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PREVIEW

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**BIOLOGY AND DRIFT OF AQUATIC INSECTS IN
SEASONAL IRRIGATION WATERS AND THEIR
SUSCEPTIBILITY TO ULV MALATHION**

**By
JAMES L. PETERSON**

**A DISSERTATION
Presented to the Faculty of
The Graduate College in the University of Nebraska
In Partial Fulfillment of Requirements
For the Degree of Doctor of Philosophy
Department of Entomology**

Under the Supervision of Dr. Kenneth P. Pruess

**Lincoln, Nebraska
January, 1972**

TITLE

BICLOGY AND DRIFT OF AQUATIC INSECTS IN SEASONAL IRRIGATION WATERS

AND THEIR SUSCEPTIBILITY TO ULV MALATHION

BY

JAMES L. PETERSON

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Funds for this study were provided under a grant from the United States Department of Agriculture.

PREVIEW

INTRODUCTION

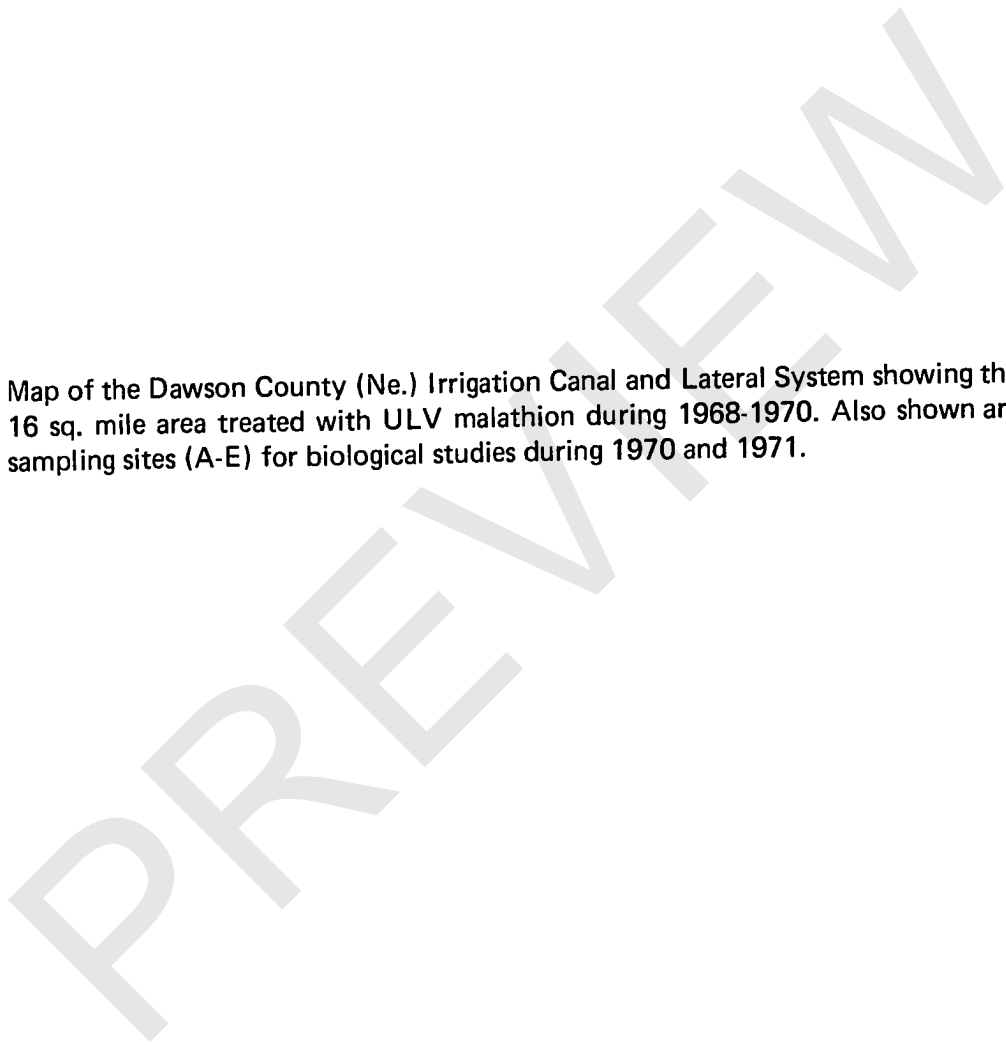
During the summers of 1968, 1969 and 1970, a wide area spray program was carried out in Dawson County, Nebraska aimed at control of the adult western corn rootworm *Diabrotica virgifera* Le Conte. Approximately 16 square miles (9567 acres) were treated with an aerial application of ULV malathion at a rate of 8 fl. oz./acre. Major emphasis was placed on the biological and ecological effects of the treatment on non-target organisms, including pest and beneficial insect species, fish, birds and small mammals. Cooperating agencies included the Entomology Department of the University of Nebraska, the Nebraska Game and Parks Commission and the Fish and Wildlife Service, U.S. Department of Interior.

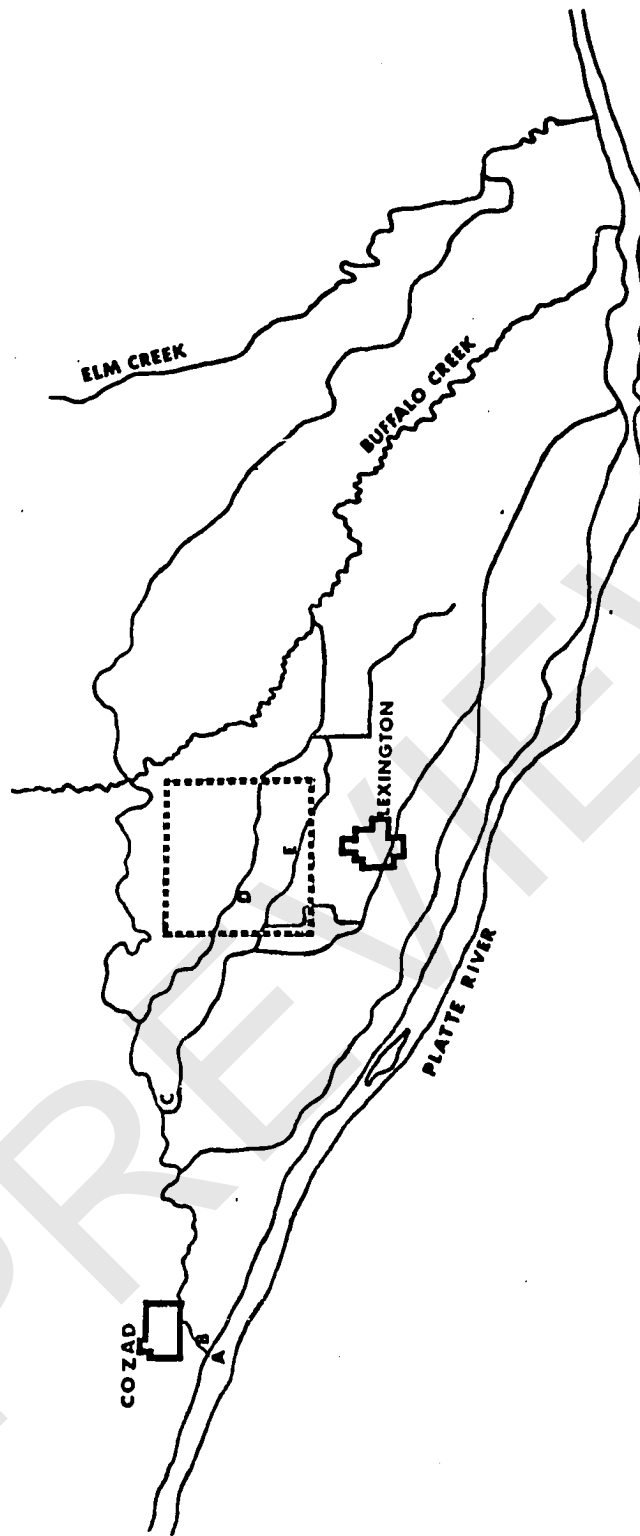
The area chosen for the project is extensively irrigated and a network of irrigation canals runs through the study area. During preliminary survey work for the project early in 1968, it was found that these small canals support substantial populations of aquatic insects. Therefore, as part of overall investigations on the effects of the malathion treatments, research was carried out during the three years of application to evaluate any short or long term effects on aquatic insects.

During early stages of the project, questions were raised regarding the source and life history of the insects in these temporary streams. Water flows in the irrigation canal system only from early May to late September. They are completely dry for the remaining 7 months of the year. Although literature is available on the fate of invertebrates in intermittent streams (as reviewed by Hynes, 1970), the survival of diverse groups of insects from year to year under conditions such as those in the canals would be most remarkable. The source of water for the entire irrigation system did not initially appear to be a good source for insect fauna in the canals. Water is drawn from the Platte River which is characterized by slow current, very shallow depths, and a constantly shifting sand bottom. Sandy substrates have been shown to be relatively undesirable for most aquatic insects and Hynes (1970) states that, "Reticulate channels are often remarkably devoid of living organisms."

Investigations were undertaken to determine 1) the source of the insects in the canal system, 2) the mechanism by which they are transported into the system, 3) some aspects of the biologies of invading insects as related to physical conditions of the canal waters, and 4) possible disruptive influences of the malathion applications.

Fig. 1. Map of the Dawson County (Ne.) Irrigation Canal and Lateral System showing the 16 sq. mile area treated with ULV malathion during 1968-1970. Also shown are sampling sites (A-E) for biological studies during 1970 and 1971.





DESCRIPTION OF THE STUDY AREA

The study area is located in Dawson County, Nebraska. This region of central Nebraska is intensively irrigated and extremely productive, with corn and alfalfa the primary crops. Investigations were concentrated in the irrigation canals which comprise the Dawson County Irrigation Canal and Lateral System (Fig. 1). Built in 1894, the system was gradually expanded through 1932 until it now services approximately 112,000 acres. The main canal is 42 miles long. Primary laterals flow a combined total of 136 miles.

The source of water for the entire system is the Platte River. During most of the year the river is wide and very shallow. Snow melt and spring rains cause flooding annually. The bottom is primarily sand which shifts constantly and at times is capable of rapid formation of large sand bars and small islands. In the area east of North Platte, Nebraska, water from the Platte River is utilized extensively for irrigation. Therefore, flow rates are regulated according to irrigation needs downstream. Water is withdrawn for the irrigation system from May 1 to October 1. The average flow rate of the river during this time is illustrated in Fig. 2.

The main canal of the Dawson County system originates at the river south of Cozad, Nebraska. The diversion structure in the river and the control gates of the main canal are pictured in Fig. 3 and 4. The S-shaped entry to the head gates is designed to reduce drifting of sand into the canal. The need to constantly dredge this area is illustrated by the sand piled on either bank. Fig. 5 shows the main canal as it moves downstream from the head gates. It is evident from the banks here that a great deal of drifting sand still enters the canal system. In fact, the normal mud bottom is covered with sand for a distance of 12-15 miles downstream.

Water is diverted into the main canal during early May and flows continually until mid-to late September. Average flow rates for 1969-1971 are shown in Fig. 6. The peaks in early July and early August indicate major periods of irrigation of corn in this area. Throughout the length of the main canal, water flows approximately 1.0-1.5 ft./ sec. at depths ranging from 2-5 ft. depending upon flow rate. The canal has a flat bed with steeply angled sides. The substrate consists of soft mud throughout most of the system with sand present only in the upper reaches. Concrete chunks have been added in some areas to stabilize banks. The

Fig. 2. Average flow rates in the Platte River south of Cozad, Ne., during the time water is withdrawn for the irrigation canal system.

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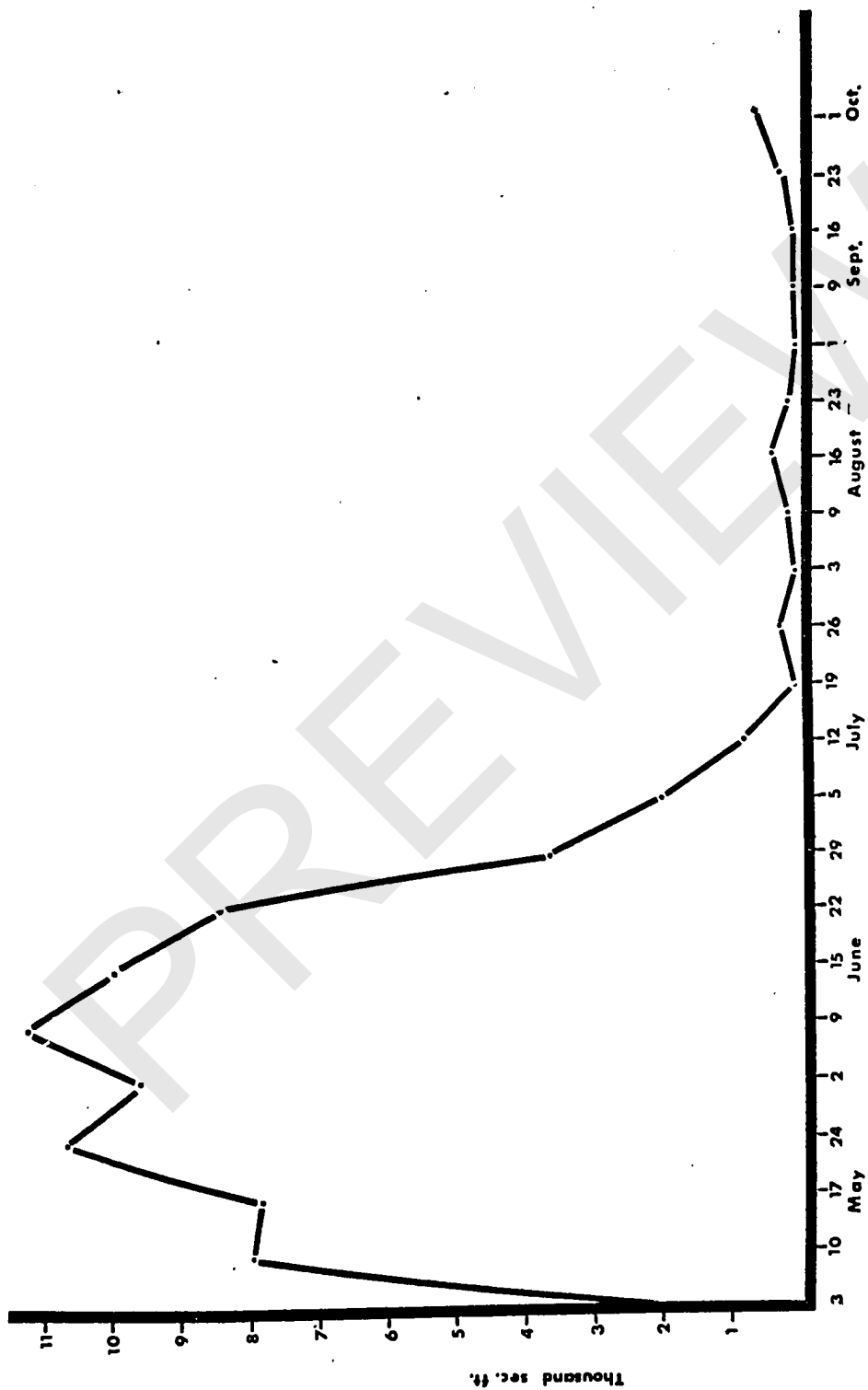


Fig. 3. Diversion structure on the Platte River south of Cozad, Ne., which supplies water for the Dawson County canal system.

Fig. 4. Entry to the head of the main canal of the Dawson County irrigation system showing the control gates which regulate flow into the main canal.



Fig. 5. Downstream view of the main canal at low flow looking north toward Cozad, Ne.

