Invasive Ambrosia Beetle Conference

The Situation in California

August 14, 2012

PUBLIC MEETING

Meeting sponsored by:

The Hofshi Foundation

University of California, Riverside

UC Center for Invasive Pest Research

The Huntington Botanical Gardens

The Los Angeles Arboretum

All participants of the meeting summarized by
Richard Stouthamer
Dept of Entomology
University of California
Riverside

SUMMARY OF SCIENTIFIC MEETING

Program of the meeting

- Systematics
  - Beetle and fungus
- Biology of the beetles
- Biology of the fungal symbiont
- Monitoring and control strategies
- Epidemiology

Systematics

- Identification of ambrosia beetles based on morphology
- Ambrosia beetles have inbreeding reproduction and are thought to diverge genetically rapidly
- We saw an example where a single morphological species has a substantial divergence in mDNA sequence yet morphologically it is thought to be a single species
- Generally single species are assumed to be able to interbreed unfortunately relatively few crossing experiments have been done between the different populations

Our beetle morphologically *Euwallacea fornicatus*

- *E. fornicatus* orginally described from Sri Lanka in 1868: Tea Shot Hole Borer
- Based on DNA sequences the beetle invading California and Israel are:
  - Identical to each other
  - Share the same fungal symbiont
  - Differ from beetles from Sri Lanka, Thailand, Australia, Florida by such an extent that they can be considered different species

Conclusion of beetle systematics

- Need for additional morphological work to see if any characters can be found that distinguish the two species
- If no difference, things become difficult because in the naming conventions for animal species, a morphological feature is required to name it
- We have worked around this by giving the animal a common name that is not bound to these strict naming requirements
- Polyphagous shot hole borer
- Where does it come from?

Solid Wood Packing Material Intercepted Scolytidae (Coleoptera) at U.S. ports of entry: 1985–2000

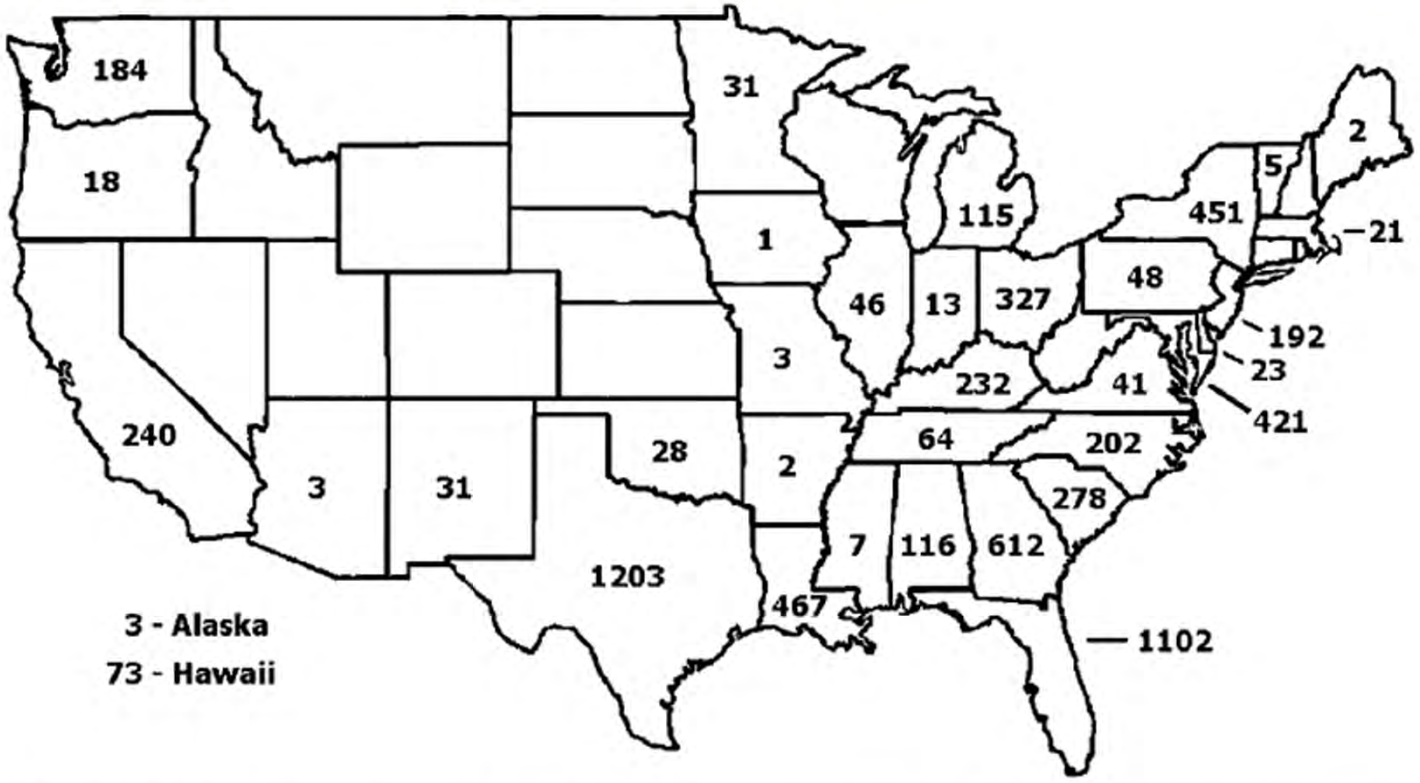
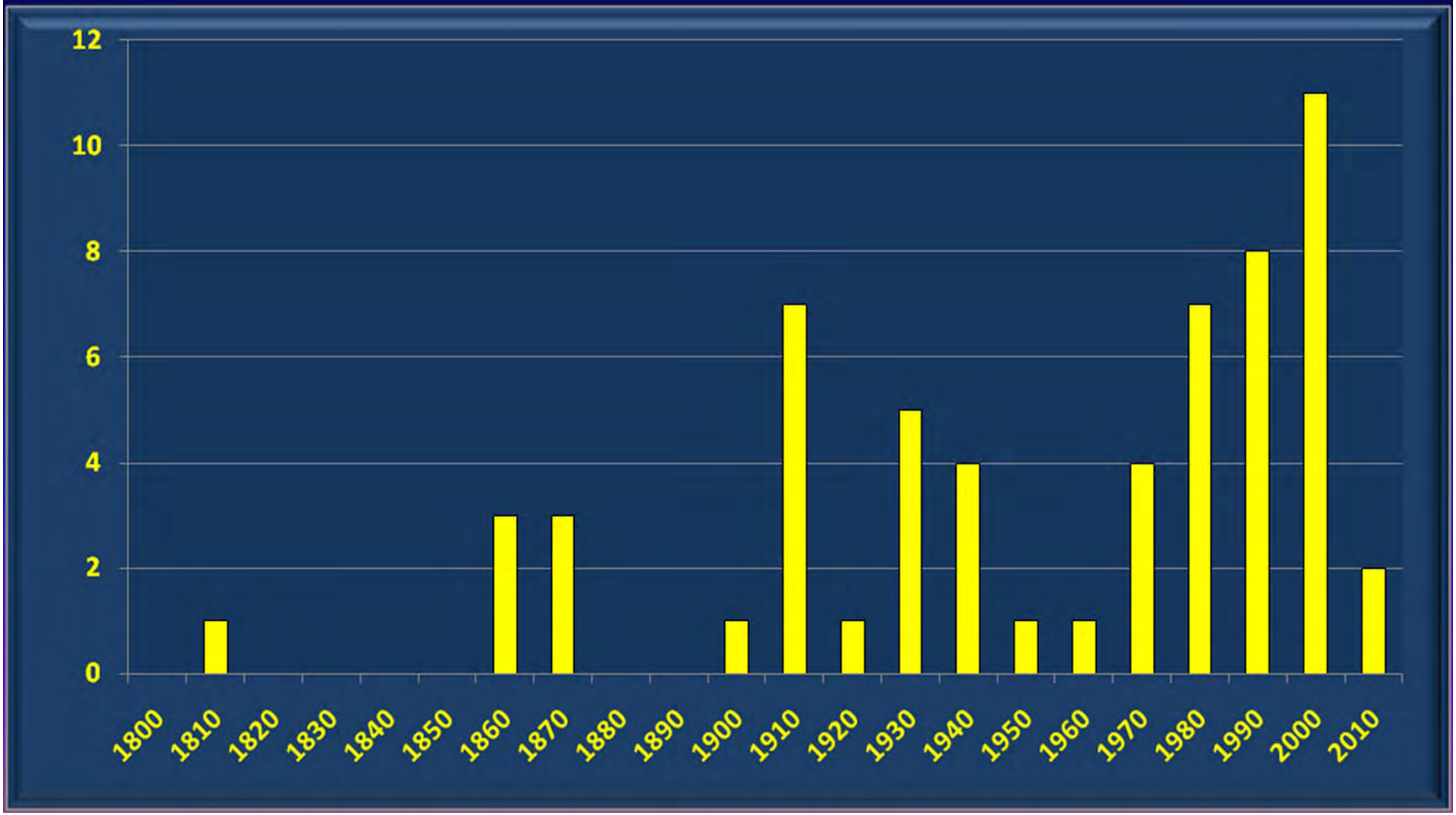


Figure 1. Number of scolytid interceptions made at U.S. ports of entry during 1985–2000 that were entered into the USDA APHIS Port Information Network (PIN) database by state.

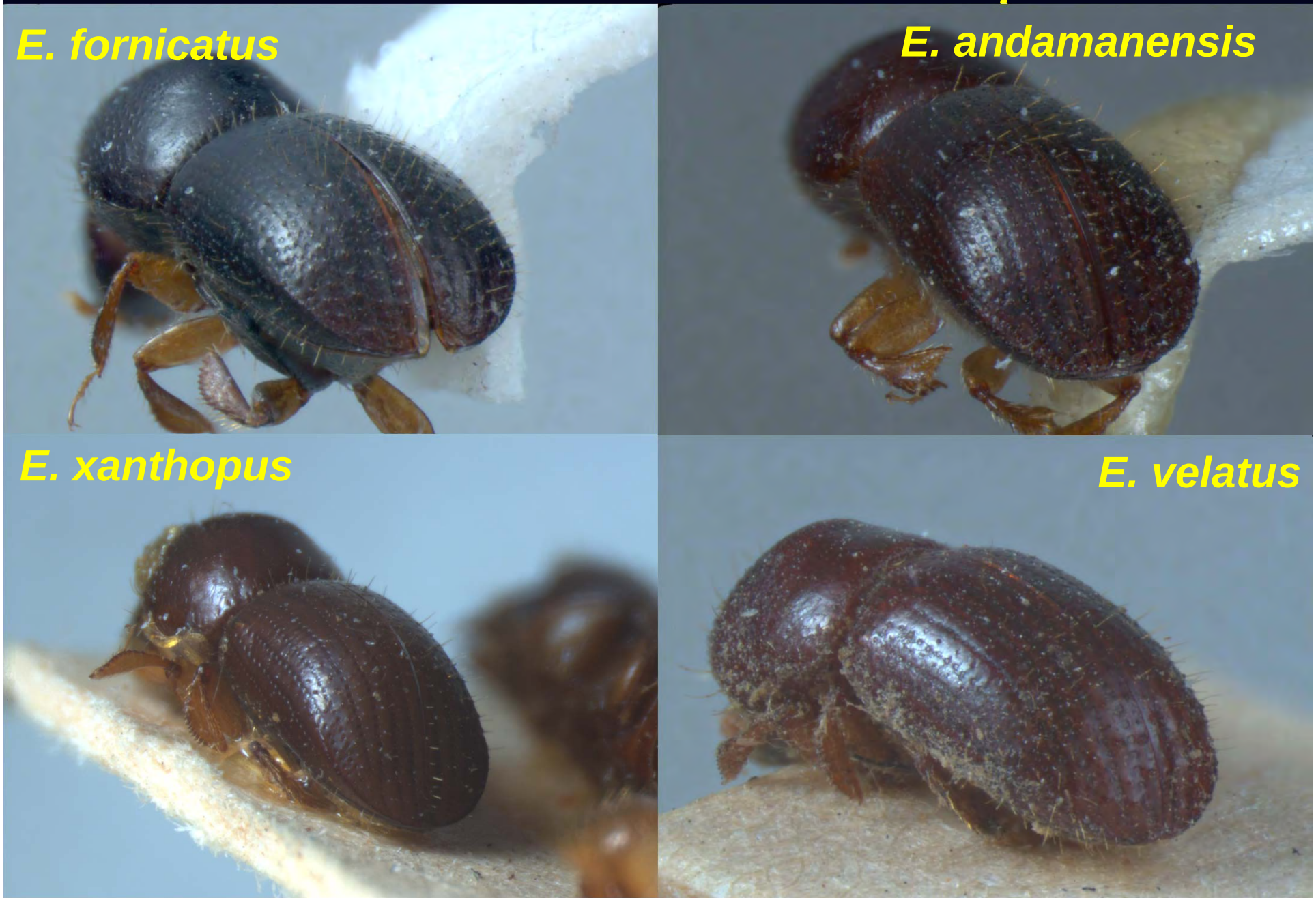
Haack, R. Integrated Pest Management Reviews 6: 253–282, 2001.

Exotic Scolytids Established in US & Canada

Decade of First Report/Detection



Euwallacea fornicatus-like species

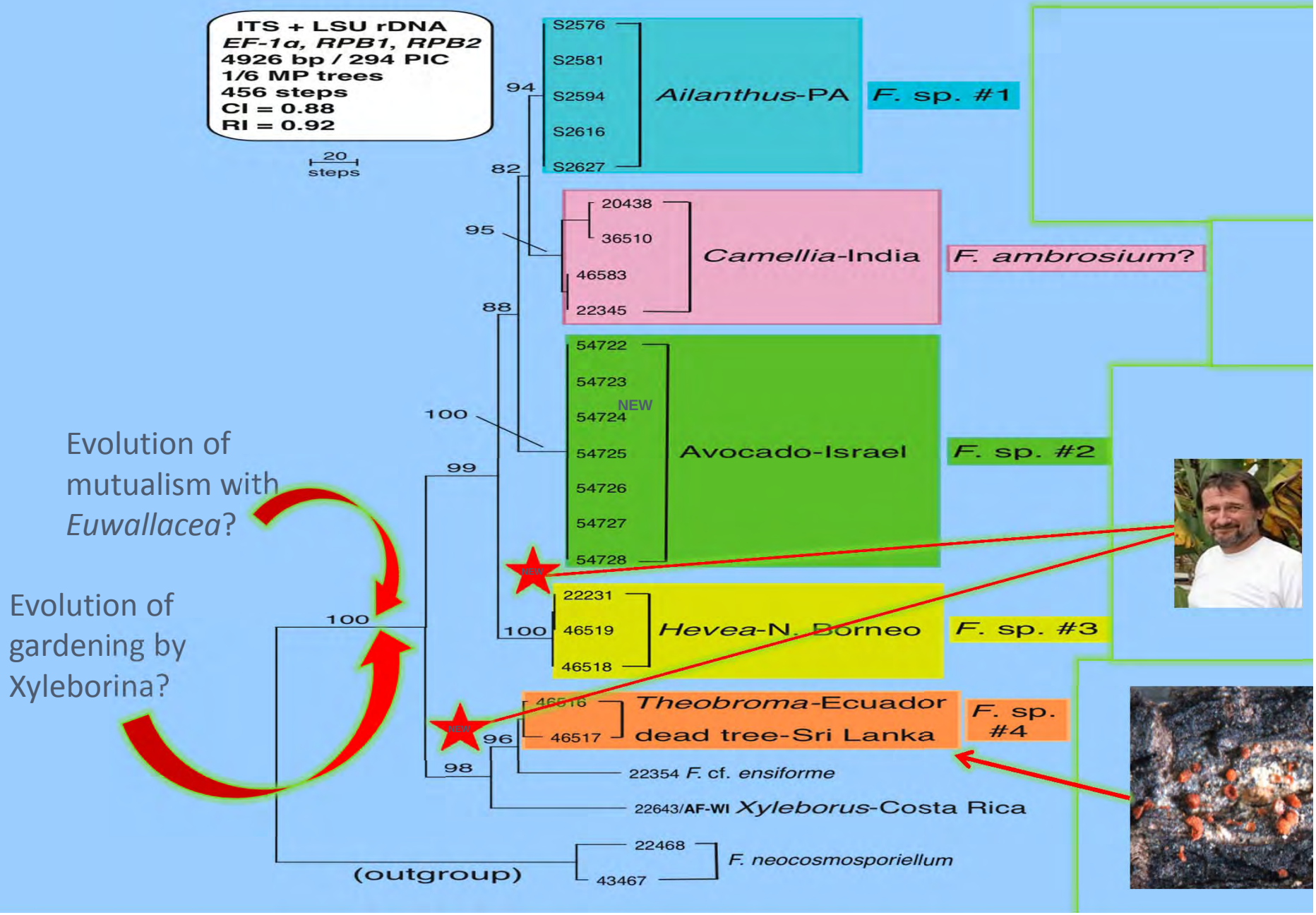


Euwallacea fornicatus Eichhoff, 1868

Fungal systematics

- Beetle and fungus live in close symbiosis
- Fungal symbiont also new to science
- Belongs to Fusarium
  - This group both virulent fungi and ambrosia beetle symbionts
  - Excellent fungal characterization system exists
  - Unusual aspect of this beetle fungus is the what we think is the mild pathogenicity of this fungus to its host plant and the wide host range in which the beetle grows

Putative Clade of Ambrosia Fusaria



Biology of the beetles

- Closely related species : Tea Shot Hole Borer
- This is a pest of tea in southern India and Sri Lanka
- Infest small branches of tea plants
- Management very difficult
- Mainly cultural measures in pruning infested tea plants
- Removal alternative host plants for the TSHB


Sanitation Pruning


Burial of Prunings /
Chipping prunes

Wound Dressing Spraying

Situation in Florida with Red Ambrosia Beetle

- Red Ambrosia Beetle transmits *Raffaelea* fungus that kills Red Bay Laural trees and Avocado
- Large similarity with PSHB
  - Invasive species
  - Ambrosia beetle
  - Spread rapidly
- Difference with PSHB
  - Narrow host range
  - Kills trees rapidly
  - Relatively effective monitoring method

Situation in Florida with Red Ambrosia Beetle

- Control of this beetle appears to be extremely difficult
- No good insecticides available to protect trees
- No biological controls as yet
- Sanitation appears not that successful because fungus is virulent and lethal to trees

- *X. glabratus* low populations or not recovered from most avocados affected by LW.
- 2011 – Large infestation (swampbays) close to avocado commercial areas
- 2012 - 1st Avocado tree diagnosed with LW in a commercial avocado grove

?

PSHB in Israel

- In Israel they have the same beetle fungus combination as we have in California
- They been working on the pest for a longer time; it became a problem there earlier
- As yet no suitable insecticide found that will keep the beetle from infesting avocado trees
- No suitable fungicide found that will kill the fungus in the tree and in that way inhibit the beetle reproduction

Biology of the fungus

- Most ambrosia beetle symbionts are not pathogenic to host, some however do show some pathogenicity (the case we have here) or a lot of pathogenicity (such as the fungus transmitted by the Red Bay Ambrosia beetle)
- What causes these fungi to be pathogenetic?
  - Beetles now infest hosts fungus that they were not associated with previously, in natural hosts not pathogenic, in novel hosts pathogenic
  - Fungus also pathogenic in home range

Situation in California

- Beetle carries same fungus as in Israel
- Different additional *Fusarium* isolates are found
- Not clear if they are also symbionts, may be fungi that are present in the environment not specifically associated with the beetle
- Additional fungus found commonly in the beetles Gnathium- this fungus not found in the Israel population
- Don't know yet what role this fungus plays

Monitoring and Control Strategies

- Beetle occurs in a very heterogenous environment
  - Urban forests
  - Not yet in commercial avocado
  - Not yet in our forests
- This variety of environments in which the beetle is found (will be found) makes controlling the animal difficult even if we had control strategies
- At this point no effective detection methods with the exception of simply looking for the many signs of beetle attack in the urban forest
- At this point no effective control methods known
  - Need further study of insecticides and fungicides
  - Slight possibility of using an insect pathogenic fungus
  - Cultural methods?

- Clearly is a need for trying to limit the spread of the beetle to its natural spread by flight
  - Trying to limit movement of fire wood
  - Methods of safely disposing infected wood
  - Inspection of nurseries so that infested trees are not sold to distant locations where they can form a source of a new infestation

Invasion epidemiology

- How fast do these beetles spread, how big is the impact going to be over time
- At this stage little needed information available and data are required to do the modelling
- Questions required to be answered are:
  - Rate of development of the beetle
  - Presence of host trees on which development can take place
  - How far will this infestation spread

Response of federal and state agencies

- We have been in contact with the various agencies and we are regularly exchanging information and specimens
- Additional action on their part will depend on how devastating the pest ends up being
- Forest service in our area has started to do surveys in the forest close to the areas where we know that the urban area is infested
- No finds as yet

Conclusion

- At this point in time the beetle and its fungus appear to be a substantial threat to the urban forest, avocado industry and natural forests
- Very few tools for the management of these beetles are yet available
- Meeting has led to the prioritizing of research needs
- Many ideas were exchanged and connections between different groups were formed
- We are in the very early stages of studying the PSHB, in Israel work started 2-3 years ago, in California about 5 months ago
- Clearly a lot more research needs to be done, to find a way to limit the damage that this beetle may cause

Aknowledgements

Hofshi foundation for organization of the meeting

All participants for freely sharing their time and knowledge