Research Note

First observation of the vector of *Dirofilaria immitis* in Hokkaido, Japan

Kenji MIYAMOTO

Department of Parasitology,
Asahikawa Medical College, Nishikagura,
Asahikawa 078, Japan

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The incidence of dog heartworm, *Dirofilaria immitis*, infection has been reported in about 26.4% of the dogs in Asahikawa city, Hokkaido (Miyamoto and Kutsumi, 1978), and dirofilariasis has recently begun to increase (36.0%) in dogs of the same area (Miyamoto *et al.*, 1987). This worm is found not only in dogs but also in humans and many cases of human dirofilariasis have been reported throughout the world, including Japan.

Aedes togoi is a notorious vector of this parasite on the main island of Japan (Inoue, 1937; Keegan *et al.*, 1967), but the vector has never been reported in Hokkaido. For this reason, attempts to discover the vector were carried out.

Mosquitoes were collected in 1985 and 1987 by a dog baited trap method. Between June and September of those years dogs were kept overnight (18:00 to 9:00) at the kennel of Asahikawa Medical College to attract mosquitoes. The mosquitoes collected were identified as a single species, *Culex pipiens pallens*. Individual mosquitoes were divided into head, thorax and abdomen on a slide-glass and examined microscopically.

In 1985, a total of 293 mosquitoes were collected from middle July to early Septem-

ber in 20 collections (Table 1). Ten out of 72 mosquitoes in late July were infected, one of which contained a second stage larva (Fig. 1) and 9 with microfilaria (Mf). Seven out of 78 mosquitoes collected in early August were infected with Mf. Four out of 124 collected in middle August were infected: first stage larvae were found in one and second stage larvae in three.

In 1987, 262 specimens were collected from early July to early September in 18 collections. Two out of 63 mosquitoes collected in early August were infected with the second stage larvae.

It has been said that the maturation of larvae to the 3rd stage in the vector occurred in minimum of 27 days at 18°C (Jankowski and Bickley, 1976), and also the optimum developmental temperature was 22.5–26.5°C without development at 14.5°C (Christensen and Hollander, 1978).

In the summer season of Asahikawa maximum temperature rises to 25°C. Therefore, it is possible to induce development of the larvae.

Meanwhile, Mf of *D. immitis* was first found in two out of 84 dogs in Wakkanai city, the northernmost part of Hokkaido, in 1985 and 1986 surveys (Miyamoto *et al.*, 1987). But the activity of the vector and development of the larvae may be suppressed due to the lower environmental temperature in Wakkanai city than in Asahikawa city during the summer season (Fig. 2).

Sasa *et al.* (1976) suggested that the potential vectors of this parasite in Hokkaido could include 10 species (*Culex pipiens molestus*, *C. p. pallens*, *C. tritaeniorhynchus*, *Aedes cinereus*, *A. excrucians*, *A. punctor*, *A. stricticus*, *A. togoi*, *A. vexans* and *Anopheles sinensis*). Although *A. togoi* distributes around the coastal areas of Hokkaido, none of this species has been collected from inland areas like Asahikawa city.

C. p. pallens was earlier confirmed as the main vector of dirofilariasis in Nagasaki city, Kyushu (Suenaga and Itoh, 1973).

From this study, the author believes that *Culex pipiens pallens* plays a role as a vector of dirofilariasis in Hokkaido, especially in inland areas.

Table 1 Detection of *Dirofilaria immitis* larvae in mosquitoes *Culex pipiens pallens* collected from the campus of Asahikawa Medical College.

Month		1985		1987	
		No. examined	No. infested	No. examined	No. infested
Jun.	early	0		0	
	middle	0		0	
	late	0		0	
Jul.	early	0		1	0
	middle	13	0	1	0
	late	72	10 (9=mf, 1=2nd)	41	0
Aug.	early	78	7 (7=mf)	63	2 (2=2nd)
	middle	124	4 (1=1st, 3=2nd)	111	0
	late	5	0	30	0
Sep.	early	1	0	15	0
	middle	0		0	
	late	0		0	
Total		293	21	262	2

Fig. 1 Larva in malpighian tube of *Culex pipiens pallens* (A) and second stage larva ($495 \times 50 \mu\text{m}$) of *D. immitis* in the vector (B).

Fig. 2 Comparison of temperature in Asahikawa and Wakkanai cities, 1982.

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摘 要

北海道における犬糸状虫の伝播蚊

北海道の犬糸状虫媒介者を決定するため、1985年と1987年に旭川医科大学構内犬舎で犬おとり法により蚊を採集した。その結果、両年とも7月下旬と8月上旬に採集したアカイエカのマルピギー氏管内で发育中の第Ⅱ期幼虫を検出できた。第Ⅲ期幼虫は発見できなかったが、本アカイエカは北海道、とくに旭川で重要な媒介者と推定した。