In Fevers’ Aftermath: Mosquitoes, Malaria, and Medical Research in Assam Valley Tea Plantations, 1900-1930

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Abstract: The concept of epidemiology has gained wide acceptance in the historical understanding of colonial development today. To locate the source of epidemics since the discovery of Ronald Ross’s mosquito vector as malaria parasite, the focus of attention is turned to major sites of colonial economy throughout the world. The factor of ‘locality’, therefore, emerged as an important field of enquiry in an attempt to identify the specific vector in malaria rejecting the earlier century old of belief in miasma. Considering the transition in the understanding of tropical diseases, this paper makes an attempt to explore the incentives for malaria research in the tea plantations of Assam Valley. Several tea estates were set up in the Valley became the places of intense malaria research in the early twentieth century as the infectivity of malaria was mostly prevalent among the immigrant labourers of the gardens. Contributions came both from the government and private entrepreneurial in malaria research which was intended to reduce mortality rates of the labourers. Yet, the region itself did not witness any sustained implementation of anti-malarial policies in terms of research and economic activity and malaria continued to kill the labouring population of the Valley gardens. By analyzing the factor of ‘locality’ in malaria research, the present paper would make an attempt to indentify the influence of local ecology i.e. mosquito vector on malarial fever on the one hand and the role of ‘tropical aggregation of labour’ or the contribution of the ‘human non-immune factor’ in the causation of malaria in the tea plantations of Assam Valley on the other.

Keywords: Malaria, Tropical Aggregation of Labour, Species Sanitation, Immunity, Prophylaxis, Plantation Economy.

The study of epidemiology as a field of historical enquiry has been considered a departure in the conventional practices to understand colonial development. The advancement of this new medical historiography has been generated by new sets of questions where the trend of re-reading colonial development under the purview of the etiological explanation has gained wide currency. In order to locate the source of epidemics the focus of attention has now been shifted to the major sites of colonial development projects examining to what extent these infrastructural developments were responsible to the creation of disease environment and inadvertently promoted the rate of mortality, the idea which often labeled as ‘death by development’. Some of the recent writings influenced by the environmental determinants have attempted to show how the issue of tropical
Development into Diseased Land: Beginning of Plantation Economy:

The Assam Valley, a frontier British colony, is situated in the easternmost part of India and consisted of six districts - from west to east, Goalpara, Kamrup, Darrang, Nowgong, Sibsagar and Lakhimpur. The present study has made an attempt to focus mainly on the last four districts (i.e. Darrang, Nowgong, Sibsagar and Lakhimpur) because of their high production of tea, settlement of majority immigrant labourers, and the direct medical intervention of the colonial state in those regions. The development of the Valley as a frontier plantation enclave in colonial India took off from the second half of the nineteenth century after its annexation by the British and the colonial government gave Assam Valley a definite shape by fully utilizing its topography. Though the climate of the region was tropical in nature and mostly unhealthy for the human inhabitants, the Valley had some potentiality in natural resources and the most important natural resource was its soil. The acidic old alluvial soil was suitable for tea cultivation and Assam Valley was considered the best tea growing area of the world with favourable soil, climate and topography. To attract the investors the colonial state enacted many laws in their favour. They encouraged investment at favourable rates in Assam, leased out so-called wasteland at ridiculously low rates to European speculators and planters. The large-scale expansion of tea, its profitability and potentiality had awakened growing interest among the British companies and private entrepreneurs in the cultivation of this plant and which entered into the different places of the Assam Valley. Once the problem of capital was solved the first major tea garden was started in upper Assam in 1839 by the Assam Company which was followed by the establishment of several other companies during the second half of the nineteenth century. Within a few decades, the combined tea production in the Assam Valley had covered 54 percent of the market in the United Kingdom and had outstripped the monopolistic market of China.

If the climatic suitability of this region was mostly helpful for tea plantation, the darker side of it which affected the works of plantation was the crucial existence of tropical diseases. The presence of extensive rainfall, swamps, marshes and other water surfaces, with large tracts of jungles and forests subjected the Valley to have precipitation thereby making its climate extremely damp. Such a climate would obviously be a dumping ground for the germs of malaria and other tropical diseases which used to take heavy tolls each year during
the later part of the nineteenth century till the first half of the twentieth century. With the growth and development of the tea industry in Assam and its transformation into a plantation economy, the region soon became an important site for medical discourse and contestation—being represented as a site of disease, fevers and fatalities. The plantation estates of Assam Valley were considered as an applied field of malaria research not only in terms of its economic potentiality but also of the identification of the causation of disease. Therefore the factor of ‘locality’ assumed greater significance within colonial medical and official discourse and emerged as an important field of enquiry in an attempt to identify the specific vector in malaria.

**Species Sanitation or Ecological Factor in Malaria:**

Prior to the end of the nineteenth century, British Indian medical officers usually subscribed to the miasma theory of disease and believed that local conditions in India contributed to the creation of a unique disease zone. This theory of disease held that miasma (i.e. poisonous chemicals, either in the form of gases or solid particles), when mixed up with certain atmospheric conditions, were transmitted by air or water, and brought about changes in the climate which helped to the occurrence of disease whereas the modern germ theory of disease explains that a specific living micro-organism (i.e. a specific virus) is chiefly responsible for a specific disease. The miasma theory of disease later developed with the application of another emergent idea of ‘species sanitation’, a term introduced by the Dutch researcher N.H. Swellengrabel, which emphasized the influence of local ecology on malarial fever. In this process, the category ‘malaria’ was contained in jungles and was known as ‘jungle fever’ in contemporary government reports and that the process of clearing jungles released malaria. According to this view, malaria contained in the jungles as the sunlight could not enter the thickly-covered tress. When the tress were cleared and the soil turned up and exposed to the air, malaria was set free from the soil and also from the decaying vegetable matter which remained on the ground.

In the light of the germ theory of disease, these ideas were incorrect, but paradoxically, it is true that the clearing of jungles resulted in the creation of suitable breeding facilities for the malaria-carrying anopheles mosquito. The link between the clearing of jungles and malaria is well illustrated in the evidence provided by Dr.G.C.Ramsay, Medical Officer to Labac Medical Practice, on 4 January 1930, to the Royal Commission of Labour in India:

*Most of the malaria in Assam has unfortunately been unwittingly created by mankind. In their natural state, that is when the plateaux and the hills in this province are covered with virgin jungle, i.e. under dense shade, the dangerous anopheles minimus is absent. When the jungle is felled and cleared, that is, when streams are exposed and drains dug; anopheles minimus and malaria are introduced. It is interesting to note that the pioneer tea planters in Assam after clearing away the jungle in order to plant tea described the fever which they unwittingly created as ‘clearance fever’. The exposed clear water in streams, stemlets and manmade drains on malarialogenic land was the source of this clearance fever not emanations from the soil after burning the jungle as originally believed.*

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With the expansion of the plantation economy, the region of Assam Valley was transformed ecologically which encouraged to the growth of the environment of mosquito. To begin with, plantation economy required cheap land and these cheap lands were available in the ‘isolated frontier areas, far away from towns and mining areas’ in what was originally virgin jungle. The colonial state surveyed, mapped and turned the jungle into land parcels to be leased to the planters and their companies. As a result, there were some natural changes in the hydrological character of the soil in Assam valley after the expansion of the tea plantation because plantation companies burnt and cleared the jungle of its original vegetation, and converted the ecologically diverse jungle into monocultural plantation (Fig. 1). These changes in the environmental conditions of the tea plantations –especially in the changes of soil texture and structure caused by deforming and destroying the macro-pores and soil pore network –dramatically influenced mosquitoes’ survival and distribution. As soil lost its total porosity, the resultant increase in surface runoff led to water logging and created new breeding places for particular anopheline species that were vectors of malaria. As a result, there was an increase in the incidence and severity of malaria. Moreover, planters resorted to construction of drainage for the successful cultivation of tea bush, and these drains with their slow-moving water became the ideal breeding ground of mosquitoes.

Fig. 1. Cutting down of trees in clearing of jungles (left) and regularly planted tea saplings in a plantation (Source: George M. Barker, Tea Planter’s Life in Assam, Thacker Spink & Co., Calcutta, 1884)
Human Factor Approach in Malaria:

To identify the causes of the transmission of malaria, another approach of ‘tropical aggregation of labour’ or the ‘human factor’ marked a significant shift in malaria research. S.R. Christophers and C.A. Bentley, two famous malariologists while presenting a paper entitled “Human factor to the Bombay Medical Congress” in 1909 coined the term ‘tropical aggregation of labour’ to clarify the causes of heightened malaria prevalence referring to particular areas, such as plantations or railway construction sites, where large number of labourers lived and congregated. Even their report on the prevalence of malaria in Duars linked malaria with the structure of the plantation economy and located the disease in the community of newly immigrant labourers. They also asserted based on the previous researches of Robert Koch and Angelo Celli (who were famous for their immunity studies) that continuous ‘non-immune immigration’ and ‘physiological poverty and hardship’ are the two factors which increased the infection rates in these places. Thus Christophers and Bentley identified three human factors which is responsible for epidemics: ‘tropical aggregation of labour’, non-immune immigration’ and ‘factor of residual infection’ (Fig.2).

Fig.2. Causal relationship of epidemic malaria (Source: S.R. Christophers and C.A. Bentley, The Human Factor: An Extension our Knowledge regarding the Epidemiology of Malarial Disease’, in W.E. Jennings (ed.) Transactions of the Bombay Medical Congress, Bombay, 1909)

Unlike Duars, the factor of Tropical aggregation of labour reflected on the tea plantation of Assam Valley in different way. The region was very sensitive for malarial fever and it is evident from the statistics available for the period 1877 and 1920 which clearly indicates that on an average one-tenth of deaths were caused by malaria. The problem in this area was not malaria among the indigenous people who had lived there for generations, but rather severe infection among the immigrants to the tea plantations. During the last phase of the nineteenth century, there was a substantial increase of labour mobility in Assam valley which was brought about by the development of plantation industry. As per the indication of official report, employment of labour in the Assam valley tea plantations increased from 107,847 in 1885 to 247,760 in 1900 and the industry continued to grow during the first half of the twentieth century. More attention was paid to the availability of labour than ever
before; and therefore malaria on the tea plantations should be understood under such a context.

During the process of labour recruitment in tea plantations, Chotanagpur was an important source of supplying overseas labour. Though there were some recruits from the North West Provinces, Oudh and Bihar, the planters emphasized more attention on Chotanagpur recruits because of their tractable nature. But the immigration of labour recruits from Chotanagpur through Bengal to the tea gardens of Assam valley placed them under great risk because the labourers of Chotanagpur were unpopular for their less immunity and their mortality rates from cholera and other tropical diseases were very high in their land. Despite the high mortality suffered by Chotanagpur recruits en route to Assam, planters in Assam Valley persisted in recruiting this source of labour and in the presence of the existing Anopheles the arrival of new labourers made an explosion of epidemic malaria.

In addition to the labour immigration factor, poor living condition of labourers in tea gardens and their nutritional deficiency contributed further to the occurrence of malaria. Due to the presence of the indentured system, most of the settled labourers lived in the garden (coolie lines) and basti labourers resided in the adjacent villages of the tea gardens. Their houses were made of bamboo and mud and had no proper ventilation system in any houses. As far as the sanitation is concern, the condition was very unsatisfactory in the coolie lines. The Whitley Commission recommended that adequate latrine facilities should be there in the working place of each plantation and this was done only in the few gardens especially in the Doom Dooma circle. In addition, malnutrition amongst the tea garden workers made them more susceptible to malaria and other diseases. The inability of wages to keep up with the rising cost of living resulted in reduction in the level of consumption causing undernourishment and malnutrition among the labour force- the point is well illustrated by Major Leonard Rogers, I.M.S.

A coolie woman, aged 19, was admitted to the Nowgong dispensary in 1896 suffering from anemia and dropsy of the feet and face. According to her story, she only received about one rupee a month from the contractor (probably minimum living allowance) and was consequently unable to feed herself properly. So she soon became ill and as she did not improve she felt the works and begged her way into Nowgong, living on what she could picked upon the way.

Thus the combination of excessive physical labor and excessive malnutrition greatly reduced the workers immunity. Their physical ill-health was further aggravated by inadequate sanitation, water supply and the generally unhealthy climate of the tropical forest areas surrounding the tea gardens.

Malaria Research and Anti-Malarial Measures:

The tropical environment of this ‘diseased’ land began to alter to some extent in the beginning of the twentieth century when medical research and the newly established
institutes of public health received financial support from private entrepreneurs, as well as the Government. The establishment of the Calcutta School of Tropical medicine (CSTM) in 1921 was an important milestone in this regard which made a considerable contribution to ward off tropical diseases through its research activities. The credit for establishing of the CSTM is generally given to Dr. L. Rogers but the very idea of establishing the project i.e. CSTM originally came from a medical practitioner, Alfred McCabe-Dallas, attached to an Assam tea plantation.\textsuperscript{23} The suggestion for a tropical school principally to carry out research into local diseases, as put forwarded by a planter’s doctor in Assam might be influenced by the necessity of ground level realities, but side by side it would be not biased to say that the emphasis of conducting and promoting of such medical research were carried out at such places which were explicitly associated with the economic interest of colonialism. Later on, the Indian Tea Association realized the importance of the School of Tropical Medicine and contributed substantially to its upkeep. As the subscriptions received for the setting up of the institution came from British-dominated tea industries in eastern India, therefore this patronage occasionally defined its activities. Although the Calcutta School of Tropical medicine at the very start of their activities began research on kala-azar because the epidemic kala-azar was endemic in the tea plantations of Assam Valley with high mortality as it indicated in details in the Indian Medical Gazette of 1885. But when the planters realized that the Government was to fund a separate research programme on the same disease, they proposed to divert the School’s research to malaria survey. In 1922, Lt. Col. McCombie Young, I.M.S., who in his report as Director of Public Health, Assam made a proposal to Dr. Megaw, Director of the School of Tropical Medicine to investigate the causes of endemic malaria in the tea plantation of Assam valley.

Beyond these observations no formed malaria research work has been conducted and the most striking aspect of our ignorance of Assam malariology is to be found in the fact that notwithstanding the enormous sums of money invested in the tea industry and the size if its labour force, the efficiency of which depends very largely upon the standard of health which is maintained in it, no precise scientific observations have been made to what are the conditions which at times and in places tend to produce an intensive prevalence of malaria on tea estates. It is not beyond the bounds of probability that if only a fraction of the money which is now spent in the prophylactic administration of quinine to the labour force were to be spent in abolishing the breeding grounds of carrier mosquitoes, the expenditure would yield a handsome return in an increased efficiency of labour forces.\textsuperscript{24} The Government of Assam also accepted the proposal and recommended it in G.R. 2445 E., dated 18\textsuperscript{th} June 1923 saying that if steps could be taken properly, the Director’s suggestions and the initiatives of the Calcutta School of Tropical Medicine might be directed to malaria research work in Assam. The understanding between the Calcutta School and the Government of Assam resulted in several malaria surveys in the tea plantations of Assam Valley. At the Annual Meeting of the Assam Branch of the British Medical Association in 1925 the decision of anti-malarial work was taken which was commonly called as mosquito malaria survey. While Ross’s discovery appeared to promise the elimination of anopheline mosquitoes, the dynamic aspects of the locality itself challenged the presumptions of malaria research\textsuperscript{25} and it is proved from the comment of Boyd, Medical officer in Assam, that ‘all anopheline mosquitoes are not the carriers of the malaria parasites and gross
variations with regard to their breeding habits are found among the different species of anophelines. To illustrate the diversity of breeding habits, the following categories of mosquitoes were found in Assam: Anopheles maculipennis, Anopheles maculates and Anopheles stephensi. On the same subject Ross at a meeting of the Royal Society of Tropical Medicine (RSTM) in 1924 stated that how different species of mosquitoes must be dealt with in different ways. Dr. Balfour and Major Austin also appreciated the observation of Ross and commented that it is necessary to make careful biological investigations before initiating any anti-malarial campaign. Reminding the Mian Mir experiment (1902-09), Ross appreciated the pioneering anti-malarial work of British Malaya in 1911 and felt that the doctrine of Malcolm Watson’s the specific prevention of malaria was still necessary in 1925 for the society of Tropical Medicine. The situation in Assam was not like that the region never witnessed any survey on malaria but a number of experiences was associated with the region in this regard: at Lumding Junction by many medical officers in co-operations, a report published by McCombie Young, I.M.S. (1921); at Nalbari, Kamrup District reported by S.R. Christophers, I.M.S. (1922); at Pasighat by McCombie Young (1921) and lastly at Doom Dooma by Malcolm Watts (1924). But the general paucity of malarial epidemiological work in Assam was explicit in the expression of McCombie Young who while illustrating the situation lamented: Certain tea garden doctors in Assam are trying to do things little by little and the doctor goes on to cite an instance of general ignorance in the matter where a malarious though otherwise excellent bungalow was dismantled rather than look for breeding-places of the mosquitoes which were the cause of the trouble.

The most important aspect of the public health work in the tea plantations in Assam Valley was the organization of measures to prevent malaria which caused most of the sickness. Until 1925, very little was known regarding the habits of those particular malaria mosquito carriers which inhabited the plantation areas. Dr. Ramsay, the then medical officer of the Labac central Hospital, started his great work on malaria control in 1925. He studied the habits and breeding places of mosquitoes and detected Anopheles minimus as the vector in the course of fifty thousand dissections. In 1930 this work was put on a more systematic basis by the establishment of an Assam Branch of the Ross Institute of Tropical Hygiene at Shillong to which the tea industry subscribed generously. Ramsay, whose work was based on methods tried elsewhere by Ross, became the first director of the branch and was indeed for years the focal point of all advances in this field. Some initiatives like the drainage measures undertaken in India under the supervision of Ross Institute were concentrated in the tea estates of Assam Valley where the large managing agencies had contiguous territories and several tea gardens under their control. The big drains alongside the tea gardens were considered the ideal breeding place of anopheles mosquito. During the initial stage of his research in Assam, Dr. Ramsay recognized that heavy downpours of rains rendered streams and rivers were completely free from all mosquito larvae and introduced the system of pipeless automatic syphon for this purpose of elimination of mosquito larvae. In some areas large siphons made of concrete discharged many thousands of gallons of water per minute with an initial velocity of 300 feet per minute. The effect of this
tremendous recurrent flush of water destroyed and removed larvae from the pools and made the pools almost dry. The two methods of shading and flushing in combination produced spectacular result in the reduction of malaria. In addition to this biological method, malaria control by means of drug prophylaxis also practiced in many tea estates. Many tea estates were the member of the Ross Institute, India branch and sometimes received expert advice and guidance of Dr. Ramsay. The result of such initiatives also reflected in many gardens. For instance, in the Doom Dooma tea estate the spleen rate became 17.56 in 1942 against rate of 70.15 in 1936.35 Seeing the satisfactory performance of the Ross Institute, the comment of Dr. Malcolm Watson, Director of the institute, at the Annual Meeting of the Indian Tea Association, 1940 remarkable: ‘Without hesitation and without qualification that in the last decade nowhere in the British Empire had such progress been made in the control of malaria as in the tea estates of India; it is a remarkable achievement’.36

In spite of undertaking a number of measures the region itself did not witnessed any sustained anti-malarial policies in terms of research and economic activity and malaria continued to kill the labouring populations of the Valley garden. In administrative terms, the main hindrance to the efforts on the part of the tea estates to engage in anti-malarial campaign was the ad hoc nature in which they operated and the short-term incentives involved, where the managers of the estate were personally responsible for the finance of the tea estates.37 Though Strickland pointed out in his report while suggesting that the managers not be made responsible for the anti-malarial sanitation work38, but the observation of the colonial medical expert Ronald Ross is different with regard to the anti-malarial works: ‘The government of our tropical dependencies has never been able to allot large enough funds for any of such (anti-malarial) works on general scale. The great success against malaria, namely, those in the Federated Malay States, in the Panama Canal Zone, and in the Suez Canal Zone, have all been effected by wealthy companies rather than by colonial administrators.’39

This necessarily reflects the corrupt nature of the planters of Assam and much of the funds were seemed to be usurped by them. Another anti-malarial measure was developed by Ross by the idea of ‘practical sanitarian’ i.e. isolation, personal prophylaxis through the use of mosquito nets, the mosquito proofing through the screening of buildings etc. were completely absent in the tea estates of Assam Valley. By the 1930s, the endemic situation of malaria improved to some extent and this happened when the planters found aid in the increasing availability of quinine for distribution among the workers. By the middle of the twentieth century, many planters would agree that the situation has markedly improved, but no one could win the war against mosquitoes and malaria- a war that was at least in part the product of the changes the planters themselves had made upon the landscape in their quest to domesticate the wild Assam tea plants.
References:


5 The Jorehaut Tea Company Ltd. (1859) in Sibsagar, The Upper Assam Tea Company Ltd (1862) in Dibrugarh, the Brahmapootra Tea Company Ltd. (1865) in Sibsagar, the Mungledye Tea Company Ltd. (1874) in Darrung, the Doom Dooma Tea Company Ltd. (1878) in Dibrugarh etc. were a few companies which were established covering the different places of the Assam Valley. For details see, Wilson Gow and Stanton (eds.), *Tea Producing Companies of India and Ceylon*, A. Southey & Co., London, 1897; C.R. Harler, The Culture and Marketing Tea, Oxford University Press, London, 1964.

6 Walter (et al.), *Children of the Plantation Labourers and Their Right to Education*, North-Eastern Social Research Centre (NESRC), Guwahati, 2003, P.2.

8 The concept of ‘locality’ is borrowed from the work of Nandini Bhattacharya’s article where she has used it to refer as both a prerequisite of colonial governance (i.e. the economic interest of colonialism) as well as the primary factor of the identification of the causation of diseases (that is in the field of malaria research) in the tea plantations of Darjeeling and Duars. For details see, Bhattacharya, *op.cit*, 2011, p.184.


20 Ralph Shlomowitz and Lance Brennan, ‘Mortality and Migrant Labour in Assam, 1865-1921’, *The Indian Economic and Social History Review*, vol.27, no.1, 1990, p.89.

22 Christophers and Bently, *op.cit.*, 1911, p.8.


26 Strickland, *op.cit.*, 1928, p. 3.


31 Rege, *op.cit.*, 1946, p. 67.


33 Bhattacharya, *op.cit.*, 2011, p. 199.

34 Rege, *op.cit.*, 1946, p. 67.


