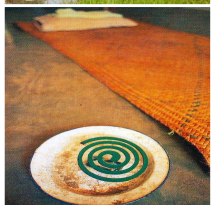


2009

GUIDELINES FOR ANTI-VECTOR INTERVENTIONS FOR MONSOON SEASON

[ABSTRACT: Malaria transmission has been closely associated with heavy rains around the globe and this disease always flourishes after rainy season when water become cessation. In Pakistan malaria is also a seasonal disease and major malaria transmission season is post monsoon (August-December) each year. During these months more than 80% of total caseload of the country has been reported every year. All major vector species of malaria named *Anopheles culicifacies*, *An. fluviatilis*, *An. annularis* and *An. stephensi* have their peak densities after monsoon season which reveals that there is a concrete relationship between rains, vector density and malaria transmission. This document mainly deals with prevention of malaria vector (s) before, during and after monsoon season to interrupt the disease transmission. These guidelines mainly focuses the adaptation of preventive measures for rural areas through Selective Indoor Residual Spraying (SIRS), larviciding, personal protection through the use of repellents, Long Lasting Insecticidal bednets (LLINs), cloth treatments etc. Fogging has also been recommended as one of the best choice for rapid knock down effect on vector densities only during the outbreak of disease and has not been recommended as routine intervention. These guidelines have been prepared in the light of best practices available in the world for routine vector control operations. These guidelines are also very effective under complex emergencies or among displaced (both internally or internationally) and for armed forces when they deployed in a new area, particularly in forests. This is an approach that aims at strengthening provincial/district level capacities in malaria vector control particularly and overall malaria generally as well as the promotion of functional mechanisms for inter-sectoral coordination for cost-effective and sustainability of vector control interventions to ameliorate malaria in country]



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GUIDELINES FOR ANTI VECTOR INTERVENTIONS FOR MOONSOON SEASON



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Background

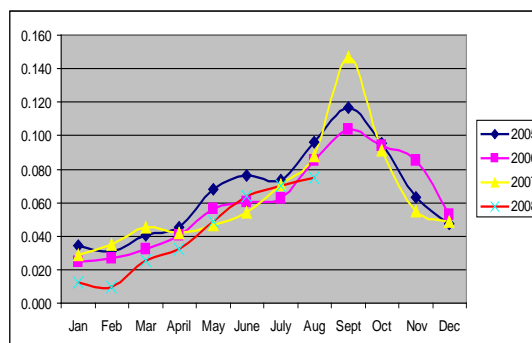
This document will explain;

- Link between monsoon rains (floods) and malaria transmission
- Effective response to control malaria during monsoon
- Recommendation for effective and sustainable preventive measures

Malaria and Monsoon season

Malaria transmission has been closely associated with heavy rains around the globe and this disease always flourishes after rainy season when water become cessation.

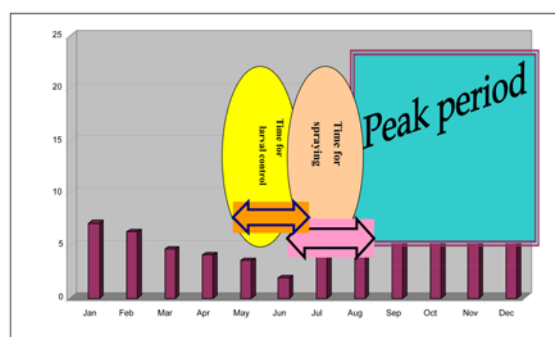
In Pakistan malaria is also a seasonal disease and major malaria transmission season is post monsoon (August-December) each year. During these months more than 80% of total caseload of the country has been reported every year. There is also a short transmission season during spring months (March-April) in country. However, most of these cases are delay expression of disease transmitted during post monsoon season or may be due to the second episode of the disease caused by relapsing vivax malaria.



Of total 24 anopheline mosquitoes in Pakistan there are two major vector species named *Anopheles culicifacies* and *An. stephensi*. Recently two new species *An. fluviatilis* and *An. annularis* have been identified from FATA and Balochistan province. Previously these two vector species have been considered confirmed malaria vectors in Iran and Afghanistan. All these vector species have peak densities after monsoon season which reveals that there is a concrete relationship between rains, vector density and malaria transmission.

Effective response to control malaria during monsoon

Though the complete prevention of disease only by vector control is not always feasible, therefore vector control interventions should also be supplemented by drug-based interventions. The implementation of vector control interventions require adequate preparation and planning and follow up. Ideally malaria vector control interventions must be implemented before the disease transmission period and should only be focused in rural areas. Moreover a good understanding of the vector (s) habits like where they breed, biting time (Diurnal, nocturnal, dawn & dusk etc) and resting places (endophilic, exophilic) and the duration of transmission (short or prolong) is crucial in determining which intervention is appropriate, cost-effective and timings of intervention. For effective response to deal malaria situation as a



result of monsoon national vector control guidelines have been revised and sequence of intervention have been shown in figure. According to these guidelines **Larviciding** is very effective tool only when this operation is carried out during dry months (May-June) when there will be limited number of breeding places which can be easily managed. This intervention will be followed by Indoor Residual Spraying (IRS) which will be conducted at least one month (July) before the transmission start (August-Dec). The overall objective of this sequence of implementation of intervention is to achieve maximum reduction in vector densities which ultimately result in reduction of “man-vector contact” and disease transmission.

Need of the document

This document mainly deals with *prevention of malaria vector (s)* in monsoon season. Presently prevention is the major activity of National Malaria Control Program (NMCP) to *interrupt the disease transmission by the reducing of densities of the malaria vectors*. These guidelines have been prepared in the light of best practices available in the world for vector control in monsoon or before the peak transmission or even during **outbreak or emergencies**. These guidelines are also very effective for the **armed forces** when they deployed in a new area, particularly in forests. Launching of this document is an approach that aims to strengthen provincial/district level capacities in malaria vector control particularly and overall malaria generally as well as the promotion of functional mechanisms for inter-sectoral coordination for cost-effective and sustainability of vector control interventions in local settings.

It is also important to understand that the appropriateness of vector control interventions for malaria and other vector borne diseases varies under different epidemiological situation as shown in following table;

Disease Scenario	SIRS	Personal protection				Larval control		Space spraying	
		LLINs	Repellents	Cloth treatment	Screening	Chemical	Source reduction	Indoor	Outdoor
Routine	++++	+++	+	+	+++	++++	+++	+++	+
Outbreak (if occurs)	+	++++	++++	++++	++	++++	+	++++	++++

For routine operations these guidelines mainly focus on following main areas (sequence of interventions);

1. Selective indoor residual spraying (SIRS)
2. Larviciding
3. Use of personal protection measures that include;
 - *Repellants*
 - Use of insecticides treated bed nets (LLINs)
 - *Treatment of cloths*
 - *Protective cloths*
 - *Screening of houses*
4. Space spraying
5. Environmental management (Source reduction)
6. Health education

However, if due to prolonged monsoon which results in floods and increased incidence of disease i.e. outbreak, the priorities for selection of intervention should be readjusted as shown in above table.

1. SELECTIVE INDOOR RESIDUAL SPRAYING (SIRS)

Generally, SIRS is a valuable option for malaria control, particularly when applied in right circumstances, with full coverage and with proper application method. Pakistan, since eradication era solely dependent on the spraying of residual insecticides for vector control. However since late 1980's this intervention was carried out on limited scale. Currently the total areas in the country covered by Indoor Residual Spraying is not more than 5-10% which is extremely low as compared to required one i.e. 80% of target areas. Since IRS is not highly recommended intervention after the outbreak of disease, therefore this activity must be completed well before the start of transmission period and all sleeping places, rooms and stores room should be sprayed thoroughly.



Following are the key points which should be considered for SIRS;

- IRS for malaria control should be limited to rural areas.
- Spraying should be started at least 1 month before the onset of the transmission season (normally July).
- Only the insecticides of WHOPES (World Health Organization Pesticides Evaluation Schemes) recommended manufacturers should be purchased and used for spraying.
- Special mobile squads (Entomologists, Assistant Entomologists, Malaria Superintendent, M. Supervisors etc) should be raised to carry out vector density surveys in district by involving district government staff and logistics.
- Indoor Residual spraying activities should be completed as soon as possible (at least one month) before the peak transmission period i.e. July.
- Try to finish the spraying operation in shortest possible period of time by employing more number of people if manageable.
- The target areas must be covered up to >80% through residual spraying
- The insecticides with longer residual efficacy (alphacypermethrin) should be preferred.
- The recommended dose of deltamethrin and Alphacypermethrin should be 25-30 milligrams/m² · active ingredient) for plastered smooth surfaces. In case of mud walls, dose might be 75 milligram/ m².
- Always use equal distribution (E type) nozzle for indoor spraying.
- All sleeping rooms, stores, bath rooms and animal sheds should be sprayed thoroughly.
- The spraying of animal shed will also be helpful to control leishmaniasis in addition to malaria.

- Ceilings of rooms particularly if made of straw must also be sprayed along with walls.
- Doors and windows from inner side and undersides/behinds of furniture boxes should also be sprayed.
- Treatment of curtains with insecticides will also be useful to control mosquitoes.
- After spraying, close the room for at least one hour.
- Keep the children and animals away from room for this period.
- Never leave any food item inside room during spraying and always transfer food item insides at least after one hour of spray.
- Never clean (broom) the wall after spray.
- In case of displaced population or deployment of armed forces, spraying the tents from inside will also be very effective and spraying operation should be done before mid of the day. After spraying, close the tent for at least half hour.
- In such cases spraying should be done after the transportation and installation of tents.
- Hang a black cloth sheet (CHADDAR) in rooms (preferably in corners) and spray it thoroughly. This will give maximum mortality of vector mosquitoes resting inside the room.
- There is no need of spraying in open air or on debris/garbage.

In case of prolonged monsoon or heavy rains and subsequent floods resulting in an outbreak of the disease the top most priority should be given to "Personal Protection" using LLINs, repellants, cloth treatment as explain in table. Similarly if spray operation could not be done and there is a threat of an outbreak again the priority should be given to Personal protection than IRS.

2. LARVICIDING:

The best and most effective method of vector (s) control is to find and eliminate their breeding places. Generally larval control includes use of chemical, environmental management, biological, etc. However in Pakistan the use of chemical has always been given top most priority. Larvicides should be used in breeding sites that cannot be drained, filled or where other larval control methods are too expensive or impossible to use. Larviciding is very effective tools when carried out during dry months (May-June).



Following points should be considered while applying larvicides;

GUIDELINES FOR ANTI-VECTOR INTERVENTIONS FOR MONSOON SEASON

- Larviciding should be done during “Dry months i.e. May & June” when there will be limited and manageable numbers of breeding places.
- Larviciding should be carried out very carefully after proper Breeding Sites Assessment Surveys (BSAS) and mapping and procedure for BSAS is as under;
 - * Mark the area within 2 km radius from center of village (within flight range of mosquito).
 - * Mark the water bodies within marked area on paper.
 - * Identify the potential breeding places and permanent and non-permanent habitats
 - * Estimate the size of water bodies
 - * Following will be criteria for collection of number of samples with respect to size of samples

	Area (m ²)	No. of samples	No of dips
1	<5	6 dips per m ²	6/ m ²
2	5-10	1 sample	30 dips
3	11-20	2 samples	60 dips
4	21-30	3 samples	90 dips
5	31-40	4 samples	120 dips
6	41-50	5 samples	150 dips
7	>50	6 samples	180 dips

The dipping should be well dispersed along the entire margin of habitat

- * Calculate the number of larvae/dip
- * Larvicides will applied in water bodies having;
 - ▶ **Anopheles** (Malaria control) 1.5-2 anopheline larvae per dip.
 - ▶ **Culicines** (Nuisance mosquito control) 4-5 culicines larvae per dip.
- Physio-Chemical analysis of these sites must be carried out before larviciding operation and decision should be taken as under;

	Characteristics	Bio-chemical			Thresh hold	Action suggested
		DO	EC	pH		
	Clean / Turbid	≥3.5 ml/l	≤4.5 ml/l	±6.8	1.5-2 larvae/dip	Use Temephos
	Organically polluted water	≤1.5 ml/l	≥5.0 ml/l	≥7.2	4-5 larvae/dip	Use fenthion

- Organically polluted water should only be focused for the control of nuisance mosquitoes by use of granular larvicides (Fenthion2%) while clean water for anophelines mosquitoes by the use of Temephos 50%.

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- Larviciding should be focused only to those water bodies which are close to human population (with 1-2 kilometer radius).
- Granulars (Fenthion 2g) should be sprinkled along the 2-3 feet from margin.
- The dose of Fenthion 2%G should be 75 gram per 100 sq. meters of stagnant water.
- Liquids larvicides (Temephos 500E) should be sprayed along margin up to 3-4 feet.
- The recommended dose of Temephos should be 1.5 lit/5hec. (3 ml/100 m²).
- No larviciding should be done in the center of water bodies.
- Normally there should be no larviciding during rains and floods.
- Larviciding should be carried out at least 2-3 weeks of cessation of rains (permanent water bodies).
- Larviciding should be focused in water bodies less than 100 sq. meters of size.
- In case of very large water bodies >100 sq. meters, larviciding (if very necessary) should be confined to areas where there are emergent vegetations along margin of pond.
- Ideally larviciding should be carried out at 2nd and 3rd stage/instars of development stage of mosquitoes.
- For spraying of larvicides, hallow/solid cone nozzles are only recommended.
- Direct mixing of liquid larvicides (Temephos) should be strictly prohibited.
- For most efficient larviciding program, treatments must be repeated at fairly short cycles which may vary from 10-15 days depending upon larval density and availability of resources (2-3 cycles per month).
- Larviciding operation should be carrier out for at least 2 months.
- In areas with very strong wind movements larviciding should be done towards downwards of wind and should be confined only along margin that produce better results.
- Larviciding in flowing water should also be avoided.
- In case of unserviceable water bodies (even for animal use), used mobil oil should be sprinkled. Similarly mixing of animal dung (15-20 kg/100 sq m) in such water bodies will also give a significant control of nuisance mosquitoes.

3. PERSONAL PROTECTION

If the rainy season become prolong which results in flooding situation and there is a threat of outbreak of malaria the personal protection should become top most priority interventions for mosquito (both nuisance and malaria vector) control as shown in table. This intervention is also equally important for displaced population

and armed forces (particularly when they deployed in forests). However their efficiency depends on their acceptance and proper usage by affected population.

Following are the main methods of personal protection;

► Use of repellents

The repellents containing N, N-Diethyl-m-toluamide (DEET), ICARIDINE (odorless and more advance form of repellants) etc are highly recommended.



- The repellants should be applied particularly to exposed body parts (foot, arms, face) to prevent mosquito bites.
- Children <5 and pregnant women (PW) should use cream, lotion and other repellent at time of sleeping, particularly when sleeping outdoors. During emergencies particularly when population displaced in areas with thick vegetation, the replants should also be used by children and PW even when they are not sleeping. However in case children <5 years no material should be applied to their hand and/or faces.
- Clothing can also be treated with DEET, ICARIDINE etc to repel mosquitoes.
- The repellents (DEET) containing concentration above 30% should be avoided.
- The repellent which gives at least 8 hrs should be preferred.
- For acceptance to community a repellent should not cause any irritation on skin.
- However prolong use of repellants for more than 2 months should be consulted with doctor.
- Natural repellants like Garlic, onion, neem, Cedar, Eucalyptus spp, cloves oils, can also be used during peak breeding times during/after monsoon or complex emergencies.
- In case of ten, burn the leaves of neem, Eucalyptus spp (smoke only) in a tin container inside and close the entrance for at least 15 minutes. This practice should be done under close supervision and at least 1-2 hours before sleeping.
- In case of open air, burn (smoke) the leaves of neem, Eucalyptus spp close to sleeping place at the time of sleeping. It is recommended that such smoking is undertaken at least 1 hr before the sleeping time and stopped just before sleeping for avoiding health hazards.



► **Use of Insecticidal Treated Nets (LLINs)**

The use of Long Lasting Insecticidal Treated mosquito nets (LLINs) should be the one of the major intervention particularly for children <5 and pregnant woman and also for those people living outdoor during peak breeding season. However during outbreak due to flooding or among displaced population the use of Long Lasting Insecticidal Treated nets (LLINs) become best choices for the control of malaria and other vectors of public health importance. Under such circumstances all pregnant women and children <5 must be provided with LLINs.



Following are the major instruction for better use of LLINs in monsoon season as per national guidelines;

- **ONLY** WHOPEs (World health Organization Pesticides Evaluation Scheme)- Recommended LLINs (PermaNet, Olyset, Interceptor, NetProtect, DuraNet) should be promoted and will be used in the country.
- In case of prolong rainy season (floods) and when there is risk of outbreak of disease whole population at risk (in that particular area) should be protected by LLINs.
- In areas of stable malaria (districts with western international border of Pakistan) the major target groups for distribution of LLINs should be pregnant women and children <5 year.
- In areas of unstable malaria whole population at risk should be provided with LLINs.
- 2 bed LLINs per house hold should be provided to cover entire family.
- Armed forces particularly when deployed in forest during rainy/flood days must use LLINs.
- Every *P. falciparum* confirmed malaria patient must be kept under LLIN.
- Leishmaniasis and dengue patients should also kept under LLINs.
- After opening of packet, LLIN should be spread under shade for 1 hrs before use.
- Never leave the net in sun or in rain in day time after use.
- Never fold the net but hang it in room or tent (preferably in corners) during day time when it is not in use.
- The use of LLINs as curtain will also give significant control of vector densities and in tents particularly, LLINs should also be used as curtains at entrance.
- Before sleeping put/tuck the hanging edges under bed sheet/mattress.
- Bednets should be washed after at least 3-4 months. However it should not be washed during rainy days.

- During emergency/epidemic/natural disaster washing of net should also be avoided.
- Avoid the washing of bed net during peak transmission months.
- Washing should not be done in lakes, well and other drinking water resources.
- Make sure the 80% coverage of target population particularly children below 5 years and pregnant women.
- If there is any hole in bed net it must be replaced when with new one. However, if new one is not available it must be repaired immediately.

► Cloth treatment

Mosquitoes can also bite through cloths particularly when they are skin tight. However, the treatment of cloths with quick-acting insecticides of *pyrethroid* group such as "permethrin" can be the best choice to prevent the mosquito bites during peak breeding season after monsoon. Though these compounds don't repel the mosquitoes but allow them to make contact with fabric and irritate or kill them before they manage to bite. The application of repellants to cloths is prefer to application on skin because of reduction of likelihood allergic reaction on skin. Some of the other pyrethroids like "*cyfluthrin*" can also be effective however degrade quickly in sunlight. However if the clothing is treated with non-repellent pyrethroids, flying insects including mosquitoes can bite on uncovered skin, necessitating the application of repellent to skin. Synthetic insecticides should generally be preferred to volatile repellents for clothing treatment because;

- They are most feasible and effective during peak breeding of mosquitoes after monsoon.
- Act quickly and repel or kill mosquitoes quickly.
- They are long lasting and to some extent withstand weathering, sunlight and washing with cold water.
- The use of repellants is also best choice for armed forces particularly when they are deployed in forests during main transmission period. They are more pleasant to use (no odor, color or greasiness).
- The recommended dose of permethrin is 1.25 mg/m². The Chaddar (Doupatta) of female (pregnant women) can also be treated with this insecticide at same dose.
- They are long lasting up to several weeks depending upon washing and exposure to rain and sun.
- Effective up to 10-12 washes in cold water. However, washing in hot water and during peak transmission period should be avoided.
- To avoid any irritation on skin, it should be applied at right dose mentioned above.

Since these synthetic pyrethroids are non-volatile in nature, therefore there is risk of attack of mosquitoes to expose body parts. Therefore during peak transmission period after monsoon the use of volatile repellents should be preferred one. They

remain effective on cloths up to a week. Treated cloths also provide protection against biting midges, fleas, sand flies, and body lice.

How to treat clothing

The clothing can be treated with permethrin by spraying the insecticides from a pressurized can or by soaking in an aqueous emulsion. The recommended dose for long sleeve shirt (*Kameez*) is 1.25mg/m².

► Protective cloths

During peak breeding of mosquitoes the protective cloths can offer one of the best protections from mosquito bite particularly when they are thick and loose. Following important measures should be considered during transmission period;

- Always wear;
 - long sleeves while sleeping particularly during day time
 - sock and also cover other exposed body parts
 - full trousers
 - loose fittings
 - light color clothings

However, these cares are particularly recommended for dengue patients (both confirm and suspected) and even for children <5 years of age against malaria. These measures are very effective for personal protection from mosquito biting and should be promoted through health promotion campaign.

► Screening of tents/houses.

- In case of house, mosquito-proof screens on doors and windows should be promoted to prevent the entry of mosquitoes.
- Screen of mesh size 150-170/ inch² or 25-30/cm² should be used.
- In case of tent net with same mesh size should be hanged at entrance.

4. HEALTH PROMOTIONAL CAMPAIGN

Before the start of monsoon season, a comprehensive mass media campaign for community awareness among common man should be started for better acceptance of interventions. Therefore health promotional campaign through public participation should be the top most priority/activity to;

- Change the behaviour of people for improved hygiene practices.
- Recognize the symptoms of disease for prompt treatment seeking behavior.
- Cleanliness of the surroundings
- Draining out of stagnant water
- Treat the undesired stagnant water with used mobil oil and chemicals (larvicides) where necessary for other nuisance mosquitoes.



- The best approach in our context is to involve local leaders, Imams, teachers, and LHWs in imparting health education messages.
- Promote the self protection practices (use of LLINs, creams, oils, coils and other repellents).

The overall success of implementation of self protection measure solely depends upon the strong and effective communication campaign. In this regards the extensive distribution of posters and pamphlets should also be one of the key strategies for the success of such campaigns.

5. SPACE SPRAYING

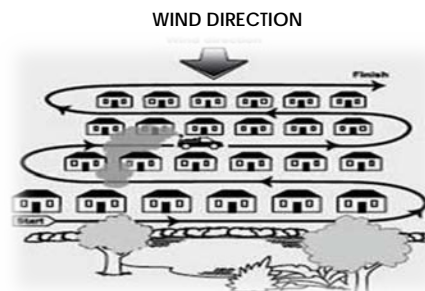
The space spraying is not recommended for routine vector control operations in Pakistan at present. Space spraying should be considered as epidemic contingency measure particularly during complex emergencies. Space spraying is usually designed to provide a rapid knock-down effect on exophilic vector mosquito during peak breeding season or during outbreak after monsoon season both in rural and urban areas.



Following are the key points for effective implementation of this intervention;

- It should be implemented in a compact community and should be within 500-1000 meter radius of affected areas.
- For endophilic vector mosquito control during emergencies situation as a result of heavy monsoon, space spraying should also be an important component of vector control. However, it should be concentrated inside houses with the help of hand carrying fog machines (**Indoor thermal fogging**).
- During outbreak fogging should be done (preferable at dawn) on alternate days during first week of outbreak and later on 3rd day for next two weeks.
- There should be 3-4 cycles/month during the epidemic/emergency situation and operation should be continued for at least 2 months.
- For indoor fogging a team of 2 persons should target 75-100 houses per day.
- The person operating should move backwards, from one end of house to other, starting with upper floors.
- Other persons should assist in moving furniture, exposing hidden sites and guide the spray man through tight spaces.
- During indoor fogging windows and doors should be closed.
- Residents and pets should move out.
- Leave the room closed for at least 15-30 minutes after treatment.

- **For out door fogging**, first prepare plan with respect to layout of streets and wind directions.
- Fogging should be done perpendicular to the wind direction. While using vehicle mounted fog machine, maintain speed of vehicle 5-10 km/hr.
- In case of outdoor fogging, the operation should not be carried out when;
 - ▶ wind speed is >10 km/h.
 - ▶ wind speed is less than 3 km/h
 - ▶ relative humidity is >90% (during/immediately after rains)
- Ask community to open doors and windows during fogging operation.
- Space spraying must be conducted at the time of peak activity of adult vector mosquitoes.
- Follow the dose criteria of manufacturer mentioned on label i.e. 1 liter insecticides in 160 liters of kerosene oil or diesel which will be sufficient for 700,000 – 800,000 sq. m area. In case of Ultra-Low Volume (ULV) there should be 1 liter insecticides for 50 liters of kerosene oil or clear water which will be sufficient for an area of 250,000-300,000 sq meters.



N.B: Blood cholinesterase must be monitored on regular basis, if organophosphates compounds are used.

5. Environmental Management (EM)

EM refers to any modification in environment which deprive the vector population of its requirements for survival (mainly breeding, resting and feeding), thus reducing human-vector contact and transmission risks. Though during rainy season EM is not effective and feasible option, however only feasible option at home level i.e. covering of water storage containers and cleaning of surroundings of houses.

Following are important points to be considered for EM for the control of mosquitoes;

- Remove the stagnant water by;
 - ▶ Fill the ditches with soils
 - ▶ Drain out water in nearby water course/channel.
- Use the used Mobil oil to cover unusable water bodies.
- Cover the water storage tanks properly.

Protection from Mosquitoes Prevention from Malaria and dengue