

YELLOW HEAD DISEASE (YHD) CAUSED BY A NEWLY DISCOVERED MATTESIA SP. IN POPULATIONS OF THE RED IMPORTED FIRE ANT, SOLENOPSIS INVICTA

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Surveys of fire ant pathogens conducted both in the imported fire ant homeland in South America (Jouvenaz et al. 1980) and in the United States (Jouvenaz et al. 1977, Beckham et al. 1982) have revealed few pathogens that can be used in biological control programs. Most of these pathogens including some Neogregarines. The Neogregarine *Mattesia geminata* infects larvae of *Solenopsis geminata* and causes mortality during the pupal stage (Jouvenaz & Anthony 1979). Infected *S. geminata* pupae turn black before dying, and infection does not occur in the adult ant. *Mattesia geminata* also infects several other Myrmicinae ants, and dying adult insects have been observed to harbor oocysts of the pathogen (Buschinger & Kleespies 1999).

Recent surveys undertaken in Florida revealed a new protozoan in *S. invicta* populations, occurring in workers and female reproductives. The disease has not been observed in immature *S. invicta*. Heads, and sometimes thoraxes, of infected workers and female reproductives show an atypical yellow-orange color. We have designated this disease as Yellow Head Disease (YHD) due to this distinctive characteristic. Many spindle-shaped oocysts can be observed inside the body of infected ants. Oocysts can be seen through the cuticle in all body regions but are easily recognized in the head and the appendages. Oocysts occur in pairs typical of *Mattesia* species (Weiser 1955). Ants with the typical yellow-head coloration may contain no oocysts but only bilobed structures similar to developing gametocysts with prespore stages of *M. geminata* described by Kleespies et al. (1997). These structures have led to the tentative classification of this pathogen in the genus *Mattesia*.

Oocysts are $18.7 \pm 0.80 \mu\text{m}$ (mean \pm sem; $n=50$) long and $10.3 \pm 0.80 \mu\text{m}$ wide, therefore larger than oocysts of *M. geminata* (13-14 x 8-9 μm ; Buschinger et al. 1995, Kleespies et al. 1997), *M. trogodermiae* (11-13 μm ; Hall et al. 1971), *M. dispersa* (15.4 μm ; Zizka 1978), *M. povdnyi* (11 μm ; Weiser 1952), *M. grandis* (11.8 μm ; McLaughlin 1965) and *Mattesia* sp. (11.2 μm ; Wright 1993). Oocysts were shorter and wider than those of *M. bombi* (21.6-27 μm by 5.4 μm ; Liu et al. 1974). The oocysts of the YHD-causing agent have the length-to-width ratio at 1.83 ± 0.155 ($n=50$) compared to ~ 1.44 -1.48 for *M. geminata* (Buschinger et al. 1995, Kleespies et al. 1997). Distinct characteristics of oocysts, presence of oocysts in adult ants, and the yellow-head sign are evidence that YHD and its causative agent are new discoveries without established taxonomic identification.

Sixty-four central and northern Florida sites and 1017 fire ant nests were examined for the presence of the *Mattesia*-like oocysts or the presence of "yellow-heads". At each site, we sampled ants from 1-81 mounds using a 7-ml plastic vial coated internally with Fluon®. Occasionally, whole colonies were collected in 20-liter buckets. In the laboratory, we examined whole ants or ant macerates under a phase-contrast microscopy (200-630X) for the mature oocysts or bilobed prespore form.

The YHD is widely distributed in Florida, affecting both polygyne and monogyne *S. invicta* colonies. The disease was present in 34% of the sites and in 8% of nests sampled. In infected sites, the pathogen was observed in 19% of the nests. Dual infection with YHD and *T. solenopsae* occurred in at least one colony and in individual ants in this colony. Field colonies

brought into the laboratory had large mortality of YHD-infected ants within days after arrival. For instance, a 250-mg live ant sample from a field-collected colony had only 3.6% infected ants whereas accumulated cadavers collected a week later from the same colony had 49% of individuals with oocysts or bilobed gametocysts. This rapid mortality of infected ants potentially indicates that this disease may have significant impact on fire ant populations.

The observed wide distribution of the previously undetected YHD is an indication that the causative agent may have dispersed through the fire ant population very rapidly. High dispersal potential is a desirable characteristic for biological control agent. This new microbial pathogen from *S. invicta* colonies is distinct from any described disease, and may have significant impact on fire ant populations.

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