NOTE

Release and Establishment of *Chilocorus kuwanae* (Coleoptera: Coccinellidae) in North Carolina[1]

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The euonymus scale, *Unaspis euonymi* (Comstock) (Homoptera: Diaspididae), is a serious pest of ornamental shrubs in the United States, and can attain populations severe enough to cause complete defoliation and death of the host plant. In an attempt to control this insect, the United States Department of Agriculture - Agricultural Research Service (USDA-ARS) in 1983-84 imported and successfully established two Korean predators of euonymus and other diaspidid scales: the coccinellid *Chilocorus kuwanae* (Silvestri), and the nitidulid *Cybocephalus* prob. *nipponicus* Endrody-Younga (Drea and Carlson, 1987. Proc. Entomol. Soc. Wash. 89: 821-824; Drea and Carlson, 1988. Proc. Entomol. Soc. Wash. 90: 307-309; Hendrickson et al., 1991. Proc. Entomol. Soc. Wash. 93: 197-200). The USDA Animal and Plant Health Inspection Service (APHIS) subsequently initiated a program for the distribution and establishment of *C. kuwanae* in the eastern United States. The North Carolina Department of Agriculture (NCDA) has cooperated with the USDA in this program from its inception and received the first shipment of the *C. kuwanae* in October of 1984. These insects were the F_1 of a culture established from C. *kuwanae* collected at Masan and Sacheon, Kyeong Sangnam Province, South Korea on 18-19 July 1984 by the Asian Parasite Laboratory, USDA-ARS. This first shipment was released on white peach scale, *Pseudaulacaspis pentagona* (Targioni-Tozzetti), in Wake County and overwintered successfully. Federal shipments of this predator to North Carolina continued yearly from 1984 to 1988. Between 1984 and 1987, all insects received by the NCDA were either released directly into field sites or cultured in the laboratory for one generation prior to release. Initially, small numbers of the predators were released onto a variety of diaspidid hosts, including white peach scale, *P. pentagona,* San Jose scale, *Quadraspidiotus perniciosus* (Comstock), obscure scale, *Melanaspis obscura*

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(Comstock), and euonymus scale, *U. euonymi.* The predators became established on both euonymus scale and white peach scale, however, no vouchers from the peach scale sites were taken because *C. kuwanae* were few in number or their presence was obscured by large numbers of *Chilocorus stigma* (Say). Because it seemed to be the preferred host and because of local availability, euonymus scale has been used exclusively as the host in release sites since 1987.

Beginning in 1987, *Euonymus* sp. plants infested with *U. euonymi* donated by local nurseries were used to establish insectaries in Wake County. A total of 86 shrubs were planted in three different plots on the grounds of the NCDA Biological Control Laboratory. These insectaries have been used to propagate *C. kuwanae* for distribution since that time. A total of nearly 6000 coccinellids have been released in North Carolina, primarily Wake County, since the inception of the program (Table 1). Beginning in 1990, shipments of *C. kuwanae* from the NCDA insectary were also made to cooperators in Georgia, Tennessee, Mississippi, and Florida.

Table 1. Number of *Chilocorus kuwanae* released in North Carolina from 1984-1991. Additional insects dispersed naturally from NCDA insectaries in Wake Co.

Year	# Released	Counties
1984	125	Wake
1985	170	Wake, Johnston, Montgomery, Sampson
1986	378	Wake, Sampson
1987	590	Wake
1988	102	Wake
1989	2562	Wake, Mecklenburg
1990	1304	Wake
1991	688	Wake
Total	5919	

Reproduction by the coccinellids in North Carolina release sites has been observed since 1986. In 1988, *C. kuwanae* was recovered approximately 16 km from the nearest known release site. As part of the Euonymus Scale Biological Control Project initiated by APHIS in 1991, surveys to determine the establishment and distribution of *C. kuwanae* in North Carolina were conducted by APHIS personnel between 27 March and 15 September, 1992. The surveys were conducted at 35 sites, in 11 cities (7 counties) (Table 2, Figure 1). Twenty-one of the 35 surveyed sites (60%) were positive for the presence of the predator. Additionally, APHIS surveys indicated recovery from 3 counties in South Carolina, where no releases have been made.

Table 2. USDA surveys for *Chilocorus kuwanae* in North Carolina, 1992.

County	City	Sites positive for *C. kuwanae*/ Sites inspected
Brunswick	Southport	1/3
Cartaret	Newport	1/1
Guilford	Greensboro	3/5
Mecklenburg	Charlotte	1/8
New Hanover	Wilmington	1/2
Wake	Cary	3/3
	Garner	3/4
	Raleigh	3/3
Wayne	Belfast	1/1
	Goldsboro	3/4
	Rosewood	1/1

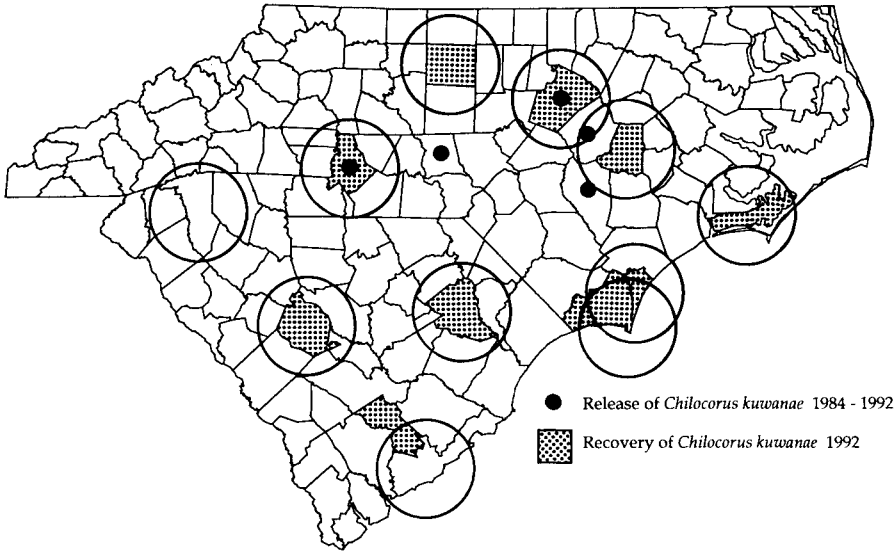

Fig. 1. Spatial distribution of releases and recoveries of *Chilocorus kuwanae* in North and South Carolina 1984 - 1992. Circles indicate APHIS survey areas in 1992; surveys were conducted within a 30 mile radius of major cities designated as survey centers.

In 1991 and 1992 the parasitoid *Aprostocetus neglectus* (Domenichini) (Hymenoptera: Eulophidae) was collected from both larvae and pupae of *C. kuwanae* in Wake County; its impact on the predator population is currently being evaluated.

The successful establishment of *C. kuwanae* in North Carolina may be due, at least in part, to the climatological origin of the predator used for release in this state. The Korean strain of *C. kuwanae* was collected at approximately the same latitude as Raleigh, North Carolina (35°N), and both South Korea and eastern North Carolina are designated as subtropical rain climates (Rudloff, 1981. World Climates. Wissenschaftliche Verlagsgesellschaft, Stuttgart).

Vouchers have been deposited in the C. S. Brimley Insect Collection of the NCDA and in the Museum Collection of the USDA-APHIS-PPQ National Biological Control Laboratory in Niles, Michigan.

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