	AACAGAACCC-ACGG			
Mne.str.26350	GGGCT	TCGGCCT	TGGC	CAAGGCC	CCCCGAG	-CTTCGG	CGG	AGGGG	CCGCA	AACAGAACCC-ACGG			
Mne.stp.26351	GGGCT	TCGGCCT	TGGC	CAAGGCC	CCCCGAG	-CTTCGG	CGG	AGGGG	CCGCA	AACAGAACCC-ACGG			
Mne.sp1.26244	GGGCT	TCGGCCT	TGGC	CAAGGCC	CCCCGAG	-CTTCGG	CTT	TGGGG	CCGCA	AACAGAACCC-ACGG			
Ere.att.26352	GGGCC	CACGGCCC	GGCACAGG	CCCCCTAG	-CCTCGG		CGA	AGGGG	CCGCA	AACAGAACCC-ACGG			
Ere.bim.26353	GGGCC	CACGGCCC	GGCACAGG	CCCCCTAG	-CCTCGG		CGA	AGGGG	CCGCA	AACAGAACCC-ACGG			
Ere.cil.26354	GGGCC	TCGGCCT	TGGC	CACGGCCC	CTAG	-CCTCGG	CGA	AGGGG	CCGCA	AACAGAACCC-ACGG			
Ere.cit.26355	GGGCC	CACGGCCC	GGCACAGG	CCCCCTAG	-CCTCGG		CGA	AGGGG	CCGCA	AACAGAACCC-ACGG			
Ere.eri.26356	GGGCT	TCGGCCC	GGCACAGG	CCCCCAG	-CCTCGG		GGA	AGGGG	CCGCA	AAAAGAACCC-ACGG			
Ere.jan.26357	GGGCT	TCGGCCC	GGCACAGG	CCCCCAG	-CCTCGG		CGA	AGGGG	CCGCA	AACAGAACCC-ACGG			
Ere.max.26358	GGGCC	CACGGCCC	GGCACAGG	CCCCCTAG	-CCTCGG		CGA	AGGGG	CCGCA	AACAGAACCC-ACGG			
Ere.sp1.26245	GGGCT	TCGGCCC	GGCACAGG	CCCCCAG	-CCTTGG		CGA	AGGGG	CCGCA	AACAGAACCC-ACGG			
Hac.gra.26234	GGGCT	TCGGCCT	TGGC	CAAGGCC	CCCCGAG	-CTTCGG	CGG	AGGGG	CCGCA	AAAAGAACCC-ACGG			
Hac.por.26235	GGGCT	TCGGCCC	GGCACAGG	CCCCCAG	-CTTCGG		CGG	AGGGG	CCGCA	AAAAGAACCC-ACGG			
Hem.com.26247	GGGCT	TCGGCCC	GGCACAGG	CCCCCAG	-CTTCGG		CGG	AGGGG	CCGCA	AAAAGAACCC-ACGG			
Hem.pra.26248	GGGCT	TCGGCCT	TGGC	AAAGGCC	CCCCGAG	-CTTCGG	CGG	AGGGG	CCGCA	AAAAGAACCC-ACGG			
Mne.lae.26236	GGGCT	TCGGCCC	GGCAAAAGG	CCCCCAG	-CTTCGG		CGG	AGGGG	CCGCA	AACAGAACCC-ACGG			
Oph.exa.26237	GGGCT	TTGGCCC	GGCAAGG	CCCCCAG	-CTTCGG		CAG	AGGGG	CCCC	AAAAGAACCC-ACGG			
Pha.zea.26238	GGGCT	TCGGCCC	GGCACAGG	CCCCCAG	-CTCCGG		CGG	AGGGG	CCGCA	AACAGAACCC-ACGG			
Rot.coc.26253				AAAGGCC	CCCCGAG	CCCTT	ATCG	GGGG	GGAGGGG	CCACA	AACAGAACCC-ACGG		
Era.bif.	GGGT	GACGGGG	CTGCTG	-CCTCCC	-GGCTT	AGGT	CCCC	AGACTT	CTGTAT	GG-AGGTTT	GGGG	CCGCA	AAAAGAACCC-ACGG
Gen.lap.26376	GGAC	GGCGGGG	CATCAT	-AG	-CCTCC	GGGG	CCCC	GGAGGGG	-AGG	-AGAGGGG	CCGCA	AACAGAACCC-AGGG	

	1441	1450	1460	1470	1480	1490	1500	1510	1520	1530
Apl.mut.26233	CGCCTTAGGGCGTCAAGGAACACTT	----	ATATTGCCTTGCCCGGGTGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Isc.bar.26363	CGCCTTAGGGCGTCAAGGAACACTC	----	ATATTGCCTCGCGCGGGCGGGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Isc.bar.26364	CGCCTTAGGGCGTCAAGGAACACTC	----	ATATTGCCTCGCGCGGGCGGGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Isc.bar.26365	CGCCTTAGGGCGTCAAGGAACACTC	----	ATATTGCCTCGCGCGGGCGGGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Isc.bar.26366	CGCCTTAGGGCGTCAAGGAACACTC	----	ATATTGCCTCGCGCGGGCGGGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Isc.hir.26249	CGCCTTAGGGCGTCAAGGAACACTT	----	GTATTGCCTTGCCCGGGCGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Isc.hub.26250	CGCCTTAGGGCGTCAAGGAACACTC	----	ATATTGCCTCGCGCGGGCGGGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Isc.ind.26367	CGCCTTAGGGCGTCAAGGAACACTC	----	ATATTGCCTCGCGCGGGCGGGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Isc.ind.26368	CGCCTTAGGGCGTCAAGGAACACTT	----	GTGTTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATC-A				
Isc.ind.26369	CGCCTTAGGGCGTCAAGGAACACTT	----	GTGTTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATC-A				
Isc.ind.26370	CGCCTTAGGGCGTCAAGGAACACTT	----	GTGTTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATC-A				
Isc.rug.26372	CGCCTTAGGGCGTCAAGGAACACTC	----	ATATTGCCTCGCGCGGGCGGGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Isc.ten.26373	CGCCTTAGGGCGTCAAGGAACACTC	----	ATATTGCCTCGCGCGGGCGGGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Isc.tim.26374	CGCCTTAGGGCGTCAAGGAACACTT	----	GTGTTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Isc.sp1.26251	CGCCTTAGGGCGTCAAGGAACACTC	----	ATATTGCCTCGCGCGGGCGGGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Isc.sp2.26375	CGCCTTAGGGCGTCAAGGAACACTT	----	GTGTTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATC-A				
Ker.sla.26252	CGCCTTAGGGCGTCAAGGAACACTC	----	ATATTGCCTCGCTCGGCGGGCGGGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Seh.ner.26239	CGCCTTAGGGCGTCAAGGAACACTC	----	ATATTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
The.ele.26240	CGCCTTAGGGCGTCAAGGAACACTC	----	GTGTTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	AATG-T				
Mne.can.26346	CGCCTTAGGGCGTCAAGGAACACTT	----	CTATTGCCTTGCTCGGCGGGCGGGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GACG-A				
Mne.gla.26347	CGCCTTAGGGCGTCAAGGAACACTT	----	ATATTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Mne.hel.26348	CGCCTTAGGGCGTCAAGGAACACTT	----	GTGTTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Mne.mol.26349	CGCCTTAGGGCGTCAAGGAACACTC	----	GTGTTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Mne.str.26350	CGCCTTAGGGCGTCAAGGAACACTT	----	GTGTTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Mne.stp.26351	CGCCTTAGGGCGTCAAGGAACACTT	----	GTGTTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Mne.sp1.26244	CGCCTTAGGGCGTCAAGGAACACTT	----	GTATTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	TATG-A				
Ere.att.26352	CGCCTTAGGGCGTCAAGGAACACTT	----	ACGCTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GACT-A				
Ere.bim.26353	CGCCTTAGGGCGTCAAGGAACACTT	----	ACGCTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GACT-A				
Ere.cil.26354	CGCCTTAGGGCGTCAAGGAACACTT	----	ACGCTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GACT-A				
Ere.cit.26355	CGCCTTAGGGCGTCAAGGAACACTT	----	ACGCTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GACT-A				
Ere.erl.26356	CGCCTTAGGGCGTCAAGGAACACTT	----	ACGCTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GACT-A				
Ere.jan.26357	CGCCTTAGGGCGTCAAGGAACACTT	----	ACGCTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GACT-A				
Ere.max.26358	CGCCTTAGGGCGTCAAGGAACACTT	----	ACGCTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GACT-A				
Ere.sp1.26245	CGCCTTAGGGCGTCAAGGAACACTT	----	ATGCTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GACT-A				
Hac.gra.26234	CGCCTTAGGGCGTCAAGGAACACTT	----	ATATTGCCTTGCAAGGGCGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Hac.por.26235	CGCCTTAGGGCGTCAAGGAACACTT	----	ATATTGCCTTGCGCGGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Hem.com.26247	CGCCTTAGGGCGTCAAGGAACACTT	----	ATATTGCCTCGCGCGGGCGGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Hem.pra.26248	CGCCTTAGGGCGTCAAGGAACACTT	----	ATATTGCCTCGCGCGGGCGGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Mne.jae.26236	CGCCTTAGGGCGTCAAGGAACACTC	----	ATGTTGCCT- GCGCGGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATC-G				
Oph.xa.26237	CGCCTTAGGGCGTCAAGGAACACTT	----	TGATTGCCTTGCTCGGCGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATC-A				
Pha.zea.26238	CGCCTTAGGGCGTCAAGGAACACTT	----	ATATTGCCTTGCCCGGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Rot.coc.26253	CGCCTTAGGGCGTCAAGGAACACTT	----	ATATTGCCTTGCGCGGGAGCGGT	CGGCCTGCCCTCCGCTCCCCGGCGCAGC	----	GATG-A				
Ere.bif.	CGCCATGGGCGTCAAGGAACACTA	----	ATATTGCCTTGCCCAAGTTACAGACCGGCT	CGCGGACGGACTTGAGCGGC	----	GATACC				
Can.lap.26376	CGCCGAAGGGCGCAAGGAACACTG	----	ATATTGCCATGCGCGAGGCCGTGGCCGGCCT	CGCGGACGGCGCGCAGC	----	GATG-C				

	1531	1540	1550	1560	1570	1580	1590	1600	1610	1620
Apt.mut.26233	T	A	T	C	T	T	A	A	T	C
Isc.bar.26363	C	C	A	C	A	C	G	A	C	T
Isc.bar.26364	C	T	C	G	G	C	A	A	C	G
Isc.bar.26365	C	T	C	G	G	C	A	A	C	G
Isc.bar.26366	C	T	C	G	G	C	A	A	C	G
Isc.hir.26249	C	T	C	G	G	C	A	A	C	G
Isc.hub.26250	C	T	C	G	G	C	A	A	C	G
Isc.ind.26367	C	T	C	G	G	C	A	A	C	G
Isc.ind.26368	C	T	C	G	G	C	A	A	C	G
Isc.ind.26369	C	T	C	G	G	C	A	A	C	G
Isc.ind.26370	C	T	C	G	G	C	A	A	C	G
Isc.rug.26372	C	T	C	G	G	C	A	A	C	G
Isc.tem.26373	C	T	C	G	G	C	A	A	C	G
Isc.tim.26374	C	T	C	G	G	C	A	A	C	G
Isc.sp1.26251	C	T	C	G	G	C	A	A	C	G
Isc.sp2.26375	C	T	C	G	G	C	A	A	C	G
Ker.sla.26252	C	T	C	G	G	C	A	A	C	G
Sehner.26239	C	T	C	G	G	C	A	A	C	G
The.ele.26240	C	T	C	G	G	C	A	A	C	G
Mne.can.26346	C	T	C	G	G	C	A	A	C	G
Mne.gla.26347	C	T	C	G	G	C	A	A	C	G
Mne.hel.26348	C	T	C	G	G	C	A	A	C	G
Mne.mol.26349	C	T	C	G	G	C	A	A	C	G
Mne.str.26350	C	T	C	G	G	C	A	A	C	G
Mne.stp.26351	C	T	C	G	G	C	A	A	C	G
Mne.sp1.26244	C	T	C	G	G	C	A	A	C	G
Ere.att.26352	C	T	C	G	G	C	A	A	C	G
Ere.bim.26353	C	T	C	G	G	C	A	A	C	G
Ere.cil.26354	C	T	C	G	G	C	A	A	C	G
Ere.cit.26355	C	T	C	G	G	C	A	A	C	G
Ere.erl.26356	C	T	C	G	G	C	A	A	C	G
Ere.lan.26357	C	T	C	G	G	C	A	A	C	G
Ere.max.26358	C	T	C	G	G	C	A	A	C	G
Ere.sp1.26245	C	T	C	G	G	C	A	A	C	G
Hac.gra.26234	C	T	C	G	G	C	A	A	C	G
Hac.por.26235	C	T	C	G	G	C	A	A	C	G
Hem.com.26247	C	T	C	G	G	C	A	A	C	G
Hem.pra.26248	C	T	C	G	G	C	A	A	C	G
Mne.lae.26236	C	T	C	G	G	C	A	A	C	G
Oph.exa.26237	C	T	C	G	G	C	A	A	C	G
Pha.zea.26238	C	T	C	G	G	C	A	A	C	G
Ret.coc.26253	C	T	C	G	G	C	A	A	C	G
Era.blf.	C	T	C	G	G	C	A	A	C	G
Cen.jap.26376	C	T	C	G	G	C	A	A	C	G

Apl.mut.26233
Isc.bar.26363
Isc.bar.26364
Isc.bar.26365
Isc.bar.26366
Isc.hlr.26249
Isc.hub.26250
Isc.ind.26367
Isc.ind.26368
Isc.ind.26369
Isc.ind.26370
Isc.rug.26372
Isc.ten.26373
Isc.tim.26374
Isc.sp1.26251
Isc.sp2.26375
Ker.sia.26252
Seh.ner.26239
The.ele.26240
Mne.can.26346
Mne.gla.26347
Mne.heL26348
Mne.mol.26349
Mne.str.26350
Mne.stp.26351
Mne.sp1.26244
Ere.att.26352
Ere.bim.26353
Ere.cil.26354
Ere.cit.26355
Ere.eri.26356
Ere.jan.26357
Ere.max.26358
Ere.sp1.26245
Hac.gra.26234
Hac.por.26235
Hem.com.26247
Hem.pra.26248
Mne.jae.26236
Oph.exa.26237
Pha.zea.26238
Rot.coc.26253
Era.bif.
Cen.lap.26376

1801 1810 1820 1830 1840 1850 1860 1870 1880 1890
GCCGGCGTATCGTGTGGGGCACAGCACGTGGTGGG-CGCC-A--TAG-CGCA-TCTG---TGCAGTGGCCCCGGCGCGGGCCGGCATC
GCCGGCGAATCGCGTGTGGGGCACAGCACGTGGTGGG-CGAC-ACCTAGTTGTT-CTCGAGGTGCAGCGCCCCGGCGCGGGCCGGC--ACC
GCCGGCGAATCGCGTGTGGGGCACAGCACGTGGTGGG-CGAC-ACCTAGTTGTT-CTCGAGGTGCAGCGCCCCGGCGCGGGCCGGCGCA--
GCCGGCGAATCGCGTGTGGGGCACAGCACGTGGTGGG-CGAC-ACCTAGTTGTT-CTCGAGGTGCAGCGCCCCGGCGCGGGCCGGCGCA--
GCCGGCGAATCGTGTGGGGCACAGCACGTGGTGGG-CGAC-ACCTAGTTGTT-CTCGAGGTGCAGCGCCCCGGCGCGGGCCGGCGCA--TT
GCCGGCGAATCGCGTGTGGGGCACAGCACGTGGTGGG-CGAC-ACCTAGT-GTTTCTC--GGTGCAGCGCCCGGCGCGGGCCGGCGCA--ATC
GCCGGCGAATCGCGTGTGGGGCACAGCACGTGGTGGG-CGAC-ACCTAGTTGTT-CTCGAGGTGCAGCGCCCCGGCGCGGGCCGGCGCA--
GCCGGCGAATCGTGTGGGGCACAGCACGTGGTGGG-CGAC-ACCTAGTTGTT-CTCGAGGTGCAGCGCCCCGGCGCGGGCCGGCGCA--ACC
GCCGGCGAATCGTGTGGGGCACAGCACGTGGTGGG-CGAC-ACTCAGT-GTTTCTC--GGTGCAGCGCCCCGGCGCGGGCCGGCGCA--ATC
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GCCGGCGAATCGCGTGTGGGGCACAGCACGTGGTGGG-CGAC-ACCTAGTTGTT-CTCGAGGTGCAGCGCCCCGGCGCGGGCCGGCGCA--TC
GCCGGCGATTTCGCGTGTGGGGCACAGCACGTGGTGGG-CGAC-ACCTAGT-GTTTCTC--GGTGCAGCGCCCCGGCGCGGGCCGGCGCATC
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GCCGGCGAATCGTGTGGGGCACAGCACGTGGTGGG-CGAC-A-TCAGTTGTT-CTC--GGTGCAGCGCCCCGGCGCGGGCCGGCGCATC
GCCGGCGAATCGTGTGGGGCACAGCACGTGGTGGG-CGAC--TCTAGTTGTT-CTC--GGTGCAGCGCCCCGGCGCGGGCCGGCGCATC
GCCGGCGAACCCTGTCTGGGGCACAGCACGTGGTGGG-CGACAA-CTAGTTGTT-CTC--GGTGCAGCGCCCCGGCGCGGGCCGGCGCATC
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GCCGGCGAATCGTGTCTGGGGCACAGCACGTGGTGGG-CGAC-ACCTAGTTGTT-CTC--GGTGCAGCGCCCCGGCGCGGGCCGGCGCATC
GCCGGCGTACCGTGTCTGGTACAGCACAAAGTGGG-TGAC-ACTTGGT-GTT-CTCG-CTGCTGTGACTTGAACCCTGCAAGGTATGCAAT
GCCGGCGTACGGCGCCGGGCACAGCACAAAGTGGGACGAC-A-CGAGTTGTT-CAC--GGTGCAGTGCCTCGGGCCCCAGCCGGCGACGT

	1981	1990	2000	2010	2020	2029
Apl.mut.26233	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Isc.bar.26363	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Isc.bar.26364	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Isc.bar.26365	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Isc.bar.26366	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Isc.hlr.26249	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Isc.hub.26250	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Isc.ind.26367	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Isc.ind.26368	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Isc.ind.26369	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Isc.ind.26370	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Isc.rug.26372	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Isc.ten.26373	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Isc.tlm.26374	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Isc.sp1.26251	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Isc.sp2.26375	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Ker.sla.26252	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Seh.ner.26239	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
The.ele.26240	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Mne.can.26346	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Mne.gla.26347	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Mne.hel.26348	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Mne.mol.26349	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Mne.str.26350	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Mne.stp.26351	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Mne.sp1.26244	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Ere.att.26352	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Ere.bim.26353	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Ere.cit.26354	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Ere.cit.26355	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Ere.eri.26356	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Ere.jan.26357	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Ere.max.26358	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Ere.sp1.26245	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Hac.gra.26234	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Hac.por.26235	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Hem.com.26247	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Hem.pra.26248	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Mne.lae.26236	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Oph.exa.26237	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Pha.zea.26238	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Rot.coc.26253	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				
Era.bif.	????????????????????????????????					
Cen.lap.26376	AAATAAGCGGGAGGAGAAGAACTTACAAGGATTC	CCCTAGTAACGGCGA				

BIOGRAPHY

Miss Paweena Traiperm was born on November 24th, 1978 in Ayutthaya Province. She earned her Bachelor Degree in Science in Biology from the Department of Biology, Faculty of Science, Khon Kaen University, Khon Kaen, in 2000. In 2003, she received her Master of Science in Botany from the Department of Botany, Faculty of Science, Chulalongkorn University, then continued her study in Biological Science Ph.D. Program, Faculty of Science, Chulalongkorn University from 2004-2007.