

Scanning Microscope Slides



EMEC45834 Cimex lectularius.jpg

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California Arthropod Diversity Online



Museum of Entomology Collections

Matches: 2050

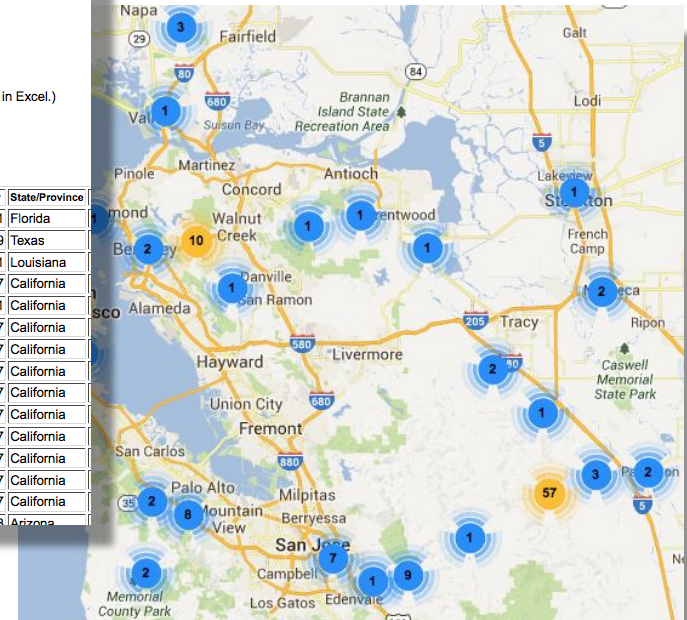
[View your results](#) (tab-delimited text file, max 2050 lines, file size = 1115.5 K)
 /Windows users: 1) Add a .txt extension to save file, or 2) tell your browser to open the file in Excel.)

[View georeferenced records on a map.](#)

SQL FROM eme WHERE ScientificName like "%Libellula%" ORDER BY Family,ScientificName

Click to see the full specimen record

Order	Family	Genus Species ssp	Collector	Year	State/Province
Odonata	Libellulidae	Libellula auripennis	Jerry A. Powell	1951	Florida
Odonata	Libellulidae	Libellula auripennis		1939	Texas
Odonata	Libellulidae	Libellula axilena	Jerry A. Powell	1951	Louisiana
Odonata	Libellulidae	Libellula comanche	John W. MacSwain	1947	California
Odonata	Libellulidae	Libellula comanche	John W. MacSwain & Ray F. Smith	1951	California
Odonata	Libellulidae	Libellula comanche	John W. MacSwain	1947	California
Odonata	Libellulidae	Libellula comanche	John W. MacSwain & William F. Barr	1947	California
Odonata	Libellulidae	Libellula comanche	John W. MacSwain & William F. Barr	1947	California
Odonata	Libellulidae	Libellula comanche	John W. MacSwain & William F. Barr	1947	California
Odonata	Libellulidae	Libellula comanche	John W. MacSwain	1947	California
Odonata	Libellulidae	Libellula comanche	John W. MacSwain & William F. Barr	1947	California
Odonata	Libellulidae	Libellula comanche	John M. Burns	1957	California
Odonata	Libellulidae	Libellula comanche	John M. Burns	1957	California
Odonata	Libellulidae	Libellula comanche	John M. Burns	1957	California
Odonata	Libellulidae	Libellula comanche	Catherine A. Toschi	1963	Arizona





CalBug

NSF - ADBC grant

Collaboration among the eight major entomology collections in California

Essig Museum of Entomology, UC Berkeley

California Academy of Sciences

California State Collection of Arthropods

Bohart Museum, UC Davis

Entomology Research Museum, UC Riverside

San Diego Natural History Museum

Santa Barbara Museum of Natural History

LA County Museum



CALIFORNIA
ACADEMY OF
SCIENCES



CALIFORNIA DEPARTMENT OF
FOOD AND AGRICULTURE

Why Image Labels?

- Magnify difficult to read labels
- Verbatim archive of label data
 - Essential for proofing data
 - Useful for taxonomists interested in label data
- Data capture can be done remotely
- Potential for Optical Character Recognition (OCR)



Digitization workflow

Legacy Specimens

(Optional)
Sort by locality,
date, sex, etc.

Remove labels, add
unique identifier

Take digital image,
name and save file

Replace labels,
return to collection

Handling & Imaging



Manually enter data
into MySQL database

Online crowd-sourcing
of manual data entry

Optical Character
Recognition (OCR) &
Automated data parsing

Data Capture



Error checking

Geographic
referencing

Aggregate data in
online cache

Temporospatial
analyses

Data Manipulation

Digital camera tethered to computer



Paracotalpa ursina

Slide Scanning



How to batch scan slides

Equipment

- ✓ Flat bed scanner
- ✓ Jig for arranging slides
- ✓ Unique ID labels

Software

- ✓ Scanner software
- ✓ Photoshop
- ✓ IrfanView

Process

1. Sort slides (optional)
2. Lay slides on scanner bed
3. Add unique ID labels
4. Scan slide set (at 400 DPI)
5. Open scan in Photoshop
6. Use an "Action" to
Divide scan -> individual slides
7. "Save for Web"
8. Rename with IrfanView

Equipment

- Any flatbed scanner will do
- Use software that comes with the scanner
- Create a jig (we use matting for framing)



Use the
Crop Tool

And

Slice Tool

To define the
individual
slides





Save the
- Crop
- Make Slice
- Divide Slice
Steps as an
"Action"

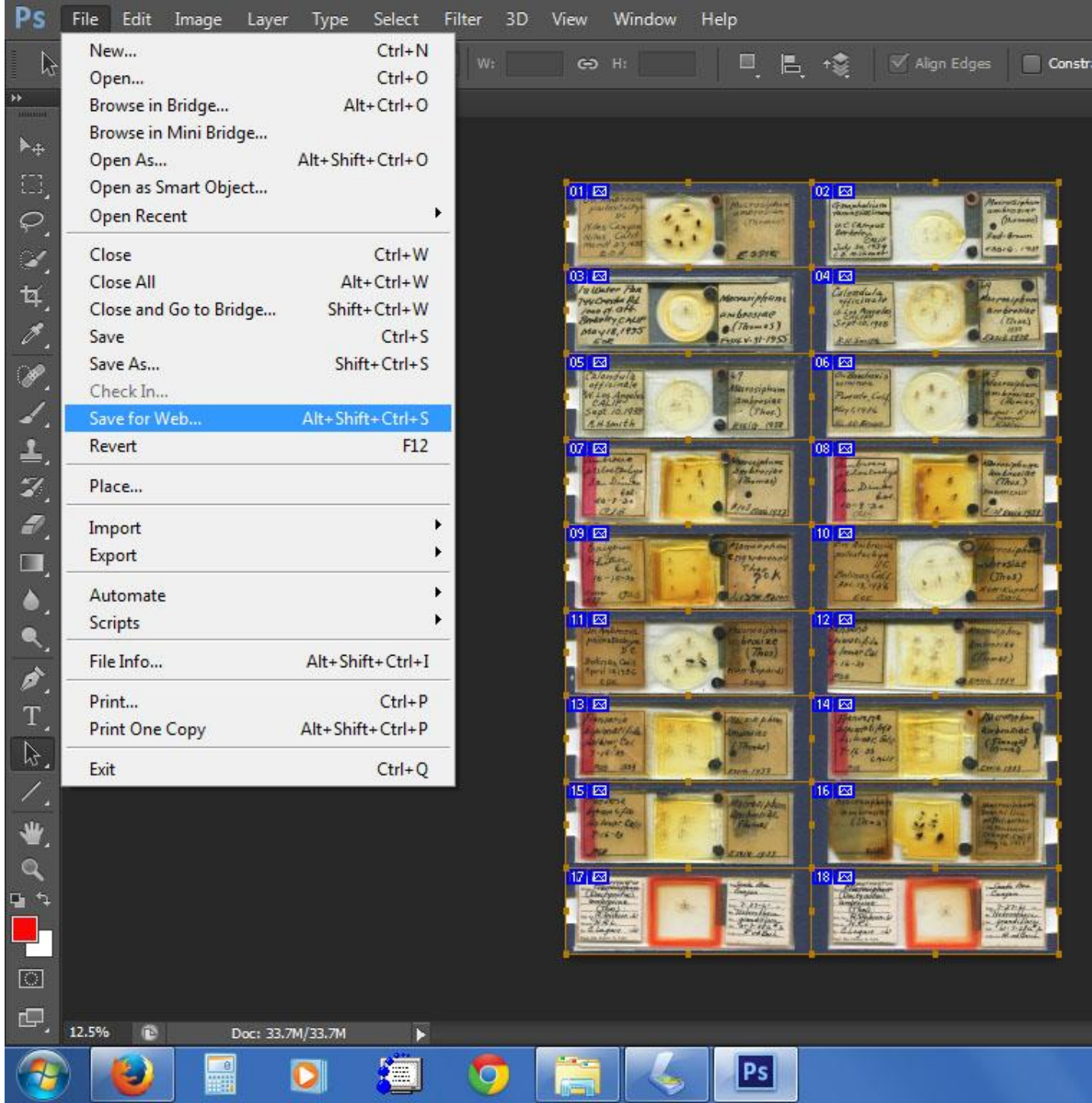
I named my
Action
"Slice It"

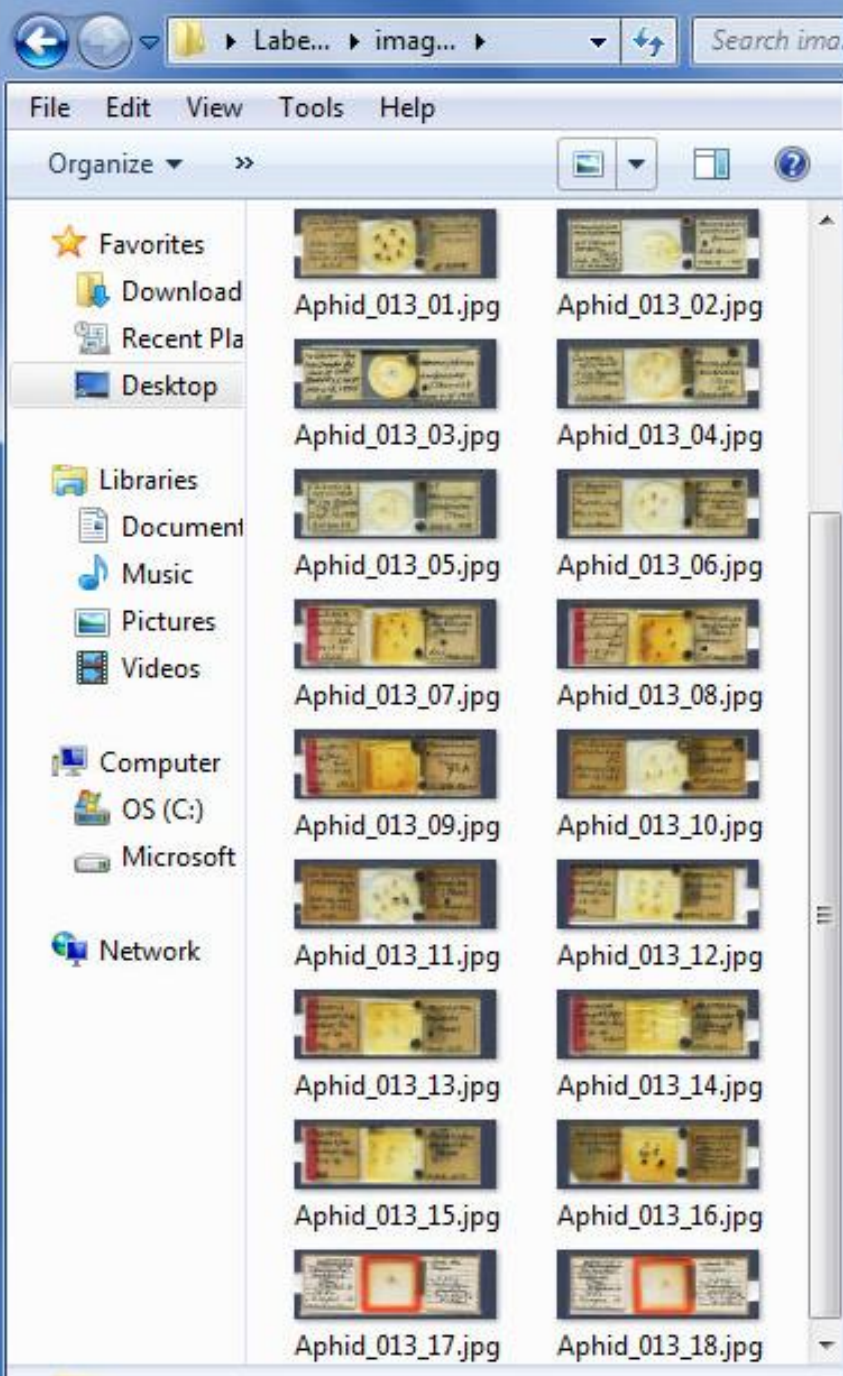
Just "play"
the Action
for each scan.

Process takes
as long as it
takes to click
the mouse.

Choose the
“Save for Web”
option in the
File menu

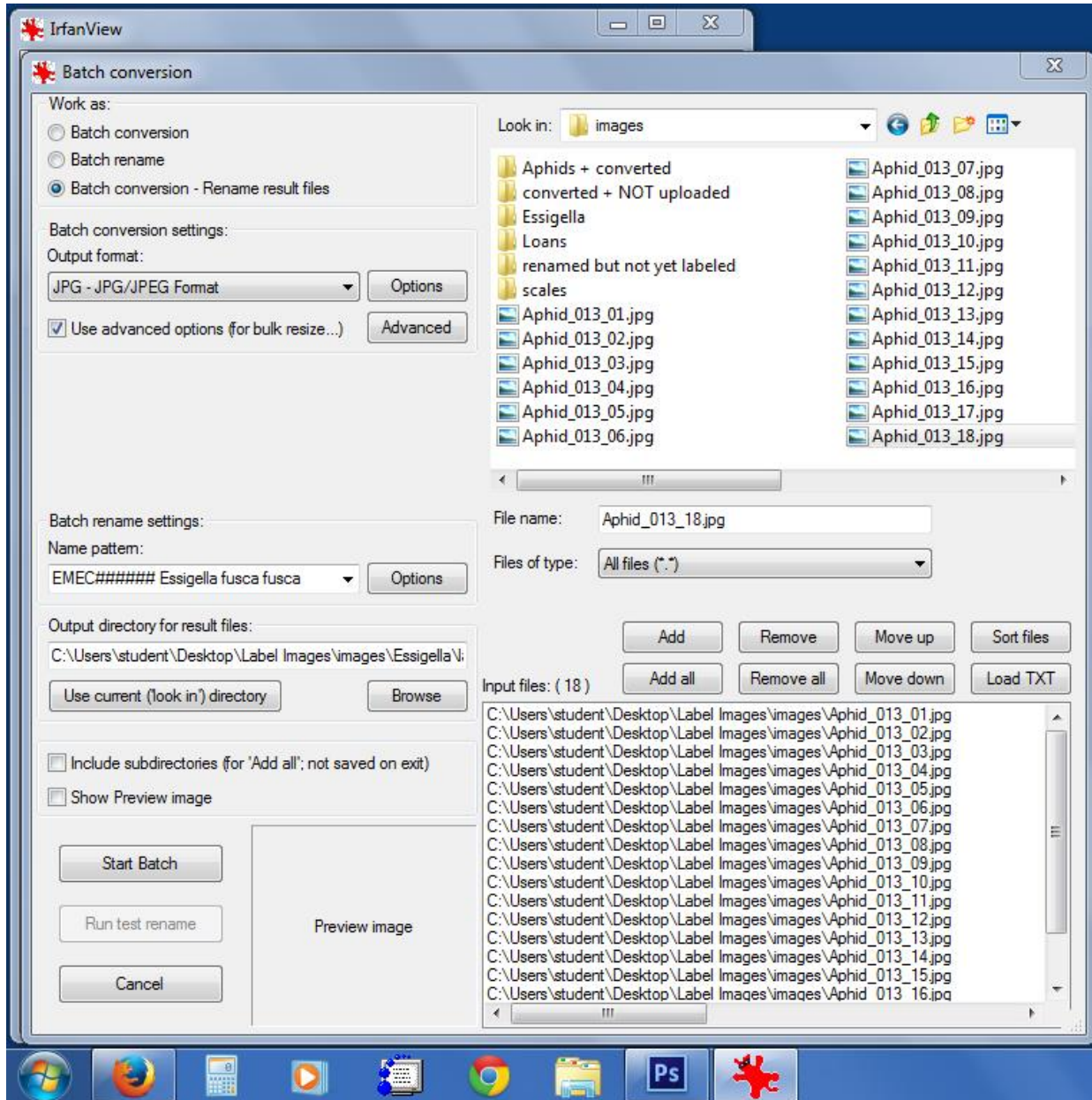
Aside:
This feature was
created for faster
loading of large
images on web sites
by cutting them into
smaller pieces to be
loaded
simultaneously.





The result of the “Save for Web” option is 18 individual files ending in _01, _02, _03, etc.

The next step is to rename each of the individual files with the unique ID, genus, and species. We use IrfanView software by creating a pattern to batch process all the files at once.



Select files



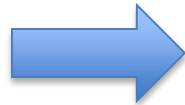
Provide filename template



Process one species at a time!

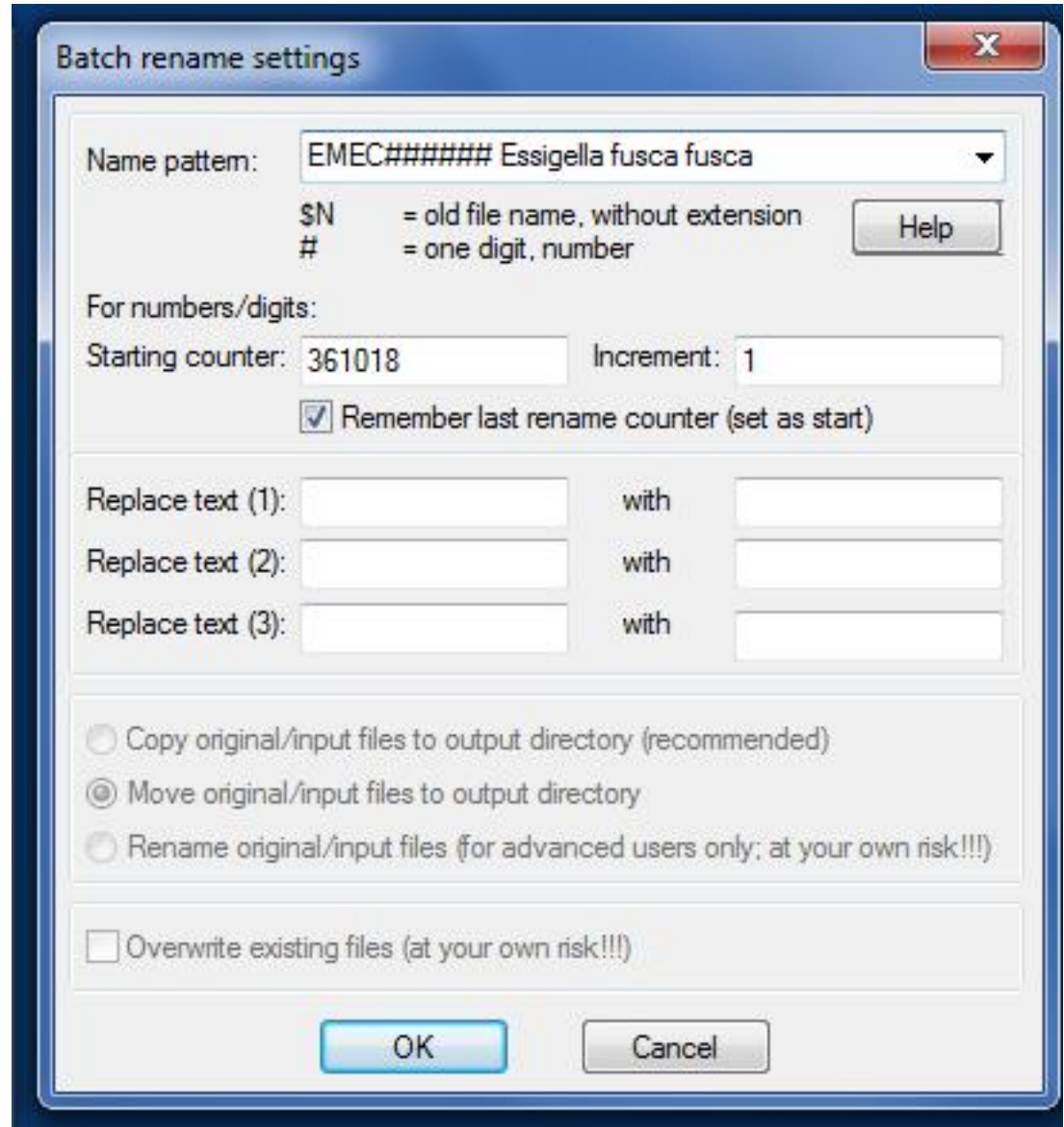
Batch file renaming with IrfanView

Create name pattern



Use # symbol for digits

Provide the starting number





Aphid_013_01.jpg



Aphid_013_03.jpg



Aphid_013_05.jpg



Aphid_013_07.jpg



Aphid_013_09.jpg



Aphid_013_11.jpg



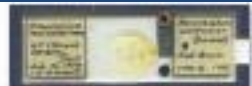
Aphid_013_13.jpg



Aphid_013_15.jpg



Aphid_013_17.jpg



Aphid_013_02.jpg



Aphid_013_04.jpg



Aphid_013_06.jpg



Aphid_013_08.jpg



Aphid_013_10.jpg



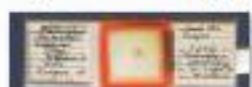
Aphid_013_12.jpg



Aphid_013_14.jpg



Aphid_013_16.jpg



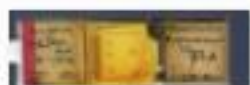
Aphid_013_18.jpg



EMEC361018
Essigella fusca
fusca.jpg



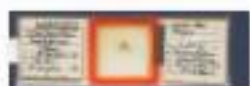
EMEC361022
Essigella fusca
fusca.jpg



EMEC361026
Essigella fusca
fusca.jpg



EMEC361030
Essigella fusca
fusca.jpg



EMEC361034
Essigella fusca
fusca.jpg



EMEC361019
Essigella fusca
fusca.jpg



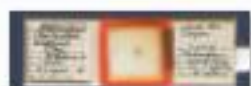
EMEC361023
Essigella fusca
fusca.jpg



EMEC361027
Essigella fusca
fusca.jpg



EMEC361031
Essigella fusca
fusca.jpg



EMEC361035
Essigella fusca
fusca.jpg



EMEC361020
Essigella fusca
fusca.jpg



EMEC361024
Essigella fusca
fusca.jpg



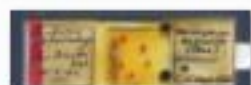
EMEC361028
Essigella fusca
fusca.jpg



EMEC361032
Essigella fusca
fusca.jpg



EMEC361021
Essigella fusca
fusca.jpg



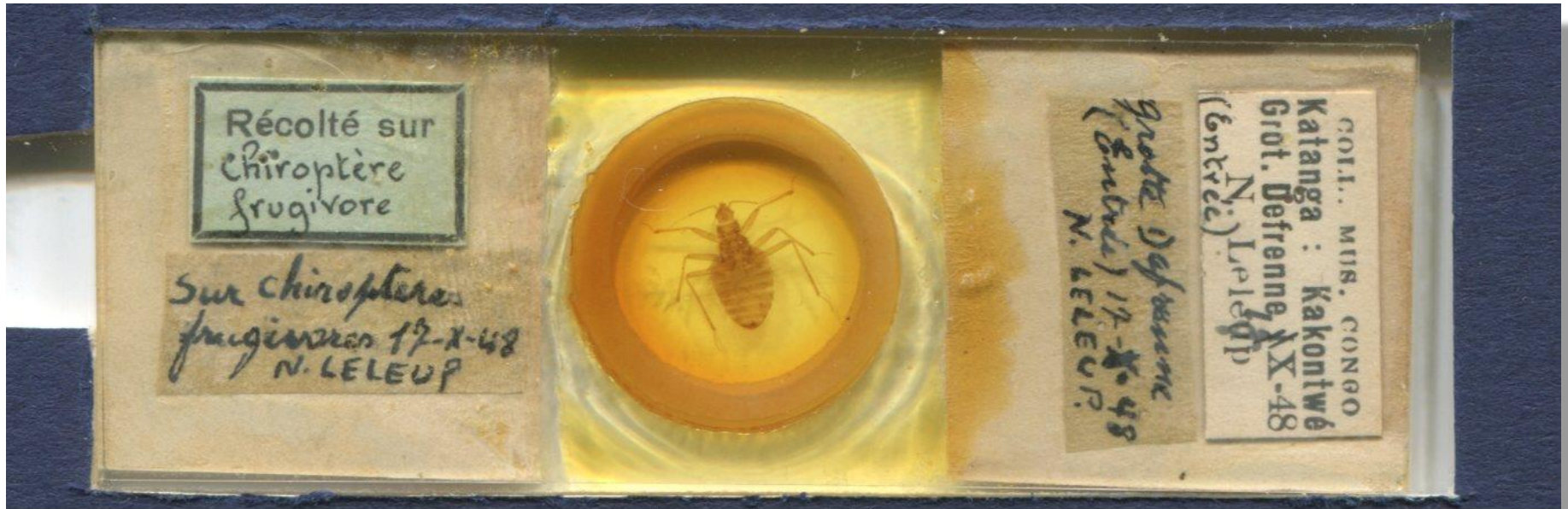
EMEC361025
Essigella fusca
fusca.jpg



EMEC361029
Essigella fusca
fusca.jpg



EMEC361033
Essigella fusca
fusca.jpg



EMEC45020 Afrocimex leleupi.jpg

We also use IrfanView to overlay the unique ID, genus, and species on the bottom of the image, since the unique ID is on the back of the slide and therefore not visible in the scan.

Create Record Stub

- Upload image file to server
- Create new record from image file
- Use filename to populate
 - Catalog Number
 - Genus
 - Species
- Automatically add
 - Higher taxonomy
 - Holding institution
 - Data entry person & date



Number of matches

next 200

Query: SELECT * FROM

Collection ID / Species

EMEC45000

EMEC45001

EMEC45002

EMEC45003

EMEC45004

EMEC45005



EMEC45000 *Afrocimex leleupi*.jpg

EMEC45006	<i>Afrocimex leleupi</i>	EMEC45006 Afrocimex leleupi.jpg	2012-11-21	no	ADD
EMEC45007	<i>Afrocimex leleupi</i>	EMEC45007 Afrocimex leleupi.jpg	2012-11-21	no	ADD
EMEC45008	<i>Afrocimex leleupi</i>	EMEC45008 Afrocimex leleupi.jpg	2012-11-21	no	ADD
EMEC45009	<i>Afrocimex leleupi</i>	EMEC45009 Afrocimex leleupi.jpg	2012-11-21	no	ADD
EMEC45010	<i>Afrocimex leleupi</i>	EMEC45010 Afrocimex leleupi.jpg	2012-11-21	no	ADD
EMEC45011	<i>Afrocimex leleupi</i>	EMEC45011 Afrocimex leleupi.jpg	2012-11-21	no	ADD
EMEC45012	<i>Afrocimex leleupi</i>	EMEC45012 Afrocimex leleupi.jpg	2012-11-21	no	ADD
EMEC45013	<i>Afrocimex leleupi</i>	EMEC45013 Afrocimex leleupi.jpg	2012-11-21	no	ADD
EMEC45014	<i>Afrocimex leleupi</i>	EMEC45014 Afrocimex leleupi.jpg	2012-11-21	no	ADD
EMEC45015	<i>Afrocimex leleupi</i>	EMEC45015 Afrocimex leleupi.jpg	2012-11-21	no	ADD
EMEC45016	<i>Afrocimex leleupi</i>	EMEC45016 Afrocimex leleupi.jpg	2012-11-21	no	ADD
EMEC45017	<i>Afrocimex leleupi</i>	EMEC45017 Afrocimex leleupi.jpg	2012-11-21	no	ADD
EMEC45018	<i>Afrocimex leleupi</i>	EMEC45018 Afrocimex leleupi.jpg	2012-11-21	no	ADD
EMEC45019	<i>Afrocimex leleupi</i>	EMEC45019 Afrocimex leleupi.jpg	2012-11-21	no	ADD
EMEC45020	<i>Afrocimex leleupi</i>	EMEC45020 Afrocimex leleupi.jpg	2012-11-21	no	ADD
EMEC45020	<i>Afrocimex leleupi</i>	EMEC45020.1 Afrocimex leleupi.jpg	2012-11-21	no	ADD
EMEC45021	<i>Afrocimex leleupi</i>	EMEC45021 Afrocimex leleupi.jpg	2012-11-21	no	ADD
EMEC45022	<i>Afrocimex leleupi</i>	EMEC45022 Afrocimex leleupi.jpg	2012-11-21	no	ADD
EMEC45023	<i>Afrocimex leleupi</i>	EMEC45023 Afrocimex leleupi.jpg	2012-11-21	no	ADD
EMEC45024	<i>Afrocimex leleupi</i>	EMEC45024 Afrocimex leleupi.jpg	2012-11-21	no	ADD
EMEC45025	<i>Afrocimex leleupi</i>	EMEC45025 Afrocimex leleupi.jpg	2012-11-21	no	ADD

Label



EMEC45000 Afrocimex leleupi.jpg

Catalog ID Num * EMEC 45000

Holding Institution *
Essig Museum of Entomology

Individual Count *

Basis of Record * PreservedSpecimen

Other Catalog Num

Related Catalog Item

Collection Code

Collecting Event ID

Project Name

Parent Record

Loan Number

Date First Entered 2016-04-04 [recheck](#)

Entered By Peter T. Oboyski

Higher taxonomy will be automatically added

ColloquialName

Kingdom Animalia

Phylum Arthropoda

Class unselected

Subclass

Order

Suborder

Superfamily

Family

Subfamily

Tribe

Subtribe

Genus **Afrocimex**

Subgenus

Species **leleupi**

Subspecies

Certainty unselected

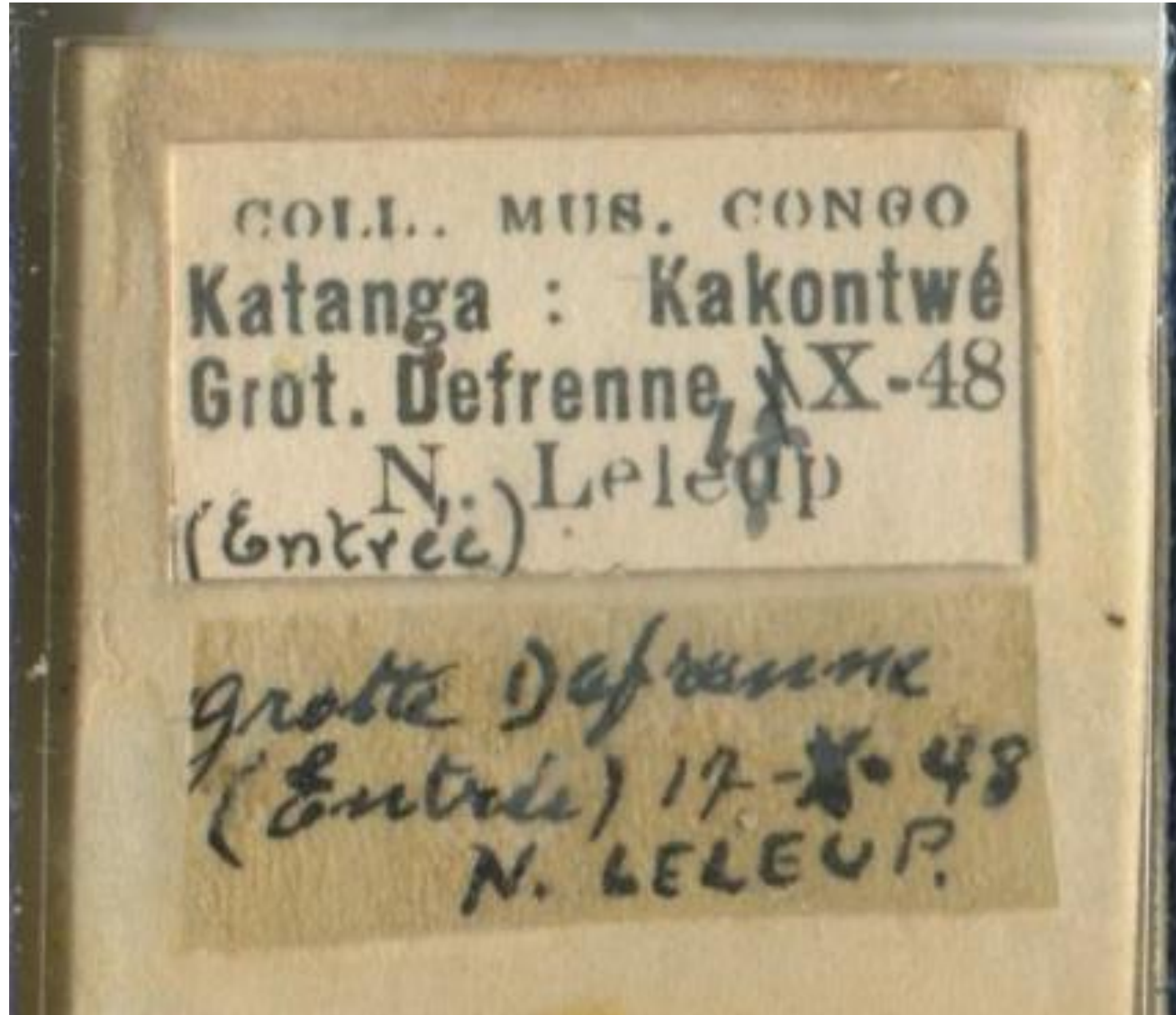
IdentifiedBy

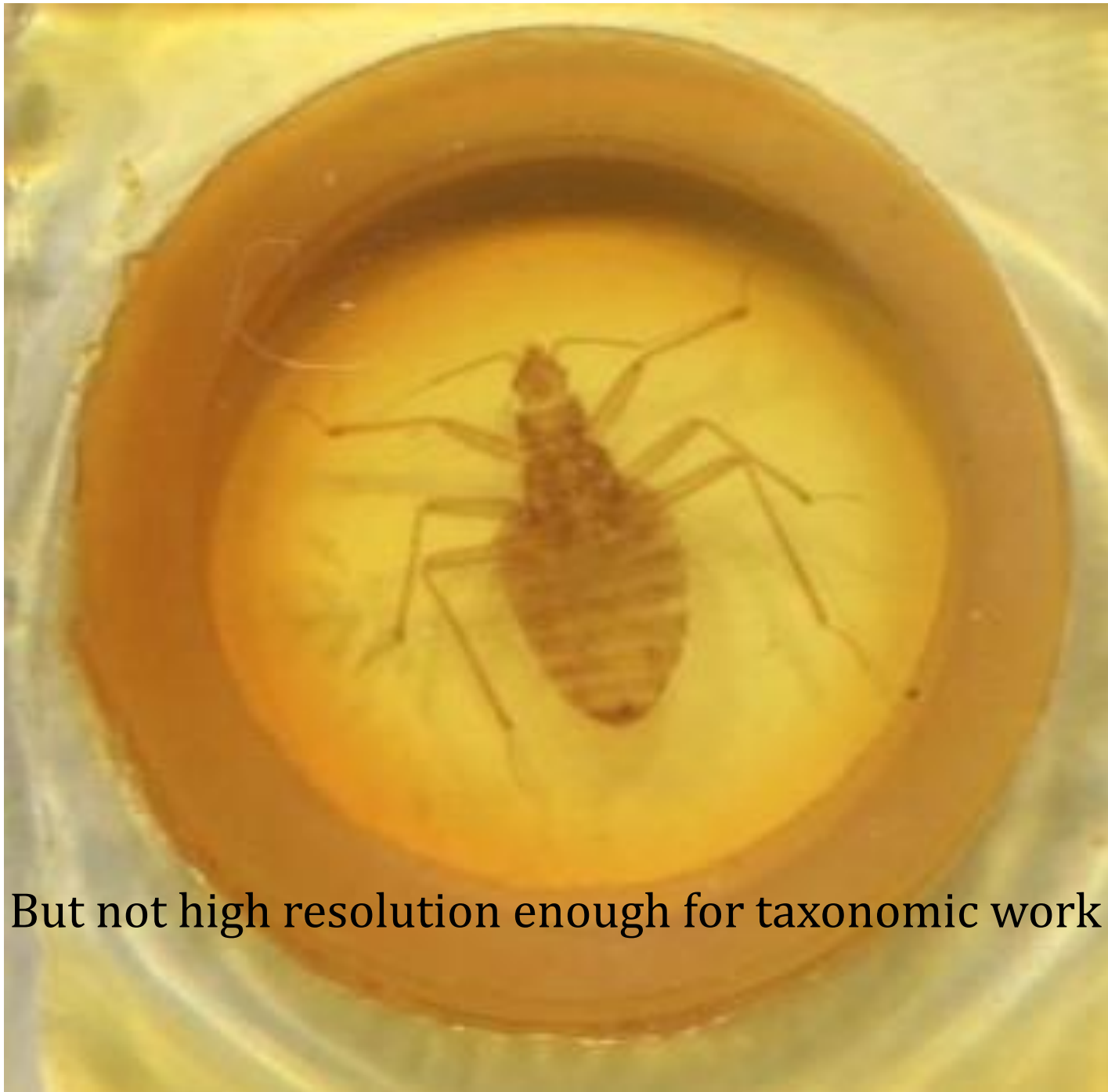
Date Ident yyyy mm dd

Previous ID

400 DPI

Provides high
enough
resolution for
difficult to read
labels while
keeping file
size relatively
small





But not high resolution enough for taxonomic work

Slide Scanning Speed

Our students average 135 to 170 slides scanned, processed, and renamed per hour.

The slowest step in the process was cutting out and sticking on the Unique ID labels. We now have pre-printed, easy-peel labels.

This does not include the actual databasing (ie. Transcribing the data from the images into our database)

Slide Scanning Cost

Scanner: \$50 - \$80

Jig (mat board): \$2 - \$10

Photoshop: \$300 - \$500 depending on version

- Photoshop freely available at some institutions
- freeware alternatives available [*GIMP, Image Cut*]

IrfanView: free



Inselect

An innovative tool for automating
digitisation of natural history collections



Laurence Livermore

Vladimir Blagoderov, Lawrence Hudson
Benjamin Price, Hillery Warner and Vincent Smith

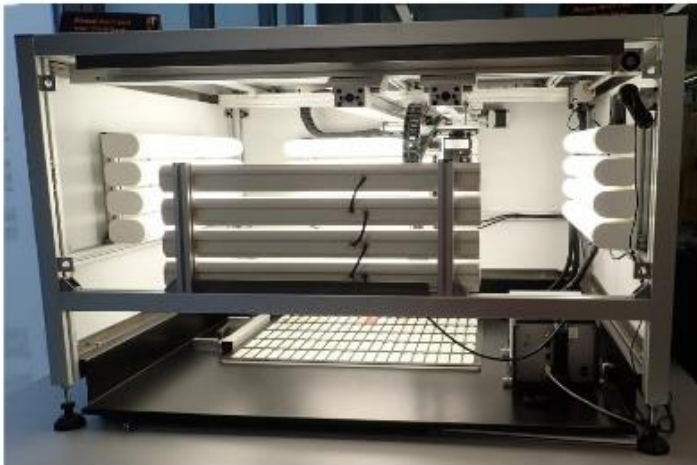
Natural History Museum, London

- Developed at British Museum Natural History
- Integration of image processing, file management, and record stub creation
- Free, open-source software (on Github)

Inselect (from iDigBio presentation)

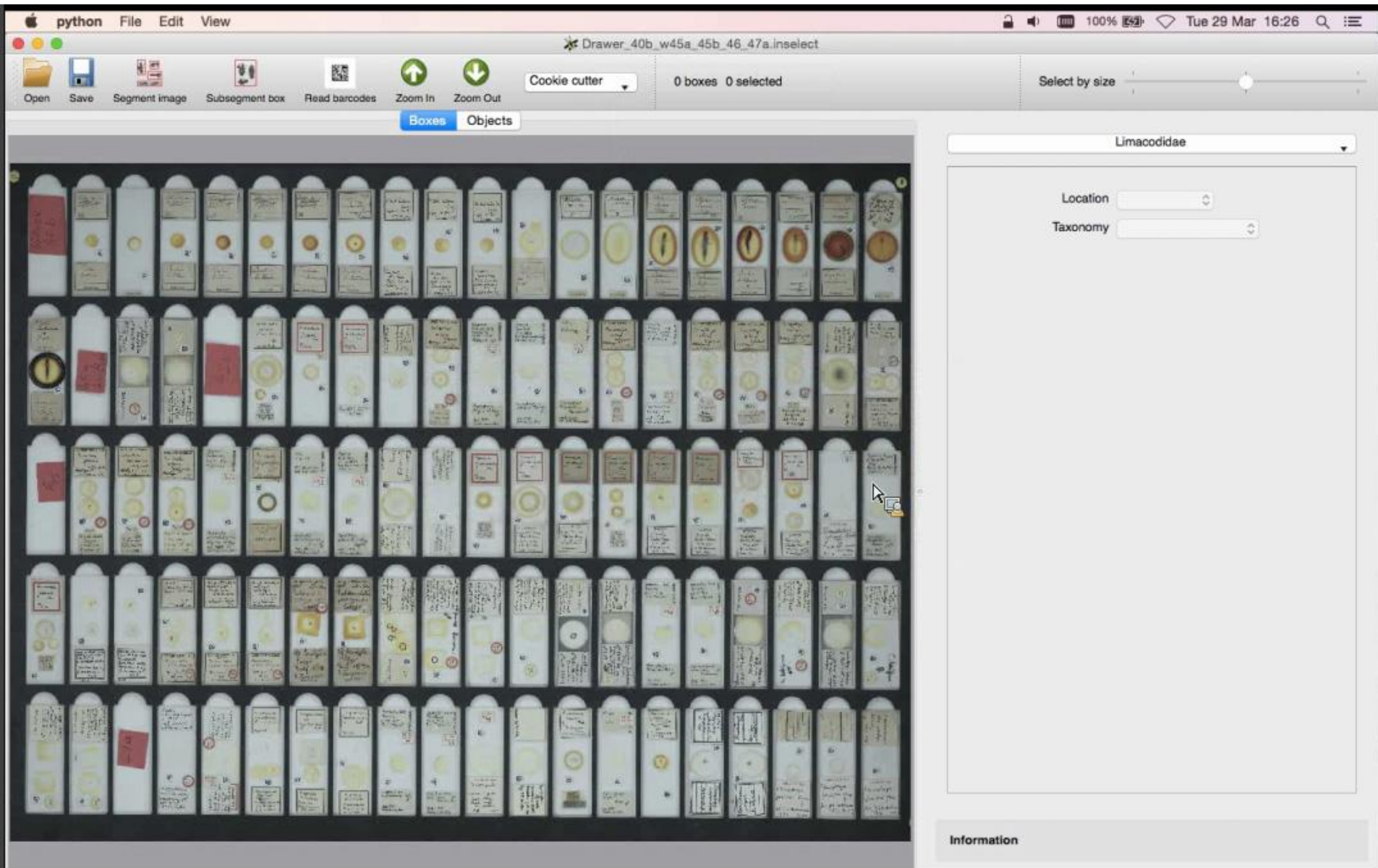
Slide scanning

- Slides transferred to slide templates (100 slides per template)
- Labelled with self-adhesive data matrix barcodes



- Imaged with SatScan
- Up to 18 templates scanned a day

Inselect – imported image



Inselect – divided image, basic metadata

The screenshot displays the Inselect software interface. At the top, the macOS menu bar shows the application name 'python' and the window title 'Drawer_40b_w45a_45b_46_47a.inselect'. The status bar indicates '100%' zoom and the date 'Tue 29 Mar 16:31'. The main toolbar includes icons for 'Open', 'Save', 'Segment image', 'Subsegment box', 'Read barcodes', 'Zoom In', and 'Zoom Out'. A 'Cookie cutter' dropdown menu is set to '100 boxes 1 selected', and a 'Select by size' slider is visible on the right. Below the toolbar, the 'Boxes' and 'Objects' tabs are active. The central area shows a grid of 100 small images of insect specimens, each with a blue border. A mouse cursor is hovering over one of the specimens. On the right side, a metadata panel for 'Sialidae' is displayed, containing the following information:

- Catalog number: 123456789
- Location: Drawer 40
- Taxonomy: Sialis cont

At the bottom right, there is an 'Information' section.

Inselect – setting metadata options

```
Sublime Text 2  File  Edit  Selection  Find  View  Goto  Tools  Project  Window  Help  100%  Tue 29 Mar 16:27  UNREGISTERED
sialadae.inselect_template -- Templates

limacodidae.inselect_template x
1  Name: Limacodidae
2  Object label: '{Taxonomy}--{Location}--{ItemNumber}'
3  Fields:
4  - Name: Location
5    Mandatory: true
6    Choices:
7      - Drawer 1
8      - Drawer 2
9      - Drawer 3
10     - Drawer 4
11  - Name: Taxonomy
12    Mandatory: true
13    Choices:
14     - Anaxidia
15     - Anepopsia
16     - Apodecta
17     - Birthamoides
18     - Calcarifera
19     - Chalcocelis
20     - Comana
21     - Comanula
22     - Doratifera
23     - Ecnomoctena
24     - Ellassoptila
25     - Eloasa
26     - Hedraea
27     - Hydroclada
28     - Lamprolepida
29     - Limacochara
30     - Mambara
31     - Mecytha
32     - Parasoidea
33     - Praesusica
34     - Pseudanapaea
35     - Pygmaeomorpha
36     - Scopelodes
37     - Squamosa
38     - Thosea
39

sialadae.inselect_template x
12  Mandatory: true
13  Choices:
14  ..... - Drawer 40
15  ..... - Drawer 41
16  ..... - Drawer 42
17  ..... - Drawer 43
18  ..... - Drawer 44
19  ..... - Drawer 45
20  ..... - Drawer 45a
21  ..... - Drawer 45b
22  ..... - Drawer 46
23  ..... - Drawer 47
24  ..... - Drawer 47a
25  ..... - Drawer 48
26  ..... - Drawer 49
27  ..... - Drawer 50
28  - Name: Taxonomy
29    Mandatory: true
30    Choices:
31     - Sialis
32     - Sialis abchasica
33     - Sialis aequalis
34     - Sialis americana
35     - Sialis annae
36     - Sialis arvalis
37     - Sialis atra
38     - Sialis bifida
39     - Sialis bilineata
40     - Sialis bilobata
41     - Sialis californica
42     - Sialis chilensis
43     - Sialis concava
44     - Sialis contigua
45     - Sialis cornuta
46     - Sialis didyma
47     - Sialis dorochovae
48     - Sialis dorsata
49     - Sialis dreisbachi
50     - Sialis elegans
51     - Sialis flavicollis
52     - Sialis formosana
53     - Sialis frequens
```

14 lines, 310 characters selected

Spaces: 2 YAML

High resolution (taxonomic quality)

100 slide capacity

whole-slide image for label data

high resolution of specimen area



Olympus VS120-SL microscope slide scanner

Key components for slide processing

- Easy peel, strong adhesive, catalog # labels
- Jig (form) for consistent, uniform placement of slides for scanning/imaging
- Software to split image into individual slides, and save them as individual files
- Software to rename files and/or add metadata

Other resources

Oboyski - iDigBio presentation on slide scanning

https://www.idigbio.org/wiki/index.php/File:Scanning_Microscope_Slides_Oboyski.pdf

iDigBio Slide Scanning Working Group meetings

https://www.idigbio.org/wiki/index.php/Fluid_Preserved_Arthropds

- Colin Favret
- Gisele Canales

Inselect - image processing software

Paper - <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4658125/>

Webinar - <http://idigbio.adobeconnect.com/p7qo63aeo4a/>

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