Isolation of Strelkovimermis peterseni, a Mermithid Parasite of Anopheline Mosquitoes in Northeastern New York[1]

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The mermithid *Strelkovimermis* (= *Diximermis*) *peterseni* (Nickle)[3] has potential as a biocontrol agent of anopheline mosquitoes (2). This parasite's occurrence has been reported infrequently, however. In an extensive survey in Louisiana, Petersen and Chapman (1) found this species in only three of several hundred mosquito breeding sites. Other records of collection were in Florida (4) and New York (D. W. Roberts, personal communication). Roberts collected *S. peterseni* for three consecutive summers from an *Anopheles punctipennis* site in Stanfordville, New York. The continued existence of the Stanfordville population is uncertain, however, because the site was washed out, and larvae collected shortly thereafter were uninfected. This paper reports the discovery, collection, and laboratory isolation of *S. peterseni* in Hampton, New York, approximately 175 kilometers north of the Stanfordville site. The results of cross-mating trials between this Hampton population and one from Louisiana are presented. Data on the incidence of infection at the Hampton site are included also.

Isolation and colonization: S. peterseni was found parasitizing *An. punctipennis* larvae in the still headwaters of a spring-fed stream on Route 22A in Hampton, New York, in mid-July 1978. Several hundred larvae were collected and placed in trays containing spring water at ambient room temperature. A 6:1 male to female ratio was recorded among the 515 postparasites that emerged from these larvae. Postparasites were reared in groups of 20–50 in 3.5-cm-d dishes containing 1–2 cm of sand covered by 1 cm of free water. Survival was excellent, as no nematode mortality was observed after rearing for 1½ months. The preparasites produced from these initial cultures were used to infect second instar larvae from a laboratory colony of *An. stephensi*. As a standard rearing procedure, 250 larvae were exposed to 500 preparasites in 25 × 30-cm trays holding 1 liter of spring water at 26(±1) C. One mg of ground rabbit chow per larva was added daily to each tray until commencement of mermithid emergence.

Each tray produced about 90 male and 70 female postparasites, with emergence beginning 6–9 d after exposure. A similar developmental period was reported in the laboratory rearing of a Louisiana popula-

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[3]*Diximermis* Nickle 1972 has been synonymized with *Strelkovimermis* Rubtsov 1969 by Poinar (3).

tion of *S. peterseni* in *An. quadrimaculatus* (1).

The rate of development of a group of postparasites obtained from field-collected mosquitoes and reared at field temperatures (19–23 C) was observed. Twenty-five days after emergence, 25% (29/119) of the males and 31% (4/13) of the females had molted to the adult stage and two of the four adult females had commenced oviposition. At 25 C, Petersen and Chapman (1) observed molting, mating, and oviposition within 9–12 d postemergence.

Parasitism apparently inhibited mosquito pupation, as postparasites were observed to emerge only from larval *Anopheles*. No infections were recorded from dissection of 1,200 *An. stephensi* pupae which had survived preparasite exposure. Petersen and Chapman (1) also noted a lack of pupal parasitism following exposure of *Anopheles* spp. larvae to *S. peterseni*.

The laboratory isolation and colonization of the Hampton population of *S. peterseni* in *An. stephensi* proved to be a simple procedure, and cultures continue to be maintained at our laboratory. Petersen and Chapman (1) reported similar ease of culture of the Louisiana population of *S. peterseni* in *An. quadrimaculatus*.

Cross-mating trials with the Louisiana population: The ability of two geographically distant *S. peterseni* populations to interbreed successfully was determined in tests involving Louisiana males and Hampton females. The virginity of the Hampton females was assured by their isolation following emergence from *An. stephensi*. Ten males and four females were placed in one rearing dish and twenty males and nineteen females in another. Both groups readily mated, oviposited, and produced preparasites. Preparasite virulence was demonstrated in laboratory assays in which they successfully penetrated and developed in *Anopheles* spp. larvae.

Incidence of field infection: Field collections indicated infection in all instars of *An. punctipennis*, with generally higher rates among late instars (Table 1). Overall infection rates ranged from 15 to 55% in individual samples with an average of 1.8 (range, 1–8) nematodes per host. At equivalent rates of *S. peterseni* parasitism (13–58%) in field samples of *An. crucians*, Petersen and Chapman (1) reported an average of 6 nematodes per host (range, 1–15).

Since preparasites of the Hampton population had a mean midbody width of 11 μm (range, 11–12 μm), parasitic *S. peterseni* juveniles with a midbody width of ≤ 30 μm were considered to have invaded their hosts only recently. An examination of the early development of *S. peterseni* juveniles in *An. stephensi* larvae supported this hypothesis. Measurements of early-stage juveniles demonstrated that infection had occurred in all instars (Table 2). The greatest numbers of early-stage parasites were found in midsized larvae, particularly second instars. First and fourth instars appeared to be less susceptible to penetration.

A larval population of *Culex territans*

Table 2. Percentages of field-collected *An. punctipennis* larvae infected with small parasitic juveniles* of *S. peterseni*.

Instar	Percentage infection (No. infected/no. examined)	
	21 July	31 July
1	0.0 (0/4)	7.1 (1/14)
2	17.9 (5/28)	17.6 (9/51)
3	20.0 (9/45)	0.0 (0/40)
4	8.9 (4/45)	0.0 (0/30)

*Midbody width ≤30 μm.

Table 1. Percentage of field-collected *An. punctipennis* larvae infected with *S. peterseni*.

Sampling date	Percentage infection (1–4 instars)	Percentage infection of four mosquito instars (No. infected/no. examined)			
		1	2	3	4
21 July	54.9	0.0 (0/4)	32.1 (9/28)	57.8 (26/45)	71.1 (32/45)
31 July	14.8	7.1 (1/14)	21.6 (11/51)	7.5 (3/40)	16.7 (5/30)
25 August	19.3	6.7 (3/45)	22.7 (5/22)	30.8 (4/13)	62.5 (5/8)

was also present at the Hampton site, but no mermithid parasitism was recorded among 171 (1–4 instars) collected on 21 July. This was not unexpected, since infection of culicine larvae by *S. peterseni* has never been reported.

This paper represents the second record of *S. peterseni* in *An. punctipennis* in eastern New York. Since we found the nematode after sampling only a few *Anopheles* sites, it is probable that *S. peterseni* is widely distributed in this region. High rates of infection at the Hampton site were observed throughout the summer of 1979, indicating that the population is well established. The pressure on the host population is significant, and the Hampton site appears to be a good example of *S. peterseni*'s biocontrol potential.

LITERATURE CITED

1. Petersen, J. J., and H. C. Chapman. 1970. Parasitism of Anopheles mosquitoes by a Gastromermis sp. (Nematoda: Mermithidae) in southwestern Louisiana. Mosq. News 30:420-424.

2. Petersen, J. J., and O. R. Willis. 1973. Diximermis peterseni (Nematoda: Mermithidae): a potential biocontrol agent of Anopheles mosquito larvae. J. Invertebr. Pathol. 24:20-23.

3. Poinar, G. O., Jr. 1979. Nematodes for Biological Control of Insects. CRC Press, Boca Raton, Florida.

4. Savage, K. E., and J. J. Petersen. 1971. Observations of mermithid nematodes in Florida mosquitoes. Mosq. News 31:218-219.