

Recovery and Distribution of *Anthribus nebulosus*, a Scale Predator Introduced into Virginia in 1981

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ABSTRACT

Anthribus nebulosus Förster (Coleoptera: Anthribidae) is a scale predator native to Eurasia that was imported from Hungary in the 1970s and released in Virginia Beach, Virginia, in 1981 as a potential biological control against soft scale insects. First recovery of *A. nebulosus* in Virginia Beach occurred in 2010, 29 years after release. Subsequent surveys of soft-scale infested oaks over a 3-year period indicated that *A. nebulosus* had spread up to 32 km from the initial site in multiple cities and directions, but further spread was limited by geographic barriers.

Key words: *Anthribus nebulosus*, scale predator, Virginia.

INTRODUCTION

Anthribus nebulosus Förster (Coleoptera: Anthribidae) is one of two common European species that are predators of soft scale (Hemiptera: Coccidae) insects and their eggs (Valentine, 1998). Larvae and adults of *A. nebulosus* feed on all stages of soft scales. Its life history closely follows the life cycle of scale insects (Kosztarab & Kozar, 1983), with adults appearing in spring to lay a single egg inside the ovisacs of female soft scales. Egg hatch typically occurs in June and July, after which the larvae feed on soft scale eggs and nymphs and pupate under the female scale cover. In Europe, newly emerged adults enter diapause in August, hibernating in bark cracks or the empty ovisacs of host scale insects (Gonget, 2003).

Anthribus nebulosus preys on at least 15 species of scale insects in Europe and Central Asia, three of which are considered pest species in the eastern United States (Hoebeke & Wheeler, 1991). In the mid-Atlantic region, oak lecanium, *Parthenolecanium quercifex* (Fitch) (Hemiptera: Coccidae), is a frequent pest of oaks planted as urban street trees. Willow oak (*Quercus phellos* L.) is a shade tree widely planted in many street medians, parking lots, and parks throughout the region, and is commonly infested with oak lecanium and

associated parasites and predators (Schultz, 1984; Robayo Camacho, 2015). Surveys after the 1981 Virginia releases of *A. nebulosus* determined that beetles released in Blacksburg survived and were recovered in low numbers (Hoebeke & Wheeler, 1991). Absent, however, was evidence confirming its establishment at or near the Virginia Beach release site (Hoebeke & Wheeler, 1991). This anthribid was collected from spruces (*Picea* spp.) infested with the coccid *Physokermes hemicryphus* (Dalman) at sites in the northeastern U.S. beginning in 1989, and in subsequent years from western Massachusetts and Connecticut to eastern New York (Hoebeke & Wheeler, 1991). The presence of large numbers of *A. nebulosus* in parts of Connecticut and Massachusetts, combined with none being found between there and Virginia, suggested that populations in New England were long-standing and adventitious, rather than the product of intentional releases (Hoebeke & Wheeler, 1991). The beetle is purported to have been accidentally introduced to the United States as early as the late nineteenth or early twentieth century, before passage of the Plant Quarantine Act of 1912 (Hoebeke & Wheeler, 1991). In 2010, *A. nebulosus* adults were collected from willow oaks heavily infested with oak lecanium at two sites in Virginia Beach within 6 km of the original release site. These unexpected collections on urban street trees

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prompted us to conduct additional surveys to delimit the establishment of the predator nearly three decades after its release. The objective of this study is to determine the adult activity period at the aforementioned two sites, and the extent of dispersal of *A. nebulosus* since its 1981 release.

MATERIALS AND METHODS

A survey was conducted in eastern Virginia from late March to July 2011 and 2012 and in northeastern North Carolina in 2013. A beat sheet used for sampling arboreal curculionids was used to survey for the presence of *A. nebulosus*. In 2011, monitoring was initiated weekly at the two sites (Site 1 = 36°52'23.8"N, 76°10'17.0"W and Site 2 = 36°53'50.2"N, 76°10'53.3"W) in Virginia Beach 6 km from where 300 beetles were originally released in 1981. The survey radiated from the original release site in multiple directions wherever willow oak infested with oak lecanium was found on public property or with permission from a property owner. A scale-infested branch was struck several times with the beat sheet positioned beneath, and beetles were collected. The survey extended outward through adjoining municipalities and continued until *A. nebulosus* was no

longer collected.

Concurrently, samples were taken from scale-infested trees with the predator present near the Hampton Roads Agricultural Research and Extension Center, Virginia Beach, VA each week to ensure that adults could still be recovered. Surveying was suspended in July 2011. Recovered adult beetles were counted and preserved in vials in 70% ethanol along with the date and site. Identification was confirmed and voucher specimens deposited in the Virginia Tech Insect Collection, Blacksburg, VA. Positive sites were used as a point of reference for extending the survey. In May 2012, surveying resumed and extended to additional sites in the cities of Virginia Beach, Chesapeake, Norfolk, Portsmouth, and Suffolk. In May 2013, monitoring extended southward into North Carolina and westward to sites beyond recovery points of the previous year.

RESULTS AND DISCUSSION

At the two sites where *A. nebulosus* initially was recovered in 2010, adults were found in low numbers in April of 2011 and 2012, with higher numbers between mid-May and late June (Figs. 1 and 2). Radiating out from the original release site in Virginia Beach

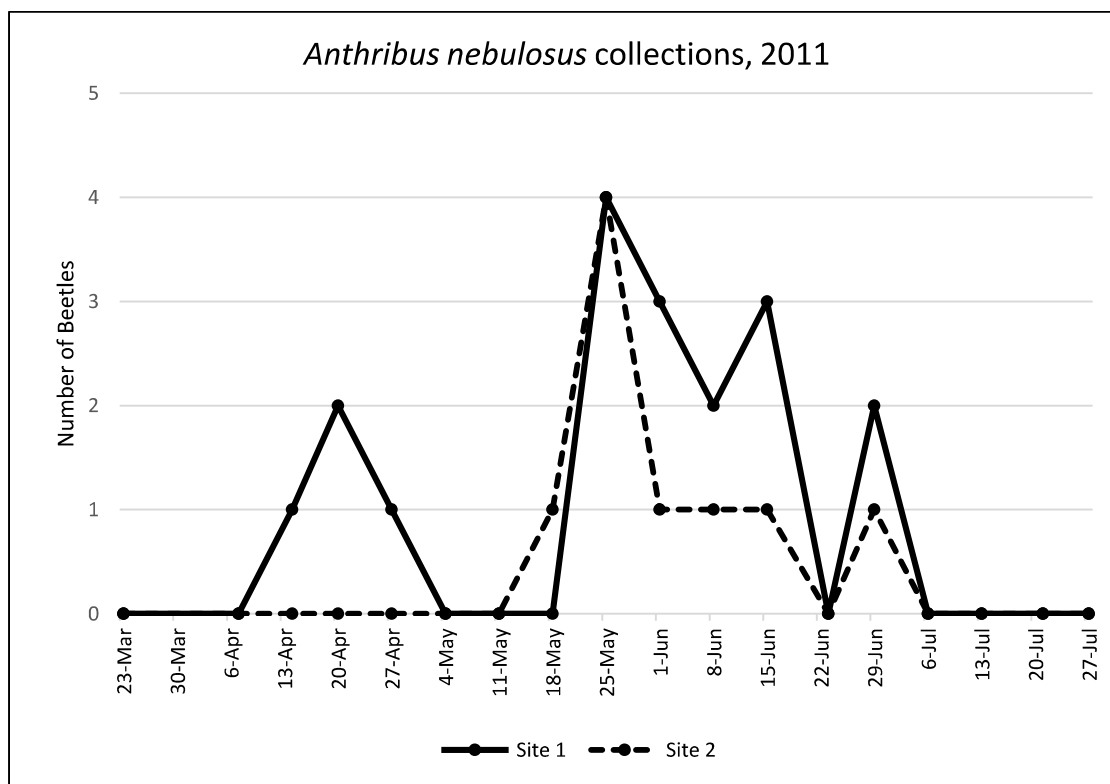


Fig. 1. *Anthribus nebulosus* adults collected from two sites in Virginia Beach, VA - 2011.

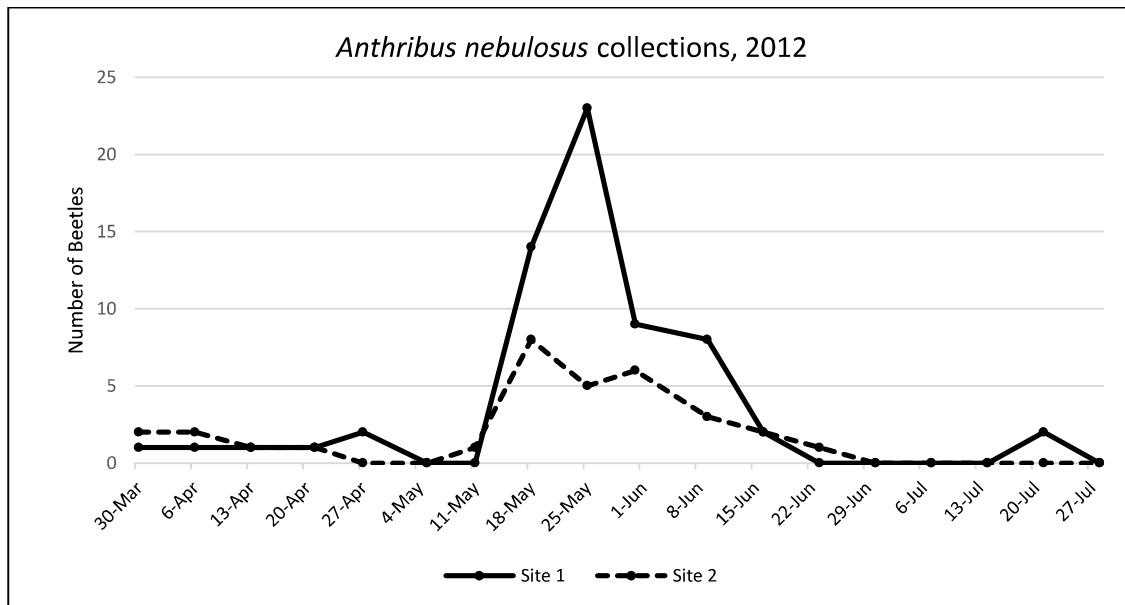


Fig. 2. *Anthribus nebulosus* adults collected from two sites in Virginia Beach, VA - 2012.

(36°53'36"N, 76°7'42"W), the surveys in 2011 and 2012 confirmed the establishment of *A. nebulosus* in previously unexplored locations in the cities of Virginia Beach, Norfolk, Chesapeake, and Portsmouth (Fig. 3). In 2013, surveying failed to confirm establishment in Hampton, Petersburg, and Richmond, and south into North Carolina. Aside from our submissions from Virginia Beach, no other *A. nebulosus* were found in the Virginia Tech or the Virginia Museum of Natural History collections (T. Dellinger, K. Ivanov, pers. comm.). Our collective data suggest that *A. nebulosus* has spread from the initial release location approximately 23 km west in Norfolk, 27 km south in Virginia Beach, 31 km southwest in Chesapeake, and 32 km west in Portsmouth. A geographical barrier was noted between the positive and negative sites. Locations separated from the positive sites by large bodies of water or swampland were negative for *A. nebulosus*. Our survey found a preference for hosts in managed landscapes of urban and suburban areas where willow oak was a common street tree and large infestations of oak lecanium were present. Trees in these habitats were ideal sampling sites for recovery of *A. nebulosus*. This anthribid similarly was found in managed landscapes (cemeteries, college campuses) in northeastern states (Hoebeke & Wheeler, 1991).

Our study provides evidence of the establishment and spread of *A. nebulosus* over four cities in southeastern Virginia since its release in 1981. Its presence adds to the beneficial insect complex previously reported (Schultz, 1984; Robayo Camacho, 2015) that suppresses outbreaks of oak lecanium in

urban landscapes. We note images labeled as *A. nebulosus* from Philadelphia, Lancaster, and Juniata counties, PA and Montgomery County, MD (<http://bugguide.net/node/view/278376>, <http://bugguide.net/node/view/1063638>) were taken 2014-2016.

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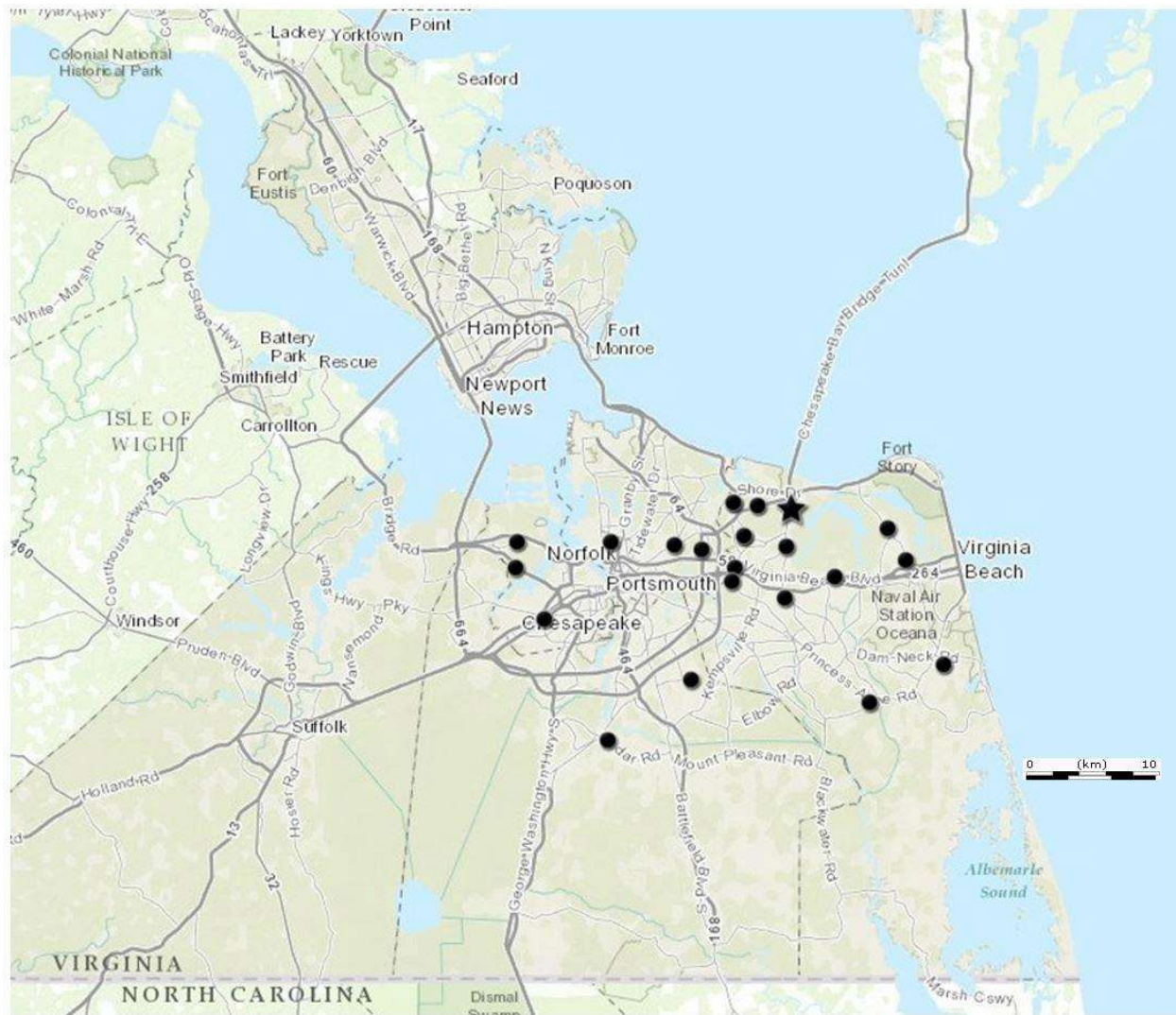


Fig. 3. Dispersal map of *Anthribus nebulosus* in southeastern Virginia (initial 1981 release site is starred).

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