

Mollusc communities in the Western Carpathian fens: ecological and paleoecological patterns

recent



history



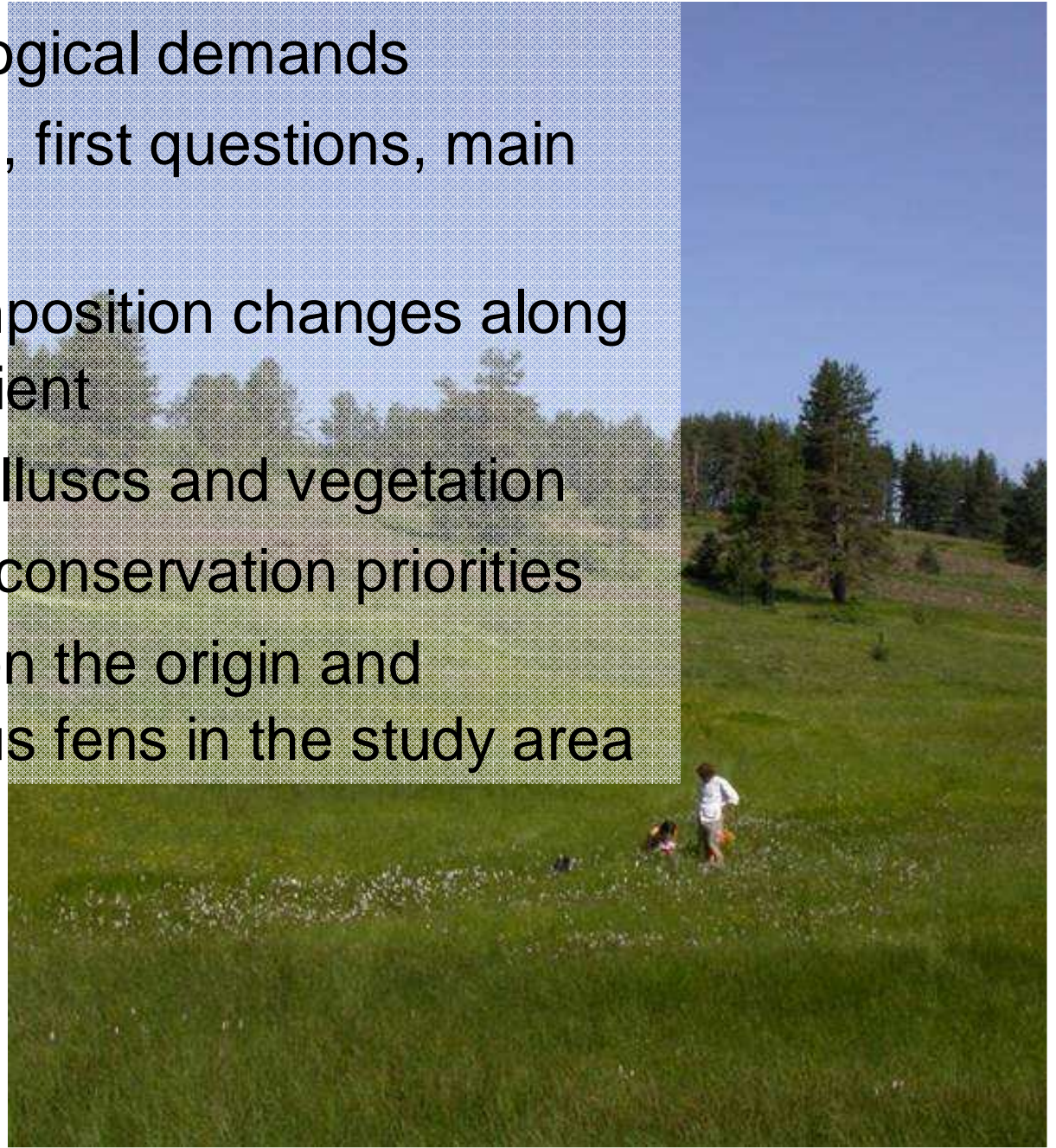
Michal Horsák et al.

Institute of Botany and Zoology, Masaryk University

Content of presentation

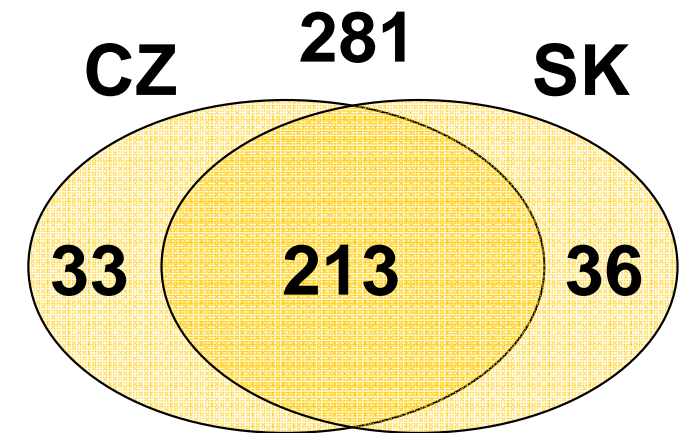


- @ molluscs – diversity, ecological demands
- @ start with molluscs in fens, first questions, main patterns
- @ diversity and species composition changes along the mineral richness gradient
- @ relationships between molluscs and vegetation
- @ endangered species and conservation priorities
- @ current research project on the origin and development of calcareous fens in the study area

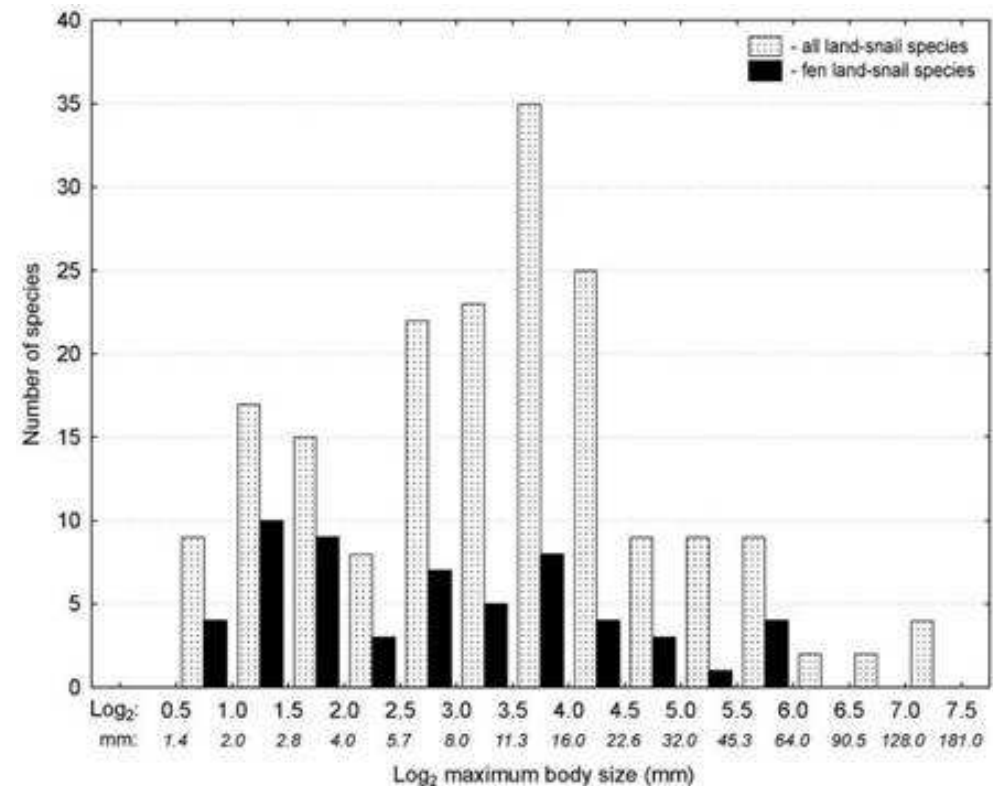


Number of species, body size distribution

- @ CZ: 246 species
 - 218 snails: 50 aquatic a 168 terrestrial
 - 28 clams
- @ SK: 249 species
 - 221 snails: 52 aquatic a 169 terrestrial
 - 28 clams



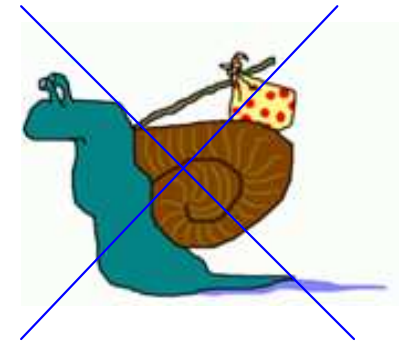
- @ bimodal distribution of land snail body sizes
- @ most land snails living in fens are mostly tiny creatures
- @ in total we found ca 75 spp.



Molluscs and environment



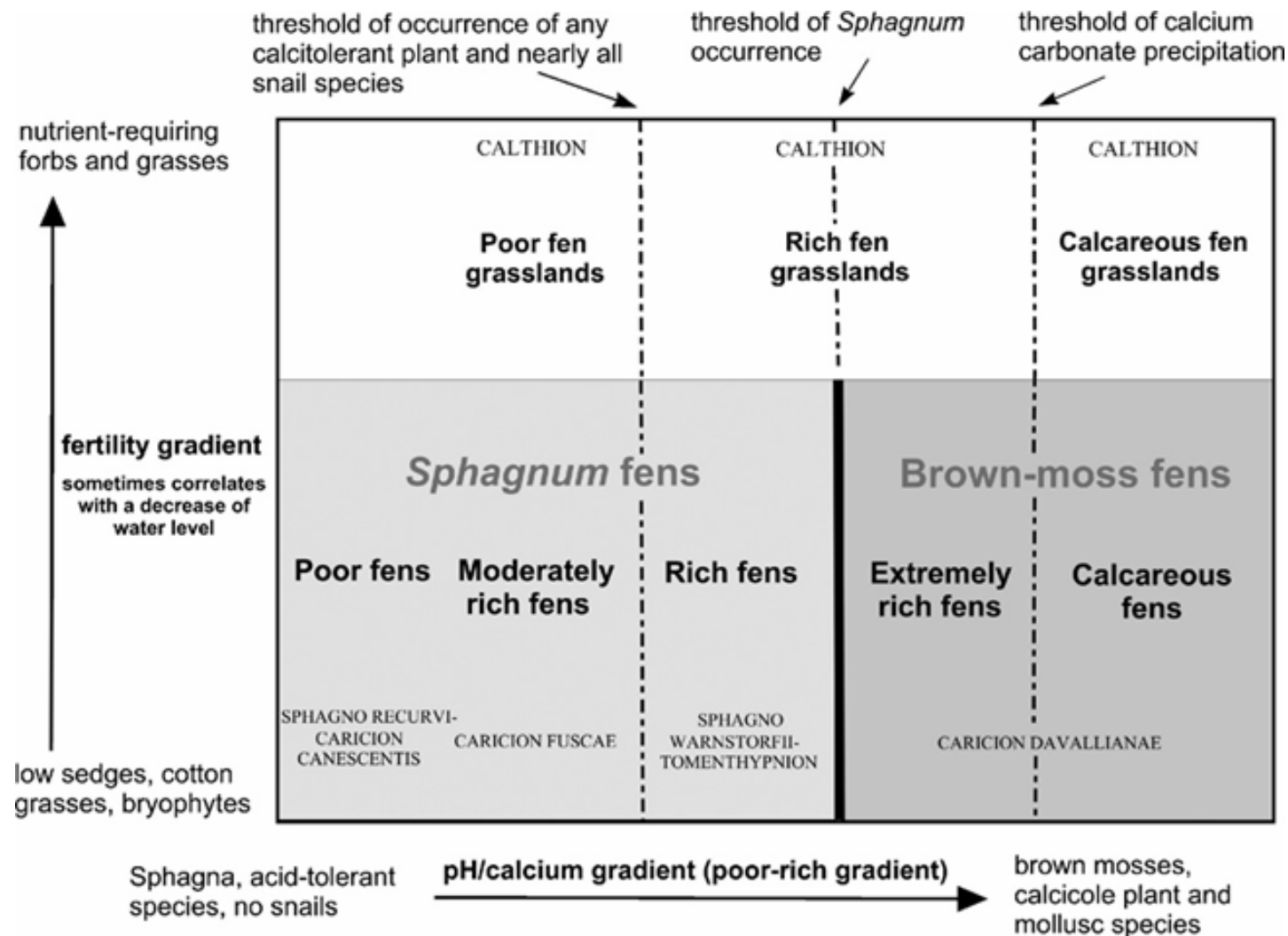
- @ autecology well known – clear ecological factors important for molluscs, most species have same responses
 1. content of available calcium
 2. moisture
 3. undisturbed conditions
- @ low vagility, close relation to particular habitats (daily movement around 100 cm, monthly up to 20 m, Marzec 2006)



Molluscs along the gradient of mineral-richness



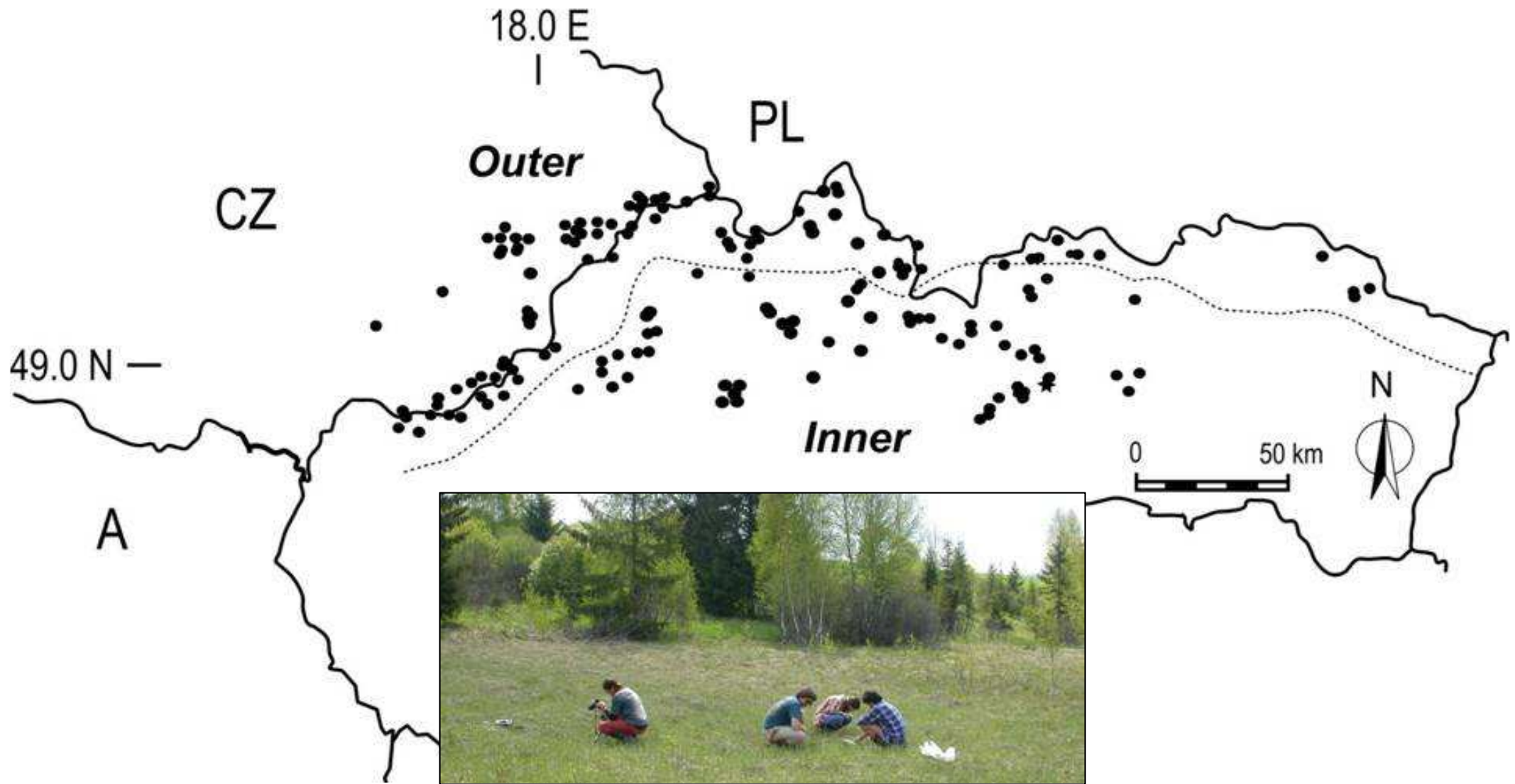
- patterns of mollusc species richness and compositional changes along ecologically the most important gradient within fen habitats – the poor-rich gradient (Malmer 1986, Hájek et al. 2006)



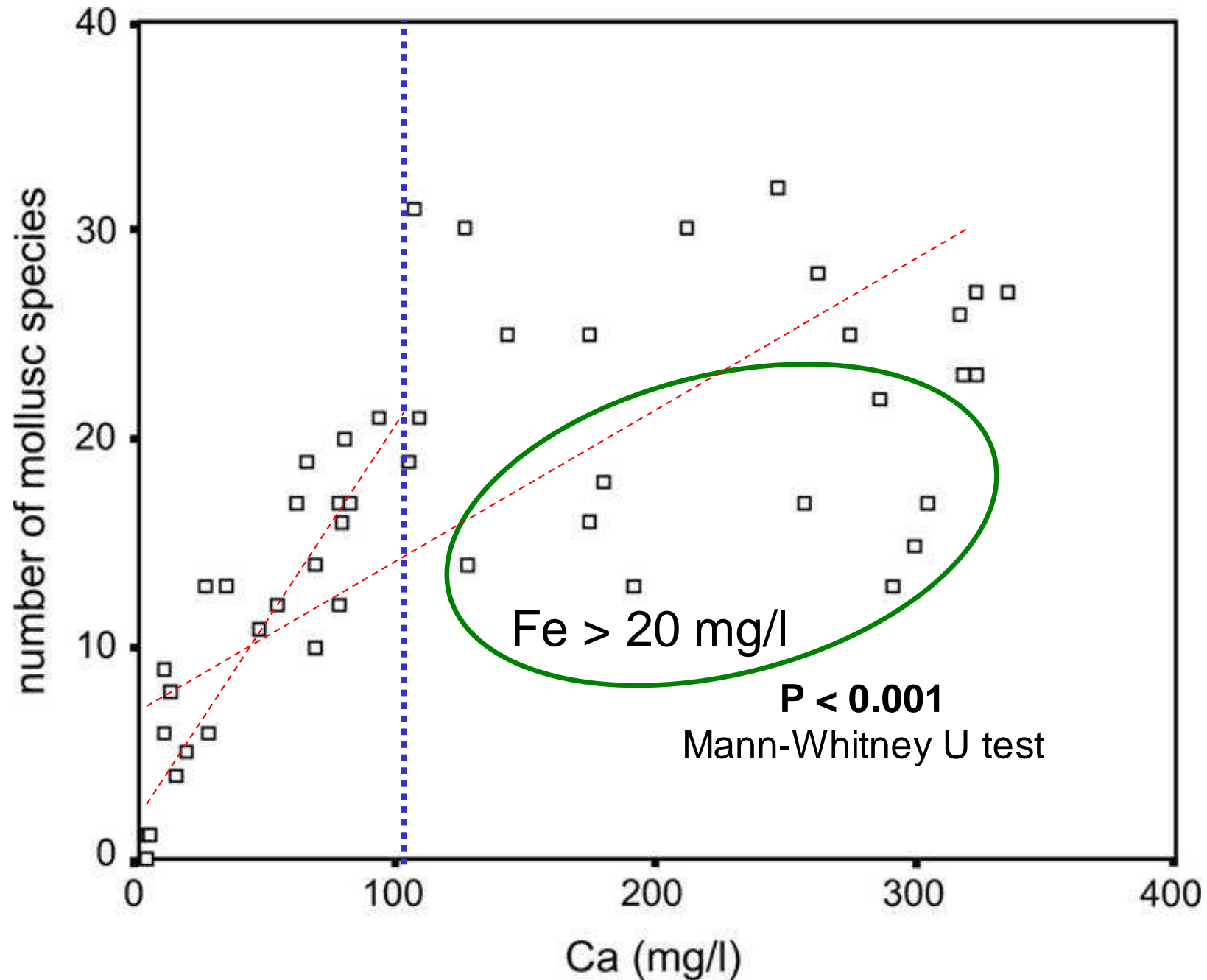
Distribution of study sites



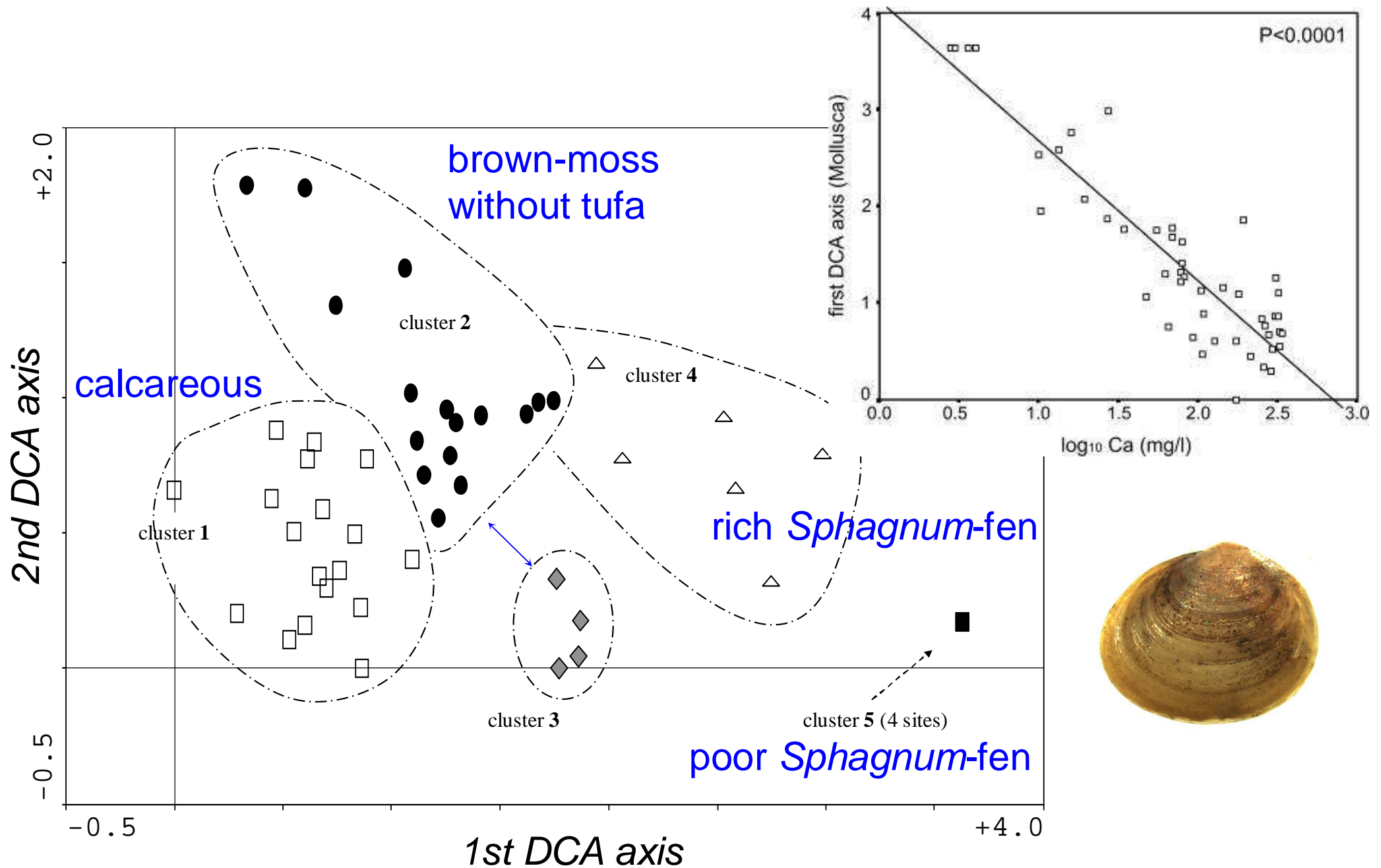
- @ currently more than 170 sampled sites
- @ molluscs, vegetation, environmental parameters recorded



Number of species and calcium amount



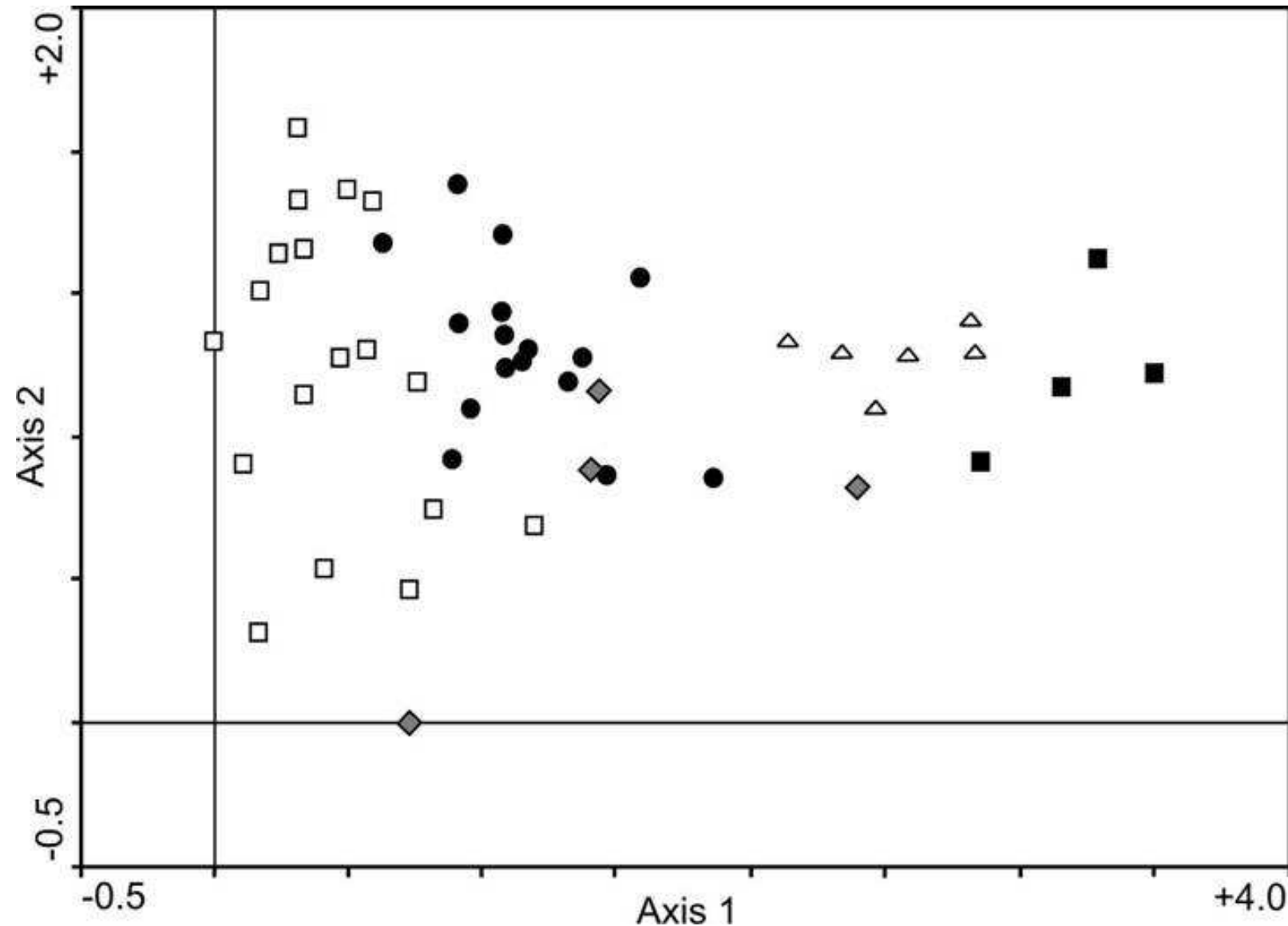
Compositional changes along the mineral richness gradient



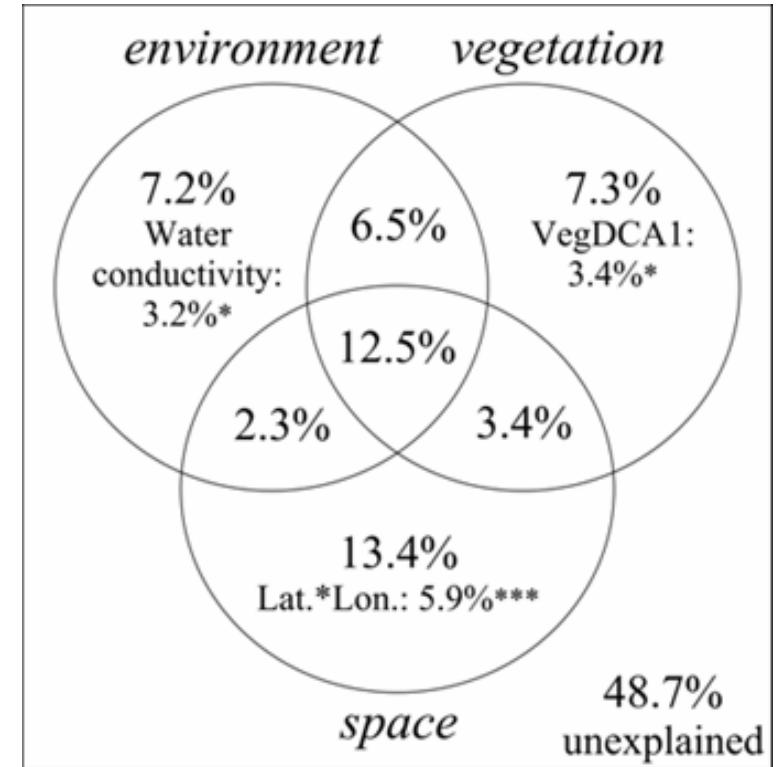
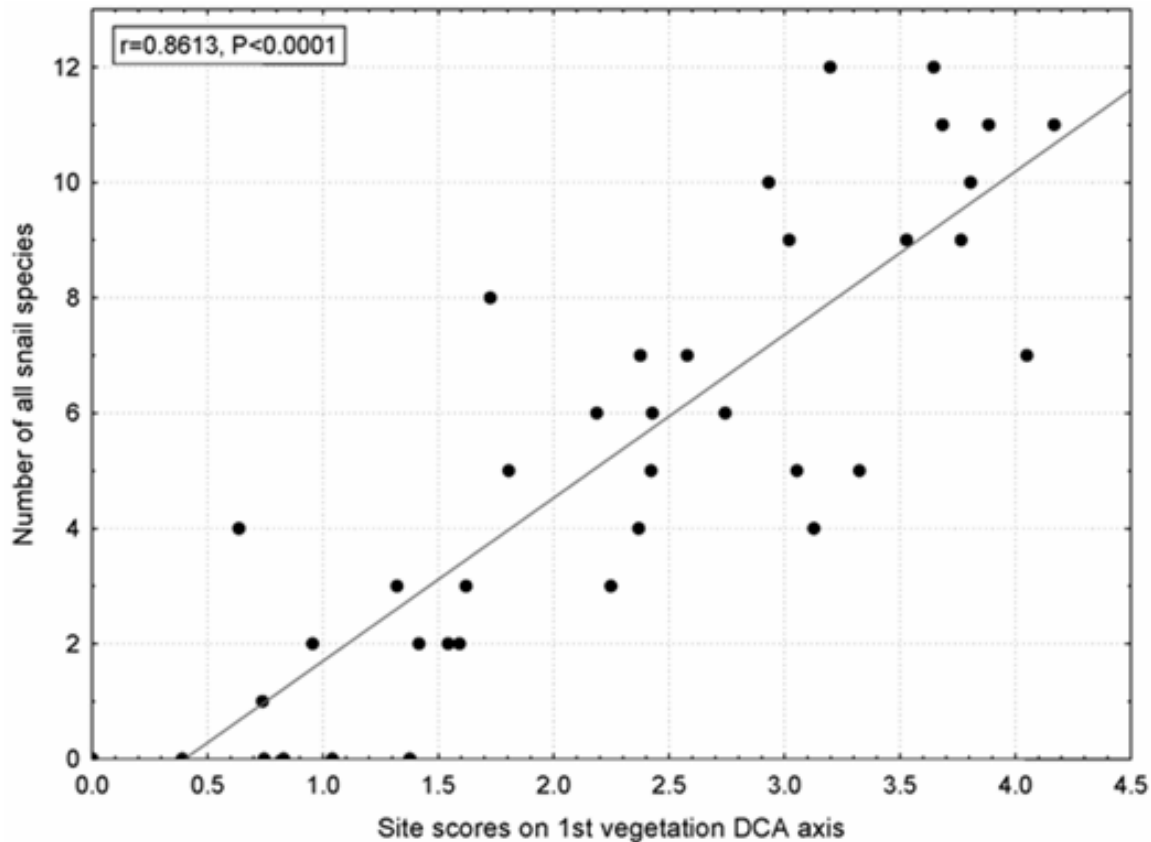
Concordance between mollusc and plant compositional changes



🌀 DCA of vegetation, classification based on molluscs



Vegetation is the best predictor



Percentage of explained variation in mollusc species data

	Bulgaria (N=40)	Carpathians (N=48)
Vegetation (4 axes)	29%	26%
Conductivity	18%	11%
Chemistry	21% (pH a cond.)	22% (complex)
Total	44%	35%

Molluscs of basic fen types



@ calcareous fens

- strong tufa precipitation (CaCO_3)
- richest in molluscs (up to 30 spp./site)
- exclusive, relict and threatened species



***Vertigo*
*moulinsiana***
(2.5 mm)



Molluscs of basic fen types

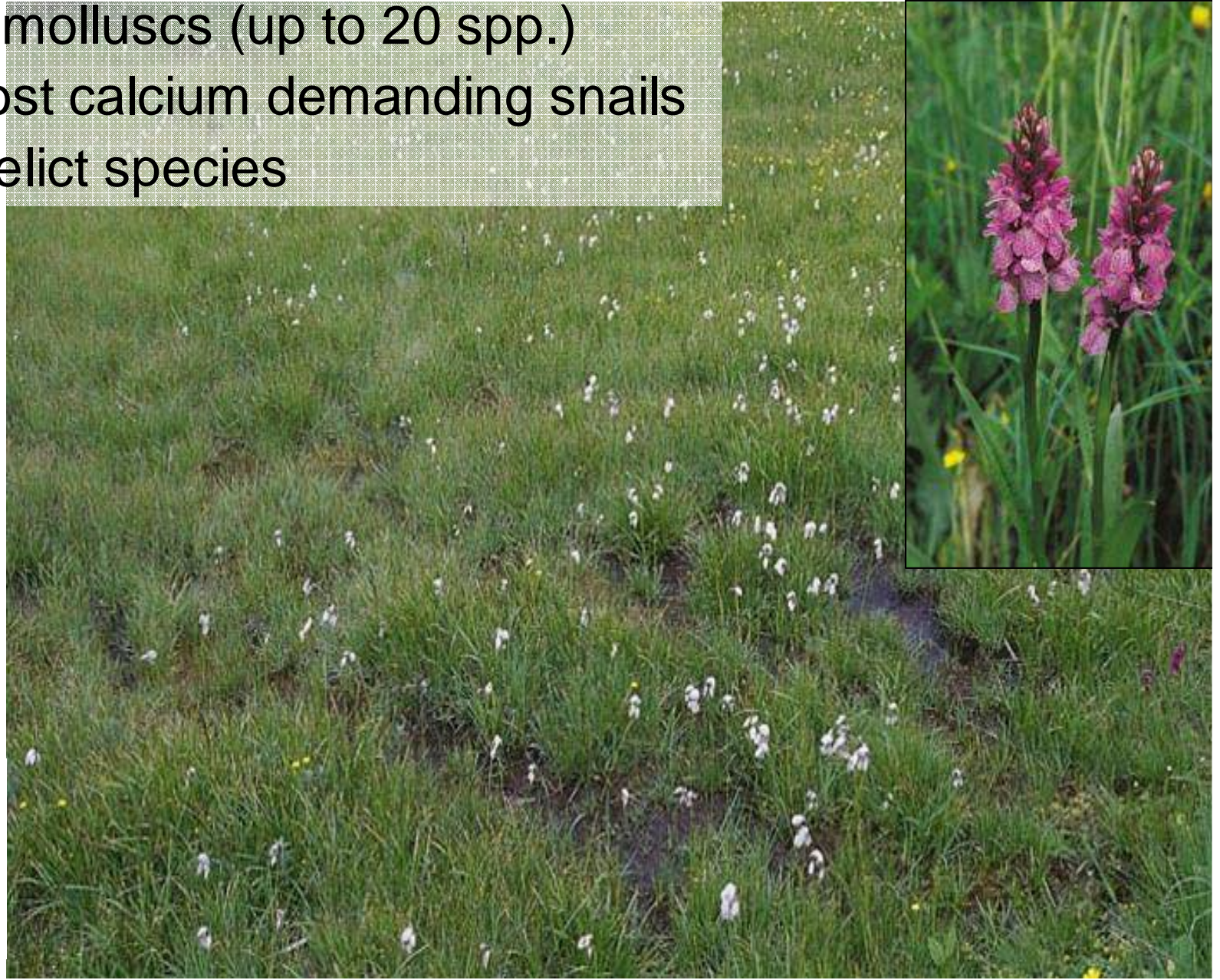


@ brown-moss fen without tufa

- still rich in molluscs (up to 20 spp.)
- without most calcium demanding snails
- also with relict species



Vertigo
geyeri
(1.8 mm)

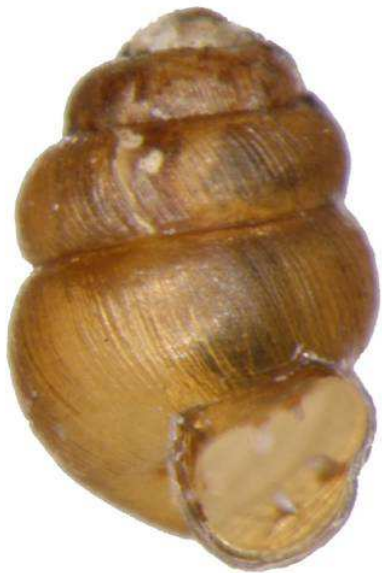


Molluscs of basic fen types



@ rich *Sphagnum*-fens

- a sharp decrease of land snails
- only acido-tolerant and aquatic species
- ecological threshold of land snails there



***Vertigo*
*substriata***
(1.7 mm)



Molluscs of basic fen types



@ moderately rich & poor *Sphagnum*-fens

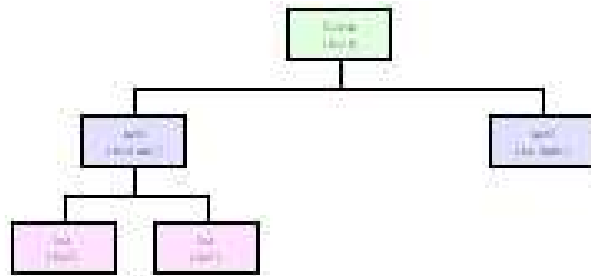
- only aquatic species
- most acid site without molluscs
- most acido-tolerant species is bivalve *Pisidium casertanum*



Pisidium
casertanum
(5 mm)

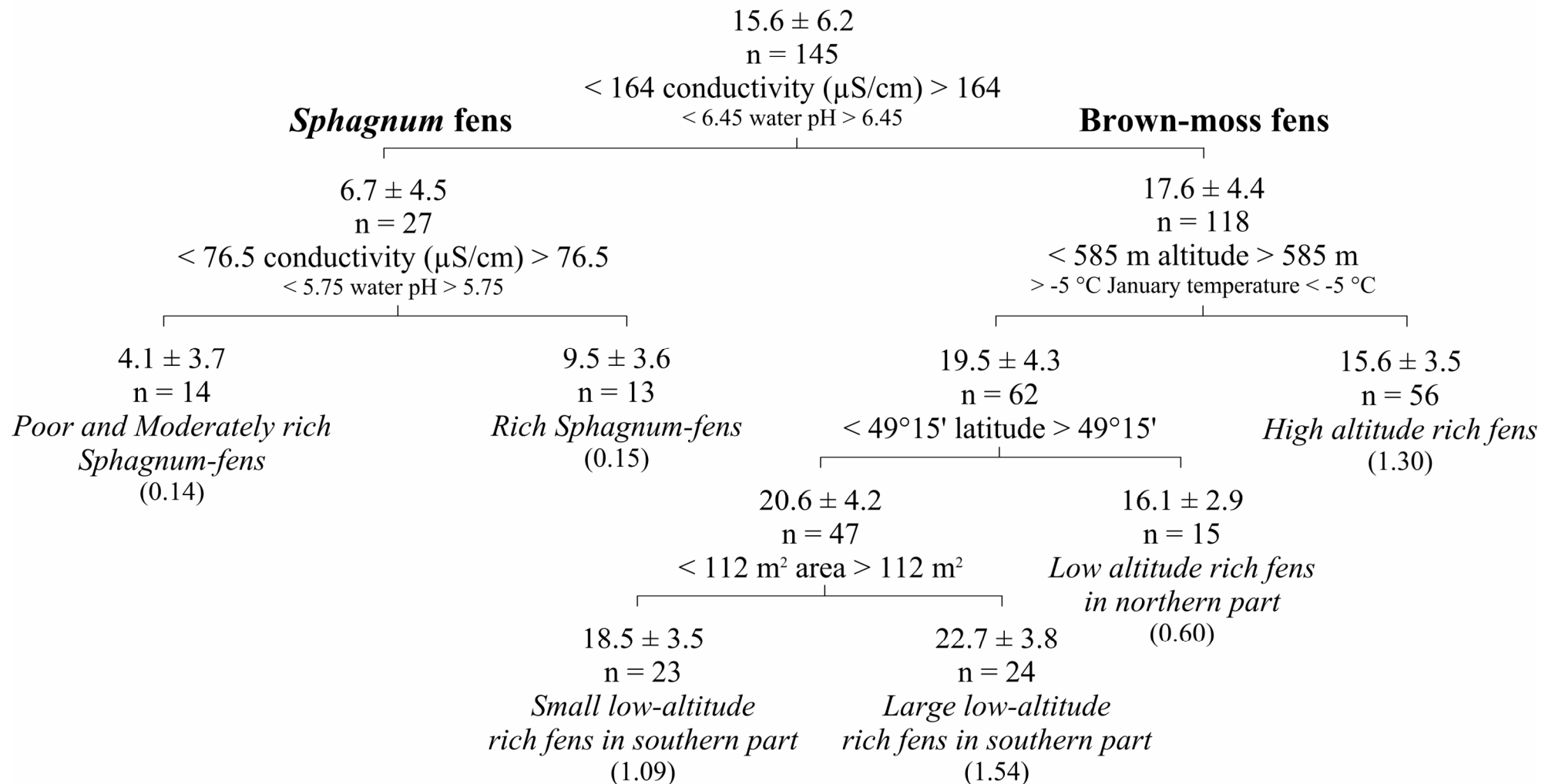


Prediction of number of species



72% of variation
was explained

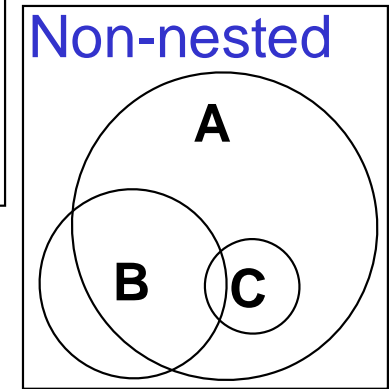
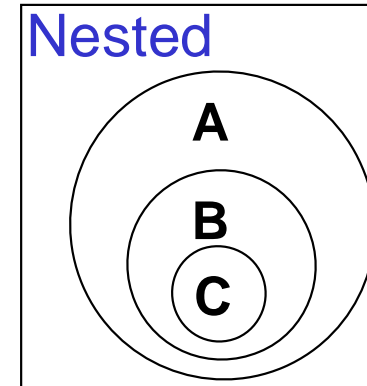
Species richness of fen mollusc faunas



Nested pattern of species composition



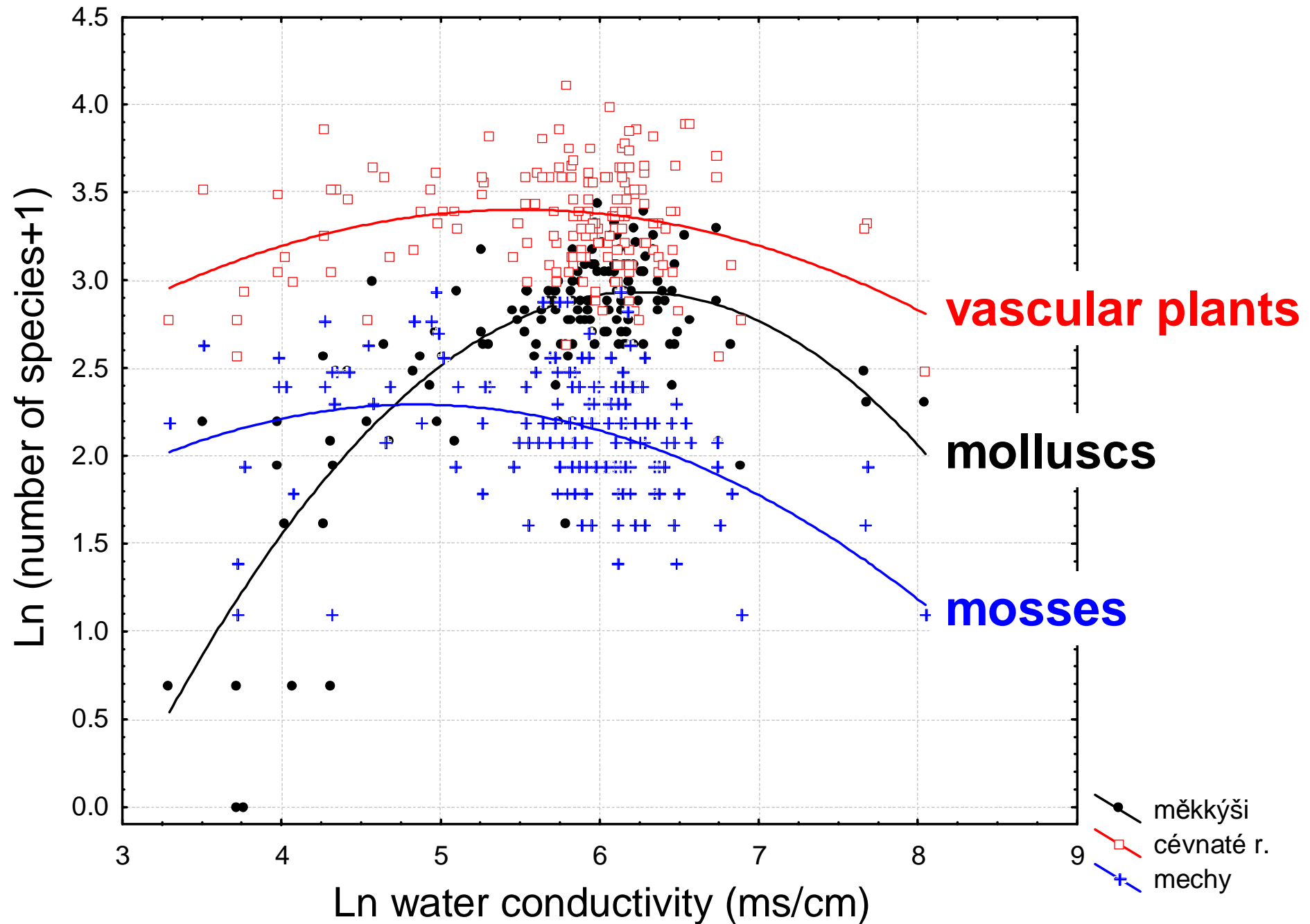
- species composition of fen mollusc communities are nested = species of species poorer sites are subset of those found in species richer fens



calcium content



Species richness along the poor-rich gradient



Highly threatened and preserved species



Threatened species	Occurrence within area under study / number of sites
<i>Cochlicopa nitens</i> (Gallenstein, 1848)‡!†	Inner Western Carpathians / 3
<i>Pupilla alpicola</i> (Charpentier, 1837)‡!†#	Inner Western Carpathians / 26
<i>Vallonia enniensis</i> (Gredler, 1856)!†	Western Carpathians / 5
<i>Vertigo angustior</i> Jeffreys, 1830*	Western Carpathians / 76
<i>Vertigo geyeri</i> Lindholm, 1925*‡!†#	Inner Western Carpathians / 27
<i>Vertigo moulinsiana</i> (Dupuy, 1849)*‡!†	Outer Western Carpathians / 11

* - species listed in the IUCN Red Data Book and Annex II of the EU Habitat Directive

‡ - relict from the Late Glacial or the Early Holocene

! - species listed in the Red Book of former Czechoslovakia (Ložek 1992)

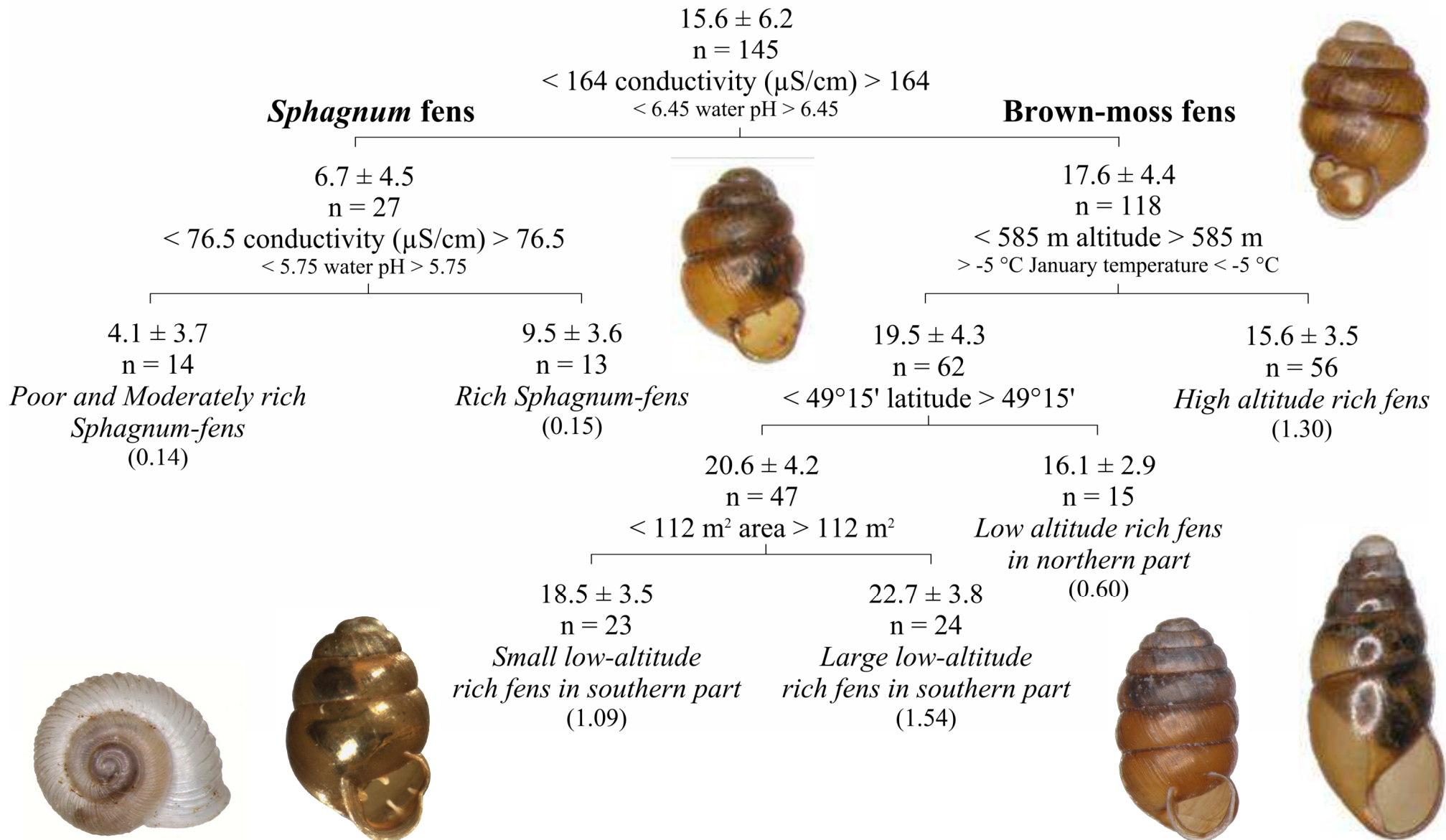
† - species listed in the Red List of the Czech Republic's molluscs (Beran et al., 2006) as a critically endangered or an endangered species

- fen specialist

Occurrence of most threatened species



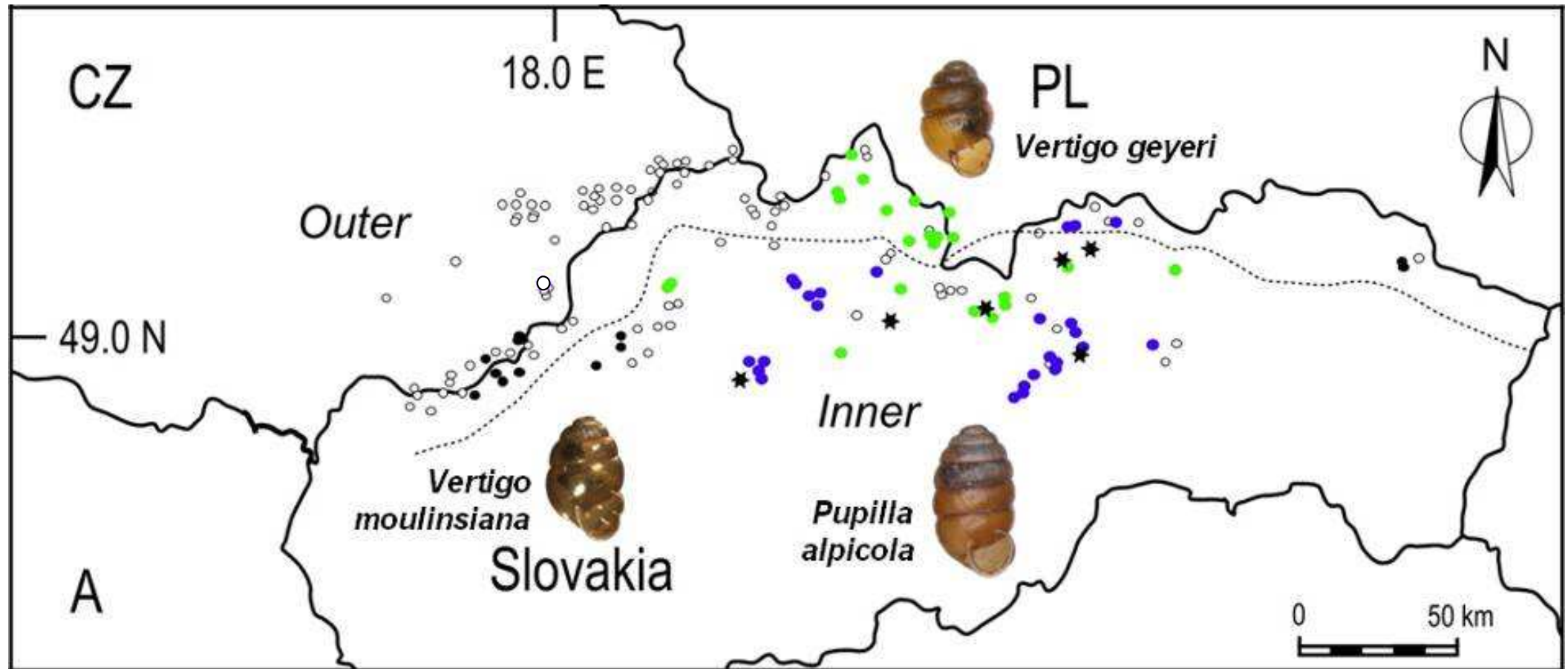
Species richness of fen mollusc faunas



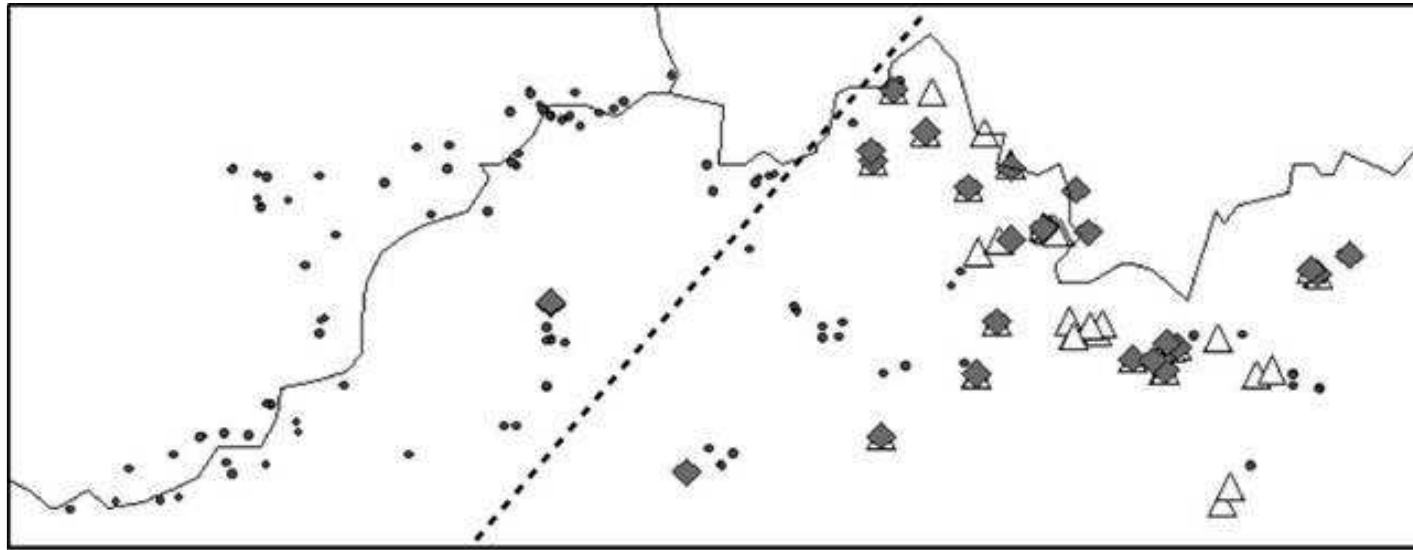
Distribution of relic snails



@ mostly in the Inner Western Carpathians



Co-occurrence of relic snails and plants

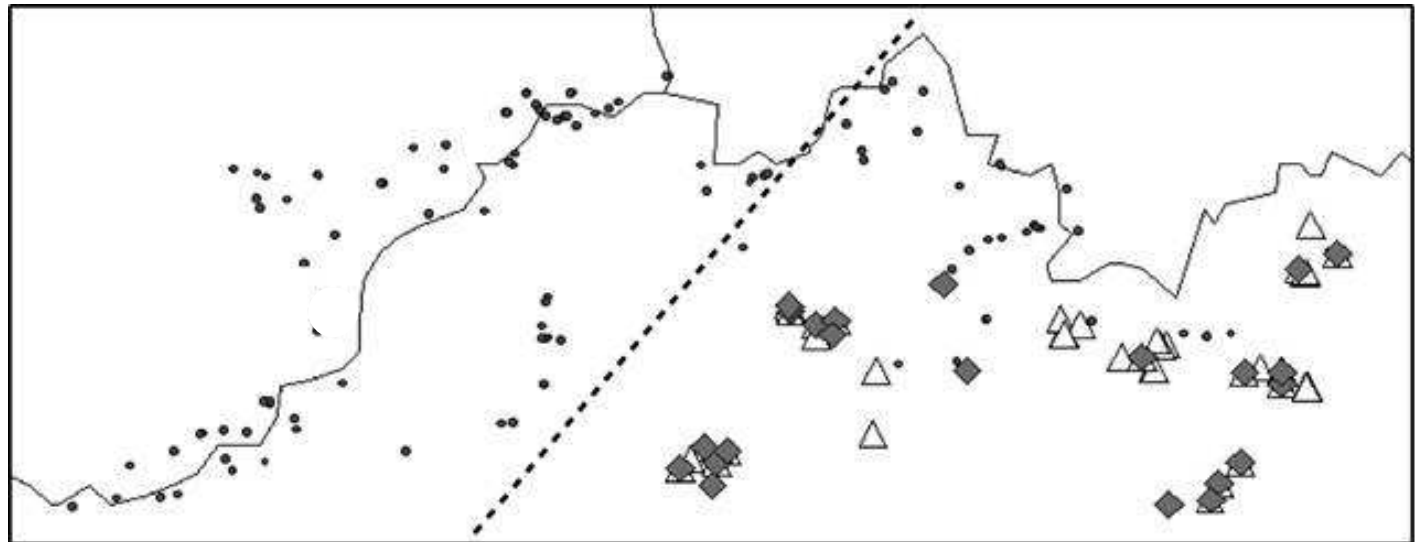


Vertigo geyeri – *Carex dioica*

■ – snail

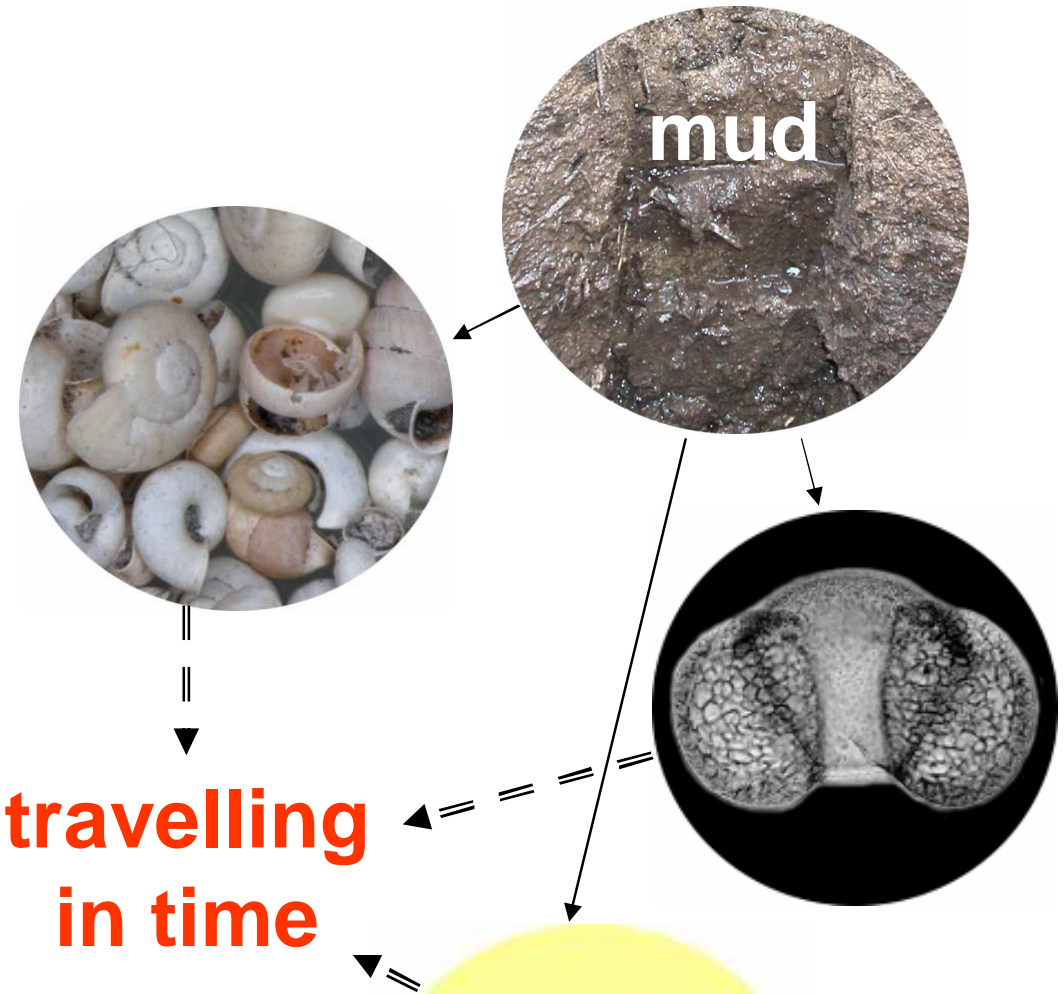
△ – plant

Pupilla alpicola – *Primula farinosa*



Origin and development of calcareous fens

*This must be the
Pleistocene!*



M. Horsák
B. Pelánková
E. Jamrichová
M. Hájek
P. Hájková

A. Lacina
J. Božková
E. Mikulášková
K. Kintrová

Advantages of study calcareous fens



- @ good conditions for fossilization of shells, plant remains and pollen (for pollen not optimal, difficult processing)
- @ possibility to make reconstruction based on three groups
- @ to compare these reconstructions
- @ each group has own specificity: regional vs. local context, species composition vs. structure of vegetation

Sediments of calcareous fens are rich in tufa which creates perfect conditions for preservation of mollusc shells.



Design and aims of current reserach



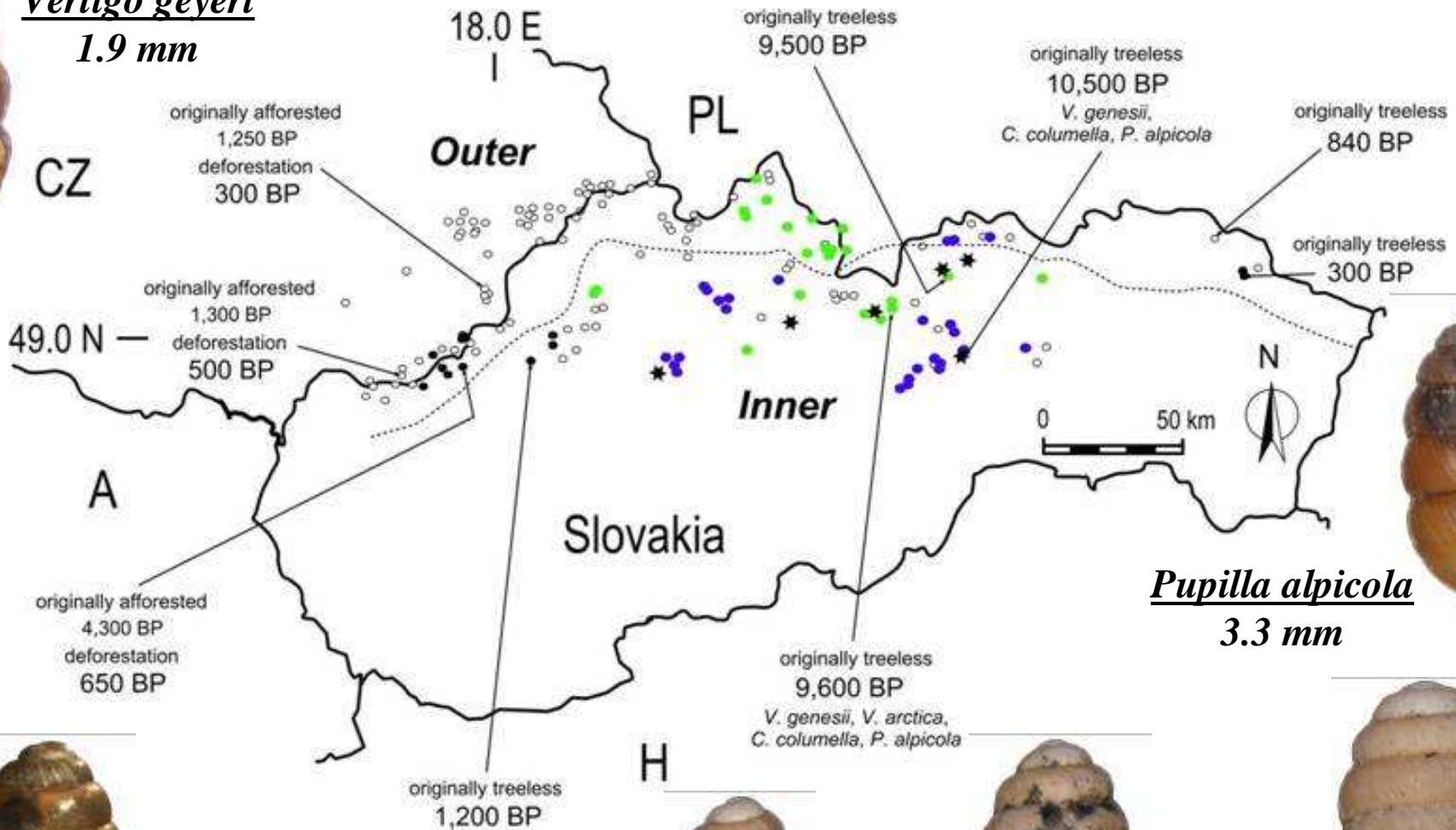
- ④ pre-selection of 40 sites from 4 groups (10 from each):
 - in Inner West Carpathians with more than 3 relicts (12-4)
 - in Inner West Carpathians with less than 4 relicts (3-0)
 - in Outer West Carpathians with any relict species (2-1)
 - in Outer West Carpathians with no relict species
- ④ in each group we excavated at least two sequences
- ④ at remaining sites we sampled bottom and the first open stage:
indication based on snails, ^{14}C dating
- ④ to find out the origin and age and to reconstruct calcareous fen development
- ④ ? correlation between age and number of relict species as well as all species



Evidence of fossil records



Vertigo geyeri
1.9 mm



Pupilla alpicola
3.3 mm



Vertigo moulinsiana
2.7 mm



Vertigo genesii
2.1 mm



Vertigo arctica
2.5 mm



Columella columella
3.1 mm

Distribution pattern of *Vertigo geyeri* – a benefit of combine ecological and paleoecological approach



@ classification of sites (poor *Sphagnum*-fens not included) based on vegetation in TWINSpan (81 sites)

