
Ampulex compressa



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Graduate
Presentation



'Jewel Wasp'

Ampulex compressa is an endoparasitoid entomophagous of the American cockroach *Periplaneta americana*



Jewel Wasp

Class: Insecta

Order: Hymenoptera

Family: Ampulicidae

Genus: *Ampulex*

Species: *compressa*



A. compressa



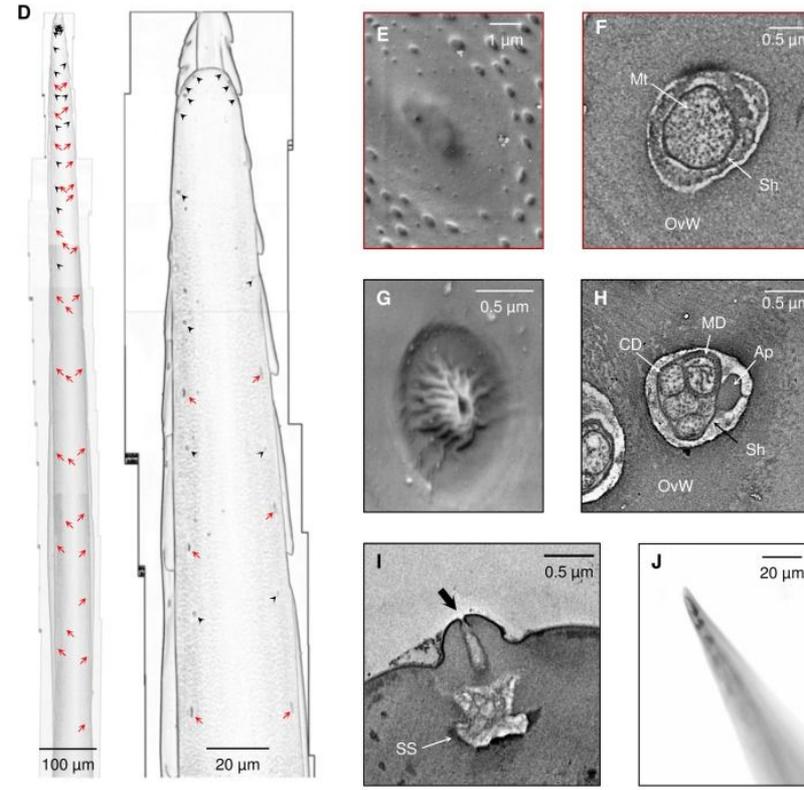
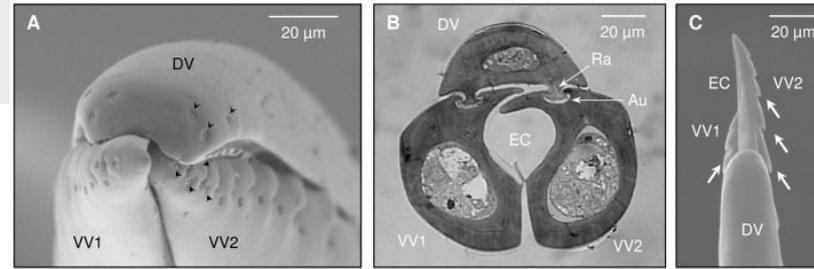
Geographic Distribution

- *A. compressa* is native to warm climates such as East Africa, South Asia, Northern South America, Central America, Hawaii, and Australia
- It has been introduced to the many locations in hopes that it would help manage the cockroach population
 - Philippines
 - Hawaii
 - Guam
 - Cook Islands



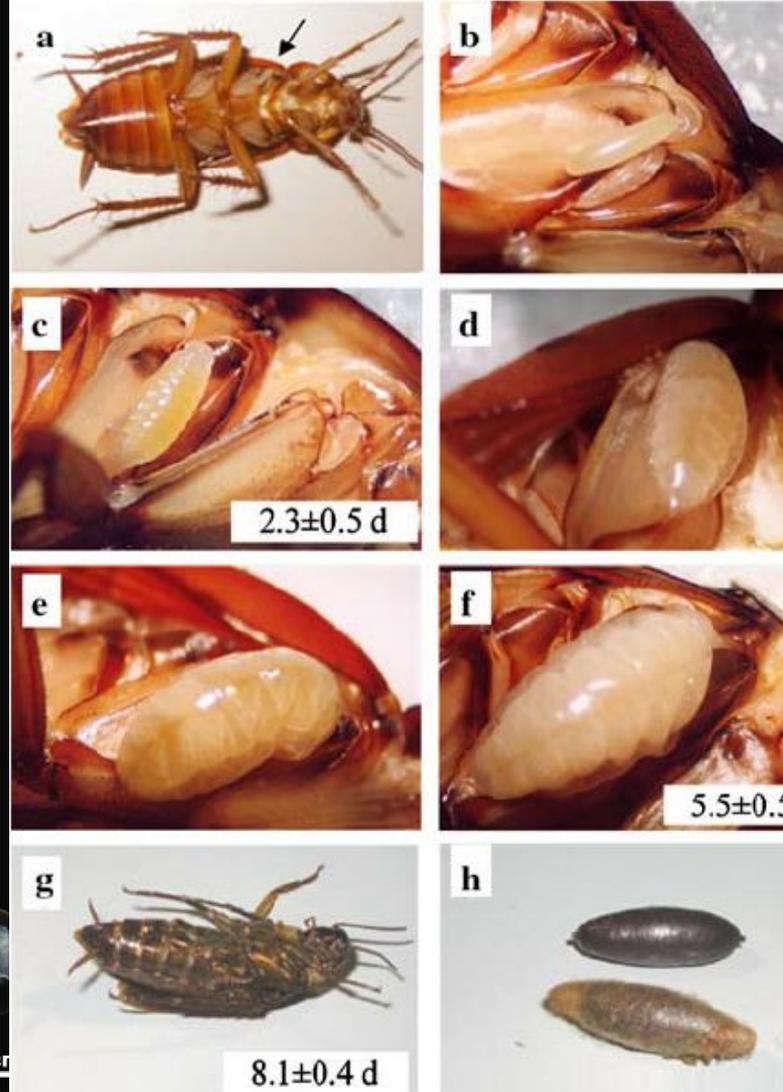
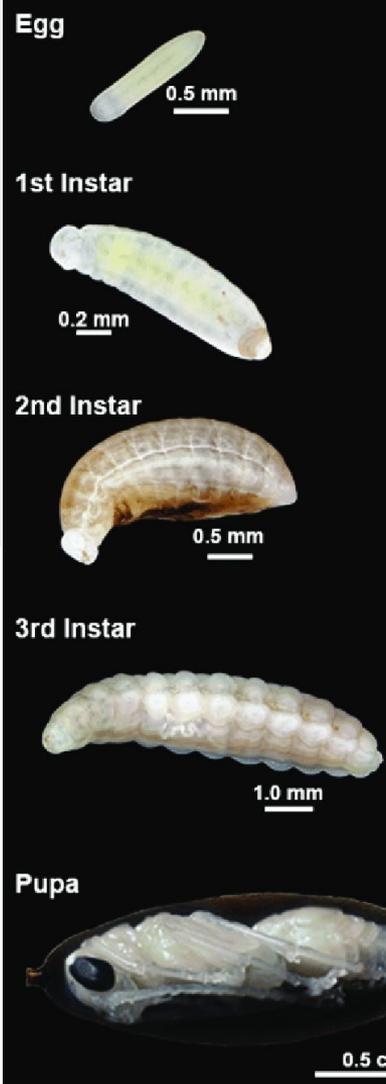
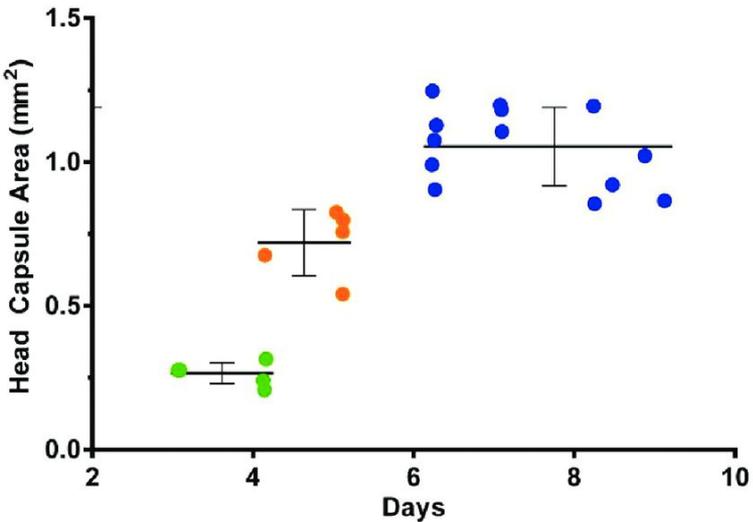
Anatomy

- Metallic blue/green body
 - upper portion of the second and third pair of legs are red
- Approximately 22 mm long
- Dioecious
 - Males are smaller
 - Only females have a stinger and produce venom
- Females lays one egg per cockroach
- Females can lay dozen of eggs during their lifetime



Instars

- *A. compressa* has a 3 instar lifecycle
 - 1st instar = ectoparasitoid
 - 2nd instar = ectoparasitoid
 - 3rd instar = endoparasitoid



Lifecycle

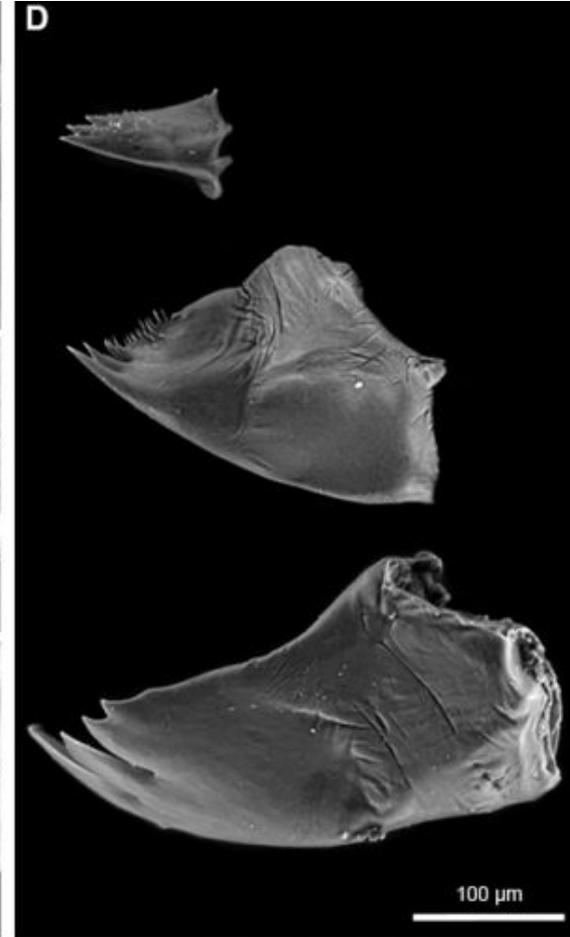
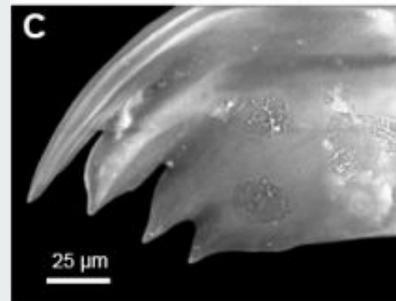
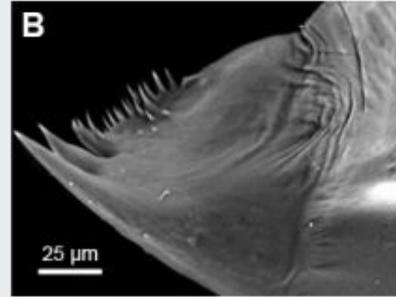
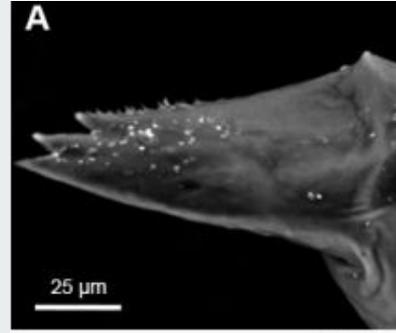
1. *A. compressa* lays a single egg on the mesothoracic leg of the host
2. Adult seals the burrow entrance with debris
3. Larvae hatch approximately three days after oviposition
4. First instar larva pierces the soft cockroach cuticle near the base of the leg to feed on hemolymph
5. Continues through the second instar, still obtaining nourishment from host hemolymph
6. At the end of the second instar, the larva enters the body cavity of the still-living cockroach and begins to consume internal organs in preparation for pupation
7. Once ready to pupate, the larva spins a cocoon with silk that forms two layers: a hard shell that encases the pupa and a thick, woven silk outer covering that surrounds the shell
8. Pupal development time lasts several weeks, after which the adult emerges from the desiccated husk of the cockroach to complete the life cycle



Mandible Morphology

Mandible morphology is unique to each instar and appears to suit the needs of each stage

1. First instar mandibles are suitable for piercing the cockroach cuticle and facilitating a steady flow of hemolymph without serious injury to the cockroach
2. The second instar mandible is larger and contains a serrated edge for cutting into the cockroach to help enter the host
3. Third instar mandibles appear after the larva enters the body cavity of the cockroach to consume fat body and muscle, these mandibles appear to be suited for crushing and macerating the internal tissues



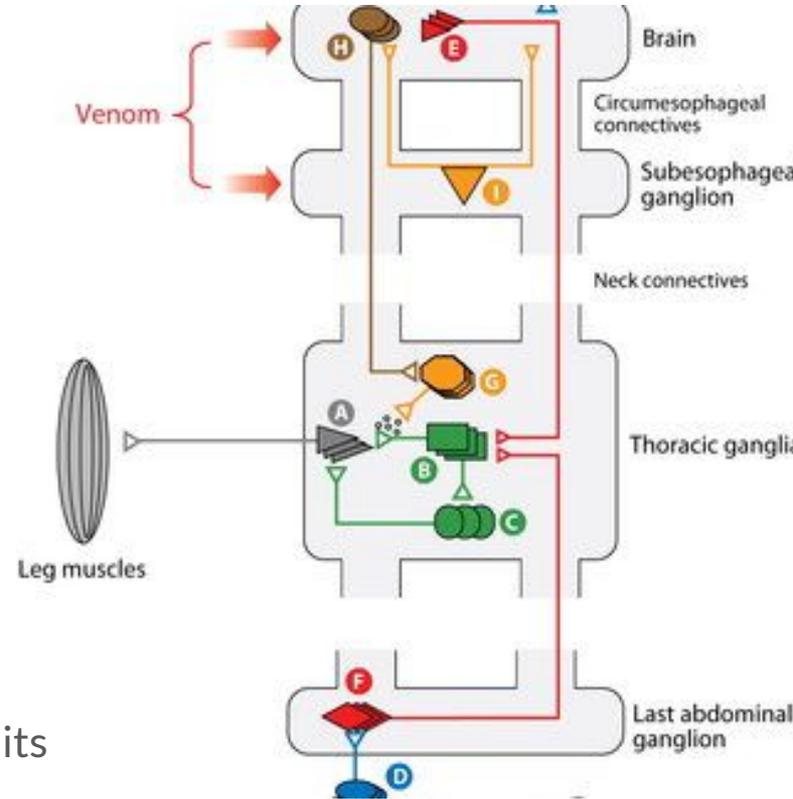
Stings

- *A. compressa* has two main types of stings:
 - 1st sting into the first thoracic segment of cockroach
 - 2-3 minutes of paralysis of front legs to prevent escape
 - 2nd sting into the first thoracic ganglion of cockroach's brain
 - 30 min of excessive grooming followed by a 2 to 5 week long lethargic state



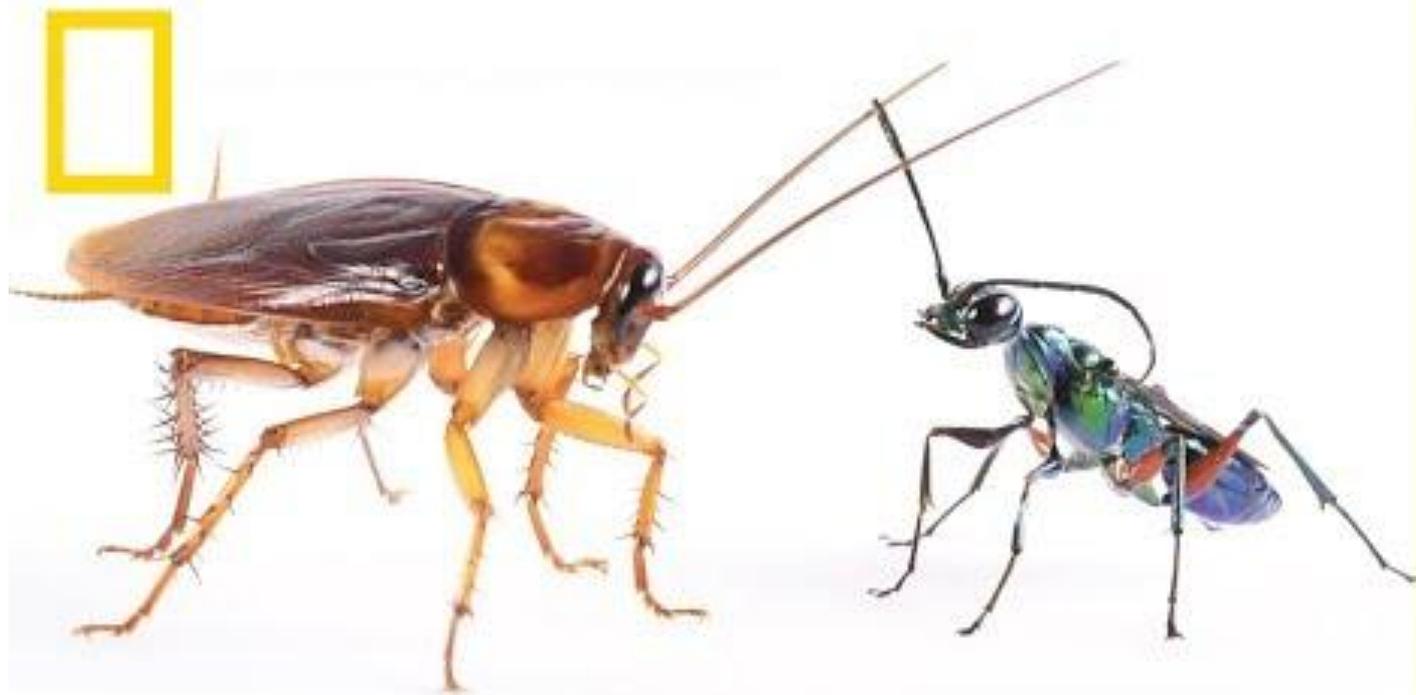
Venom

- “Milked venom”
 - venom contains monoamines, amino acids, peptides, and proteins
 - targets neuromodulatory systems, such as the octopaminergic and enkephalinergic
 - hijacks control of the host brain by introducing a “storm” of its own neurochemicals
 - when the venom takes effect, the cockroach becomes passive, or a “zombie”
- After the cockroach is subdued, the wasp clips the antennae at precise locations with buzzsaw actions of its mandibles, then drinks the hemolymph, using the antennal stumps as straws



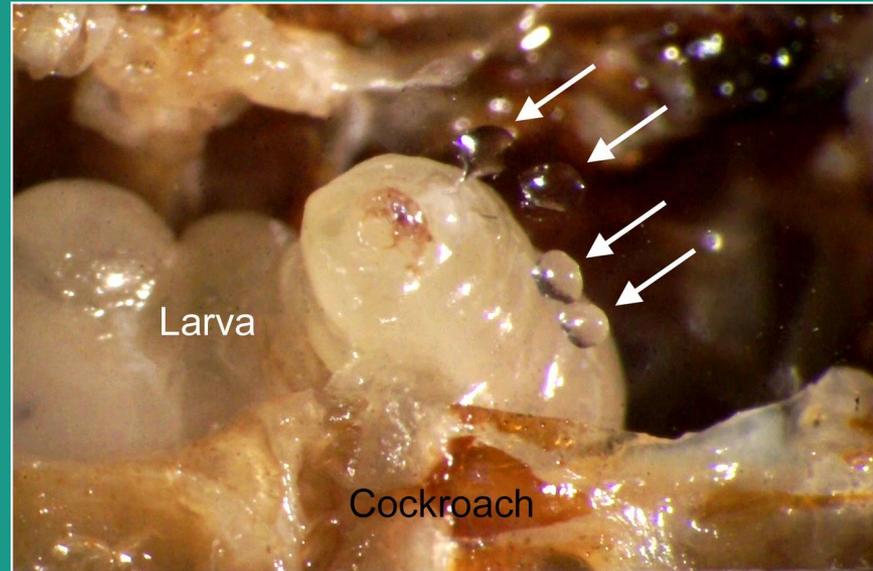
Treatment?

- No treatment
- BUT... cockroaches can defend themselves from an attack
- The cockroaches raise their bodies, bringing their neck out of reach, and kicked at the wasp with their spiny hind legs, attempting to strike the wasp's head multiple times
- The raised position allows the cockroach to detect and evade the wasp's lunging attack
- If grasped, the cockroaches parried the stinger with their legs, used a "stiff-arm" defense to hold back the stinger, and could stab at, and dislodge, the wasp with tibial spines
- Lastly, cockroaches bite at the abdomen of wasps delivering the brain sting
- Their best strategy is to be vigilant, protect their throat, and strike repeatedly at the head of the wasp



Relevance to humans?

- Larvae produce antimicrobials
 - Could be superior antimicrobial than the ones produced in plants and fungi
- Venom is also being looked into for treating Parkinson's Disease
- Jewel wasps have been used to control the *Periplaneta americana* cockroach population
 - introduced to Philippines (1917), Hawaii (1940), Guam (1954), and the Cook Islands (1955)
 - Believed to be a good control of cockroaches reduce populations



References



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Ampulex compressa is a beautiful wasp, known as "jewel" or "emerald" wasp in her common names. But behind her beauty is a dark secret.

Don't hate me because I'm beautiful...



When it is time for her to lay an egg she seeks out a cockroach, usually much larger than herself. She has special plans for it.

Wanna feed my babies?

Yeah, fat chance, lady.



She quickly stings the cockroach in its prothoracic ganglion, temporarily immobilizing its front legs.

Ow! What are you doing?!

Oh, don't you worry one bit!



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This allows her to deliver another sting, directly into the area of the brain that controls the escape reflex.

Hey, now wha-blargh...



The wasp then chews off half the antennae of the cockroach, and uses them like a "leash" to direct the cockroach back to her burrow.

Come here boy! Come on!

I...uh...can't seem to resist...



The wasp's single larva will consume the still-living cockroach from the inside. Being sure to eat the organs in an order that keeps the roach alive as long as possible.

Sigh... no TV.

