

CONTROL DEMONSTRATION OF THE RICEFIELD BREEDING MOSQUITO  
*ANOPHELES ACONITUS* DONITZ IN CENTRAL JAVA, USING  
*POECILIA RETICULATA* THROUGH COMMUNITY PARTICIPATION .  
3. FIELD TRIAL AND EVALUATION\*

Sustriayu Nalim<sup>1</sup>, Damar Tri Boewono<sup>1</sup>, Arief Haliman<sup>2</sup>  
dan Elias Winoto<sup>2</sup>

ABSTRAK

Suatu penelitian dilakukan untuk menjajagi kemungkinan menggunakan minapadi sebagai cara pemberantasan nyamuk *Anopheles aconitus*. Minapadi dilakukan dengan ikan *Cyprinus carpio*. Dengan tersedianya air di sawah untuk ikan, ikan pemakan jentik *Poecilia Reticulata* yang ditebarkan dapat hidup pula. Penebaran dilakukan oleh masyarakat. Hasil Penelitian ini menunjukkan bahwa melalui minapadi yaitu dengan penebaran ikan *P. reticulata* pada kepadatan 2 ekor/m<sup>2</sup>, populasi *An. aconitus* selama 5 tahun dapat diturunkan sebanyak 99,7% dan S.P.R. malaria sebanyak 98,8%.

INTRODUCTION.

A study was conducted to explore the feasibility of controlling the malaria vector *Anopheles aconitus* Donitz in ricefields through release of the larvorous fish *Poecilia reticulata*. Farmers were encouraged to breed *Cyprinus carpio* in ricefields for consumption, or other commercial purposes. *Poecilia reticulata* synchronously released with *Cyprinus carpio* to control mosquito larvae in ricefields, could thrive well in the ricefields. Details on the study such as, study design, farmers encouragement, biological studies on fish and mosquito larvae, were discussed in former papers<sup>1</sup>

This paper will report the final activities, results, and prospects for further implementation of this technique in other villages, through coordination of the local government.

MATERIALS AND METHODS

Detailed information on the area is described in the first paper. The final evaluation was conducted after enough brood was available to fulfill the needs of approximately 112 farmers, working in 24,8 ha wetland.

Mass breeding of *Cyprinus carpio* and *Poecilia reticulata*.

To fulfill the needs of 112 farmers cultivating in 24,8 ha of wetland, mass breeding was conducted:

- Mass breeding of *Poecilia reticulata* :  
Two ponds of 4 x 2 m<sup>2</sup> were provided for mass breeding of *Poecilia reticulata*. This pond was tended by the local fishery official.
- Mass breeding of *Cyprinus carpio*  
Nine ponds of appr. 6 x 4m<sup>2</sup> were hired for mass breeding of *Cyprinus carpio*. Approximately 103 adult stock

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1. National Institute of Health Research and Development, Ministry of Health, Ungaran, Indonesia.  
2. Regency Health Service, Banjarnegara Regency, Central Java.

was used for the mass breeding.

Since farmers did not have the experience to mass breed *Cyprinus carpio*, the fishery official, in cooperation with village officials, supervised by the village head, bred the *Cyprinus carpio*. Fish was provided with local fish food. Ponds were classified as ponds for females, ponds for egg-laying, ponds for males and ponds for the brood respectively 2 plots, 1 plot, 2 plots and 4 plots.

#### Distribution of fish to the farmers.

To avoid mishandling of the fish, fry was distributed by the fishery official to respective farmers, *Cyprinus carpio* at a density of 9/10m<sup>2</sup> and *Poecilia reticulata* at a density of 2/m<sup>2</sup> (previous studies showed that these were appropriate densities both for development of *Cyprinus carpio* and larvivorous potential of *Poecilia reticulata*).

#### Evaluation of mosquito densities in ricefields.

Emergence traps were placed at random in the ricefields in the treated and control area. In each area 40 traps were placed. The traps were observed daily and moved every three days to avoid creation of specific habitats.

Details of the traps are discussed elsewhere<sup>1</sup>.

The traps were placed continuously during planting seasons for five years. Data obtained was summarized yearly, since specific fluctuations depended on riceplanting.

#### Evaluation of malaria incidence.

The malaria incidence was monitored by the Regency Health Department, since in malaria endemic areas, active

case detection is implemented as a regular policy.

Data used in this study was taken from this routine monitoring and compared for 5 years in the control as well as the treated area.

## RESULTS AND DISCUSSION.

Total area and number of farmers participation.

Until the final observations only 96,4% of the total 24,8ha were included for the study. The area denoted above reflects the total number of farmers participating. Out of the 112 farmers recorded in the beginning of the study, only 92 (82,14%) participated in the fish culture in ricefields.

Problems encountered in determining the number of farmers actively participating in the program was that not all farmers owned the land that they cultivated. Farmers owning the land totalled only 85% of the total number of farmers registered in this area. Quite often farmers changed plots or plots changed workers.

Mass breeding of *Poecilia reticulata* and *Cyprinus carpio* and its distribution to the farmers.

#### *Poecilia reticulata*.

The number of *Poecilia reticulata* distributed for the ricefields was a total of 478,000 fish. Ponds of mass breeding yielded more than the required numbers. After distribution to the ricefields, ponds for breeding still retained enough stock for future distribution (see Table 1).

Table 1. Summary of farmers participation and distribution of fish.

Farmers participation	Number of farmers	Area used in study	C. carpio distributed	C. carpio* harvested	P.reticulata distributed
Farmers with/ no individual ponds	52	13,8 ha	124200 fish	12400 kg	276000
Farmers owning individual ponds	40	10.1 ha	50000+ 40900 fish**	9090 kg	202000

\* Fingerlings distributed 3 months old.

\*\* C. carpio distributed in ricefields from individual ponds.

### *Cyprinus carpio*

A total number of 762,000 fingerlings were available for distribution. Since only 174,200 fingerlings were needed, the remaining fingerlings were distributed to farmers ponds to be reared into adults (see Table 1).

The fishery officials carried both *Poecilia reticulata* as well as *Cyprinus carpio* to the farmers field plots. Every farmer was supplied with both species as requested. The distribution took approximately 3-5 days to fulfill the needs of the requesting farmers.

### Evaluation of mosquito densities in ricefields

Mosquito emergence figures summarized yearly for averaged daily emergence showed a decrease in five years of 59,71%. *Anopheles aconitus* emergence figures summarized for five years decreased by 99,7%. In 1982, a long drought decreased the *Poecilia reticulata* population and the stock

was reseeded.

A slight increase occurred in the mosquito emergence figures which decreased again after reseeded of larvivorous fish. The control area was sprayed once with fenitrothion at the end of 1982 due to rising mosquito population densities. However mosquito emergence figures in the control area remained higher than the treated area. In the trial area no other intervention methods were used for mosquito control and the decrease in mosquito densities reveals the impact of the release of larvivorous fish. A similar study conducted in India<sup>2</sup> of fish release in wells also revealed satisfactory results. In this study, periodical reseeded of fish was necessary. The ricefields due to its flooding and drying pattern for proper ricegrowth is reseeded every new planting season, through coordinated distribution by the local fishery official.

Table 2. Number of mosquitoes collected in traps averaged per year.

Species	Y e a r											
	1979		1980		1981		1982		1983**		1984	
	fish seeded	con-trol	fish seeded	con-trol	fish seeded	con-trol	fish seeded	con-trol	fish seeded	con-trol	fish seeded	con-trol
<i>An. aconitus</i>	3.35	2.4	0.4	3.1	0.2	4.2	0.1	2.1	0.2	1.8	0.01	1.2
<i>An. barbirostris</i>	6.0	7.6	4.7	7.6	4.7	6.0	2.9	3.0	4.7	3.0	2.9	3.2
<i>An. annularis</i>	3.35	3.0	2.25	4.2	1.13	4.2	0.7	1.2	1.02	1.2	0.7	2.2
<i>Cx. fuscocephalus</i>	0.12	1.2	0.7	0.9	0.7	1.2	0.9	0.9	0.5	0.8	0.4	0.9
<i>Cx. vishnui</i>	0.7	0.9	0.4	0.7	0.2	0.9	0.1	0.2	0.2	0.7	0.1	0.6
<i>Cx. bitaeniorhynchus</i>	5.0	4.97	5.07	4.79	4.35	5.0	3.35	3.3	4.35	3.8	3.35	3.75
Total	18.52	20.07	13.52	21.47	11.28	19.95	7.55	10.7	10.97	11.3	7.46	11.85

\*. Number of mosquitoes/m<sup>2</sup>/day (trap area = 0,25 m<sup>2</sup>).

\*\* Long drought, *Poecilia reticulata* breeding ponds reseeded.

### Evaluation of malaria incidence.

Regular routine monitoring of malaria cases conducted by the local Health officials (CDC) revealed a drop in the slide positive rate in five years. Yearly observations in S.P.R. showed a gradual decrease from 16.49%-6.46% the first

year, till 0.2% five years after the first fish release. Routine monitoring was conducted through active case detection and cases detected were treated with chloroquine. This was done for the treated as well as the trial area, and the effect of fish culture in ricefields is shown by the decrease in S.P.R. in the trial area.

Table 3. Malaria Slide Positive Rates for Pagak (treated) and Purwonegoro (control) area averaged per year.

Villages	Y e a r					
	1979	1980	1981	1982	1983	1984*
P a g a k	16.49	6.46	3.12	0.24	0.49	0.2
Purwonegoro	2.98	10.12	4.96	2.25	3.07	3.36

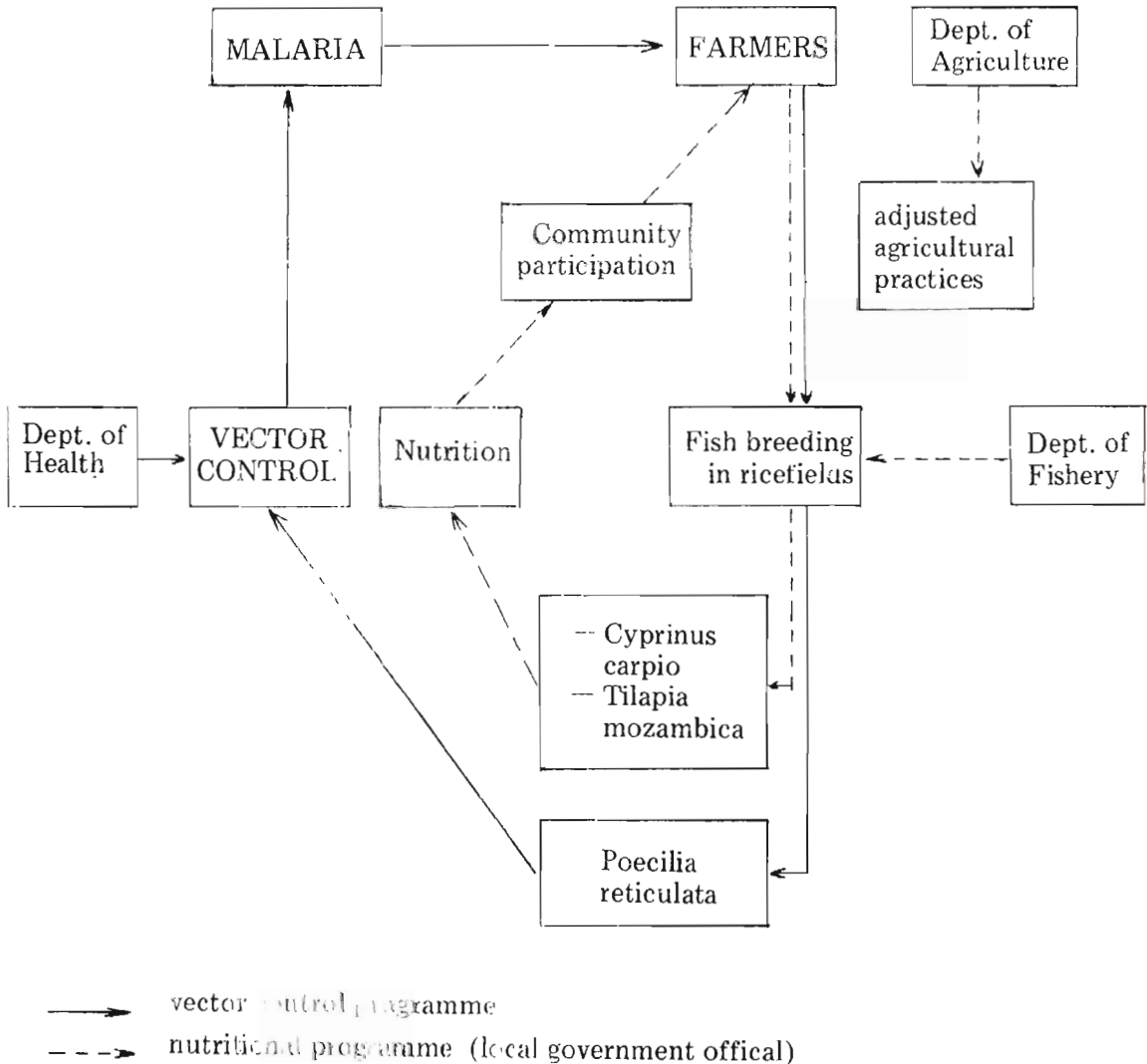
\* Malaria data analyzed until June 1984

**Prospects for further implementation of fish breeding in ricefields.**

Following the final evaluation, results obtained were discussed in a meeting between the various parties involved in the trial. This meeting was held at the regency level between the Health Department, the Agricultural Department to

coordinate activities in the respective villages.

Plans are made to implement this technique in various other malarious villages. Considering the extra yield of fish from the ricefields, even nonmalarious villages will implement this fish breeding technique, which indirectly will result in larval control in ricefields (see Fig.1).



**Figure 1. Flowchart of interdepartmental cooperation in biological control in ricefields using larvivorous fish**

## CONCLUSION

1. *Poecilia reticulata* introduction and breeding in Pagak village has lowered mosquito population densities, especially of *An. aconitus*, the malaria vector.
2. The introduction of *Cyprinus carpio* breeding in ricefields has stimulated farmers to cultivate fish in ricefields, thus creating a favourable habitat for *Poecilia reticulata*, the larvivorous fish.
3. Malaria cases in Pagak village have dropped drastically after fish introduction and culture in ricefields, and no further outbreaks have been reported after the trial was concluded.

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