MALARIA IN CENTRAL JAVA

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ABSTRACT

Like in the Southeast Asian countries, malaria is still a public health problem in Indonesia. The province of Central Java is one of the most dense populated areas in Indonesia with an estimated 27 million populations in 1984.

Malaria inflicting human health in Central Java is primarily caused by *P. vivax, P. falciparum* and very rarely by *P. malariae*. Malaria cases are estimated by slides positivity rates (SPR), annual parasites incidence (API) and annual blood examination rates (ABER).

Small epidemics occurred in several villages and the reasons for it were two fold, namely the occurrence of DDT resistance by the main vector *An. aconitus, An. sundaicus* and *An. maculatus* and the occurrence of chloroquine resistance by *P. falciparum*. The control programme made adaptations by using Fenitrothion in highly endemic areas and administration of Fansidar in chloroquine resistant cases of *P. falciparum*. The figures of SPR and API for 1979 until 1985 were constantly above 1.00, ranging from 1.18 - 4.19 for SPR and 1.37 until 6.00 for API. Fortunately the figures were coming down from 1986 until 1988.

In 1988 was reported 0.67 for SPR and 0.63 for API.

Constant surveillance and alertness in endemic "pockets" is obligatory to prevent uprising.

INTRODUCTION

Malaria is one of the parasitic diseases that is up to now still prevalent and constitutes one of the public health concerns in Indonesia. A brief review on the disease would be presented with special reference to the situations found in the Province of Central Java and in the Province of Yogyakarta Special Territory. Main attention would be centered on the three aspects of malaria status in the two regions, namely epidemiology, control and the related problems, particularly encountered in the last decade (1979-1988) that might be overcome by biotechnological approaches.

EPIDEMIOLOGY

Parasites

Malaria inflicting human health in both provinces is primarily caused by *Plasmodium vivax, P.falciparum* and very rarely by *P.malariae*. Out of 2,691,536 blood slides examined between 1979-1988, 8.333, 9.639 and 141 slides were positive respectively for *P.vivax, P.falciparum* and a mixture of *P.vivax* and *P.falciparum*.

Malaria status

Malaria cases among people living in endemic areas of the Central Java and

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Yogyakarta Special Territory Provinces in the last decade are presented respectively in Table 1 and 2.

Table 1. Malaria Cases in the Province of Central Java[1)]

Year	SPR*)	API**)	ABER***)
1979	1.94	2.18	11.27
1980	4.19	6.00	14.32
1981	2.95	4.22	10.42
1982	1.94	2.79	14.35
1983	2.98	4.08	13.66
1984	2.10	2.48	11.86
1985	1.18	1.37	11.60
1986	0.45	0.48	10.69
1987	0.42	0.29	7.42
1988	0.67	0.63	9.37

Note: *) Slide Positivity Rate
**) Annual Parasite Incidence
***) Annual Blood Examination Rate
1) Central Java Regional Office of Department of Health (unpublished data)

Three parameters, i.e. Slide Positive Rate (SPR), Annual Parasite Incidence (API) and Annual Blood Examination Rate (ABER) were used to indicate the malaria status and dynamics of transmission in the regions. They were determined by means of Active Case Detection (ACD), Passive Case Detection (PCD) and Field Investigation (FI) primarily accomplished by village malaria cadres.

In the Central Java Province (Table 1) starting from 1979 there was a sudden increase of API, that was from 2.18 in 1979 to 6.00 in 1980, but it then steadily declined and finally, since 1986, it has been controlled very well. In the last three years the average of API was 0.47 ± 0.17.

Among 11 out of 18 regencies noted as the more malarious areas in the Central Java

Table 2. Malaria API in 11 Regencies in Central Java Province, 1985 - 1988*)

Regency	Year and Malaria API			
	1985	1986	1987	1988
Banjarnegara	0.33	0.16	0.79	3.56
Batang	3.96	0.54	0.25	0.88
Cilacap	1.15	0.15	0.24	0.67
Jepara	8.57	1.93	0.73	1.25
Karanganyar	3.50	0.43	0.06	0.03
Magelang	0.99	0.99	1.40	0.77
Pati	1.41	0.49	0.49	0.32
Pekalongan	19.36	5.25	2.06	1.09
Purworejo	4.50	4.12	3.91	3.70
Semarang	1.07	0.47	0.26	0.41
Wonosobo	1.65	0.55	0.97	6.27

*) Central Java Regional Office of Department of Health (unpublished data)

Province malaria, in Purworejo was the most highly stable endemicity during the last five years (Table 2), the API ranged from 3.70 to 4.50. Pekalongan was the most malarious in 1985 (API = 19.36), but in the following years the API in 1988 was significantly lower (API = 1.09). Conversely Wonosobo the API of which was relatively low in 1985 (API = 1.65) ranked the first as the most malarious regency (API = 6.27).

In the Yogyakarta Special Territory (Table 3) the malaria annual incidence in the last decade seemed to be very low and relatively stable. The API ranged from 0.20 to 0.98 and the average was 0.44 ± 0.28. Among 5 regencies belonging to this province Kulon Progo seemed the most malarious in the last 5 years, although the API ranged only from 0.40 - 0.89 with an average of 0.68 ± 0.19.

Most malaria cases detected in Central Java during 1985-1988 through ACD, PCD

and FI proved to be indigenous, i.e. in 1988 a number of 15,397 out of 18,111 cases was indigenous, while the other proportions were relapses (133 cases), imported (2,175 cases) and unclassified (114 cases).

A different situation was found in the Province of Yogyakarta Special Territory. Since 1979 to 1988 most malaria cases were imported, and only few cases were indigenous relapses or unclassified, i.e. in 1988 a number of 894 out of 1,011 cases were imported, while the other proportions were indigenous (22 cases), relapses (85 cases) and unclassified (10 cases).

The pattern of malaria cases by the age groups both in the Central Java Province and Yogyakarta Special Territory are presented respectively in Table 4 and 5.

Table 3. Malaria Cases in The Province of Yogyakarta Special Territorry[1)]

Year	SPR*)	API**)	ABER***)
1979	0.65	0.98	11.51
1980	0.56	0.90	11.81
1981	0.35	0.52	11.82
1982	0.36	0.24	12.35
1983	0.29	0.43	12.52
1984	0.16	0.22	12.10
1985	0.15	0.20	12.20
1986	0.20	0.25	11.65
1987	0.53	0.32	5.30
1988	0.63	0.34	4.20

Note: *) Slide Positivity Rate
**) Annual Parasite Incidence
***) Annual Blood Examination Rate
1) Yogyakarta Special Territory Regional Office of Department of Health (unpublished data)

It was realized that in general an occasional number of incidences of the infection increased accordingly with age. The lowest proportion of the infected group was infants (0-1 years), while the highest was the age group of 15 years or more, i.e. 1.7% and 58.6%, and 0.5and 90.2 % in the year of 1988 respectively in Central Java (Table 4) and in Yogyakarta Special Territory (Table 5).

Higher malaria incidence in infants in Central Java compared to that in Yogyakarta Special Territory indicated the more intense trasmission of the disease in the former than in the latter province, i.e. 1.7% and (0%) respectively in 1988.

Vectors

Several species of anopheline mosquitoes proved to play important roles in malaria transmission both in Central Java in Yogyakarta Special Territory. In general *Anopheles aconitus* Donitz breeding in fresh water in the inland, and *An.sundaicus* Roden-

Table 4. Pattern of Malaria Cases by Age Groups in Central Java Province 1985-1988*)

Year	No.of cases	Age (Years) Groups and No (%)				
		0 - 1	1 - 4	5 - 9	10 - 14	15 +
1985	37,789	644 (1.7)	3,533 (9.3)	5,156 (13.6)	7,406 (19.6)	21,050 (55.8)
1986	13,062	220 (1.7)	1,113 (8.3)	1,565 (12.0)	2,372 (18.1)	7,792 (59.7)
1987	11,247	191 (1.7)	1,030 (9.2)	1,388 (12.3)	1,992 (17.7)	6,646 (59.1)
1988	18,111	312 (1.7)	1,924 (10.6)	2,419 (13.4)	3,043 (16.5)	10,610 (58.6)

*) Central Java Regional Office of Department of Health (unpublished data)

Table 5. Pattern of Malaria Cases by Age Groups In Yogyakarta Special Territory Province 1979-1988*)

Year	No.of Cases	Age (Years) Groups and No. (%)				
		0 - 1	1 - 4	5 - 9	10 - 14	15 +
1979	2,646	10 (0.4)	102 (3.9)	100 (3.8)	53 (2.0)	2,381 (89.9)
1980	2,468	8 (0.3)	99 (4.0)	57 (2.3)	65 (2.6)	2,209 (89.5)
1981	1,431	4 (0.3)	61 (4.3)	67 (4.7)	48 (3.4)	1,251 (87.4)
1982	708	5 (0.7)	38 (5.4)	43 (6.1)	36 (5.1)	586 (82.8)
1983	1,203	3 (0.2)	82 (4.9)	66 (3.6)	86 (7.1)	966 (80.3)
1984	634	1 (0.2)	31 (4.9)	23 (3.6)	24 (3.8)	553 (87.2)
1985	574	- (0)	20 (3.5)	16 (2.8)	24 (4.2)	515 (89.7)
1986	743	1 (0.1)	33 (4.4)	32 (4.3)	20 (2.7)	643 (86.5)
1987	952	6 (0.6)	56 (5.9)	51 (5.8)	26 (2.7)	313 (82.9)
1988	1,011	- (0)	36 (3.6)	37 (3.7)	26 (2.6)	912 (90.2)

*) Yogyakarta Special Territory Regional Office of Department of Health (unpublished data)

waldt breeding in brackish water of the lagoons along the south coast are the primary vectors, while *An.maculatus* Theobald and *An.balabacensis* both breeding in fresh water in hilly areas are the secondary vectors of malaria particularly in Yogyakarta Special Territory[1,2].

An.aconitus is the most widely spread malaria vector with its distribution from the coastal plain at sea level to the central plateauup to an altitude of approximately 1200 m. It typically breed in rice field which usually reaches a peak density around March-April-May. The species is mostly zoophilic and mainly associated with cattle and water buffaloes.

It is considered to be highly exophilic and found mostly resting in hollows along

stream banks.[3] *An.maculatus* and *An. balabacensis* are limited to hilly areas bordering Kulon Progo and Purworejo[2].

CONTROL

Malaria Eradication had been undertaken in both Central Java and Yogyakarta Special Territory since 1959 as an integral part of the National Malaria Eradication Programme (MEP) launched by Indonesian Government (Department of Health). As the base line data was the results of field surveys carried out in 1953 that revealed the SPR being 23.73 %. DDT or dieldrin spraying of full coverage in highly malarious areas were the main method of vector control besides quinine treatment of all malaria cases detected through ACD, PCD and FI.

Good results of MEP were obtained, however, due to political constrains, the MEP was stopped in 1965. Since then, particularly in the period of 1965-1969, malaria control had been undetermined. Such a situation resulted in the significant increase of malaria incidence of about 50 times or more, eventhough in 1964 the SPR of 0.06 % had been achieved.[4]

Reorganization of malaria eradication operation team and modification of the term of "eradication" to "control" was commenced in 1969 in accordance with the beginning of REPELITA I (The First Five Year Development Plan). However, due to limited budget, technical, social and administrative constraints, the SPR continued to increase to 28.6 %, in 1973 about the same with that found before 1959.[4]

In the ongoing REPELITA (I to IV) the main objectives of malaria control in Java-Bali are to reduce the morbidity rate or Incidence Rate (IR) per 1000 of population to less than 1 and to reduce the API in the sub-regencies which is more than 7.5 %.

These objectives were achieved through surveillance, treatment of cases, epidemiological studies and vector control.

Surveillance was carried out with case detection: ACD by village malaria cadres, PCD by health workers at the Health Centres and FI by the CDC staff at regency or province level. In addition, microscopists at Health Centres examined the blood slides. The results of the blood screening would be rechecked or confirmed by malarias microscopists at the regency or provincial level.

Treatment was directed to them suffering from fever with or without priorly proven positive for malarial parasites in their blood found in the surveillance. Presumptive treatment with a single dose of chloroquine and primaquine was given to anyone showing fever while his (her) blood was being examined. Radical treatment was applied to individuals positive for malarial parasites (Pv) in their blood with or without fever. For this purpose chloroquine and primaquine of standard doses were administered. Suppressive treatment was applied temporarily to individuals with clinical symptoms of malaria with a single dose of chloroquine and primaquine.

Epidemiological studies were carried out in endemic areas particularly showing an epidemic proportion, directed to the human hosts and related environmental factors, including also entomological investigations mainly concerned with the vector(s) (species determination, bionomics, population dynamics, ecology, susceptibility tests to insecticides). The data obtained from such activities would be very useful for control of the disease.

Vector control was primarily done in highly malarious areas or whenever there was an epidemic to support mass treatment. The method of choice was chemical control using DDT house spraying with a dose of 2 g/m^2

which possesed residual effect. The result were usually good in places where the mosquito vector(s) was (were) still susceptible to it. However, in case of the emergence of vector resistance to DDT, indoor house spraying of fenitrothion with a dose of 1-2 g/m^2 could be applied instead of DDT, since this insecticide was proved to be better than chlorphoxim, decamethrin, organochlorine, pirimiphos-methyl, bendiocarb, cypermethrin and baythroid.[5]

The cost might be reduced if the spraying specifically directed to the resting preference of the vectors, i.e. *An.aconitus* proved to prefer resting on the wall at the height of below 150 cm with a median height of about 38 cm.[6]

Fenitrothion was registered in the operational work of the National Malaria Control Program since 1984. The first good result in such operation in the field was shown in Cilacap and Banjarnegara[6] as shown also in Table 2.

PROBLEMS

Various problems related to the implementation of the malaria control programme were faced. They could be classified into four categories[4] as the following: technical, administrative, social and ecological ones.

Technical problems were associated with the emergence of *P.falciparum* strain and *An.aconitus* strain resistant respectively to chloroquine treatment and DDT application.

The first evidence of the presence of chloroquine resistant *P.falciparum* was noted in Jepara by Simanjuntak et al.[7] Now it seems to spread more widely in Central Java. No resistance of *P.falciparum* was found in Yogyakarta Special Territory until recently.

An.aconitus was known to be doubly resistant to DDT and dieldrin much earlier.[8] Now such problem is widespread in Central Java but fortunately not in Yogyakarta Special Territory.

Administrative problems particularly deal with personnel and logistics. The number of trained workers decreases gradually without immediate replacement by the younger generation. The supply of logistic materials, i.e. insecticides, is frequently not on time.

Social problems relate to people's refusal on the use of DDT house spraying for various reasons, unappropriate perceptions on treatment and vector control related problems.

Ecological problems are associated with the creation of man-made breeding places of vectors.

BIOTECHNOLOGICAL APPROACHES

Some biotechnological techniques might be applied or developed to overcome some epidemiological problems, i.e.:

1) laboratory diagnosis;
2) sporozoite detection and identification in mosquitoes;
3) strain determination of parasite and vectors.

Similar techniques might be applied to develop a vaccin for preventive measures, and to develop microbials potential to vector control.

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