

# Infections of Orthopterans by *Mermis subnigrescens* Cobb (Nematoda) in Iowa

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## Abstract

The average annual mermithid infection in grasshopper populations in central Iowa is approximately 16 to 17%. Female grasshoppers tend to have a higher incidence of infection than do male grasshoppers. *Mermis subnigrescens* (Cobb) apparently infects only members of the families Acrididae and Tettigoniidae in central Iowa.

## Introduction

*Mermis subnigrescens*, a nematode parasite in the body cavity of orthopterans, has been reported from throughout the northern half of the United States and in southern Canada. Most reports have been incidence reports without any further observations on the biology of the parasite. Some observations on their biology have been made (2, 4, 5, 6).

## Methods and Materials

A preliminary survey in 1964 indicated that the grassy areas of Iowa Lakeside Laboratory in northwest Iowa, and four areas in and near Ames, Iowa, had large populations of orthopterans and a high incidence of *Mermis subnigrescens* infection.

Field collections of insects were made by using a heavy duty insect sweeping bag. Insects brought back to the laboratory were placed in a refrigerator at 0°C for approximately 10 minutes or until they became quiescent. The orthopterans were then separated from other insects and plant material, killed by ethyl ether fumes, dissected with microdissection equipment, and examined for parasites.

In the present study, collections of orthopterans made in Iowa during 1965-1968 involved the dissection and examination of 8,107 orthopterans (Table 1).

TABLE 1. Annual percent infection of Orthopterans by Mermithids in Iowa for the Years 1965-1968.

Year	Number of Orthopterans		% Infected
	Dissected	Infected	
1965	787	140	17.7
1966	1,803	190	10.5
1967	4,282	819	19.1
1968	1,235	212	17.2
Total	8,107	1,361	16.8

## Annual Infections for 1965-1968

Christie (4) examined 2,500 grasshoppers from New Hampshire and found an average infection of mermithids of 12%. Blickenstaff and Sharifullah (1) found 25% infection by mermithids in Missouri. In Quebec, 12 to 23% infection of orthopterans by *Mermis subnigrescens* was recorded (2). A 10-year survey of mermithids near Belleville, Ontario, indicated a 3% annual average and a maximum of 32% in one area (9). A 14% infection in grasshoppers, mostly *Melanoplus femurrubrum* and *M. differentialis*, was reported near Urbana, Illinois, in 1937 (8).

The average annual infection of mermithids in orthopterans in Iowa is approximately 16 to 17% (Table 1). The low percentage in 1966 can be attributed, in part, to the exceptionally dry months of June, July and August of that year. This lack of rain probably prevented deposition of eggs in appreciable numbers, since it is only during or after a rain that gravid female mermithids come to the surface to lay eggs. *Mermis subnigrescens* females which are prevented from coming to the surface to deposit eggs will remain in good condition for several years. When conditions become favorable, these females then lay their eggs (4). The rather high percentage of infection in 1967 indicates that females which were prevented from laying eggs in 1966 probably laid their eggs in 1967. This caused an unusually high number of eggs to be present on vegetation in a normal year and resulted in a higher incidence of infection.

## Host Sex and Infection

Sex of the host and its ability to harbor mermithid infections shows considerable variability. One study showed mermithid parasites in about 45% of female grasshoppers, but in only about 9% of the males (7). Christie (3) found that 10.7% of male Acrididae and 10.2% of the females were infected. In the family Tettigoniidae, he found 19.6% of the males and 14.6% of the females parasitized. Results of this study (Table 2) indicate that the rate of infection according to sex in Christie's study is probably the more normal situation.

TABLE 2. A comparison of infection by *Mermithids* of male and female grasshoppers in Iowa for the Years 1965-1968.

Year	Number of Grasshoppers				% Infected	
	Collected		Infected		Male	Female
	Male	Female	Male	Female		
1965	361	426	66	74	18.1	17.3
1966	864	939	91	99	10.5	10.5
1967	2,229	2,053	390	429	17.5	20.9
1968	510	480	83	87	16.3	18.1
Total	3,964	3,898	630	689	15.9	17.7

## Host Specificity

Two subfamilies of Acrididae, Cyrtacanthacridinae and Oedipodinae and the subfamily Conocephalinae of Tettigoniidae were the principal sources of data studied with reference to natural infection (Table 3).

TABLE 3. A comparison of Mermithid infection in selected subfamilies of Orthoptera.

Orthopteran Hosts	No. Examined	% of Total Orthoptera	% Infected
Cyrtacanthacridinae	2,776	34.2	17.7
Oedipodinae	1,816	22.4	15.0
Conocephalinae	505	6.2	15.3
Other Families	3,010	37.1	16.9

As indicated in Table 3, it appears that the rate of infection with mermithids is approximately equal in the three subfamilies. *Mermis subnigrescens* was found only in the two families, Acrididae and Tettigoniidae. Mermithids, later identified as *Agamermis decaudata*, were found in the family Gryllidae. Experimental attempts to infect individuals of the family Gryllidae (*Acheta assimilis* and *Nemobius sp.*) with *M. subnigrescens* proved unsuccessful in this study.

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