

RECORDS OF ANOPHELINE MOSQUITOES COLLECTED FROM MANIPUR WITH ECOLOGICAL NOTES

K. B. RAJPUT* AND T. K. SINGH

Department of Life Sciences, Manipur University, Imphal 795003

INTRODUCTION

The state of Manipur has remained poorly known for its mosquito-fauna and species description due to its inadequate accessibility. In spite of more attention of being paid for Anophelines due to their involvement in malaria transmission, thirteen Anopheles species were known during first half of this century (Covell 1927, 1931; Christophers, 1933; Puri, 1936, and Mortimer, 1946). In a recent survey, Malhotra et al. (1983) added Anopheles subpictus to the list of Anophelines.

In view of the above the state was surveyed for the mosquito-fauna during the period 1983 to 1985. The present communication presents the distribution record with ecological notes for the Anophelines.

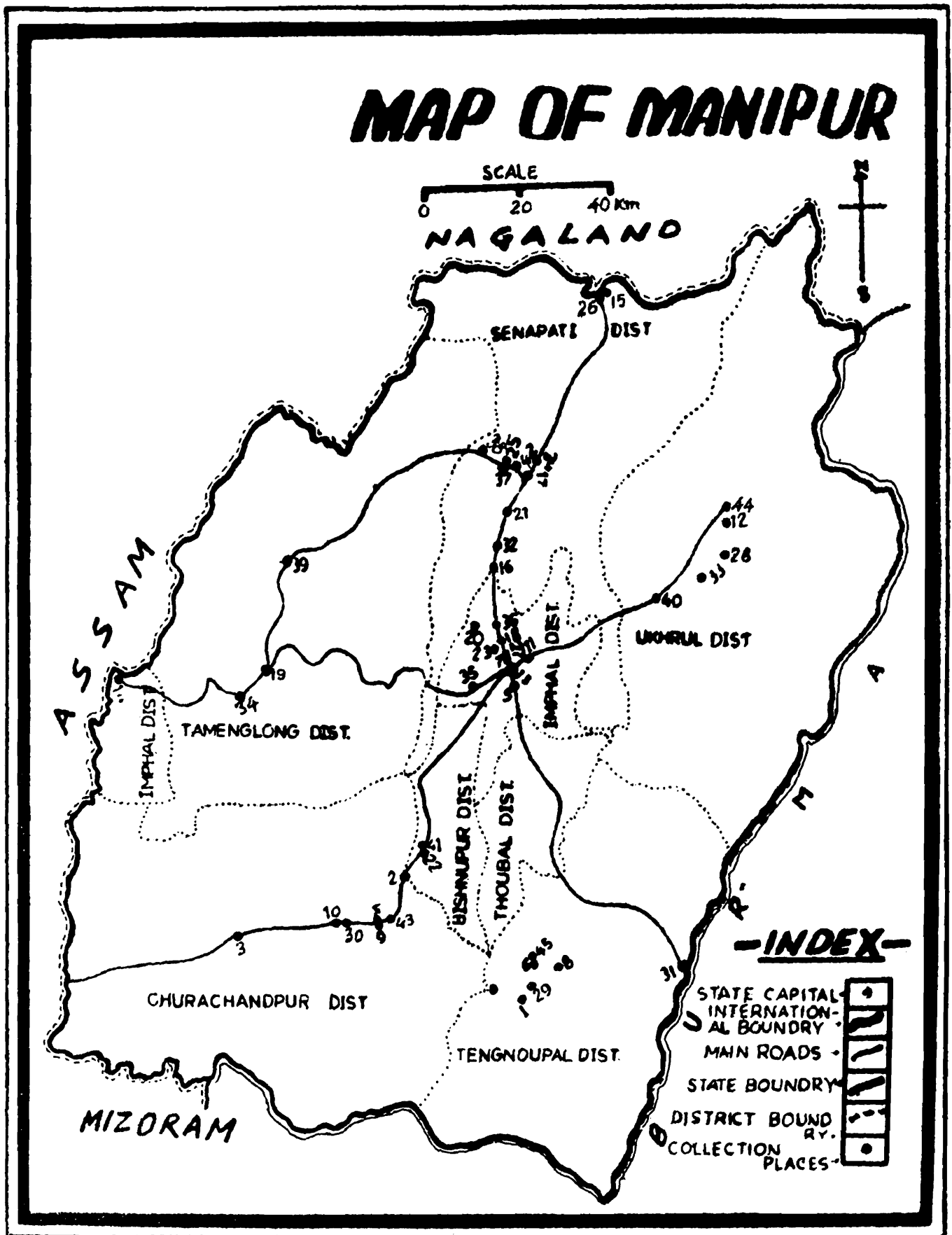
TOPOGRAPHY AND CLIMATE

The state of Manipur lies in the northeast corner of the country and extends from 23.83° to 25.68° N latitude and from 93.05° to 94.78°E longitude. The state have an area of about 22,327 sq. kilometres. The state have a centrally situated valley bounded with north to south running hill range at both the sides. A total of about 20,736 sq. kms area of the state is covered by the hills and they are covered with the mixed-type of vegetation. The state is drained by several small to large rivers, muddy and rocky nalas, streams, lakes and ponds.

The state enjoys the salubrious climate with well marked winter, and overlapping summer and rainy season. The winter season commences in November and continues up to February, and the summer commences in April and continues up to September. The summer season is the season of rain also. With the altitude variation, the state also admits the climatic variation in different parts. The temperature and relative humidity in the state usually varies from 0°C to 38.5°C and 20° to 100° respectively. The hilly region of the state receives more precipitation than the valley. The detailed ecogeographic features have been described by Ansari (1973).

The collections were made from 45 localities (vide Map) situated in different physiographic divisions of the state.

* Present Address – Regional Tasar Research Station, Imphal, Manipur, 795 002.



MATERIALS AND METHODS

The adult mosquitoes were collected from different resting habitats viz., abandoned houses, cattle-sheds, banana groves, discarded motor-tyres, dried leaves, vegetation, human dwellings, nullah margin-grooves, pit-shelters, and trees holes etc. with the help of flash light and aspirator-tube. Fortnightly collections from human and bovine-baits were made during the dusk-hours in the valley. For recording day biting species regular collections were made with self-bait technique (WHO, 1975; and Rajput and Sinha, 1986). During night, the adults landing over electric light was also collected. In addition to these the immatures were also collected from different breeding places viz., ponds, pools, drains, nala margins, paddy fields, tree holes, bamboo-stumps, rock holes, discarded domestic containers, ant-wells, discarded motor tyres, and tanks etc. They were reared in the laboratory up to adult stage.

The field collected or reared mosquitoes were identified with the help of Christophers (1933); Harrison (1980); Harrison and Scanlon (1975); Puri (1955); Rao (1984); and Wattal & Kalra (1967). Besides, some recent papers were also consulted for the purpose. Identification was mainly done on adult characters. Genital characters of males and characters of immatures were also taken into consideration whenever these forms were available. Classification and nomenclature used here is based on *The Catalog of the Mosquitoes of the World* (Knight and Stone, 1977).

SYSTEMATIC ACCOUNTS

Tribe ANOPHELINI

1. *Anopheles barbirostris* van der Wulp

1884. *Anopheles barbirostris* van der Wulp, *Notes from the Leyden Museum*, 6 : 248.

Distribution : Throughout oriental region. In India recorded from almost all zones except high altitudes of Kashmir.

Present records : Bungmul (850 m.) - 1 ♀ (27 No.'84) from herb vegetation. Chingmeirono (785m.) - 17 ♀♀, 14 ♂♂ between 2 Oct.'83 and 14 Oct.'84 from shrubby vegetation, 5 ♀♀ between 30 Oct.'83 and 14 Oct.'84 from human bait during day, 1 ♂ (27 Jul.'84) from herb vegetation. Geljang (850m.) - 1 ♀ (27 Nov.'84) from shrubby vegetation of *Lithocarpus dealbata*. Imphal (785m.) - 2 ♀♀ (1 Nov.'84) from cattle-shed. Khongampat (785m.) 1 ♂, 5 ♀♀ between 27 No.'83 and 16 Dec.'84 from herb vegetation. Mantripukhari (785m.) - 8 ♀♀ between 11 Oct.'83 and 21 Oct.'84 from electric light, 7 ♂♂ between 23 Oct.'83 and 14 Oct.'84 from human bait, 23 ♀♀ between 26 Nov.'83 and 29 Oct.'84 from bovine bait, 3 ♀♀ between 26 Jul.'84 and 15 Oct.'84 from cattle-shed. Moltan-hill (820m.) - 1 ♂, 1 ♀ (1 Nov.'84) larvae reared from medows-pool. The species was found to associately breeding with *Anopheles nigerrimus* and *Culex pseudovishnui*.

2. *Anopheles crowfordi* Reid

1953. *Anopheles crowfordi* Reid : 41.

Distributed in some southeast Asian countries viz., Kampuchea, Malaysia, Sumatra and Vietnam. In India, the species have been recorded from Assam and Manipur only.

Present records : Mao (1,850m.) - 1 ♀ (8 Sept.'85) from human-bait.

3. *Anopheles gigas* Giles

1901. *Anopheles gigas* Giles, *Entom.Month.Mag.Ser. 2* : 196.

The species is restricted to oriental region only. In India, it have been recorded from high altitudes of Manipur, Meghalaya, Mizoram, Nagaland and Tamil Nadu.

Present records : Ukhrul (2,000m.) - 2 ♂♂, 2 ♀♀ (8 Jul.'84) reared from larval collection from discarded motor-tyres. The species associately breeds with *Aedes shortti*, *Culex theleri* and *Cx. vorax*.

4. *Anopheles lindesayi* Giles

1900. *Anopheles lindesayi* Giles, *Handb.ed. 1* : 116.

This montane species has been recorded from India, Pakistan, Nepal, U.S.S.R. and Burma. Recorded all along the Himalayas upto an altitude of about 3,000 meters.

Present records : Toribari (1,000m.) - 3 ♂♂, 2 ♀♀ (7 Dec.'83) larvae were reared from a stream-bed.

5. *Anopheles nigerrimus* Giles

1900. *Anopheles nigerrimus* Giles, *Handb. of Gnats or Mosq. ed. 1* : 161.

The species is endemic to oriental region and distributed throughout Indian region.

Present records : Canchipur (785m.) - 1 ♀ (20 Oct.'84) larva reared from paddy field. Chingmeirong (785m.) - 51 ♂♂, 36 ♀♀ between 11 Sep.'83 and 14 Oct.'84 from herbaceous growth below *Quercus acutissima* plants, 78 ♂♂, 53 ♀♀ between 12 Feb. '84 and 4 Dec.'84 larvae were reared from pond margin. Churachandpur (850m.) - 2 ♂♂ (8 Oct.'83), larvae reared from road side pool, 1 ♂, 2 ♀♀ (1 No.'84) larvae reared from pond margin. Geljang (850m.) - 3 ♂♂, 4 ♀♀ (27 Nov.'84) reared from a muddy-pit. Gwaltabi (785m.) - 5 ♂♂ (19 Nov.'84) collected from dried leaves of *Quercus acutissima*. Jiribam (150m.) - 1 ♂, 2 ♀♀ (7 Oct.'84) from herb vegetation and 4 ♀♀ (7 Oct.'84) from bovine-bait. Khongampat (785m.) - 6 ♂♂, 7 ♂♂ (27 No.'83), 3 ♂♂, 4 ♀♀ (29 Jan.'84), 3 ♂♂, 2 ♀♀ (12 Aug.'84), 1 ♂ (16 Dec.'84), from herb vegetation. Khurkhul (830m.) - 2 ♀♀ (29 Jan.'84), from herb vegetation. Koubruleikha (1,040m.) - 1 ♂ (12 Aug.'84) from shrubby vegetation. Langol-hill (785m.) - 1 ♂ (19 Feb.'84) larvae reared from road side pool, 1 ♂ (26 Jan.'84), larvae reared from pond margin, 1 ♂, 3 ♀♀ (26 Jan.'84) larvae reared from weedy pool. Mantripukhri (785m.) - 22 ♀♀ between 12 Sept.'83 and 15 Oct.'84 from cattle-sheds, 34 ♀♀, 2

♂♂ between 11 Oct.'83 and 21 Oct.'84 from electric light, 1 ♂ (23 Oct.'83), 1 ♀ (26 Sept.'84) from human-bait, 405 ♀♀ between 14 Nov.'83 and 29 Oct.'84 from bovine-baits, 1 ♀ (15 Nov.'83), 1 ♀ (14 Oct.'84) from human dwellings, 1 ♂, 1 ♀ (12 Jan.'84), 12 ♂♂, 14 ♀♀ (25 Mar.'84) larvae reared from pond margin. *Moltam-hill* (820m.) - 2 ♂♂, 3 ♀♀ (1 Nov.'84) larvae reared from meadows-pool. *New-heaven* (1,600m.) - 1 ♂, 2 ♀♀ (19 Nov.'84), larvae reared from a pit in the paddy field. *Nungba* (750m.) - 1 ♂ (8 Oct.'84), from bovine-bait. *Sumphejung* (1,280m.) - 2 ♂♂, 1 ♀ (7 Dec.'83), larvae reared from a harvested paddy field. *Tongou-Lonkoy* (820m.) - 1 ♀ (9 Jul.'84), from herbs in forest. *Toranglobi* (765m.) - 2 ♂♂, 3 ♀♀ (1 Nov.'84), larvae reared from road side pool. *Zaphou* (1,000m.) - 1 ♀ (21 Oct.'85), 1 ♂ (22 Oct.'85), from human-bait.

Associate-breeders were *Anopheles annularis*, *Anopheles barbirostris*, *An. peditaeniatus*, *Culex bitaeniorhynchus*, *Cx. fuscocephala*, *Cx. mimulus*, *Cx. malayi*, *Cx. pseudovishnui*, *Cx. tritaeniorhynchus*, *Cx. vishnui* and *Mimomyia chamberlaini*.

6. *Anopheles nitidus* harrison, Scanlon and Reid

1973. *Anopheles nitidus* Harrison, Scanlon and Reid, *Mosq.Syst.* 5 : 266.

The species is distributed in Indonesia, Kampuchea, Malaysia and Thailand. It has been recorded from Assam and Manipur in India.

Present records : *Chingmeirong* (785m.) - 1 ♂ (14 Aug.'84), larva was reared from pond margin. The species associately breeds with *Anopheles nigerrimus*.

7. *Anopheles peditaeniatus* (Leicester)

1908. *Anopheles peditaeniatus* (Leicester), 31.

The species is widely distributed in Oriental region and south Palaearctic region. Recorded from Assam, Bihar, Karnataka, Madhya Pradesh, Punjab, Tamil Nadu and West Bengal in India.

Present records : *Chingmeirong* (785m.) - 3 ♀♀, 2 ♂♂ between 11 Sept.'83 and 30 Oct.'83 from herbs below *Quercus acutissima* plantation, 3 ♀♀ between 30 Oct.'83 and 14 Jul.'84, larvae reared from pond margin. *Khongampat* (785m.) - 2 ♀♀ (27 Nov.'83) from herb vegetation. *Kwakta* (760m.) - 1 ♀ (8 Oct.'83), from herbs below mulberry plantation. *Mantripukhri* (785m.) - 6 ♀♀ between 21 Oct.'83 and 26 Jul.'84 from cattle-shed, 16 ♀♀ between 11 Oct.'83 and 21 Oct.'84 from electric light, 1 ♀ (30 Oct.'83) from human-bait. *Zaphou* (1,000m.) - 1 ♀ (22 Oct.'85) from human-bait.

Associated breeder was *Anopheles nigerrimus*.

8. *Anopheles sinensis* Wiedmann

1828. *Anopheles sinensis* Wiedmann, *Auss zweifl. Inst.* : 547.

Widely distributed in Oriental and south Palaearctic region. The species in India were reported to be endemic in Manipur.

Present records : Chingmeirong (785m.) - 1 ♀, 1 ♀ (12 Feb.'84), 1 ♀, 1 ♂ (26 Feb.'84), larvae reared from pond-margin, 1 ♀ (13 Feb.'84) adults collected from herb-vegetation. Gwaltabi (785m.) 1 ♀ (19 Nov.'84) from dried leaves. Hundung (2,000m.) - 1 ♂, 1 ♀ (19 Sept.'84), 3 ♂ ♂ (1 Feb.'85) larvae reared from pit in the harvested paddy-field. Kwakta (760m.) - 1 ♀ (8 Oct.'83) from herb vegetation. Langol-hill (785m.) - 4 ♀♀ (19 Feb.'84) larvae reared from an algal-pool. Mantripukhri (785m.) - 3 ♀♀ (23 Oct.'83), from human-bait, 1 ♀ (25 Feb.'84), from bovine-bait, 1 ♀ (25 Feb.'84) from cattle-shed, 1 ♀ (21 Oct.'84) from bulb-light. Mao (1,850m.) - 1 ♀ (8 Sept.'85) from cattle-shed. Zaphou (1,000m.) - 3 ♀♀ (22 Oct.'85) from human-bait. The species breeds in association with *Anopheles nigerrimus*.

9. *Anopheles annularis* Van der Wulp

1884. *Anopheles annularis* Van der Wulp, *Notes from the Leyden Museum*. 6 : 249.

The species has wide range of distribution in oriental region. Recorded from all over India.

Present records : Bullian (775m.) - 1 ♀ (8 Oct.'83) from cattle-shed. Chingmeirong (785m.) 5 ♀♀ (11 Sept.'83), 1 ♂ (18 Sept.'83) from shrubby vegetation, 24 ♀♀, 16 ♂ ♂ between 21 Nov.'83 and 25 Aug.'84 larvae were reared from pond margin. Gwaltabi (785m.) - 1 ♂ (19 Nov.'84) from dry leaves of *Quercus acutissima*. Mantripukhri (785m.) - 148 ♀♀ between 12 Sept.'83 and 15 Oct.'84 from cattle-shed, 1 ♀ (30 Oct.'83), 1 ♀ (14 Oct.'84) from human bait, 45 ♀♀ between 24 Mar.'84 and 29 Oct.'84 from bovine bait, 1 ♀ (23 Jan.'84) from wooden logs, 2 ♂ ♂ (13 Mar.'84) attracted to light, 16 ♂ ♂, 13 ♀♀ (25 Mar.'85) larvae reared from pond.

Associated breeders were *Anopheles nigerrimus*, *Culex bitaeniorhynchus*, *Cx. mimulus*, *Cx. malayi* and *Cx. pseudovishnui*.

10. *Anopheles jeyporiensis* var. *candidiensis* Koidzume

1924. *Anopheles jeyporiensis* var. *candidiensis* Koidzumi, *Trans. 5th Cong. F.E.A.T.M.*:98.

It has wide range of distribution in Oriental and south Palaeartic region. In India, it has been recorded from Andhra Pradesh, Assam, Manipur, Maharashtra, Madhya Pradesh, Uttar Pradesh and West Bengal.

Present records : Zaphou (1,000m.) - 11 ♀♀ (21 Oct.'85), 7 ♂ ♂ (22 Oct.'85) from human-bait.

11. *Anopheles kochi* Doenitz

1901. *Anopheles kochi* Doenitz, *Insektenborsa* 18 : 36.

The species is distributed in Oriental and south Palaeartic region. Recorded from Arunachal Pradesh, Assam, Manipur, Maghalaya, Mizoram, Nagaland, Sikkim and Tripura, in India.

Present records : Kongampat (785m.) - 6 ♂♂, 6 ♀♀ (27 Nov.'83) from herb vegetation. Moreh (150m.) - 1 ♀ (18 Aug.'84) from nala side groove in forest, 4 ♂♂, 3 ♀♀ (18 Aug.'84) larvae from rainy-pool, having turbid water.

Associated breeders were *Anopheles nigerrimus*, *Aedes caecus*, and *Culex fuscocephala*.

12. *Anopheles maculatus* Theobald

1901. *Anopheles maculatus* Theobald, *Monogr.Cul.* 1 : 171.

Distributed in Oriental region. Recorded from almost all parts of India.

Present records : Gwaltabi (785m.) - 1 ♂ (19 Nov.'84) from dry leaves of *Quercus acutissima*. Kanglatongbi (1,000m.) - 2 ♂♂, 2 ♀♀ (12 Aug.'84) from herb vegetation. Koubru-leikha (1,040m.) - 1 ♀ (7 Dec.'84) larvae reared from a pit at nala margin. Mantripukhri (785m.) - 1 ♀ (23 Oct.'83) from human-bait. New-heaven (1,600m.) - 1 ♀ (19 Nov.'84) larvae reared from road side drain. Nungba (750m.) - 2 ♀♀ (8 Oct.'84) from bovine-bait, 2 ♀♀ (8 Oct.'84) larvae reared from road side rainy pit. Nungdalal (1,100 m.) - 1 ♀ (7 Sept.'84) larvae reared from roadside rainy-pit. Tamenglong (1,200m.) - 1 ♀ (8 Nov.'84) from indoor cattle-shed, 2 ♀♀ (8 Nov.'84) from shrubby vegetation, 1 ♀ (8 Sept.'84) from indoor human dwellings. Zaphou (1,000m.) - 1 ♀ (21 Oct.'85) from human-bait.

The species associately breeds with *Anopheles maculatus* var. *willmorei*, *Culex bitaeniorhynchus*, *Cx. mimulus*, and *Cx. quinquefasciatus*.

13. *Anopheles maculatus* var. *willmorei* (James)

1903. *Anopheles maculatus* var. *willmorei* (James) in Theobald *Monogr.Cul.* 3 : 100.

The distribution of var. *willmorei* is restricted to Burma, Nepal, India and Pakistan. In India, it has been recorded from Himalayan and eastern part.

Present records : Mao (1,850m.) - 1 ♀ (8 Sept.'85) from human-bait. New-heaven (1,600m.) - 2 ♀♀ (19 Nov.'84) larvae reared from a road-side drain in forested area. Nungba (750m.) - 8 ♀♀ (8 Oct.'84) from bovine-bait, 3 ♂♂ (8 Oct.'84) larvae reared from road side rainy-pit. Nungdalal (1,100m.) - 3 ♂♂, 14 ♀♀ (7 Sept.'84) larvae reared from a road side rainy-pool. Tamenglong (1,200m.) - 2 ♂♂ (8 Sept.'84) larvae reared from a cement tank.

Associated breeders were *Anopheles maculatus*, *Culex mimulus* and *Cx. quinquefasciatus*.

14. *Anopheles minimus* Theobald

1901. *Anopheles minimus* Theobald, *Monogr.Cul.* 1 : 186.

The species has a wide distribution in Oriental and southern Palaearctic region. It is prevalent in Orient in Assam and eastern India including Manipur; northern and last central India with scattered distribution in Andhra Pradesh, Kerala, Karnataka and Tamil

Nadu.

Present records : Moreh (150m.) - 1 ♂ (18 Aug.'84) from human-bait, 21 ♂♂, 14 ♀♀ (18 Aug.'84) larvae reared from road side rainly-poll, 1 ♀ (19 Aug.'84) from nala margin groove in dense forest.

Associated breeder was *Culex quinquefasciatus*.

15. *Anopheles philippinensis* Ludlow

1902. *Anopheles philippinensis* Ludlow, *Journ.Amer.Med. Assoc.* : 426.

Mainly Oriental and Palaearctic in distribution. In India, it has been recorded from Andamans Island, Andhra Pradesh, Assam, Bihar, Karnataka, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Orissa, Uttar Pradesh and West Bengal.

Present records : Chingmeirong (785m.) - 2 ♂♂ (6 No.'83) larvae reared from pond margin.

16. *Anopheles splendidus* Koidzumi

1920. *Anopheles splendidus* Koidzumi, *Daiwan Kenkyujo Hokoku* 8 : 23, 32, 55.

The species is known to be distributed in oriental region, southern Palaearctic region and Afghanistan. It has been recorded from most of the states in India.

Present records : Mantripukhri (785m.) - 1 ♀ (14 Oct.'84) from human-bait. Langol-hill (785m.) - 1 ♀ (26 Jan.'84) from dried leaves below *Quercus acutissima* plantation.

17. *Anopheles subpictus* Grassi

1899. *Anopheles subpictus* Grassi, *R. C. Accad. Lincer.* 8 : 101.

The species has a wide geographic range including entire oriental region, Afghanistan, Iran, southern China and New Guinea. The species has been recorded from all over India.

Present records : Mantripukhri (785m.) - 35 ♀♀ between 4 Apr.'84 and 23 Jun.'84 from bovine-baits, 1 ♂, 12 ♀♀ between 9 and 23 Jun.'84 from cattle-sheds, 6 ♂♂ (15 Apr.'84) larvae reared from a muddy-pit in a dried pond with turbid water. Tongou-Lonkoy (820m.) - 1 ♀ (9 Jul.'84) from herb vegetation in forest.

Associated breeders were *Anopheles vagus* and *Culex pseudovishnui*.

18. *Anopheles tessellatus* Theobald *Mono.Cul.* 1 : 175.

1901. *Anopheles tessellatus* Theobald, *Mono. Cul.* 1 : 75;

The species distribution is restricted to oriental and southern Palaearctic region. In India, it is widely distributed and includes Andaman and Lakshadweep, but scarce in north western part.

Present records : Manipur : Mantripukhri (785m.) - 1 ♂ (19 Nov.'83) collected from bulb-light.

19. *Anopheles vagus* Donitz

1902. *Anopheles vagus* Donitz, *Zeit.f.Hyg.* : 80.

The species has a wide distribution in Oriental region, Kampuchea, Mariana Island, Moluccas and New Guinea. Records from all over India including Andamans.

Present records : Bungmul (850m.) - 1 ♀ (27 Nov.'84) from herb vegetation. Chingmeirong (785m.) - 1 ♂, (11 Sept.'83), 2 ♂ ♂, 1 ♀ (28 Jul.'84) from shrubby vegetation of *Quercus acutissima*, 1 ♀ (27 Jul.'84) from herb vegetation, 1 ♂, 3 ♀ ♀ (23 Oct.'83) larvae reared from cart-tract. Gwaltabi (785m.) - 1 ♀ (19 Nov.'84) from dry leaves of *Q. acutissima*. Imphal (785m.) - 1 ♀ (1 Nov.'84) from cattle-shed. Jiribam (150m.) - 1 ♂ from herb vegetation and 47 ♀ ♀ from bovine-bait (7 Oct.'84). Kanglatonqbi (785m.) - 1 ♂, 2 ♀ ♀ (12 Aug.'84) from herb vegetation. Khongampat (785m.) - 11 ♂ ♂, 12 ♀ ♀ (12 Aug.'84) from herb vegetation. Khongsong (650m.) - 1 ♂, 7 ♀ ♀ (9 Sept.'84) from road side rainy-pool. Mantripukhri (785m.) - 81 ♀ ♀, 8 ♂ ♂ between 12 Sept.'83 and 15 Oct.'84 from cattle-shed, 4 ♀ ♀ between 23 Oct.'83 and 11 Aug.'84 from human-bait, 855 ♀ ♀ between 14 Nov.'83 and 29 Oct.'84 from bovine-bait, 1 ♀ (13 Mar.'84), 1 ♀ (23 Aug.'84) attracted to electric light; 1 ♂ (9 Apr.'84), 1 ♂ (23 Aug.'84) from human dwellings, 5 ♂ ♂, 9 ♀ ♀ (15 Apr.'84) larvae reared from muddy-pit in a dried pond. Nungba (750m.) - 8 ♀ ♀ (8 Oct.'84) from bovine-bait, 2 ♀ ♀ (9 Oct.'84) from cattle-shed. Tamenglong (1,200m.) - 4 ♀ ♀ (8 Sept.'84) from bovine-bait. Ukhrul (1,200m.) - 1 ♂, 1 ♀ (8 Jul.'84) larvae reared from a rainy-pool.

Associated breeders were *Anopheles subpictus*, *Culex fuscocephala*, *Cx. pseudovishnui* and *Cx. quinquefasciatus*.

SUMMARY

The mosquito-survey of the state during 1983 to 1986 shows the presence of 19 species viz., *Anopheles barbirostris*, *An. crowfordi*, *An. gigas*, *An. lindesayi*, *An. nigerrimus*, *An. nitidus*, *An. peditaeniatus*, *An. sinensis*, *An. annularis*, *An. jeyporiensis* var. *candidensis*, *An. kochi*, *An. maculatus*, *An. maculatus* var. *willmorei*, *An. minimus*, *An. philippinensis*, *An. splendidus*, *An. subpictus*, *An. tessellatus* and *An. vagus* from the state. This communication includes the distribution records and ecological notes for the recorded species. The record of the *An. minimus* is noteworthy due to its vectorial role in the transmission of malaria in the northeast region.

ACKNOWLEDGEMENTS

The authors are thankful to Dr. Bruce A. Harrison, Manager, Welter Reed Biosystematics Unit, Smithsonian Institution, Washington and Dr. V. P. Sharma, Director Malaria Research Centre, New Delhi for confirmation and comments, on the identity of some of the mosquito-species.

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