



Broomrape biology and control in tomato

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Processing Tomato Production Mtg
Woodland, CA
1/8/20

University of California
Agriculture and Natural Resources

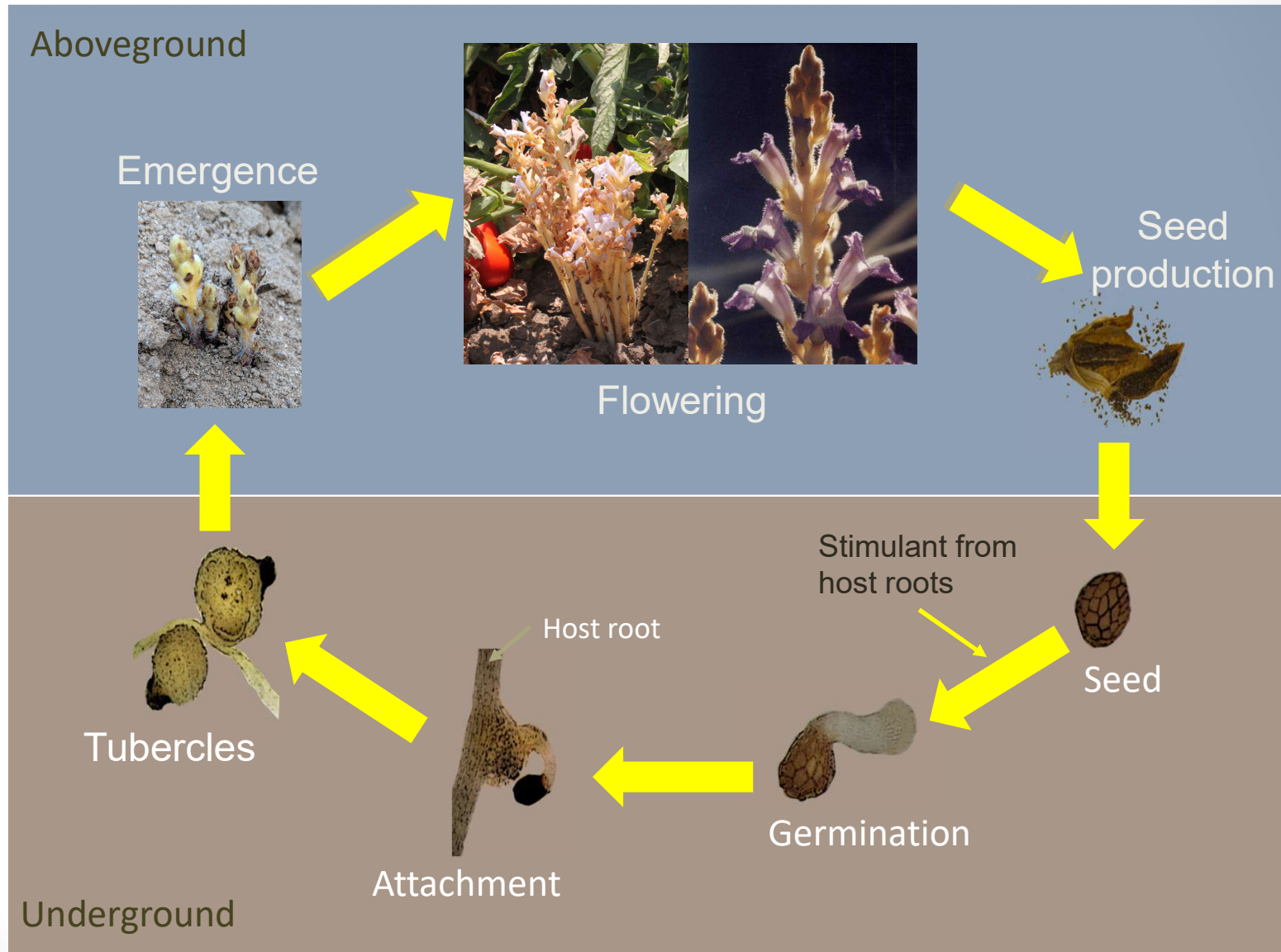
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DEPARTMENT OF PLANT SCIENCES
College of Agricultural and Environmental Sciences

Broomrape

- A genus of >200 parasitic herbaceous plants
 - *Orobanche* spp (aka *Phelipanche* spp).
- Broomrapes are root parasites (attach below ground)
- Holoparasites = derives all carbon from a host plant
- Plants lack chlorophyll
 - Usually yellow- or straw-colored
- Some broomrapes have narrow host range, but others have a much wider host range
- At high density, can greatly reduce yield or even result in crop failure



Lifecycle



Broomrape in California

- At least two species have been detected in CA tomato fields
 - Branched broomrape (*Orobanche ramosa*) - “A-listed”
 - Egyptian broomrape (*Orobanche aegyptiaca*) – “Q-listed”
 - First report in North America – Solano Co. in 2014
- Branched broomrape has been reported on-and-off for several decades in CA
- Egyptian broomrape has a wider host range (~23 crops grown in CA!) and may be an even more serious risk
 - Potential for non-crop risks too

The screenshot displays the CDFA website's pest rating profile for Egyptian Broomrape. The page is titled "PEST RATING PROPOSALS AND FINAL RATINGS" and features a navigation menu on the left with options like "PEST RATING PROPOSALS WELCOME PAGE" and "CDFA'S PEST RATINGS HOME PAGE". The main content area includes the following sections:

- WEEDS:** EGYPTIAN BROOMRAPE | OROBANCHE AEGYPTIACA PERS. (dated APRIL 8, 2015 by DEAN KELCH)
- California Pest Rating for:** Egyptian broomrape | *Orobanche aegyptiaca* Pers.
- Lamiales: Orobanchaceae**
- Pest Rating: A | Proposed Seed Rating: P**
- PEST RATING PROFILE**
- Initiating Event:** Egyptian broomrape was found for the first time in North America in Solano County, California in July, 2014.
- History & Status:** Egyptian broomrapes are annual plants that grow from seed and require a host to survive. They are parasitic plants that grow on the roots of Broad-leaf hosts and obtain all of their nutrients and water from these plants. As such, they can seriously reduce the yield of infested crops. Seeds germinate in response to chemicals released by host plant roots. The broomrape seedling root then attaches itself to the host plant root and remains underground until flowering. The plant has no chlorophyll and no photosynthetic leaves. Flowering stems emerge about 6 weeks after germination, then flower and begin to set seed within 2-3 weeks. Seed capsules dry and shatter in...

On the right side, there are sections for "LINKS" (Insects, Mites & Earthworms, Nematodes, Plant Pathogens, Snails and Slugs, Vertebrate Pests, Weeds, Image Credits), "DOCUMENTS" (Pest Ratings and Mitigating Actions, Section 3162 (PDF), Pest Rating Process | Instructions (PDF), Pest Rating Proposal Form (Word Document)), and "RESOURCES" (Common Names of Insects and Related Organisms, California Plant Links, California Noxious Weed List, The Jepson eflora, Most recent manual of California plants with up-to-date names, CalWeedMapper: Maps showing distribution and status of California weeds, California: Localities of California plants, including weeds, The Consortium of California Herbaria).

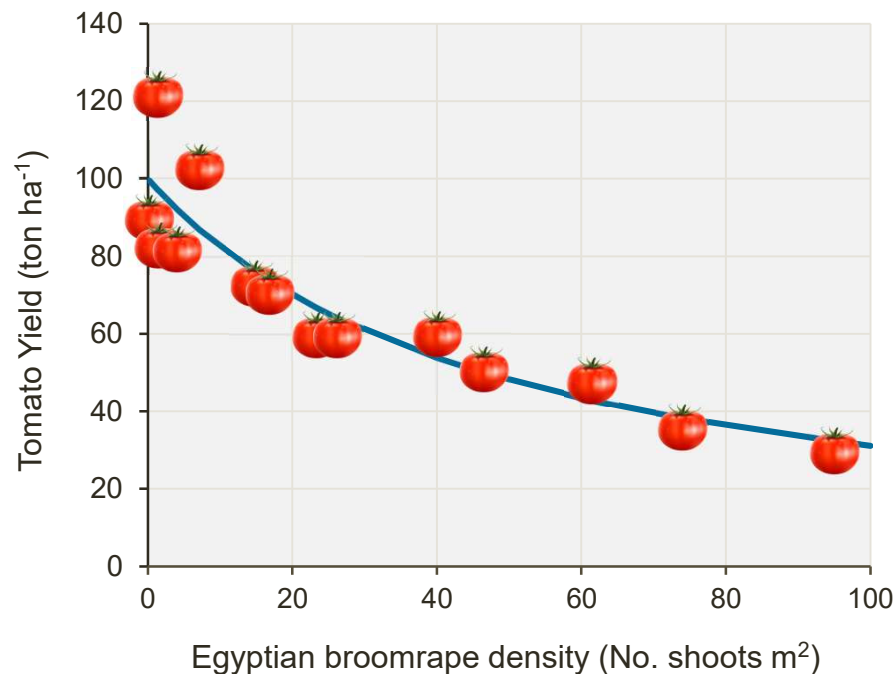
CDFA weed ratings reminder

- “A” listed
 - A pest of known economic or environmental detriment that is not known in CA or is present in limited distribution that allows for the possibility of eradication or successful containment
 - Subject to state enforced action involving eradication, quarantine, regulation, containment, rejection or other holding action
- “Q” listed
 - An organism or disorder suspected to be of economic or environmental detriment, but whose status is uncertain because of incomplete identification or inadequate information.
 -

https://www.cdfa.ca.gov/plant/ipc/encycloweedia/wininfo_weedratings.html

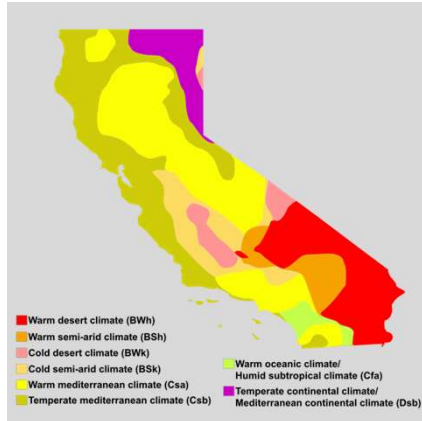
A threat to California tomato industry

- CDFA - “A-listed” quarantine pest
- Can be devastating in other countries
 - › Up to 70% yield loss in tomato
 - › Annual damage of \$200 million in Turkey, \$5 million in Israel



High Risk of Spread in California

Climate similarity



Diversity of hosts



Cabbage, carrot, sunflower...

Lack of control options in California



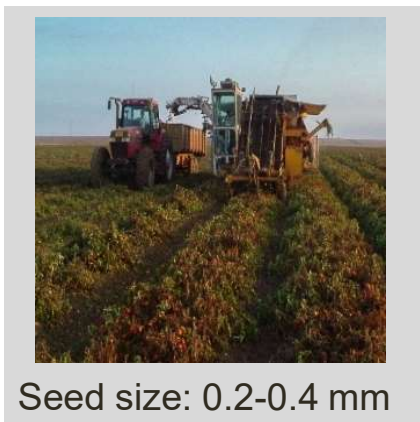
Empty toolbox

High seed longevity



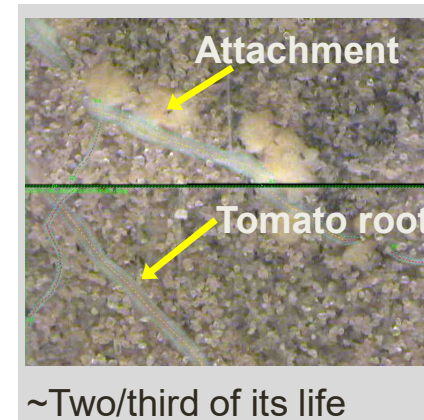
> 30 years in the soil

Easy dispersal of dust-sized seeds



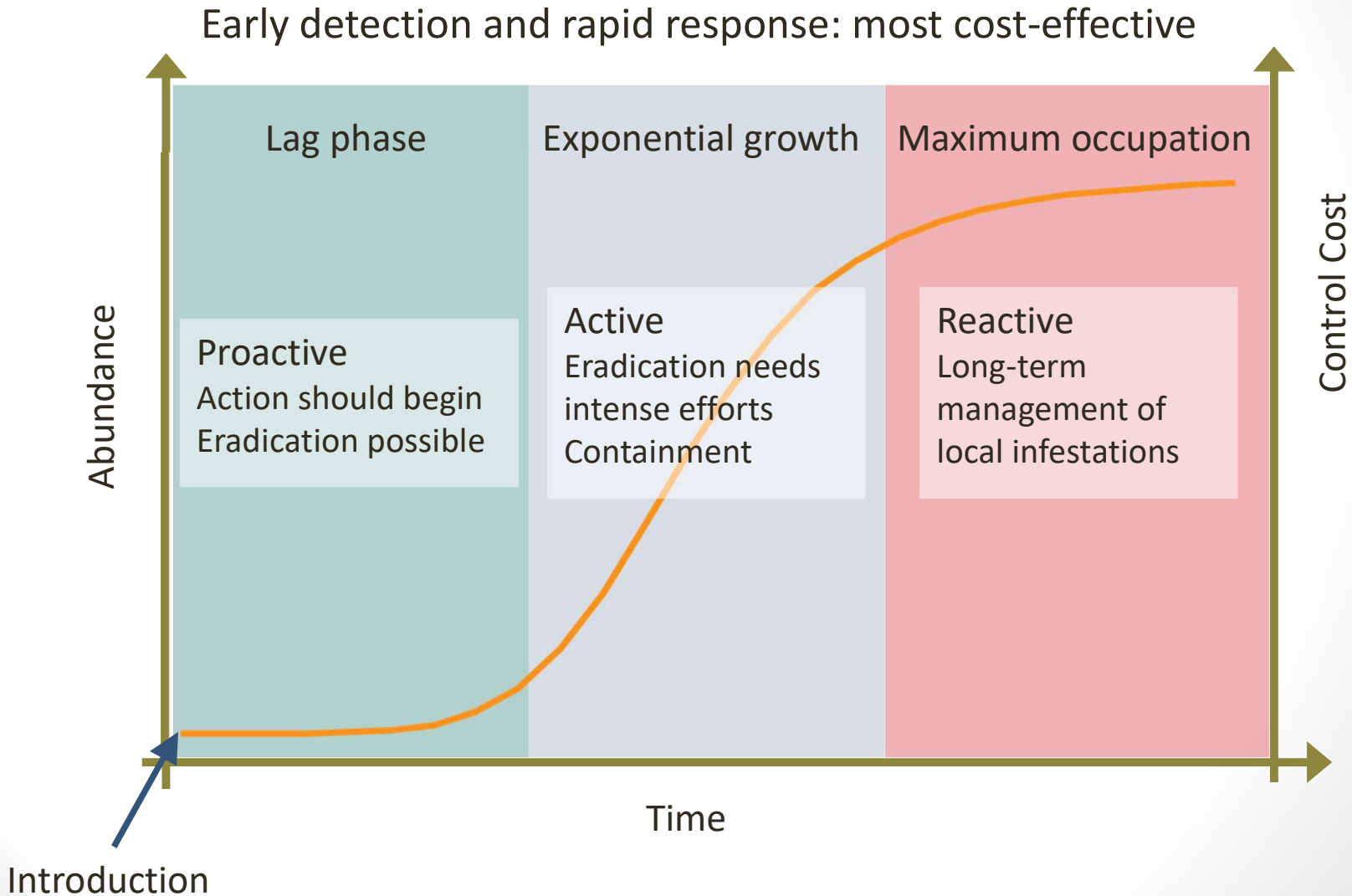
Seed size: 0.2-0.4 mm

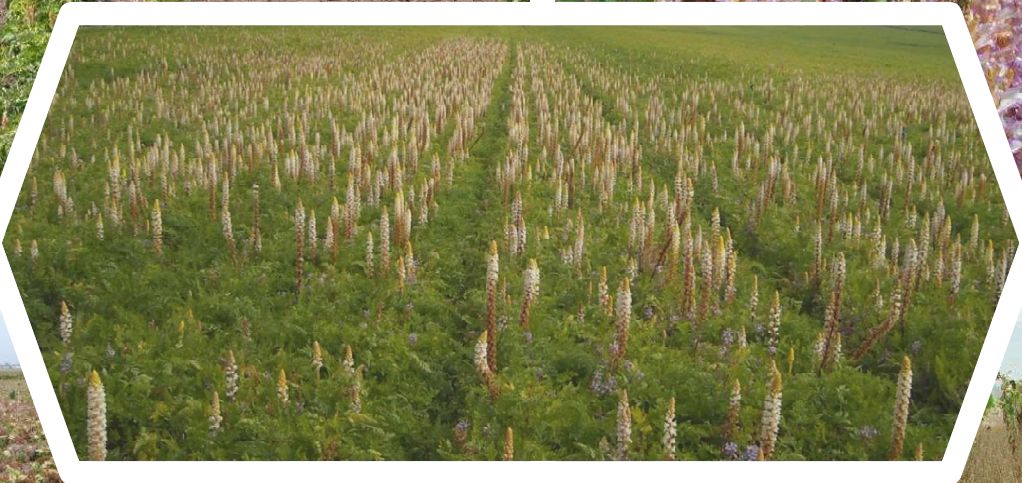
Hidden belowground



~Two/third of its life

Phases of Invasion:





Current management plan in CA

Current management plan in CA

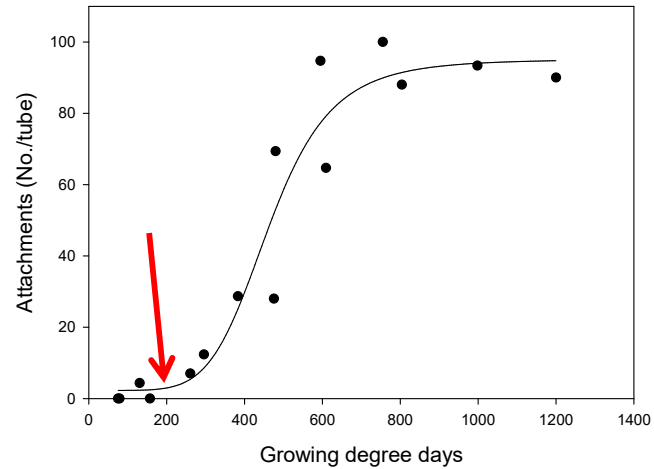
- Scouting, reporting, quarantine, crop destruct...
- We do not currently have data on suppression/control of branched or Egyptian broomrape with CA-registered pesticides
 - Both species have been detected in conventional processing tomato fields; suggests little (or incomplete) efficacy of registered herbicide programs
 - Quarantine treatments are based on soil fumigation
- Minimizing spread will be key in the short-term
- Will need to develop mitigation approaches for our systems

Broomrape management elsewhere

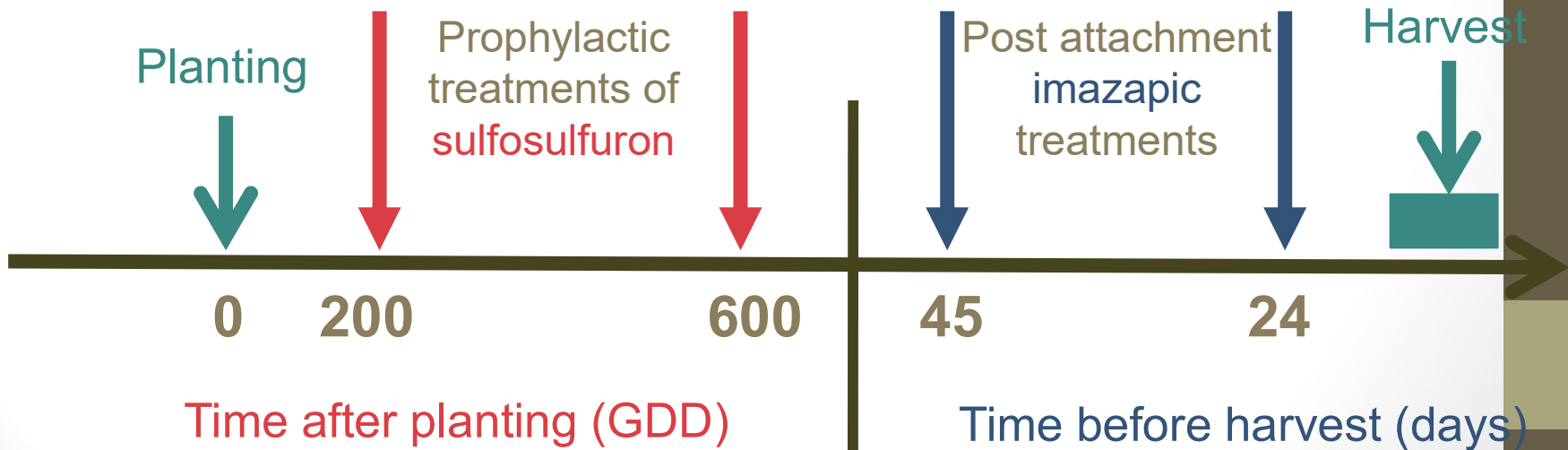
- Israeli cooperators have been working on broomrape management for several decades
 - Eizenberg and others
- Weed is not eradicated, but is managed to an acceptable level
 - Management is based on carefully-timed and –placed herbicides to disrupt key broomrape life stages
 - Uses a Decision Support System known as PICKIT
 - Sequential herbicide treatments applied based on growing degree day modeling
 - Takes into account severity of the broomrape infestation

How PICKIT Works:

Modeling parasitism



Precision-in-time application of herbicides



Success with PICKIT: \$4,731/ha increase in net revenue



Ongoing/planned research

- Herbicide approaches
 - Based on Israeli-developed PICKIT system
 - Will need efficacy and crop safety data under CA production systems to facilitate registration
- Modeling species/system
 - Confirm and fine-tune thermal time modeling for decision-support
- Evaluation of soil disinfestation approaches
 - Fumigants, biosolarization, etc.
- Detection and identification
 - Sensor technologies
- Equipment sanitation approaches



- Project collaborators
 - CTRI, UCCE, UC Davis, Newe Ya'ar Research Center
- Funding sources
 - California Tomato Research Institute
 - USDA-IR4 and CDFA-DPR grants
 - CDDA – Specialty Crop Block Grant funding

UNIVERSITY OF CALIFORNIA AGRICULTURE & NATURAL RESOURCES

UC IPM
Statewide Integrated Pest Management Program

Weed Gallery > Broomrape Family: Orobanchaceae

HOME


ON THIS SITE

- What is IPM?
- Home & landscape pests
- Agricultural pests
- Natural environment pests
- Exotic & invasive pests
- Weed gallery
- Natural enemies gallery
- Weather, models & degree-days
- Pesticide information
- Research
- Publications
- Events & workshops
- Online training
- Links
- About us
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MAKE A GIFT

Branched broomrape (*Orobanche ramosa*)

Click on images to enlarge



What is IPM?

Branched broomrape is an annual and sometimes perennial parasitic plant that has no chlorophyll and lacks conspicuous leaves. It attaches to plant roots and is visible above ground only when flowering and inhabits ornamental and vegetable crop fields and margins, especially tomato fields. Branched broomrape is found in the San Francisco Bay region, northern San Joaquin Valley, eastern South Coast Ranges, and Southwestern regions up to an elevation of about 160 feet (50 m). It is an A-rated ("A"-eradication, containment, rejection, or other holding action at the state-county level. Quarantine interceptions to be rejected or treated at any point in the state) noxious weed in California. If you find it, contact your agricultural commissioner.

Seedling

Seedlings grow below ground.

Young plant

The young plant looks like a yellowish spear or spike.

Mature plant

The mature plant is 4 to 12 inches (10-30 cm) tall. The aboveground parts are pale to bright yellow. Stems are slender, covered with very short glandular hairs, and have many branches arising from the base. Leaves are reduced to scales that alternate along the stem.

Flowers

Branched broomrape blooms from late June through September in crop fields with irrigation and suitable host plants. In natural areas, the flowers may appear later, coinciding with rain in October and November. Flowers resemble small snapdragons, ranging in color from white to blue or violet. Twenty or more flowers cluster to form a spike-shaped flower head. Upper flowers are stalkless and lower flowers are short stalked. Stems and flower heads are covered with very short glandular hairs.

Fruits

The fruit is a one-chambered capsule that opens by two valves at the tip.

Seed

Seeds are angular to egg shaped and yellowish brown, with a dull and netlike surface.

Reproduction

Identify a weed
List of all weeds
Key to weeds in turf



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**UC Davis Weed Research
and Information Center**

<http://wric.ucdavis.edu/>

<http://ucanr.org/blogs/UCDWeedScience/>



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