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European Corn Borer Parasitoids; Distribution in Southern Minnesota

W.V. WINNIE,* D.D. SREENIVASAM,** H.C. CHIANG***

ABSTRACT — During the 1940's and 1950's seven exotic parasitoids of the European corn borer (ECB) *Ostrinia nubilalis* (Hubner), were released in Minnesota. This study was done to determine which introduced parasitoids became established and their distribution in Minnesota. The experiment was conducted during the summer of 1977 and fall of 1977, 78, 79- and 80 in conjunction with the annual ECB population surveys in southern Minnesota by the State Department of Agriculture, Division of Plant Industry. Three introduced parasitoids, *Macrocentrus grandii* Goidanich, *Eriborus Terebrans* (Gravenhorst), and *Sympiesis viridula* (Thomson) and two native parasitoids, *Ishnus inquisitorius atricollaris* (Walsh) and *Aplomya caesar* (Aldrich) were recovered. *M. grandii* was confined to the eastern portion, while *E. terebrans* was recovered from throughout southern Minnesota. *S. viridula* was found in only three counties, perhaps because of its biology it may have eluded recovery, resulting in underestimated distribution. The two native species, *I. inquisitorius atricollaris* and *A. caesar*, occur only occasionally in Minnesota.

In Minnesota the introduction of European corn borer (ECB), *Ostrinia nubilalis* (Hubner) parasitoids was conducted from 1945 to 1952 with the release of seven exotic species in 30 counties (Minnesota Department of Agriculture) 1957 and 1954). The identity of the parasitoids and release data are available for only five parasitoids, *Lydella thompsoni* (Herting) (= *griseus* Robineau-Desvoidy of Authors), *Eriborus terebrans* (Gravenhorst) (= *Horogenes punctorius* (Roman), *Macrocentrus grandii* Goidanich (= *gifuensis* Ashmead), *Sympiesis viridula* (Thomson) (= *Eulophus viridulus*), and *Chelonus annulipes* Wesmael and for releases in 1945, 46, 47, 48, and 49 (Arbuthnot et al 1947, 47, 48, 49, Clark et al 1946) (Table 1). All parasitoids released were collected in the eastern United States where each species was established after importation from Europe and Asia in the 1920's and 1930's.

Review of the literature gives scanty information on the subsequent establishment or distribution of the introduced parasitoids in Minnesota. One study found *L. thompsoni* and *S. viridula* during the early 1950's (Warters 1969). Another study conducted by the USDA-ECB Research Laboratory in 1956, recovered *L. thompsoni*, which was dominant, *S. viridula* and *E. terebrans* (Minnesota Department of Agriculture.) These studies also recovered three native species: two tachinids, *Lixophaga variabilis* (Coquillett) (Warters 1969) and *Aplomya caesar* (Aldrich) (Minnesota Department of Agriculture - 1957), and one ichneumonid, *Melanichneumon brevicinctus* (Say) (Waters 1969).

This study determines the current status of the introduced ECB parasitoids and their distribution in southern Minnesota.

Survey Techniques and Handling of Collected Larvae

Larvae were collected in the summer of 1977 and fall of 1977, 78, 79, and 80 in conjunction with the ECB population survey conducted by the Minnesota Department of Agriculture, Division of Plant Industry. The area surveyed included the major corn growing districts of the state (Figure 1).

In the summer survey plants with ECB damage were dissected and the larvae present put in 25 ml. glass vials, the vials were plugged with cotton, and returned to the laboratory. In the laboratory and the larvae were given artificial diet, and allowed to complete development to adult ECB or parasitoid at 25 C., 85 percent R.H., and 16 hour photoperiod.

In the fall surveys sections of corn stalks with evidence of recent ECB tunneling were cut from the plants and returned to the laboratory. In the laboratory the stalks were dissected, larvae present were put in 25 ml. glass vials and the vials plugged with cotton. Most of the larvae had completed larval development and were in diapause. Therefore, they were held at 15 C., 75 percent R.H., and 12 hour photoperiod for two months, then transferred to 25 C., 85 percent R.H., and 16 hour photoperiod to break diapause and complete development to adult ECB or parasitoid.

Most Parasitoid Recoveries in 1977 Summer

The majority of the parasitoids were obtained from the summer 1977 survey. The larvae from the fall surveys had high mortality due to the entomophagous fungus, *Beauveria bassiana* (Bals.) and only a small number of parasitoids were obtained from these samples.

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Three introduced parasitoids, *M. grandii*, *E. terebrans*, and *S. viridula*, were recovered (Figure 1). While recovery of the latter two has been reported by earlier workers, *M. grandii* was recovered for the first time in Minnesota since its release. Regarding the other two introduced parasitoids, the once important tachinid, *L. thompsoni* was not found in this study and has not been reported from any midwestern state since the mid 1960's. *C. annulipes* also was not recovered in this study or previous studies in Minnesota.

Two native parasitoids were recovered, *Ischnus inquisitorius atricollaris* (Walsh) in Watonwan County, and *A. caesar* in Stearns and Pine Counties (Figure 1.) This is the first record of *I. i. atricollaris* from the ECB in Minnesota, although the distribution of this parasitoid covers North America, east of the continental divide. *A. caesar* is a commonly occurring parasitoid of ECB and has been reported from New England, New York, New Jersey (Arbuthnot 1950), Ohio, Illinois (Arbuthnot and Wright 1951), northwestern and western United States, and Ontario and Quebec, Canada (Whishart 1946). In most of these areas *A. Caesar* parasitized about one percent of the samples.

Distributions of Recovered Parasitoids

E. terebrans was widespread in Minnesota while *M. grandii* was confined to the eastern portion of the surveyed area (Fig. 1). The distribution of these two parasitoids in the five state (ND, SD, IA, WI, MN) region shows a similar trend. *E. terebrans* has been widely reported from the region, North Dakota (U.S.D.A. 1975), South Dakota (U.S.D.A. 1965, 1966, and 1967), Wisconsin (Lovett 1980), and Iowa (Blickenstaff et al 1953). While *M. grandii* has been reported predominately from the eastern portion of the region, Wisconsin (U.S.D.A. 1971, Lovett 1979) and northeastern and central Iowa (U.S.D.A. 1971, Blickenstaff et al. 1953), with only one report from South Dakota (U.S.D.A. 1965).

S. Viridula was found in only three Minnesota counties: Ramsey, Redwood, and Waseca (Fig. 1). Its distribution may actually be wider due to the following four factors. One, its larvae feed on the host externally and overwinter as pupae in the tunner (Parker and Smith, 1933), therefore, this parasitoid was difficult to detect with the methods used in this study. Two, *S. viridula* has been recovered from adjacent states, South Dakota (U.S.D.A. 1965, 1965, 1966, 1966, and 1967), North Dakota (U.S.D.A. 1967, 1967, 1975, and Frye 1965), Wisconsin (U.S.D.A. 1958), and Iowa (Blickenstaff, et al. 1953 and Showers and Reed, 1969). Three, Arbuthnot and Wright (1951) and Blickenstaff et al. (1953) reported that this species has excellent dispersal ability, but has a low maintenance population. Four, Showers and Reed (1969) reported that *S. viridula* rarely searched below the ear of the plant. In this study most of the samples were from the ear level or below, therefore, this study would have underestimated the abundance of *S viridula*.

Three Species Established Permanently

Of the seven exotic species of parasitoids released, *M. grandii*, *E. terebrans*, and *S. viridula* became permanently established. *E. terebrans* was widely distributed throughout the corn growing areas of Minnesota. The distribution of *M. grandii* was restricted to the eastern section of the corn growing region. *S. viridula* was found in only three counties, but it was probably more widely distributed than indicated by the recoveries in this study. Two native parasitoid species *I. i. atricollaris* and *A. caesar* were recovered, but both are only occasional parasitoids of the ECB.

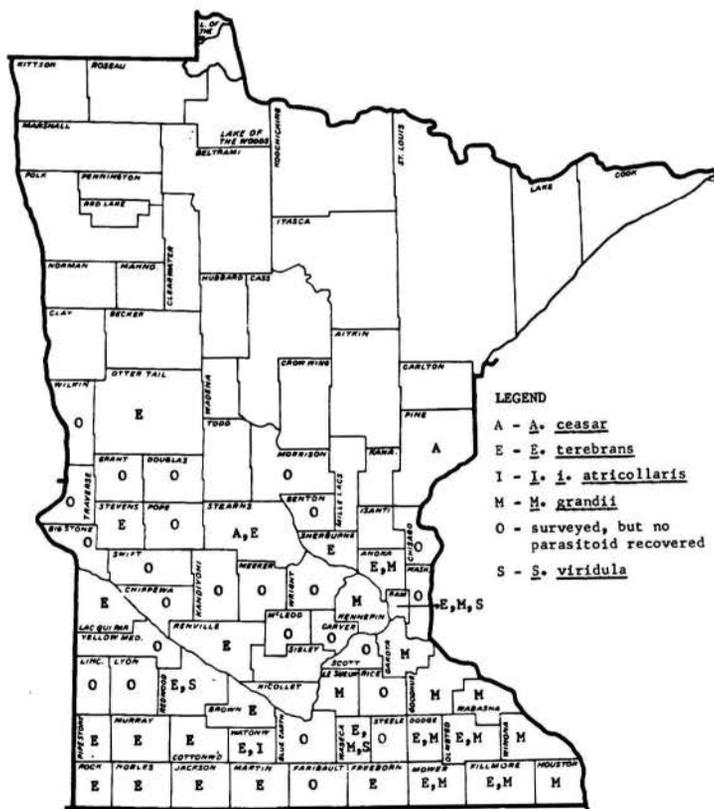


FIGURE 1. — Distribution of European Corn Borer parasitoids in Minnesota counties, from 1977-1980 experiment.

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TABLE 1. NUMBERS OF PARASITOIDS RELEASED IN MINNESOTA

Year	<i>Macrocentrus grandii</i>	<i>Lydella thompsoni</i>	<i>Sympiesis viridula</i>	<i>Eriborus terebrans</i>	<i>Chelonus annulipes</i>
1945	5,950	496	1,700	--	--
1946	6,550	1,979	1,300	835	--
1947	9,550	1,457	982	488	--
1948	19,200	361	515	492	--
1949	3,277	--	--	--	5,623
Total	44,527	4,293	4,497	1,815	5,623
