# CONTROL DEMONSTRATION OF THE RICEFIELD BREEDING MOSQUITO *ANOPHELES ACONITUS* DONITZ IN CENTRAL JAVA, USING *POECILIA RETICULATA* THROUGH COMMUNITY PARTICIPATION : 1. EXPERIMENTAL DESIGN AND CONCEPT *

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## ABSTRAK

Penelitian dilakukan untuk menjajagi cara memberantas vektor malaria *Anopheles aconitus* di sawah dengan ikan pemakan jentik *Poecilia reticulata.*

Dalam penelitian ini terlihat bahwa dalam pelaksanaan program pemberantasan ini, partisipasi petani untuk mina padi dapat digalakkan melalui rapat kelompok tani. Program mina padi menyediakan tempat hidup bagi ikan pemakan jentik.

Rencana pelaksanaan program ini serta cara penggalakan petani dibicarakan dalam makalah ini.


## INTRODUCTION

Banjarnegara regency has been highly endemic for malaria for many years. Control of malaria is performed by routine DDT spraying twice a year. However, DDT resistance, first reported in Central Java in 1965 (Soerono, et. al., 1965) also occured in Banjarnegara regency, causing a constant high prevalence of malaria cases regardless of the routine spraying operations with DDT.

To improve vector control methods, several methods have been suggested, among which the use of larvivorous fish was found promising (WHO, 1982). Larvivorous fish have been used for mosquito control in Indonesia in the past, however no systematic studies have been conducted to evaluate the efficacy of fish in control of the malaria vector.

In the present study, an attempt was made to investigate the feasibility of using the larvivorous fish *Poecilia reticulata* to control vector mosquitoes breeding in ricefields, involving community participation in fish culture (Consumptive and larvivorous). This paper will discuss the biological control concept and activities involved to stimulate community participation.

## DESCRIPTION OF THE STUDY AREA

Pagak village with a population of 2644, was selected for this trial. It is located in Banjarnegara regency at an altitude of 200 - 300 m. (Fig. 1). Malaria was endemic in this village with a SPR of 45.2 % in 1979.

Rice culture is performed once a year in 85.2 ha of land with rotation to dry crops. In another 24.8 ha, rice is cultivated all year round yielding 2 crops per year or 5 crops in 2 year. Plot sizes are not uniform and vary from 3 x 5 sq. m to 20 x 30 sq. m. The area is hilly and rice is mostly cultivated in terraces. The monsoon starts in October or November,

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giving an average annual rainfall of 1914 mm. The heaviest months of rainfall are January and February. The monsoon usually ends in March.

Purwonegoro village located at a similar altitude with same rice culture patterns, was selected for the control area.

## EXPERIMENTAL DESIGN.

The study was divided into three phases conducted over five years :

First phase :
- Preparation of control concept.
- Selection of larvivorous fish.
- Health and Agricultural practices education to promote farmers participation.
- Introduction of *Poecilia reticulata* and *Cyprinus carpio* (first release in ricefields and provision of stock for mass breeding).

Second phase :
- Biological studies on *An. aconitus*, *P. reticulata* and *C. carpio* to (1) determine effective *P. reticulata* densities and (2) mass breeding techniques for *C. carpio*.
- Pilot trial to evaluate effective *P. reticulata* densities for larval control in ricefields.

Third phase :
- Mass breeding of *P. reticulata* and *C. carpio*.
- Evaluation of *An. aconitus* population densities and malaria prevalence.

## CONCEPT OF BIOLOGICAL CONTROL IN RICEFIELDS

A concept for biological control in ricefield using community participation was formulated (Fig. 2) taking advantage of the existing community patterns and hierarchy. The community system in the villages in Indonesia is heavily influenced by the hierarchy existing in the villages, where the village chief (the lurah) is a very influential person. Studies performed by the Woodhouse and Lubis (1977) revealed the important role of the lurah in the vilages. Another key person in the village used for the study was the village educator, conveying messages for most departments to the villagers by regular visits to farmers.

Since mosquitoes became risistent to DDT in the Pagak village, DDT spraying of houses was ineffective and the community became reluctant in accepting routine DDT spraying in the houses. It was for this reason that the villagers were receptive for the biological control concept rather than spraying.

The concept of maintaining *P. reticulata* in ricefields requires the full cooperation of the farmers to maintain water throughout the planting season in the ricefields. Since *P. reticulata* is of no economic value, as an incentive for the farmers to cooperate, edible species of fish are also provided to the farmers to be cultured in the ricefields. These fish were *Cyprinus carpio* which is known to thrive best under ricefield conditions and *Tilapia mozambica*, easier to breed.

## SELECTION OF LARVIVOROUS FISH

A presurvey in the Pagak village revealed *Aplocheilus panchax* at very low densities. Attempts were made to select appropriate larvivorous fish to obtain effective control.

The larvivorous fish *Poecilia reticulata* was used in this study. This fish was selected because it was already used in a neighbouring regency i.e. Temanggung. First introduced in 1961, at present malaria cases are very low in this area. Advantages of using this fish are because it is viviparous, with a high predation potential. Studies performed in simulated ricefield plots (10 simulated plots of 50

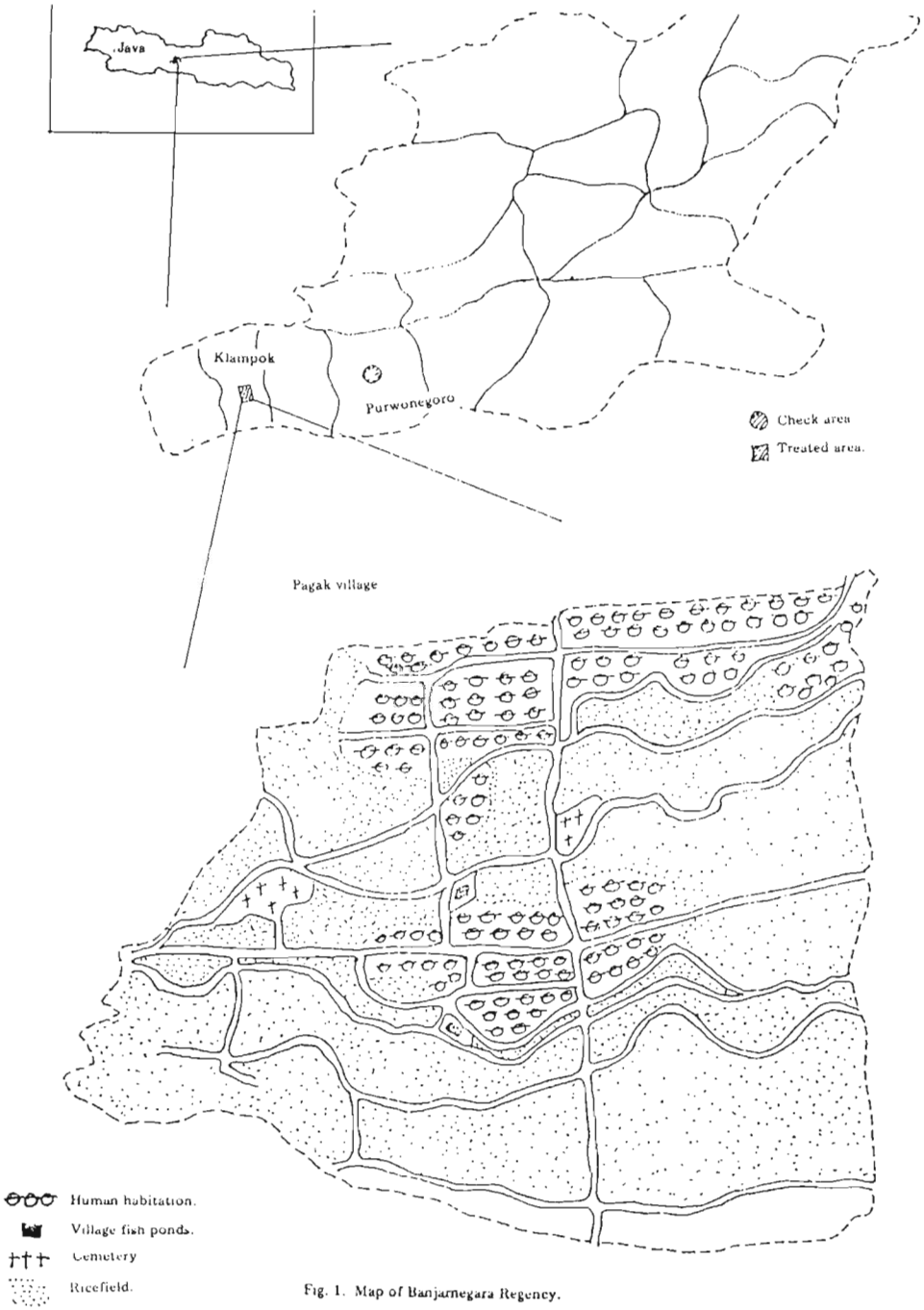


Fig. 1. Map of Banjarnegara Regency.

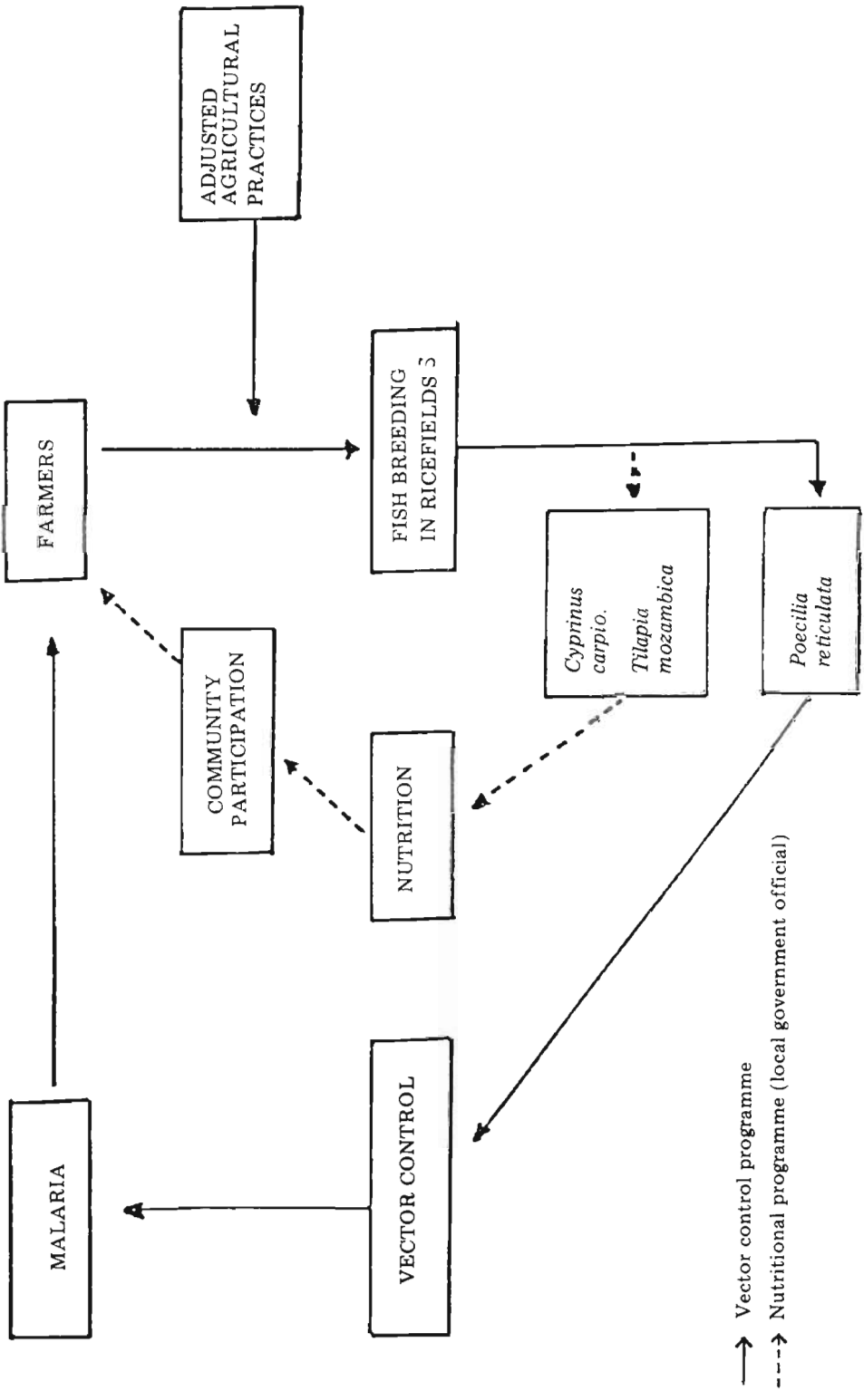


Fig. 2. Flow chart : Biological control in ricefields.

x 100 x 150 cubic meters) using *P. reticulata* collected from the Temanggung and Banjarnegara regency, and *Aplocheilus panchac* from Pagak village, revealed that the most potential fish was *P. reticulata* from the Temanggung regency. This fish was mass produced and used for the study.

## HEALTH AND AGRICULTURAL PRACTICES EDUCATION

Health education and education of specific agricultural practices for fish breeding cultures in ricefields were performed by first approaching the lurah, who further requested full cooperation of the farmers. Education to the farmers was performed during regular farmers union meetings (meeting regularly 2 x m / month).

Special tilting practices required to obtain success in fish culture in ricefields were suggested. These specific practices suggested ploughing of the ricefield bottom slightly slanted ($10^{o}$) to provide a slope. At the lower end of the ricefield, a row of plants is sacrificed and a canal is dug. At the corners of the canal, pits of 1 x 1.5 sq. meters are made (Fig. 3). As ricefields are dried 3 times during the planting season, fish can retreat in the pits when the ricefields are dried for application of fertilizers to the crop. An on-site visit to the Temanggung regency was conducted after tilting demonstrations.

Fish culture in ricefields has been practiced for many years in this regency.

## FIRST INTRODUCTION OF *POECILIA RETICULATA* AND *CYPRINUS CARPIO*

Both *Poecilia reticulata* and *Cyprinus carpio* were not present in the Pagak village. These fish were introduced into the area from the Temanggung regency. Approximately 20.000 *P. reticulata* was carried in oxygena' ' plastic bags and cultured in local por

As the farmers were eager to start the fish culture, approximately 60.000 1 month old fry of C. *carpio* was bought and distributed to the farmers. However, the first fish culture failed completely, since farmers had no previous experience in handling the fry. A survey was carried out to find out the reasons for the total failure of this fish culture. This survey revealed that only 40% of the farmers had attended the farmers meeting, thus causing an unawareness of proper fry handling. Other causes for the failure, according to farmers who attended the regular meeting were as follows :

- fish fry was too small and were easily carried away by floods, so farmers requested that the fry be distributed when 3 months old.
- children and birds of prey took away the fry.
- inexperience of the farmers frequently caused ignorance in proper fish handling.

To improve further fish distribution practices, fry will be distributed to the farmers by the local fishery official, the village educator was paid an incentive to visit the farmers every 2 weeks and supervise the fish culture in ricefields.

As time elapsed more participation was noted. More private owned ponds were established, more farmers requested for fry to be cultured in their respective ricefield plots (Table 1).

At present, fish culture in ricefields, breeding of *C. carpio* and *P. reticulata* and distribution of fish to the farmers is already a common practice in the village, under the supervision of the lurah.

## SUMMARY

With proper education and supervi-

Fig. 3. Soil tilting for fish culture in ricefields.

Table 1. A summary of farmers participation program and *C. carpio* breeding at Pagak village.

| Year | Farmers request-ing/supplied fish | Private owned** fish ponds | | Fish stock available for the program | | |
|---|---|---|---|---|---|---|
| | | No. of Owners | No. of Fish | Adults | | Fry available for distribution |
| 1980 | 45/17 | 15 | 25.100 | 13 | 11 | 16.550 |
| 1981 | 45/20 | 20 | 40.750 | 13 | 11 | 31.350 |
| 1982 | 50/35 | 25 | 90.600 | 17 * | 14 | 35.450 |
| 1983 | 90/50 | 36 | 114.156 | 25 | 20 | 62.260 |

* Rejuvenation of female fish for better reproduction.
** Private owned fish ponds increased during program.
For mass distribution anticipated for 1984, 120.000 fish fry is ready to be distributed in 30 ha of ricefield, at appr. 4000 fish/ha.

sion, faarmers can be encouraged to breed fish for consumption in ricefields, and through fish culture in ricefields, a habitat is created for larvivorous fish to breed and reproduce, thus contributing to mosquito control in ricefields.

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