Emerald Ash Borer Flight Potential

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ABSTRACT

The emerald ash borer (EAB), *Agrilus planipennis* Fairmaire (Coleoptera: Buprestidae), is an invasive pest of ash trees (*Fraxinus spp*.) that is rapidly spreading from the probable introduction site in Detroit, Michigan. The rapid spread to areas outside Michigan is undoubtedly due to phoretic transport on nursery stock, logs, and firewood. However, not all the range expansion can be attributed to human agency. Despite attempts to contain the core infestation to the counties surrounding Detroit and Essex County, Ontario, EAB range has continued to expand. This is due in part to the natural dispersal of EAB. Failure to understand the natural dispersal will impede attempts contain and control EAB; knowledge of flight behavior and physiology is needed to estimate dispersal capabilities in order to develop effective containment strategies.

A cooperative research venture between The Ohio State University and USDA-Forest Service is using computer-monitored flight mills with tethered EAB adults to measure flight speed, duration, and periodicity. Preliminary results from 28 adults, flying without rest, food, or water, showed that about half of the tethered beetles flew >50 m, while one 3-day old male flew a total of 5.2 km in 40 hrs. Subsequent data have confirmed the maximum flight speed as 1.5 m/sec (3.5 mph) which occurs in bouts of about 1 min each. The individual that flew the furthest in 24 hrs started with 70 sec flight bouts followed by an idle periods of about 130 sec. After about 2 hr, the idle time increased, rising to about 20 min at 24 hr. Although the detailed bout patterns differ between individuals, this overall pattern appears to be the norm. Bigger differences are observed in the length of time spent flying. In particular, females flew twice as far as males in 24 hr ($P < 0.002$) and mated females flew twice as far as unmated females ($P < 0.0001$). The average distance flown in 24 hrs by mated females was 1.7 km. The frequency

distribution of distance flown by all females in 24 hrs is skewed to the right (mode = 800 m, median = 1 km, mean = 1.7 km, 20 percent flew >2km, 1 percent flew > 4km).

The discovery that mated females fly longer, farther, and faster than either males or unmated females is rather alarming as it suggests females are programmed to make a dispersal flight. The absence of a correlation ($R^2 = 0.007$) between distance flown and size (mg) of mated females suggests there are no other distinct classes of migrants.

A simple random walk model suggests that ~20 percent of mated females are displaced >250 m while flying 2 km; ~1 percent are displaced ~500m while flying 4 km. The random walk assumption is probably optimistic; the flight is probably less random, which means that these are underestimates of the actual displacement of gravid females in their dispersal flight. In order to determine how significant this is for control and containment efforts, we need to know how directional the flights actually are and how receptive gravid females are to cues from ash trees for stopping their dispersal flight to settle.