

S 1665

# REPORT

ON

S1665

CERTAIN FEATURES OF

# MALARIA

IN THE ISLAND OF SALSETTE

BY

MAJOR J. L. MARJORIBANKS, M.D., D.P.H., I. M. N.,  
*Deputy Sanitary Commissioner, Western Registration District.*



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## P R E F A C E

Government Resolution, General Department, No. 4008 of 26th June 1912, runs as follows :—

“ His Excellency the Governor in Council is pleased to direct that Major J. L. Marjoribanks, I. M. S., Deputy Sanitary Commissioner, Western Registration District, be deputed to investigate the malarial conditions prevailing in the Island of Salsette with a view to ascertaining and defining the dangerous malarious tracts of the taluka and indicating the direction in which and the limits within which residential development should proceed. Major Marjoribanks should also enquire and consider what measures are possible for the removal or abatement of the causes and conditions which give rise to Malaria in the tracts affected. He should carry out the enquiry during the months of September and October when the incidence of the disease will be at its height, and report the result to Government through the Sanitary Commissioner. During this time he will remain in charge of his ordinary duties.”

In a subsequent resolution the period allowed for the investigation was extended by a month.

The examination of a representative number of blood-films to the endemic index, and the dissection of mosquitos caught in houses, which species are the local carriers of Malaria, could only have been done by a full-time Malaria Officer, especially over so large an area as Salsette. Accordingly, the present investigation was limited to an examination of the Vital Statistics of Salsette, to collection of larvæ and adult anopheline mosquitos throughout the island, and their identification at a temporary headquarters, and to the taking of a Spleen Census of the children in the villages and hamlets.

For the collection of larvæ and adult mosquitos four compilers of the Sanitary Department were employed on a scale of pay similar to that of the Malaria Sub-Inspectors of the Health Department of Bombay Municipality, and two of them received preliminary training under the Malaria Assistant to the Health Officer. Each was given a cooly, paid at the Bombay rate.

The identification of specimens and the Spleen Census were carried out in person by the writer.

He acknowledges heartily the assistance rendered to him and the information given, by the Revenue, Educational and Meteorological Departments, and also the help he received from the parish priests and other clergy of Salsette.

If this report is read from the point of view of town-planning in Salsette it is assumed that the report “ On the possibilities of development of Salsette as a residential area ”, by Mr. P. J. Mead, I. C. S., is available for reference.

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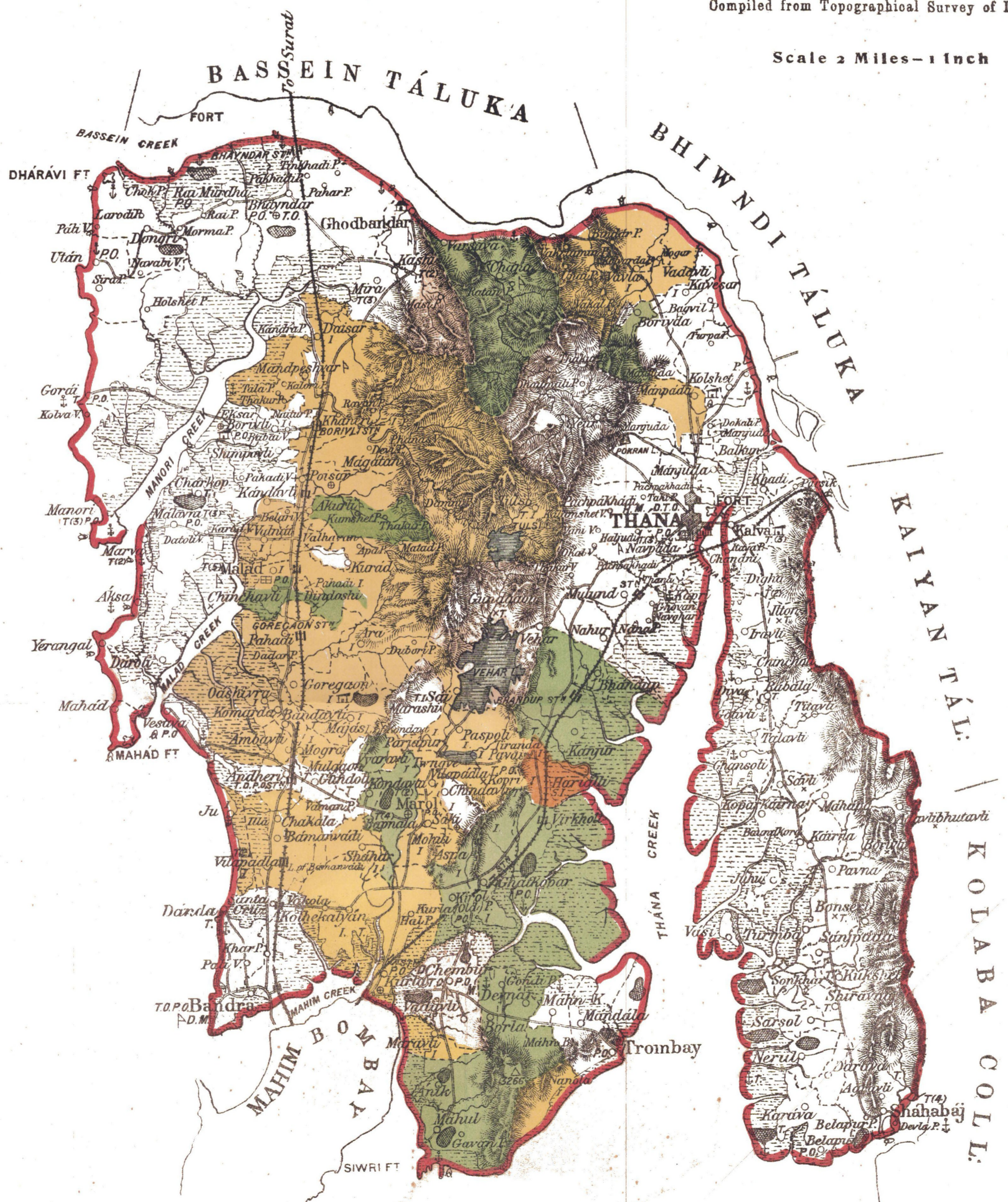
MAP  
of the  
**SALSETTE TALUKA**  
of the  
**THANA COLLECTORATE**

Compiled from Topographical Survey of India

Scale 2 Miles - 1 Inch

References

- Enam Village
- Bazar Village
- Khoti Village
- Sharikati Village
- Lakes



## APPENDIX I.

*Table of anophelines, showing places where found, and name of nearest railway station. Stations on the B. B. & C. I. Railway are taken in order going "Up" towards, and stations on the G. I. P. Railway "Down" from Bombay. The record of N. rossii has been omitted from this table. The term "Gauthan" means the actual village site.*

*M. Barbirostris* was found at the following places :—

(Borivli Railway Station).—Larvæ in Railway Borrow pit, mile No. 21 east side; 20 east side; 21-24, 20 west side; No. 24 west side.

DAHISAR.—Larvæ in 2 wells in S. No. 133.

KASHI.—Larvæ in rice field in S. No. 6; well in S. No. 95; rice field in S. No. 3 in the village; adults in cowshed in Gauthan.

MIRA.—Larvæ in rice fields and stream named Dhobidai; Tank named Chari Adults in cowshed in Gauthan.

(Kandivli Railway Station).—POISAR.—Larvæ in well of D. L. B. Adults in cowshed in Gauthan.

(Malad Railway Station).—ARE.—Adults in cowshed in Gauthan.

CHARKOP.—Larvæ in well in S. No. 12.

KURAR.—Larvæ in well in S. No. 11.

MALAD.—Adults in cowshed in Gauthan.

MALAVNI.—Larvæ in wells in S. No. 12.

VALNAI.—Larvæ in Tank in S. No. 10; and tank named Khandala.

(Andheri Railway Station).—Adults in cowsheds in S. Nos. 19 and 9.

AMBIVLI.—Adults in cowshed.

BANDIVLI.—Larvæ in Tank in S. Nos. 24 and 25; wells in S. Nos. 1, 17 and 19.

CHAKALE.—Larvæ in rice field in S. No. 39.

MAROL.—Adults in cowshed in Gauthan.

MANJAS.—Adults in cowshed in Gauthan.

WYARAVLI.—Adults in hut in Gauthan.

(Bandra Railway Station).—Larvæ in Railway Borrow pit near mile No. 10 east side; well right hand side of St. Joseph's Convent School; Pool in S. No. 241; wells in S. Nos. 235, 241, 223, 204, 189, 203, 240, 198, 197, 239, well in Gauthan; well in Bungalow No. 40; well in Rungari's chawl, well in Municipal School No. 1.

MATMAULI (MOUNT MARY).—Larvæ in wells in S. Nos. 280, 271, 27; 282, 281, 268, 246, well of Bungalow No. 81, well of houses Nos. 4 and 88, well in S. Nos. 270, 282, 281, 270.

PALI HILL.—Larvæ in well in S. No. 325.

(Ghatkopar Railway Station).—Adults in cowshed in Gauthan.

KIBOL.—Adults in Pacca house in Gauthan.

MAHAL.—Larvæ in wells in S. Nos. 139, 147.

MAHN KHURD.—Larvæ in wells in S. Nos. 88, 91, 38.

MARAVLI.—Larvæ in wells in village.

NAVALI.—Larvæ in rice fields in village.

WADHAVLI.—Larvæ in wells in S. No. 2; Pool in S. No. 1; well in village.

(Vikhroli Railway Station).—HARIYALI.—Adults in cowshed.

PACHKOLI.—Larvæ in Pool in the village.

(Bhandup Railway Station).—Adults in cowshed in Gauthan.

(Thana Railway Station).—DHOKALI.—Larvæ in wells in the village. Adults in cowshed in Gauthan.

KAVESAR.—Adults in cowshed in Gauthan.

KOLSET.—Larvæ in well in S. No. 268. Tank in village; wells in S. Nos. 247, 10.

KOPRI.—Adults in cowshed in Gauthan.

MANJIVDA.—Adults in cowshed in Gauthan.

MANPADA.—Larvæ in well in the village.

THANA.—Larvæ in well in B. No. 127; rice field in S. No. 6; well in H. No. 56; well in B. No. 122; well in H. No. 194.

*Ny. Fuliginosus* was found at the following places:—

(Bhaynder Railway Station).—Larvæ in Railway B. P. near mile No. 22 east side of Railway line of B. B. & C. I. Railway B. P. mile No. 24 west side; mile No. 25 east side.

(Borivli Railway Station).—Larvæ in Railway B. P. near mile No. 23 east side; mile No. 22 west side; mile No. 20 west side; of Railway line of B. B. & C. I. Tank in the same village.

DAHISAR.—Adults in cowshed in Gauthan.

EKSAR.—Larvæ, rice field in S. No. 20; tank in S. No. 202.

KASHI.—Adults in cowshed in Gauthan.

MAGATNA.—Adults in cowshed in Gauthan.

MIRA.—Larvæ, Pool in the same village; in S. No. 323; tank in the same village Tank, Chari, in the same village; rice field; Stream, Dhobidai running by the village Adults in cowshed in Gauthan.

(Kandivli Railway Station).—AKARLI.—Larvæ in Pool, well in the village. Adults in cowshed and Hut in Gauthan.

KANDIVLI.—Larvæ in Railway B. P. near mile No. 19 east side, west side of the Railway line of B. B. & C. I.; tank near S. No. 15; rice field in S. No. 12; Adults in cowshed in Gauthan.

POISAR.—Larvæ in Pool stream in S. No. 5 of the village. Adults in Pucca houses and cowshed in Gauthan.

(Malad Railway Station).—ARE.—Adults in hut in Gauthan.

KURAR.—Larvæ in tank in the village in S. No. 3.

MALAD.—Larvæ in Railway B. P. near mile No. 18 east side of B. B. & C. I. Railway; well; rice field in S. No. 106 of the village. Adults in cowshed in Gauthan.

MALAWANI.—Larvæ, well in S. No. 64; tank; wells in S. Nos. 50 and 88; tank to the east of S. No. 99.

WALNAI.—Larvæ in rice field in S. No. 14. Adults in cowshed in Gauthan.

(Goregaon Railway Station).—PAHADI.—Adults in cowshed in Gauthan.

GOREGAON.—Larvæ in Railway B. P. near mile No. 17 west side; 16 east side of B. B. & C. I. Railway; tank in S. No. 100; well in S. No. 24 in the village.

(Andheri Railway Station).—Larvæ in Railway B. P. near mile No. 17 east side, 16 west side of B. B. & C. I. Railway; Railway B. P. in S. No. 24; rice field; tank in S. No. 81; rice field in S. No. 81 in the village.

BANDIVLI.—Larvæ in Pools in S. Nos. 41 and 24; well in S. No. 17, and tank in S. Nos. 24 and 25 in the village.

BRAHMANWADA.—Larvæ in well in S. No. 54; tank in the village. Adults in cowsheds in Gauthan.

CHAKALE.—Larvæ in tank in S. No. 48 in the village; and rice field in S. No. 39. Adults in cowsheds in Gauthan.

GONDIVLI.—Larvæ in tank in the village.

KANDIVLI.—Adults in cowshed in Gauthan.

MANJAS.—Adults in cowshed and hut in Gauthan.

MAROL.—Adults in Pucca house, and cowshed in Gauthan.

MOGARE.—Larvæ in Railway B. P. on the B. B. & C. I. line.

OSHIWARA.—Larvæ in wells in S. No. 48 in the village.

(Vila Parla Railway Station).—Larvæ in Railway B. P. near mile No. 16 west side; 15 east side and west side; 14 east side of B. B. & C. I. Railway; tank named Gaon Talav in the village.

(Santa Cruz Railway Station).—Larvæ in rice field in S. No. 377; Railway B. P. near mile No. 13 east side; 12 west side; 13 west side of B. B. & C. I. Railway.

(Bandra Railway Station).—Larvæ in Railway B. P. near mile No. 11 west side; 10 west side; 11 east side; 10 east side of B. B. & C. I. Railway; well in house No. 14; well in S. No. 261; tank in the town.



MATMAULI (MOUNT MARY).—Larvæ in well in the village.

PALI HILL.—Larvæ in well in S. No. 264 in the village.

(Kurla Railway Station).—Larvæ in Pools in S. Nos. 212 and 215; rice fields in S. Nos. 262 and 211, and 253; Railway B. P. on G. I. P. Railway line.

(Ghatkopar Railway Station).—ANIK.—Larvæ in tank in Gauthan; wells in S. Nos. 4, 23; rice field in S. No. 20; Pool in S. No. 75 in the village.

CHEMBUR.—Larvæ in Pool in the village.

GHATKOPAR.—Adults in other building in Gauthan.

MAHUL.—Larvæ in rice fields in S. Nos. 2 and 66; stream east of S. No. 172; Tank south of S. No. 179 in the village.

MAHN KHURD.—Larvæ in stream near S. Nos. 104 and 105 in the village.

MARAWALI.—Larvæ in tank south of Gauthan in the village.

NANALA.—Larvæ in well and rice fields and stream in the village.

(Vikhroli Railway Station).—HARIYALI.—Adults in hut and cowshed in Gauthan; adults in cowshed in Gauthan.

PACHAKOLI.—Larvæ in Pool in the village.

PAWAI.—Larvæ in tank of Pawai south side of the tank.

VIKHROLI.—Larvæ in rice fields; well; Tulsi Tank in the village.

(Bhandup Railway Station).—Larvæ in well in S. No. 31; rice field in S. No. 39 in the village; adults in cowshed in Gauthan.

KANJUR.—Larvæ in Pool; rice field in the village.

(Mulund Railway Station).—Adults in cowshed in Gauthan.

(Thana Railway Station).—BALKUMB.—Larvæ in well in the village.

DHOKALE.—Larvæ in well in the village.

KAVESAR.—Adults in cowshed in Gauthan of Wagbilpada of the village.

KOPRI.—Larvæ in rice field in S. No. 36 of the village. Adults in cowshed in Gauthan.

MANJIVDA.—Adults in cowshed in Gauthan. Larvæ in rice fields of the village.

MANPADA.—Adults in cowshed in Gauthan.

NAVADA.—Larvæ in rice field in S. No. 42 of the village. Adults in cowshed in Gauthan.

KOLSET.—Adults in cowshed at tari in the village.

THANA.—Larvæ in tank behind House No. 57; well in H. Nos. 131 and 132 tank named Makhwal; well in H. No. 38 in the town.

WADHAWLI.—Larvæ in tank, well in the village; adults in cowshed in Gauthan.

*My. Jamesii* was found at the following places:—

(Borivli Railway Station).—DAHISAR.—Adults in cowshed in Gauthan.

KASHI.—Larvæ in rice field in S. No. 14.

MIRA.—Larvæ in rice field.

(Kandivli Railway Station).—AKURLI.—Larvæ in Dhondlai Tank.

KANDIVLI.—Larvæ in rice field in S. No. 12.

(Andheri Railway Station).—ANDHERI STATION.—Larvæ in Railway B. P.

(Bandra Railway Station).—BANDRA.—Larvæ in well.

(Ghatkopar Railway Station).—GHATKOPAR.—Larvæ in well in S. No. 1,

CHEMBUR.—Larvæ in salt pool.

MAHUL.—Larvæ in well in S. No. 1.

MARAVLI.—Larvæ in rice field.

(Vikhroli Railway Station).—VIKHROLI.—Larvæ in Vihad Tank and rice field.

PAWAI.—Larvæ in tank.

(Bhandup Railway Station).—BHANDUP.—Larvæ in tank, adults in cowshed in Gauthan.

(Mulund Railway Station).—NAHUR.—Larvæ in well and rice field.

(Thana Railway Station).—THANA—Larvæ in well.

WADHAVLI.—Adults in cowshed in Gauthan.

*Py. Jeyporiensis* was found at the following place :—

(Borivli Railway Station).—MAGATNA—Adults in cowshed in Gauthan.

*N. Punctulata* was found at the following places :—

(Bhandup Railway Station).—Adults in cowshed in Gauthan.

(Mulund Railway Station).—Adults in cowshed.

(Thana Railway Station).—KOPRI—Adults in cowshed on Gauthan.

*Ne. Stephensi* was found at the following places :—

(Malad Railway Station).—WALNAI—Adults in cowshed in Gauthan.

(Andheri Railway Station).—GONDIWALI—Larvæ in rice field in S. No. 21.

(Ghatkopar Railway Station).—MARAWALI—Larvæ in Pool.

(Thana Railway Station).—MANPADA—Adults in cowshed in Gauthan.

WADHAVLI.—Adults in cowshed on Gauthan.

*My. Listonii* was found at the following places :—

(Borivli Railway Station).—EKSAR—Adults in cowshed in Gauthan.

DAHISAR.—Larvæ in well in S. No. 249, and stream in S. No. 24, and rice field.

(Kandivli Railway Station).—POISAR.—Larvæ in well in S. No. 5.

(Malad Railway Station).—KURAR.—Larvæ in wells in S. Nos. 11 and 30 and stream in S. No. 5.

CHARKOP.—Larvæ in well in S. No. 12.

WALNAI.—Larvæ in wells in S. Nos. 13 and 19.

(Goregaon Railway Station).—Larvæ in Railway Borrow pit, mile No. 17, west side.

(Andheri Railway Station).—Larvæ in well in S. No. 14.

(Vila Parla Railway Station).—Larvæ in Railway Borrow pit.

(Santa Cruz Railway Station).—Adults in Building.

(Bandra Railway Station).—Larvæ in well behind St. Joseph's Convent School.

MATMAULI.—Larvæ in wells in S. Nos. 27, 271 and 282 and a well in Bungalow No. 38.

PALI HILL.—Larvæ in wells in S. Nos. 161 and 325 and in Bungalow No. 6.

(Vikhroli Railway Station).—TIRANDAJ.—Larvæ in pool and stream in Bhui Dongari ;

(Bhandup Railway Station).—Larvæ in well in S. No. 23.

KANJUR.—Larvæ in stream.

(Thana Railway Station).—Larvæ in wells in S. Nos. 3 and 127.

YEUB.—Adults in cowsheds in Gauthan.

*My. Culicifacies* was found at the following places :—

(Borivli Railway Station).—Larvæ in Railway Borrow Pit mile No. 22 and No. 21 west and east side, No. 20 east side, and a well in S. No. 12.

DAHISAR.—Larvæ in wells in S. Nos. 29, 133, 254 and in Railway Borrow pit.

EKSAR :—Larvæ in well.

MIRA :—Larvæ in pool.

(Kandivli Railway Station).—Larvæ in tank near S. No. 15.

AKURLI.—Larvæ in rice field.

POISAR.—Larvæ in rice field, and in well in S. No. 5.

WADHWAN.—Larvæ in well in S. No. 12.

(Malad Railway Station).—Larvæ in wells in S. Nos. 1, 2 and 102.

ARE.—Adults in hut in Gauthan.

- DINDOSHI.—Larvæ in well.
- KURAR.—Larvæ in well in S. No. 5.
- WALNAI.—Larvæ in well in S. No. 13.
- (Goregaon Railway Station).—Larvæ in Railway Borrow pit mile No. 14 west side.
- (Andheri Railway Station).—Larvæ in rice-field in S. No. 809.
- BRAHMANWADA.—Larvæ in well in S. No. 3.
- CHAKALA.—Larvæ in well in S. No. 46.
- MOGRA.—Larvæ in Sarkari well.
- OSHIWARE.—Larvæ in pool in S. No. 48.
- (Vila Parla Railway Station).—Larvæ in Railway Borrow pit mile No. 14 east side, and in wells in S. Nos. 241, 245 and 247.
- (Santa Cruz Railway Station).—Larvæ in wells, Railway Borrow pit, and in well in S. No. 114.
- (Bandra Railway Station).—Larvæ in well in S. No. 261 and in Railway Borrow pit mile No. 10 west side.
- PALI HILL.—Larvæ in wells in S. No. 325.
- MATMAULI.—Larvæ in wells in S. Nos. 270, 281 and 282.
- (Kurla Railway Station).—Larvæ in well.
- (Ghatkopar Railway Station).—Larvæ in tank and rice-field in S. No. 195.
- VADHAVLI.—Larvæ in well in S. No. 55.
- ANIK.—Larvæ in stream.
- MAHAL.—Larvæ in stream to the north of S. No. 151.
- NANALA.—Larvæ in stream.
- (Vikhroli Railway Station).—Larvæ in wells.
- HARIYALI.—Adults in cowshed on Gauthan.
- TIRANDAJ.—Larvæ in well and stream.
- (Bhandup Railway Station).—Larvæ in Railway Borrow pit mile No. 14/15 and in well in S. No. 3 and some others; adults in pucca house on Gauthan.
- KANJUR.—Larvæ in well.
- (Mulund Railway Station).—Larvæ in well in S. No. 30 and in rice-fields in S. Nos. 16 and other in Gawhanpada; adults in cowshed on Gauthan of Nawa-gharpada.
- NAHUR.—Larvæ in well, pool in S. No. 102 and stream in S. No. 1.
- (Thana Railway Station).—Larvæ in wells in house Nos. 3 and 194 and in other wells and stream.
- DHOKALE.—Larvæ in well.
- MANJIVDA.—Adults in cowshed.
- MANPADA.—Larvæ in wells.
- NAVAPADA.—Larvæ in Railway Borrow pit.

## APPENDIX II.

Table of villages in alphabetical order in which anopheline larvæ and adults were found :—

AKURLI.—*My. Culicifacies* larvæ in rice field ; *Ny. Jamesii* larvæ in tank named Dhondlai ; *My. Fuliginosus* larvæ in pool, and well ; *My. Fuliginosus* adults, hut and cowshed in Gauthan.

ANDHERI.—*My. Listonii* larvæ in well in S. No. 14, tank in S. No. 81, rice-fields in S. Nos. 81 and 809 ; *My. Barbirostris* adults, cowsheds in S. Nos. 9 and 12.

ANIK.—*Ny. Fuliginosus* larvæ in tank in Gauthan ; *My. Culicifacies* larvæ in stream ; *Ny. Fuliginosus* larvæ in wells in S. Nos. 4 and 23 ; pool in S. No. 75 ; rice-fields in S. No. 20.

AMBIVLI.—*M. Barbirostris* adults, cowshed.

ARE.—*Ny. Fuliginosus* adults, huts and cowshed on Gauthan ; *My. Listonii* adults, cowshed in Gauthan ; *M. Barbirostris* adults, cowshed in Gauthan ; *My. Culicifacies* adults, hut in Gauthan.

BALKUMB.—*Ny. Fuliginosus* larvæ in well.

BANDIVLI.—*M. Barbirostris* larvæ in wells in S. Nos. 1, 17 and 19 ; tank in S. Nos. 24 and 25 ; *Ny. Fuliginosus* larvæ in tank in S. Nos. 24 and 25, pools in S. Nos. 24 and 41, well in S. No. 17.

BANDRA (SEE ALSO MATMAULI AND PALI HILL).—*M. Barbirostris* larvæ in wells in S. Nos. 189, 197, 198, 204, 223, 230, 235, two in 239, 240 and 241, one in Gauthan, one in Bungalow No. 40, one in Municipal school No. 1, one in Rangari's chawl, one at right hand side of St. Joseph Convent's School, and 5 wells, and one pool in S. No. 241 ; *Ny. Fuliginosus* larvæ in well in S. No. 261, one in House No. 14, and one tank ; *My. Culicifacies* larvæ in well in S. No. 261 ; *Ny. Jamesii* larvæ in well ; *My. Listonii* larvæ in well at side of St. Joseph Convent's School ; *M. Barbirostris* adults in cowshed in Gauthan.

BHANDUP.—*Ny. Fuliginosus* larvæ in well in S. No. 31 ; rice field in S. No. 39 ; adults in cowshed in Gauthan ; *My. Culicifacies* larvæ in well in S. No. 3, well of khot, well of Mahar ; adults in pacca house on Gauthan ; *Ny. Jamesii* larvæ in tank, adults in cowshed in Gauthan ; *My. Listonii* larvæ in well in S. No. 23 ; *N. Punctulata* adults in cowshed in Gauthan.

BORIVLI.—*Ny. Fuliginosus* larvæ in tank ; *My. Culicifacies* larvæ in well in S. No. 12, and one well.

BAMANVADA.—*Ny. Fuliginosus* larvæ in well in S. No. 54, in tank ; adults in cowsheds in Gauthan ; *My. Culicifacies* larvæ in well in S. No. 3.

CHAKALE.—*M. Barbirostris* larvæ in rice field in S. No. 39 ; *Ny. Fuliginosus* larvæ in rice field in S. No. 39 ; tank in S. No. 48 ; adults in cowsheds in Gauthan ; *My. Culicifacies* larvæ in well in S. No. 46.

CHARKOP.—*M. Barbirostris* larvæ in well in S. No. 12 ; *My. Listonii* larvæ in well in S. No. 12.

CHEMBUR.—*Ny. Fuliginosus* larvæ in pool ; *My. Jamesii* larvæ in salt pool.

DAHISAR.—*M. Barbirostris* larvæ in two wells in S. No. 133 ; *Ny. Fuliginosus* adults in cowshed in Gauthan ; *My. Culicifacies* larvæ in wells in S. Nos. 133, 29 and 254 and one well ; *My. Listonii* larvæ in well in S. No. 249, and one well, stream near S. No. 24 ; *Ny. Jamesii* adults in cowshed in Gauthan.

DHOKALE.—*M. Barbirostris* larvæ in wells ; adults in cowshed in Gauthan ; *Ny. Fuliginosus* larvæ in one well ; *My. Culicifacies* larvæ in well.

DINDOSHI.—*My. Culicifacies* larvæ in well.

EKSAR.—*Ny. Fuliginosus* larvæ in rice field in S. No. 20 ; tank in S. No. 202 ; *My. Culicifacies* larvæ in well ; *My. Listonii* adults in cowshed in Gauthan ;

GHATKOPER.—*Ny. Barbirostris* adults in cowshed in Gauthan ; *Ny. Fuliginosus* adults in building in Gauthan ; *My. Culicifacies* larvæ in tank, rice field in S. No. 185 ; *Ny. Jamesii* larvæ in well in S. No. 1.

GONDIVLI.—*Ny. Fuliginosus* larvæ in tank ; *Na. Stephensii* larvæ in rice-field in S. No. 21.

GOREGAON.—*Ny. Fuliginosus* larvæ in well in S. No. 24, tank in S. No. 100.

HARIYALI.—*M. Barbirostris* adults in cowshed in Gauthan ; *Ny. Fuliginosus* adults in hut and cowshed in Gauthan ; *My. Culicifacies* adults in cowshed in Gauthan.

KANDIVLI.—*Ny. Fuliginosus* larvæ in rice-field in S. No. 12, tank in S. No. 15 ; adults in cowshed in Gauthan ; *My. Culicifacies* larvæ in tank in S. No. 15 ; *Ny. Jamesii* larvæ in rice-field in S. No. 12.

KANJUR.—*Ny. Fuliginosus* larvæ in rice-field, in pool ; *My. Culicifacies* larvæ in well ; *My. Listonii* larvæ in stream.

KASHI.—*M. Barbirostris* larvæ in well in S. No. 95, rice-fields in S. Nos. 3 and 6, adults in cowshed in Gauthan; *Ny. Fuliginosus* adults in cowshed in Gauthan; *Ny. Jamesii* larvæ in rice-field in S. No. 14.

KAVESAR.—*M. Barbirostris* adults in cowshed in Gauthan; *Ny. Fuliginosus* adults in cowshed in Gauthan of Waghilpada.

KIROL.—*M. Barbirostris* adults in pæca house in Gauthan.

KOLSET.—*Ny. Barbirostris* larvæ in tank, wells in S. Nos. 247 and 268, well in S. No. 10 of Tarichapada; *Ny. Fuliginosus* adults in cowshed in Gauthan of Tarichapada.

KONDIVTA.—*Ny. Fuliginosus* adults in cowsheds in Gauthan.

KOPRI.—*Ny. Barbirostris* adults in cowshed in Gauthan; *Ny. Fuliginosus* larvæ in rice-field in S. No. 36, adults in cowshed in Gauthan; *N. Punctulata* adult in cowshed in Gauthan.

KURLA.—*Ny. Fuliginosus* larvæ in rice-fields in S. Nos. 211, 258 and 262, pools in S. Nos. 212 and 215; *My. Culicifacies* larvæ in well.

KURAR.—*M. Barbirostris* larvæ in well in S. No. 11; *Ny. Fuliginosus* larvæ in tank in S. No. 3; *My. Culicifacies* larvæ in well in S. No. 5; *My. Listoni* larvæ in well in S. No. 11, streams in S. Nos. 5 and 30.

MAGATNA.—*Ny. Fuliginosus* adults in cowshed on Gauthan; *Pg. Jeyporiensis* adults in cowshed in Gauthan.

MAHUL.—*Ny. Fuliginosus* larvæ in rice-fields in S. Nos. 2 and 66, in tank to the south of S. No. 179, in stream to the east of S. No. 172; *M. Barbirostris* larvæ in wells of S. Nos. 139 and 147; *My. Culicifacies* larvæ in stream to the north of S. No. 151; *Ny. Jamesii* larvæ in well of S. No. 1.

MANJIVDA.—*My. Culicifacies* adults in cowshed; *M. Barbirostris* adults in cowshed on Gauthan; *Ny. Fuliginosus* adults in cowsheds and larvæ in rice-fields.

MALAD.—*My. Culicifacies* larvæ in wells of S. Nos. 1, 2 and 102; *Ny. Fuliginosus* adults in cowsheds on Gauthan, larvæ in well and in rice-field in S. No. 106; *M. Barbirostris* adults in cowshed on Gauthan.

MALAVNI.—*M. Barbirostris* larvæ in well in S. No. 12 and other well; *Ny. Fuliginosus* larvæ in tank to the east of S. No. 99, and in wells of S. Nos. 50, 64 and 84.

MARAWALI.—*M. Barbirostris* larvæ in well; *Ny. Fuliginosus* larvæ in tank; *My. Jamesii* larvæ in rice-field; *Ne. Stephensi* larvæ in puddle.

MATMAULI (MOUNT MARY OR BANDRA HILL).—*M. Barbirostris* larvæ in wells of S. Nos. 27, 271, 282, 270, 281, 282, 270, 246, 268, 281, 280, and in wells of houses Nos. 4, 38 and 81; *Ny. Fuliginosus* larvæ in well; *My. Culicifacies* larvæ in wells of S. Nos. 281, 282 and 270; *My. Listoni* larvæ in wells of S. Nos. 27, 271, 282 and a well of bungalow No. 38.

MANJAS.—*M. Barbirostris* adults in cowshed on Gauthan; *Ny. Fuliginosus* adults in cowshed and hut of Gauthan.

MAHN KHURD.—*M. Barbirostris* larvæ in wells of S. Nos. 58, 91 and 88; *Ny. Fuliginosus* larvæ in stream.

MANPADA.—*M. Barbirostris* larvæ in well; *Ny. Fuliginosus* adults in cowshed of Gauthan; *My. Culicifacies* larvæ in well; *Ne. Stephensi* adults in cowshed on Gauthan.

MAROL.—*M. Barbirostris* adults in cowshed on Gauthan; *Ny. Fuliginosus* in house and cowshed on Gauthan.

MIRA.—*M. Barbirostris* larvæ in Dhobidai stream and Chari Tank and in rice-fields, adults in cowshed on Gauthan; *Ny. Fuliginosus* larvæ in puddles and tank, adults in cowsheds on Gauthan, in streams, in tank and in rice-field; *My. Culicifacies* larvæ in Sarkari well, puddle and rice-field; *Ny. Jamesii* larvæ in rice-field; *My. Listoni* larvæ in rice-field.

MULUND.—*Ny. Fuliginosus* adults in cowsheds on Gauthan; *My. Culicifacies* larvæ in well in S. No. 80 and in rice-field in S. No. 16, adults in cowshed on Gauthan.

NAHUR.—*My. Culicifacies* larvæ in well, stream in S. No. 1, puddle in S. No. 102; *Ny. Jamesii* larvæ in well and rice-field.

NAUALA.—*M. Barbirostris* larvæ in rice-fields; *Ny. Fuliginosus* larvæ in rice-fields, in well and in stream; *My. Culicifacies* larvæ in streams.

NAVAPADA.—*Ny. Fuliginosus* larvæ in rice-field in S. No. 42, adults in cowsheds on Gauthan; *N. Punctulata* adults in cowshed on Gauthan.

OSHIVRA.—*Ny. Fuliginosus* larvæ in well in S. No. 48; *My. Culicifacies* larvæ in puddle in S. No. 48.

PAOHAKOLI.—*M. Barbirostris* larvæ in puddle; *Ny. Fuliginosus* larvæ in puddle.

PAHADI.—*Ny. Fuliginosus* adults in cowshed on Gauthan.

PALI HILL.—*M. Barbirostris* larvæ in well in S. No. 325; *Ny. Fuliginosus* larvæ in well in S. No. 264; *My. Culicifacies* larvæ in wells in S. No. 325; *My. Listoni* larvæ in wells in S. Nos. 6, 161 and 325.

PAVAI.—*Ny. Fuliginosus* larvæ in tank; *Ny. Jamesii* larvæ in tank.

POISAR.—*M. Barbirostris* larvæ in well, adults in cowshed on Gauthan; *Ny. Fuliginosus* larvæ in puddle and in stream S. No. 5; adults in house and cowshed on Gauthan; *My. Culicifacies* larvæ in well in S. No. 5 and rice-field; *M. Listoni* larvæ in well in S. No. 5.

SANTA CRUZ.—*Ny. Fuliginosus* larvæ in rice-field in S. No. 377; *My. Culicifacies* larvæ in well in S. No. 114 and other; *My. Listoni* adults in building in Gauthan.

THANA.—*M. Barbirostris*, larvæ in wells in S. Nos. 56, 122, 194, 127, and in rice-field in S. No. 6; *Ny. Fuliginosus* larvæ in wells in S. Nos. 38, 132, 131, and in tanks one named Mahhamel and the other behind H. No. 57; *My. Culicifacies* larvæ in wells in Patawai No. 3, in H. No. 194 and some others and in stream; *Ny. Jamesii* larvæ in well; *My. Listoni* larvæ in wells in S. Nos. 127 and 3.

TIRANDAJ.—*My. Culicifacies* larvæ in well and stream; *My. Listoni* larvæ in stream and puddles.

VADHAVAN.—*My. Culicifacies* larvæ in well in S. No. 12.

VALNAI.—*M. Barbirostris* larvæ in tank called Khandala and in tank in S. No. 10; *Ny. Fuliginosus* larvæ in rice-field in S. No. 14, adults in cowshed on Gauthan; *My. Culicifacies* larvæ in well in S. No. 13; *My. Listoni* larvæ in wells in S. Nos. 13 and 19; *Ne. Stephensi* adults in cowshed on Gauthan.

VIKROLI.—*Ny. Fuliginosus* larvæ in well, tank, and rice-fields; *My. Culicifacies* larvæ in wells; *My. Jamesii* larvæ in rice-field, Vihad Tank and other tank.

VILA PARLA.—*Ny. Fuliginosus* larvæ in tank; *My. Culicifacies* larvæ in wells in S. Nos. 245, 241 and 247.

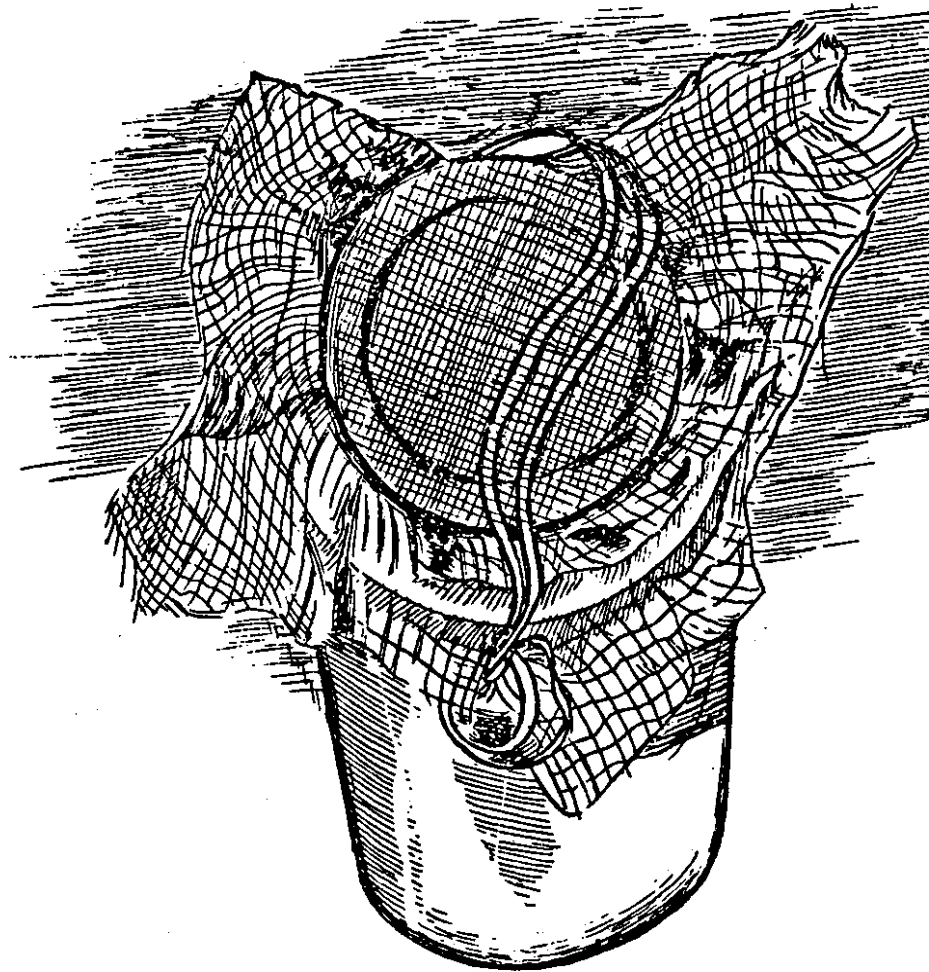
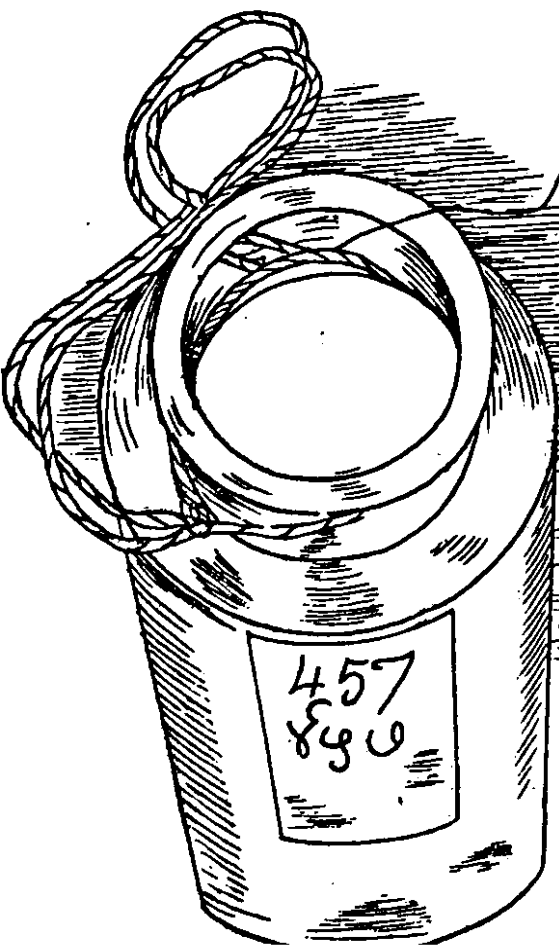
WADHAVLI in TROMBAY.—*M. Barbirostris* larvæ in puddle and in well in S. No. 2; *Ny. Fuliginosus* larvæ in well and tank; *My. Culicifacies* larvæ in well and in stream in S. No. 55.

WADHAVLI near THANA.—*Ny. Fuliginosus* adults in cowshed on Gauthan; *Ny. Jamesii* adults in cowshed on Gauthan; *Ne. Stephensi* adults in cowshed on Gauthan.

WYARAWALI.—*M. Barbirostris* adults in hut on Gauthan.

YEUB.—*My. Listoni* adults in cowsheds on Gauthan.

Dr. Williamson



## APPENDIX II.

*Apparatus used for the Capture and Development of Larvæ.*

The Salsette enquiry afforded a pretty extended opportunity for testing the relative usefulness of different forms of apparatus that have been used or suggested for use elsewhere, and finding out the best way of using those that were found to be really practical. The following were found the best to use:—

**DR. BENTLEY'S WELL-NET.**—This is described in Dr. Bentley's Report on Malaria in Bombay. A substitute, which does not fold up like the original, was obtained for the Salsette investigation through the Malaria Assistant to the Health Officer, Bombay Municipality, from a Borah named Hassan Ali Abdul Ali. The well-net is absolutely indispensable, and even with its use larvæ will be missed if Dr. Bentley's directions about inverting the net and washing it are not followed in every case.

**BUCKET.**—This is needed to bring up some of the water of each well to wash the larvæ out of the net. If the rest of the kit is to be carried in it the bucket should be as large as possible; otherwise, the smaller it is the better.

**ENAMELLED FRYING-PAN.**—This was introduced by Dr. Bentley merely to wash the net, but in the Salsette enquiry it proved to be by far the most useful vessel for catching larvæ in tanks and streams, as the width of the sweep one can give with it enables such a large surface of water to be examined at a time, and as it can stand rough usage so well, when the bottom of a stream is being examined.

**LONG ENAMELLED SPOON.**—This is chiefly of use in skimming the larvæ from the water in the frying-pan, but it is also useful in examining hoof-prints and other small hollows containing water.

**ENAMELLED MUG.**—The two latter articles suffice for nearly every open place but a mug is needed for work in rice-fields and places where long grass stands in water.

**QUININE BOTTLE.**—Both for carrying in the field and for keeping the larvæ in afterwards to hatch out, the most useful bottles to use are ounce-of-quinine bottles, which are obtainable easily in the bazaar. These are cylindrical bottles of seven fluid ounce capacity, and the most suitable ones are those which have a broad flange on the lip. Each should be fitted with a string round the neck to which to fix another loop of string, like the handle of a basket, to carry the bottle by. The cap of the bottle is best made of a little square of coarse *dangri* or *khadi* cloth, tied to the string on the neck by a thread a couple of inches long. This cloth is of open texture, and allows free access of air. To the upper surface of the cap, near one edge, should be sewn a loop of silk elastic. If the cap is laid on the mouth of the bottle it can be fixed on in a second by laying the forefinger of the left hand, which holds the bottle, on the insertion of the loop, against the neck, and slipping the loop down over the mouth with the right hand. The bottles are carried in the field with the caps hanging down. Each is capped as soon as it is filled, without the aid of any string. A good rule to make is that, once it is capped, no bottle is to be opened, except by the Malaria Officer himself.

Each bottle has a label, bearing simply a serial number, in English and in the vernacular, which is written on it when the day's batch of bottles is being issued, and which corresponds with a number in the register. The bottles are carried in a wooden box or tray with compartments, which has a handle rising from the middle compartment, and as each is filled and capped the searcher enters the number in the margin of his note-book, and opposite this makes a note of the kind of collection of water the larvæ were taken from, and the village survey number, or other means of identification of the place. At the end of the morning's or evening's search the bottles are returned to the laboratory, and the notes copied from the searcher's note-book into the register, opposite the serial numbers. If carbons are used with the note-books individual searchers need not attend the laboratory; they tear out the pages and send them in with the bottles. The bottles are examined as soon as the Malaria Officer has time to attend to them and then write up his part of the register. In Salsette the register was kept somewhat in the following fashion:—

Serial number.	Date.	Rice-field.	Well.	Tank.	Cistern.	Puddle.	Salt-pan.	Railway Borrow Pit.	Stream.	Swamp.	Locality.	<i>My. halimnosa.</i>	<i>N. rosei.</i>	<i>My. cutifacies.</i>	<i>My. Jamesi.</i>	<i>My. listoni.</i>	<i>M. barbirivris.</i>	<i>Ms. stephens.</i>	Remarks.	Identified by larva of image.
457	5th Oct. 1913	..	1	..	..	..	..	..	..	..	S. N. 271 Mount Mary.	..	..	..	..	1	1	..	} I = I } I = L } I	
458	Do.	..	..	1	..	..	..	..	..	..	Gauthan of Akarli.	1	..	..	..	..	..	..		



As the examination of the contents of each bottle is finished and the result registered the number on its label is heavily crossed out with blue pencil. The peon in attendance, who recognizes this marking, removes the bottle, rinses it out, and fixes on a new blank label, and the bottle, with its cap and elastic hanging from it, is placed in the stock for re-issue with a fresh serial number.

Although it pays to keep the specimens for several days, to let as many adults develop as possible, it is seldom worth the trouble to change the water in the bottles; as a rule if larvæ will not develop in their own water they will not do so in any other. In Salsette it was found that a greater proportion of specimens yielded adults when kept standing in the dry weather after the monsoon than during the wet weather itself.

However many bottles have accumulated on the shelves, with only the numbers on them to distinguish them, if a rule is observed that only one bottle is allowed to have its cap off at one time no mistake in identity can occur, even if the Malaria Officer is called away in the middle of examining larvæ or adults taken out of a bottle.

A stylo pen pipette is useful for taking out larvæ for examination under the microscope.

When adults have developed in a bottle, if it is desired to mount them without chloroforming them *in situ*, which would wet them, and kill the remaining larvæ in the bottle, they may be transferred to a dry bottle in the following way; to let any escape should be considered bad technique:—

Hold the wet bottle in the left hand, with the forefinger and thumb forming a ring round the neck, and pressing the margins of the cap against the glass. Slip off the elastic band inserted on the cap. Invert a dry bottle, with its cap hanging off, over the wet one, and clasp both bottles with the right hand. With the left pull off the cap of the wet bottle sideways from between the two mouths, and let it hang. The mosquitos will fly up into the dry bottle. If any are sluggish the lower bottle may be bumped on the table, or tilted so that the water touches their hind legs. When all have flown up and been counted lay the cap of the dry bottle on the palm of the left hand, slip the still inverted bottle rapidly on to it, and adjust the elastic before turning the bottle up. Then copy the number of the wet bottle on to the label of the dry.

A window-sill is a convenient place for this dry bottling.

The following directions to those who are to collect the larvæ are only for the using of the kit described above, and are intended to supplement the general instructions which are usually given. The use of Dr. Bentley's well-net is described on page 69 of his report, so directions for this are not given here.

#### *Directions given to Searchers.*

For field work the following should be taken:—A well-net, a bucket, a frying-pan, a long spoon, a mug, a boxful of quinine bottles and a note book with carbon sheet and pencil. The mug, the spoon and pan should each have a loop of string fixed to its handle. When a tank or stream is to be examined the pan, the spoon and a bottle, with its cap hanging down, should be taken from the cooly, and the spoon and the bottle hung from the third and fourth fingers of the left hand. Nothing is to be put on the ground. The water should be considered to be in three layers or levels, the surface, at which the larvæ may be feeding, the middle, in which they may be concealed in green weed, and the bottom, on which they may be resting. The surface should first be skimmed with the pan. After each sweep the pan should be held at rest, and examined, plenty of time being given to allow the larvæ to come to the surface. If any are seen the pan should be grasped at the side opposite the handle with the thumb and first two fingers of the left hand, while the spoon is taken off the third finger with the right hand. Held like a pen, it is used to skim the larvæ off the surface and pour them into the bottle which hangs from the little finger.

If the bottle gets too full of water before there are many larvæ in it the water may be partly poured away by bridging the mouth of it with the forefinger at one side, and cautiously tilting the bottle in that direction. The water runs away under the finger, while the larvæ at the surface are not disturbed.

The "middle layer" of the water of the tank or stream should then be examined, if there is green weed present, piece after piece of it being brought up in the pan. If no larvæ come out of the weed to the surface of the water in the pan the weed should be squeezed like a sponge with the hand under water.

Lastly, the bottom should be examined, and stirred up with the pan, the surface water being then skimmed for the larvæ that may have come up when disturbed.

The cooly may meanwhile employ himself in searching for larvæ with the mug.

The larvæ of not more than one tank, well or stream may be put into one bottle, though a chain or rice-fields or borrow-pits may be considered as one. When enough larvæ have been secured the cap is to be fixed on with the elastic, and the bottle given back to the cooly. The number of the bottle, and a short description of the piece of water from which the larvæ were taken, with the name of the village, and if possible the survey number, should be entered in the note-book, before the cooly replaces the bottle in its compartment of the box.

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