



Some Methods of Mosquito Control in Bangkok

In the previous section, it is told about the species of mosquitoes and breeding places of mosquitoes in Bangkok. The following section will show about some method for mosquito control in Bangkok. These method of control in detail will be found in the other thesis written by Udon. In this part of this thesis will show some methods which should be used for mosquito control in Bangkok. These methods are not suitable for all part of Bangkok but may be used in control of mosquitoes. The mosquito control in Bangkok is the main problem and should be cooperated with the government and other relation parts.

Mosquito control may be divided into two steps. The first step is larvicidal method. The second step is adulticidal method. These two steps will show briefly in the following part.

Larvicidal Method

This step of control will employ these methods. They are drainage, filling, toxic agents, and naturatistic methods.

Drainage

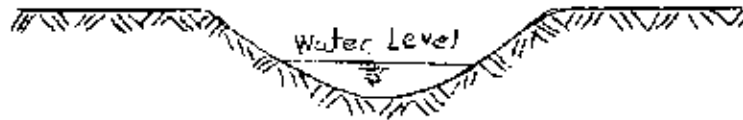
Drainage is the method of mosquito control in the larvae stage. Drainage for this purpose is different from the ordinary drainage in the case that water must drain from that area in the short time or the water must run all time for preventing laying eggs. Drainage may be made by these methods.

1. Drain ditch or open ditch
2. Subsurface drainage
3. Street drainage

Open ditch

By ditching the ground in form of trench have trapezoid figure. The bed of ditch must have slope of 0.05 ft. per 100 ft. for ditch which does not build by concrete. The bed must narrow. The line must not bend. If there are sharp bent it should make a curve. Maximum slope of ditch should be used between 0.6 - 0.8 ft. per 100 ft. If the slope is greater than this it will cause erosion on the bed or the bank. Side slope of the channel be 1 horizontal to 1 vertical for firm loam and sand clay. If soft, loose clay slope will be 1.5 horizontal to 1 vertical. In hard the side slope may be steep than 1 to 1

The cross section of open ditch should have shape as shown in the figure.



The bottom and side of ditch should line with concrete and the bottom should be curve or flat. The concrete proportion is usually 1 : 3 : 5 mix. In this case it will prevent the erosion of bed and side. In some area, it will not necessary to line with concrete, if it considered that places will not occur in erosion. These places are hard clay or rocky material. The ditches should be carefully maintain or they may themselves become breeding places of mosquitoes. In maintenance of ditches, the main condition should be considered.

They are :-

1. Growth of vegetation
2. Caving or sloughing of banks
3. Artificial obstruction

Thus if this method is completed, the mosquitoes may reduce because of lacking breeding places.



Subsurface drainage

This method uses underground tile drainage for mosquito control. It is advantageous in swamp area where open ditches cannot use because of choking with vegetation or tramples by cattle. It is also advantage in reducing maintenance cost and elimination of breeding places.

The tile which is used varies from 3 inches in diameter upward and have suitable space between the tile and is laid at depth of 2 to 4 ft. The pipe is laid with close joint and slope should be 2 inches to 100 ft. at least.

Street drainage

The storm sewer can be used as the mosquito control. Now the storm sewers of Bangkok are the breeding places of mosquitoes. Thus we must improve these sewers by cleaning or construction new sewer with suitable slope for carrying the water and small particles in prevention the settlement. Before the construction, the topography of that area must know. In the case of unpaved street, the side ditch should be brought to grade, clean and breed of weeds.

Pumping

It is the method of drainage by using pump in the area which cannot use the drainage method by ditching. This method will be used when these conditions are required :-

1. The place which is drained is at or below the low water level of an adjacent river or bay
2. When a drainage area, especially in peat or muck soil, has sunk or subsided below the adjacent water level.

Filling

In some area that cannot drain or pump and sometime be economically and adequately kept from breeding mosquitoes by filling. In filling of that area we can use the soil, rubbish, garbage and ashes or cinder. If the rubbish is used, it should be covered with ashes, cinder, or soil so that they will not hold water and breed the mosquitoes or cause other nuisances. The other type of material for filling is street sweepings. In filling there are two method :-

1. Sanitary fill
2. Dumping

Sanitary fill use rubbish, garbage and is covered with soil for preventing flies and rats. Dumping use the same materials, but is not covered with soil.

Toxic Agents

Toxic agents which is used for mosquito control may be divided into two groups.

1. Petroleum derivative oils
2. Larvicides

In using these two kinds of toxic agents it should use the method of spraying on the surface of stagnant water. The correct use of toxic agent should be observed at all times.

When the toxic agent is used, these agents will spread over the surface of water. The larvae or pupae will breathe the toxic agent by breathing tube. Thus the toxic agent have a poisoning effect to them and will clog the breathing which will cause larvae death.

Petroleum derivative oils which are used for this purpose may be direct refinery product, such as kerosene, benzene, diesel oil and stove oil; or reclaimed waste oil, such as crank case oil. The oil which is to be used on

water to destroy the aquatic stage of mosquito must be lethal to all larvae and pupae at least in time. It must spread well on the surface of water and must have lasting quantities. Mixture suitable for larvicidal purposes should have specific gravity of 31° to 39° Baume' (API) and viscosity of 45 or lower Saybolt at 100° F, easily obtainable, not unpleasant to handle and if possible non-toxic to animals.

In using oils for mosquito control, the following requirement must be kept in mind :-

1. It must be homogeneous
2. It must not separate into fractions on prolonged standing
3. It must be free from granular or fibrous materials
4. It should have physical characteristic within the requirements of that area by testing the oil.

However, there are some suggestions for using oil. These are the specific gravity at 60°F not less than 0.830 nor more than 0.870, viscosity (Saybolt universal) at 100°F not less than 30, nor more than 45.

Larvicides

These are the chemical agents and are used for killing the larvae and pupae and are also for adult. These Chemicals are pyrethrum, cresylic acid, paris green, DDT powder or DDT oil solution, and phenothiazine. These chemicals are used in the same way as oils by spraying or dipping on the surface of water. The detail of these chemical will be seen in other part written by Udon.

In using these chemicals the applying of these is done by hand sprayer or power sprayer.

Natural Enemies

The mosquitoes like most animals and insects has its natural enemies. The natural enemies are dragonflies, birds, bats, and some larvae of mosquitoes. For dragonflies, they are predaceous in both the nymphal and adult stage. The common predator is fish which is the cheapest method for control mosquitoes in larvae stage. These fishes are fighting fish, gold fish, top water minnow and small catfish. These fishes are not suitable for all part of the country, close observation will help the selection of suitable fish

for mosquito control. However fish have limitation under natural condition because fish can live on the clean water and cannot live on the polluted water. These natural conditions should be tested for suitable conditions in control of mosquito by fish. However the natural enemies can be used for mosquito control if the studying is enough in the natural enemies.

The another method of control by the natural is improvement of impounded water, such as reservoir. Cistern, or barrel and the like. The reservoir should be clean and free from vegetable or small plants. The barrels and cisterns should be covered with screen

These method which is shown in above is used for control in larvac stage. The detail of these method is shown on the other part

Adulticidal Method

In this stage, it is the method of mosquito control in adult stage. The main problem of this control is the preventing annoyance or biting and preventing transmitted disease. By the nature the female mosquitoes like to eat

blood of human for development of viable eggs. If they cannot eat blood meal the eggs are not viable. Thus the method of control are spraying with DDT oil solution in the form of residual spray or space spray; fumigant with DDT or DDT with other toxic agents such as, benzene hexachloride. The other kind of chemical used for fumigant are hydrogen cyanide, sulfur dioxide, and para-dichlorobenzene. These chemicals are used for killing insects and may be used for killing mosquitoes. The other kind is the chemical repellents. Most of these chemical repellents were mixtured of oil of citronella with various added ingredients such as camphur, eucalyptus oil, tar, oil of cedar or carbolic acid. Now there are many chemical repellents which have new formula of mixing. These chemicals may be used in the form of smoke by lighting, or spraying and smearing the skin. However these chemicals are less effective in for three to five hours. They remain effective for long time when sprayed on clothing.

The another method used for control is screening of the houses or other places which will be the breeding place. Screening is made of wire, generally galvanized. The other

materials are copper and bronze which has longer life than galvanized iron. Now there are plastic screen cloth which is corrosive resistant and has longer life than metal. Generally the screen has 18 meshes which has eighteen openings to inch each way as the standard screen. The aperture of screen is about 0.0456 inch. Sometime sixteen meshes screen is used, it has an aperture of about 0.0475 inch. Another kind of screen is mosquito net which will be used where screening is impracticable. This screen is made of thread. In using the screen is hanged over the bed and should be tucked in around the mattress and not allowed to hang loosely to the floor. Thus the net are used for nuisance prevention and disease prevention.

The simple method of prevention of mosquitoes is made by exposing to wind which will reduce in the annoyance or nuisance. Sometime the removal of shelter, or destruction of unnecessary will be the reduction number of mosquitoes in biting and resting. The other way of mosquito control is trapping by using mosquito light trap which is the New Jersey light trap type or hand catching or killing with suction tube using chloroform for killing.

For adult mosquitoes, the method of control may use the natural condition for nuisance prevention and biting by using chemical in the nature, such as sulfur which cause odorous perspiration by burning, or use some odorous plant such as herbs and smoke smudge. The other way of natural condition will use the physical characteristic such as clearing or removing of shelter or rendering dwelling in bed room. The natural enemies can be used for mosquito control. The natural enemies are dragonflies, birds and bats. These enemies feed on wing mosquitoes and other insects. In some area using animal as the bait for deviation of mosquitoes to animals. In this case will reduce the number of mosquitoes in nuisance

From the mention above, it is the same method of mosquito control in adult stage. The detail of these method will be found in the other section written by Udon.

Discussion

From the writing of this thesis by method of collecting data, which will give very useful to the reader. This result will be seen in the following items :-

1. Mosquitoes, in the world, have many species.

From the text book of Medical Entomology written by Horn. show that there are about 1,600 species

2. Mosquitoes can be divided into four tribes. These tribes are Megarhinini, Culicini, Aedini and Anophelini

3. Mosquitoes are the vector of disease from man to man, generally, the Anophelini tribe of genus Anopheles. The genus Anopheles is the vector of malaria fever. This fever is found in all part of Thailand but have a little in Bangkok. Now this fever is reduced by mosquito control of genus Anopheles with Health Department and USOM. The other kind of fever is Thai haemorrhagic fever which is found in Thailand, especially in Bangkok and Thonburi, and nearby province. The vector of disease is the mosquito of genus Aedes aegypti. This genus is also found the vector of disease of yellow fever which is found in Central America and South America

4. Know the life cycle of mosquitoes which have four stage, 1) eggs, 2) larval, 3) pupae, and adults.

5. This result will give the knowing characteristic in general of mosquitoes. The knowledge will give the way for further study of mosquitoes in Thailand in order to control.

6. Know the species of mosquitoes in Bangkok. From the data above, there are forty eight species of mosquitoes in Bangkok. (This data is worked by the Department of Pathology of Chulalongkorn Hospital). In forty eight species, there are fourteen species which is the vector of disease.

7. The report which were collected will show the mosquitoes in Bangkok being the genus of *Aedes aegypti* and *Culex quiquefasciatus*. These two species are the vector of Thai Haemorrhagic fever which occurred in Bangkok few year ago in the case of epidemic. Now there are occurred rarely, and is not epidemic. From this data we will find that mosquito in Bangkok will also be the vector of filariasis fever. The fever is found in the Southern part of Thailand. This fever is rarely found in Bangkok in the patient. In this case the people of Bangkok have the good education and know the method of prevention from mosquitoes. The other case is the place which is not observed, so that we do not know the number of patient.

8. From the data, the greatest number of mosquitoes are the *Culex pipien quinquefasciatus*. This species is the annoyance mosquitoes and also be the vector of disease of THF. This species is found in polluted water such as pools under houses. The number of Mosquitoes will be shown in Appendix Chart.

9. Know the breeding place of mosquitoes. Some species of mosquitoes like the clean water, some species like polluted water. Some type like to lay eggs in tree holes. Thus mosquitoes like to stay on different places. So that it should have the surveying for knowing the characteristic of these breeding places for further study. Now there is the studying of this purpose, but all of this points will be the studying in medical ways more than engineering way. Thus it should study on engineering way in branch of sanitary engineering. In studying on engineering way it should study about the characteristic of water, temperature and environmental condition. This studying will give the result in mosquito control. Thus this is an important problem

10. In this story the main problem will be the method of control of mosquitoes in Bangkok more than knowing characteristic of the mosquitoes of the species. However the knowing of the characteristic will take to know the species. All of the species of mosquitoes have the same characteristic but they are different in detail which is the function of entomologist or biologist in classification. The function of engineer in this branch is to observe the characteristic of breeding places for finding the suitable method of control

11. The method of control of mosquito will be completed in two stage. One stage is the larvae. The second stage is the adult. The detail of the control will be seen in the other thesis written by Gdon. However the mosquito control in Bangkok is the main problem and must be cooperated from the relation parts, such as Bangkok Municipality, Health department and other relation or the aim is not fulfillment

12. The method of control of mosquitoes, the suitable method are drainage, filling, DDT and the natural enemies.

Drainage may be made by using the storm sewers of the streets. These sewers should be improved for carrying water.

The water should be clean, run all time and is not stagnant water or polluted water. The sewer should have sufficient slope for carrying water. In using these sewers because they are saving in economics and lower cost in new construction. The sewers must be cleaned by flushing at some period.

Filling, this method may be used in some area of Bangkok, some places can do and some places cannot do. Filling may be suitable for marsh. Filling may use soil, garbage or rubbish, ashes and cinders. Besides the filling, pumping may be used. In using pump, the cost of maintenance may be high. But pump can be used with the sewer for carrying water in the case of water cannot run or stagnant water.

DDT, It is the chemical agent and use for killing mosquito larvae and adult mosquitoes. DDT is used with the other material such as oil, or may used in the form of dust. In general, DDT is mixed with oil called DDT oil solution. The applying may be made by spraying with hand sprayer or power sprayer or spraying by aeroplane. In using this, the latter working can be used for control of mosquitoes in Bangkok. We know that Bangkok Municipality will use this method. In using by this method, it may affect

to the other kind of insects which will be useful to the human or agriculture. The insects will have the resistance occurred in the body if they get a little agents which will make hard in control in future.

Besides the prior method by using physical method or chemical method, the nature may be used for mosquito control. The nature may be living things or non-living things. The living things are fish, birds, and other kinds of living things which must be studied in the future. However, the fish is the cheapest method in control. The studying of fishes will help in mosquito control in the future if there is enough study.

13. In population, it should have the proclamation and request in mosquito control of the vicinity of houses and the water containers, such as jars, vases, ponds and wells. These things will be the breeding places of mosquitoes of genus *Aedes aegypti* (From the report of SEATO LAB.), because this species like to lay eggs on clear water and still water. In control this species of mosquito the simplest method may use screen or lid covering these containers. The other method may use by chemical agents.

14. The mosquito control in Bangkok is the main problem. Now there are no exact method for control. The method will use for reduction number of mosquitoes. However, in the future, it hope that there are some exact method. At the present the mosquitoes in Bangkok is not only the location mosquitoes but they are the mosquitoes from near province or the suburb. These places are rice field, garden or marsh area and these places will are the good breeding places. Thus it is very hard to control. Although the method of control will succeed but the number of mosquitoes is only reduced. The mosquitoes from the other place will come because that area is not control or a little control. The Bangkok mosquito control will be succeeded if the near province will worked in the same time with close cooperation.

Conclusion

The studying of Bangkok mosquitoes will give the good result in mosquito control in the future because of knowledge in the species of mosquitoes, the characteristics of breeding places, the method of collection, and also give some method of mosquito control in Bangkok. I hope that these method will give very useful, if the studying of these method is enough.