ARCHBOLD
BIOLOGICAL STATION

Phone 863.465.2571
123 MAIN DRIVE ★ VENUS, FLORIDA 33960

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Archbold's Diet Detectives: The Case of the Bronze Blister Beetle

Scientists working at Archbold Biological Station are interested in many facets of natural history, meaning the entire lifestyle of animals and plants living on the Lake Wales Ridge. This typically is a long, involved process involving a host of people with different areas of expertise. Dr. Jim Carrel, Research Associate at Archbold and former professor at the University of Missouri explains, "The process begins with the 'discovery phase' in which an organism is observed in the wild for the first time and notes on where and when it was found are recorded."

Dr. Carrel states, "Next is the 'identification phase', the process of giving the organism both a scientific and a common name." This involves an expert botanist or zoologist who has training in the internationally recognized rules for scientific naming for any creature on Earth, a discipline called nomenclature. Dr. Carrel adds, "Subsequently, during the 'inventory phase' the new organism is added to Archbold's immense list of organisms and preserved specimens are placed in the natural history (museum-type) collections for reference purposes." Depending on the organism's lifestyle, it can be challenging to go beyond the inventory phase. This article is a case study in solving what on the surface seemed a simple, straightforward question. Here's how it unfolded.

Dr. Jim Carrel states, "Back in 1983 I had a federal research grant to study how blister beetles make the distasteful toxin they carry in their blood and other tissues that, upon contact, causes blistering of human skin. This study included the Bronze Blister Beetle (*Lytta polita*) at Archbold."

Dr. Carrel continues, " I knew the Bronze Blister Beetle flew at night to lighted buildings at Archbold in the winter from the pioneering work of an entomologist named Professor Stuart Frost." In 1957, upon his retirement, Frost came down to Archbold from Penn State University and operated light traps nightly for 14 winters. In all, he collected and processed an astounding 400,000 specimens. He deposited some at Archbold, but the vast majority he shipped back to his beloved university. Furthermore, he was so taken by the beauty of the Bronze Blister Beetle that he published a scientific paper documenting the number of beetles he trapped each week. Dr. Carrel used Frost's paper to time his visits to Archbold so that they coincided with the peak activity of Bronze Blister Beetles.

This strategy worked well. Dr. Carrel notes, "In February I collected Bronze Blister Beetles at almost any kind of light. They'd fly in and land on the sides of illuminated windows, walls, and walkways after dark, even on evenings when it was near freezing outside. I just had to carefully pick up the immobile beetles."

Dr. Carrel had a major problem: he needed to figure out what to feed the adult insects in order to keep them alive in his lab. He had read reports that they occasionally ate flowers of pear and apple trees in springtime in Georgia and the Carolinas. Clearly the beetles did not feed on commercial fruit trees in winter at Archbold; there were none growing nearby. When offered fresh bouquets cut from local flowers, the caged beetles at best nibbled on them. Nothing seemed to whet their appetites.

Dr. Carrel explains, "I placed an urgent call to a close colleague back at Missouri, Professor Joseph Wood, an expert at identifying microscopic pollen grains, and asked for his professional advice. I proposed the notion that contents of guts dissected from newly captured Bronze Blister Beetles, viewed through a powerful microscope, would contain pollen from flowers they'd recently eaten. If this worked, perhaps I could use the pollen to track down the flower species." Dr. Wood agreed, informing Dr. Carrel that pollen grains typically are at least somewhat resistant to digestion and their shapes and sizes vary in such a way that they can serve as 'fingerprints' for identifying flowering plants. Hence, Dr. Carrel and Dr. Wood agreed to partner as Diet Detectives to identify the diet of the Bronze Blister Beetle.

After several days of investigation, Dr. Wood called to say that the beetle's guts were virtually devoid of flower pollen. Dr. Carrel was dismayed, but he persevered in the conversation. Dr. Carrel states, "I asked Dr. Wood if not pollen, then what was all the other stuff that filled beetle guts to bursting? Dr. Wood responded that he thought it was of no consequence. He related the vast bulk of material was chewed up male pine cones interlaced with pine pollen, but dismissed it as food because all of the scientific literature claimed that no animal on Earth was known to partake of pine pollen."

Dr. Carrel was excited. He thought he might have actually solved the dietary mystery. Pine trees were in full bloom at Archbold, sending out clouds of yellow pollen from clusters of spindle-shaped, inch and a half long male cones located at tips of the tree's branches whenever the wind gusted. Hurriedly he picked a handful of cones and tossed them in with the insects. Instantly a feeding frenzy erupted. Dr. Carrel commented,

“Beetles rushed over, mounted cones with all six legs, and started to chew. They formed a scrum roiling in the screened cages. In an hour they’d gnawed the cones to bits. The commotion was so noisy that it attracted the attention of other scientists in the lab.”

A few years later Dr. Carrel got confirmation that Bronze Blister Beetles feed on male pollen cones in the field. A forester in North Florida reported finding the insects high in commercial pines destined for breeding programs. Dr. Carrel of Archbold and Dr. Wood discovered the first insect to feed on protein-rich pine pollen.

Photo 1. Bronze Blister Beetle sitting on illuminated board at night. Photo by Jim Carrel.

Photo 2. Bronze Blister Beetle using its strong jaws to eat male pine cone. Yellow pollen grains dust the beetle's body. Photo by Jim Carrel.

Photo 3. Intact male pine cones before and after Bronze Blister Beetles have dined on them. Photo by Jim Carrel.