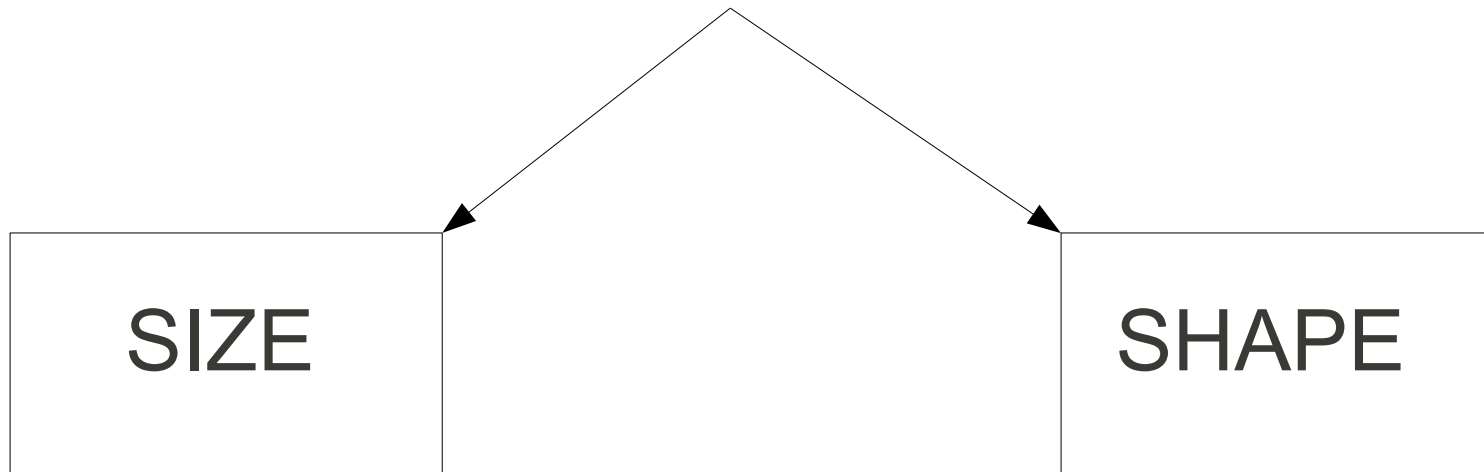


MORPHOMETRIC SHIFTS
DETECTED ACROSS GEOGRAPHY
in *Aedes albopictus* and *Ae. aegypti*

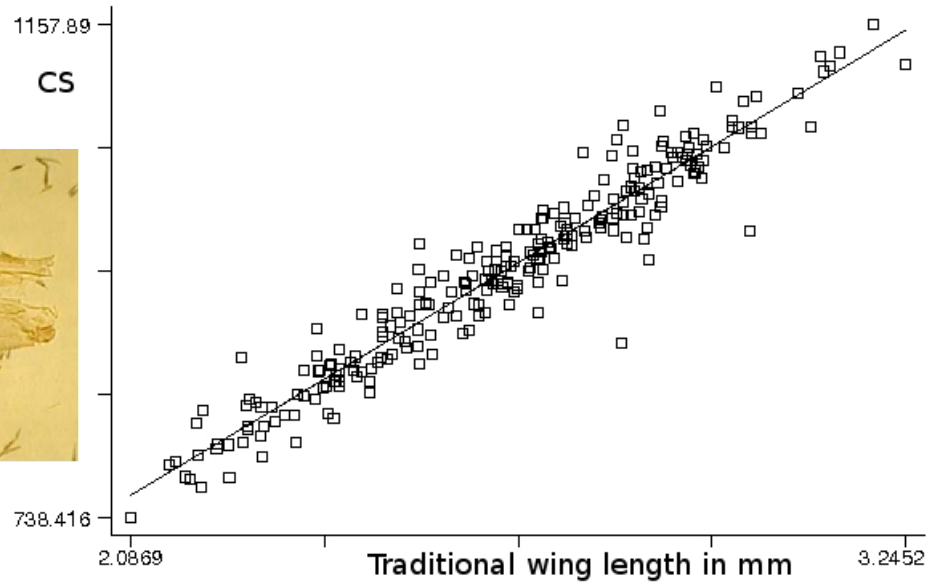
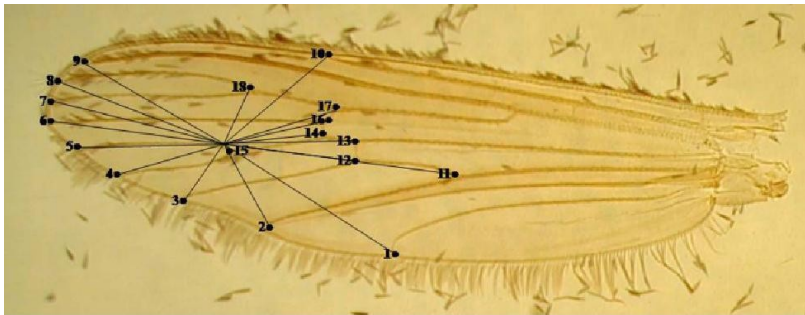
Jean-Pierre Dujardin, Ronald Morales-Vargas,
Amy B. Henry, Nuananong Jirakanjanakit,
Frederic Simard
and Chamnarn Apiwhatnasorn.

Modern MORPHOMETRICS

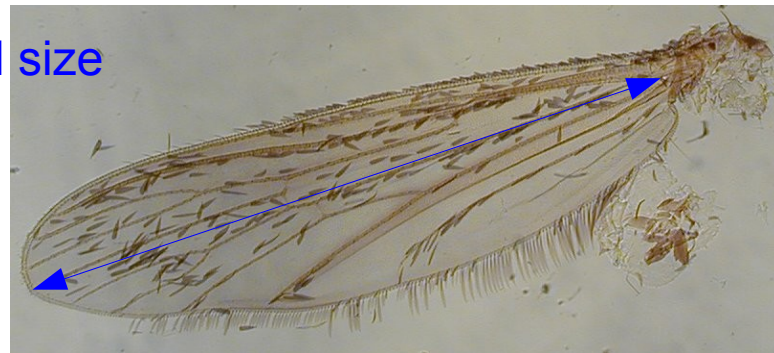


SIZE

Centroid size (CS)



Traditional size



Size matters ...

**HIGHER
BLOOD-FEEDING
FREQUENCY**

**LONGER
SURVIVAL**

**HIGHER
FECUNDITY**

Anopheles

1. Lyimo & Takken, 1993	+	+	+
2. Takken et al., 1998	+	+	+
3. Manoukis et al., 2006.	+	+	+

Aedes

1. Nasci, 1986	+	+	+
2. Packer & Corbet, 1989	+	+	+
3. Lounibos et al., 1990	+	+	+
4. Xue et al., 1995	+	+	+
5. Blackmore & Lord, 2000	+	+	+
6. Briegel & Timmermann, 2001	+	+	+
7. Lounibos et al., 2002	+	+	+
1. Maciel de Freitas et al., 2007	-	-	/
2. Leisnham et al., 2008	-	-	/

Larger insects are better vectors ...

1. Nasci 1986
2. Sumanochitraponet al., 1998

Larger insects are better vectors ...

1. Nasci 1986
2. Sumanochitraponet al., 1998

Smaller insects are better vectors ...

1. Nasci & Mitchell, 1994
2. Xue et al., 1995b
2. Scott et al., 2000
3. Maciel de Freitas et al., 2007

Larger insects are better vectors ...

1. Nasci 1986
2. Sumanochitraponet al., 1998

Smaller insects are better vectors ...

1. Nasci & Mitchell, 1994
2. Xue et al., 1995b
2. Scott et al., 2000
3. Maciel de Freitas et al., 2007

No relationship with size

1. Bosio et al., 1998;
2. Schneider et al., 2007

What is affecting size ?

A. Larval habitat quality

1. Nasci & Mitchell, 1994
2. Strickman & Kittayapong, 2003
3. Schneider et al., 2004
4. Schneider et al., 2007
5. Jirakanjanakit et al., 2007

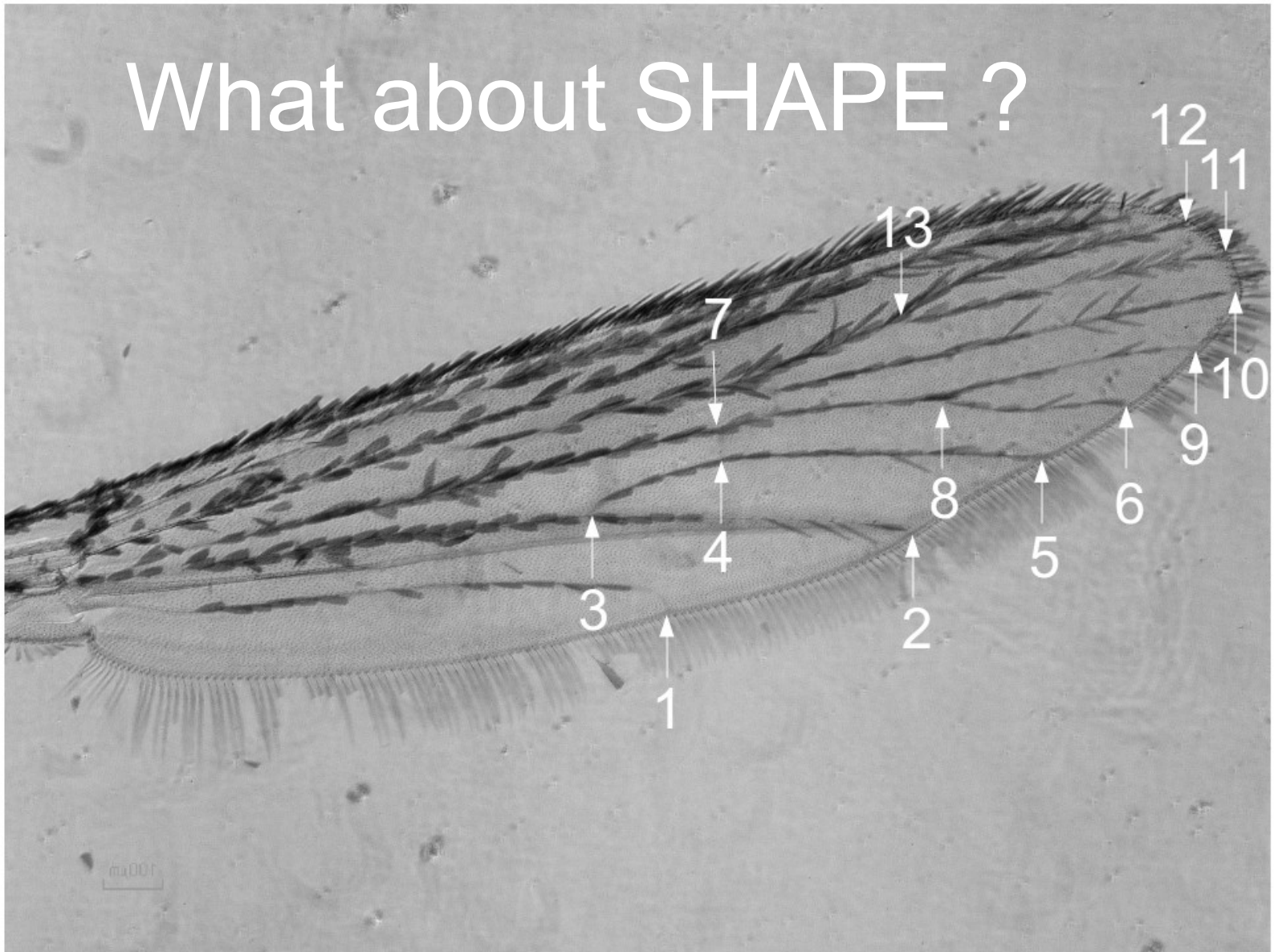
B. Larval competition

1. Renshaw et al., 1994
2. Gimnig et al., 2002
3. Jirakanjanakit et al., 2007

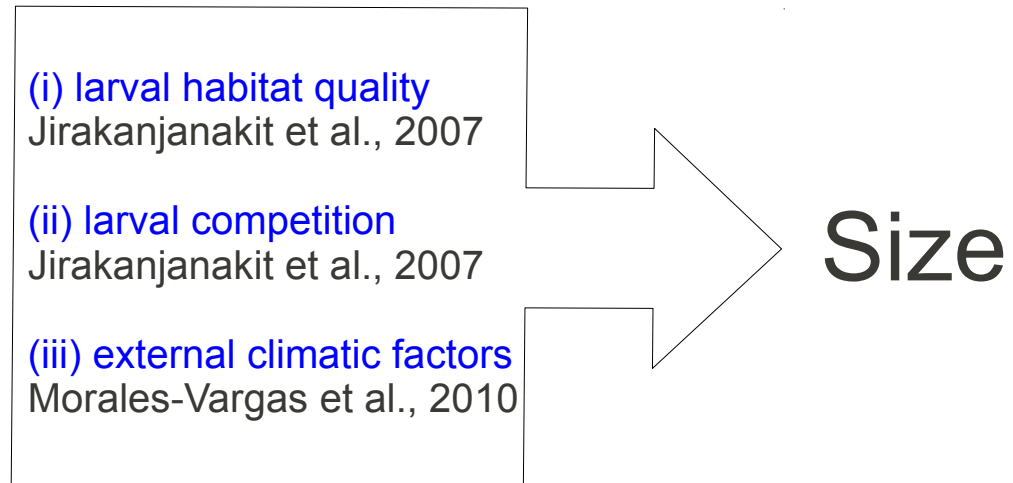
C. External climatic factors

1. Tsuda & Takagi, 2001
2. Morales-Vargas et al., 2010

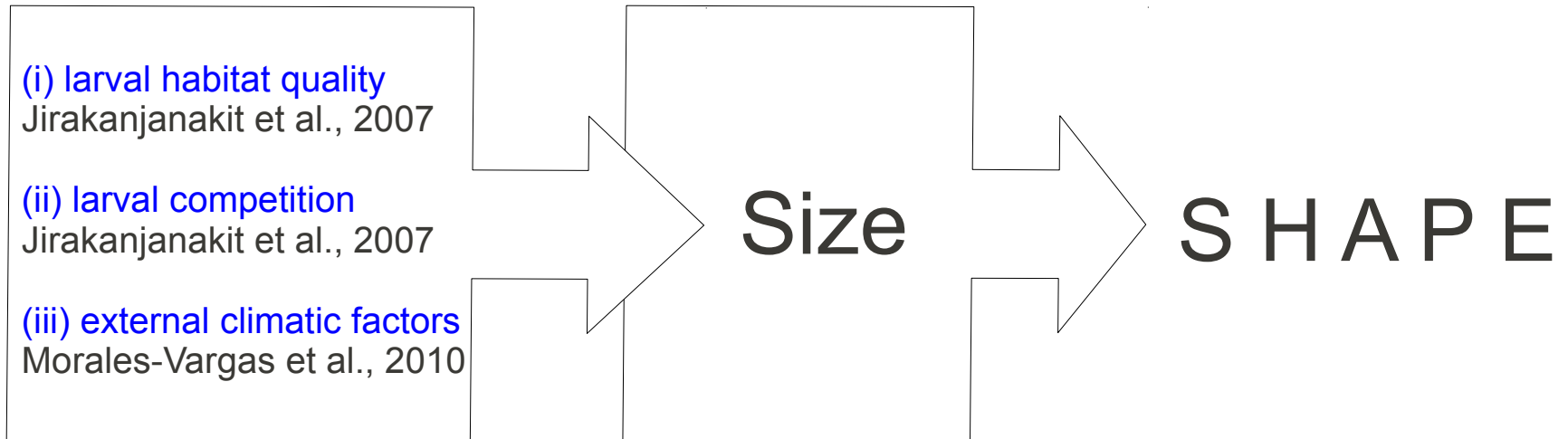
What about SHAPE ?



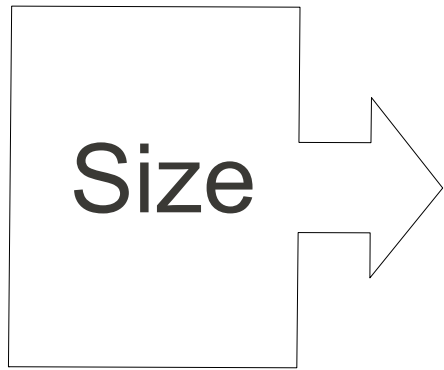
What is affecting shape ?



Allometry

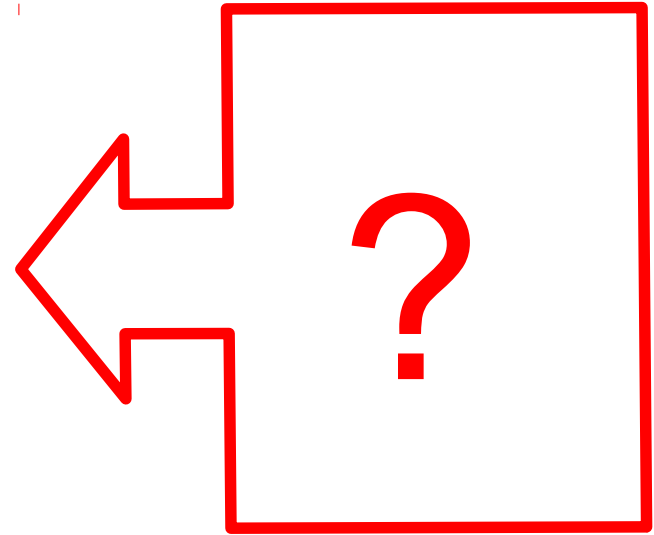


Allometric effects

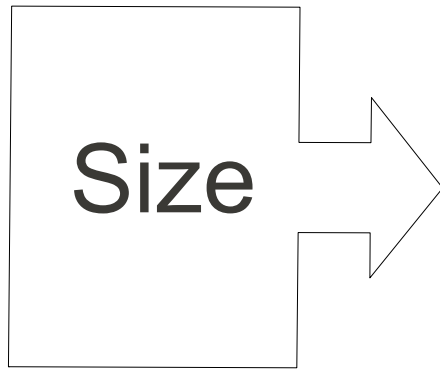


S H A P E

Non-allometric effects

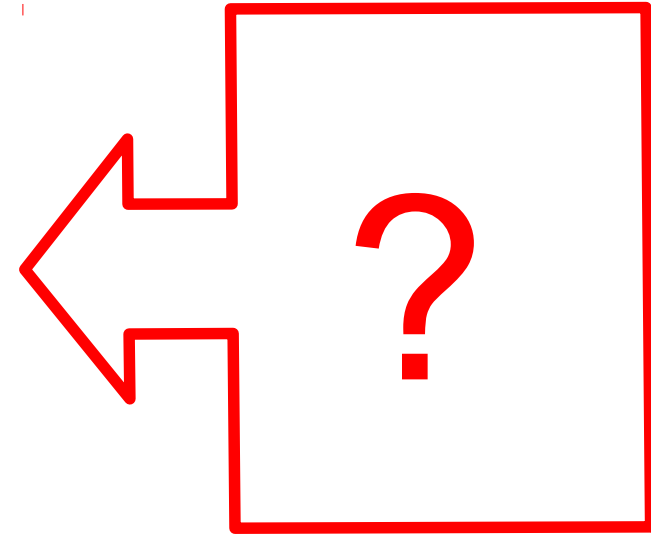


Allometric effects



S H A P E

Non-allometric effects



Chromosome polymorphism

Bitner-Mathe and Klaczko, 1999
Orengo and Prevosti, 2002
Hatadani and Klaczko, 2008

QTL for shape

Klingenberg et al., 2001
Workman et al., 2002
Klingenberg et al., 2004

polygenic inheritance

Shrimpton and Robertson, 1988
Long et al., 1995
Iriarte et al., 2003
Breuker et al., 2006
Patterson and Klingenberg, 2007

Shape and genealogy

N. Jirakanjanakit et al. / Infection, Genetics and Evolution 8 (2008) 414–421

4

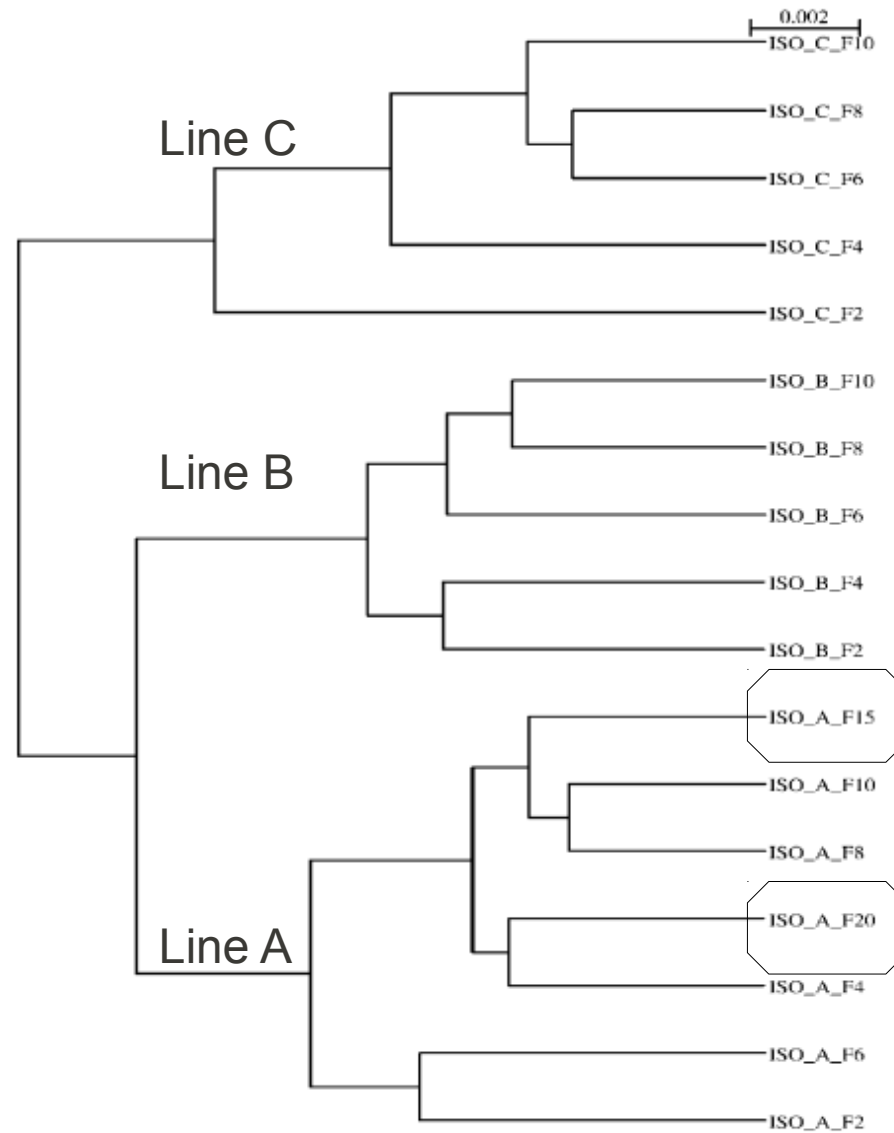
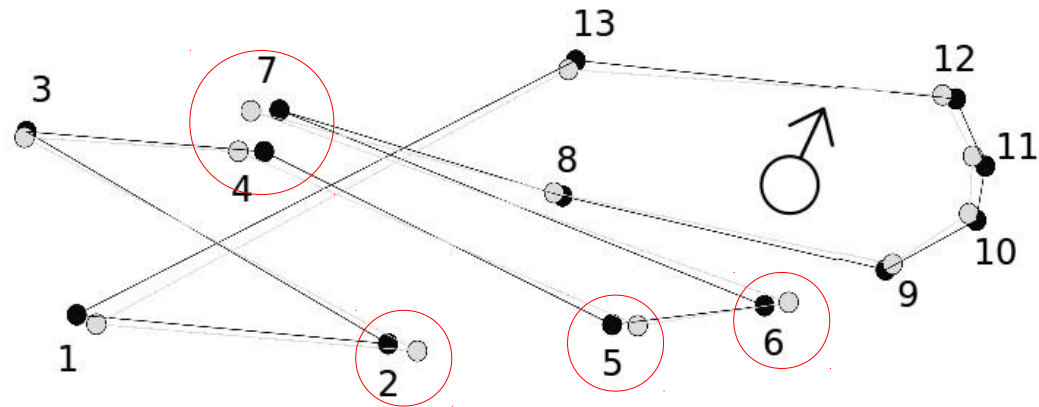
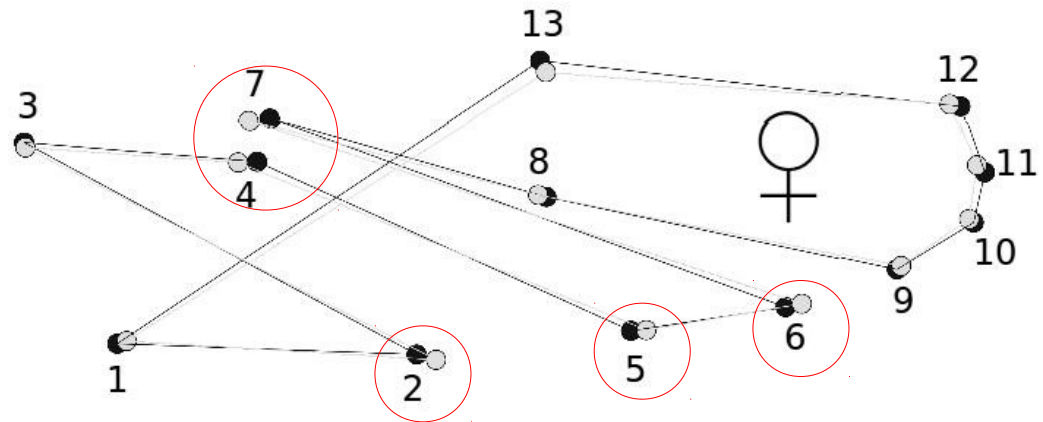


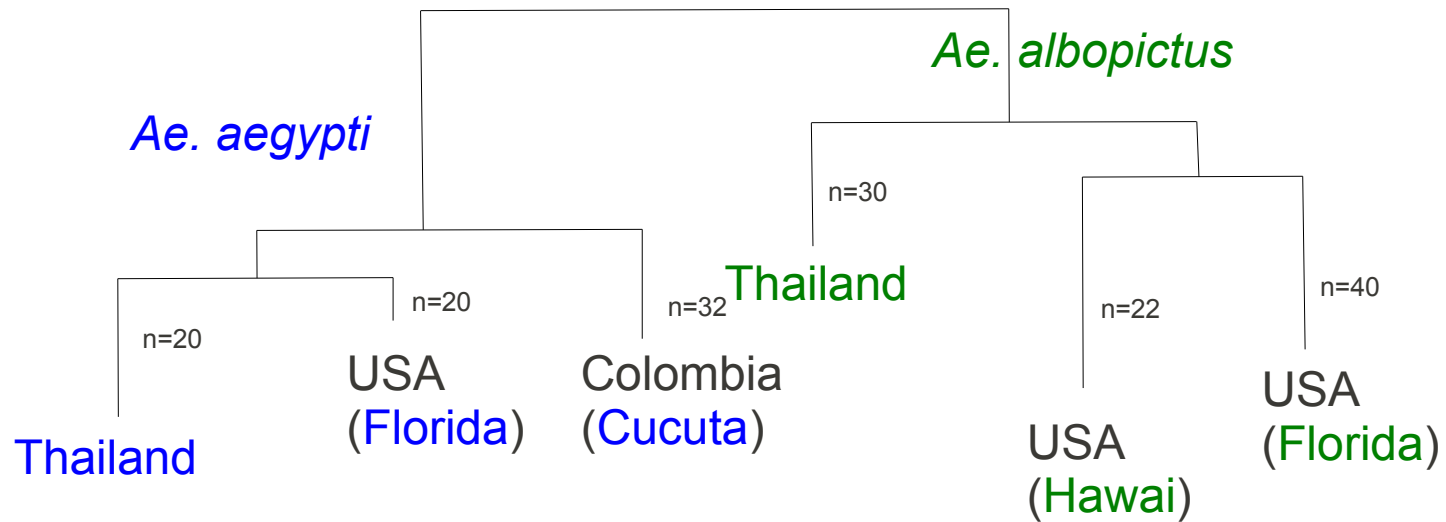
Fig. 3. UPGMA tree of female *Ae. aegypti* at different generations of isofemale lines A, B and C based on Euclidian distances between mean shapes.

Shape and systematics



● *aegypti* ○ *albopictus*





Infection, Genetics and Evolution 10 (2010) 207–214



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Wing shape of dengue vectors from around the world.

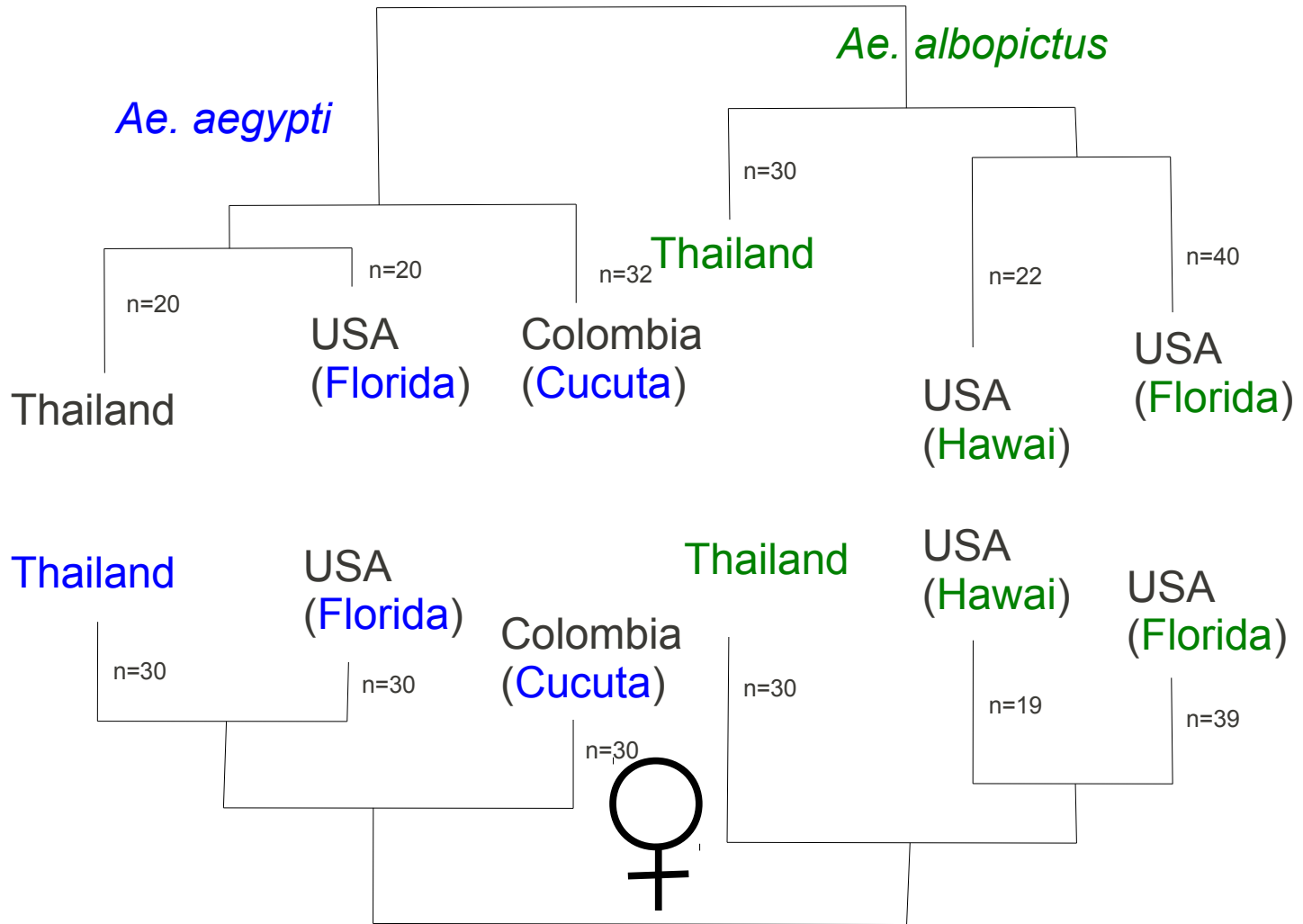
A. Henry^{a,b}, P. Thongsripong^{a,b}, I. Fonseca-Gonzalez^c, N. Jaramillo-Ocampo^c, Jean-Pierre Dujardin^{a,d,*}

^aCenter of Excellence for Vectors and Vector-borne Diseases (CVVD), Faculty of Sciences, University of Mahidol, Thailand

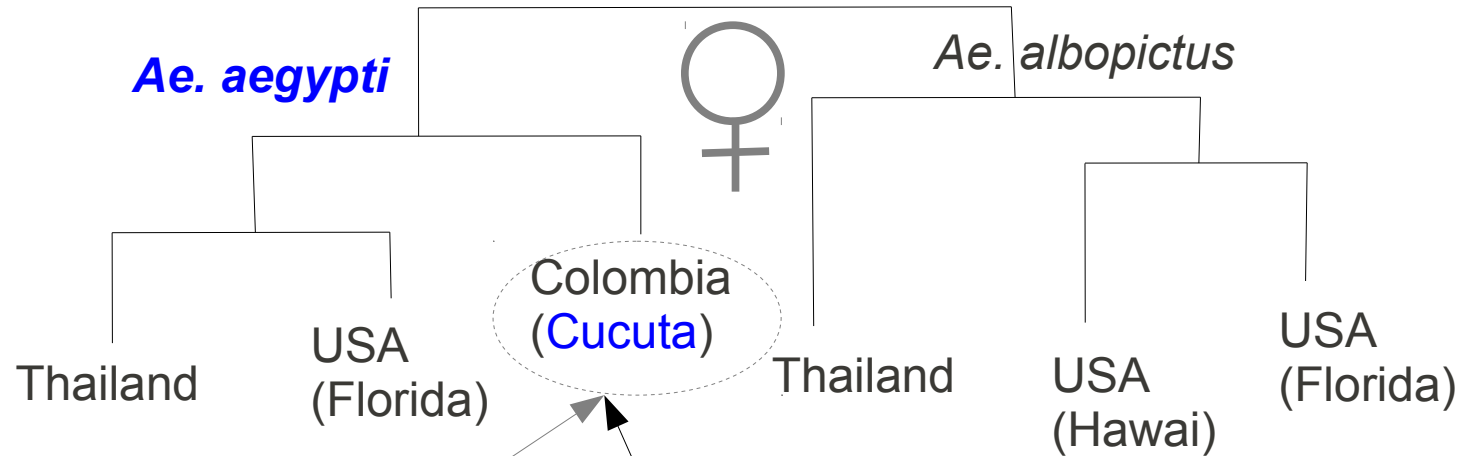
^bAsia-Pacific Institute of Tropical Medicine and Infectious Diseases, University of Hawaii at Manoa, Honolulu, United States

^cGrupo Chagas, Instituto de Biología, Universidad de Antioquia, AA 1226 Medellín, Colombia

^dUMR IRD-CNRS 2724, Agropolis, 911, BP 64501, 34394, Montpellier, France



Geographic structuring or migration history?



Gubler, D.J., 1997
Lourenco-de-Oliveira, R., Vazeille, M., de Filippis, A.M.B., Failloux,
A.B., 2004.

Groot, H., 1980. The **reinvansion of colombia by *Aedes aegypti***:
aspects to remember. *American Journal of Tropical Medicine
and Hygyene* 29 (3), 330.

Aedes aegypti

Aedes aegypti



Africa ?

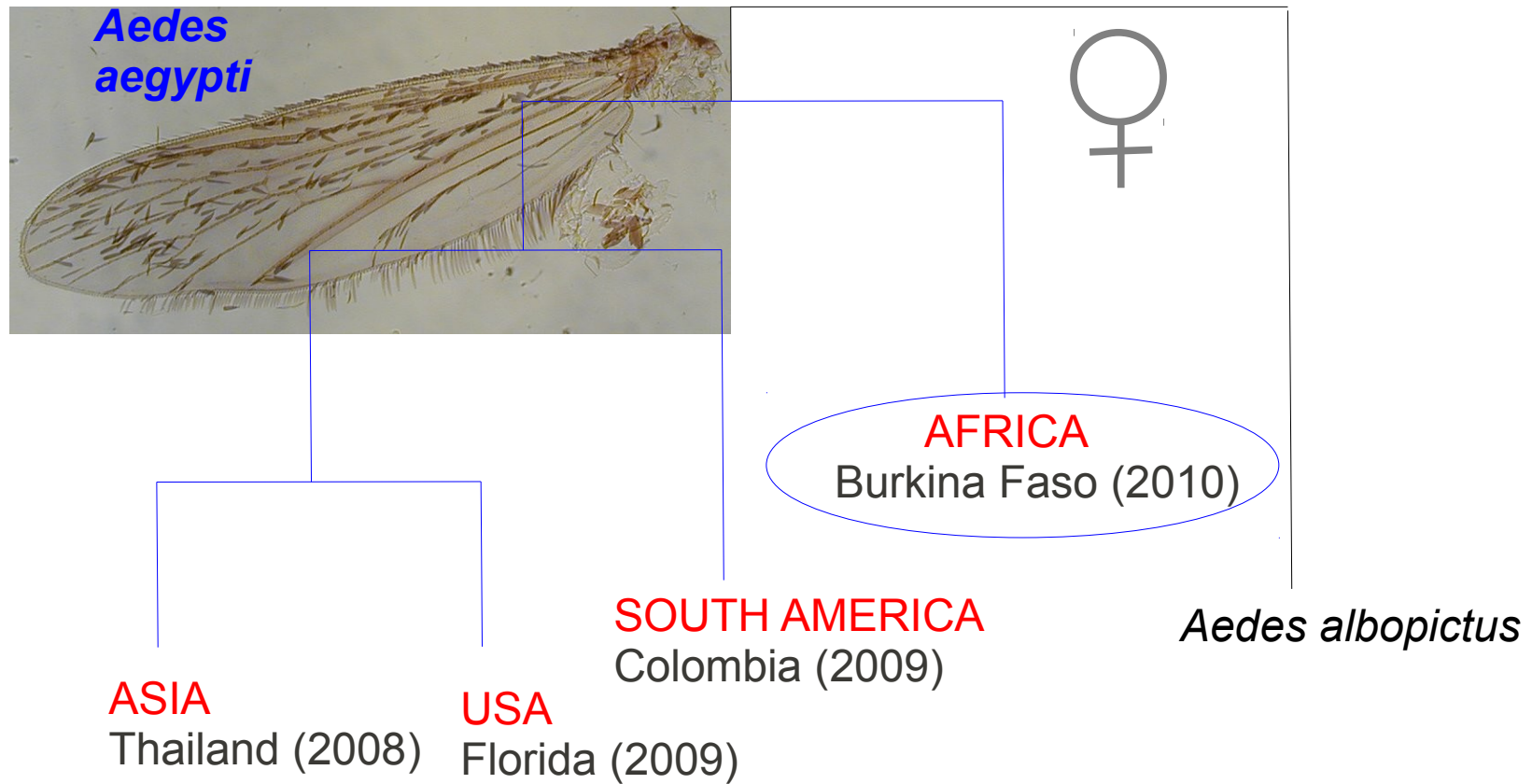
ASIA
Thailand
(2008)

USA
Florida
(2009)

SOUTH AMERICA
Colombia
(Cucuta, 2009)

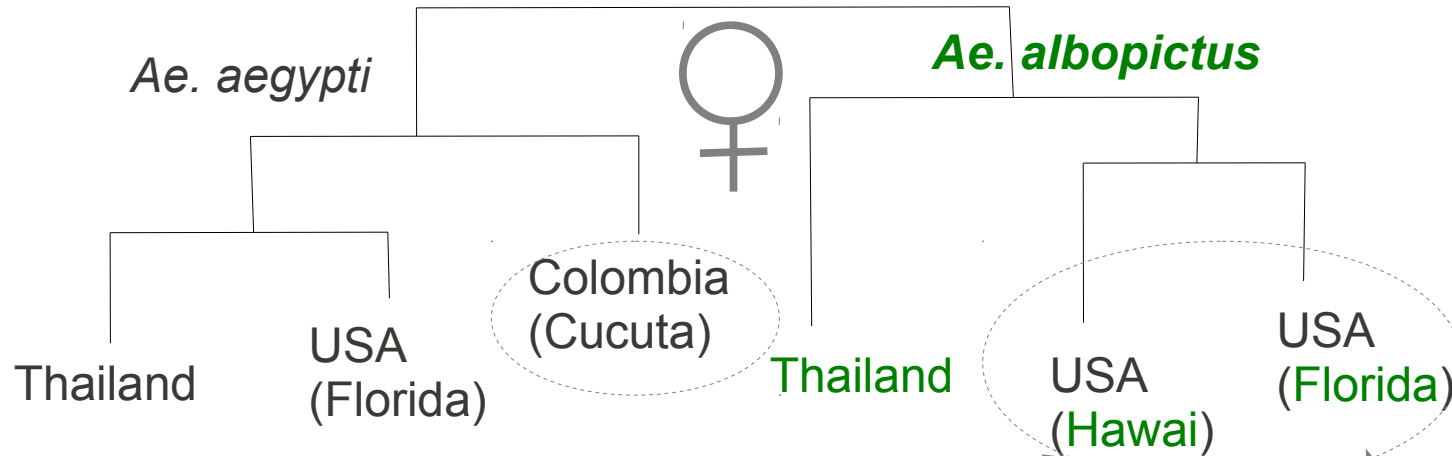
Aedes albopictus

Geographic structuring or migration history?



Aedes albopictus

Geographic structuring or migration history?



Leon Rosen, Lloyd E. Rozeboom, William C. Reeves, Jacques Saugrain, And Duane J. Gubler. A **field trial** of competitive displacement of *Aedes polynesiensis* by *Aedes albopictus* on a **pacific atoll**. The American Journal Tropical Medicine Hygiene, 25, No. 6

Hawley, W.A., Reiter, P., Copeland, R.S., Pumpuni, C.B., Craig, G.B., 1987. *Aedes albopictus* in North America: probable **introduction in used tires from northern Asia**. *Science* 236 (4805), 1114–1116.

A FIELD TRIAL OF COMPETITIVE DISPLACEMENT OF *Aedes polynesiensis* BY *Aedes albopictus* ON A PACIFIC ATOLL

LEON ROSEN, LLOYD E. ROZEBOOM, WILLIAM C. REEVES,
JACQUES SAUGRAIN, AND DUANE J. GUBLER

Pacific Research Section, Laboratory of Parasitic Diseases, National Institute of Allergy and Infectious Diseases, P.O. Box 1680, Honolulu, Hawaii 96806, School of Hygiene and Public Health, Johns Hopkins University, Baltimore, Maryland 21205, Department of Biomedical and Environmental Health Sciences, School of Public Health, University of California, Berkeley, California 94720, Institut de Recherches Médicales "Louis Malardé," Papeete, Tahiti, and Department of Tropical Medicine and Medical Microbiology, School of Medicine, University of Hawaii, Honolulu, Hawaii 96816

Abstract. Prior laboratory studies and field observations suggested that it might be possible to reduce the size of the population of, or eliminate, *Aedes polynesiensis* by the introduction of *Aedes albopictus*. The former mosquito is the principal vector of nonperiodic filariasis caused by *Wuchereria bancrofti* and the latter is a closely related species refractory to the development of human filariae. The practicability of such competitive displacement was studied by a field trial on a remote coral atoll where there was an established population of *A. polynesiensis*. Three strains of *A. albopictus* were liberated at separate localities on the atoll and their fate was followed for 4 years. One strain disappeared within 12 months after release and the other two disappeared within 48 months. It was not clear whether *A. albopictus* failed to become established because the strains were unsuitable, the general environment was inappropriate, or *A. polynesiensis* was present in such numbers that *A. albopictus* rarely succeeded in mating with its own species.

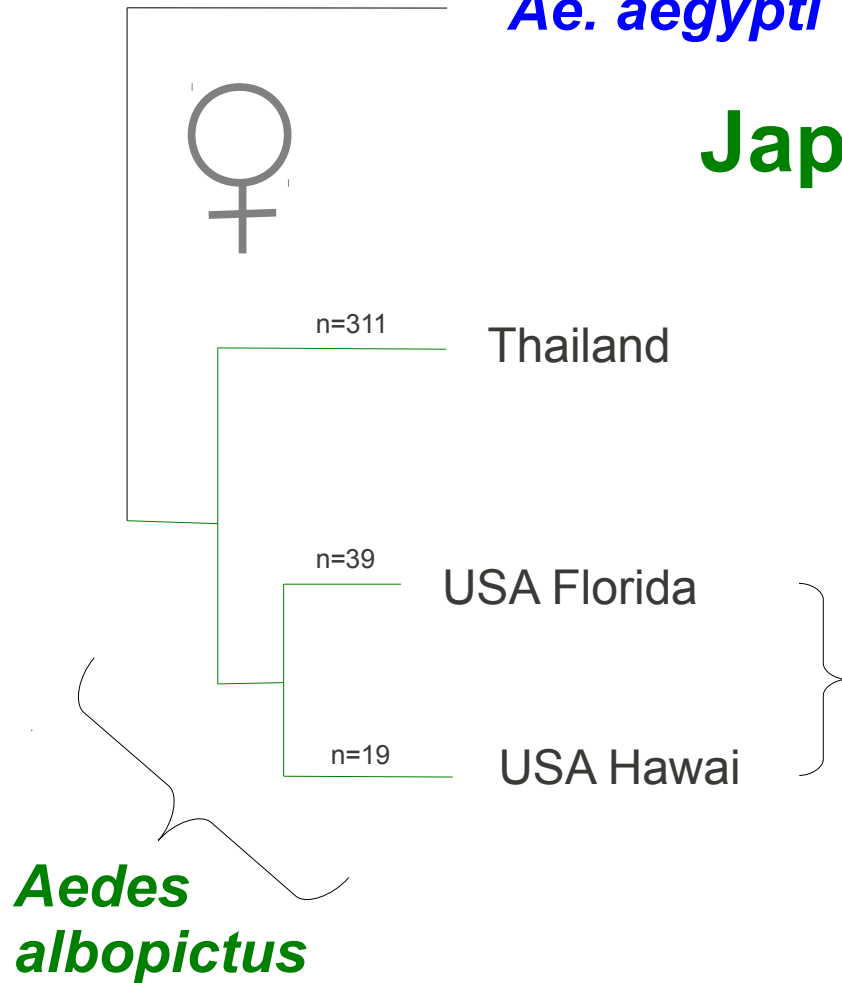
Aedes albopictus

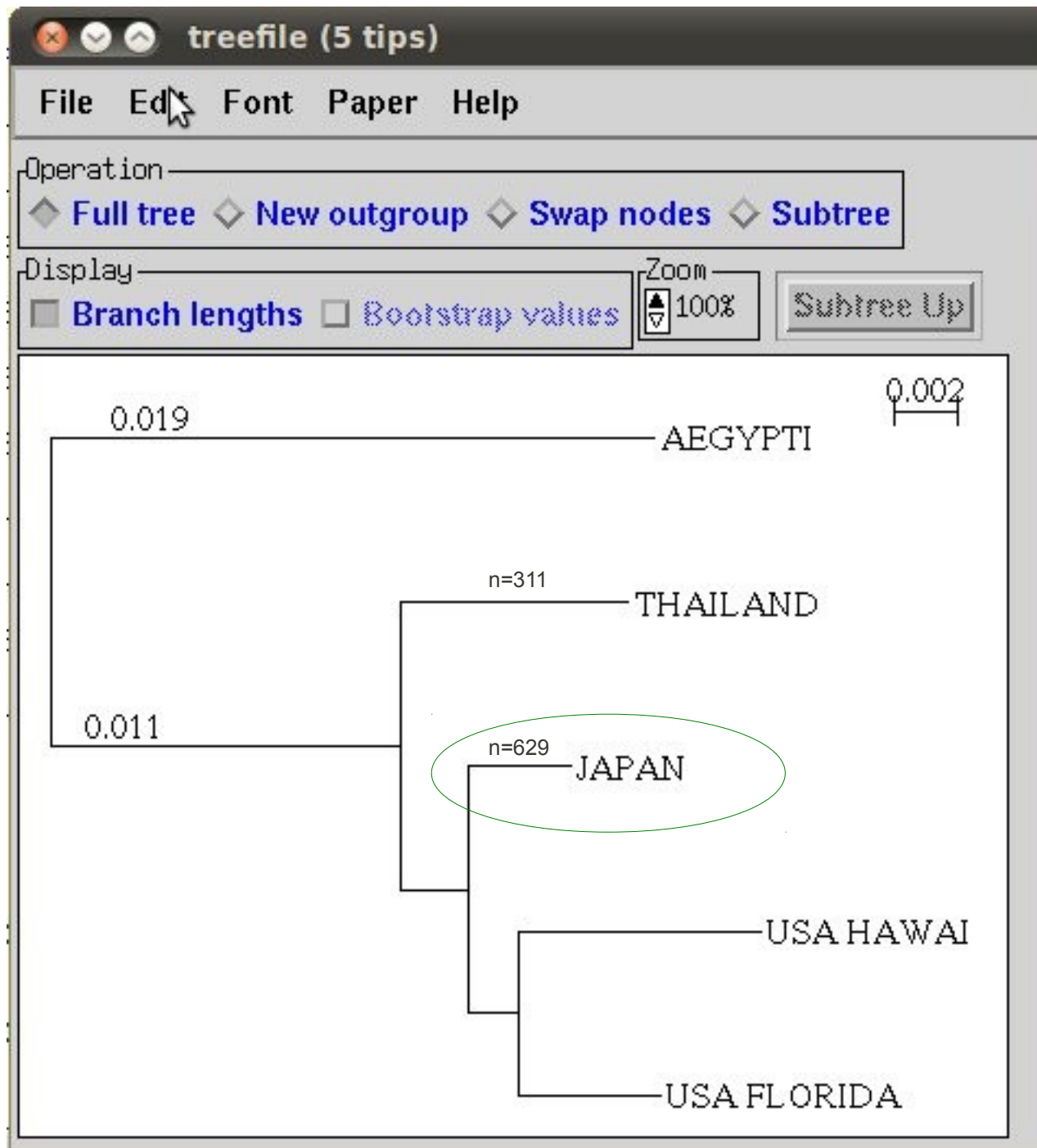
Ae. aegypti

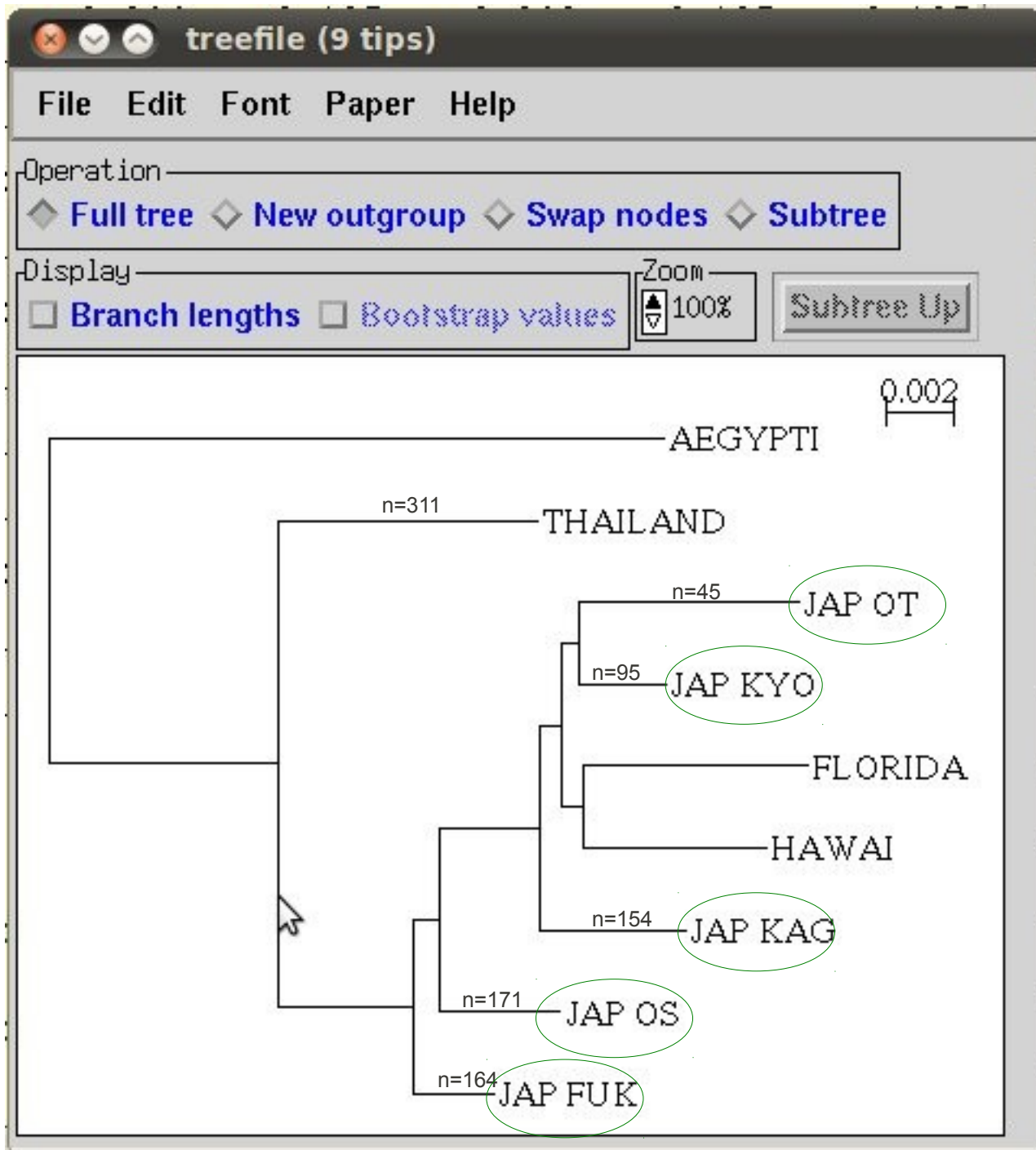
Japan ?

Hawley, W.A., Reiter, P., Copeland, R.S., Pumpuni, C.B., Craig, G.B., 1987. *Aedes albopictus* in North America: probable introduction in used tires from northern Asia. *Science* 236 (4805), 1114–1116.

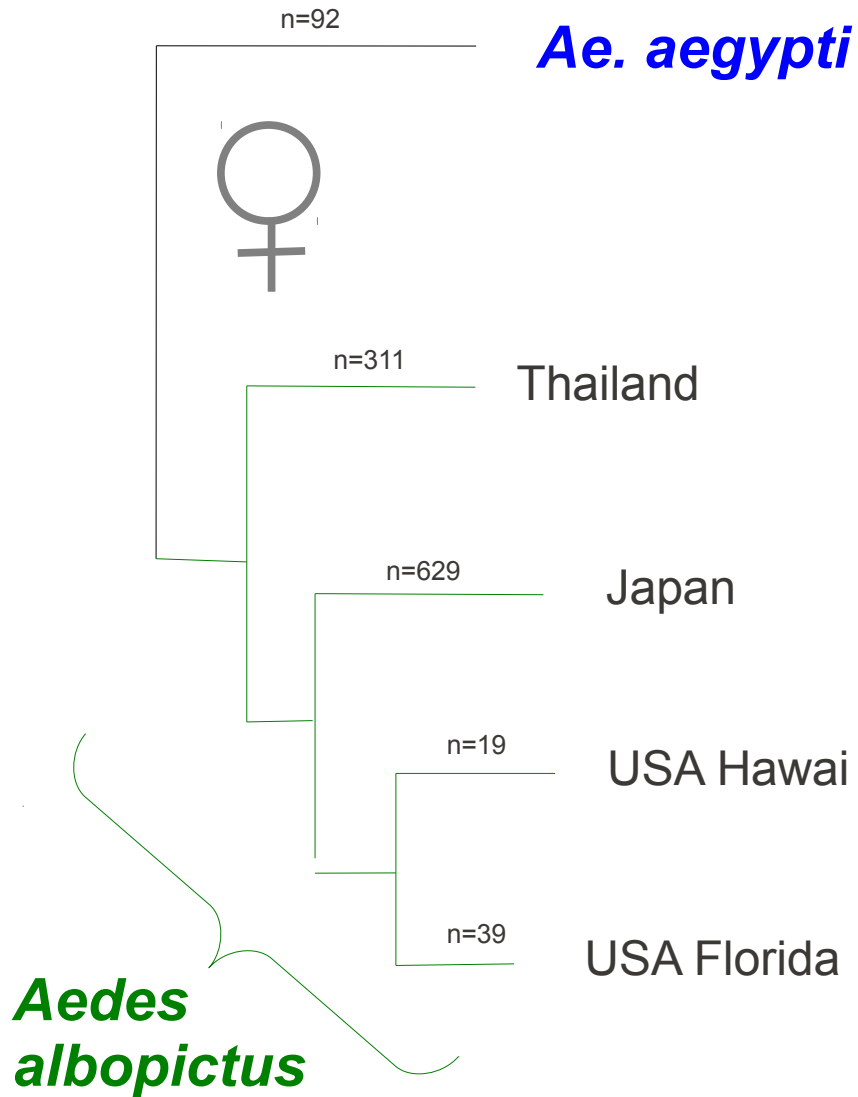
Leon Rosen, Lloyd E. Rozeboom, William C. Reeves, Jacques Saugrain, And Duane J. Gubler. A field trial of competitive displacement of *Aedes polynesiensis* by *Aedes albopictus* on a pacific atoll. *The American Journal Tropical Medicine Hygiene*, 25, No. 6





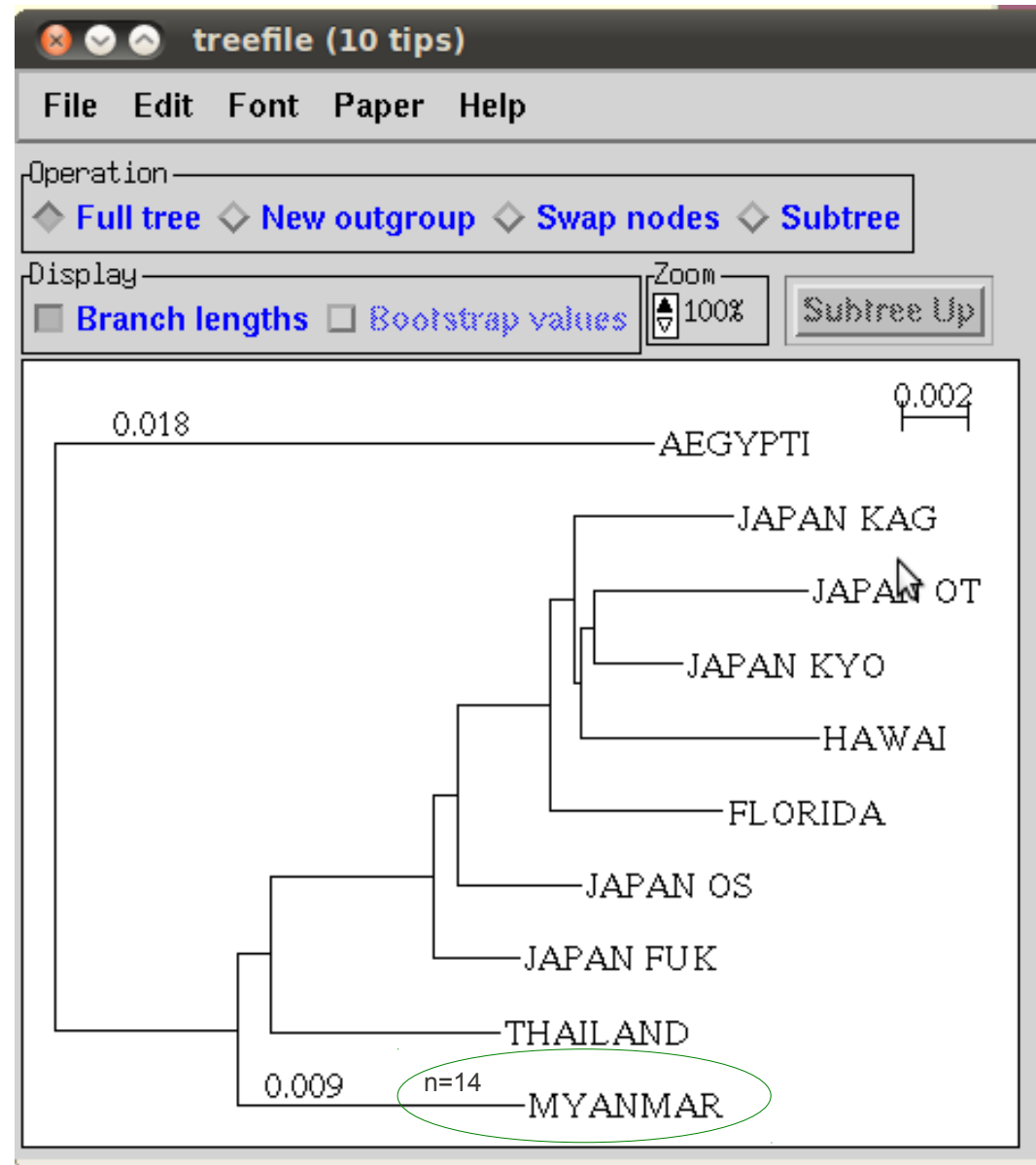


Aedes albopictus

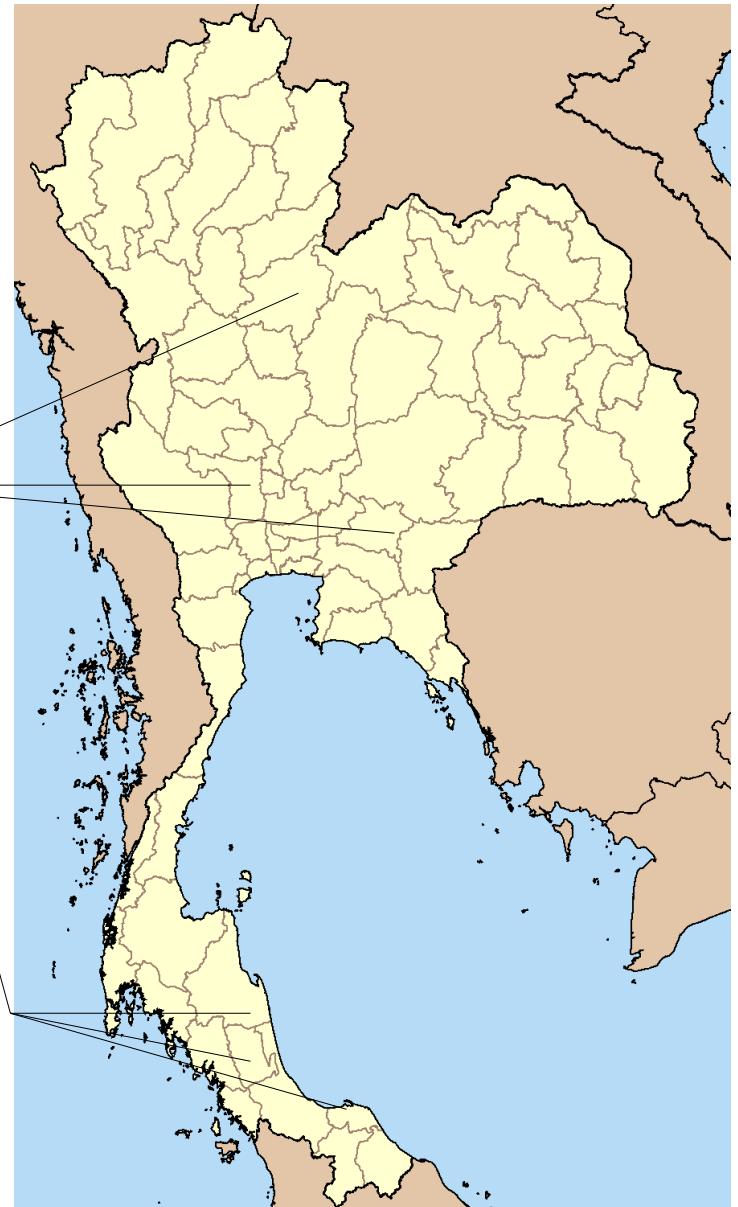
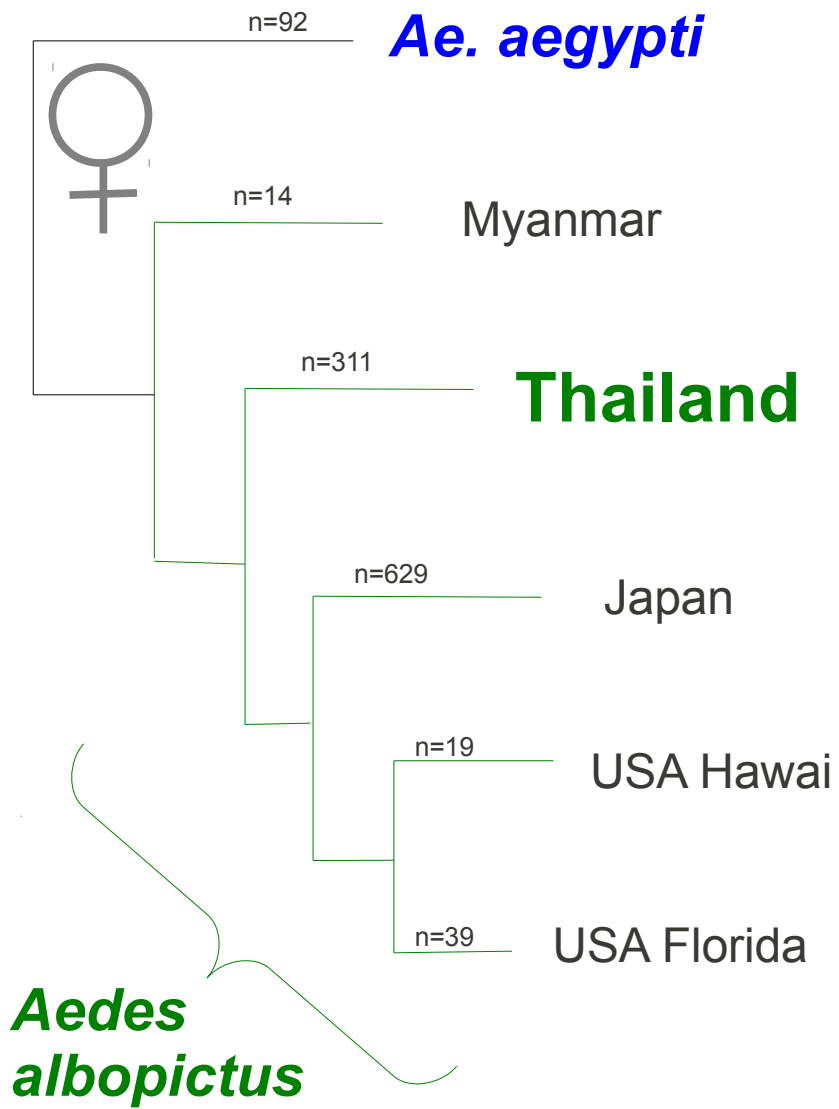


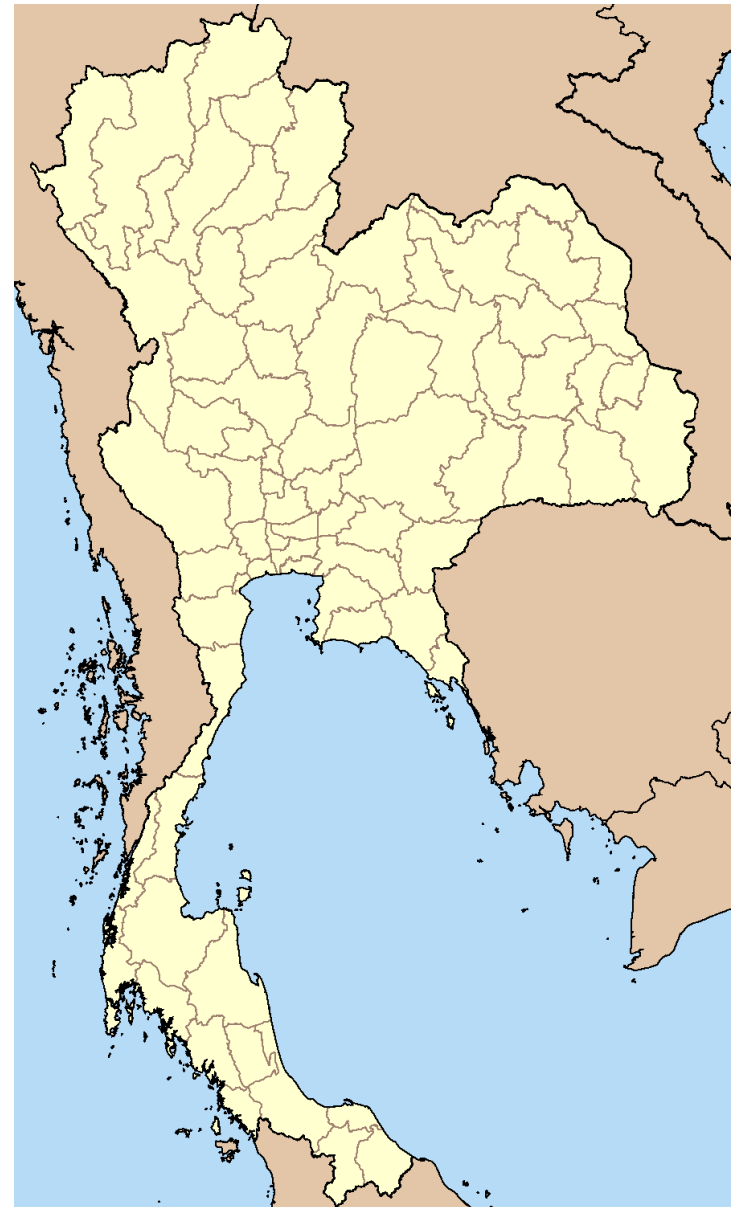
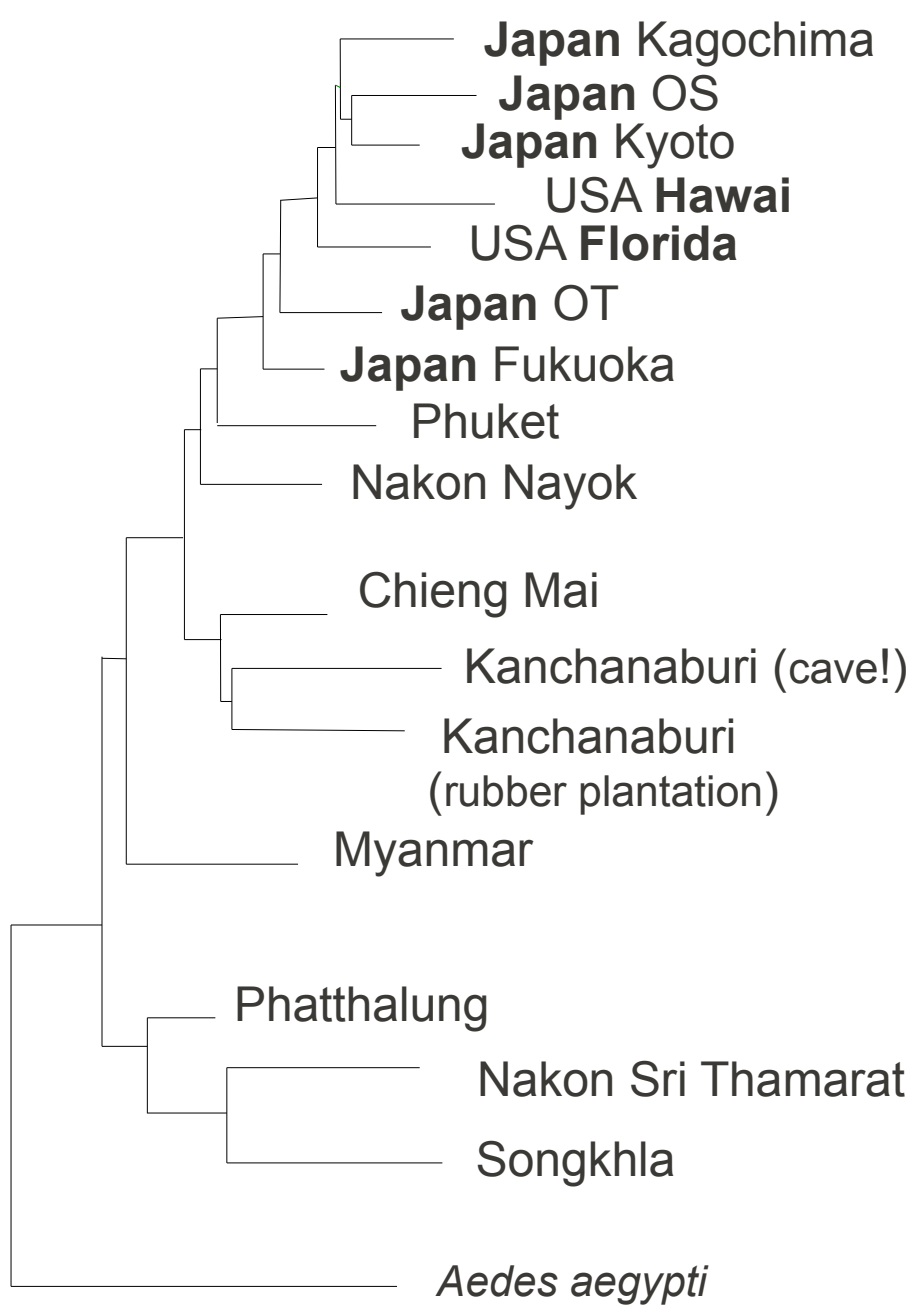
Myanmar ?

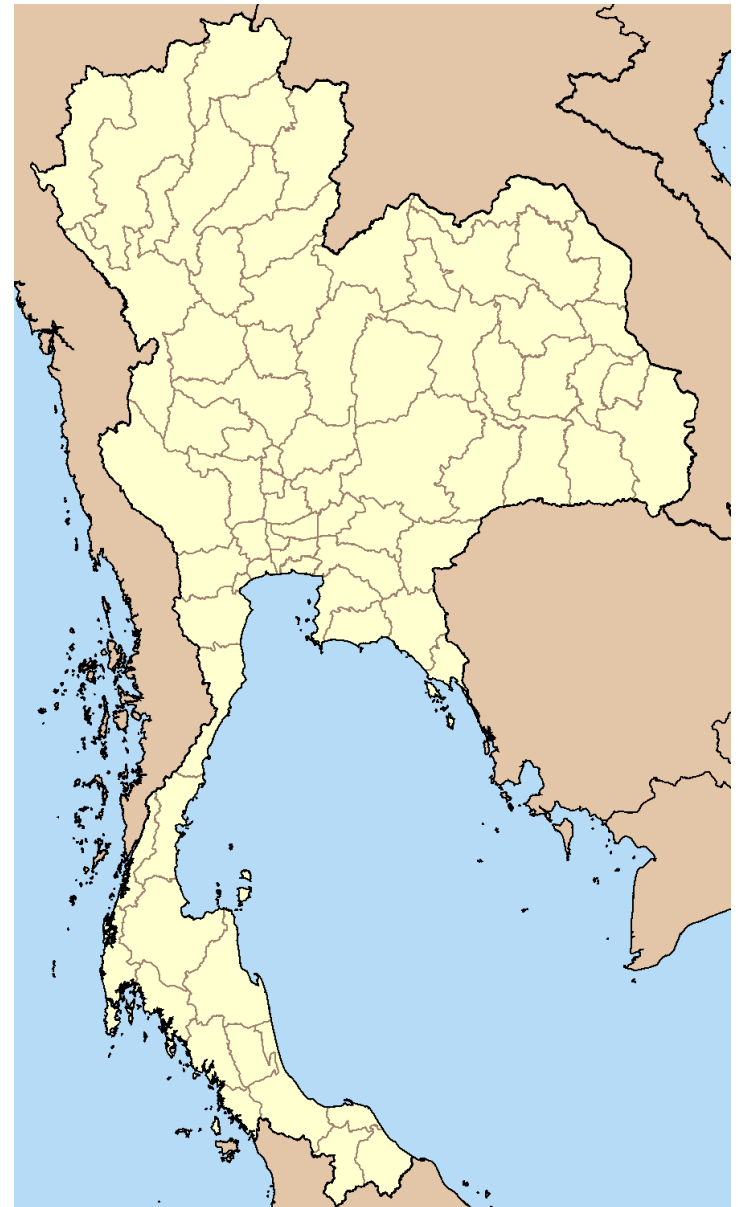
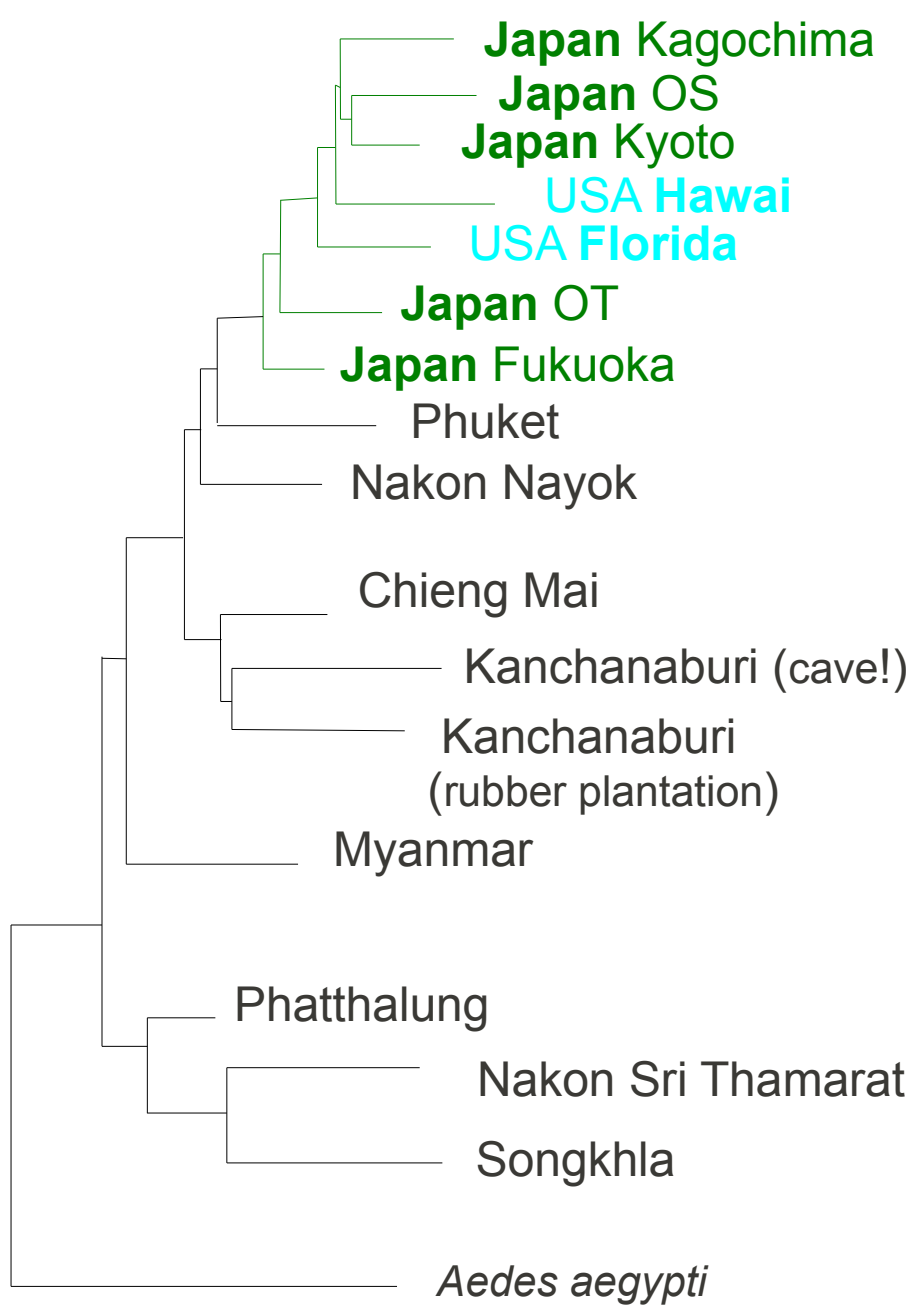
Morphometric shifts in *Aedes albopictus*

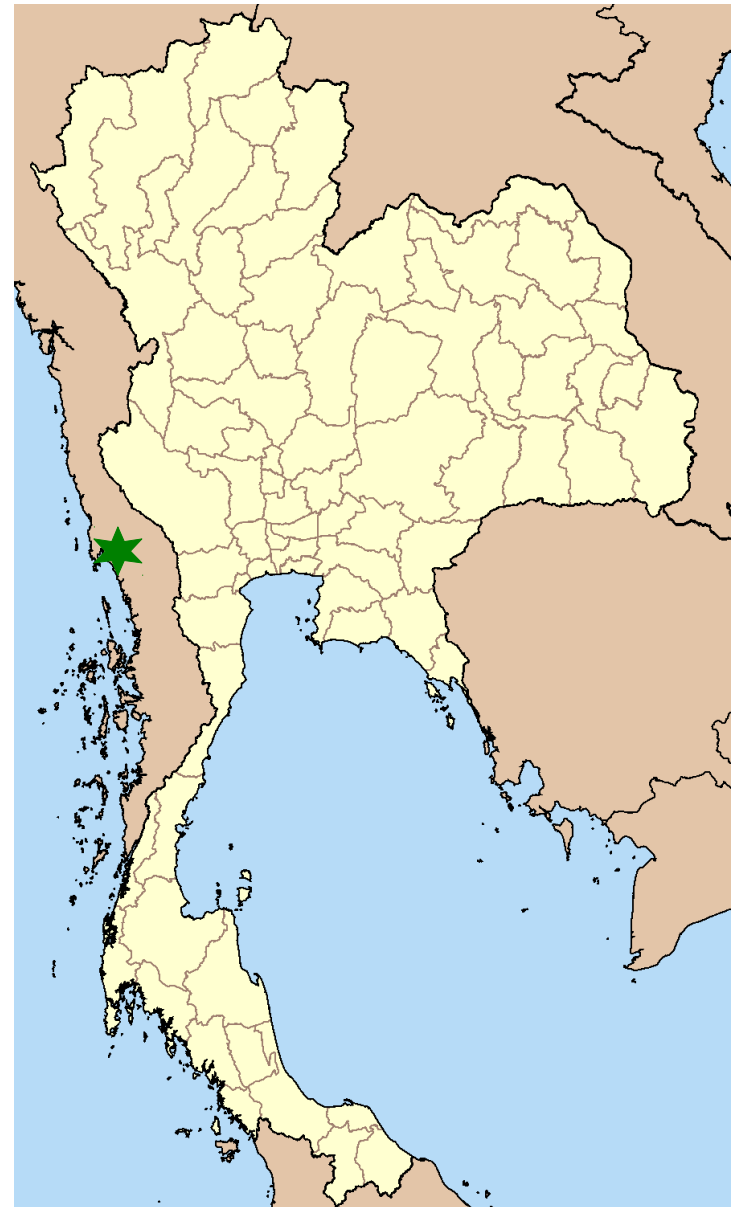
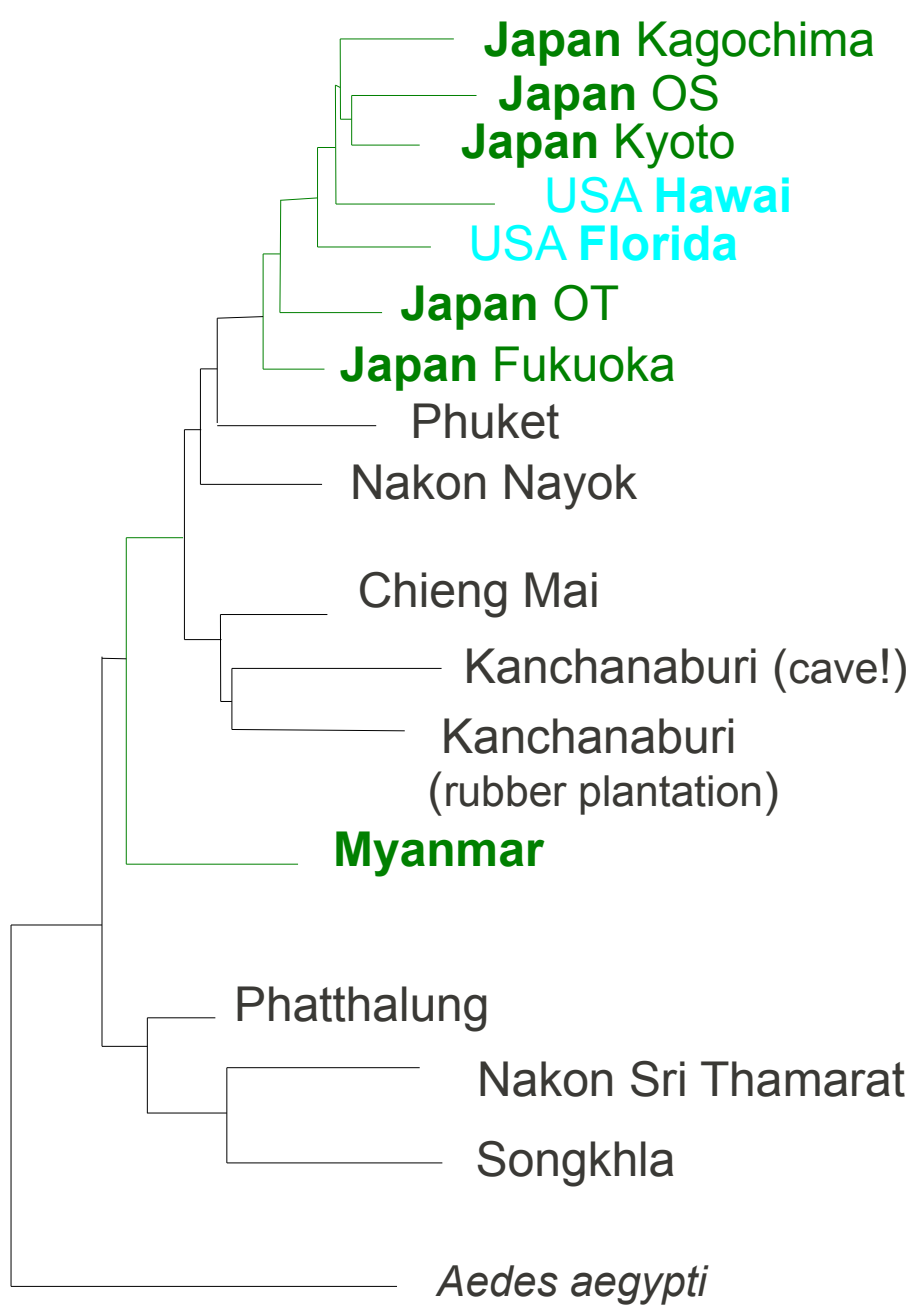


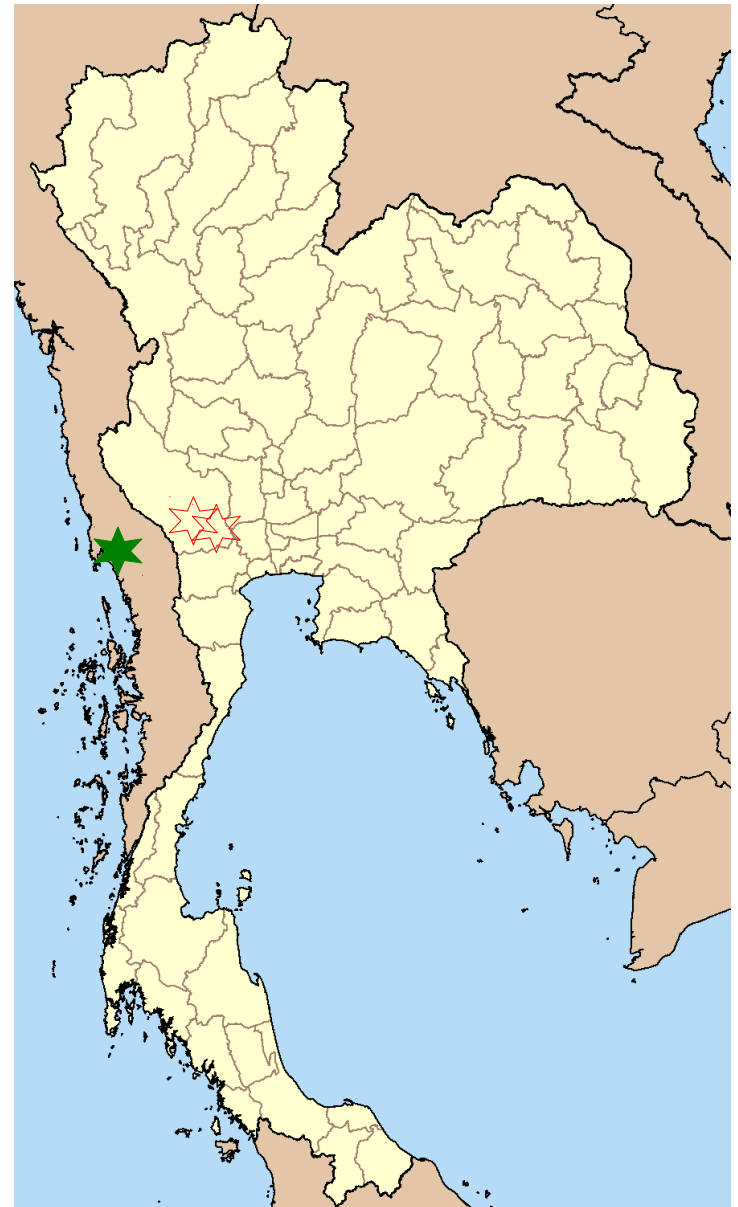
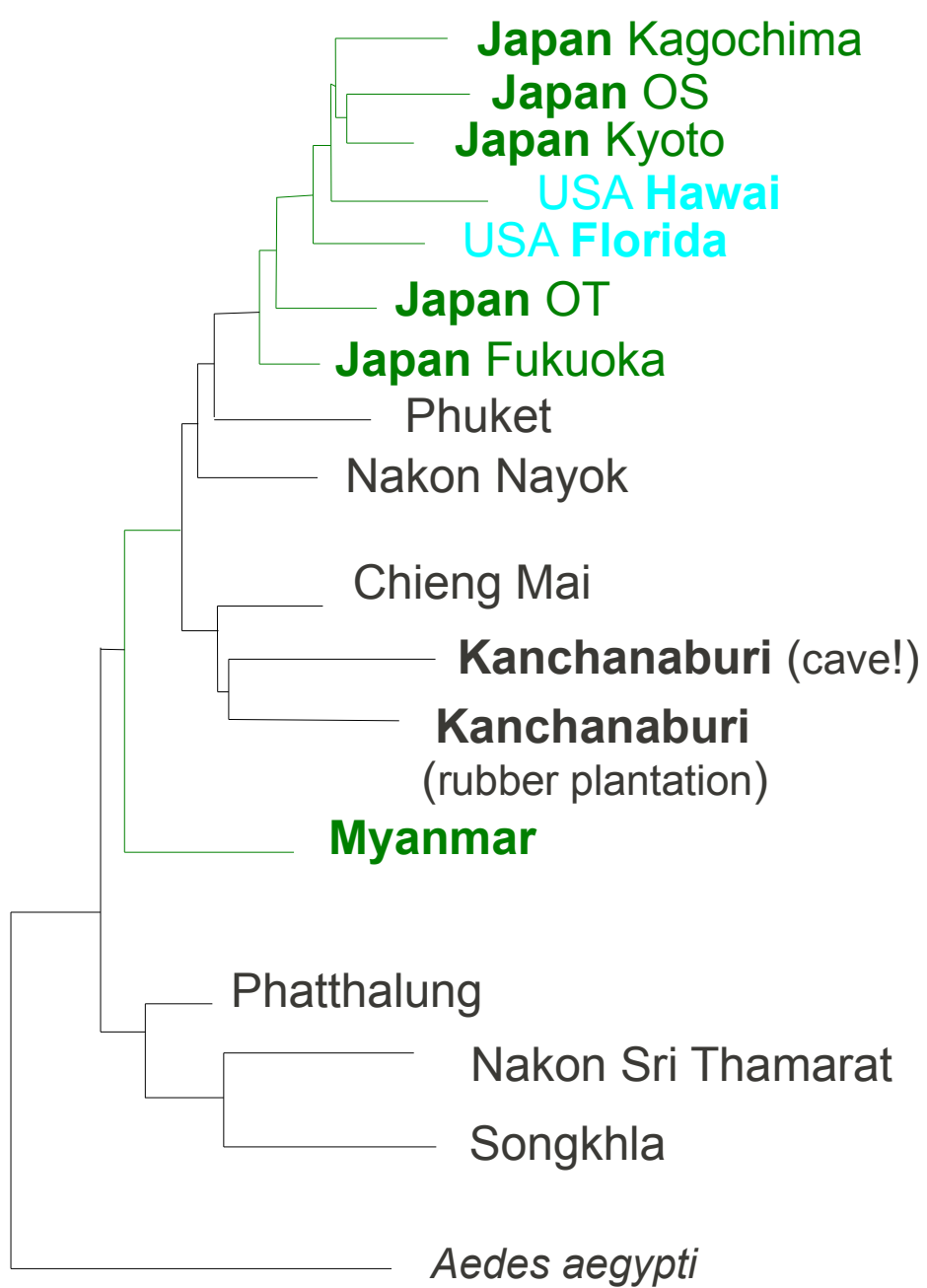
Aedes albopictus

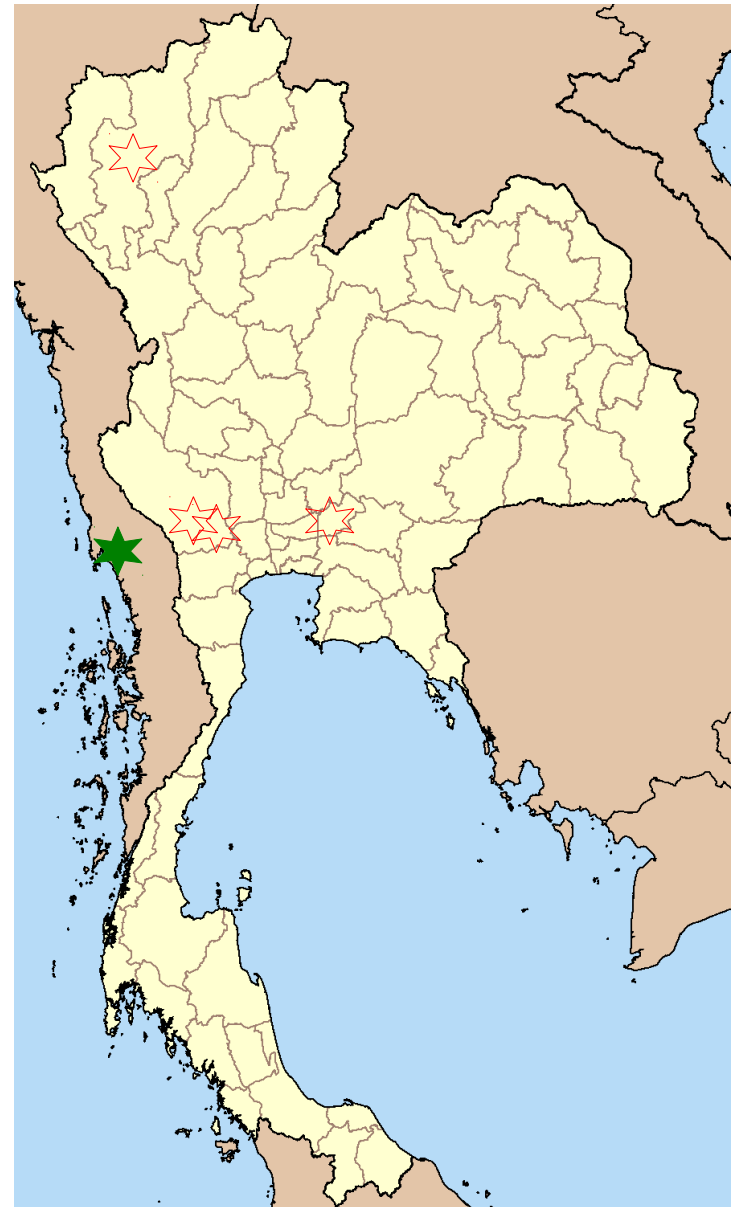
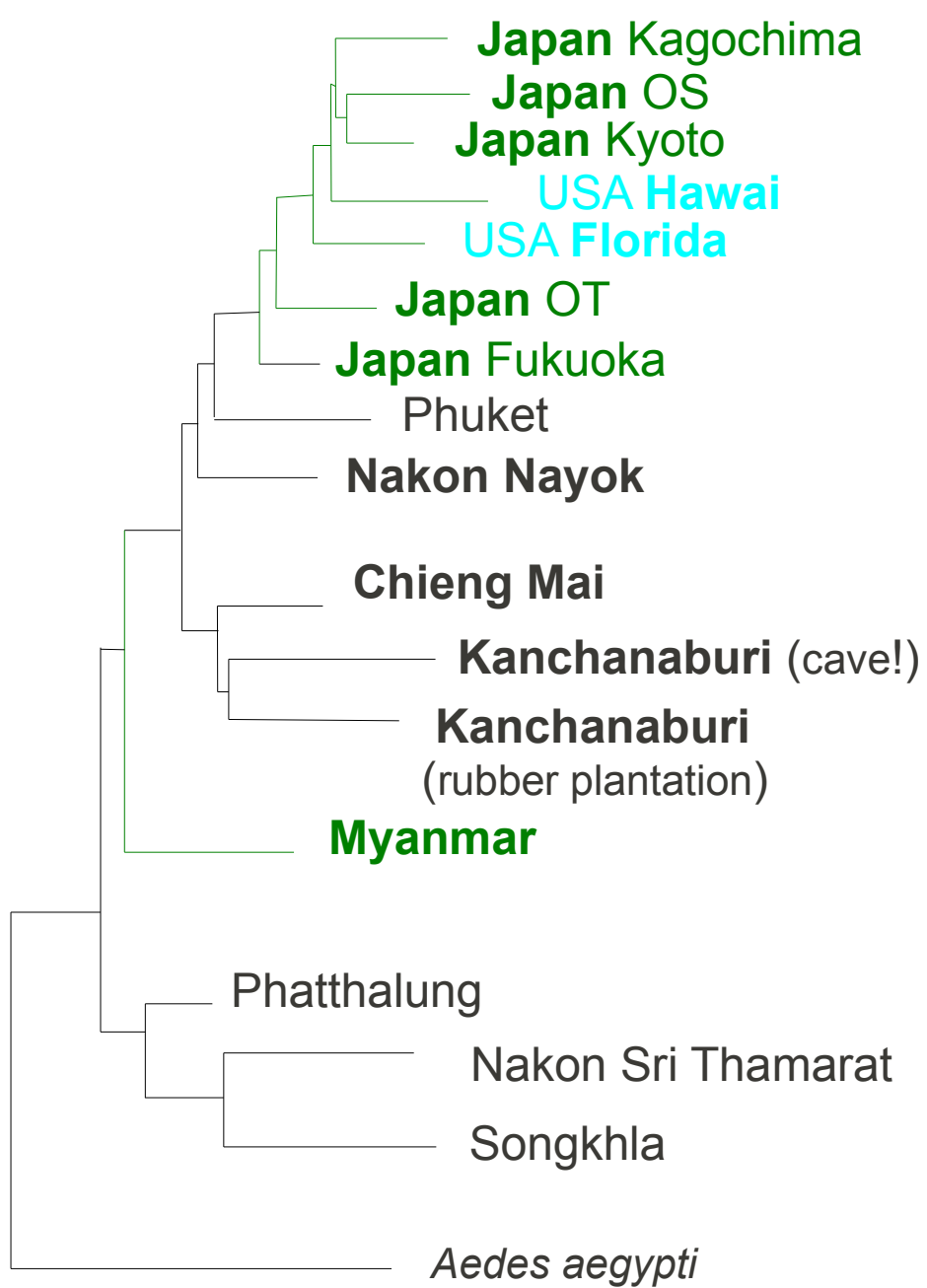


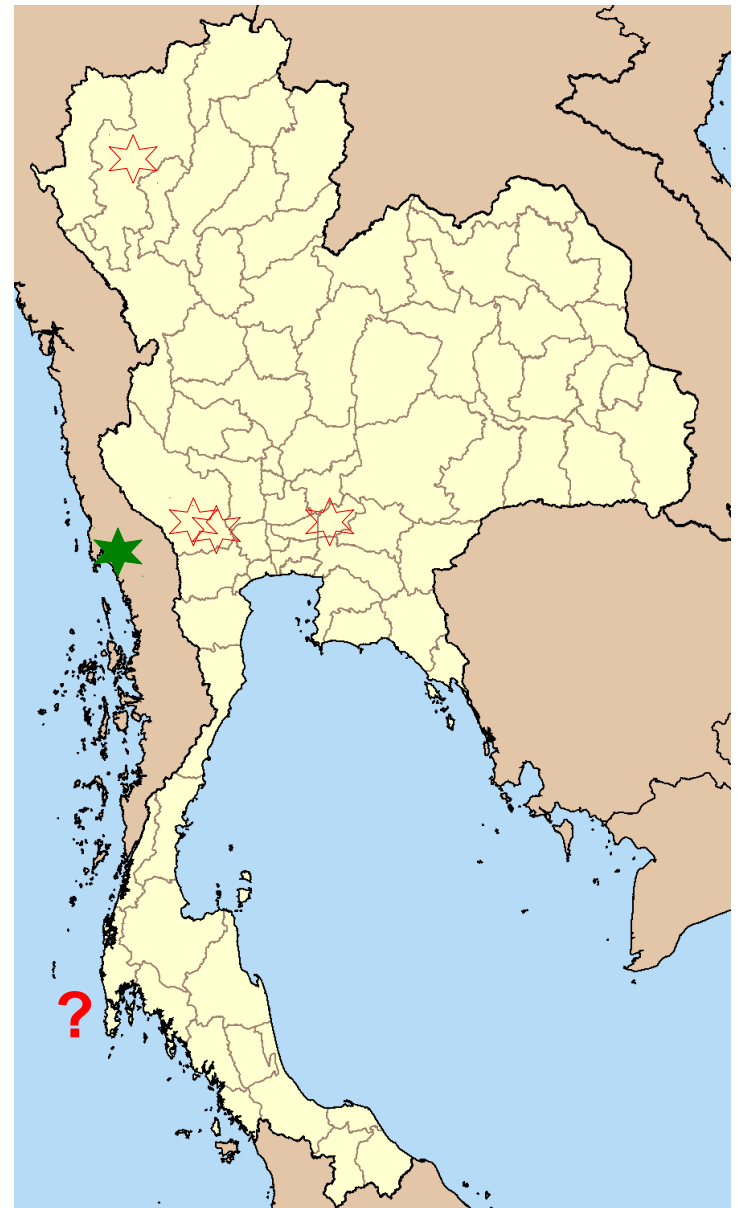
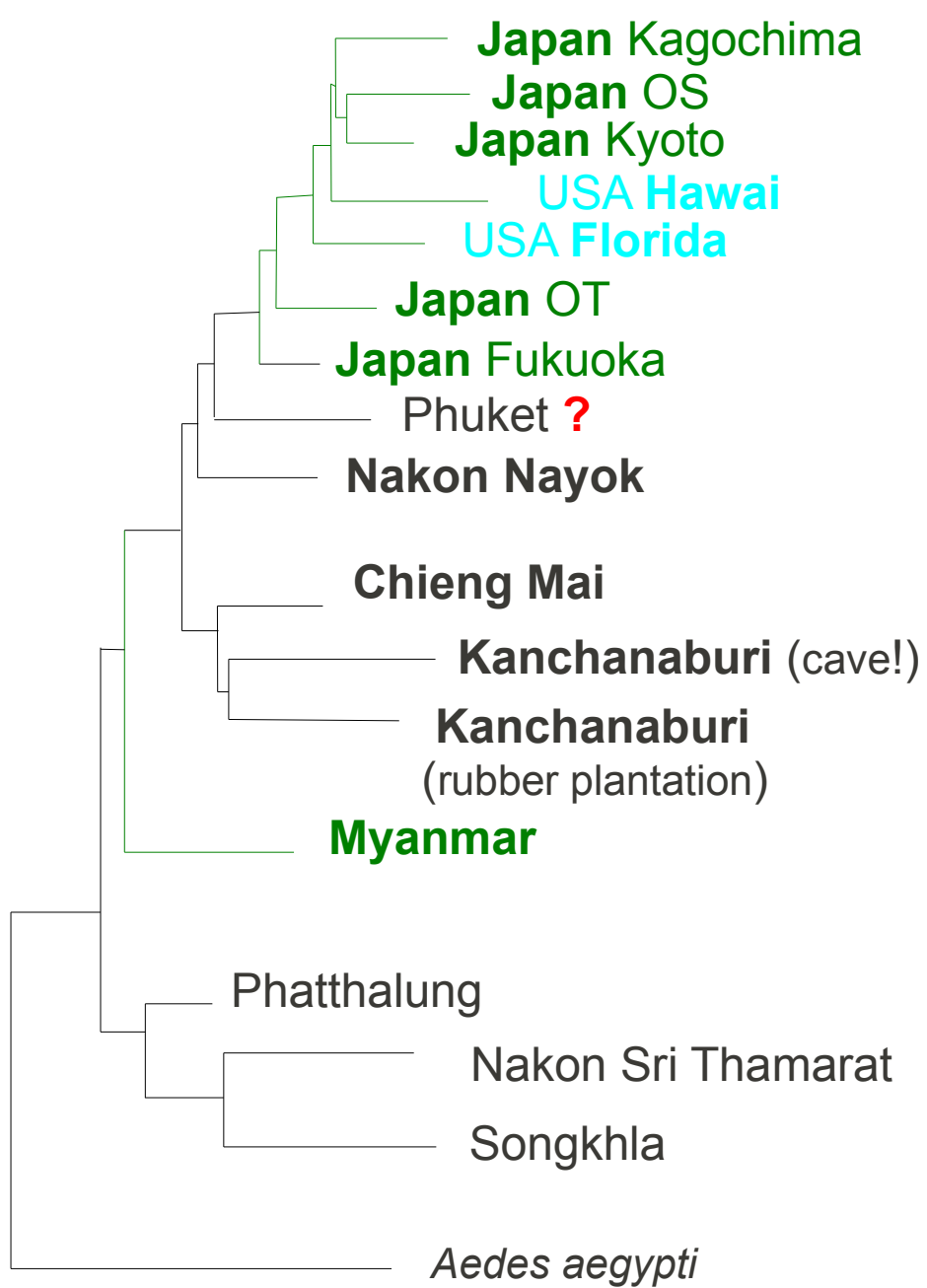


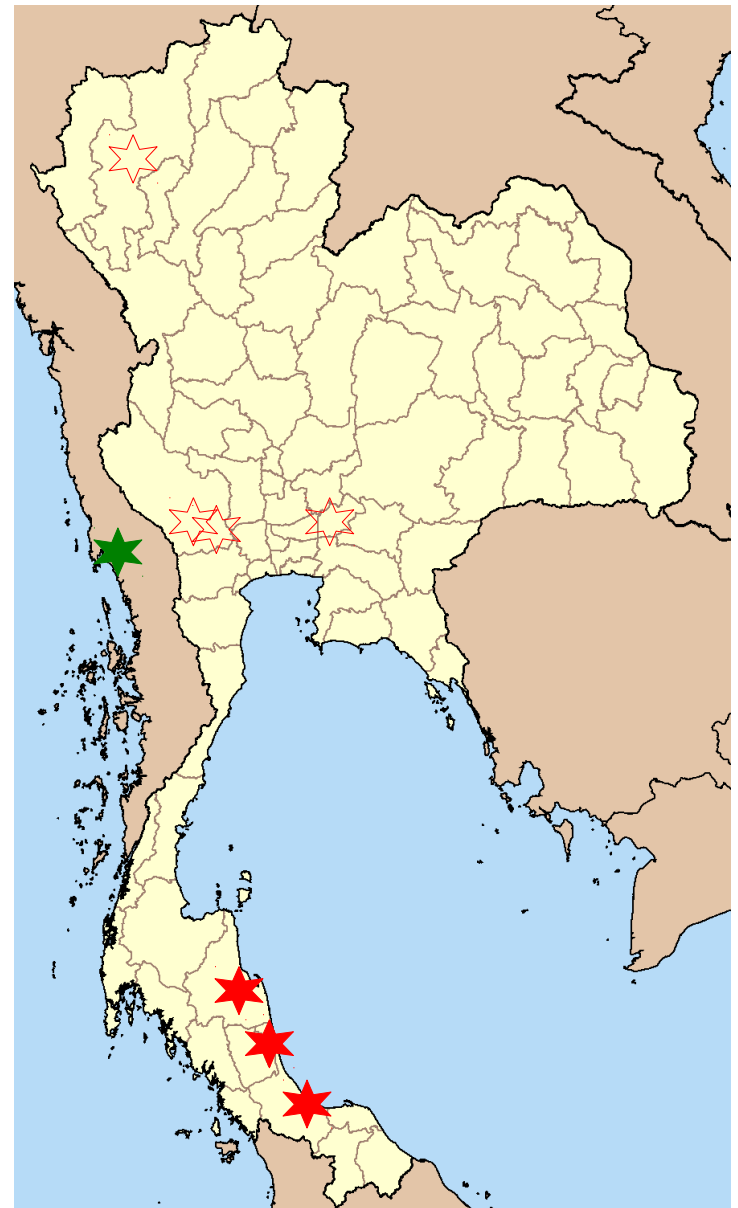
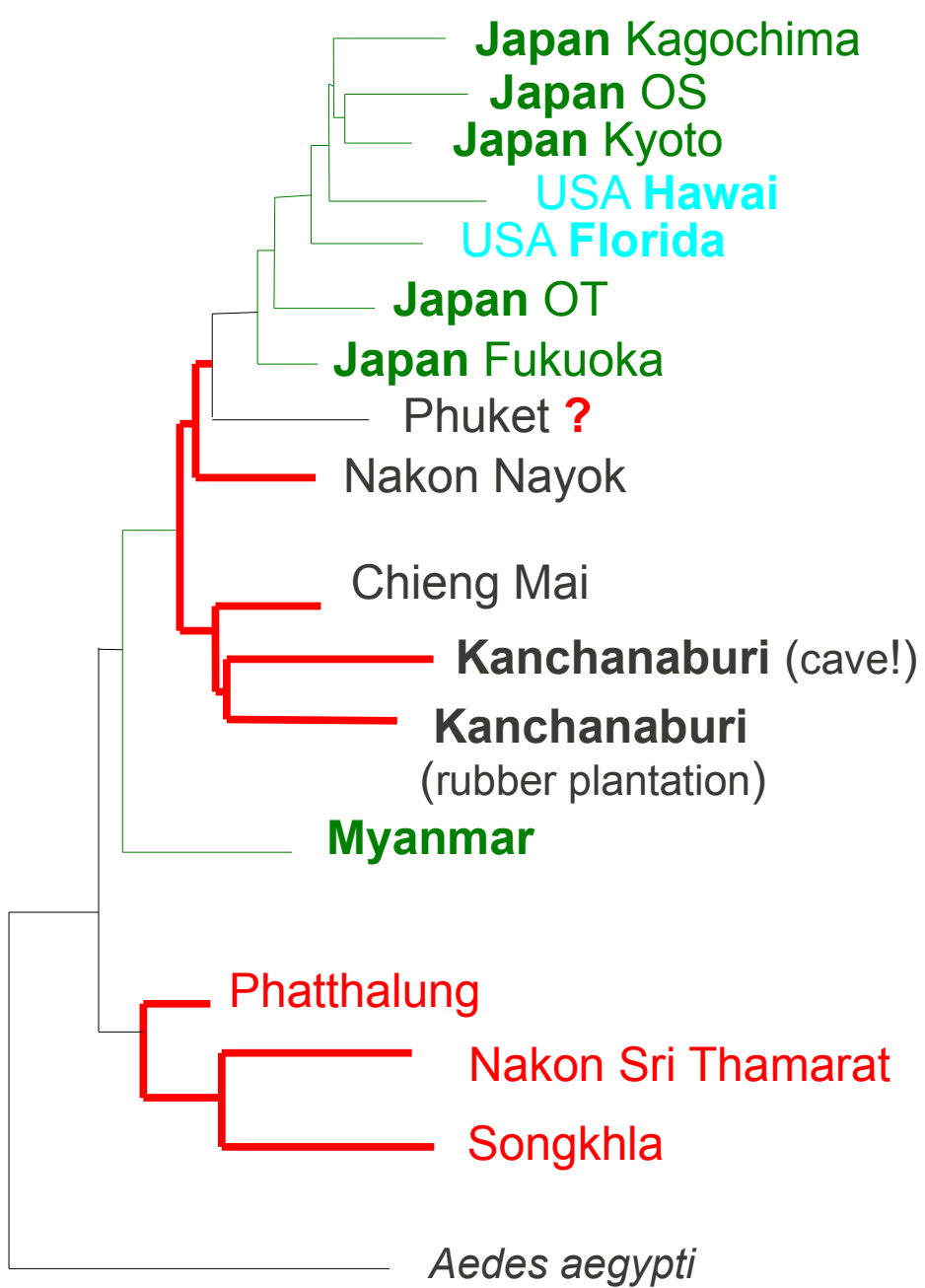




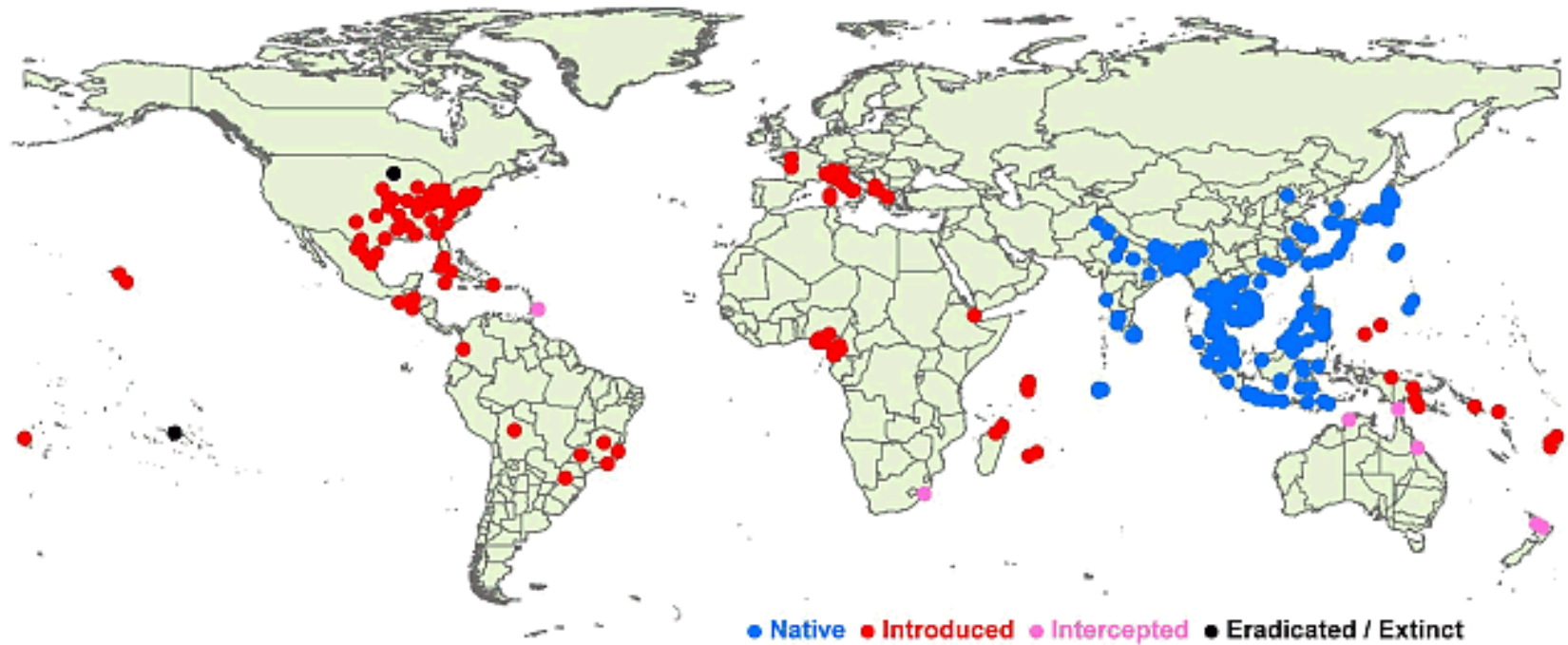




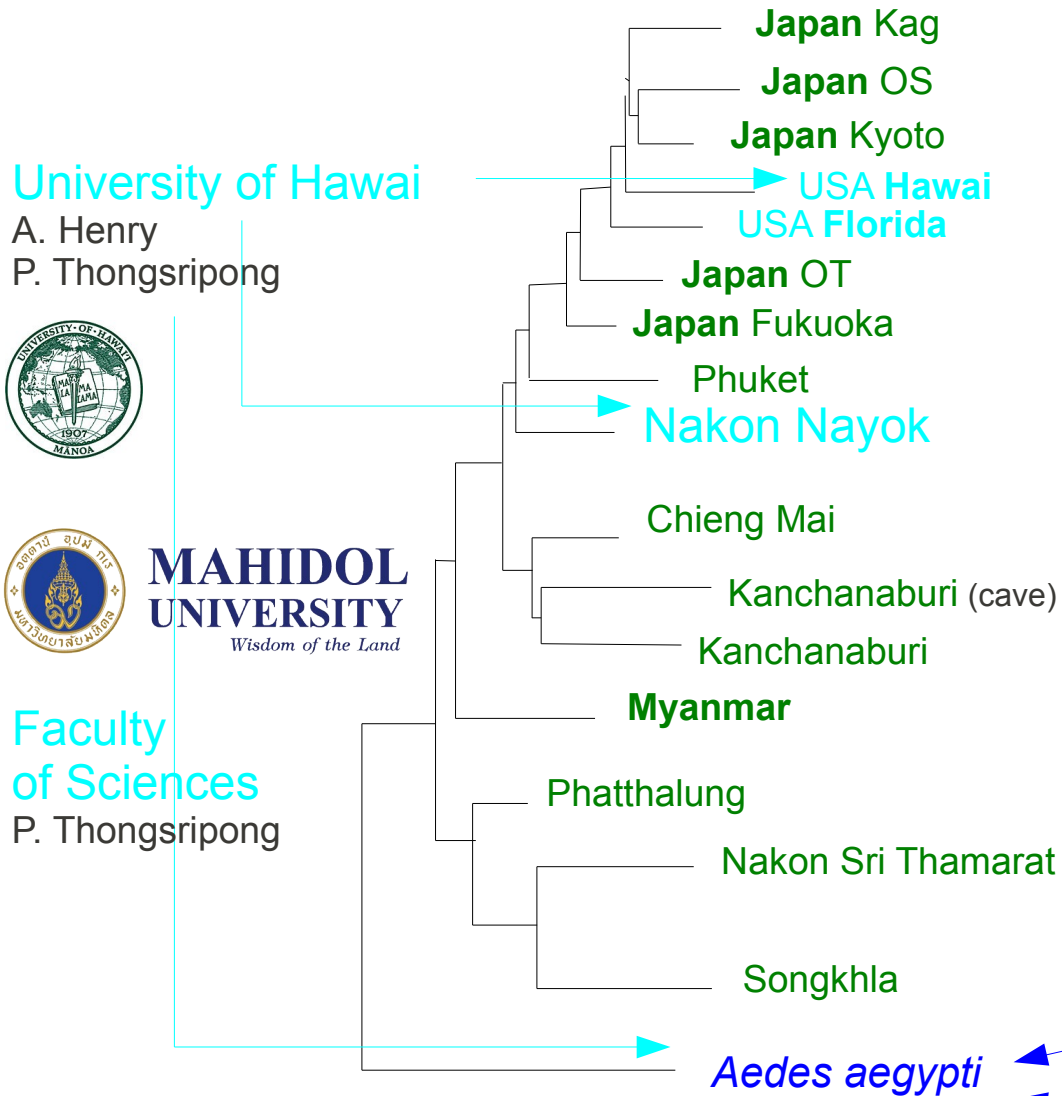




Aedes albopictus is an invasive species



Thank you



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Wisdom of the Land

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Dr. S. Sungvornyothin

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IRD (Mivegec), France
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N. Jaramillo