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SHORT COMMUNICATION

A peer-reviewed open-access journal  
  
Launched to accelerate biodiversity research

# A set of multi-entry identification keys to African frugivorous flies (Diptera, Tephritidae)

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<http://zoobank.org/0C5847D5-EC3D-4CE6-9579-282846092D99>

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# a set of multi-entry electronic identification keys to African FF

originally the keys were provided as supplementary files to the paper,  
(<http://dx.doi.org/10.3897/zookeys.428.7366>)

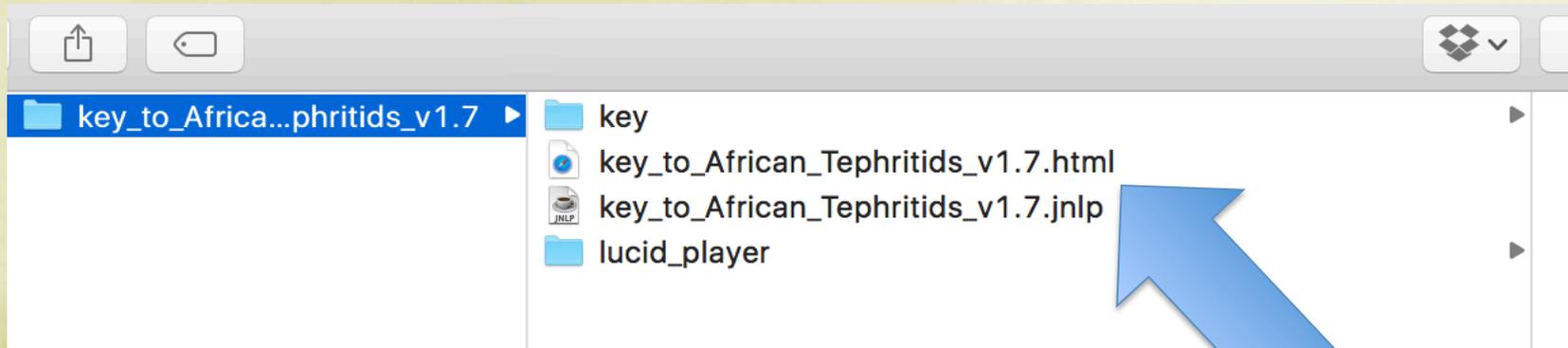
BUT

NO IMAGES AND NO UPDATES THERE

the updated versions of the keys are only available at:  
<https://fruitflykeys.africamuseum.be>

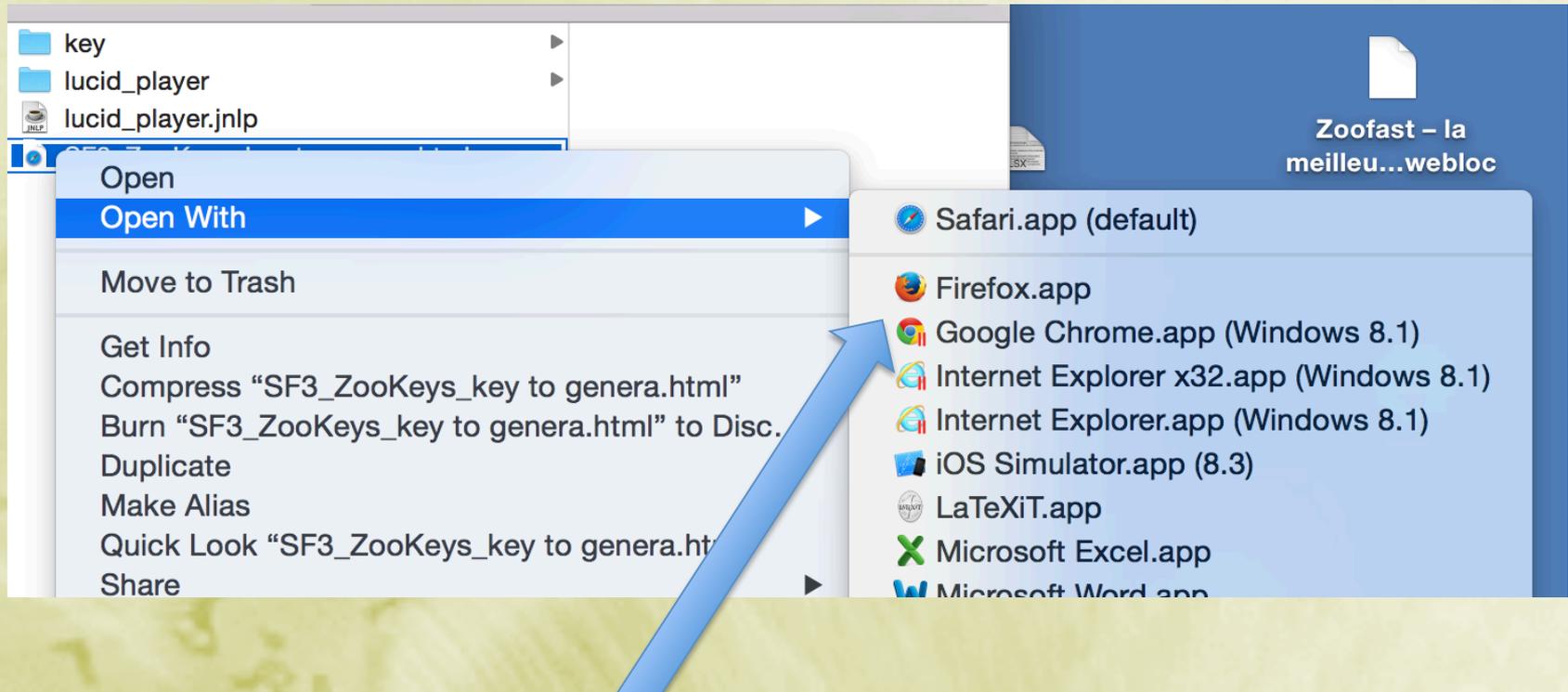
you can also contact:  
[massimiliano.virgilio@africamuseum.be](mailto:massimiliano.virgilio@africamuseum.be)  
[marc.de.meyer@africamuseum.be](mailto:marc.de.meyer@africamuseum.be)

# launch the key



# right click html file

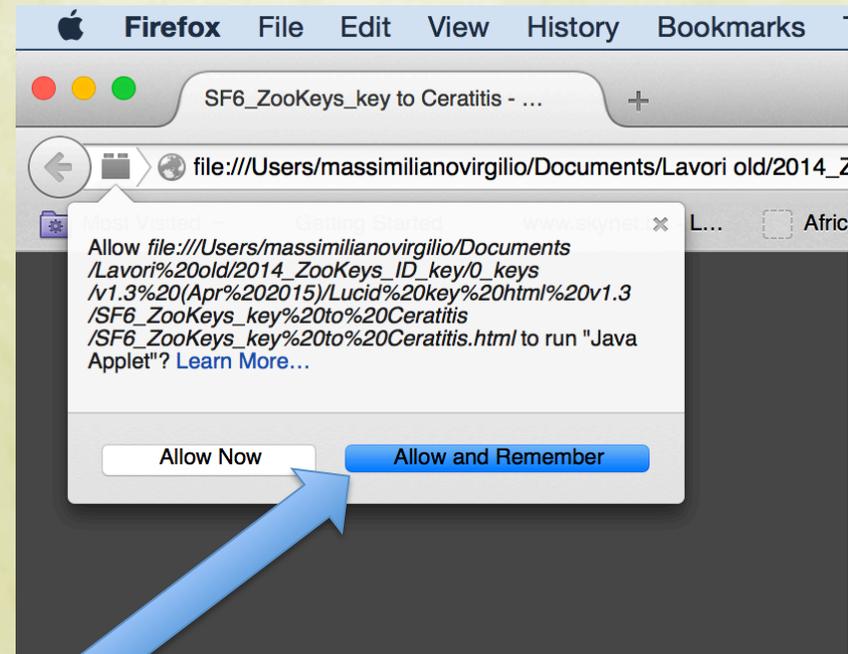
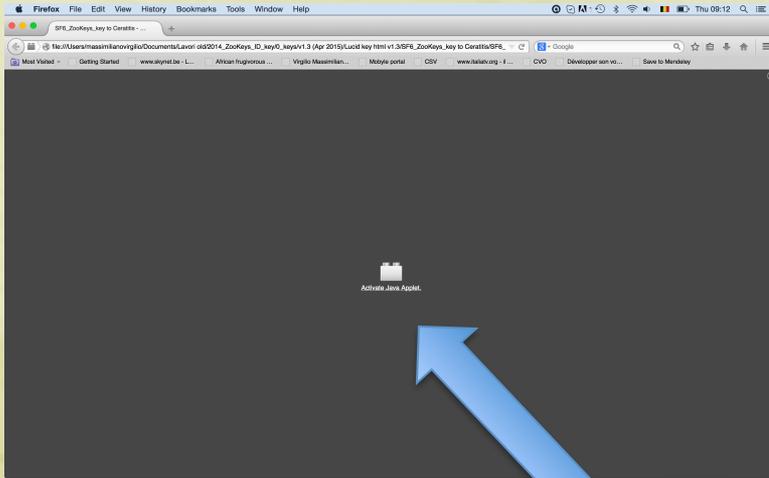
# launch the key



## choose a browser

- be sure your Java is updated (google: "verify java version")
- if it doesn't work try a different browser (explorer, firefox, safari, etc.)

# launch the key



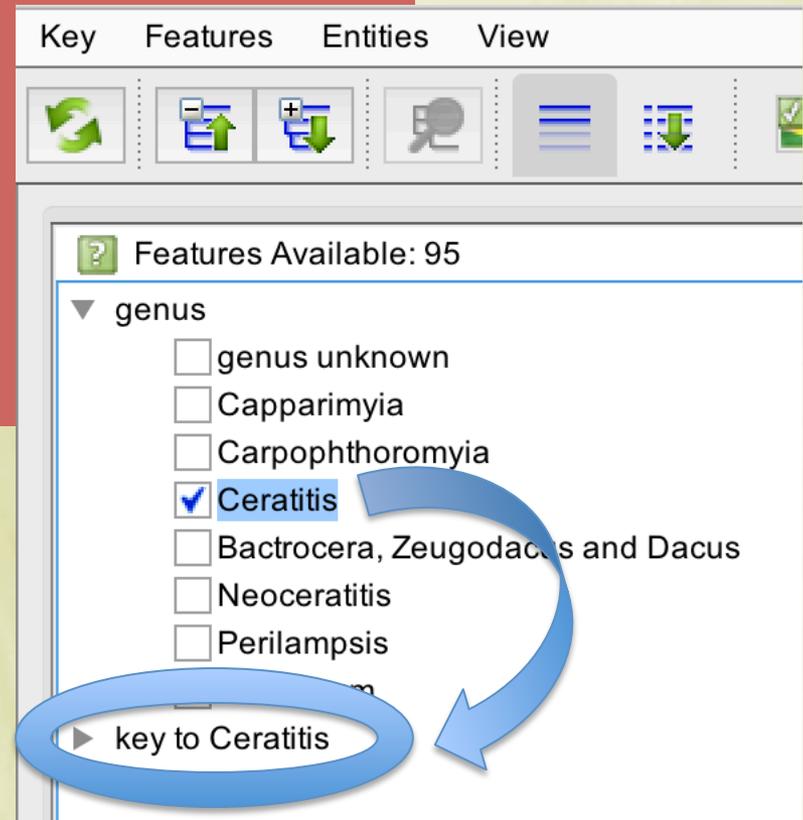
activate and authorise whatever you can activate and authorise

# key structure

if you can already tell the genus,  
select the corresponding key.

Seven keys available:

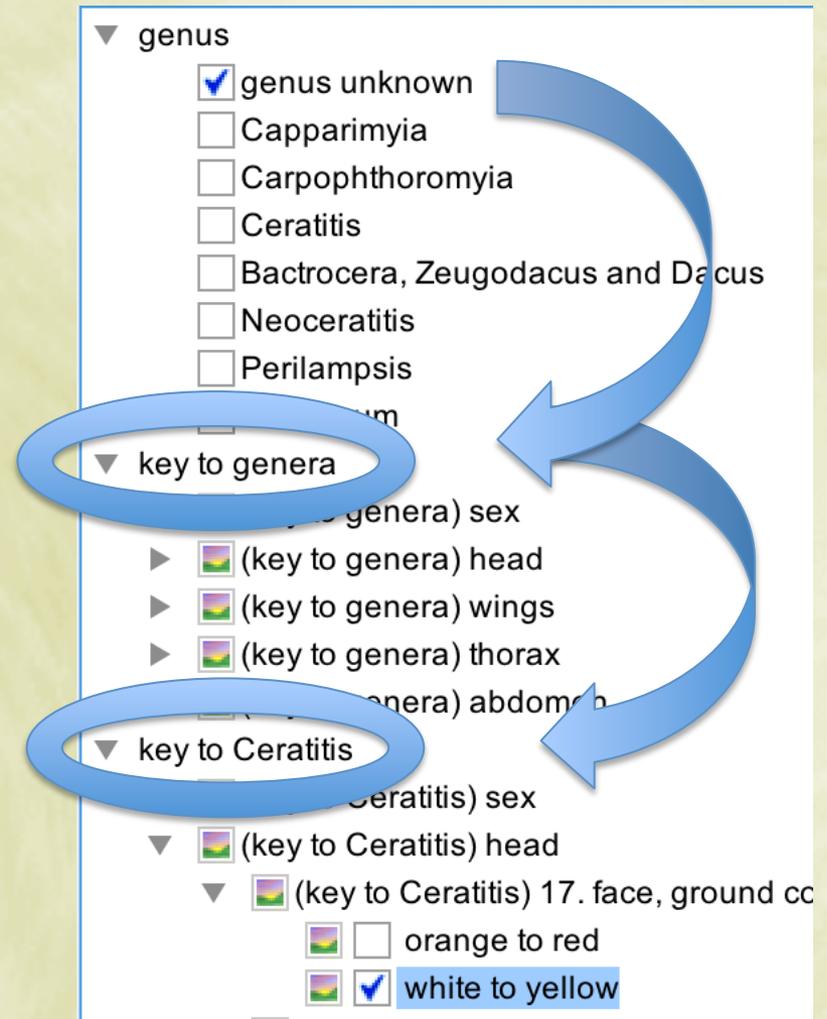
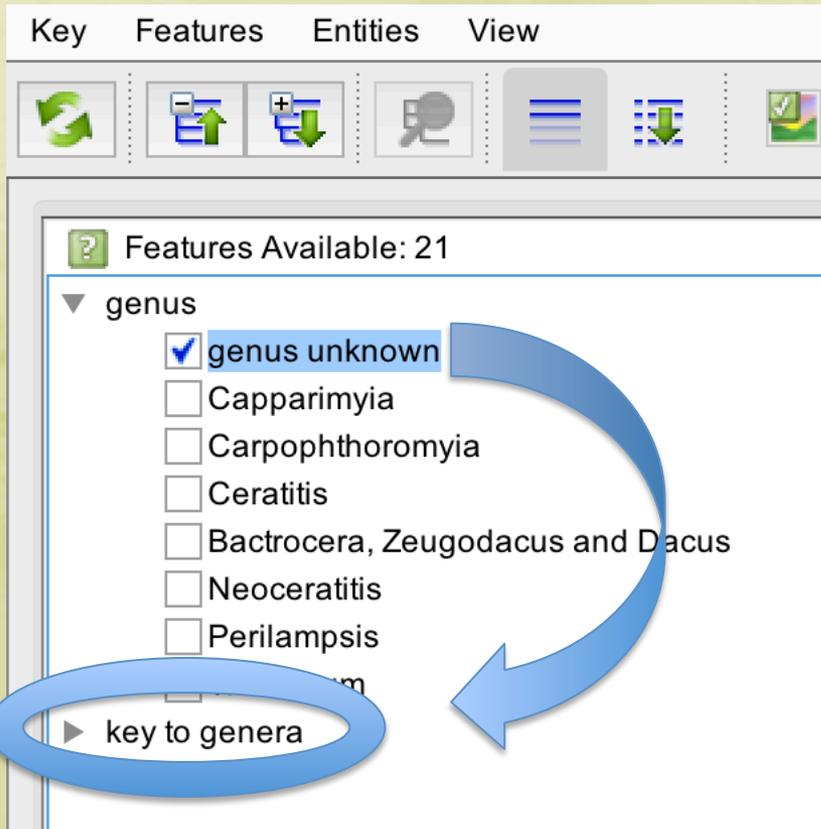
- to *Capparimyia*
- to *Carpophthoromyia*
- to *Ceratitis*
- to *Bactrocera* + *Zeugodacus* + *Dacus*
- to *Neoceratitis*
- to *Perilampus*
- to *Trirhithrum*



# key structure

alternatively:  
start from genus  
identification

and just proceed until a species is identified  
(the suitable generic key will be automatically  
launched once the genus is identified)



# key structure

LucidPlayer (UNREGISTERED) - A multi-entry identification key to African frugivorous fruit flies (Diptera, Tephritidae) - D:\demeyer Documents\collaborations\webkey\ID keys\0\_key to genera.lk4

Key Features Entities View Window Help

Features Available: 15

- (key to genera) sex
- (key to genera) head
- (key to genera) wings
- (key to genera) thorax
- (key to genera) abdomen

Entities Remaining: 399

- Bactrocera
- Capparimyia
- Carpophthoromyia
- Ceratitis
- Dacus
- Neoceratitis
- Peniampsis
- Tririthrum

Features Chosen: 0

Characters in morphological groupings:

- head
- wings
- thorax
- abdomen
- (plus sex)

Trees Lists Images

Africa TERVUREN

# key structure

click to unfold and see images

LucidPlayer (UNREGISTERED) - A multi-entry identification key to African frugivorous fruit flies (Diptera, Tephritidae) - D:\demeyer Documents\collaborations\webkey\ID keys\0\_key to genera.lkc4

Key Features Entities View Window Help

Features Available: 15

- (key to genera) sex
  - female
  - male
- (key to genera) head
- (key to genera) wings
- (key to genera) thorax
- (key to genera) abdomen

Features Chosen: 0

- (key to genera) sex
  - female

Entities Remaining: 399

- Bactrocera
- Capparimyia
- Carpophthoromyia
- Ceratitis
- Dacus
- Neoceratitis
- Perilampus
- Triethirus

Entities Discarded: 0

female - Lucid3



Dacus phantoma (HT female) abdomen x0.8 (ZMHU) [© NHM 2003]

female

# key structure

click to see explanatory illustrations

LucidPlayer (UNREGISTERED) - A multi-entry identification key to African frugivorous fruit flies (Diptera, Tephritidae) - D:\demeyer Documents\collaborations\webkey\ID keys\0\_key to genera.lkc4

Key Features Entities View Window Help

Features Available: 15

- (key to genera) sex
  - female
  - male
- (key to genera) head
  - (key to genera) 1. first flagellomere**
  - (key to genera) 7. frontal setae
  - (key to genera) 22. ocellar setae
- (key to genera) wings
- (key to genera) thorax
- (key to genera) abdomen

Entities Remaining: 399

Bactrocera

(key to genera) head:(key to genera) 1. first flagellomere - Lucid3

## head parts

Labels in diagram:  
occiput  
ocellar tubercle  
eye  
frons  
lunula  
arista  
antenna: pedicel  
antenna: 1st flagellomere  
palpus  
face  
ptilinal suture

(key to genera) 1. first flagellomere

# key structure

tick box to select

LucidPlayer (UNREGISTERED) - A multi-entry identification key to African frugivorous fruit flies (Diptera, Tephritidae) - D:\demeyer Documents\collaborations\webkey\ID keys\0\_key to genera.lkc4

Key Features Entities View Window Help

Features Available: 14

- (key to genera) sex
  - female
  - male
- (key to genera) head
  - (key to genera) 1. first flagellomere
    - longer than facial margin
    - shorter than facial margin
  - (key to genera) 7. frontal setae
  - (key to genera) 22. ocellar setae
- (key to genera) wings
- (key to genera) thorax
- (key to genera) abdomen

Entities Remaining: 211

- Bactrocera
- Dacus

Features Chosen: 2

- (key to genera) sex
  - female
  - male
- (key to genera) head
  - (key to genera) 1. first flagellomere
    - longer than facial margin

Entities Discarded: 188

- Capparimya
- Carpophthoromyia
- Ceratitis
- Neoceratitis
- Perilampus
- Trirhithrum

longer than facial margin - Lucid3



Dacus famona (PT male) face x1.8 (BMNH 532563) [© NHM 2003]

longer than facial margin

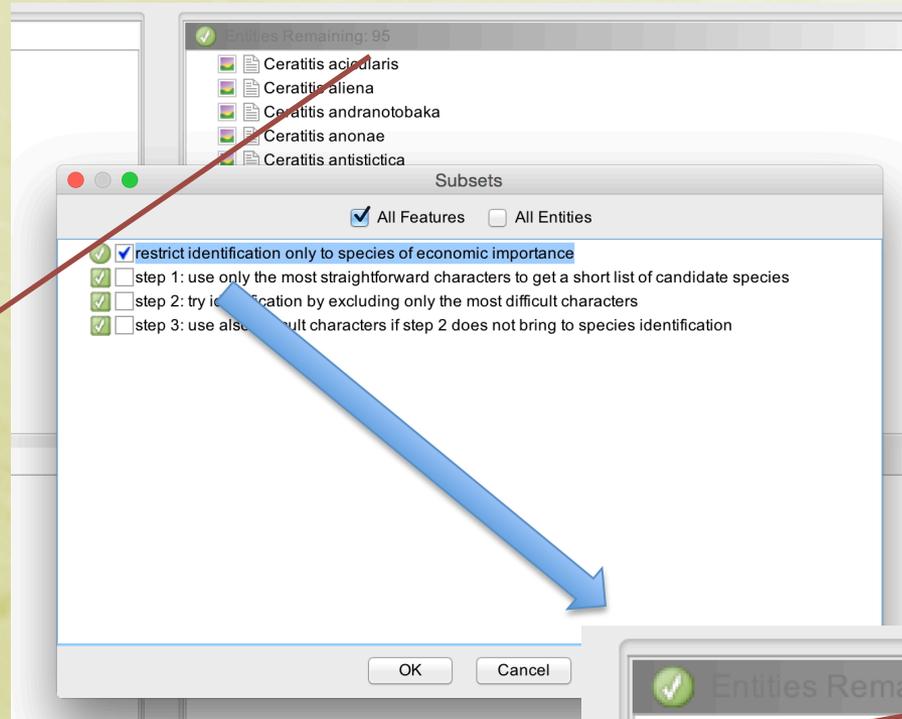
# reducing the key complexity: using the option "subsets"

The screenshot shows a web browser window displaying a key reduction tool. The main interface is titled "key to Ceratitix" and shows a list of features available for reduction. A blue arrow points from the "Features Available" list to the "Subsets" dialog box. The dialog box has the following options:

- All Features
- All Entities
- restrict identification only to species of economic importance
- step 1: use only the most straightforward characters to get a short list of candidate species
- step 2: try identification by excluding only the most difficult characters
- step 3: use also difficult characters if step 2 does not bring to species identification

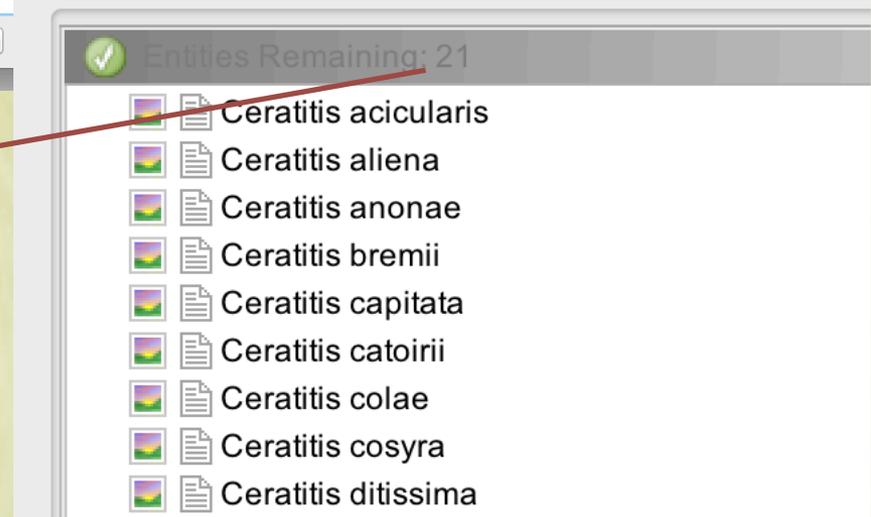
The "Subsets" dialog box also has "OK" and "Cancel" buttons at the bottom.

# reduce the n. of species (e.g., for preliminary screening)

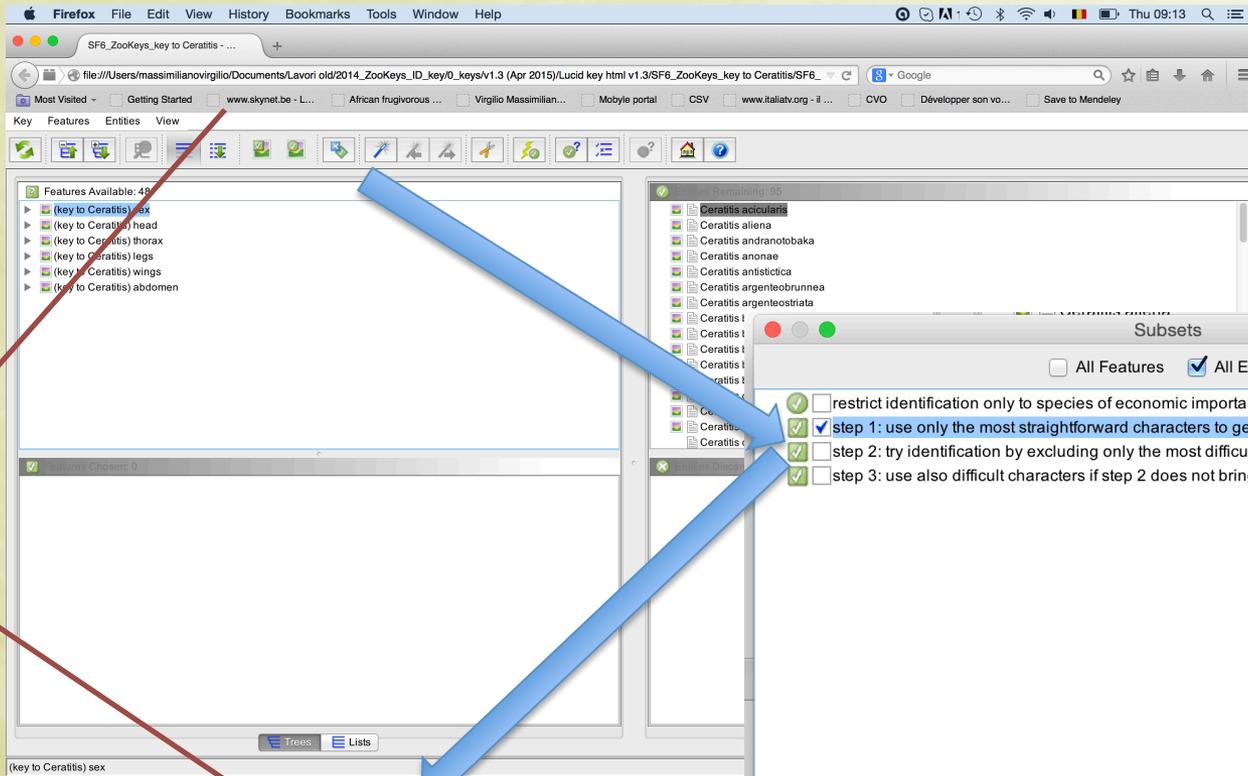


from 95 species

to 21  
economically  
important  
species

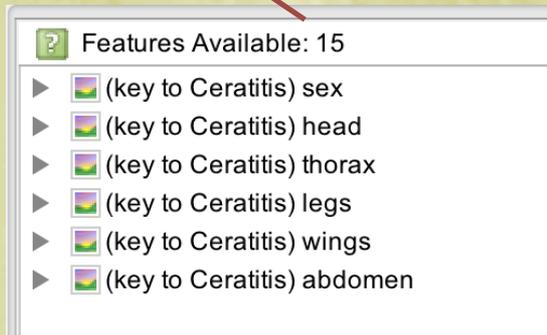


# reduce the n. of characters: start trying "easy characters"!



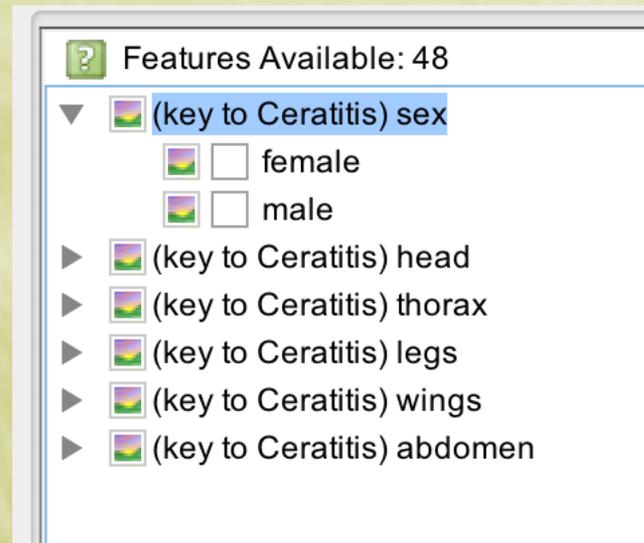
from 48  
"mixed"  
characters

to 15  
"easy"  
characters

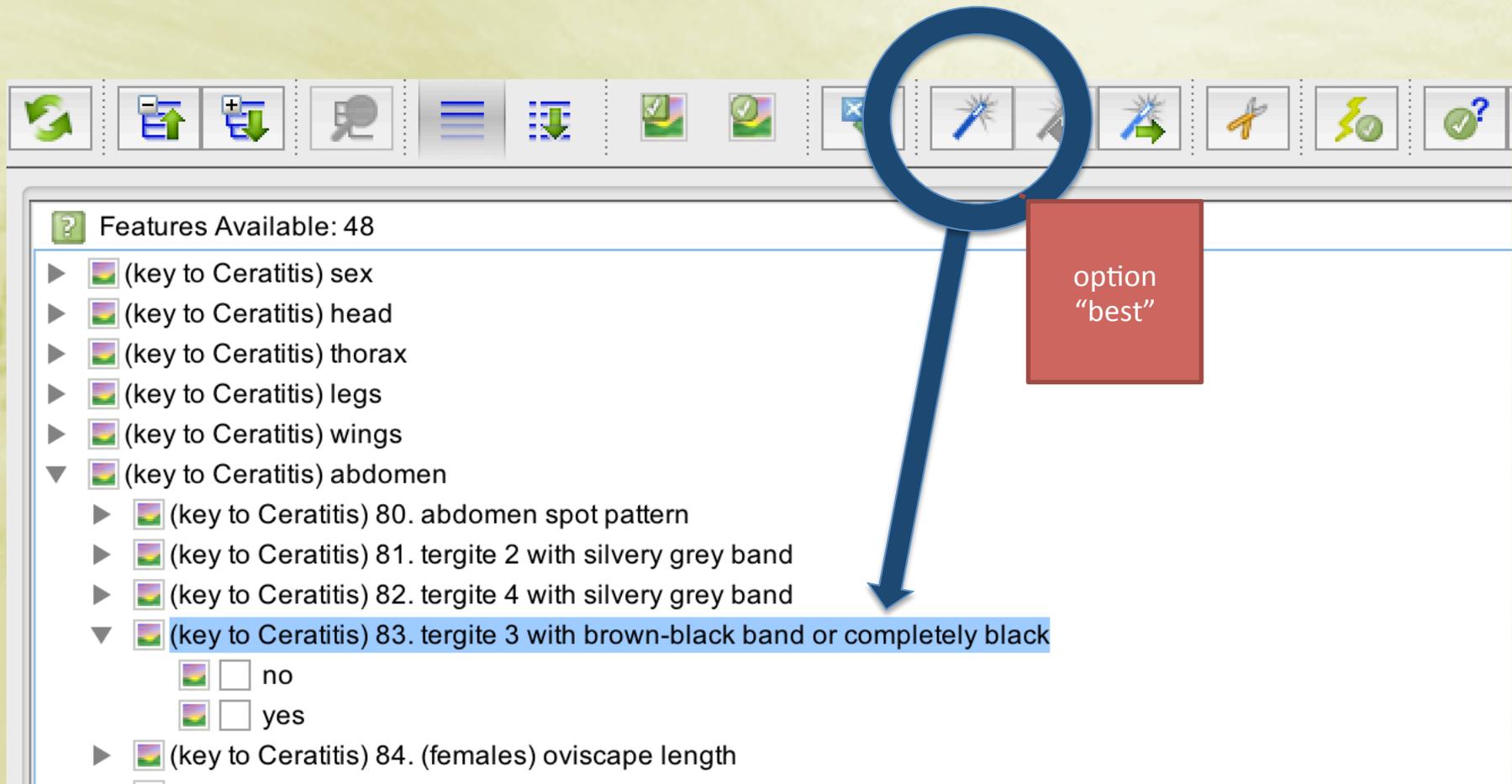


many characters are sex related:

eliminate the unnecessary characters  
by specifying the specimen sex  
**AT FIRST**



# let the software choose the "best" character for the identification of your species



The screenshot shows a software interface with a toolbar at the top and a list of features below. The toolbar contains various icons for navigation and editing. The list of features is titled "Features Available: 48" and includes several categories of characters for identification. A magnifying glass is positioned over the toolbar, and a red box with the text "option 'best'" is connected to the magnifying glass by a blue arrow. The feature "(key to Ceratitis) 83. tergite 3 with brown-black band or completely black" is highlighted in blue.

Features Available: 48

- ▶ (key to Ceratitis) sex
- ▶ (key to Ceratitis) head
- ▶ (key to Ceratitis) thorax
- ▶ (key to Ceratitis) legs
- ▶ (key to Ceratitis) wings
- ▼ (key to Ceratitis) abdomen
  - ▶ (key to Ceratitis) 80. abdomen spot pattern
  - ▶ (key to Ceratitis) 81. tergite 2 with silvery grey band
  - ▶ (key to Ceratitis) 82. tergite 4 with silvery grey band
  - ▼ (key to Ceratitis) 83. tergite 3 with brown-black band or completely black
    - no
    - yes
  - ▶ (key to Ceratitis) 84. (females) oviscape length

if you can't answer,  
just skip to the "next best" character

Features Available: 48

- ▶ (key to Ceratitis) sex
- ▶ (key to Ceratitis) head
- ▶ (key to Ceratitis) thorax
- ▼ (key to Ceratitis) legs
  - ▶ (key to Ceratitis) 63. fore coxa black
  - ▶ (key to Ceratitis) 64. fore coxa with silvery patch
  - ▶ (key to Ceratitis) 65. (males) fore femur anteriorly with black/white pattern and median patch of dense black h
  - ▶ (key to Ceratitis) 66. (males) fore femur with anteroventral dense row of silvery hairs
  - ▶ (key to Ceratitis) 67. (males) fore femur posteriorly with bush of hairs
  - ▶ (key to Ceratitis) 69. (males) mid femur, ventrally with feathering (even only partly)
  - ▼ (key to Ceratitis) 73. (males) mid tibia with feathering
    - no
    - yes
  - ▶ (key to Ceratitis) 76. (males) mid tibia flattened and broadened

if you do answer,  
use "best" again and proceed (don't use "next best"!)

The screenshot shows a software interface with a menu bar (Key, Features, Entities, View) and a toolbar. The main area is titled "Features Available: 48" and contains a list of features for identifying Ceratitis species. Each feature has a small icon and a checkbox. A blue arrow points from a circled "yes" checkbox for feature 83 to a circled "next best" button in the toolbar. The "best" button is crossed out with a blue 'X'.

Key Features Entities View

Features Available: 48

- yes
- ▶  (key to Ceratitis) 79. (females) fore femur with dark hairs between posterior
- ▶  (key to Ceratitis) wings
- ▼  (key to Ceratitis) abdomen
  - ▶  (key to Ceratitis) 80. abdomen pattern
  - ▶  (key to Ceratitis) 81. tergite 2 with silvery grey band
  - ▶  (key to Ceratitis) 82. tergite 4 with silvery grey band
  - ▼  (key to Ceratitis) 83. tergite 3 with brown-black band or completely black
    - no
    - yes
  - ▶  (key to Ceratitis) 84. (females) oviscape length
  - ▼  (key to Ceratitis) 85. (females) aculeus tip simple, without notch, indentations
    - yes
    - no
  - ▶  (key to Ceratitis) 92. (females) aculeus distal end elongated but straight

if you are not completely sure  
you can give multiple answers

- ▼  (key to Bactrocera, Zeugodacus and Dacus) legs
- ▼  key (to BZD) 72. fore femur colour
  -   fuscous / black
  -   pale basally, black apically
  -   pale basally, red-brown apically
  - pale, with dark spot
  -   red-brown
  -   yellow / pale

check the n. of species remaining  
after every character score

Entities Remaining: 21

-  Ceratitis acicularis
-  Ceratitis aliena
-  Ceratitis anonae
-  Ceratitis breinii
-  Ceratitis capitata
-  Ceratitis catoirii
-  Ceratitis colae
-  Ceratitis cosyra
-  Ceratitis ditissima
-  Ceratitis fasciventris
-  Ceratitis malgassa
-  Ceratitis marriotti
-  Ceratitis pedestris
-  Ceratitis penicillata
-  Ceratitis punctata

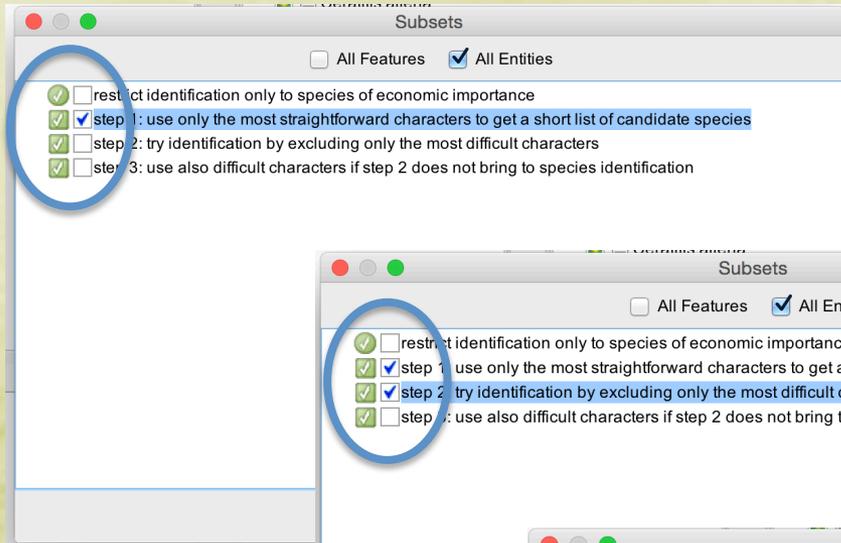
Entities Remaining: 7

-  Ceratitis capitata
-  Ceratitis cosyra
-  Ceratitis pedestris
-  Ceratitis punctata
-  Ceratitis quinaria
-  Ceratitis rubivora
-  Ceratitis silvestrii

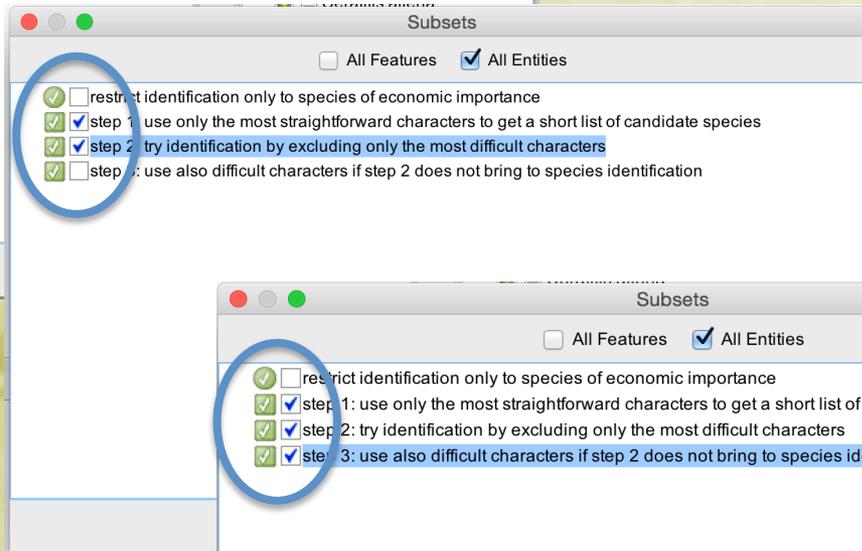
Entities Remaining: 2

-  Ceratitis pedestris
-  Ceratitis rubivora

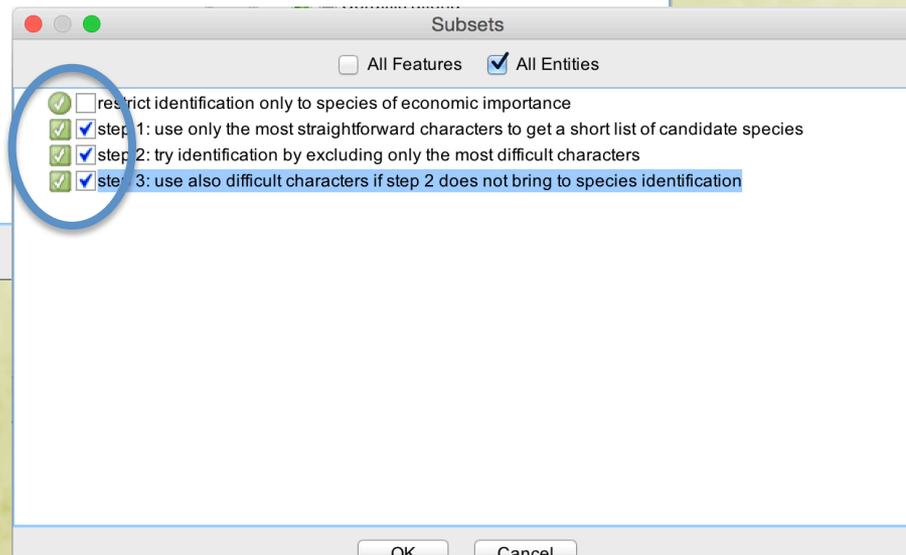
if you can't reduce the n. of species  
increase the n. of characters  
(option "subsets"):



easy characters



medium



difficult

if you are stuck then  
just check the differences  
between few remaining species

The screenshot shows a software interface with a toolbar at the top. A blue circle highlights a button with a list icon. Below the toolbar, a list of species is shown, with 'Ceratitis cosyra' and 'Ceratitis striatella' circled in blue. A 'Differences' window is open, displaying a list of features under the heading 'Different Features'. A blue circle highlights the 'Show All Features' checkbox at the bottom of the window.

Features Remaining: 2

- Ceratitis cosyra
- Ceratitis striatella

Differences

Different Features

- (key to Ceratitis) head:(key to Ceratitis) 8. ocellar setae colour
- (key to Ceratitis) head:(key to Ceratitis) 20. face with transverse median band
- (key to Ceratitis) thorax:(key to Ceratitis) 39. base scutellum with 2 brown or black spots
- (key to Ceratitis) head:(key to Ceratitis) 6. frons with silvery shine, at least in some areas
- (key to Ceratitis) thorax:(key to Ceratitis) 44. anepisternal setae
- (key to Ceratitis) head:(key to Ceratitis) 19. face, ground colour
- (key to Ceratitis) wings:(key to Ceratitis) 55. subapical band

Differences

Ceratitis cosyra:  
black or pale

Ceratitis striatella:  
black

Show All Features

option "differences + show all  
features"  
(e.g. between *C. cosyra* and *C. striatella*)

# final selection

Features Available: 49

- (key to Ceratitis) 77. (males) mid tibia anterior side with long (and dispersed) hairs
- (key to Ceratitis) 77bis. (males) mid tibia anterior side with long (and dispersed) hairs
- (key to Ceratitis) 78. (males) mid tibia anterior side with silvery shine when viewed from certain angle
  - no
  - yes
- (key to Ceratitis) 79. (females) fore femur with dark hairs between posterior and posterodorsal row of bristles
- (key to Ceratitis) wings
- (key to Ceratitis) abdomen
- (key to Ceratitis) 80. abdomen spot pattern
- (key to Ceratitis) 81. tergite 2 with silvery grey band
- (key to Ceratitis) 82. tergite 4 with silvery grey band
- (key to Ceratitis) 83. tergite 3 with brown-black band or completely black
  - no
  - yes
- (key to Ceratitis) 84. (females) oviscaple length
- (key to Ceratitis) 85. (females) aculeus tip simple, without notch, indentations, serrations or appendages

Entities Remaining: 1

**Ceratitis rubivora**

- species description
- taxonomy, description, distribution (bebif)
- Encyclopedia of Life (eol)
- Barcode of Life Data Systems (BOLD)
- all character states

right click

# verify species description and images!

Entities Remaining: 1

Ceratitis rubivora

- species description
- taxonomy, description, distribution (bebif)
- Encyclopedia of Life (eol)
- Barcode of Life Data Systems (BOLD)
- all character states

Firefox File Edit View History Bookmarks Tools Window Help

Ceratitis rubivora - Lucid3

**Ceratitis (Pterandrus) rubivora** Coquillett  
*Ceratitis rubivora* Coquillett, 1901: 29.

Body length: 4.56 (3.95-5.00) mm; wing length: 4.98 (4.45-5.45) mm.  
 Male

Head: Antenna yellow. First flagellomere 2-3 times as long as pedicel. Arista with short to moderately long rays; ventral rays shorter and sparser than dorsal rays, especially basally. Frons pale, in center more yellow; with short scattered setulae of same color as frons. Frontal setae well developed, occasionally anterior one slightly underdeveloped. Face white. Genal seta and setulae dark or dark reddish, latter moderately to poorly developed.

Thorax: Postpronotal lobe yellowish white, without spot, at most with darker yellow coloration near postpronotal seta. Scutal pattern: ground color, grayish-brown, usually with orange tinge, sometimes without; with streaks and darker markings but without distinct spots or clearly defined stripes, except prescutellar white separate markings, with paler gray area in between. Scapular setae dark reddish or black. Scutellum yellowish white, basally with ill defined separate dark spots (occasionally well developed), apically with three separate black spots, extending to basal 0.33, sometimes only to half-way. Anepisternum on ventral half yellowish orange to brown; setulae pale.

Legs: Yellow except where otherwise noted; setation typical for subgenus, mixed pale and dark. Foreleg: femur anteriorly with dorsal margin brownish over entire length; posterodorsally brown, with dispersed long dark setulae along entire length, but not forming distinct bush; ventral setae pale, distally dark, rarely dark over entire length. Midleg: femur brown on distal half to 0.66 (usually only ventral part brown anteriorly) except at apical margin where white, with weak silvery shine; ventrally with dark feathering along distal half, basally with more dispersed pale or dark setulae; tibia broadened, largely brownish black except at extremities, with conspicuous silvery shine when viewed from certain angle, with black feathering dorsally along distal 0.8-0.9 and ventrally along distal 0.8. Hindleg: femur partly brownish colored; at apical 0.25 with longer setulae dorsally and ventrally. Darker coloration of legs in some specimens more pronounced and more extensively blackish.

Wing: banding yellowish brown. Interruption between marginal and discal bands near vein R<sub>1</sub> clear and complete; discal band often partly, occasionally fully interrupted in discal cell; cubital band free; medial band free (not always well defined, sometimes missing); crossvein R-M at or just proximal to middle of discal cell. Apex of vein R<sub>1</sub> distal to level of crossvein R-M. Crossvein DM-Cu oblique anterobasally.

Abdomen: Mostly yellow. Tergite 1 with black patches across posterior margin. Tergites 2 and 4 with pale gray band on posterior half; tergite 4 with anterior margin brown. Tergite 3 with brown transverse band along posterior half to 0.66; tergite 5 with brown band along anterior 0.33 and narrowly brownish black across posterior margin. Brown bands on tergites 3, 4 and 5 often interrupted in middle. Male epandrium in lateral view with posterior lobe of lateral surstylus short and slightly curved, anterior lobe pronounced.

Female

SF6\_ZooKeys\_key to Ceratitis - ... x Ceratitis (Pterandrus) rubivora C... x

file:///Users/massimilianovirgilio/Documents/Lavori old/2 ... Google

Most Visited - Getting Started - www.skyinet.be - L... African frugivorous ... Virgilio Massimilian...

116%

# have a look at the hyperlinks

Entities Remaining: 1

- [Ceratitis rubivora](#)
  - species description
  - taxonomy, description, distribution (bebif)
  - Encyclopedia of Life (eol)
  - Barcode of Life Data Systems (BOLD)
  - all character states



**BOLDSYSTEMS** Databases | Taxonomy | Identification | Workbench | Resources

Ceratitis rubivora (species) - [Arthropoda](#); [Insecta](#); [Diptera](#); [Tephritidae](#); [Dacinae](#); [Ceratitids](#); [Print](#)

[Sub-taxa](#) [Taxon Description \(Wikipedia\)](#) [full article at Wikipedia](#)

**BOLD Stats**

Specimen Records:	15	Public Records:	9
Specimens with Sequences:	12	Public Species:	1
Specimens with Barcodes:	10	Public BINs:	1
Species:	1		
Species With Barcodes:	1		

[Species List - Progress](#) [Access Published & Released Data](#)

**Contributors (Specimens & Sequencing)**

**Specimen Depositories:**

- Mined from GenBank, NCBI [8]
- International Centre of Insect Physiology and Ecology [3]
- Royal Museum for Central Africa [2]

**Sequencing Labs:**

- Mined from GenBank, NCBI [8]
- Biodiversity Institute of Ontario [3]
- Royal Museum for Central Africa [1]

Navigation: Home, Taxa list, Taxa trees, Basic search, Advanced search, Specimen search, Fulltext search

**Ceratitis rubivora Coquillett**

Taxonomy

Status: valid

**Current Taxonomy**

Subfamily	Dacinae
Tribe	Ceratitidini
Genus	Ceratitis
Species	rubivora

**Original Taxonomy**

Subfamily	Dacinae
Tribe	Ceratitidini
Genus	Ceratitis
Species	rubivora

[back to top](#)

Species description [download](#) [back to top](#)

Specimens

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learn more about names for this taxon

Overview | Detail | Data | 7 Media | 3 Maps | Names | Community | Resources | Literature | Updates

**EOL has data for 4 traits** [see all](#)

type specimen repository	National Museum of Natural History, Smithsonian Institution (USNM)
habitat	woodland
habitat	non-marine
extinction status	extant

**Found in 4 classifications** [see all](#)

Species recognized by NCBI Taxonomy:

- Ceratitis rubivora*
- Ceratitis acaciariae*
- Ceratitis anomae*
- Ceratitis colae*
- Ceratitis copelandi*
- Ceratitis curvata*
- Ceratitis FAR complex sp. HD-2013*
- Ceratitis fasciventris*
- Ceratitis flexuosa*

[see all media](#) [see all maps](#)

*Ceratitis rubivora* [BOLD](#)  
  
 © Copeland  
 Source: Atrotropical Fruitley Project