



Role of insects in fire blight transmission

Larry Gut





Dissemination of fire blight

- Water and wind



- Insects and other arthropods



- Birds, deer

- Humans and mechanical equipment





Merton Waite, U.S. Dept. of Agric.



- First to implicate insects as vectors of fire blight
Observed that honey bees and wasps carry fire blight bacteria from flower to flower

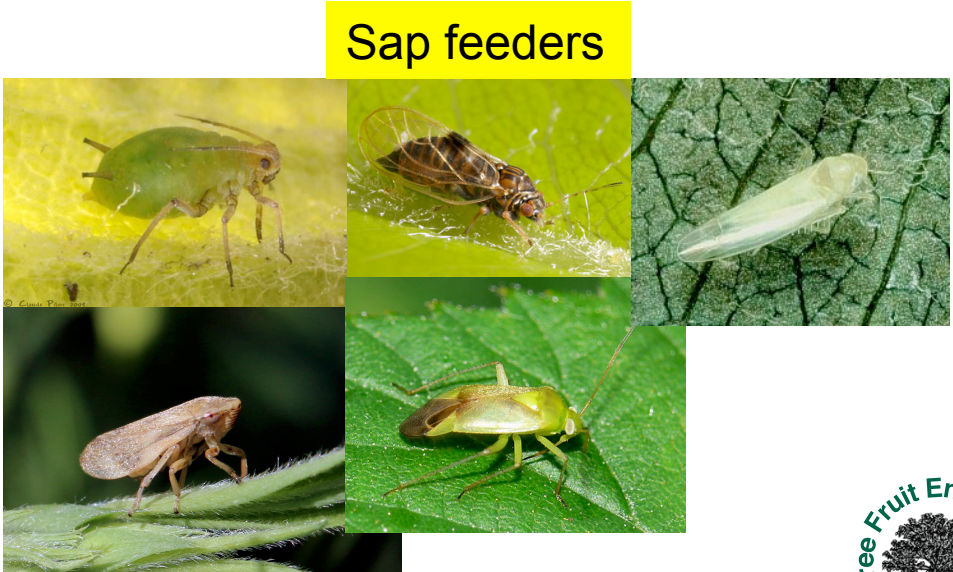
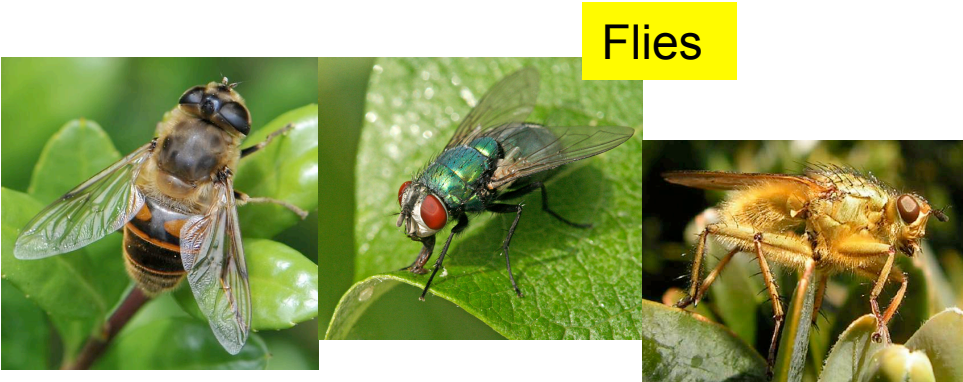


Waite, M. B. 1892. Results from recent investigations in pear blight. Am. Assoc. Advan. Sci. Proc. 1891 40:315



Literature review by Van der Zwet and Keil (1979) revealed:

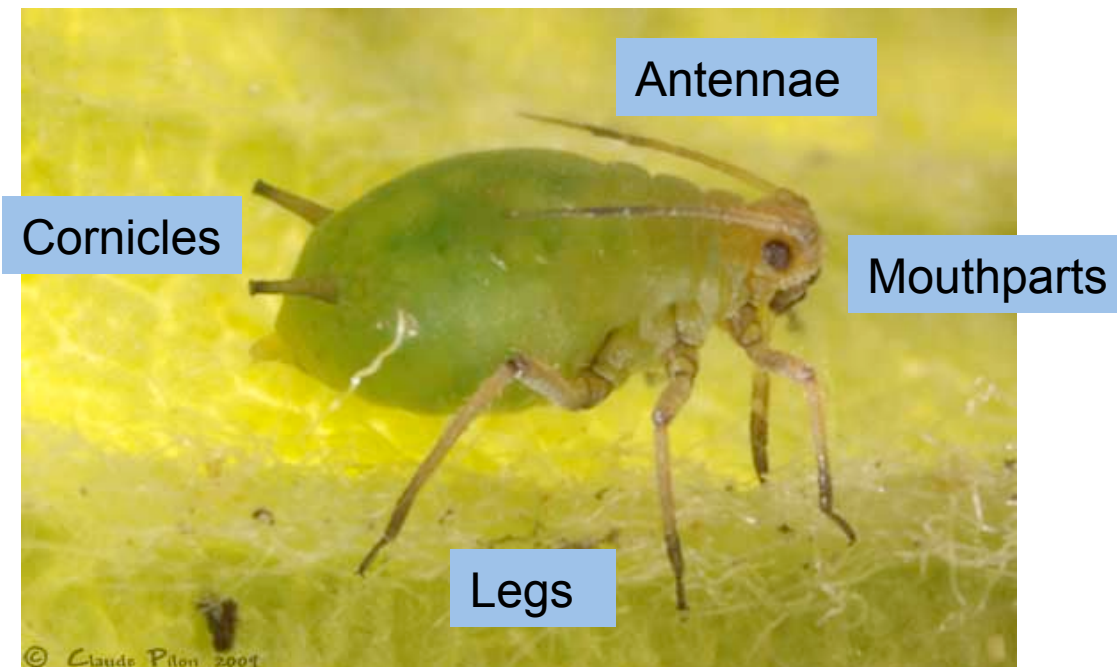
- Numerous insects associated with the dissemination of fire blight
- Represented 77 genera





Insect transmission of fire blight occurs mechanically

- Bacteria adhere to various body parts
- No evidence that the bacteria colonize insects internally



Hildebrand et al 2000

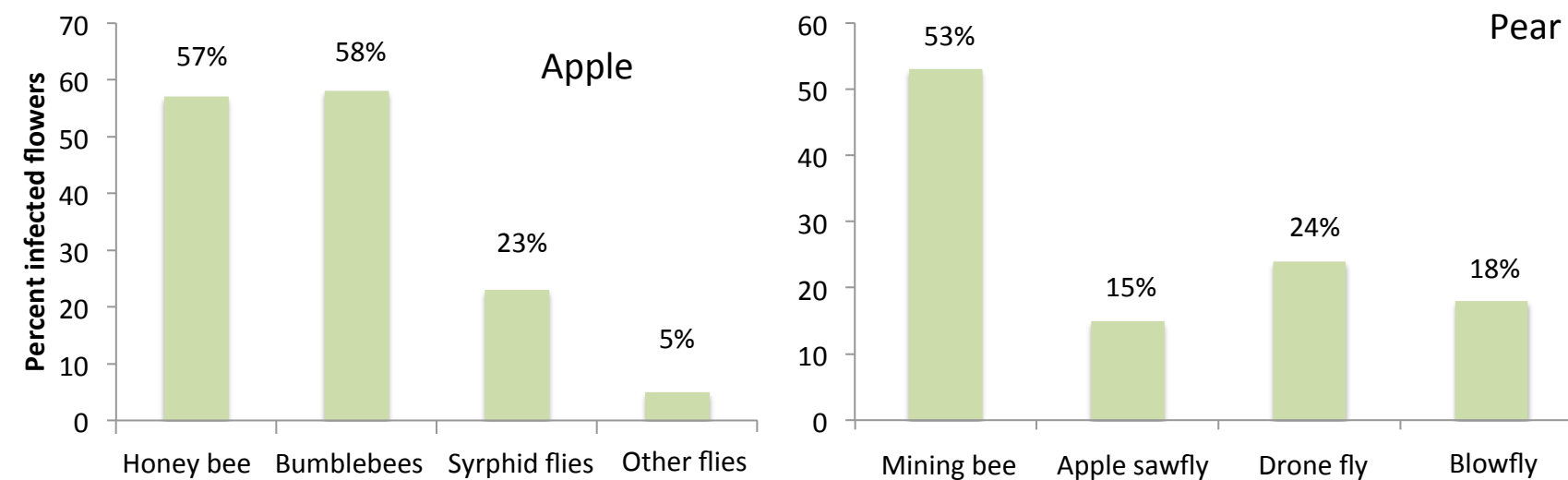




Infection of blossoms with fireblight using insects as vectors (Emmett and Baker, 1971)

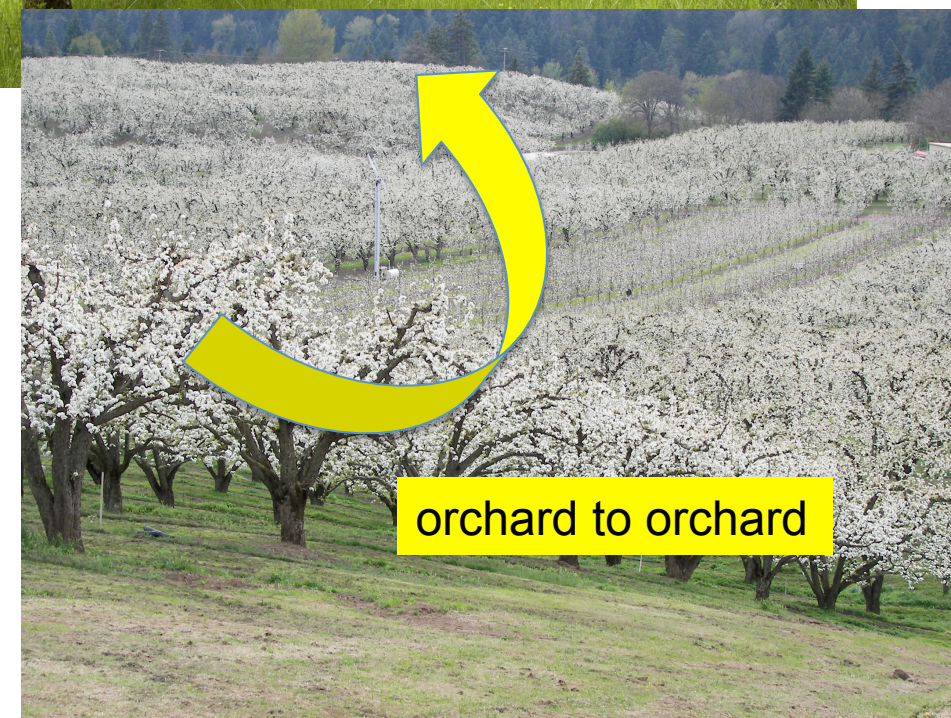


- Insects exposed to infected pear slices
- Caged with blossoms
- Assessed blossom infection





Flower visitors - blossom transmission

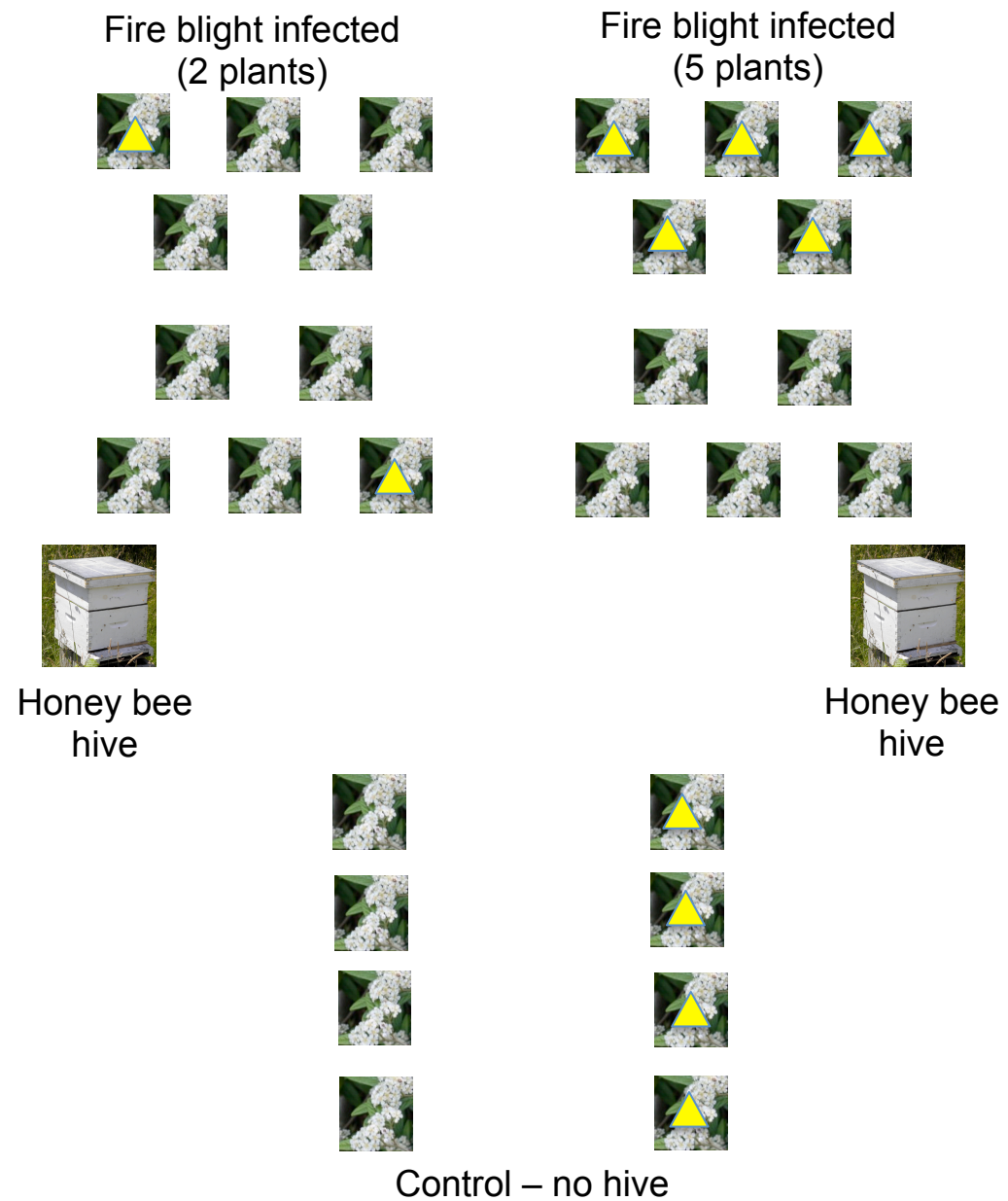




Influence of honey bees on fire blight transmission
(Van Laere et al 1981)

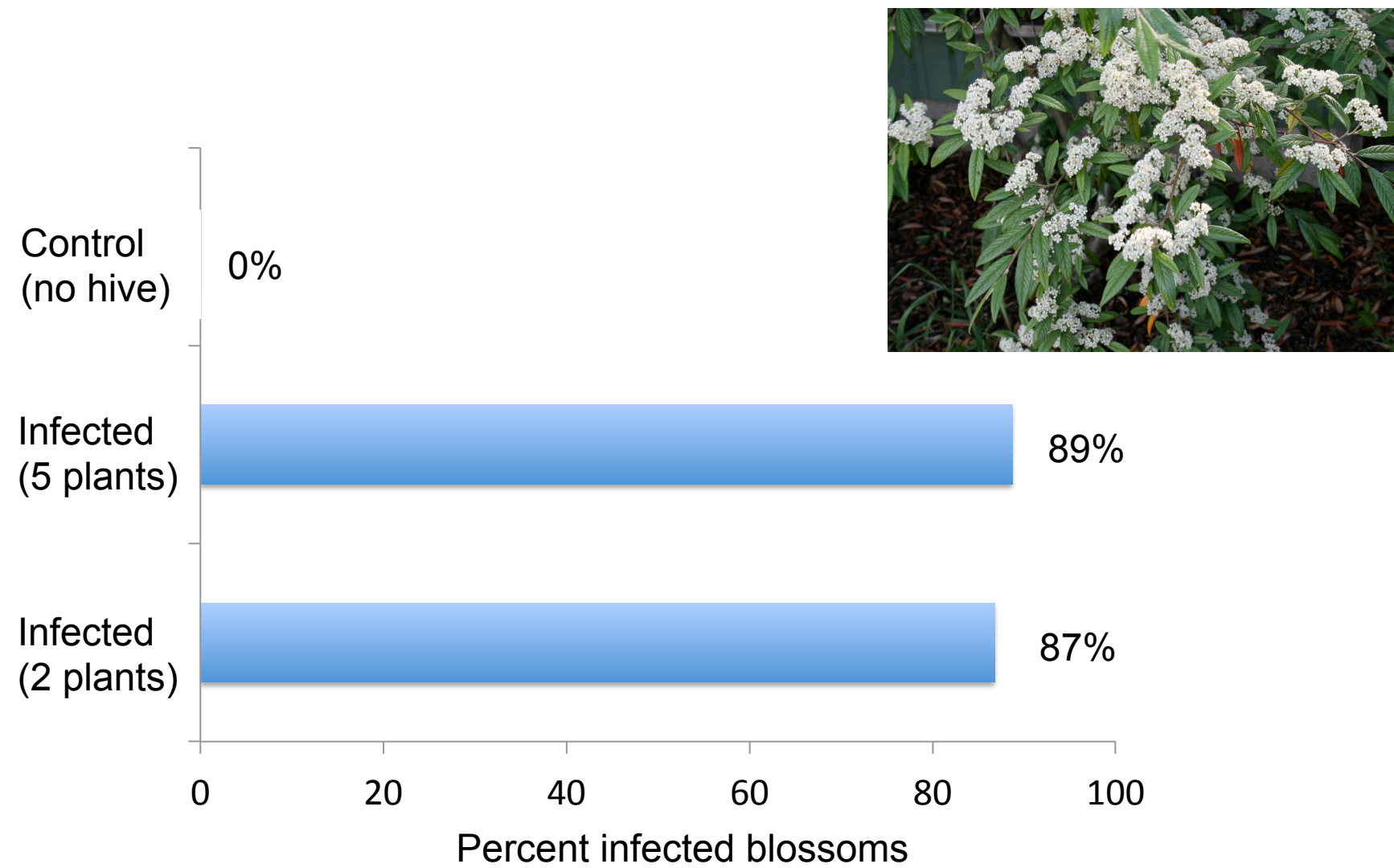


- Conducted in nylon mesh cages
- Test plant – *Cotoneaster salicifolius*
- Some artificially infected with fire blight
- Sprayed with *Erwinia* suspension (10^9 bacteria/ml)
- Flower clusters checked for infection every 5 days for 4 weeks





*Influence of honey bees on fire blight transmission
(Van Laere et al 1981)*





Survival of fire blight bacteria in the hive and in honey

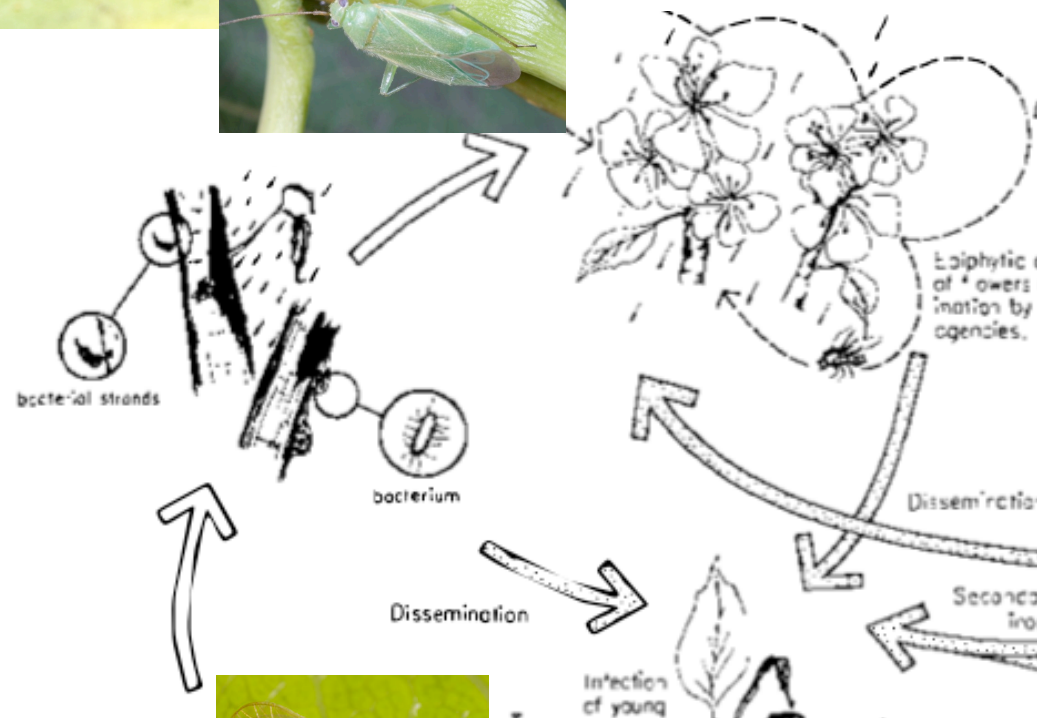


- Reported survival time in honey ranged from 2-11 days
- In other parts of the hive, a few days to a few weeks
- Consensus is that overwintering of fire blight bacteria in the bee colony is very unlikely





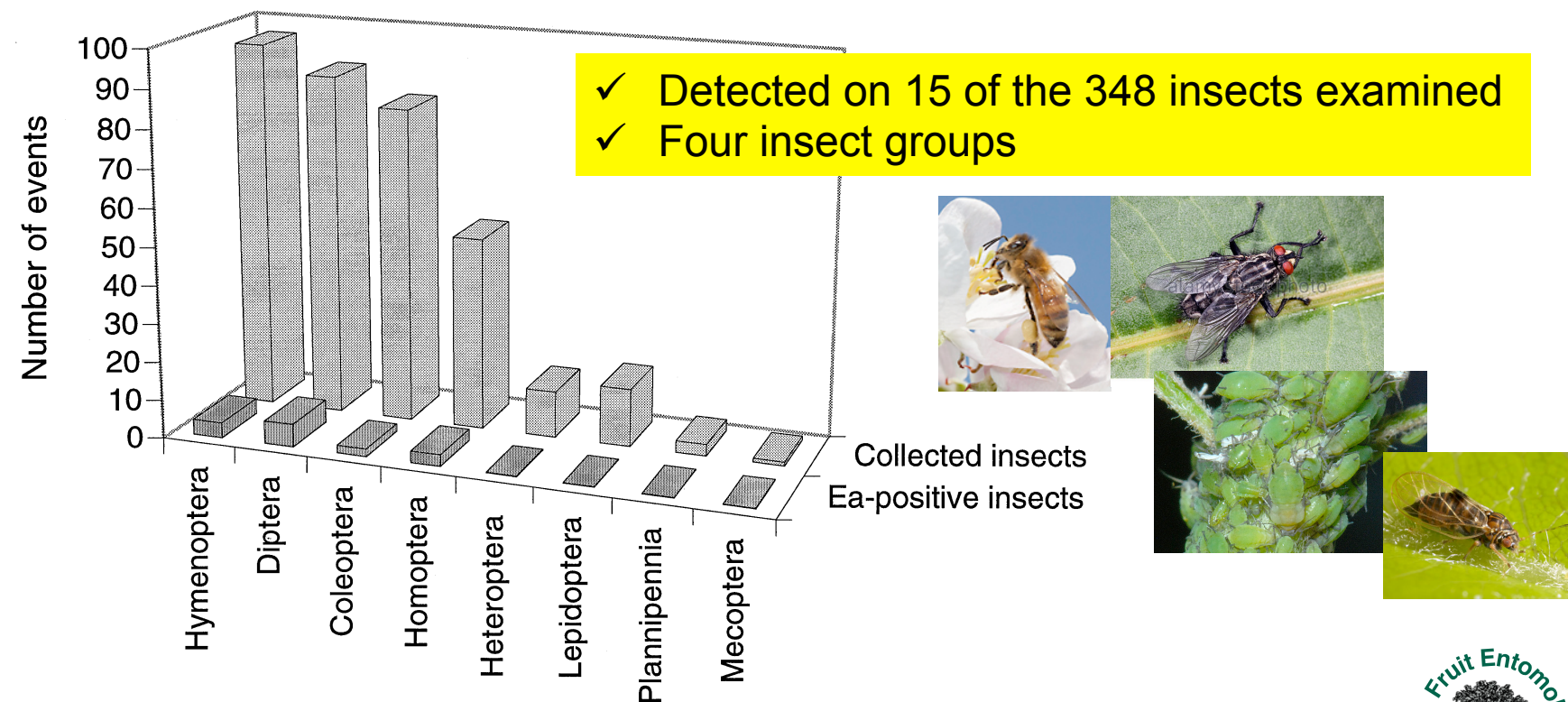
Insects that contact or feed on ooze





Occurrence of *E. amylovora* on Insects in a fire blight orchard (Hilderbrand et al 2000)

- Collected insects in a fire blight infected apple and pear orchard
- Screened for the presence of the bacteria



Collected and contaminated specimens of various insect orders





Persistence of fire blight bacteria on insects (Hilderbrand et al 2000)

- Lacewings fed fire blight laced food
- Aphids surface contaminated



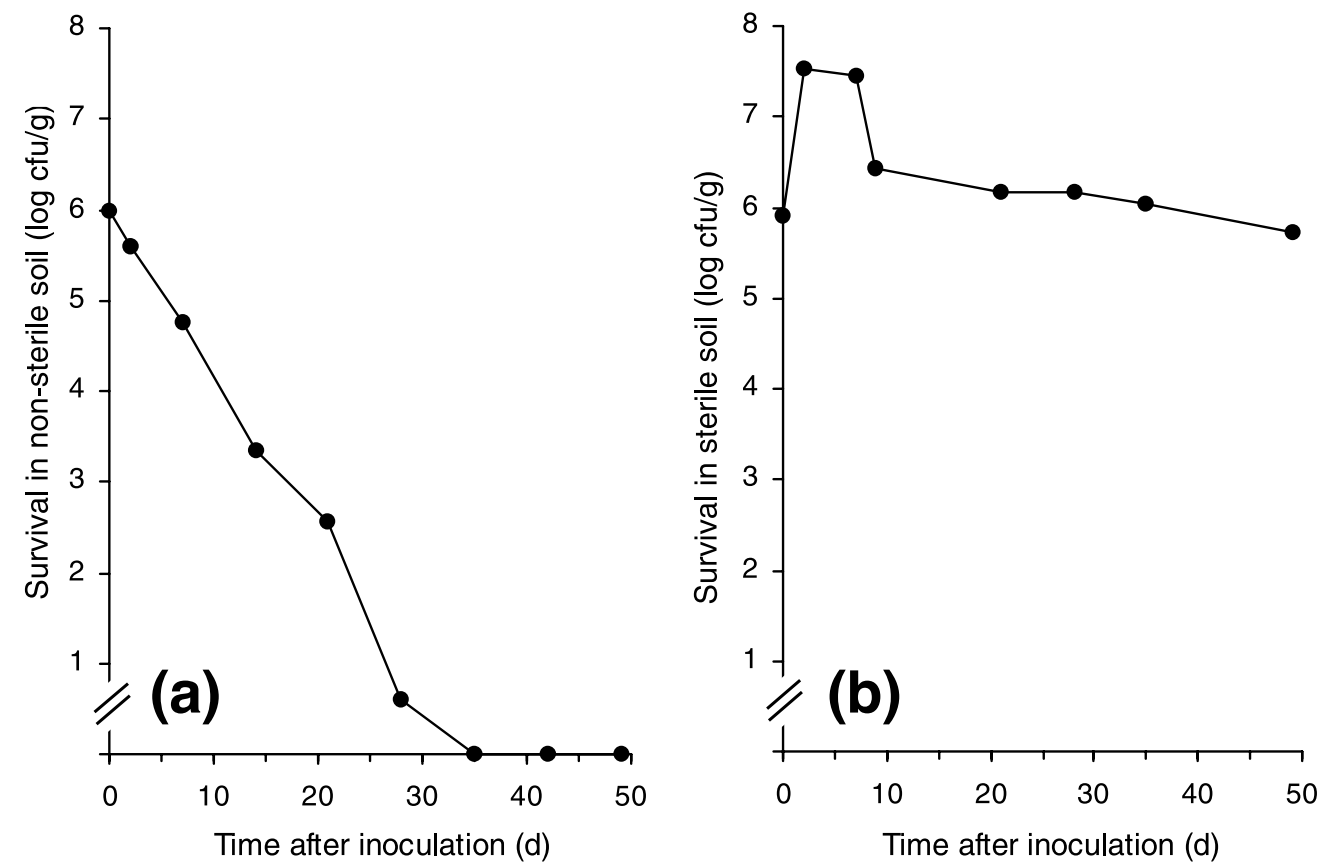
✓ Detected for up to 5 days



✓ Detected for up to 12 days



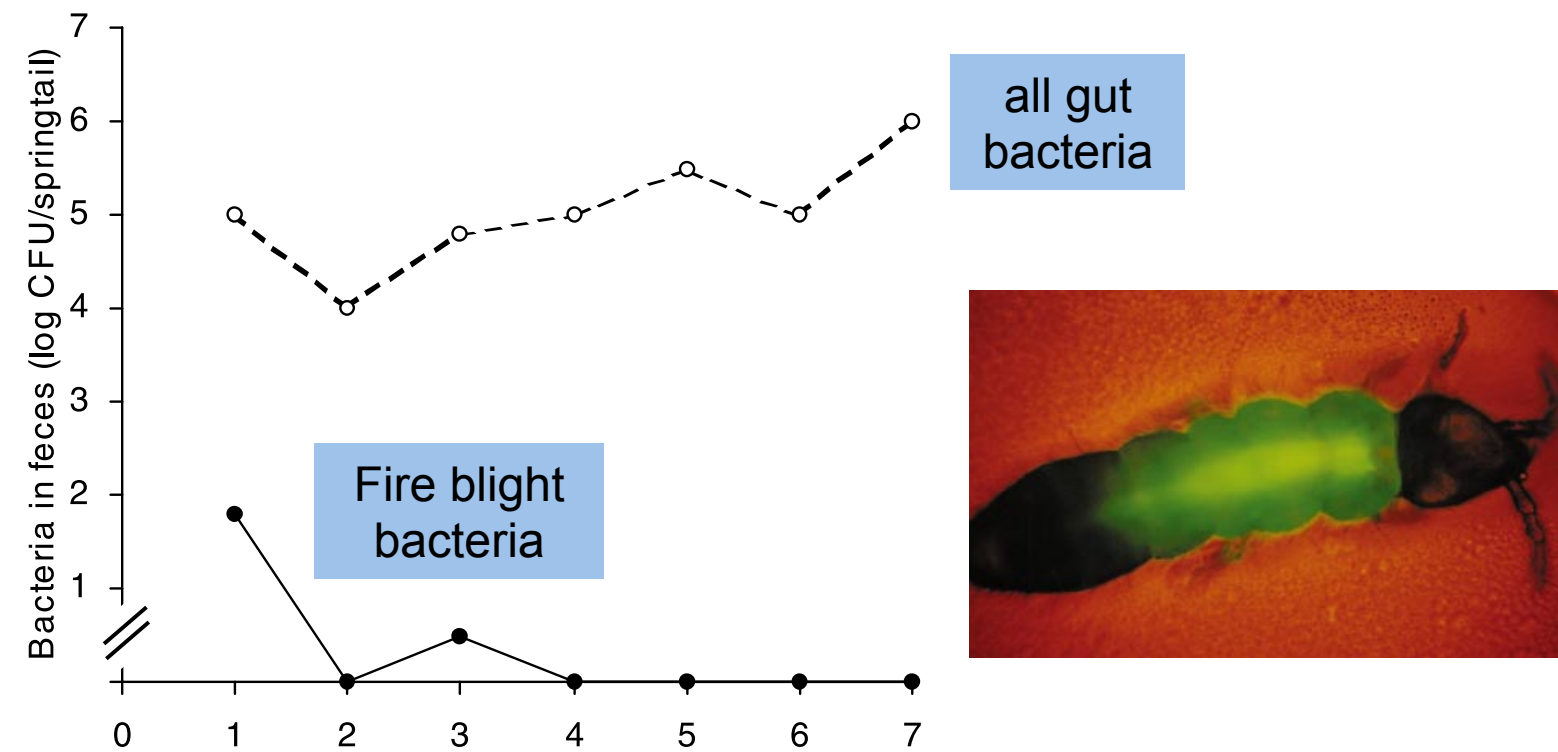
Survival rates of *E. amylovora* in (a) non-sterile soil or (b) sterile soil (Hildebrand et al 2001)



- Competition for limiting nutrients
- Predation by protozoans
- Growth inhibition originating from toxic derivatives produced by micro-organisms



Survival of *E. amylovora* in the gut of the collembolan, *Folsomia candida* (Hildebrand et al 2001)



- bacteria were fed to the insects
- re-isolated from the feces by plating on selective agar



Controlling honey bees



Table 1. Reduced-risk, OP-alternative, biopesticide, kairomone and natural products tested organophosphate Azinphosmethyl have been summarized for impact on bees, mite predators such as lady beetles and Syrphid flies, and functional ecology indexes, which indicate over ecosystem.

EPA Class.	Class. Chemical	Compd.	Bees	Mite predators	Predators	Functional ecology
—	Organophosphate	Diazinon	T	M	T	-30
RU	Organophosphate	Imidan	T	S	M	-10
RU	Organophosphate	Lorsban	T	T	T	-40
—	Organophosphate	Malathion	T	M	M	-30
OP-Alt	Carbamate	Sevin	T	T	T	-40
OP-Alt	Synthetic Pyrethroid	Asana	T	T	T	-60
OP-Alt	Pyrethrum	Pyganic	M	M	M	-5
OP-Alt	Synthetic Pyrethroid	Ambush, Pounce	T	T	T	-40
OP-Alt	Pipronyl Butoxide + Pyrethrum	Evergreen	M	M	M	-10
OP-Alt	Synthetic Pyrethroid	Warrior	T	T	T	-50
RR	IGR (Juvenoid)	Esteem	S	S	S, MG	+20
RR	Oxadiazine	Avaunt	T	S	S	-10
RR	IGR (MACs)	Intrepid, Confirm	S	S	S	+10
RR	Spinosyn	GF-120	U	S	U	+10
RR	Spinosyn	SpinTor, Entrust	M	S	M	-10
RR	Particle Film	Surround	S	M	M	-5



Management considerations

- Honeybees and other flower visitors provide essential pollination services and should never be the target of control measures



- keeping sap-feeding insects, such as aphids, psyllids and leafhoppers, in check can reduce the incidence of fire blight infections



- best means of managing fire blight are the standard practices of removing infecting plant material, reducing shoot growth and applying bactericides



Questions!

