INSECT DISEASE VECTORS BIO CONTROL

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I. Background and Rationale

The WHO says some 2.5 billion people, two fifths of the world's population, are now at risk from dengue and estimates that there may be 50 million cases of dengue infection worldwide every year. The disease is now epidemic in more than 100 countries.

There are 350 to 500 million clinical episodes of malaria each year. The disease causes over 1 to 1.5 million deaths every year and is the eighth most important disease in terms of lost disability-adjusted life years (DALYs). Previously extremely widespread, malaria is now mainly confined to Africa, Asia and Latin America. The problems of controlling malaria in these countries are aggravated by inadequate health infrastructures 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*.**

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.

Puthajhora Tea Estate in Dooars area of West Bengal in India, which is under Tea Promoters India Pvt. Ltd., has been carrying out mosquito malaria control through “sustainable and organic” methods since 2004, at 1/3rd of the cost incurred previously, leading to the medical costs coming down to approximately 10% of the costs incurred earlier.

Below is the basic survey done in the target population where malaria is been controlled for the past five years in an organic and bio-dynamic tea garden, accredited and certified for the most important agencies in EU, US, Japan, India and Australia.

Table No. 1 shows the progress of the control in this target population over the last five years.

Table No. 2 shows details for of inputs and labor cost for malaria control per year.

Table 3 shows a preliminary report for larvae control of *Aedes sp*. with Loyola College in Chennai – India.

Table 4 shows a preliminary report for larvae control of *Culex sp*. with PECET – Research Centre for Tropical Disease, Antioquia University in Medellin – Colombia.

Table 5 shows a preliminary report for larvae control of wild *Culex sp*. Calazans with PECET – Research Centre for Tropical Disease, Antioquia University in Medellin – Colombia.

Table 6 shows a preliminary report for larvae control of *Anopheles sp*. with PECET – Research Centre for Tropical Disease, Antioquia University in Medellin – Colombia.

II. Goals and Objectives

1. To demonstrate the scalability of the current technology (which has been used in the experiment above) to a larger population and area
2. To achieve near eradication of Malaria in the target population of 6,000, chosen for the project
3. To demonstrate the reliability of a sustainable, low cost and eco-friendly alternative to chemical treatment processes to control malaria.

III. Materials and method

The program is using the sustainable and eco-friendly technology which is already in use in many parts of the world. This technology is: SCD Probiotics Technology developed by Sustainable Community Development LLC ("SCD"), U.S.A.

SCD Probiotics Technology is a product developed by SCD, which essentially consists of four types of bacterial strains: (a) Phototrophic bacteria, (b) Lactic Acid bacteria, (c) Yeast and (d) Actinomycetes. SCD Probiotics Technology is a mixed, probiotic culture of beneficial microorganisms which works to repopulate environments with good bacteria. This is a natural process, harnessing powerful and beneficial microbes to achieve results. The SCD Probiotics Technology uses microbes which are safe, natural, non-GMO and OMRI listed for use in organic production.

Dr. Margarita Correa, the Project Leader, has been working on applications of Consortia Probiotics Technology for over 15 years for various fields including agriculture, aquaculture, animal husbandry, environmental rehabilitation, bioremediation and human health, in India and all over the world. She has successfully conducted experiments over the last 5 years in demonstrating the synergistic effect of this technology in controlling malaria causing mosquito in Dooars in the West Bengal area of India. As mentioned, this approach has proven to be 1/3rd of original costs of controlling mosquitoes and has reduced the medical costs to approximately 10% of the costs incurred earlier.

IV. Results

Area: Dooars – West Bengal. India. Location: Puthajhora T.E. Total population: Approx 6,000. Number of houses: 793. Population is 60% Indian-Nepalese and 40% tribal (Adivasis). The last DDT spray according with DDT spray register with stamp of Malaria Inspector Mal Block, Jalpaiguri District-WB was done in 15.05.2004. The malaria pick season is May-June-July-August and September. Year 2006 was declared malaria prone area by West Bengal Government.

The spray of 793 houses (approx 800) is covered by two people that spray around 60 houses/day. The spray start in April and finish in September, a total of 6 rounds (1 per month).

Table No.1. Malaria Control in last 5 years in a target population of 6,000 people.

YEAR	Blood Test	*Pf*	*Pv*	Total patients	% Incidence	Total Cost Medicines
2003	2,609	491	243	734	12.23	US $ 5,500
2004 start Probiotics	657	98	46	144	2.40	US $ 1,200
2005	391	79	57	136	2.26	US $ 841
2006	640	24	17	41	0.68	US $ 617
2007	280	47	10	57	0.95	US $ 237

Pf = Plasmodium falciparum. Pv = Plasmodium vivax.

Table No. 2. Expenses of malaria spray 2007 year on 6,000 people.

EXPENSES	US$/Year
Inputs	117
Labor (included PF and extras)	120
TOTAL	**237 (or US $ 0.04/person/year)**

Puthajhora T.E. has a hospital, is managed by Mr. Manoj Kumar Saha MD; graduated from LMF Dhaka as general practitioner with 40 years of experience. The blood test are sent to Oodlabari town for analysis and, some cases, to Malbazar town where is analised by Malaria Antigen method.

Table No. 3. Bioassay data (%mortality) on the Third Instar larvae of *Aedes aegypti* exposed to various concentrations of Probiotic solution.

Conc.	24 hours	48 hours	72 hours	96 hours	120 hours
Control	Nil	Nil	Nil	Nil	Nil
0.1%	Nil	10%	20%	30%	50%
1%	Nil	20%	50%	60%	80%
3%	10%	40%	80%	100%	100%

The third instar larvae of the mosquito species were collected from the ICMR lab, Madurai. (Data received on August 27th, 2007. Loyola College-Zoology Department. Chennai).

Table No. 4. Bioassay data (% mortality) on the Third Instar larvae of *Culex quinquefasciatus* exposed to various concentrations of Probiotic solution.

Totals consolidates	24 hours	48 hours	72 hours	120 hours
Average mortality (%) with SCD MF	89.20	97.10	96.27	99.17
Control (%)				3.75

The third instar larvae of the mosquito species were collected from the PECET Research Centre, Medellin, Colombia.
(Data received on March 26th, 2009. PECET. http://medicina.udea.edu.co/pecet/)

Table No. 5. Bioassay data (% mortality) on the Third Instar larvae of wild *Culex quinquefasciatus* Calazans exposed to various concentrations of Probiotic solution.

Totals consolidates	24 hours	48 hours	72 hours	120 hours
Average mortality (%) with SCD MF	18.80	38.80	61.30	82.50
Control (%)				7.50

The third instar larvae of the mosquito species were collected from the PECET Research Centre, Medellin, Colombia.
(Data received on June 9th, 2009. PECET. http://medicina.udea.edu.co/pecet/)

Table No. 6. Bioassay data (% mortality) on the Third Instar larvae of *Anopheles albimanus* exposed to various concentrations of Probiotic solution.

Totals consolidates	24 hours	48 hours	72 hours	120 hours
Average mortality (%) with SCD MF	93.80	97.50	98.80	98.80
Control (%)				10.0

The third instar larvae of the mosquito species were collected from the PECET Research Centre, Medellin, Colombia.
(Data received on June 9th, 2009. PECET. http://medicina.udea.edu.co/pecet/)

Figure No. 1. *Aedes* larvae disrupted by Probiotics SCD formulation

V. Conclusions

The research so far has proven the effectiveness of Consortia Probiotics Technology for near eradication of Malaria in a remote community of 1,291 families (6,000 people).

The main advantages of the method implemented in this area are:

- Impressive reduction of patients affected by malaria in this target population
- Environmental friendly, avoiding the use of DDT spray

- Conservation of the status and qualification of “Organic and Bio-Dynamic Tea Garden”
- Reduction of medicine treatment expenses
- Cost effective mosquito malaria control
- Practically eliminated one of the causes of absenteeism in the garden
- Dooars was claimed in 2006 year “malaria prone area” by West Bengal Govt.

Figure No. 2. *Culex* larvae after 24 hours application Probiotics SCD formulation

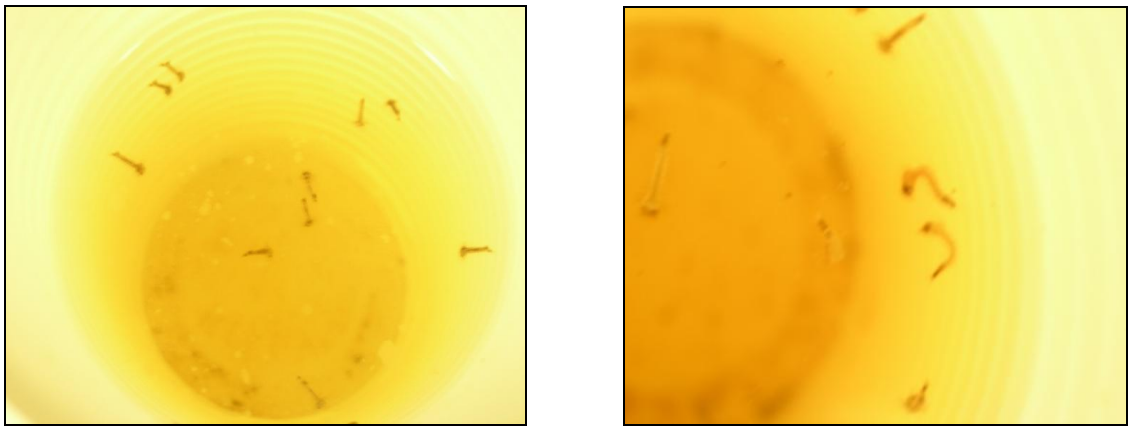
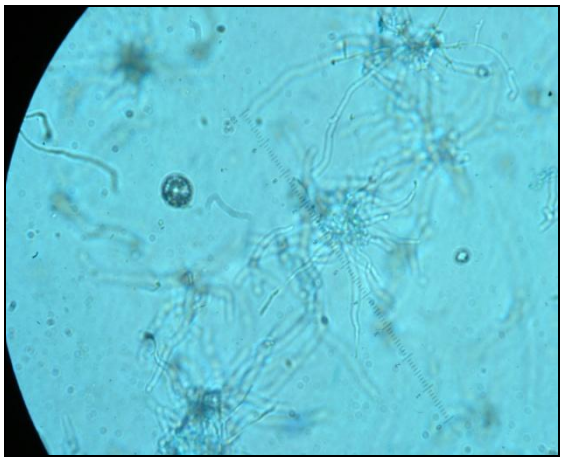


Figure No. 3. *Culex* larvae microscope observation at 50X after 24 hours application Probiotics SCD formulation



VI. Monitoring and Evaluation

The progress of the project would be monitored by the following tasks:

1. Assay of blood samples of the target population for malaria parasite once every month during the peak malaria season of April to September, each year for the coming 4 years.
2. Counting the SCD Probiotics Technology formulation in an experimental insectarium in Colombia under Research Centre in Tropical Diseases PECET University of Antioquia – Colombia, for the effectiveness of the formulation to control larvae populations on *Aedes aegypti, Culex quinquefasciatus* and *Anopheles sp*.

3. Research on the safety of the formulation for mammals, birds, bees, aquatic plants and fish.
4. Second field work in Colombian tropical rain forest area.
5. Evaluate the same formulation for control of the follow insect disease: dengue, chikungunya, yellow fever (by *Aedes)*, malaria (by *Anopheles)*, and filariais, elephantiasis, and Japanese encephalitis (by *Culex*).

Table No. 7. Concentration % of SCD Probiotics vs. Mortality % for *Culex sp.*