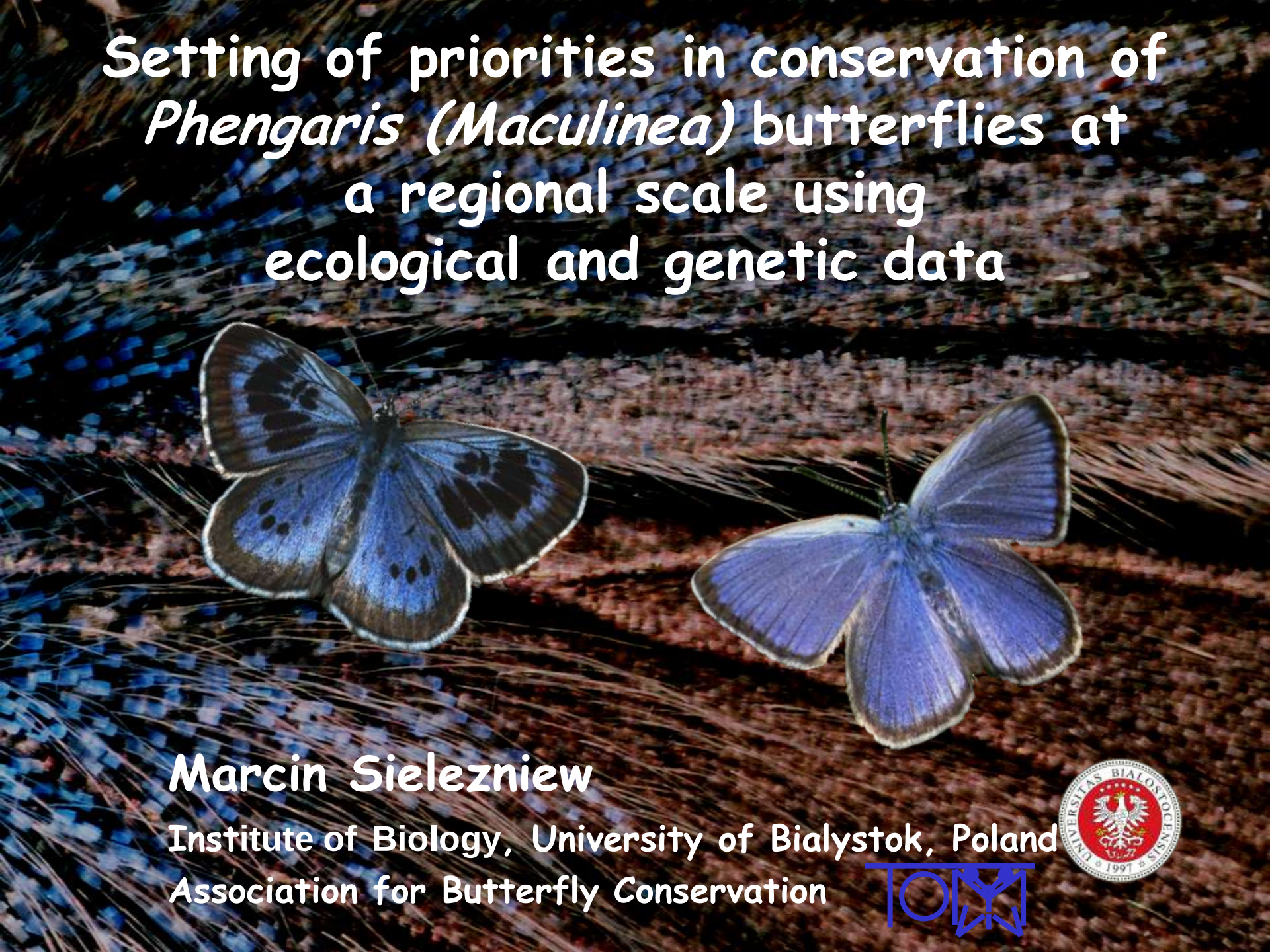
Setting of priorities in conservation of *Phengaris (Maculinea)* butterflies at a regional scale using ecological and genetic data



Marcin Sielezniew

Institute of Biology, University of Bialystok, Poland

Association for Butterfly Conservation

Phengaris (Maculinea)

arion *alcon*















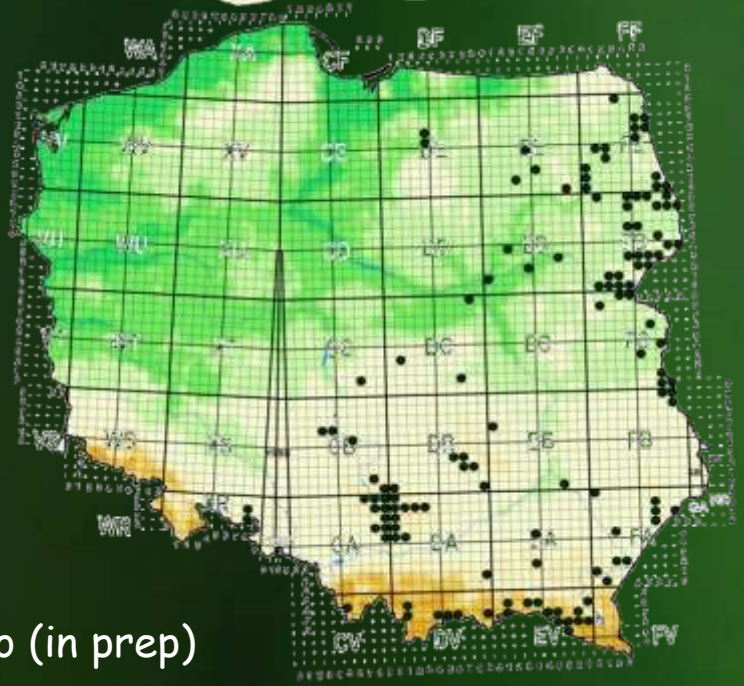
Phengaris (Maculinea)

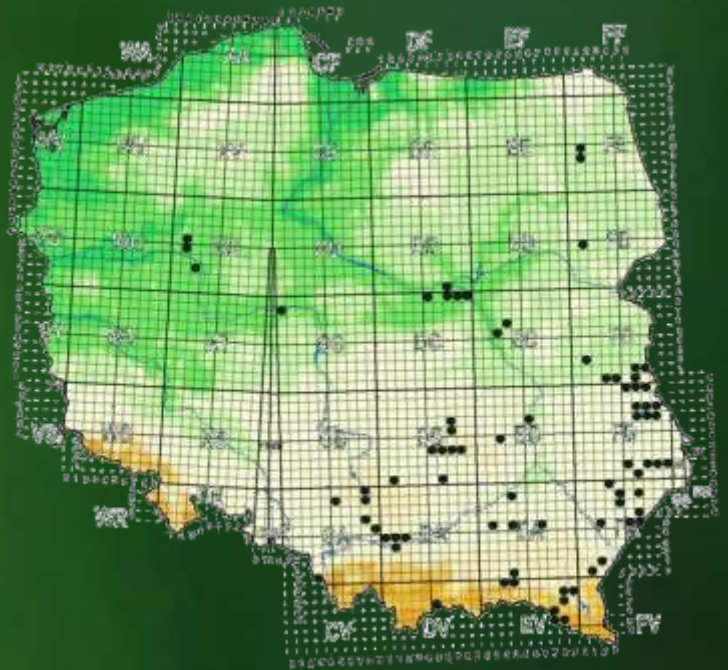
arion *alcon*

a local scale:

SE Poland

Phengaris (Maculinea) arion *alcon*





Buszko (in prep)

Alcon Blue *Phengaris (Maculinea) alcon*

P. 'alcon'

P. 'rebeli'

Mountain Alcon Blue ***Phengaris (Maculinea) rebeli***

Alcon Blue *Phengaris (Maculinea) 'alcon'*




no morphological differences in Poland




Mountain Alcon Blue *Phengaris (Maculinea) 'rebeli'*

Alcon Blue *Phengaris (Maculinea) 'alcon'*

wet meadows

Gentiana pneumonanthe

different habitats and host plants

dry grasslands

Gentiana cruciata

Mountain Alcon Blue *Phengaris (Maculinea) 'rebeli'*

Ecotypes of *P. alcon* are adapated to local phenology of their local host plants

P. 'alcon'

P. 'rebeli'

Sielezniew & Stankiewicz (2007) *Eur. J. Entomol.*

Host ants of *P. alcon*

P. 'alcon'

a single host race

P. 'rebeli'

M. scabrinodis and *M. vandeli*

Sielezniew & Stankiewicz-Fiedurek (2004, 2009) *Eur. J. Entomol., Pol. J. Entomol.*

Host ants of *P. alcon*

P. 'alcon'

two host races

P. 'rebeli'

M. schencki

M. sabuleti
M. scabrinodis

Sielezniew & Dziekańska (2009) *Pol. J. Ecol.*

Three ecotypes of Alcon Blues

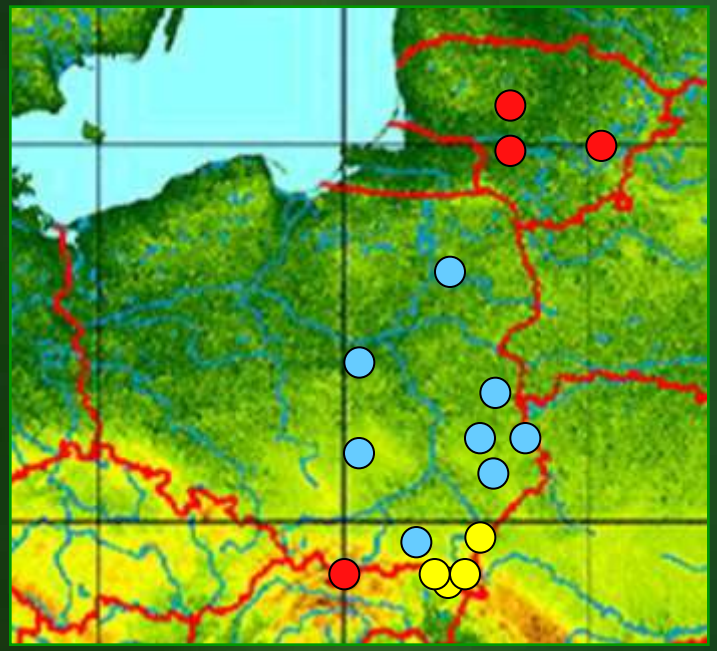
P. alcon/ scabrinodis

P. 'rebeli'/ schencki

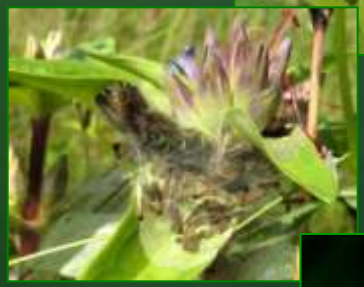
P. 'rebeli'/sabuleti & scabrinodis

Three ecotypes of Alcon Blues in Poland - interesting system for genetic studies

P. 'rebeli'/ schencki



P. alcon/ scabrinodis



P. 'rebeli'

P. 'rebeli'/ schencki

P. 'rebeli'/ sabuleti & scabrinodis

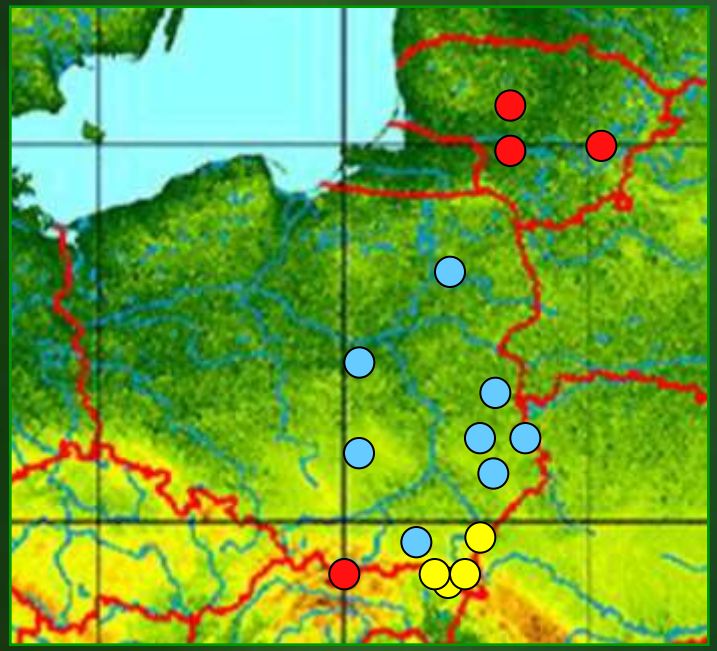
Stankiewicz, Sielezniew, Švitra (2005) *Myrmecol. News.*

Three ecotypes of Alcon Blues in Poland - interesting system for genetic studies

P. 'rebeli'/ schencki

16 populations
365 individuals

P. alcon/ scabrinodis



P. 'rebeli'/ schencki

P. 'rebeli'/ sabuleti & scabrinodis

Genetic analyses

mitchodrial marker

cytochrome oxidase I (*COI*) - 'barcoding gene'

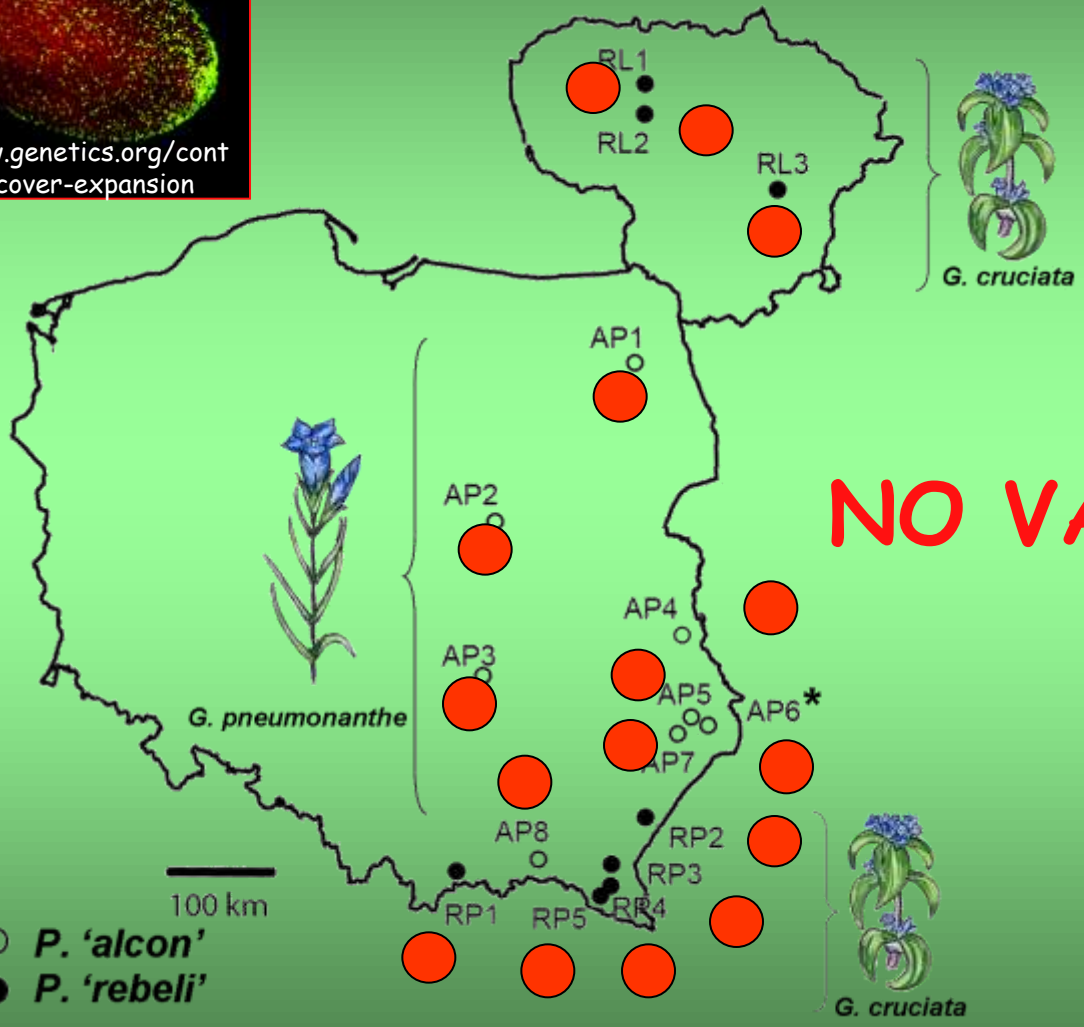
nuclear markers

elongation factor (*EF1-a*)

six microsatellite loci

Main results for *P. alcon*

mtDNA (*COI*)



NO VARIATION

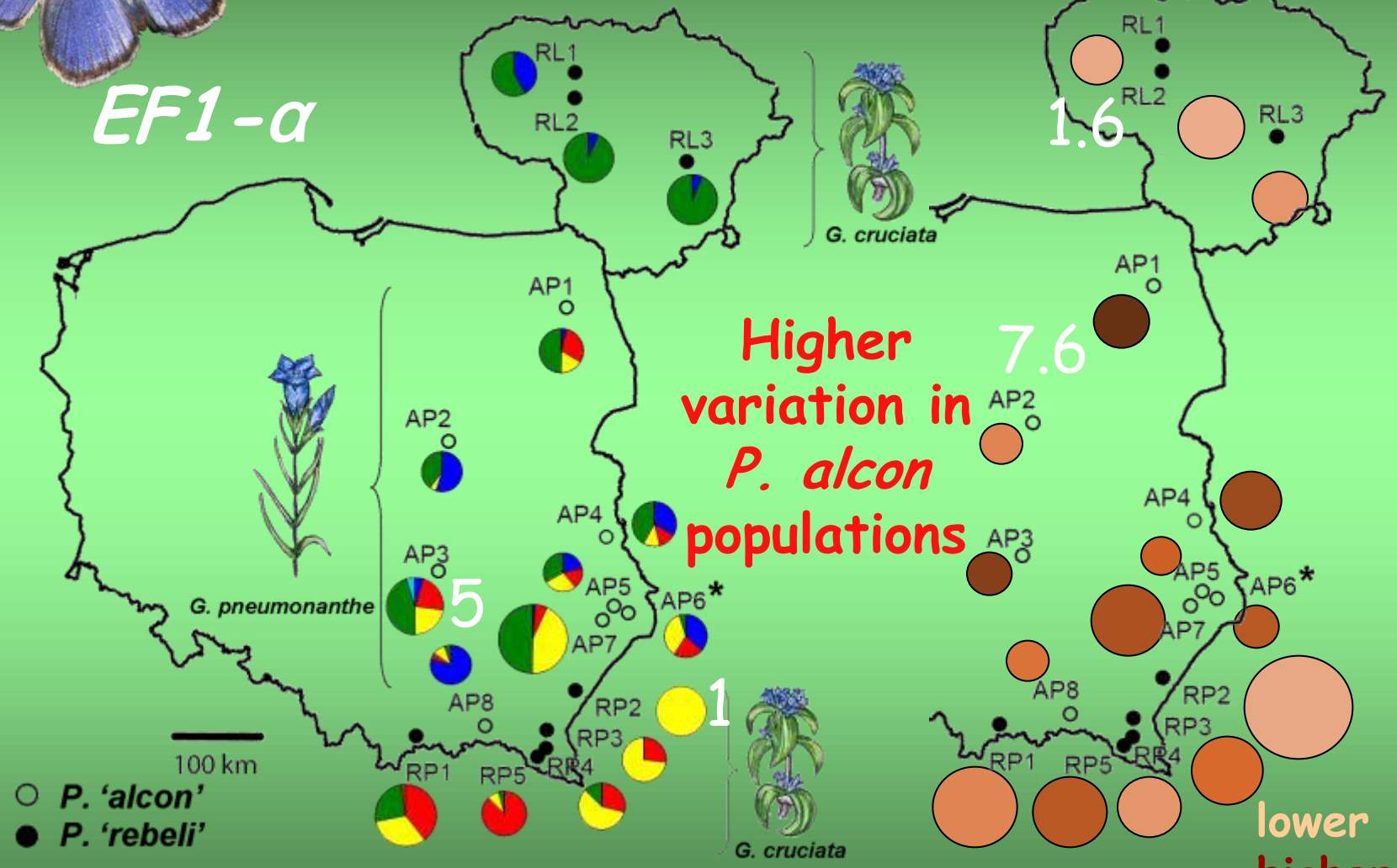
a selective sweep reduced variation?

All samples were infected by *Wolbachia* !

What about nuclear markers?

microsatelllites

EF1-α



Higher variation in *P. alcon* populations

lower
higher

Haplotype frequencies

Mean number of alleles

Isolated region but relatively high variability

Podlasie – Biebrza Valley

P. 'alcon'

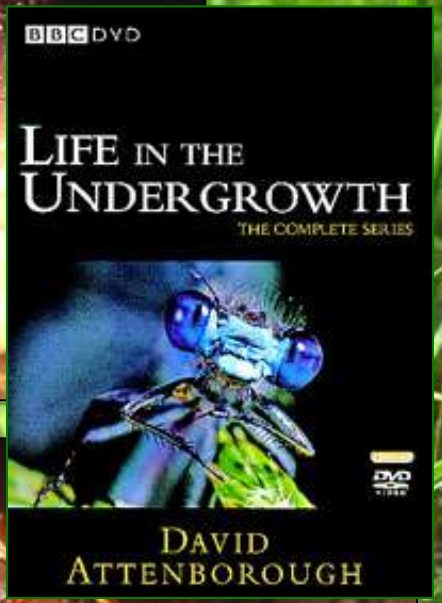
Relatively high variability and…

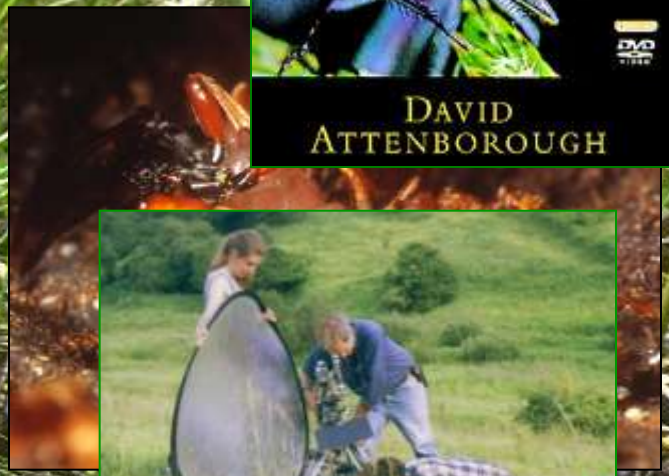
S Poland

… ultimate indicators of value of *Phengaris* systems are also present!

Specific parasitoid *Ichneumon eumerus*

evoking civil war in a nest





Thomas et al.(2002) *Nature*

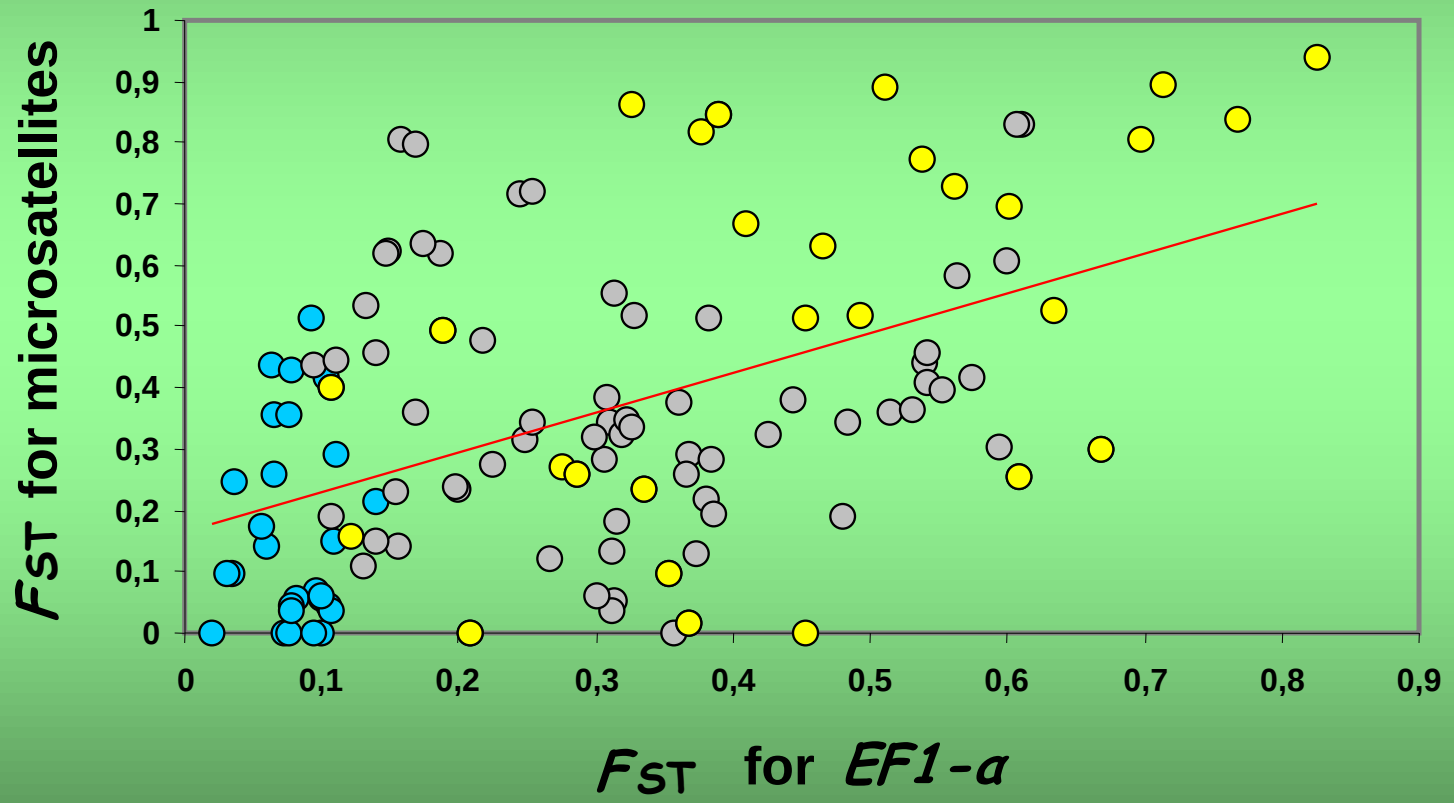
A large population but very low variability

Other threats are sometimes more important than loss of genetic variation!

Differentiation among populations

Much higher for *P. 'rebeli'*

0,08
0,50

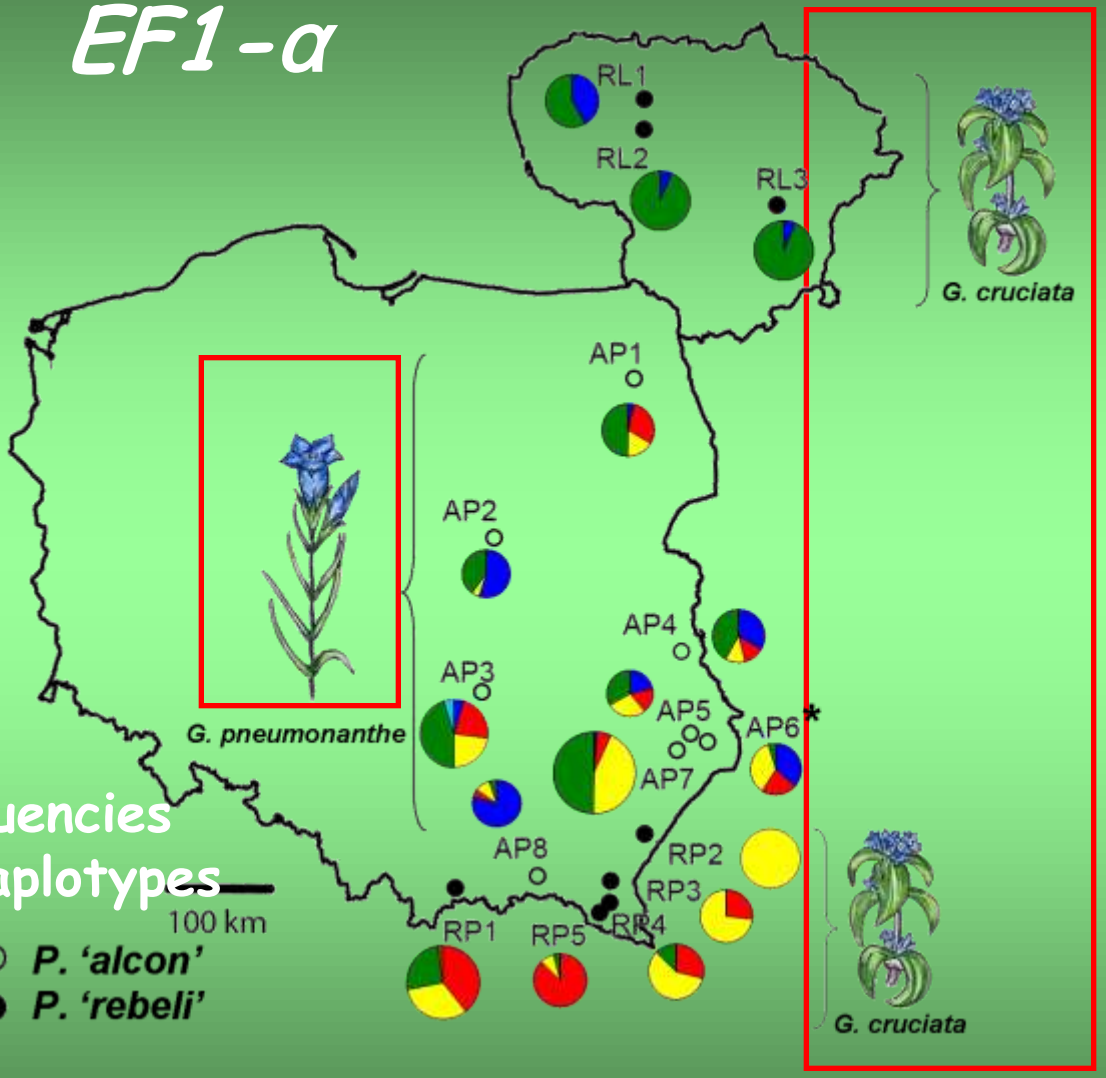


0,18
0,63

P.'alcon' – P.'rebeli'

Two ecotypes? NO

EF1-α

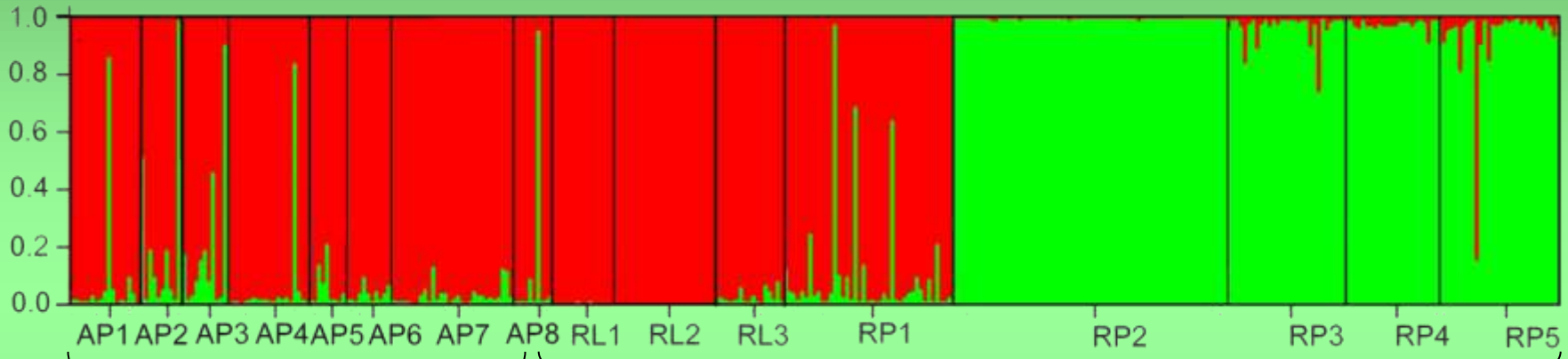


AMOVA

Va=0.54%
p=0.28

Two ecotypes ? NO

Microsatellites



G. pneumonanthe

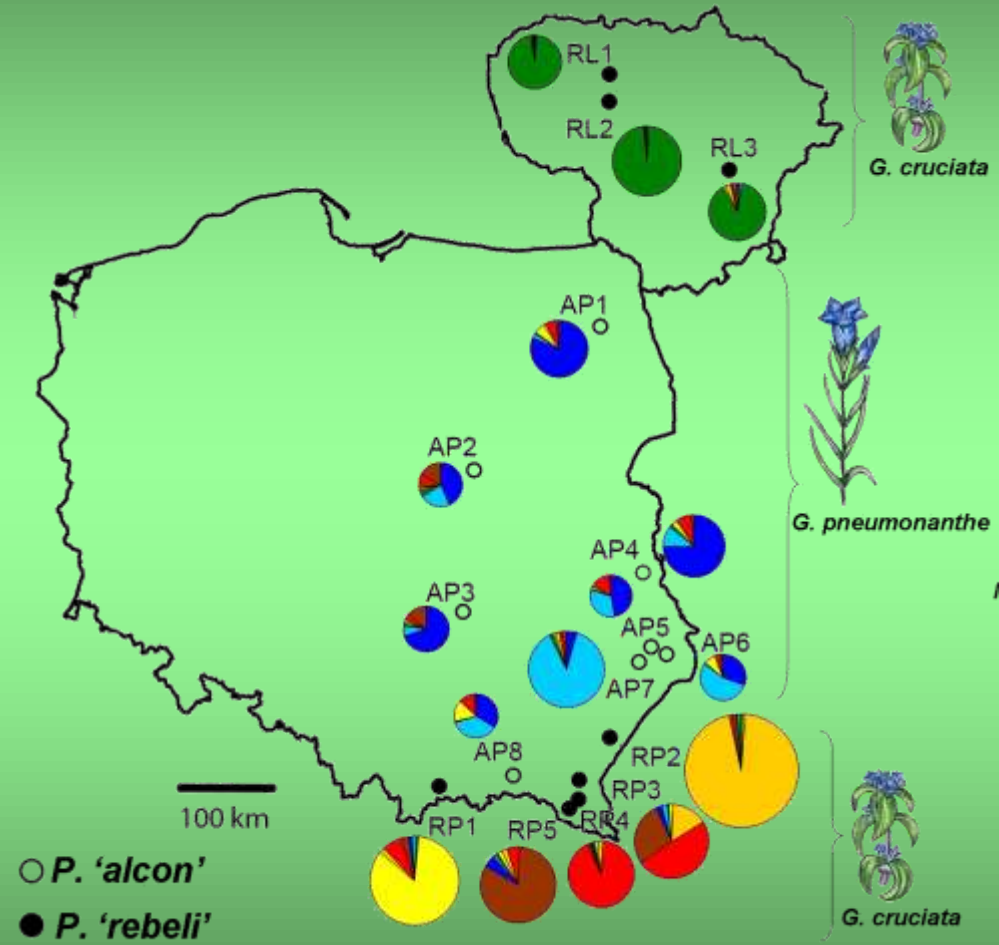
G. cruciata

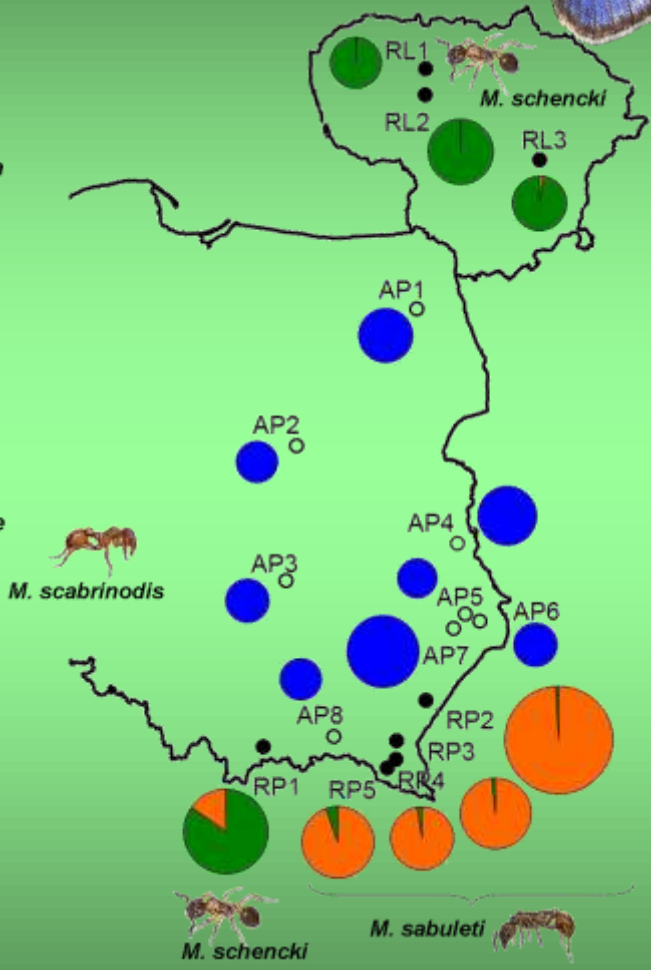
STRUCTURE analysis for k=2

How many ecotypes?

Microsatellites

Three?





STRUCTURE for k=7

two groups of *P. 'rebeli'*?

Sielezniew et al. (2011) *Insect Cons. Div.*


OK, but
where is
P. arion ?

Practical consequences of different life styles

508 larvae/pupae

63 nests infested (37%)

N = 171 *Myrmica* nests

16x

4 larvae/pupae

4 nests infested (2.3%)

175 *Myrmica* nests

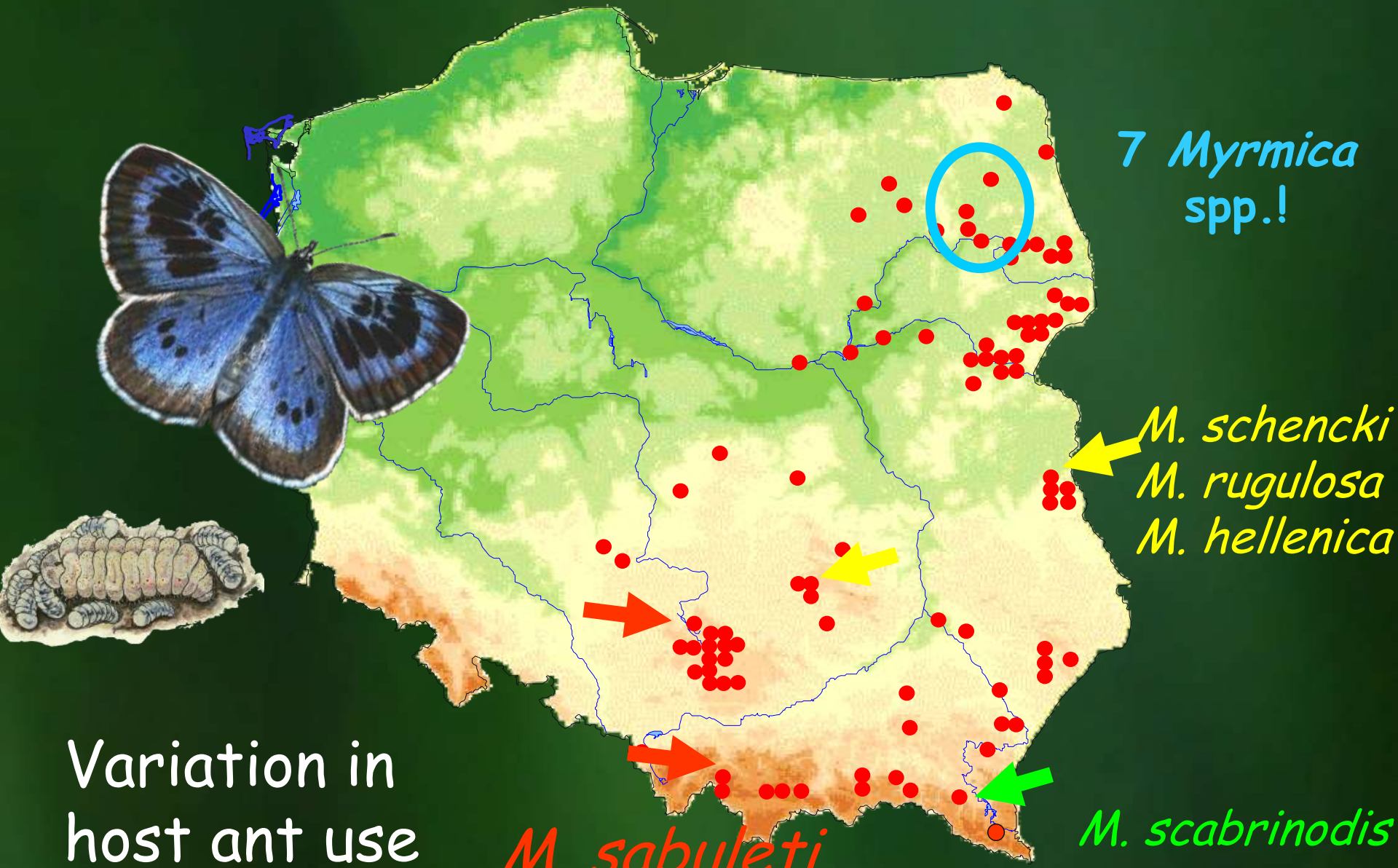
Large Blue *Phengaris (Maculinea) arion*

T. serpyllum

Thymus pulegioides

Variation in biotope use

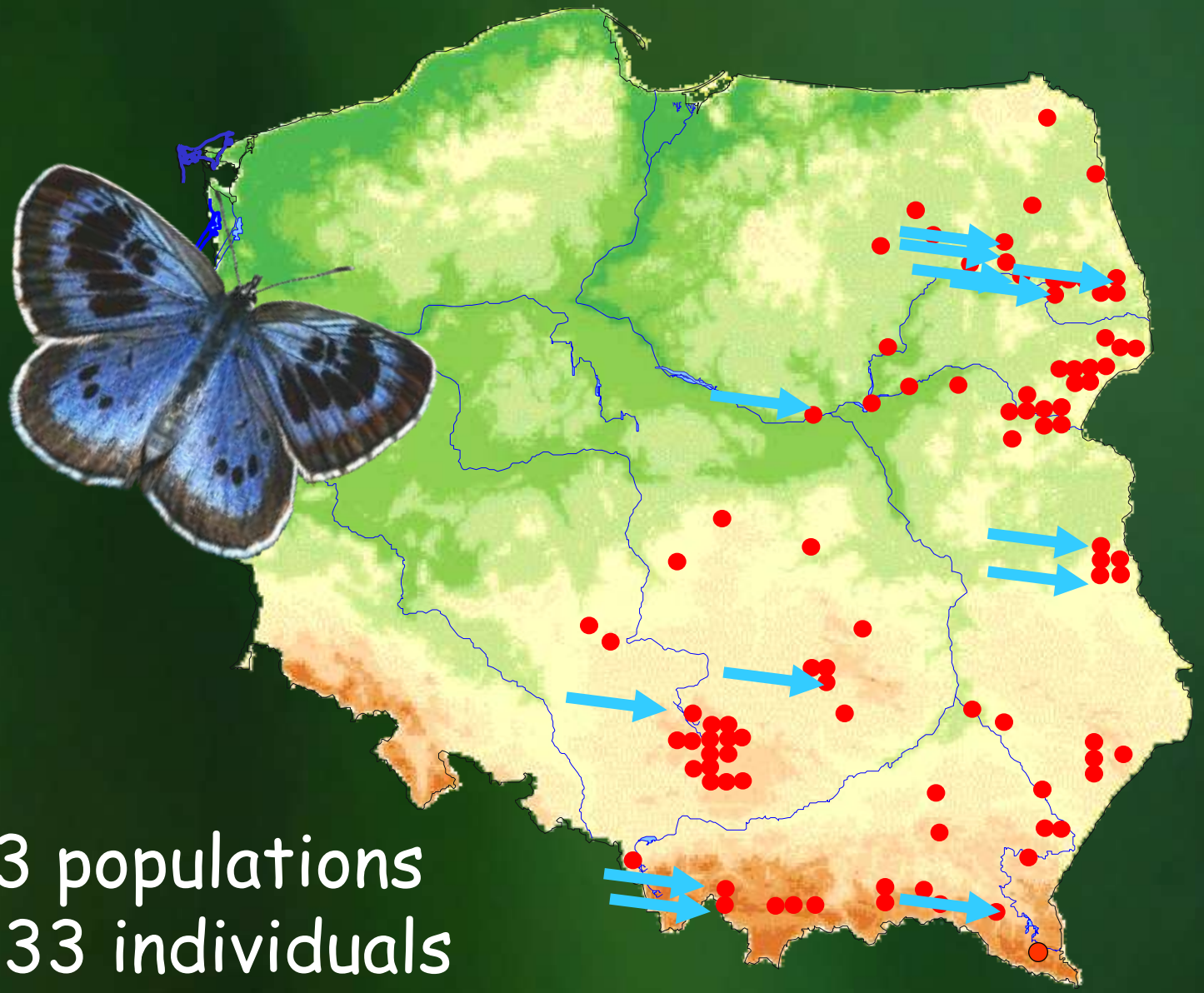
Large Blue *Phengaris (Maculinea) arion*



Variation in host ant use

Sielezniew et al. (2010a,b,c) *J. Insect Cons., Sociobiology*

Sampling for genetic studies

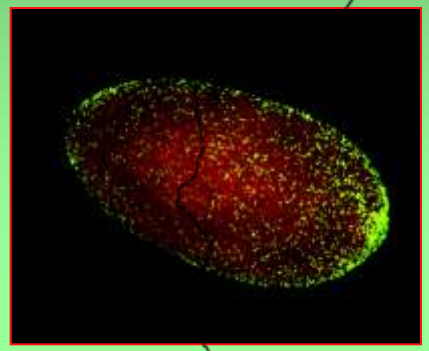


13 populations
233 individuals

Sielezniew et al. (2010a,b,c) *J. Insect Cons., Sociobiology*

Main results for *P. arion*

mtDNA (*COI*)



Plebejus argus

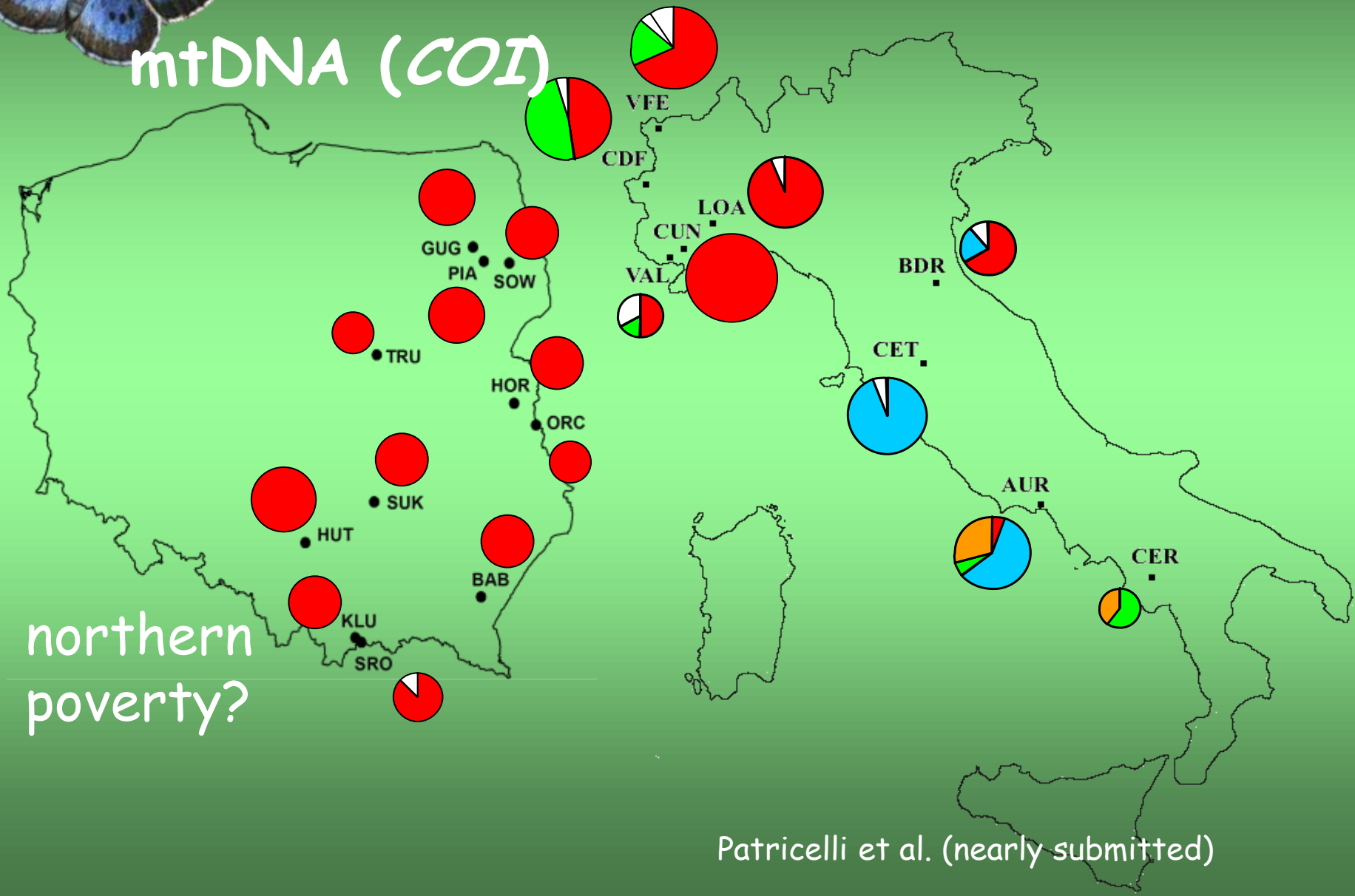
ALMOST NO VARIATION

All infected by *Wolbachia* but by a different strain than *P. alcon* !

Sielezniew et al. (2011) *Eur. J. Entomol.*

What about other countries?

mtDNA (*COI*)



northern poverty?

Patricelli et al. (nearly submitted)

What about nuclear markers?

EF1-α

Microsatellites

SQS
GUG
PIA
SOW
LUZ
TRU
HOR
ORC
SUK
BAB
KLU
SRO
SRO

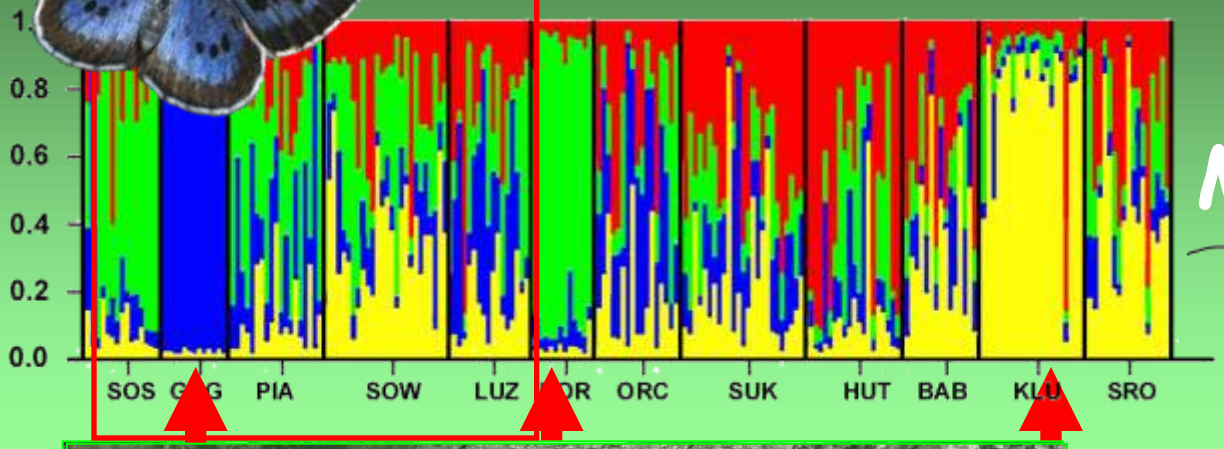
lower
higher

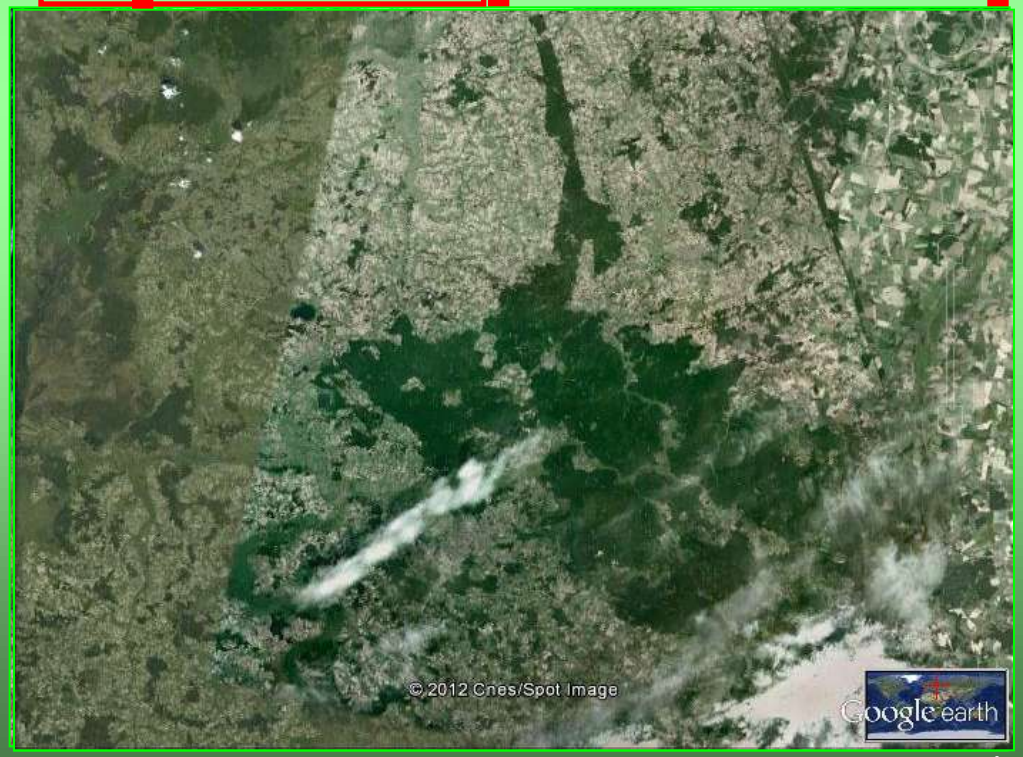
Haplotype frequencies

Mean number of alleles

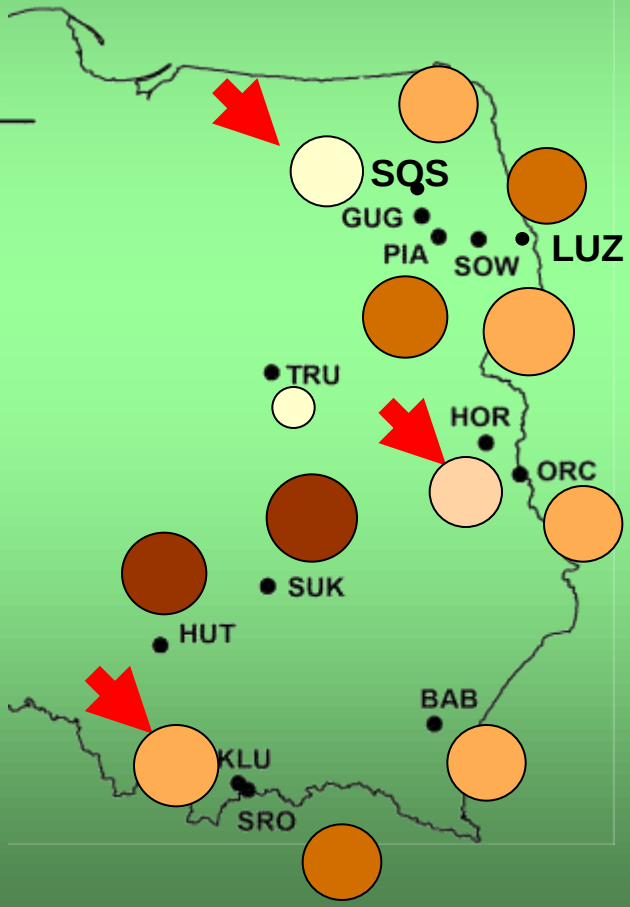
Sielezniew & Rutkowski (2012) *J. Insect Cons.*

A regional scale of a regional scale

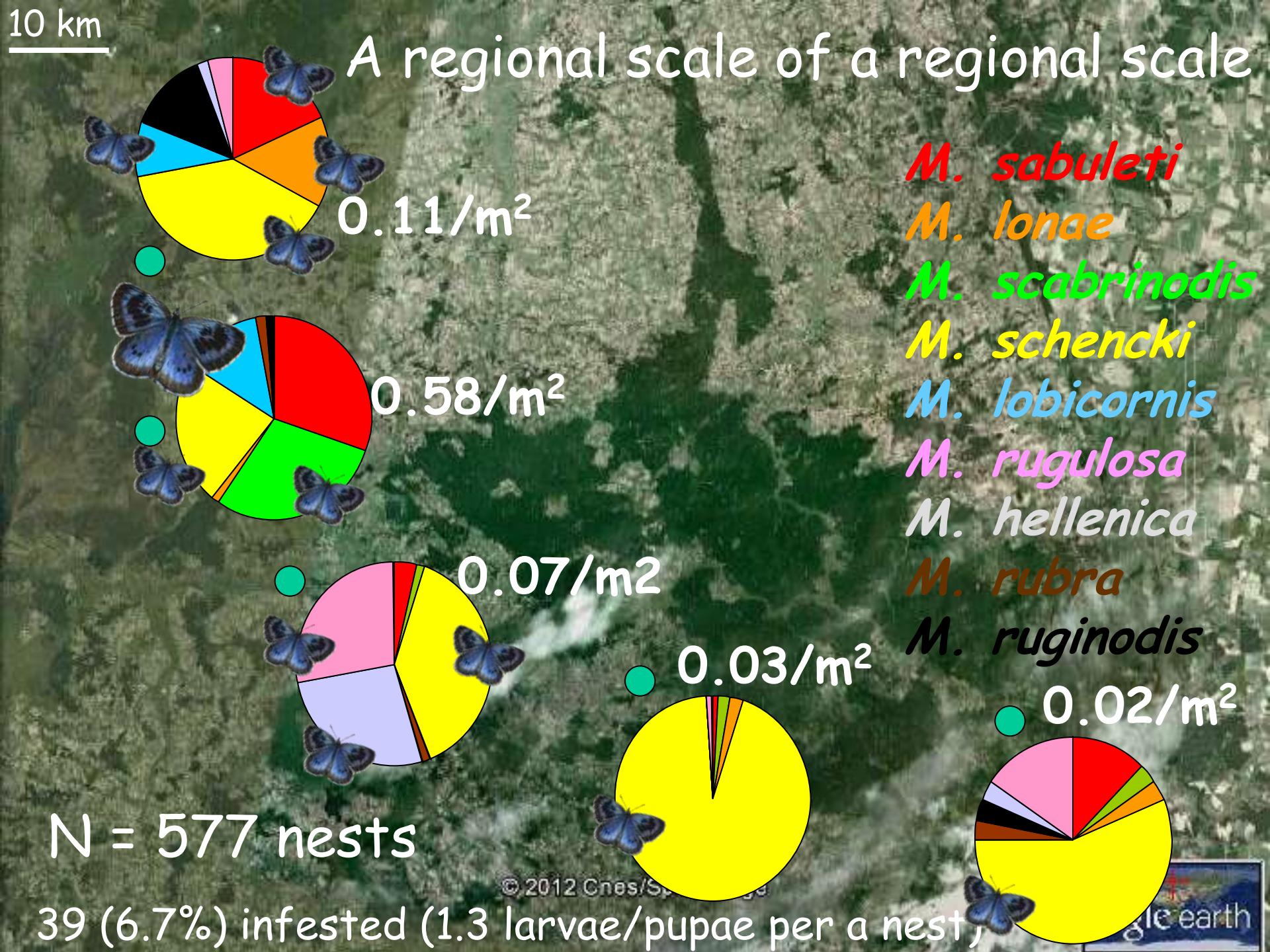




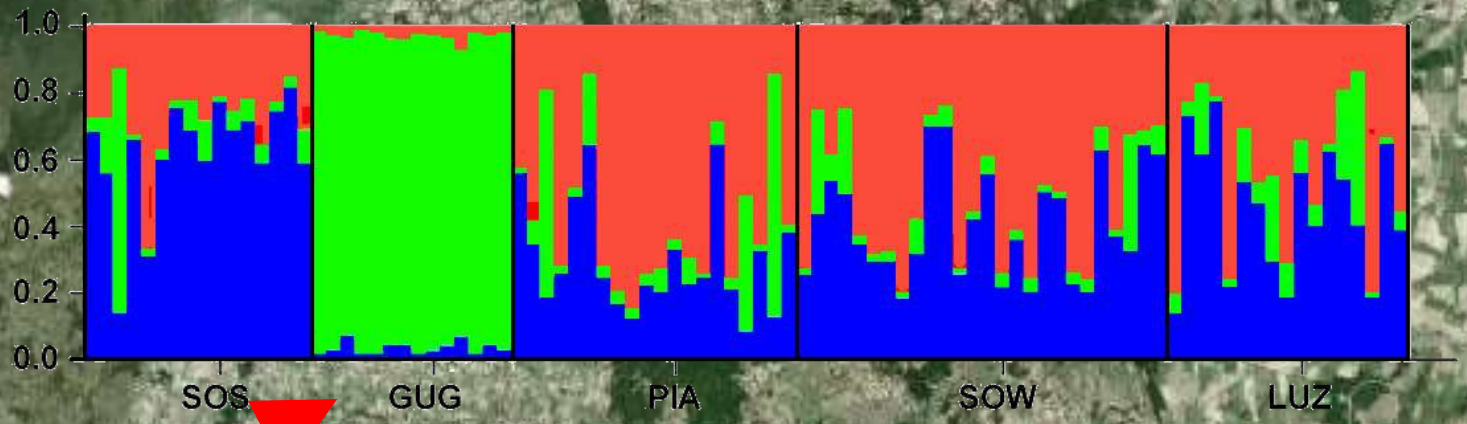
Microsatellites



Sielezniew & Rutkowski (2012) *J. Insect Cons.*


10 km
A regional scale of a regional scale
0.11/m²
0.58/m²
0.07/m2
0.03/m²
0.02/m²
M. sabuleti
M. lonae
M. scabrinodis
M. schencki
M. lobicornis
M. rugulosa
M. hellenica
M. rubra
M. ruginodis
N = 577 nests
39 (6.7%) infested (1.3 larvae/pupae per a nest)
© 2012 Cnes/Sp
earth

10 km



6.6

3.8

M. lobicornis

8.2

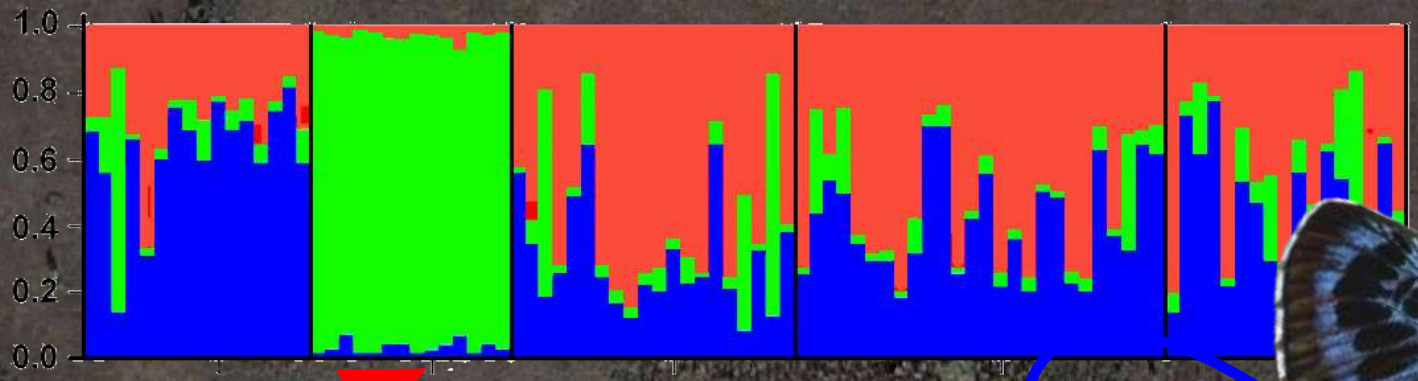
7.8

9.0

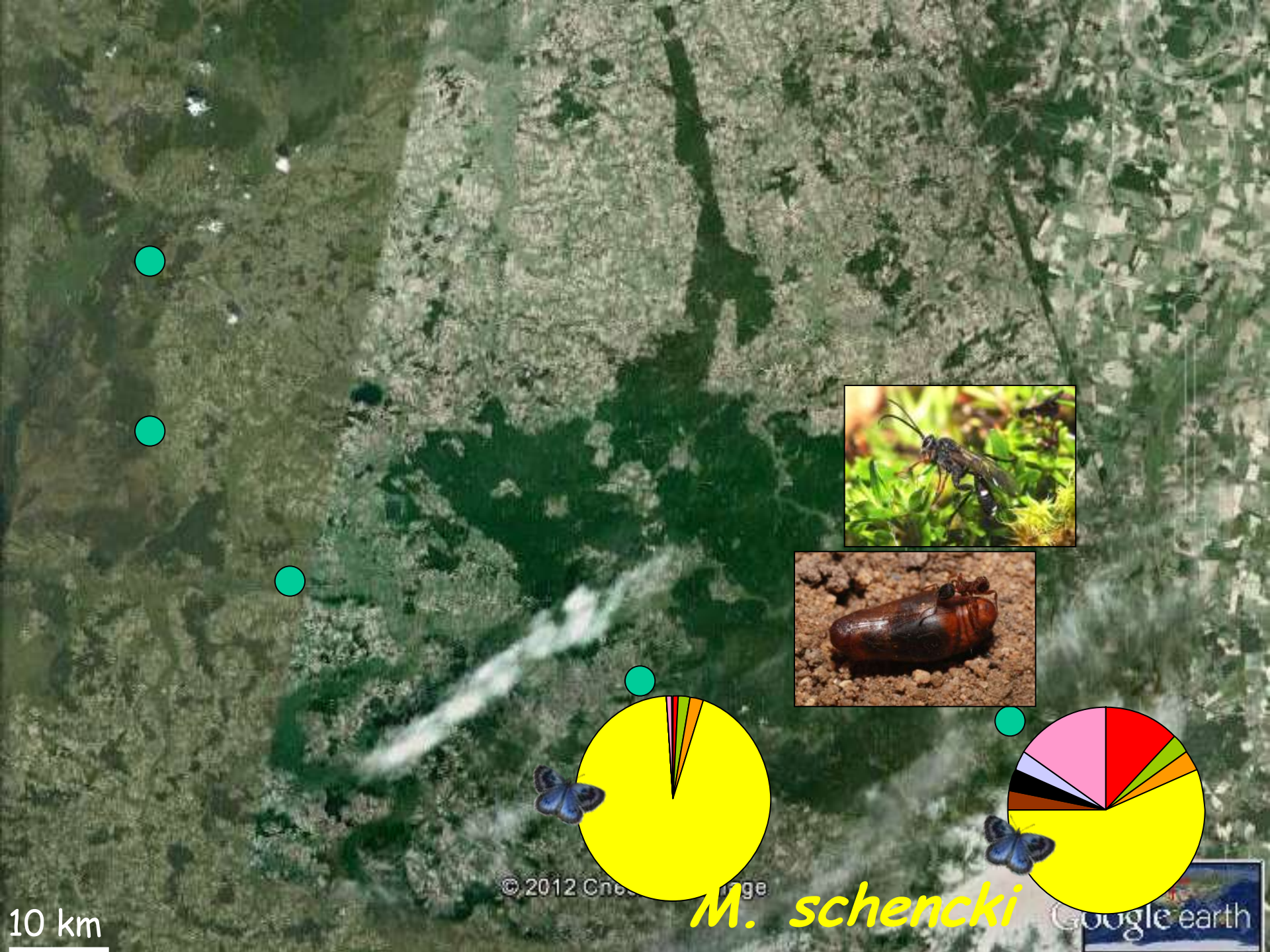
Mean number of alleles

Sielezniew & Rutkowski (2012) *J. Insect Cons.*

Google earth

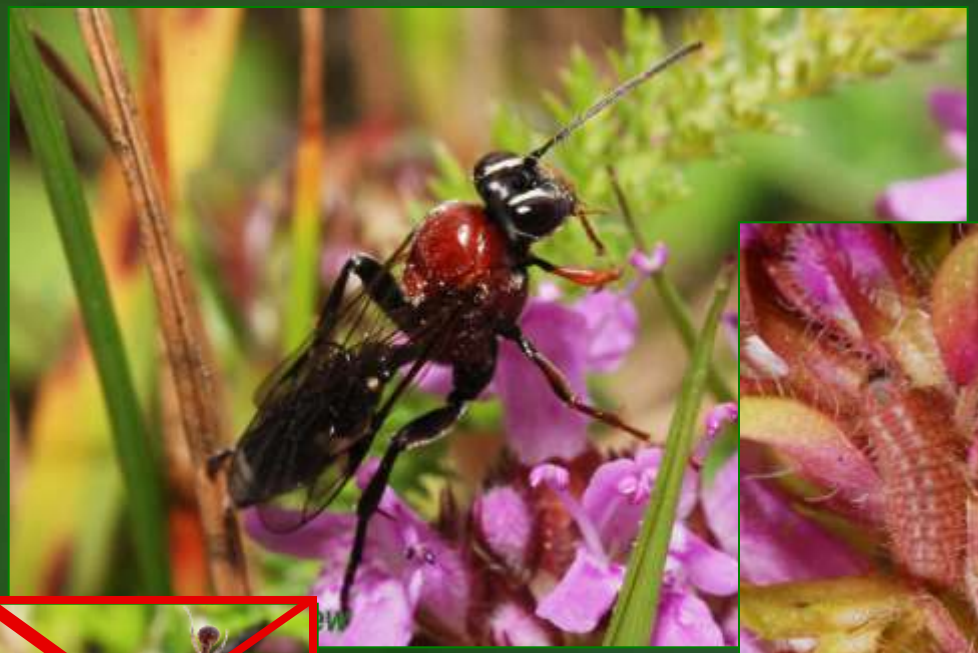


difficult to reach not only for butterflies


10 km
M. schencki
Google earth

parasitoid of *P. arion*

ichneumonid wasp *Neotypus coreensis*



Future of the butterfly = future of the parasitoid!

Colias myrmidone

Other important butterly species

Conclusions

There are three clear ecotypes within *Phengaris alcon* and *'rebeli'* ecotypes should be priority ones

No clear differentaion within *Phengaris arion* - genetic structure shaped mainly by isolation and habitat fragmentation

Special attention (monitoring and conservation) should be paid to isolated populations with reduced variability

Sites with parasitoids for both *P. arion* and *P. alcon* should be of a special conservation concern as well

Acknowledgments

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European Red List of
Butterflies


Thank you!