RESEARCH NOTE

Biological Control of *Aedes albopictus* (Diptera: Culicidae) Larvae in Trap Tyres by *Mesocyclops longisetus* (Copepoda: Cyclopidae) in Two Field Trials

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Cyclopid copepods have been evaluated and used in at least six countries as biological control agents for container-breeding *Aedes* larvae (GG Marten 1990 *J Am Mosq Control Assoc 6*: 681-688, B Kay et al. 1992 *J Med Entomol 29*: 599-692). Three copepod species have received more attention: *Macrocyclops albidus*, *Mesocyclops aspericornis* and *Mesocyclops longisetus*. The last species has been pointed out as the most effective not only due to its higher voracity as a predator but also due to a best survival capacity in the absence of mosquito larvae. Some control studies have been carried out involving community participation in the distribution of copepods (E Fernadez, R Soto 1991 *J Am Mosq Control Assoc 7*: 633-645). Moreover, some evaluations have revealed the feasibility of spray applications of copepods through conventional equipament (GG Marten 1991 *J Am Mosq Control Assoc 6*: 689-693). In late 1991 one strain of *M. longisetus* was obtained by the first two authors in Campinas, State of São Paulo, and maintained under laboratory cultures at the Departament of Zoology/ Universidade Estadual de Campinas (UNICAMP).

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This strain (ML/01) was screened against *Culex quinquefasciatus* and *Ae. albopictus* larvae and appeared to be more effective against the latter species (unpublished data). The aim of the present study was to evaluate the predation capacity, survival and reproduction of *M. longisetus* strain ML/ 01 in trap tyres, as a requisite for its possible use as a control agent in the attract and kill method.

Two field evaluations were performed. In the first one, ten couples of trap tyres were distributed throughout an area of 245 ha in the UNICAMP campus. Each pair of traps was installed in a shady place fixed to trees surrounded by vegetation. These sites were shown to be successful in capturing *Ae. albopictus* in previous monitoring programs. One tyre in each pair received 20 *M. longisetus* adults in 2.5 liters of tap water and 3% (v/v) of water from the mosquito breeding trays as food for the microcrustaceans. The second tyre received the same treatment except for the copepods and was considered as control. Predation was evaluated during 10 days in 2 day intervals. In a second trial 20 tyres were placed in pairs as before, but the traps with copepods in this trial were 1/3 sections of the whole tyres, in order to enable easier collection of the copepods at the end of the experiment. Moreover, the volume of water was established as 2 liters and the added food was increased to 20% (v/v). Slices of polystyrene were placed floating on the water in order to serve as resting and oviposition sites for adult mosquitoes. The mosquito cohorts and copepod predation in this second trial were evaluated during 32 days in 2 day intervals.

At each evaluation the water of traps without copepods was transferred to pots and the mosquito larvae were collected for counts and identification in the laboratory. The water in the tyres with copepods was accessed *in situ* for the presence of mosquito larvae. Only larvae in the two last instars were removed for identification since predation occurs upon the two first instars. Both evaluations received the same sampling method.

At the end of both trials, the copepod-containing samples were collected in order to access final amount of adult copepod, amount of imature forms (copepodids) and reproductive females with egg sacs. Mosquito cohorts naturally colonized the traps along all the experiments with *Ae. albopictus* representing 99.2% of the traped larvae.

In the first trial the mean number of mosquito larvae found per trap was 15.1 per 2 days for untreated traps and 0.4 per 2 days for treated traps, resulting in a mean control efficiency of 97.5%. Copepod reproduction was shown to be low. In only 2 of the 10 traps reproductive females were observed ($\overline{X}$=1.5), with copepodids (n=2) occurring in only one of those traps. Copepod survival ranged from 0 to 85% in the traps. In 4 of 10 tyres no copepods could be recovered at the end of the trial but despite this, mosquito larvae occurred in only one of those traps. Although not accessed, we believe that copepod mortality occurred at the end of the trial. It could be preliminarily concluded that copepod survival and reprodution should be increased in such traps.

In the second trial the number of mosquito larvae found in untreated traps averaged 18.1 per 2 days while for treated traps the average was 0.3 per 2 days, resulting in a final mean control efficiency of 98.1%. Only two of 10 traps produced full grown mosquito larvae during the trial, and only one trap produced such larvae during all the trial span. This might be explained considering that both these tyres contained only one copepod at the end of the experiment. Due to the larger amount of initial food, the mean copepod reproduction in this trial was found to be greater than in the first one, represented by 8 of 10 traps with reproductive females ($\overline{X}$=15) and 6 of the 10 traps with immature forms ($\overline{X}$=58). Copepod mortality occurred in only 3 traps ranging from 40 to 95%.

The attract and kill method has been widely used against many agricultural pest in management programs and could be improved against urban *Aedes* mosquitoes. Despite the relative success of the evaluated *M. longisetus* strain against *Ae. albopictus* larvae, a close monitoring of such traps seems to be imperative to assure permanent control. The use of this method of mosquito control in areas where trained employees or community members could act as monitors is suggested. Environments such as cemiteries, public parks, closed condominiums and school campuses could be greatly benefited by this attract and kill method of mosquito control.