

DNA Barcoding

Čárkový kód ADN

Nový pohled na biodiverzitu motýlů

Integrovaný a multidisciplinární přístup
Jean HAXAIRE

Odborný pracovník pařížského Národního přírodovědného muzea
Člen řízení projektu SOW,
projekt biodiverzity BOLD, Institute of Ontario, Canadian Centre for DNA Barcoding
University of Guelph, Canada
Director: Prof. Paul D. N. Hebert





Making Every Species Count



Building a Bioliterate World

What would it be like to live in a bioliterate world - a world where you could know, in minutes, the name of any animal or plant - any time, anywhere? And not just its name but everything about it - what are its habits, is it endangered, is it dangerous, should it even be there or is it an invader from somewhere else?

How could we use that knowledge to protect our planet's biodiversity and promote human health and well-being?

The International Barcode of Life project (iBOL), the largest biodiversity genomics initiative ever undertaken, is unlocking the door to that world by creating a digital identification system for life.



Wales to barcode all its flowering plants



Researchers with the Barcode Wales project want Wales to be the first country to barcode every one of its native flowering plants.

• Breaking News for Wednesday, May 25, 2011 •

GBIF welcomes iBOL as new Participant



iBOL has signed a Memorandum of Understanding making it an Associate Participant of the Global Biodiversity Information

Registration opens for Adelaide 2011 conference



Registration is now open for the Fourth International Barcode of Life Conference to be held in Adelaide, November 28-December

Spotlight on China in the Barcode Bulletin



Read iBOL's quarterly newsletter for a special report on the growth of DNA barcoding in China and a preview of the big meeting in

Čárkově kódované živé objekty

Počet evidovaných exemplářů: **1,680.124**

Exempláře s čárkovým kódem: **1,250.791**

Druhy s čárkovým kódem: **103.456**

Živočichové:

[Acanthocephala \[188\]](#)

[Annelida \[19345\]](#)

[Arthropoda \[1 230 904\]](#)

[Brachiopoda \[125\]](#)

[Bryozoa \[652\]](#)

[Chaetognatha \[168\]](#)

[Chordata \[239796\]](#)

[Cnidaria \[2835\]](#)

[Cyclophora \[294\]](#)

[Echinodermata \[19588\]](#)

[Echiura \[24\]](#)

[Gnathostomulida \[8\]](#)

[Hemichordata \[15\]](#)

[Mollusca \[51719\]](#)

[Nematoda \[4631\]](#)

[Onychophora \[209\]](#)

[Platyhelminthes \[5946\]](#)

[Porifera \[1161\]](#)

[Rotifera \[3062\]](#)



[Sipuncula \[68\]](#)

[Tardigrada \[703\]](#)

[Xenoturbellida \[2\]](#)

Houby:

[Ascomycota \[3173\]](#)

[Basidiomycota \[4916\]](#)

[Chytridiomycota \[1\]](#)

[Myxomycota \[8\]](#)

[Zygomycota \[23\]](#)

Rostliny:

[Bryophyta \[58\]](#)

[Chlorophyta \[4710\]](#)

[Lycopodiophyta \[82\]](#)

[Magnoliophyta \[44365\]](#)

[Pinophyta \[810\]](#)

[Pteridophyta \[1477\]](#)

[Rhodophyta \[21062\]](#)

Protisté:

[Chlorarachniophyta \[65\]](#)

[Ciliophora \[499\]](#)

[Heterokontophyta \[9936\]](#)

[Opalozoa \[1\]](#)

[Pyrrophytophyta \[2145\]](#)





Určit druh znamená...

- Rozpozнат na vnějším vzhledu exempláře určitý počet specifických charakteristik.
- Přiřadit exemplář k determinovanému druhu a pojmenovat jej (binominální nomenklatura).
- Případně popsat (nový druh).

Tinae
scripta
punctatus
us undulatus
don platyrhinos
Gallus gallus
Turdus migratorius
Oryctolagus cuniculus
Rattus norvegicus
Mus musculus
Homo sapiens
Typhlonectes natans
Ichthyophis bannanicus
Hypogeophis rostratus
Grandisonia alternans
Discoglossus pictus
Xenopus laevis
Scaphiopus holbrookii
Xenopus carolinensis
comantis thomasi
Bufo vallensis
Hyla

Konkrétně

- Odvolat se na původní popis.
- Lokalizovat a rozpoznat druh.
- Porovnat vzorkový exemplář s odchyceným exemplářem, ověřit všechny diagnostické charakteristiky.



Banister Falls,
Upper Maranon,
N. Peru, 1,000 ft.
A. E. Lepage.

8

10
Holo-
type

X. 2006.

London. Photo J. Haxaire.

Pachygonia
ribbei
peruviana
TYPE H.T.



~~Daphnis~~ Chimaera
~~Daphnis~~ Rothschild
Type Jan 1894

Borneo.

Type

Sphingid
genitalia slide
No. 755

Rothschild
Bequest
B.M. 1939-1.

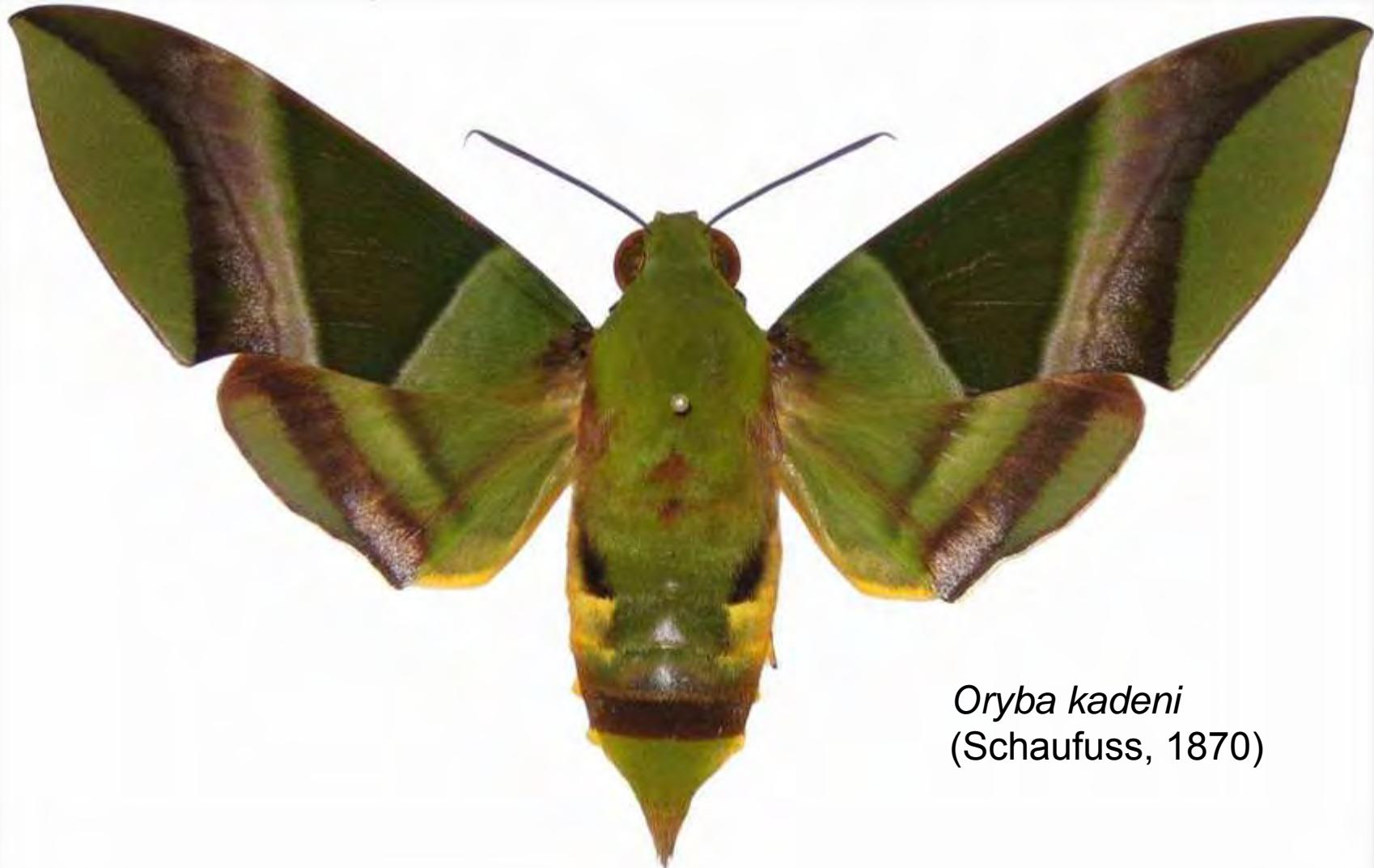
BMNH (E) # 272248

Proč určovat?

« Vědec, který se neujistí přesnou identifikací a není si jistý druhem se kterým pracuje, provádí výzkum jenž není vědecký. Jeho poznání nejsou opakovatelná, jeho hypotézy nejsou ověřitelné ... »

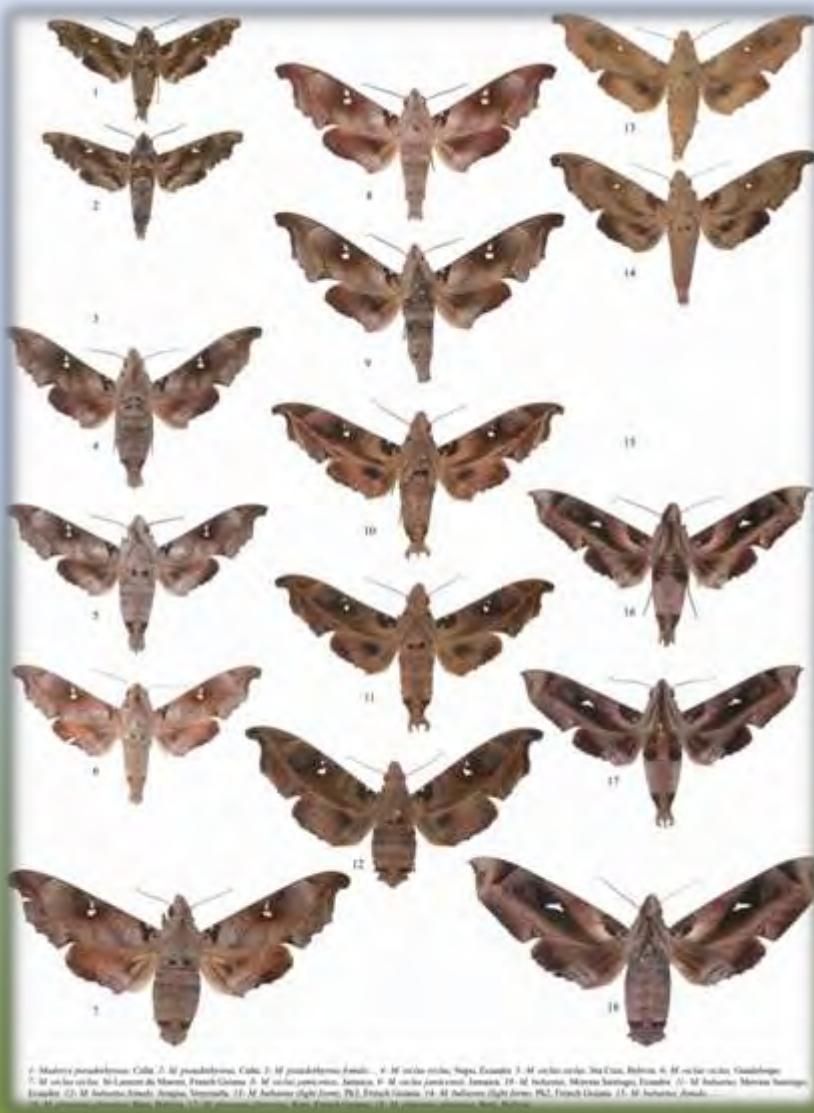
Loïc Matile, 1987

Zde určení je bezproblémové



Oryba kadeni
(Schaufuss, 1870)

V tomto případě je určení složitější



- Druh *Madoryx*.
- Exempláře jsou homogenní, identifikovatelné vnějším vzhledem.

Určení je komplikované



- Druh *Perigonia*
- Určení není možné bez podrobnější analýzy...

Druhá úroveň analýzy

- Genitálie nebo jejich jednotlivé části.
- „Pro zabezpečení vlastní identity a její vývojové charakteristiky, musí být jednotlivé druhy reproduktivně izolovány jedny od druhých“. (Hennig, 1960)

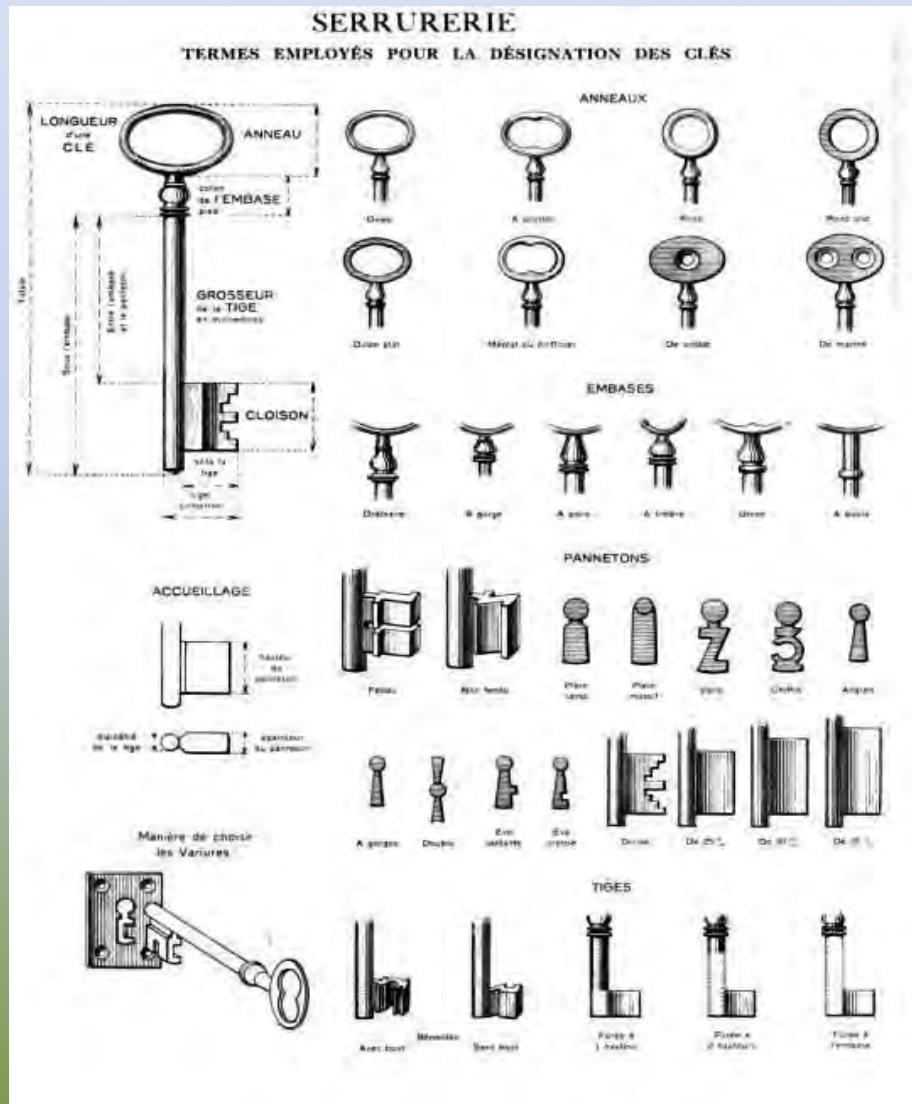
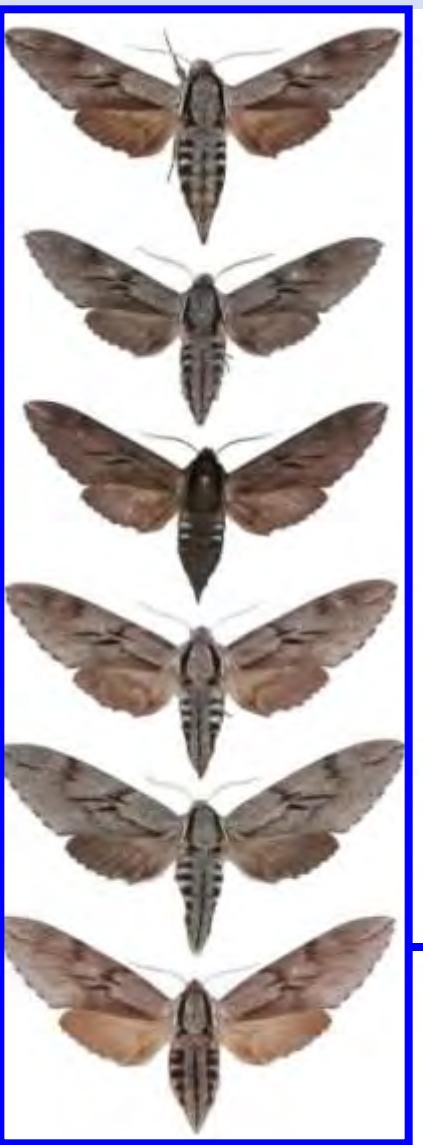


PLATE LIV.

Fig. 1.	Penis-sheath of <i>Xylocopa hypoticta</i>	.	.	.	.	.	.	p. 416
" 2.	" " "	<i>angustia</i>	.	.	.	.	.	p. 418
" 3.	" " "	<i>aztecus</i>	.	.	.	.	.	p. 419
" 4.	" " "	<i>taenia</i>	.	.	.	.	.	p. 418
" 5.	" " "	<i>crucifera</i>	.	.	.	.	.	p. 416
" 6.	" " "	<i>Perigoniam grisea</i>	.	.	.	.	.	p. 424
" 7.	" " "	<i>Sesia fadua</i>	.	.	.	.	.	p. 429
" 8.	" " "	<i>titaea</i>	.	.	.	.	.	p. 436
" 9.	" " "	<i>tantalus tantalus</i>	.	.	.	.	.	p. 435
" 10.	" " "	<i>clavigipes</i>	.	.	.	.	.	p. 436
" 11.	" " "	<i>zumata</i>	.	.	.	.	.	p. 435
" 12.	" " "	<i>Eupyrrhoglossum sagittatum</i>	.	.	.	.	.	p. 430
" 13.	" " "	<i>Sciaea ceculata</i>	.	.	.	.	.	p. 433
" 14.	" " "	<i>Amphion nessus</i>	.	.	.	.	.	p. 407
" 15.	" " "	<i>Proscopia marofasciata atlantica</i>	.	.	.	.	.	p. 613
" 16.	" " "	<i>Dicroidia inscripta</i>	.	.	.	.	.	p. 604
" 17.	" " "	<i>Darapsa phobus</i>	.	.	.	.	.	p. 525
" 18.	" " "	<i>Ampelocera myrus</i>	.	.	.	.	.	p. 523
" 19.	" " "	<i>ceraticolor</i>	.	.	.	.	.	p. 522
" 20.	" " "	<i>Elaphria dolichos</i>	.	.	.	.	.	p. 521
" 21.	" " "	<i>Ampelophaga leucogaster</i>	.	.	.	.	.	p. 519
" 22.	" " "	<i>rufibrunneata</i>	.	.	.	.	.	p. 517
" 23.	" " "	<i>Chrysops ketiale</i>	.	.	.	.	.	p. 505
" 24.	" " "	<i>crotus</i>	.	.	.	.	.	p. 503
" 25.	" " "	<i>Pholus fasciatus</i>	.	.	.	.	.	p. 404
" 26.	" " "	<i>satellitia</i>	.	.	.	.	.	p. 480
" 27.	" " "	<i>luteus</i>	.	.	.	.	.	p. 495
" 28.	" " "	<i>Tenostoma smaragditis</i>	.	.	.	.	.	p. 498
" 29.	" " "	<i>Dakris rubiginosa</i>	.	.	.	.	.	p. 510



Obrázek: Lišaj borovicový



Příklad: dva snadno zaměnitelné druhy,
morfologicky podobné



Sphinx pinastri (Linnaeus, 1758)



Sphinx maurorum (Jordan 1931)

Třetí úroveň analýzy

Kanadské výzkumné centrum pro DNA Barcoding





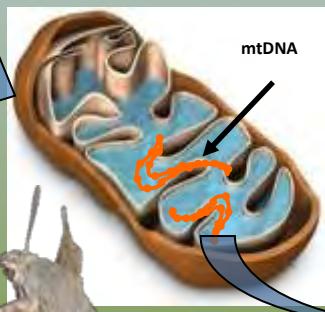
DNA Barcoding ?



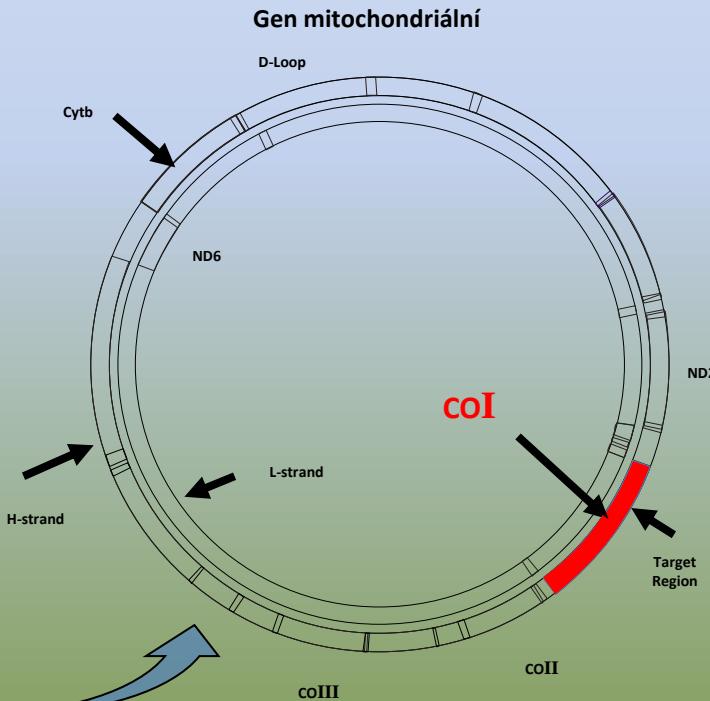
DNA barcoding – Čárkové kódy ADN

Čárkový kód ADN je krátký fragment genu použitý standardním způsobem pro genetické označení identifikace druhů.

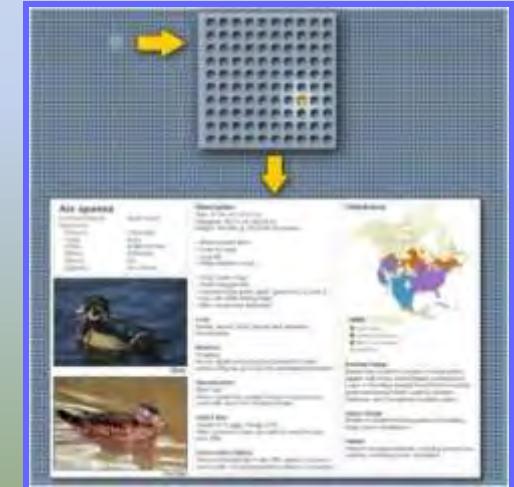
Systém vnitřní identifikace



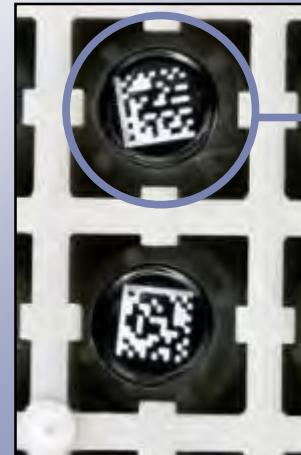
Gen mitochondriální



Tvorba datové knihovny



Odběr vzorku



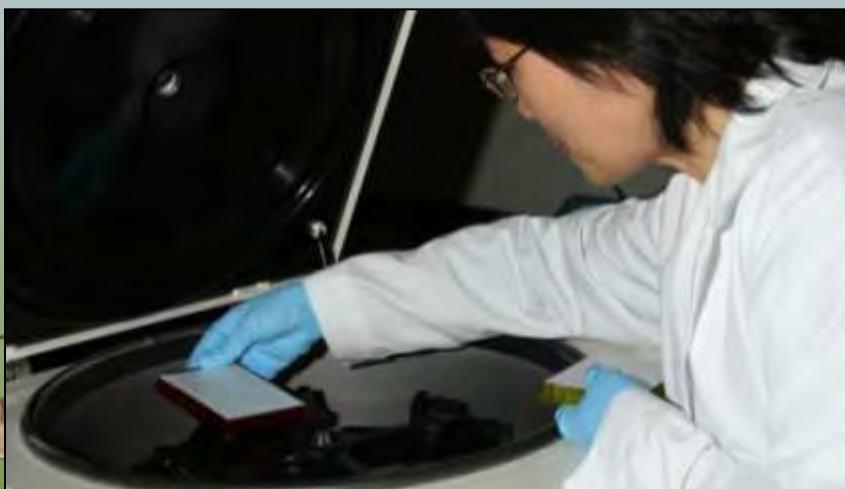


Extrakce ADN

Manuální metoda



Automatická metoda



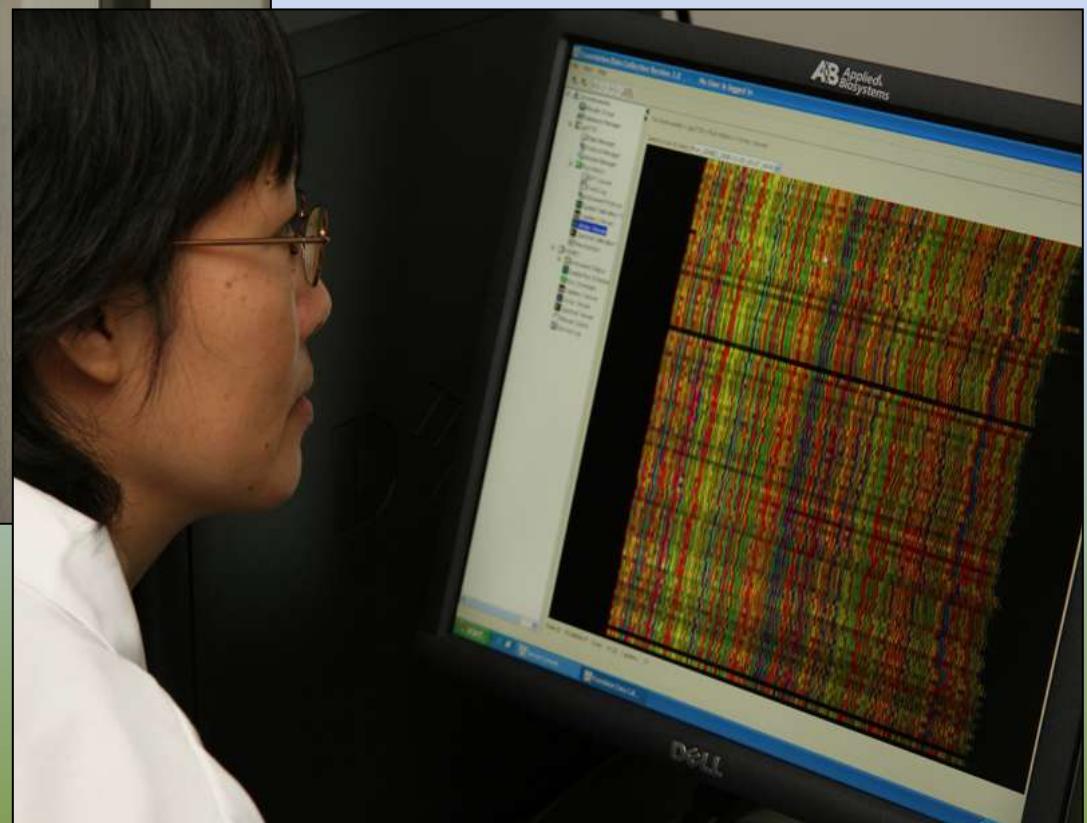
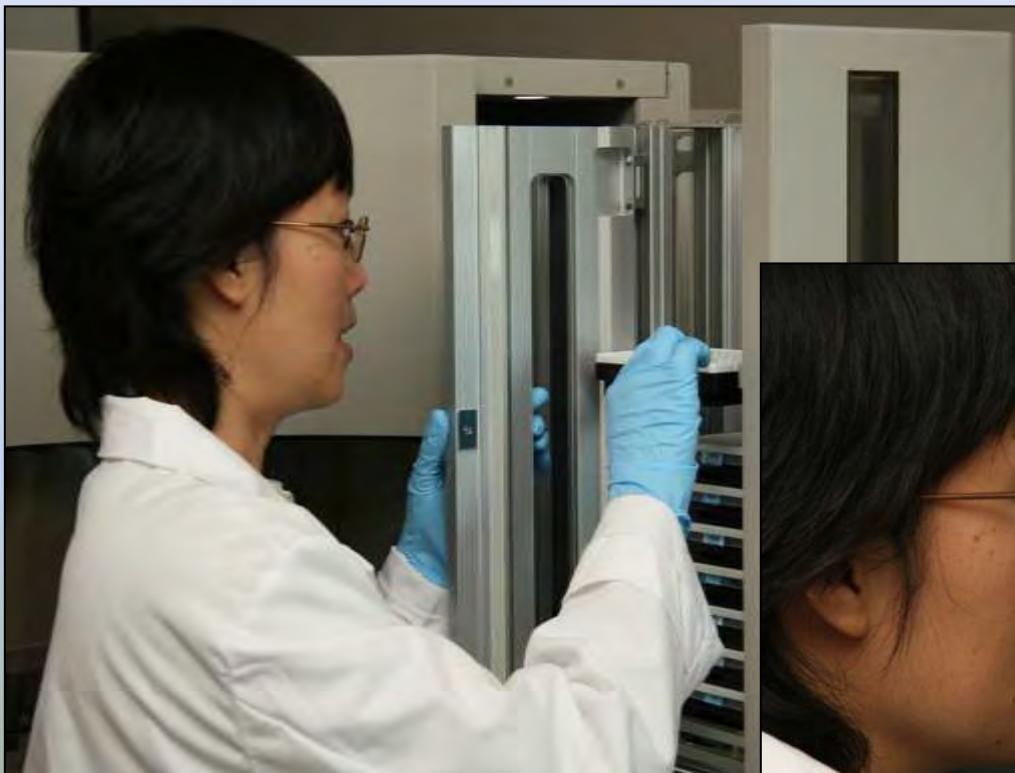
Amplifikace a vytváření sekvence genu

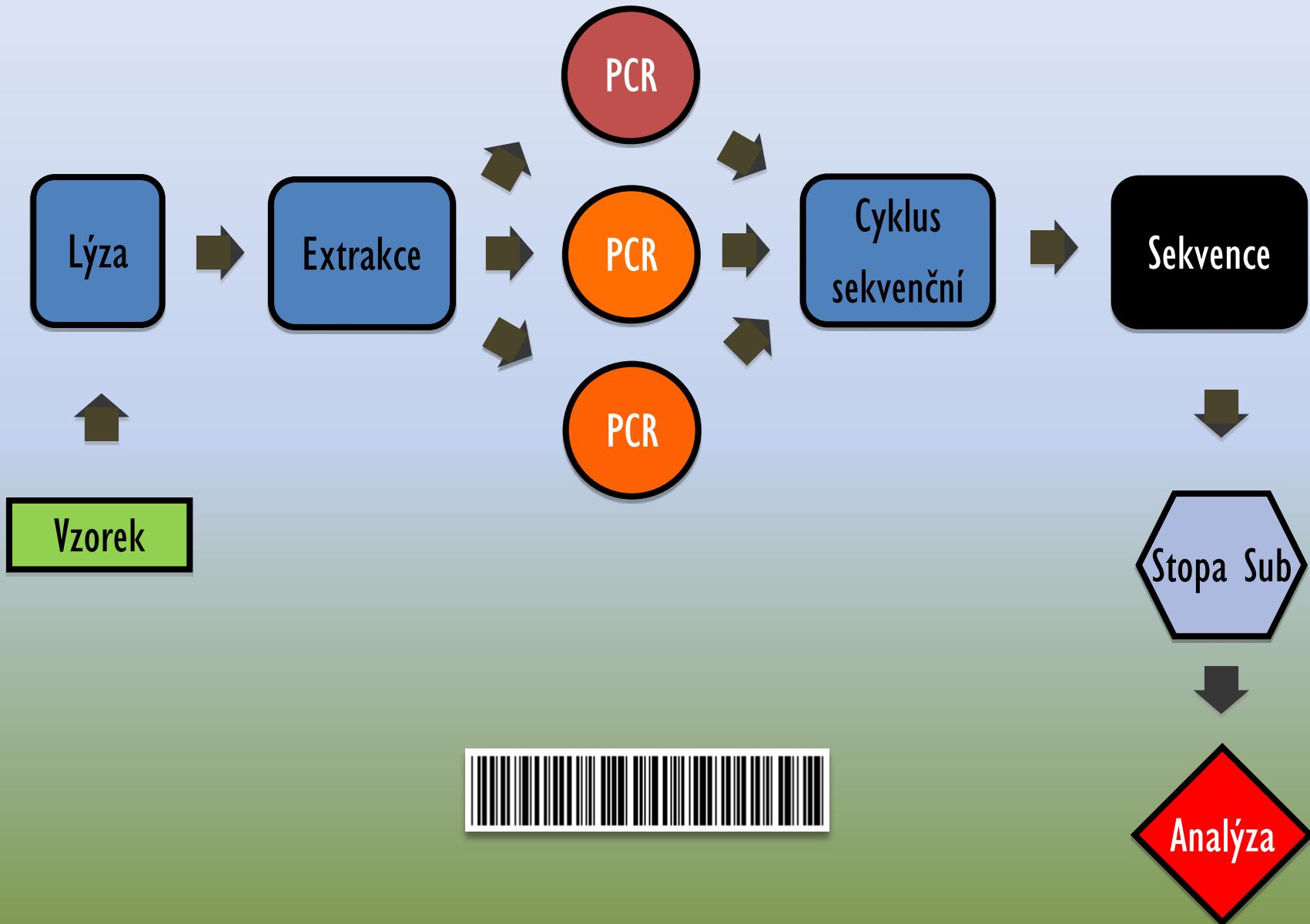


Čištění



Vytváření standardních bidirekcionálních sekvencí





Projekt „Lepidoptera“ – Protokol CCDB

		Čerstvý/Zmrazený	Čas/Miska (min)
	Vzorkování tkáně	\$0.48	60
	DNA Extrakce	\$0.64-0.83	30
	PCR Amplifikace	\$0.49	90
	PCR Ověření výtažku	\$0.41	5
	Sekvenční cyklus	\$0.82	150
	Sekvenční čištění	\$1.16	5
	Sekvence	\$0.97	90
<u>Celkem:</u>		\$4.97-5.16	430 min (7.1 h)

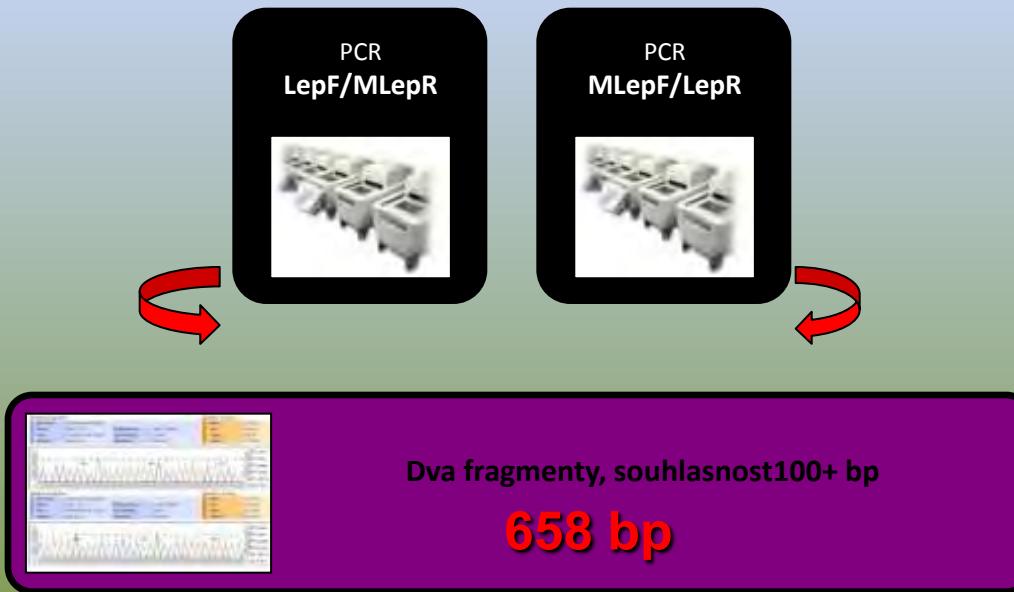


Projekt „Lepidoptera“ – Protokol CCDB

PCR – Běžně používaná metoda

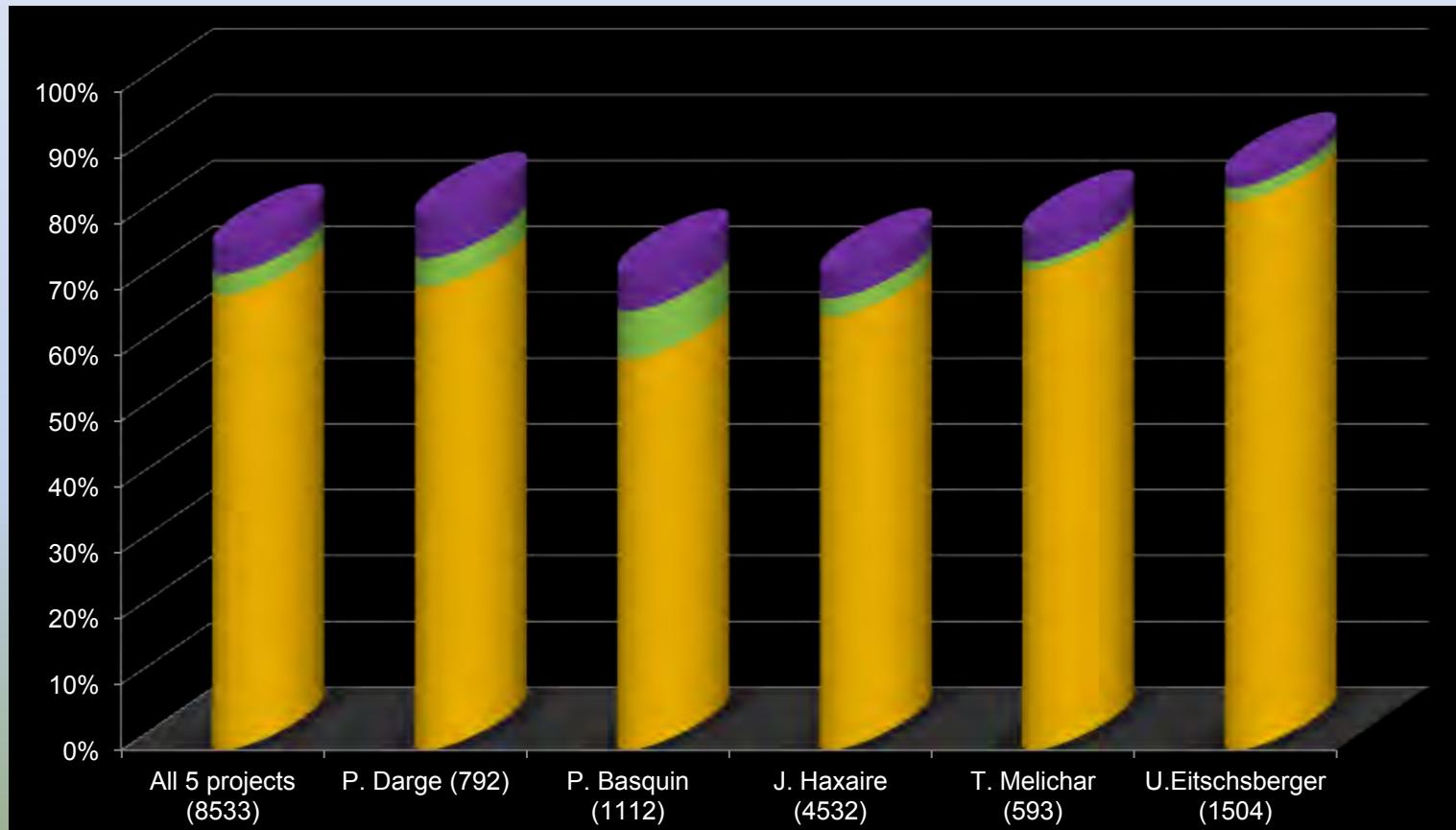


Druhý pokus – kontrolní pro vyloučení chyb



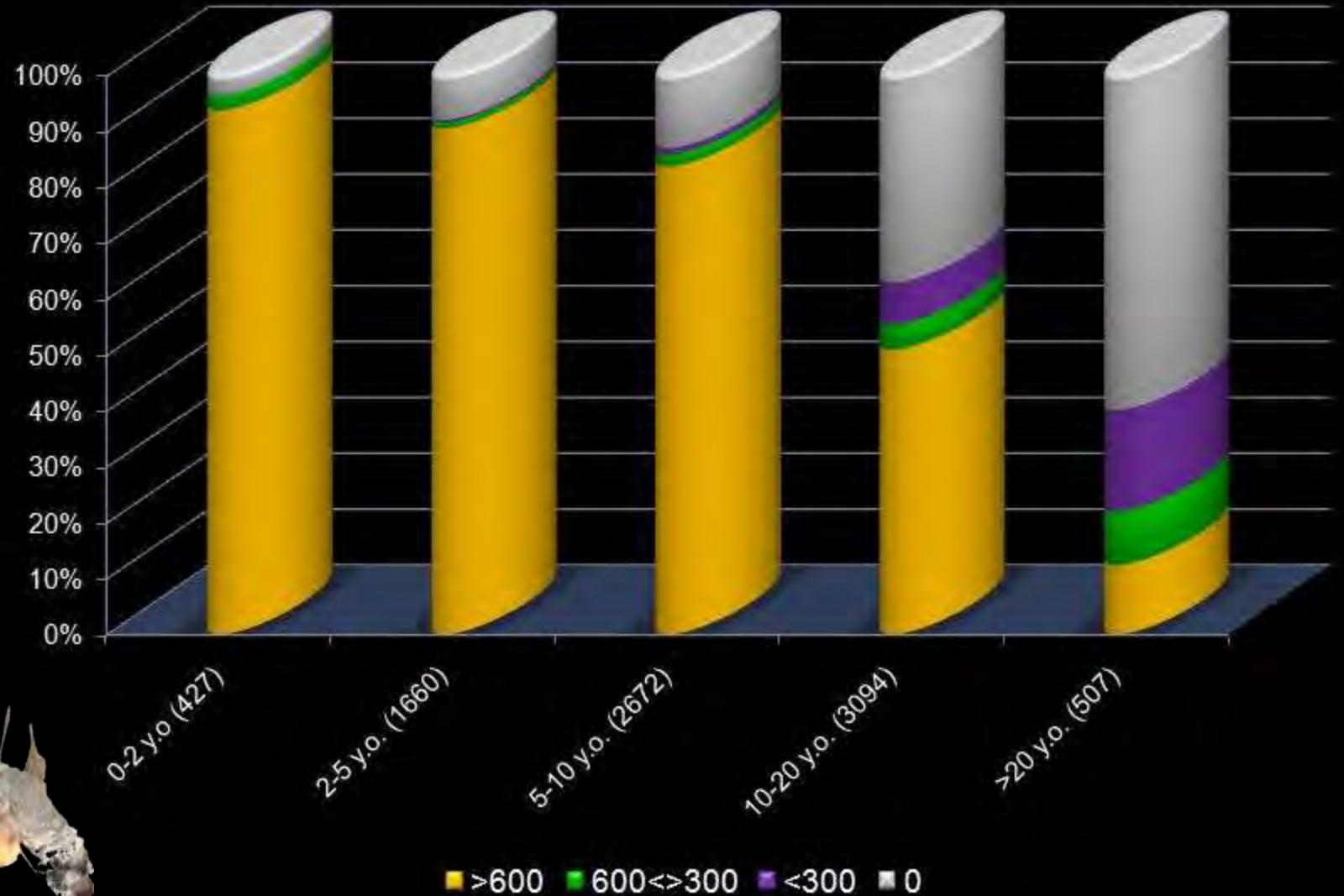
Projekt „Lepidoptera“ – Protokol CCDB

Úspěšnost vytváření sekvencí (čeleď Lišajovití)



Projekt „Lepidoptera“ – Protokol CCDB

Úspěšnost vytváření sekvencí a stáří vzorků



Celkem projektových aktivit: Čeleď „Lišajovití“



Sphingidae Summary

Number of Species: 1288

Lineage : Arthropoda; Insecta; Lepidoptera;

Specimen Records : 23,015

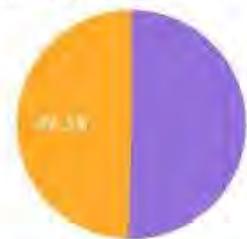
Specimens with Barcodes : 16,976

Public Sequences : 2,174 (Download)

[List of Species Barcoded](#) ([Download](#))

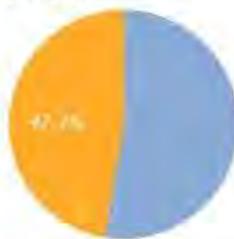


Barcodes :



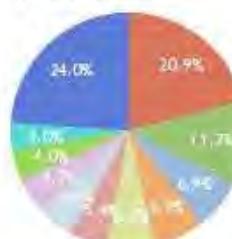
Total Barcodes: 16976
Ref. Barcodes: 8397

Species :



Species Barcoded: 1757
Species with Ref. Barcodes: 830

Deposited in :



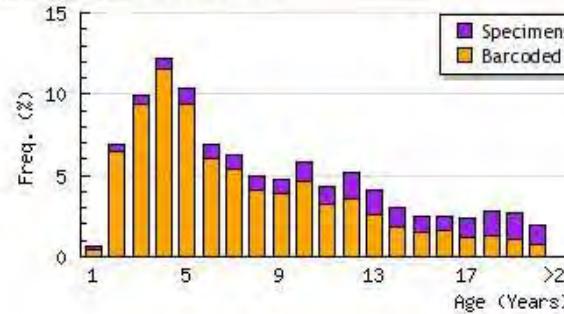
Research Collection of Jean Haxaire [4802]
University of Pennsylvania [2685]
Area de Conservacion Guanacaste [1589]
Entomologisches Museum Eitschberger Marktleuthen [1583]
Biodiversity Institute of Ontario [1546]
Research Collection of Ron Brechlin [1241]
Research Collection of Tomas Melichar [1131]
Research Collection of Patrick Basquin [1091]
Research Collection of D. H. Janzen & W. Hallwachs [923]
Research Collection of Philippe Darge [910]
62. Others [5515]

*Reference barcodes are a validated subset of the full database containing only those species represented by three or more individuals showing less than 2% sequence divergence.



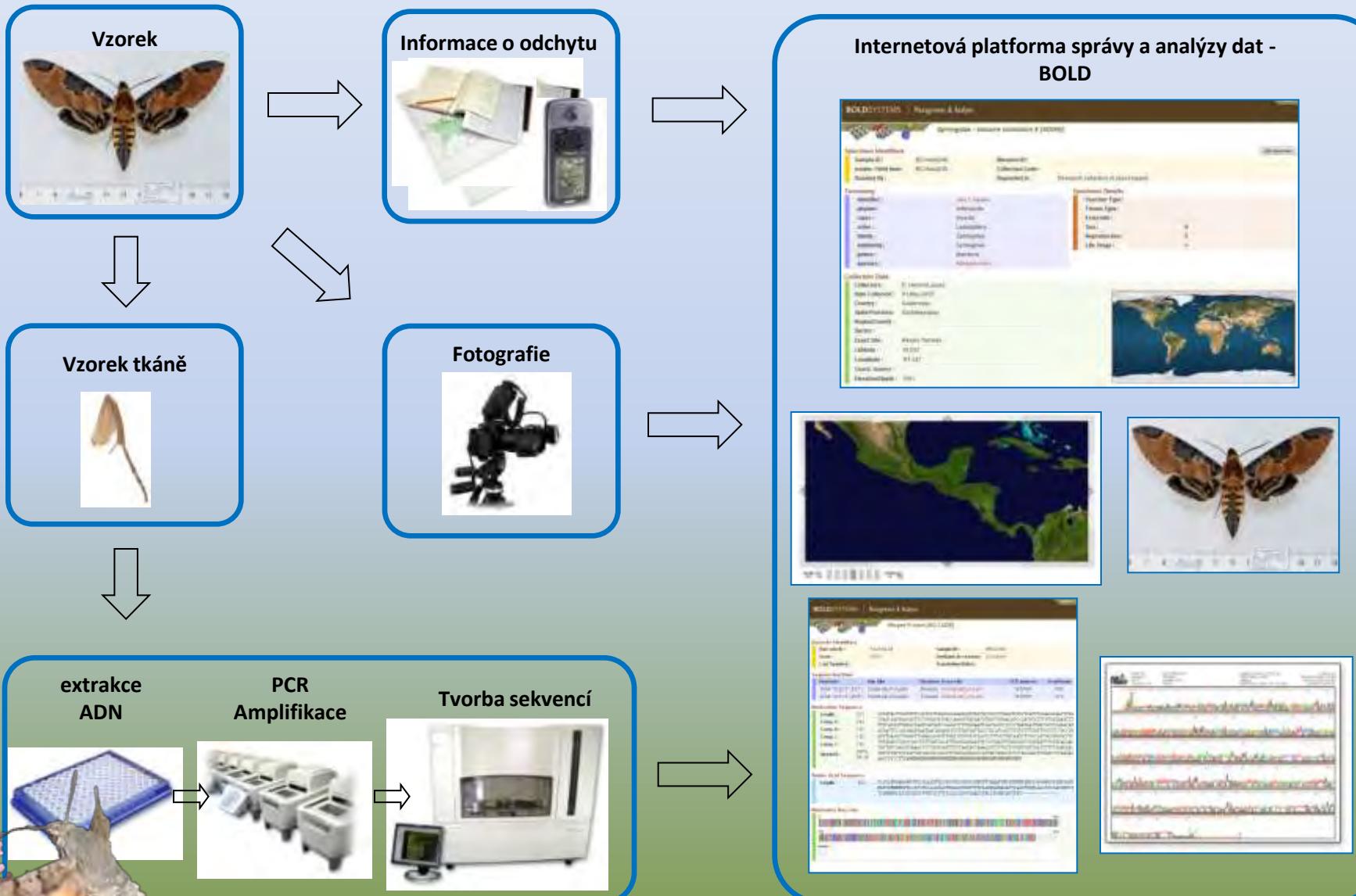
Collected in the following 143 countries :

Specimen Age Distribution



Projekt „Lepidoptera“

Protokol vzorkování



BOLD – Bioinformatický internetový portál

BARCODE OF LIFE DATA SYSTEMS
Advancing species identification and discovery through the analysis of short, standardized gene regions.

[SEARCH](#) [About BOLD](#) [Contact Us](#)

[Published Projects](#) | [Taxonomy](#)

The Barcode of Life Data System analysis, and use of DNA barcode addresses the needs of various users.

MANAGEMENT

BOLD-MAS provides a reporting system for records coupled with analysis as an online workbench for the community.

IDENTIFICATION

BOLD-ID5 provides a species identification tool that accepts DNA sequence data from a specific region and returns a taxonomic classification at the species level when possible.

EXTERNAL COLLABORATION

BOLD-ECS provides web-based tools for bioinformaticians and the able workflows that can be integrated into their analytical framework. We welcome the addition of analytical modules.

<input type="checkbox"/> SPTOL	Sphingidae - LTOL collection	295	302	199	194	
<input type="checkbox"/> PMSKN	Sphingidae of Kenya and Nigeria	291	293	59	59	
<input type="checkbox"/> HCKN	Sphingidae of Kenya & Virgin Islands	0	3	1	0	
<input type="checkbox"/> HCPN	Sphingidae of Papua New Guinea	143	153	30	29	
<input type="checkbox"/> SPHOW	Sphingidae - Research collection of Jean Haxaire	3010	4435	1109	901	
<input type="checkbox"/> SOWA	Sphingidae - Haxaire collection 1		738	952	263	230
<input type="checkbox"/> SOWB	Sphingidae - Haxaire collection 2		721	983	216	202
<input type="checkbox"/> SOWC	Sphingidae - Haxaire collection 3		585	890	229	190
<input type="checkbox"/> SOWD	Sphingidae - Haxaire collection 4		559	987	336	223
<input type="checkbox"/> SOWE	Sphingidae - Haxaire collection 5		385	601	161	130
<input type="checkbox"/> SHCHA	Sphingidae - Haxaire collection HUB access		22	22	6	6
<input type="checkbox"/> SPPAN	Sphingidae - Research collection of P. Annoyer	48	90	52	33	
<input type="checkbox"/> SPHPA	Sphingidae - Annoyer collection		46	88	50	31
<input type="checkbox"/> ANNSP	Sphingidae - Annoyer collection HUB access		2	2	2	2
<input type="checkbox"/> SPHPD	Sphingidae - Research collection of Philippe Darge	439	596	219	143	
<input type="checkbox"/> SPPDA	Sphingidae - Darge collection 1		439	596	219	143
<input type="checkbox"/> SPDHA	Sphingidae - Darge collection HUB access		0	0	0	0
<input type="checkbox"/> SPHTV	Sphingidae - Research collection of Thierry Vaglia	324	752	245	138	
<input type="checkbox"/> SPTVA	Sphingidae - Vaglia collection 1		324	752	245	138



BOLD – Bioinformatický internetový portál

The screenshot shows the BOLD Systems Management & Analysis interface for the "Earthworms of Normandie (France) [EWNOR]" project. The interface is divided into several sections:

- Project Data Views:** Includes links to "View All Resources" and "Search & Filter".
- Project Options:** Includes "LMU Project", "My Project Properties", and "Report Prints".
- EWNOR Project:** Shows "Submit to GigaBlast", "Project Summary: Specimens, Locations, and Genbank", and "Primary Marker: COI 5'".
- Data Report:** Displays specimen records (436), lacking gene reference (0), lacking photographs (0), lacking traces (34), seqs with stop codons (0), and contaminated seqs (0).
- Project Details:** Includes "Resources", "Data Summaries", "Specimen Lists", and "Trace File".
- Geographic Distribution:** A pie chart showing specimen progress by location.
- Sequence Length Distribution:** A histogram showing the frequency of sequence lengths.
- Project Growth - Specimens:** A bar chart showing the number of specimens sequenced over time.
- Project Growth - Species:** A bar chart showing the number of species sequenced over time.
- Contributors:** A list of users and their contact information, including Rodolphe Rougerie, René Richard, David Perez, Agata Pawlowska, and Thibaud Decaens.
- Footer:** Includes links to "Barcode of Life Data System", "Barcode of Life in India", and "Barcode of marine life in Indonesia".

A large black arrow points to the "EWNOR" project link in the sidebar.

BOLD – Bioinformatický internetový portál

BOLDSYSTEMS | Management & Analysis

Earthworms of Normandie (France) [EWNOR]

Project Data Select ▾ **Specimens & Taxa** 376 / 436

Identification	Specimen Page	Sequence Page	Residues [Ambig]	Contains	Extra Info	Set	
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0297	EWNOR396-08	656 [0n]				PrPa
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0187	EWNOR186-08	0				PrCot
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0188	EWNOR185-08	602 [0n]				PrCot
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0185	EWNOR184-08	620 [0n]				PrCot
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0188	EWNOR184-08	655 [0n]				PrCot
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0164	EWNOR163-08	658 [0n]				PrCot
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0163	EWNOR162-08	644 [1n]				PrCot
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0152	EWNOR151-08	589 [0n]				PrPa
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0151	EWNOR150-08	652 [0n]				PrPa
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0150	EWNOR149-08	655 [0n]				PrPa
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0137	EWNOR136-08	655 [0n]				PrPa
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0136	EWNOR135-08	655 [0n]				PrPa
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0088	EWNOR088-07	658 [0n]				FeCot
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0243	EWNOR342-08	648 [0n]				PrCot
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0342	EWNOR341-08	648 [0n]				PrCot
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0341	EWNOR340-08	648 [0n]				PrCot
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0331	EWNOR330-08	648 [0n]				PrCot
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0230	EWNOR329-08	648 [0n]				PrCot
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0229	EWNOR320-08	648 [0n]				PrCot
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0218	EWNOR315-08	648 [0n]				PrCot
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0215	EWNOR314-08	648 [0n]				PrCot
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<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0200	EWNOR299-08	648 [0n]				PrVal
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0287	EWNOR285-08	582 [0n]				PrVal
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0286	EWNOR285-08	199 [0n]				PrVal
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0273	EWNOR272-08	649 [0n]				PrVal
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0272	EWNOR271-08	654 [0n]				PrVal
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0236	EWNOR235-08	655 [0n]				FePa
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0235	EWNOR234-08	656 [0n]				FePa
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0234	EWNOR233-08	620 [0n]				FePa
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0087	EWNOR087-07	658 [0n]				FeCot
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0288	EWNOR286-07	658 [0n]				FeCot
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0085	EWNOR085-07	658 [0n]				FeCot
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0084	EWNOR084-07	658 [0n]				FeCot
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0083	EWNOR083-07	658 [0n]				FeCot
<input type="checkbox"/> <i>Alobophora chlorotica</i>	EW-ECO-0080	EWNOR082-07	658 [0n]				FeCot

Options
List All Projects
Back to Project Console
Move Records to another Project
Summary- Specimens, Localities, and Identifiers

Downloads
Sequences
Data Spreadsheet
Specimen Labels
Trace Files

Sequence Analytics
Taxon ID Tree
Distance Summary
Sequence Composition
Nearest Neighbor Summary
Specimen Age vs Seq Length

Identifications

Distribution Analytics
Distribution Map
Image Library



BOLD – Bioinformatický internetový portál

The image displays a screenshot of the BOLD Systems Management & Analysis interface. On the left, a sidebar shows 'Specimen Identifiers' with Sample ID EW-ECO-0314 and Isolate / Field Num. EW-ECO-0314. Below this are sections for 'Taxonomy' (Phylum: Annelida, Class: Clitellata, Order: Haplotaxida, Family: Lumbricidae, Genus: Allolobophora, Species: *Allolobophora caliginosa*) and 'Collection Data' (Collector: B. Richard, Date Collected: 17-Mar-2008, Country: France, State/Province: Seine Maritime, Region/County: Seine Maritime, Sector: Hors-sol, Exact Site: Hors-sol, calcaire, Latitude: 49.484, Longitude: 0.931, Coord. Source: Elevation Depth:). A 'Photographs' section shows a hawkmoth specimen with its wings spread, placed on a ruler for scale. In the center, a map of Normandy, France, is displayed with a red location pin. A small inset map shows the location of Normandy relative to the world map.

BOLDSYSTEMS | Management & Analysis

Earthworms of Normandy

Specimen Identifiers

Sample ID : EW-ECO-0314
Isolate / Field Num. : EW-ECO-0314

Donated By :

Taxonomy

Identifier: *Allolobophora caliginosa*

phylum: Annelida
class: Clitellata
order: Haplotaxida
family: Lumbricidae
genus: Allolobophora
species: *Allolobophora caliginosa*

Collection Data

Collectors : B. Richard
Date Collected : 17-Mar-2008
Country : France
State/Province : Seine Maritime
Region/County : Seine Maritime
Sector :
Exact Site : Hors-sol, calcaire
Latitude : 49.484
Longitude : 0.931
Coord. Source :
Elevation Depth :

Photographs

Earthworms of Normandy (France) [EWIVOR]

Specimen Identifiers

Sample ID : EW-ECO-0314
Isolate / Field Num. : EW-ECO-0314

Catalog Number :
Collection Code :
Voucherized at : 622

Photographs

A photograph of a hawkmoth specimen with its wings spread wide, revealing intricate patterns. The specimen is placed on a ruler for scale, with markings visible from 6 to 18 cm. The background is a plain, light-colored surface.

BOLD – Bioinformatický internetový portál

 Lumbricidae	EW-ECO-0252	EWNOR251-08	657 [0n]	  	FoPla
 Lumbricidae	EW-ECO-0251	EWNOR250-08	658 [0n]	  	FoPla
 Lumbricidae	EW-ECO-0249	EWNOR248-08	658 [0n]	  	FoPla
 Lumbricidae	EW-ECO-0245	EWNOR244-08	658 [0n]	  	FoPla
 Lumbricidae	EW-ECO-0244	EWNOR243-08	649 [0n]	  	FoPla
 Lumbricidae	EW-ECO-0243	EWNOR242-08	658 [0n]	  	FoPla
 Lumbricidae	EW-ECO-0242	EWNOR241-08	658 [0n]	  	FoPla
 Lumbricidae	EW-ECO-0229	EWNOR228-08	658 [0n]	  	FoPla
 Lumbricidae	EW-ECO-0057	EWNOR057-07	658 [0n]	  	PrPla
 Lumbricidae	EW-ECO-0056	EWNORD056-07	0	  	PrPla
 Lumbricidae	EW-ECO-0055	EWNOR055-07	658 [0n]	  	PrPla



BOLD – Bioinformatický internetový portál

BOLDSYSTEMS Management & Analysis

Barcode Identifiers

Barcode ID: EW NOR242-08
Gene: COX1
Last Updated: 2008-05-02

Sequencing Runs

Run Date	Direction	Trace File
2008-04-18 01:14:33	Reverse	EW NOR242-08_R.fsa
2008-04-17 09:27:44	Forward	EW NOR242-08_F.fsa

Nucleotide Sequence

Residues:	Sequence
658	AACCTTATATTCTTCCTGGGTC AAGACAGCCCGUGAGGCTTCTTGGC TTCTCTCTTAACTTACGCTATTTC CATAGCTTCCCACGCCCTAAATAAT CCTGTAGAAAAGGACTGGACAC TTCAGTAGCTTGCAATTCTCC GACCTTAATTTATACGATGAGAA GTTGTTTACTCTTAACTCTCTA TACTICATTTTGACCCCGCTGGAA

Amino Acid Sequence

Residues:	Sequence
218	XILYFILQVWAGHVAGKNSILLTRIEEQPQHAYLSDQDQI DIAFFPLIQRGIFNLLPPSLILLVSSAAVERGAGIQTWYTF TIVIIRRQHSQSLRERIPLPVAVVITVVLLLSPIPVLAGAA

Illustrative Barcode

Report From LIMS

Report Available

BOLDSYSTEMS Management & Analysis

Earthworms of Normandie (France) [EW NOR]

W-ECO-0243 [EW NOR242-08]

Sequencing Run

Date: 2008-04-18 PCR primers: LC01490_H1-HC02198_11
File: EW NOR242-08_R.fsa Seq Primer: M13R
Status: high qual Direction: Reverse

Quality Scores

Mean:	51.4914
Var:	68218.5
SdDev:	297.016
SdErr:	11.2422

Sequencing Run

Date: 2008-04-18 File: EW NOR242-08_R.fsa Status: high qual

Specimen Identification Request

Search Request:
Type: ECOPIA DATABASE

Search Result:
A species level match could not be made, the queried specimen is likely to be one of the following:

- Apertochiles caliginosus
- Lumbriculus
- Apertochiles sp.
- Ornithodoros sp.
- Apertochiles paucisetosus
- Apertochiles transversalis

Distance Summary

Distance scores of the top 100 matches

Display options:	default										
Phylum:	Chelata	Order:	Reptilia	Family:	Lumbricidae	Genus:	Apertochiles	Species:	caliginosus	Specimen Similarity (%)	100
Chelata	Chelata	Reptilia	Reptilia	Lumbricidae	Apertochiles	caliginosus	caliginosus	caliginosus	caliginosus	Specimen Similarity (%)	100
Arthropoda	Chelata	Reptilia	Reptilia	Lumbricidae	Apertochiles	caliginosus	caliginosus	caliginosus	caliginosus	Specimen Similarity (%)	100

BOLDSYSTEMS Management & Analysis

Earthworms of Normandie (France) [EW NOR]

W-ECO-0243 [EW NOR242-08]

Sequencing Run

Date: 2008-04-18 PCR primers: LC01490_H1-HC02198_11
File: EW NOR242-08_R.fsa Seq Primer: M13R
Status: high qual Direction: Reverse

Quality Scores

Mean:	51.4914
Var:	68218.5
SdDev:	297.016
SdErr:	11.2422

Sequencing Run

Date: 2008-04-18 File: EW NOR242-08_R.fsa Status: high qual

Specimen Identification Request

Search Request:
Type: ECOPIA DATABASE

Search Result:
A species level match could not be made, the queried specimen is likely to be one of the following:

- Apertochiles caliginosus
- Lumbriculus
- Apertochiles sp.
- Ornithodoros sp.
- Apertochiles paucisetosus
- Apertochiles transversalis

Distance Summary

Distance scores of the top 100 matches

Display options:	default										
Phylum:	Chelata	Order:	Reptilia	Family:	Lumbricidae	Genus:	Apertochiles	Species:	caliginosus	Specimen Similarity (%)	100
Chelata	Chelata	Reptilia	Reptilia	Lumbricidae	Apertochiles	caliginosus	caliginosus	caliginosus	caliginosus	Specimen Similarity (%)	100
Arthropoda	Chelata	Reptilia	Reptilia	Lumbricidae	Apertochiles	caliginosus	caliginosus	caliginosus	caliginosus	Specimen Similarity (%)	100

BOLD – Bioinformatický internetový portál

BOLDSYSTEMS Management & Analysis

Earthworms of Normandie (France) [EWNOR]

Options
List All Projects
Back to Project Console
Move Records to another Project
Summary- Specimens, Localities, and Identifiers

Data Analysis
Sequences
Data Spreadsheet
Specimen Labels
Trace File

Sequence Analysis
Taxon ID Tree
Distance Summary
Sequence Composition
Nearest Neighbor Summary
Specimen Age vs. Seq Length

Identification

Specimen Administration
Distribution Map
Image Library

Pages

1 2 3 4 5

Apply Filters: Sequence Length > 200 bp
 Only sequences with < 1% ambiguous bases

Colorize Tree Based on: None
 Build Tree

EW-ECD-0272
EW-ECD-0238
EW-ECD-0235
EW-ECD-0234
EW-ECD-0087
EW-ECD-0086
EW-ECD-0085
EW-ECD-0054
EW-ECD-0053
EW-ECD-0052
EW-ECD-0051

EWNDR083-07 658 [0n]
EWNDR083-07 658 [0n]





Projekt - Lišajové

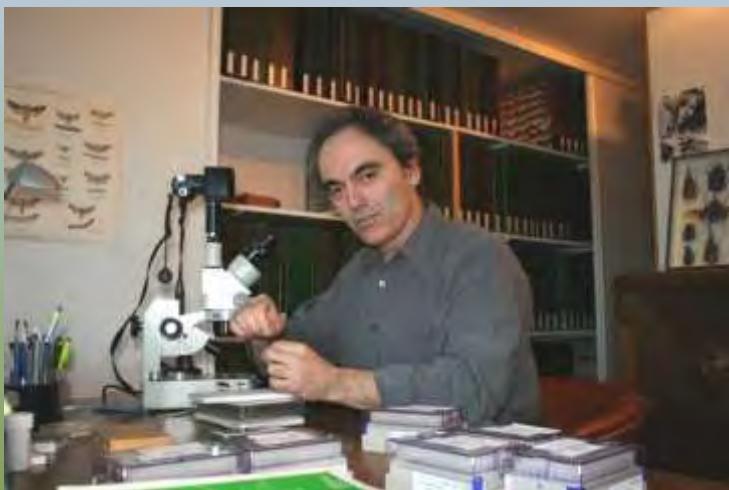


Globální druhová rozmanitost je podmíněna:

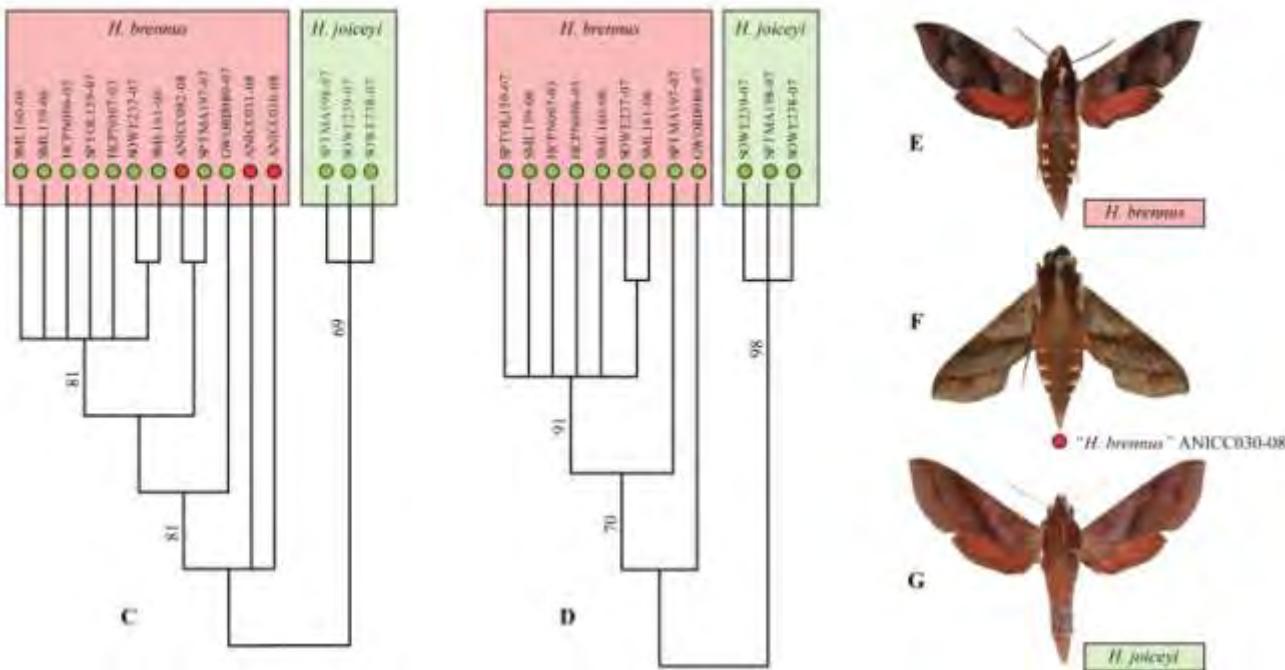
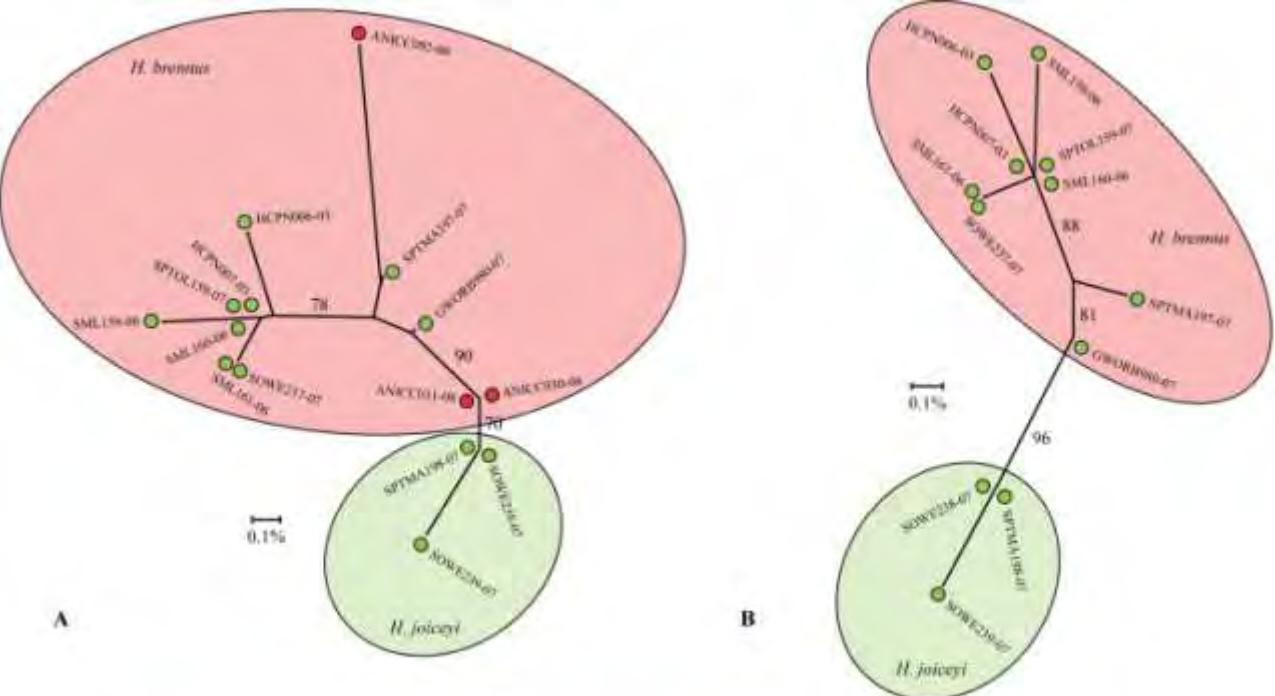
- (+) Kryptickou diverzitou.
- (+) Přehodnocením synonymů.
- (-) Synonymy.

Projekt: čeled' martináčovití a lišajovití

Původ vzorků a taxonomických expertiz



zobrazení



Xylophanes

skupiny *Neoptolemus*

Druhý případ: blízký druh, morfologicky podobný

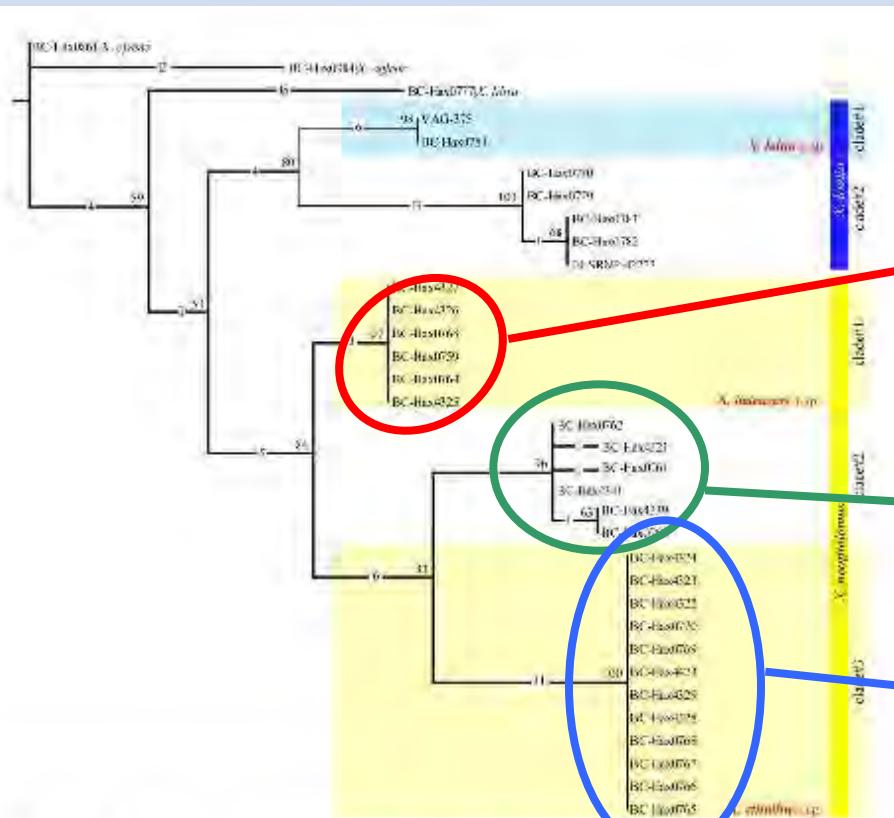
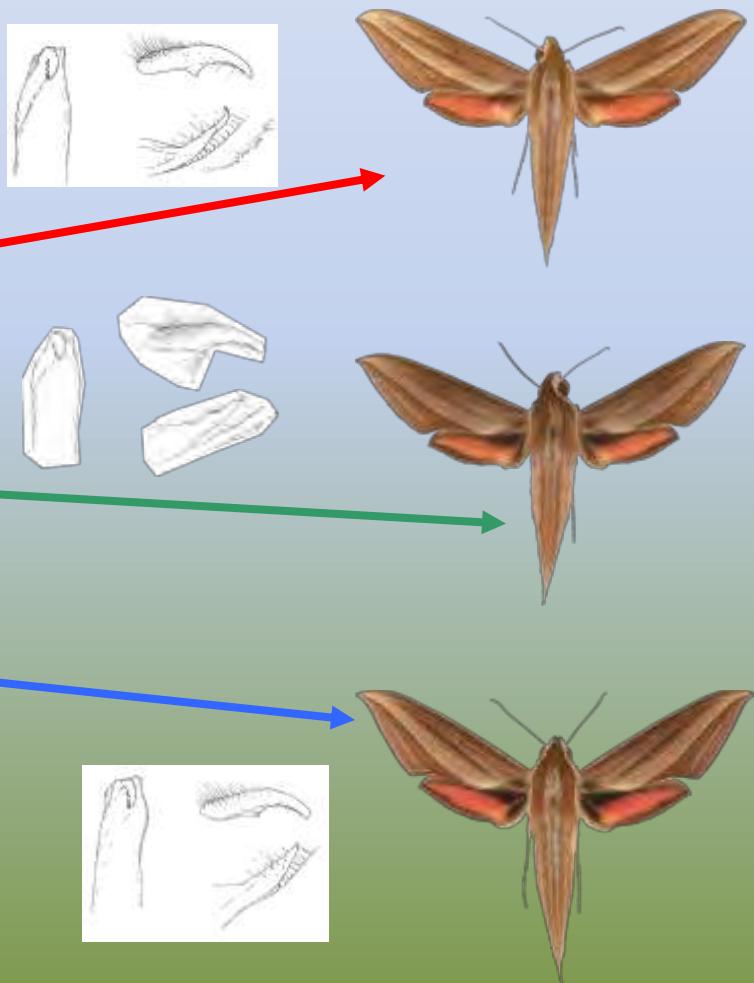


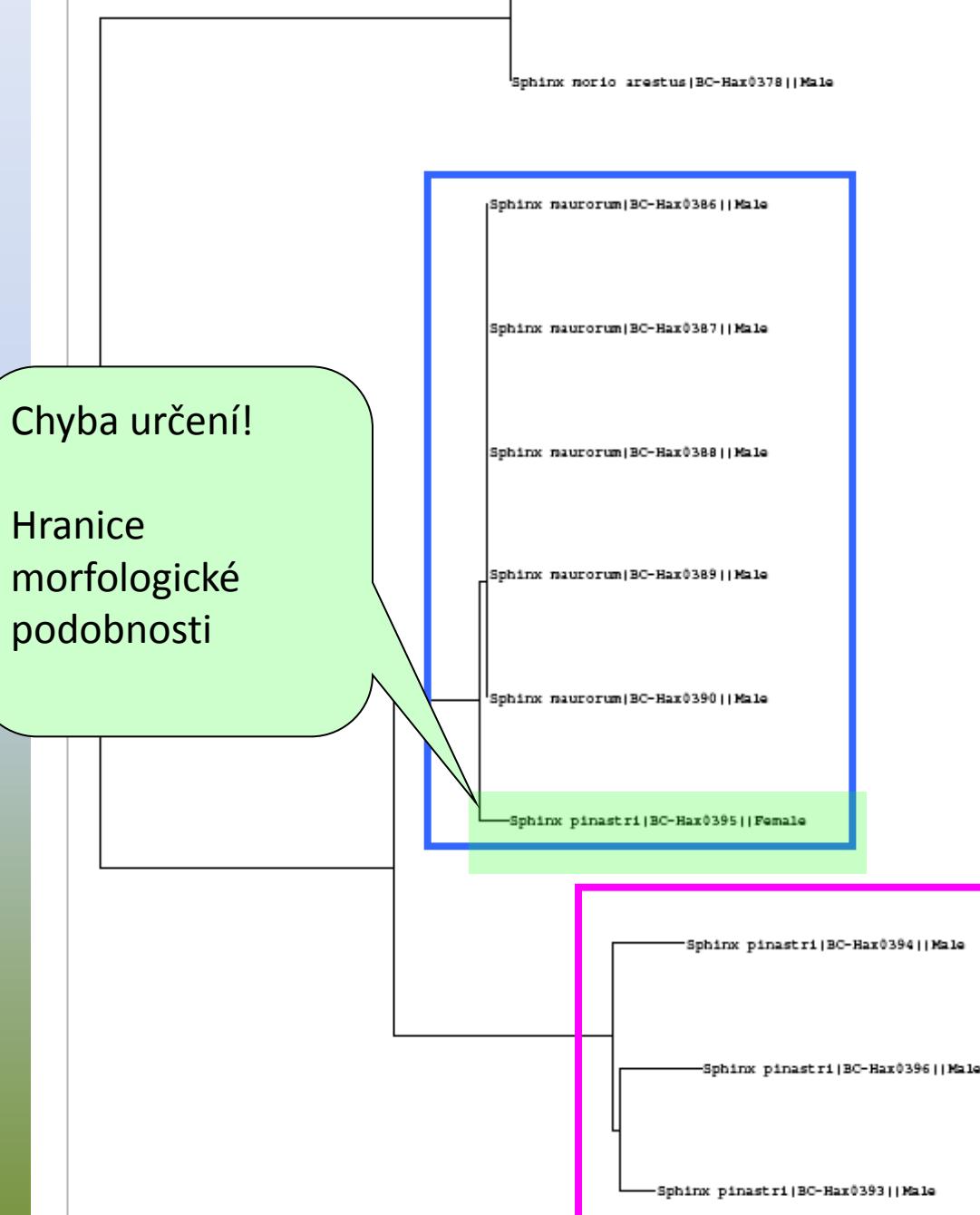
Fig. 34. Single most parsimonious tree ($L=132$, $CI=0.78$, $RI=0.93$) obtained after analysis of the 34 full-length barcodes, each terminal being identified by its sampleID code (see table 1). The number of inferred unambiguous substitutions is indicated on each branch, and the bootstrap support is given at each node.



V případě liší je borovicového

Chyba určení!

Hranice
morfologické
podobnosti



Příčiny chyby



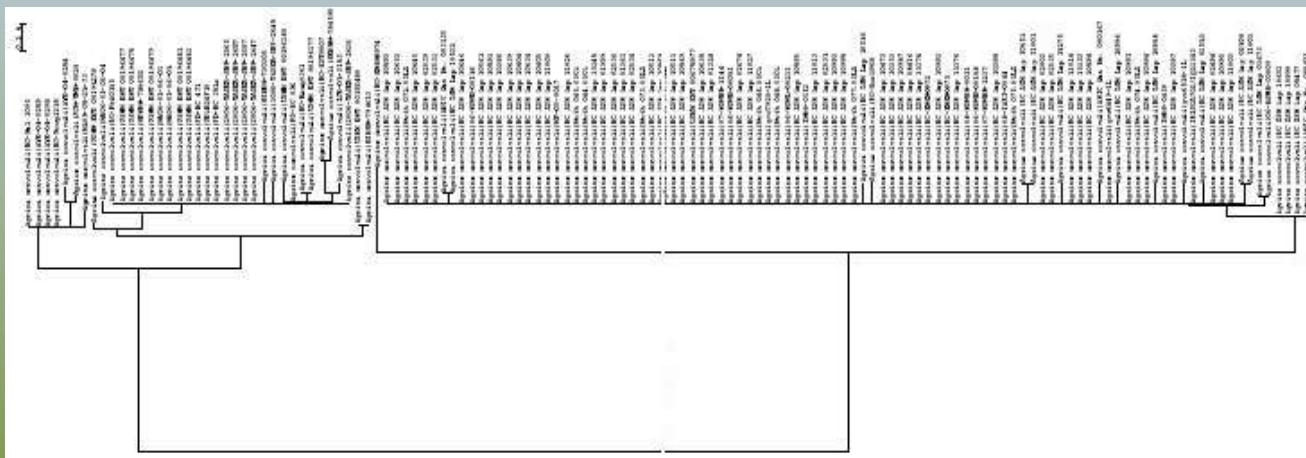
Stejný druh: *Sphinx maurorum*
Vnější vzhled housenek je odlišný

Čárkový kód ADN – za hranicemi taxonomie

- Přehodnocení endemity australských lišajů

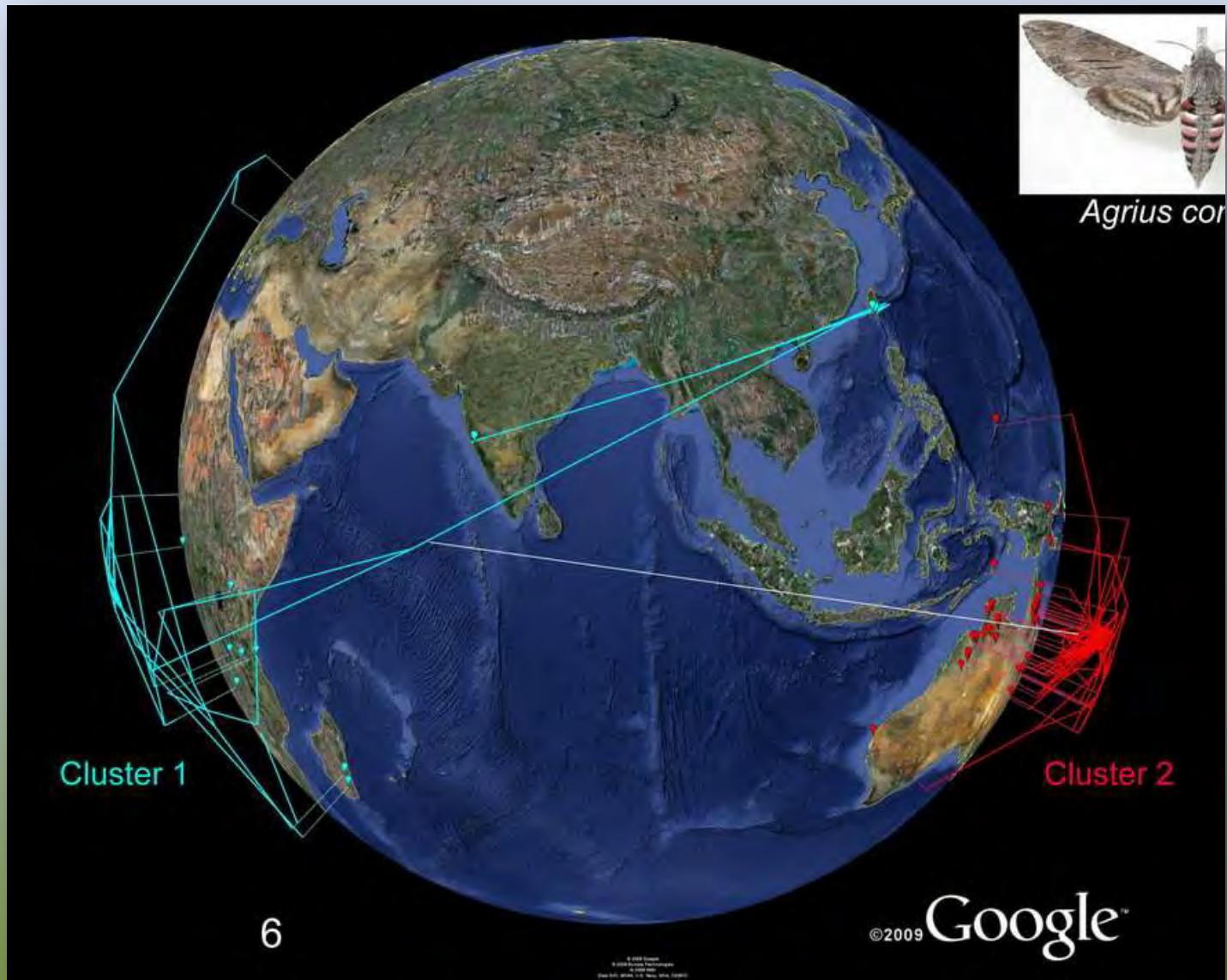


Agrius convolvuli



Čárkový kód ADN – za hranicemi taxonomie

- Přehodnocení endemity australských lišajů



Integrace typových exemplářů

Hajibabaei, M., A. Smith, et al. (2006). „I minimální čárkový kód může s konečnou platností identifikovat exemplář , jehož DNA je poškozený." Molecular Ecology Notes: 959-964.



Sphinx lugens Walker, 1856

> 150 roků



Integrace typových vzorků

Sphinx lugens souhrnně

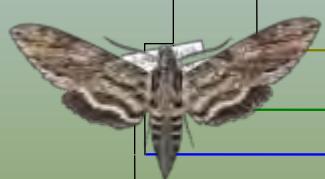


NHM, Londýn
Lectotyp

Sphinx lugens
> 150 roků – 120 bp

BC-Hax4126
BC-Hax2819
BC-Hax2822
BC-Hax2829
BC-Hax2824
BC-Hax2832
BC-Hax2817
BC-Hax2834
BC-Hax2823
BC-Hax2839
BC-Hax2827
BC-Hax2838
BC-Hax2816
BC-Hax2820
BC-Hax2828
BC-Hax2837
BC-Hax2830
BC-Hax2831
BC-Hax2825
BC-Hax2836
BC-Hax2842
BC-Hax2821
BC-Hax2818
BC-Hax2846
BC-Hax2847

Sphinx lugens



BC-Hax2843
VAG-048

Sphinx smithi

BC-Hax0338
BC-Hax0336
BC-Hax4231
BC-Hax2845
BC-Hax2844

Sphinx geminus

Sphinx n.sp.

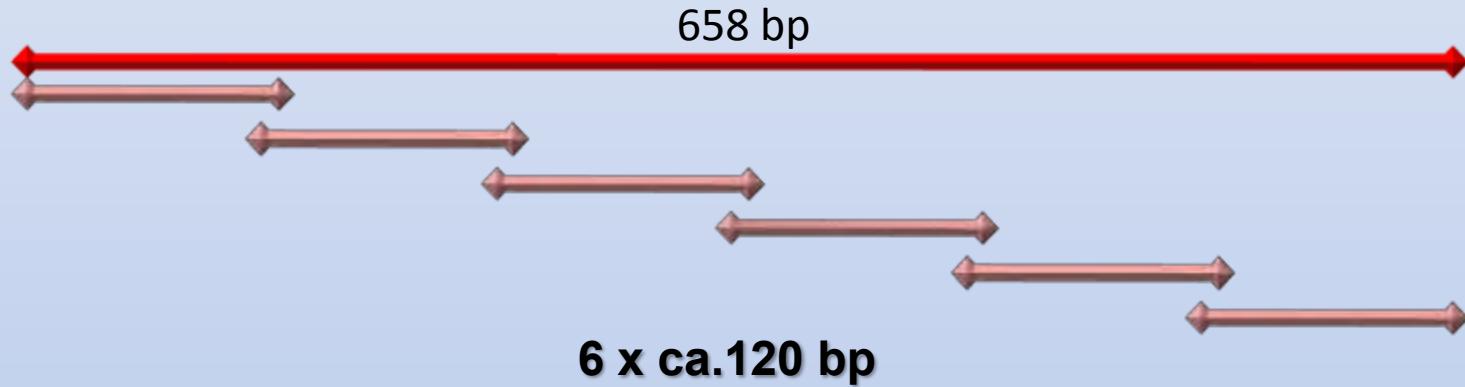
Sphinx bolleyi

0.5 %



Integrace typových vzorků

Nový protokol pro vytváření sekvencí starých typových exemplářů
(Rougerie et al., in prep)



Xylophanes virescens (Butler, 1875)



© The Natural History Museum, London - pic. #BNHED74128

Sphinx lugens Walker, 1856

>130 roků

>150 roků

Projekt „Lišajovití“

Gnathothlibus eras



Gnathothlibus collardi Haxaire, 2003



Philodila astyanor



SOWB351-06

SOWB350-06

SOWB352-06

● SOWB417-06

SOWB349-06

SOWB422-06

SOWB424-06

SOWB425-06

Philodila astyanor

Gnathothlibus collardi

Philodila astyanor

Gnathothlibus eras

0.5%



Čárkový kód ADN – za hranicemi taxonomie

MOLECULAR ECOLOGY

Molecular Ecology (2009) 18, 3458–3470

doi: 10.1111/j.1365-294X.2009.04290.x

Mitochondrial and microsatellite DNA markers reveal a Balkan origin for the highly invasive horse-chestnut leaf miner *Cameraria ohridella* (Lepidoptera, Gracillariidae)

R. VALADE,^{*} M. KENIS,[†] A. HERNANDEZ-LOPEZ,^{*} S. AUGUSTIN,^{*} N. MARI MENA,^{*} E. MAGNOUX,^{*} R. ROUGERIE,[‡] F. LAKATOS,[§] A. ROQUES^{*} and C. LOPEZ-VAAMOND^{*}
^{*}INRA, UMR6333 Zoologie Forestière, F-45075 Orléans, France, [†]CABi Europe-Suisse, 2900 Delémont, Switzerland, [‡]Canadian Centre for DNA Barcoding, Biodiversity Institute of Ontario, University of Guelph, 579 Gordon Street, Ontario, N1G 2W1 Canada, [§]University of West-Hungary, Institute of Forest- and Wood Protection, H-9400 Szeged/C, Hungary



3464 R. VALADE ET AL.



Fotografie flickR – felloff123 & Dave JG

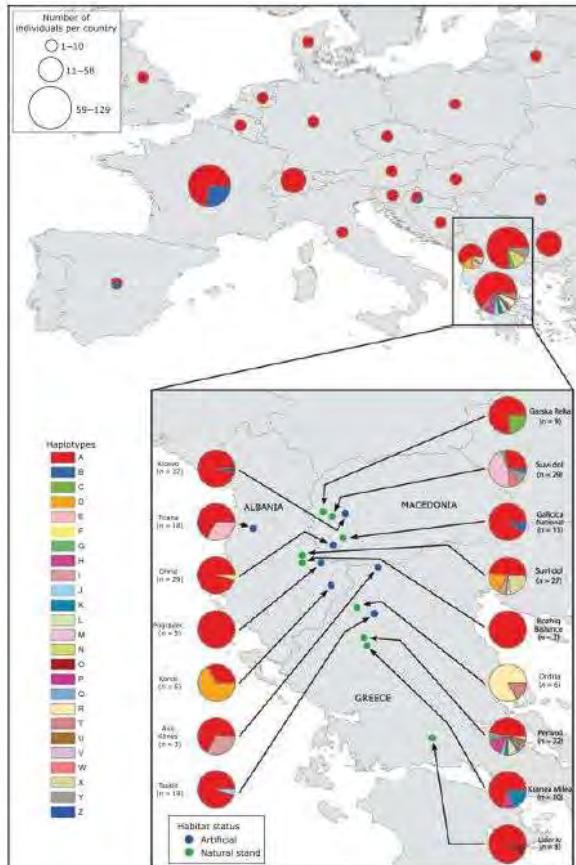
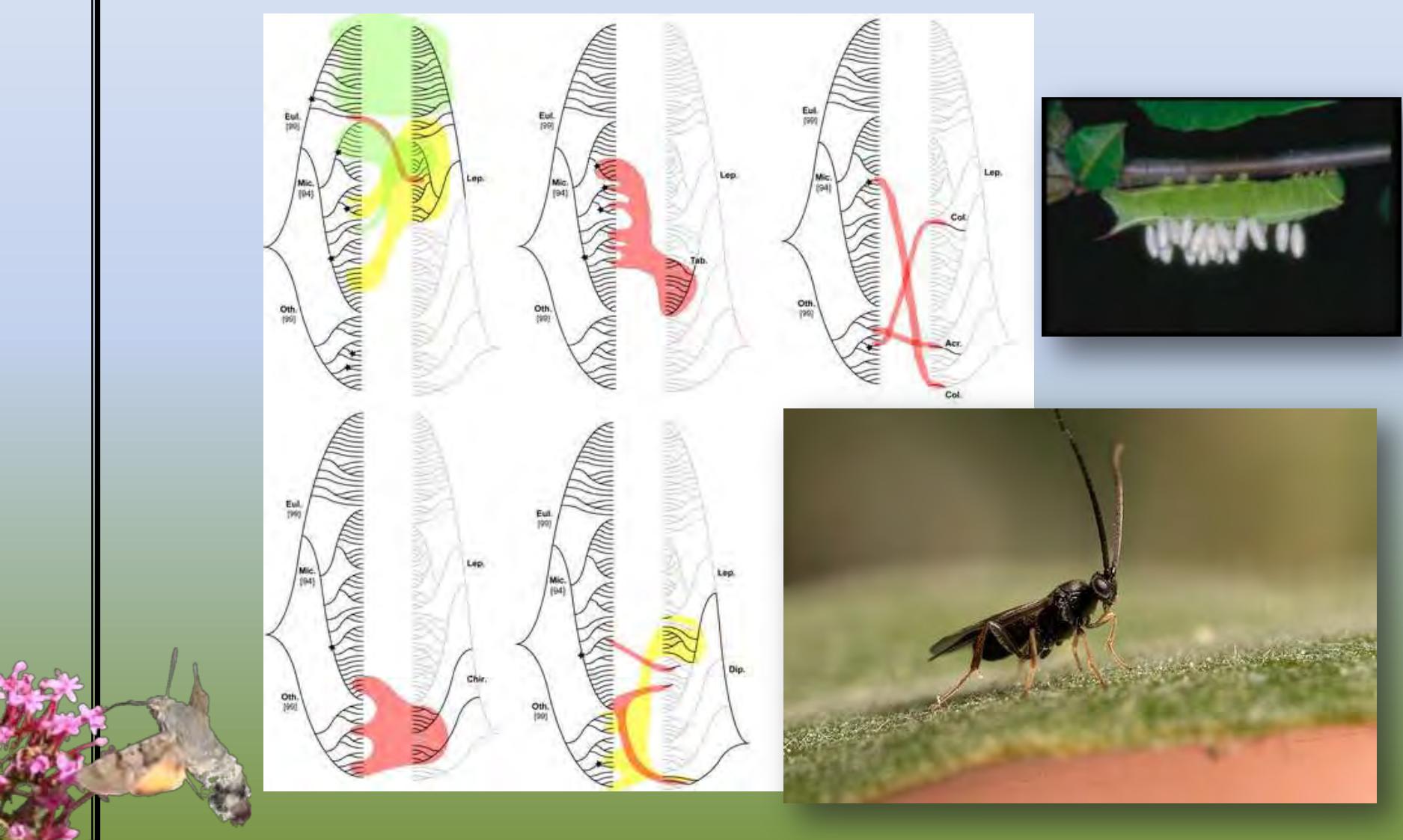


Fig. 2 Geographic distribution of the 25 haplotypes among the 22 sampled countries. Each pie chart represents a country and each haplotype is represented with a different colour. Number of individuals sampled per country is proportional to the size of each pie chart. For the southern Balkans, we illustrate the geographic distribution of the 25 haplotypes among 16 localities. Natural forests of *Aesculus hippocastanum* are represented by black circles and artificial habitats (i.e. planted trees in parks, gardens, along roads in urban or sub-urban areas) by blue circles. Number of individuals sampled per locality is indicated between parentheses.

Čárkový kód ADN – za hranicemi taxonomie

- Identifikace hostitele parazitických vos za použití molekulární analýzy obsahu trávicího aparátu (Rougerie et al., in prep)



Astraptes viracocha sp. nov.

Type locality. Costa Rica, Alajuela Prov. Area de Conservacion Guanacaste, Sector Cacao, Sendero Circular, 10.92714° N, 85.46683° W, 1185 m.

Diagnosis. The species may be differentiated from other members of the *Astraptes fulgerator* complex by the following unique character states of the DNA barcode: 379G; 389C; 391G.

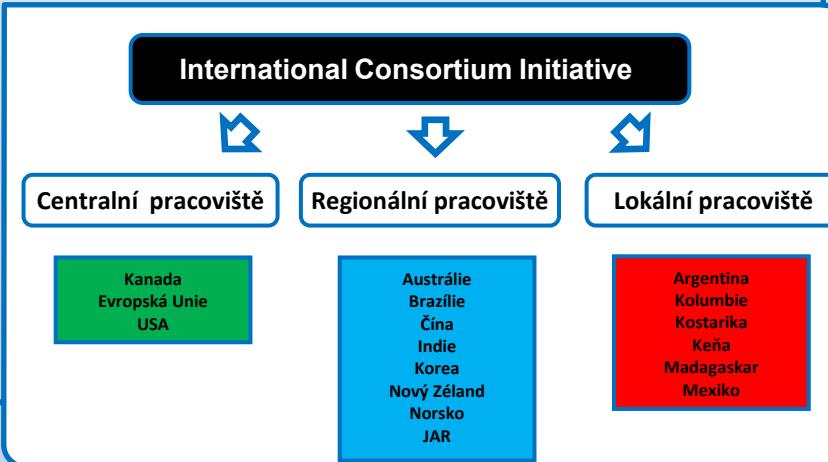
Holotype. Voucher 02-SRNP-24219, deposited at the University of Pennsylvania.

Note: This species corresponds to the OTU ‘LONCHO’ of Hebert *et al.* (2004).

Etymology. The name *viracocha*, a noun in apposition, is the name of a bearded white god of the Incas. The species is named for Dan Janzen.

iBOL – Mezinárodní čárkový kód projektu Barcode of Life

Zakládající členové



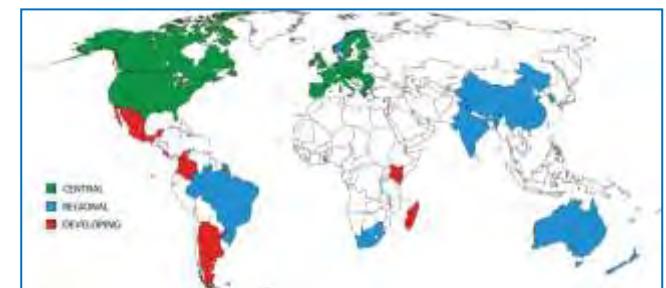
**5,000.000 vzorků
500.000 druhů
5 let činnosti**

10 pracovních skupin

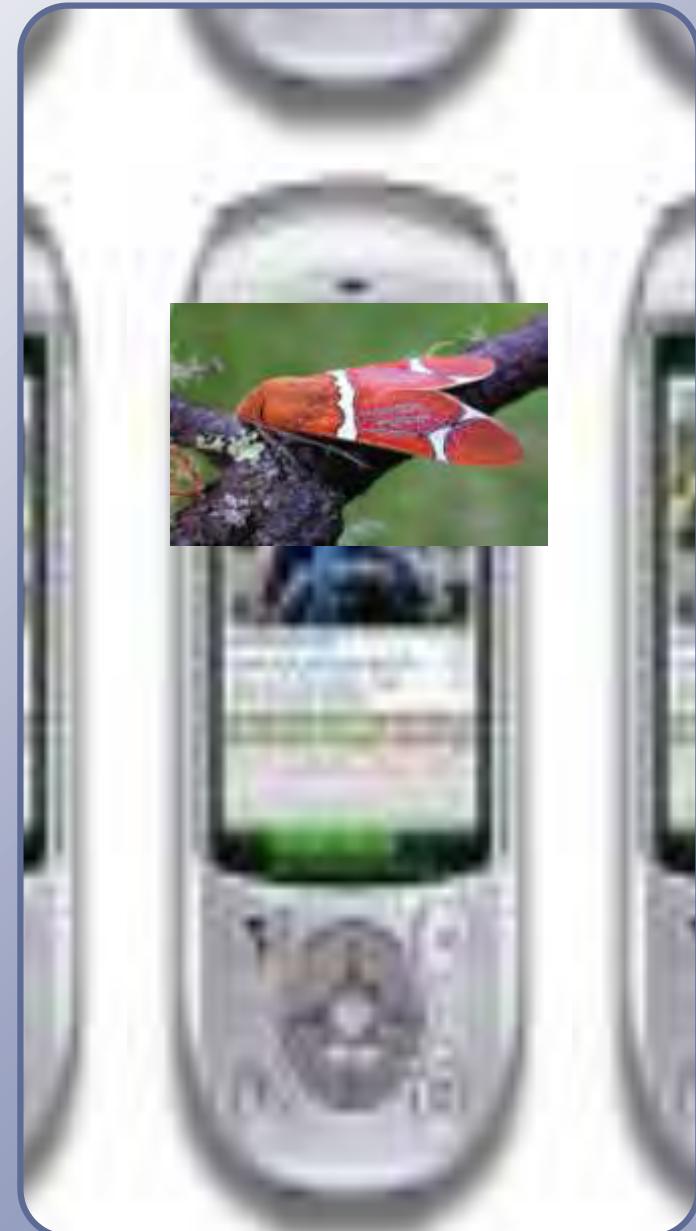
- WG1.1 – Obratlovci
- WG1.2 – Vyšší rostliny
- WG1.3 – Houby
- WG1.4 – Patogeny ohrožující homo sapiens
- WG1.5 – Škůdci a paraziti
- WG1.6 – Opylovači
- WG1.7 – Říční živočichové
- WG1.8 – Mořští živočichové
- WG1.9 – Suchozemští živočichové
- WG1.10 – Polární živočichové

Fondy celkem \$150 milionů

- Centrální pracoviště > \$25 milionů/pracoviště
- Regionální pracoviště > \$5 milionů/pracoviště
- Lokální pracoviště > \$1 milionů/pracoviště



Průvodce třetího tisíciletí problematikou Barcodeing DNA





Dr. Paul Hebert
Professor
Canada Research Chair, Tier 1
Director, Biodiversity Institute of Ontario



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Office: SCIE 2022H

Ext: 56668

Lab: SCIE 1403/1404

Ext: 58381



Kentrochrysalis heberti
Haxaire & Melichar 2010



Sujeevan Ratnasingham

Rodolphe Rougerie

Mehrdad Hajibabaei

Spolupracovníci

JAR: Allan Connell, John Joannou

Německo: Ron Brechlin, Gunnar Brehm, Ernst Brockmann, Ulf Eitschberger, Axel Hausmann, Anna Hundsorfer, Hauke Koch, Frank Meister, Wolfgang Nässig, Stefan Naumann, Matthias Nuss, Ulrich & Laela Paukstadt, Alexander Schintelmeister, Erik Van Schayck, Thomas Witt

Austrálie: Ted Edwards, Andrew Mitchell, Max Moulds, James Tuttle, Cathy young

Rakousko: Erwin Hauser, Franz Puhringer, Gerhard Tarmann,

Belgie: Thierry Bouyer, Jurate De Prins, Alain Drumont, Rene Lahousse, Eric Vingerhoedt

Brazílie: Mirna M. Casagrande, Olaf H.H. Mielke, Carlos G.C. Mielke

Burkina Faso: Jeremy Bouyer

Kanada: Jeremy deWaard, Jose Fernandez Triana, Mehrdad Hajibabaei, Daniel Handfield, Paul D.N. Hebert, Don Lafontaine, Jean-François Landry, Vazrick Nazari, Bill Oehlke, David Porco, Chris Schmidt, Justin Schonfeld, M. Alex Smith, Dirk Steinke, Thierry Vaglia, John Wilson, Evgeny Zakharov

Jižní Korea: Pierre Tripotin

Kostarika: Winnie Hallwach, Dan Janzen

Ukrajina: Konstantin Efetov,

Španělsko: Joaquin Baixeras, Roger Vila

Finsko: Pasi Sihvonen, Niklas Wahlberg

Francie: Philippe Annoyer, Jerome Barbut, Patrick Basquin, Philippe Darge, Thibaud Decaens, Louis Deharveng, Yves Estradel, Jean Haxaire, Daniel Herbin, Michel Laguerre, Luc Legal, Antoine Leveque, Carlos Lopez-Vaamonde, Joël Minet, Jacques Pierre, Angelo Santin, Paul Thiaucourt, Bernard Turlin, Romain Valade, Jean-Pierre Vesco, Benoit Vincent

Indie: Boregowda Manjunatha H.

Itálie: Luigi Racheli, Tommaso Racheli, Roberto Vinciguerra

Lucembursko: Steve Kohll

Madagaskar: Maminirina Randrianandrasana,

Mexiko: Julio C. Urueta

Nizozemsko: Cees Gielis, Erik van Nieukerken, Jaap Zwier

Peru: John Janovec

Česká republika: Tomas Melichar

Británie: Ian J. Kitching, David Lees, Geoff Martin

Rusko: Vadim Zolotuhin

Taiwan: Shen-Horn Yen

USA: Jeff Boettner, John W. Brown, Chris Conlan, Akito Kawahara, Scott Miller, Charlie & Kim Mitter, Ric Peigler, Jerry Regier, Kirby Wolfe, Jen Zaspel



Děkujeme za pozornost

