

Mesocyclops of Vietnam

Part I –Laboratory Evaluation as Biological Agent for Control of *Aedes aegypti*

By

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Abstract

Nine species of Mesocyclops reportedly present in Vietnam have been widely distributed; especially they are naturally present in certain drinking water containers such as concrete tanks, wells and jars. Mesocyclops can survive and develop in normal conditions and are good predators of first instars of *Aedes aegypti* larvae, the major vector of dengue fever/dengue haemorrhagic fever in Vietnam. In laboratory, a single Mesocyclops can kill the first-instar of *Aedes aegypti* larvae (on average) up to 41 by *M. pehpeiensis*, 37 by *M. aspericornis*, 31 by *M. woutersi*, 22 by *M. thermocycloides*, 21 by *M. affinis* and 16 by *M. ogunnus* during 24 hours. The studies suggest that Mesocyclops hold high potential as a biological agent for the control of *Aedes aegypti*.

Key words: Mesocyclops, Dengue haemorrhagic fever, *Aedes aegypti*, biological control, Vietnam

Introduction

In Vietnam, dengue fever/dengue haemorrhagic fever (DF/DHF) has currently become an important health problem. During the recent five-year period 1994-1998, the number of reported cases and the

incidence rate increased considerably. The number of cases reported were 44,944 (1994); 80,447 (1995); 74,569 (1996); 107188 (1997), 235000 (1998) while the incidence rate per 100,000 population was

65.8 (1994), 115.5 (1995), 105.0 (1996), 148.9 (1997) and 312.3 (1998). *Aedes aegypti* is the main vector of DF/DHF virus transmission in Vietnam. Recent studies indicate that insecticide spraying had a very limited effect, considering its cost and impact on the environment^(1,2). Mesocyclops, has drawn attention as a biological agent during the recent years for the control of *Aedes aegypti* larvae in some countries, e.g. Tahiti, French Polynesia, Honduras, Brazil, Mexico, Puerto Rico, Australia and Trinidad⁽¹⁾. In Vietnam, the predatory capacity of Mesocyclops was first detected in 1989. The present study lists the species prevalent in Vietnam and their laboratory evaluation as biological agents for the control of *Aedes aegypti*.

1989 through 1998 in the Laboratory of Entomology, Institute of Hygiene and Epidemiology, Hanoi.

Nets with mesh size of 200 µ were used to collect Mesocyclops from 458 different water containers such as ponds, lakes, wells, concrete tanks, clay jars and ornamental aquaria. Species were identified in the Natural Museum, Washington D.C., USA, the Zoo Museum, Warsaw, Poland, and the Laboratory of Entomology, Institute of Hygiene and Epidemiology, Hanoi.

In the laboratory, the predatory capacity of Mesocyclops species was studied in 325 experiments, based on larval survival counts within 24 hours after the release of 50 first instars *Aedes aegypti* larvae and one Mesocyclops into a glass container of 500 ml capacity.

Materials and methods

Research studies had been conducted during

Table 1. Species of Mesocyclops and their distribution by water containers in Vietnam

S.No.	Mesocyclops species	Natural Habitat			Artificial Habitat						Total
		Pond/lake	River	Rice-field	Tank	Jar	Drum	Discard	Aquarium	Well	
1.	<i>M. affinis</i>	6	1	1	9	1	-	-	-	7	25
2.	<i>M. aspericornis</i>	4	2	1	21	5	3	1	-	6	43
3.	<i>M. ogunnus</i>	6	2	2	17	1	-	-	1	4	33
4.	<i>M. pehpeiensis</i>	5	-	-	34	7	-	-	4	38	88
5.	<i>M. thermocycloides</i>	20	2	-	12	13	-	-	1	1	49
6.	<i>M. woutersi</i>	22	-	1	129	19	4	-	5	34	214
7.	<i>M. ferjemurami</i>	1	-	-	-	2	-	-	-	1	4
8.	<i>M. yena</i>	-	-	-	1	-	-	-	-	1	2
9.	<i>M. dissimilis</i>	1	-	-	-	-	-	-	-	-	1
	Total	64	7	5	223	48	7	1	11	92	458

Table 2. Geographical distribution of *Mesocyclops* by province in Vietnam

Province	M. woutersi	M. aspericornis	M. thermocyclopoides	M. pehpeiensis	M. affinis	M. ogunnus	M. yenaе	M. ferjemurami	M. dissimilis	No of species
Northern										
Lang Son	+	+	+	-	-	+	-	-	-	4
Quang Ninh	+	+	+	+	-	-	-	-	-	4
Bac Ninh	+	+	+	+	-	-	-	-	-	4
Bac Giang	+		+	-	+	+	-	-	-	4
Phu Tho	+	+	+	+	+	-	-	-	-	5
Vinh phu	-	-	-	-	-	-	-	-	+	1
Ha Noi	+	-	+	+	-	-	-	-	-	3
Hai Duong	+	-	-	+	-	-	-	-	-	2
Hung Yen	+	+	+	+	+	-	-	-	-	5
Hai Phong	+	-	-	+	+	+	+	-	-	5
Ha Tay	+		+	+	+		-	-	-	4
Nam Dinh	+	+	+	+	+	+	-	-	-	6
Thanh Hoa	+	-	-	+		-	-	-	-	2
Central										
Nghe An	+	+	-	+	+	-	-	-	-	4
Ha Tinh	-	-	+	+	+	-	-	-	-	3
TT-Hue	+	+	-	+	+	+	+	-	-	6
Da Nang	+	+	+	+	+	+	-	-	-	6
Khanh Hoa		+	+	+	+	+	-	+	-	6
Ninh thuan	+		+	-	-	+	-	+	-	4
Dac Lac	+	+	-	+	-	-	-	-	-	3
Southern										
Dong Nai	-	+	+	-	+	-	-	-	-	3
H.C.Minh	+	+	-	+	+	-	-	-	-	4
Can Tho	-	+	+	-	-	-	-	-	-	2
Tien Giang	-	+	-	-	-	-	-	-	-	1
Kien Giang	-	+	-	-	-	-	-	-	-	2
Ca Mau	-	-	-	-	-	+	-	-	-	1
Total	18	16	16	17	13	9	2	2	1	

Results

Mesocyclops species and their distribution

From 1989 up to 1998, a total of 458 copepod samples were collected from different water containers. Fifteen species comprising 5 genera were identified, which included 9 species of *Mesocyclops*. The results are presented in Table 1.

The geographical distribution of *Mesocyclops* is presented in Table 2. Data in Tables 1 and 2 show that 6 out of 9 species had been widely distributed in different localities and water containers, and were available in drinking water containers as well. Every inspected province had at least 1 species and a maximum of 6 species.

Laboratory studies

Predatory capacity of *Mesocyclops* to *Aedes aegypti* larvae

Among the detected nine species, six were confirmed to be predatory to *Aedes* larvae. In the laboratory, these six species were tested for their predatory capacity to *Aedes aegypti* larvae (Table 3). They were *M. woutersi*, *M. pehpeiensis*, *M. aspericornis*, *M. thermocyclopoides*, *M. affinis* and *M. ogunnus*. The results also showed that *Mesocyclops* had not only eaten but also killed the *Aedes* larvae. Different species had different eating and killing capacities. During the same period of time, a *M. pehpeiensis* ate less (11.7) but killed more (29.9) larvae than other species, resulting in the highest predatory capacity, followed by *M. aspericornis* and *M. woutersi*. Experiments showed that a population of primary 10 *Mesocyclops*, after one month, could kill at least 350 first instar *Aedes aegypti* larvae per day during 10 days (every day 350 larvae had been added, and no one could survive after 24 hours).

Table 3. Predatory capacity of *Mesocyclops* to *Aedes aegypti* larvae - First instar

Species	No. of experiments	No. of <i>Ae. aegypti</i> larvae used	Average No. of larvae eaten by <i>Mesocyclops</i> in 24 hours	Average No. of larvae killed in 24 hours	Total
<i>M. woutersi</i>	75	3750	20.57	16.03	36.60
<i>M. pehpeiensis</i>	40	2000	11.70	29.90	41.30
<i>M. thermocyclopoides</i>	50	2500	9.58	12.48	22.06
<i>M. affinis</i>	50	2500	11.30	10.42	21.72
<i>M. aspericornis</i>	60	3000	23.75	13.43	37.18
<i>M. ogunnus</i>	50	2500	8.48	7.54	16.02
Control	20	1000	0	1.40	1.40

Discussion and conclusion

From 1989 through 1998, there were nine species of *Mesocyclops* reported for the first time in Vietnam^(3,4). This is a good piece of information for people working on copepods, especially using them for biological control. Previous authors^(5,6) had reported the presence of only one species of *Mesocyclops* (*M. leuckarti* (Claus)). The work of Maria Holynska⁽⁷⁾ showed that 21 species of *Mesocyclops* had been detected in Asia; therefore, new species were expected in Vietnam. *Mesocyclops* were naturally available in the drinking water containers of people (83.0% of the collected *Mesocyclops* samples). That is in contrast with other developing countries and is the most important factor to promote the use of *Mesocyclops* for dengue vector control in Vietnam. Results obtained in laboratory conditions showed that the predatory capacity of *Mesocyclops* for the control of *Aedes aegypti* was very high. Among the six species tested, *M. pehpeiensis* had the highest predatory capacity.

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