

# Urban malaria & vector control

## Presented By Dr.L.R.Wagh



Anopheles  
mosquito

*The culprit that can kill  
millions by its deadly bite!*

# Introduction

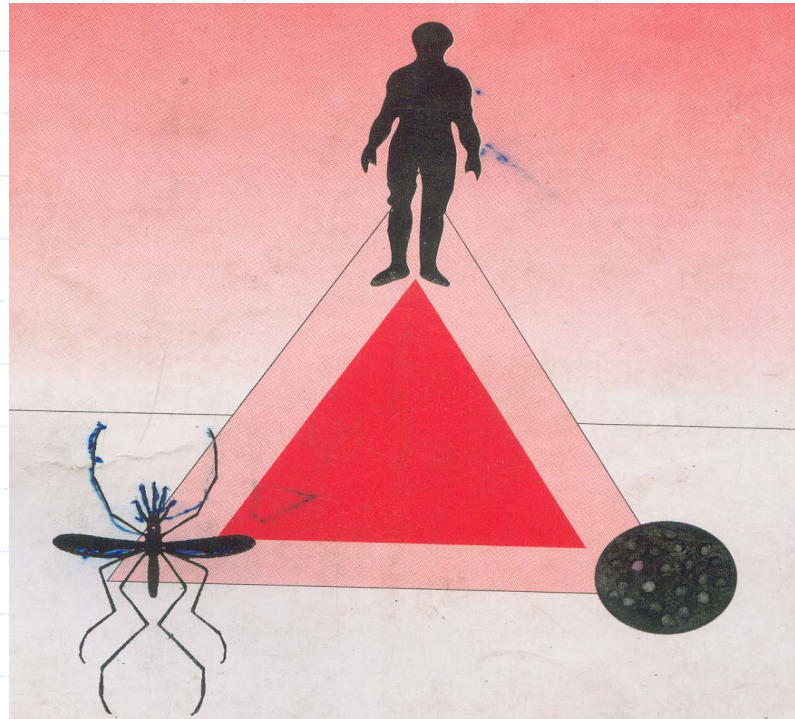
◆ Rapid and uncontrolled growth of Mumbai with unabated proliferation of slums have brought in their wake several public health problems among which mosquito rodent and other pest menace and the threat of diseases transmitted by them is most reckonable. Rising incidence of malaria the recent traumatic of dengue and leptospirosis the all pervading mosquito rat and fly nuisance are the clear manifestations of the problem

# Misconceptions about malaria

- ◆ Some of the usual misconceptions about the causation of malaria are that it is caused by bad air, drinking contaminated water, garbage accumulation or even wetting in the rain. No doubt, that these beliefs are wholly erroneous and have no scientific basis.

# WHAT IS MALARIA?

- ◆ Malaria is communicable disease caused by certain parasite of the genus-plasmodium. It is caused by the bite of an infected female Anopheles mosquito



# MALARIA AND DENGUE MOSQUITO

- ◆ Malaria and Dengue these diseases are caused by mosquitoes which are breed only in clean stagnant water. These mosquitoes do not breed in dirty places or in garbage.

# Scale of Malaria

- ◆ Around 2.5 billion people (at least 40% of the world's population) are at risk in over 90 countries
- ◆ Malaria causes or contributes to 3 million deaths and up to 500 million acute clinical cases each year. In other words:
- ◆ Almost as many deaths per annum as the AIDS death total in the last 15 years

◆ Malaria is one of leading causes of morbidity and mortality in the developing world (along with TB, acute respiratory syndrome, diarrhoea and HIV) but still not recognised in developed countries as a disaster like AIDS or EBOLA.

◆ The main areas affected are Africa, South East Asia, **India** and South America but surveillance and records are too poor to know the real distribution and case numbers.

# SPREAD

- ◆ Malaria kills more people today than three decades ago. Reasons for the spread include
  - ◆ Increasing drug resistance
  - ◆ Increased migration and immigration
  - ◆ Increase in size of endemic territories (e.g. people moving from countryside to cities)

# Spread (contd)

- ◆ **Tourist and business travel (increased air travel since 1950s/60s)**
- ◆ **Decreased mosquito control efforts (insecticide spraying)**
- ◆ **Deforestation and mining (development activities)**

◆ Malaria is spreading to new territories for example, India, Brazil, Sri Lanka, Turkey, and the Middle East

◆ Malaria is spreading from the countryside into cities (e.g. Mumbai), increasing the risk for city dwellers and tourists in these 'safe' zones of endemic countries.

**40 years ago malaria had been eradicated or dramatically reduced in 37 countries (WHO insecticide spraying programme 1956-69) but this situation has been rapidly reversing, especially over the last decade. The reversal is largely due to the cost of sustaining programmes, loss of motivation in the face of a seemingly declining threat, and the development of insecticide and drug resistance.**

- ◆ **Malaria exacts an enormous toll in lives, medical costs and days of labour lost**
- ◆ **Educational system also suffer as large no of children miss several weeks of school each year in endemic regions.**
- ◆ **The direct annual commercial loss in Africa due to malaria was estimated to be US \$3.6 billion by 2000 (US \$10 million a day).**
- ◆ **A single bout of malaria is estimated to cost a sum equivalent to 10-20 working days in India and Africa.**

# Obstacle & Remedial action

## *Political commitment*

**Insufficient political commitment for improved health services**

**Inadequate surveillance and control programmes**

**Insufficient international public funding**

**Inadequate training/career opportunities for local malaria scientists/health professionals**

# *Resistance*

- ◆ Drug resistance is increasing rapidly, largely due to widespread uncontrolled and unregulated drug distribution.
- ◆ Another underlying factor contributing to the development of resistance is the improper usage of the drugs; for example, sub curative doses - people feel better, so stop taking their medicine, and some resistant parasites may be given the chance to survive and be transmitted by mosquitoes.

There is insufficient research into novel drug targets. Current new options are based on the same three families of compounds (the quinolines, antifolates, and artemesinin derivatives) all of which have records of resistance and/or ineffectiveness.

Insecticide programmes have also been hampered by the emergence of resistance to DDT and other insecticides.

## *Problem in vaccine development*

- ◆ Parasites have a more complex structure than viruses and bacteria and change appearance over the course of an infection.
- ◆ Finding the best way to attack them via vaccination is not easy - further research on their composition and biology is needed even before addressing major issues such as how to produce and administer a vaccine.
- ◆ The two main malaria parasite species are sufficiently different from each other that a vaccine based on one will probably not prevent malaria by the other.

# Gaps in malaria research

- ◆ Biochemistry of the parasite
- ◆ Basis of parasite drug resistance
- ◆ How people build up immunity to malaria
- ◆ Transmission characteristics and epidemiology (differs throughout the world)
- ◆ Pathogenesis (i.e. development characteristics of malaria)
- ◆ Mosquito biology, infection, genetics, insecticide resistance
- ◆ Effect of malaria on other diseases and vice versa
- ◆ Environmental factors

# Investment in Research

*Global expenditure on research per associated death for various diseases*

<b>Diseases</b>	<b>Annual global research (\$ million)</b>	<b>Global mortality (1990: Thousands)</b>	<b>Estimated global research expenditure per fatal case worldwide (1990)</b>
<b>HIV/AIDS</b>	<b>952</b>	<b>290.8</b>	<b>3274</b>
<b>Malaria</b>	<b>60</b>	<b>926.4</b>	<b>65</b>

Malaria control is everybody's business and everyone should contribute to it, including community members and people working in education, environment, water supply, sanitation, and community development. It must be an integral part of national health development and community action for control must be sustained and supported by intersectoral collaboration at all levels and by monitoring, training and evaluation, and operational and basic research

# Types of mosquitoes

◆ In the world there are more than 3000 species of mosquitoes belonging to 37 genera. Out of these only 15 genera are recorded from India which are

◆ 1. Anopheles

9. Mimomyia

◆ 2. Aedeomia

10. Mansonia

◆ 3. Aedes

11. Orthopodomyia

◆ 4. Armigeres

12. Malaya

◆ 5. Heizmania

13. Tripteroides

◆ 6. Culex

14. Uranotaenia

◆ 7. Culiseta

15. Toxorhynchitis

◆ 8. Ficalbia

# Malaria vector in India/Mumbai

◆ Malaria in India is transmitted by 9 well known Anopheles species,

◆ A. culicifacies

◆ A. philippinensis

◆ A. fluviatilis

◆ A. annularis

◆ A. minimus

◆ A. varuna

◆ A. stephensi

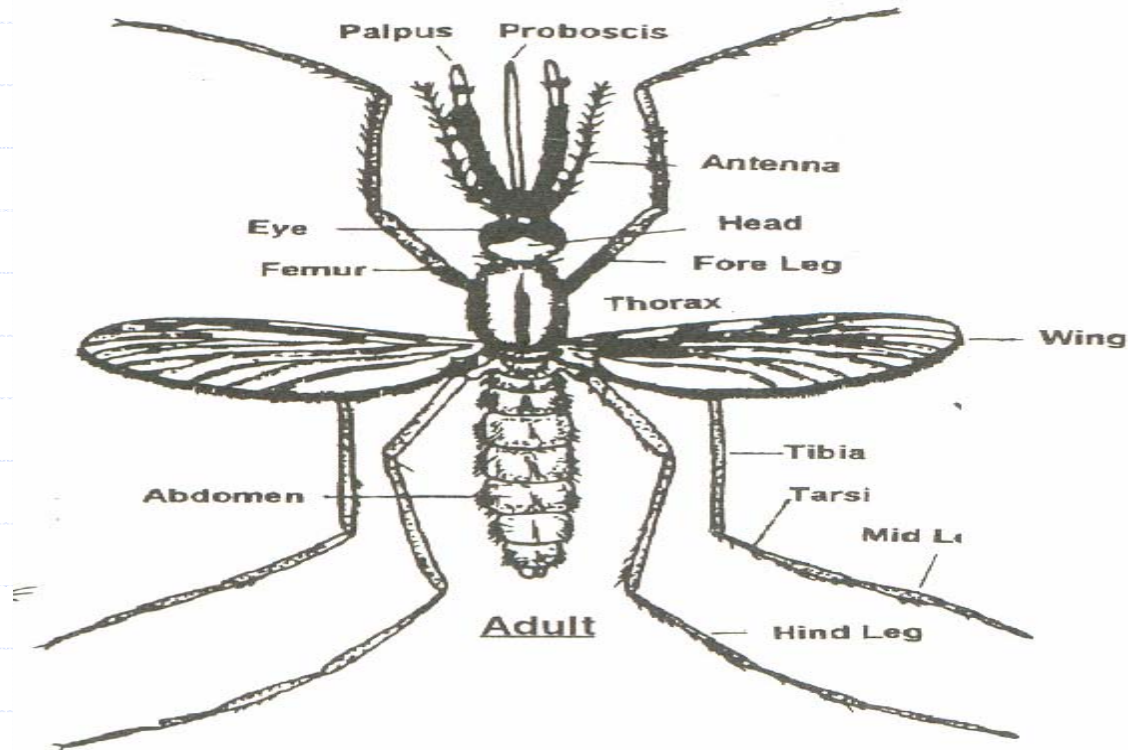
A. sundaicus

◆ A. balabacensis

◆ Malaria vector in Mumbai is A. Stephensi

# Mosquito morphology

- ◆ The body of the adult mosquito consist of three regions; head , thorax and abdomen



# Life cycle of mosquito

- ◆ The cycle completed in water & part in terrestrial environment
- ◆ Cycle consist of four stages **egg, larva, pupa & adult**
- ◆ Egg: The eggs are tiny approx. half a millimeter in length and are laid on the surface of water
- ◆ Anopheles & Aedes lay eggs singly, whereas Culex mosquitoes lay them in rafts
- ◆ Anopheles female lays 130 eggs on every alternate day, whereas culex lays 150 eggs.
- ◆ Within 24-48 hrs a tiny 1st stage larva hatches from the egg

# Larva

- ◆ The 1st stage larva is tiny & upon hatching begins to feed on microorganisms & organic particles.
- ◆ Larvae are active swimmer
- ◆ Respire with the help of respiratory siphon in the case of culex & Aedes & through spiracles in the case of Anopheles larvae.
- ◆ The larvae grow by shedding their skin thrice in their life span of approx. 7-10 days from first to second, second to third & third to fourth stage.
- ◆ Shedding called moulting. Fully grown larva moults and forms pupa.

# Pupa

- ◆ The pupa are 'comma shaped' with flexible abdomen for swimming.
- ◆ They have a pair of trumpet like structure on the dorsal surface for breathing.
- ◆ The pupa does not feed & being lighter than water floats on the surface of water
- ◆ The stage lasts for 2-3 days and the adult mosquito develop within pupa emerges.

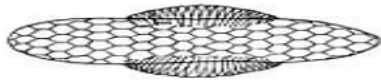
# Differentiation of life stages

ANOPHELES

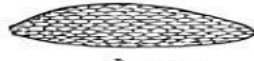
A E D E S

C U L E X

## Egg Stage



Single Eggs with Floats



Single Eggs on Dry Surface



Floating Egg Raft

## Larval Stage



Air Tube Absent;  
Rests Parallel to  
Water Surface



Short Air Tube  
Air Tube Present;  
Rests at Angle  
Below Water Surface



Slender Air Tube  
Air Tube Present;  
Rests at Angle  
Below Water Surface

## Pupal Stage



More of Body  
Touches Surface

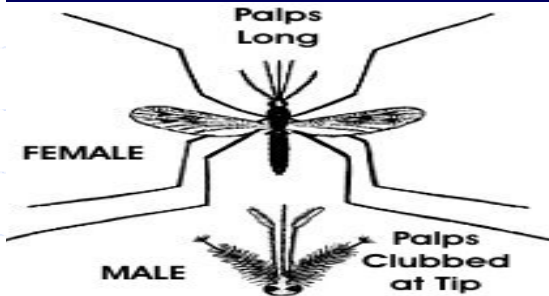


Less of Body  
Touches Surface

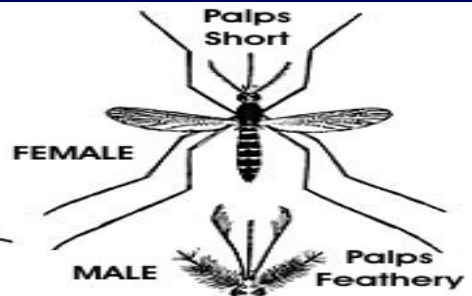


Less of Body  
Touches Surface

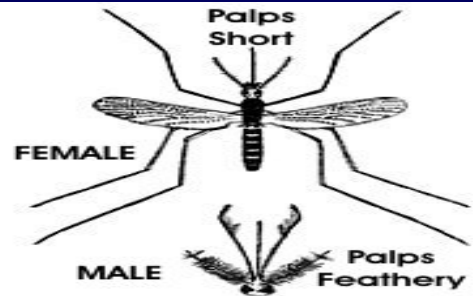
## Adult Stage



Palps Long  
FEMALE  
MALE  
Palps Clubbed at Tip



Palps Short  
FEMALE  
MALE  
Palps Feathery



Palps Short  
FEMALE  
MALE  
Palps Feathery

# Adult

- ◆ From pupae male & female mosquitoes emerge in almost equal proportion.
- ◆ On the third day of their emergence the adults start feeding and subsequently on every alternate day the female feed on blood of human being or animals whereas male feeds on the plant sap & juices.
- ◆ Male have shorter life span (about week)
- ◆ The adult female mosquito survive for 15 to 30 days in warm & humid climate.

# EMERGENCE OF PUPA FROM LARVA



# Culex quiquefasciatus



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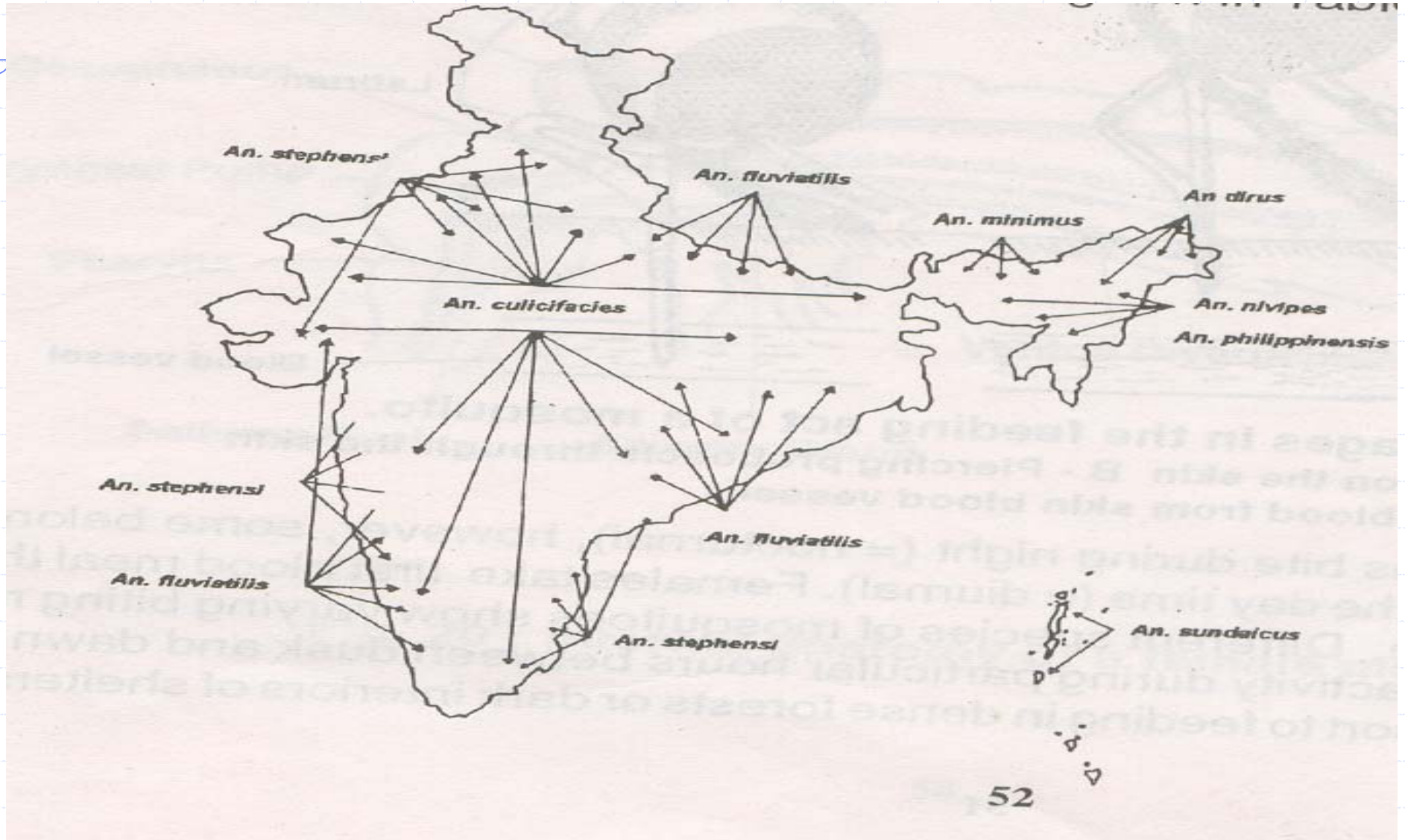
# Anopheles stephensi (Adult female)



# Aedes aegypti (Dengue vector)



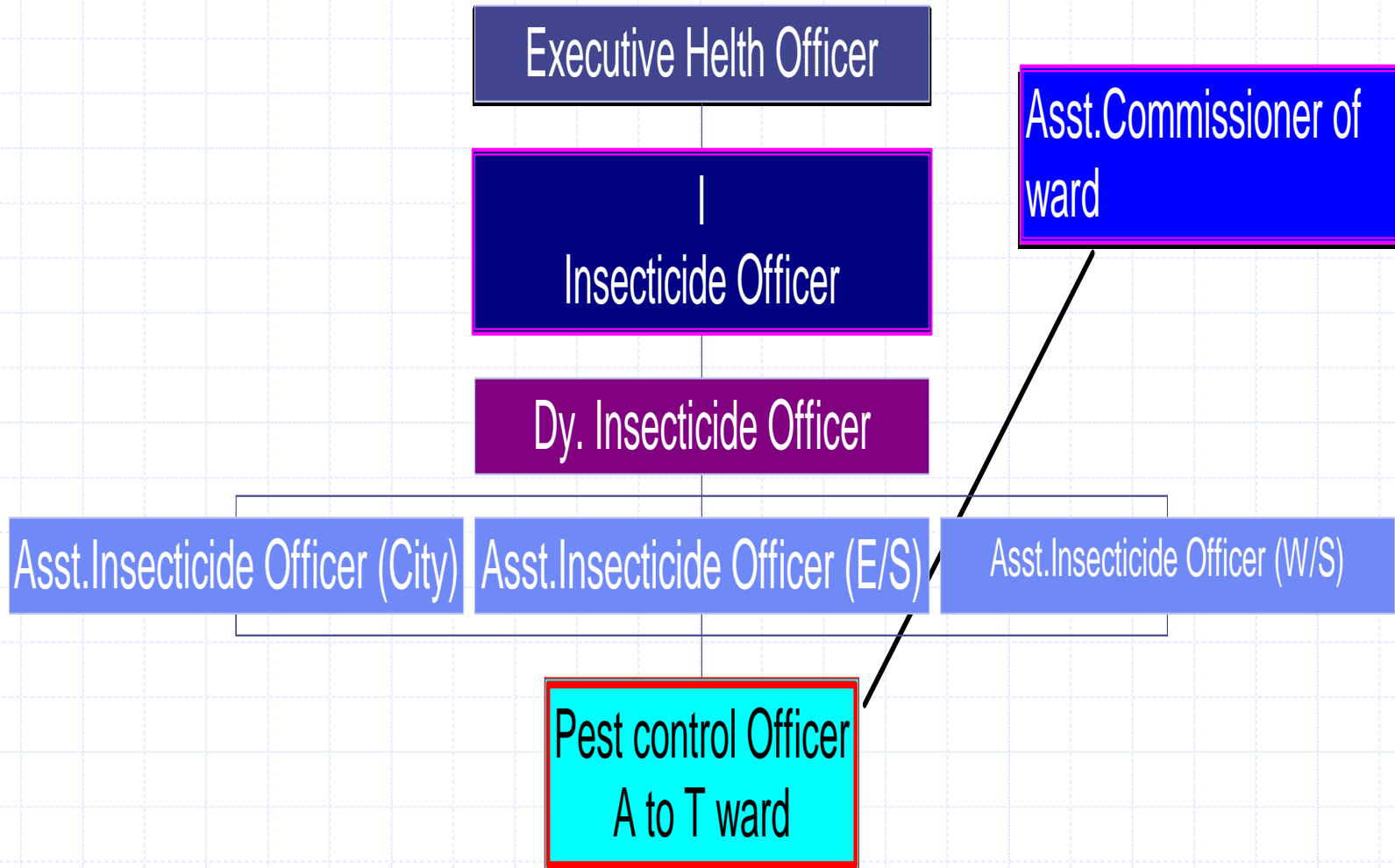
# General distribution of malaria vectors in India



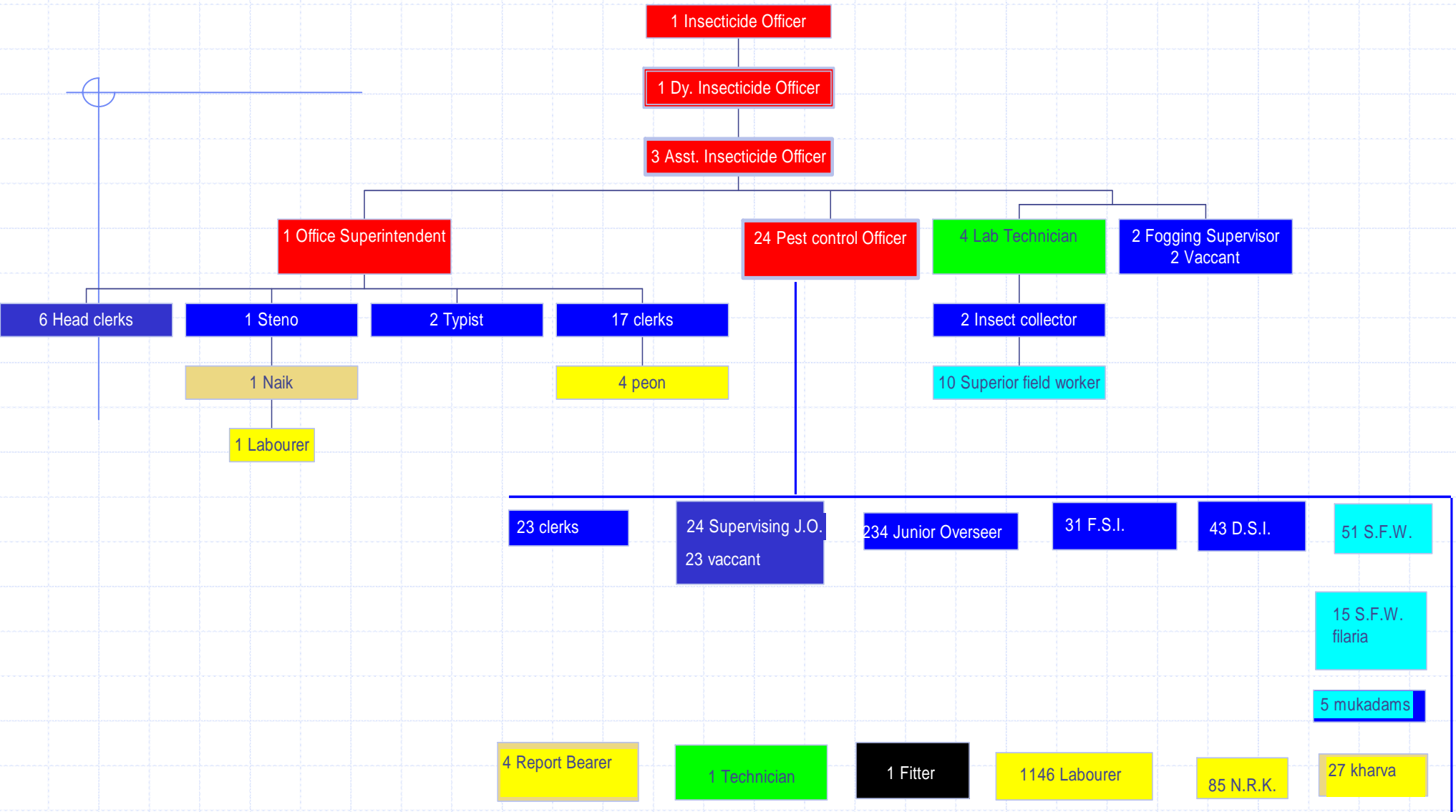
# Brief History of Insecticide Branch

- ◆ Special Malaria Dept was created in April 1912
- ◆ Scheme was only for A,B,C,D,& E ward
- ◆ **Staff proposed was as follows**
- ◆ 5 Inspectors
- ◆ 50 Sub Inspector and 150 coolies
- ◆ 7 Sub inspectors and 35 coolies as well-gangs
- ◆ 3 Sub Inspectors and 12 coolies as fish- gangs
- ◆ **Staff appointed**
- ◆ 5 Inspector
- ◆ 38 Sub-Inspector and 76 coolies and 4 Mukadams

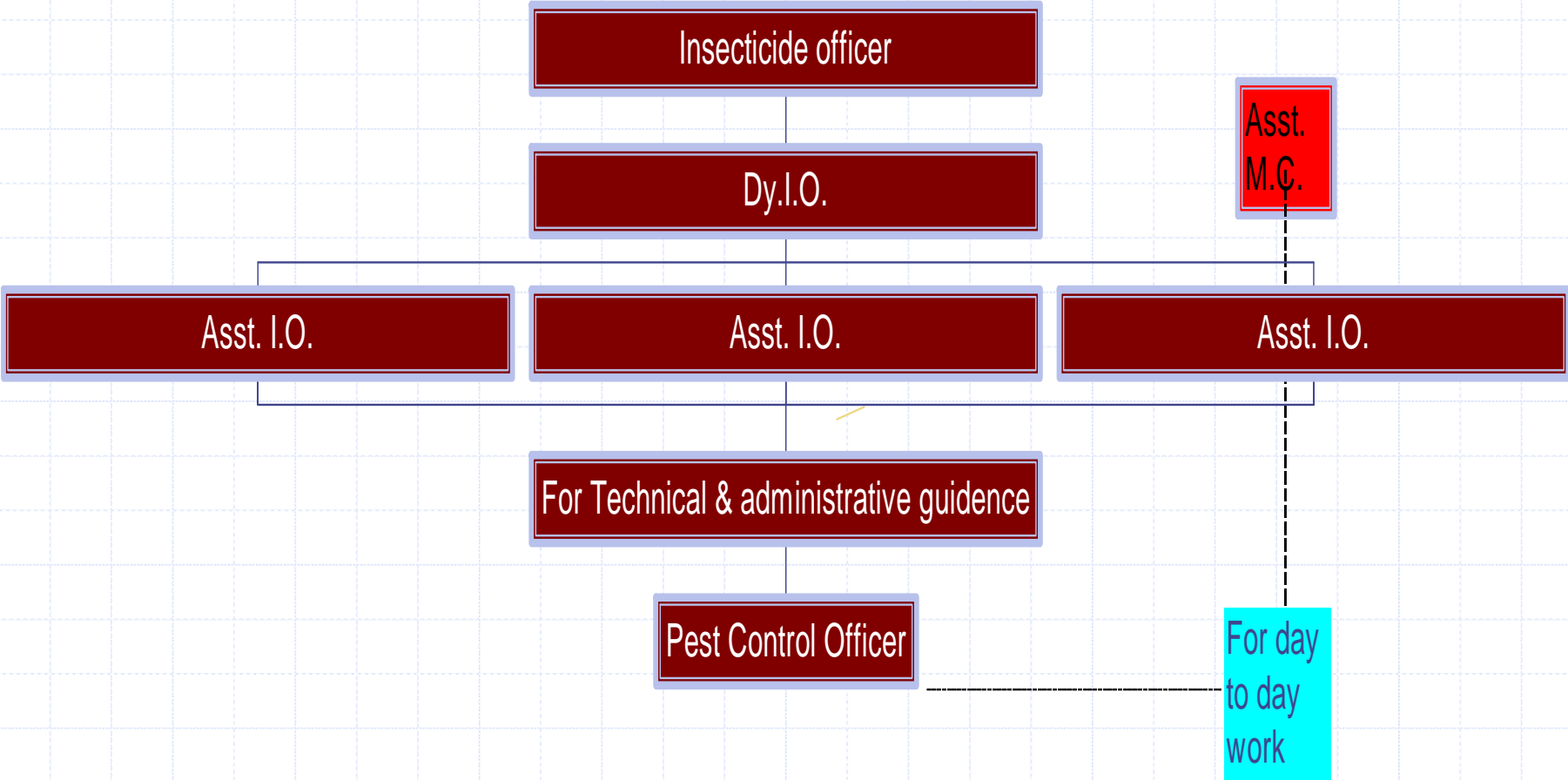
# ORGANOGRAM



# Overall staff position of Insecticide branch



# Supervision over Pest Control Officer



## STAFF AT WARD LEVEL (CITY WARDS)



### Pest Control Officer

Category	Strength per ward	Labour under supervision
Clerk	1	Nil
Supervising J.O.	1	2
J.O. (mosquito control)	Varies as per norms	2 per J.O.
J.O. (Rat)	1	Varies per ward
F.S.I. (Fogging)	1	2
D.S.I. (Fly control)	Varies as per ward	3
S.F.W.	seasonal post	Varies as per programme

# Genesis of Vector control

- All attempts at the control/eradication of the vector borne diseases have been based upon
  - (a) removing the conditions which make possible the breeding of vector(mosquito)
  - (b) destroying vector at some period of its life I.e. during the adult or larval

# Genesis of vector control continued

-  (c) Preventing the mosquito from biting the man
-  (d) Attacking parasite as and when it circulate in the blood of man i.e. adoption of antimalarial drugs.

# Vector control methods

- ◆ (a) Environmental sanitation
- ◆ (b) Public education
- ◆ (c) Protective and preventive measures
- ◆ (d) Legislation
- ◆ (e) Ecological control
- ◆ (f) Biological control
- ◆ (g) Chemical control
- ◆ (h) Genetic control

# PEST CONTROL ACTIVITIES

MALARIA MOSQUITO CONTROL	DENGUE VECTOR CONTROL	NUISANCE MOSQUITO CONTROL	FLY CONTROL	RAT CONTROL
<p>1)Source reduction</p> <p>1) identification &amp; record of breeding places</p> <p>2)Biological control</p> <p>3)chemical control</p> <p>Larviciding work</p> <p>1)M.L.O</p> <p>ii)Fenthion</p> <p>iii)Temephos</p> <p>4)Thermal fumigation for adult mosquito control</p> <p>5) Legal actions</p>	<p>Aedes larvae survey</p> <p>destruction of larvae</p> <p>thermal fumigation</p> <p>public education</p>	<p>source reduction</p> <p>biological control</p> <p>chemical control</p> <p>weekly larvicidal treatment</p> <p>thermal fumigation</p> <p>legal actions</p>	<p>regular anti fly treatment</p> <p>intensified during monsoon</p> <p>places covered</p> <p>1)dust bins</p> <p>ii)trailers</p> <p>iii) Refuse shades</p> <p>iv) Refuse heaps</p> <p>v)markets</p> <p>vi) Hospitals</p> <p>vii) dispensaries</p>	<p><b>Regular trapping</b></p> <p><b>Complaints</b></p> <p><b>Indoor</b></p> <p><b>setting traps</b></p> <p><b>Outdoor</b></p> <p><b>Poison baiting</b></p> <p><b>Night rat killing</b></p> <p><b>Burrow fumigation</b></p>

**MUNICIPAL CORPORATION OF GREATER MUMBAI  
INSECTICIDE BRANCH**

**LIST OF POSSIBLE BREEDING SOURCES OF MALARIA, DENGUE  
AND FILARIA VECTOR MOSQUITOES**

malaria vector	dengue vector (Aedes)	Filaria vector (culex)
<b>A) Permanent sources</b>		
<b>1) Wells</b>	Drums	All sources mentioned in column no 1&2 and Nullah
i) Open wells	Tyres	
ii) Trap door wells	Odd articles & receptacle	Open channel drains
iii) H.C.C. wells	Garden tanks	Storm water entrances
iv) Tube wells	Fountains	septic tanks
v) Ring wells		aquaprivies
		creek lands
<b>2) Cisterns (tanks)</b>		Low lands
i) R.C.C.		grass plots
ii) Mild steel		Ditches
iii) Hume pipe		
iv) H.D.P.E.		
v) L.D.P.E.		
<b>3) Elevated overhead tanks</b>		
<b>4) Mill tanks</b>		
<b>5) Masonary tanks</b>		
<b>6) Garden tanks</b>		
<b>7) Static tanks</b>		
<b>8) Mill ponds</b>		
<b>9) Village ponds</b>		
<b>10) Fountains</b>		
<b>11) Swimming pools</b>		
<b>12) Cooling tanks</b>		
<b>13) Cooling towers</b>		
<b>14) Building constructions</b>		
<b>B) Temporary Sources</b>		
i) Cellars		
ii) Roof gutters		
iii) Odd articles & receptacles		
iv) Building constructions		









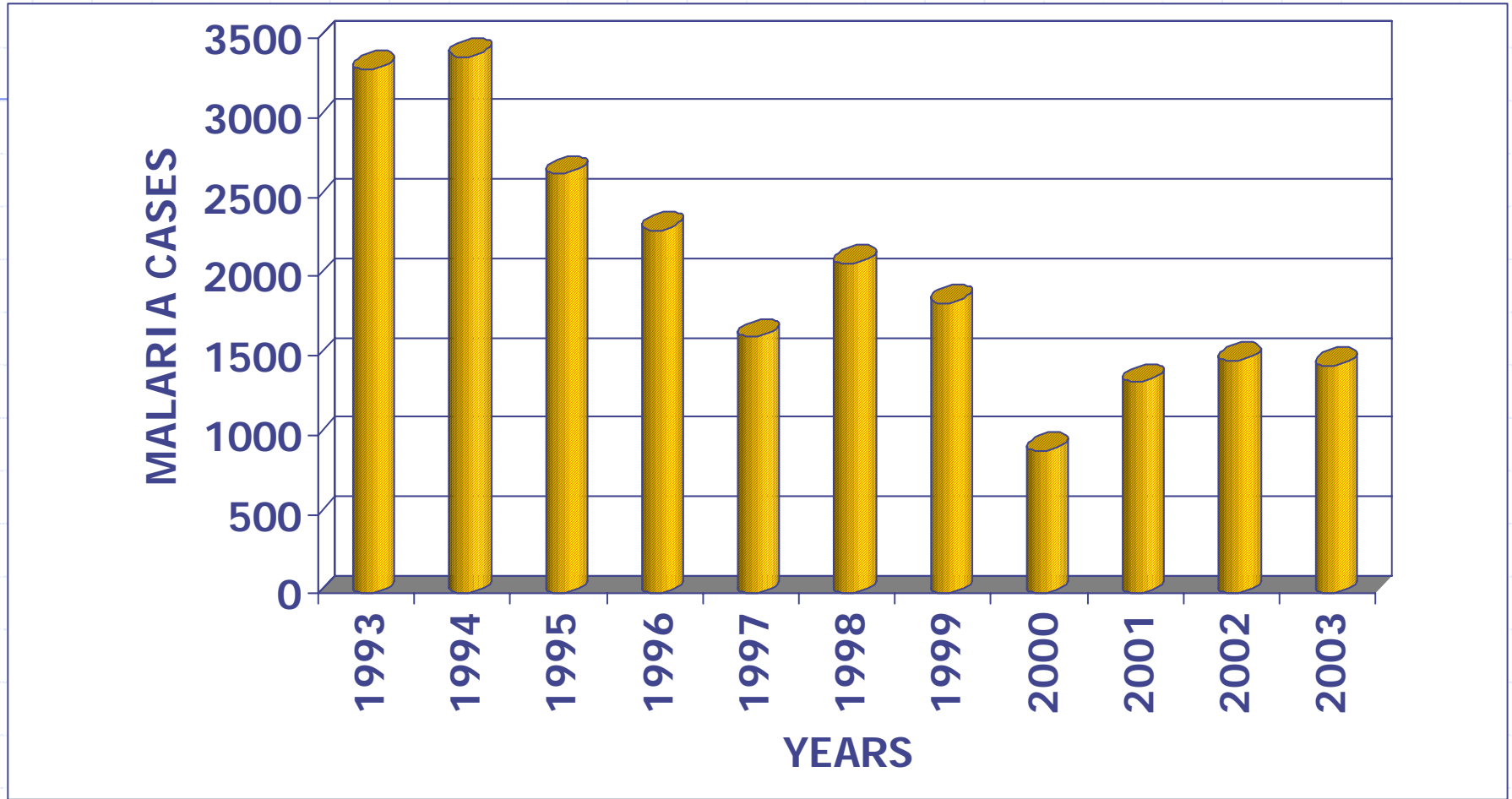
# MUNICIPAL CORPORATION OF GREATER MUMBAI

## INSECTICIDE BRANCH

### MALARIA STATISTIC OF F/SOUTH WARD FOR THE LAST TEN YEARS

YEAR	ACTIVE B.S.	PASSIVE B.S.	MASSES B.S.	TOTAL	vivax	falaciparum	MIX	TOTAL+V E	SPR	SvR	SfR	API
1993	0	0	0	0	0	0	0	3306				8.06
1994	0	0	0	0	0	0	0	3387				8.26
1995	11394	39618	0	50111	2149	491	0	2645	5.28	4.29	0.98	6.45
1996	14169	39979	7058	61504	1986	305	2	2294	3.73	3.23	0.50	5.60
1997	14354	40395	1217	55966	1356	260	3	1619	2.89	2.42	0.47	3.95
1998	14350	41557	3258	57967	1765	325	3	2083	3.59	3.04	0.57	5.08
1999	14019	30402	689	45100	1628	204	3	1835	4.07	3.61	0.46	4.48
2000	14217	16745	1618	32580	806	90	4	900	2.76	2.47	0.29	2.20
2001	16196	15200	703	33101	1171	160	3	1334	4.03	3.54	0.49	3.25
2002	16534	20088	1280	40944	1232	181	4	1470	3.59	3.01	0.45	3.59
2003	17323	31578	1210	50111	1274	160	3	1437	2.88	2.54	0.32	3.35

# Malaria cases in F/S ward



# Insecticide store



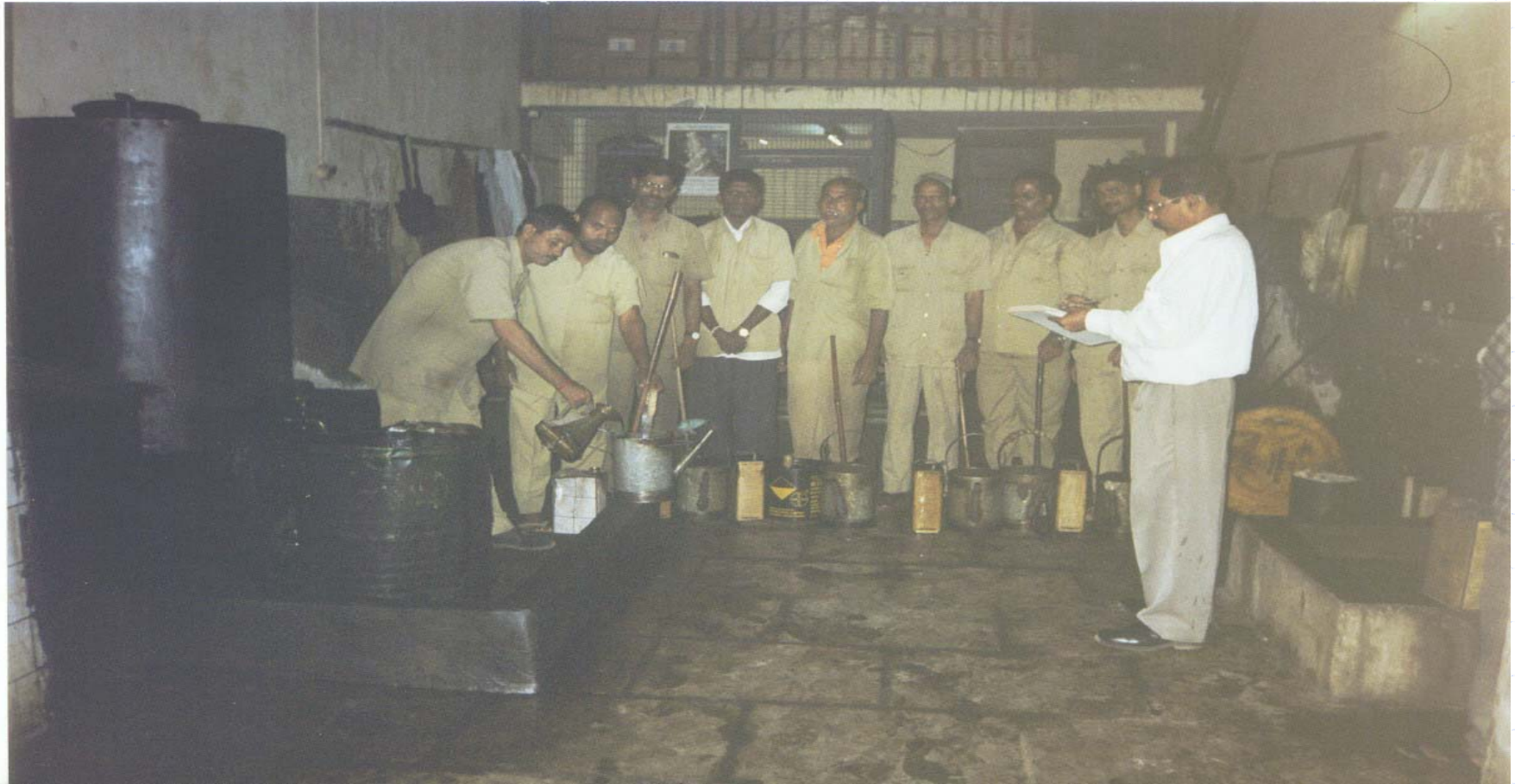
# J.O. entering their Daily visit schedule



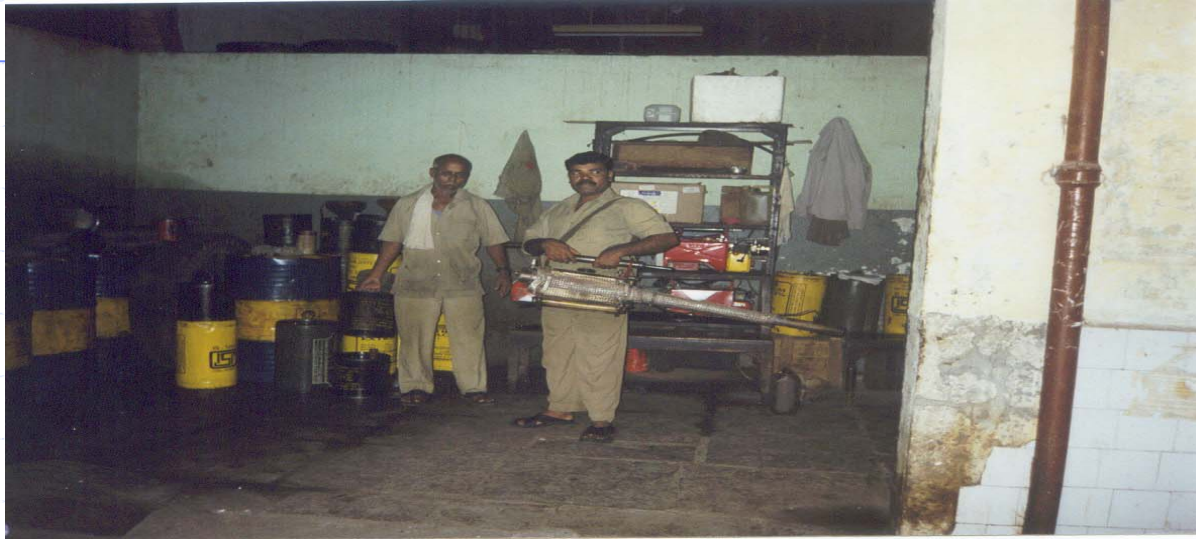
# Cistern inspection labourer



# Distribution of insecticide to ground labourer



# FOGGING STORE & VEHICLE



# Larvicidal work by ground labourer



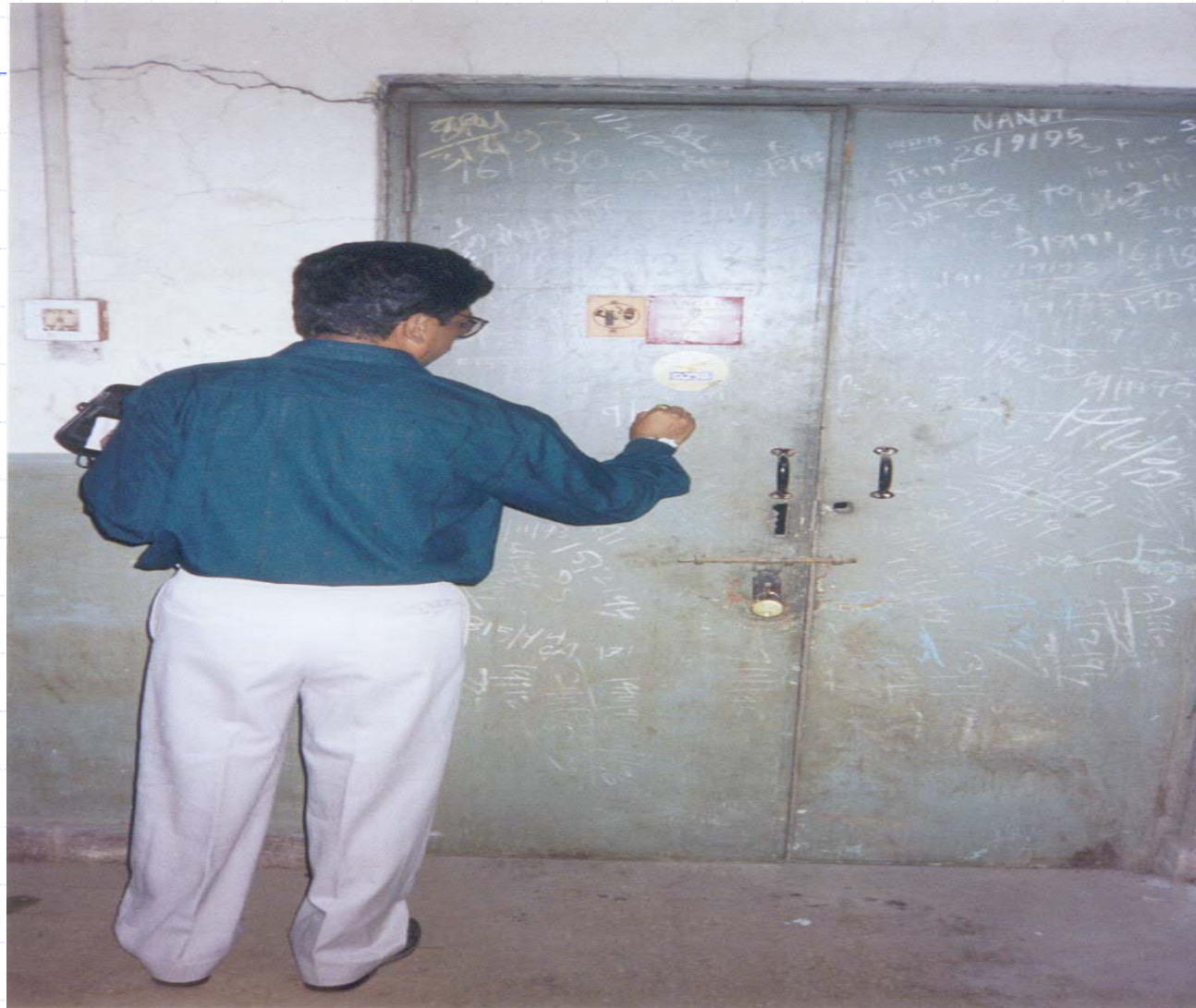
# Detection of Anopheles mosquito larvae



# Tank inspection & noting of defects



# Chalk marking on the door by J.O.



# FOGGING OPERATION



# STANDARD PATTERN MOSQUITO PROOF CISTERN

288

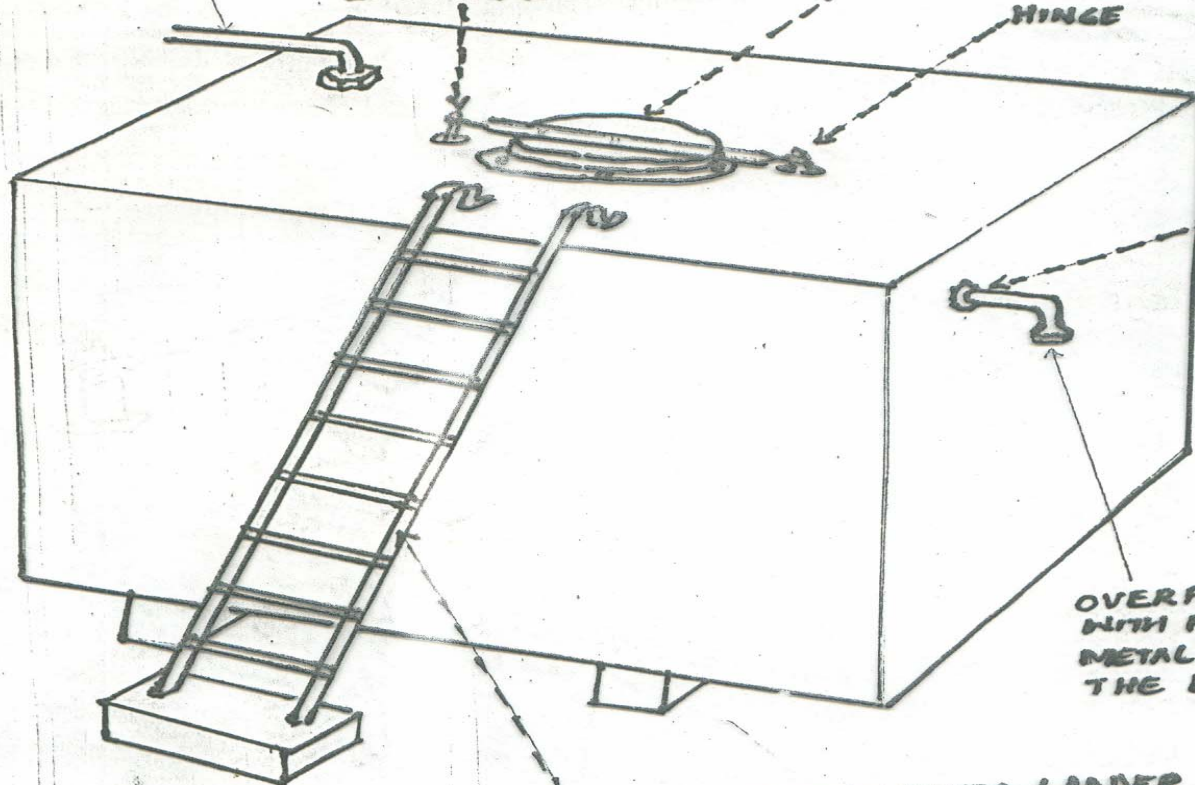
2831

FEEDING PIPE WITH  
CHECK NUT

ROUND CAST IRON COVER  
SITTING ON THE BASERING

LOCKING ARRANGEMENT

HINGE



CHECK NUT

OVERFLOW PIPE  
WITH PERFORATED  
METAL PLATE AT  
THE END

PERMANENTLY FIXED LADDER

# Surface well



# Open well covered with R.C.C. slab



# CONSTRUCTION SITE



# Masonry tank



# Garden tank



# COOLING TOWER



# H.D.P.E. water tank



# R.C.C. Overhead tank



# Mill Overhead tank



# Mild steel overhead tank



# Elevated R.C.C.tank



# Fountain (Dry & with water)



# Swimming pool



# ROOF GUTTER HOLDING RAIN WATER



# BLOW ROOM CELLAR IN MILL



# Modern designs creating new mosquitogenic situations



# Masonry tank under kitchen platform



# Loft tank



# INTER DOMESTIC BREEDING OF MOSQUITO



# Odd articles and Receptacles



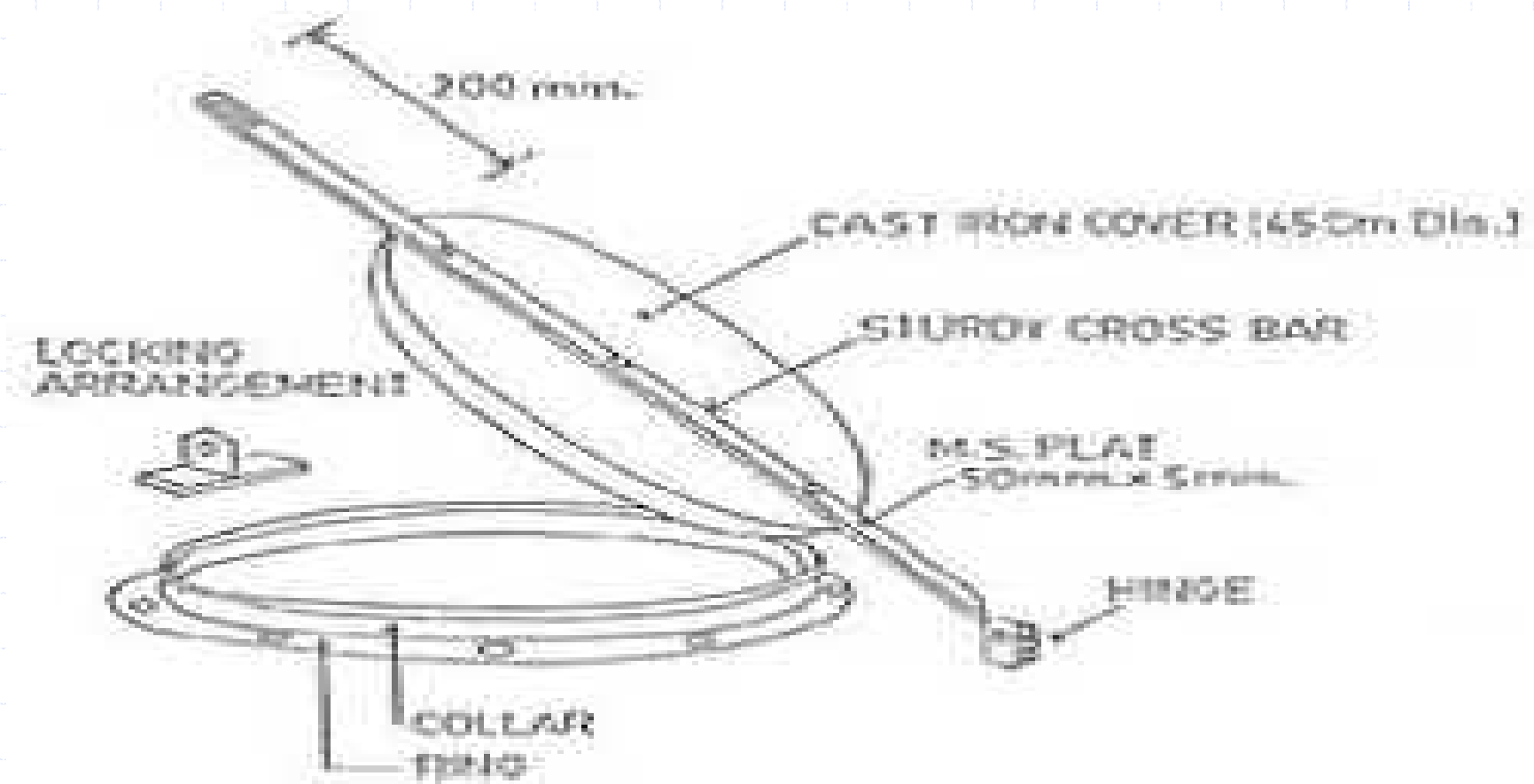
# Different types of odd articles

- ◆ 1) Tyres
- ◆ 2) Drums
- ◆ 3) Machinery & its part
- ◆ 4) Tins
- ◆ 5) Earthen pots
- ◆ 6) China-clay pots
- ◆ 7) Tarpaulin
- ◆ 9) Coconut shells
- ◆ 10) Empty bottles
- ◆ 11) Plastic crates & trays
- ◆ 12) Vases/Flower pots
- ◆ 13) Buckets
- ◆ 14) Tree holes
- ◆ 15) Wooden tray
- ◆ 16) Pipe bents
- ◆ 17) Glass aquaria
- ◆ 18) Disused bath tubs
- ◆ 19) Disused wash basins
- ◆ 20) Stone ragda
- ◆ 21) Unused utensils
- ◆ 22) Thermo coal Packing material
- ◆ 23) Metal sheets with depression
- ◆ 24) Bird bath

# Standard pattern cast iron cover



# MUNICIPAL APPROVED CAST IRON COVER



# Culex breeding place its detection by J.O



# Open drain with Dhapa & katchara breeding place for culex mosquito



# NULLAH HAVING WATER HYCINTH (1) & GARBAGE (2) SUPPORTING CULEX MOSQUITO BREEDING



# Insecticides used by Insecticide branch

## ◆ LARVICIDES

- 1) Mosquito larvicide oil
- 2) Pyrosene oil
- 3) Fenthion (Baytex E.C.)
- 4) Fenthion granules
- 5) Temephos (Abate)

## ◆ Fumigation for adult mosquito control

- 1) Pyrethrum extract
- 2) D.D.V.P. (Dichloroovas)
- 3) Deltamethrin (Kingfog)

## ◆ FLY CONTROL

- 1) D.D.V.P.
- 2) Propoxure bait

## ◆ INDOOR SPAY

- 1) Cyfluthrin (Solfac)
- 2) Deltamethrin

## ◆ RODENTICIDES

- 1) Zinc Phosphide
- 2) Couma tetraryl (Racumin)
- 3) Aluminium Phosphide (celphos)

# Legal sections for Pest control Officer

- ◆ Sec.253:- All drains ventilation shafts, pipes, house gutters, water closets, privies, latrines & urinals which do not belongs to Corporation shall be open for inspection & examination
- ◆ Sec.274:- Provision of access(ladder) to cisterns invokes
- ◆ Sec.274A:- Provision for keeping cisterns locked.
- ◆ Sec.381(i):- Rectification of existing defects are carried out.
- ◆ Sec.381A:- Prevention of formation of new breeding places

## *Legal sections continued*

- ◆ Sec 375A:- Removal of building materials from any premises which could be harborage or breeding place for rats.
- ◆ Sec.488:- The Commissioner etc. may enter any premises for the purpose of inspection,survey or examination & necessary work.

# Rat control

## Economic importance of Rats

- ◆ Rodents are competitors to human beings and other animals for food & feed. The damage they do is both qualitative and quantitative.
- ◆ The World Health Organisation has estimated that rats cause losses amounting to approx. 33 million tones of food each year, enough to feed 130 million people.
- ◆ It is estimated that 16% of the food is destroyed by rats.
- ◆ Rat contaminate & destroy three times more food than they eat

◆ One pair of Rat can produce 3000-4000 rats/year

◆ Rats are responsible for both direct and indirect transmission of diseases to man & animals. (Plague, Salmonellosis, Rat bite fever & Leptospirosis)

◆ Rats have a very complex behaviour. Due to their instinctive fear of unfamiliar objects (neophobia), the acute sense of smell & highly developed sense of taste, it is difficult to find and successfully employ measures for their control.

# *Formula of 4D's*

◆ The formula of 4D's is useful in rat control

◆ 1) D-deny entry

◆ 2) D-deny shelter

◆ 3) D-deny food

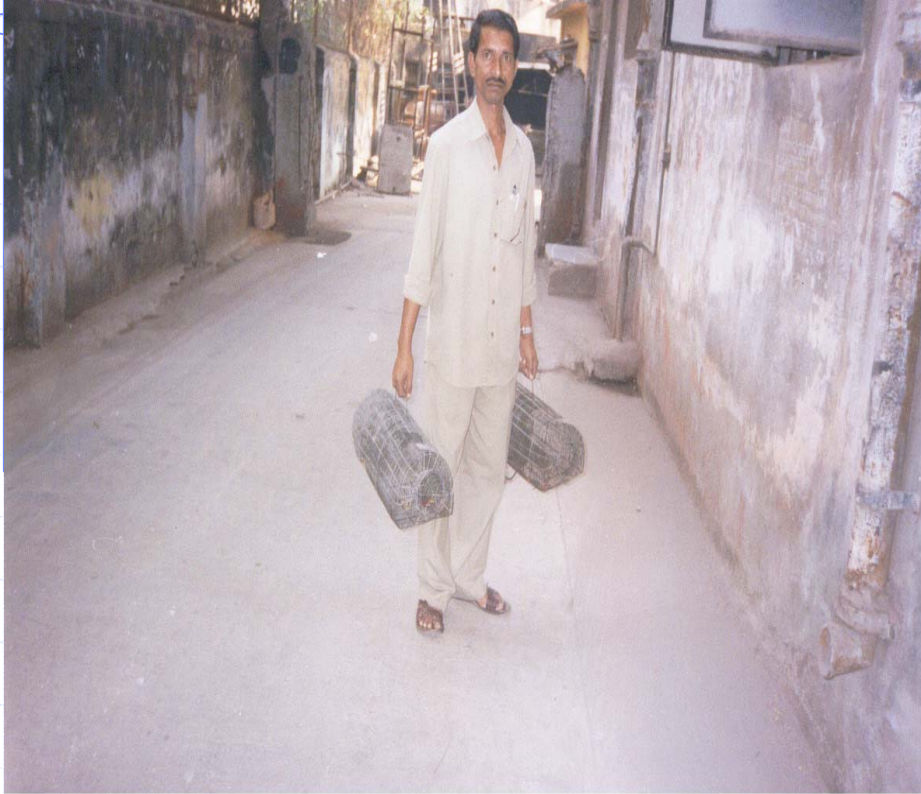
◆ 4) D-destroy

Broadly the control measures fall into four categories 1) Mechanical 2) Biological 3) Ecological 4) Chemical

# *Mechanical control*

- ◆ Use of traps 1) mass trapping 2) complaint basis
- ◆ Rat proofing 1) providing physical barriers to houses to deny entry for the rats (e.g. Rat guards to drain pipes.
- ◆ Night rat killing is carried out only city wards

# Rat labourer with rat collection & while killing



# NIGHT RAT KILLING



# *Biological control of rats*

- ◆ This method on large scale is not feasible in the long run.
- ◆ It includes employing predators like the Monitor Lizard, Mongoose, Cat & Weasel.

## *Ecological control*

- ◆ In this method, sanitation plays a very important role.
- ◆ Proper disposal of garbage will help to reduce rat infestation.
- ◆ Intersectoral co-ordination will help in a broader rodent control programme.
- ◆ Results can be achieved only after sustained implementation and monitoring.

# *Chemical control*

- ◆ The chemicals use in killing of rats are called as Rodenticide. These are classified into two categories
- ◆ A) Acute:- These are single dose poison and are fast acting and effective against types of rats. The risk to man and non-target animals is however great e.g. Zinc Phosphide.
- ◆ Chronic:- These are multiple dose anti coagulant poison and are slow acting e.g. Bromodiolone, Racumin etc.
- ◆ Fumigation of burrows with chemicals is also carried out. These are fast acting e.g. Aluminium Phosphide.

# FLY CONTROL

- ◆ Houseflies should be regarded as a sign of insanitation
- ◆ Single female fly produce 2387 flies/month
- ◆ Flies breed mainly in places such as horse manure, human excreta, manure of other animals, garbage, decaying foods and vegetables, damp rubbish containing organic matter
- ◆ They are prevalent near dwelling houses, restaurants hospitals, cattle sheds, slaughter houses and dumping grounds.

- ◆ Flies transmit diseases by mechanical transmission with its body parts, vomit drops and defecation.
- ◆ Diseases are typhoid and Para-typhoid fever, diarrhoea, cholera, gastro enteritis, amoebiasis, Poliomyelitis, conjunctivitis, anthrax etc.

# Control measures

◆ The best way to control houseflies is to eliminate their breeding places and to bring about an overall improvement in the environmental sanitation on a community wide basis. This effect implies the following:-

- ◆ 1) Storing garbage, kitchen wastes and other refuse in the bins with tight lids, pending disposal
- ◆ 2) Efficient collection, removal and disposal of refuse by incineration, composting or sanitary land fill

- ◆ 3) Provision of sufficient sanitary facilities. e.g. pot privies, septic tanks, water seal, latrines and sanitary sewerage system.
- ◆ 4) Stopping open air defecation
- ◆ 5) Sanitary disposal of animal excreta
- ◆ 6) Stepping up general sanitation. A clean house with clean surrounding is the best answer to the fly problem.

# Insecticidal control

- ◆ Fly control can also be achieved by using various insecticides like DDVP, baigon baits etc.
- ◆ Space sprays in general have little or no residual action. They produce only a temporary effect on adult fly.
- ◆ In summary, insecticides at best, are only a supplement, but not a substitute for sanitation.
- ◆ Protection against flies:- Screens with 14 meshes per inch will keep out the flies from houses, hospitals, markets, restaurants and other places.

- ◆ Willing co-operation and 'Fly Consciousness' should be created among the people through health education.
- ◆ Fly control campaigns require organised individual community efforts which is the basis of successful Public Health Programme.
- ◆ Special attention is given by intensifying antifly measures at dumping grounds, municipal and private markets and hospitals by spraying insecticides for adult flies to avoid any type of disease spread.

# Requirements for successful mosquito control

- ◆ Whole-hearted adoption of radical and systematic vector control measures.
- ◆ Chief officers of the different bodies should realise –
  - 1) That malaria is a very serious source of loss of lives and revenue
  - 2) That an unprotected source of breeding of this mosquito is an immediate danger and that every day's delay in dealing with it means that the health of this person living in the vicinity is menaced
- ◆ Information, Education and Communication
- ◆ Individual Responsibility
- ◆ Community Action
- ◆ Government Support