MARYLAND ENTOMOLOGIST 3(3):123-128 (1989)

Status of *Rhinocyllus conicus* (Coleoptera: Curculionidae) in Maryland

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Abstract

The distribution and abundance of *Rhinocyllus conicus* in Maryland were determined in a survey of eight counties. This beneficial weevil was introduced into Maryland in 1975 as part of a classical biological control program on *Carduus* spp. thistles. Large numbers of *R. conicus* were commonly found infesting *C. thoermeri*, and to a lesser extent *C. acanthoides*, in areas with high thistle populations. In counties with scattered populations of thistles, *R. conicus* was frequently absent. No significant decline in thistle populations was detected at selected sites where *R. conicus* and other beneficial insects were present. However, surveying these sites began eleven years after *R. conicus* was released, and the sites suffered constant disturbance from mowing and spraying.

A seed destroying weevil, *Rhinocyllus conicus* (Froelich) (RC), was first introduced into Canada from Europe in 1968 for the control of musk (= nodding) thistle, *Carduus nutans* L. and *C. thoermeri* Weinm. (Harris and Zwolfer 1971). Subsequent releases were made in 1969 in Virginia and Montana (Surles et al. 1974, Hodgson and Rees 1976).

RC was released in Maryland in 1975 and reported as established in 1978 (Batra 1980). Since then, there have been no extensive studies on RC in Maryland. The present paper reports on the current distribution and abundance of RC in Maryland.

Materials and Methods

Distribution and abundance of RC. Eight Maryland counties were sampled for the presence of RC in 1988: Anne Arundel, Baltimore, Carroll, Frederick, Harford, Howard, Prince George's, and Washington. However, 86% of all sample sites were in the "thistle-belt" counties of Carroll, Frederick, and Washington. Each county was divided into five, square-mile quadrats, with a single sample site in each quadrat. A suitable sample site was one that was infested with either musk (*C. thoermeri*) or plumeless (*C. acanthoides*) thistle, or both. Sampling consisted of clipping five primary and five secondary seed heads from different thistle plants.

A primary seed head on *C. thoermeri* was defined as the terminal seed head on the main stem, or the terminal seed head from one of the top three branches. These three or four seed heads were the largest, earliest developing, and contained the most viable seeds on the plant (McCarty and Lamp 1982). Secondary heads were terminal seed heads on lower branches or lateral seed heads on any branch. These heads were typically smaller and developed later in the year.

The earliest appearing seed heads were sampled for *C. acanthoides*. This species flowers later in the year than *C. thoermeri*, and the seed heads tend to be uniform in size throughout the growing season.

The seed heads were dissected, and the numbers of RC larvae, pupae, and adults were recorded. A total of 81 sites was sampled and 925 seed heads dissected. Sampling began on June 14 and ended on July 27, 1988.

Impact of RC on thistles. In 1983, thirteen sites were selected for the release and evaluation of the impact of various biological control agents on thistles. Most of these sites were on the Interstate-70 right-of-way. However, it was not until 1986 that quantitative, comparable measurements were taken of the thistle populations located at nine of these sites. The sites were surveyed again in 1987 and 1989.

The surveys were conducted using a belt transect sampling method. Ten transects, each 15 m x 0.4 m, were made at eight of the sites, while 15 transects, each 10 m x 0.4 m, were used at one of the sites that was less than 15 m in width. All reproductive (bolting) stages of *C. thoermeri* and *C. acanthoides* were counted.

Results and Discussion

RC was present in those areas where *Carduus* thistles have been a problem for many years: Carroll, Frederick, and Washington Counties. In these counties, RC was present in large numbers, averaging 6.7, 15.2, and 15.5 weevils per primary head, respectively (Table 1). Secondary seed heads in these counties were also infested, as were the primary seed heads of *C. acanthoides*. In Frederick and Washington Counties, RC was consistently found at high levels on *Carduus* thistles. These two counties supported the highest populations of *Carduus* thistles (P. W. T., unpublished data). The distribution of RC in Carroll County was more spotty. This was probably a reflection of the lower density of thistle populations in the county. RC is known to favor areas where *C. thoermeri* populations are high (L. T. Kok, pers. comm. 1988) The reasons for this are unclear but, in the presence of a stable food supply, populations of RC can build to large numbers.

Table 1. Mean number (±SD) of *Rhinocyllus conicus* found infesting primary and secondary seed heads of *Carduus thoermeri* and *C. acanthoides*.

County	Type[1]	N[2]	Insects / seed head
Anne Arundel	M1	10	0.0 (±0.0)
	M2	5	0.0 (±0.0)
Baltimore	M1	25	2.4 (±1.4)
	M2	25	0.2 (±0.2)
Carroll	M1	85	6.8 (±4.2)
	M2	85	1.6 (±1.4)
	P1	5	1.4 (±2.2)
Frederick	M1	155	15.2 (±6.4)
	M2	155	4.8 (±2.5)
	P1	30	1.4 (±0.9)
Harford	M1	10	0.0 (±0.0)
	M2	10	0.0 (±0.0)
Howard	M1	5	0.0 (±0.0)
	M2	5	0.0 (±0.0)
	P1	5	3.4 (±1.7)
Prince George's	M1	5	0.2 (±0.4)
	M2	5	0.0 (±0.0)
Washington	M1	95	15.5 (±7.7)
	M2	95	4.9 (±4.2)
	P1	110	1.4 (±0.8)

[1] M1 = primary seed head, *C. thoermeri*. M2 = secondary seed head, *C. thoermeri*. P1 = earliest available seed head, *C. acanthoides*.
[2] Number of seed heads sampled.

As expected, those areas with scattered populations of *C. thoermeri* did not support large populations of RC. This was characteristic of parts of Carroll, Baltimore, Harford, Howard, Anne Arundel, and Prince George's Counties. Although populations of *C. thoermeri* in these counties were locally heavy in some cases, they frequently escaped attack by RC.

Another impediment to the establishment of RC in these areas may be a lack of sufficient "buffer" areas containing thistles which would not be affected by local control measures, such as the eradication of a small field infestation by herbicides.

Despite a general lack of synchronization with *C. acanthoides*, RC did attack this species. Rowe and Kok (1984) noted a delayed ovipositional period for RC in pure stands of *C. acanthoides*, suggesting the development of a strain that can take advantage of this thistle species by shifting its activity to later in the year. If true, the same may occur in Maryland.

Impact of RC on thistles. The densities of the two thistle species fluctuated during the course of this study (Fig. 1). There were no obvious trends and no significant changes in the populations of *Carduus* thistle species at any site, despite the presence of RC. Also present at some of the sites were *Trichosirocalus horridus* (Panzer), a rosette feeding weevil, and *Cassida rubiginosa* (Muller), a leaf feeding beetle.

It is not known why the thistle populations, primarily *C. thoermeri*, did not decline. The most obvious reason is because data on thistle densities were not collected until 1986, eleven years after RC was released. The interval may have been sufficient for RC to reduce significantly the density of *C. thoermeri* to its present level, despite the fluctuations that were noted during this study. Kok and Surles (1975) found that RC reduced significantly the density of *C. thoermeri* four years after it was introduced.

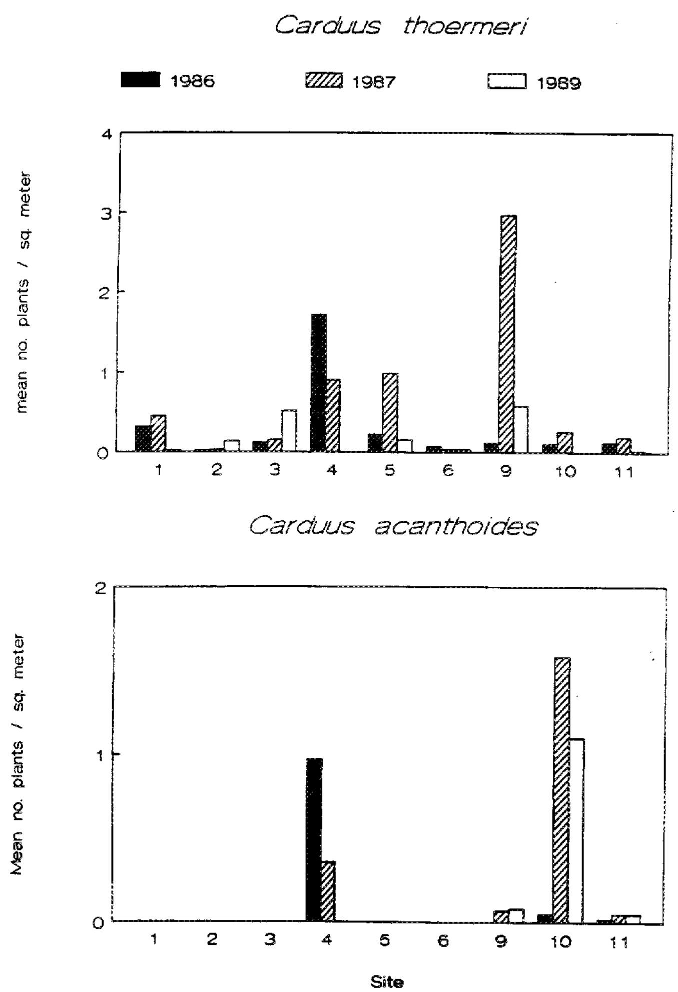
Another problem encountered at the sites was the interference caused by the routine mowing or spraying of the study areas. Annual broadcast treatments of broadleaf herbicides were applied to roadsides, usually killing the crown vetch, *Coronilla varia* L., that had been planted to control erosion. Often these areas were quickly colonized by thistles that persisted for several years until grasses became established. Those sites most severely disturbed by spraying were not included in the results.

Without pre-release information on thistle populations, it is impossible to document quantitatively the beneficial impact of RC in Maryland. However, the results in nearby Virginia, as well as in other states and countries, provide ample evidence of their efficacy.

In 1988, populations of RC in primary seed heads of *C. thoermeri* were high, with up to 45 weevils per head. Although no data were gathered on the number of viable seeds per plant remaining after RC attack, it appeared that a large portion of the most viable seed in the "thistle-belt" was destroyed in 1988. This conclusion is based on our observations and evidence provided by other researchers. Surles and Kok (1978), found that 6.8 weevils per seed head reduced the amount of seed by 75%. McCarty and Lamp (1982) found that an average of 2.3 and 11.5 weevils per seed head reduced the total number of the most viable seeds per plant by 28.2% and 77.9%, respectively.

RC is well established in the "thistle-belt" area of Maryland. The weevil destroys a large portion of the seed produced by *C. thoermeri*, as well as a smaller portion of *C. acanthoides* seed. However, there are still areas of the State with isolated but heavy populations of *C. thoermeri* that thus far have escaped attack by this weevil.

Fig. 1. Density of *Carduus thoermeri* and *C. acanthoides* at selected release sites in Central Maryland from 1986 to 1989.



Acknowledgment

The authors thank A. Atwood, P. Cubbage, G. Kidd, and J. Yuill for their assistance in field surveys. This study was supported in part by the Maryland State Highway Administration. Maryland Department of Agriculture CN 63-89.

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Cover illustration: The logo of the Maryland Entomological Society features the Maryland Shield and a specimen of Euphydras phaeton (Drury), the Baltimore checkerspot, which is the offical insect of the state of Maryland.

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