

Parasitoids of the poorly known Neotropical myrmicine ant *Pheidole susannae*



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Myrmecophiles

- Organisms that live in or near ant nests and establish a range of symbiotic interactions with their hosts for a considerable part of their life cycle
- A few interactions have attracted much attention
- Myrmecophile diversity hypotheses
 - Ant species with exceptionally large mature (populous) colonies support a higher diverse community of myrmecophiles
 - Polygynous ant species (less aggressive) should support more myrmecophile species than monogynous and more aggressive ant species



***Pheidole* spp. (Formicidae: Myrmicinae)**

- *Pheidole* is a dominant, hyperdiverse genus (≈ 1050 species)
- Invasive species (*P. megacephala*)
- *Pheidole* myrmecophiles ?
- New data and associations for *Pheidole susannae*
- Preliminary results of a literature survey



Pheidole bergi



Pheidole pallidula

Pheidole susannae Forel, 1886

- Neotropical ant
- Distribution: southern Mexico – Brazil (Longino 2009)
- Disturbed and pristine forest (5 - 1480 m asl)
- Opportunistic cavity nesting
- Omnivorous, foraging at the soil level and in the canopy



Pheidole susannae Forel, 1886

- Sanitary problem in hospitals in Brazil (Castro et al. 2015)
- Potential pest in urban environments in Colombia (Ulloa et al. 2011)
- Intercepted in commercial shipments at toll in the Netherlands (Boer & Vierbergen 2008)
- Very common ant, poorly studied
- Social structure?
- Colony size?
- Natural enemies?
- Mutualisms?



Material and methods

- Study site: Laguna Guerrero, Quintana Roo, Mexico ($18^{\circ}41'20''\text{N}$, $88^{\circ}15'55''\text{O}$)
- Vegetation: mangrove – secondary forest – coconut and indigenous palm trees



Material and methods

- June 2018- Feb 2019
- Direct searching
 - Under stones
 - In decaying wood
 - In decomposing coconut shells
 - Among roots of ferns and other epiphytes
- Detailed inspection of adults and brood
- DNA barcoding of wasp parasitoids and assistance of specialists



Results

- 6 colonies (or fragments) of *Pheidole susannae*
- Colony relocation frequently observed
- Monogynic colonies
- Mean colony size: 1200 \pm 506 individuals
- 7441 adults and immatures inspected
- Two parasitoids so far encountered
 - Eucharitidae: brood parasitoid
 - Phoridae: worker parasitoid



0.5 mm

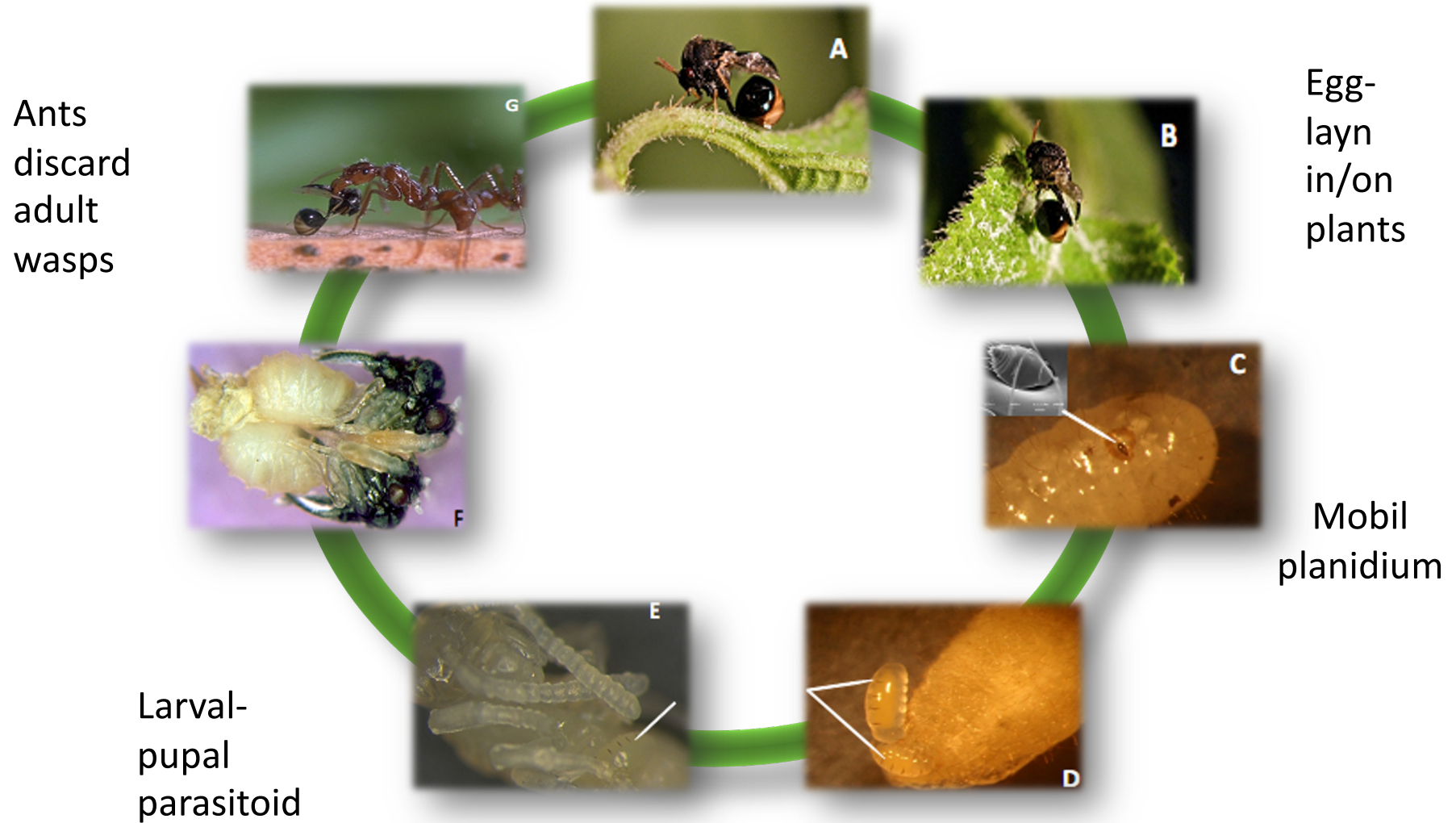


0.5 mm



Results

Eucharitidae: is the only parasitoid family that exclusively parasitize ants, specialized life cycle



Results

- Eucharitid wasp identified through barcoding (J. Heraty)
- Phorid fly identified by B. Brown (species group pending revision)



Hymenoptera,
Eucharitidae

Orasema evansi

brood parasitoid

Diptera, Phoridae

Apocephalus sp.
grandipalpis complex

Parasitoid of workers



0.5 mm



0.5 mm

Results

Orasema evansi

- Solitary parasitoid, larval-pupal
- Chemical mimicry of the host colony odor (Vander Meer et al. 1989)
- Ants tolerate and even care wasps
- Distribution: Texas, Florida (USA), Guatemala, Panama, St Domingue



Burks et al. (2018)

Host ants	Host plant	Site	References
	Banana (Musaceae)	Costa Rica	Kerrich 1963
<i>Pheidole dentata</i>	<i>Quercus nigra</i> (Fagaceae)	Texas, Florida, USA	Vanpelt 1950; Heraty 1994b
	<i>Alchornea costaricensis</i> (Euphorbiaceae)	Costa Rica	



Orasema evansi n=666



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<i>Pheidole susannae</i>	?	Mexico	This study

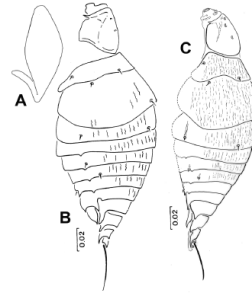


Orasema evansi n=666

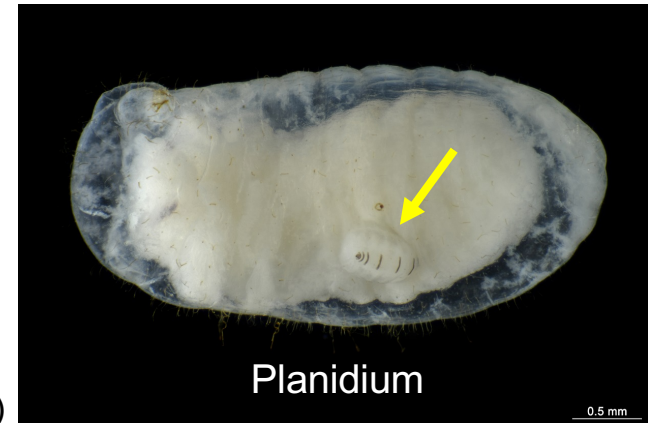
Results

Orasema evansi

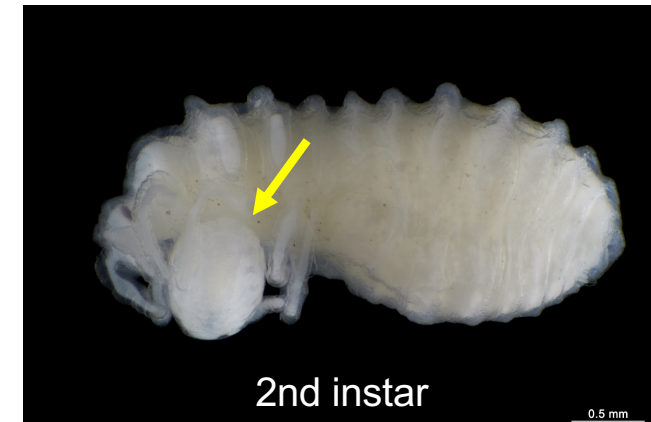
- All the developmental stages were observed
- All *P. susannae* castes are potential hosts
- parasitism rate: up to 12% of the brood during the rainy season (0-2% dry season)
- Parasitism: localized in time and space



Burks et al. (2018)



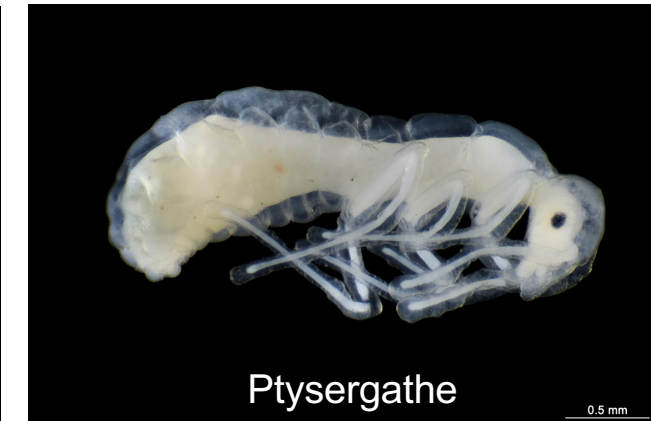
Planidium



2nd instar



pupa ♀



Ptysergathe

Results

Apocephalus sp. *grandipalpis* complex

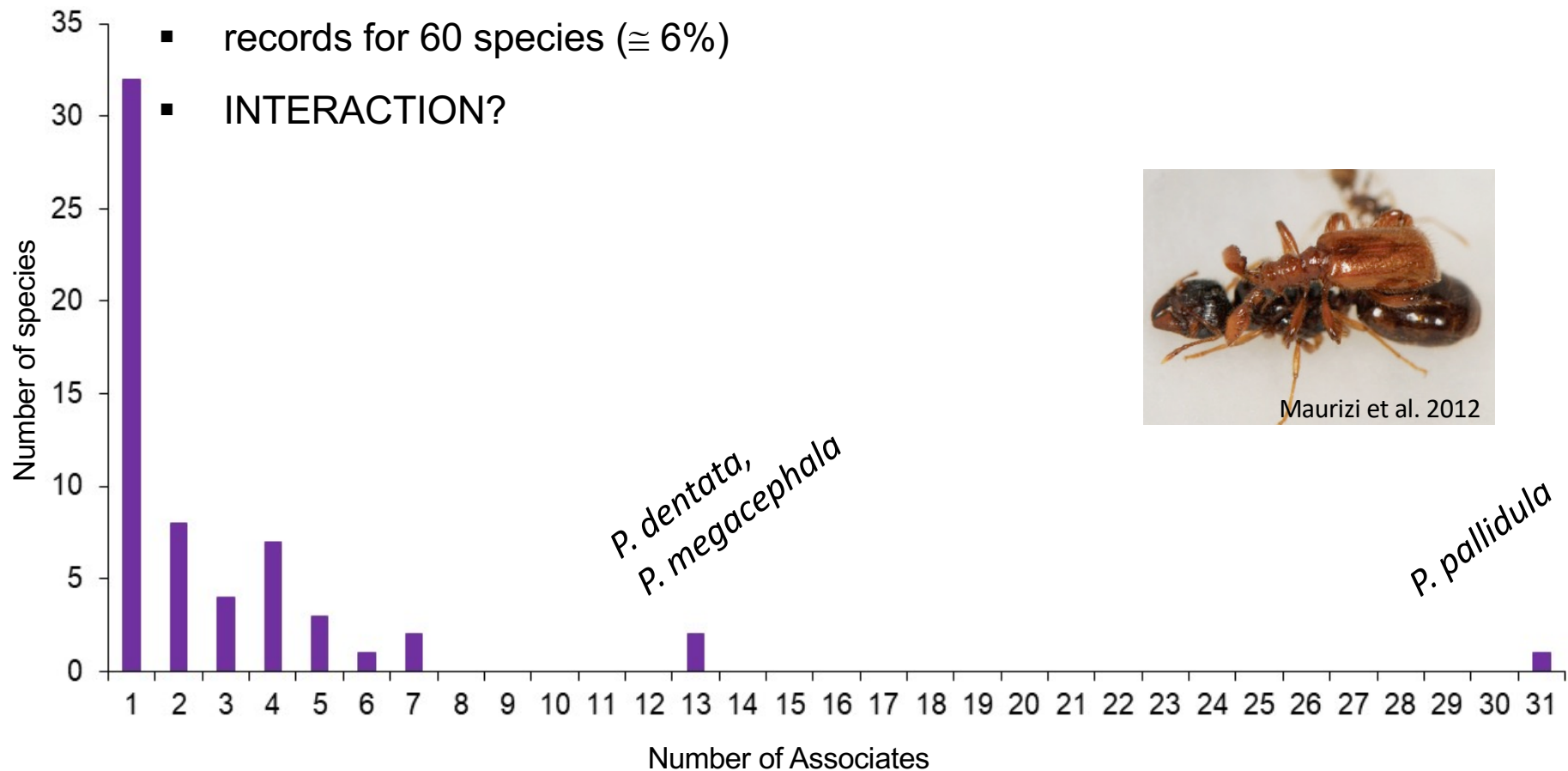
- "Ant-decapitating flies"
- Endoparasitoids of workers
- High specificity (species and caste attacked)
- A single attack observed during colony relocation (rainy season)
- Ants transport *Orasema*
- 11 females secured



Results

Literature survey – *Pheidole* associates (preliminary results)

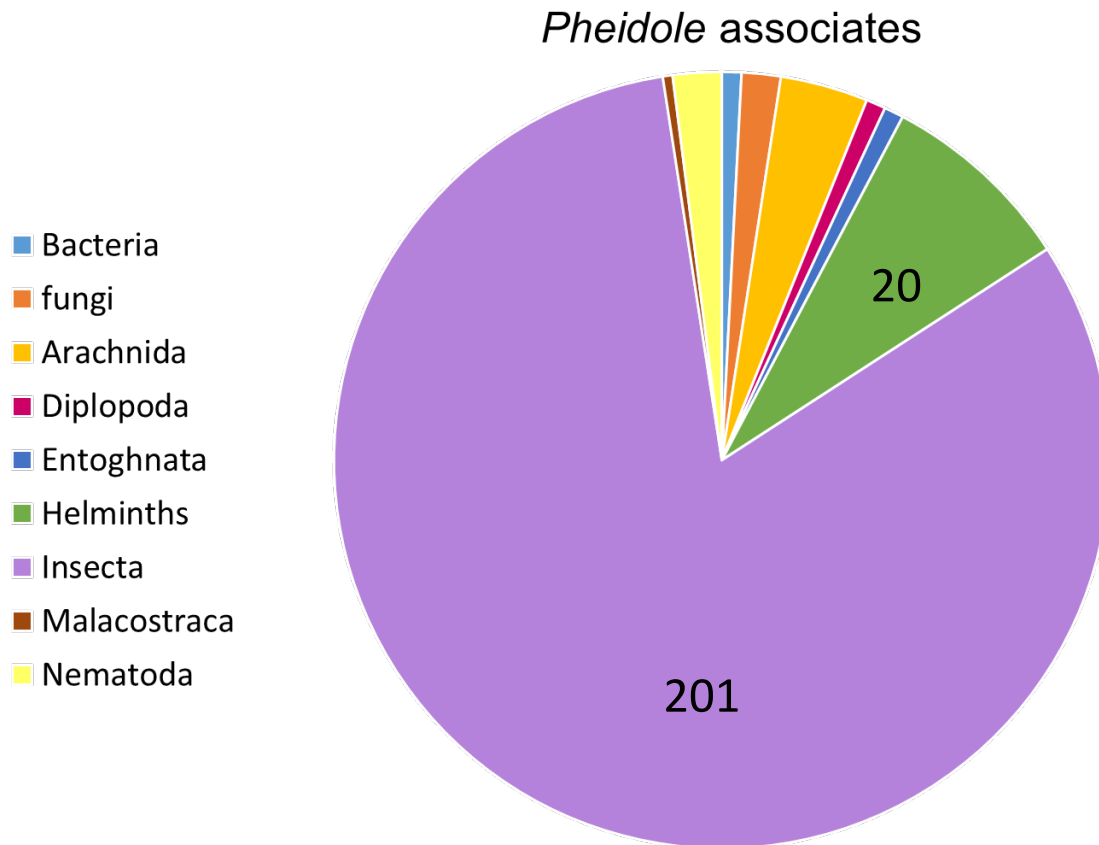
- 246 records (Arachnida, Cestoda, Insecta, Helminths, Nematoda)
- Studies are scattered in the literature (more than 75 references)
- 28% records are only at the genus level (n = 68)
- records for 60 species ($\cong 6\%$)
- INTERACTION?



Results

Literature survey – *Pheidole* associates (preliminary results)

- Insects: 81.7% of all records
 - Coleoptera: 51.2% (Carabidae, Histeridae, Tenebrionidae)
 - Hymenoptera: 29.3% (Eucharitidae, Formicidae)



Conclusions

- Two new associations for the genus *Pheidole*
- New biological data on *Pheidole susanae*
- Though *Pheidole* is a hyperdiverse genus, only 6 % of the species have been studied for myrmecophiles
- *Pheidole* associates are also a very diverse group
- The nature of the relationship with ants is known for only a few associates
- Some groups have not been investigated (viruses, bacteria, fungi)
- The microbiome and invertebrate associates of only a few selected *Pheidole* species are known or are under investigation



“The number and diversity of myrmecophilous arthropods are almost incredible. In 1894 Wasmann enumerated 1,246 species... Wasmann's and Escherich's estimate of 3,000 species is probably below rather than above the total number that will be recorded when the ant-nests of the tropics and many other regions have been as carefully searched for these insects as those of Europe”

W.M. Wheeler (1910)



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