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Annick Guénel

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Malaria control, land occupation and scientific developments in Vietnam in the XXth  
century

Annick Guénel

CNRS - INSERM, Paris

I - Introduction

According to an old Vietnamese legend, highland forests were inhabited by spirits who ruled over waters and communicated "wood fever" (rừng sốt rét).<sup>1</sup> The term was borrowed by the French military doctors during the Tonkin conquest, and was finally appropriated so as to designate a form of malaria by Alphonse Laveran, the French scientist who had first described the parasite in Algeria, in a general paper on the mosquito-borne infection.<sup>2</sup>

At the beginning of the 20th century, French colonial doctors were relatively unanimous in dividing the Vietnamese territory into two regions with regards to malaria: a weakly infected region including all the lowlands, densely populated and cultivated, broad plateaus and coastly plains, and a strongly infected region including all the mountainous territories, covered with woods and uncultivated.

This view also satisfied the traditional ideal of land exploitation as a way of discarding the disease. The vector that ensures the cycle of the parasite in man, the anopheles mosquito, had been recently discovered, and the Pastorian Paul Louis Simond was thus able to declare in a collective book dedicated to "Hygiene in Indochina": "Agriculture is a crucial factor of salubrity. It is a way to hold Anopheles at a distance and to turn a previously malaria stricken

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<sup>1</sup> M. A. Laveran. Anophèles et paludisme. *Annales d'Hygiène et de Médecine coloniales*, 1903, 6, p. 689.

<sup>2</sup> P. Gourou. *La terre et l'homme en Extrême-Orient*. Paris: Flammarion, 1972, pp. 36-39; Lê Thanh Khôi. *Histoire du Viêt-Nam des origines à 1858*. Paris: Sudestasie, 1981; p. 33.

area into a healthy place. Conversely, a territory that ceases to be cultivated returns swiftly to its former malarious condition"<sup>3</sup>. The cultivated and densely occupied areas, obviously not plagued by the most terrible kind of malaria, seemed a good omen for the future of the colony and its economical prospects.

As in most other countries of mainland South-East Asia, the agricultural systems in Vietnam differentiated the politically dominant society of Viêt or Kinh, living in lowlands and cultivating wet rice-fields, from the numerous and scattered tribal groups of the uplands, mainly living from the "slash and burn" agriculture. Throughout the French domination, colonial interests focused mostly on the lowland society. Some tribal groups of the uplands were even brought under colonial rule only late in the century.

In particular, French medicine hardly reached upland society, if at all. By opposition, the French medical school trained an active medical elite among the lowland peoples. At the time of independence, although Vietnamese doctors were still very few, their abilities had become quite equal to those of French doctors.

Thus, the history of malaria control in Vietnam is paradoxical from many points of view. The development of scientific knowledge on malaria resulted more from inquiries made in the upland out of colonial economic interests, but had very few repercussions on the health of the local population. For all that, the disease was not eradicated in the lowlands, and is not yet eradicated to-day everywhere. Until late, due to gaps in the knowledge of many factors involved in local malaria patterns, land occupation and agricultural efforts seemed be able to take the place of a coherent program of public health. In other words, the agricultural dynamism of Vietnamese people which had struck the colonizers in the lowlands was exploited to achieve the French "civilizing mission" in endemic areas.

## II - Lands and French colonization

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<sup>3</sup> PL. Simond. Hygiène de l'Indochine. In: A. Chantemesse et E. Mosny. *Traité d'Hygiène. XI - Hygiène coloniale*. Paris: Baillière et fils, 1907, p. 444.

Up to the first decade of the 20th century, the Cochin-Chinese rice was the main asset of colonial economic development. When the French launched their conquest, Vietnamese settlement of the South, which had already started in the 17th century, was not completely achieved and wide areas of lowlands were not yet cultivated, especially in Western regions, apparently more plagued by malaria than the central region of the Mekong delta<sup>4</sup>. The agricultural extension in some areas could have brought about a decrease of malaria prevalence. Thus, in the province of Chaudoc, close to Cambodia, the introduction of rice culture seemed to have changed the economic as well as the demographic pattern of many villages.<sup>5</sup> But generally speaking, local medical data in the countryside were lacking until late, with the exception of areas where dramatic epidemics occurred.

Indeed, even in the lowlands, the ideal of land exploitation, reinforced by colonial interests, did not everywhere converge with scientific emphasis on the eradication of the vectors. The narrow cultivated plains of Annam (Central Vietnam), between the mountains and the sea, were the scene of periodic epidemic, which were particularly severe since the population had generally no immunity to malaria. As soon as 1899, Simond himself studied this phenomenon in the Binh Dinh province, up to this date free of malaria<sup>6</sup>. In this case, the epidemic was due to meteorological events and water outflow from the close mountains. However, the instability of epidemiological patterns could also be attributed to more complex causes<sup>7</sup>. The movements of Vietnamese between the mountains and the lowlands, sometimes due to their early attempts at cultivating the first slopes of the hills, were among the factors raised by the colonial doctors.

If rice cultivation in new lands was much more limited in already overpopulated Tonkin and Annam than in Cochin-China, such an extension of cultivated areas to the hill borders might have had dramatic consequences. Early observation had pointed out the predilection of *Anopheles* for the terraced rice-fields, irrigated by running water<sup>8</sup>. But, most of the first

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<sup>4</sup> C. Grall et H. Reboul. *L'assistance médicale en Indochine*. Marseille: Moulot, 1907, pp. 39-47.

<sup>5</sup> M. Borel. Anophèles et paludisme dans la région de Chaudoc (Cochinchine). Résultats d'une enquête faite du 16 au 21 janvier 1926. *Bulletin de la Société de Pathologie exotique*. 1926, 19, 806-815.

<sup>6</sup> P.L.S. Simond. Paludisme. *Annales d'Hygiène et de Médecine coloniales*. 1901, 4, 128-133.

<sup>7</sup> J. Allain. Paludisme et quinine d'Etat en Annam pendant l'année 1912. *Bulletin de la Société de Pathologie exotique*. 1913, 6, 730-752.

<sup>8</sup> L. Gaide. Le paludisme en Annam et au Tonkin. *Annales d'Hygiène et de Médecine coloniales*. 1909, 12, pp. 288-289.

investigations on anophele fauna in cultivated areas were elementary and rather confusing. The flooded rice-fields and the large fish ponds of the lowlands generally seemed less dangerous than household waters or other puddles. But anopheles larvae were captured on the former as well. In the absence of well identified targets, any kind of works to destroy the mosquitoes were merely estimated as impossible in the countryside. Only French centers and military garrisons benefited from antianophelian measures, before the 1920s<sup>9</sup>.

As "State quinine" had first been instituted in 1909, mass quininization seemed the most adequate preventive measure. An active campaign began in the 1910s in Central Vietnam. But, it ran up against many difficulties in the product distribution as well as against some reluctance of the population towards a new drug, anyway often used in very short cures because of its price.<sup>10</sup>

The lack of scientific interest concerning malaria in the countryside had an economic counterpart. At the turn of the century, colonial ambitions began to turn to more profitable and more prestigious crops than rice. Wide spaces remained unbroken grounds on which first acclimatization trials for interesting crops, such as tea, coffee and above all rubber-tree seemed full of promise<sup>11</sup>.

As early as the first decade of the century, to the colonial plantations on the "grey lands", north of Saigon, rapidly succeeded plantations on more distant but wider and more fertile "red lands", north and west of Cochinchina. If in these areas covered by forests only cut by some "slash and burn" fields, some upland people could be recruited for the felling of trees, the following works needed a numerous labour force. Coolies were imported from the Mekong delta and, more importantly, from the overpopulated Northern delta. This "wide-scale

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Further studies pointed out that the breeding places of local dangerous anopheles was correlated to the irrigation system: J. Kérandel. Riziculture et distribution géographique du paludisme en Annam. *Bulletin de la Société de Pathologie exotique*. 1925, 18, 815-821.

<sup>9</sup> See note 4.

<sup>10</sup> J. Allain, *op. cit.*; Hermant. Fonctionnement du service de vente de la quinine d'Etat dans la province de Nghê-An en 1912. *Bulletin de la société médico-chirurgicale de l'Indochine*. 1913, 4, 231-233.

<sup>11</sup> See: Christophe Bonneuil. *Mettre en ordre et discipliner sous les Tropiques: Les sciences du végétal dans l'empire français, 1870-1940*. PhD Dissertation, Université Paris VII, pp. 277-372.

experience of malaria transmission", as a Pastorian later formulated it<sup>12</sup>, confirmed the unhealthy reputation of the region, seen as the seat of genies by the delta inhabitants.

Malaria was certainly not the only cause of morbidity in these first plantations, where hygiene in the barracks was poor, food was scarce and working days were long. But malaria was the first official cause of dismissal of coolies, when they did not die on the plantations. Later, in 1917, the coming back of the workers, possible "parasite carriers" to their villages alarmed the colonial authorities who had learnt from the malaria experience of the Armée d'Orient in the Balkans. They convened a commission in agreement with the Chamber of Agriculture. In fact, before any governmental incitation to take medical measures in plantations, some land-owners had already asked for the advices of Pasteur Institute.<sup>13</sup>

Noël Bernard, in charge of the investigations in the plantations owned by big colonial societies (in Suzannah and Anloc) first planned to apply Sergent brothers' method used in Algeria to complete prophylactic quininization of workers, insufficient by itself. He was aware however that mechanical protection against mosquitoes was not realistic in this populous community. Moreover, stream edge regularization of the rivers, bush clearing or any other antianophelian measure produced only short-lived results or required permanent maintenance in the tropical forest conditions. In order to find an elegant and low-cost solution, he conducted a comparative experiment and tested the respective advantages of two kinds of camps: good dwelling located close to the river and poor dwelling established at a distance from rivers, potential sources of Anopheles. The camp he identified as healthy was located on a piece of land further than 1000 meters from a river, was bush-cleared and transformed into grassland. Drinkable water came from wells dug at a depth of 10 meters, according to the technics of hill-land people. The camp dwelling was rudimentary with straw huts and bamboo beds raised one meter above the ground.

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<sup>12</sup> L.A. Bordes. *Le paludisme en Indochine (Historique, épidémiologie, état actuel de la lutte antipalustre)*. Hanoi: Impimerie d'Extrême Orient, 1931, p. 14.

<sup>13</sup> National Archives of Vietnam. Center n°2 (HCM-city), Goucoch, IA 7/236 (6): "Lutte contre le paludisme. Assainissement des plantations.

### III - Human "races" and anopheles species

Bernard's study was not completed by an entomological survey in the Red lands where the contamination source remained obscure. If the numerous rivers seemed to be the elected niches for the mosquitoes, on the other hand, the human reservoir of parasites seemed to be lacking in some areas sparsely populated. As the colonial sanitary services had not progressed in the region, lifestyle and health conditions of local natives were actually unknown.

Although Bernard published a pamphlet addressed to the French settlers of Cochin-China, sanitary measures were hardly applied outside the plantations whose land-owners had called upon his advice. Moreover, planted areas continued to increase, at least up to 1930 and the world economic crisis. In 1930, 70 000 workers were employed in the Cochin-Chinese plantations.<sup>14</sup>

Furthermore, other colonial works also called forth important population migrations. The railway construction which had begun in 1904 in the north of the country and was pursued up to the beginning of the 1940s, often required the crossing of mountainous and very unhealthy areas. During the first year, among about 10 000 recruited workers, half had been victims of malaria.<sup>15</sup>

The numerous desertions or dismissals of "parasite carriers" were often evoked as causes of local epidemics in plain villages. We do know that the workers inflated the malaria statistics in the annual reports of the Health bureau, or *Assistance Médicale Indigène*. Ranking malaria as the first morbidity cause among the natives, the statistics remained relatively invariable: between 1915 and 1930, 10 to 13% of the hospitalisations were attributed to various forms of malaria<sup>16</sup>. However, this figure is unreliable. On the one hand, the weight of the disease must have been overestimated since the decisive proof (positive slides) for the diagnosis was missing most of the time<sup>17</sup> On the other hand, due to the slow

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<sup>14</sup> Bonneuil, *op. cit.*

<sup>15</sup> Noël Bernard. Rapport médical sur l'application du programme d'organisation ouvrière aux chantiers de la ligne de Yen-Bay à Lao-Kay, Tonkin (1er octobre 1904-1er octobre 1905). *Annales d'Hygiène et de Médecine coloniales*. 1907, 10, 426-449.

<sup>16</sup> L. Monnais-Rousselot. *Médecine coloniale, pratiques de santé et sociétés en Indochine française (1860-1939). Une histoire de l'Indochine médicale*. PhD dissertation, Université Paris VII, 1997, p. 253.

<sup>17</sup> Le Roy des Barres. Le paludisme au Tonkin. *Bulletin de la Société Médico-chirurgicale de l'Indochine*. 1927, 14, 198-212.

development of Western medicine which was frequently used only as a last resort, the cases were probably greatly underestimated.

In this general context, in 1923, an agreement between the colonial government and the Pasteur Institute was reached to mission an entomologist, in charge of specific inquiries on malaria.<sup>18</sup>

In fact, some serious entomological investigations had been conducted on the Vietnamese territory before this date. The first one had been committed to Vassal, Yersin's collaborator, in 1905, with the aim of studying the feasibility of sanatorium creation in Dalat (1500 meters high) on the Lang-Bian plateau of Southern Annam. Vassal had conducted a medical survey among inhabitants and initiated investigation of Anopheles, in villages of the plateau as well as in villages of the valleys leading to the plain. Given the entomological knowledge of the time, he had concluded that the few anopheles species whose larvae were captured in Dalat were not pathogen, while numerous species captured at the height of about 1000 meters were effective vectors of malaria<sup>19</sup>.

The second survey of importance was conducted by two other Pastorian, Mathis and Léger, on their own initiative, in different regions of Tonkin around 1910. They performed spleen examination and blood tests among a large sample of children, which allowed them to distinguish different forms of malaria. While confirming that the epidemiological patterns of malaria were clearly distinct in the lowlands and in the hill-lands, they pointed out local differences within each one of the regions. They captured 15 different species of anopheles, some ubiquitous but other ones, either in larger amounts or quite specific to hyperendemic areas of the uplands<sup>20</sup>.

Despite this important breakthrough, before the war in Europe the colonial administration had refused to allocate special funds to further local studies on anti-anophelian measures.<sup>21</sup> When Borel, the entomologist commissioned by the Pasteur Institute, began his

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<sup>18</sup> Archives of Pasteur Institute in Paris. N. Bernard's letter, Saigon, 23/11/1923: "Envoi d'un entomologiste, en mission à l'Institut Pasteur de Saigon".

<sup>19</sup> J.J. Vassal. Rapport sur une mission au Lang-Bian du point de vue du paludisme. *Bulletin économique de l'Indochine*. 1905, 919-936.

<sup>20</sup> C. Mathis et M. Léger. Le paludisme au Tonkin. *Annales d'Hygiène et de Médecine coloniales*. 1911, 14, 294-316, 523-548; La faune anophélienne du Tonkin dans ses rapports avec l'endémie palustre. *Bulletin de la Société Médico-chirurgicale de l'Indochine*. 1911, 12, 83-95.

<sup>21</sup> Archives d'Outremer (Aix-en-Provence, France). Gougal 3069, 4409, 4414, 47425.



investigations, in 1925, the scientific knowledge on malaria and anopheles in the French colony was backward in comparison with that of the neighbouring European colonies. Malaysian States and Indonesia, whose malarial conditions were rather similar to Indochina, had already developed antimosquito measures in their large plantations of rubber-trees.

Borel's inquiries focused on Cochin-China and the South of Annam where malaria studies had been much neglected and where most of the big plantations were located. Though Borel's work did not allow for a complete mapping of Anopheles in the region, it pointed to the ecological specificity of most of the collected species<sup>22</sup>. Thus, the *maculata* species seemed the predominant carrier of malaria on the Red lands, the more dangerous as new breeding places of this species appeared with the first clearing works, due to the particular nature of the soil in this area.<sup>23</sup>

More importantly, the survey on the Red lands threw new light on the local demography and its connection with malaria. The survey was primarily related to the settlement possibilities of new permanent human communities on the plantations. But as it also involved the hill-land workers and their families who continued to live in their villages, it gave some of the first insights into the life conditions of local people.

Very low birth rates, high death rates among young children as well as spleen enlargement among the surviving children were the rule in plantations deprived of medical services. The blood tests confirmed the high incidence of *Plasmodium* infections, seen as mainly responsible for the demographical stagnation. The *falciparum* species, associated with the most serious malaria cases, predominated over *vivax* species in some areas (South of Annam). The hill-land people were at least as much affected by malaria as the immigrants who used to settle their camps near fishy rivers, where the protective role of larvivorous fish against mosquito was suspected by doctors. Starvation due to bad harvests and to the scarcity of cattle - another protection against mosquitoes -, seemed to aggravate the malaria endemy among hill-people and called forth frequent exodus.<sup>24</sup>

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<sup>22</sup> M. Borel. *Les moustiques de la Cochinchine et du Sud-Annam*. Paris: Masson, 1930.

<sup>23</sup> M. Borel. La constitution du sol et le paludisme en Cochinchine. *Bulletin de la Société de Pathologie exotique*. 1926, 19, 935-942.

<sup>24</sup> Borel. Résultats d'une enquête épidémiologique à Yaback (Annam). *Bulletin de la Société de Pathologie exotique*, 1926, 19, 845-852; Contribution à l'étude de la mortalité infantile en Cochinchine.

Following Borel's work, new agreements were concluded between Pasteur Institute and colonial government to reinforce the malaria control among workers. Special malaria services were created first in the Saigon Institute (1928), then in the Hanoi Institute (1930), including a full staff of malaria specialists, in charge of epidemiological studies and mosquito control. The beginnings of work regulations and of a greater concern for the coolie's health condition around 1930, coincided with more frequent troubles in the colony.

These various surveys yielded an accurate knowledge of pathogenic anopheles, of their local habits and breeding places. They established the threshold of *An. minimus*, a species which selects its breeding places in pure and slightly running streamlets and which is still recognized as the most effective vector of severe malaria in Vietnam. The surveys resulted into various works of drainage, pool petrolizing and other larvae destruction measures, conducted mainly in working places with a numerous labor force. The improved medical surveillance which benefitted workers thus contributed to a better production and was often as strickly enforced as in the army.<sup>25</sup>

The better understanding of factors involved in the endemicity degree of the hill-lands since the 1920s had not only focused attention on anopheles niches but also on the human reservoir of parasites constituted by local people. The "sterilization" of parasite carriers by quinine or new drugs, already difficult in medically controlled communities, seemed to be quite impossible among this "primitive" people. As a consequence, distancing of lowland people camps, as well as European ones, from the local villages appeared as a very important and easy measure. The first administrative measures aimed at maintaining the integrity of upland people territories (reserves) were even dropped. The camp segregation had of course to be observed when hill-land workers lived in the working places. The minimal distance of 1500 meters was even calculated, according to the flight of Anopheles.<sup>26</sup>

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*Bulletin de la Société de Pathologie exotique*, 1927, 20, 52-55; Enquête malariologique à la station d'essai de Giaray (Cochinchine). *Bulletin de la Société de Pathologie exotique*. 1928, 21, 312-314.

<sup>25</sup> H.G.S. Morin et L.A. Morin. *Essai sur la prévention pratique du paludisme dans les exploitations agricoles en Indochine*. Chambre de l'Agriculture de l'Annam, 1933, pp. 69-91.

<sup>26</sup> J. Mesnard et L.A. Bordes. L'importance du virus autochtone dans la lutte contre le paludisme en Indochine. *Bulletin de la Société de Pathologie exotique*. 1930, 23, 811-820; L'infection paludéenne chez les Moï et son importance épidémiologique dans le Sud Indochinois. *Bulletin de la Société de Pathologie exotique*. 1930, 23, 919-926.

As already mentioned, the ultimate aim of this "civilizing mission" in the uplands was the creation of Vietnamese villages. Successes, such as the one registered in a plantation of the Quang-Ngai province (Annam) where healthy people were cultivating small gardens around their houses, were apparently exceptional.<sup>27</sup> Incentives to bush-clearing and land farming through granting small concessions to Vietnamese people may have initiated settlements in other upland areas. But, ecological changes due to new irrigation systems could then worsen the malarious situation of some areas. Other factors could interfere, such as important population movements. In the Nghê-An province (Annam), villages along roads leading to highlands were progressively deserted by the new settlers<sup>28</sup>.

Alarming data about changes in Anopheles fauna had been also recorded in Dalat, the altitude of which seemed, however, to stave off any malarian risk. However, the city whose population had expanded since the beginning of the century, was declared to be infected by malaria at the end of the 1930s<sup>29</sup>. In a sense, the acknowledgement that the running waters of uplands were the breeding places of the most dangerous mosquitoes, revived the old legends.

### Conclusion

The history of malaria control in Vietnam is a good example to challenge the idea that medical developments were a prerequisite to colonization and land exploitation. The farming of new lands always anticipated the investigation in the local anopheles fauna and antimalarian measures. If these studies finally built up a remarkable bulk of knowledge on anopheles fauna in Vietnam, the antimoquito measures remained focused on limited areas.

While malaria remained the most prevalent disease in the whole country throughout the colonial period, it was often relegated to the margin as a pathology proper to peripheral areas. In the case of Red lands and other hill-land exploited areas, French scientists and

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<sup>27</sup> National Archives of Vietnam. Center n°2 (HCM-city). RSA/HC 3374: "Programme des travaux d'assainissement en Annam (Rapport Antoine), 1935".

<sup>28</sup> National Archives of Vietnam. Center n°2 (HCM-city). RSA/HC 3373: "Enquête malariologique dans la vallée du Sông-ca et à Cua-rao (Nghê An), 1935".

<sup>29</sup> Archives of the Tropical Medicine Institute, Marseilles (France): Indochina. Annual report of the health bureau, 1939, p. 114.

engineers only succeeded to create healthy "enclaves", where workers were brought under severe control. There were some improvements in medical facilities available to hill people in the late 1930s, and above all after 1945, due to the competition between French and Vietminh troop propaganda<sup>30</sup>. The war experience rekindled the malaria problem, as the uplands turned to be an important scene of military operations.

A national malaria program was launched by the government of Democratic Republic of Vietnam in 1957, just few years after WHO had spelt instructions for eradicating of the disease. This program which followed a wide epidemiological survey allied home insecticide spraying and preventive antimalarian drugs. If it raised some resistance, due for example to spraying in front of the ancestors' altar, population education and enrollment, also named "rectification campaign", were included in the program. In the mid-1960s, a state of near-eradication (with plasmodic index under 0,5%) was declared in about 500 northern villages, including highland villages.<sup>31</sup>

The program, however, encountered many difficulties. Antimalarian drug resistances and changes in mosquito habits combined with socio-economic factors as well as with the difficulty to extend the health system to the whole country after 1975. At the present time, the official data show a rather global low malaria prevalence (8,5 per 1000) in the whole of the country, but with striking disparities. The central upland provinces remain the most stricken areas (with rates sometimes over 10%). Northern provinces close to the Chinese border as well as remote southern coastal regions are also areas of persisting endemicity<sup>32</sup>. Although malaria is no longer considered as a major problem of public health by the Vietnamese authorities, it remains a disease of the peripheral zones and a potential threat for neighbouring areas where the epidemiological situation is still instable.

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<sup>30</sup> Archives d'Outremer, Aix-en-Provence (France). Commission Guernut, 25 Bf: "La question mǎi", 1937.

Archives of the Tropical Medicine Institute, Marseilles (France), n° 168-8: "Rapport d'inspection du service de santé dans les provinces Mois du Lang-Bian et du Haut-Donnai, 1946".

<sup>31</sup> Trần Vinh Hiên. *La lutte contre le paludisme au Nord-Vietnam*. Medicine thesis. Paris, 1965.

<sup>32</sup> M. Morillon, D. Baudon, Bui Dai. Les paludismes au Viet-Nam en 1996. Brève connaissance des connaissances épidémiologiques. *Médecine Tropicale*. 1996, 56, 197-200.