Current Pest Challenges in California Date Production

Sonia Rios
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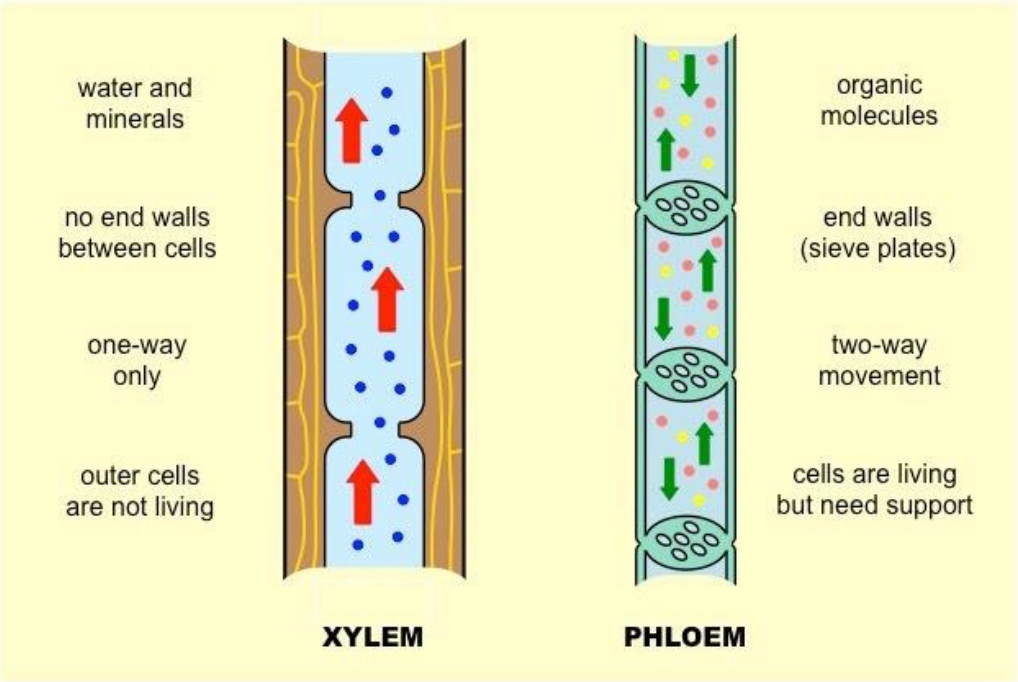
- The total world production of dates was 7.78 million tons in 2013 (FAO 2015).
- California leads the nation in date production, with 99% of the production (US Department of Agriculture 2015). In 2014, 16,238 tons of dates valued at $35,800,000
- Two varieties make up most of this production, Deglet Noor and Medjool.
- Currently, the only substantial production of soft dates in the US is ‘Medjool’

Verticillium and Fusarium

- Vascular wilts are xylem diseases- soilborne fungi
- Discoloration of the active xylem is an important symptom
- Most vascular wilts start at the roots
  - Leaves may become yellow and wilt from the bottom of the plant up
- Almost identical, ID is required
  - Fusarium *oxysporum* f. sp



Symptoms

- One-sided death of pinnae (leaflets) along the frond, with dark coloration of the rachis (petiole) on the side with necrotic pinnae.

- This onesided dieback will eventually progress to total frond death.
  - Frond death usually begins in the lower portion of the crown and moves upwards.

- Internal discoloration
  - normally white or cream in color, but infected tissue will be brown or pink internally

- Date palms may be infected with a vascular wilt for months or years prior to symptoms being displayed

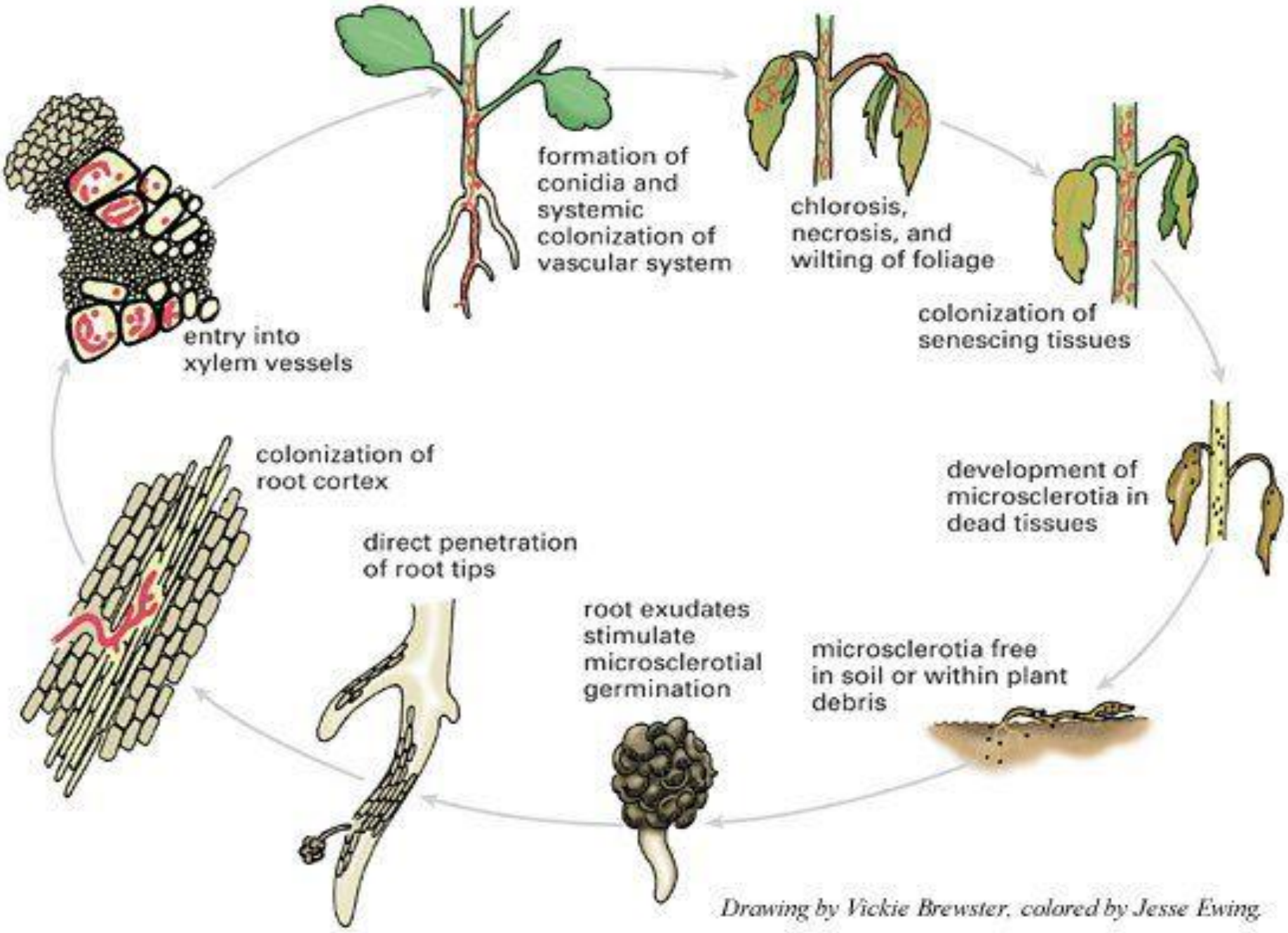
- The fungus also can reside in soil for long periods (~25 YEARS) of time & can be transferred to landscape sites when transplanting nursery stock.

- The fungus is readily spread from diseased to healthy palms on pruning tools

- The ideal sample contains rachis tissue with visible pink or brown discoloration.

Treatment

- There is no chemical treatment that has proven effective against this disease.
- It is important to remember in all phases of plant care that this is a highly infectious
- Once Fusarium wilt is confirmed in a tree, removal is always the primary recommendation.
  - This disease is lethal in nearly 100% of infected trees
  - Sawdust & all wood waste must be removed from the site to reduce potential spread.
  - Removed- it should not be replaced with the same species.


entry into
xylem vessels
formation of
conidia and
systemic
colonization of
vascular system
chlorosis,
necrosis, and
wilting of foliage
colonization of
senescing tissues
development of
microsclerotia in
dead tissues
microsclerotia free
in soil or within plant
debris
root exudates
stimulate
microsclerotial
germination
direct penetration
of root tips
colonization of
root cortex
Drawing by Vickie Brewster, colored by Jesse Ewing

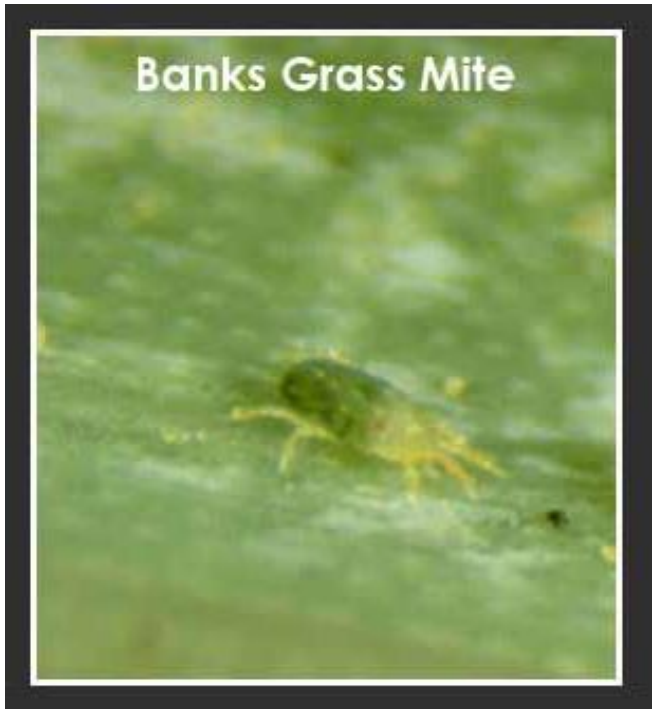
Spider Mites

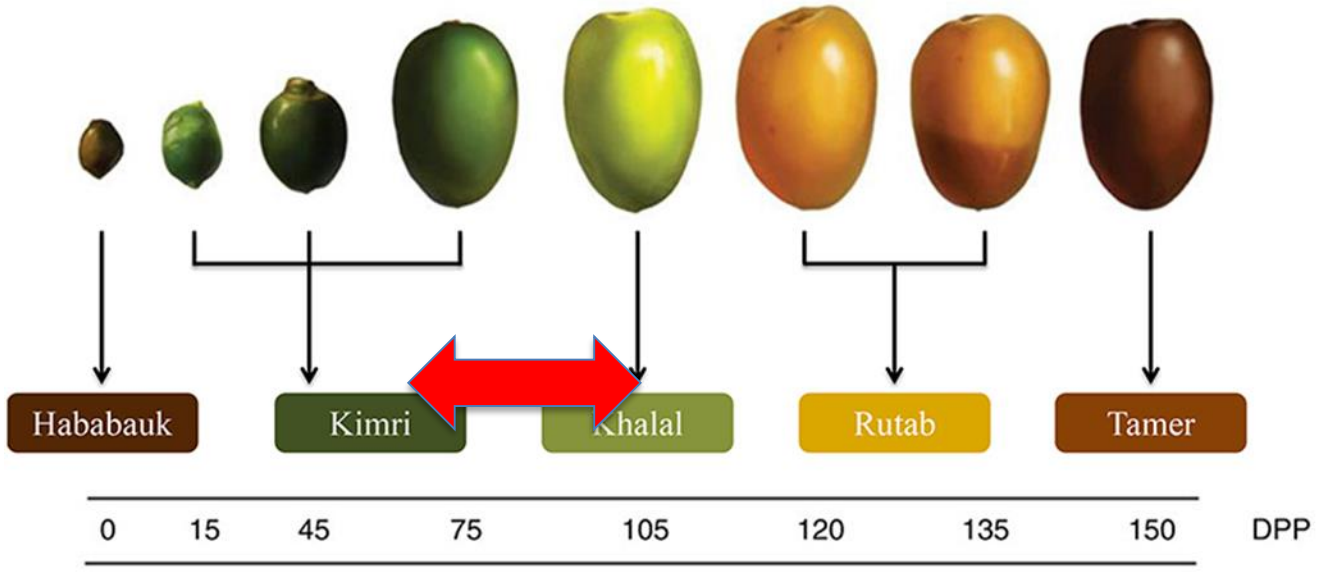
- Major pest
  - **Banks grass mite**, *Oligonychus pratensis*-the only mite pest of dates in North America.

- In CA, Banks grass mite caused annual losses and control costs between 1 & 2.5 million U.S. dollars.

- Nearly all of the damage by *O. pratensis* is on **Deglet Noor.**

- Egg to adult development is closely linked with **temperature** (Malcolm 1955 ; Feese and Wilde 1977) and **humidity** (Perring et al. 1984).





- Mite colonies reach maximum abundance in mid-July and begin to decline with the onset of the Khalal or ripening stage- tougher skin

Symptoms

- Feed on the immature green dates causes severe fruit scarring- dates turn brown & have a scabbed appearance.

- Fronds can also get damaged
  - The highest numbers of mites on the fronds occur from March through September, while numbers are low from October through February.

- The majority of new infestations in date bunches is thought to come from windborne mites

- They infest bunches- crawling from infested fronds

- Feeding damage on Deglet Noor date fruit. Normal, non-damaged date is on the left (Photo: Thomas M. Perring)

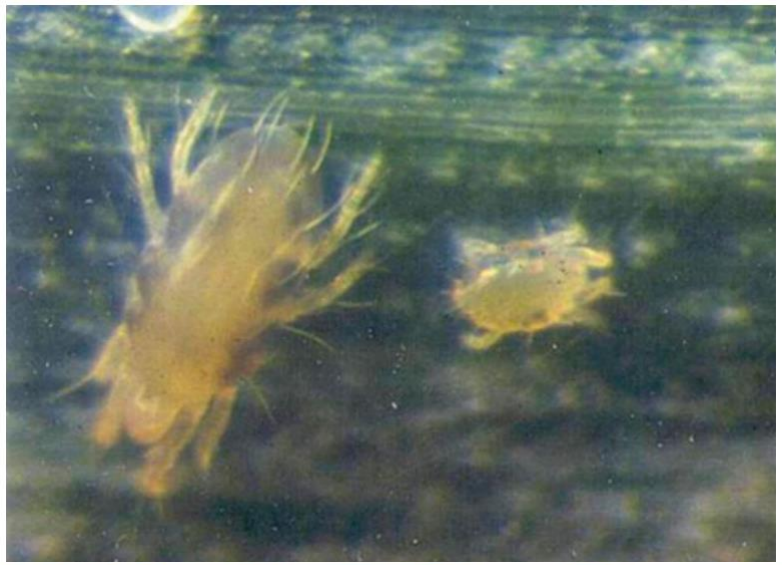
Fig. 12.2 Progression of *Oligonychus pratensis* infestation of date fruit Deglet Noor. Early infestation of young Kimri dates (**a**); Rapid spread in Kimri dates (**b**); Heavy webbing as dates enter Khalal stage (**c**); Completely infested date bunch (**d**) (Photos: Thomas M. Perring)

Treatment

- Strategies used for mites are centered on the use of chemical pesticides.
  - extensive use of these products has resulted in secondary pest outbreaks

- Alternative management tactics, including biological control, have not been widely adopted by date producers.

- Therefore, since more research is needed



carob moth

- First was observed in California in 1982 (CDFA 1983).
- 2000s, it was the most economically important pest in the USA date industry in the Coachella Valley (Nay et al. 2007).

Symptoms

- Fruit infested with larvae can cause damage reaching 10-40% to the harvestable crop each year (Warner 1990a, Nay et al. 2006)

- Often it infests during the ripening stages- remains in infested fruit through the post harvest processing , becoming a pest of the stored product.
    - This is the nature of its damage in dates, particularly in varieties that are allowed to remain in the field to dry prior to harvest

- Largest density of adult moths from late August through mid-October.

Fig. 6.2 Carob moth, *Ectomyelois ceratoniae* life stages; (**a**) egg and first instar larva, (**b**) late instar larva in date fruit with copious amounts of frass, (**c**) silk "cap" at the calyx end of date fruit, (**d**) pupa displayed by opening silken chamber (Photos: Justin E. Nay)

- Carob moth damage to the fruit is caused by the developing larvae.

- First and second instar larvae are small & fruits that are infested in the field can be fumigated during post harvest processing; these small larvae are difficult to detect in the finished date products.

    - However, post-second instar larvae consume large portions of the date fruit.
    - The feeding is accompanied by large quantities of frass

Egg	New larva	Mature larva	Pre pupa	Pupa	Adult
0.7mm long. White when laid, pink when mature.	1mm long. Typically pink. Actively feeding.	Up to 15mm long. Typically pink. Actively feeding.	Up to 15mm long. Typically pink. Stops feeding & spins a silk cocoon for pupation.	About 12mm long. Dark ridge and double row of 'teeth' on back.	8-12mm long. Grey with 13-20mm wingspan and wavy pattern.

Treatment

- Include over-winter (Carpenter and Elmer 1978) & in-season (Warner et al. 1990a, 1990b) removal of waste dates that fall to the garden floor.
- Dislodging abscised kimri dates and khalal dates from bunches during August with a bunch cleaning tool exposes larvae in the fruit to predation & heat (Nay and Perring 2005).
- Another strategy is center cut strand thinning of date bunches to facilitate abscised fruit drop to the ground (Nay and Perring 2009).
- Mesh bags can be used to (Perring, unpublished data).
- 3 registered insecticides: **Delegate (spirodiclofen), Intrepid (methoxyfenozide**), which was registered through support by IR-4, and Malathion dust-emergence of new chemicals and technologies, resulted in growers no longer using this material.

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- Mating disruption involves the use of a pheromone scent to interfere with male moths locating females.

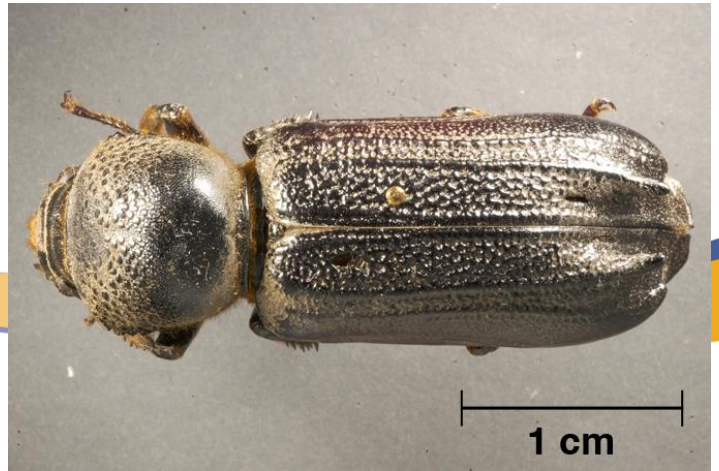
- Carob moth pheromone, mixed in a 2% formulation with a biodegradable wax carrier (**SPLAT®**), was developed.

- This formulation, SPLAT EC™ (SPLAT Ectomyelois ceratoniae), when applied in a 2.5 g "dollop" to the date palm trunk resulted in very low male trap counts

    - Suggesting that males were confused by the pheromone scent & were unable to locate females.

    - one-time application of SPLAT EC™ provided season-long control

Giant palm borer

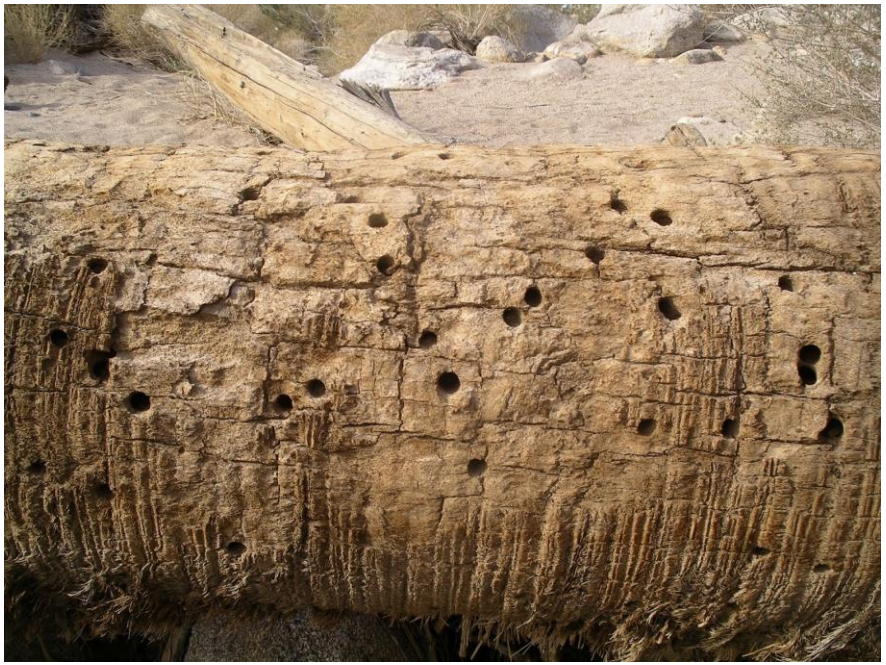


Symptoms

- Palm borer adults are large, brown to black beetles-Adults are up to 2 inches long.
- Larvae are stout and yellowish and live within palm trunks, taking several years to reach maturity.
- Adults and larvae tunnel into wood leaving large holes about 1/2 inch in diameter.
- Fronds turn yellow and plants may die.
- Plant tissue may contain tunnels or boring insects.
- The giant palm borer is probably a secondary pest attacking dead and dying plants.

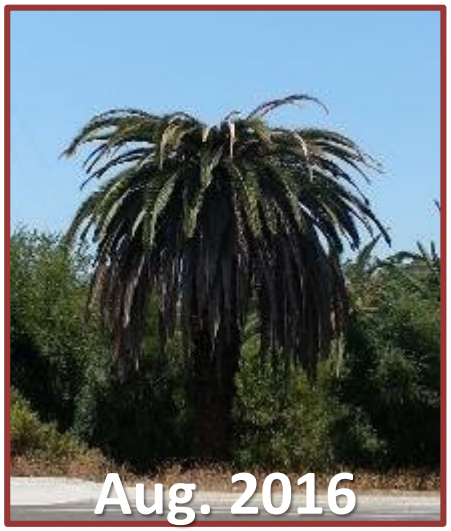
Treatment

- Provide good growing conditions and proper cultural care. Dispose of dead palms in which beetles breed.

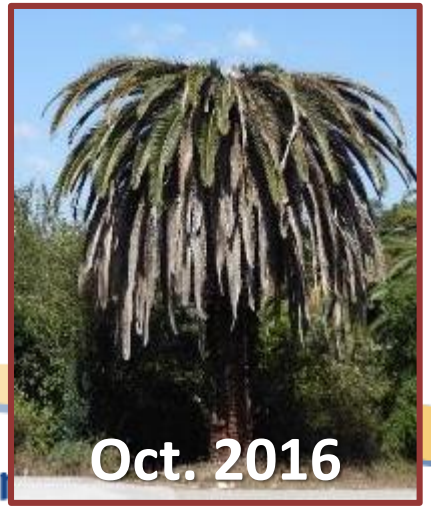


South American Palm Weevil

- First identified in 2011 in San Ysidro in San Diego.
- SAPW has killed hundreds of Canary Island date palms in Tijuana & parts of San Diego County (Hoddle 2017).
- These large urban infestations pose a significant risk to the multi-million dollar date palm industries.
- Losses of ornamental Canary Island date palms in SD County, are probably significant and likely now reaching millions of dollars in killed palms, reduced aesthetics & removal costs.



The demise of a Canary Island Date Palm in Bonita SD County



Control

- Some trees can be salvaged, depending on the extent of damage
- Highly destructive → zero tolerance
- Monitoring
  - Pheromones
  - Visual
- Sanitation
  - Removal, burning
- Insecticides
  - Systemic (imidicloprid)
  - Foliar (synthetic pyrethroids)

TRAP BAITING

- Killing & Preservation Agent
  - 50/50 Solution of Water and Low-Tox Antifreeze.
- PW Aggregation Lure (Species Specific Pheromone).
- Lure Enhancer (Ethyl Acetate) or leave bait to furminatate.
- Food Source – Apples.
- Switch put bait about once a month

(K Hoffman, CDFA)

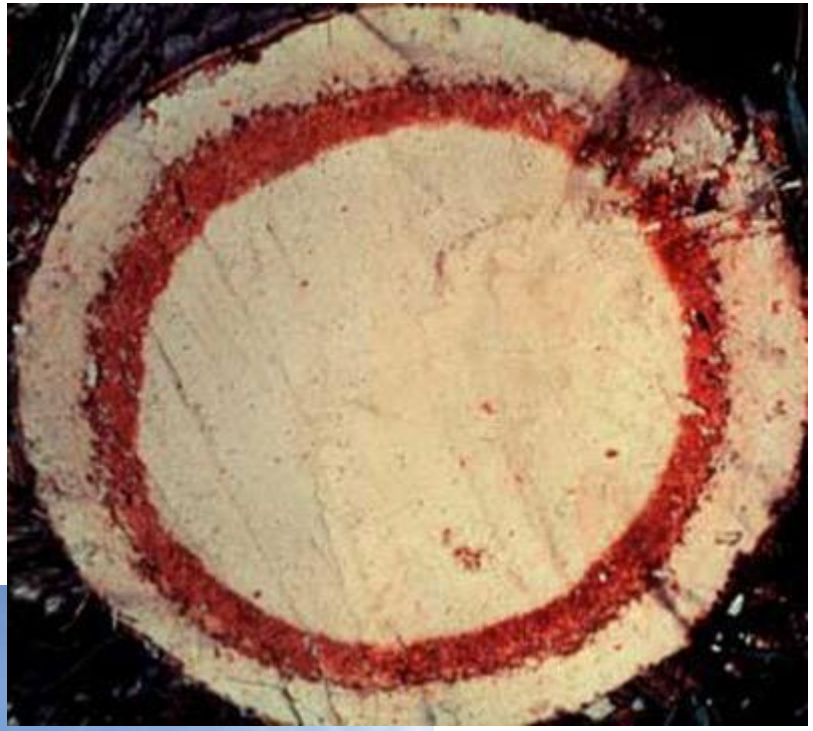
TRAP PLACEMENT

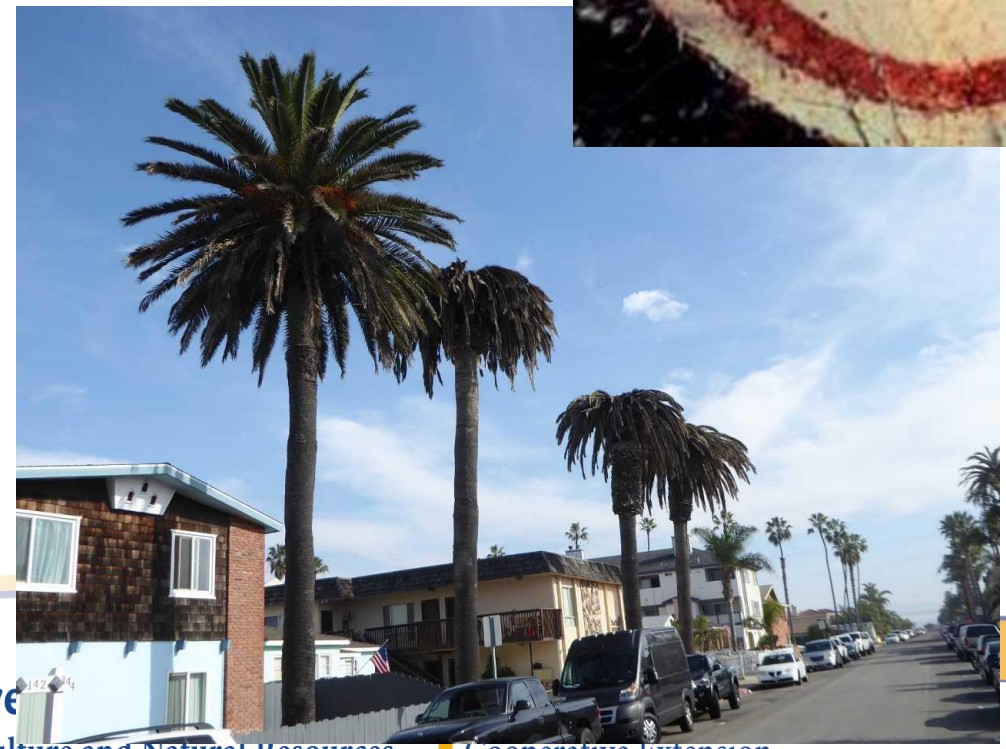
- Traps placed 6 to 7 feet above the ground.

- Traps may also be placed on non-host trees.

(K Hoffman, CDFA)

- Primary vector of the nematode that causes red ring disease - a fatal wilt disease of palms.
    - Disease has not yet been detected in SAPWs or palms attacked in San Diego (Hoddle et. al. 2016).





For More Information on SAPW

http://cisr.ucr.edu/palmarum.html

cisr.ucr.edu/palmarum.html

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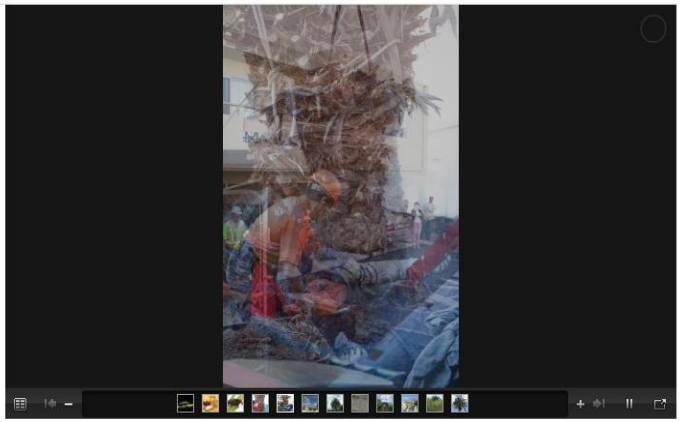


Has the South American Palm Weevil, *Rhynchophorus palmarum*, Established in Southern California?

The Situation: The South American palm weevil, *Rhynchophorus palmarum* (Coleoptera: Curculionidae), has a known distribution that includes Mexico, Central and South America, and the Caribbean. Like other species of *Rhynchophorus*, such as the red palm weevil, *R. ferrugineus*, and the palm weevil *R. vulneratus*, *R. palmarum* is a destructive palm pest in its native and invaded ranges.

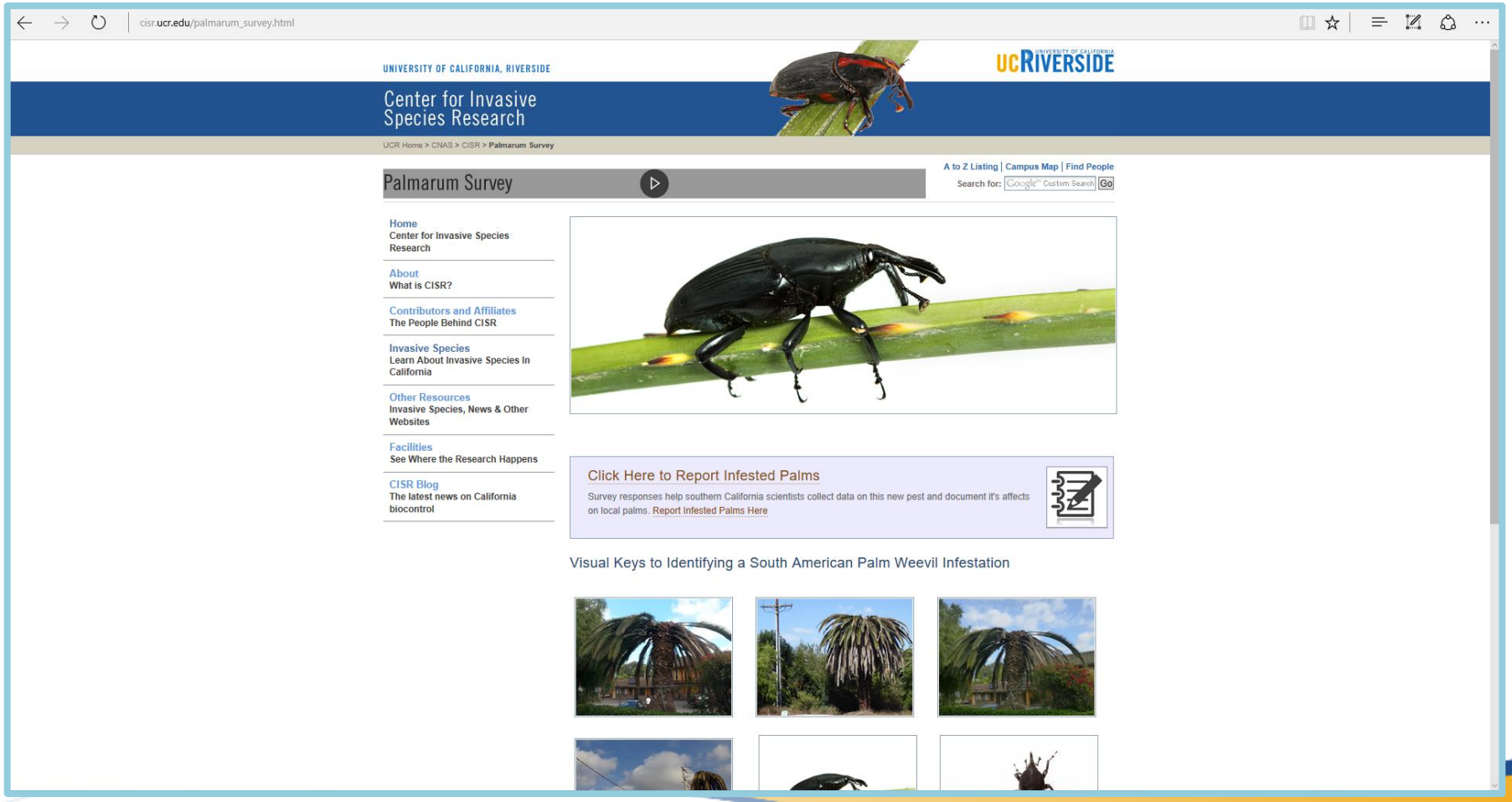
Click Here to Report Infested Palms

Survey responses help southern California scientists collect data on this new pest and document it's affects on local palms. Report Infested Palms Here

Feeding by weevil larvae in the crown of palm trees, causes significant damage that may result in the death of meristematic tissues. If meristematic tissue is destroyed, it results in the "crown" of the palm dying and this inability to produce new fronds gradually leads

Report Infested Palms

http://cisr.ucr.edu/palmarum.html



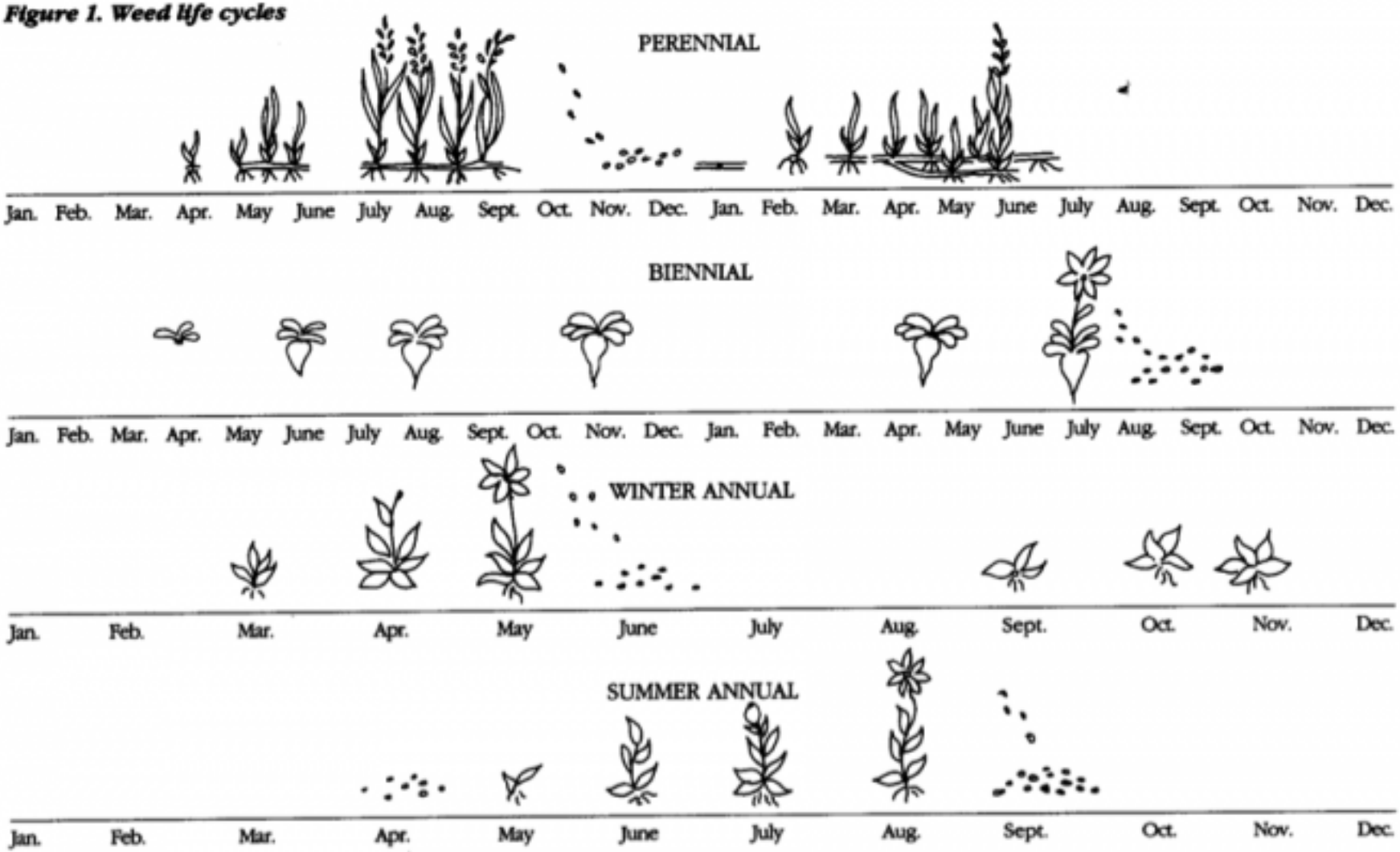
Avocado Grove- Pauma Valley, CA

- After water & labor costs, weed management is ranked 3rd most expensive cultural practice in a subtropical grove (Takele et. al. UCCE Cost Studies 2011)

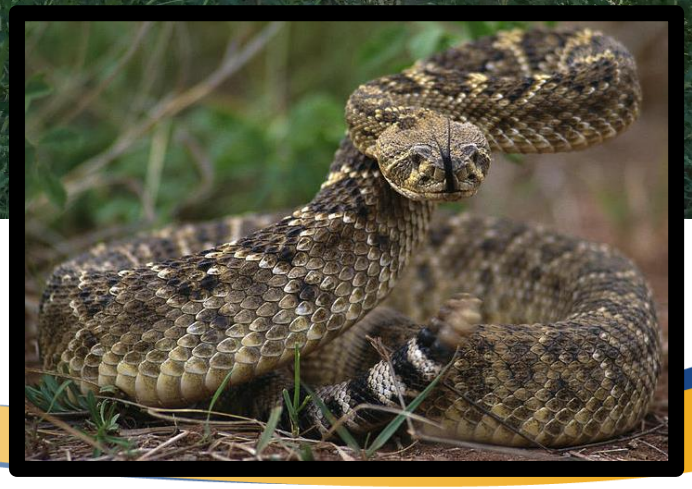
Weeds can impact:

- cultural operations
- tree growth
- low-volume irrigation systems
- intercepting soil-applied chemicals (fertilizer and agricultural chemicals)
- reducing grove temperatures
- during freeze events
- create a favorable environment for pathogens that infect the trunk and roots

Figure 1. Weed life cycles



Date Palm Grove- Thermal, CA



- interfering w/pruning & harvest operations.
- affect insect populations & create an environment for dangerous vertebrate pests such as coyotes & venomous snakes which can be hazards to hand picking crews

Background Information: Consider two weed mgmt. truisms

Weed management issues we think are problems based on evidence from other crops in CA

- Problem #1: Diverse growing conditions (climate, soils, irrigation and cultivation practices, organic vs conventional) = no "one size fits all" for chemical control.

- Problem #2: Long-term use of single mode of action (MOA) herbicide chemistry = high risk for herbicide resistant weeds (Example, Glyphosate).

Problem #1: Diverse growing conditions (climate, soils, irrigation and cultivation practices, organic vs conventional) = no “one size fits all” for chemical control.

- limited in some cases by:
  - Economic
  - Practical limitations

Environmental- cultivation practices used in certain area, water availability, soil types, etc.

Problem #2: Long-term use of single mode of action (MOA) herbicide chemistry = high risk for herbicide resistant weeds (Example, Glyphosate).

- Southern California mild climate
  - certain annuals may behave as biennials or short-lived perennials- for example, horseweed, fleabane, and mallow.

Lack of chemistries registered for specialty crops?

Herbicide Registration on CA Sbutripical Crops -*(updated October 2015 - UC Weed Science)*

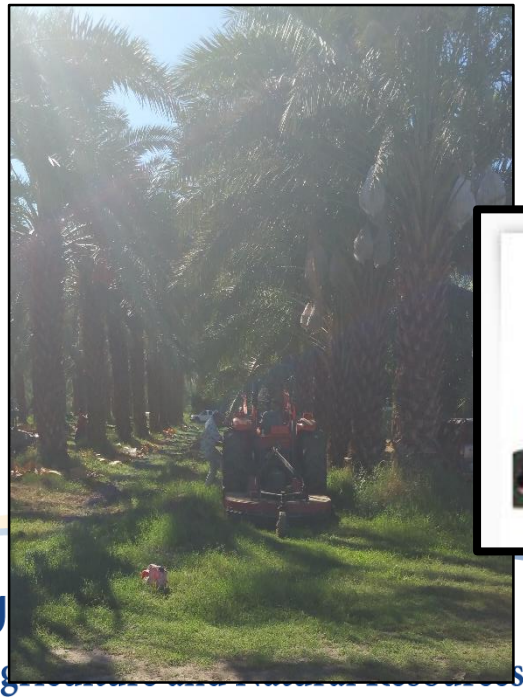
	Herbicide-Common Name *(example trade name)*	Site of Action Group[1]	Avocado	Citrus	Date	Fig	Kiwi	Pomegranate
Preemergence	dichlobenil *(Casoron)*	L / 20	N	N	N	N	N	N
	diuron *(Karmex,Diurex)*	C2 / 7	N	R	N	N	N	N
	EPTC *(Eptam)*	N / 8	N	R	N	N	N	N
	flazasulfuron *(Mission)*	B / 2	N	N	N	N	N	N
	flumioxazin *(Chateau)*	E / 14	NB	NB	N	NB	N	R
	indaziflam *(Alion)*	L / 29	N	R	N	N	N	N
	isoxaben *(Trellis)*	L / 21	NB	NB	N	NB	NB	NB
	napropamide *(Devrinol)*	K3 / 15	N	N	N	N	R	N
	norflurazon *(Solicam)*	F1 / 12	R	R	N	N	N	N
	oryzalin *(Surflan)*	K1 / 3	R	R	N	R	R	R
	oxyfluorfen *(Goal, GoalTender)*	E / 14	R	NB	R	R	R	R
	pendimethalin *(Prowl H2O)*	K1 / 3	N	R	N	N	N	R
	penoxsulam *(Pindar GT)*	B / 2	N	N	N	N	N	N
	pronamide *(Kerb)*	K1 / 3	N	N	N	N	N	N
	rimsulfuron *(Matrix)*	B / 2	N	R	N	N	N	N
	sulfentrazone *(Zeus)*	E / 14	N	R	N	N	N	N
	simazine *(Princep,Caliber 90)*	C1 / 5	R	R	N	N	N	N
Postemergence	carfentrazone *(Shark)*	E / 14	R	R	R	R	R	R
	clethodim *(SelectMax)*	A / 1	N	R	N	N	N	N
	clove oil *(Matratec)*	NC[3]	R	R	R	R	R	R
	2,4-D *(Clean-crop, Orchard Master)*	O / 4	N	N	N	N	N	N
	diquat *(Diquat)*	D / 22	NB	NB	NB	NB	NB	NB
	d-limonene *(GreenMatch)*	NC[3]	N	R	N	R	R	N
	fluazifop-p-butyl *(Fusilade)*	A / 1	NB	R	NB	NB	N	NB
	glyphosate *(Roundup)*	G / 9	R	R	R	R	R	R
	glufosinate *(Rely 280)*	H / 10	N	R	N	N	N	N
	halosulfuron *(Sandea)*	B / 2	N	N	N	N	N	N
	paraquat *(Gramoxone)*	D / 22	R	R	N	R	R	R
	pelargonic acid *(Scythe)*	NC[3]	R	R	R	R	R	N
	pyraflufen *(Venue)*	E / 14	N	N	R	R	R	R
	saflufenacil *(Treevix)*	E / 14	N	R	N	N	N	N
	sethoxydim *(Poast)*	A / 1	NB	R	NB	NB	N	NB

Notes: R = Registered, N = Not registered, NB = nonbearing. This chart is intended as a general guide only. Always consult a current label before using any herbicide as labels change frequently and often contain special restrictions regarding use of a company's product.

Most Popular methods of Control

- Herbicide Management
  - Glyphosate

- Mowing/Hand weeding



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Conclusion

- Start looking into additional herbicide treatments/rotations- more items registered.
  - Bring PRE back into current programs
  - Follow the label's direction & use caution.

- Need for research in organic production- herbicide alternatives

- High risk commodities –
  - economically important
    trees

- Other issues seem to push weeds out the picture- Invasive pests, cost of water & labor issues

- **Preventive programs are key- practices as sanitation, spot spraying, or hand labor to prevent the source of weed infestation.**

Questions?

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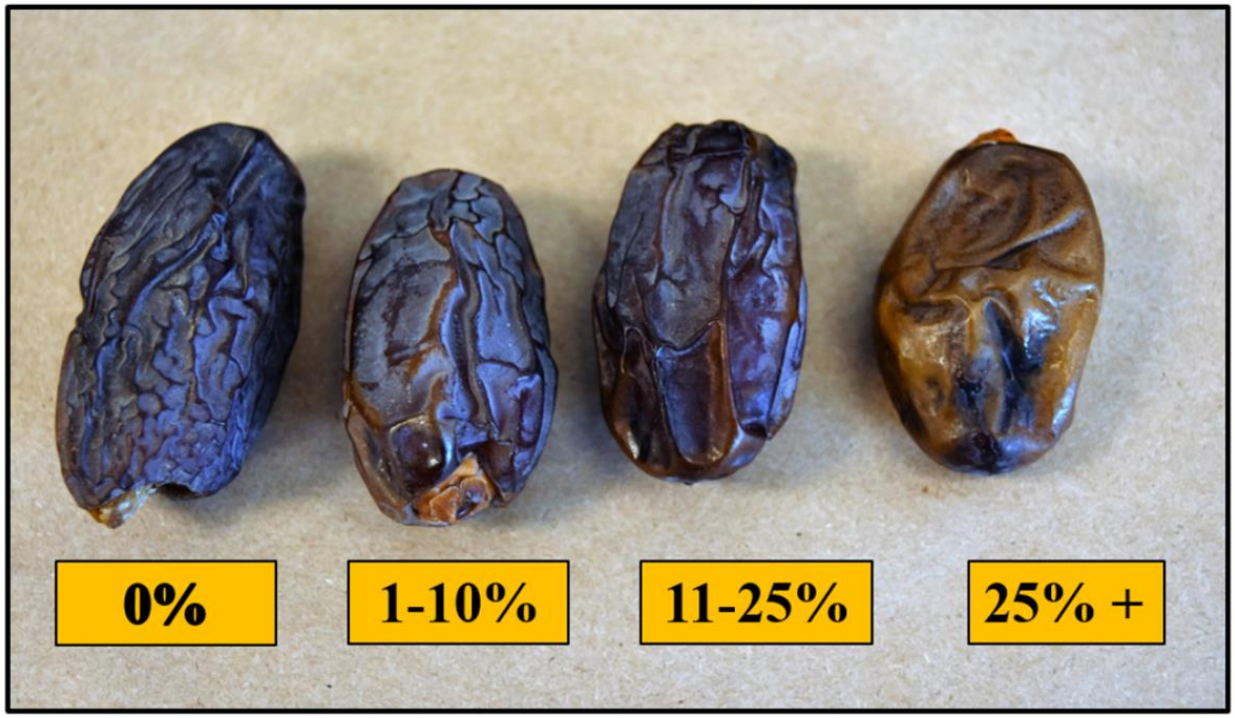
Puffy skin

- Skin separation (also referred to as “puffy skin” and “blistering”) has long been a production problem in soft dates.

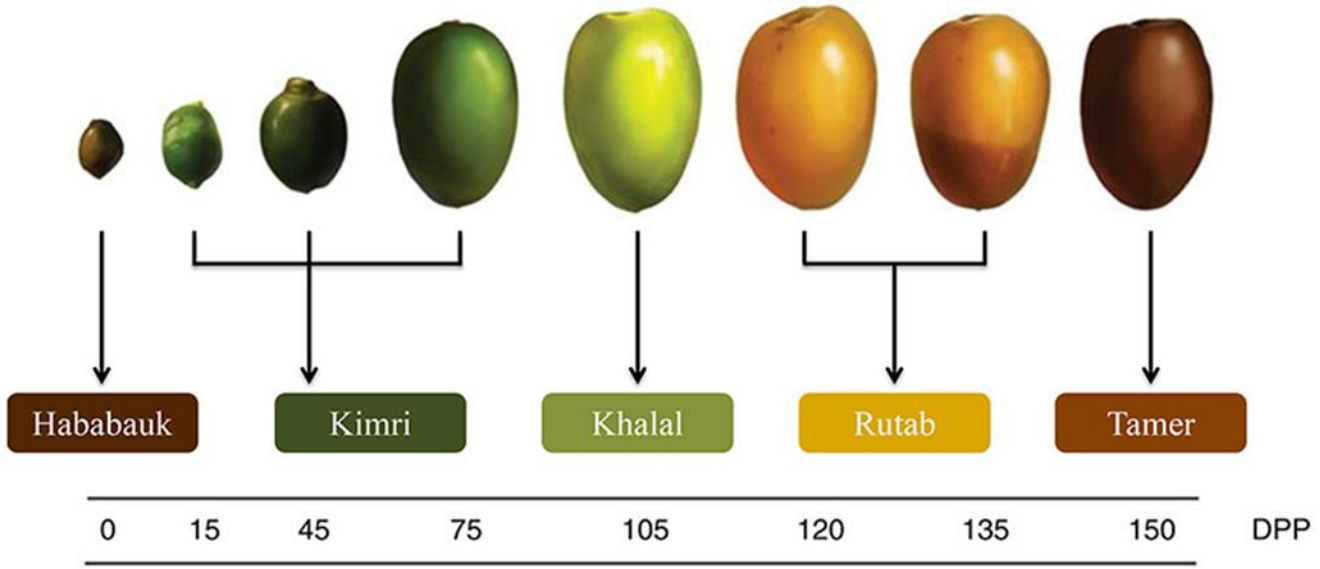
- Skin separation is a large production problem in ‘Medjool’ and reduced fruit quality has an economic impact on the US industry.

- **It is suggested that there is a climatic factor involved- humidity**



- It is also not clear when the critical stage in fruit ripening or development for the skin separation to occur.

- Irrigation regime, microclimate conditions within the fruit bunches, and mineral fertilization



- Possible treatments in Israel were suggested: increasing the airflow around the strands (bunch management), increasing the water permeability or mechanical properties of the skin via chemical treatments, & restricting the water flow from the tree to the fruits (Lustig *et al* 2014).

To summarize, despite the widespread distribution and severe damage due to skin separation, the cause is poorly understood.

Past studies and observations:

(1) skin separation is associated with anatomical (skin elasticity) and physiological (fruit turgor) properties of the fruits

(2) these fruit properties are influenced by the microclimate in the bunch during fruit ripening, the water balance of the date fruit, and the micronutrients related to skin elasticity and adherence to the flesh.

(4) these factors can be manipulated by specific cultural practices, including but not limited to, plant water relations, irrigation timing, and applications of plant nutrients to the date fruit.