

Species sanitation of malaria in the Netherlands East Indies (1913–1942)

– an example of applied medical history?¹

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To the World Health Organization malaria remains ‘one of the world’s most important public health concerns’. During the post-eradication era of the 1980s there was no clear answer to the following question: what kind of intervention could be effective against malaria in the ‘roll back malaria’ programme? In this situation there were also calls for an ‘applied history of medicine’, since the anti-malaria programmes during the pre-eradication era might help overcome the crisis of finding an appropriate way to fight malaria. At this point the concept of species sanitation was considered. Developed in the 1920s in the former Netherlands East Indies the thrust of this concept is that anopheles, as obligatory vectors of malaria, have species-specific breeding sites; when these sites are sanitized, malaria is deprived of its ecological preconditions. This double question – the history of species sanitation and the possibility of an applied history of medicine – is the starting point of this paper. The results of the historical analysis are that in terms of the biological, technical, economical, social and political conditions, species sanitation remains limited to a few locally specified exceptions. The attempt to find answers in history demonstrates that an evaluation of historical anti-malaria measures can be helpful in determining the fundamental elements of a given situation necessary for an effective malaria control programme.

1 Key-note-lecture given at The XXII Nordic Congress on the History of Medicine, Bergen, Norway, 3rd – 5th June 2009. See also: Imam I, Labisch A. Species sanitation of malaria in the Netherlands East Indies (1913-1942) – an example of applied medical history? *Medizinhistorisches Journal* 2006; 41: 291-313. This text has been translated into English by the novelist Sandra Lessmann, Düsseldorf. The translation was supervised by the microbiologist and native speaker Colin R. MacKenzie, Düsseldorf. We are both very grateful for their help and appreciate especially the continuous discussion on the topic.

The current situation of malaria and the subject of this study

The World Health Organization (WHO) regards malaria as 'one of the world's most important public health concerns'.² The last annual report of the WHO records 247 million new cases worldwide in 2006, the majority (86 %) of them in black Africa. The number of malaria deaths per year varies between 610.000 and 1.2 million – 85 % of which are children, most of them in Africa.³ Many victims, especially children, who are infected with malaria, are thrown back in their development for a considerable time. Malaria therefore constitutes a challenge, not only for the individual or society in general, but also economically for the countries concerned.

In 1955 the World Health Organisation launched a world-wide malaria eradication programme. Right from the beginning this programme was pressed for time.⁴ Even before the start of the programme it was known that the anopheles mosquitoes quickly developed resistance to DDT. After initial success the malaria eradication programme failed.⁵ Although more and more control programmes were carried out, the aim of eradicating malaria was, at least officially, not abandoned. This lack of clarity had a fatal result. The initial successes of the eradication programme and individual control programmes had the effect that malaria became to be regarded as a 'normal' health problem. Subsequently the special departments and task forces concerned with malaria were transferred into the 'normal' health care

2 Cf. for current information the websites: <http://www.who.int/topics/malaria>.

3 The range of variation can be explained by the fact that either a clear cause of death has not been determined or – if it has been determined – it was inspired primarily by clinical symptoms. Often the initial phase of malaria cannot be distinguished from other diseases, not even by an experienced doctor. This is especially the case with typhoid. The quoted numbers are stated by the 'Multilateral Initiative on Malaria' (= 'MIM'). For the MIM cf. the following website: <http://www.mim.su.se>.

4 Cf. the analysis of Randall M. Packard, 'No other logical choice'. Global malaria eradication and the politics of international health in the post-war era. *Parasitologia* 1998; 40: 217-229.

5 Cf. Geoffrey M Jeffery, Malaria Control in the Twentieth Century. *American Journal of Tropical Medicine and Hygiene* 1976; 25: 361-371; Michael W. Service, Some problems in the control of malaria, in: F.H. Perring, K. Mellanby (eds.) *Ecological Effects of Pesticides* (Academic Press) London 1977, 151-164; José A. Najera, Malaria control: Present situation and need for historical research. *Parasitologia* 1990; 32: 215-229; Michael W. Service, Vector control, Where are we now? *Bulletin of the Society for Vector Ecology* 1992; 17: 94-108. Randall M. Packard, Malaria Dreams: Postwar Visions of Health and Development in the Third World. *Medical Anthropology. Cross-Cultural Studies in Health and Illness* 1997; 17: 279-296.

Among the mass of basic works on malaria see Socrates Litsios, *The tomorrow of Malaria*, Wellington: New Zealand: Pacific Pr., 1996; and generally about the mischief done by public interventions see James C. Scott, *Seeing like a state. How certain schemes to improve the human condition have failed* (= *The Yale ISPS series*), (Yale Univ. Press) New Haven et al. 1998.

services. This resulted in a resurgence of malaria as witnessed during the 1960s/1970s in many tropical regions which previously had achieved satisfying figures relating to incidence and mortality.

Since the 1990s the post-eradication era has been interpreted as a time of total confusion, even of anarchy.⁶ In a situation without a convincing concept or any distinctive basis an 'applied' medical history was called for. M. A. Farid, one of the protagonists of eradication, wrote in a personal review of the year 1980:⁷

'Confidence in DDT spraying blinded everybody to the need to promote research and to extend the utilization of conventional antilarval, engineering, or biological methods where applicable, particularly in urban areas and in arid countries. (...)

It is astonishing that WHO (...) has forgotten many of the malaria lessons gained in the pre-eradication era. (...)

The excuse that old malariologists have died out is not tenable, because their works and contributions are in all libraries and can be consulted by those who are determined to control the disease'.

If this were true, it would mean that a pragmatic history of medicine could provide direct help for the problems facing the 'roll-back malaria' concept. The notion of remedying the current plight in the combat against malaria with the help of a systematized medical history fell on fertile ground as early as the 1990s.⁸ Prophylactic and therapeutic measures and vaccines have repeatedly disappointed in the long term. DDT caused an ecological disaster, not because of its medical, but rather its extensive and uncritical use in agriculture and forestry. For this reason ecologically sound interventions came into focus, which were directed against the anopheles mosquitoes as vectors rather than against plasmodia or infected people. At this point the concept of species sanitation, developed in the Netherlands East Indies in the 1920s and 1930s, has to be considered. So the possibility of an applied history of medicine is the subject of this paper.⁹

6 Cf. (and many others) David. J. Bradley, Malaria – whence and whither?, in: Targett Gat, eds., *Malaria. Waiting for the Vaccine*, Chichester: Wiley, 1991, 11-29.

7 M.A. Farid, The malaria programme. From euphoria to anarchy, in: *World Health Forum* 1980;1: 8-22, 15, 19f.

8 Cf. Najera, Malaria control: Present situation and need for historical research, 1990; see also the other historical issues of *Parasitologia*.

9 For a more elaborated version cf. Irawan Imam, 'Spezies-Assanierung'. *Die Entwicklung natürlicher Methoden der Malariabekämpfung in Niederländisch-Indien (1913-1938) und ihre mögliche Bedeutung für aktuelle Probleme der Malaria-Bekämpfung*, med. thesis. HHUD Düsseldorf 2003 (Internet Public.: Online-Resource: <http://diss.ub.uni-duesseldorf.de/ebib/diss/show?dissid=817>; URL: <http://deposit.ddb.de/cgi-bin/dokserv?idn=971275130>).

‘Species Sanitation’ – stages of fighting malaria in the Netherlands East Indies

Three biological factors cause malaria: plasmodia, mosquitoes and humans. The life cycle of plasmodia and the pathogenesis of malaria involving these three prerequisites were discovered between 1880 and 1900. At the time malaria was regarded as the result of three constant factors – plasmodia, mosquitoes and humans. It was believed that if it were possible to eliminate one of the three factors, malaria would vanish. After a considerable number of experiences to the contrary, e.g. during the building of the Panama Canal or with the failed interventions in Mian Mir in today’s Pakistan, it became clear in the early 20th century that malaria was not as simple a disease as previously thought.¹⁰

In 1911 and 1912 the British tropical doctor Malcolm Watson (1873-1955) succeeded in the sanitation of the harbour of Klang in British Malaya of Malaria.¹¹ He cleared the breeding sites of the mosquitoes in the neighbourhood of the new port and managed thus, that one of the big enterprises of British colonialism, to turn British-Malaya into a region of plantations, would not be subdued by a permanently raising death-toll of newly infected coolies combined with a devastating thread for the European colonizers. When Malcolm Watson crossed the streets of Malacca in March 1913 to find out how the Dutch coped with malaria, he found a well trained team of doctors and scientists of different background – but working until this encounter mainly on other health-hazards of public concern, as e.g. plague, cholera, beri-beri, and hookworm: among them Wilhelm August Paul Schüffner (1867-1949) and Nicolaas H. Swellengrebel (1885-1970) as a practically orientated and scientifically trained zoologist, who over the years was to develop into one of the world-wide leading malariologists. In 1921 they were joined by Ernst Rodenwaldt (1878-1965), an experienced German tropical doctor and geologist, who had a special awareness of the geological factors of malaria.¹²

10 As a historical introduction cf. the caustic book by Gordon Harrison, *Mosquitoes, Malaria and Man. A History of Hostilities since 1880*, London: Murray, 1978 (or: New York: Dutton, 1978), and the concise article by Leonard Jan Bruce-Chwatt, History of malaria from prehistory to eradication, in: Walther H. Wernsdorfer, Ian McGregor (ed.), *Malaria. Principles and Practice of Malariology*, Edinburgh: Churchill Livingstone, 1988, 1-59.

11 For the ‘lucky’ Malcolm Watson – so Harrison, *Mosquitoes, Malaria and Man*, 1978, 130-140; idem., *Rural Sanitation in the Tropics*, London: Murray, 1915; idem., *The prevention of Malaria in the Federated Malay States. A Record of Twenty Years’ Progress*, New York: Dutton, 1. Ed. 1911, 2. Ed., revised a. enlarged 1921; idem., *African Highway. The Battle for Health in Central Africa*, London: Murray, 1953; idem., Some pages from the history of the prevention of malaria, in: *Glasgow Medical Journal* 1935: 123: 49-70, 130-153, 202-220.

Until then in the Netherlands East Indies malaria was regarded primarily as a problem where important investment were at stake. Schüffner – among others – had demonstrated this already in 1907 for the health care on the plantations in Deli on Sumatra. The new awareness of malaria followed the concept of an extensive and therefore expensive general sanitation despite numerous discoveries which were made for example concerning the ecology of the anopheles. In the spring of 1913 the memorable encounter between Watson, Schüffner, and Swellengrebel took place in Medan. The measures in Sibolga in 1915 ff. and in the plains of Mandailing in 1916 ff. on Sumatra Netherlands East Indies were the first to follow the new idea that it was possible to manipulate the breeding places of a local vector which was to be determined carefully in a way that malaria would decrease considerably in the locality. So these programs could be considered as the first trials of species sanitation in the Netherlands East Indies. The two projects, however, were never completed, and therefore did not serve to test or to refine the concept of species sanitation.

Species sanitation aims to intervene in the complex interdependences of malaria in a way that a single intervention interrupts the entire development of the disease with a lasting effect. The basis for this calculated intervention is the assumption that

- 1) there is a limited number of local vectors, or even a single species responsible for a malaria epidemic, which
- 2) characteristically need a specific habitat for their breeding. These breeding places are specific for the species and can
- 3) be sanitised with a calculated as well as limited intervention in a way that the local vector disappears in the course of one period of reproduction, i.e. within three weeks, or that it is replaced by other anopheles which are unsuitable as malaria vectors.

However, when medical personal tried to transform the first trials of species sanitation and the fight against malaria into a general concept of public health, the colonial administration demanded that the still costly interventions should present a permanent solution or at least reduce malaria to such an extent as to considerably remove its potential as a threat.

12 For the somehow hidden role of Ernst Rodenwaldt in racial hygiene and NS-medicine see Wolfgang U. Eckhart, *Medizin und Kolonialimperialismus. Deutschland 1884-1945*, Paderborn u.a.: Schöningh, 1997, 519-528; idem., Generalarzt Ernst Rodenwaldt, in: Gerd R. Ueberschar (Hrsg.), *Hitlers militärische Elite. Bd. 1: Von den Anfängen des Regimes bis zum Kriegsbeginn*, Darmstadt: wbg, 1998, 210-222.

In public health care ‘vertical’ interventions and ‘horizontal’ interventions represent opposing viewpoints. Vertical interventions are aimed directly against the factor which is regarded as the cause, irrespective of the surrounding circumstances. A classic example is active immunisation through vaccination campaigns, for instance against smallpox. On the other hand horizontal interventions address a broad front. All possible factors are preferably altered in such a way that the disease is suppressed along with the causes and mitigating factors. With sanitation measures like these it is often difficult to assess afterwards which specific interventions were finally effective or which measure was accountable for which result. A classic example is the fight against malaria by general sanitation and measures of social hygiene as was attempted in Italy in the late 19th / early 20th century by Angelo Celli (1857-1914).

In the Netherlands East Indies the fight against malaria in Sibolga began as a vertical intervention. Only the bogs of brackish water which resulted from building the harbour, docks and large city with areas for indigenous labourers and remote European quarters were supposed to be eliminated. Gradually these measures turned into a horizontal, general sanitation related to the environmental health conditions. Finally, in addition to the measures which were adapted to the external circumstances, there were health measures aimed at the health behaviour of the indigenous population. This was implemented because the entire infrastructure of the new plantation region including the neatly built European residential areas was to be improved. In order to elucidate the danger and conditions of malaria the indigenous population also had to be included in the health measures.

Vertical interventions according to a strictly interpreted concept of species sanitation were carried out in the port of Belawan, Deli/Sumatra in 1919, in the Tjihea plain, Java, in 1921 ff., in the port of Tjilatjap, Java, in 1922 ff. and in the port of Tandjoeng Priok, Batavia, in 1923 ff. A large number of examples can be found.¹³ The following towns and regions underwent measures of species-sanitation:

Ports and coastal towns:

- Batavia – Tandjoeng Priok, West Java, 1913ff.
- Surabaya, East Java, 1916-1920
- Belawan, Deli / Sumatra, 1919
- Sibolga, Sumatra, 1915-1919

13 Cf. the general survey in: W.B. Snellen, Dr. Ir.J. Kuipers. Civil engineer and malariologist, in: Takken et al., *Environmental measures for malaria control in Indonesia*, 1991, 129-140.

- Tjilatjap, Central Java, 1919
- Probolinggo, East Java, 1921
- Semarang, Central Java, 1927
- Tegal, Central Java, 1928-29
- Banjoewangi, East Java 1928
- Batavia – Tandjoeng Priok, West Java, 1928-1932
- Surabaya, East Java, 1930
- Batavia – Tandjoeng Priok, West Java, 1937-1938

All these measure were directed against *Anopheles ludlowi* var. *sundaicus*, a notorious brackish-water-breeder.

Malaria regions in the interior of the country:

- Mandailing, Sumatra, 1916, against *An.ludlowi* var. *sundaicus* (fresh water!)
- Tjihea, Central Java, 1919, against *An.aconitus*
- Tjihea, Central Java, 1922, against *An.aconitus*
- Mandailing, Sumatra, 1927, against *An.ludlowi* var. *sundaicus* (fresh water!)
- Tjihea, Central Java, 1931, against *An.aconitus*.

During these campaigns the measures of intervention gradually evolved to a different standard:

Sanitation of geologically created breeding places by engineering works:

- Raising of low-lying regions including drainage: Tandjong Priok 1913 (planned), Sourabaya 1916; Tegal 1928
- Raising of low-lying regions including floodgates etc.: Tjilatjap 1919, 1922 ff.
- Lowering of the water table by drainage: Sibolga 1919
- Hygiene of traffic routes: Tandjoeng Priok 1923, 1937/38

Sanitation of fishponds:

- Fishponds of brackish water are connected with the sea: Probolinggo 1921; Banjoewangi 1927
- Building of flood dikes: Probolinggo 1921
- ‘hygienic exploitation’ (regular change of salt water; control of algae; predatory fish) of the fishponds: Batavia, Semarang, Japara, Tajoe, Toeban, Panaroekan (after 1928)

Sanitation of rice fields:

- Continuous maintenance of the canal system: Tjihea plain 1921 ff.
- Consistent and simultaneous cultivation of the rice fields: Tjihea plain 1921 ff.

Setting up of plantations and settlements inland:

- Preservation or restoration of the local water conditions of the primeval forest
- Hygienic management of water supply and drainage.

In the course of time an intervention model developed which could be adapted to the different local conditions according to the following basic pattern:

If peripheral institutions of the public health system – either military, colonial or even private – noticed an increased malaria morbidity, they documented it and passed it on to the central malaria office which was created in 1922 and formally founded in 1924. Representatives of this office then arrived and started to work according to the following pattern:

- 50 men, 50 women, 50 children over the age of 6, 50 children under the age of 6 are examined in 3-month-intervals: the spleen index gives information about the chronic, the parasite index about the current malaria activity;
- the settlement situation is examined, especially in relation to the local conditions of coasts and water; the local vectors and their typical breeding places are determined; the breeding possibilities characteristic of the local species are eliminated with the least possible or even one single effort; approximately every two weeks the larvae are identified; in the same intervals the houses in the vicinity of the breeding places are checked for mosquitoes.

In this version species sanitation was primarily directed against the aquatic stage of the vectors.

From an epidemiological point of view species sanitation stands for

- a locally, if necessary regionally, limited ecological control of excess morbidity and mortality of malaria
- on the basis of a ‘normal’ malaria prevalence and incidence including a corresponding ‘basis’ mortality.

The limits of the concept of species sanitation

Even a short glimpse at the historic succession of interventions shows that species sanitations usually had to be repeated after a few years and then with a considerably greater effort. This suggests that it is necessary to investigate the historic and, in addition, the systematic limits of the concept of species sanitation.

In summary, the systematic limits of the concept become clear:

- the expenses for the infrastructure (‘surveillance’, ‘maintenance’, independent malaria task force in the form of the Malaria-Bureau, epidemiologically safe interventions) were growing
- the expenses of each intervention – examples: hygienic exploitation of fishponds; building of ports and industrial regions near the coasts – were growing
- the aquatic forms of the anopheles do not always have clearly identifiable habitats – if there is no such habitat the concept of species sanitation cannot be applied
- the continuous danger, which was realized quite early on, that the mosquitoes can adapt to the changed living conditions, meaning that their apparently hereditary behaviour is in fact a plastic behaviour;
- the decreasing immunity of the local population (a species sanitation programme is followed by a malaria hyper-epidemic ca. 5 to 10 years later).

At the end of the 1930s the Malaria-Bureau had become a veritable enterprise. It was becoming clear, however, that the Malaria-Bureau could not fulfil the two essential conditions under which it was founded. These were:

- the intervention must be limited, especially regarding the costs;
- the success of the intervention must be lasting.

In view of the immunity of the population it must be said that the Dutch and the indigenous population of the Netherlands East Indies were actually

spared the more severe setbacks. In this context the notorious malaria epidemic in Ceylon from 1934 to 1936 deserve mention.¹⁴ A change in the ecological conditions – in this instance a period of severe rain after a dry spell of several years – resulted in a situation in which an immunological weakened population, which had not been in regular contact with malaria during the dry period, were faced with a population of malaria-transmitting mosquitoes which had considerably spread geographically.

This and similar incidents caused Swellengrebel to reach a fatal conclusion in later years: The cost in terms of life, health and well-being which were claimed by malaria remained constant if regarded over a longer time-period. If there was no intervention there would be a continuous low-level loss; however, any successful intervention would be punctuated by an excess mortality in regular intervals of five to fifteen years. Furthermore, he concluded that the loss of life during the epidemics would be similar to that over a similar period of time if there had been no intervention at all.

Species sanitation of malaria in the Netherlands East Indies – an example of applied medical history?

In summary – regarding species sanitation: Under these biological, technical, economical, social and political conditions species sanitation implies a constant measure of control of malaria which is limited to a few exceptional, locally restricted areas. In order to optimize the success of the concept and avoid failure or disappointment, a prospective evaluation of the biological, social and political factors is essential. Furthermore, constant monitoring

¹⁴ This disaster was to repeat itself in the period from 1968 to 1970 on a catastrophic scale after the great successes of the eradication programme in the 1950s and early 1960s (1960 to 1964 under 200 cases of malaria; 1968 to 1970 ca. 1,5 million cases of malaria). Then as now the malaria epidemics in Ceylon represented key examples in the discussion of anti-malaria programmes. From the discussion of the time cf. Clifford Allchin Gill, *Report on the Malaria Epidemic in Ceylon in 1934-35. Together with a scheme for the control of malaria in the island ... September, 1935* (= Papers laid before the State Council of Ceylon during the year 1935. Sessional Paper 23.), (Government Record Office) Colombo 1935; Rupert Briercliffe, *The Ceylon Malaria Epidemic, 1934-35. Report by the Director of Medical and Sanitary Services* (= Papers laid before the State Council of Ceylon. Sessional Papers. 1935. no. 22.), (Ceylon Government Press) Colombo 1935; Ernst Rodenwaldt, Die Malariaepidemie auf Ceylon 1934/35 als geomedizinisches Problem, *Koloniale Rundschau* 1937;28: 330-344; Anantaswami B. Rao, *Malaria Control in Malaya, Java, Ceylon and South India* (= Mysore State Department of Public Health, Bulletin No. 15), (Government Press) Bangalore 1939. See also Gisela Peters, *Malaria in Sri Lanka. Eine geomedizinische Analyse*, (Univ. Diss.) Mainz 1982; Christopher M. Langford, Reasons for the decline in mortality in Sri Lanka immediately after the Second World War. A re-examination of the evidence, in: *Health transition review* 1996;6: 3-23; from a modern point of view relating to social and colonial history cf. Margaret Jones, The Ceylon Malaria Epidemic of 1934-35: A Case Study in Colonial Medicine, *Social History of Medicine* 2000;13: 87-109.

of the key factors – especially those beyond the mere biological and medical questions is paramount for success.

The historical question posed at the beginning as to how useful species sanitation developed in the Netherlands East Indies could be today, almost a hundred years later and in our present state of knowledge, can now also be answered shortly. According to the evidence laid out in this article it is doubtful if the use of historic concepts could provide a solution to the current medical problems, at least in this naïve and optimistic version.

In summary – regarding applied medical history: The historical evaluation of malaria control programmes may help to establish the key factors for the general situation relating to a malaria control programme and especially to assess the specific conditions for single measures of control. A historical analysis can be useful to describe the problem in the explorative (conceptual) phase of an intervention project, to identify factors which have been overlooked before, and to validate the established factors.

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