Cankers, wilts, and die-backs

- Includes extremely aggressive, often easy to import tree diseases: pine pitch canker, Dutch elm disease, Chestnut blight, White pine blister rust but also recent large scale tree dieback in Northern California

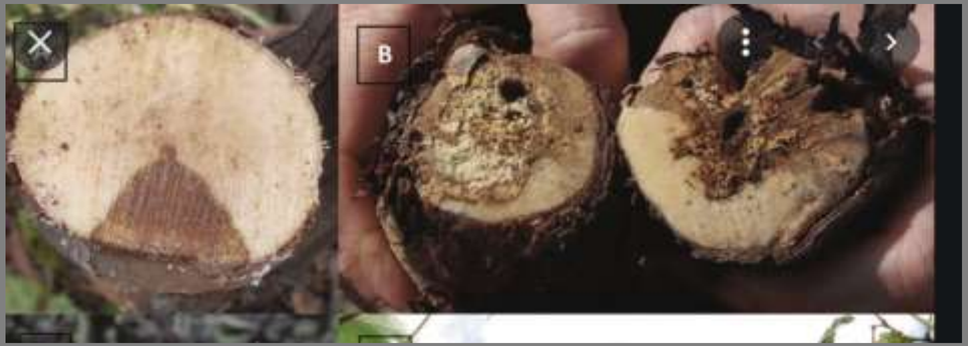
- Lethal in most cases, generally narrow host range with the exception of Sudden Oak Death

- Cankers: normally refer to death of the cambium caused by a pathogen, often lesion will extend to the bark causing fissures, and to the xylem, causing discoloration and vessel damage. Stem cankers are the most serious for the health of a tree. Will a tree die? Yes if canker expansion rate is greater than tree growth rate

- Wilts and die-back can be caused by cankers, but also by vascular diseases and by root rots. Toxins exacerbate wilt symptoms.

- Die-back can be caused by stem cankers but also by branch cankers.

BOT Cankers



Aerial stem cankers on oak spp. and tanoaks: deadly but not infectious, e.g. stem lesions do not produce significant number of spores

Girdling aerial 'cankers' removed from roots

Progression of cankers

Older canker with dry seep

***Hypoxylon*, a secondary sapwood decayer will appear**

Jack Kelly Clark

Jack Kelly Clark

Jack Kelly Clark

Left, pale sawdustlike ambrosia beetle frass and seeping bark typical of SOD on coast live oak. *Above*, an adult ambrosia beetle and frass from tunneling into heartwood. *Right*, an adult ambrosia beetle.

Root diseases

- Extremely common, probably represent the most economically damaging type of forest diseases

- Effects: tree mortality (direct and indirect), cull, effect on forest structure, effect on composition (major drivers of succession), stand density, growth rate, soil nutrients

- *Heterobasidion, Armillaria, Phellinus weirii, Phytophthora cinnamomi*

Root rot pathogens Infect trees by growing from tree to tree. Some species like Armillaria produce rhizomorphs that can grow in soil, while most root rot pathogens require root contacts to go from tree to tree along the roots

Armillaria ostoyae in OR: largest organism in the world

The fungus *Armillaria bulbosa* is among the largest and oldest living organisms

Myron L. Smith*, Johann N. Bruhn† & James B. Anderson*

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Root disease center in true fir caused by *Heterobasidion occidentale*


LITTLELEAF DISEASE
PHYTOPHTHORA CINNAMOMI
PIEDMONT REGION OF USA

Blackstain root disease in Douglas Fir

Scolytus ventralis in true fir

Root Disease Interactions

- Trees are more attractive to insects
- Trees with root disease are more susceptible to ozone damage
- Can cause a priory effects making trees more susceptible (root disease centers)
- Cross generational (*Heterobasidion* can survive 70 years)

Sequoia National Park's giant trees at risk as fires grow

NOAH BERGER and JOHN ANTCZAK, Associated Press

Sep. 15, 2021 | Updated: Sep. 16, 2021 8:35 p.m.

News / California Wildfires

What likely saved the General Sherman Tree from the KNP Complex Fire

Amy Graff, SFGATE

Sep. 20, 2021 | Updated: Sep. 20, 2021 4:53 p.m.

Sequoia trees stand in Lost Grove along Generals Highway as the KNP Complex Fire burns about 15 miles away on Friday,

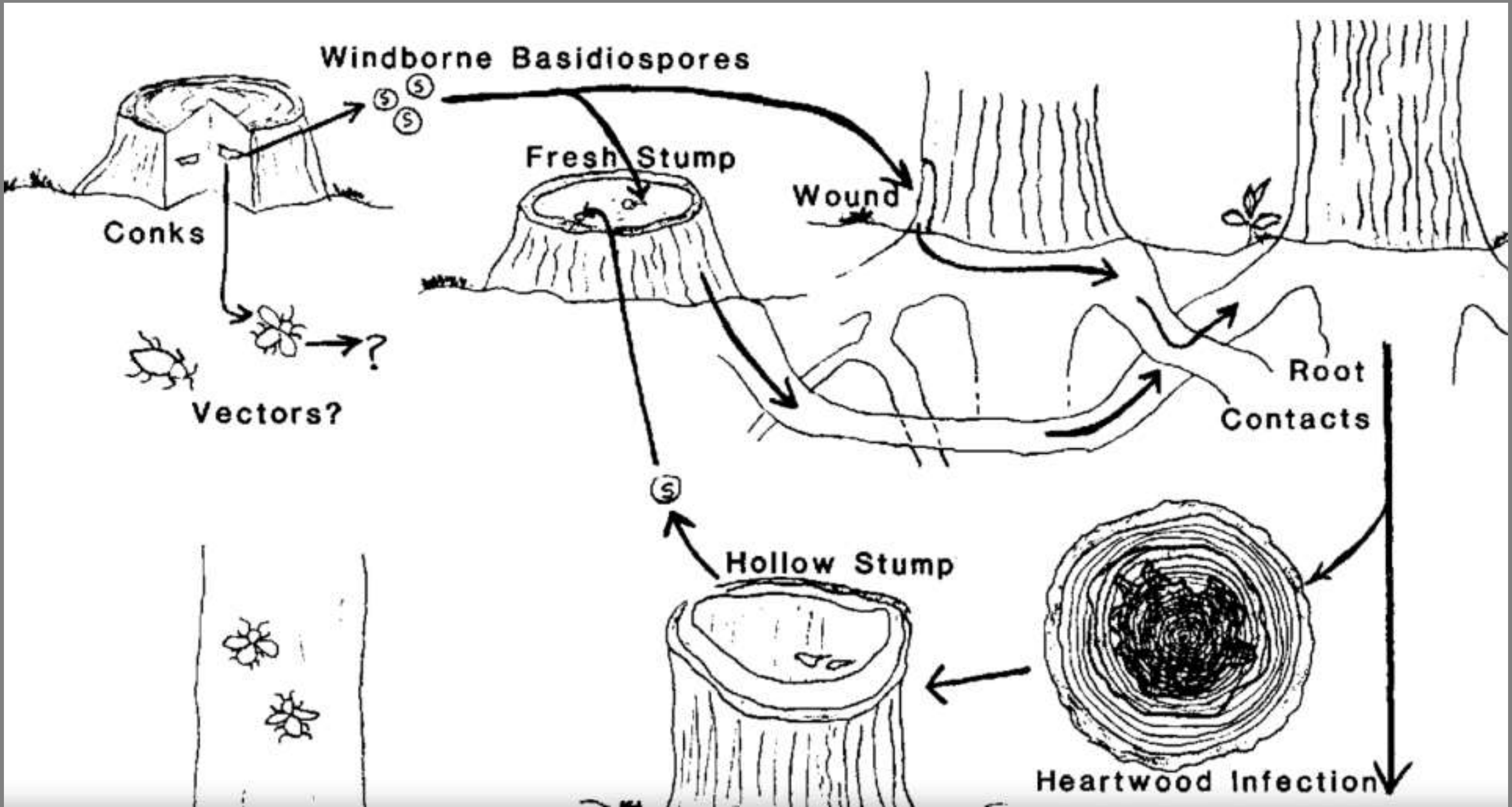
Giant Sequoia Insect, Disease, and Ecosystem Interactions[1]

Douglas D. Piirto[2]

GIANT SEQUOIAS

True Fir

Sequoia



True firs and sequoias

- True firs are fire intolerant and can burn easily and hot
- True firs carry endophytically the root rot *Heterobasidion*
- Fire exclusion and no logging: too much true fir, too much *Heterobasidion*
- Fires too hot can affect smaller sequoias and root rot can affect sequoias of all sizes

Root Disease and insects



Aggregation pheromones, climate and generations of insect, sanitation (debarking)

Floral diseases

- Pollinator vectored smut on silene offers an example of well-known dynamic interaction in which pathogen drives genetic variability of hosts (females are more likely to be infected and more infected the flower hangs on) and is affected by environmental (higher elevation facilitates disease) and flower populations (smaller populations experience less disease)

- *Puccinia monoica* produces pseudoflowers that mimic real flowers. Effects: reduction in seed production, reduction in pollinators visits

Floral mimicry by a plant pathogen

B. A. Roy

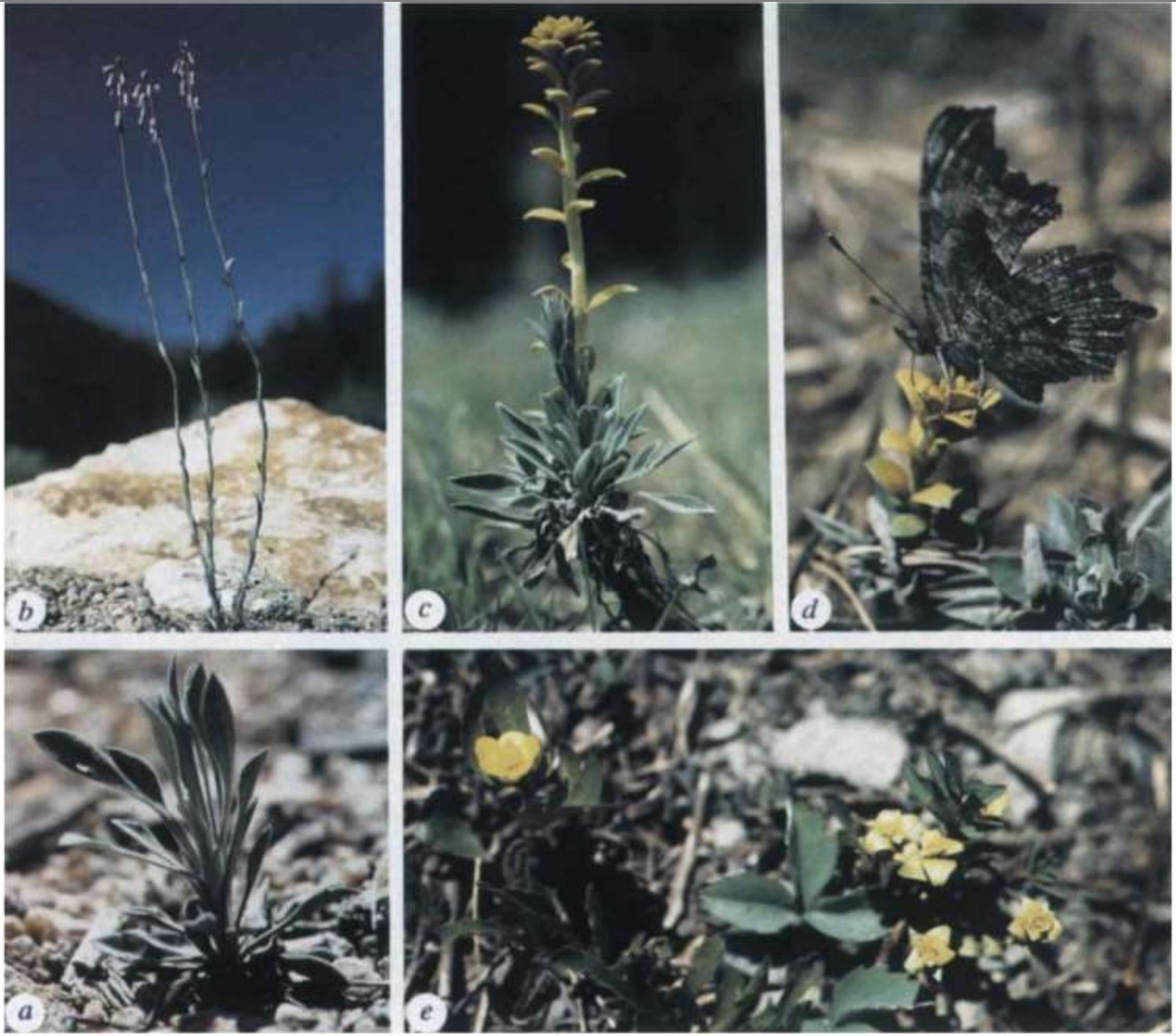


FIG. 1 Morphological transformation of *Arabis* by *Puccinia monoica* rust infection. *a*, Rosette stage of uninfected *A. holboellii*. Uninfected plants remain in the rosette stage for 2–5 years. *b*, Flowering stage of uninfected *A. holboellii*. Infection of this host almost always prevents flowering and is usually lethal; in 116 pairs of infected and uninfected plants, 71% of infected plants died without flowering (versus only 12% of the uninfected plants), and none of the infected plants set seed. *c*, Bolting stage of *A. holboellii* infected by *P. monoica*. Infected plants act like they are bolting (elongation of the stem before flowering), but elongation stops long before normal flowering height is attained and true flowering almost never occurs. *d*, *Polygonia zephyrus* (Nymphalidae) feeding on the spermatial fluid of *P. monoica* on *A. holboellii*. *e*, *A. drummondii* infected by *P. monoica* (right) strongly resembles *Ranunculus inamoenus* (left), in shape, size and colour in the visible spectrum.

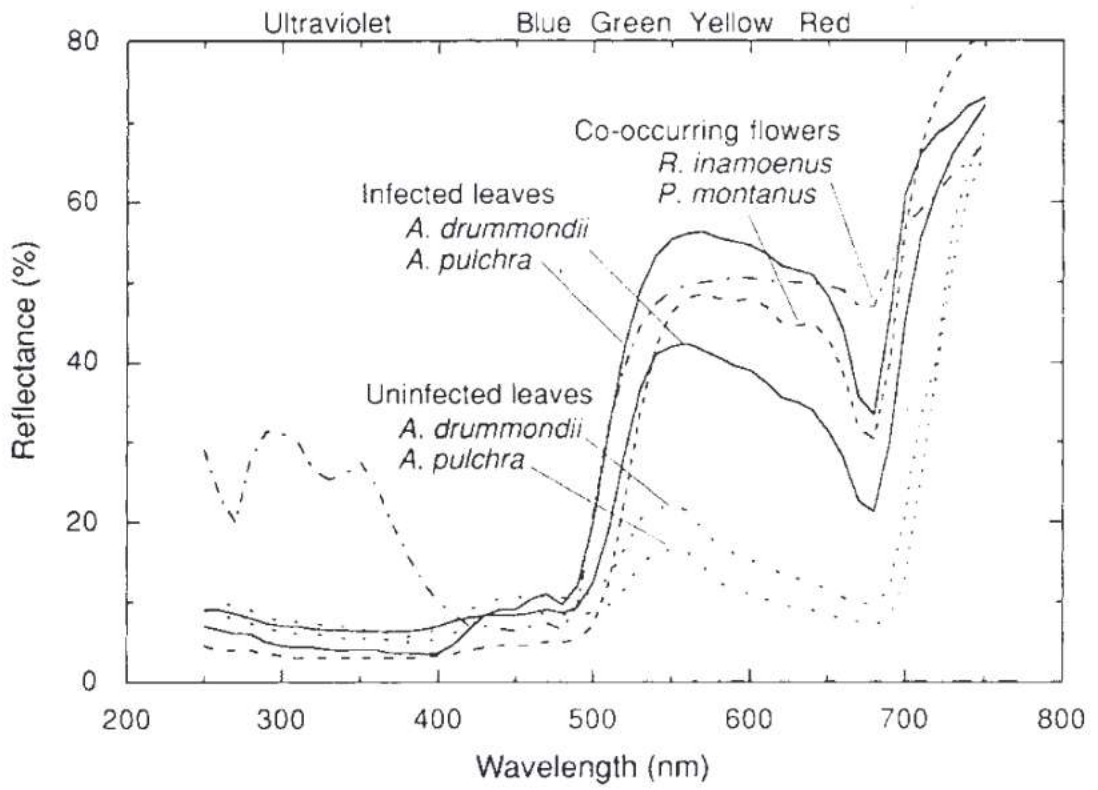


FIG. 2 Reflectance spectra of uninfected and infected *Arabis* leaves and petals of two co-occurring yellow flowers, *Ranunculus inamoenus* and *Pseudocymopterus montanus*. All spectra coincide in the visible spectrum; *Ranunculus inamoenus* also reflects in the near ultraviolet ('bee purple'). Leaves of *Arabis drummondii* were infected by *Puccinia monoica*, whereas leaves of *A. pulchra* were infected by *P. thlaspeos*. *P. thlaspeos* is very closely related to *P. monoica*[30] and also causes similar pseudoflowers to form on its hosts[24].

Reflectance of infected leaves comparable to that of flowers!!