

REFERENCES

- Artama, W.T., Agey, M.W. and Donelson, J.E. 1992. DNA comparisons of *Trypanosoma evansi* from Indonesia and *Trypanosoma brucei* spp. *Parasitology* 104: 67-74.
- Boehringer Mannheim Biochemica, 1993. The DIG system user's guide for filter hybridization. Germany. Boehringer Mannheim GmbH, Biochemica. 90 pp.
- Borror, D.J., DeLong, D.M. and Triplehon, C.A. 1976. An introduction to the study of insect, New York: Rinchart and Winston, 690-699 pp.
- Calwell, D.B., 1972. Nature of ColE I plasmid replication in *E. coli* in the presence of chloramphenicol. *J. Bacteriol* 110: 667-676.
- Carlson, D.P., Mackey, J., Gaskill, M.E. and Hanson, P. 1990. Chemiluminescent detection of nucleic acid hybridization. *Focus* 12: 9-12.
- Carter, R.E. 1991. DNA fingerprinting in molecular techniques in taxonomy. (eds) Hewitt, G.M., Johnston, A.W.B. and Young, J.P.W. Springer-Verlag: Berlin, 323-328 pp.
- Crain, W.R., Davidson, E.H. and Britten, R.J. 1976. Contrasting patterns of DNA sequence arrangement in *Apis mellifera* (Honey Bee) and *Musca domestica* (House fly). *Chromosome* 59: 1-12.

- Crane, E. 1993. Current status of research on Asian honey bees. In Asian Apiculture, ed. Connor, L.J., Rinderer, T., Sylvester, H.A. and Wongsiri, S. Cheshire: Wicwass Press, 19-41 pp.
- Crozier, R.H. and Crozier, Y.C., 1993. The mitochondrial genome of the honey bee *Apis mellifera*: Complete sequence and genome organization. Genetics 133: 97-117.
- Daly, H.V. 1991. Systematics and Identification of Africanized Honey bees. In The "African" Honey Bee. eds. Spivak, M., Fletcher, D.J.C. and Breed, M.D., Boulder: Westview Press, 13-44 pp.
- Davis, L.G., Dibner, M.D. and Battey, J.F. 1986. Basic method in Molecular Biology. New York: Elsevier Science Publishing Co., Inc. 42-43 pp.
- Gibson, W.C., Dukes, P. and Gashumba, J.K. 1988. Species-specific DNA probes for the identification of trypanosomes in tsetse. Parasitology. 97: 63-73.
- Gojmerac, W.L. 1980. Bee, beekeeping, honey and polination. Westport. The AVJP Publishing company, Inc, 27-55 pp.
- Graur, D. 1985. Gene diversity in hymenoptera. Evolution 39: 190-199.
- Green, M.R. 1986. Pre-mRNA splicing. Ann. Rev. Genetics 20: 671-708.
- Hall, H.G. 1986. DNA differences found between Africanized and European honey bees. Proc. Natl Acad. Sci. 83: 4874-4877.

- _____. 1988. Distinguishing African and European honeybees using nuclear DNA restriction fragment polymorphisms. Florida Entomologist 71(3): 294-299.
- _____. 1990. Paternal analysis of introgressive hybridization between African and European honey bees using nuclear DNA RFLPs. Genetics 125(3): 611-621.
- _____. and Muralidharan, K. 1989. Evidence from mitochondrial DNA that African honey bees spread as continuous maternal lineages. Nature 339: 211-213.
- _____. and Smith, D.R. 1991. Distinguishing African and European honey bee matrilineages using amplified mitochondrial DNA. Proc Natl. Acad. Sci. U.S.A. 88: 4548-4552.
- Hoelzel, A.R. and Amos, W. 1988. DNA fingerprints and "scientific" whaling. Nature 333: 305.
- Ischii, T. 1992. Non-radioactive labelling and detection protocol for rice RFLP analysis. 2nd ed. Plant Breeding, Genetic, and Biochemistry Division. Manil: International Rice Research Institute.
- Jeffrey, A.J., Wilson, V. and Thein, S.L. 1985. Hypervariable minisatellite regions in human DNA. Nature 314: 67-74.
- _____. and Morton, D.B. 1987. DNA fingerprints of dogs and cats. Anim. Genet. 18: 1-15.

- Kassler, C. 1992. Nonradioactive labeling methods for nucleic acids, in Nonisotopic DNA probe techniques, ed. Kricka, L.J. San Diego: Academic Press Inc. 29-92 pp.
- Kirby, L.T. 1992. DNA fingerprinting. New York: W.H. Freeman and Company.
- Kozlowski, M. and Stepien, P.P. 1982. Restriction enzyme analysis of mitochondrial DNA of member of the genus *Aspergillus* as aid in taxonomy. J. Gen. Microbiol 128: 471-476.
- Kukla, B.A., Majiwa, P.A.O., Young, J.R., Moloo, S.K. and Ole-Moi Yoi, O. 1987. Use of species-specific DNA probes for detection and identification of trypanosome infection in tsetse flies. Parasitology 95: 1-16.
- Lee, M.L. 1993. Morphological and biochemical characteristics of *Apis cerana* in South Korea. In Asian Apiculture, ed. Connor, L.J., Rinderer, T., Sylvester, H.A. and Wongsiri, S. Cheshire: Wicwass Press, 161-183 pp.
- Levin, M.D. and Weller, G.D. 1989. Evaluating the role of honey bees in food production. Apiacta 65-69 pp.
- Li, S., Meng, Y., Chang, J.T., Li, J., He, S. and Kuang, B. 1986. A comparative study of esterase isozymes in 6 species of *Apis* and 9 Genera of Apoidea. J. Apic. Res 25: 129-133.
- Limbipichai, K. 1990. Morphometric Studies on Eastern Honey Bee (*Apis cerana* Fabricius) in Thailand and Malaysian Peninsula. Master's Thesis, Chulalongkorn University.

- Lion, T. and Hass, O.A. 1990. Nonradioactive labeling of probe with digoxigenin by polymerase chain reaction. *Anal. Biochem* 188: 335-337.
- Maa, T.C. 1953. An inquiry into the systematics of the tribus apidini or honey bees. *Trebuia* 21: 525-640.
- Majiwa, P.A.O., Hamers, R. van, Miervenne, N and Matthyssens, G. 1986. Evidence for genetic diversity in *Trypanosoma (Nannomonas) Congolense*. *Parasitology*. 93: 291-304
- _____ and Webster, P. 1987. A repetitive deoxyribonucleic acid sequence distinguishes *Trypanosoma simiae* from *T. congolense*. *Parasitology* 95: 543-558.
- Mandel, M. and Higa, A. 1970. Calcium chloride dependent bacteriophage DNA infection. *J. Mol. Biol.* 53: 159-162.
- Maniatis, T., Fritsh, E.F. and Sambrook, J. 1982. *Molecular Cloning A Laboratory Manual* Cold Spring Harbor Laboratory, New York: Cold Spring Harbor.
- Martin, R., Hoover, C., Grimme, S., Grogan, C., Holtke, H.J. and Kessler, C. 1987. Applications of non-radioactive digoxigenin labeling and detection system. *Biotechniques* 9: 762-768.
- Mohamed, F.D., Murphy, N.B. and Gardiner, P.R. 1993. DNA fingerprinting of *Trypanosoma vivax* isolates rapidly identifies intraspecific relationships. *J. Euk. Microbiol.* 40(2): 132-134.

- Moritz, R.F.A., Hawkins, C.F., Crozier, R.H. and Mackinlay, A.G. 1986.
A mitochondrial DNA polymorphism in honey bees
(*Apis mellifera* L.) *Experientia* 42: 322-324.
- Nakamura, J., Wongsiri, S. and Sasaki, M. 1991. *Apis cerana* on
samui island and its beekeeping. *Honeybee Science*. 12(1): 27-30.
- Nunamaker, R.A., Wilson, W.T. and Ahmad, R. 1984. Malate dehydrogenase
and non-specific esterase isoenzymes of *Apis florea*, *A. dorsata*, and
A. cerana as detected by isoelectric focusing. *J. Kans. Entomol. Soc.*
57: 591-595.
- Oldroyd, B.P., Sheppard, W.S. and Stelzer, J.A. 1992. Genetic characterization
of the bees of Kangaroo Island, South Australia.
J. Apic. Res. 31(3/4): 141-148.
- Page, R.E. and Erickson, E.H. 1985. Identification and certification of
Africanized honey bees. *Ann. Entomol. Soc. Am.* 78: 149-158.
- _____. 1986. Kin recognition and virgin queen
acceptance by worker honey Bee (*Apis mellifera* L.). *Anim. Behav.*
34: 1061-1069.
- _____, Robinson, G.E. and Fondrk, M.K. 1989. Genetic specialists,
kin recognition and neotism in honey bee colonies. *Nature*
338: 576-579.

- Parkhill, J.M. 1982. Wonderful World of Bee Pollen. Serryville. Country Bazaar, Publishing Co.
- Planchetot, A. 1992. DNA fingerprinting analysis in the solitary bee megachile-roundata variability and nest mate genetic relationships. Genome 35(4): 681-688.
- Rinderer, T.E. 1986. Selection, In Bee Genetics and Breeding, ed. T.E. Rinderer. Orlando: Academic Press, 23-30 pp.
- _____. Stelzer, J.A., Oldroyd, B.P., Bucu, S.M. and Rubink, W.L. 1991. Hybridization between European and Africanized honey bees in the neotropical Yucatan Peninsula. Science 253: 309-311.
- _____. and Sylvester, H.A. 1981. Identification of Africanized bees Am. Bee J. 121: 512-516.
- Ruttner, F. 1986. Geographical variability and classification. In Bee Genetics and Breeding, ed. T.E.Rinderer. Orlando: Academic Press, 23-56 pp.
- _____. 1988. Biogeography and Taxonomy of Honeybees. Springer-Verlag. 120-161 pp.
- Seeley, T.D. 1985. Honeybee Ecology. New Jersey: Princeton University Press, 20-38 pp.
- Severson, D.W., Aiken, J.M. and March, R.F. 1988. Molecular analysis of North American and Africanized honey bees. In Africanized Honey bees and Bee mites. Chichester: Ellis Horwood Limited, 294-302 pp.

- Sheppard, W.S. and Berlocher, S.H. 1989. Allozyme variation and differentiation among four *Apis* species. *Apidologie* 20: 419-431.
- _____, and McPheron, B.A. 1986. Genetic variation in honey bees from an area of racial hybridization in western Czechoslovakia. *Apidologie* 17: 21-32.
- _____. 1993. Honey bee molecular systematics and DNA sequence data: A review of recent studies. In *Asian Apiculture*, ed. Connor, L.J., T. Rinderer, H.A. Sylvester and S. Wongsiri. Cheshire: Wicwas Press, 185-193 pp.
- _____, Rinderer, T.E., Mazzoli, J.A., Stelzer, J.A. and Shimanuki, H. 1991. Gene flow between African and European derived honey bee populations in Argentina. *Nature* 349: 782-784.
- Smith, D.R. 1988. Mitochondrial DNA polymorphisms in fire old world subspecies of honey bees and in new world hybrids, In *Africanized honey bees and bee mites*, eds. G.R. Needham, R.E. Page, J.M. Delfinado-Baker, and C.E. Bowman, Chichester: Ellis Horwood, 303-312 pp.
- _____. 1991. *Diversity in the genus Apis*. Boulder: Westview Press, Inc.
- _____. 1993. Mitochondrial DNA variation in *Apis* species and subspecies in *Asian Apiculture*, ed. Connor, L.J., T. Rinderer, H.A. Sylvester and S. Wongsiri. Cheshire: Wicwas Press, 173-183 pp.

- _____. and Brown, W.M. 1988. Polymorphisms in mitochondrial DNA of European and Africanized honey bees (*Apis mellifera*). *Experientia* 44: 257-260.
- _____. 1990. Restriction endonuclease cleavage site and length polymorphisms in mitochondrial DNA of *Apis mellifera mellifera* and *A. m. carnica* (Hymenoptero Apidae) *Ann. Entomol. Soc. Am.* 83: 81-88.
- _____, Palopoli, M.F., Taylor, B.R., Garnery, L., Cornuel, J.M. Solignae, M. and Brown, W.M. 1991. Geographical overlap of two mitochondrial genomes in Spanish honey bees (*Apis mellifera iberica*). *J. Hered* 82: 96-100.
- _____, Taylor, O.R. and Brown, W.M. 1989. Neotropical African bees have African mitochondrial DNA. *Nature* 339: 213-215.
- Svensson, B.1991. Bees and Trees. Swedish University of Agricultural Sciences International Rural Development Centre. Sweden, 7-11 pp.
- Sylvester, H.A. 1982. Electrophoretic identification of Africanized honey bees. *J. Apic. Res.* 21: 93-97.
- _____ and Wongsiri, S. 1993. DNA analysis of genetic variation in Asian honey bees in *Asian Apiculture*, ed. Connor, L.J., T. Rinderer, H.A. Sylvester and S. Wongsiri. Cheshire: Wicwas Press, 156-160 pp.

- Tanabe, Y. and Tamaki, T. 1985. Biochemical genetic studies on *Apis mellifera* and *Apis cerana* Proc. 30th International Beekeeping Congress. Nagoya, Japan. 152-154 pp.
- Tanskul, S. 1991. DNA restriction analysis of *Streptomyces* spp. by agarose gel electrophoresis. Master's Thesis, Chulalongkorn University.
- Tingek, S., Marden, M., Rinderer, T.E., Koeniger, N. and Koeniger, G. 1988. Rediscovery of *Apis vechti* (Maa, 1953): the saban honey bee. Apidologie 19(1): 97-102.
- Washio, K., Misawa, S. and Ueda, S. 1989. Individual identification of non-human primates using DNA fingerprinting. Primates 30: 217-212.
- Wilde, J.de and Beetsma, J. 1982. Advances insect physiology vol.1 London: Academic Press, Inc. 196 pp.
- Wongsiri, S., Lai, Y and Liu, Z. 1986. Beekeeping in the guangdong province of China and some observations on the Chinese honey bee *Apis cerana cerana* and the European honey bee *Apis mellifera ligustica*. Am. Bee. J. 126(11): 748-752.
- _____, Tangkanasing, P. and Sylvester, H.A. 1987. Mites, pests and beekin with *Apis cerana* and *Apis mellifera* in Thailand. Am. Bee. J. 127(7): 500-503.

_____, Limbipichai, K., Tangkanasing, P., Mardan, M.,
Rinderer, T.E., Sylvester, H.A., Koeniger, G. and Otis, G. 1990.
Evidence of reproductive isolation confirms *Apis andreniformis*
(Smith, 1858) is a separate species from sym-patic *Apis Florea*
(Fabricius, 1787). *Apidologie* 21: 47-52.

Zyskind, J.W. and Bernstein, S.I. 1992. Recombinant DNA Laboratory
Manual. San Diego. Acardemic Press, Inc., 224 pp.



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Appendix 1 Collection of *Apis cerana* from the Northern of Thailand

Number of Colony	Date of Collection	Sampling Area
N ₁	03/11/92	Hang Dong - Chiang Mai
N ₂	03/11/92	Hang Dong - Chiang Mai
N ₃	02/11/92	Chom Thong - Chiang Mai
N ₄	01/11/92	Chom Thong - Chiang Mai
N ₅	22/11/93	Muang Chiang Mai
N ₆	07/02/93	Muang Lamphun
N ₇	03/11/92	Ko Kha - Lampang
N ₈	04/02/93	Muang Lampang
N ₉	08/02/93	Ban Khok - Uttaradit
N ₁₀	08/02/93	Luplae - Uttaradit
N ₁₁	22/01/93	Muang Uttaradit
N ₁₂	08/02/93	Fak Tha - Uttaradit
N ₁₃	08/02/93	Si Satchanalai - Sukhothai
N ₁₄	23/01/93	Bang Rakam - Phitsanulok
N ₁₅	23/01/93	Bang Rakam - Phitsanulok
N ₁₆	23/01/93	Bang Rakam - Phitsanulok
N ₁₇	09/02/93	Muang Phitsanulok
N ₁₈	18/04/93	Wang Chin - Phrae
N ₁₉	18/04/93	Wang Chin - Phrae
N ₂₀	18/04/93	Wang Chin - Phrae
N ₂₁	19/04/93	Muang Tak
N ₂₂	19/04/93	Muang Tak

Appendix 2 Collection of *Apis cerana* from the North-Eastern of Thailand

Number of Colony	Date of Collection	Sampling Area
E ₁	14/03/93	Nong Bunnak - Nakohn Ratchasima
E ₂	14/03/93	Nong Bunnak - Nakohn Ratchasima
E ₃	14/03/93	Nong Bunnak - Nakohn Ratchasima
E ₄	14/03/93	Prakhonchai - Buriram
E ₅	15/05/93	Prasat - Surin
E ₆	15/05/93	Chomphra - Surin
E ₇	15/05/93	Muang Surin
E ₈	15/05/93	Rattanaburi - Surin
E ₉	15/05/93	Muang Sisaket
E ₁₀	16/05/93	Warin Chamrap - Ubon Ratchathani
E ₁₁	16/05/93	Khuang Nai - Ubon Ratchathani
E ₁₂	16/05/93	Sai Mun - Yasothon
E ₁₄	17/05/93	Muang Kalasin
E ₁₅	17/05/93	Sahasakhan - Kalasin
E ₁₆	18/05/93	Muang Khon Kaen
E ₁₇	18/05/93	Pho Chai - Nong Bua Lam Phu
E ₁₈	19/05/93	Kranuan - Khon Kaen
E ₁₉	19/05/93	Kranuan - Khon Kaen
E ₂₀	19/05/93	Akat Amnuai - Sakon Nakhon
E ₂₁	19/05/93	Akat Amnuai - Sakon Nakhon

Appendix 3 Collection of *Apis cerana* from the Central part of Thailand

Number of Colony	Date of Collection	Sampling Area
C ₁	10/02/93	Muang Samut Songkhram
C ₂	10/02/93	Muang Samut Songkhram
C ₃	10/02/93	Muang Samut Songkhram
C ₄	10/02/93	Muang Samut Songkhram
C ₅	23/11/92	Kleang - Rayong
C ₆	23/11/93	Kleang - Rayong
C ₇	23/11/93	Kleang - Rayong
C ₈	23/11/93	Kleang - Rayong
C ₉	23/11/93	Kleang - Rayong
C ₁₀	23/11/93	Kleang - Rayong
C ₁₁	01/03/93	Tha Mai - Chanthaburi
C ₁₂	08/03/93	Pong Nam Ron - Chanthaburi
C ₁₃	24/03/93	Ban Bung - Chon Buri
C ₁₄	24/03/93	Muang Chachoengsao
C ₁₅	17/05/93	Lat Lum Kaeo - Pathum Thani
C ₁₆	17/05/93	Sam Khok - Pathum Thani
C ₁₇	18/05/93	Muang Suphan Buri
C ₁₈	18/05/93	Muang Suphan Buri
C ₁₉	18/05/93	Muang Suphan Buri
C ₂₀	18/05/93	Kamphaeng Saen - Nakhon Pathom
C ₂₁	18/05/93	Nakhon Chaisi - Nakhon Pathom

Appendix 4 Collection of *Apis cerana* from the Southern of Thailand

Number of Colony	Date of Collection	Sampling Area
S ₁	21/10/92	Thap Sakae - Prachuap Khiri Khan
S ₂	21/10/92	Thap Sakae - Prachuap Khiri Khan
S ₃	21/10/92	Thap Sakae - Prachuap Khiri Khan
S ₄	21/10/92	Thap Sakae - Prachuap Khiri Khan
S ₅	21/10/92	Thap Sakae - Prachuap Khiri Khan
S ₆	22/10/92	Sawi - Chum Phon
S ₇	22/10/92	Sawi - Chum Phon
S ₈	22/10/92	Sawi - Chum Phon
S ₉	22/10/92	Sawi - Chum Phon
S ₁₀	22/10/92	Sawi - Chum Phon
S ₁₁	03/06/93	Khuan Niang - Songkhla
S ₁₂	03/06/93	Khuan Niang - Songkhla
S ₁₃	03/06/93	Khuan Niang - Songkhla
S ₁₄	03/06/93	Na Thawi - Songkhla
S ₁₅	03/06/93	Na Thawi - Songkhla
S ₁₆	03/06/93	Na Thawi - Songkhla
S ₁₇	04/06/93	Thung Wa - Satun
S ₁₈	04/06/93	Thung Wa - Satun
S ₁₉	04/06/93	Thung Wa - Satun
S ₂₀	04/06/93	Palian - Trang
S ₂₁	04/06/93	Palian - Trang

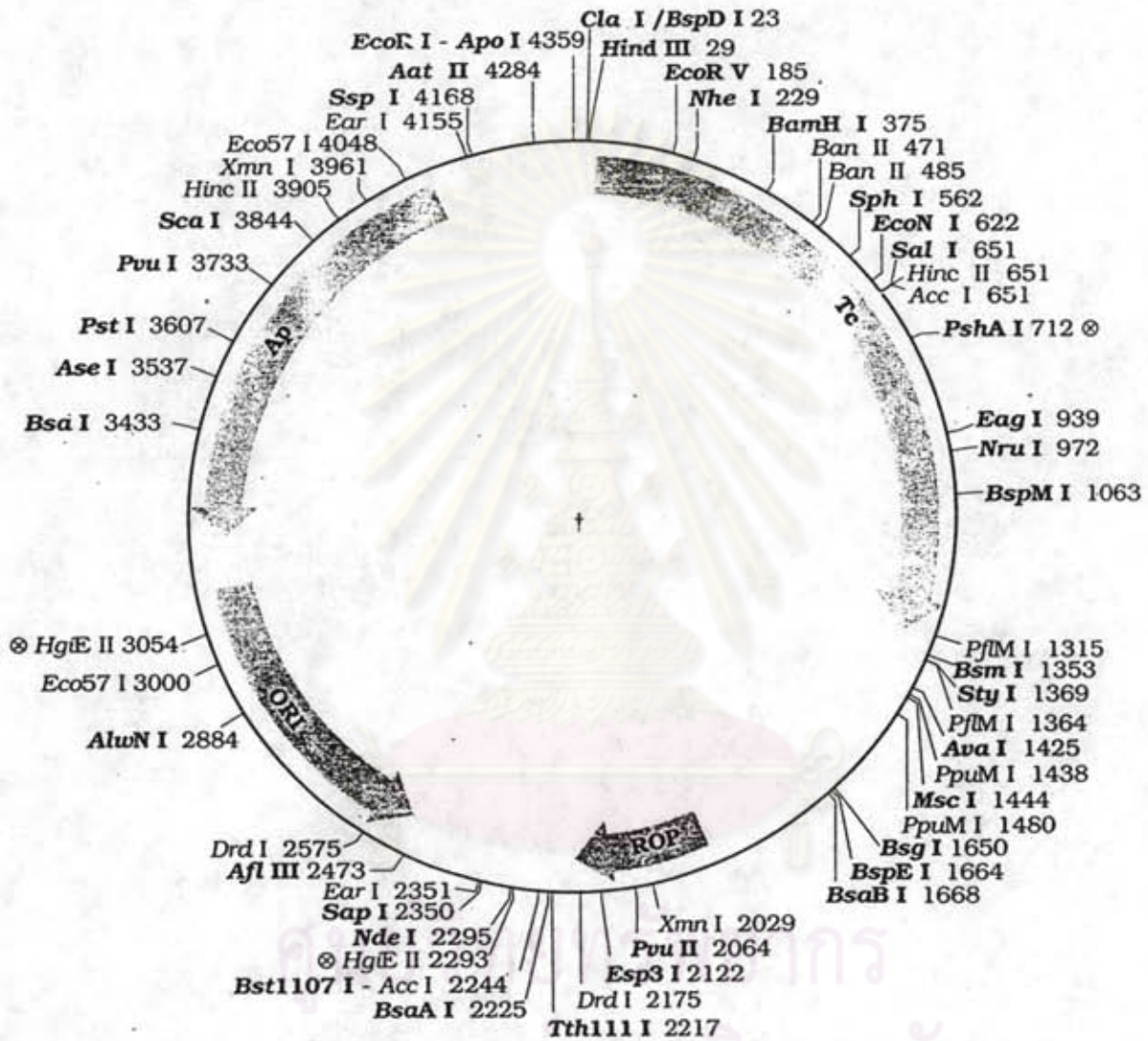
Appendix 5 Collection of *Apis cerana* from the Samui island of Thailand

Number of Colony	Date of Collection	Sampling Area
I ₁	23/10/92	Tham Bon Maret
I ₂	23/10/92	Tham Bon Maret
I ₃	23/10/92	Tham Bon Maret
I ₄	23/10/92	Tham Bon Maret
I ₅	23/10/92	Tham Bon Maret
I ₆	23/10/92	Tham Bon Maret
I ₇	23/10/92	Tham Bon Maret
I ₈	23/10/92	Tham Bon Maret
I ₉	23/10/92	Tham Bon Maret
I ₁₀	23/10/92	Tham Bon Maret
I ₁₁	23/10/92	Tham Bon Maret
I ₁₂	23/10/92	Tham Bon Maret
I ₁₃	15/10/92	Tham Bon Taling Ngam
I ₁₄	15/10/92	Tham Bon Taling Ngam
I ₁₅	15/10/92	Tham Bon Taling Ngam
I ₁₆	15/10/92	Tham Bon Taling Ngam
I ₁₇	16/10/92	Tham Bon Limpanoi
I ₁₈	16/10/92	Tham Bon Taling Ngam
I ₁₉	16/10/92	Tham Bon Taling Ngam
I ₂₀	16/10/92	Tham Bon Taling Ngam
I ₂₁	16/10/92	Tham Bon Taling Ngam
I ₂₂	16/10/92	Tham Bon Taling Ngam

Appendix 5 (continue)

Number of Colony	Date of Collection	Sampling Area
I ₂₃	16/10/92	Tham Bon Taling Ngam
I ₂₄	16/10/92	Tham Bon Maret - Samui island
I ₂₅	16/10/92	Tham Bon Maret - Samui island
I ₂₆	16/10/92	Tham Bon Maret - Samui island
I ₂₇	16/10/92	Tham Bon Maret - Samui island

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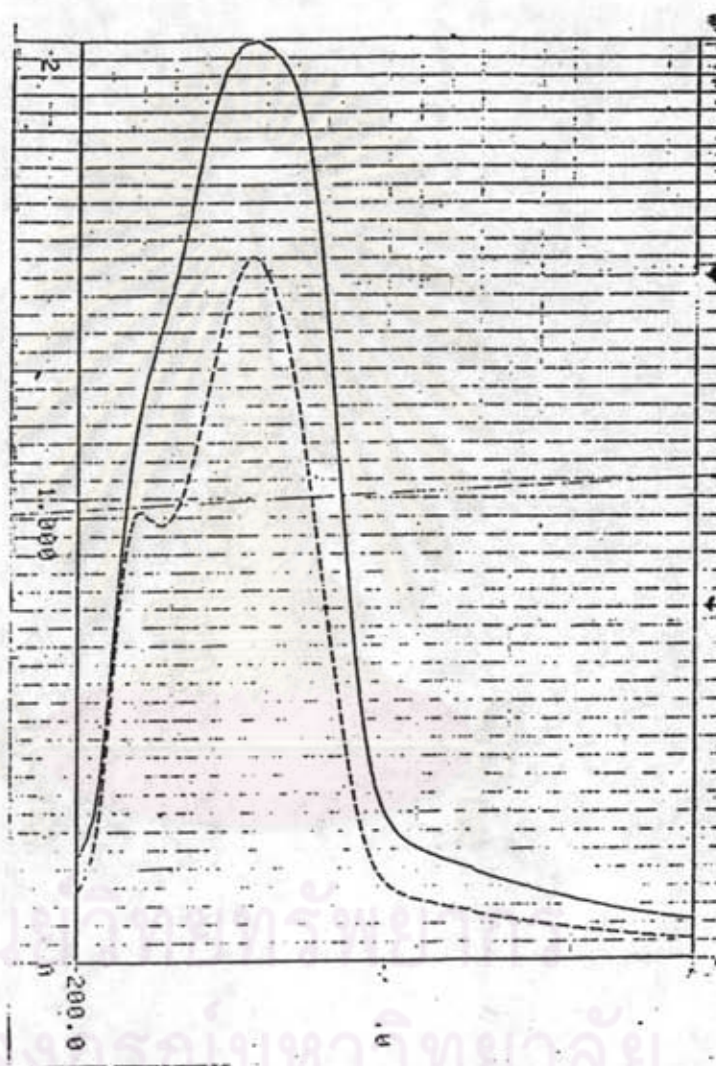


Appendix 6 Restriction map of pBR322 shows the restriction sites of these enzymes, the position of the ampicillin resistance gene (A_p) and tetracycline resistance gene (T_c). Size of the plasmid are 4,361 base pairs.

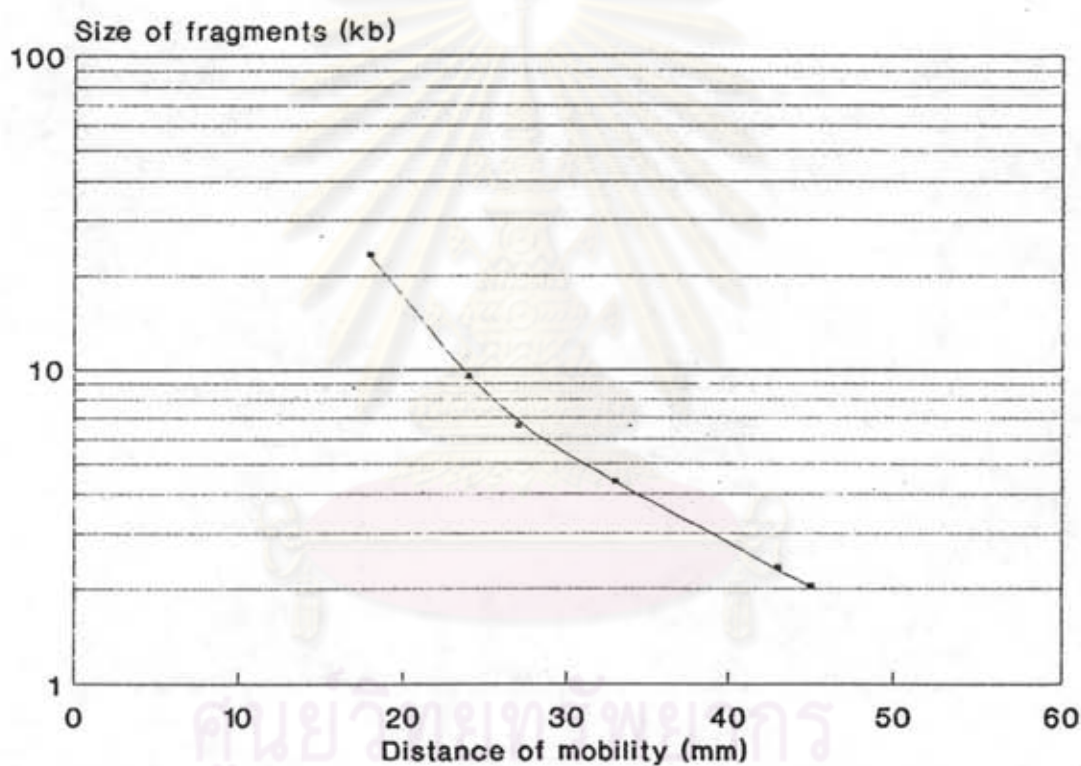
Appendix 7 Luria - Bertani (LB) medium (Maniatis *et al.*, 1982)

Tryptone	10 g
Yeast extract	5 g
Sodium chloride	10 g
Distilled water to	1 l
adjust pH to 7.4 with NaOH	
Agar	15 g per l (for LB-Agar medium)

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Appendix 8 The absorption spectrum of purified *A. cerena* DNA prepared from total DNA extraction (.....) and nuclear DNA extraction (—), measured from 200 to 400 nm.



Appendix 9 Standard curve of mobility versus log molecular weight of λ phage DNA *Hind*III fragments. Electrophoresis was performed on 0.7% agarose at 80 V for 3 hours.

Appendix 10 Buffer for Restriction endonuclease digestion

Buffer	NaCl	KCl	Tris-HCl	Tris-HCl	MgCl ₂	DTT
			pH 7.5	pH 8.0		
Low	0 mM	-	10 mM	-	10 mM	1 mM
Medium	50 mM	-	10 mM	-	10 mM	1 mM
High	100 mM	-	50 mM	-	10 mM	1 mM
Specific	-	50	-	-	10 mM	1 mM

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Appendix 11 The restriction pattern classification of *A. cerana* total DNA from the Northern digested with different restriction endonucleases

The Northern sample	<i>Bgl</i> III	<i>Cal</i> I	<i>Eco</i> RI	<i>Hae</i> III	<i>Nde</i> I
N ₁	B1	C1	E1	H1	N1
N ₂	B1	C1	E1	H1	N1
N ₃	B1	C1	E1	H2	N1
N ₄	B1	C1	E1	H1	N1
N ₅	B1	C1	E1	H1	N1
N ₆	B1	C1	E2	H2	N1
N ₇	B1	C1	E3	-	N1
N ₈	B1	C1	E1	H2	N1
N ₉	B1	C1	E1	H2	N1
N ₁₀	B1	C1	E1	H2	N1
N ₁₁	B1	C1	E1	H2	N1
N ₁₂	B1	C1	-	H2	N1
N ₁₃	B1	C1	E1	H2	N1
N ₁₄	B1	C1	E1	H2	N1
N ₁₅	B1	C1	E1	-	N1
N ₁₆	B1	C1	E1	H1	N1
N ₁₇	B1	C1	E1	H1	N1
N ₁₈	B1	C1	E1	H2	N1
N ₁₉	B1	C1	E1	H1	N1
N ₂₀	B1	C1	-	H1	N1
N ₂₁	B1	C1	E1	H2	N1
N ₂₂	B1	C1	E1	H2	N1

Appendix 12 The restriction pattern classification of *A. cerana* total DNA from the North-Eastern digested with different restriction endonucleases

The North-Eastern sample	<i>Bgl</i> III	<i>Cal</i> I	<i>Eco</i> RI	<i>Hae</i> III	<i>Nde</i> I
E ₁	B1	C1	E1	H2	N1
E ₂	B1	C1	E1	H2	N1
E ₃	B1	C1	E1	H2	N1
E ₄	B1	C1	E1	H2	N1
E ₅	B1	C1	E1	H2	N1
E ₆	B1	C1	E1	H1	N1
E ₇	B1	C1	E1	H1	N1
E ₈	B1	C1	E1	H2	N1
E ₉	B1	C1	E1	H2	N1
E ₁₀	B1	C1	E1	H2	N1
E ₁₁	B1	C1	E1	H2	N1
E ₁₂	B1	C1	E1	H1	N1
E ₁₃	B1	C1	E1	-	N1
E ₁₄	B1	C1	E1	H2	N1
E ₁₅	B1	C1	E1	H2	N1
E ₁₆	B1	C1	E1	H1	N1
E ₁₇	B1	C1	E1	H2	N1
E ₁₈	B1	C1	E1	H2	N1
E ₁₉	B1	C1	E1	-	N1
E ₂₀	B1	C1	E1	-	N1
E ₂₁	B1	C1	E1	H2	N1

Appendix 13 The restriction pattern classification of *A. cerana* total DNA from the Central part digested with different restriction endonucleases

The Central part sample	<i>Bgl</i> II	<i>Cal</i> I	<i>Eco</i> RI	<i>Hae</i> III	<i>Nde</i> I
C ₁	B1	C1	E1	H1	N1
C ₂	B1	C1	E1	H1	N1
C ₃	B1	C1	E1	H1	N1
C ₄	B1	C1	E1	H1	N1
C ₅	B1	C1	E1	H1	N1
C ₆	B1	C1	E1	H1	N1
C ₇	B1	C1	E1	H1	N1
C ₈	B1	C1	E1	H1	N1
C ₉	B1	C1	E1	H1	N1
C ₁₀	B1	C1	E1	H1	N1
C ₁₁	B1	C1	E1	H1	N1
C ₁₂	B1	C1	E1	H1	N1
C ₁₃	B1	C1	E1	H1	N1
C ₁₄	B1	C1	E1	H1	N1
C ₁₅	B1	C1	E1	H1	N1
C ₁₆	B1	C1	E1	H1	N1
C ₁₇	B1	C1	E1	H1	N1
C ₁₈	B1	C1	E1	H1	N1
C ₁₉	B1	C1	E1	H1	N1
C ₂₀	B1	C1	E1	H1	N1
C ₂₁	B1	C1	E1	H1	N1
C ₂₂	B1	C1	E1	H1	N1

Appendix 14 The restriction pattern classification of *A. cerana* total DNA from the Southern digested with different restriction endonucleases

The Southern sample	<i>Bgl</i> III	<i>Ca</i> II	<i>Eco</i> RI	<i>Hae</i> III	<i>Nde</i> I
S ₁	B1	C1	E1	H2	N1
S ₂	B1	C2	E1	H2	N1
S ₃	B1	C2	E1	H2	N1
S ₄	B1	C1	E1	H2	N1
S ₅	B1	C2	E1	H2	N1
S ₆	B1	C2	E1	H1	N1
S ₇	B1	C2	E1	H1	-
S ₈	B1	C2	E1	H1	N2
S ₉	B1	C1	E1	H1	-
S ₁₀	B1	C1	E4	H1	N2
S ₁₁	B1	C2	E1	H1	N2
S ₁₂	B1	C1	E4	H1	-
S ₁₃	B1	C1	E4	H1	N2
S ₁₄	B1	C1	E1	H1	N2
S ₁₅	B1	C1	E1	H1	N2
S ₁₆	B1	C1	E1	H2	N2
S ₁₇	B1	C2	E4	H1	N2
S ₁₈	B1	-	E1	H2	N2
S ₁₉	B1	C2	E1	H1	N2
S ₂₀	B1	C2	E1	H1	N2

Appendix 15 DNA from the Samui Island digested with different restriction endonucleases

The Samui Island sample	<i>BglII</i>	<i>CalI</i>	<i>EcoRI</i>	<i>HaeIII</i>	<i>NdeI</i>
I ₁	B1	C1	E1	H3	N2
I ₂	B1	C1	E1	-	N2
I ₃	B1	C1	E1	H3	N1
I ₄	B2	C1	E2	H1	-
I ₅	-	C1	-	-	-
I ₆	-	C1	E1	H3	N2
I ₇	-	C1	E1	H3	N2
I ₈	B2	C1	-	H1	N1
I ₉	B2	C1	-	H1	N1
I ₁₀	B1	C1	-	H3	-
I ₁₁	-	C1	E2	H1	-
I ₁₂	B2	C1	E2	H1	N1
I ₁₃	B2	C1	E2	H1	N1
I ₁₄	B1	C1	E1	H3	-
I ₁₅	B2	C1	E2	H1	N1
I ₁₆	B1	C1	E1	H1	N2
I ₁₇	B1	C1	E1	H3	N2
I ₁₈	-	C1	E1	H3	N2
I ₁₉	B2	C1	E1	H3	N1
I ₂₀	B2	C1	E1	H1	N1
I ₂₁	B2	C1	E5	H1	N1
I ₂₂	B1	C1	E1	H3	N2
I ₂₃	B1	C1	E5	-	N2

Appendix 15 (Continue)

The Samui Island sample	<i>Bgl</i> II	<i>Ca</i> II	<i>Eco</i> RI	<i>Hae</i> III	<i>Nde</i> I
I ₂₄	B1	C1	E1	H3	N2
I ₂₅	B2	C1	E5	H1	N1
I ₂₆	B1	C1	E5	H1	N1
I ₂₇	B1	C1	E5	H3	N2



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