phlebotomines

- current data on phlebotomine distribution in Turkey
- historical phlebotomine data in Europe
- missing data and way forward

Bulent Alten, Hacettepe University-Ankara
Yusuf Ozbel, Ege University-Izmir

description of the Mediterranean: the role of the geography

Fernand Braudel (1966) "*The Mediterranean and the Mediterranean world in the age of Philip II* " William Collins Sons and Co Ltd, Glasgow. Vol. 1, 2nd Edition (1st ed. 1949), 642 pp

" Geography of a particular kind, with special emphasis on human factors. But it is more than this. It is also an attempt to convey a particular kind of history.

Geography, to understand the distribution of the animals, plants and human populations, is no longer an end in itself but a means to an end. It helps us to rediscover the slow unfolding of structural realities, to see things in the perspective of the very long term "

description of the Mediterranean: the role of the geography

" The Mediterranean has at least two faces.

In the first place, it is composed of a series of compact, mountainous peninsulas, interrupted by vital plains : Italy, the Balkans Peninsulas, Asia Minor, North Africa, The Iberian peninsula.

Second, between these miniature continents lie vast, complicated, and fragmented stretches of sea, for the Mediterranean is not so much a single entity as a complex seas. Peninsulas and seas: these are the two kinds of environment we shall be considering first of all, to establish the general conditions of distribution of natural organisms as much as human life "

But they will not tell the whole story!!

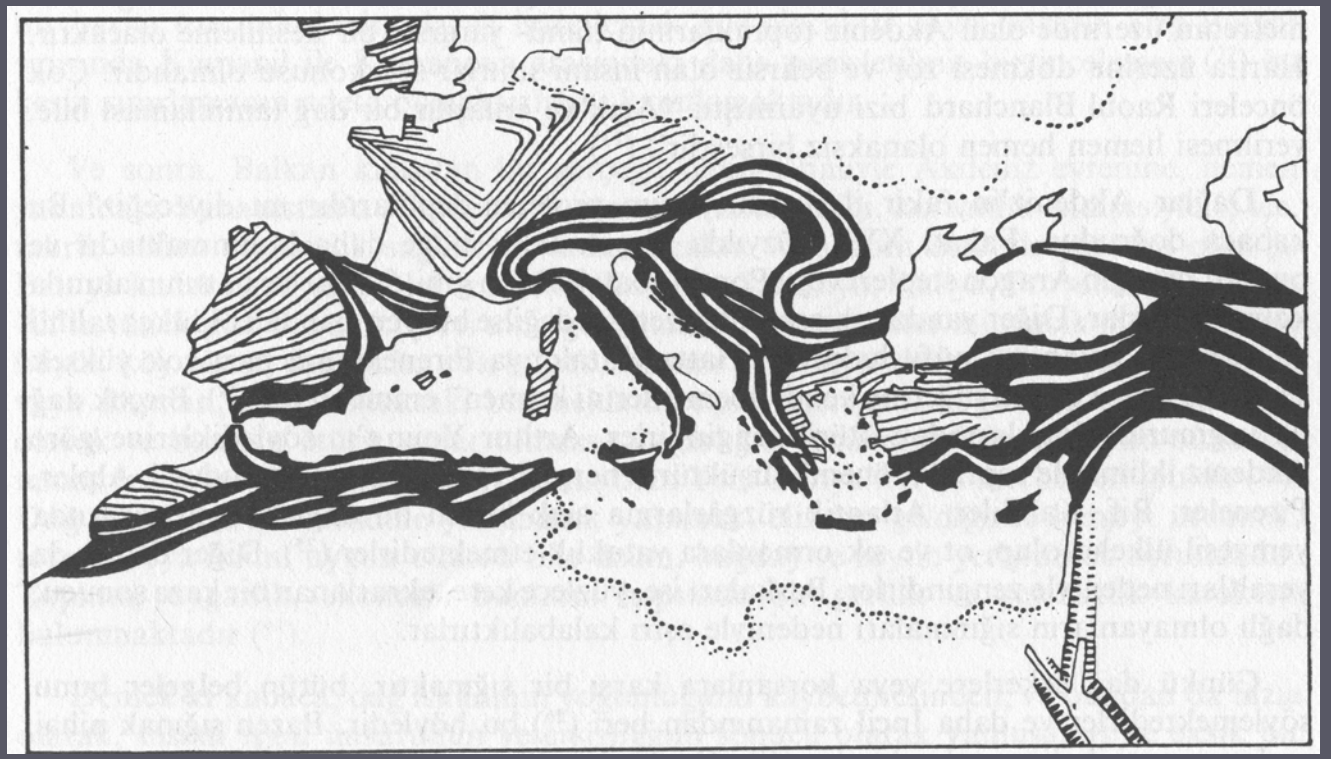
description of the Mediterranean: the role of the geography

Braudel precisely described the real biogeographical border of the Mediterranean regarding its all dynamics:

" On one side, to the south, the Mediterranean is a near neighbour of the great desert that runs uninterrupted from the Atlantic Sahara to the Gobi Desert and up to the gates of Peking. From southern Tunisia to southern Syria, the desert directly borders of the sea. The relationship is not casual; it is intimate, sometimes difficult, and always demanding. So the desert is one of the faces of the Mediterranean.

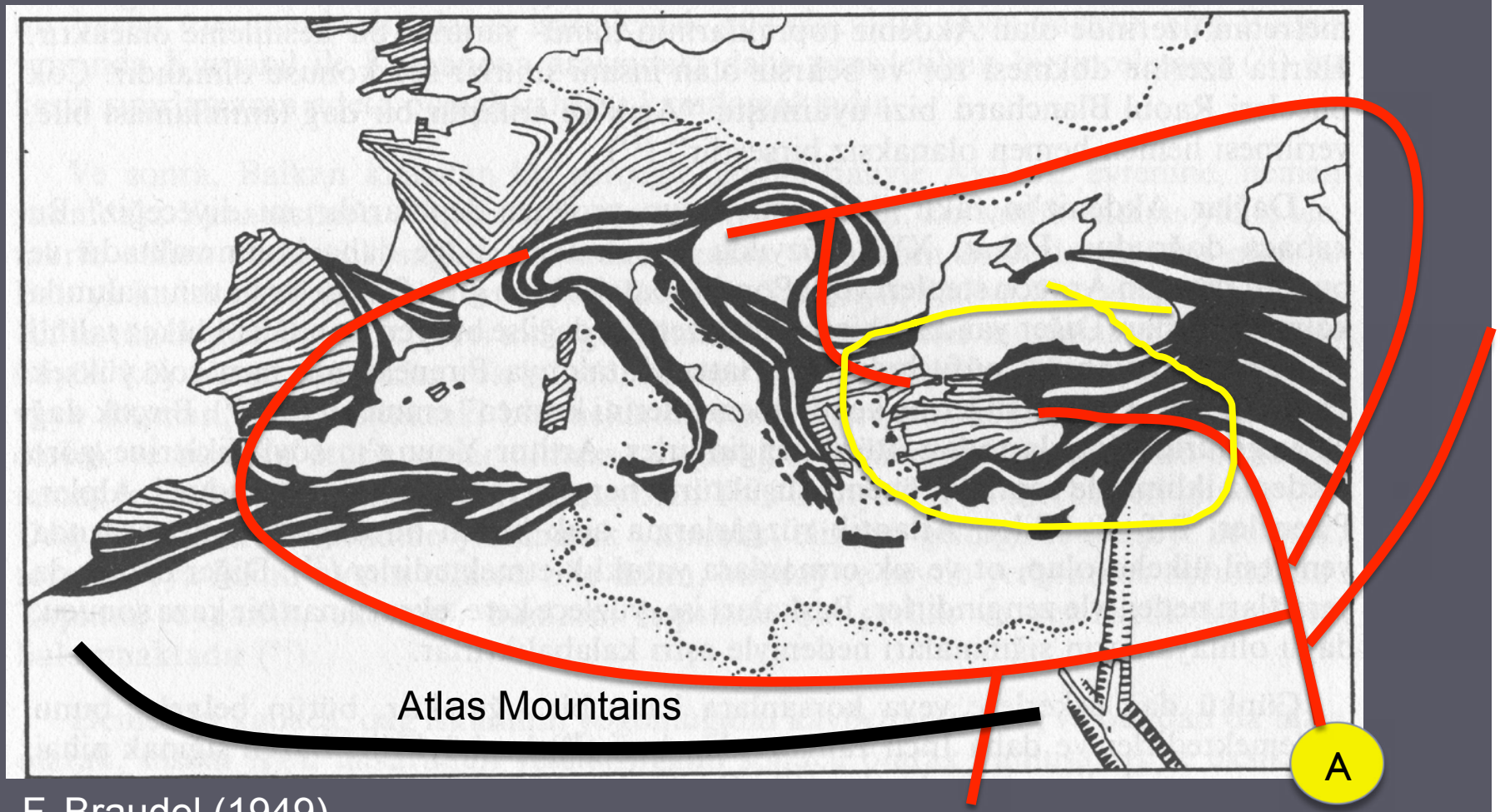
On the other side, to the north, lies Europe, which if often shaken by Mediterranean influences has had an equally great and sometimes decisive influence on the Mediterranean "

description of the Mediterranean: the role of the geography



Hereynian blocks banded, Alpine foldings in black; the white lines indicate the direction of the mountain ranges.
To the south, the Saharan plateau in white, borders the Mediterranean from Tunisia to Syria.
To the east, the tectonic fractures of the Dead Sea and the Red Sea.
To the north, the intra-Alpine and extra-Alpine plains are in white.
The doted lines mark the furthest limit of former glaciers.

description of the Mediterranean: the role of the geography



F. Braudel (1949)

phylogenetic studies on distribution of phlebotomine sand flies

Hundreds of the studies are available for scientists

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- Aransay, A.M., Scoulica, E., Chaniotis, B., Tselentis, Y., 1999. Typing of sandflies from Greece and Cyprus by DNA polymorphism of 18S rRNA gene. Insect Mol. Biol. 8, 179–84.

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- Volf, P., Ozbel, Y., Akkafa, F., Svobodova, M., Votypka, J., Chang, K.P., 2002. Sand flies (Diptera: Phlebotominae) in Sanliurfa, Turkey: rela- tionship of Phlebotomus sergenti with the epidemic of anthroponotic cutaneous leishmaniasis. J. Med. Entomol. 39, 12–15.

phylogenetic studies on distribution of phlebotomine sand flies

Depaquit, J., Ferte , H., Leger, N., Killick-Kendrick, R., Rioux, J.A., Killick-Kendrick, M., Hanafi, H.A., Gobert, S., 2000. Molecular systematics of the Phlebotomine sandflies of the subgenus Paraphlebotomus (Diptera, Psychodidae, Phlebotomus) based on ITS2 rDNA sequences. Hypotheses of dispersion and speciation. Insect Mol. Biol. 9, 293–300.

Insect Molecular Biology (2000) **9**(3), 293–300

Molecular systematics of the Phlebotomine sandflies of the subgenus *Paraphlebotomus* (Diptera, Psychodidae, Phlebotomus) based on ITS2 rDNA sequences. Hypotheses of dispersion and speciation

J. Depaquit,[1] H. Ferté,[1] N. Léger,[1] R. Killick-Kendrick,[3] J.-A. Rioux,[4] M. Killick-Kendrick,[3] H. A. Hanafi[5] and S. Gobert[2]

[1] *Laboratoire de Parasitologie and* [2] *English Laboratory, Faculté de Pharmacie, Reims, France,* [3] *Biology Department, Imperial College at Silwood Park, Ascot, UK,* [4] *Institut de Botanique, Montpellier, France,* [5] *Naval Medical Research Unit n°3, Cairo, Egypt*

Abstract

Phylogenetic *Paraphlebotomus* relationships are inferred by a study based on the sequences of ITS2, which

tropica (Al-Zahrani *et al.*, 1988; Guilvard *et* *P. alexandri*, a proven vector of *L. donovan* 1986). Recently, the revisions of the subgenus the description of two new species (Killick-K 1997; Depaquit *et al.*, 1998a), the syno *P. marismortui* with *P. alexandri* (Depaquit *et* have questioned the taxonomic statute of a time when the Linnean systematic and typological approaches tend to be systematically supplemented by a phylogenetic study, we propose a cladistical analysis of the *Paraphlebotomus* subgenus. Within this group, the few discriminating morphological characters appear to be inadequate for an acute approach and it was therefore

franc, C. Alves-Pires, H. Hanafi, M. . Svobodova, and P. Volf. 2002. ITS2 s sergenti and Phlebotomus similis

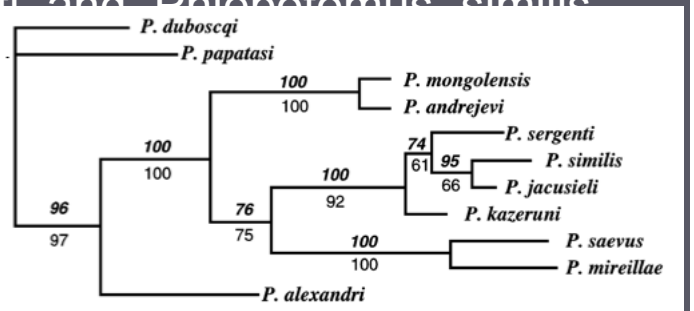
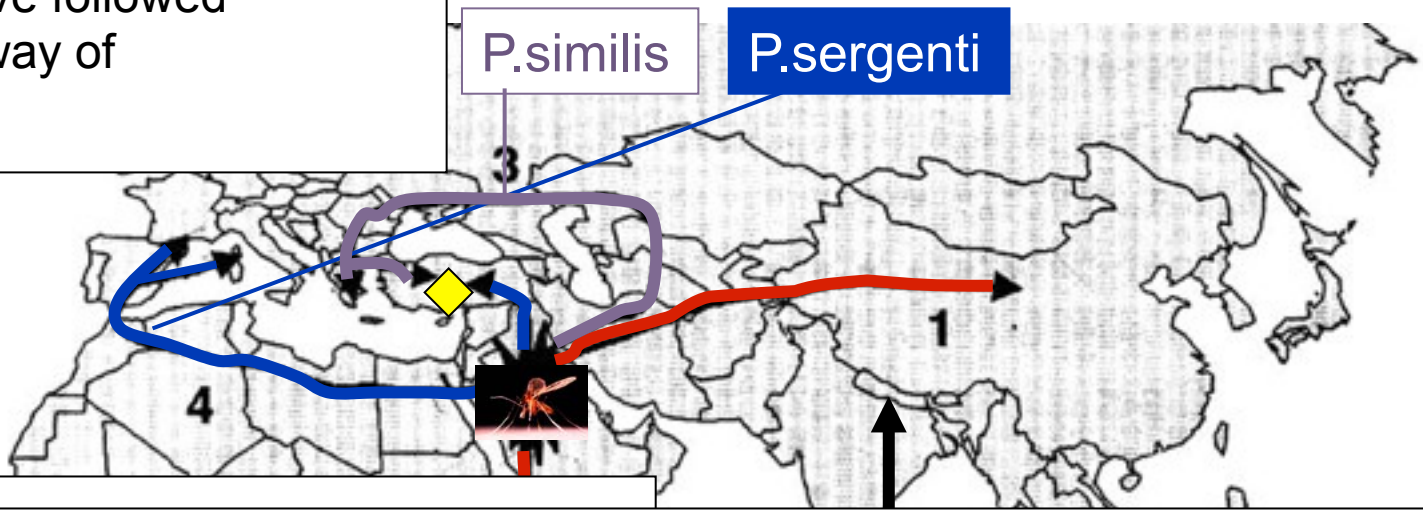


Figure 2. Maximum parsimony tree obtained by the branch and bound search option of PAUP is 425 steps long, with CI = 0.800 and RI = 0.751. All types of mutations are equally weighted. 1000 bootstrap replicates realized by PAUP program give bold and italic values mentioned on the top of the resolved branches. Bootstrap support with gaps removed appear below each branch. In this analysis, transitions and transversions are equally weighted and maximum parsimony tree obtained is 155 steps long, with CI = 0.806 and RI = 0.773.

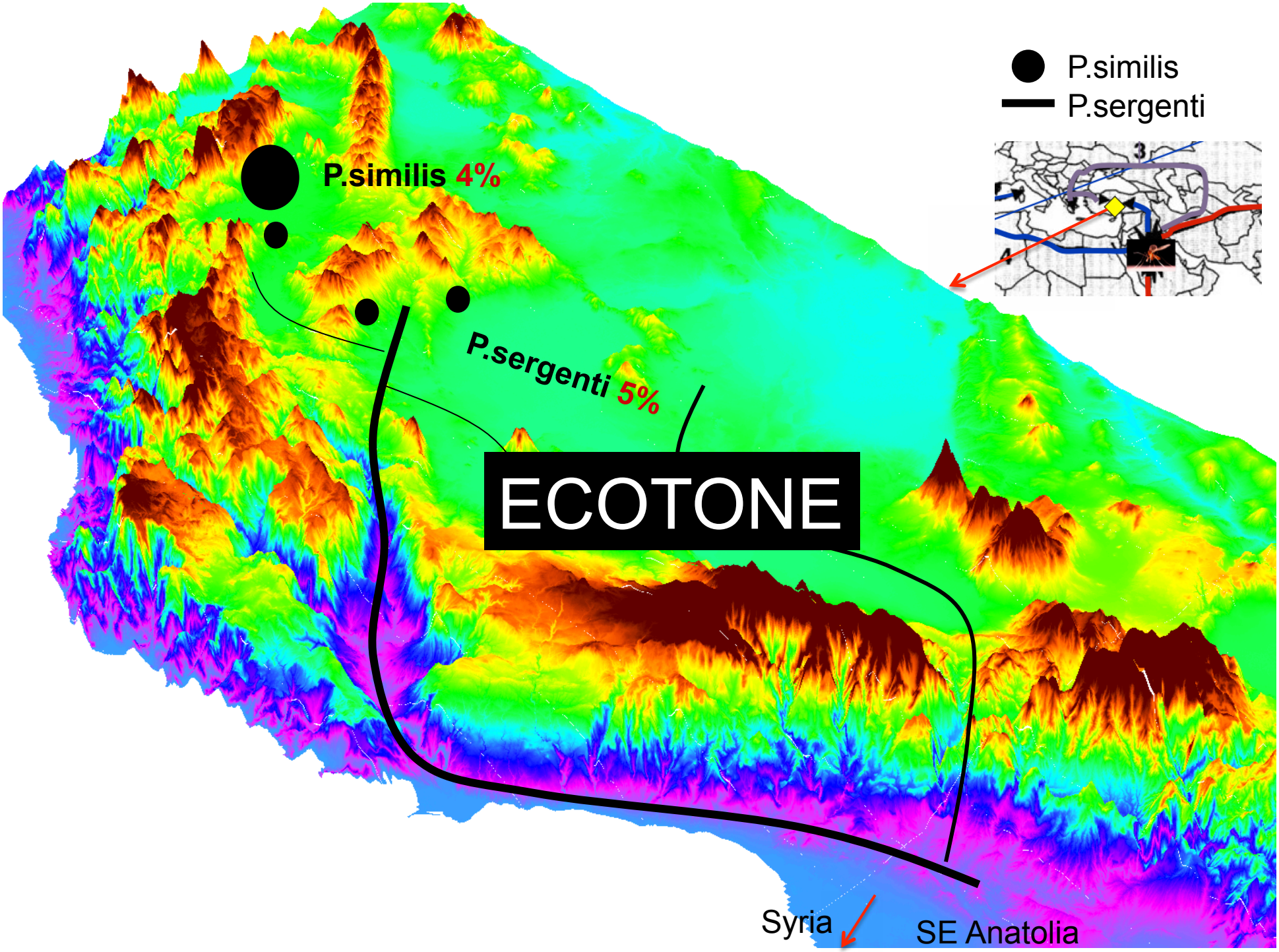
a hypothesis of settlement of the old world by the subgenus
persion (Depaquit et al.2000)

Paraphlebotomus similis, or its ancestor, would have followed the most northern way of migration



P.similis and *P. sergenti* are allopatric. In Turkey, *P. similis* is present only in the Western part of the country, that is to say western Taurus and Antitaurus. Eastward, *P. sergenti* replaces it. Turkey constitutes the only country in which the two species are mentioned. Researchers had access to an Eastern Turkish material which confirms the presence of *P. sergenti*, East of Tarus and Antitaurus mountains. It would be interesting to include other Western Turkish populations in order to confirm the presence of *P. similis* alone there.

According to results of previous studies, in the East, there were no or little variation between the sequences of flies from populations of Cyprus, Syria, Pakistan and Turkey, **where *P. sergenti* and *P. similis* seem to be separated by Taurus and Antitaurus mountains**


P.similis
P.sergenti
P.similis 4%
P.sergenti 5%
ECOTONE
Syria
SE Anatolia

phylogenetic studies on distribution of phlebotomine sand flies

Vol. 32, no. 2 *Journal of Vector Ecology* 269

Distribution and altitudinal structuring of phlebotomine sand flies (Diptera: Psychodidae) in southern Anatolia, Turkey: their relation to human cutaneous leishmaniasis

Fatih M. Simsek[1], Bulent Alten[2]✉, Selim S. Caglar[2], Yusuf Ozbel[3], A. Murat Aytekin[2], Sinan Kaynas[2], Asli Belen[2], Ozge Erisoz Kasap[2], Mehmet Yaman[4], and Samiye Rastgeldi[3]

[1]*Adnan Menderes University, Art and Science Faculty, Biology Department, Ecology Section, 09010 Aydin, Turkey*
[2]*Hacettepe University, Faculty of Science, Department of Biology, Ecology Section, ESRL Laboratories, 06800 Ankara, Turkey*
[3]*Ege University, Faculty of Medicine, Department of Parasitology, 35100 Izmir, Turkey*
[4]*Mustafa Kemal University, Faculty of Veterinary Medicine, Department of Parasitology, 31040 Hatay, Turkey*

Received 19 March 2007; Accepted 15 June 2007

ABSTRACT: The two Old World genera, *Phlebotomus* and *Sergentomyia*, were both recorded in southern Anatolia in Turkey. *Phlebotomus* species predominated and comprised about 93% of the entire collection (3,172 specimens). Out of the sixteen species identified, two belonged to the genus *Sergentomyia*: *S. dentata* and *S. theodori*. The remaining fourteen species in the genus *Phlebotomus* were grouped under four subgenera including some species that are elsewhere known to act as vectors of human cutaneous leishmaniasis. Most of the *Phlebotomus* were *P. tobbi* (32.5%), but *P. papatasi*, *P. transcaucasicus*, *P. halepensis*, *P. galilaeus*, *P. sergenti*, *P. syriacus*, *P. neglectus*, *P. simici*, *P. alexandri*, *P. similis*, *P. jacusieli*, *P. perfiliewi*, and *P. brevis* were also identified. There were two associations of sand fly fauna with altitudinal gradient; the first one at relatively higher altitudes and the second one at lower altitudes. The transition between these two assemblages was within the range of 800-1,000 m. It is likely that Adana and Hatay provinces are transitional areas between western and eastern Anatolia. Mountains do not appear to be important geographical barriers for sand fly distribution. We also found that the proven vector *P. sergenti* is a widely distributed species throughout southern Anatolia and this species, together with its closely related species *P. similis*, shows sympatry in Konya Province. ***Journal of Vector Ecology* 32 (2): 269-279. 2007.**

226 *Journal of Vector Ecology* December 2007

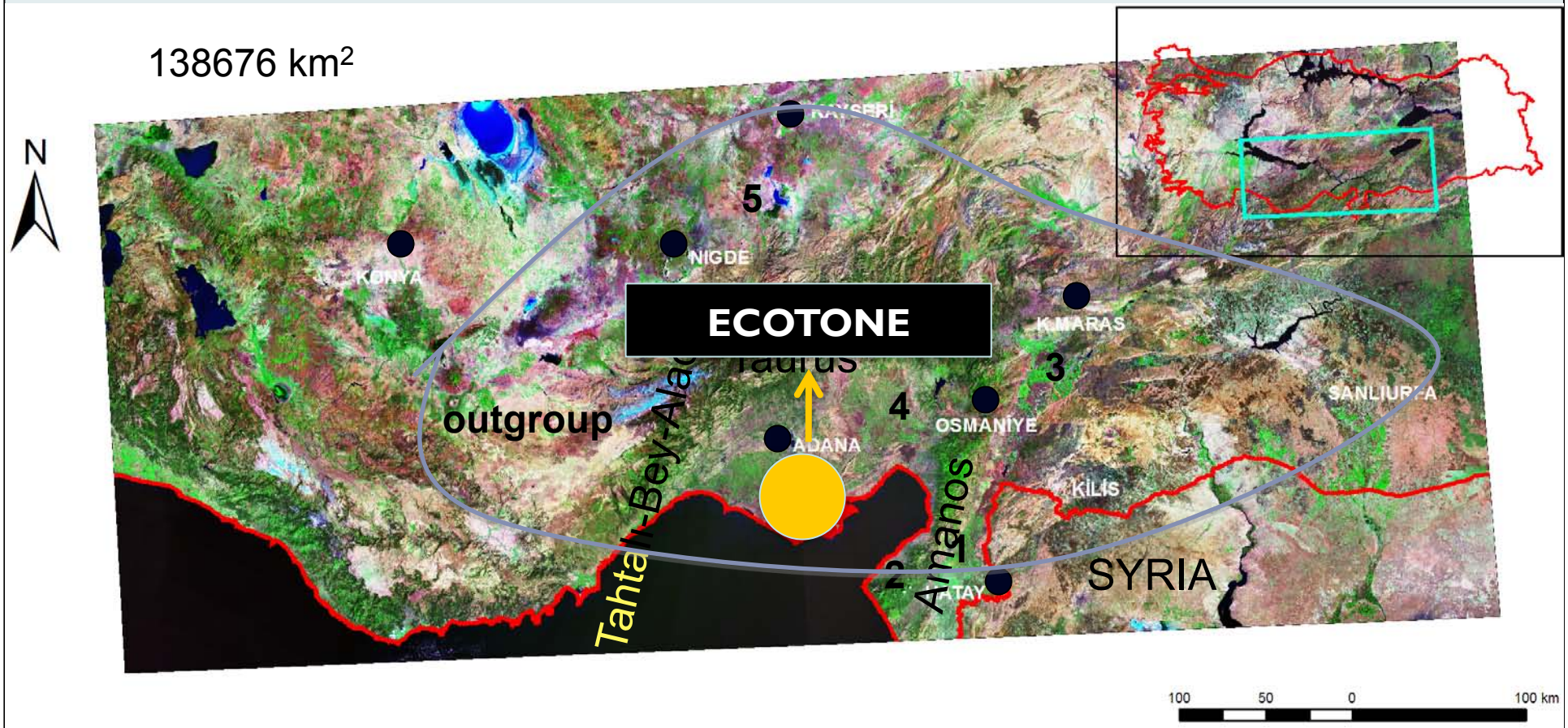
Phenotypic variation among local populations of phlebotomine sand flies (Diptera: Psychodidae) in southern Turkey

A. Murat Aytekin[1], Bulent Alten[1]✉, Selim S. Caglar[1], Yusuf Ozbel[2], Sinan Kaynas[1], Fatih M. Simsek[3], Ozge Erisoz Kasap[1], and Asli Belen[1]

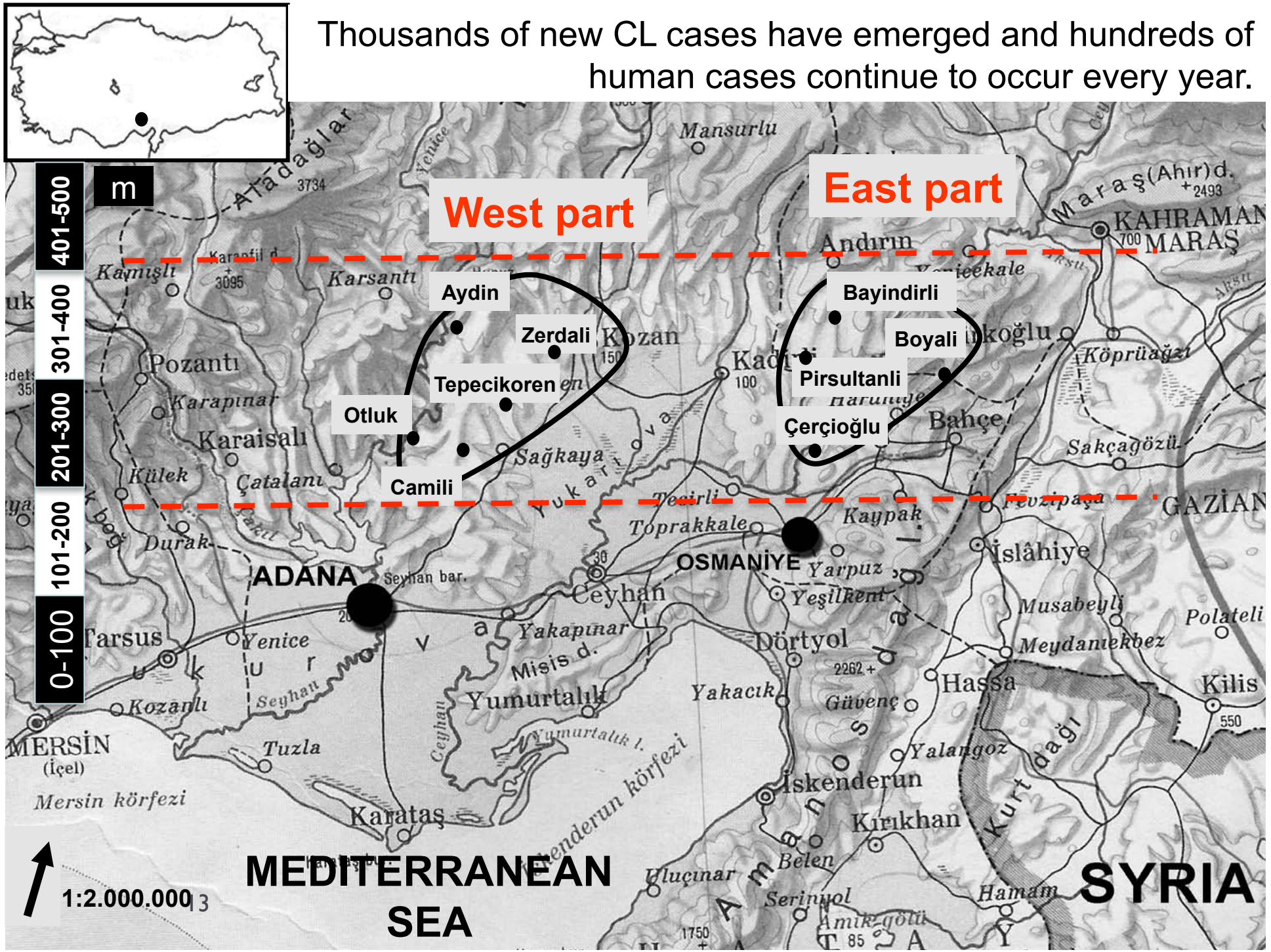
[1]*Hacettepe University, Department of Biology, Faculty of Science, ESRL, 06800 Beytepe, Ankara, Turkey*
[2]*Ege University, Faculty of Medicine, Department of Parasitology, 35100, Izmir, Turkey*
[3]*Adnan Menderes University, Art and Science Faculty, Department of Biology, 09010, Aydin, Turkey*

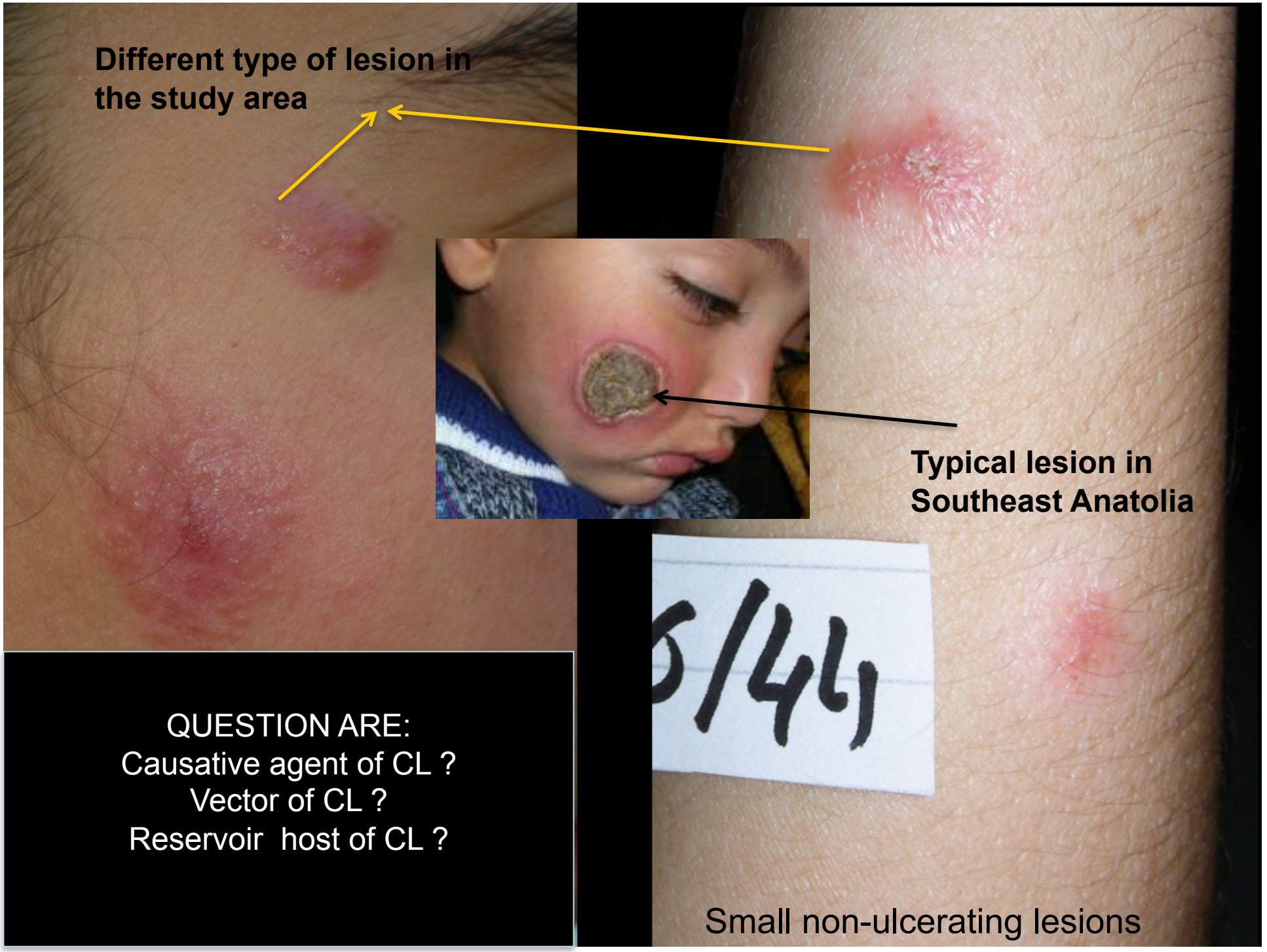
Received 26 March 2007; Accepted 8 May 2007

ABSTRACT: The wing-shape morphology of local populations of the medically important phlebotomine sand flies, *Phlebotomus sergenti*, *P. papatasi*, *P. tobbi*, and *P. similis*, were examined in both sexes by using geometric morphometrics. There are three major mountain ranges that may serve as geographical barriers for species distribution in the study area and four main gaps were recognized among these barriers. **We found no statistically important differences in wing morphology** in all examined species in both sexes for all local populations. These results show that the barriers are not sufficient to stop gene flow among local populations of sand flies. The graphical depiction of PCA, CVA, and F-test confirmed our morphometric study suggesting that the difference in wing morphology between *P. similis* and *P. sergenti* indicates that these are clearly different species. These two show sympatric distribution in the Konya Plain of Anatolia. ***Journal of Vector Ecology* 32 (2): 226-234. 2007.**


138676 km²
N
KONYA
NIGDE
5
ECOTONE
K.MARAS
3
outgroup
Taurus
4
OSMANİYE
ADANA
Tahtalı-Bey-Alan
Amanos
KİLİS
2
1
SYRIA
100
50
0
100 km

Thousands of new CL cases have emerged and hundreds of human cases continue to occur every year.



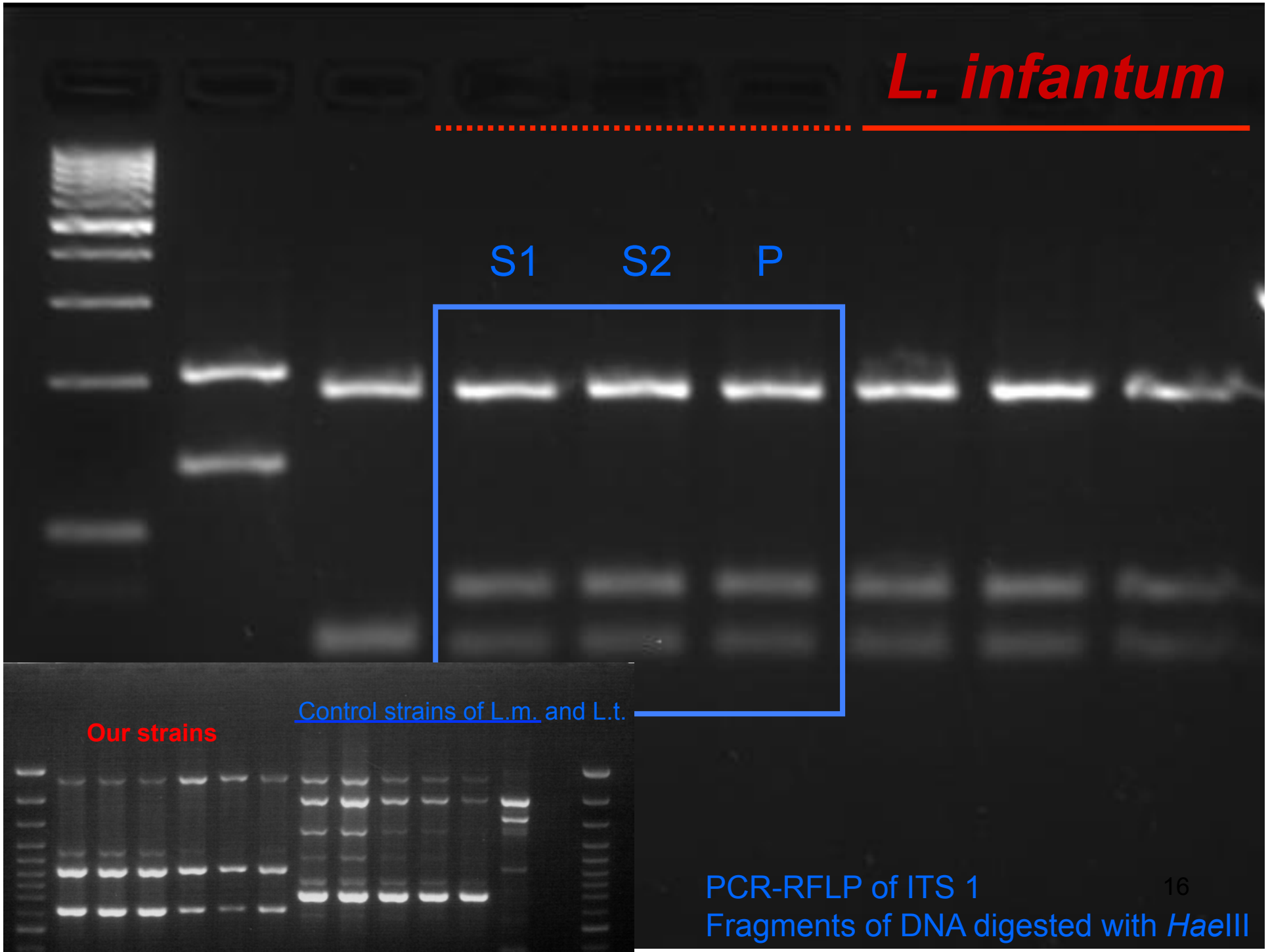

Different type of lesion in the study area
Typical lesion in Southeast Anatolia
QUESTION ARE:
Causative agent of CL ?
Vector of CL ?
Reservoir host of CL ?
Small non-ulcerating lesions

Leishmania typing
(strains from patients and sand flies)

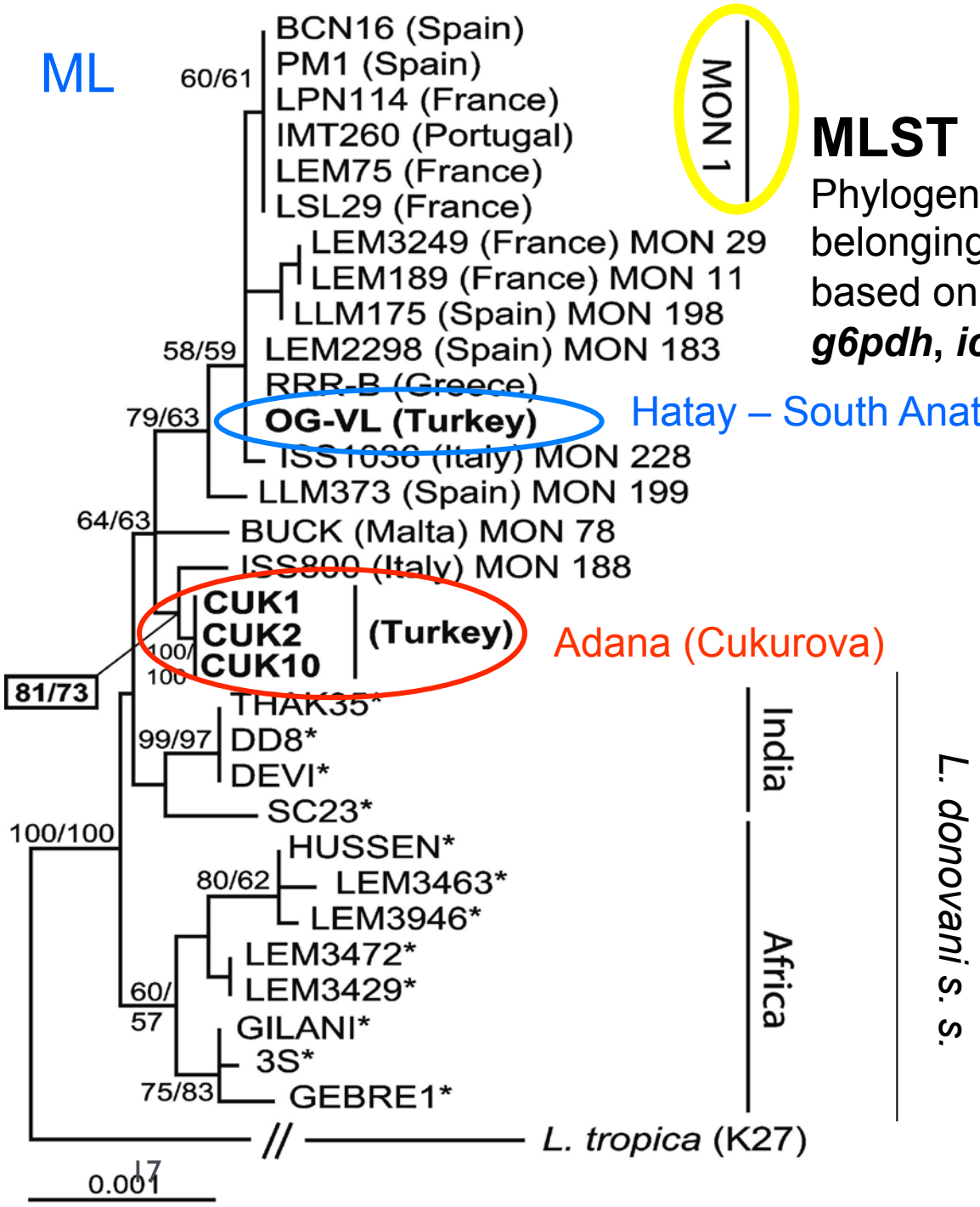
RAPD (Random Ampliphied Polymorphic DNA)

ITS PCR-RFLP(Restriction Fragment Length Polymorphism)

MLST (Multi Locus Sequencing Typing)



PCR-RFLP of ITS 1
Fragments of DNA digested with *Hae*III



Hatay – South Anatolia

Adana (Cukurova)

MLST

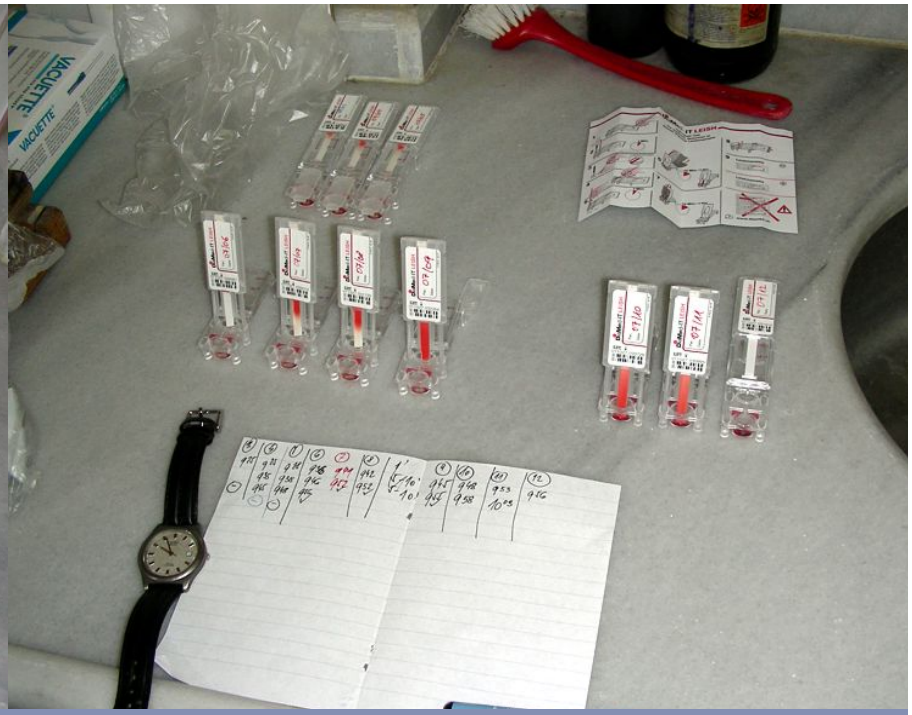
Phylogenetic analysis of available strains belonging to *Leishmania donovani* complex based on sequences of the ***me***, ***mpi***, ***g6pdh***, ***icd***, and ***fh*** genes.

Leishmania typing
(strains from patients and sand flies)

RAPD — ***Leishmania*** **(more-or-less same strains)**

ITS PCR-RFLP — ***Leishmania infantum***

MLST — ***Leishmania infantum*** (close to „MON 188“)

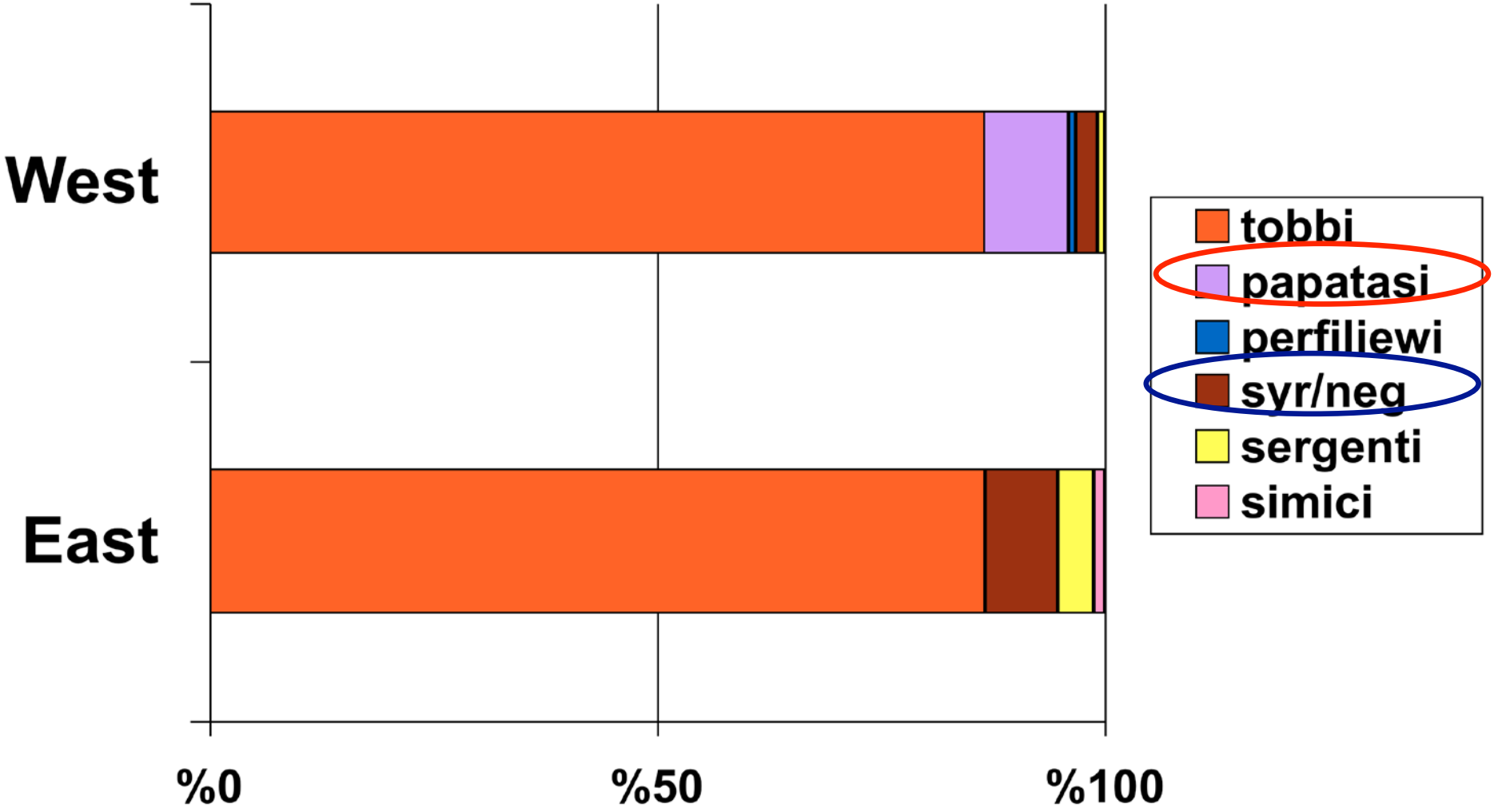


DiaMed-IT LEISH dipstick test clearly demonstrated non-visceral form of leishmaniosis

N = 26

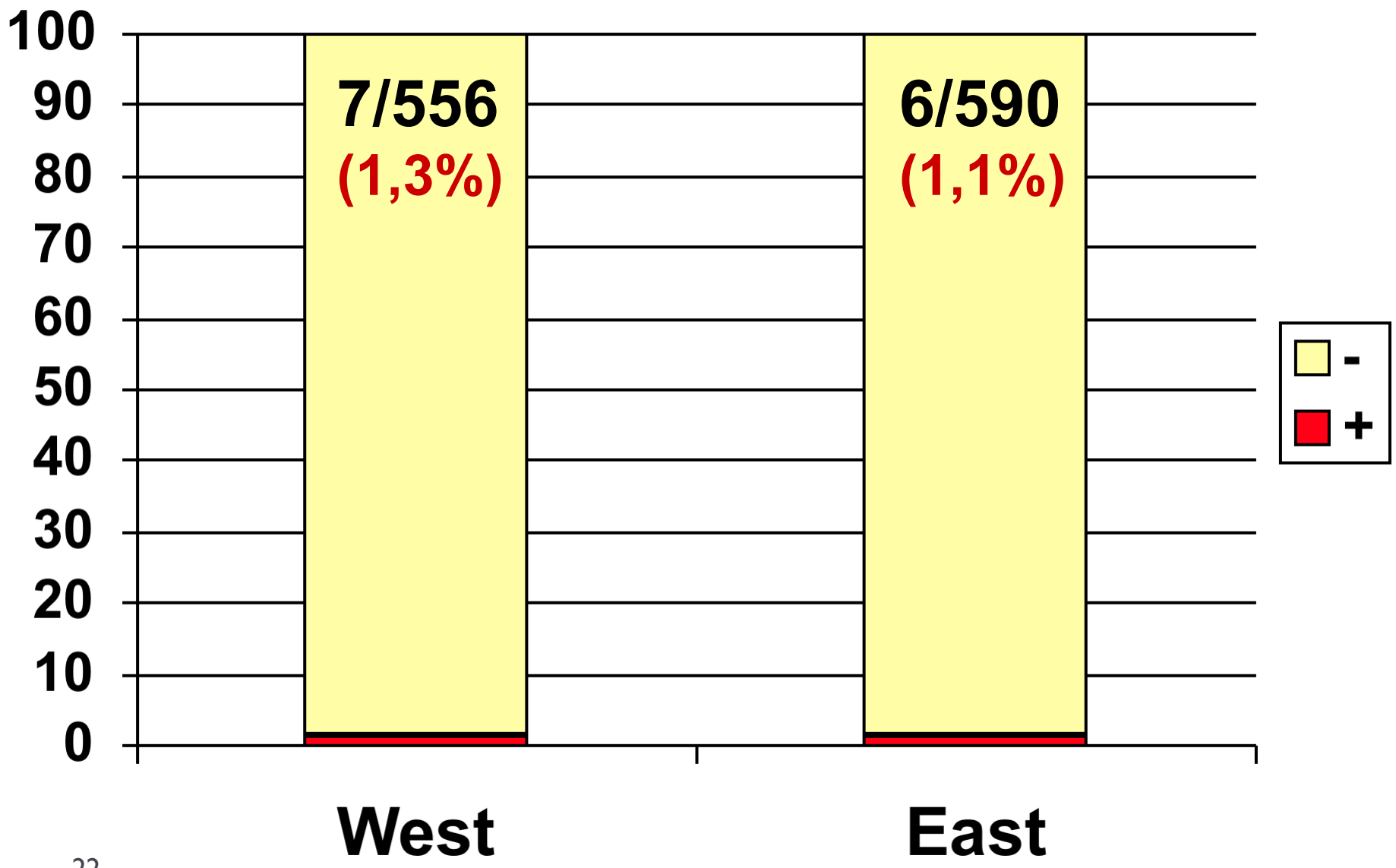

1
2
3
4
5
6
7
a
b

Sand fly fauna



N = 1251 (West), 1281 (East)

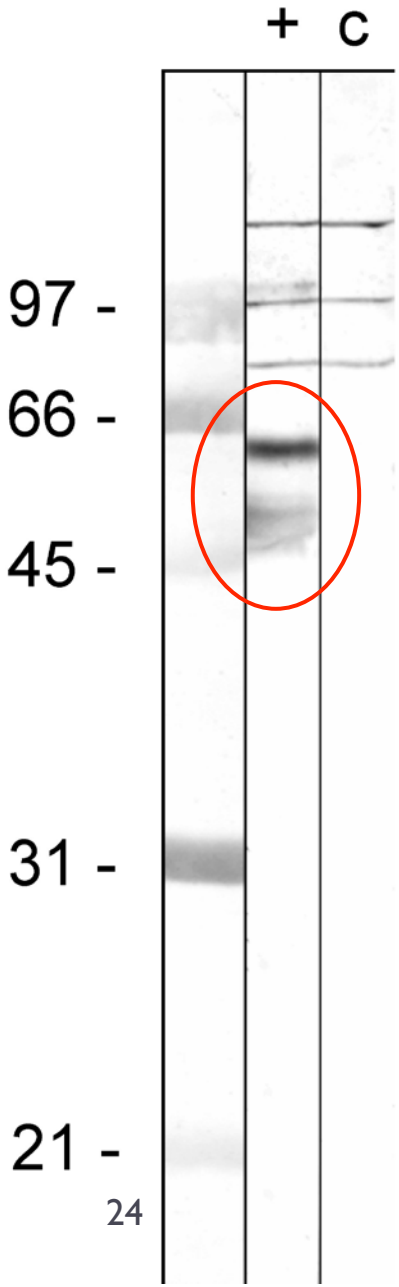
% of infected *Ph. tobbi*



Phlebotomus tobbi

P. tobbi colony for study of experimental infections by *L. infantum*

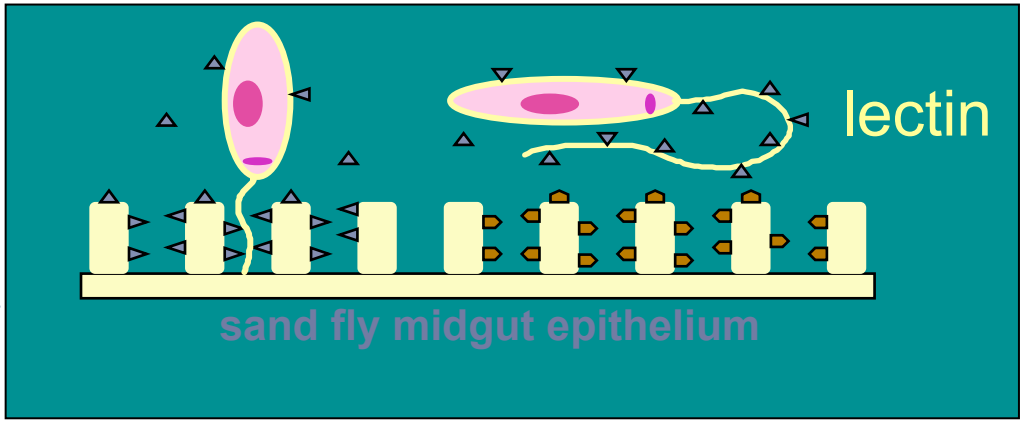
O-glycosylated epitopes in the gut



Blotting of *P. tobbi* midgut lysate with HPA.
+: positive reaction
c: preincubation with specific inhibitor (GalNAc)

The positive reaction indicates the presence of terminally exposed GalNAc which is typical for O-linked glycan. This type of midgut glycosylation is typical for permissive vectors (sand fly species susceptible to development of various *Leishmania*).

= *P. tobbi* is a **permissive vector**, similarly to other species transmitting parasites of the *L. donovani* complex.



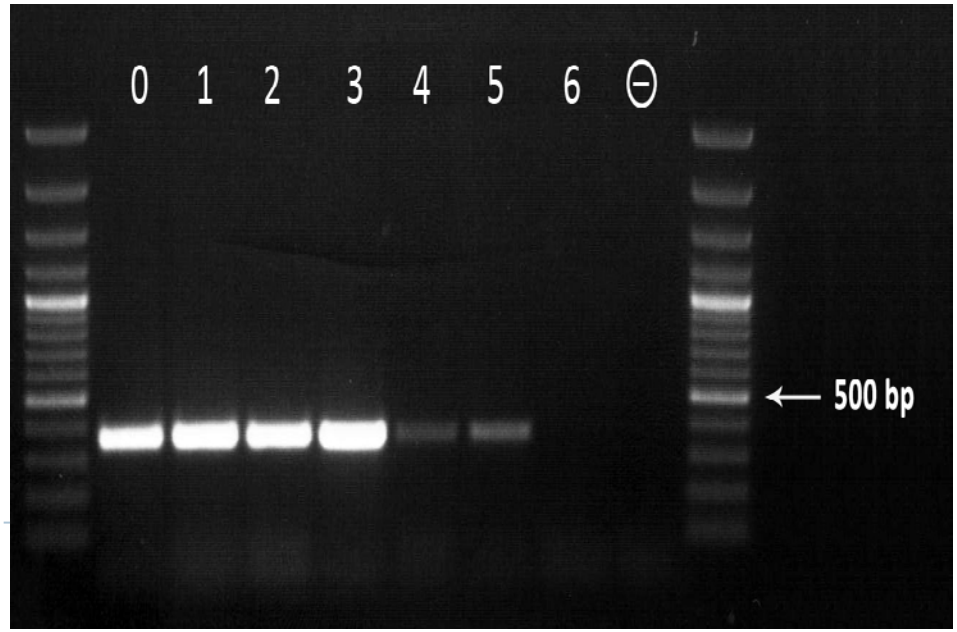
L. infantum hosts/reservoir

- **dog**

BUT!

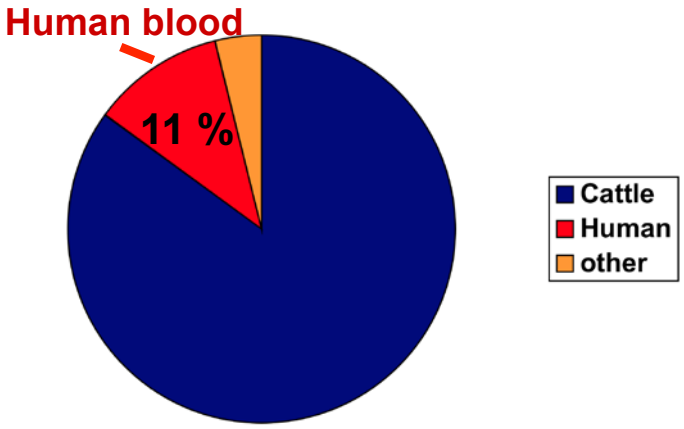
Blood-meal identification

- PCR – cytochrome b (mtDNA)
- High sensitive method (up to 5 days after blood feeding)



Blood-meal identification

- 267 blood fed females (*Phlebotomus tobbi*,
- *Ph. papatasi, Ph. sergenti, Ph. perfiliewi*)
- In 220 source of blood was determined (82%)

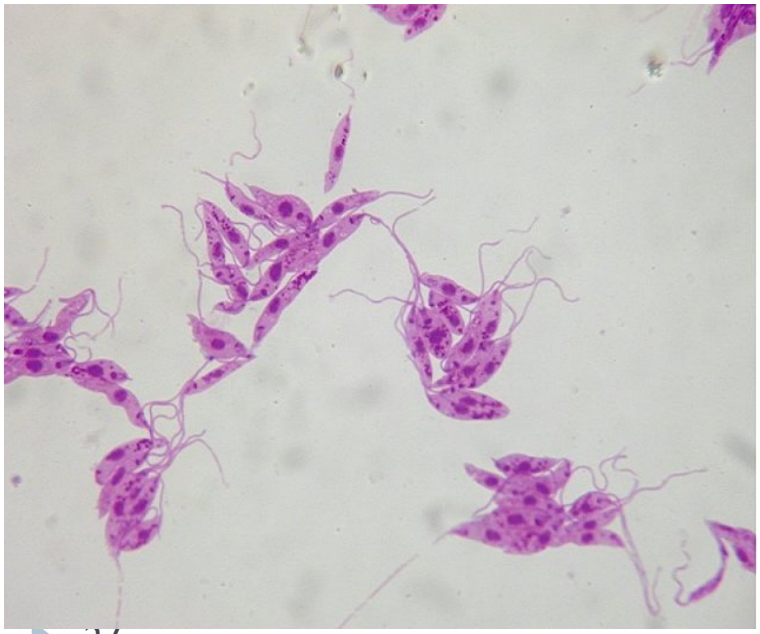


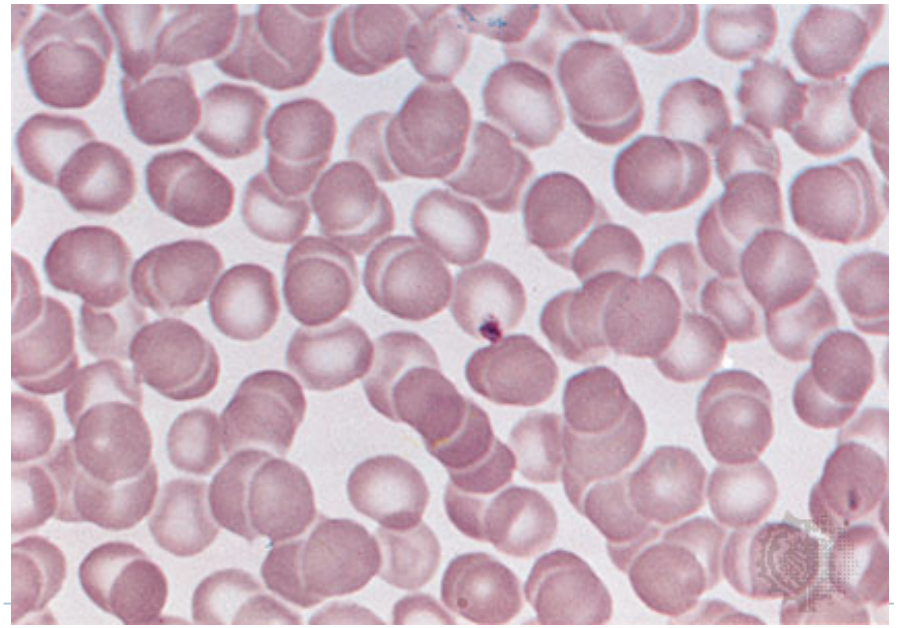
Sand fly host	TOB	PAP	LAR	SER
cattle	159 (70.7%)	11	6	0
human	23 (10.2%)	8	0	0
chicken	5 (2.2%)	2	2	1
goat	1 (0.4%)	0	0	0
mouse	1 (0.4%)	0	0	0
vole	1 (0.4%)			
non-identified	35 (15.6%)			
Total	**225**			

BUT …
NO DOG

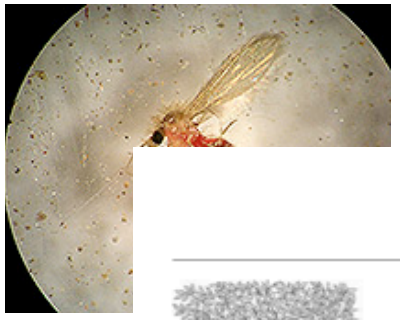
Blood-meal identification

- In 4 *Leishmania*-infected females of *Ph. tobbi* blood source was identified
- In all four cases HUMAN blood was detected





27



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International Journal for Parasitology 39 (2009) 251–256

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International Journal for Parasitology

journal homepage: www.elsevier.com/locate/ijpara

Cutaneous leishmaniasis caused by *Leishmania infantum* transmitted by *Phlebotomus tobbi* ☆

Milena Svobodová [a,*], Bulent Alten [b], Lenka Zídková [a], Vít Dvořák [a], Jitka Hlavačková [a], Jitka Myšková [a], Veronika Šeblová [a], Ozge Erisoz Kasap [b], Asli Belen [b], Jan Votýpka [a], Petr Volf [a]

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Epidemiology

ABSTRACT

Transmission of cutaneous leishmaniasis (CL) caused by *Leishmania infantum* was studied in South Anatolia, Turkey. Small, non-ulcerating lesions prevailed and patients were negative in rK39 tests for antibody detection for human visceral leishmaniasis (VL). The most abundant sand fly species, *Phlebotomus tobbi*, was found positive for *Leishmania* promastigotes with a prevalence of 1.4% (13 out of 898 dissected females). The isolated strains were identical with those obtained from patients with CL and were typed as *L. infantum*. Phylogenetic analysis revealed similarity to MON-188 and a clear difference from the MON-1 clade. Blood-meal identification showed that *P. tobbi* feeds preferentially on cattle and humans. This finding, the high number of CL patients and relative scarcity of dogs in the focus, suggests that the transmission cycle could be anthroponotic.

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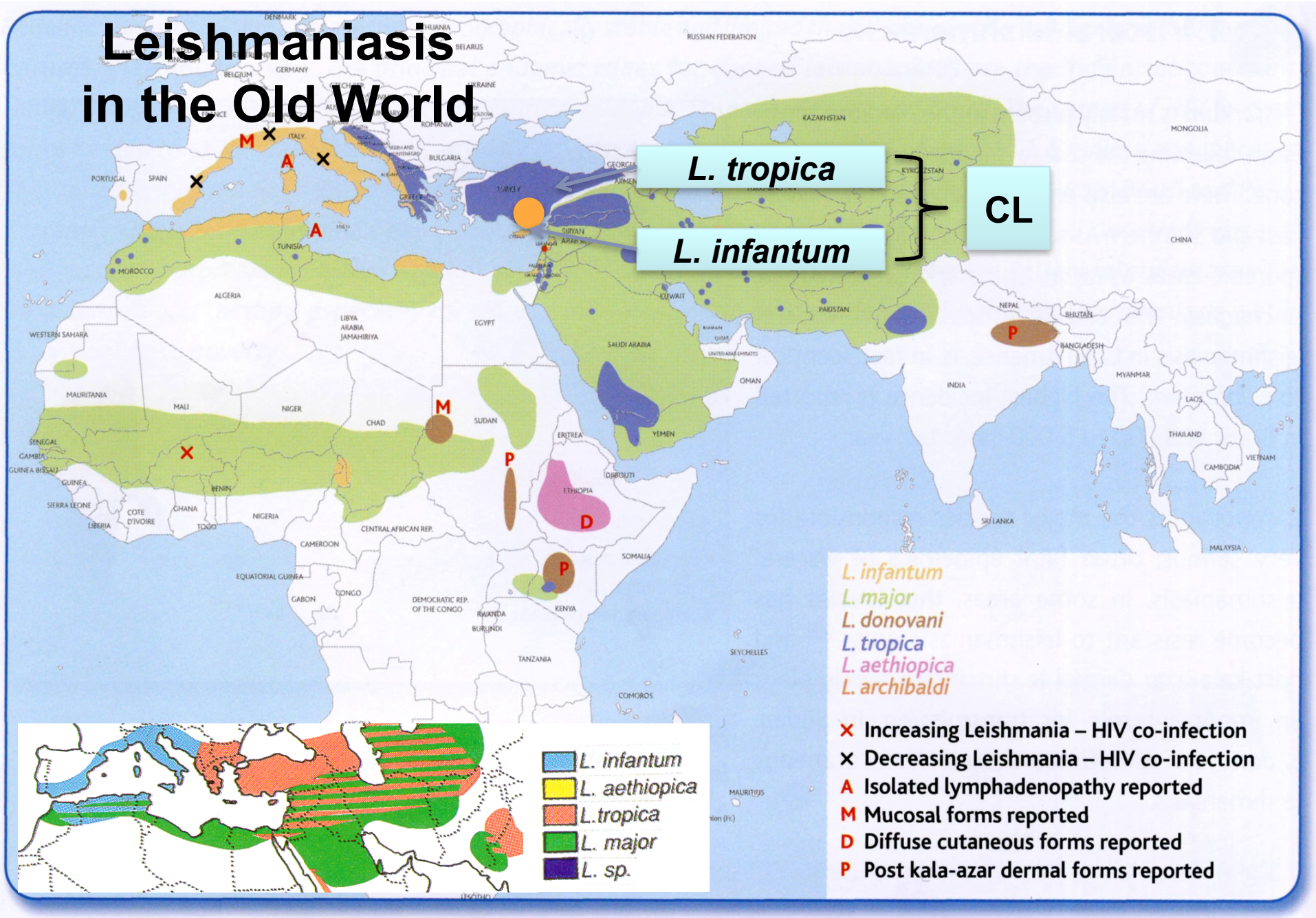
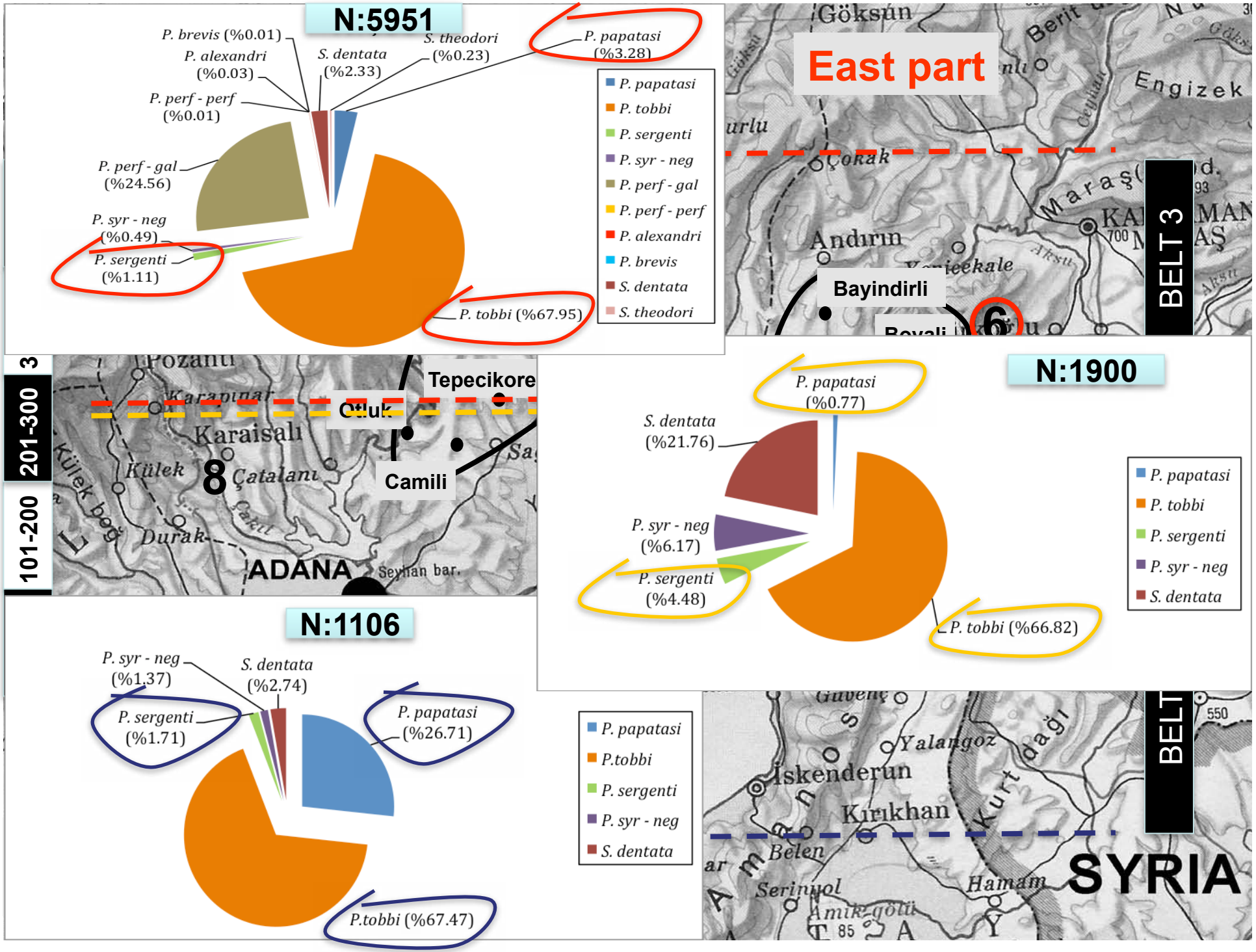


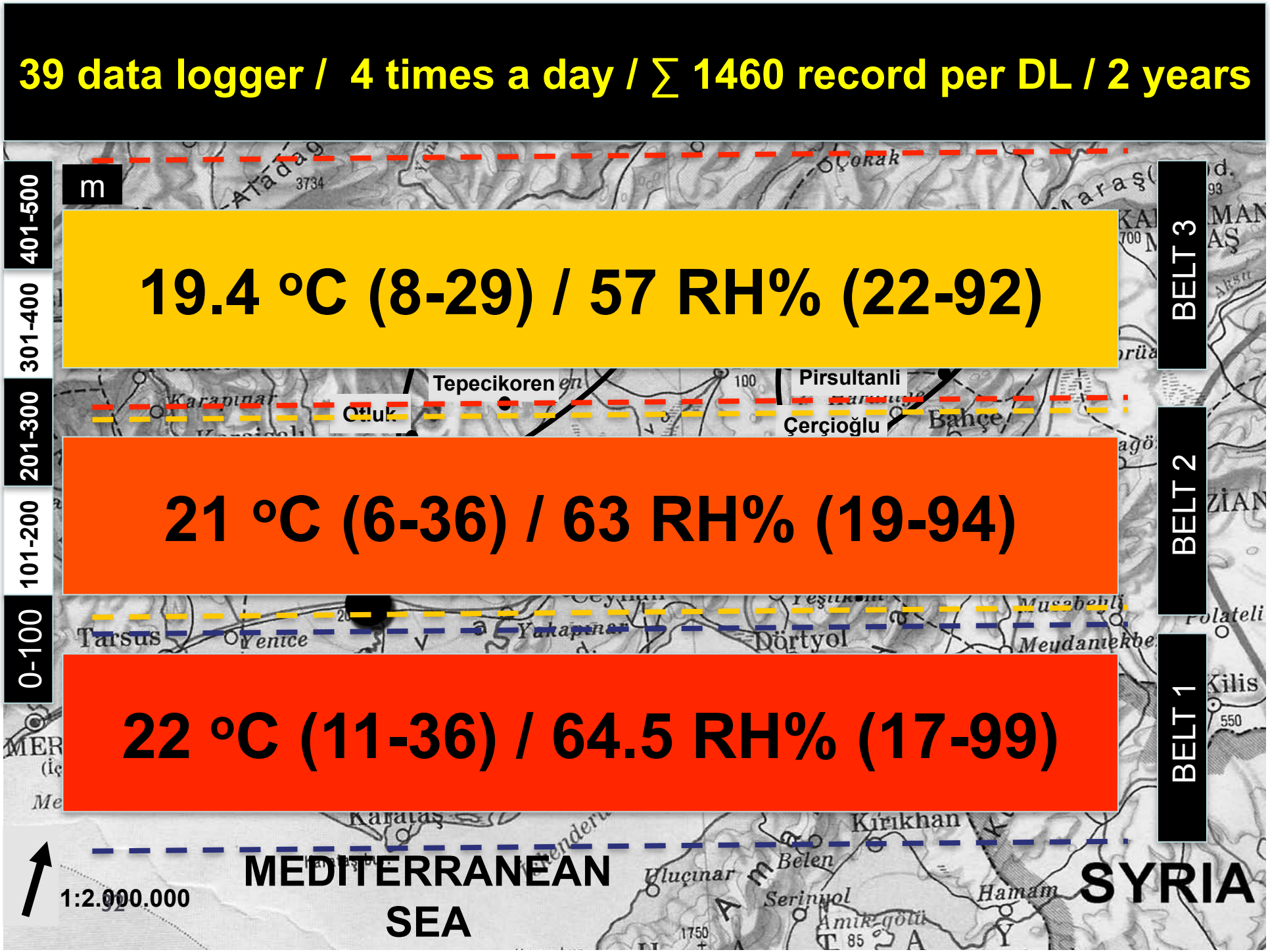
Figure 14A: Geographic distribution of the primary cutaneous leishmaniasis species Old World.

Adapted from Magill, A.J. [1]

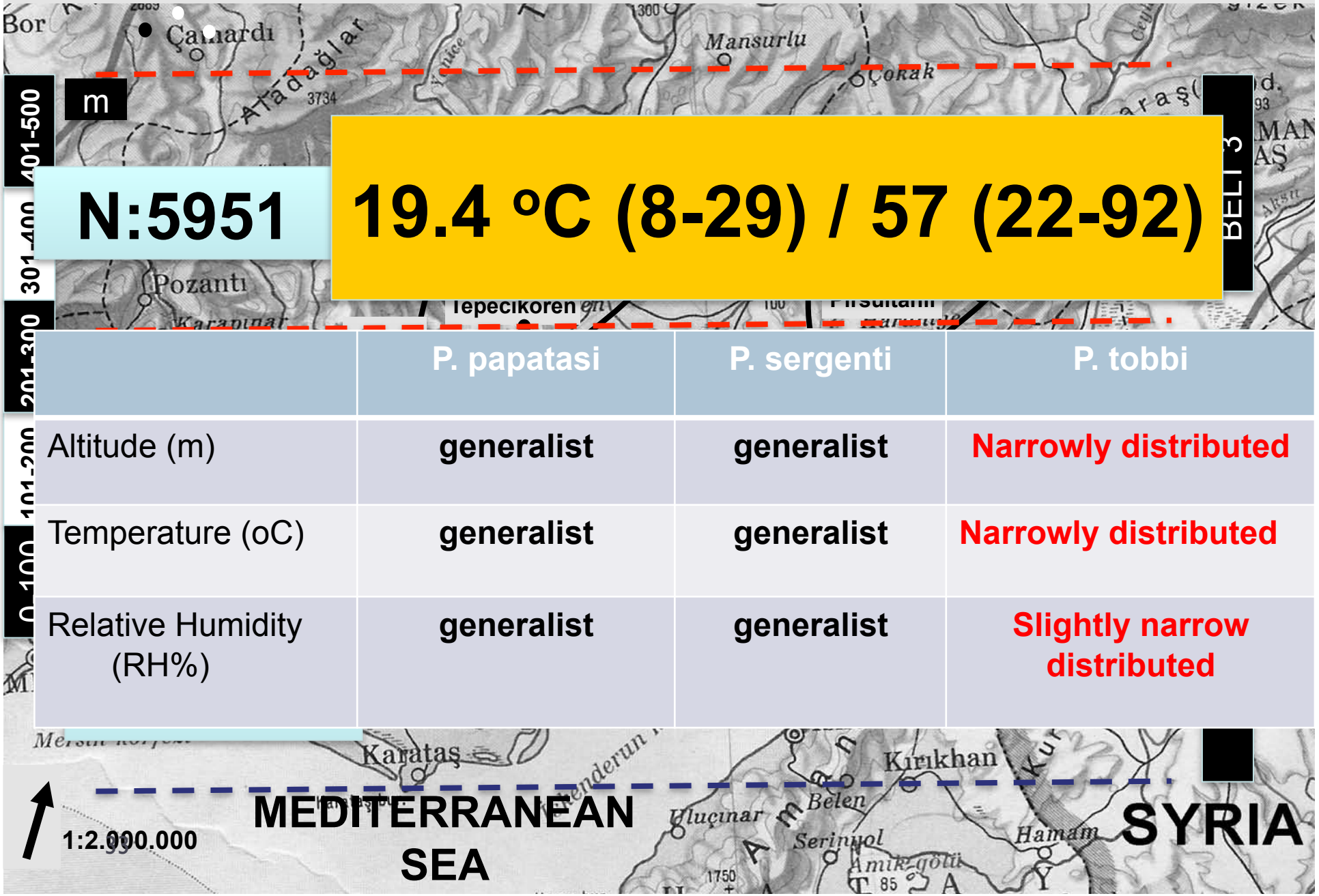
Factors affecting vector distribution

- environmental factors
- climatological factors
- genetic factors
- anthropogenic factors

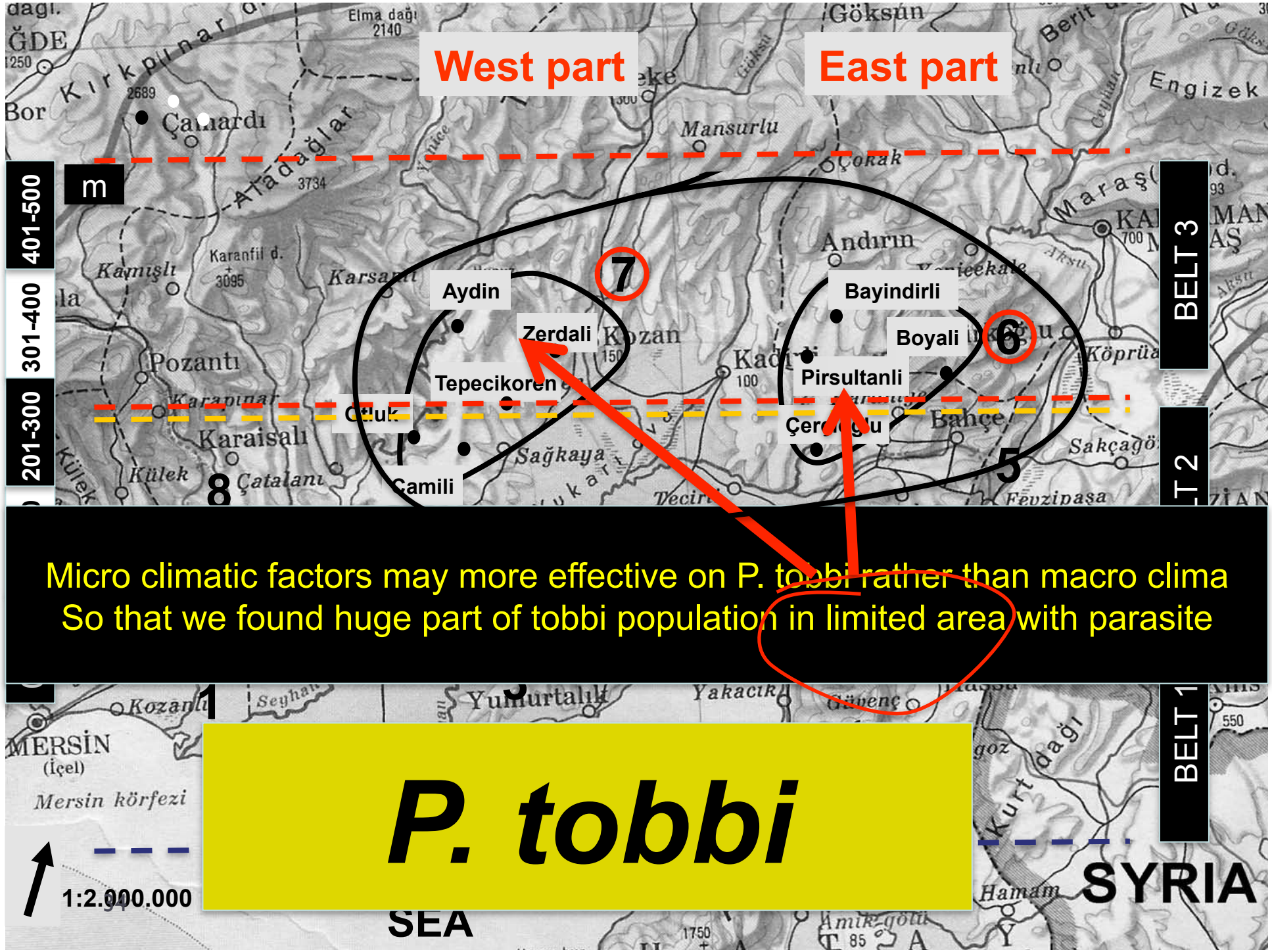

N:5951
P. brevis (%0.01)
P. alexandri (%0.03)
P. perf - perf (%0.01)
S. dentata (%2.33)
S. theodori (%0.23)
P. papatasi (%3.28)
P. perf - gal (%24.56)
P. syr - neg (%0.49)
P. sergenti (%1.11)
P. tobbi (%67.95)
P. papatasi
P. tobbi
P. sergenti
P. syr - neg
P. perf - gal
P. perf - perf
P. alexandri
P. brevis
S. dentata
S. theodori
East part
Göksun
Çorak
Andırın
Bayindirli
BELT 3
6
3
201-300
101-200
Pozantı
Karapınar
Karaisalı
Külek
8
Çatalanı
Durak
Tepecikore
Otluk
Camili
ADANA
Seyhan bar.
N:1900
P. papatasi (%0.77)
S. dentata (%21.76)
P. syr - neg (%6.17)
P. sergenti (%4.48)
P. tobbi (%66.82)
P. papatasi
P. tobbi
P. sergenti
P. syr - neg
S. dentata
N:1106
P. syr - neg (%1,37)
S. dentata (%2.74)
P. sergenti (%1.71)
P. papatasi (%26.71)
P.tobbi (%67.47)
P. papatasi
P.tobbi
P. sergenti
P. syr - neg
S. dentata
İskenderun
Yalangoz
Kırıkhan
Belen
Hamam
SYRIA
BELT
550


39 data logger / 4 times a day / ∑ 1460 record per DL / 2 years
m
401-500
301-400
201-300
101-200
0-100
19.4 °C (8-29) / 57 RH% (22-92)
21 °C (6-36) / 63 RH% (19-94)
22 °C (11-36) / 64.5 RH% (17-99)
BELT 3
BELT 2
BELT 1
Tepecikoren
Pirsultanli
Çerçioğlu
Otluk
Tarsus
Dörtyol
Yenice
Karataş
Kırıkhan
Belen
Hamam
SYRIA
MEDITERRANEAN SEA
1:2.000.000

P. tobbi



	P. papatasi	P. sergenti	P. tobbi
Altitude (m)	**generalist**	**generalist**	**Narrowly distributed**
Temperature (oC)	**generalist**	**generalist**	**Narrowly distributed**
Relative Humidity (RH%)	**generalist**	**generalist**	**Slightly narrow distributed**


West part
East part
m
401-500
301-400
201-300
BELT 3
BELT 2
BELT 1
Aydin
Zerdali
Tepecikoren
Camili
Bayindirli
Boyali
Pirsultanli
7
6
5
8
Micro climatic factors may more effective on P. tobbi rather than macro clima
So that we found huge part of tobbi population in limited area with parasite
P. tobbi
1:2.000.000
SYRIA
SEA

Effect of different larval rearing temperatures on the productivity (R_o) and morphology of the malaria vector *Anopheles superpictus* Grassi (Diptera: Culicidae) using geometric morphometrics

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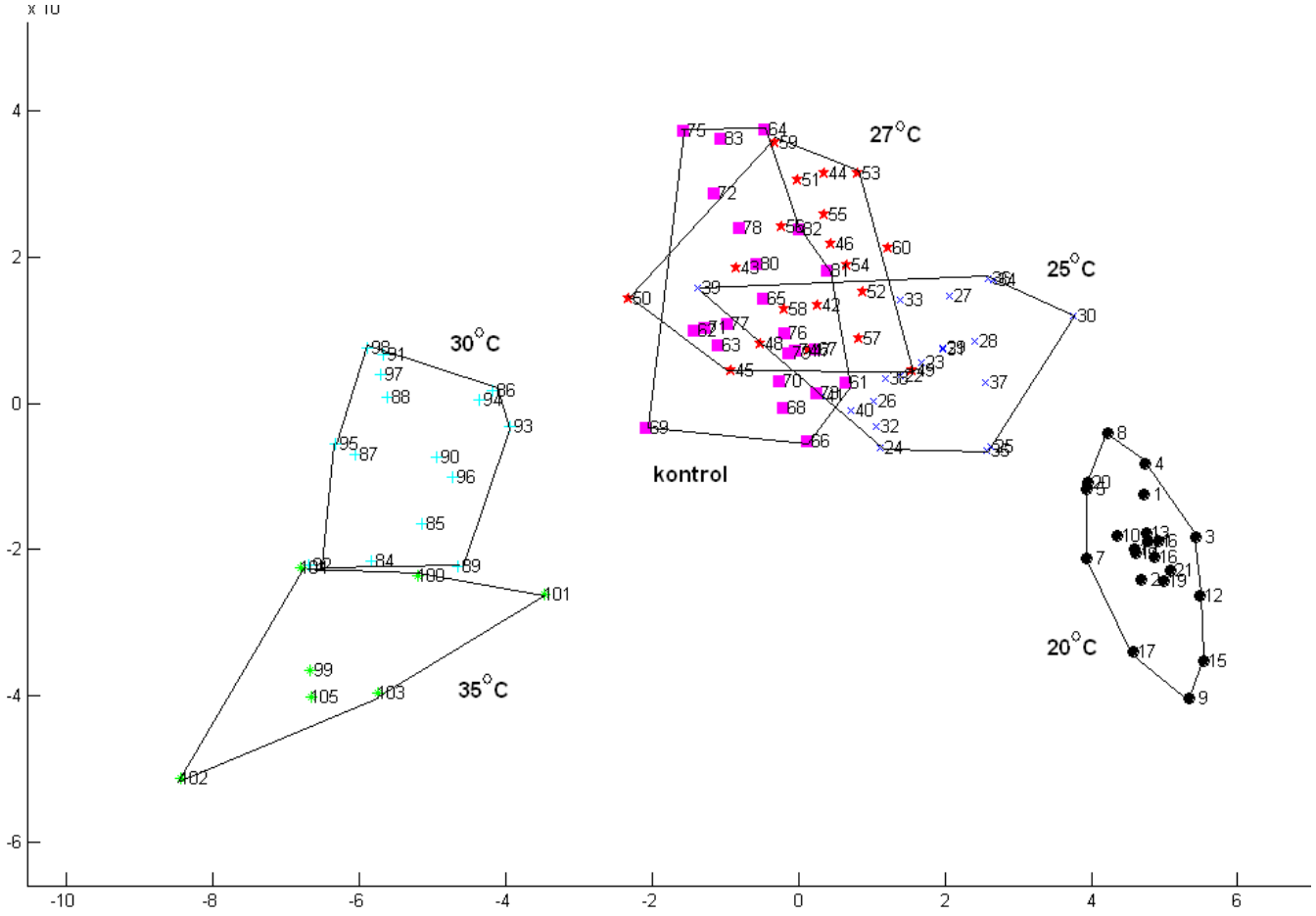
Hacettepe University, Faculty of Science, Department of Biology, 06800 Beytepe-Ankara, Turkey

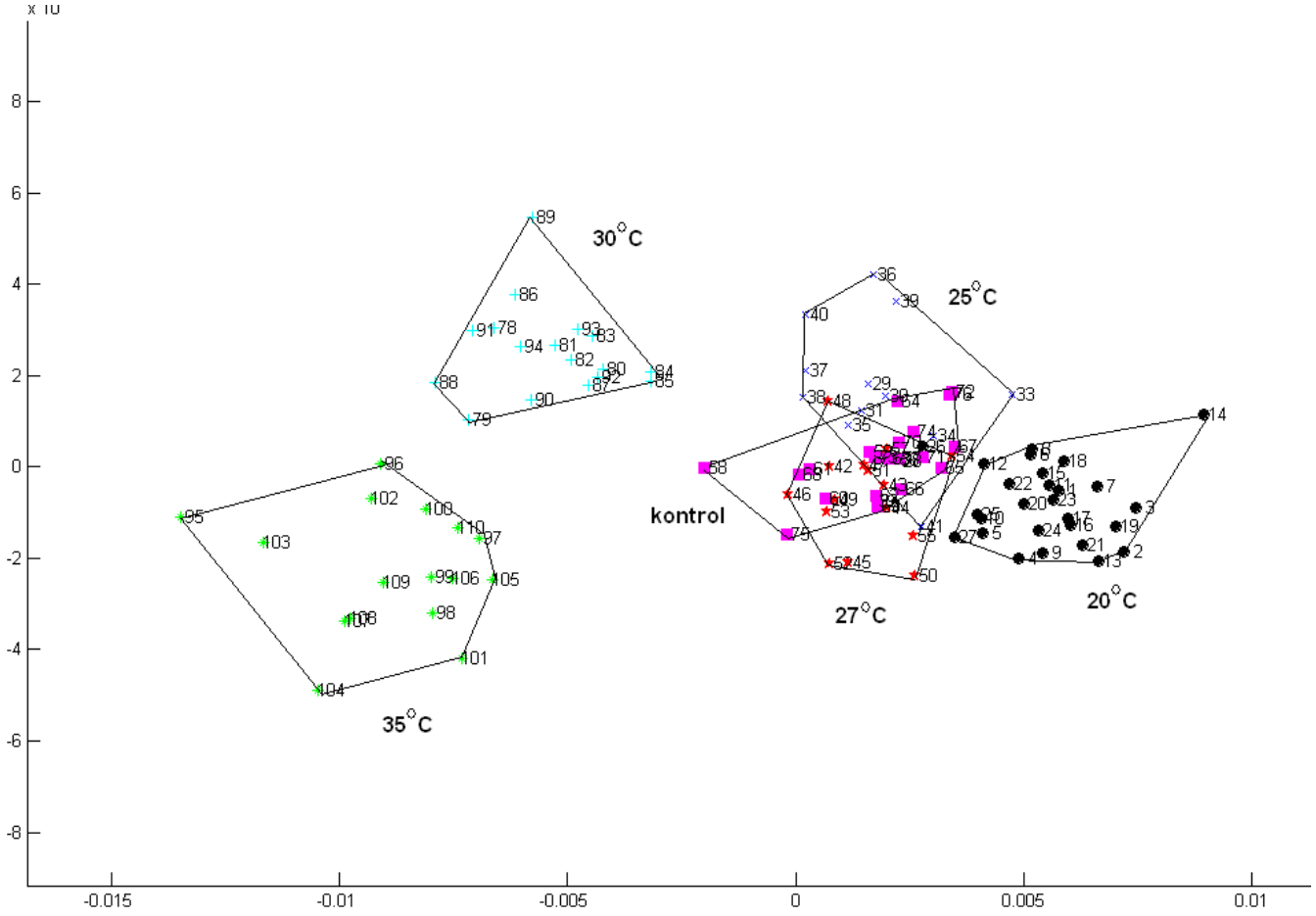
Received 26 May 2008; Accepted 5 March 2009

ABSTRACT: Temperature affects both the biology and morphology of mosquito vectors. Geometric morphometrics is a useful new tool for capturing and analyzing differences in shape and size in many morphological parameters, including wings. We have used this technique for capturing the differences in the wings of the malaria vector *Anopheles superpictus*, using cohorts reared at six different constant temperatures (15°, 20°, 25°, 27°, 30°, and 35° C) and also searched for potential correlations with the life tables of the species. We studied wing shape in both male and female adults, using 22 landmarks on the wing in relation to ecological parameters, including the development rate. The ecological zero was calculated as 9.93° C and the thermal constant as 296.34 day-degrees. The rearing temperature affects egg, larval, and pupal development and also the total time from egg to adult. As rearing temperatures increased, longevity decreased in both sexes. In *An. superpictus*, R_o value and productivity correlated with the statistically significant gradual deformations in the wing shape related to size in both sexes. These deformations directly linked to differences in immature rearing temperatures. Analysis using PCA and UPGMA phenograms showed that although wings of females became narrower dorsoventrally as the temperature increased, they became broader in males. Comparisons of the wing landmarks indicated the medial part of the wing was most affected by larval rearing temperatures, showing relatively more deformations. Algorithmic values of the life tables were determined in correlation with the results of geometric morphometrics. Comparisons of centroid sizes in the cohorts showed that overall wing size became smaller in both sexes in response to higher rearing temperatures. ***Journal of Vector Ecology* 34 (1): 32-42. 2009.**

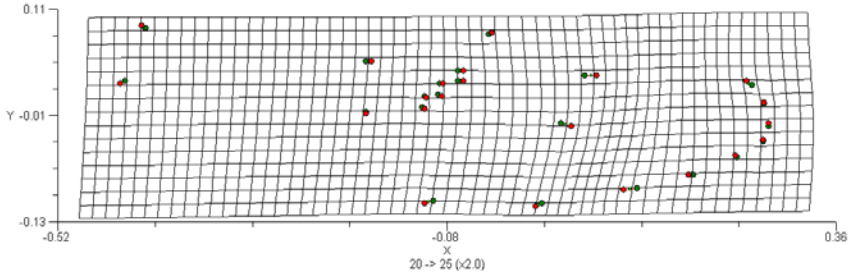
CANOVAR (FEMALE)



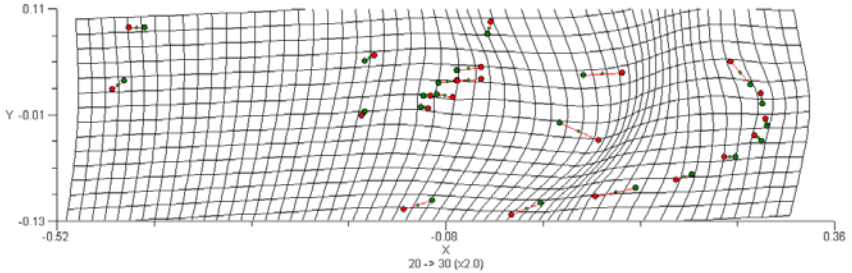
CANOVAR (MALE)



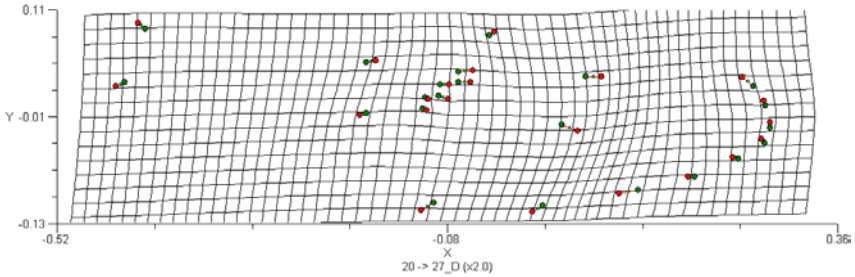
SHAPE DEFORMATION OF WING (FEMALE)



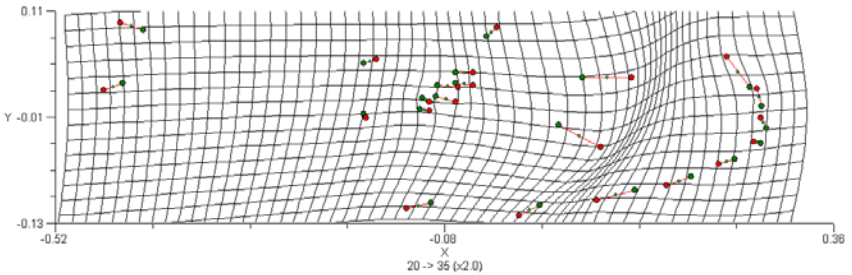
25 ^{O}C (optimum)



30 ^{O}C

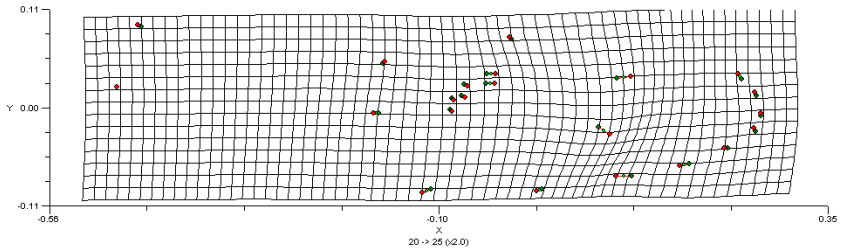


28 ^{O}C

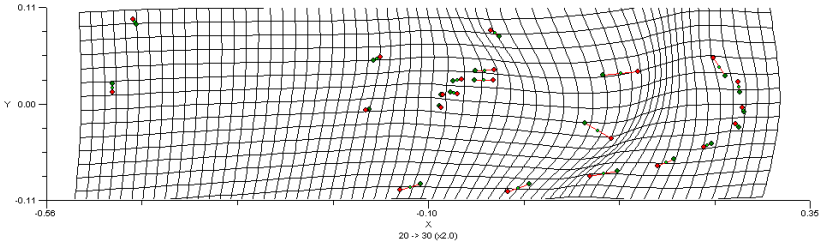


35 ^{O}C

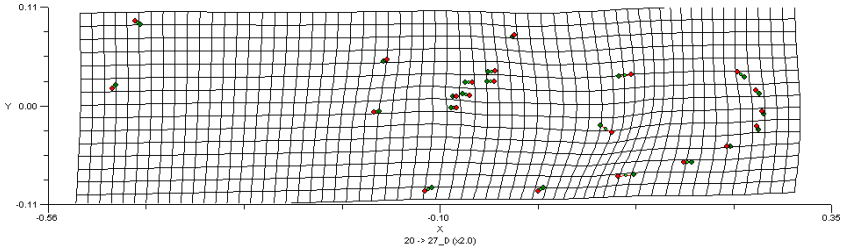
SHAPE DEFORMATION OF WING (MALE)



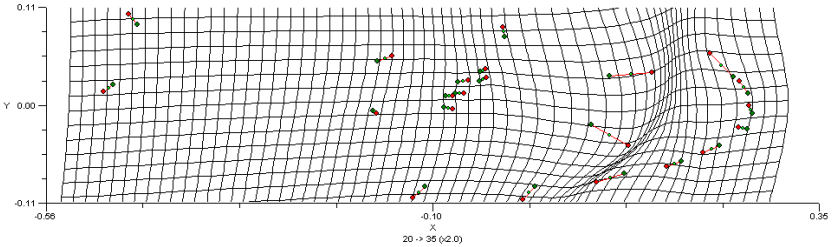
25 ^{O}C (optimum)



30 ^{O}C



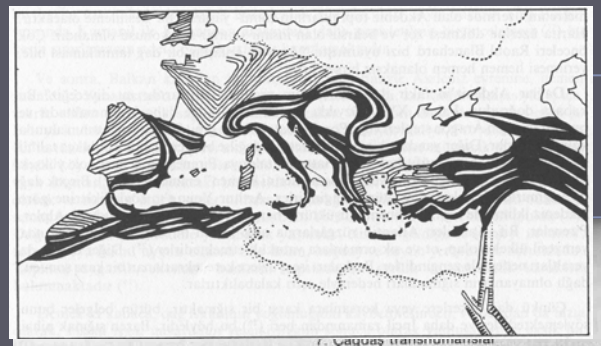
28 ^{O}C



35 ^{O}C

Factors affecting vector distribution

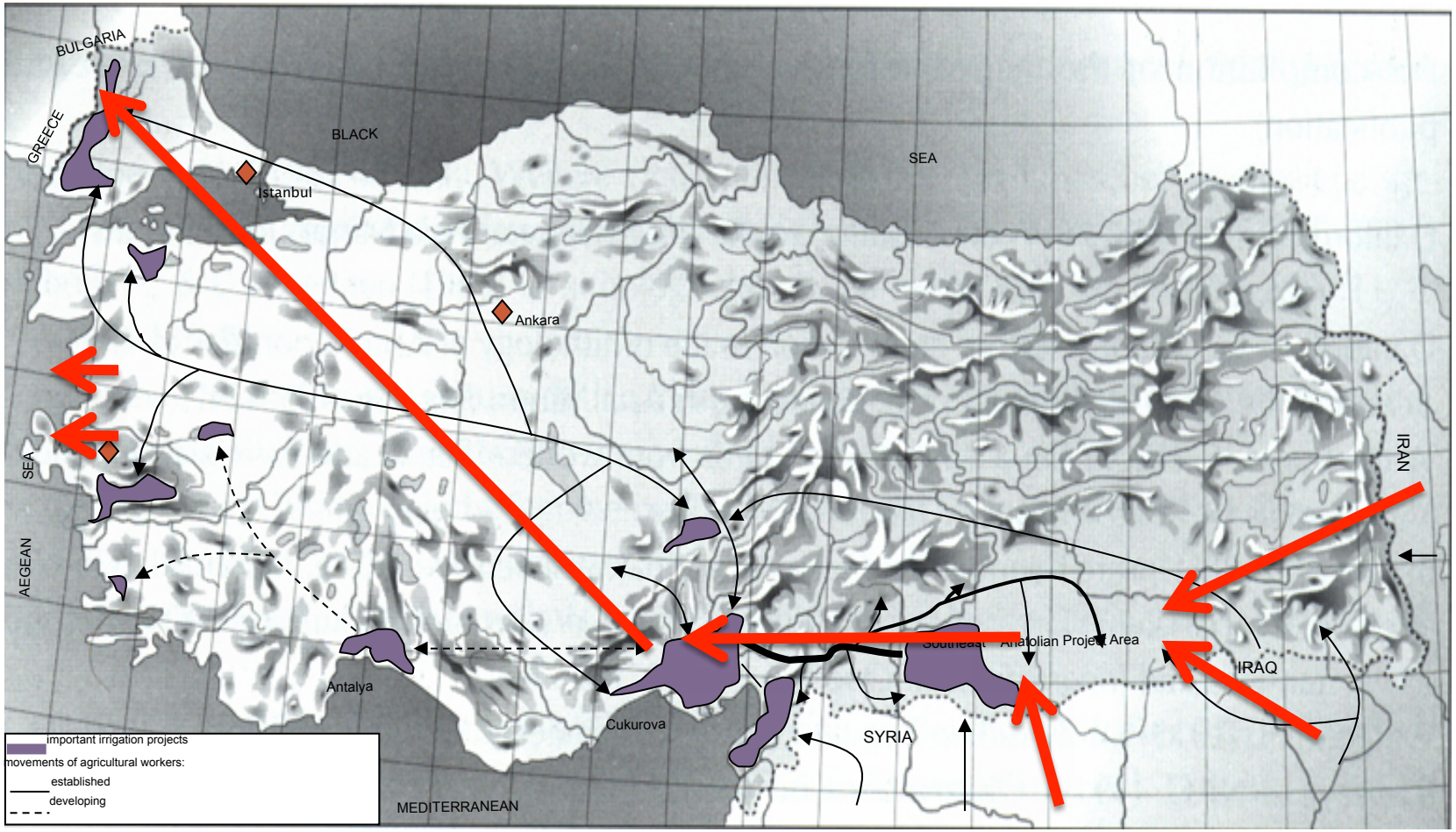
- environmental factors
- climatological factors
- genetic factors
- anthropogenic factors



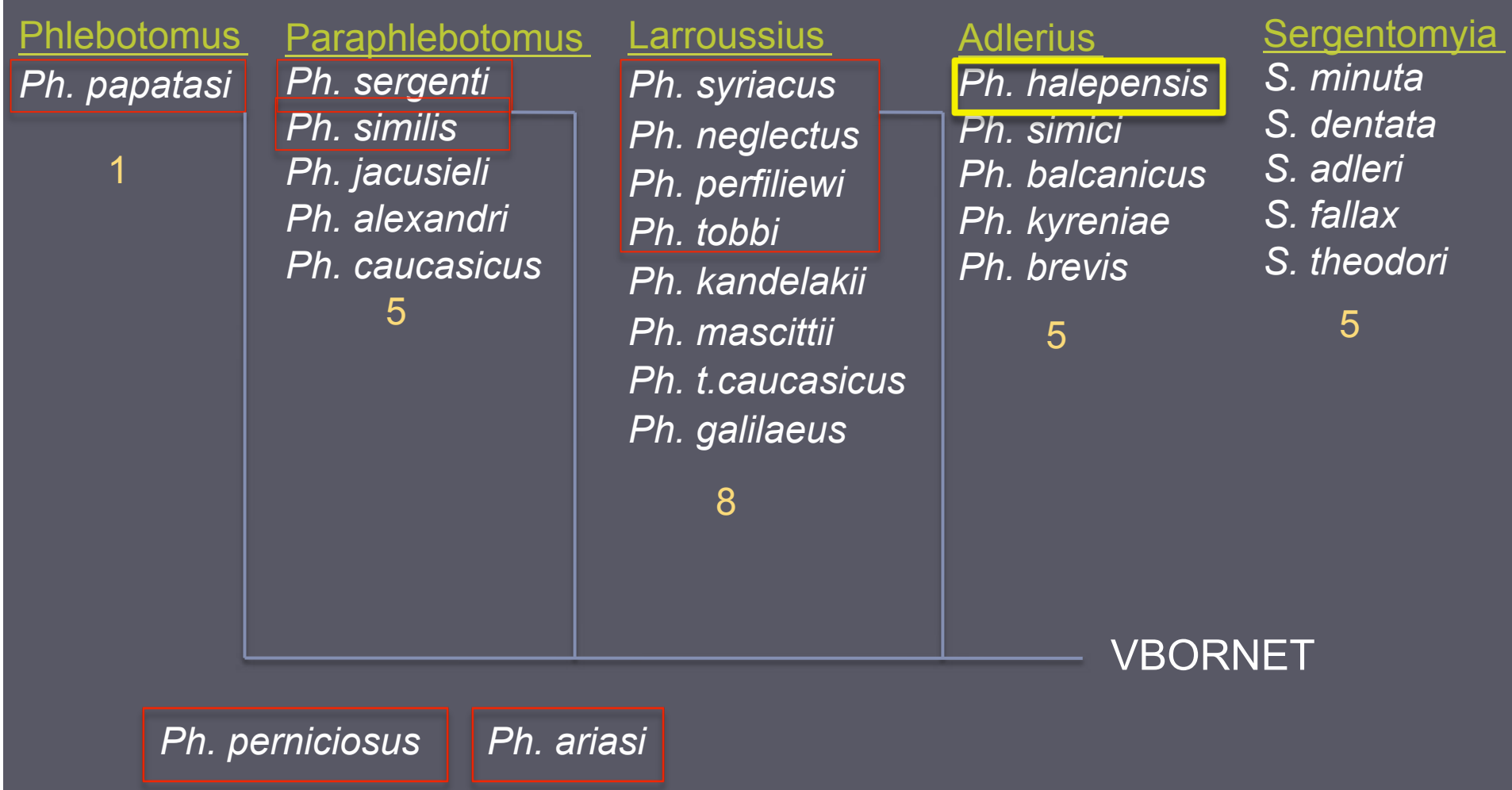
Kaynak: Elli Müller, "Die Herdenwarderungen Mittlemeergebiet" in, **Petermann's Mitteilungen**, 1938.

Transhumance in modern times, from Elli Müller (1938) in F. Braudel, 1949

Human movement from east to west in last 30 years in Anatolia



current data on phlebotomine distribution in Turkey




Turkiye/Turkey (NUTS 3)
Vector Distribution
Vector Surveillance
Phlebotomines
Phl. (Larroussius) ariasi
Phl. (Larroussius) perniciosus
Phl. (Larroussius) perfiliewi
Phl. (Larrouss.) neglectus/syriacus
Phl. (Larroussius) tobbi
Phl. (Phlebotomus) papatasi
Phl. (Paraphlebotomus) sergenti
Phl. (Paraphlebotomus) similis
Phlebotomus papatasi
NUTS 1
NUTS 2
NUTS 3
Adana
Adiyaman
Afyon
Agri
Aksaray
Amasya
Ankara
Antalya
Ardahan
Artvin
Zoom to NUTS 0
Set Status
Copy Status
History / Undo
Report
VBORNET v1.0.0 ©2010 Euro-Aegis


Turkiye/Turkey (NUTS 3)
Vector Distribution
Vector Surveillance
Phlebotomines
Phl. (Larroussius) ariasi
Phl. (Larroussius) perniciosus
Phl. (Larroussius) perfiliewi
Phl. (Larrouss.) neglectus/syriacus
Phl. (Larroussius) tobbi
Phl. (Phlebotomus) papatasi
Phl. (Paraphlebotomus) sergenti
Phl. (Paraphlebotomus) similis
Phlebotomus sergenti
NUTS 1
NUTS 2
NUTS 3
Adana
Adiyaman
Afyon
Agri
Aksaray
Amasya
Ankara
Antalya
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Artvin
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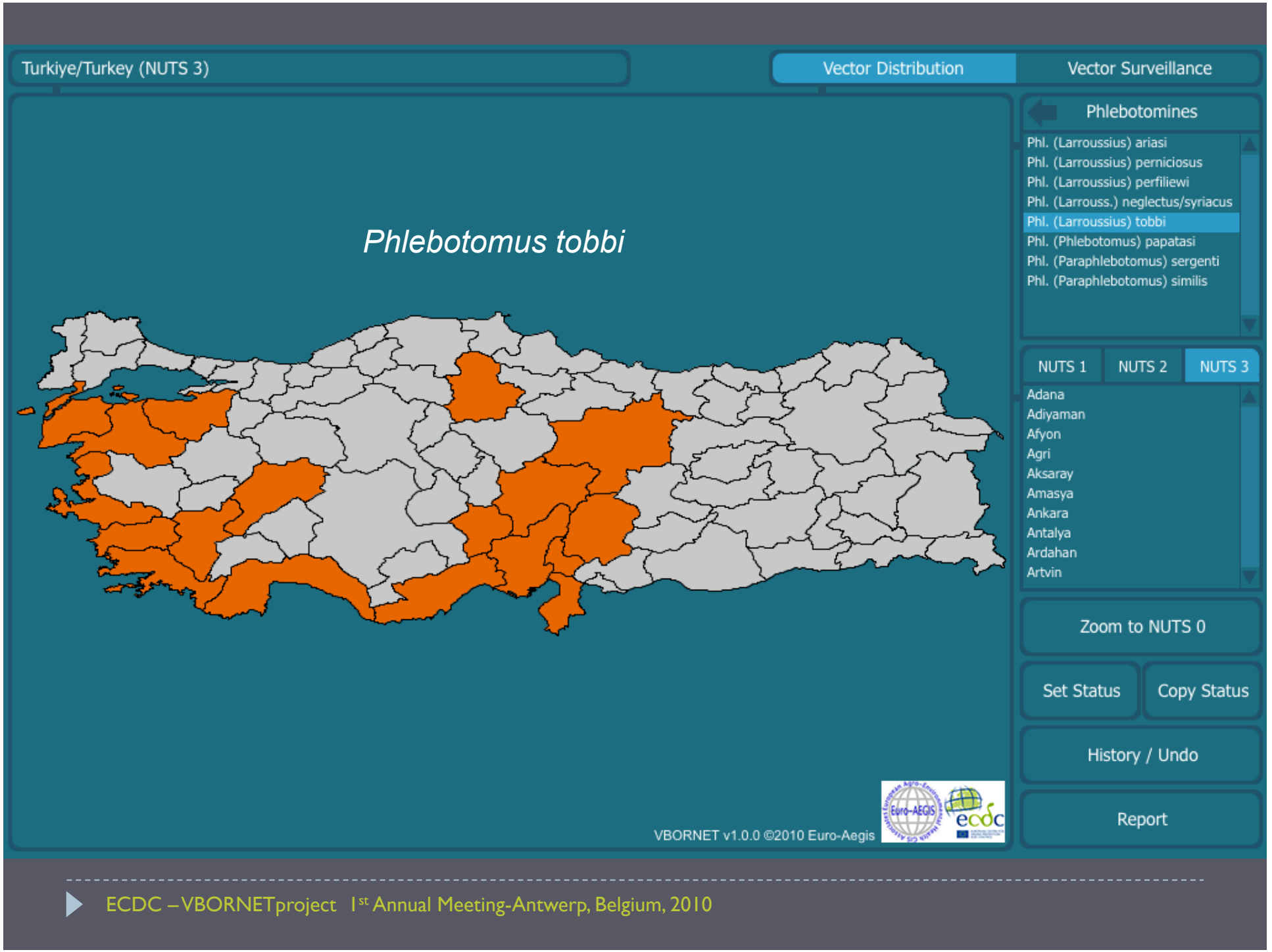
Set Status
Copy Status
History / Undo
Report
VBORNET v1.0.0 ©2010 Euro-Aegis


Turkiye/Turkey (NUTS 3)
Vector Distribution
Vector Surveillance
Phlebotomines
Phl. (Larroussius) ariasi
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NUTS 1
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Ankara
Antalya
Ardahan
Artvin
Zoom to NUTS 0
Set Status
Copy Status
History / Undo
Report
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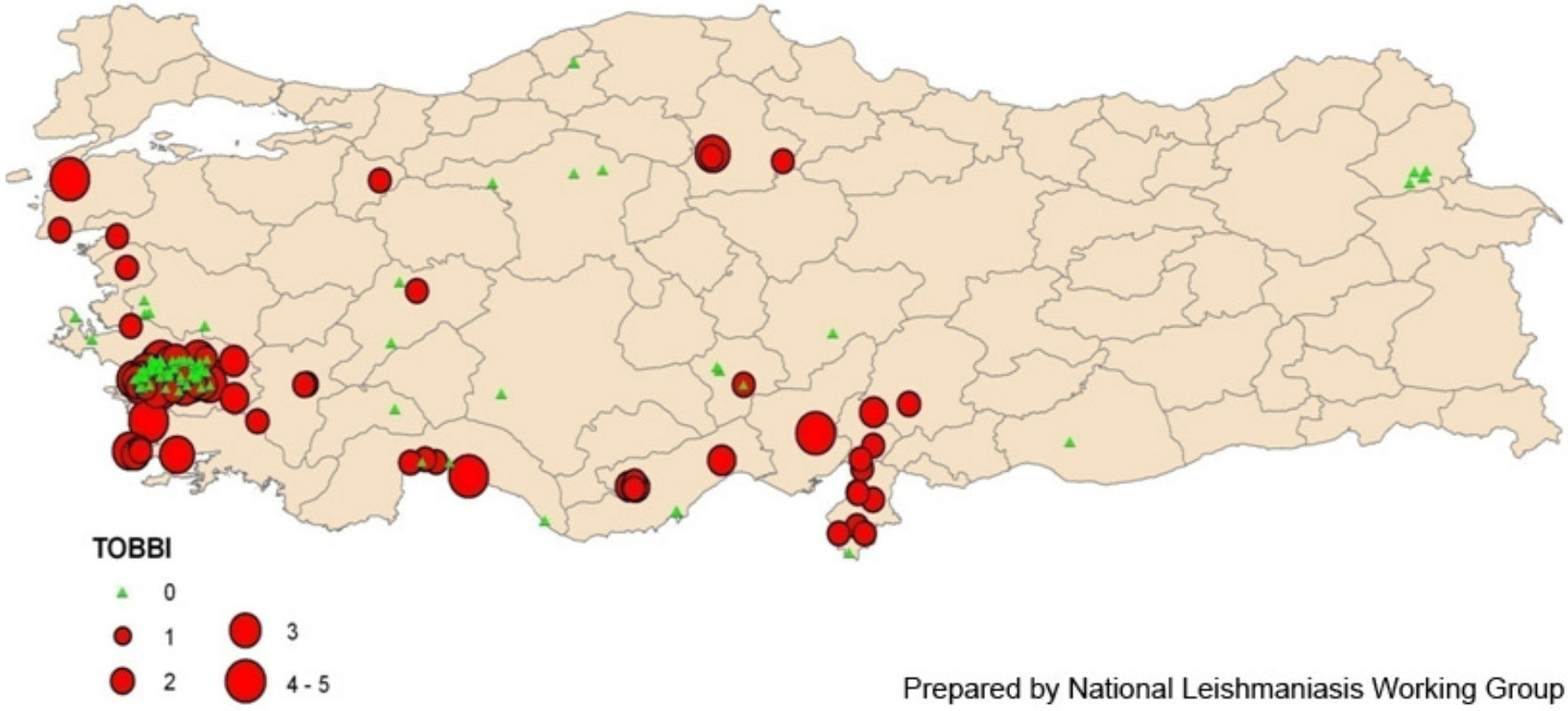
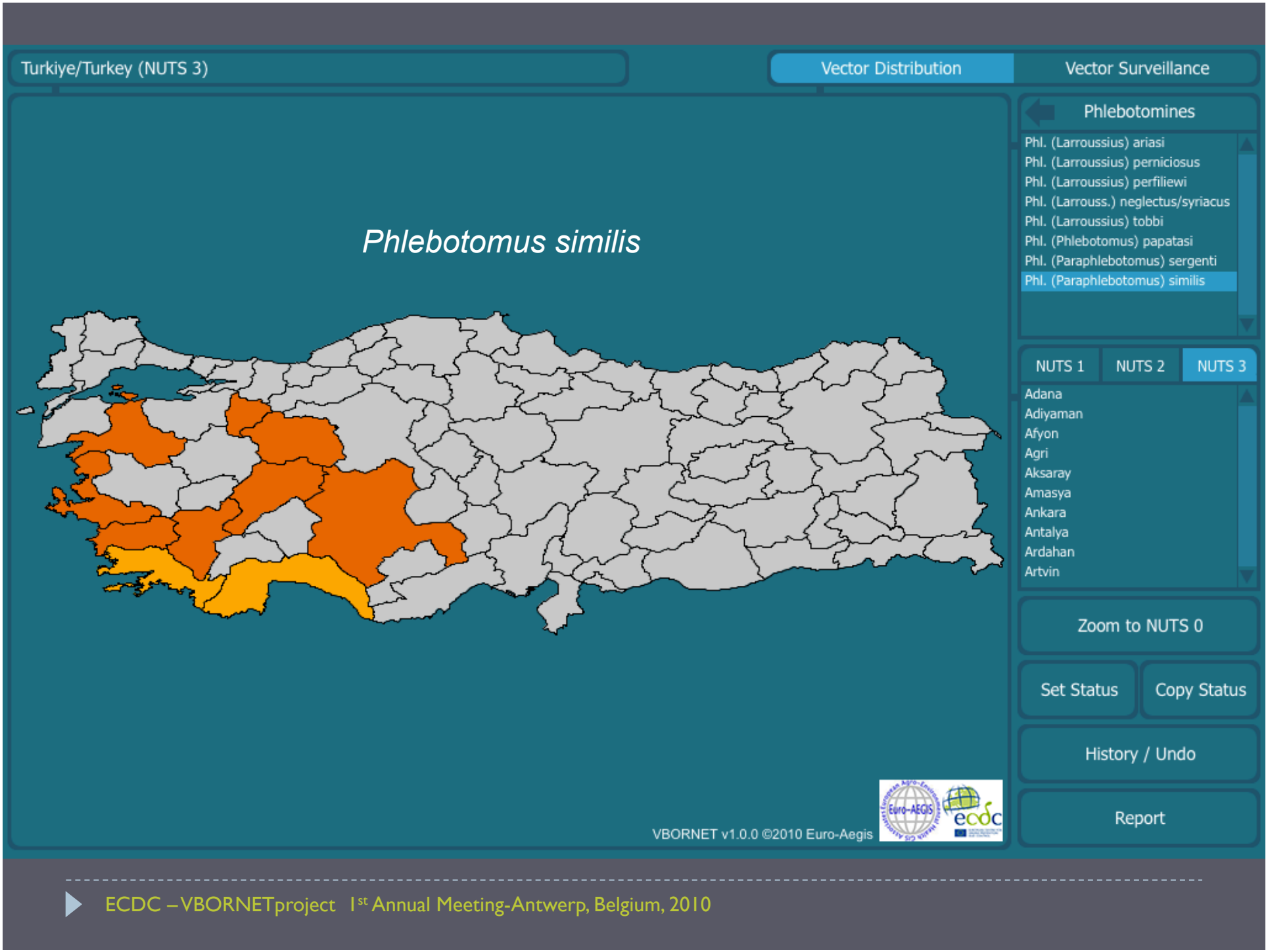
Distribution of **P. tobbi** in Turkey (according to historical data)




Turkiye/Turkey (NUTS 3)
Vector Distribution
Vector Surveillance
Phlebotomines
Phl. (Larroussius) ariasi
Phl. (Larroussius) perniciosus
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Phl. (Larroussius) tobbi
Phl. (Phlebotomus) papatasi
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Phl. (Paraphlebotomus) similis
Phlebotomus similis
NUTS 1
NUTS 2
NUTS 3
Adana
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Amasya
Ankara
Antalya
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Artvin
Zoom to NUTS 0
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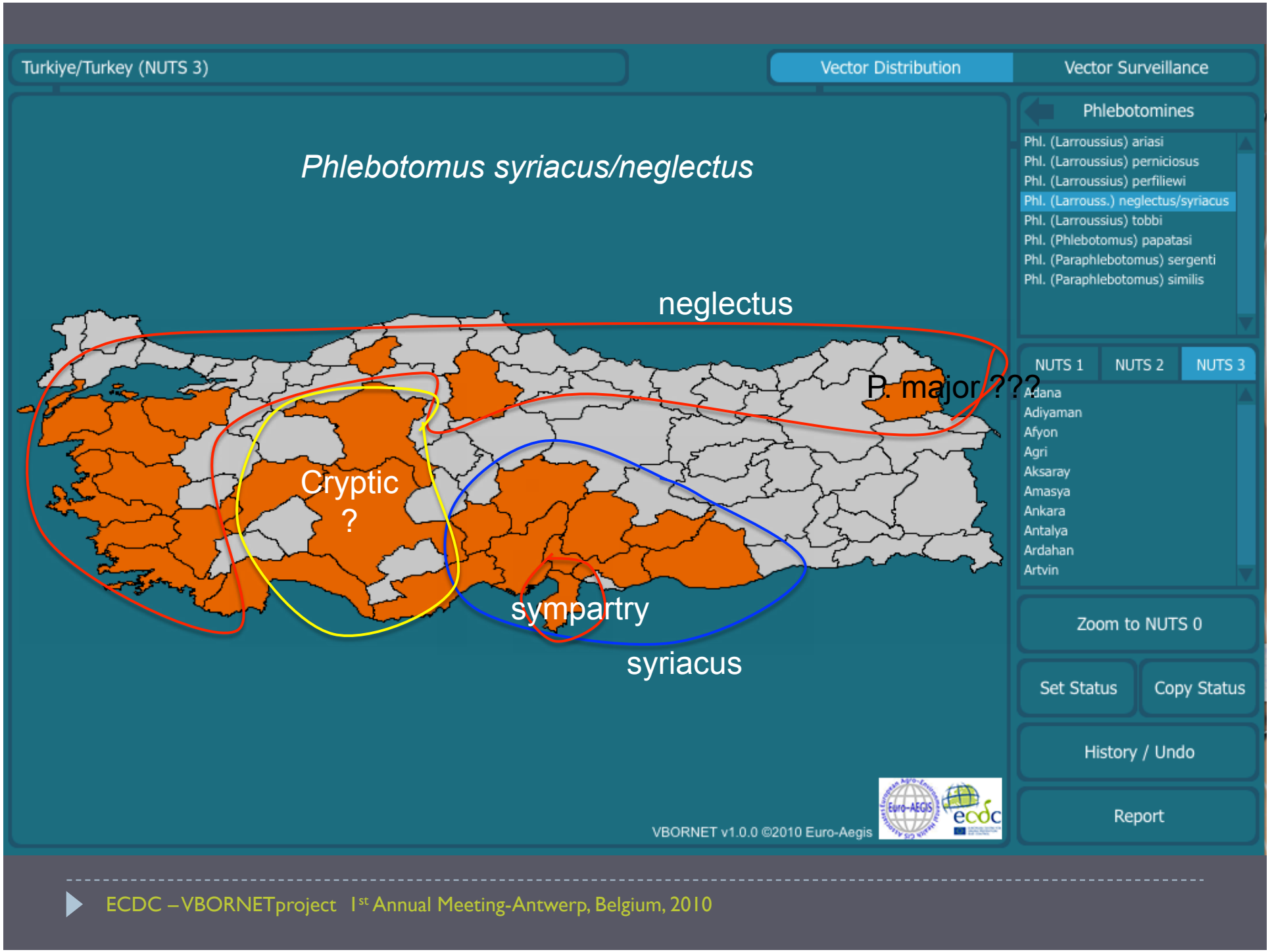
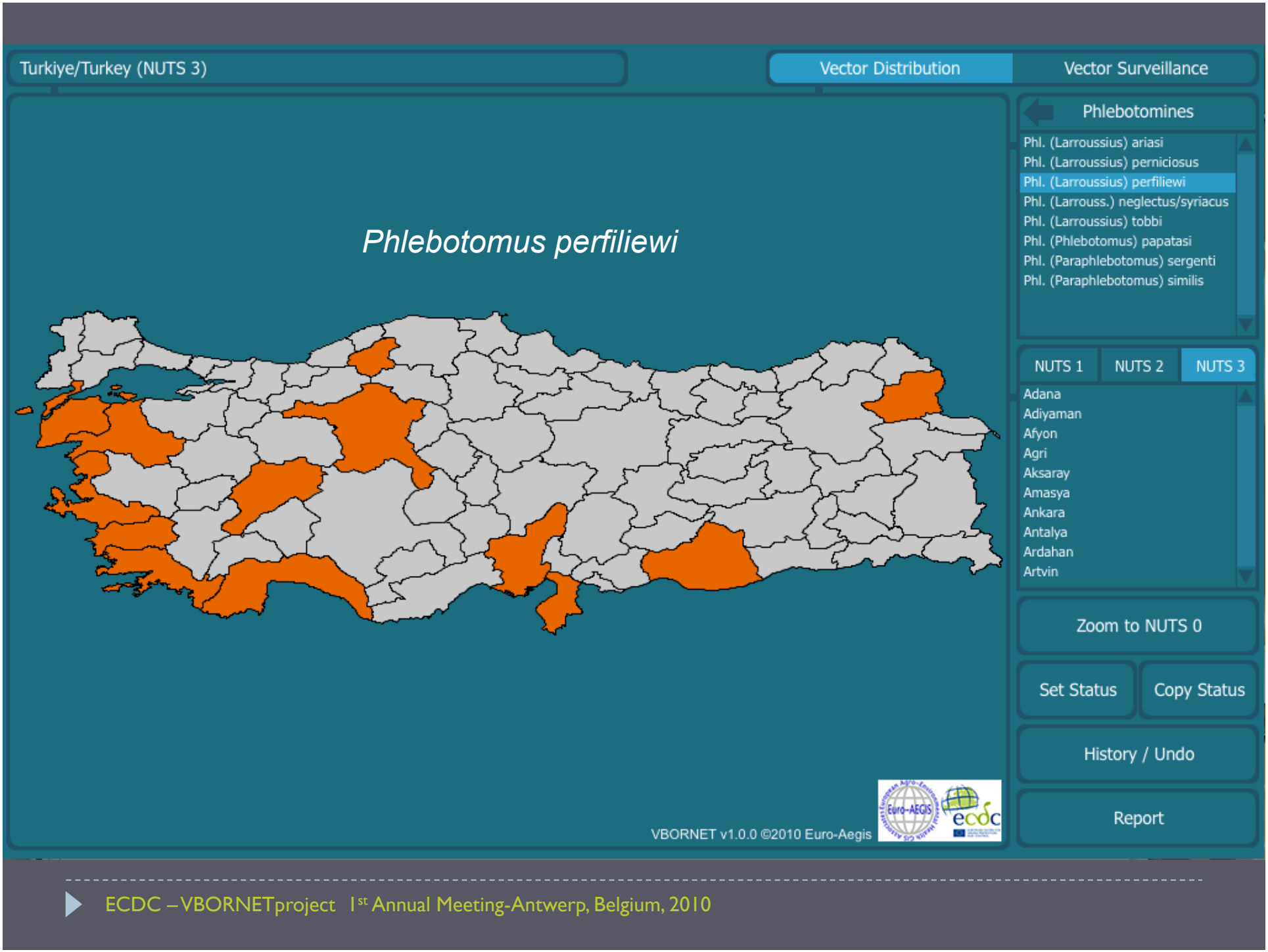

Turkiye/Turkey (NUTS 3)
Vector Distribution
Vector Surveillance
Phlebotomines
Phl. (Larroussius) ariasi
Phl. (Larroussius) perniciosus
Phl. (Larroussius) perfiliewi
Phl. (Larrouss.) neglectus/syriacus
Phl. (Larroussius) tobbi
Phl. (Phlebotomus) papatasi
Phl. (Paraphlebotomus) sergenti
Phl. (Paraphlebotomus) similis
Phlebotomus syriacus/neglectus
neglectus
P. major ???
Cryptic
?
sympartry
syriacus
NUTS 1
NUTS 2
NUTS 3
Adana
Adiyaman
Afyon
Agri
Aksaray
Amasya
Ankara
Antalya
Ardahan
Artvin
Zoom to NUTS 0
Set Status
Copy Status
History / Undo
Report
VBORNET v1.0.0 ©2010 Euro-Aegis


Turkiye/Turkey (NUTS 3)
Vector Distribution
Vector Surveillance
Phlebotomines
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Phl. (Larroussius) perniciosus
Phl. (Larroussius) perfiliewi
Phl. (Larrouss.) neglectus/syriacus
Phl. (Larroussius) tobbi
Phl. (Phlebotomus) papatasi
Phl. (Paraphlebotomus) sergenti
Phl. (Paraphlebotomus) similis
Phlebotomus perfiliewi
NUTS 1
NUTS 2
NUTS 3
Adana
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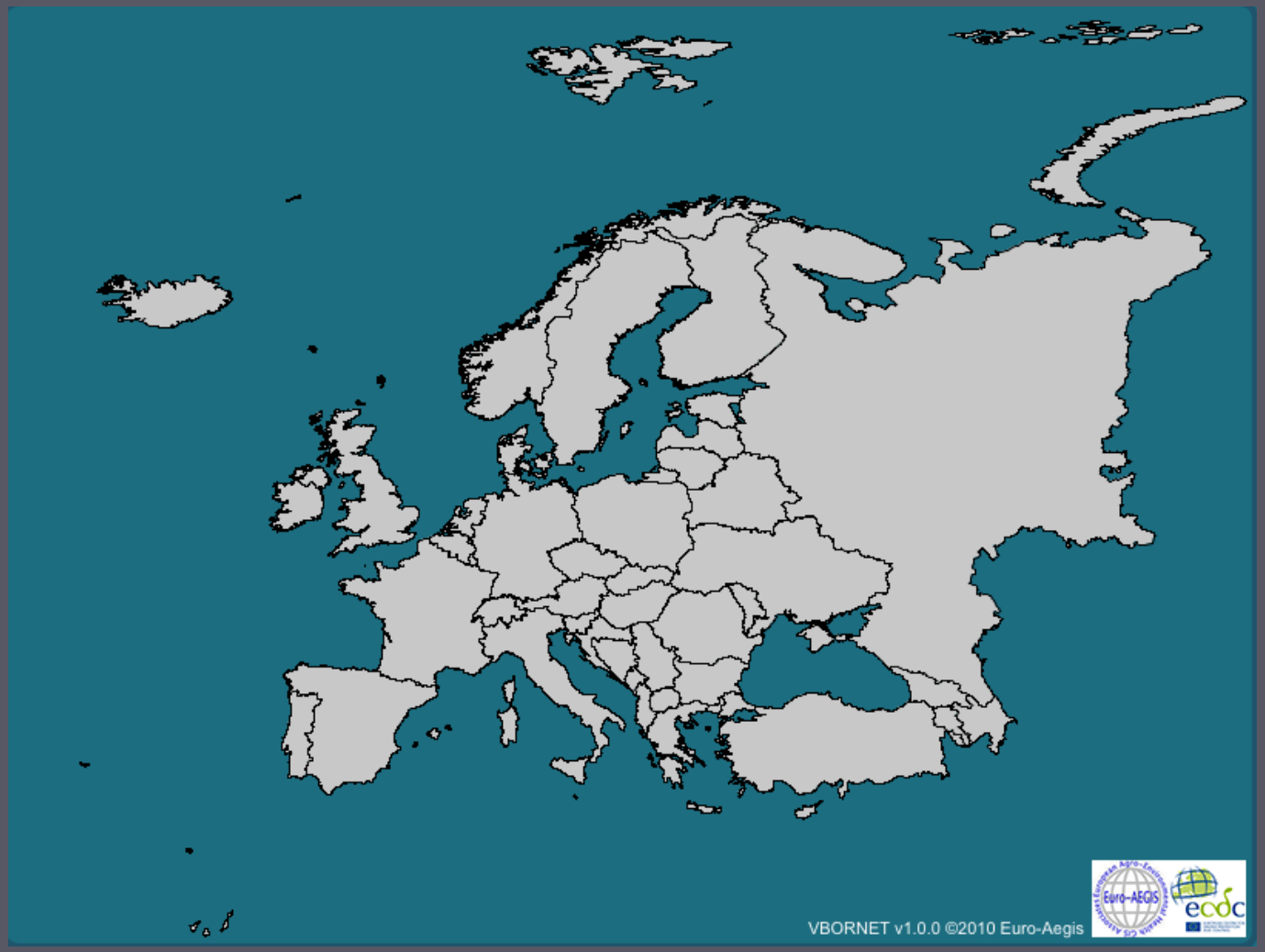
Amasya
Ankara
Antalya
Ardahan
Artvin
Zoom to NUTS 0
Set Status
Copy Status
History / Undo
Report
VBORNET v1.0.0 ©2010 Euro-Aegis

historical phlebotomine data in Europe



REVIEW ARTICLES

Leishmaniasis emergence in Europe

P D Ready (P.Ready@nhm.ac.uk)[1]
1. Department of Entomology, Natural History Museum, London, United Kingdom

Citation style for this article:
Citation style for this article: Ready PD. Leishmaniasis emergence in Europe. Euro Surveill. 2010;15(10):pii=19505. Available online: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19505

This article has been published on 11 March 2010

FIGURE 1
Distribution by country of *Leishmania* species transmitted by phlebotomine sandflies in Europe up to 2009

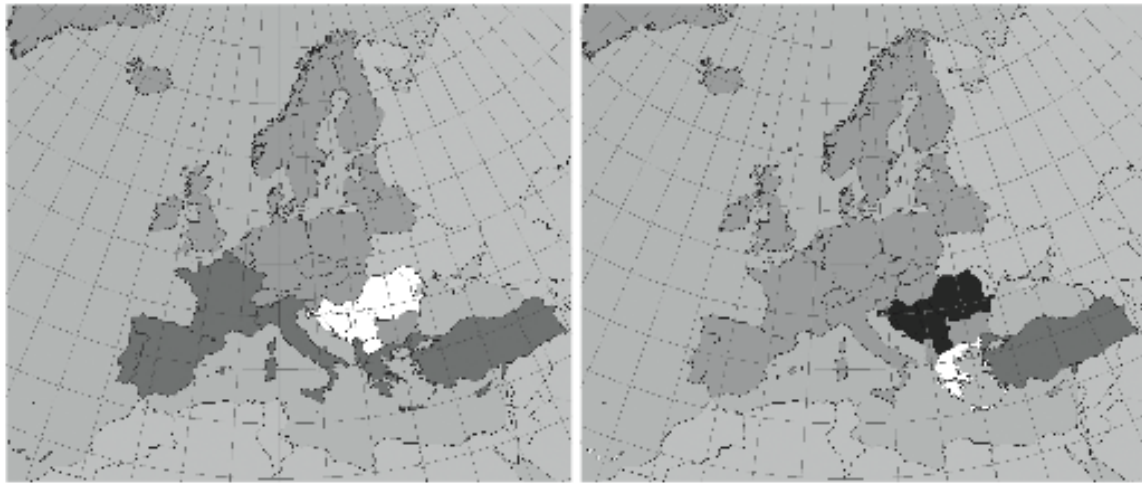
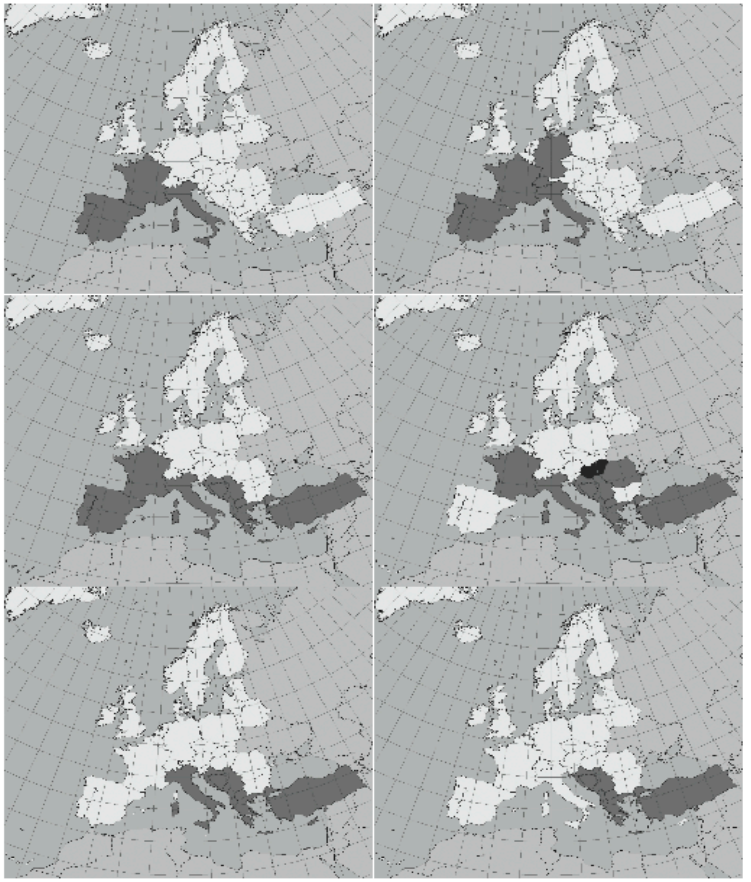


FIGURE 2
Distribution of vectors of leishmaniasis in European countries up to 2009



From left to right and top to bottom: (a) *Phlebotomus ariasi*, (b) *P. perniciosus*, (c) *P. sergenti*, (d) *P. perfiliewi*, (e) *P. neglectus*, (f) *P. tobbi*.
Dark grey: present; light grey: absent; black: old record.
Presence in North Africa and Middle East is not depicted.
Source: V-borne project; reproduced with permission from the European Centre of Disease Prevention and Control.

Arthropod-borne viruses transmitted by Phlebotomine sandflies in Europe: a review

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1. Université de Reims Champagne Ardenne, AFSSA, JE 2533-USC "VECPAR", Reims, France
2. Laboratoire associé au Centre national de référence des arbovirus, Unité de virologie tropicale, Institut de médecine tropicale du Service de santé des armées, Marseille, France
3. Centre national de référence des arbovirus, Institut Pasteur, Paris, France
4. Cellule d'Intervention Biologique d'Urgence (CIBU), Institut Pasteur, Paris, France
5. Unité de virologie, Département de Biologie des Agents transmissibles, Centre de Recherche du Service de Santé des Armées, Grenoble, France

Citation style for this article:
Citation style for this article: Depaquit J, Grandadam M, Fouque F, Andry P, Peyrefitte C. Arthropod-borne viruses transmitted by Phlebotomine sandflies in Europe: a review . Euro Surveill. 2010;15(10):pii=19507. Available online: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19507

This article has been published on 11 March 2010

FIGURE 1

Distribution of (a) Toscana, (b) Sicilian, and (c) Naples viru
the Mediterranean Sea up to 2009

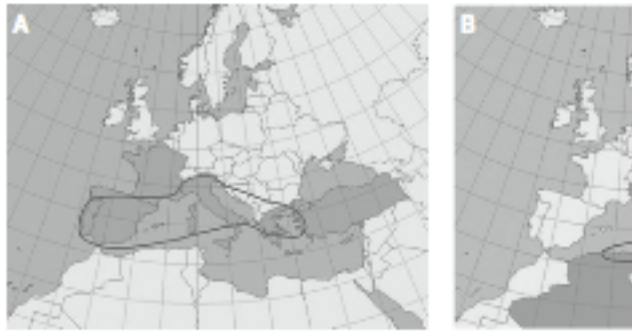
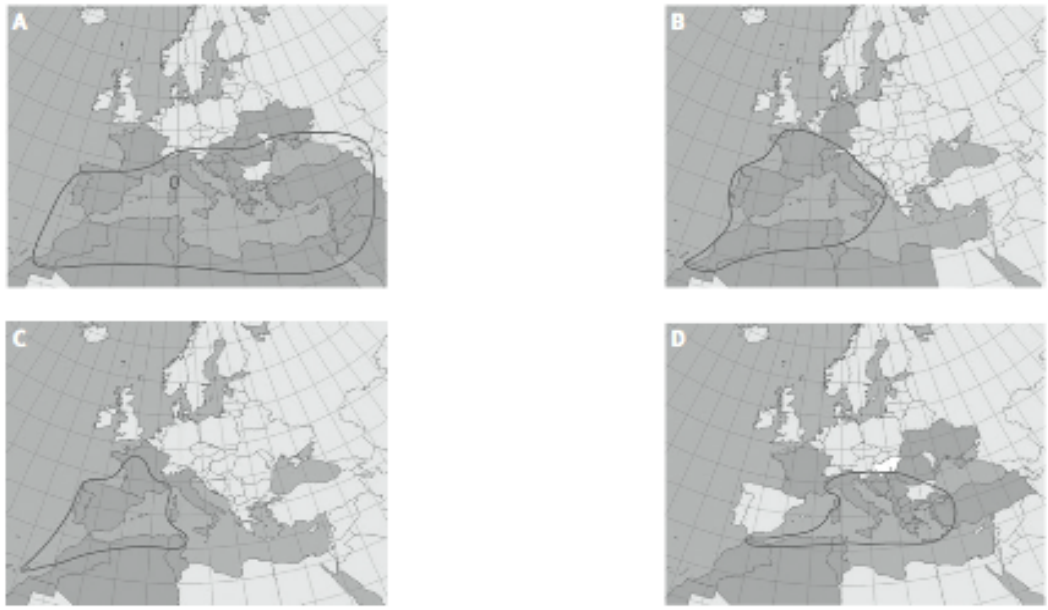


FIGURE 3

Distribution of main vectors in the European Union and neighbouring countries around the Mediterranean Sea up to 2009



From left to right and from top to bottom: (a) *Phlebotomus papatasi*, (b) *P. perniciosus*, (c) *P. ariasi*, and (d) *P. perfiliewi s. st.*
Countries with confirmed presence are depicted in mid grey, estimated distribution limits are depicted in dark grey.
Source: V-borne project; reproduced with permission from the European Centre for Disease Prevention and Control.

historical phlebotomine data in Europe

67 published papers

1972 to 2010

- **Aransay AM., Testa JM., Marquez MF., Lucientes J., Ready PD.,** 2004., Distribution of sandfly species in relation to canine leishmaniasis from the Ebro Valley to Valencia, northeastern Spain. Parasitol Res (2004) 94: 416–420.
- **Ascione R., Gradoni L., Maroli M.,** 1996, Eco-epidemiological study of Phlebotomus perniciosus in foci of visceral leishmaniasis in Campania. Parassitologia. 1996 Dec;38(3):495-500.
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- **Bongiorno G., Habluetzel A., Khoury C., Maroli M.,** 2003, Host preferences of phlebotomine sand flies at a hypoendemic focus of canine leishmaniasis in central Italy. Acta Tropica 88 (2003) 109–116.
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- **Grimm F., Gessler M. and Jenni L.,** 1993, Aspects of sandfly biology in southern Switzerland. Medical and Veterinary Entomology (1993) 7, 170-176.
- **Hukić M., Bešić I.S.,** 2009, Sandfly Pappataci Fever in Bosnia And Herzegovina: The New-Old Disease. Bosnian Journal of Basic Medical Sciences, 2009; 9 (1): 39-43.
- **Ivovic V., Patakakis M., Tselentis Y. And Chaniotis B., 2007,** Faunistic study of sandflies in Greece. Medical and Veterinary Entomology (2007) 21, 121–124.
- **Knechtli R., Jenni L.,** 1989, Distribution and Relative Density of three Sandfly (Diptera: Phlebotominae) Species in Southern Switzerland. Ann. Parasitol. Hum. Comp., 1989, 64, n° 1, pp. 53-63.

- **Leger N., Pesson B., Leblond G.M.,** 1986, Les Phlebotomes De Grece, Bull. Soc. Path. Er., 79, 1986, 386-397.
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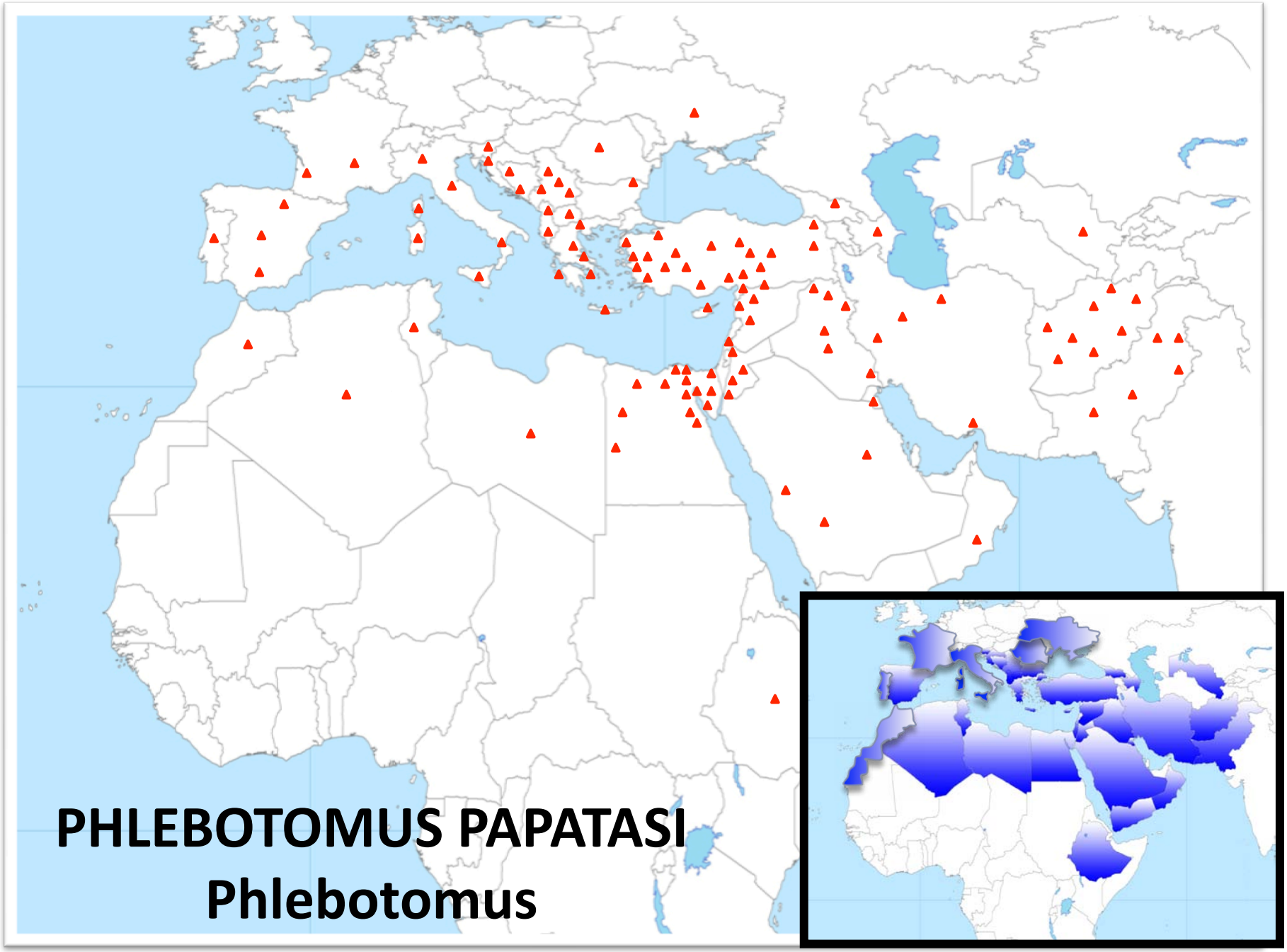
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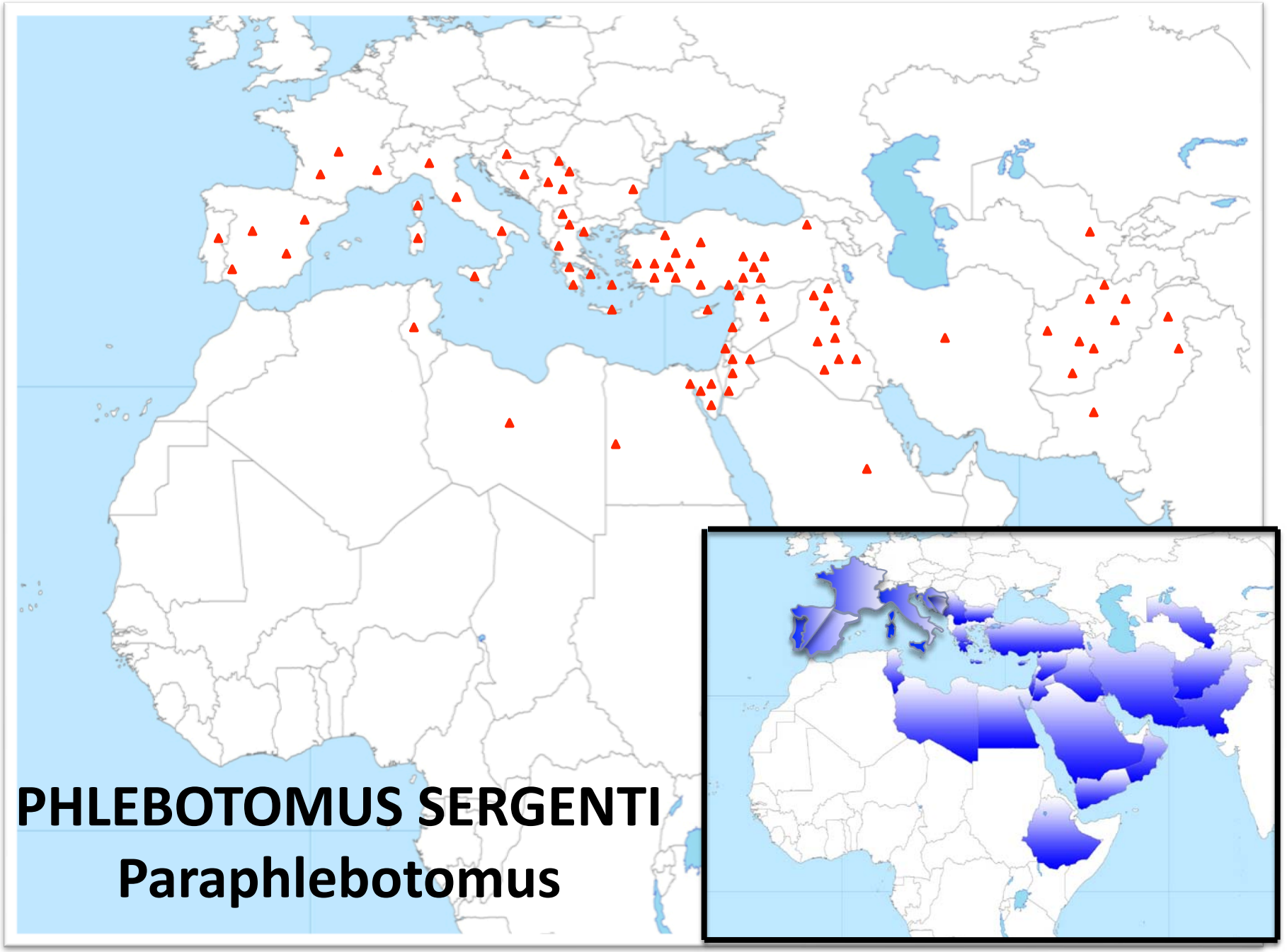
Phlebotomus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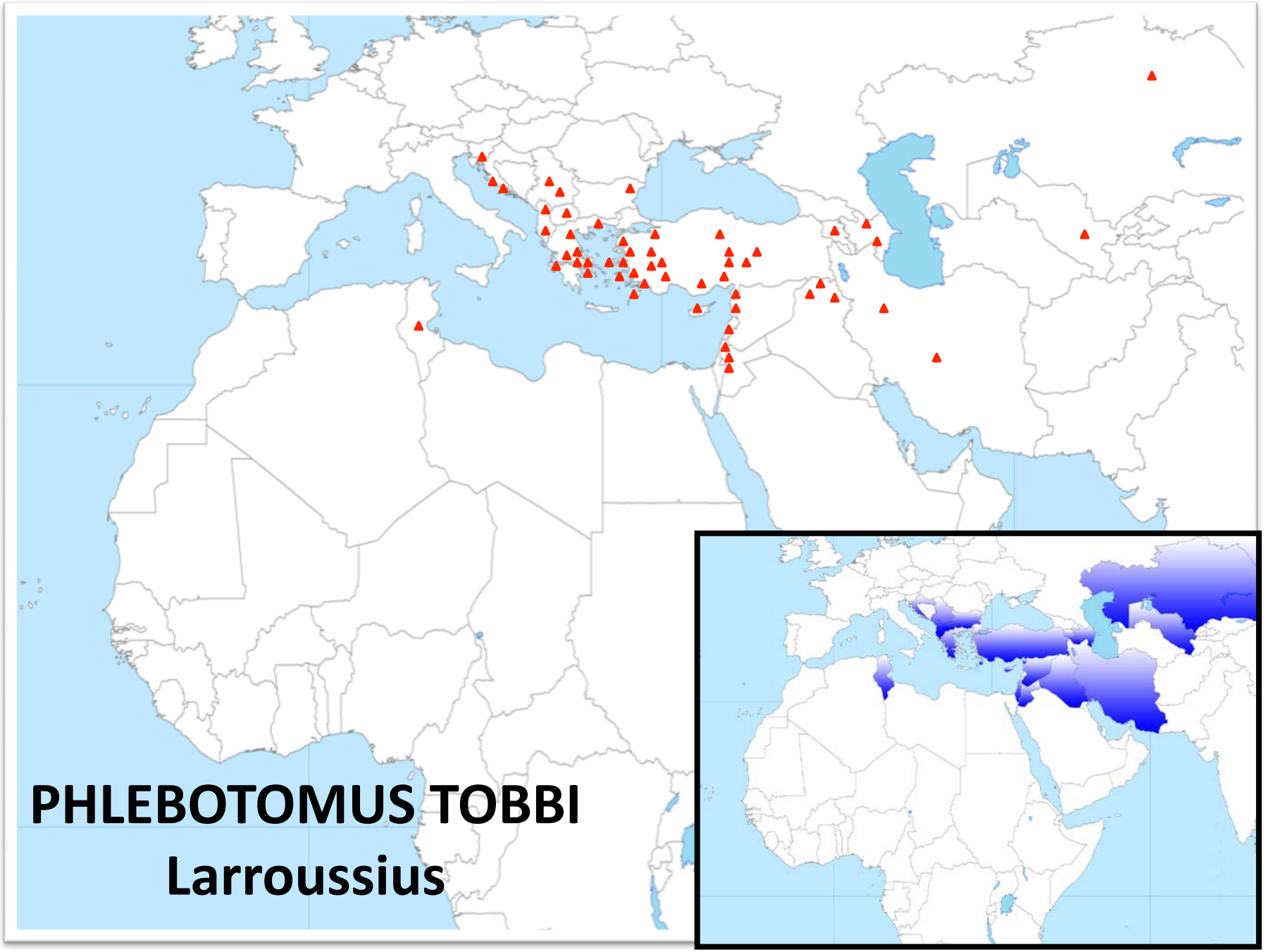
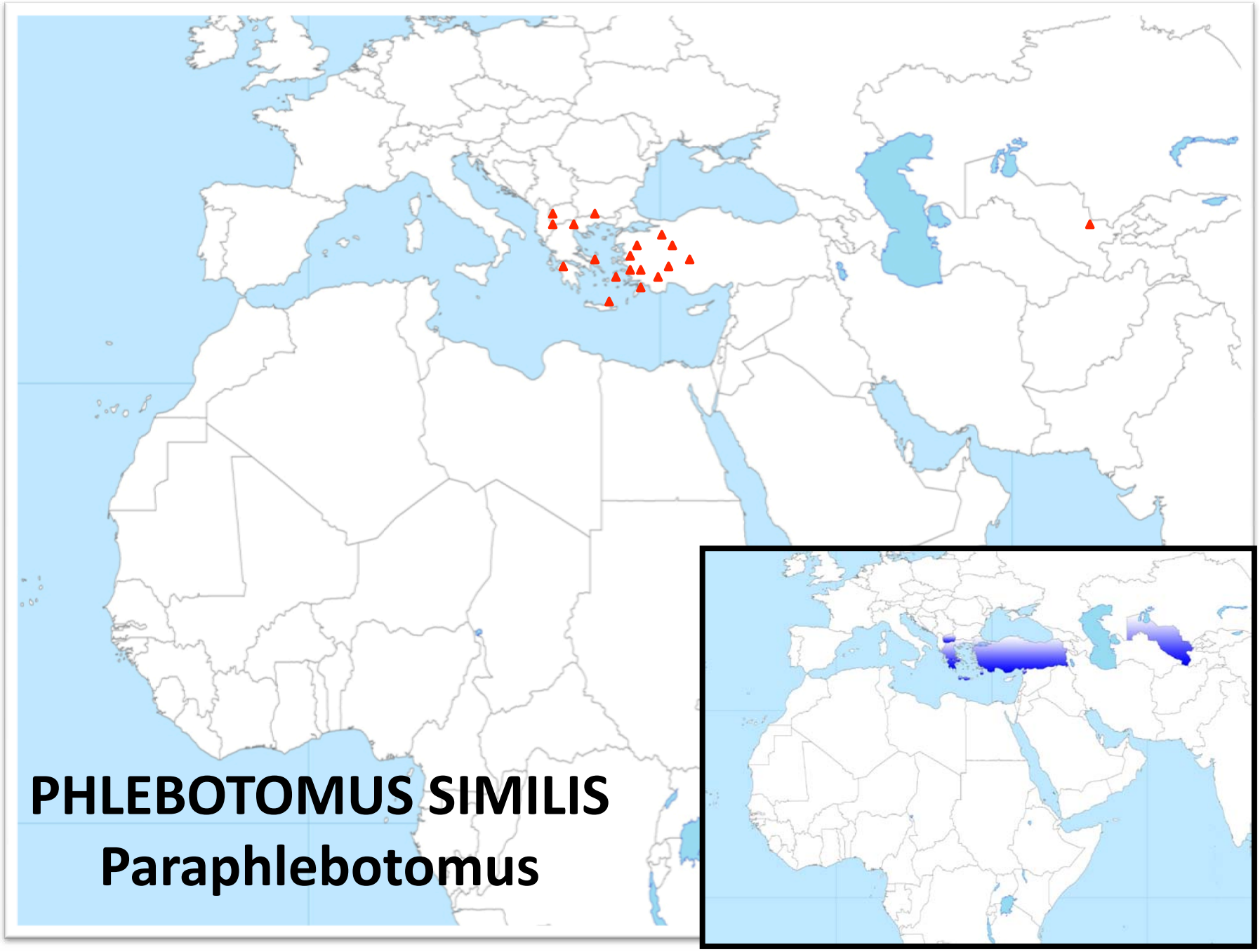

PHLEBOTOMUS TOBBI
Larroussius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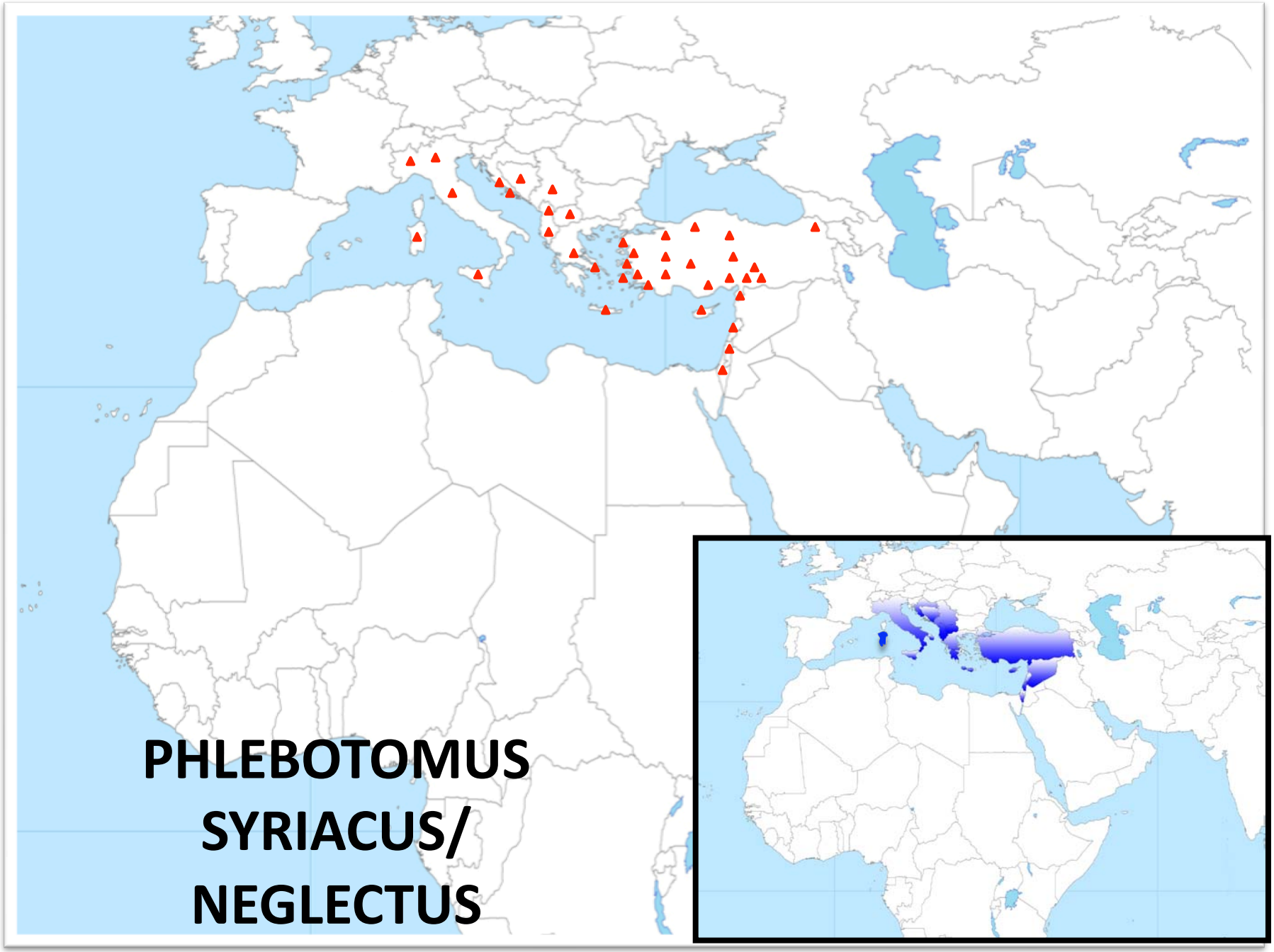
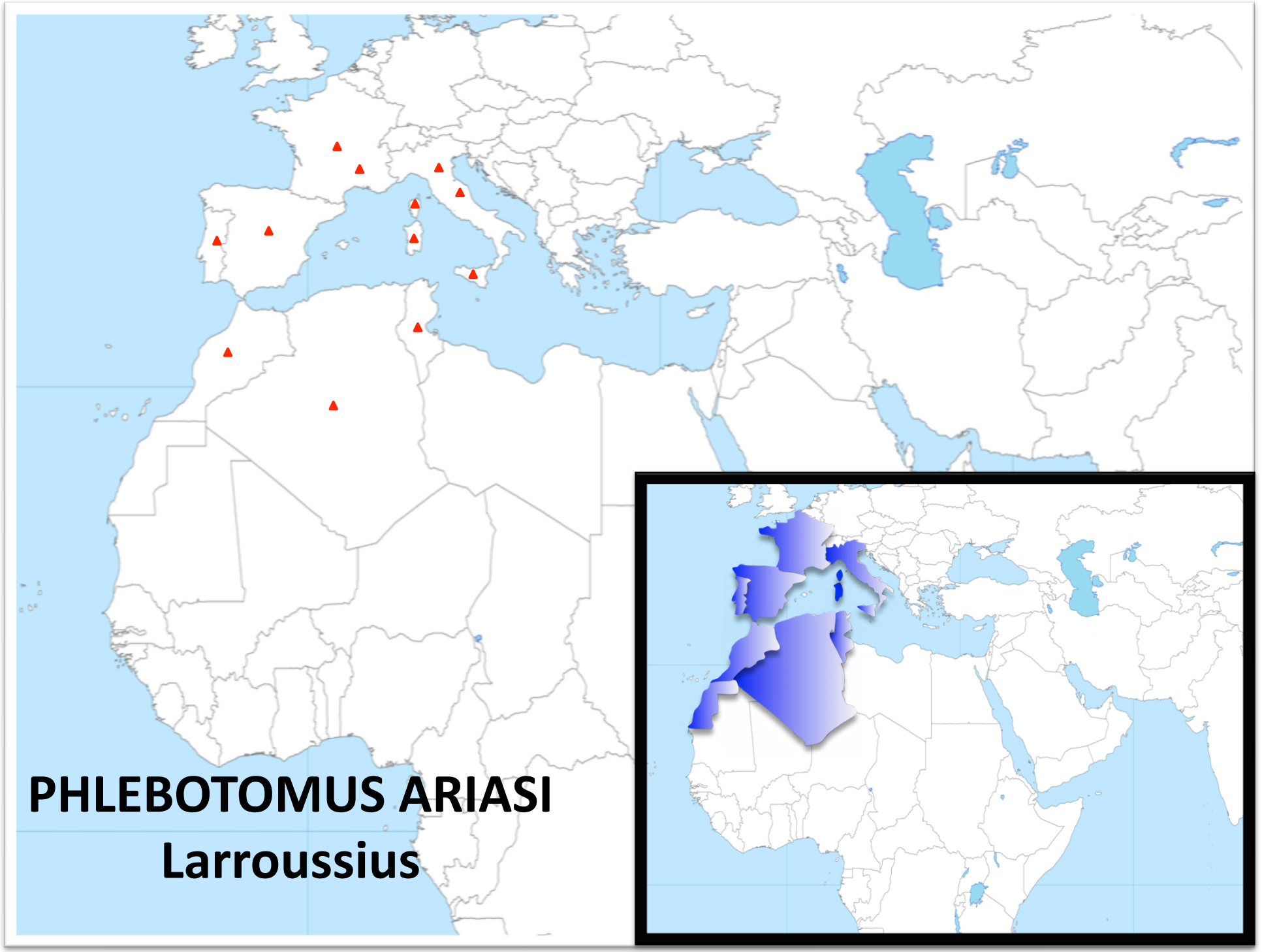
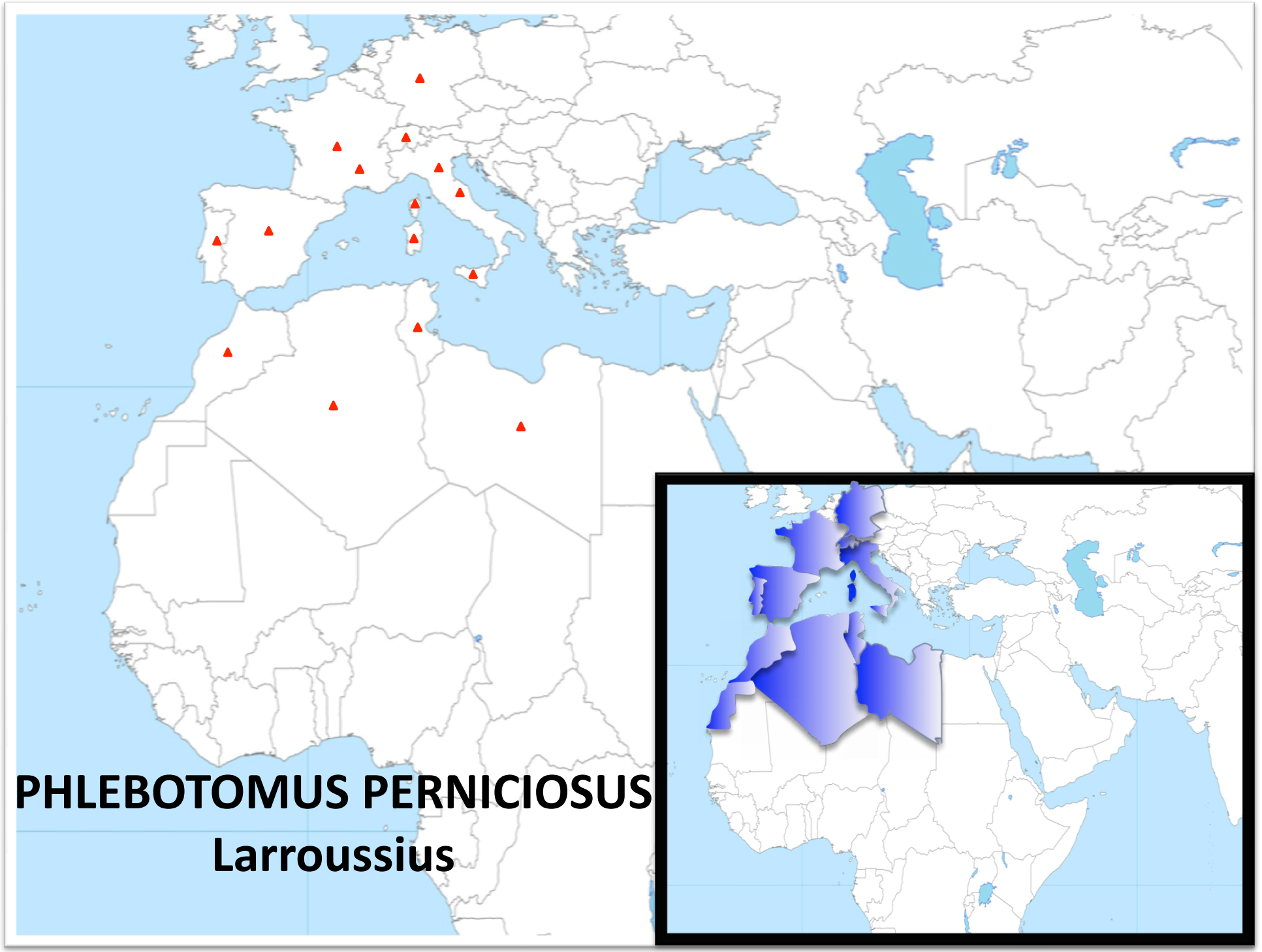
Paraphlebotomus



PHLEBOTOMUS SYRIACUS/ NEGLECTUS Larroussius


PHLEBOTOMUS ARIASI
Larroussius


PHLEBOTOMUS PERNICIOSUS
Larroussius

conclusion

We have to pay attention some other species and the vectorial competence of these *Phlebotomus* species should be tested because these species are now known to be spread in most of European and also north African countries.

1.*Ph. mascittii*: Italy, France, Belgium, Germany, Sicily, Turkey
(However, low rates of biting humans and autogeny (the ability to produce eggs without a blood- meal) cast doubt on its epidemiological importance) (P.D. Ready 2010)

2. *Ph. major*: Greece, Bulgaria, Romania, Sicily
3. *Ph. kandelakii*: Croatia, Slovenia, Turkey
4. *Ph. alexandri*: Greece, Tunisia, Turkey

5. *Ph. halepensis*: Turkey

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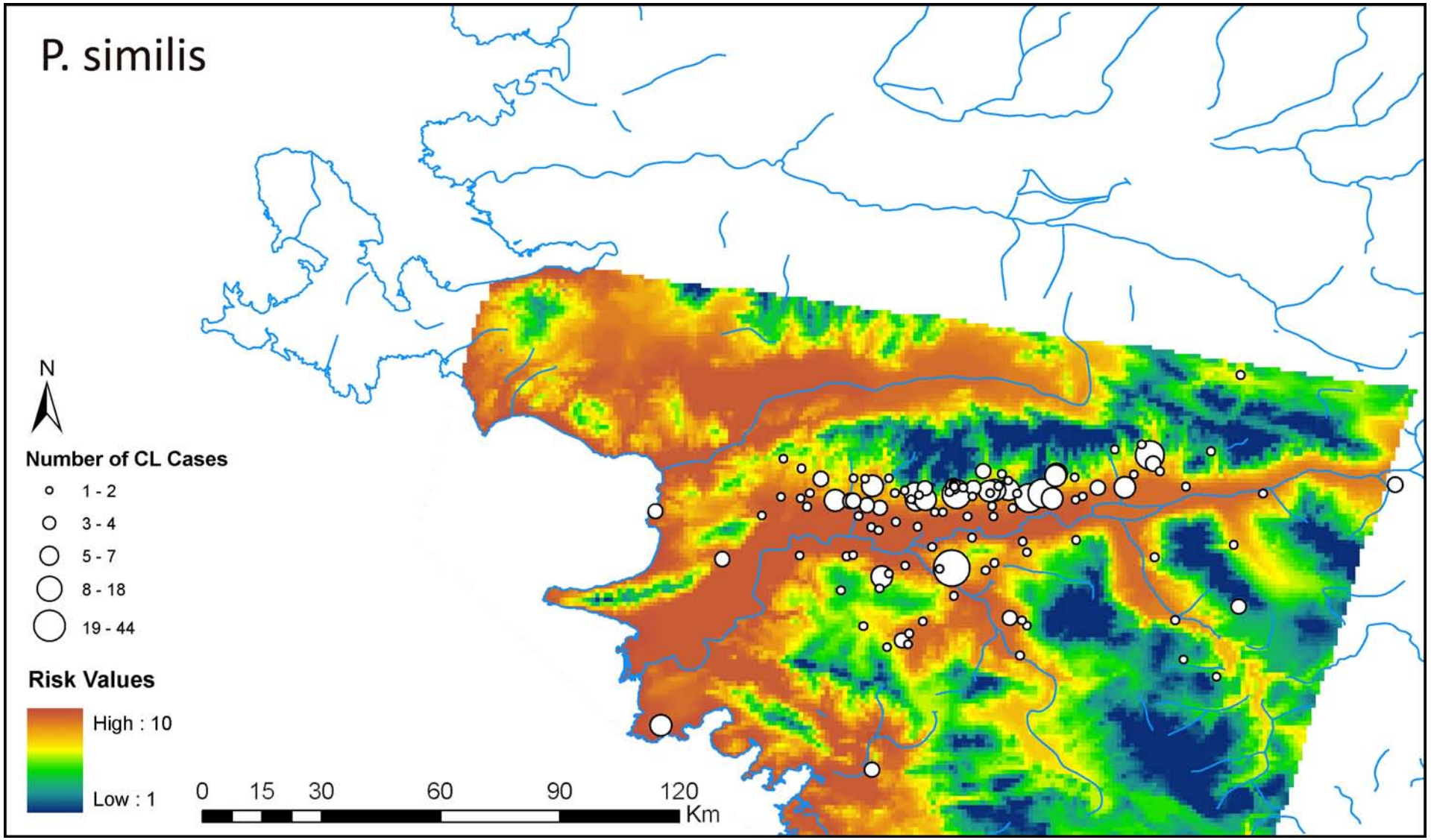
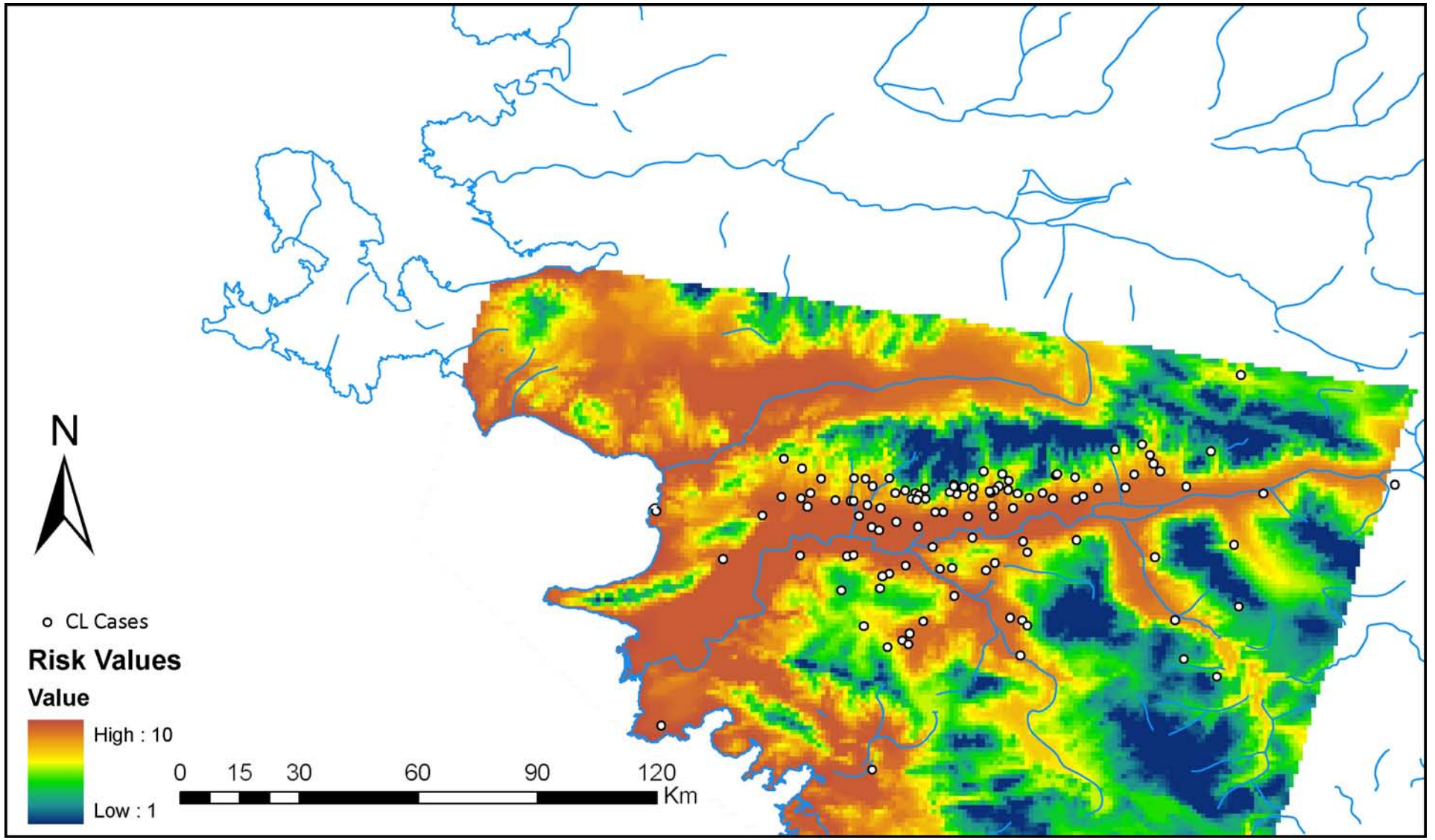
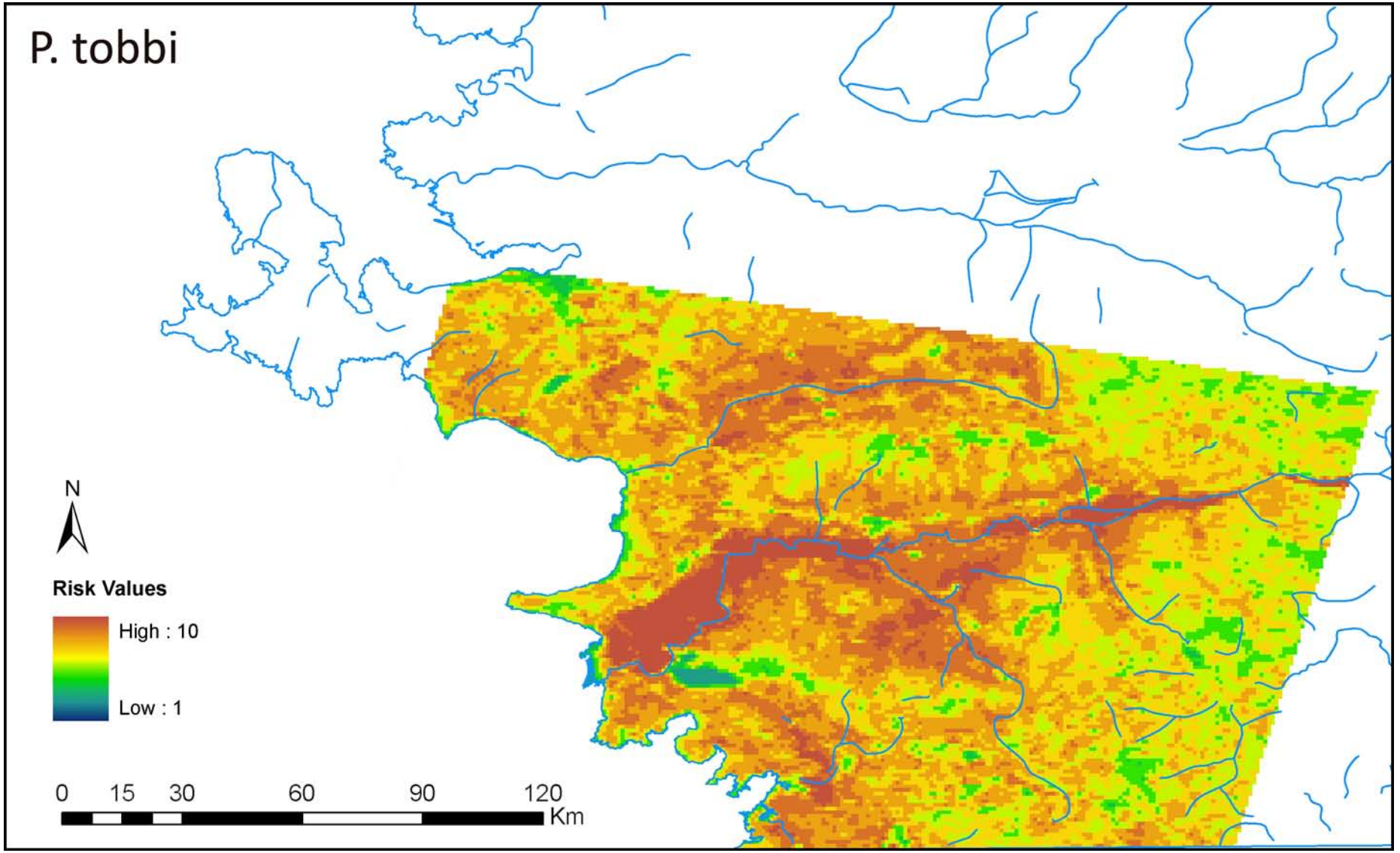

P. similis
N
Number of CL Cases
1 - 2
3 - 4
5 - 7
8 - 18
19 - 44
Risk Values
High : 10
Low : 1
0 15 30 60 90 120
Km


N
CL Cases
Risk Values
Value
High : 10
Low : 1
0 15 30 60 90 120
Km


P. tobbi
N
Risk Values
High : 10
Low : 1
0 15 30 60 90 120
Km