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OVERVIEW OF RESEARCH ACTIVITIES OF THE SEMARANG SUBUNIT OF THE VECTOR BIOLOGY AND CONTROL RESEARCH UNIT-II.

INTRODUCTION

In view of increased resistance of many malaria vectors to DDT in many parts of Southeast Asia, including Indonesia, the World Health Organization (WHO), in collaboration with the Ministry of Health (MOH) of Indonesia and with financial support from USAID, established a sub-unit of the Vector Biology and Control Research Unit (VBCRU-II) in Semarang, Central Java, in June 1975. The principle objective of this Sub-unit was to search for an environmentally acceptable alternative for DDT for the control of DDT-resistant Anopheles aconitus, and possibly other DDT-resistant vectors in other countries of the region as well. Other objectives were to test any new application methods with new formulations and practices, as may appear practical.

The MOH provided the laboratory facilities and placed at the disposed of the Sub-unit 28 of junior and senior staff. With the financial support of USAID, one entomologist and one sanitarian were assigned while WHO appointed one entomologist in Semarang, in addition to technical supervision provided by periodic visits and field participation by other WHO staff from the Jakarta based VBCRU-II. In addition to the main laboratories in Semarang, the Sub-unit established, in collaboration with the provincial Health Authorities of Central Java, a field station at Tambangan near the areas where the field trials have been carried out since 1976 (Fig. 1).

RESEARCH ACTIVITIES

During the past four years (1976-79) four OP compounds in different formulations and dosages were tested to determine their residual effectiveness in groups of villages (Stage V trials) and five residual insecticides were tested in house-scale trials (Stage IV). In addition, two village-scale trials were conducted to develop new application methods applicable to local conditions of intensive rice growing areas of Central Java, i.e. outdoor ULV application of fenitrothion technical grade by knapsack machines and partial indoor treatment of fenitrothion on only lower part of walls. None of the compounds had been tested before in this area for the control of DDT-resistant An.aconitus.

A list of the Stage IV trials is shown in Table 1. Fenitrothion 40% wdp at 1 and 2 gr/m^2, and pirimiphos-methyl 50% EC at 2 gr/m^2 showed sufficient promise to be further evaluated in Stage V trials, i.e. having bioassay mortalities on sprayed surfaces above 50% for about 8 weeks or longer, and/or evidence of an airborne effect. A summary of these stage V trials are shown in Table 2 and comparative results in Table 3. Other research activities have been studied on the ecology and behaviour of An.aconitus in Central Java (Table 4).

Fenitrothion: This compound has been the most effective all of those tested. However, high cost has prevented large scale operational use of this insecticide at the standard dosage of 2 gr/m^2 by the MOH. Because of cost, as well as mammalian toxicity and possible resistance considerations, two stage V trials have been carried out using reduced amounts. In the first trial, with normal total coverage at 1 gr/m^2 manpower requirements were the same as at 2 gr/m^2, but insecticide usage was reduced by one-half and the residual effectiveness only by about 1/3, i.e. to 2 months from 3 months at 2 gr/m^2. The second trial to reduce amounts of insecticide was by spraying at 2 gr/m^2 only one horizontal swath between 10 and 85 cm from the ground. This reduced insecticide use by about two-third and manpower by over one-half. Preliminary analyses of results indicate that vector populations were effectively suppressed for over 2 months, slightly less than that of total coverage at 2 gr/m^2, but more effective than at 1 gr/m^2 total coverage.

The rationale of this one swath "selective" spraying was based on observations on othe resting behaviour of An.aconitus, which showed that about 78% rest below 85 cm from the ground.

Malathion: This OP compound has been the most common replacement for DDT since the early 1960's, because of its safety, relatively low scost and effectiveness. As the DDT-resistant population of An.aconitus prevailed in Java, the MOH became extremely interested in replacement of DDT with malathion. Accordingly, the Sub-unit tested this insecticide in 3 trials in 1976 and 1977 against DDT-resistant An.aconitus and found to be ineffective each time. Man-vector contact indices (indoor and outdoor landing rates) and associated parous rates were not reduced, and other population density indices and parous rates were only reduced for short periods, generally less than 4-6 weeks. The reasons for this is yet to be established.

Pirimiphos-methyl: Two trials of this compound were carried out, one with a 25% wdp formulation at 2 gr/m^2 and the other with 50% EC at 1 gr/m^2. The 2 gr/m^2 wdp treatment was effective for about 3 months, but the formulation was shown to be unsuitable because of heavy, unsightly brown deposits left on surfaces and high erosion of nozzle tips. The 1 gr/m^2 EC treatment was effective for about 2 months and the formulation very suitable.

Chlorphoxim: This compound was applied as a 50% wdp at 2 gr/m^2 and was found to be only marginally effective, the most important deficency being failure to reduce indoor and outdoor man-vector contact.

Fenitrothion ULV: A stage V trial of ground ULV treatments was carried out using back-pack machines and 95% fenitrothion to apply 5 weekly cycles of about 40 ml per house per cycle. Vector populations were effectively suppressed during the treatment and for about 2 weeks after the last cycle. However, considering the amount insecticide used (about the same as selective spraying), short residual effects, equipment costs and intensive supervision required, it was concluded this type of ULV application would only be useful for epidemic situations of limited area.

RELEVANCE TO APPLICATION

The implications of these results for the Government of Indonesia (GOI) are the following:

a). The three village trials with malathion enabled the MOH to avoid planned large expenditures for this compound to replace DDT.

b). The MOH will spray 200 tons of 40% fenitrothion wdp in 1980/81 as a pilot operation, and have proposed an operational trial of "selective" spraying in two high malarious districts in Central Java.

c). Also, the MOH is planning to carry out a large scale operational trial covering a population of over 75,000, with pirimiphos-methyl in Central Java with financial support from the chemical company and technical assistance of the VBCRU-2.

d). Based on the field studies on the ecology and the behaviour of An. aconitus, advanced selective spray trials can be organized to reduce further insecticide use in the near future by the team in collaboration with local Government.

e). In addition, the GOI and MOH have been enjoying in the in-service training opportunities for htheir personnel assigned to the Sub-unit, both in entomology and spraying operations. Also, 10 WHO fellows from WHO member states in the Southeast Asia and Western Pacific Regions have visited annually and been trained at the Sub-unit.

Table 1. Summary of Stage IV trials.

Trial No.	Year	Insecticide and formulation	Target dosage
1.	1976	fenitrothion (OMS-43), 40% wdp	2 gr/m^2
2	1976	fenitrothion (OMS-43), 23.9% encapsulated EC	2 gr/m^2
3	1977	biodegradable DDT (OMS-1856), 75% wdp (in a DDT resistant area)	2 gr/m^2
4	1977	As above, in a DDT susceptible area	2 gr/m^2
5	1978	pirimiphos-methyl (OMS-1424), 50% EC	2 gr/m^2
6	1978	carbaryl (OMS-29), 75% wdp	2 gr/m^2
7	1978	fenitrothion (OMS-43), 40% wdp	1 gr/m^2

Table 2.

Summary of Stage V trials: Number of houses treated, amount of, insecticides used and spraymen employed.

Trial No.	Year (No.hamlet)	Insecticides and formulation	Target dosage (gr/m2)	No. houses (pop.)	Amount insecticides per house (kg)	1/	Sprayman Total (man day)	No.house/ man day
1	1976 (16)	fenitrothion 40% wdp	2	978 (4469)	1.53	613	200	4.9
2	1976 (8)	malathion 50% wdp	2	819 (3823)	1.22	612	190	4.3
3	1977 (16)	malathion 50% wdp	2	836 (4064)	1.35	675	252	3.3
4	1977 (16)	malathion 2/ 50% wdp	2	1078 (5382)	1.20	599	300	3.6
5	1978 (14)	Pirimiphos methyl 25% wdp	2	1122 (5088)	2.03	509	264	4.3
6	1978 (10)	Chlorphoxim 50% wdp	2	829 (3814)	1.14	572	180	4.6
7	1979 (15)	Pirimiphos methyl 50% EC	1	874 (4152)	0.54	271	210	4.2
8	1979 (18)	fenitrothion 40% wdp	1	1053 (4554)	0.75	298	240	4.4
9	1979 (10)	fenitrothion 3/ 40% wdp	2	1062 (5005)	0.55	221	118	9.0

1/ Active ingredient in grams used per house
2/ The 2nd round in June-July
3/ One horizontal swath between 10 and 85 m above the ground and applies against the 2nd peak.

Table 3.

Number of weeks showing effective control of *Anopheles aconitus* by various residual sprayings as determined with female densities (d) and parity (p).

Trial No.	Insecticide and dosage	1/	Night landing catches		Resting catches			
			Indoor	Outdoor	houses morning	cattle-shelter night	cattle-shelter morning	natural-site morning
1	OMS-43 wdp	d	12	12	> 30	7	12	< 12
	2 g/m^2,1976	p	12	13	NA	17	12	20
2	OMS-1 wdp	d	< 2	NS	> 25	< 2	2	< 2
	2 g/m^2,1976	p	NA	3	NA	7	NA	NA
3	OMS-1 wdp	d	1	NS	7	NS	4	4
	2 g/m^2,1977	p	7	7	6	7	6	8
4	OMS-1 wdp	d	NS	2	NS	5	1	NS
	2 g/m^2,1977	p	2	NS	NA	7	1	2
5	OMS-1424 wdp	d	9	9	14	7	> 10	7
	2 g/m^2,1978	p	9	8	> 10	11	10	12
6	OMS-1197 wdp	d	5	4	> 10	4	> 10	10
	2 g/m^2,1978	p	7	7	14	5	14	> 14
7	OMS-1424 EC	d	6	5	> 10	7	4	> 10
	1 g/m^2,1979	p	6	7	NA	6	7	6
8	OMS-43 wdp	d	> 10	10	14	3	17	17
	1 g/m^2,1979	p	11	11	13	8	9	9
9	OMS-43 wdp	d	11	> 11	> 12	9	> 12	> 12
	2 g/m^2,1979	p	11	11	NA	6	> 12	8

1/ "d" refers to natural densities while "p" represents parous rate.

NA = not applicable

NS = no significant

Table 4. List of Publications of VBCRU-II Sub-unit, Semarang.

Trials made in	Authors	Insecticides/or subject	Trial	WHO/VBC document
1976	Joshi et al	Fenitrothion wdp 2 g/m^2	Stage V	77.675
1976	Joshi et al	Ecoloy/ An.aconitus	Field	77.677
1977	Pradhan et al	Fenitrothion 95% ULV	Stage V	79.729
1978	Shaw et al	Pirimiphos methyl wdp, 2 g/m^2	Stage V	79.722
1978	Fanara et al	Chlorphoxim wdp, 2 g/m^2	Stage V	79.724
1978	Pradhan et al	CMS-43, CMS-1424 CMS-29, 2 g/m^2	Stage IV	79.739
1979	Supratman et al	Fenitrothion wdp, 1 g/m^2	Stage V	79.738
1979	Supalin et al	Pirimiphos methyl EC, 1 g/m^2	Stage V	79.752
1979	Damar et al	Behaviour/ An.aconitus	Field	manuscript in preparation
1979	Bang et al	Seasonal abundance/ An.aconitus	Field	manuscript in preparation.