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APPENDIX A

Collection of *A. cerana* from the North of Thailand

Code of Colonies	Date of collection	Sampling Area	Composite Haplotype
N1	05/12/1995	Muang, Uttaradit	AAA
N2	07/09/1996	Muang, Lumphun	AAA
N3	07/09/1996	Muang, Lumphun	AAA
N4	08/09/1996	Sun Pa Tong, Chiang Mai	AAA
N5	08/09/1996	Sun Pa Tong, Chiang Mai	AAA
N6	08/09/1996	Sun Pa Tong, Chiang Mai	AAA
N7	09/09/1996	Hang Dong, Chiang Mai	AAA
N8	10/09/1996	Muang, Uttaradit	BAA
N9	10/09/1996	Muang, Phitsanulok	AAA
N10	10/09/1996	Muang, Phitsanulok	ADA
N11	10/09/1996	Muang, Phitsanulok	AAA
N12	05/02/1997	Phayuha Khiri, Nakhon Sawan	AAA
N13	05/02/1997	Manorom, Chainat	AAA
N14	06/02/1997	Watsingh, Chainat	AAG
N15	06/02/1997	Muang, Chainat	AAA
N16	05/06/1997	Banphotphisai, Nakhon Sawan	AAA
N17	05/06/1997	Banphotphisai, Nakhon Sawan	AAA
N18	05/06/1997	Muang, Kamphaengphet	AAA
N19	06/06/1997	Ban Tak, Tak	AAA
N20	06/06/1997	Ban Tak, Tak	AAA
N21	06/06/1997	Sam Ngao, Tak	AAA
N22	06/06/1997	Sam Ngao, Tak	AAA
N23	06/06/1997	Thoen, Lumpang	AAA
N24	06/06/1997	Thoen, Lumpang	AAA
N25	06/06/1997	Mae Tha, Lumphun	AAA
N26	07/06/1997	Doi Saket, Chiang-Mai	AAA
N27	07/06/1997	Doi Saket, Chiang-Mai	AAA
N28	07/06/1997	Weang Pa Pao, Chiang-Rai	AAA
N29	07/06/1997	Weang Pa Pao, Chiang-Rai	AAA
N30	07/06/1997	Weang Pa Pao, Chiang-Rai	AAA
N31	07/06/1997	Ngao, Lumpang	AAA
N32	08/06/1997	Sungmen, Phrae	AAA
N33	08/06/1997	Sungmen, Phrae	AAA
N34	08/06/1997	Sungmen, Phrae	AAA

Collection of *A. cerana* from the North-East of Thailand

Code of Colonies	Date of collection	Sampling Area	Composite Haplotype
NE1	07/04/1996	Na Haeo, Loei	AAA
NE2	14/02/1993	Nongburnak, Nakhon Ratchasima	AAA
NE3	19/03/1993	Akatamunuai, Sakon Nakhon	AAB
NE4	15/03/1993	Prasat, Surin	ADA
NE5	16/03/1993	Warinchumrab, Ubonratchathani	AAA
NE6	14/03/1993	Nongbunnak, Nakhon Ratchasima	AAA
NE7	16/03/1993	Pattanaburi, Surin	AAA
NE8	15/03/1993	Muang, Si Sa Ket	AAA
NE9	19/03/1993	Kranuan, Khon Kaen	AAA
NE10	18/03/1993	Muang, Khon Kaen	AAA
NE11	15/03/1993	Chom Phra, Khon Kaen	AAA
NE12	06/12/1996	Muang, Khon Kaen	AAA
NE13	06/12/1996	Muang, Khon Kaen	ADA
NE14	06/12/1996	Chum Phae, Khon Kaen	AAA
NE15	06/12/1996	Chum Phae, Khon Kaen	AAA
NE16	06/12/1996	Chum Phae, Khon Kaen	AAH
NE17	06/12/1996	Chum Phae, Khon Kaen	AAH
NE18	07/12/1996	Ubol Ratana, Khom Kaen	AAA
NE19	07/12/1996	Non Sang, Nong Bua Lamphu	AAA
NE20	07/12/1996	Non Sang, Nong Bua Lamphu	AAA
NE21	07/12/1996	Non Sang, Nong Bua Lamphu	AAA
NE22	07/12/1996	Nong Wua-So, Udon Thani	AAA
NE23	07/12/1996	Muang, Udon Thani	AAA
NE24	07/12/1996	Muang, Udon Thani	AAA
NE25	08/12/1996	Muang, Udon Thani	AAA
NE26	08/12/1996	Muang, Nong Khai	AAA
NE27	08/12/1996	Muang, Nong Khai	AAA
NE28	09/12/1996	Nong han, Udon Thani	AAA
NE29	09/12/1996	Phungkon, Sakon Nakhon	AAA
NE30	09/12/1996	Phungkon, Sakon Nakhon	AAA
NE31	10/12/1996	Nongbunnak, Nakhon Ratchasima	AAA
NE32	10/12/1996	Nongbunnak, Nakhon Ratchasima	AAA

Collection of *A. cerana* from the Central of Thailand

Code of Colonies	Date of collection	Sampling Area	Composite Haplotype
C1	21/01/1996	Pra Pra Daeng, Samut Prakan	ADA
C2	22/01/1996	Kumphaehsan, Nakhon Pathom	AAA
C3	17/02/1996	Dan Chang, Suphanburi	AAA
C4	28/02/1996	Muang, Samutt Songkhrom	AAA
C5	28/02/1996	Muang, Samutt Songkhrom	AAA
C6	28/02/1996	Muang, Samutt Songkhrom	AAH
C7	31/03/1996	Pra Pra Daeng, Samut Prakan	ADA
C8	12/04/1996	Don Tom, Nakhon Pathom	AAA
C9	15/04/1996	Dan Chang, Suphanburi	AAA
C10	15/04/1996	Dan Chang, Suphanburi	ADA
C11	18/03/1996	Phong Nam Ron, Chanthaburi	AAA
C12	10/08/1996	Makham, Chanthaburi	AAA
C13	10/08/1996	Makham, Chanthaburi	AAA
C14	11/08/1996	Makham, Chanthaburi	AAA
C15	23/03/1996	Samrotyot, Prachup Khiri Khan	AAA
C16	24/03/1996	Samrotyot, Prachup Khiri Khan	ADA
C17	24/03/1996	Samrotyot, Prachup Khiri Khan	AAA
C18	06/03/1997	Muang, Trat	AAA
C19	07/03/1997	Muang, Trat	AAA
C20	07/03/1997	Khao Saming, Trat	AAA
C21	07/03/1997	Khao Saming, Trat	AAA
C22	12/04/1996	Nong Prua, Kanchanaburi	AAA
C23	16/04/1996	Thong Phaphum, Kanchanaburi	AAB

Collection of *A. cerana* from the South of Thailand

Code of Colonies	Date of collection	Sampling Area	Composite Haplotype
S1	25/03/1996	Thalang, Phuket	BBB
S2	25/03/1996	Muang, Chumphon	CED
S3	25/03/1996	Muang, Chumphon	BBB
S4	12/05/1996	Tha Chana, Surat Thani	BBB
S5	12/05/1996	Tha Chana, Surat Thani	BBB
S6	13/05/1996	Muang, Phuket	BBB
S7	14/05/1996	Thalang, Phuket	BBB
S8	14/05/1996	Thalang, Phuket	BBB
S9	14/05/1996	Muang, Phuket	BBB
S10	15/05/1996	Sawi, Chumphom	BBB
S11	15/05/1996	Sawi, Chumphom	BBB
S12	15/05/1996	Sawi, Chumphom	BBB
S13	15/05/1996	Muang, Chumphon	BBB
S14	15/05/1996	Muang, Chumphon	BBB
S15	21/03/1996	Muang, Chumphon	BBB
S16	21/03/1997	Kra buri, Ranong	BBB
S17	22/03/1997	Kapoe, Ranong	BBB
S18	22/03/1997	Kapoe, Ranong	BBB
S19	22/03/1997	Kapoe, Ranong	BBB
S20	22/03/1997	Muang, Ranong	BBB
S21	23/03/1997	Khura buri, Phang Nga	BBB
S22	23/03/1997	Khura buri, Phang Nga	BBB
S23	23/03/1997	Phanom, Surat Thani	BBB
S24	24/03/1997	Ao Luk, Krabi	BBB
S25	24/03/1997	Ao Luk, Krabi	BBB
S26	24/03/1997	Ao Luk, Krabi	BBE
S27	24/03/1997	Ao Luk, Krabi	BBB
S28	24/03/1997	Muang, Krabi	BBB
S29	25/03/1997	Muang, Krabi	BBB
S30	25/03/1997	Nua Klong, Krabi	BBB
S31	25/03/1997	Nua Klong, Krabi	BBB
S32	25/03/1997	Khao-Phanom, Krabi	BBB
S33	25/03/1997	Thungyai, Nakhon Si Thammarat	BBC
S34	25/03/1997	Thungyai, Nakhon Si Thammarat	BBB
S35	25/03/1997	Thungsong, Nakhon Si Thammarat	BBC
S36	26/03/1997	Sikao, Trang	BBB

Collection of *A. cerana* from the South of Thailand (continue)

Code of Colonies	Date of collection	Sampling Area	Composite Haplotype
S37	26/03/1997	Huai Yot, Trang	BBB
S38	26/03/1997	Huai Yot, Trang	BBB
S39	26/03/1997	Sri Nakarin, Phatthalung	BBF
S40	26/03/1997	Huai-Yot, Trang	BBB
S41	26/03/1997	Sri Nakarin, Phatthalung	CED
S42	26/03/1997	Pa Bon, Phatthalung	BBB
S43	27/03/1997	Hat Yai, Songkhla	BBB
S44	27/03/1997	Muang, Songkhla	BBB
S45	27/03/1997	Muang, Songkhla	BBE
S46	27/03/1997	Muang, Songkhla	BBC
S47	28/03/1997	Chaloemphrakiat, Nakhon Si Thammarat	BBB
S48	28/03/1997	Chaloemphrakiat, Nakhon Si Thammarat	BBB
S49	28/03/1997	Tha Sala, Nakhon Si Thammarat	BBB
S50	28/03/1997	Tha Sala, Nakhon Si Thammarat	BBB

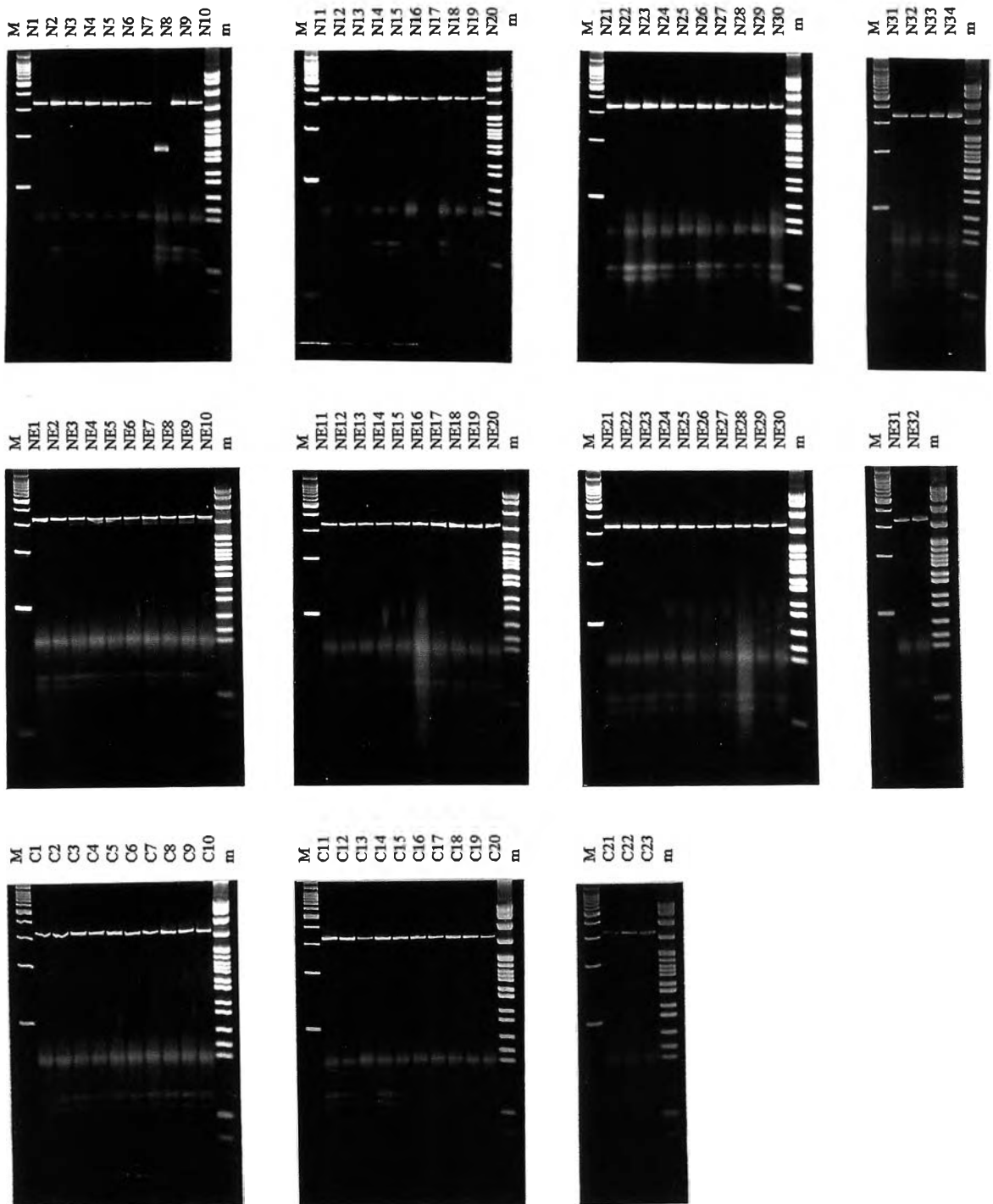
Collection of *A. cerana* from Samui Island of Thailand

Code of Colonies	Date of collection	Sampling Area	Composite Haplotype
I1	13/03/1996	Tham Bon Maret	BBB
I2	13/03/1996	Tham Bon Maret	BBB
I3	13/03/1996	Tham Bon Maret	BBB
I4	13/03/1996	Tham Bon Maret	BBB
I5	13/03/1996	Tham Bon Limpanoi	BBB
I6	30/03/1997	Tham Bon Maenam	BCB
I7	30/03/1997	Tham Bon Maenam	BBB
I8	30/03/1997	Tham Bon Maenam	BCC
I9	30/03/1997	Tham Bon Maenam	BBB
I10	30/03/1997	Tham Bon Maenam	BBB
I11	30/03/1997	Tham Bon Maenam	BCB
I12	30/03/1997	Tham Bon Maenam	BCB
I13	30/03/1997	Tham Bon Maenam	BCC
I14	30/03/1997	Tham Bon Maenam	BCB
I15	30/03/1997	Tham Bon Boput	BBB
I16	30/03/1997	Tham Bon Boput	BBB
I17	30/03/1997	Tham Bon Boput	BCC
I18	30/03/1997	Tham Bon Boput	BBB
I19	30/03/1997	Tham Bon Maret	BCC
I20	30/03/1997	Tham Bon Maret	BCC
I21	30/03/1997	Tham Bon Maret	BCC
I22	30/03/1997	Tham Bon Maret	BCC
I23	30/03/1997	Tham Bon Maret	BCC
I24	30/03/1997	Tham Bon Maret	BBB
I25	30/03/1997	Tham Bon Maret	BCC
I26	30/03/1997	Tham Bon Boput	BBB
I27	12/03/1996	Tham Bon Aungthong	BBB
I28	12/03/1996	Tham Bon Aungthong	BBB
I29	12/03/1996	Tham Bon Aungthong	BBB
I30	12/03/1996	Tham Bon Aungthong	BCC
I31	14/03/1996	Tham Bon Boput	BCC
I32	14/03/1996	Tham Bon Boput	BBB
I33	13/03/1996	Tham Bon Maret	BCC

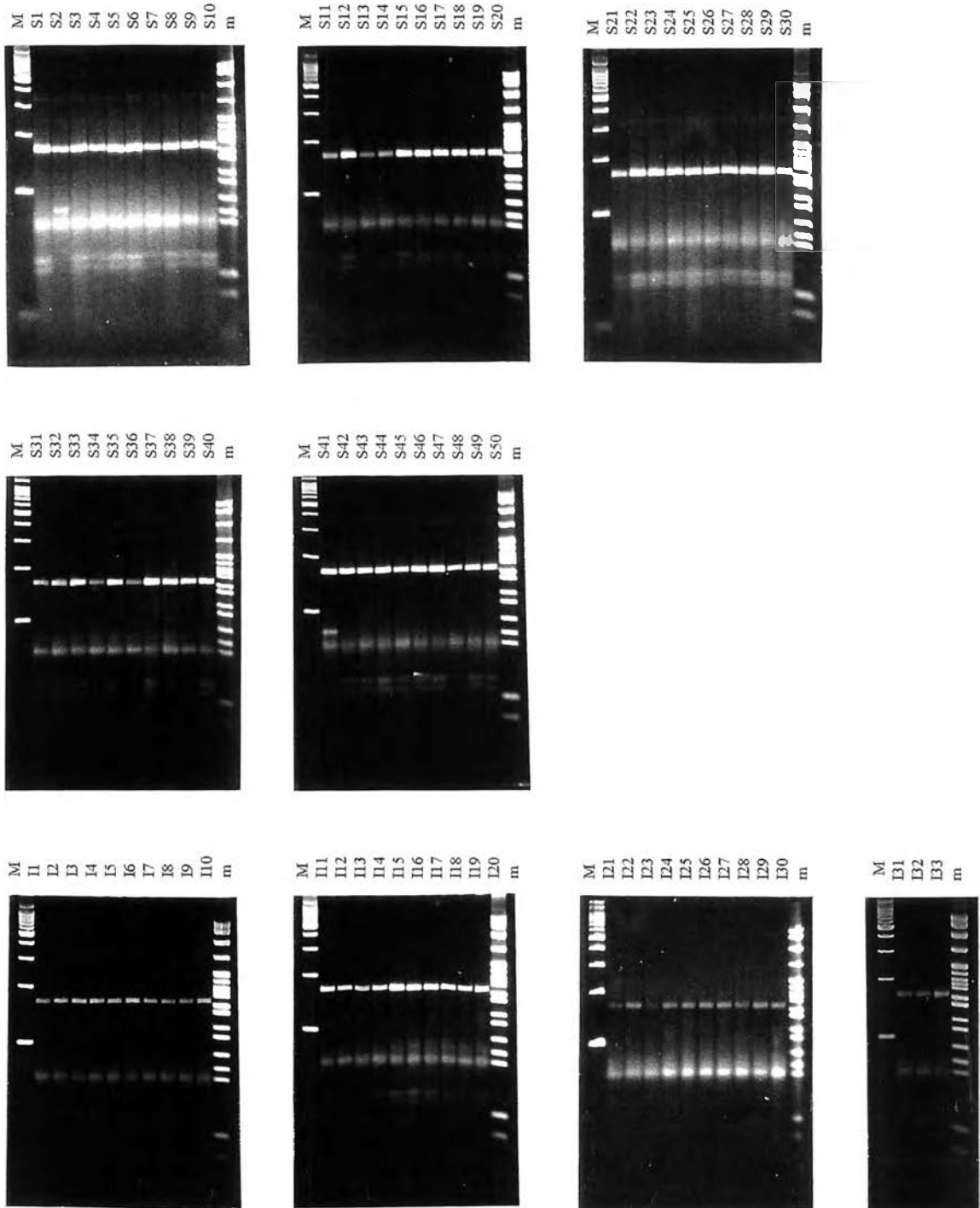
APPENDIX B

Restriction patterns of PCR-amplified sRNA gene, lrRNA gene and inter COI-CO II region digested with *Dra* I for 172 *A. cerana* individuals collected from five geographic locations in Thailand.

Dra I digestion of sRNA gene



Dra I digestion of sRNA gene (continue)

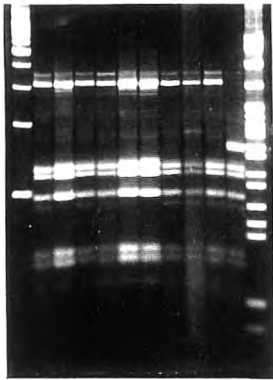


lane M = 100 bp DNA ladder

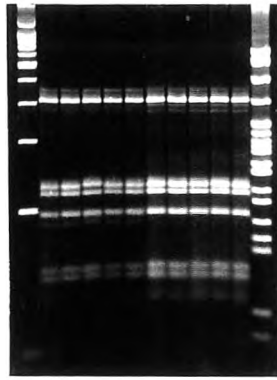
lane m = pBR 322 DNA-*Msp* I marker

Dra I digestion of IrRNA gene

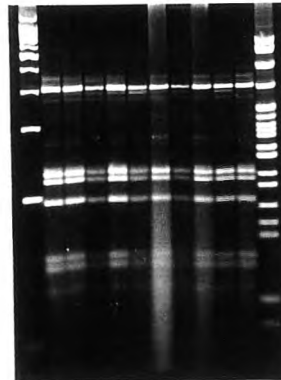
M N1 N2 N3 N4 N5 N6 N7 N8 N9 N10 m



M N11 N12 N13 N14 N15 N16 N17 N18 N19 N20 m



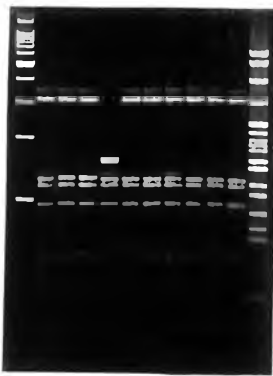
M N21 N22 N23 N24 N25 N26 N27 N28 N29 N30 m



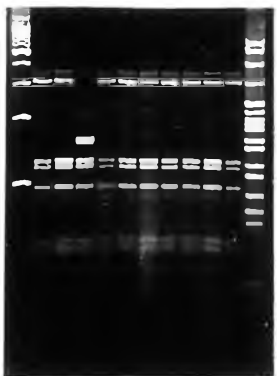
M N31 N32 N33 N34 m



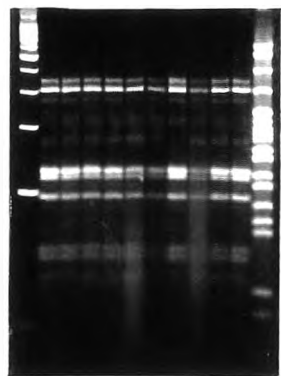
M NE1 NE2 NE3 NE4 NE5 NE6 NE7 NE8 NE9 NE10 m



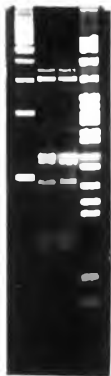
M NE11 NE12 NE13 NE14 NE15 NE16 NE17 NE18 NE19 NE20 m



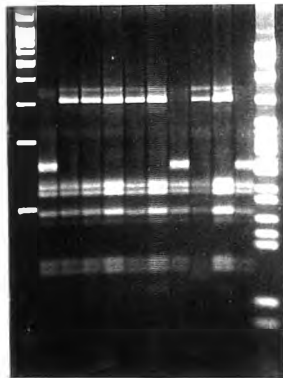
M NE21 NE22 NE23 NE24 NE25 NE26 NE27 NE28 NE29 NE30 m



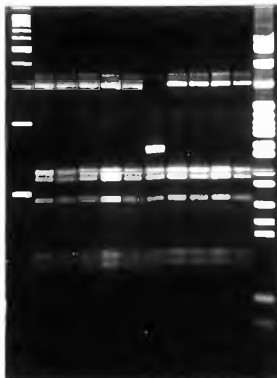
M NE31 NE32 m



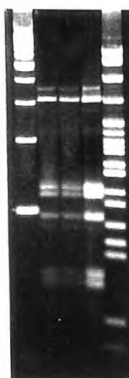
M C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 m



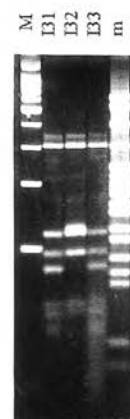
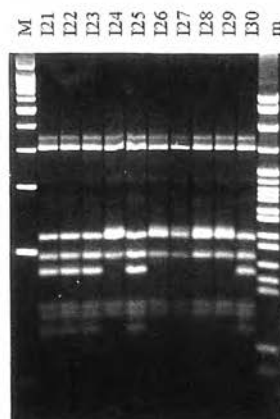
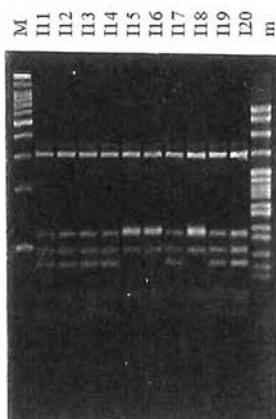
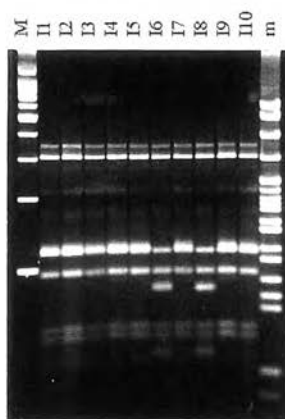
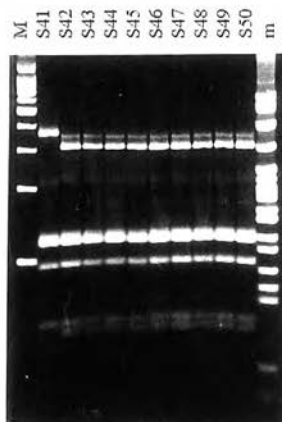
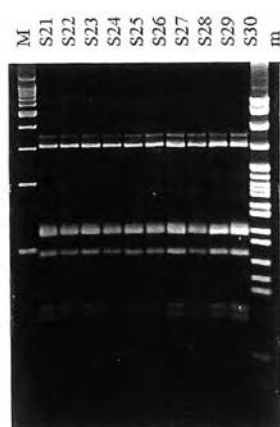
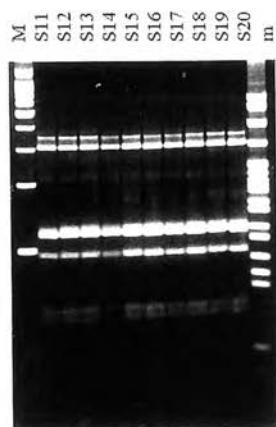
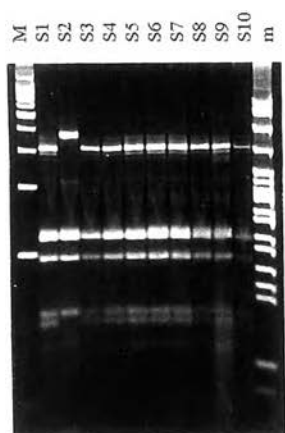
M C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 m



M C21 C22 C23 m



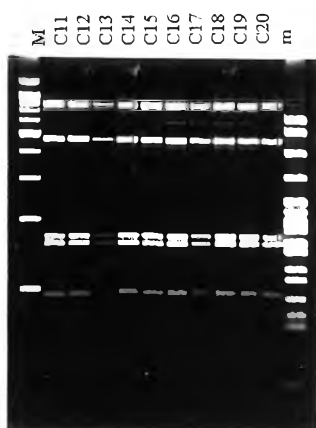
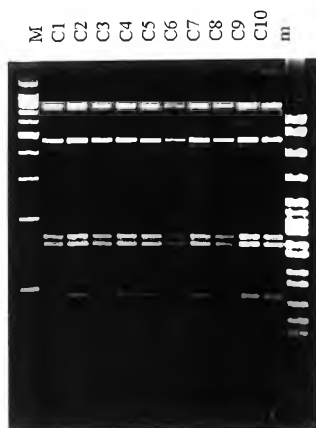
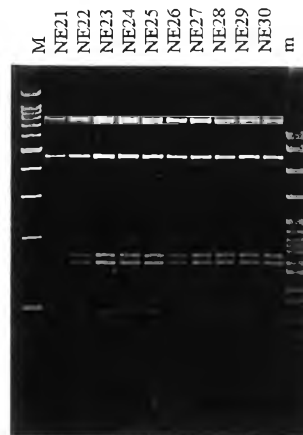
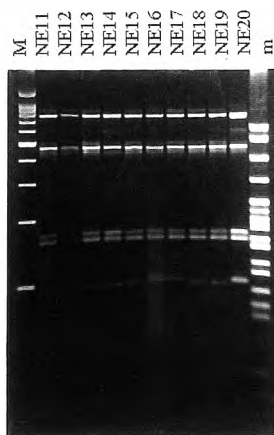
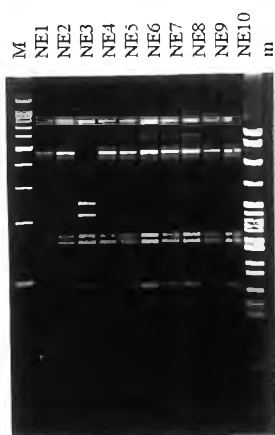
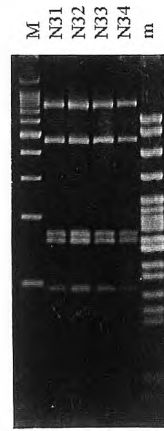
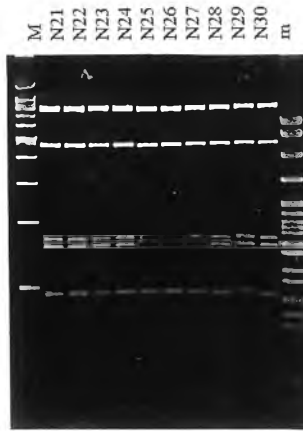
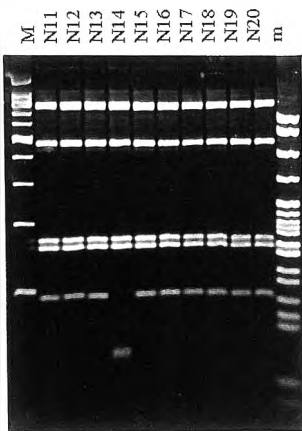
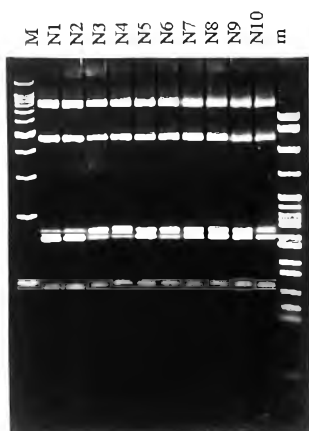
Dra I digestion of lrRNA gene (continue)



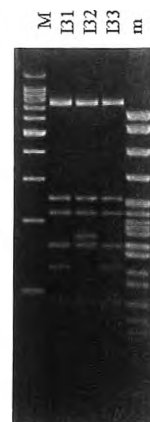
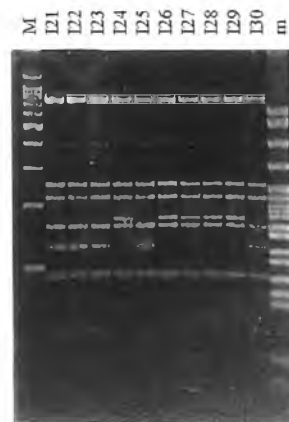
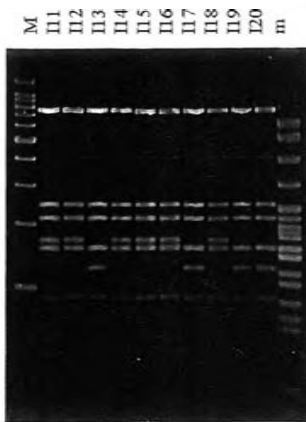
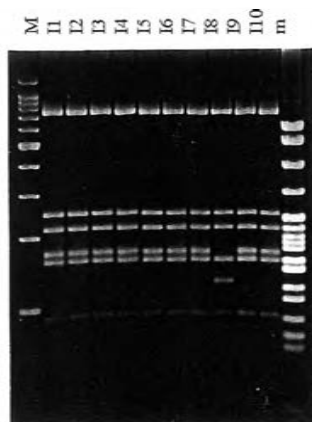
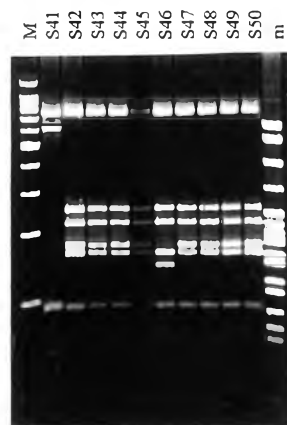
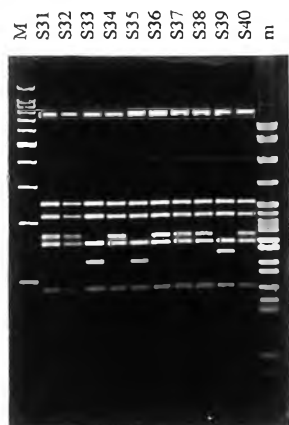
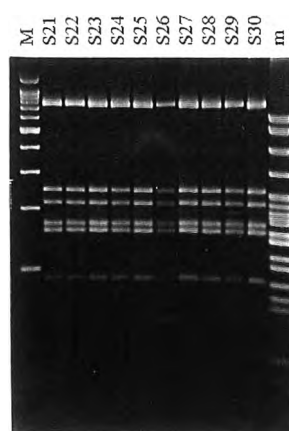
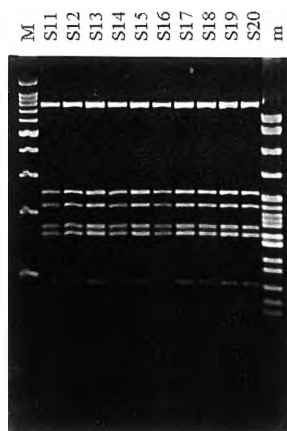
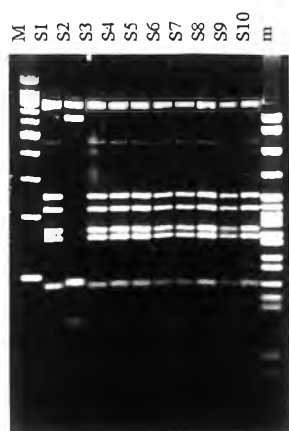
lane M = 100 bp DNA ladder

lane m = pBR 322 DNA-*Msp* I marker

Dra I digestion of inter CO I-CO II region



Dra I digestion of inter CO I-CO II region (continue)



lane M = 100 bp DNA ladder

lane m = pBR 322 DNA-*Msp* I marker

APPENDIX C



Partial alignment of the lrrNA gene of *A. cerana* was searched for the most similar sequences through the web site (<http://www.genome.ad.jp/SIT/BLAST.html>). The result showed that the closest sequence to lrrNA gene in *A. cerana* was that from *A. mellifera*.

Score 1116 (308.4 bits), Expect = 5.5e-143, Sum P(3) = 5.5e-143
Identities = 316/432 (73%), Positives = 316/432 (73%), Strand = Plus / Plus

```
A.cerana : 223 ATTATTAATATACTTTTATTACTAATTTAATCATTATCACTATATCTTAAAAATTAAAA 282
      ||||| ||||| ||||| ||||| ||||| ||||| ||||| ||||| ||||| |||||
A.mellifera:13991 ATTATAAAATATAACTTTATTACTAATCTAATCACTATTTCTATATTTTATTAATTAATA 14050

A.cerana : 283 TATATGTTTTTATAGAATAAAATAAAATTCAAAATTTAAATTTTAAAAATTAATAACTAA 342
      ||||| ||||| ||||| ||||| ||||| ||||| ||||| ||||| ||||| |||||
A.mellifera:14051 TATAAATTTTATAGAAAAATAAAATATAAATTTAAATCATTATTAATTTATAAATATTA 14110

A.cerana : 343 ATTATTAATTTTTTTATATTAATAAAAAATTAACCTCATAATATTATAAATAAAATCA 402
      ||||| ||||| ||||| ||||| ||||| ||||| ||||| ||||| ||||| |||||
A.mellifera:14111 AATTATTAATTTATTAATAATTAAGAAAAATATTATCTCTATAACATTAAAAATTAAT 14170

A.cerana : 403 AAAATTTTATAAATAAATTTATAGTTTATCCCATAAATTTTAAATATAAAAAATTAATAC 462
      ||||| ||||| ||||| ||||| ||||| ||||| ||||| ||||| ||||| |||||
A.mellifera:14171 TAAATTTTATCTTAAATTTATAGATTATCCCATAAATTTTAAATATAAAAAATTAATAAA 14230

A.cerana : 463 TATAAATAAATTTTAAGGTATTAAAAATTTTATATCTAAATTAATTTATTTCTAAAAAA 522
      | ||||| ||||| ||||| ||||| ||||| ||||| ||||| ||||| ||||| |||||
A.mellifera:14231 TTAAAAATAAATTTAATTTACTAAAATAATTATATCTAAATTAATTTATTTCTAAAAAA 14290

A.cerana : 523 ACTAGATATCAATAACTTCGAATGACATTTAATCTCTAAATTTATATTTATAATTTTATT 582
      ||||| ||||| ||||| ||||| ||||| ||||| ||||| ||||| ||||| |||||
A.mellifera:14291 ACTAGATATTAATAAGTTCGTTAACATTTAATTTCTAAATCTATATTTATAATTTTATT 14350

A.cerana : 583 GCAACAAAAAATATTACAAATTTAGCTCACTTATTTTCGAGATATTTAAATTTATTAA 642
      || ||||| ||||| ||||| ||||| ||||| ||||| ||||| ||||| |||||
A.mellifera:14351 GCTACAAAAAATAATATAAATTTAGCTCCCTTATTTTCGAGATATTTAAATCATTAA 14410

A.cerana : 643 ATAAATTTAAT 654
      ||||| |||||
A.mellifera:14411 ATAAATTTAAT 14422
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BIOGRAPHY

Miss Duangporn Sihanuntavong was born on September 11, 1972 in Bangkok, Thailand. She finished her primary and secondary educations from Kasetsart University Laboratory School in 1989, and graduated with Bachelor degree of Science in Biochemistry from Chulalogkorn University in 1993. She has studied for Master degree of Science at Department of Biotechnology, Chulalogkorn University since 1995.

