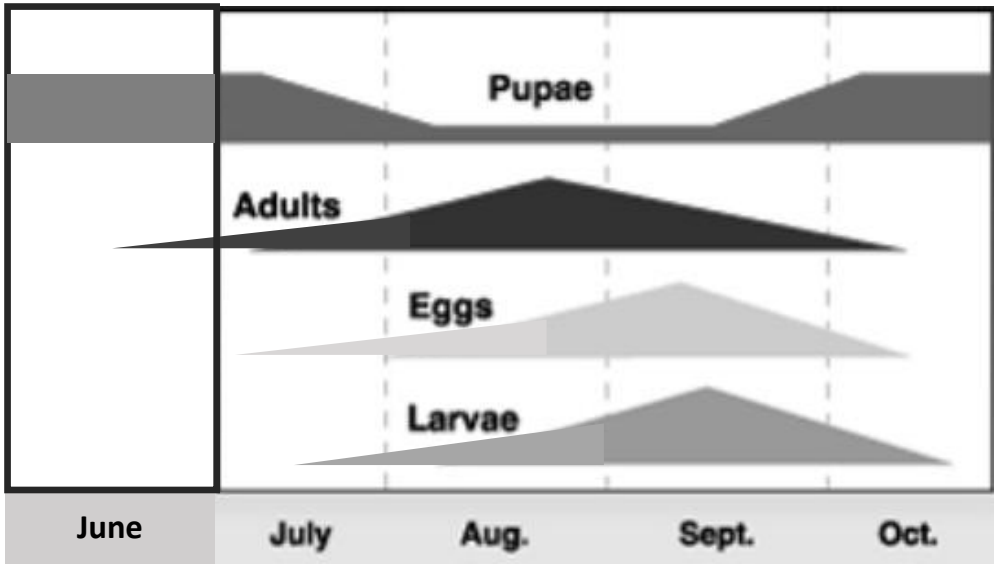
Walnut Husk Fly Research

Nick Mills
UC Berkeley

Walnut Husk Fly (WHF) Life Cycle



Cultivar Susceptibility to WHF

- All walnut cultivars plus black walnut can be suitable hosts for WHF
- Chandler, Howard and Tulare appear less susceptible
- Chico, Franquette, Hartley, Payne, Pedro, Serr and Vina appear more susceptible

- Partly due to cultivar-specific trichome density on the surface of the hull in Jun/July

WHF Management

- In absence of natural enemies, WHF management relies on effectively-timed insecticide treatments
- Until recently 1-2 spray treatments with an OP were sufficient
- Within the last 10 years the number of spray treatments has escalated to 4-6 combinations of neonicotinoid/ pyrethroid
- Increased number of sprays may be disrupting natural enemies of spider mites, scales, etc and leading to resistance

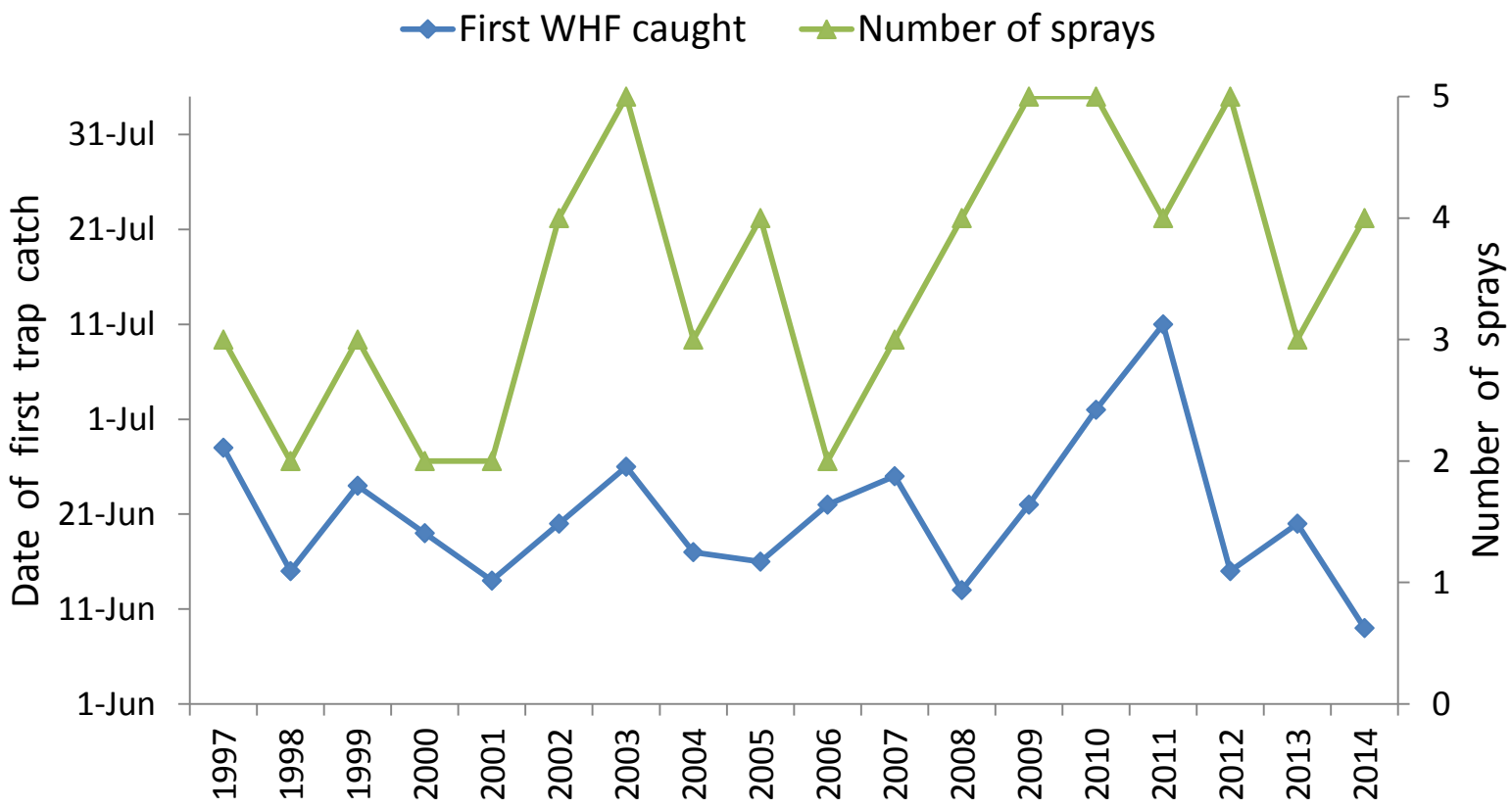
Research Goals

- What factors influence the timing of WHF emergence and egg laying?
- First emergence tends to occur mid June
- Egg laying begins from 2-6 weeks after first emergence
- Develop a phenology model for WHF in CA to predict timing of emergence and egg laying and reduce the need for multiple sprays

WHF Emergence (Trap Catch)
Red Bluff

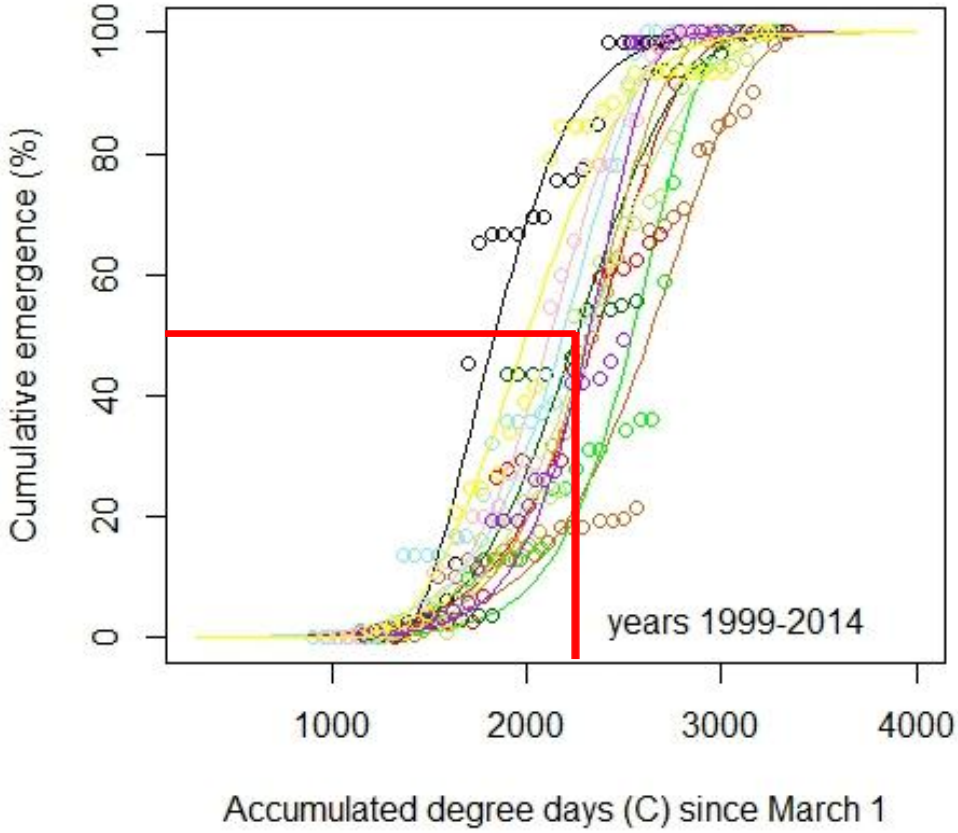
- Data set (1997 – 2014) limited to years with >25 females trapped
- Climate data from nearest CIMIS station
- Degree day accumulation from March 1 based on 5°C low temp threshold (from OR)
- Variation among years in first female and first fly (males +females combined) trapped

WHF Emergence (Trap Capture) Red Bluff

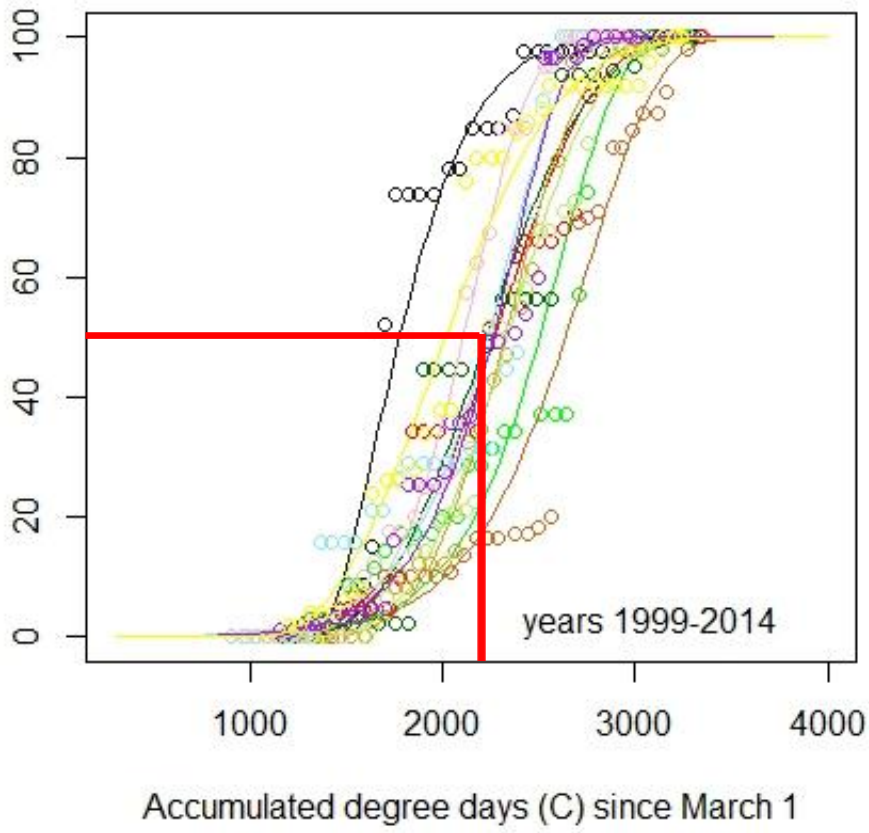


WHF Emergence (Trap Capture) Red Bluff

Females only

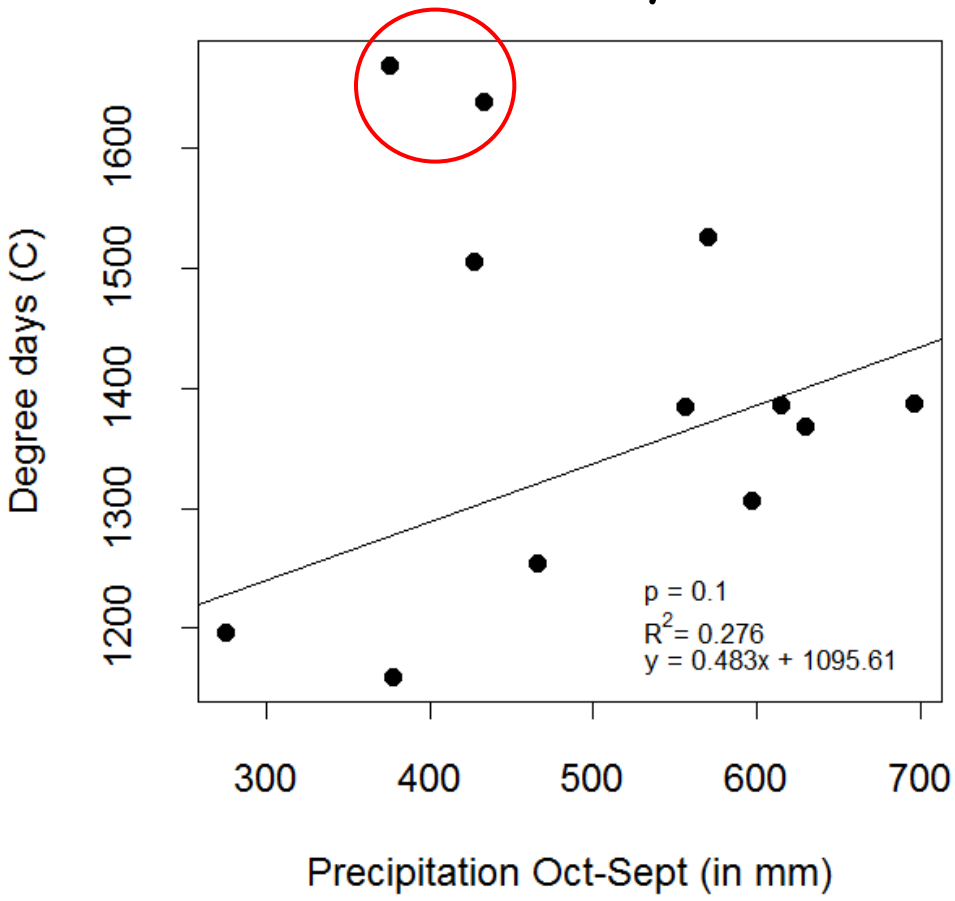


Males and females combined

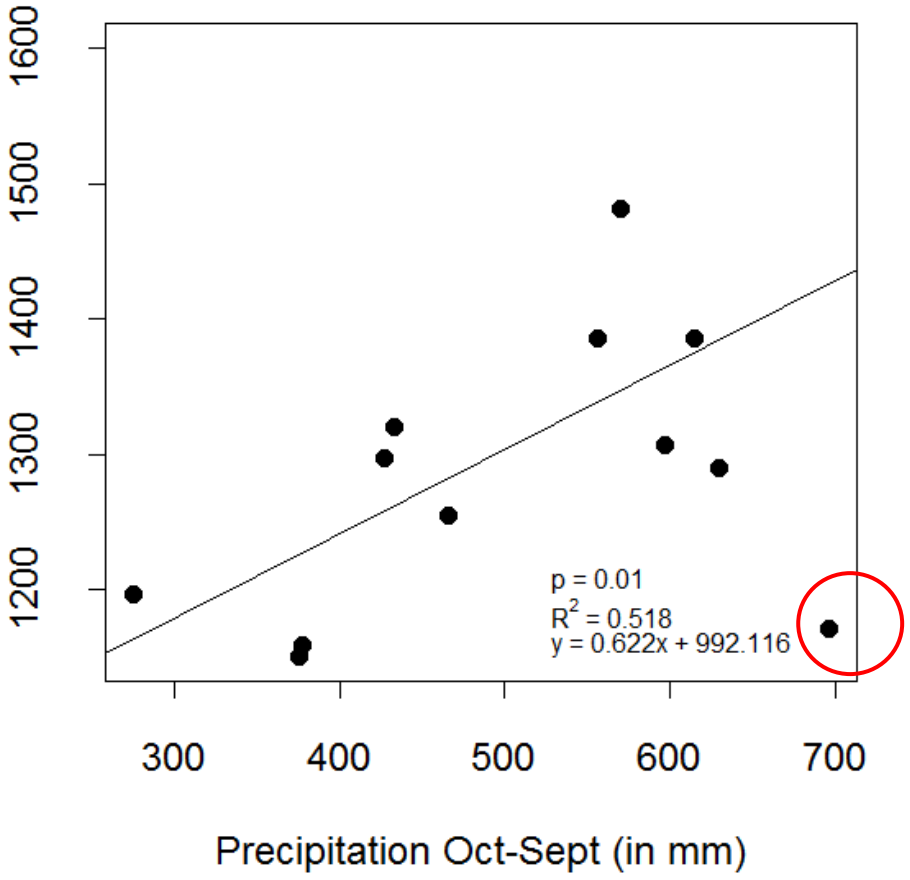


Positive Influence of Annual Rainfall on First Trap Catch

Females only

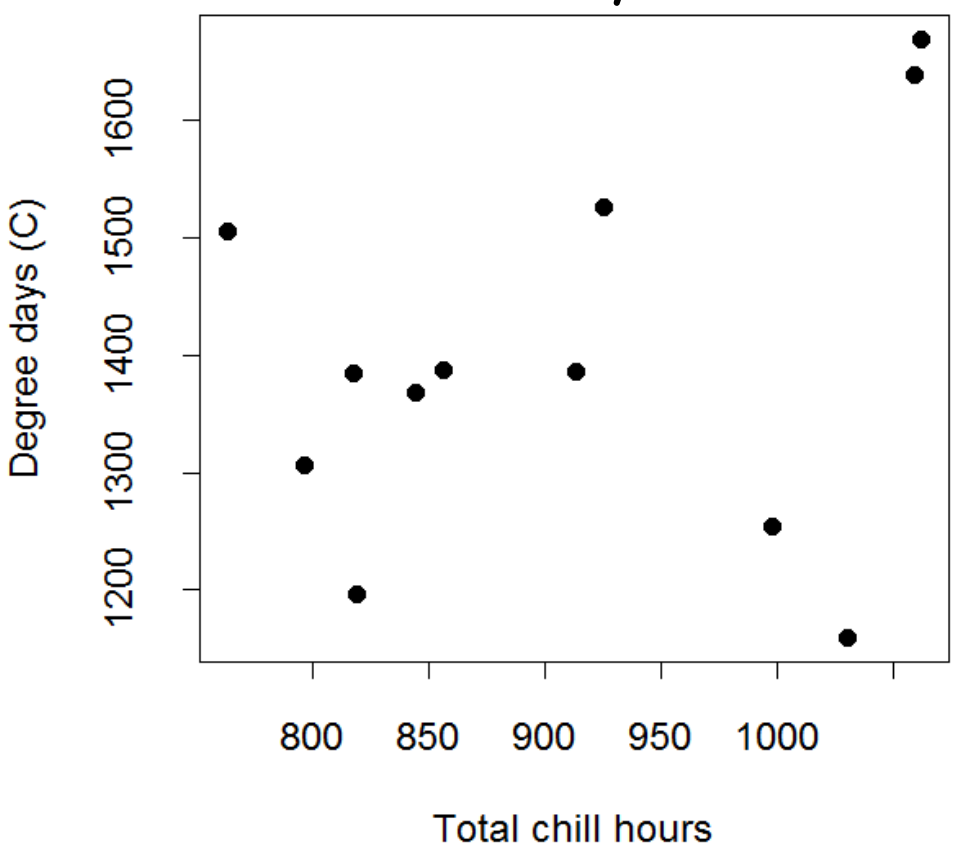


Males and females combined

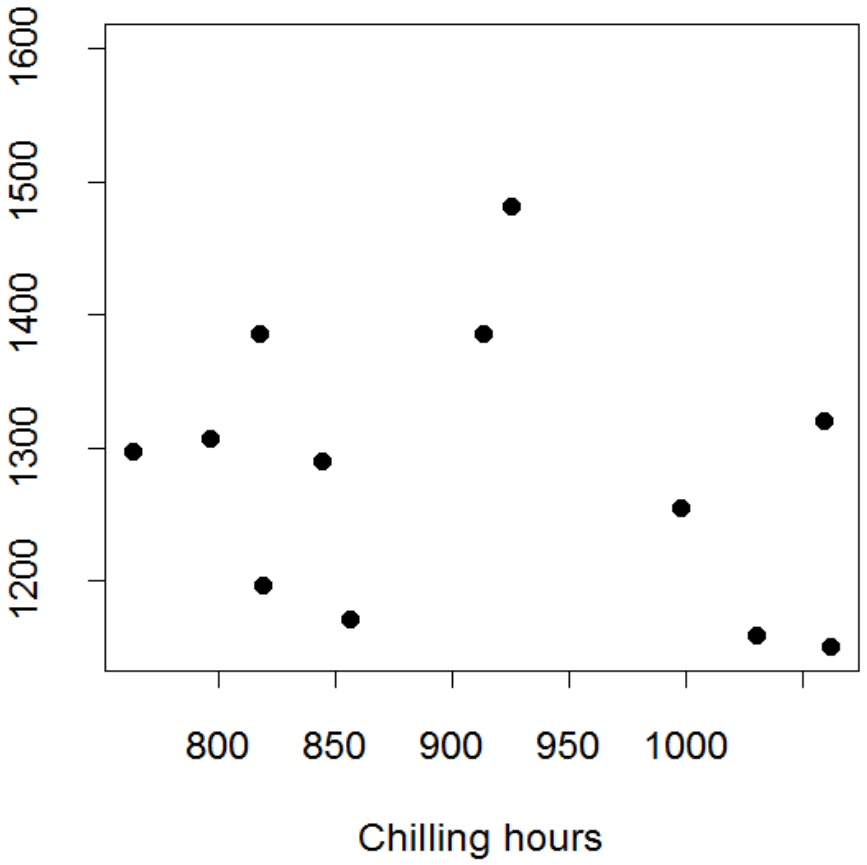


Lack of Influence of Winter Chill on First Trap Catch

Females only



Males and females combined



Lab Study of Thermal Requirements for WHF in CA

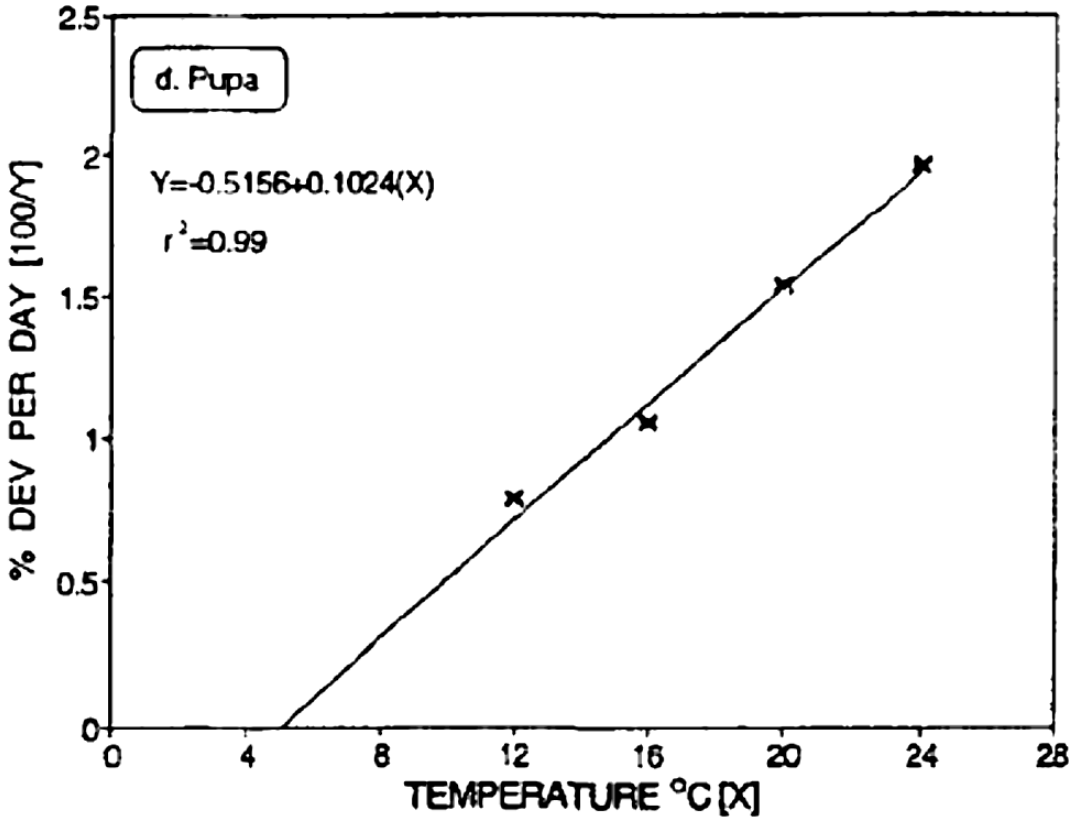
- Infested nuts collected from field and larvae allowed to pupate in sand/peat moss in the lab
- Puparia chilled (4°C) for 120 days
- 10 replicates of 10 puparia in Petri-dishes at a series of constant temperatures
- First and median (50%) emergence

Lab Study of Thermal Requirements for 50% Emergence of WHF in OR

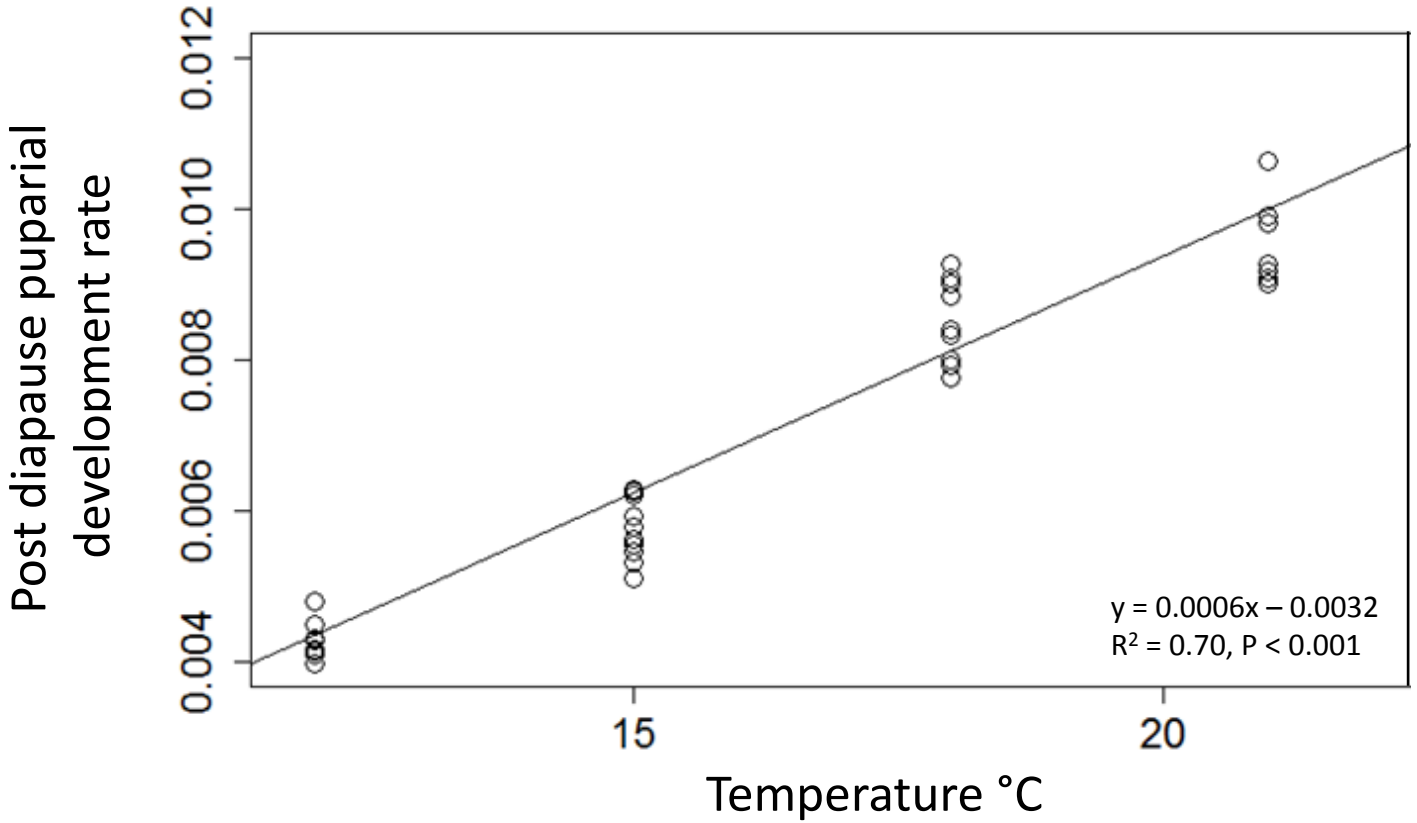
- Study of temperature threshold and accumulation for WHF in OR (Kasana & AliNiazee 1994)

LDT = 5.0°C

DD(°C) = 976



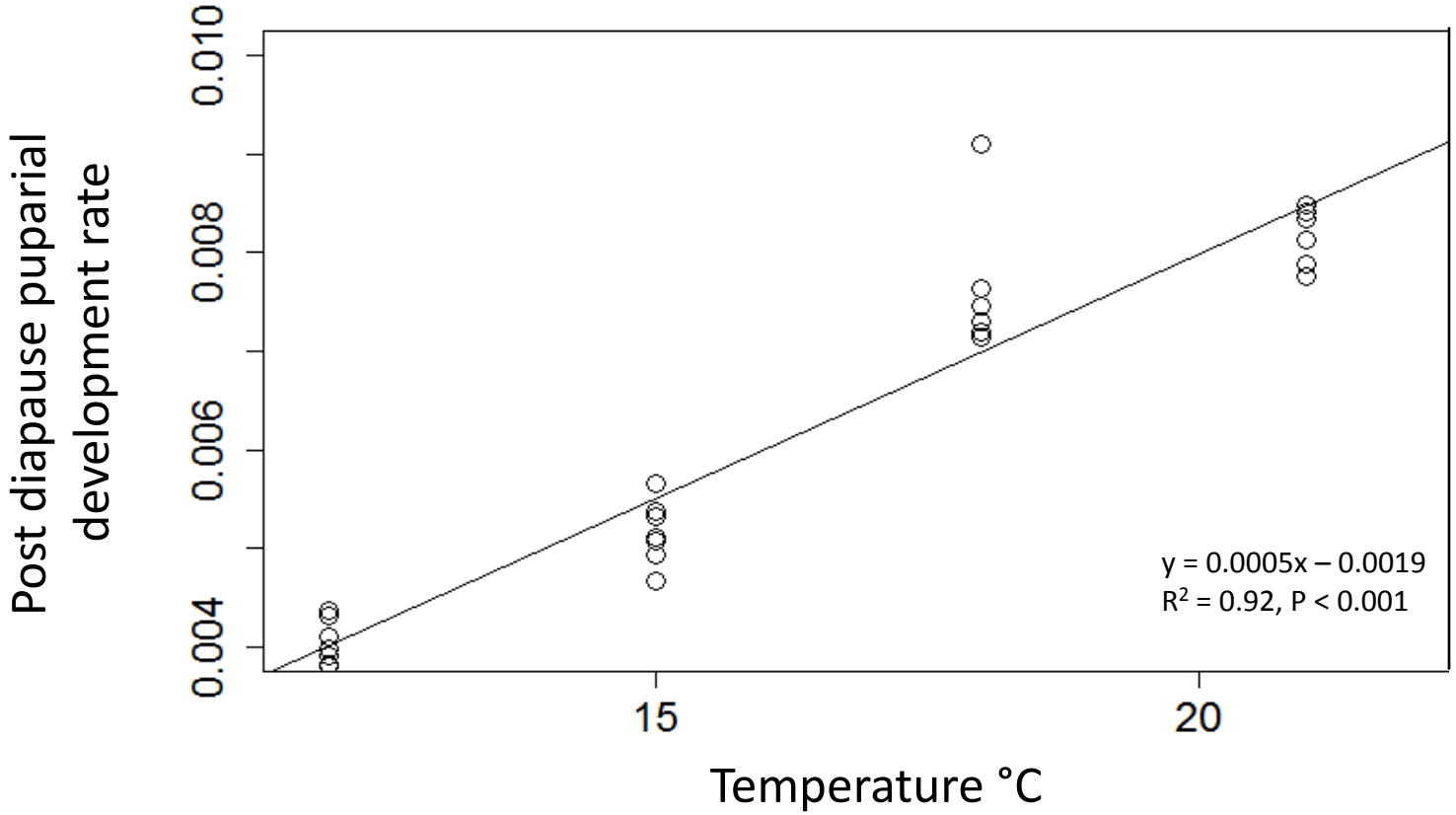
Lab Study of Thermal Requirements for First Emergence (Male + Female) of WHF in CA



Lower development threshold = 5.3 °C

Degree day accumulation = 1563 DD(°C)

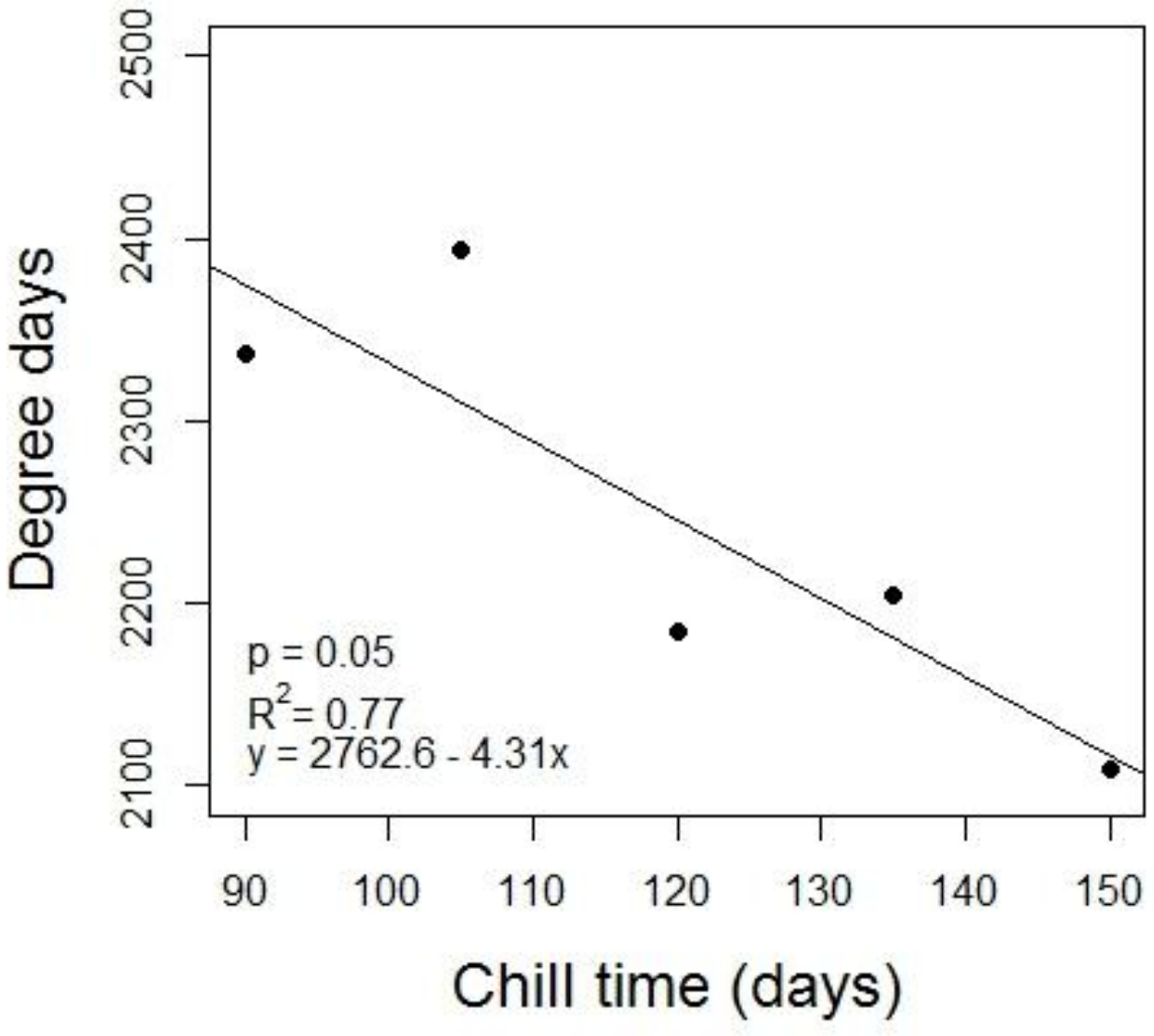
Lab Study of Thermal Requirements for 50% Emergence (Male + Female) of WHF in CA



Lower development threshold = 3.8 °C

Degree day accumulation = 2000 DD(°C)

Lab Study of Effect of Winter Chill on 50% Emergence (Males + Females Combined)



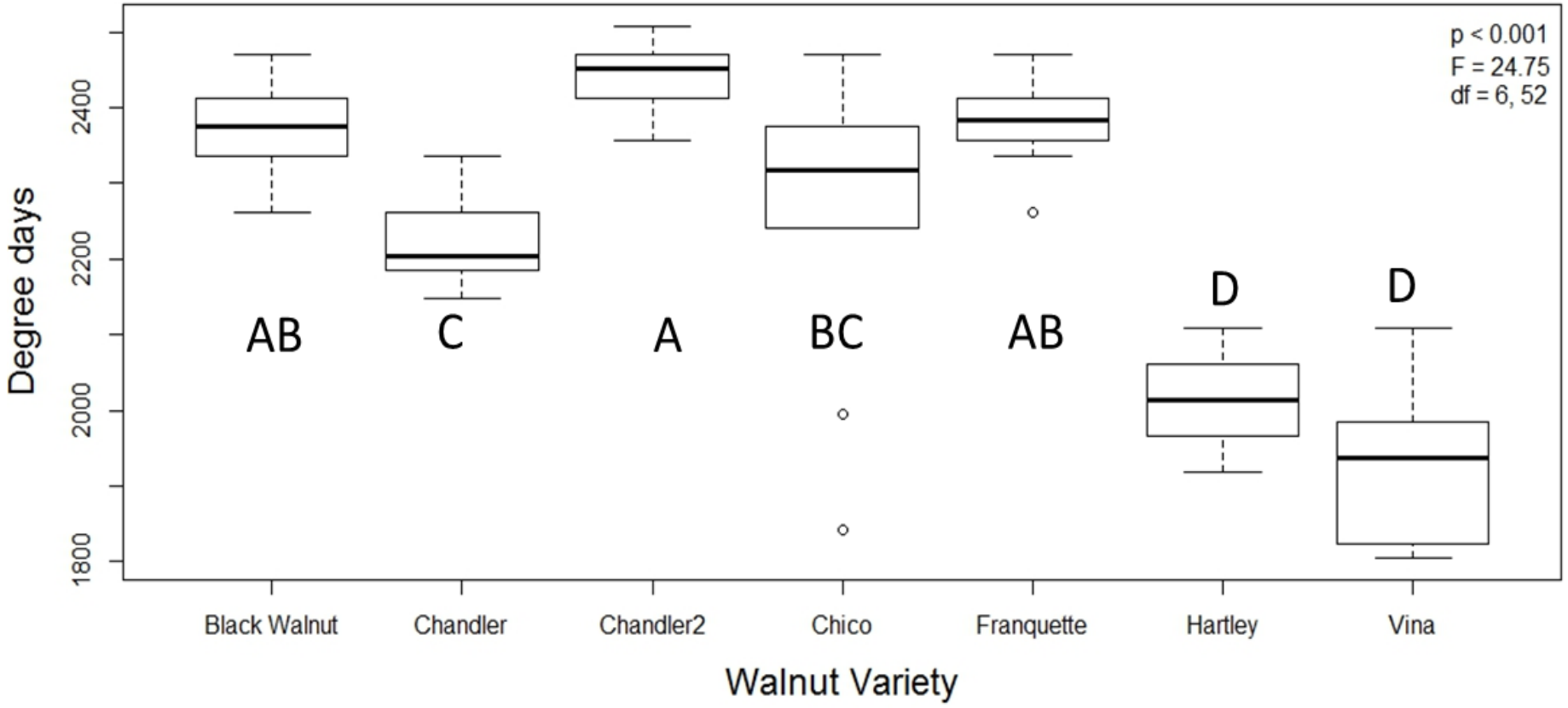
50 puparia for each chill time

Subsequent emergence at 24°C

Red Bluff 64 days of soil chilling in 2014

Lab Study of Effect of Walnut Cultivar on 50% Emergence (Males + Females Combined)

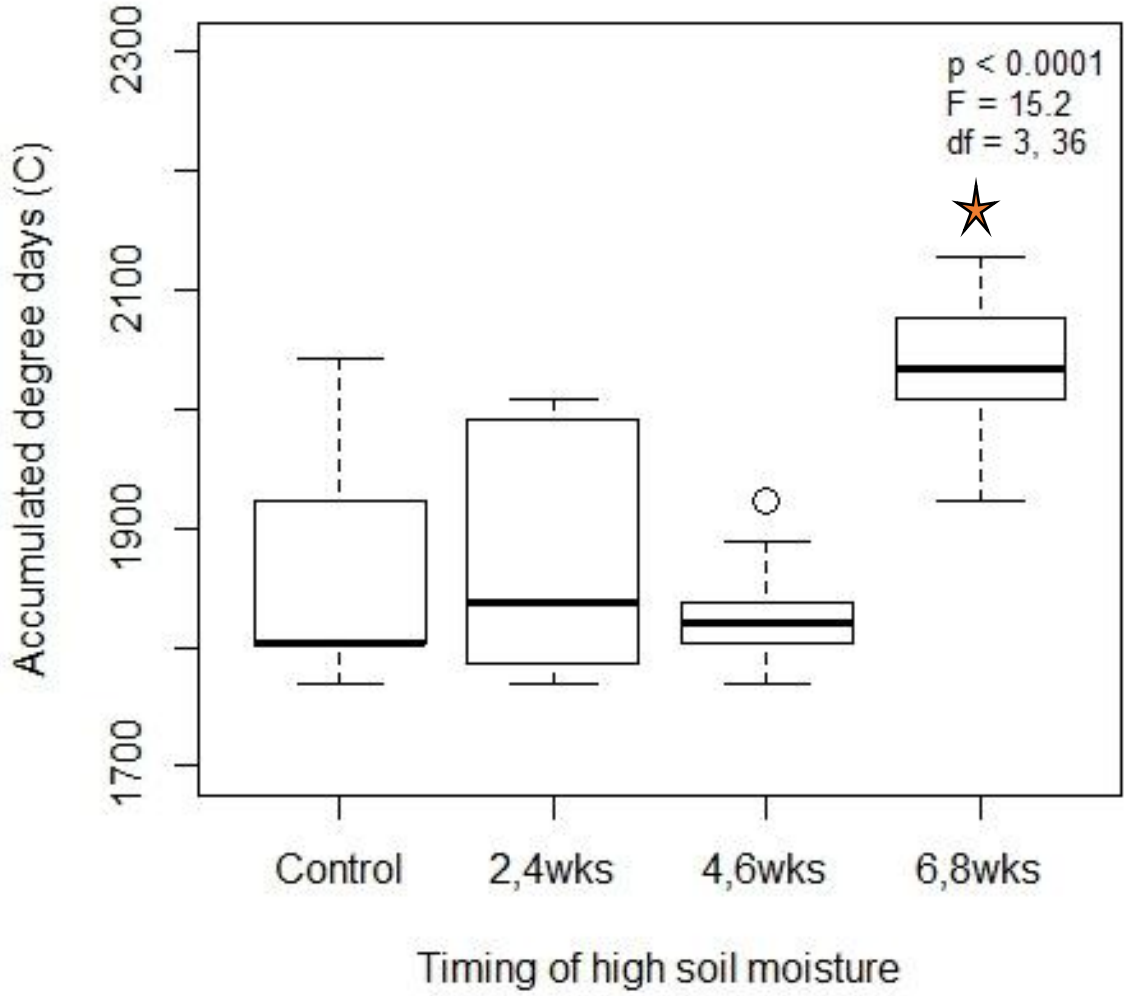
Puparia chilled for 105 days, 10 puparia per Petri dish, 4 to 10 dishes per cultivar, emergence at 24°C



Lab study of Effect of Irrigation on 50% Emergence (Males + Females Combined)

- Puparia chilled for 105 days at 4°C
- 15 puparia/cup
- 10 cups/treatment
- Control treatment – 9% moisture
- Irrigation treatments – 9% constant plus 100ml water on two separate occasions

Lab Study of Effect of Irrigation on 50% Emergence (Males + Females Combined)



- Constant moisture (control) caused earlier emergence 1820 versus 2200 DD(C)
- Irrigation later in post diapause development delayed emergence

Summary

- Field records suggest that winter rainfall can be used in addition to temperature to better predict first emergence of WHF
- Winter chilling influences emergence in the lab, but appears not to in the field
- Thermal accumulation for adult emergence is double in CA compared to OR
- Emergence times with soil moisture reduced by 18%
- Initial lab experiments suggest that both cultivar and irrigation could influence WHF emergence