PRELIMINARY REPORT ON ORGANIC MALARIA CONTROL USING EFFECTIVE MICROORGANISMS (EM)

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Submitted to: Mr. H. Uemura, EM Research Organization (EMRO) - Japan.

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1. Background:

   Tea Promoters India (TPI) is a market leader in Organics in Indian Tea by planting and processing organic teas under certification by international agencies like Demeter, IMO, IFOAM, Naturland, JAS, Skal, NOP, Bio Suisse, NPOP, HACCP and ISO.

   One of the organic tea estates under TPI Group named Puthajhora Tea Estate is located in high prune malaria area. The West Bengal Government control malaria in those areas by spraying DDT along all workers houses, hospitals and factory premises. Due to the International Regulations in Organic Products, the use of DDT was not allowed in Puthajhora due to the risk of contamination of DDT.

   Puthajhora T.E was forced to find out the way to control malaria organically under strict scrutiny of West Bengal Government since 2004.

2. Objective:

   -. To control effectively malaria in Puthajhora T.E. using Effective Microorganisms.
   -. To keep systematic and scientific documentation along the process of validation of the method.

3. Key Personnel:

   3.1. Chairman TPI: Mr. Brij Mohan
   Managing Director TPI: Mr. Binod Mohan

   3.2. Research and Development
   Mr. Brij Mohan
   Dr. Margarita Correa (Organic Consultant for TPI Group)

   3.3. General Administration:
   Mr. K.C. Agrawal (Executive Gardens TPI)

3.4. Tea Garden Managers

3.4.1. Putharjhora Garden: Mr. Prasad (Manager)
Dr.SukumarChakarvorty,MD(Garden Hospital)
Mr. Manoj Prasad (Assistant Field Manager)
Mr. Rana (Assistant Field Manager)

4. Garden Information:

4.1 Basic Information

Name of Garden	Putharjhora				
Location	Dooars				
Garden Altitude (mtrs)	170-350				
Gross Area (ha)	565				
Number of workers	1,200				
Tea Production per annum (kgs)	600,000				

4.2 Characteristic of the Garden

Putharjhora Garden is about 2 hours drive away from the Bagdogra Airport. It is located on the plains, in the region called Dooars region of West Bengal, India.

Putharjhora Tea Garden is located on undulating land at the foothills on undulating terrain. Elevation varies from 177 m to 291 m above sea level. Temperature ranges between 7° C to 37° C. Rainfall is received mainly in the months of May to September and averages between 300 to 400 cm annually.

Putharjhora Tea Garden is one of the estates under Tea Promoters India (TPI) Group. The estate was taken over by TPI in December, 1996 and is under organic certification from 1997. The entire estate has attained organic status from Jan. 2004. It is the only organic garden in Dooars region.

Out of a grant area of 566.80 ha, tea has been planted in 369.44 ha. While Sections 1 to 7 (91.33 ha) have been organic previously, Sections 8 to 28 (278.11 ha) have attained organic status from January, 2004.

In addition to tea, different herbs like lemon grass, Pepper, Basil, Jasmine Calendula, Mint and Peppermint are also cultivated. All are under organic agriculture practices.

4.3 Research

Puthajhora Tea Estate has 800 houses with an average of 5 people per house. Total population is around 4,000. All of the workers stay in the garden. The workers could be divided into 2 ethnic groups, Nepali Indians and Adivasis (Tribals). One problem in this area, including at this tea garden is the availability of clean water and the outbreak of diseases such as malaria and dysentery. The water comes down from the Himalayas, with

a lot of silt and is contaminated as it flows down. In the past, about 60 people die in about 4 months due to these diseases and averaging about 200 people getting sick or dying every year. This garden is classified under endemic area in West Bengal. Initiatives were undertaken to control these diseases.

5. Basic Information on Malaria

Approximately 300 million people worldwide are affected by malaria and between 1 and 1.5 million people die from it every year. Previously extremely widespread, the malaria is now mainly confined to Africa, Asia and Latin America. The problems of controlling malaria in these countries are aggravated by inadequate health structures and poor socioeconomic conditions. The situation has become even more complex over the last few years with the increase in resistance to the drugs normally used to combat the parasite that causes the disease.

Malaria is caused by protozoan parasites of the genus ***Plasmodium.*** Four species of *Plasmodium* can produce the disease in its various forms:

- *Plasmodium falciparum*
- *Plasmodium vivax*
- *Plasmodium ovale*
- *Plasmodium malaria*

P. falciparum is the most widespread and dangerous of the four: untreated it can lead to complications that include: cerebral malaria, in which the brain is infected; severe malaria, in which the parasitic infection essentially "runs out of control;" and placental malaria, in which *falciparum* is a grave complication of pregnancy, and coma. Each of these complications is very serious and often fatal.

Infection with *Plasmodium falciparum* kills approximately 1-2% of those who come down with it. *Falciparum* malaria is a serious illness characterized by fever, headache, and weakness.

The other species of malaria cause a debilitating illness characterized by spells of chills, fever and weakness. This illness generally lasts 10-14 days, and is self-limiting in nature. The malaria caused by these species is rarely fatal.

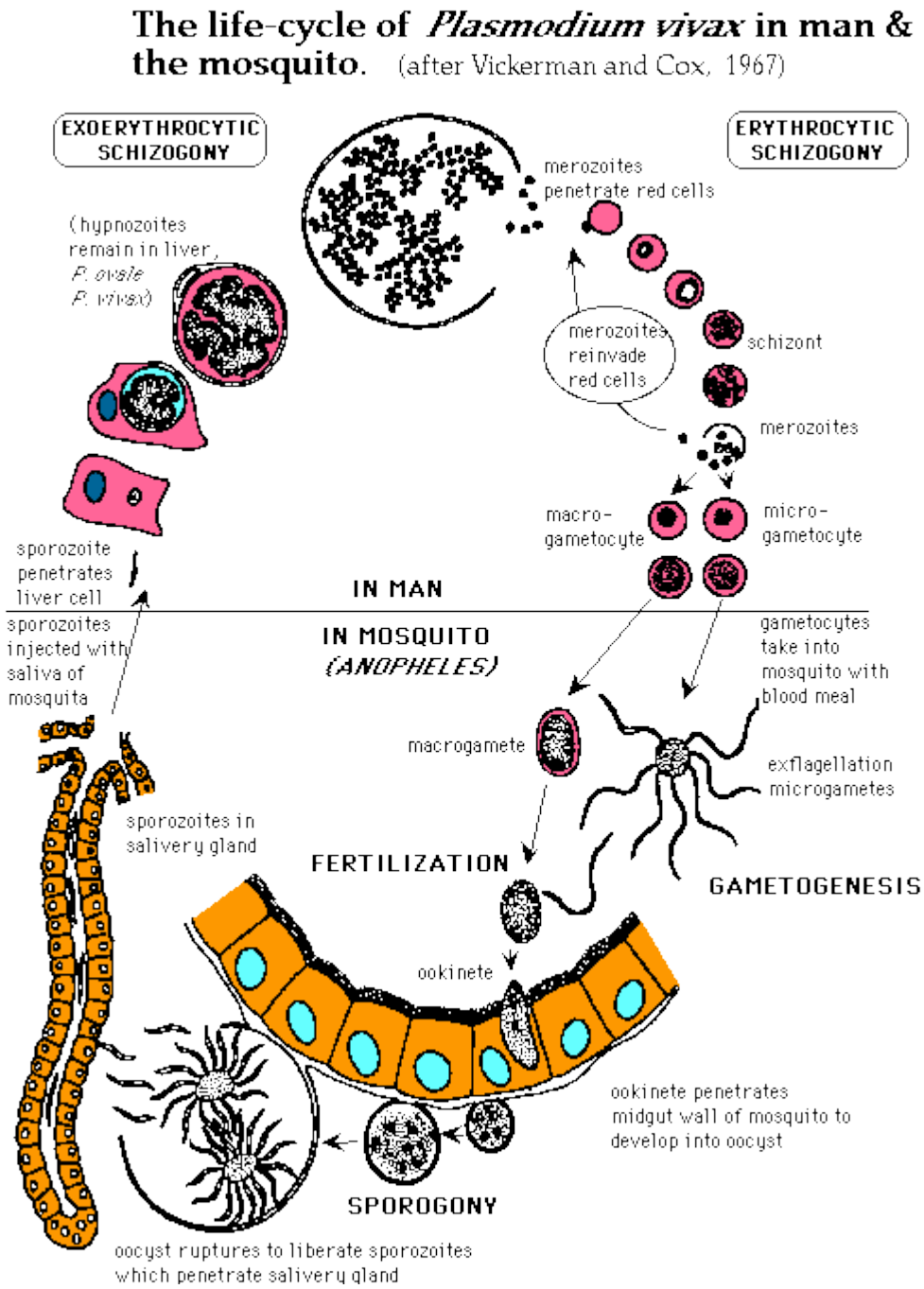
Malaria caused by *Plasmodium vivax* and *Plasmodium malariae* can relapse [come back] if it is not properly treated with medicine.

Unfortunately, in places where *Plasmodium vivax* has become more common, such as India, the more dangerous *Plasmodium falciparum* hasn't been far behind.

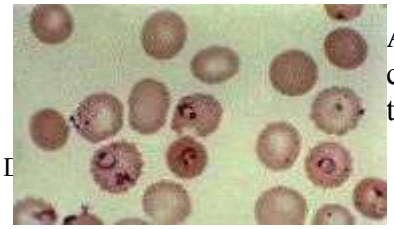
Malaria parasites are transmitted from one person to another by the female anopheline mosquito. The males do not transmit the disease as they feed only on plant juices. There are about 380 species of anopheline mosquito, but only 60 or so are able to transmit the parasite.

Like all other mosquitos, the anophelines breed in water, each species having its preferred breeding grounds, feeding patterns and resting place. Their sensitivity to insecticides is also highly variable.

Plasmodium develops in the gut of the mosquito and is passed on in the saliva of an infected insect each time it takes a new blood meal. The parasites are then carried by the blood in the victim's liver where they invade the cells and multiply:



[Lifecycle of a malaria parasite from mosquito to blood stages]



After 9-16 days they return to the blood and penetrate the red cells, where they multiply again, progressively breaking down the red cells. This induces bouts of fever and anaemia in the

infected individual. In cerebral malaria, the infected red cells obstruct the blood vessels in the brain. Other vital organs can also be damaged often leading to the death of the patient.

Malaria is diagnosed by the clinical symptoms and microscopic examination of the blood. It can normally be cured by antimalarial drugs. The symptoms, fever, shivering, pain in the joints and headache, quickly disappear once the parasite is killed. In certain regions, however, the parasites have developed **resistance** to certain antimalarial drugs, particularly chloroquine. Patients in these areas require treatment with other more expensive drugs. Cases of severe disease including cerebral malaria require hospital care.

In endemic regions, where transmission is high, people are continuously infected so that they gradually develop immunity to the disease. Until they have acquired such immunity, children remain highly vulnerable. Pregnant women are also highly susceptible since the natural defence mechanisms are reduced during pregnancy.

Malaria has been known since time immemorial, but it was centuries before the true causes were understood. Previously, it was thought that "miasma" (bad air or gas from swamps - "mal air ia") caused the disease. Surprisingly in view of this, some ancient treatments were remarkably effective. An infusion of qinghao (*Artemesia annua*) has been used for at least the last 2000 years in China, its active ingredient (artemisinin) having only recently been scientifically identified. The antifebrile properties of the bitter bark of (*Cinchona ledgeriana*) were known in Peru before the 15th century. Quinine, the active ingredient of this potion was first isolated in 1820 by the pharmacists.

Although people were unaware of the origin of malaria and the mode of transmission, protective measures against the mosquito have been used for many hundreds of years. The inhabitants of swampy regions in Egypt were recorded as sleeping in tower-like structures out of the reach of mosquitoes, whereas others slept under nets as early as 450 B.C.

Systematic control of malaria started after the discovery malaria parasite by Laveran in 1889 (for which he received the Nobel Prize for medicine in 1907), and the demonstration by Ross in 1897 that the mosquito was the vector of malaria. These discoveries quickly led to control strategies and with the invention of DDT during the World War II, the notion of global eradication of the disease. Effective and inexpensive drugs of the chloroquine group were also synthesized around this time.

The hope of global eradication of malaria was finally abandoned in 1969 when it was recognised that this was unlikely ever to be achieved. Ongoing control programs remain essential in endemic areas. Malaria is currently endemic in 91 countries with small pockets of transmission occurring in a further eight countries. *Plasmodium falciparum* is the predominant parasite.

Around 800,000 children under the age of five die from malaria every year, making this disease one of the major causes of infant and juvenile mortality. Pregnant women are also at risk since the disease is responsible for a substantial number of miscarriages and low birth weight babies.

Malaria thus has social consequences and is a heavy burden on economic development . The cost of treatment is between $US0.08 and $US5.30 according to the type of drugs prescribed as determined by local drug resistance. In 1987, the total "cost" of malaria - health care, treatment, lost production, etc. was estimated to be $US800 million for tropical Africa and this figure is currently estimated to be more than $US1,800 million.

The distribution of malaria varies greatly from country to country and within the countries themselves. In 1990, 75% of all recorded cases outside of Africa were concentrated in nine countries:

- India
- Afghanistan
- Thailand
- Vietnam
- China
- Brazil
- Sri Lanka
- Indonesia
- Cambodia

The significance of malaria as a health problem is increasing in many parts of the world. Epidemics are even occurring around traditionally endemic zones in areas where transmission had been eliminated. These outbreaks are generally associated with deteriorating social and economic conditions, and main victims are underprivileged rural populations. Demographic, economic and political pressures compel entire populations (seasonal workers, nomadic tribes and farmers migrating to newly-developed urban areas or new agricultural and economic developments) to leave malaria free areas and move into endemic zones. People are non-immune are at high risk of severe disease. Unfortunately, these population movements and the intensive urbanization are not always accompanied by adequate development of sanitation and health care. In many areas conflict, economic crises and administrative disorganization can result in the disruption of health services. The absence of adequate health services frequently results in a recourse to self-administration of drugs often with incomplete treatment. This is a major factor in the increase in **resistance** of the parasites to previously effective drugs.

(Source: Some of the information in this document is provided by generous permission of the: World Health Organization - Division of Control of Tropical Diseases- http://www-micro.msb.le.ac.uk/default.html)

6. EM Applications

6.1. Method

Due to Puthajhora Tea Garden is doing effective control of the most serious pest on tea named Tea Mosquito Bug (*Helopeltis Tiivora)* organically for the last 3 years, the research team focused the Preventive Malaria Programme under the Sustainable Organic Programme (SOP) – Social Responsibility based in the control of malaria mosquito population in houses, water bodies and roads by application of different Effective Microorganisms formulations till finally encourage results were obtained in a single formulation named TPI-ML1.

6.2. Spray

To control malaria bearing mosquitoes as well, TPI-ML1 is prepared and sprayed in 30 houses per day. An especial team was deployed with 3 backpack sprayers and a supervisor per day. Every 26 days the Tea Garden is fully covered. The spray is done systematically 4.5 times in the year, during the peak season (May, June, July, August and half September) since the last DDT spray registered on 17.05.2004 by stamp of Malaria Inspector of Mal Block – West Bengal, India.

6.3. Observed results

Year 2003:

From a population of 4,000 people, 2,609 came to Puthajhora's hospital with Malaria symptoms (65.22%) and 652 gave Malaria positive by blood test (25%). *P. falciparum* was 66% and *P. vivax* was 37%.

Year 2004:

Start TPI-ML1 sprays in 11.05.2004. Last DDT spray on 17.05.2004 in only 33% of the garden (Adivasis line).

From a population of 4,000 people, 555 came to Puthajhora's hospital with Malaria symptoms (13.88%) and 126 gave Malaria positive by blood test (22.7%). *P. falciparum* was 72% and *P. vivax* was 28%.

Year 2005 (till August 26th):

Already set up spray TPI-ML1. No sprays of DDT.

From a population of 4,000 people, 91 came to Puthajhora's hospital with Malaria symptoms (2.27%) and 16 gave Malaria positive by blood test (17.5%). *P. falciparum* was 69% and *P. vivax* was 31%.

The number of disease fatalities had decreased significantly. This year, at the time of preparation of this report, no deaths have occurred so far, whereas this monsoon time is usually the time of high incidence. A visit from EMRO and EMCO staff on July 2005 to the garden clinic also showed no sick patients inside.

Only 3 serious cases were sent to Malbazar Hospital – West Bengal at 12 Km from Puthajhora Tea Garden this year.

7. Documentation

Register books for documentation have been done since 2003.

Blood Test Register: Include name of the patience, age, sex, FRT (first retical treatment) and results (*P.F* or *P.V).*

First Retical Treatment is done to all people who arrive to garden hospital with malaria symptoms prior to blood test. It consists on chloroquine (cq) or preamaquine (pq),

paracetamol for fever. Three days treatment till blood test slide. The blood test is done in garden hospital and sent to Malbazar Hospital for analysis.

DDT Spray Register under West Bengal Government: With stamp of Malaria inspector.

EM Formulation Spray Register: Include name of the head of the each house sprayed, day of spray and houses sprayed per day.

Dr. Sukumar MD from Bangladesh is conducing all documentation in the garden hospital.

Mr. Manoj Prasad is documenting and supervising all relative to EM spray.

8. Certification

On 13.08.2005, a inspection to the garden by IMO who certified Demeter, Naturland, Bio Suisse, NOP and NPOP for this garden involved the inspection and certification of Malaria Programme as part as of DDT free garden for tea exports to overseas countries.

Methods, documentation, villages visit, interaction with locals in their language for testimony of incidence (sickness or deaths) in Adivasis lines.

9. Final Comments

The objectives of the experimentation were met till now. We reduced drastically the presence of malaria symptoms and malaria confirmation by blood test in 2005 in this garden, when the malaria incidence increased dramatically in Dooars area in the same period of time, according with local authorities report.

We recall the attention that these results are preliminary and that we have long journey to go before a conclusion can be stated.

The encourage results, the health of the people in this endemic area, the cost value of the programme and the support of the TPI Group under its Social Responsibility Programme encourage us to continuous in our research.

At the same time, TPI stated that it is their goal to change the tea industry in Darjeeling, as well as the tea industry as a whole. This change they want to promote is educating people on the need to shift to natural/organic methods as well as in changing the mindsets of people and in enhance the livelihood of people involved in the tea industry, right down to the ordinary tea workers as a whole. They would like their research to have an impact in the future to the tea industry as a whole, in promoting not only organic, but Sustainable Organic Agriculture and Sustainable Organic Life.