

**Genetic and behavioral discrimination of
host plant populations of the leaf beetle,
Psylliodes chalconera, for biological
control of three thistles (Cardueae).**

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Need host specific natural enemies

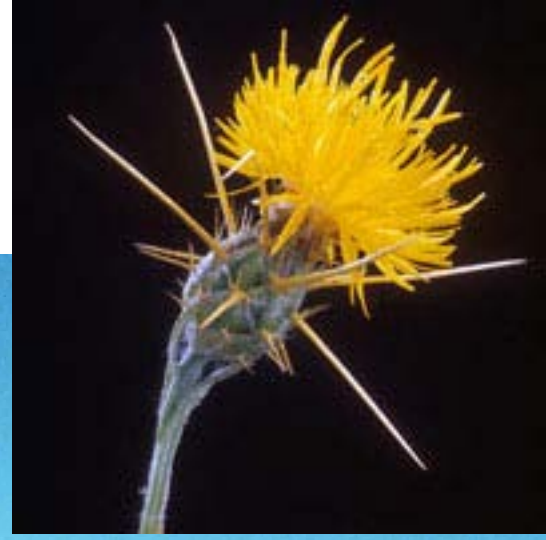
Limited by the number of host specific species found in foreign exploration.

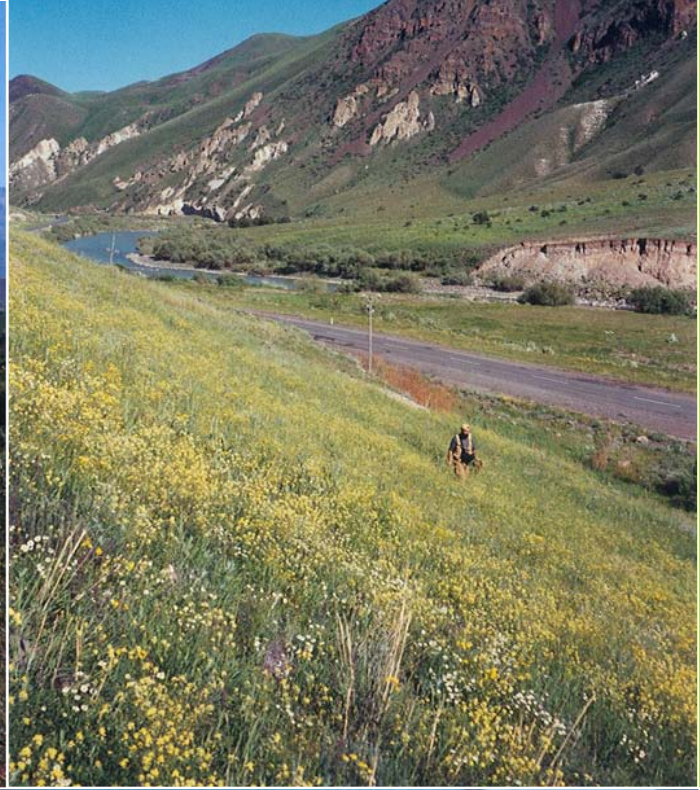
Cryptic populations = more BC agents?

ID by behavior and morphology.

Now molecular genetics.

Yellow Starthistle (*Centaurea solstitialis*)

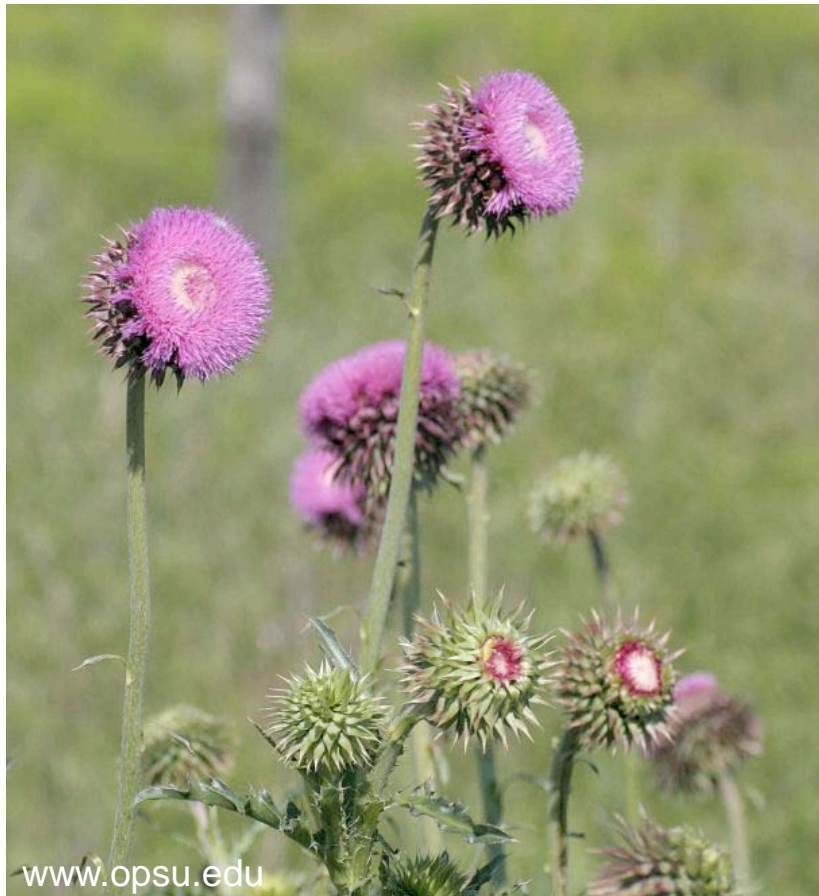




I. Psylliodes chalcomera

Psylliodes chalconera

Released against Musk thistle
(*Carduus nutans*) in USA

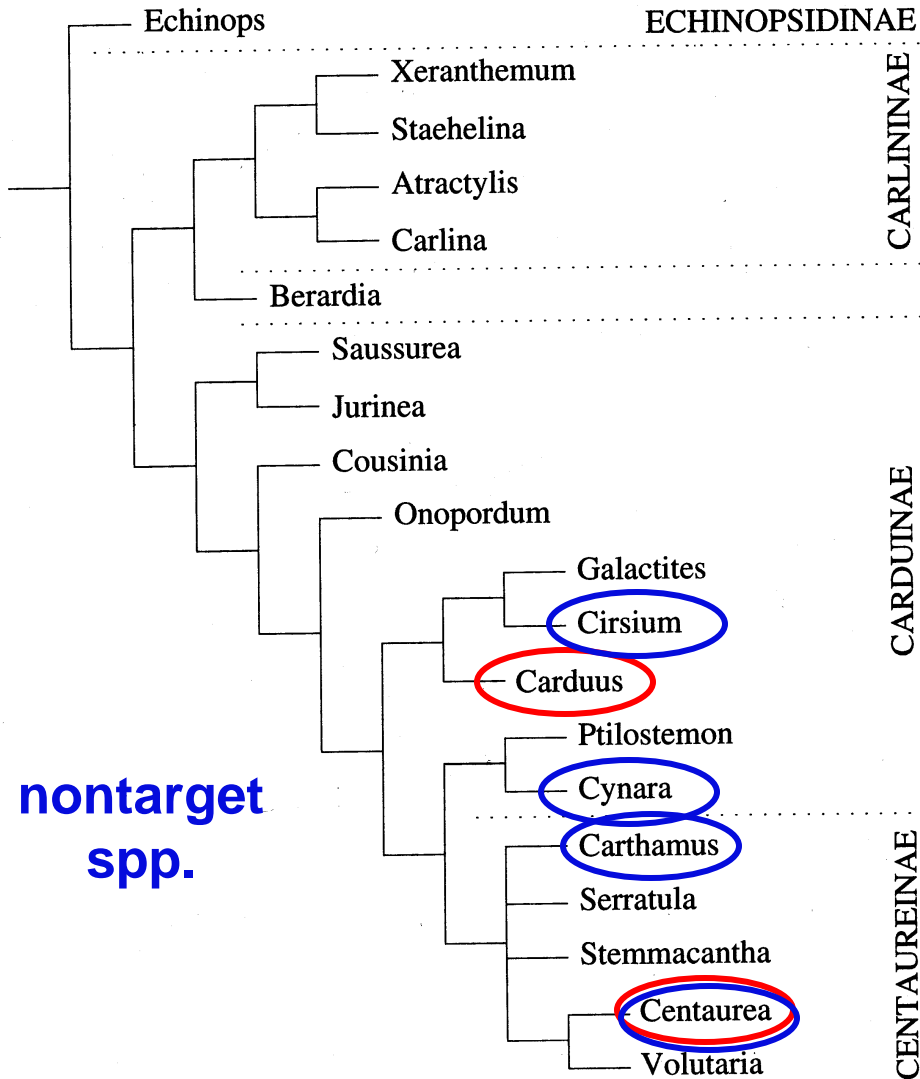


probably not established

Kok et al. (1982), Dunn & Campobasso (1993), Hennessey (1997)

Tribe Cardueae (Asteraceae)

Subtribes



nontarget
spp.



musk thistle
(*Carduus nutans*)



yellow starthistle
(*Centaurea solstitialis*)

Psylliodes chalcomera on *Carduus nutans*



Laboratory No-Choice Oviposition

Eggs on: *Cirsium arvense*, *Ci. monspessulanum*,
Ci. vulgare, *Cynara* (artichoke), *Carthamus*
(safflower), *Centaurea moschata* (Dunn & Rizza 1977)

Larval transfer

Not devel. on: artichoke, safflower, *Centaurea*

Laboratory Choice Oviposition

Eggs on: *Ca. pycnocephalus*, *Cynara* (artichoke)
(Dunn & Rizza 1977)

Field expts., Rome Italy

Adults left *Cynara* (artichoke), *Carthamus* (safflower), *Ce. montana*
(Dunn & Rizza 1977)

- not attack 5 *Cirsium* spp. (Dunn & Campobasso 1993)

NOT TEST: *Onopordum* sp. or *Centaurea solstitialis*

Psylliodes chalconera

Found on Yellow Starthistle
and Scotch Thistle in Russia



yellow starthistle
(*Centaurea solstitialis*)

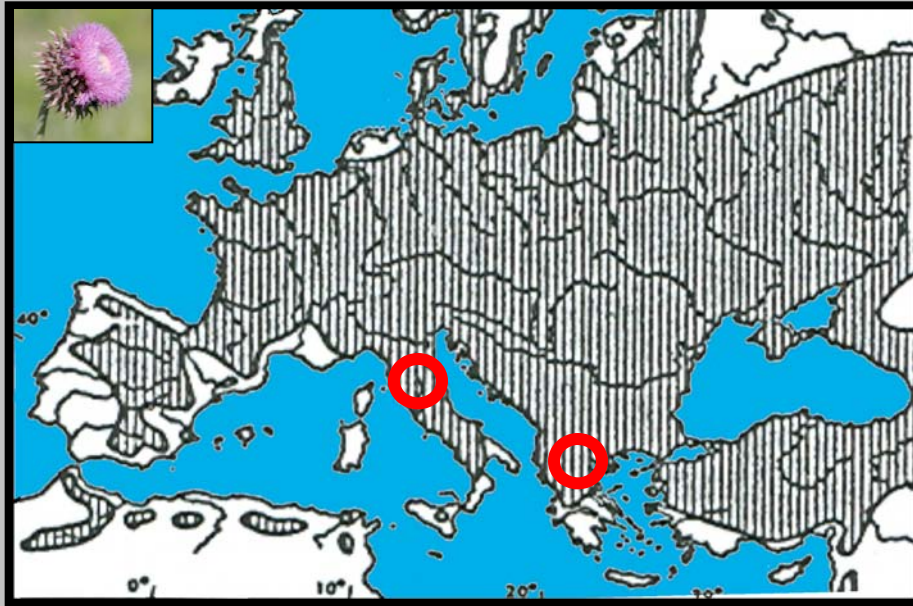


Scotch thistle
(*Onopordum* spp.)

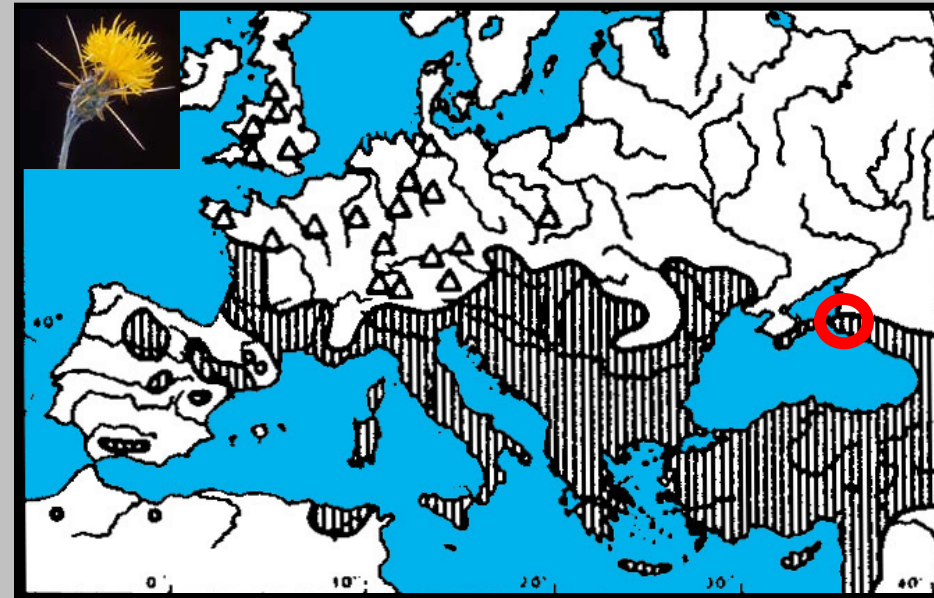
Cristofaro et al. 2004

Distribution in Europe

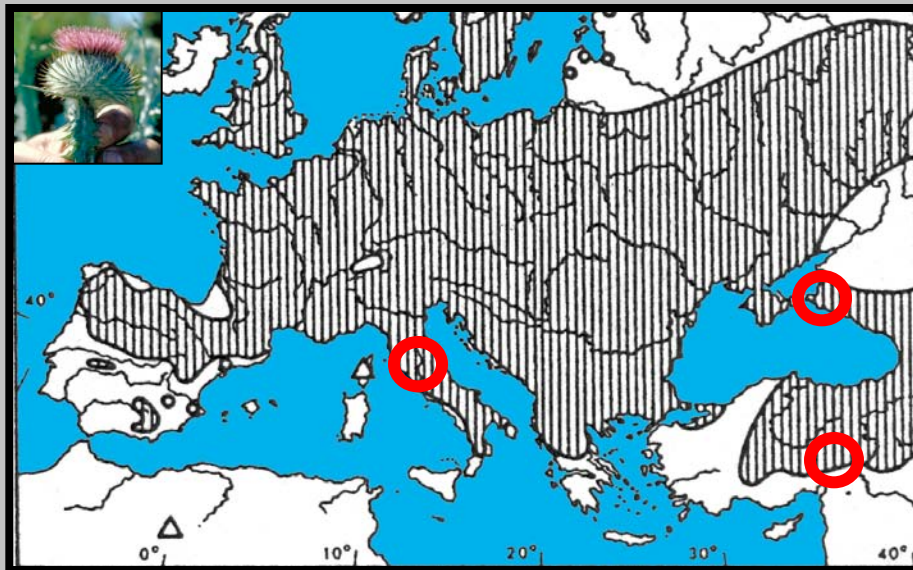
P. chalconera
collection sites



Musk thistle



Yellow Starthistle



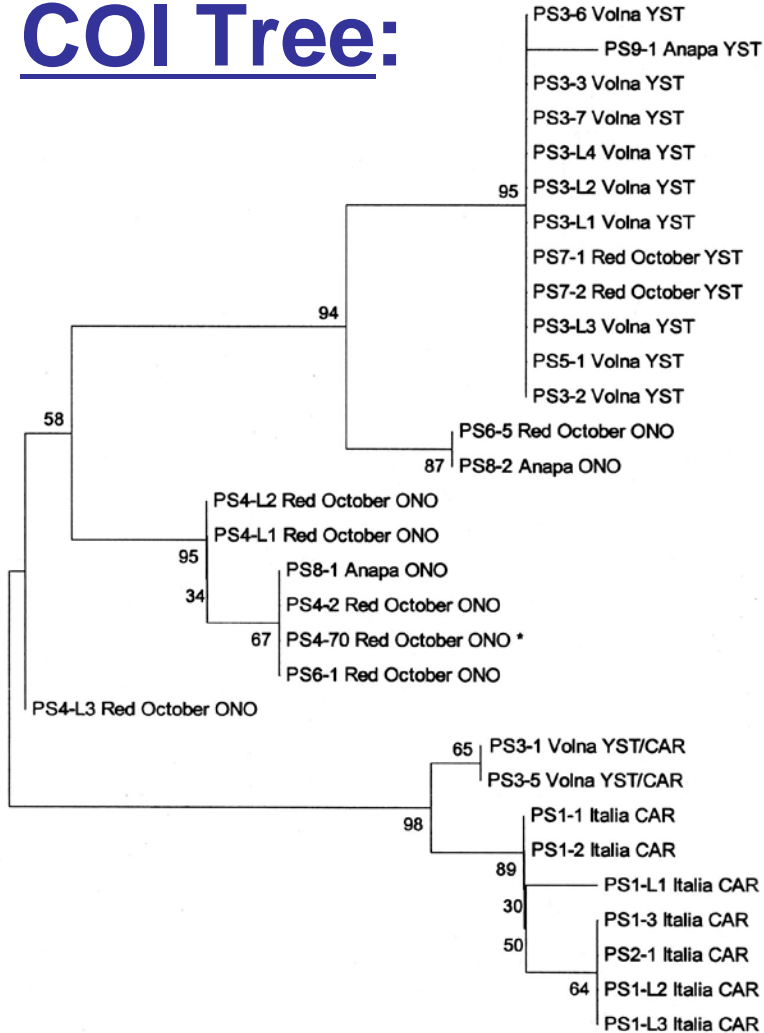
Scotch thistle

Psylliodes chalcomera



Fig 1. Neighbor Joining Tree on the K2P distances matrix

COI Tree:



0.005

Adult from:

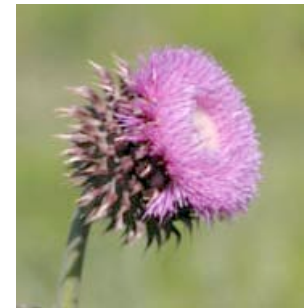
yellow starthistle
(Centaurea solstitialis)



Scotch thistle
(Onopordum spp.)



musk thistle
(Carduus nutans)



Psylliodes chalconera

Host plant specificity (3-way choice)



*Onopordum
acanthium*

*Carduus
nutans*

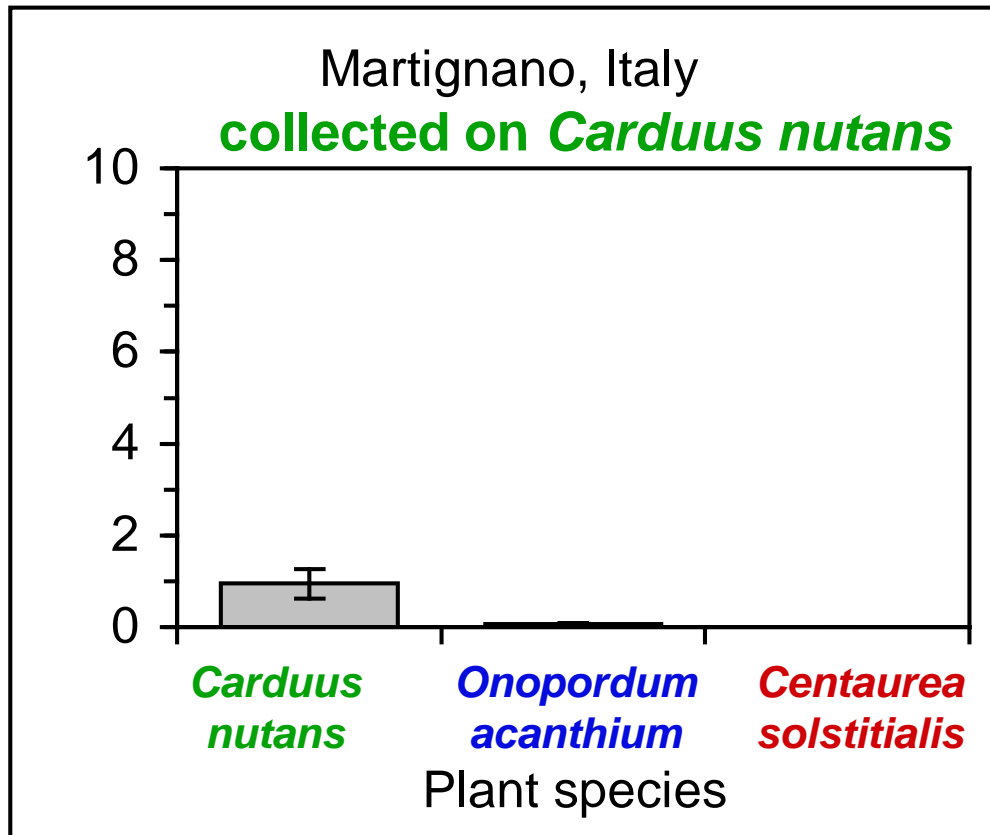
*Centaurea
solstitialis*



L. Smith (unpubl. data)

Psylliodes chalconera

Host plant specificity (3-way choice)

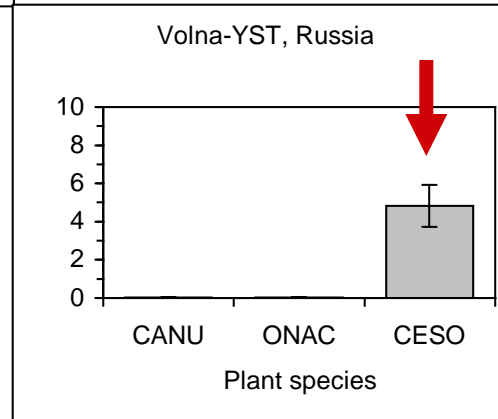
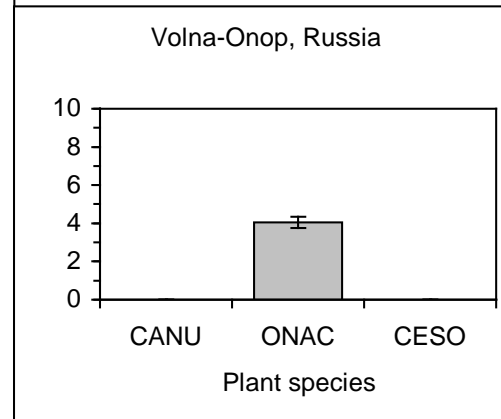
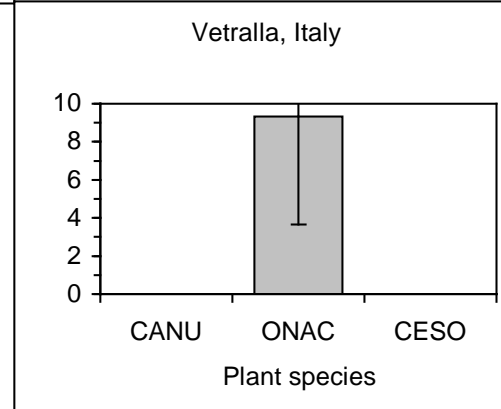
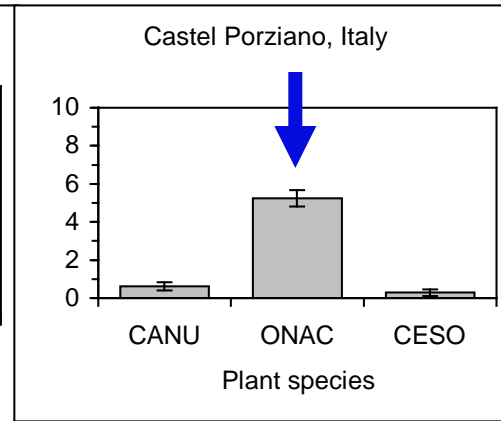
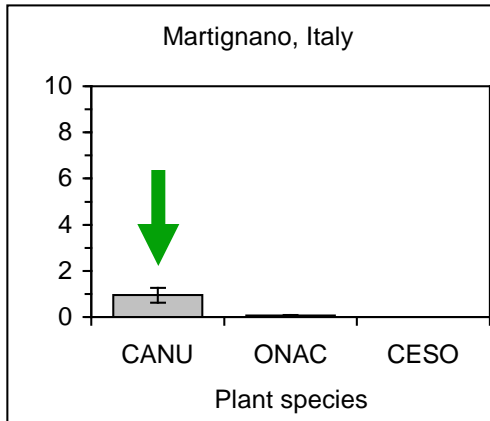


L. Smith (unpubl. data)

Psylliodes chalcomera



Host plant
specificity
(3-way choice)



Carduus nutans

Onopordum acanthium

Centaurea solstitialis

Psylliodes chalcomera



Scotch thistle

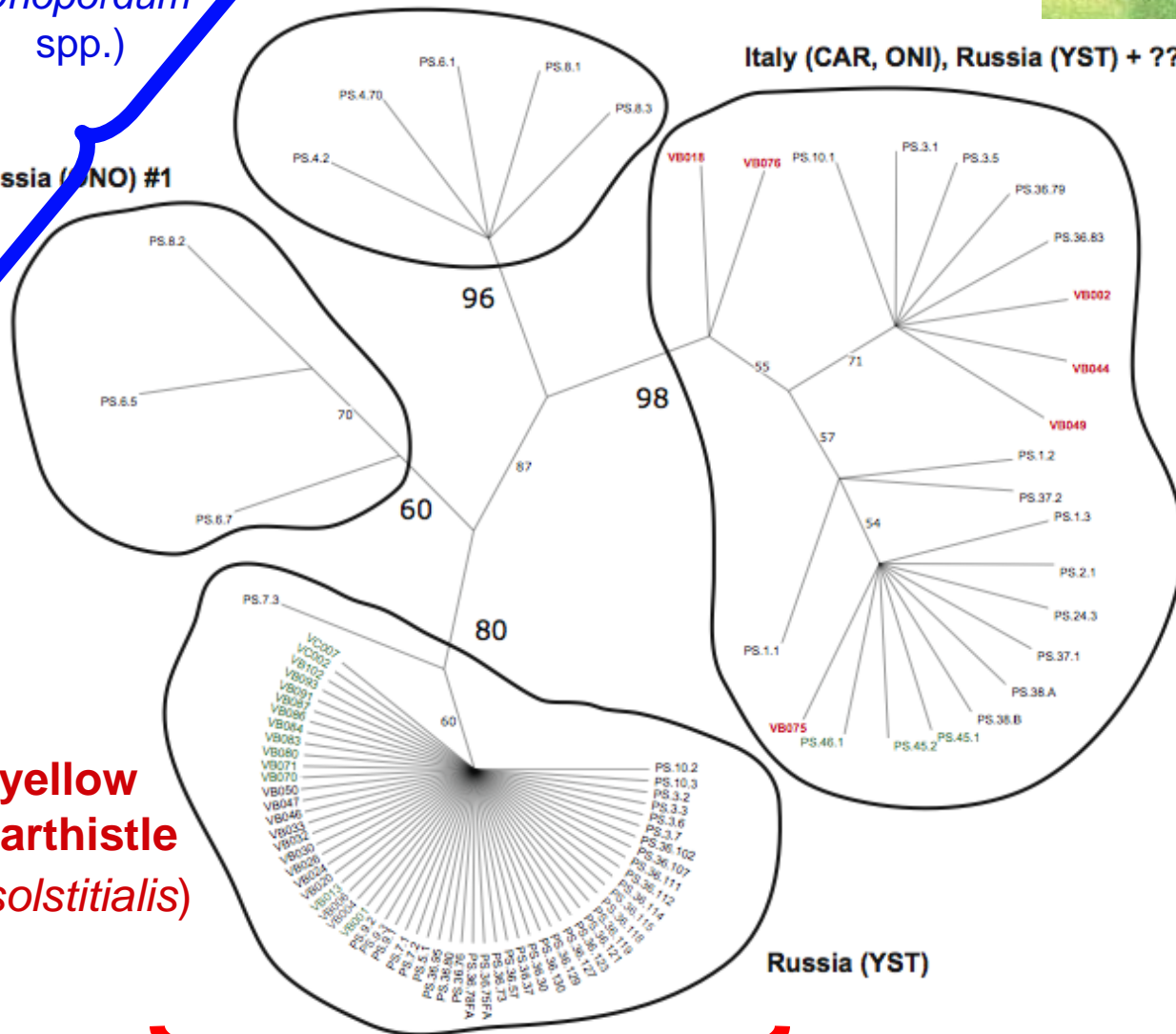
(*Onopordum* spp.)



Russia (ONO) #1

Russia (ONO) #2

Italy (CAR, ONI), Russia (YST) + ??



musk thistle
(*Cardus nutans*)

yellow starthistle
(*Centaurea solstitialis*)



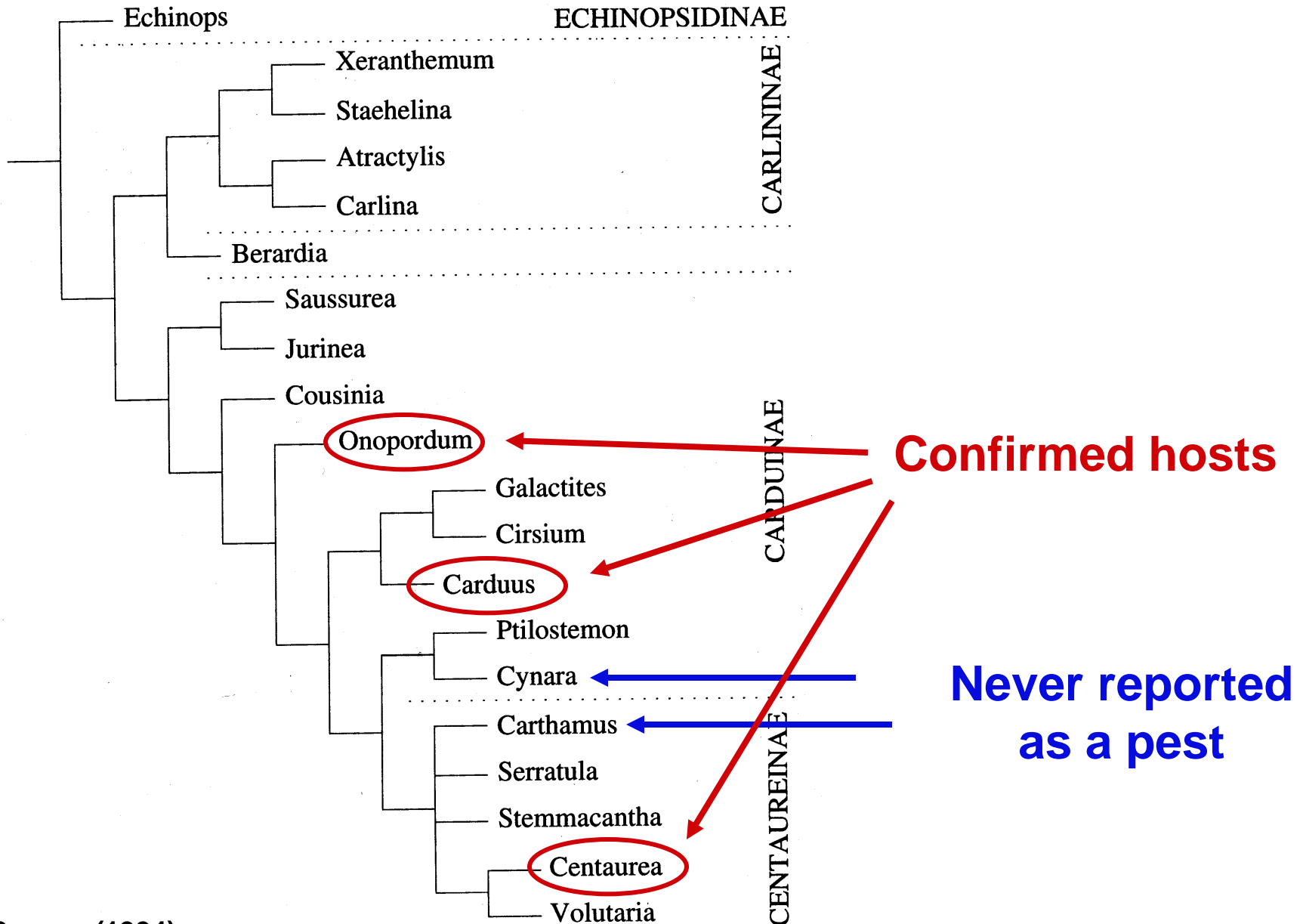
Neighbor Joining

COI Tree

A. DeBiase (unpubl. data)

Tribe Cardueae

Subtribes



II. Other Examples of Cryptic Species

Trichosiocalus horridus



- Introduced to USA in 1975 against musk thistle (*Carduus nutans*).
 - Also attacks *Cirsium arvense* & *Cirsium vulgare*!
 - Introduced to Canada, New Zealand, Australia for *Carduus*.
 - Population specific to *Onopordum* found in Spain.
Released in Australia in 1997 (Briese et al. 2002).
 - 3 species described (Zarazaga et al. 2002):
 - T. horridus* -- *Cirsium* only**
 - T. mortadelo* -- *Carduus* only**
 - T. briesei* -- *Onopordum* only**
- But, no DNA analysis.
- R. Groetmann (2007) - specimens from *Cirsium* & *Carduus* in NZ are not *T. mortadelo*. Look like *T. horridus*.
 - **So, not really sure what species were released!**

Whitetop (*Lepidium* [= *Cardaria*] *draba*)



claude.schott.free.fr

collar gall weevil *Ceutorhynchus assimilis* (Coleoptera: Curculionidae).

Pest of more than 13 species of Brassicaceae including cabbage.

No infestation of cabbage next to heavily infested *L. draba* in s. France.

Specific to *Lepidium* in initial host specificity tests.

Sobhian (2000); Fumanal et al. 2004 (Biol. Control 30: 598-607)

**III. Are they true species?
Does it matter?**

Regulatory issues

What name to use?

Need to register COI "bar code"

Current policy to use individuals from one location?

Can genetic analysis substitute for behavioral evaluation of host plant specificity?

Research Challenges

Nonlethal DNA analysis.

e.g., frass (Fumanal et al. 2005)

Evolutionary stability of host plant specificity?

What controls host plant specificity?