EMBLEMASOMA ALBICOMA REINHARD (DIPTERA: SARCOPHAGIDAE), A PARASITOID OF NEOTIBICEN CANICULARIS (HARRIS) (HEMIPTERA: CICADIDAE) IN ONTARIO, CANADA

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The New World genus Emblemema Aldrich (Diptera: Sarcophagidae) is an acoustic parasitoid of cicadas (Hemiptera: Cicadidae) and includes 16 species (Pape 1996). These flies locate their adult cicada hosts by homing in on the mating call, attacking both stationary and flying cicadas (Soper et al. 1976; Stucky 2015). They have also been reported as showing an attraction to the recorded calling songs of cicadas (Soper et al. 1976; Lakes-Harlan 2009). Emblemema find their hosts with insect “ears” (present in both sexes), which are sound-sensitive enlarged tympanal membranes near the prosternum and connected to the anterior spiracles (Tron et al. 2016).

Prior to this study, host associations were known only for two species of Emblemema: E. erro Aldrich with hosts Quesada gigas (Olivier) (Lopes 1971), Ameritibicen dorsatus (Say) (Stucky 2015) and Neotibicen linnei (Smith and Grossbeck) (Young 2020); and E. auditrix (Shewell) with host Okanagana rimsa (Say) (Soper et al. 1976). Parasitized cicadas are primarily calling males and only occasionally are females parasitized, likely due to their close proximity to a calling male (Stucky 2015; Young 2020). Males of E. erro are also attracted to calling male cicadas, around which they then engage in mate-finding behaviour (Stucky 2016). In addition, males of Emblemema are known to concentrate at hilltops, presumably for mating purposes, as evidenced from specimens of E. erro in the Canadian National Collection of Insects, Arachnids and Nematodes (CNC, Ottawa) collected at hilltops.

This study began with the opportunistic collection of a barely-alive male cicada of the species Neotibicen canicularis (Harris) in a park in Ottawa, Ontario on 12 August 2013. The specimen was placed in a vial, and after several weeks a dead, shrunken sarcophagid larva was discovered along with the then-dead cicada. No morphological identification of the larva beyond family was possible.

Following this chance discovery of parasitism, similarly lethargic specimens of N. canicularis were collected in subsequent years at entrances to the K.W. Neatby Building on the Central Experimental Farm in Ottawa (45°23.5’N 75°42.9’W) during August and early
September, usually in early morning. These cicadas were held in containers until either parasitoids emerged or the cicadas died.

In 2016, a male cicada was collected in early September and two larvae emerged and pupariated on 20 September, but adult flies failed to emerge following overwintering procedures outlined below. In 2017, a male cicada was collected in mid-August and three larvae emerged on 20 August (Fig. 1), but again adult flies failed to emerge following overwintering. In 2018, a male cicada was collected on 14 August and two larvae emerged and pupariated on 16 August. These puparia were transferred to a small container with potting soil and kept at room temperature until moved to an overwintering chamber held at 22°C (16L:8D). The temperature was lowered to 18°C (12L:12D) on 23 October 2018, then to 8°C (45% RH) on 8 November, and finally to 4°C (60% RH) on 22 November. The chamber was warmed to 18°C (14L:10D) on 17 May 2019 and later to 22°C (16L:8D) on 30 May 2019. After this date the puparia were removed and held at room temperature until a single female adult fly emerged on 4 July 2019 (Fig. 2). All specimens are housed in the CNC. The timing of emergence coincides with the emergence of the cicada hosts in early July in this region.

The parasitoid was identified as \textit{E. albicoma} Reinhard using the identification key to species in Lopes (1988) and by comparison to identified specimens in the CNC. In addition, a leg from the fly was submitted to the Biodiversity Institute of Ontario in Guelph, ON, Canada for sequencing and alignment of the “Barcoding” region (Hebert \textit{et al.} 2003) of the Cytochrome \textit{c} oxidase subunit I (COI) mitochondrial gene, a 658 base-pair region of this gene. A sequence analysis was performed constructing a neighbour-joining tree with all available sequences using the BOLD website (Fig. 3). The author’s specimen (CNC1424066) is genetically closest (99.19%) to an \textit{E. albicoma} specimen (JQ806981) collected from an observation tower in Wisconsin by sarcophagid expert Greg Dahlem (Dahlem pers. comm. 2019). The analysis included a male specimen of \textit{E. erro} from Wisconsin, reared from

\textbf{FIGURES 1 and 2.} (1) Puparia of \textit{Emblemasoma} sp., larvae emerged from a male \textit{Neotibicen canicularis} on 20 August 2017; (2) Female of \textit{Emblemasoma albicoma} Reinhard, reared from \textit{Neotibicen canicularis}. 
**Emblemasoma albicoma**, a parasitoid of *Neotibicen canicularis*  JESO Volume 151, 2020

**FIGURE 3.** Neighbour-joining tree of *Emblemasoma* with COI sequences, including unique voucher number, sequence length, GenBank accession number and province/state.

*N. linnei* (Young 2020). This last specimen clustered with four Ontario specimens, one of which was collected in Malaise trap surveys of Ontario provincial parks (Centre for Biodiversity Genomics 2017).

This is the first rearing report and first published Ontario record for *E. albicoma* and *N. canicularis* as a host. Collection of “stunned” cicadas will continue in the hopes of rearing additional specimens of *Emblemasoma*.

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References


