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## NOTE

### First Records of *Alcathoe carolinensis* Engelhardt and *Synanthedon alleri* (Engelhardt) in South Carolina, U.S.A.<sup>1</sup>

Juang Horng Chong<sup>2</sup> and James D. Young<sup>3</sup>

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Clearwing moths (Lepidoptera: Sesiidae) are day-flying hornet and wasp mimics that can be found visiting flowers for nectar. Larvae bore in the roots, branches and trunks of woody and some herbaceous plants. Some of these larvae are pests in orchards, nurseries and commercial forestry operations. For example, *Synanthedon exitiosa* (Say) and *Synanthedon pictipes* (Grote & Robinson) are major pests of peach [*Prunus persica* (L.) Batsch; Rosaceae] (Johnson et al. 2005), and *Synanthedon scitula* (Harris) is a major pest of apple (*Malus domestica* Borkh.; Rosaceae) (Bergh & Leskey 2003). These species, and *Podosesia syringae* (Harris), *Podosesia aureocincta* Purrington & Nielsen and *Paranthrene simulans* (Grote) are pests of ornamental trees (Brown and Mizell 1993, Braxton & Raupp 1995, Held 2019).

About 135 sesiid species in 20 genera occur in North America (Pühringer & Kallies 2004, Pohl et al. 2016). Forty-four species are likely to occur in South Carolina based on collection records from South Carolina and neighboring states documented in Eichlin & Duckworth (1988). This species richness has not been validated with a comprehensive survey of sesiid diversity in the state. As a first step to better understand sesiid species diversity in South Carolina, a survey was conducted in three counties (Darlington, Georgetown and Pickens) from March 2011 to December 2013. A mixed pine-hardwood forest, an ornamental plant nursery and a botanical garden were surveyed in each of Darlington and Georgetown Counties to diversify the habitats and outcome of this exploratory survey. In Pickens County, a single ornamental plant nursery was surveyed. Surveyed locations in Georgetown County lay within the Sea Island and Coastal Marsh Ecoregion, those in Darlington County within the Atlantic Southern Loam Plain Ecoregion, and that in Pickens County within the Southern Outer Piedmont Ecoregion (Griffith et al. 2002). Locations within a county were separated by at least 20 km.

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**Fig. 1.** Adult male *Alcatheo carolinensis* Engelhardt captured with pheromone traps in South Carolina. (Photo credit: J. H. C.)

Pheromone traps were used to capture sesiids at each location. Green plastic bucket traps (Great Lakes IPM, Vestaburg, MI) were each baited with a rubber septum lure impregnated with synthetic sex pheromone. Three different lures were used for this survey—"general clearwing moth" (88:12% Z-Z-3,13-C18-acetate: Z,Z-3,13-C18-OH; Vickers & Rumbo 2001), lesser peachtree borer (100% E,Z-3,13-C18-acetate; Tumlinson et al. 1974) or dogwood borer (100% Z,Z-3,13-C18-acetate; Nielsen et al. 1975) (Scentry Biologicals, Billings, MT). Each trap contained a small amount of propylene glycol as killing agent and preservative. Three parallel transects were prepared, with a distance of about 50 m between adjacent transects. Within each transect, three bucket traps (each baited with a different lure, with the order of the lures randomized within each transect) were hung about 1 m from the ground and 50 m between adjacent traps. Lures were replaced monthly based on manufacturer's recommendation. Trap contents were emptied into plastic containers and brought back to the laboratory at Clemson University Pee Dee Research and Education Center (PDREC) in Florence, SC, where sesiids were removed from the preservative, rinsed with clean tap water, and stored in 70% ethanol until identification. In total, 9,571 sesiids were captured over the three-year period and included two species not previously recorded in South Carolina.

*Alcatheo carolinensis* Engelhardt (Figure 1), identified by J. H. C. using Eichlin & Duckworth (1988), were collected in Darlington and Pickens Counties. Aberrant



**Fig. 2.** Atypical dark morph of *Synanthedon alleri* (Engelhardt) collected in Darlington County, South Carolina. Note the lack of orange or yellow bands on the hindlegs and the dark collar behind the head. The abdomen has no obvious banding. (Photo credit: J. H. C.)

dark forms of *Synanthedon alleri* (Engelhardt) (Figure 2) were collected in Darlington and Georgetown Counties, and were identified by J. D. Y. by comparing male genitalia to those prepared and identified by G. P. Engelhardt (Figure 3). In total, 25 *A. carolinensis* and 65 *S. alleri* were collected. Voucher specimens of *A. carolinensis* and *S. alleri* are deposited in the Arthropod Collection at PDREC, and two specimens of *S. alleri* are deposited in the U.S. National Museum in Washington, D.C.

*Alcathoe carolinensis* was collected from Darlington (N = 11) and Pickens Counties (N = 14). All specimens collected in Pickens County were taken from a single nursery, whereas specimens collected in Darlington County were from one botanical garden (N = 10) and one pine-hardwood forest (N = 1). The majority of specimens (N = 20) were taken in traps baited with lesser peachtree borer lures; the rest were taken in traps baited with general clearwing moth (N = 4) and dogwood borer (N = 1) lures. *Alcathoe carolinensis* were collected in August (N = 8), September (N = 16) and October (N = 1).

In addition to the type location in North Carolina (Engelhardt 1946), *A. carolinensis* was also recorded from Indiana (Reed et al. 1981), Missouri (Brown 1986),



**Fig. 3.** Male genitalia of *Synanthedon alleri* (Engelhardt) from a specimen collected in Darlington County, South Carolina. (Photo credit: J. D. Y.)

Arkansas (BugGuide 2017), Tennessee (Hansen et al. 2010), Georgia (Snow et al. 1985), Florida (Sharp et al. 1978, Brown 1985), and Alabama, Mississippi, and West Virginia (Moth Photographers Group 2020). Its first collection in South Carolina seems to suggest that, despite its rarity, *A. carolinensis* may be distributed over a wide range from the Midwest east to the Mid-Atlantic Coast and south to central Florida. *Alcathoe* spp. rely on clematis plants (*Clemantis* spp.; Ranunculaceae) for larval development (Hansen et al. 2010). *Clemantis terniflora* DC., an invasive ornamental species, is widely available at the botanical garden where 40% of all specimens in this survey were taken. We did not conduct a floral survey in and around other survey sites to determine the presence and abundance of *Clemantis* spp. so we are unable to establish an association with collections of *A. carolinensis*.

*Synanthedon alleri* is a native sesiid species previously recorded from the coastal plains of Alabama (type location), Florida, Georgia, Louisiana and Mississippi (Engelhardt 1946, Eichlin & Duckworth 1988, Brown & Mizell 1993), and North Carolina (Moths of North Carolina 2020). Among the 65 specimens collected in Darlington (N = 49) and Georgetown (N = Counties (N = 16)). A search of BOLD (Barcode of Life) database (Ratnasingham & Hebert 2007) discovered two specimens of *S. alleri* collected in Charleston County in 1994 suggesting the species is likely distributed throughout the southeastern Coastal Plains and the Gulf Coast. In this study, the majority of specimens (N = 52) were collected in the

pine-hardwood forests, and the rest were collected at the botanical gardens (N = 11) and in nurseries (N = 2). Most specimens were collected in traps baited with lesser peachtree borer (N = 33) or general clearwing moth (N = 30) lures, while dogwood borer lures only captured two specimens. The host(s) of *S. alleri* has not been conclusively identified, but Brown & Mizell (1993) suggested that holly (*Ilex* spp.; Aquifoliaceae) is a potential host. American holly (*Ilex opaca* Aiton) and other ornamental *Ilex* species and hybrids are widely distributed and abundant in and around our survey locations. In this survey, *S. alleri* was collected from May to September, with the greatest numbers of the specimens being collected in August and September (N = 42). *Synanthedon alleri* and *A. carolinensis* are not known pests.

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