



Mosquito Surveillance and Management in Turkey



Filiz GÜNAY and Bülent Alten

Native and non-native vector management in the Eastern Mediterranean and Middle East (EMME)
18-20 April 2018, Cyprus

MOSQUITO BORN DISEASES IN TURKEY

Malaria

Vector species in Turkey
Anopheles sacharovi
Anopheles superpictus

1970
Widespread in the past
Number of cases
170.000

1994 - 2012
Number of cases
84.345 - 5

2017
Number of cases
101 (MoH)

West Nile Encephelitis

Vector species in Turkey
Culex pipiens s.s.
Culex quinquefasciatus
Culex perexiguus

Difficult to control
Birds

Blood samples from Human
Horse Dog and Cow

Egean, Mediterranean,
Central, South East,
Anatolia

Dengue

Vector species in the world
Aedes aegypti
Aedes albopictus

Rarely seen in Turkey

Central Anatolia antigens in
serum of animals

Past studies on Mosquito Surveillance in Turkey

| Parrish 1959 | Ramsdale et.al. 2001 | Aldemir et.al. 2009 SOVE | Simsek et.al. 2011 |
|-------------------------------------|--|---------------------------|--------------------|
| 1 <i>Anopheles algeriensis</i> | <i>Anopheles algeriensis</i> | | |
| 2 <i>Anopheles claviger</i> | <i>Anopheles claviger</i> | | |
| 3 <i>Anopheles hyrcanus</i> | <i>Anopheles hyrcanus</i> | | |
| 4 <i>Anopheles maculipennis ss</i> | <i>Anopheles maculipennis ss</i> | | |
| 5 <i>Anopheles messeae</i> | | | |
| 6 <i>Anopheles sacharovi</i> | <i>Anopheles sacharovi</i> | | |
| 7 <i>Anopheles melanoon</i> | <i>Anopheles (subalpinus) melanoon</i> | <i>Anopheles melanoon</i> | |
| 8 <i>Anopheles marteri</i> | <i>Anopheles marteri</i> | | |
| 9 <i>Anopheles plumbeus</i> | <i>Anopheles plumbeus</i> | | |
| 10 | <i>Anopheles pulcherimus</i> | | |
| 11 <i>Anopheles superpictus</i> | <i>Anopheles superpictus</i> | | |
| 12 | <i>Acartomyia phoenicae</i> | | |
| 13 | <i>Acartomyia zammitii</i> | | |
| 14 | <i>Aedes cinereus</i> | | |
| 15 <i>Aedes vexans</i> | <i>Aedimorphus vexans</i> | | |
| 16 <i>Aedes geniculata</i> | <i>Dahiana geniculata</i> | | |
| 17 <i>Aedes echinus</i> | <i>Dahiana echinus</i> | | |
| 18 <i>Aedes annulipes</i> | Listede yer verilmemiş | | |
| 19 <i>Aedes caspius</i> | <i>Ochlerotatus caspius</i> | | |
| 20 <i>Aedes communis</i> | <i>Ochlerotatus communis</i> | | |
| 21 <i>Aedes detritus</i> | <i>Ochlerotatus detritus</i> | | |
| 22 <i>Aedes dorsalis</i> | <i>Ochlerotatus dorsalis</i> | | |
| 23 <i>Aedes excrucians</i> | <i>Ochlerotatus excrucians</i> | | |
| 24 <i>Aedes flavescens</i> | <i>Ochlerotatus flavescens</i> | | |
| 25 | <i>Ochlerotatus cataphylla</i> | | |
| 26 | <i>Ochlerotatus cypris</i> | | |
| 27 | <i>Ochlerotatus leucomelas</i> | | |
| 28 | <i>Ochlerotatus pullatus</i> | | |
| 29 | <i>Ochlerotatus punctor</i> | | |
| 30 <i>Aedes lepidonotus</i> | <i>Ochlerotatus lepidonotus</i> | | |
| 31 <i>Aedes nigrocanus</i> | <i>Ochlerotatus nigrocanus</i> | | |
| 32 <i>Aedes pulicaris</i> | <i>Ochlerotatus pulicaris</i> | | |
| 33 <i>Aedes refiki</i> | <i>Ochlerotatus refiki</i> | | |
| 34 <i>Aedes rusticus</i> | <i>Ochlerotatus rusticus</i> | | |
| 35 | <i>Stegomyia cretina</i> | | |
| 36 <i>Culex deserticola</i> | <i>Culex deserticola</i> | | |
| 37 <i>Culex hortensis</i> | <i>Culex hortensis</i> | | |
| 38 <i>Culex laticinctus</i> | <i>Culex laticinctus</i> | | |
| 39 <i>Culex marinii</i> | <i>Culex marinii</i> | | |
| 40 <i>Culex mimeticus</i> | <i>Culex mimeticus</i> | | |
| 41 <i>Culex modestus</i> | <i>Culex modestus</i> | | |
| 42 | <i>Culex peregrinus</i> | | |
| 43 <i>Culex pusillus</i> | <i>Culex pusillus</i> | | |
| 44 <i>Culex theileri</i> | <i>Culex theileri</i> | | |
| 45 <i>Culex quinquefasciatus</i> | Hatalı Kayıt Olarak Belirttilmiş | | |
| 46 <i>Culex pipiens ss</i> | <i>Culex pipiens ss</i> | | |
| 47 <i>Culex torrentium</i> | <i>Culex torrentium</i> | | |
| 48 <i>Culex tritaeniorhynchus</i> | <i>Culex tritaeniorhynchus</i> | | |
| 49 | <i>Culex temtans</i> | | |
| 50 | <i>Culiseta alaskaeensis</i> | | |
| 51 <i>Culiseta annulata</i> | <i>Culiseta annulata</i> | | |
| 52 | | <i>Culiseta subochrea</i> | |
| 53 <i>Culiseta fumipennis</i> | <i>Culiseta fumipennis</i> | | |
| 54 <i>Culiseta longiareolata</i> | <i>Culiseta longiareolata</i> | | |
| 55 <i>Culiseta morsitans</i> | <i>Culiseta morsitans</i> | | |
| 56 <i>Mansonia richardii</i> | <i>Coquillettidia richardii</i> | | |
| 57 <i>Orthopodomyia pulcipalpis</i> | <i>Orthopodomyia pulcipalpis</i> | | |
| 58 <i>Uranotaenia unguiculata</i> | <i>Uranotaenia unguiculata</i> | | |

- D Parrish 1959

The Mosquitoes of Turkey

52 Tür; *Anopheles* (13), *Aedes* (17), *Culex* (16), *Culiseta* (4), *Uranotaenia* (1), *Orthopodomyia* (1).

- CD Ramsdale, B Alten, SS Çağlar and N Özer 2001

A Revised, Annotated Checklist of the Mosquitoes (Diptera, Culicidae) of Turkey

48 Tür; *Anopheles* (10), *Aedes* (3), *Ochlerotatus* (15), *Culex* (13), *Culiseta* (4), *Coquillettidia* (1), *Uranotaenia* (1), *Orthopodomyia* (1).

- A Aldemir, F Erdem, B Demirci, H Bedir, E Koç 2009

Species Composition and Seasonal Dynamics of Mosquito Larvae (Diptera: Culicidae) in Kars Plateau and Six New Records for Turkey

Aedes cataphylla, *Aedes cyprius*, *Aedes leucomelas*, *Aedes punctor*, *Aedes pullatus*, *Culiseta alaskaensis*

- FM Şimşek, C Ülger, MM Akiner, F Günerkan, SI Cihangir, F Bardakçı 2011

Mosquito Species in Southern Turkey

Anopheles melanoon, *Culiseta subochrea*

| Parrish 1959 | Ramsdale et.al. 2001 |
|--------------------------------|------------------------|
| 59 <i>Anopheles arenosus</i> | Hatalı Kayıt |
| 60 <i>Anopheles multicolor</i> | Günümüzde Mevcut Değil |
| 61 <i>Anopheles sergentii</i> | Günümüzde Mevcut Değil |
| 62 <i>Aedes asepti</i> | Günümüzde Mevcut Değil |
| 63 <i>Aedes maniae</i> | Hatalı Kayıt |
| 64 <i>Culex apicalis</i> | Hatalı Kayıt |
| 65 <i>Culex adamsi</i> | Hatalı Kayıt |
| 66 <i>Culex univittatus</i> | Hatalı Kayıt |
| 67 <i>Culex vagans</i> | Hatalı Kayıt |

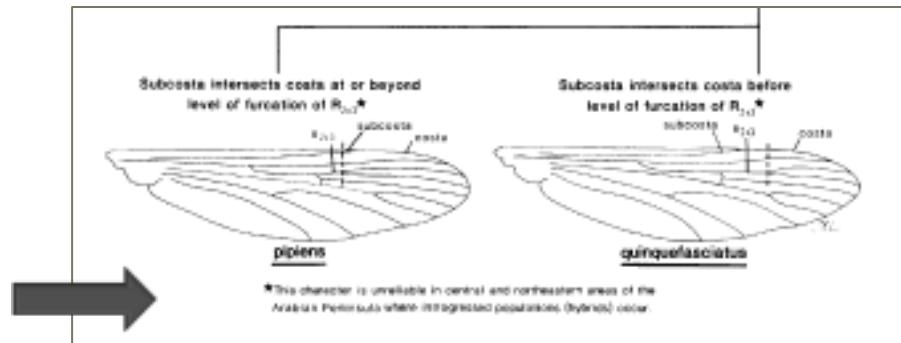
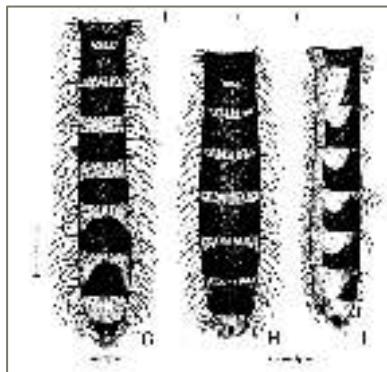
Genel Bilgiler

Gereç ve Yöntem

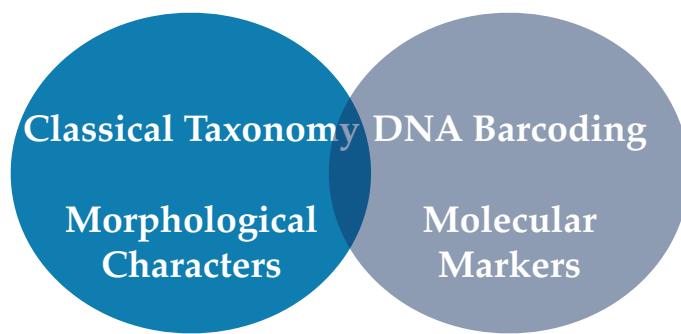
Bulgular ve Tartışma

Sonuçlar

Difficulties on morphological identification



- Samples can be damaged
- Seta and scales fall off, colours fade away
- Recognition requires experience and expertise
- Phenotypic plasticity and morphological variation of neotype and alloneotype



NEW TAXONOMY

MOLECULAR IDENTIFICATION

- DNA barcoding: cytochrome oxidase subunit I (COI) - Neighbor joining (NJ) method using Kimura 2 parameter
- Barcode of Life Data System, BOLD Natural History Museum in London and Washington DC
- Reliable data to compare sequences was created
- Molecular evolution is slow on mtDNA and distance within two species is rarely over 2%.

| Accession of the Part | P.L. Evidence | Species | Evidence + Previous | Trusted | P.L. Taxon |
|-----------------------|---------------|---------|---------------------|---------|------------|
| BL12217779 - Adel | 10 | 10 | 11 | 10 | Adel |
| BL12217780 - Adel | 11 | 9 | 1 | 1 | Adel |
| BL12217781 - Adel | 11 | 9 | 1 | 1 | Adel |
| BL12217782 - Adel | 11 | 9 | 1 | 1 | Adel |
| BL12217783 - Adel | 10 | 10 | 11 | 10 | Adel |
| BL12217784 - Adel | 9 | 9 | 1 | 1 | Adel |
| BL12217785 - Adel | 9 | 9 | 1 | 1 | Adel |

| Accession of the Part | P.L. Evidence | Species | Evidence + Previous | Trusted | P.L. Taxon |
|-----------------------|---------------|---------|---------------------|---------|------------|
| BL12217786 - Adel | 10 | 11 | 11 | 10 | Adel |
| BL12217787 - Adel | 10 | 11 | 11 | 10 | Adel |
| BL12217788 - Adel | 9 | 9 | 1 | 1 | Adel |

SAMPLING SITES

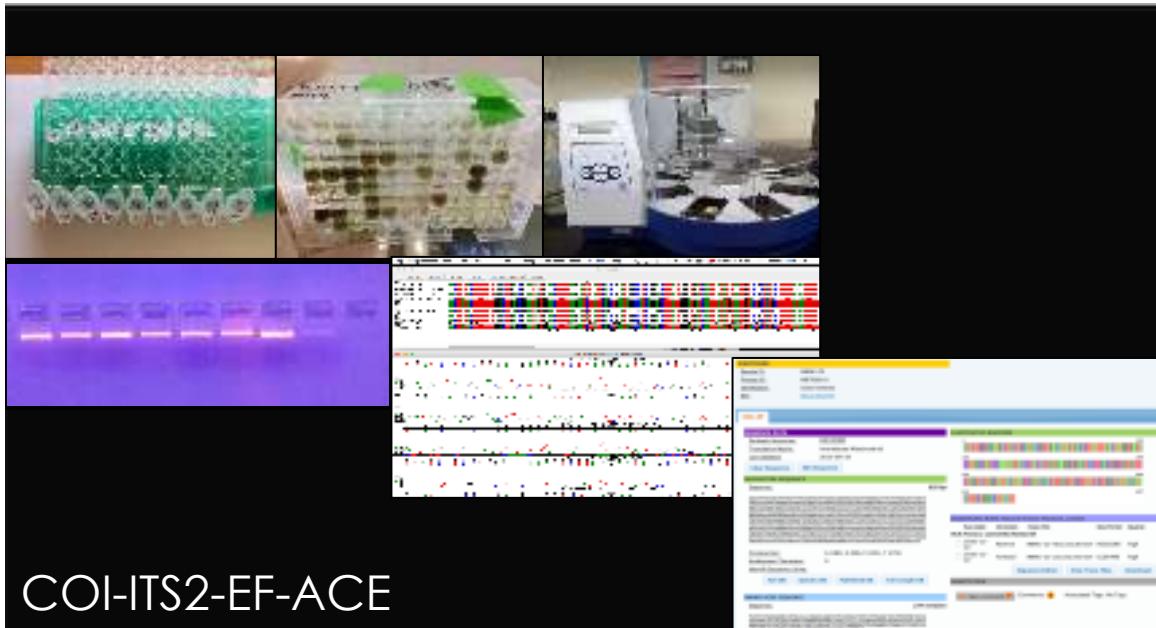
0 3 degrees



2010-2017:
34 Cities from all over Turkey



Standard Method



COI-ITS2-EF-ACE

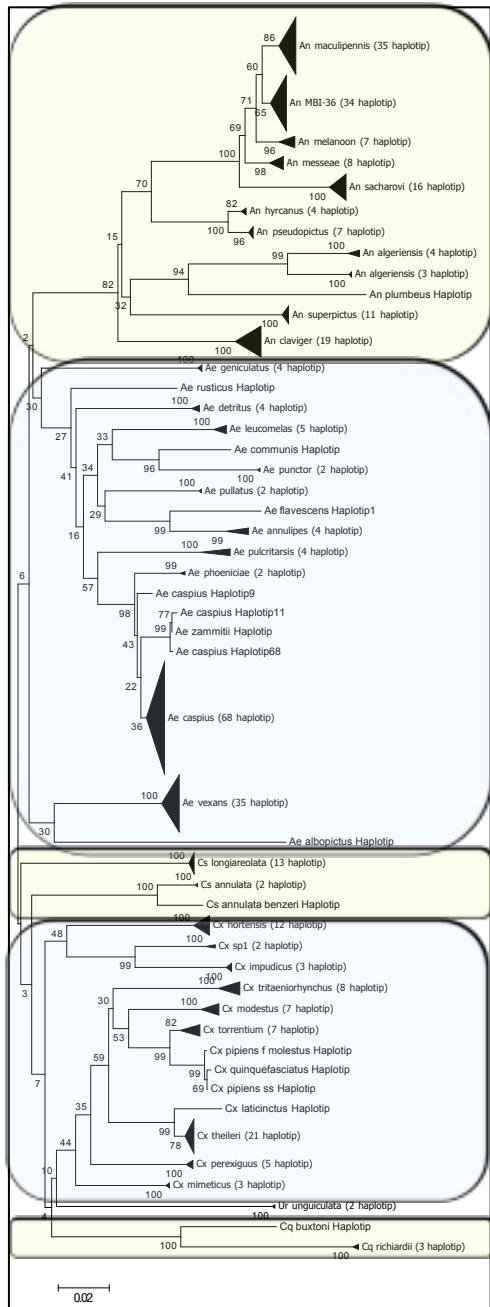
1959-2011: 54 taxa

Anopheles 10
Aedes 23
Culex 13
Culiseta 5
Coquillettidia 1
Uranotaenia 1
Orthopodomyia 1

2010-2017: 63 taxa;

Anopheles 13 taxa (+3)
Aedes 24 spp. (+1)
Culex 16 taxa (+3)
Culiseta 6 spp. (+1)
Coquillettidia 2 spp. (+1)
Uranotaenia 1 sp.
Orthopodomyia 1 sp.





2 *Anopheles* species as new records & 2 suspected new species

- *Anopheles messeae* or *dacie*
- *Anopheles hyrcanus* var *pseudopictus*

Aedes albopictus & 4 other species were approved

1 *Culiseta* species as new record

- *Culex quinquefasciatus*
- *Culex pipiens* f. *molestus*
- *Culex impudicus*

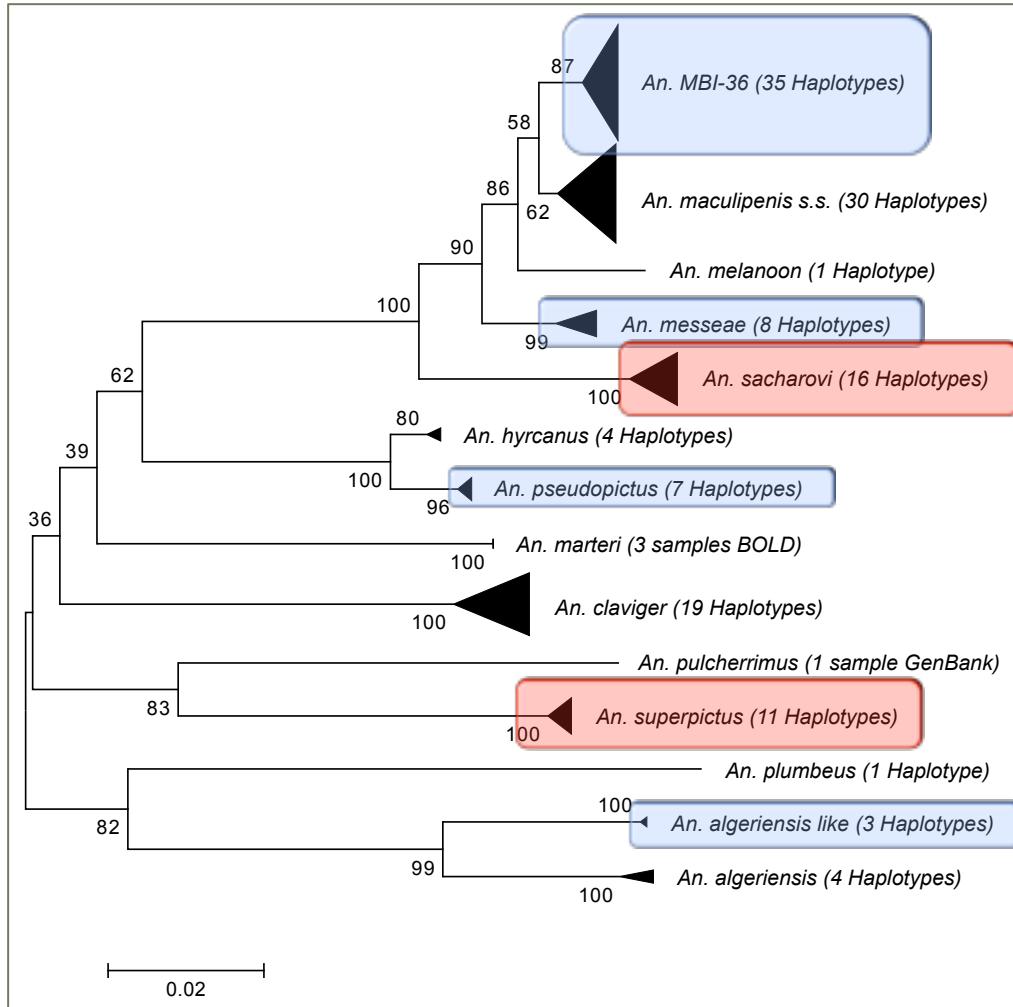
Culex quinquefasciatus & 2 other species as new records

Culiseta alaskaensis or *subochrea*

- *Coquillettidia buxtoni*

1 *Coquillettidia* species as new record

Anophelinae Subfamily

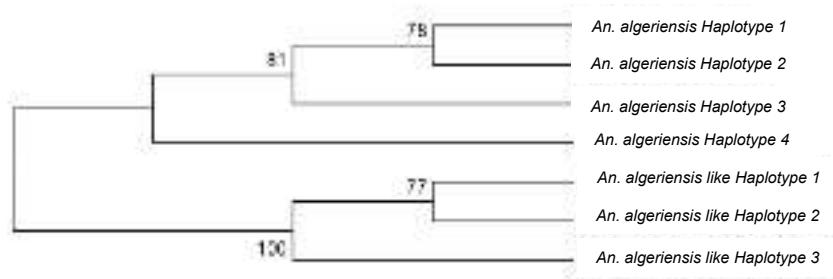
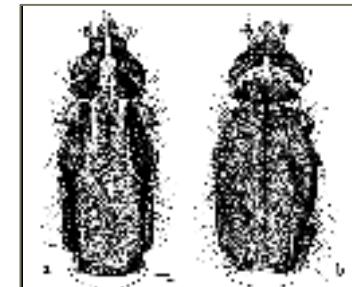


- 24 cities 1.794 samples - 345 mosquitoes barcoded
- 10 *Anopheles* species + 4 new taxon

Anopheles Genus *Anopheles* Subgenus

Anopheles (Anopheles) algeriensis, Theobald, 1903

- 40 samples are *An. algeriensis*, 16 of them barcoded
- 6 of them are 5% different than the other 10 samples



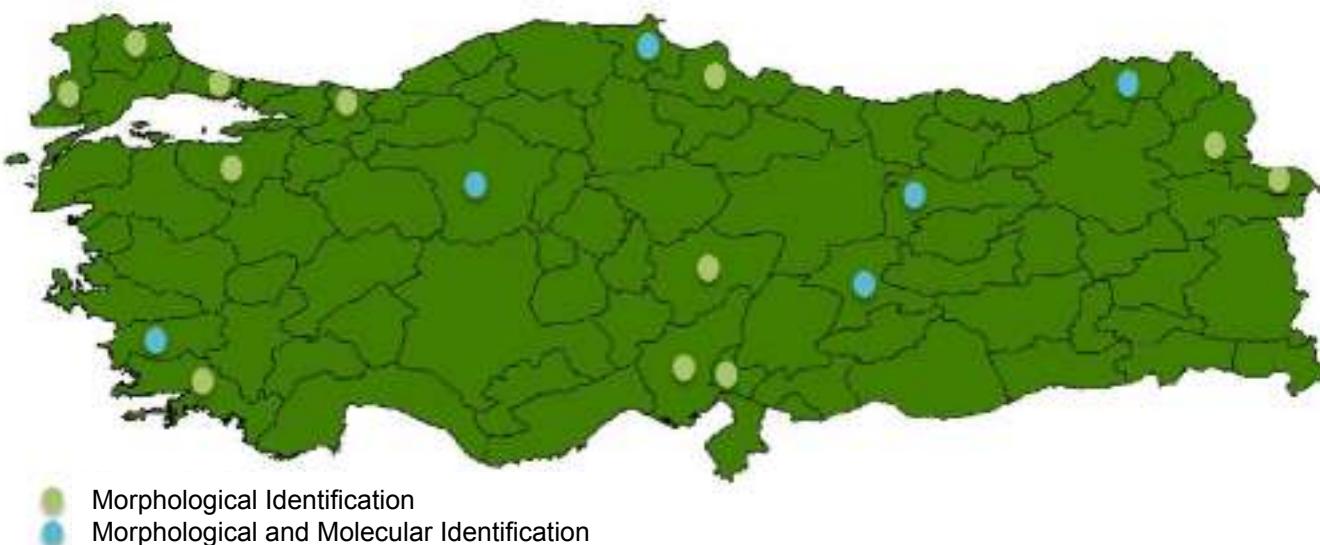
Sequence data for An. algeriensis Haplotype 1, An. algeriensis Haplotype 2, An. algeriensis Haplotype 3, An. algeriensis Haplotype 4, An. algeriensis like Haplotype 1, An. algeriensis like Haplotype 2, and An. algeriensis like Haplotype 3.

| Sequence | Length |
|------------------------------------|--------|
| ATGCCTGGCTTCATTCCCGCTTCTAAGATCATGC | 360 |
| TGATTAATCCTGCCTTTATGCTCGTGGAACTAT | 360 |
| TGATTAATCCTGCCTTTATGCTCGTGGAACTAT | 360 |
| TGATTAATCCTGCCTTTATGCTCGTGGAACTAT | 360 |

Anopheles Genus *Anopheles* Subgenus

Anopheles (Anopheles) claviger, Meigen, 1804

- *Anopheles claviger* s.l. 17 cities 74 samples, 28 were barcoded
- None of them are *Anopheles petragnani* with 6.8% distance



Anopheles Genus *Anopheles* Subgenus

Anopheles (Anopheles) hyrcanus, Pallas, 1771

- 4th tarsal segment
- 200 samples, 26 were barcoded
- **1,4 % genetic distance**



Anopheles hyrcanus (a) *Anopheles pseudopictus* (b)



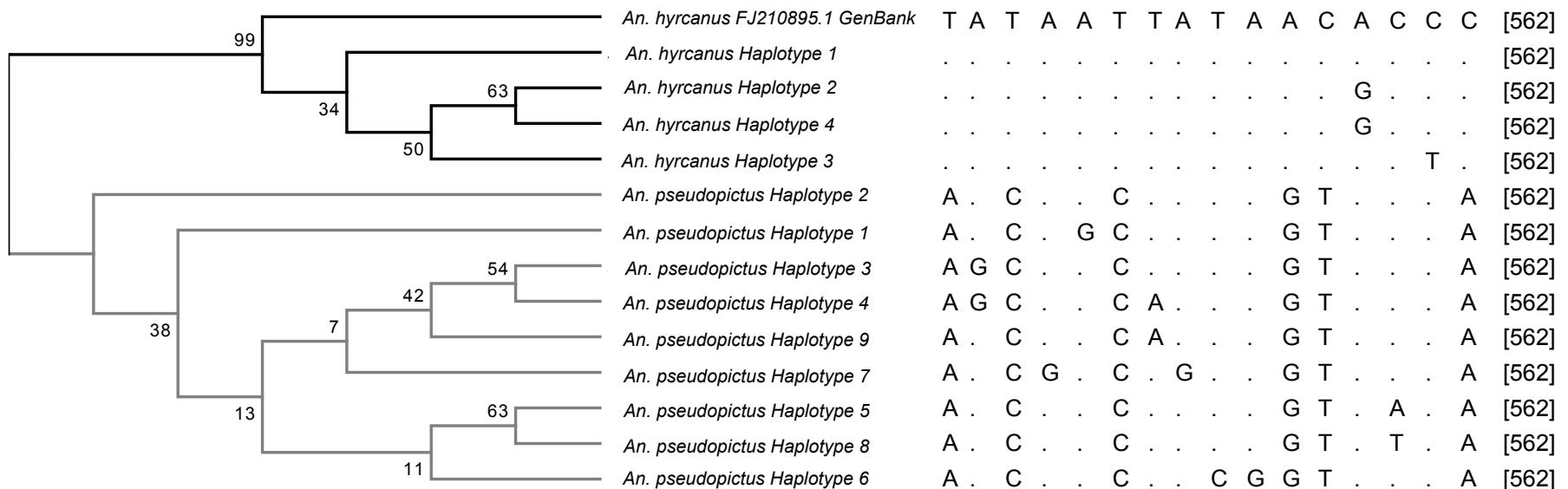
Morphological and Molecular Identification

Anopheles Genus *Anopheles* Subgenus

Anopheles (Anopheles) hyrcanus, Pallas, 1771



Anopheles hyrcanus (a) *Anopheles pseudopictus* (b)



Anopheles Genus *Anopheles* Subgenus

Anopheles (Anopheles) maculipennis, Meigen, 1818 species complex

In Palearctic:

- *An. artemievi* Gordeev, 2005;
 - *An. atroparvus* van Thiel, 1927;
 - *An. beklemishevi* Stegnii ve Kabanova, 1976;
 - *An. daciae* Nicolescu, 2004;
 - *An. labranchiae* Falleroni, 1926;
 - *An. maculipennis* s.s. Meigen, 1818;
 - *An. martinius* Shingarev, 1926;
 - *An. melanoon* Hackett, 1934;
 - *An. messeae* Falleroni, 1933;
 - *An. persiensis* Linton, 2003;
 - *An. sacharovi* Favre, 1903
-
- 11 species



Anopheles Genus *Anopheles* Subgenus

Anopheles (Anopheles) maculipennis, Meigen, 1818 species complex

In Palearctic:

- *An. artemievi* Gordeev, 2005;
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- *An. maculipennis* s.s. Meigen, 1818;
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- *An. melanoon* Hackett, 1934;
- *An. messeae* Falleroni, 1933;
- *An. persiensis* Linton, 2003;
- *An. sacharovi* Favre, 1903

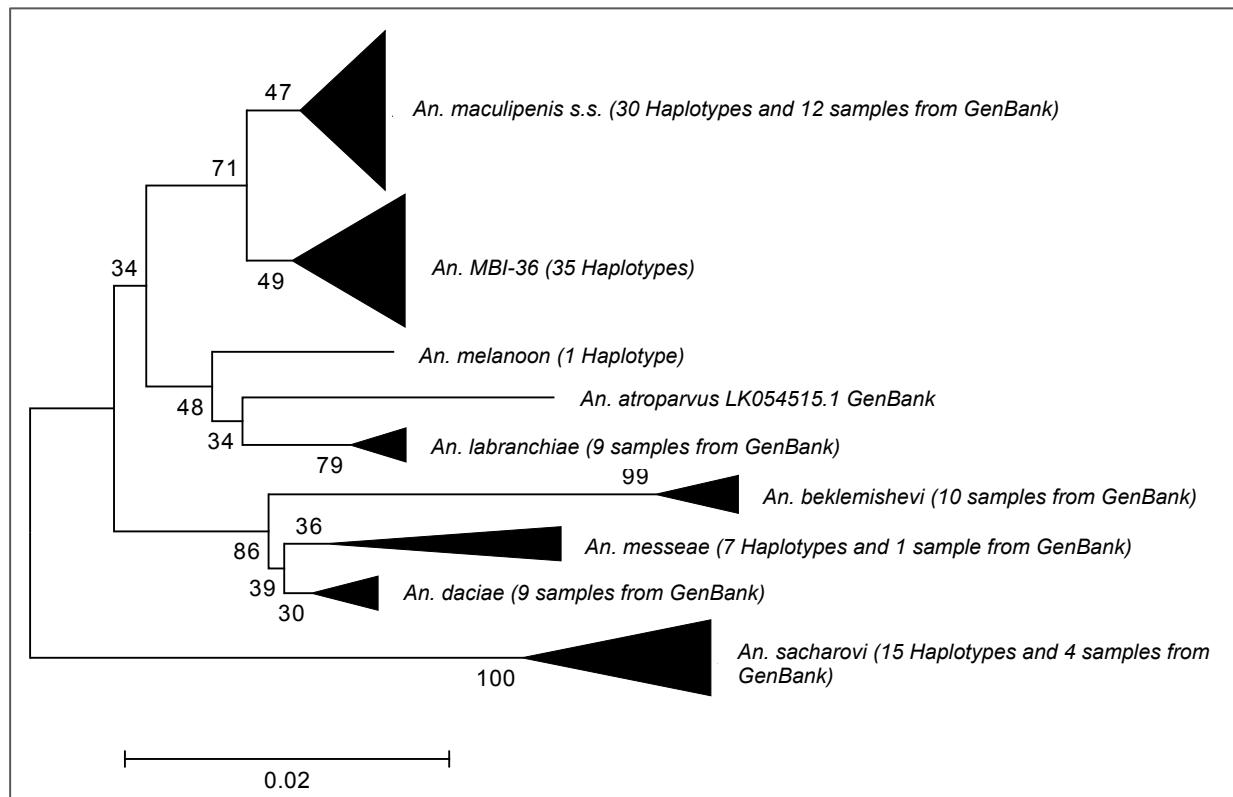
- 11 species



Anopheles Genus *Anopheles* Subgenus

Anopheles (Anopheles) maculipennis, Meigen, 1818 species complex

- *An. maculipennis* s.s. (n= 172), *An. messeae* (n= 11), *An. melanoon* (n= 3) and *An. sacharovi* (n= 42)



Anopheles Genus *Anopheles* Subgenus

Anopheles (Anopheles) maculipennis, Meigen, 1818 species complex

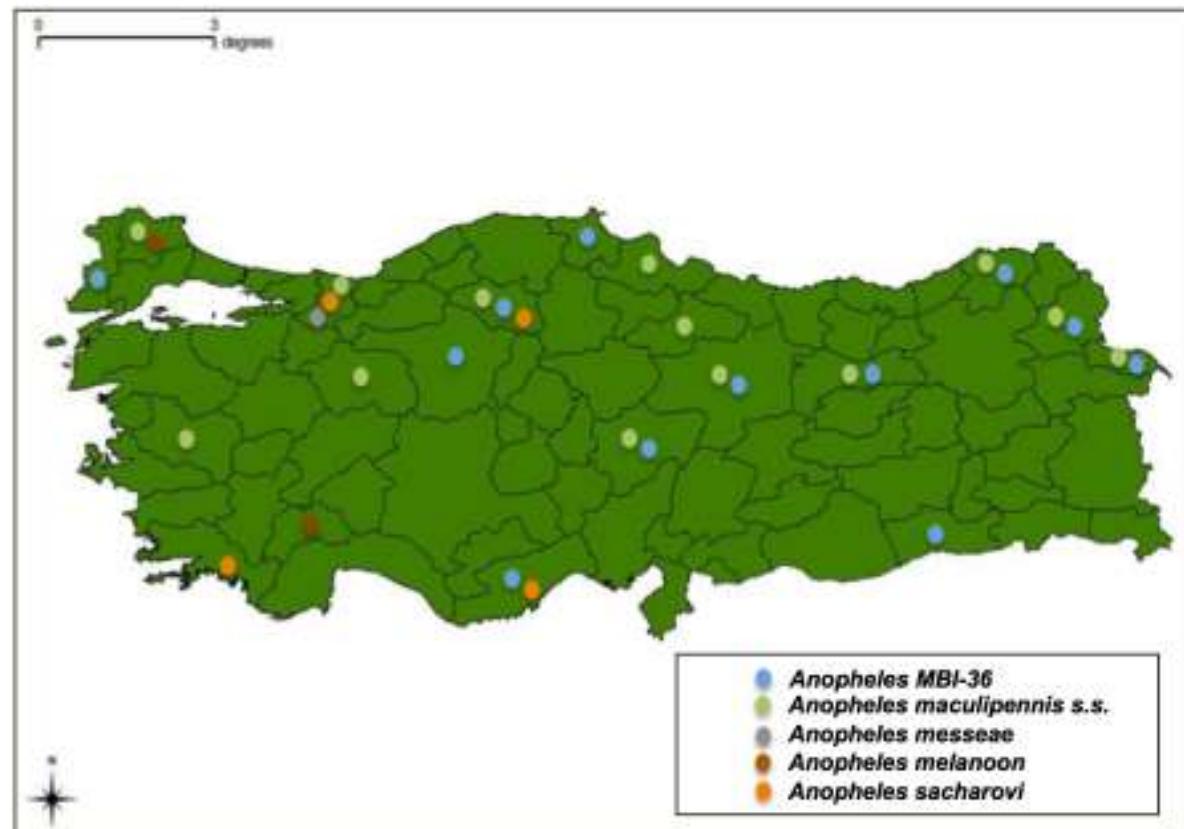
■ *An. maculipennis* s.l. Samples from 2013



Anopheles Genus *Anopheles* Subgenus

Anopheles (Anopheles) maculipennis, Meigen, 1818 species complex

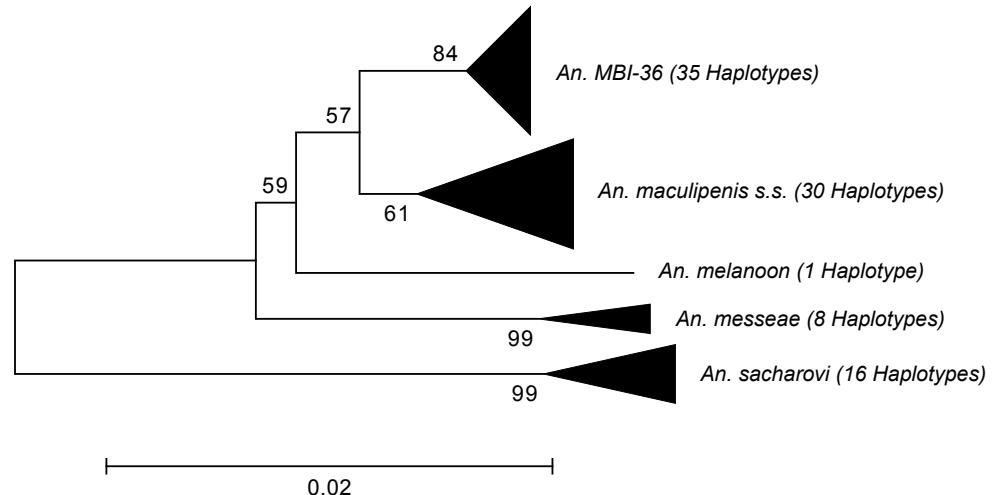
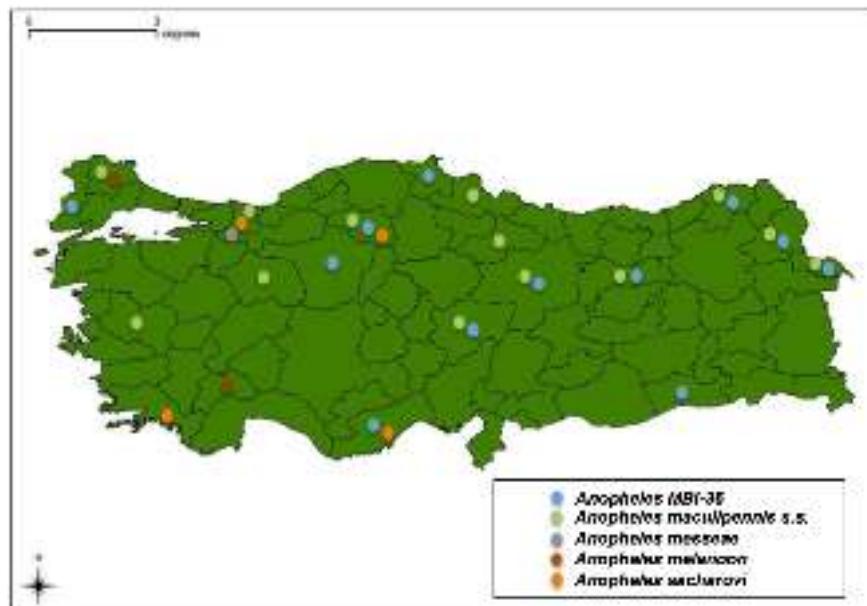
- 22 cities 1.382 samples of *An. maculipennis* s.l. – 228 were barcoded



Anopheles Genus *Anopheles* Subgenus

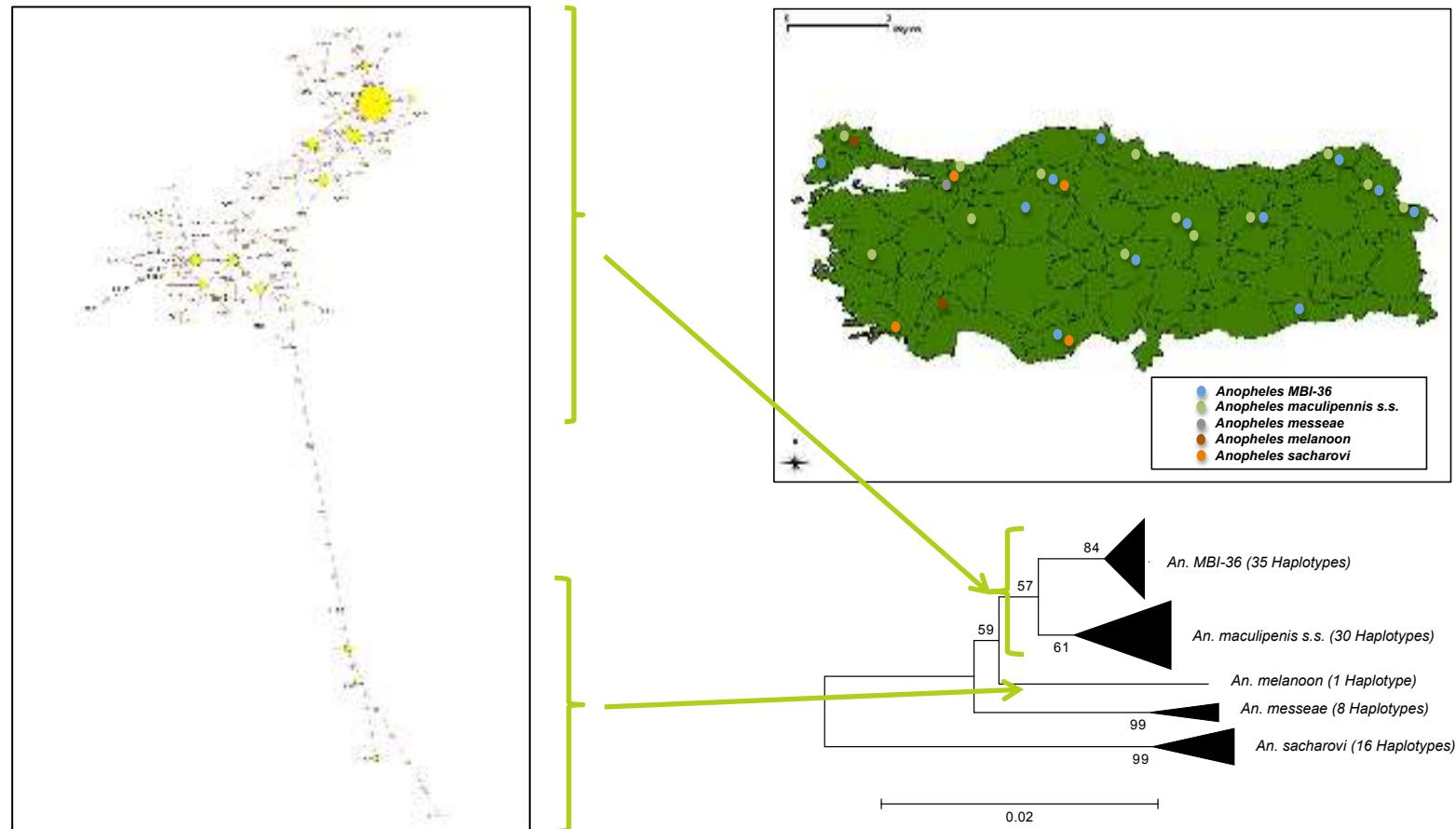
Anopheles (Anopheles) maculipennis s.s. Meigen, 1818

- *An. maculipennis* s.l. 75 % are *An. maculipennis* s.s. And they are forming 2 groups: **1,4 % genetic distance**
- Genetic distance between *An. messeae* and *An. daciae* is 0.7%!!!
- NEW SPECIES?



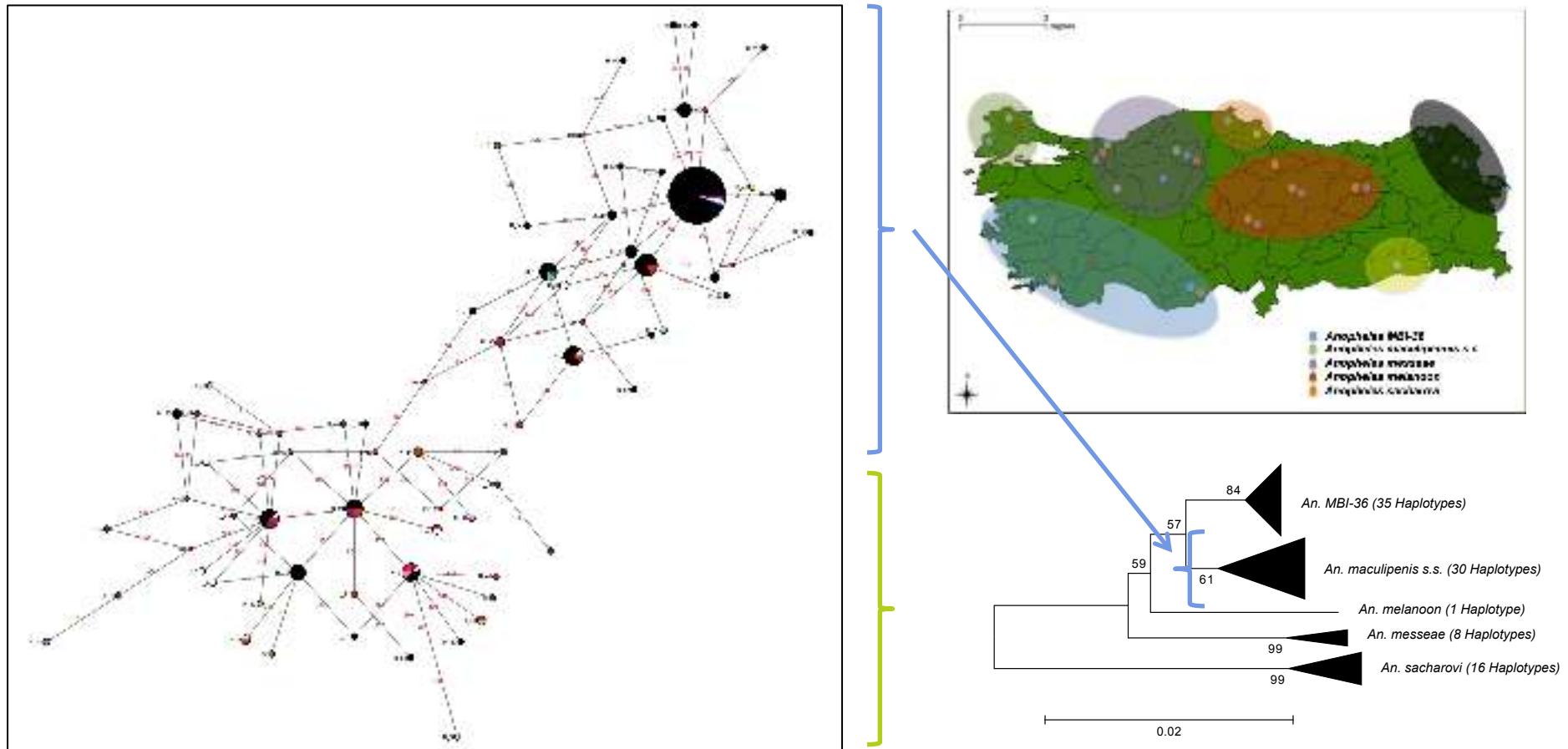
Anopheles Genus *Anopheles* Subgenus

Anopheles (Anopheles) maculipennis s.s. Meigen, 1818



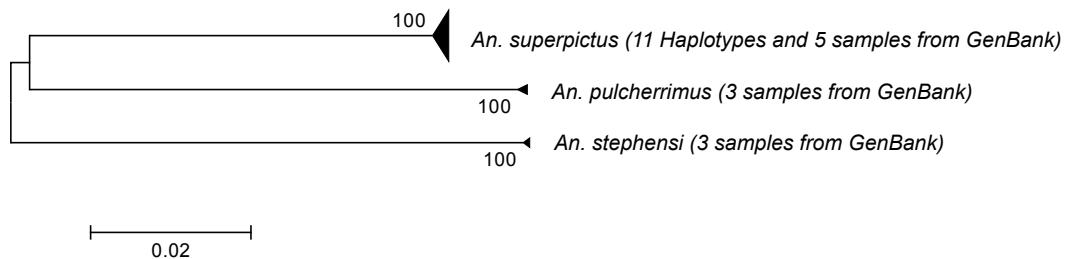
Anopheles Genus *Anopheles* Subgenus

Anopheles (Anopheles) maculipennis s.s. Meigen, 1818



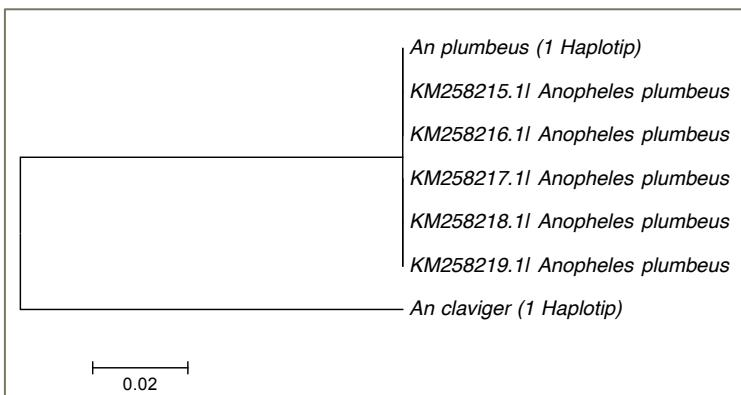
Anopheles Genus *Anopheles* Subgenus

Anopheles (Cellia) superpictus, Grassi, 1899

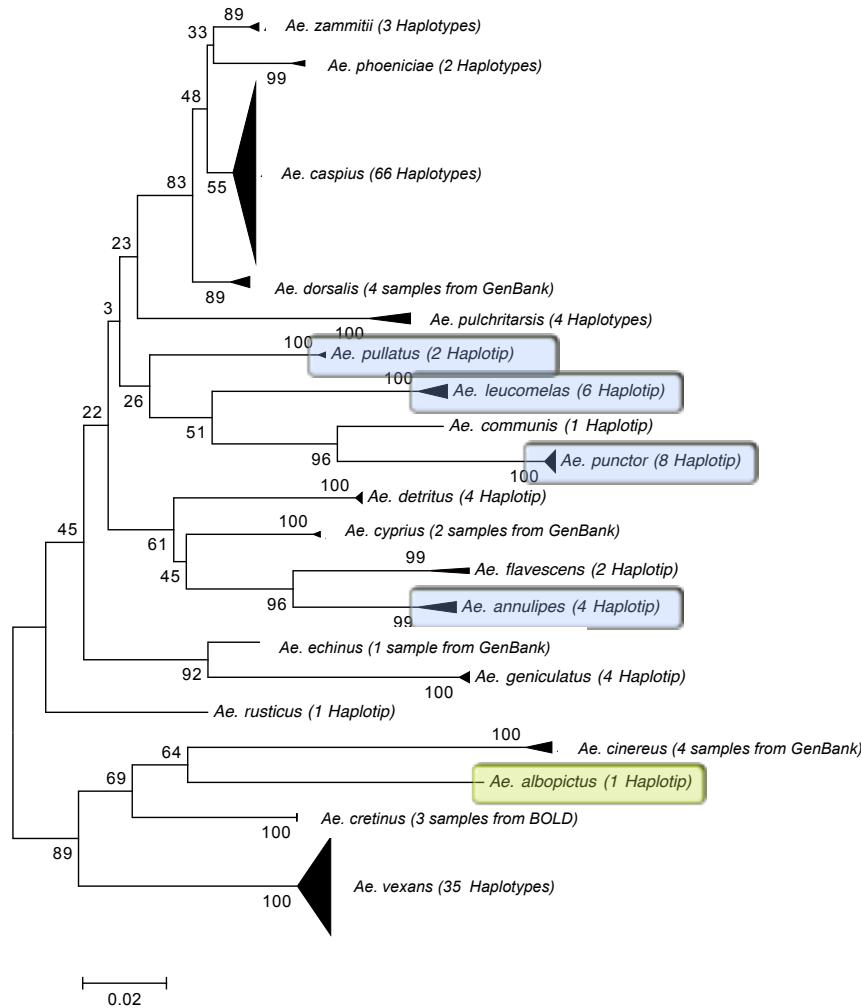


- Adana, Aydin and Erzincan
3 cities – South, West and
East Anatolia
- **2nd important malaria
vector**

Anopheles (Anopheles) plumbeus, Stephens, 1828



Culicinae Subfamily; Aedini Tribe



- 20 cities 1968 *Aedes* samples – 296 barcoded
- *Aedes albopictus* new record for the country
- *Aedes aegypti* and *Aedes albopictus* in North East Turkey
- Presence of *Ae. annulipes*, *Ae. leucomelas*, *Ae. pullatus* and *Ae. punctor* proven.

Culicinae Subfamily; Aedini Tribe

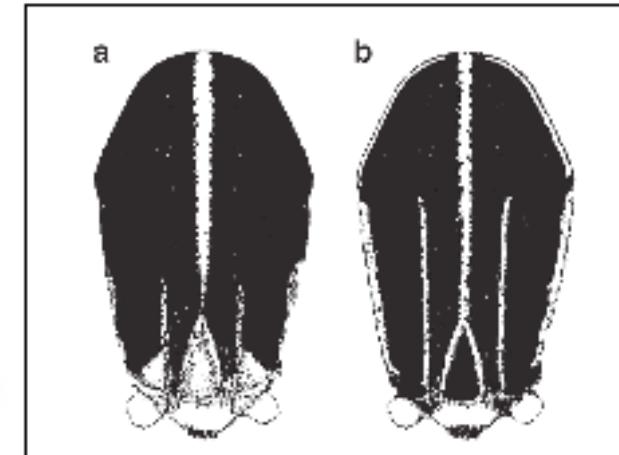
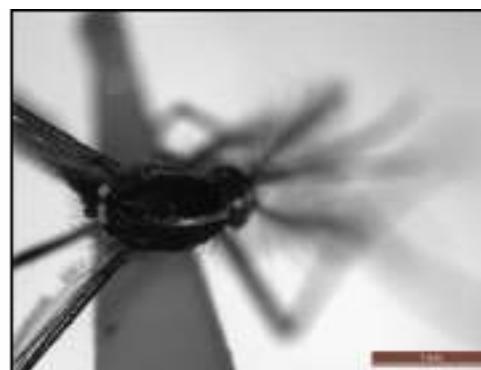
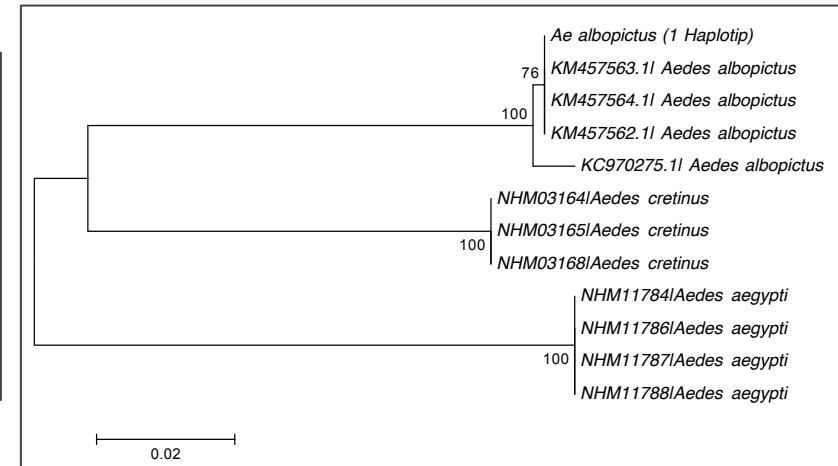
Stegomyia Subgenus

VECTOR-BORNE AND ZOONIC DISEASES
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ORIGINAL ARTICLE

First Record of *Stegomyia albopicta* in Turkey Determined By Active Ovitrap Surveillance and DNA Barcoding

Kemal Özer,¹ Eliz Güney,² Erol Uzun,¹ Yvette Marie Linton,³ Deniz Delimi,⁴ and Dulent Alten⁵



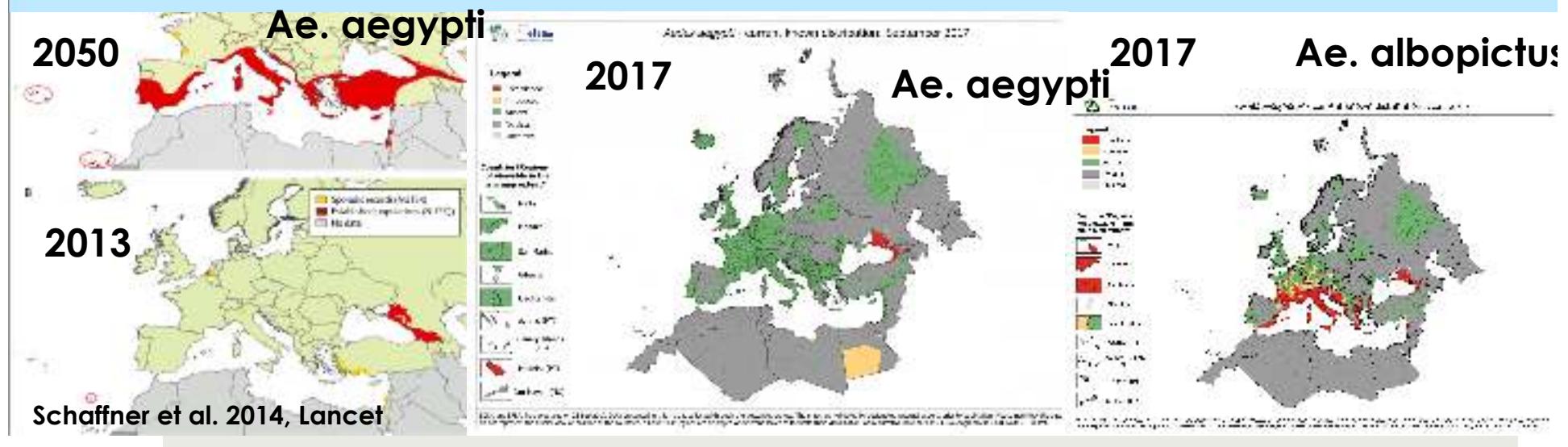
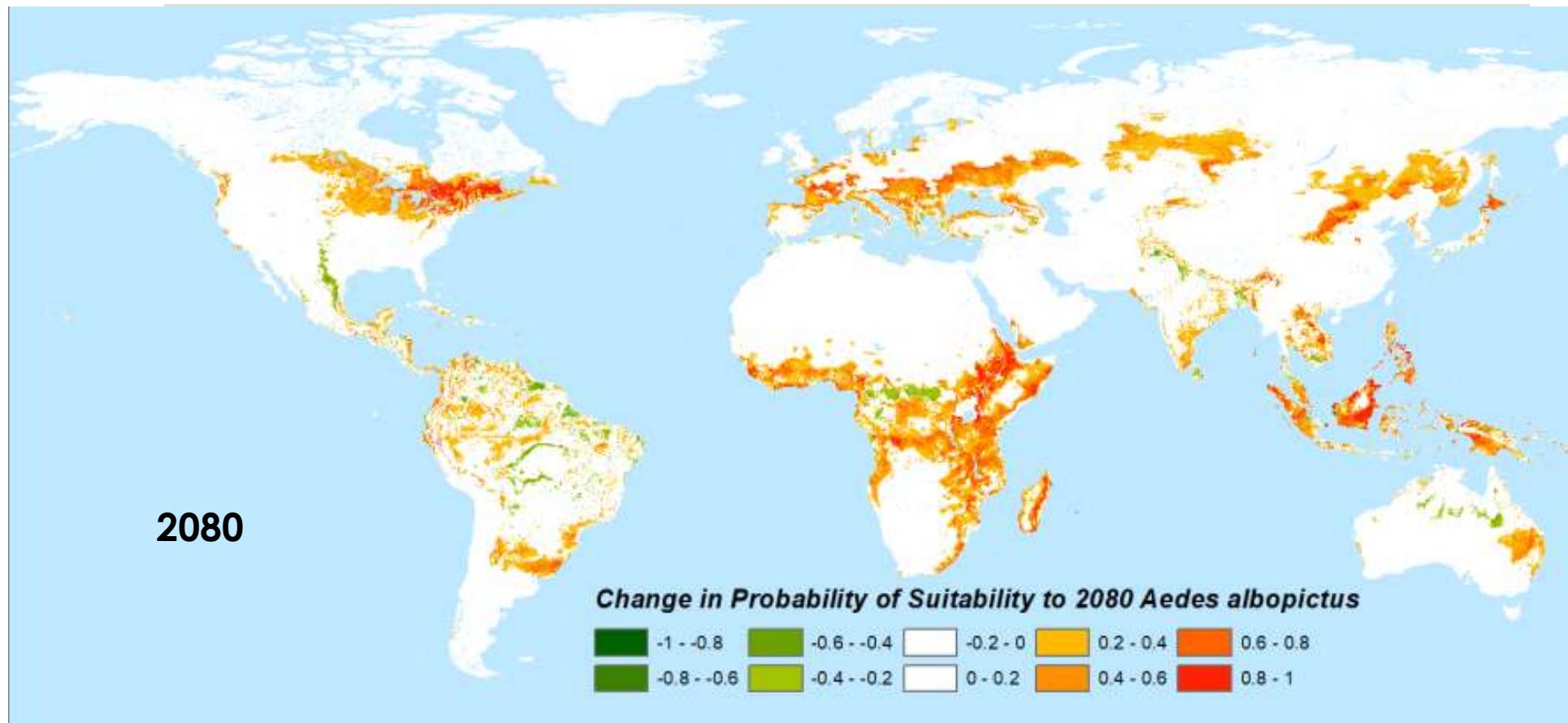
Culicinae Subfamily; Aedini Tribe

***Aedes albopictus* in
North West Turkey**

- 2011 -

***Aedes aegypti* and
Aedes albopictus in
North East Turkey
2015. Akiner et al.
2016**

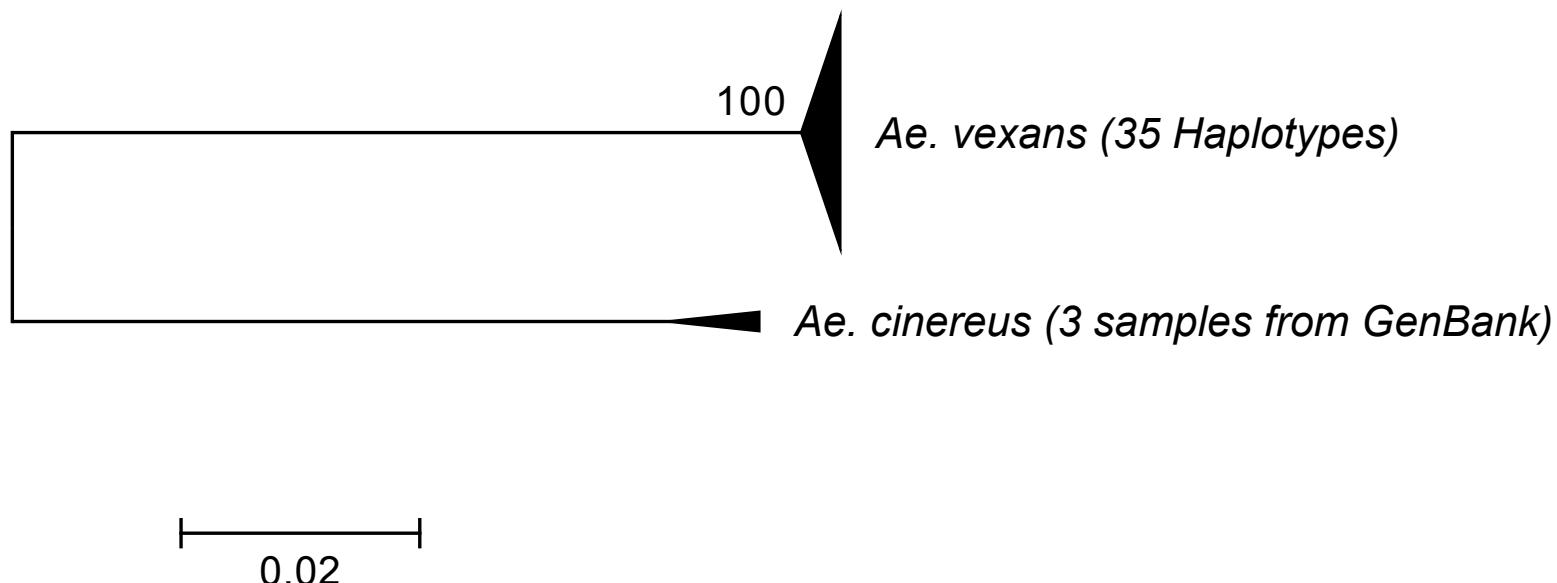




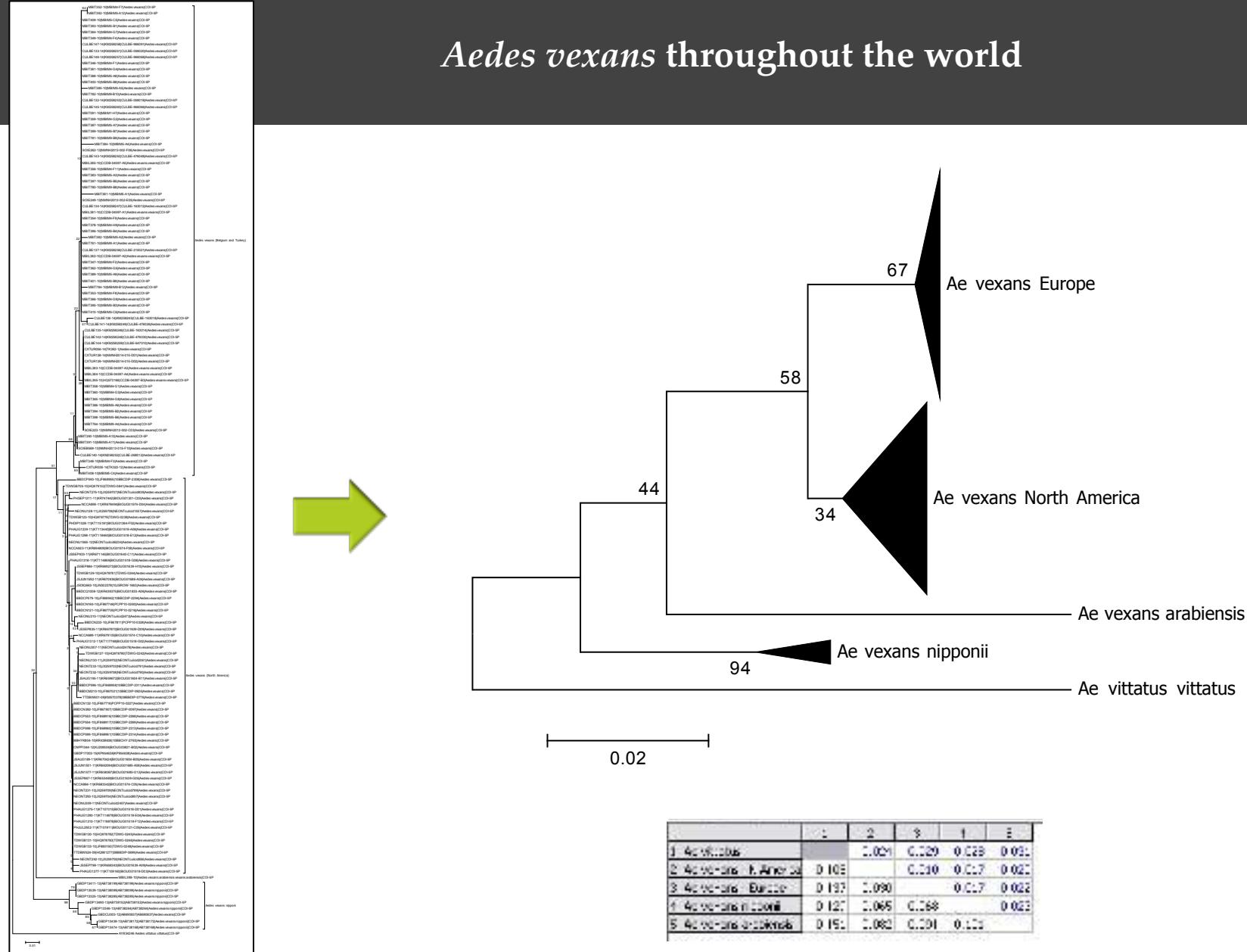
Culicinae Subfamily; Aedini Tribe

Aedes and *Aedimorphus* Subgenus

- *Aedes (Aedes) cinereus*, Meigen, 1818
- *Aedes (Aedimorphus) vexans*, Meigen, 1830

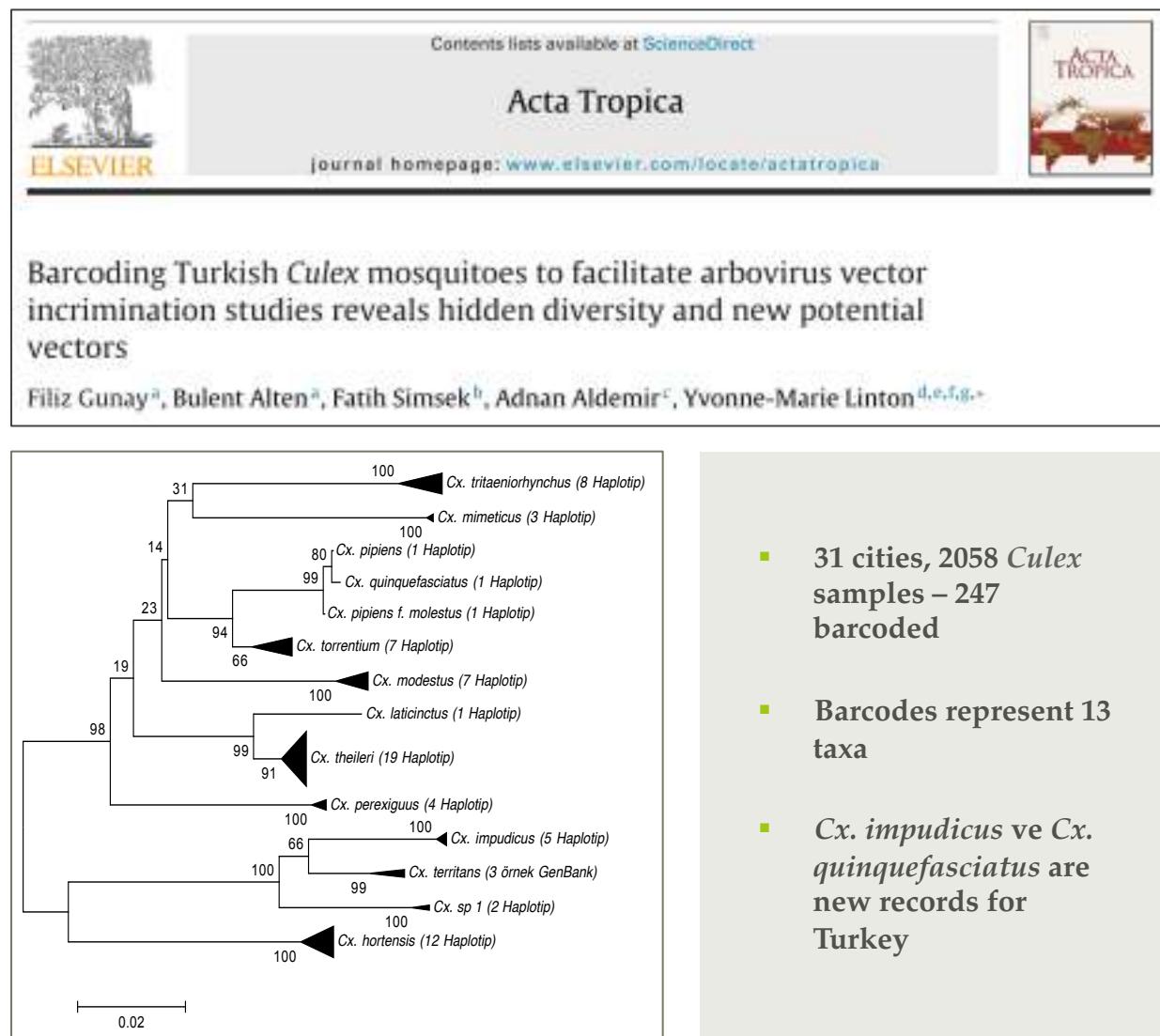


Aedes vexans throughout the world



Culicinae Subfamily; Culicini Tribe

- *Culex (Barraudius) modestus*, Ficalbi, 1889
- *Culex (Barraudius) pusillus*, Macquart, 1850
- *Culex (Culex) laticinctus*, Edwards, 1913
- *Culex (Culex) mimeticus*, Noe, 1899
- *Culex (Culex) perexiguus*, Theobald, 1903
- *Culex (Culex) pipiens ss*, Linnaeus, 1758
- *Culex (Culex) pipiens f. molestus*, Forskal 1775
- *Culex (Culex) quinquefasciatus*, Say, 1823
- *Culex (Culex) theileri*, Theobald, 1903
- *Culex (Culex) torrentium*, Martini, 1925
- *Culex (Culex) tritaeniorhynchus*, Giles, 1901
- *Culex (Maillotia) deserticola*, Kirkpatrick, 1924
- *Culex (Maillotia) hortensis* Ficalbi, 1889
- *Culex (Neoculex) europaeus*, da Cunha Ramos, Ribeiro ve Harrison, 2003
- *Culex (Neoculex) impudicus*, Ficalbi, 1890
- *Culex (Neoculex) martinii*, Medschid, 1930



Culicini Tribe; *Culex* Genus

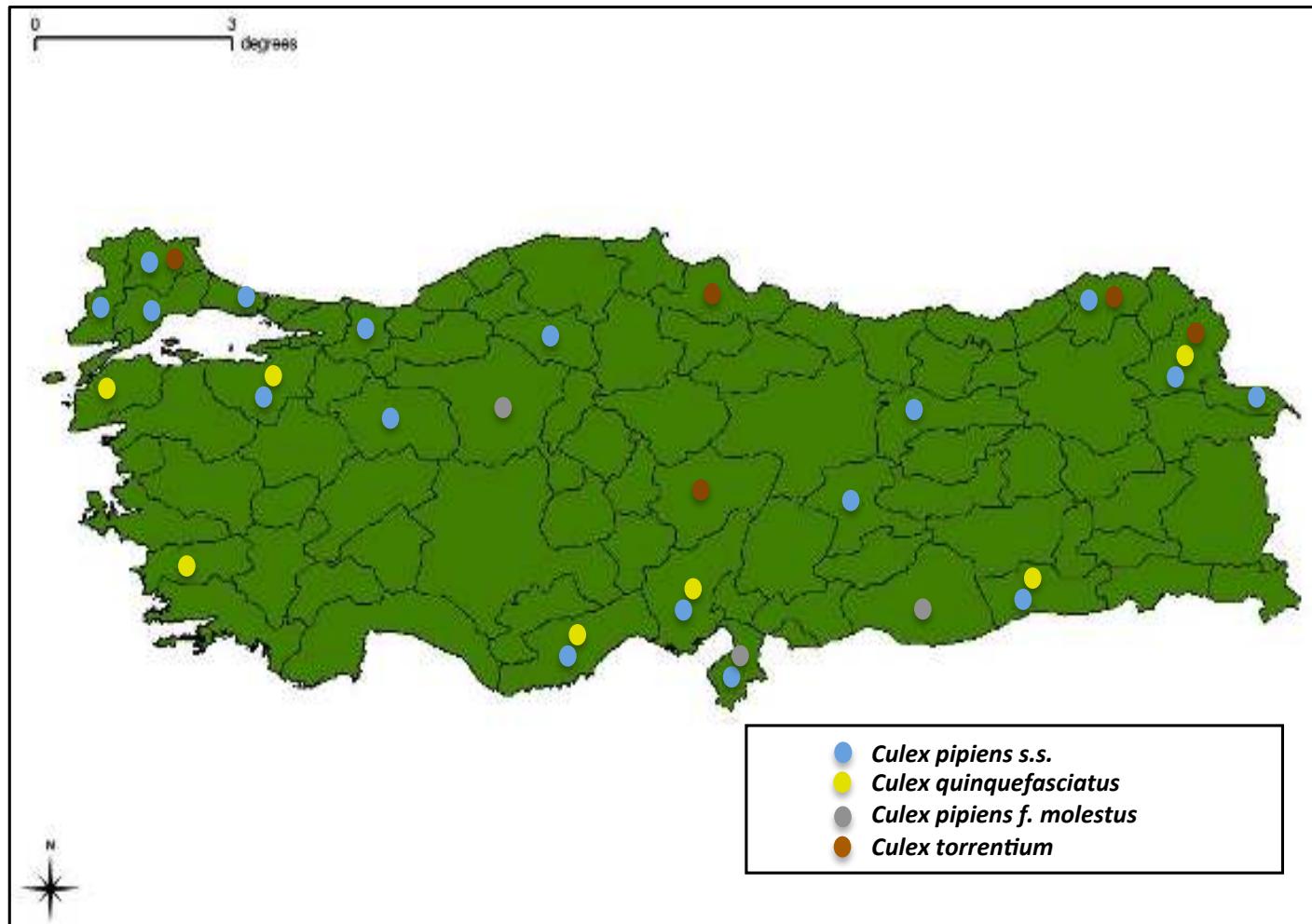
Neoculex Subgenus

- *Culex (Neoculex) europaeus*, da Cunha Ramos, Ribeiro ve Harrison, 2003
- *Culex (Neoculex) impudicus*, Ficalbi, 1890
- *Culex (Neoculex) martinii*, Medschid, 1930



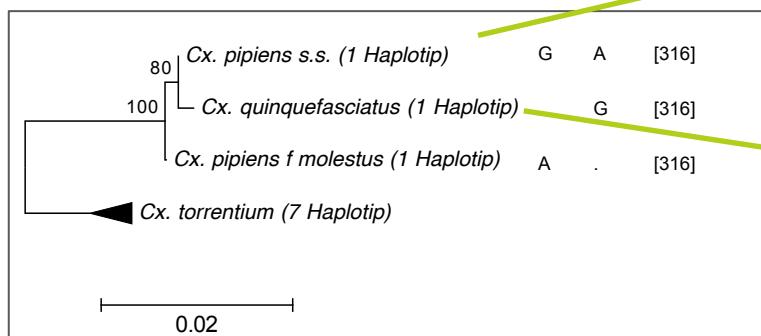
Culicini Tribe; *Culex* Genus

Culex Subgenus *Culex pipiens* species complex and *Culex torrentium*



Culicini Tribe; *Culex* Genus

Culex Subgenus



VECTOR-BORNE AND ZOONOTIC DISEASES
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ORIGINAL ARTICLE

Arboviral Surveillance of Field-Collected Mosquitoes Reveals Circulation of West Nile Virus Lineage 1 Strains in Eastern Thrace, Turkey

Koray Ergunay¹, Filiz Gunay², Kerem Oter³, Ozge Erisoz Kasap², Sema Orman¹, Ayse Zeynep Akkula², Ismail Erdogan², Akyel Ozkul², Taner Karaoglu⁴, PLOS MEDICAL ENTOMOLOGY

OPEN ACCESS Freely available online



Serological, Molecular and Entomological Surveillance Demonstrates Widespread Circulation of West Nile Virus in Turkey

Koray Ergunay¹, Filiz Gunay², Ozge Erisoz Kasap², Kerem Oter³, Sepandar Gargari⁴, Taner Karaoglu⁴, Seda Tezcan⁵, Mehmet Cabalar⁶, Yakup Yildirim⁷, Guler Emekdas⁸, Bulent Alten⁴, Akyel Ozkul^{2*}

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New records for Turkey:

Ae. albopictus,

An. hyrcanus var. pseudopictus *Cq. buxtoni*,

Cx. impudicus

Cq. buxtoni, *Cx. hortensis*, *Cx. laticinctus* ve *Cx. perexiguus* were
barcoded for the first time

We aproved the presence of *Ae. annulipes*, *Ae. leucomelas*, *Ae. pullatus*, *Ae. punctor*, *An. messeae*, *Cx. quinquefasciatus* and *Cx. pipiens f. molestus* molecularly

ARBOVIRUSES ON THE SYRIAN BORDER

powered by QGIS

Data now available from Turkey and Jordan

Go



ARBOVIRUSES ON THE SYRIAN BORDER

HOME

PROJECT

DATA

REGIONAL MAP

USA

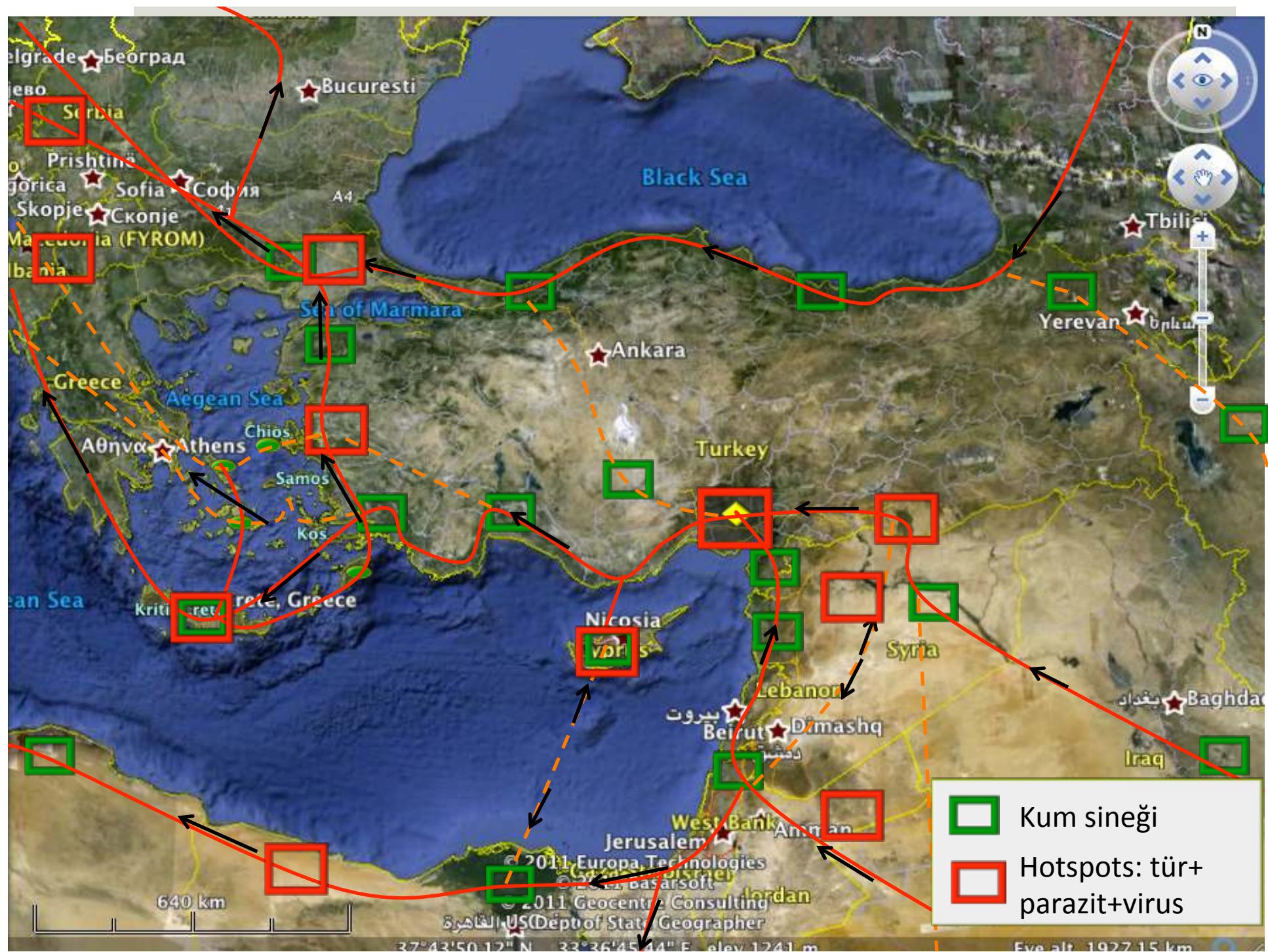
TURKEY

JORDAN

CONTACT



Optimized by
SureVisit



Syria Project

28441 Specimens (Morphology)

28203 Specimens (Virus screening)

238 Specimens (DNA barcoding)

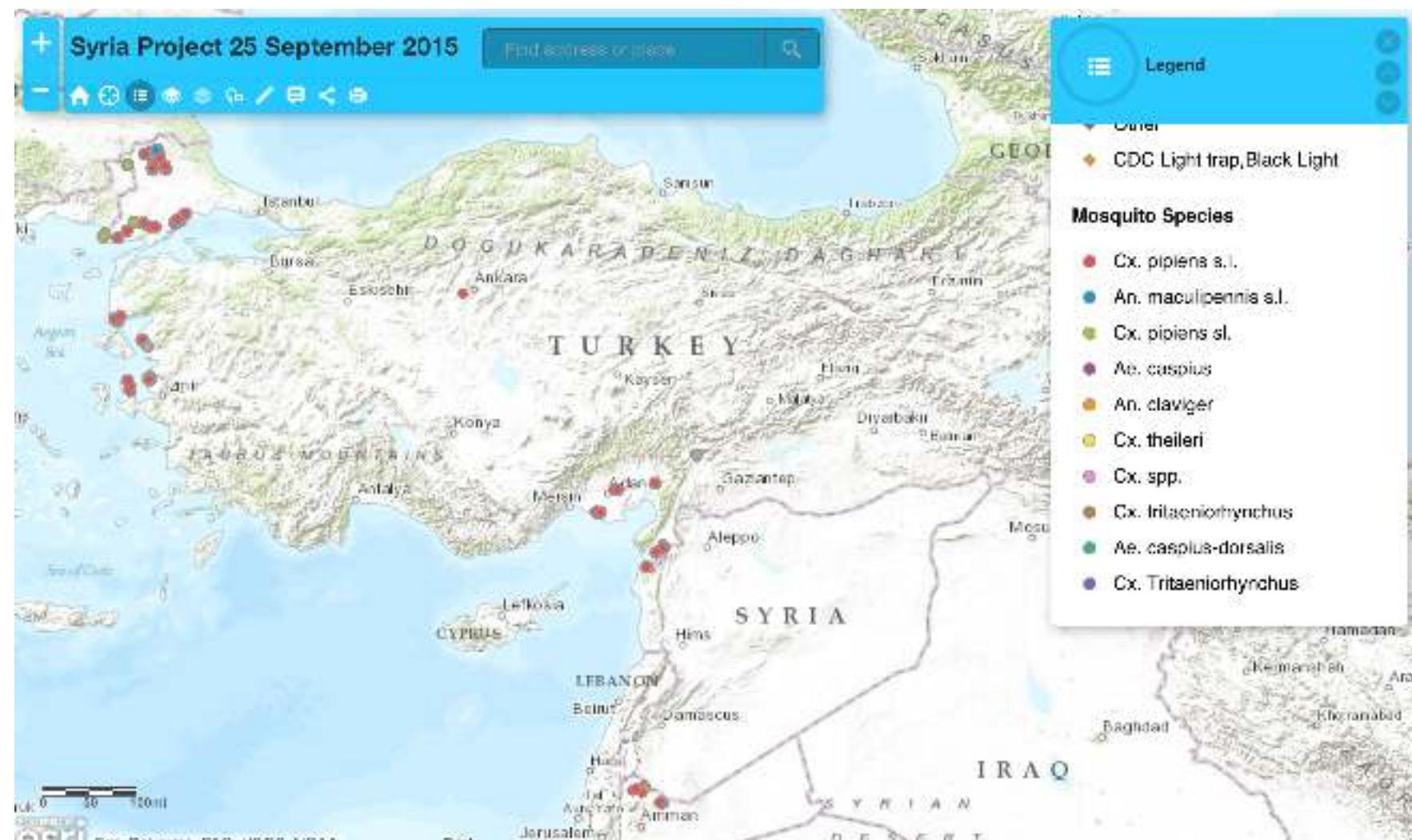
8 pools (Virus +)



ARBOVIRUSES ON THE SYRIAN BORDER

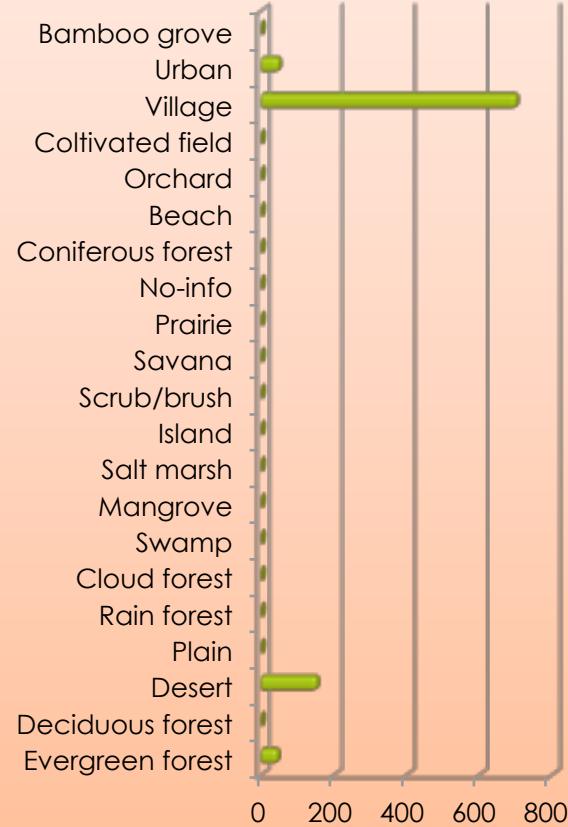


ARBOVIRUSES ON THE SYRIAN BORDER

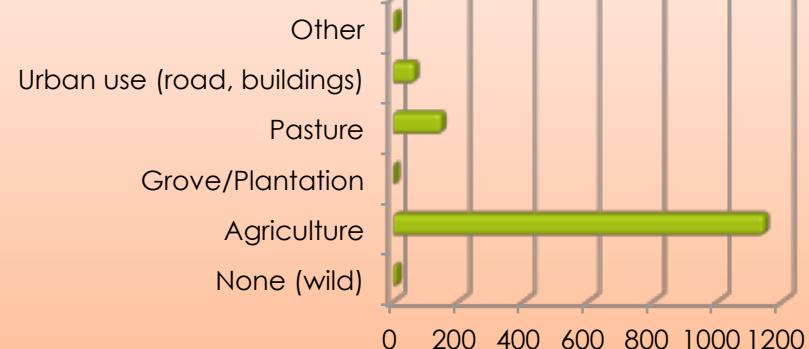


ARBOVIRUSES ON THE SYRIAN BORDER

Environment



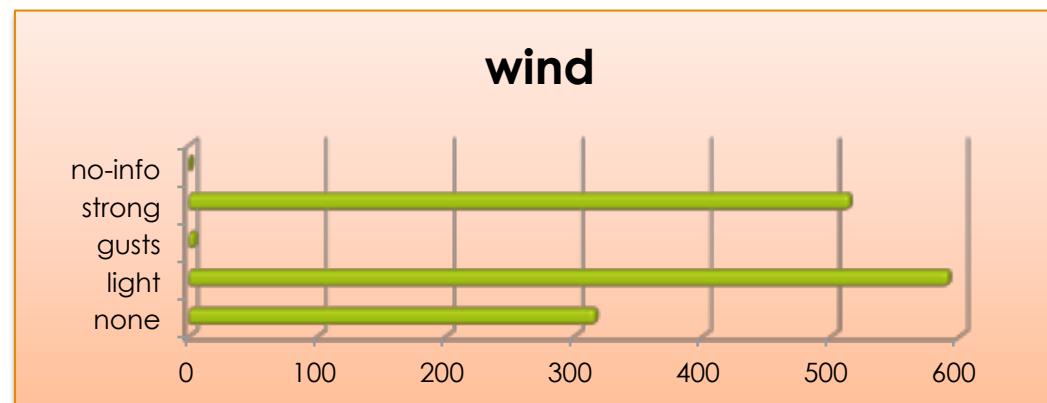
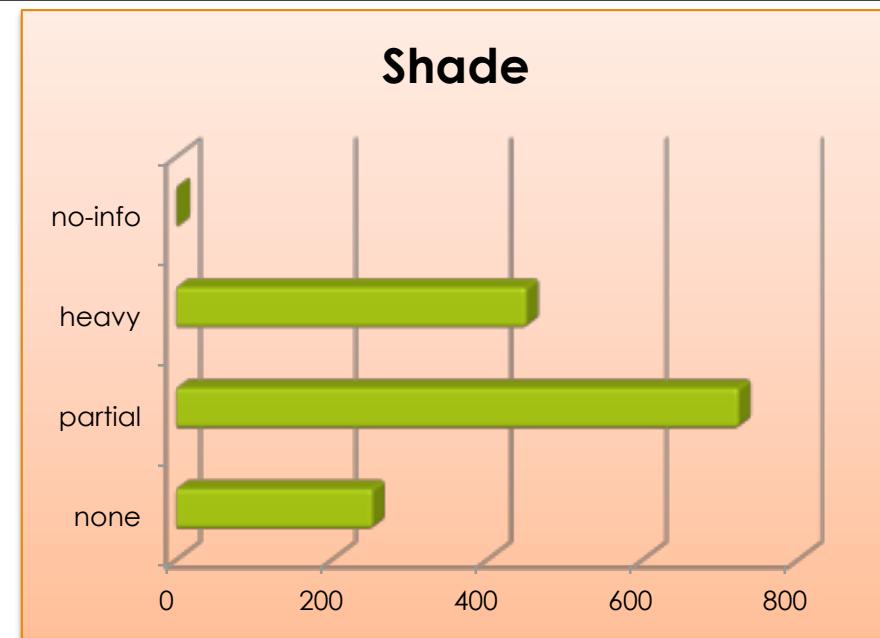
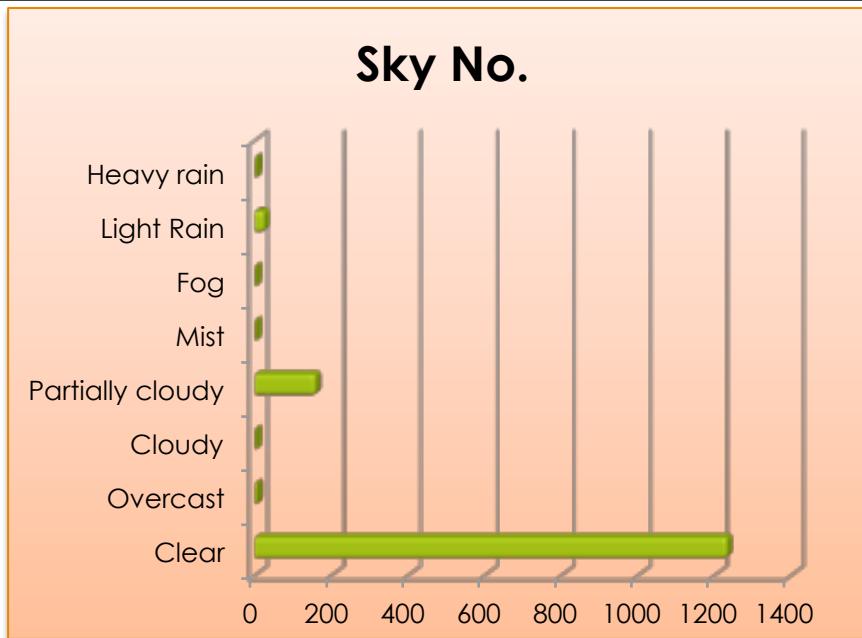
Ground Use No.



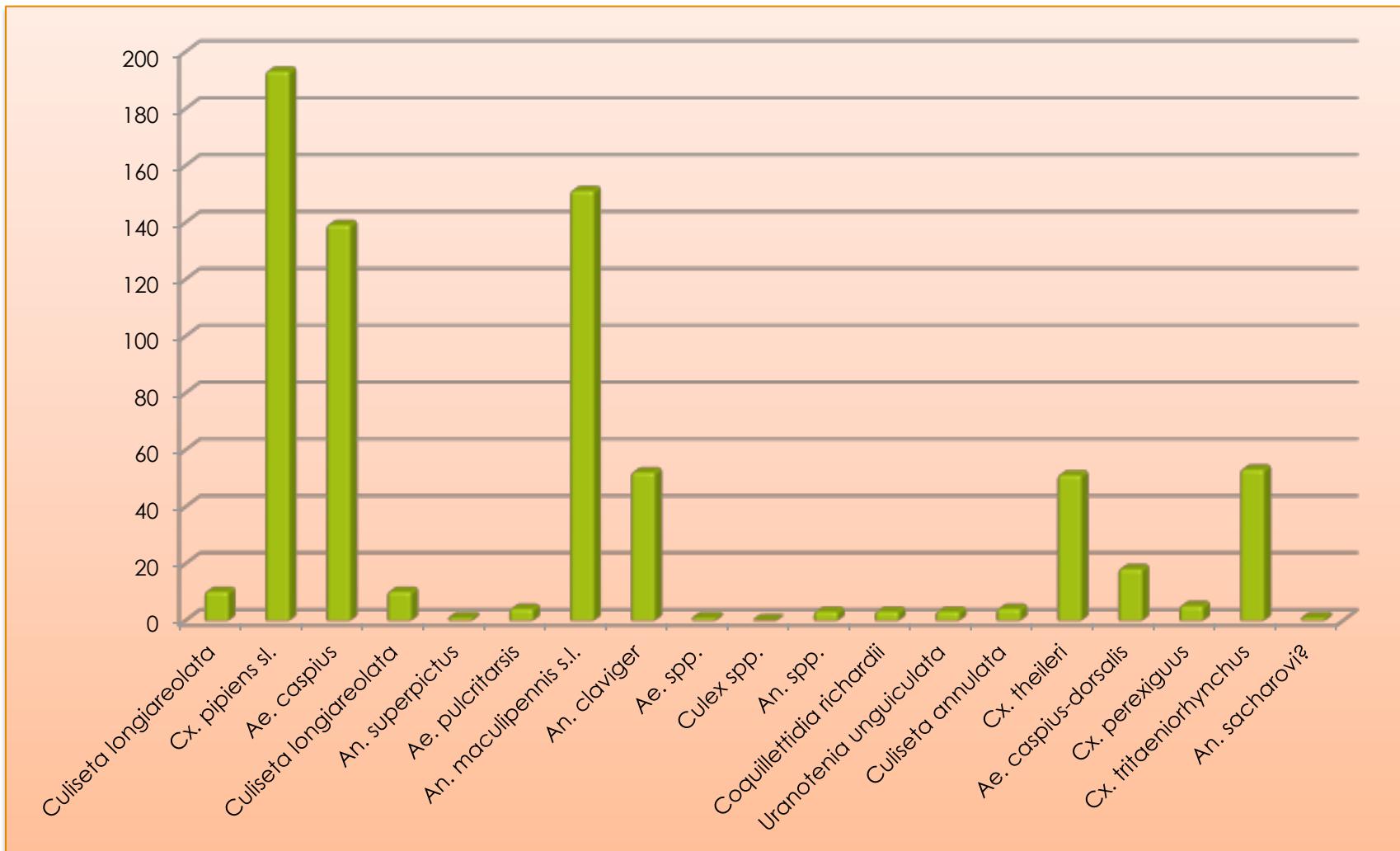
Terrain



ARBOVIRUSES ON THE SYRIAN BORDER



ARBOVIRUSES ON THE SYRIAN BORDER



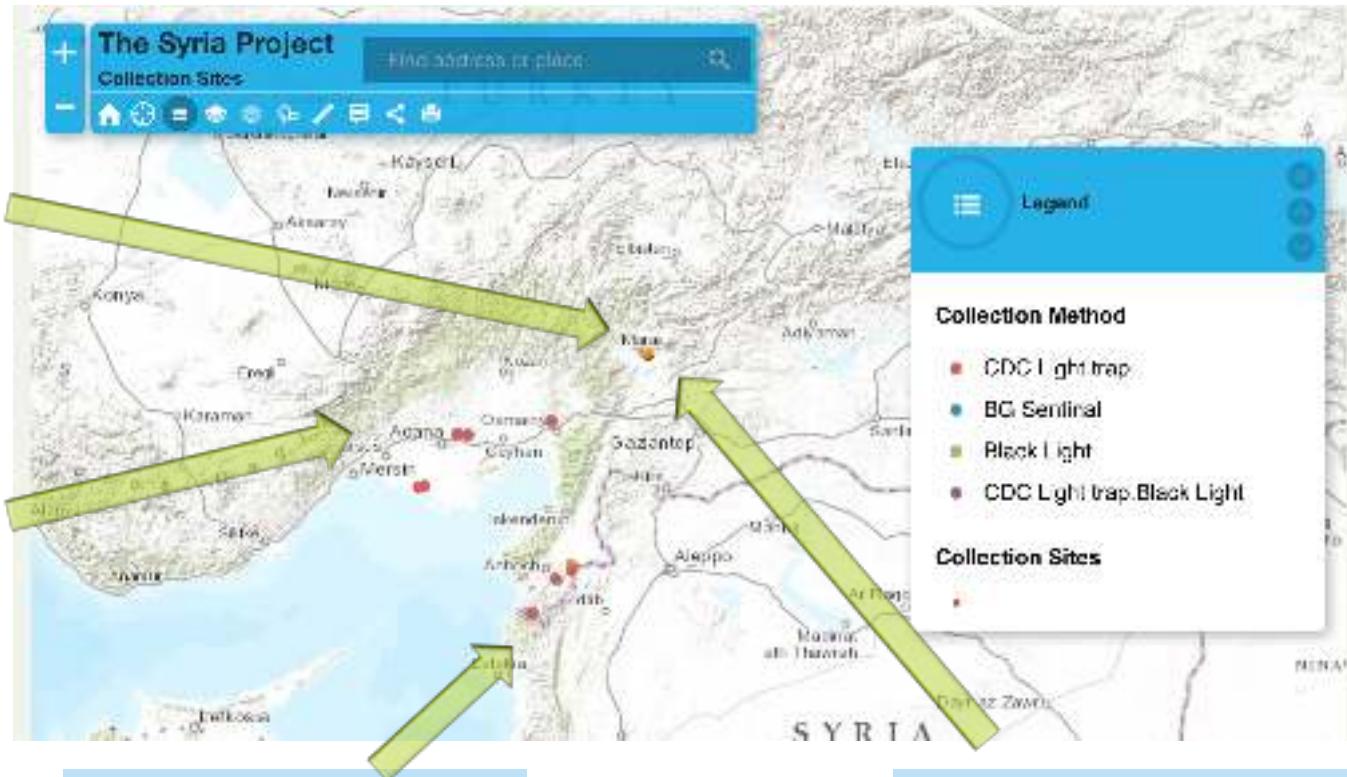
ARBOVIRUSES ON THE SYRIAN BORDER

Osmaniye:

Aedes caspius
Anopheles claviger
Anopheles maculipennis s.l.
Anopheles sachorovi
Culex perexiguus
Culex pipiens s.l.
Culex tritaeniorhynchus

Adana:

Aedes caspius
Anopheles claviger
Anopheles maculipennis s.l.
Anopheles sachorovi
Culex perexiguus
Culex pipiens s.l.
Culex tritaeniorhynchus



Hatay:

Aedes caspius
Aedes dorsalis
Culiseta longiareolata
Culex pipiens sl
Culex theileri

Kahramanmaraş:

Culex pipiens sl
Culex theileri
Uranotaenia unguiculata

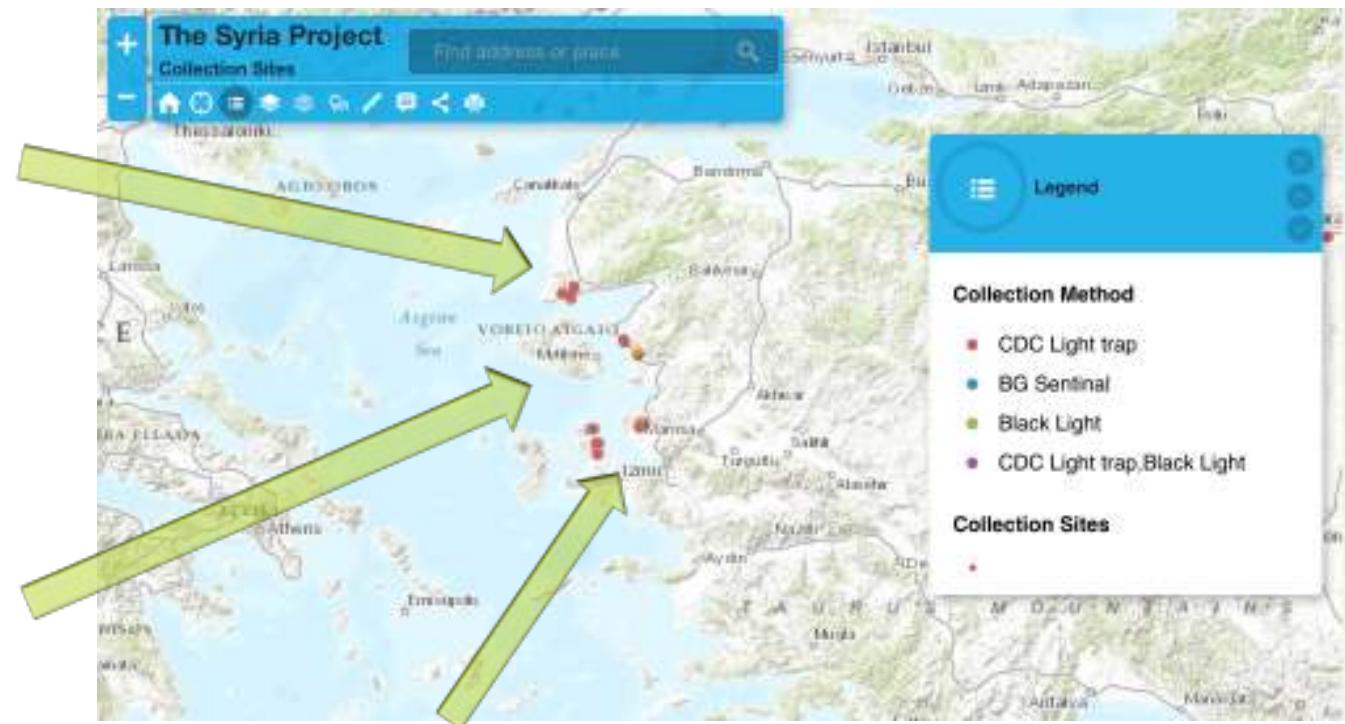
ARBOVIRUSES ON THE SYRIAN BORDER

Çanakkale:

Aedes caspius
Culiseta longiareolata
Culex pipiens s.l.
Culex theileri

Balıkesir:

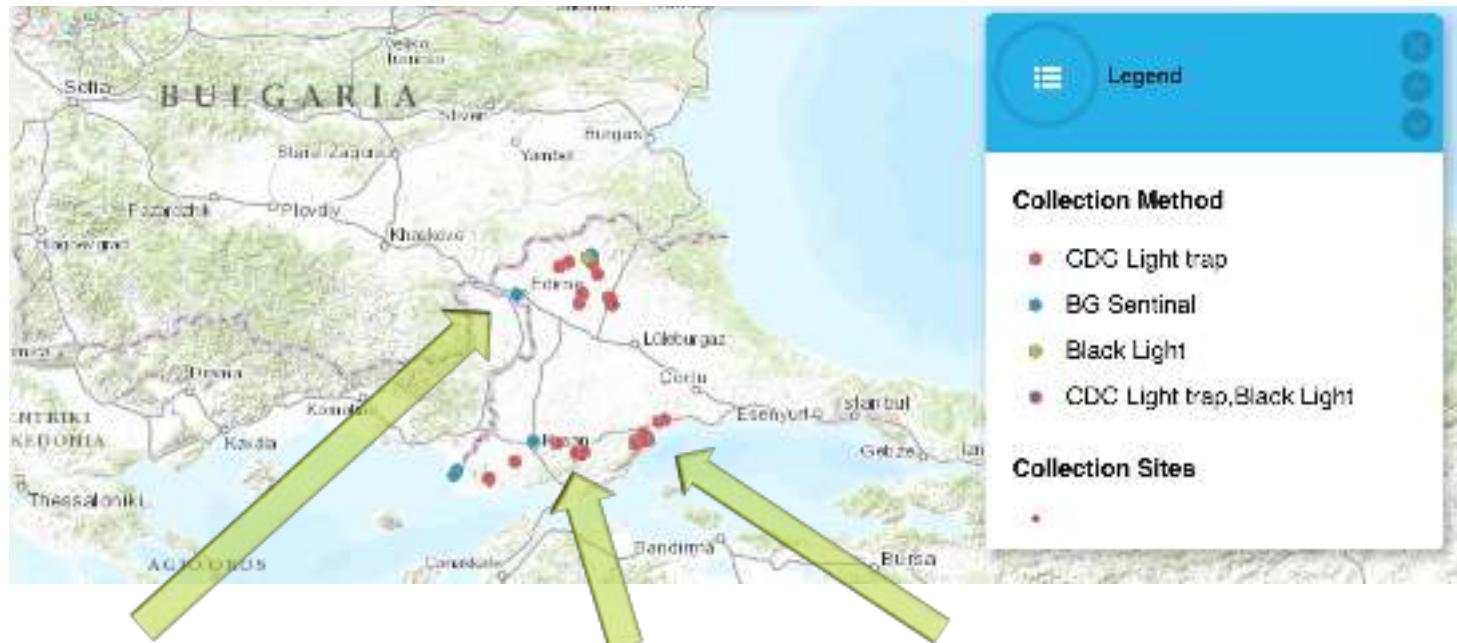
Culex pipiens sl
Culex theileri



İzmir:

Aedes caspius
Anopheles superpictus
Culiseta longiareolata
Culex pipiens sl
Culex theileri

ARBOVIRUSES ON THE SYRIAN BORDER



Kiklareli:

Aedes caspius
Aedes pulchritarsis
Anopheles maculipennis sl
Culiseta annulata
Culiseta longiareolata
Culex pipiens sl
Culex theileri

Edirne:

Aedes caspius
Anopheles claviger
Anopheles maculipennis sl
Coquillettidia richiardii
Culex pipiens sl
Culex theileri
Uranotaenia unguiculata

Tekirdag:

Aedes caspius
Aedes pulchritarsis
Anopheles claviger
Anopheles maculipennis sl
Culiseta longiareolata
Culex pipiens sl

| virus detection | | | | | |
|---------------------|------|------------------------------------|------------------------------------|------------------|-------------------|
| Pool code | year | Morphological ID | Molecular ID | province | Virus detected |
| TK599-1 | 2014 | <i>Culiseta annulata</i> | <i>Culiseta annulata</i> | Kirkclareli (NW) | Chikungunya virus |
| TK614-3A | 2014 | <i>Culex pipiens s.l.</i> | <i>Culex pipiens s.s.</i> | Kirkclareli (NW) | Chikungunya virus |
| TK610-12A | 2014 | <i>Culex pipiens s.l.</i> | <i>Culex pipiens s.s.</i> | Tekirdag (NW) | Chikungunya virus |
| TK587-1 | 2014 | <i>Anopheles maculipennis s.l.</i> | <i>Anopheles maculipennis s.s.</i> | Kirkclareli (NW) | Chikungunya virus |
| TR138-408-160 8R | 2015 | <i>Aedes caspius</i> | <i>Aedes caspius</i> | Kirkclareli (NW) | Chikungunya virus |
| TK579-1A | 2014 | <i>Anopheles maculipennis s.l.</i> | <i>Anopheles maculipennis s.s.</i> | Kirkclareli (NW) | Chikungunya virus |
| TR139-23-46 | 2015 | <i>Culex pipiens s.l.</i> | <i>Culex pipiens s.s.</i> | Kirkclareli (NW) | West Nile virus |
| TR013-55-59 | 2015 | <i>Anopheles maculipennis s.l.</i> | <i>Anopheles sacharovi</i> | Adana (SE) | Chikungunya virus |

- The presence of Chikungunya virus in the country was recorded for the first time
- The ongoing circulation of West Nile virus was revealed
- CHICK virus has been found in inefficient vector species but recent studies have shown the distribution of *Aedes albopictus* and *Aedes aegypti* is expanding in the North East of Turkey, which increases the risk of transmission
- Executing a mosquito DNA barcode reference database is helpful to estimate the primary vector species in the critical areas

