

The flatheaded fir borer: knowns & unknowns



Trees on the Edge: Understanding & Managing Douglas-fir Decline & Mortality in SW Oregon

Bill Schaupp, USFS, Forest Health Protection (retired), May 4, 2023

Is flatheaded fir borer responsible for all die-off?

-no-

Opportunistic “secondary” insects and plant pathogens

- response to host stress

Mortality of Douglas-fir in southwestern Oregon

- primarily from flatheaded fir borer in Klamath ecoregion
- increases during and after drought
- especially severe with “high temperature” drought
- other agents, esp. on smaller D-f, involved
- may persist after drought conditions improve

Phaenops drummondi (Kirby)

[Coleoptera:Buprestidae]

- Woodborer known as *Melanophila drummondi* until 1996
- Nearctic, hosts in all native genera of Pinaceae
- Prefers dying, burned, and recently downed hosts
- Associated with mortality of western hemlock and Douglas-fir by A.D. Hopkins in 1889 in Oregon
- Noted as capable of infesting and killing “apparently healthy” green conifers in reference texts and textbooks
- Little research, few publications, episodic attention
- May not be acting alone (e.g. *Phaenops vandykei*)
- Unassociated with Douglas-fir beetle at lower elevations, for now

Lifecycle



- Normally requires one year
- Can have extended life cycle depending on host quality
- Hosts in Oregon
 - *** Douglas-fir, true fir, western larch
 - ** spruce, western hemlock
 - * pines
- Dimorphic, varied adult forms



Generalized life cycle of *Phaenops drummondi* (Kirby) drawn by D. Scott

Scott's introduction cites textbooks (1919, 1924, 1960) describing much of what we've rediscovered about the *P. drummondi* life cycle in standing green Douglas-fir

Scott, D. W. 1978. Survival and Development of the Flatheaded Fir Borer in Forest Residues as Affected by Host and Microclimatic Conditions. Unpublished Ph.D. thesis, Oregon State University, 233 pgs

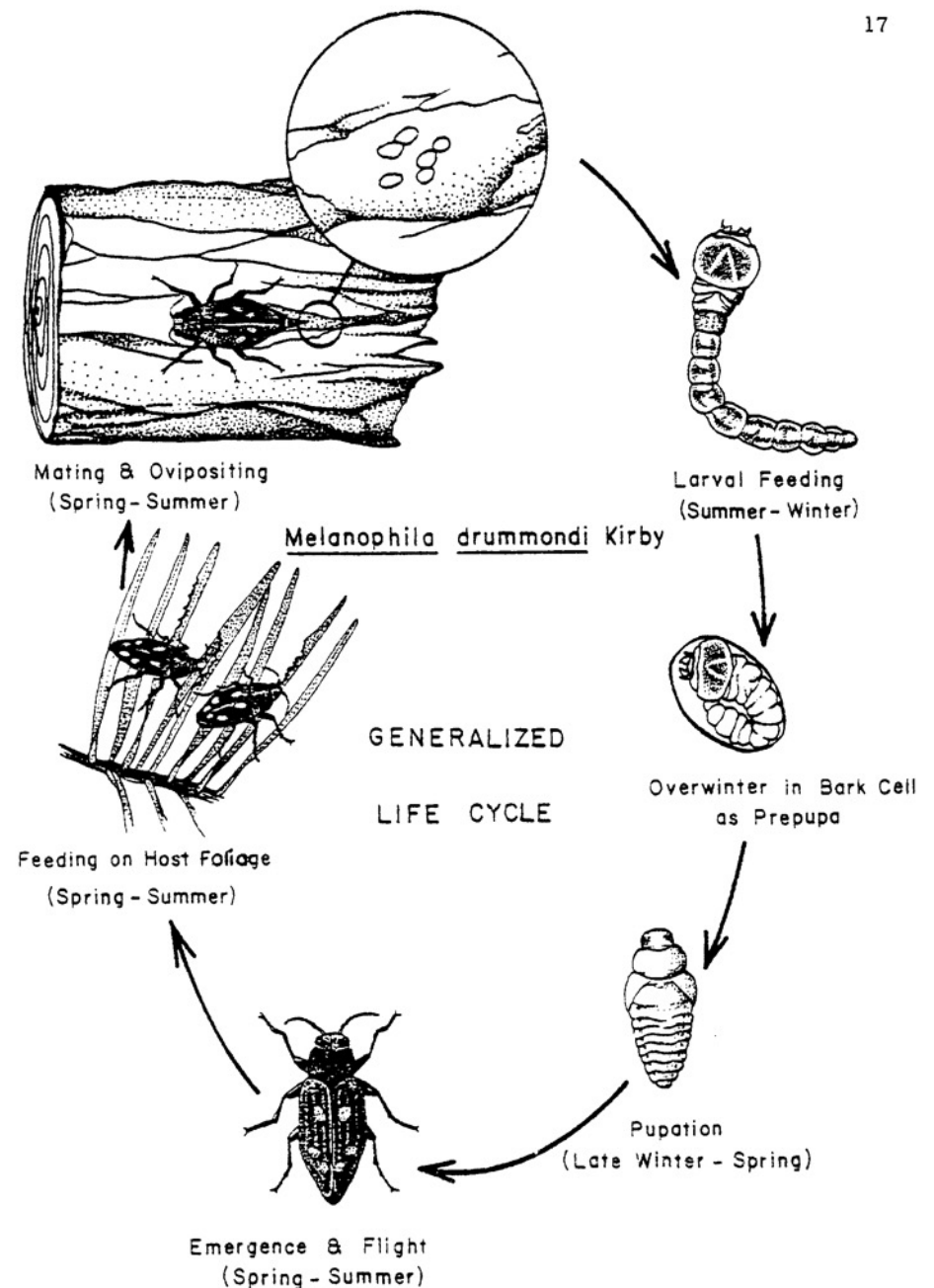


Figure 2. Generalized life cycle of Melanophila drummondi.

Lifecycle in standing green Douglas-fir

- Adult emergence begins Spring, feed on conifer needles, bask in sunlight, mate
- Eggs laid in bark crevices, under flaps
- Larvae bore into the xylem/phloem interface, begin feeding, xylem unscored
- Tiny larvae with slow development
- ❖ If host compromised, actively feed on inner phloem and cambium; if host vigorous, larvae quiescent
- Mature larvae move to outer bark, make cell, overwinter



Phloem layer hardens,
dries, is little consumed

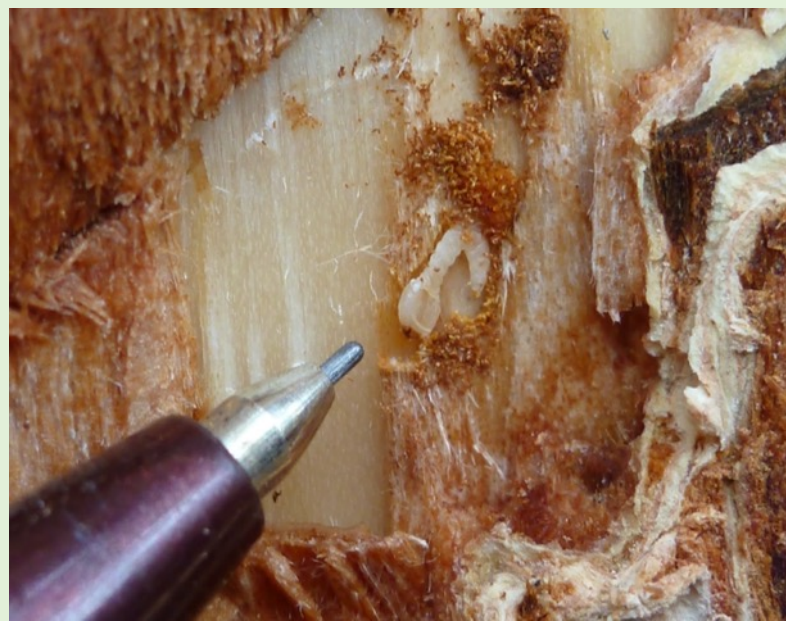
Some infested Douglas-fir fade from green to orange/red in one year (left)...and others take longer (right)

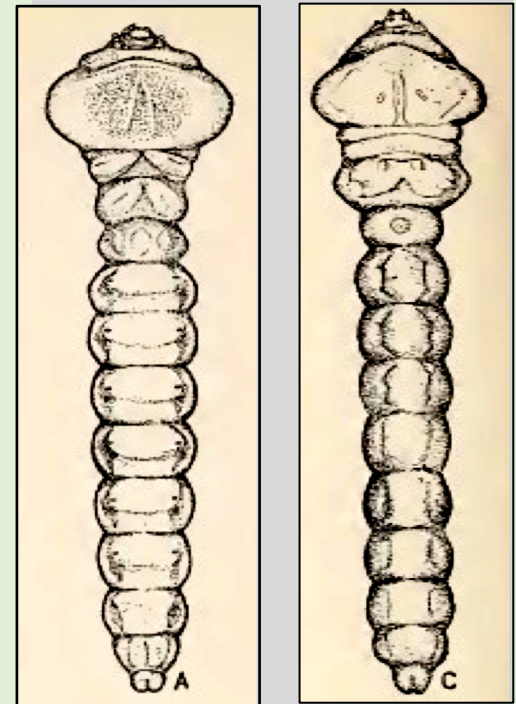


May 2013



June 2014





Dorsal (L.) and Ventral (R.)



Fresh emergence
hole of flatheaded
fir borer with frass,
July 24, 2013
Ashland Creek
watershed

Some flatheaded fir borer characteristics

Sunlight is preferred.

Host finding may be chemically mediated.

High heat and/or sunlight and moisture deficit may change volatile chemicals coming off Douglas-fir that are attractive.

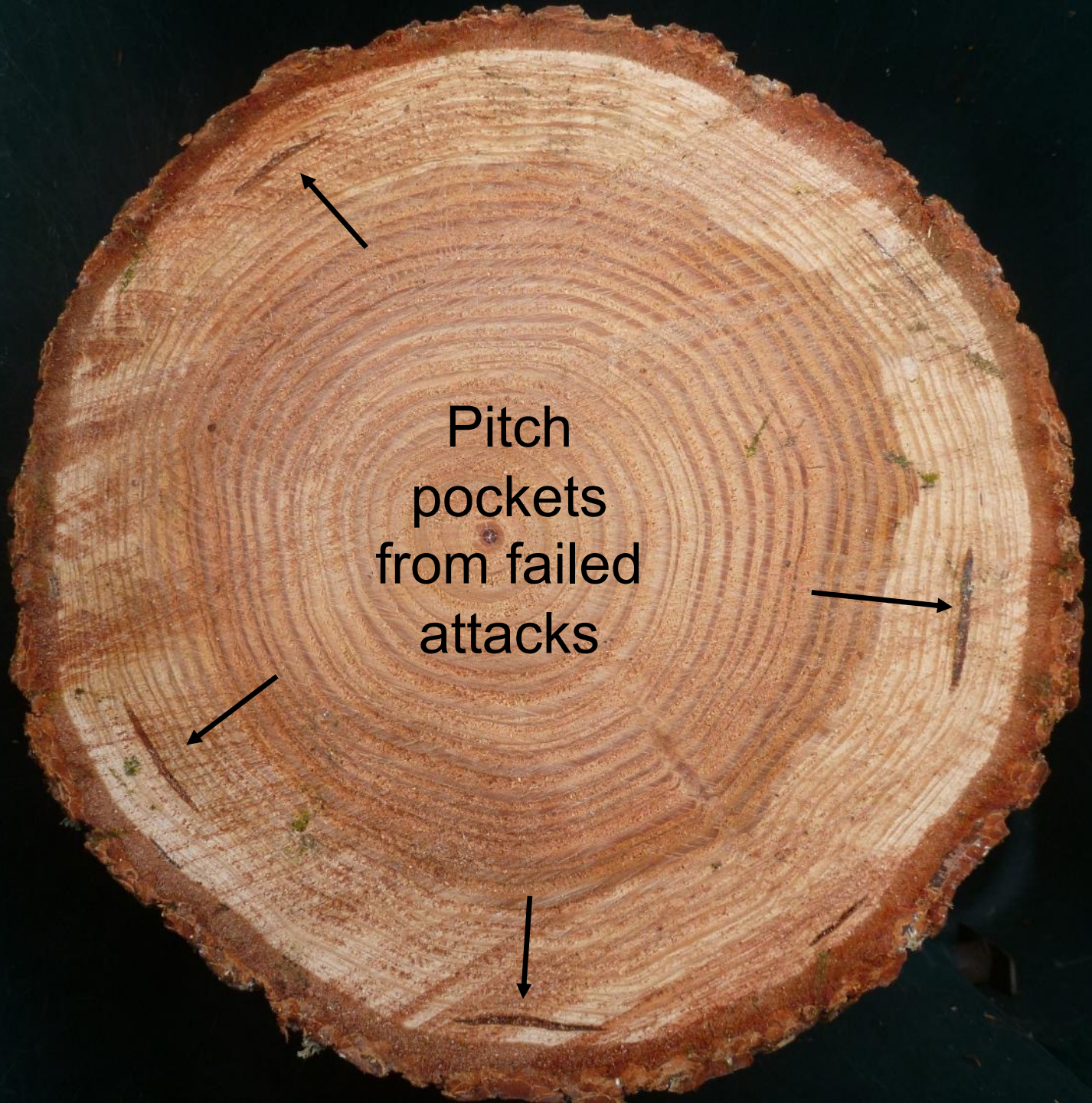
Larval success is greater at the bottom & host resistance greater at the top...attack profile oft referred to as “top down”.

“Apparently only when the radial tree growth stops are they able to grow rapidly and mature” – R.F. Anderson, Forest and Shade Tree Entomology (1960)



Atanycolus sp.

- D-fir planted at JH Stone Nursery in 1979 or 1980
- Watered regularly until 1998-2000, then cut off
- Hot droughts during 2013 through 2015
- Woodborer frass, wasp oviposition detected 2017
- Trees fade Fall 2017, cut down, show pitch pockets



Pitch
pockets
from failed
attacks

Detection in green Douglas-fir

- Difficult --- no early positively diagnostic host symptoms
 - No pitch tubes, frass or boring dust prior to emergence
 - Other woodborer species quickly colonize declining host
 - Larvae tough to locate and identify, “key” to genus
-
- ❖ Bark removal by woodpeckers feeding on overwintering larvae
 - Jewel-like pitch droplets inside bark crevices (entrances sites?)
 - Thin crown, low crown ratio, stress crop of cones
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- One or more faded branches for one or more years
 - Foliage fading observed all year, mostly in late Spring/early Summer; faded foliage often falls rapidly



E. Goheen, photo





Inner phloem of Douglas-fir cut from underneath outer bark with “pitch jewels” in bark crevice showing tiny larval galleries (red lines) and one larger gallery



Contagion

Years of impact from flatheaded fir borer:

- snapped snags (foreground)
- old grey faders (left)
- new red fader (center)
- green, infested Douglas-fir with bird-excavation of the lower stem (right).



Lower stand area thinned and burned in 2009 during 3rd year of drought; photo taken 2011

Bandersnatch Trail traverse:
from untreated loss (L.) to
repeated thin retention (C.)
to untouched high site (R.)



Where has flatheaded fir borer killed green Douglas-fir?

Oregon:

- Locations with ingrowth of Douglas-fir on harsh sites better suited for other species (oaks, pines)
- Columbia Gorge; the eastern edges of the Willamette Valley; and rain shadows of Mt. Hood; SW Oregon.
- Eastern Oregon on western larch

California:

- NE (post-drought; drier D-f sites, oak & pine; also scattered)
- NW (continuous, slow-paced, different associates; alluvial floodplains during drought)
- Yosemite Valley 1932-1935
- Southern Sierra Nevada (Douglas-fir beetle also rare)

Idaho:

- Following large Douglas-fir beetle epidemic, during drought



Phaenops vandykei (Obenberger)

What is the role of *Phaenops vandykei* in green Douglas-fir?

What of the 20+ spp. in 5 genera of Buprestidae?

How is the tree killed ?



Phaenops drummondi, the flatheaded fir borer