

Evaluation of the rosette weevil, *Ceratapion basicorne*, a new biological control agent of yellow starthistle



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Classical Biological Control

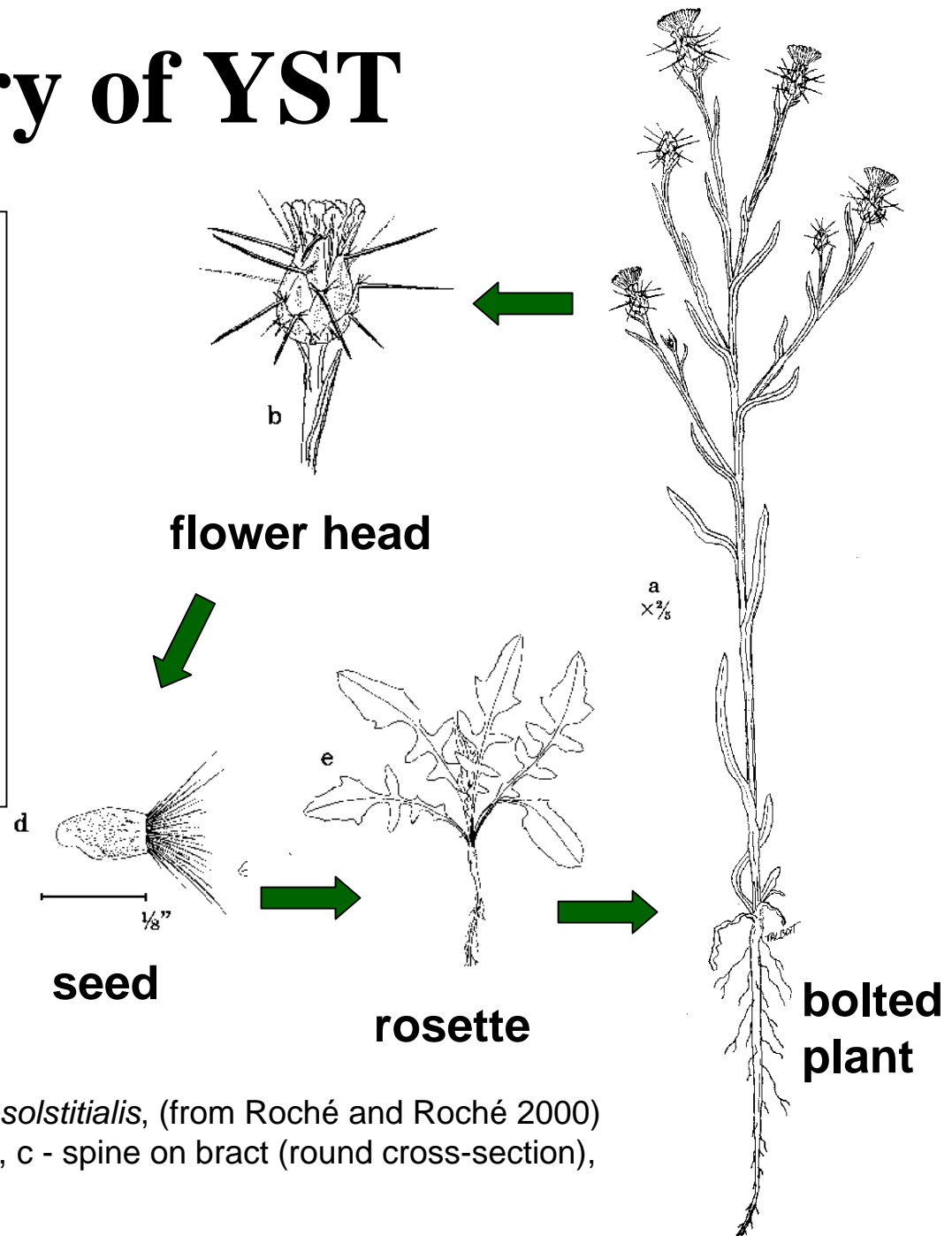
- **Use an alien to control an alien**
- **One tool in the toolbox**
- **Safety is the primary concern**
- **Not always possible**
- **Provides self-perpetuating control**
- **Environmentally safe**

Development of a New Agent

- **Feasibility**
- **Foreign Exploration**
- **Preliminary evaluation**
- **Host specificity testing**
- **“Petition” to TAG**
- **Permit application**
- **BA, FONSI, release permit**

Life History of YST

- Seeds germinate in late fall - early spring
- rosettes
- “Bolts” in May-June
- Flowers continuously until too dry or frost



Illustrations of Yellow starthistle, *Centaurea solstitialis*, (from Roché and Roché 2000) (a - mature plant, b - flowerhead (capitulum), c - spine on bract (round cross-section), d - seed (achene), e - rosette).

Status of Biological Control Agents of Yellow Starthistle

Biological control agent	Common name	First release	Status in USA
<i>Urophora jaculata</i>	gall fly	1969	Not established.
<i>Urophora sirunaseva</i>	gall fly	1984	Widespread but few.
<i>Bangasternus orientalis</i>	bud weevil	1985	Widespread but few.
<i>Chaetorellia australis</i>	peacock fly	1988	Prefers bachelor's button
<i>Eustenopus villosus</i>	hairy weevil	1990	Widespread & abundant.
<i>Larinus curtus</i>	flower weevil	1992	Widespread but few.
<i>Puccinia jacea</i> var. <i>solstitialis</i>	rust fungus	2003	Established and being distributed
Unapproved accidental introduction:			
<i>Chaetorellia succinea</i>	false peacock fly	1991	Widespread & abundant.



Urophora sirunaseva



Bangasternus orientalis



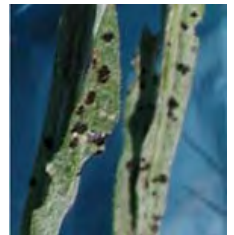
Eustenopus villosus



Larinus curtus



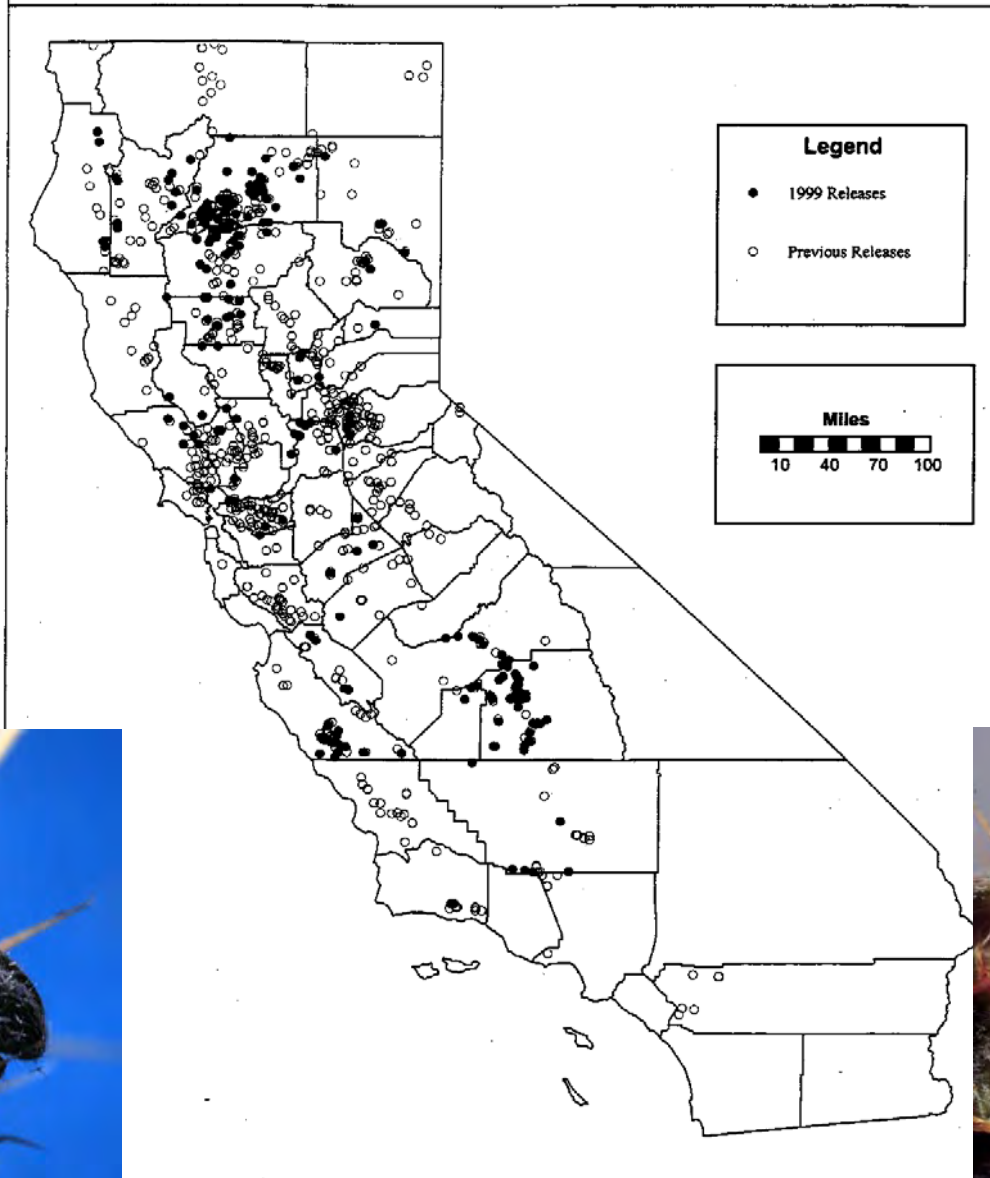
Chaetorellia succinea



Puccinia jacea var *solstitialis*

Figure 1: Releases of the Hairy Weevil in California in 1990-1999

Biological Control Program, CDFA



Hairy weevil

False Peacock Fly



Yellow Starthistle, Myrtle Creek, OR, 6/91



grazed by cattle

Yellow Starthistle, Myrtle Creek, OR, 7/95



**Hairy weevil
(no grazing)**

Rust Fungus

Puccinia jaceae var. *solstitialis*

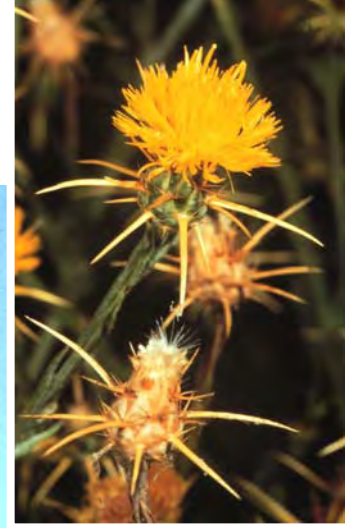


yellow starthistle

- **Released by CDFA (2003-06)**
- Currently monitoring 80 sites
- Low establishment & impact

Dale Woods, CDFA
Alison Fisher, USDA-ARS
& cooperators

Yellow Starthistle *Centaurea solstitialis*



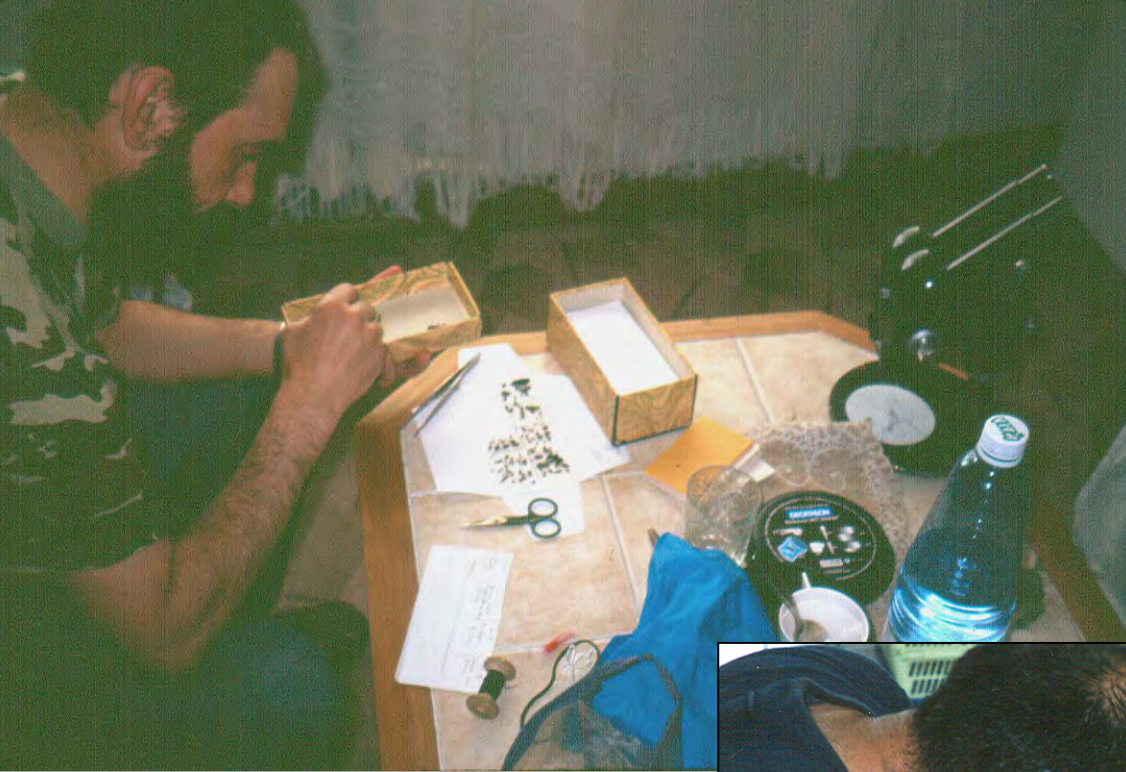
- **Seedhead insects need help**
- **Rust is doubtful**
- **Need to attack rosette stage**

Distribution of Yellow Starthistle in Europe



Foreign cooperators





Prospective Agents for Yellow Starthistle

Rosette weevil - *Ceratapion basicorne*

Turkey



Flea beetle - *Psylliodes* sp. nr. *chalcomera*

Russia



Lace bug - *Tingis grisea*

Turkey



Blister mite - *Aceria solstitialis*

Turkey



Rosette-boring fly - *Botanophila turcica*

Greece

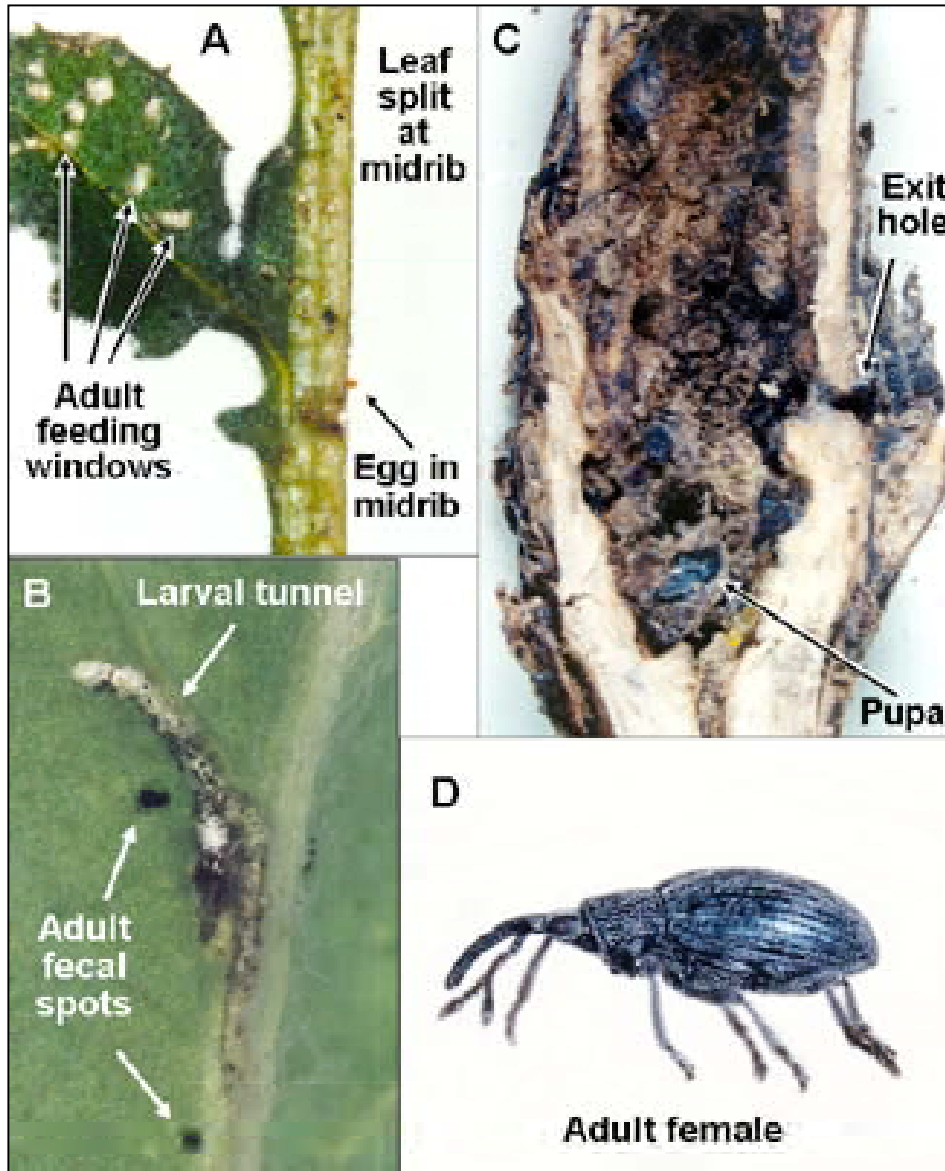


Seedhead weevil - *Larinus filiformis*

Turkey

Soil borne pathogens - *Synchytrium solstitiale*
and *Phoma exigua* (soilborne fungi) - France

Life Cycle of *Ceratapion basicorne*



- Oviposits in rosette leaf
- Larvae tunnel into upper root
- Pupates inside plant
- Adults emerge as plant bolts
- Adults in diapause until following spring

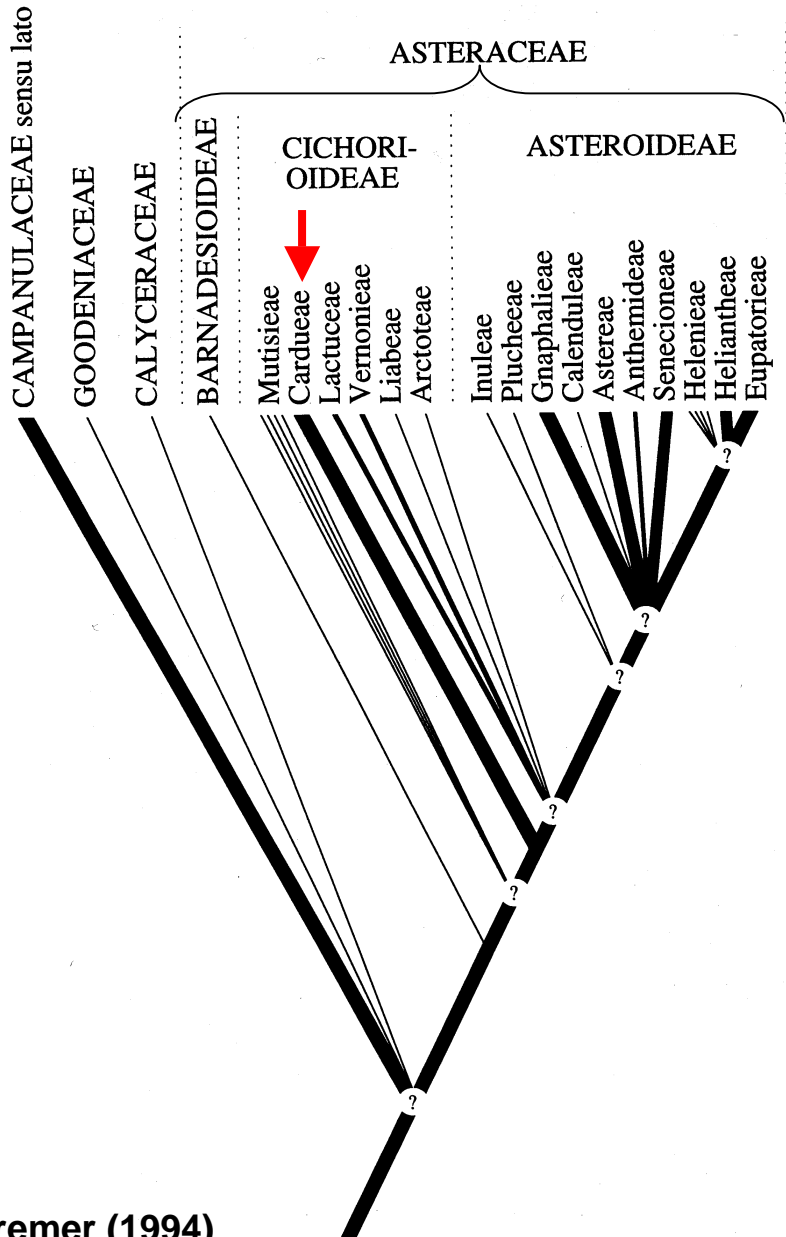


**Yellow
Starthistle
“YST”**

***Centaurea
solstitialis***

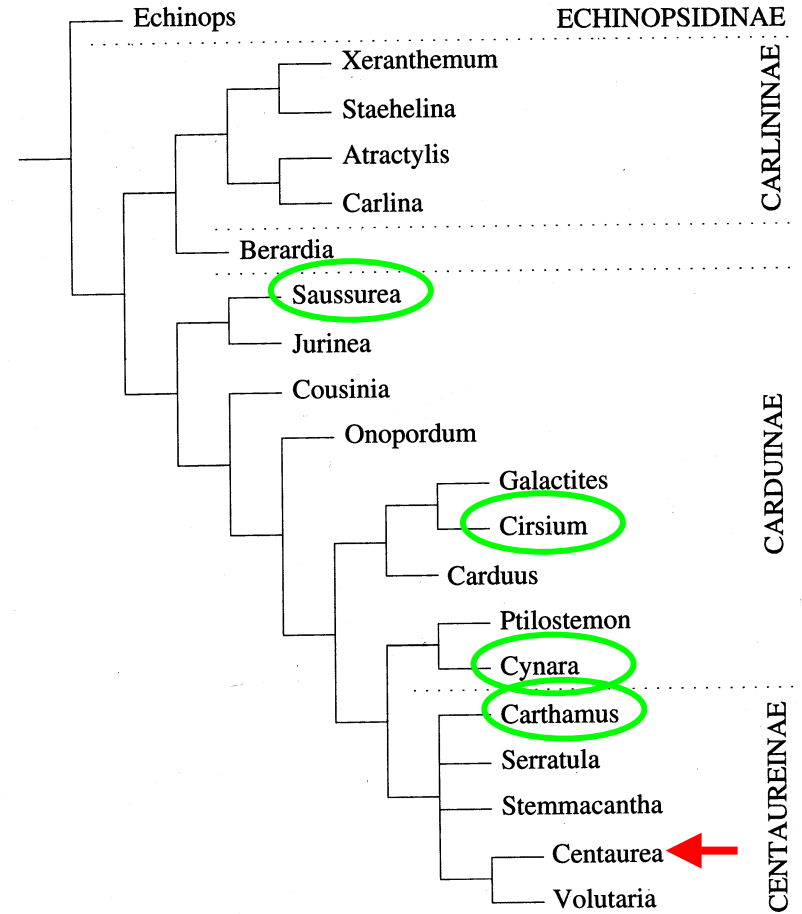
**Asteraceae
(sunflower
family)**

Phylogeny of family Asteraceae



Tribe Cardueae

Subtribes



Reported host plants of *Ceratapion basicorne* collected in the field.



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Adults reared from:

- Centaurea solstitialis* L.^{1,2,3,4} ----- **YST**
- Centaurea cyanus* L.² ----- bachelor's button
- Centaurea depressa* M.Bieb.⁴
- Cnicus benedictus* L.⁴ ----- (now *Centaurea*)

-
- ¹ Alonso-Zarazaga (1990a)
² Wanat (1994)
³ Campobasso et al. (1999)
⁴ J. Balciunas (unpubl. data)



photo Henriette Kress

Host Specificity Testing

- **No-choice oviposition**
- Choice oviposition (lab)
- Field oviposition & damage

No-choice Oviposition Experiment

1 female *Ceratapion basicorne* in tube for 5 days



American sawwort (*Saussurea americana*)

Subfamily

Asteroideae

Cichorioideae

Tribe

**Veronieae
Lactuceae
Mutisieae**

Cardueae

Subtribe

**Echinopsidinae
Carlininae**

Carduinae

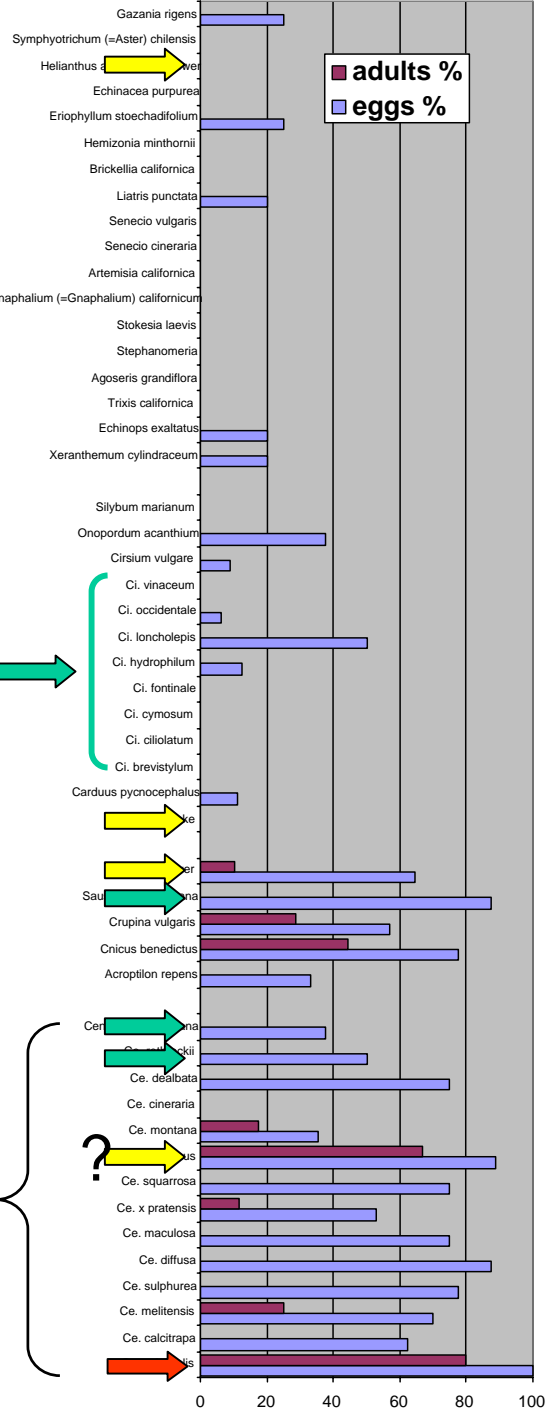
Centaurinae

Centaurea

Native

Commercial

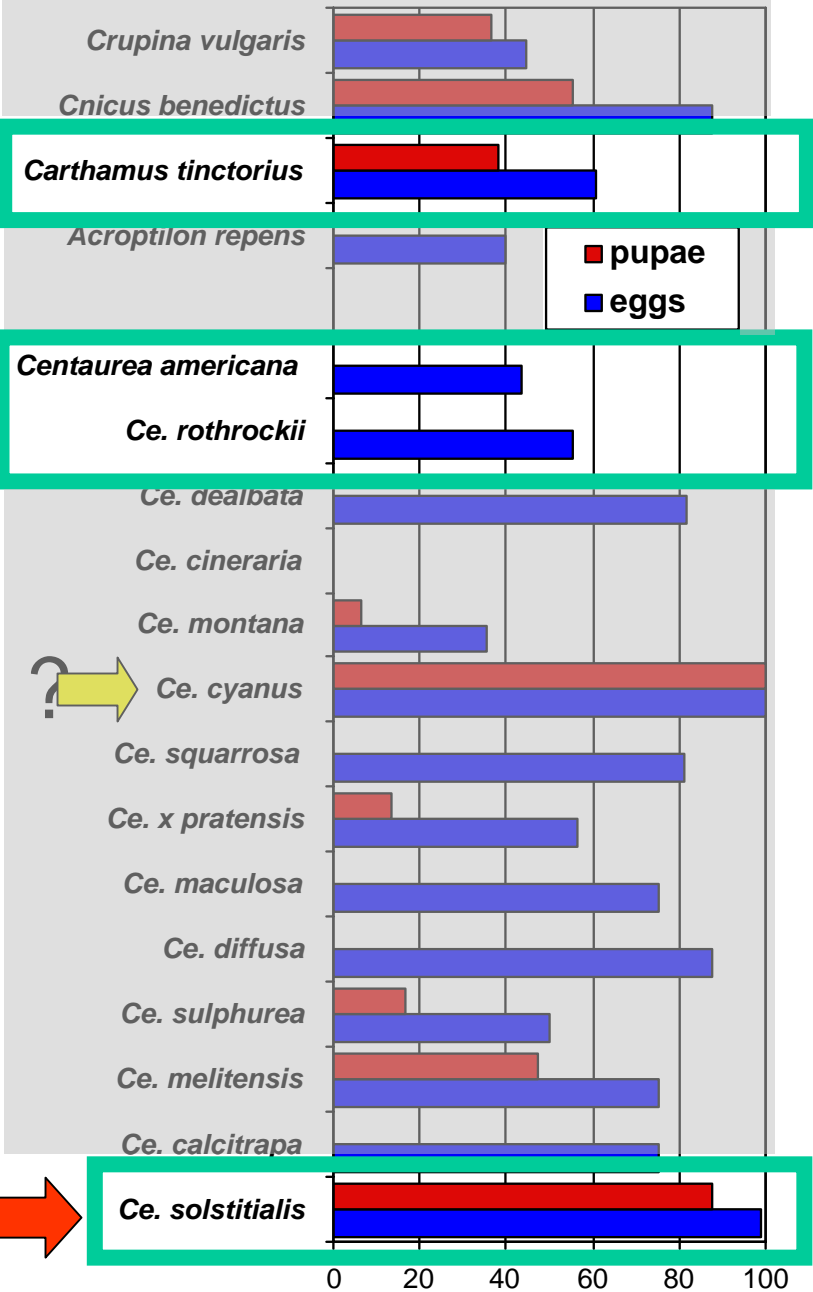
Target



No-choice Oviposition

Subtribe
Centaurinae

Centaurea



- ➔ Native
- ➔ Commercial
- ➔ Target

Host Specificity Testing

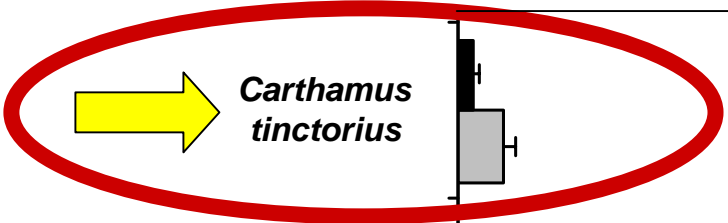
- No-choice oviposition
- **Choice oviposition (lab)**
- Field oviposition & damage

Choice Oviposition Experiment

1 female *Ceratapion basicorne* in sleevebox for ≥ 5 days



Choice Oviposition



Carthamus tinctorius

Centaurea rothrockii

Centaurea americana

Centaurea sulphurea

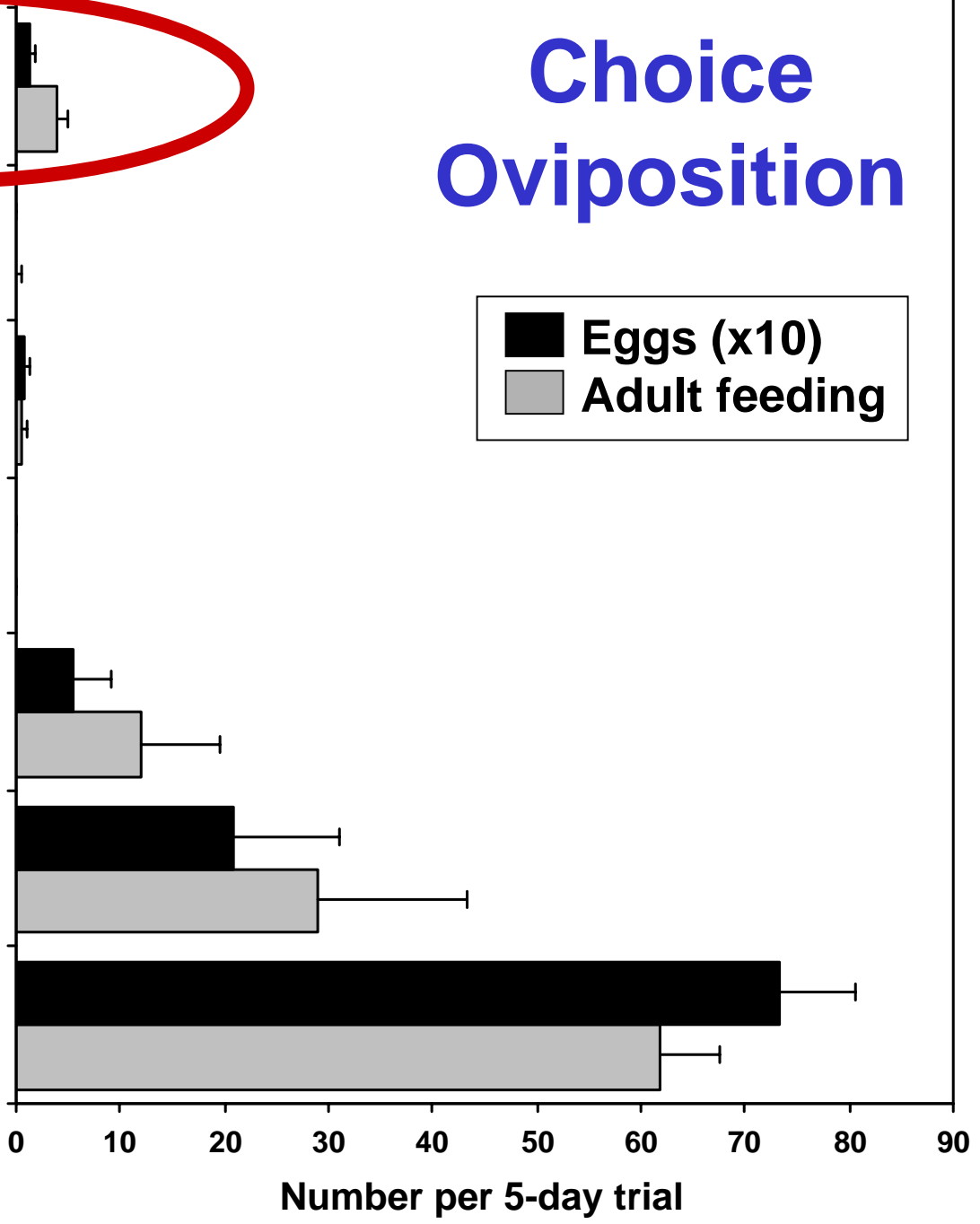
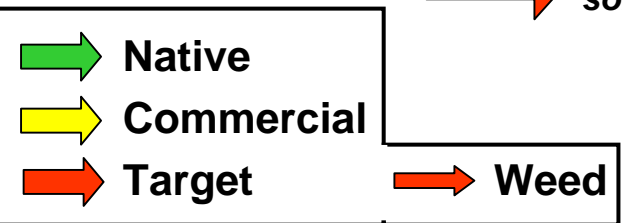
Centaurea melitensis

Centaurea cyanus

Centaurea solstitialis

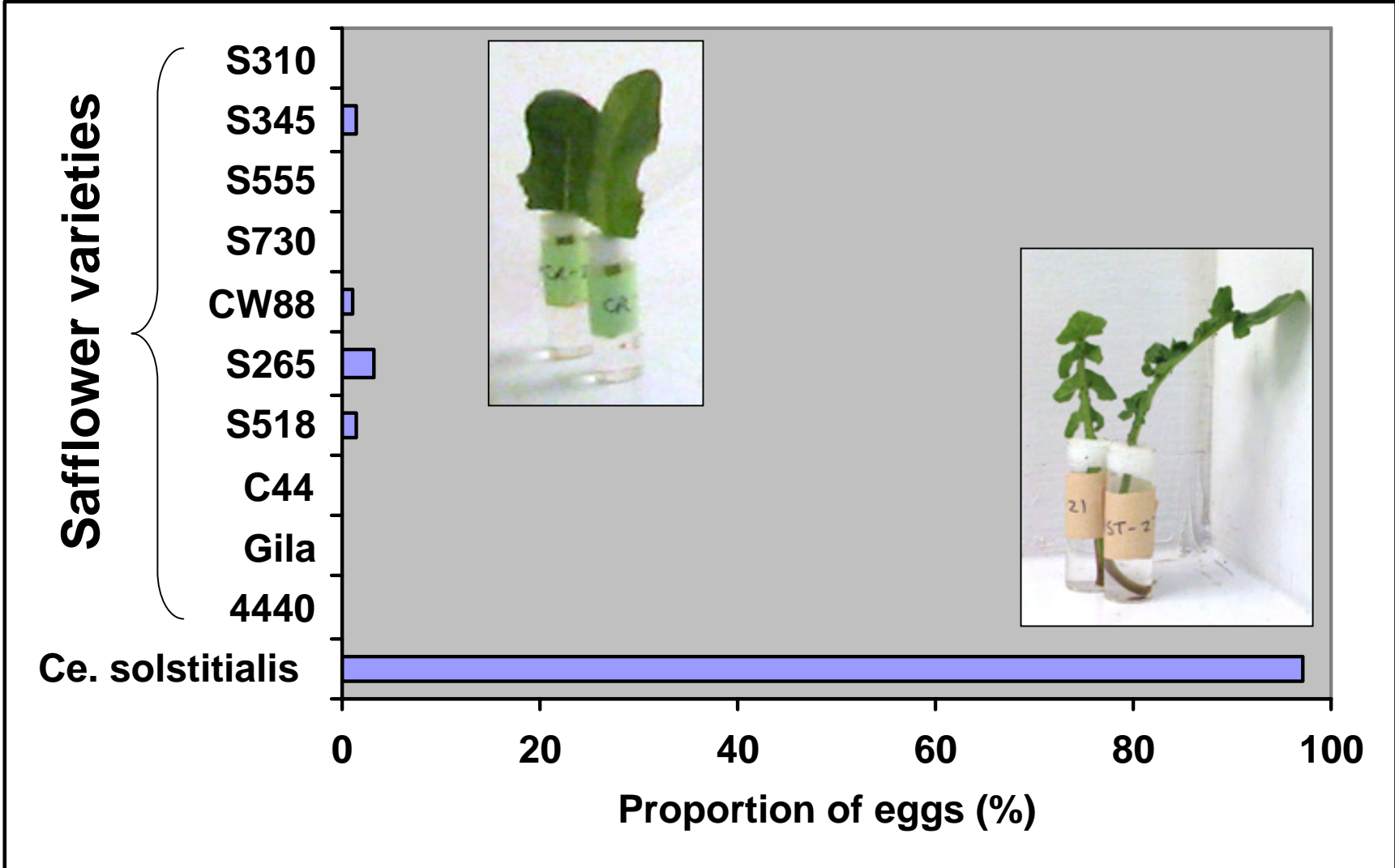


Bachelor's button



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Choice Oviposition Experiments



Host Specificity Testing

- No-choice oviposition
- Choice oviposition (lab)
- **Field oviposition & damage**

Ceratapion Yellow Starthistle Field Tests



Ataturk University, Erzurum, Turkey



Cat (1850 m), 3/29/02



Askale (1630 m), 4/27/02



Horasan (1500m), 5/27/02



YST

- Turkey
- California

Safflower

- oleic
- linoleic



Safflower Field Tests in Turkey

Proportion of plants infested (%)^a

Site	Test plant				No. Safflower plants
	YST(US)	YST(TR)	Oleic	Linoleic	
2002					
Horasan	83 b	100 a	0 c	0 c	45
Cat	28 b	67 a	0 c	0 c	38
Askale	59 b	87 a	19 c ^b	16 c ^c	40
2003					
Cat	37 a	45 a	0 b	0 b	57
Askale		77 a	8 b ^d		39
2004					
Horasan		98 a	0 b		250
Askale		100 a	34 b ^e		99
					390

^a Values followed by the same letter in the same row are not significantly different (chi-square test, $P < 0.01$).

^b Adults identified: 4 *C. scalptum*, 1 *C. orientale*, 2 *C. onopordi*.

^c Adults identified: 2 *C. scalptum*.

^d Adults identified: _ * *C. scalptum*, _ *C. orientale*.

^e Adults identified: 8 *C. scalptum*, 2 *C. orientale*.

Probability of infestation
< 0.0026

Safflower Field Tests in Turkey

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Askale		77 a	8 b ^d		39
2004					
Horasan		98 a	0 b		250
Askale		100 a	34 b ^e		99
					568

^a Values followed by the same letter in the same row are not significantly different (chi square test, $P < 0.01$).

^b Adults identified: 4 *C. scalptum*, 1 *C. orientale*, 2 *C. onopordi*.

^c Adults identified: 2 *C. scalptum*.

^d 3 unidentified adults.

^e Adults identified: 8 *C. scalptum*, 2 *C. orientale*.

Probability of infestation < 0.0018

Conclusion for *Ceratapion basicorne*

- Safflower, artichoke and sunflower are not at risk.
- Native *Centaurea*, *Cirsium* and *Saussurea* are not at risk.
- **Potential harm:**
Bachelor's button (*Ce. cyanus*) is at risk for possible collateral damage. (ornamental & invasive weed)
- **Petition was “approved”** by Technical Advisory Group.
- Release permit application is being reviewed by USDA-APHIS.
- **Planning for possible releases in spring 2008.**



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PAMUI
E YAF

STİK

GAN
RU SETİ

PAY ÇİÇE
TIAN PERAKEN
15 ml. KESİNE



