

## The widespread slug *Limax maximus*: species boundaries and redescription



Isabel Hyman<sup>1</sup>, Barbara Klee<sup>1</sup>, Ulrich Schneppat<sup>2</sup>,  
Gerhard Haszprunar<sup>1</sup>

<sup>1</sup> Zoologische Staatssammlung München, Germany  
<sup>2</sup> Bündner Naturmuseum, Switzerland

Bündner Naturmuseum  
Museum de la natura dal Grischun  
Museo della natura del Grigioni

## *Limax maximus* - variation



## What do we know so far about *Limax maximus*?

- Mantle with dark spots
- Sole of foot unicolour
- Relatively short penis
- Adult body length 10-20 cm



## *Limax maximus*

- Formal description: Linnaeus, 1758
- probably native to southwest Europe
- Occurs in the rest of Europe
- Introduced into North and South America, Australasia, Hawaii, South Africa

## Why study *Limax maximus*?

- Type species of *Limax*
- Complex taxonomic history
- Extremely variable appearance
- Very widespread species
- Introduced to many countries
- Confusion with other *Limax* species



## Taxon sampling

- *Limax maximus* from:
  - Many populations around Europe
  - Australia, New Zealand
  - North America, Hawaii
  - South Africa
  - Wide variety of colour forms
- ... over **200** specimens
- Many other *Limax* species
- Outgroups from Limacidae

## Comparisons

Other species confused with *L. maximus* in literature, bioinventories and collections

### Dark forms:

– *Limax cinereoniger*

– *Limax sp. nov. MOTU #012*

– *Limax* MOTU #011



## Comparisons

### Spotted forms:

– *Limax cinereoniger*

– *Limax sp. nov. MOTU #012*

– *Limax* MOTU #013

– *Limax conemenosi*

– *Limax punctulatus*



## Sole field coloration - a good character?



*Limax maximus*



*Limax cinereoniger*

## Comparisons

### Striped forms:

– *Limax cinereoniger*

– *Limax sp. nov. MOTU #012*



### Pale forms:

– *Limax cinereoniger*

– *Limax sp. nov. MOTU #012*



## Comparisons

### Pale forms:

– *Limax cinereoniger*

– *Limax sp. nov. MOTU #012*



## Anatomy

- Important characters include
  - Penis length
  - Presence of blind penis tip
  - Attachment of penis retractor muscle
  - Attachment of vas deferens
- *Limax maximus*: short penis, very short blind tip
- Some externally similar species can be distinguished from *L. maximus* based on penis length





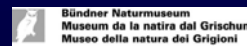
## Conclusions

- Range of *L. maximus* now better known
- Colour ranges from black to pale cream; strong to weak pattern of spots and / or stripes
- Always (?): mantle with dark spots and sole uniformly pale
- Colour variations independent of biogeography or habitat
- Penis anatomy as good character in sexually mature/healthy specimens
- Can be distinguished from all other species by analysis of COI sequences

## Acknowledgements

- Thank you to those who provided samples and other assistance
- Thank you for listening!

Photographs: R. Heim, I. Hyman, A. Klee, B. Klee, R. Melzer, M. Unsöld



## Announcement

II. International Meeting of Task-Force-*Limax*  
in Val Resia / Udine  
Italy, Natural Park of Julian Pre-Alps  
21. September – 23. September 2007