Pictorial identification key of important disease vectors in the WHO South-East Asia Region

2020

World Health Organization
REGIONAL OFFICE FOR South-East Asia

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Foreword

Major vector-borne diseases (VBDs) together account for around 17% of the estimated global burden of communicable diseases and claim more than 700 000 lives each year. More than 80% of the global population live in an area at risk from at least one major VBD. More than half of the global population live in an area at risk from two or more major VBDs. Every year more than one billion people are infected by a VBD. More than one million people die from VBDs globally.

The WHO South-East Asia Region is particularly affected. In 2018 the Region reported an estimated 8 million malaria cases and 11 600 malaria deaths. In the past 50 years dengue incidence has surged more than thirty times the base level. More than 52% of the Region's population is at risk of dengue, which is now endemic in 10 of 11 Member States. Chikungunya is endemic in all Member States except Timor-Leste and the Democratic People's Republic of Korea. Zika virus disease has been reported from India, Indonesia, Thailand and Maldives. The Region accounts for around 58% of the global burden of lymphatic filariasis. Japanese encephalitis continues to be a significant public health problem in India, Nepal and Sri Lanka. Bangladesh, India, Nepal and Bhutan report around 6000 cases of leishmaniasis annually.

Member States and partners must continue to aggressively respond. To help do that, this pictorial key will increase knowledge of mosquito vector fauna, its bionomics and proper identification to enhance the epidemiologic understanding of VBDs. It is the first pictorial key of its kind and provides a user-friendly guide for public health workers, school teachers, students, researchers and other interested groups. The illustrations and terms used throughout are simplified to facilitate the identification process. Rather than portray every taxonomic character, the guide deals only with characters that are directly relevant to identifying mosquitoes in the Region.

I urge all stakeholders to make the most of this tool. In recent years the Region has more than halved the incidence of malaria and kala-azar, demonstrating what focus and determination can achieve. WHO will continue to support Member States as together we continue the battle against VBDs for the health of all people everywhere.

Dr Poonam Khetrapal Singh
Regional Director
WHO South-East Asia Region

Acknowledgements

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Introduction

Vector-borne diseases (VBDs) are widespread in the WHO South-East Asia Region. Most Member States report the transmission of multiple vector-borne diseases, and only one Member State (DPR Korea) reports transmission of only a single vector-borne disease. Mosquitoes are most important among vectors as they transmit six major diseases, namely malaria, filariasis, Japanese encephalitis, dengue, chikungunya and Zika virus. Mosquitoes are characterized by a slender elongated body covered with scales and bearing mouth parts of the piercing and sucking type. They belong to the phylum Arthropoda, class Insecta, subclass Pterygota, division Endopterygota, order Diptera, suborder Nematocera, super family Culicoidea, family Culicidae, and the sub families Culicinae, Anophelinae and Toxorhynchitinae.

In the WHO South-East Asia Region, malaria is transmitted by *Anopheles*; filariasis by *Culex*, *Mansonia*, *Anopheles* and *Aedes*; Japanese encephalitis by *Culex*; dengue, chikungunya, and Zika virus by *Aedes* and kala-azar by *Phlebotomus*. Among the more than 3500 species of mosquitoes in the world, more than 300 species are recorded in the WHO South-East Asia Region. Of these, 76 species are transmitting vector-borne diseases. This key covers pictorial mosquito identification of 58 *Anopheles* species, 9 *Culex* species, 4 *Aedes* species, 3 *Mansonia* and 2 *Phlebotomus* species.

The key presents maps showing the distribution of vectors of vector-borne diseases in the WHO SEA Region followed by a list of vectors, a note on how to use the key, and the stages of vector and body parts that are used in their identification. An important feature of the key is that it not only covers morphological identification of vectors of VBDs but also identification of all mosquito species of the associated group, such as *maculatus* group, *dirus* group, etc. It is noteworthy to mention that various keys are available country-wise but this is the first key that covers all vectors of vector-borne diseases in the Region. The key also elucidates the bio-ecology of each species, i.e. breeding and resting sites.

All drawings depicted in the key have been designed using Coreldraw 13 software. The old names of a few species such as *An. sundaicus* (*An. ludlowae, An. epiroticus*), *An. minimus* (*An. flavirostris*) and *An. umbrosus* (*An. letifer*) have been used in the key.

List of vectors and their distribution

A review of literature on vectors of vector-borne diseases revealed that there are 74 species of mosquitoes and two species of *Phlebotomus* responsible for the vector-borne diseases of malaria, dengue, chikungunya, Zika virus disease, Japanese encephalitis, filariasis and leishmaniasis, in the WHO South-East Asia Region. The vectors transmitting these vector-borne diseases are listed below and the distribution of these vectors according to disease in the Region are also illustrated through maps. From the list of vectors and their distribution it is revealed that malaria is transmitted by 58 species of *Anopheles* mosquito; filariasis by 5 species of *Culex*, 3 species of *Aedes,* 4 species of *Mansonia* and 8 species of *Anopheles* mosquitoes; Japanese encephalitis by 9 species of *Culex*; dengue, chikungunya and Zika by 2 species of *Aedes* mosquito; and leishmaniasis by 2 species of *Phlebotomus*.

Anopheles

1. *An. aconitus* Döenitz, 1902
2. *An. annularis* Van der Wulp, 1884
3. *An. argyropus* (Swellengrebel), 1914
4. *An. baimaii* Sallum & Peyton, 2005
5. *An. balabacensis* Baisas, 1936
6. *An. barbirostris* Van der Wulp, 1884
7. *An. barbumbrosus* Strickland and Chowdhruy, 1927
8. *An. bengalensis* Puri, 1930
9. *An. cracens* Sallum & Peyton, 2005
10. *An. crawfordi* Reid, 1953
11. *An. culicifacies* Giles, 1901
12. *An. dirus* Peyton and Harrison, 1979
13. *An. dravidicus* Christophers, 1924
14. *An. farauti* s.s. Laveran, 1902
15. *An. fluviatilis* James, 1902
16. *An. hackeri* Edwards, *1921*
17. *An. introlatus* Colless, 1957
18. *An. jamesii* Theobald, 1901
19. *An. jeyporiensis* James, 1902
20. *An. karwari* James, 1903
21. *An. kochi Dönitz,* 1901
22. *An. koliensis* Owen, 1945
23. *An. koreicus* Yamada & Watanabe, 1918
24. *An. latens* Sallum, Peyton, Wilkerson, 2005
25. *An. lestri* de Meillon, 1931
26. *An. lindesayi* Giles, 1900
27. *An. macarthuri* Colless, 1956
28. *An. maculatus* Theobald, 1901
29. *An. minimus* Theobald, 1901
30. *An. nigerrimus* Giles, 1900
31. *An. nilgiricus* Christophers, 1924
32. *An. nitidus* Harrisson, Scanlon and Reid, 1973
33. *An. nivipes* (Theobald), 1903
34. *An. notanandai* Rattanarithikul & Green, 1987
35. *An. pallidus* Theobald, 1901
36. *An. paraliae* Sandosham, 1959
37. *An. peditaeniatus* Leicester, 1908
38. *An. philippinensis* Ludlow, 1902
39. *An. pseudojamesii Strickland & Chowdhury, 1927*
40. *An. pseudowillmori* Theobald, 1910
41. *An. pujutensis* Colless, 1948
42. *An. punctulatus* Doenitz, 1901
43. *An. pursati* Laveran, 1902
44. *An. sawadwongporni* Rattanarithikul & Green, 1987
45. *An. scanloni* Sallum & Peyton, 2005
46. *An. sinensis* Weidemann, 1828
47. *An. sinerodes* Yamada, 1924
48. *An. splendidus* Koidzumi, 1920
49. *An. stephensi* Liston, 1901
50. *An. subpictus* Grassi, 1899
51. *An. sundaicus* Rodenwaldt, 1925

52. *An. tessellatus* Theobald, 1901
53. *An. theobaldi* Giles, 1901
54. *An. umbrosus* (Theobald), 1903
55. *An. vagus* Döenitz, 1902
56. *An. varuna* Iyengar, 1924
57. *An. willmori* James, 1903
58. *An. yatsushiroensis* Miyazaki, 1951

Culex

59. *Cx. bitaeniorhynchus* Giles, 1901
60. *Cx. fuscocephala* Theobald, 1907
61. *Cx. gelidus* Theobald, 1901
62. *Cx. perexiguus* Theobald, 1903
63. *Cx. pseudovishnui* Theobald, 1901
64. *Cx. quinquefasciatus* Say, 1823
65. *Cx. tritaeniorhynchus* Giles, 1901
66. *Cx. vishnui* Theobald, 1901
67. *Cx. whitmorei* (Giles, 1904)

Aedes

68. *Ae. aegypti* (Linnaeus in Hasselquist, 1762)
69. *Ae. albopictus* (Skuse, 1894)
70. *Ae. niveus* Ludlow, 1903
71. *Ae. vittatus* Bigot, 1861

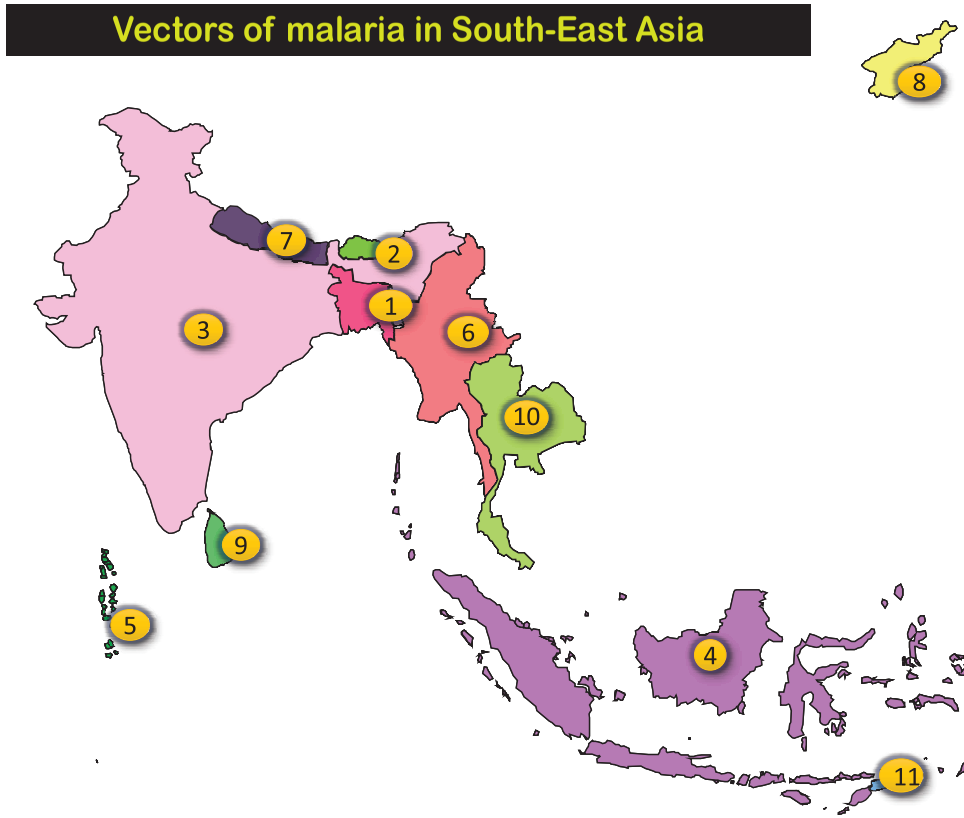
Mansonia

72. *Ma. annulifera* Theobald, 1901
73. *Ma. indiana* Edwards, 1930
74. *Ma. uniformis* Theobald, 1901

Phlebotomus

75. *P. argentipes* Annandale & Brunetti, 1908
76. *P. papatasi* Scopoli, 1786

Distribution of vectors of VBDs in the WHO South-East Asia Region



1 Bangladesh
An. aconitus
An. annularis
An. baimaii
An. barbirostris
An. bengalensis
An. dirus
An. jeyporiensis
An. maculatus
An. minimus
An. philippinensis
An. sundaicus
An. vagus

2 Bhutan
An. culicifacies
An. dirus
An. minimus
An. pseudowillmori

3 India
An. annularis
An. baimaii
An. culicifacies
An. dirus
An. fluviatilis
An. jeyporiensis
An. minimus
An. philippinensis
An. stephensi
An. sundaicus
An. varuna

4 Indonesia
An. aconitus
An. farauti
An. ludlowae
An. puntulatus
An. vagus
An. balabacensis
An. flavirostris
An. maculatus
An. sinensis
An. bancrofti
An. koliensis
An. minimus
An. subpictus
An. barbirostris
An. letifer
An. nigerrimus
An. sundaicus

5 Maldives
An. subpictus
An. tessellatus

6 Myanmar
An. aconitus
An. baimaii
An. dirus
An. maculatus
An. philippinensis
An. sundaicus
An. annularis
An. culicifacies
An. jeyporiensis
An. minimus
An. sinensis

7 Nepal
An. annularis
An. fluviatilis
An. minimus
An. willmori
An. dravidicus
An. maculatus
An. pseudowillmori

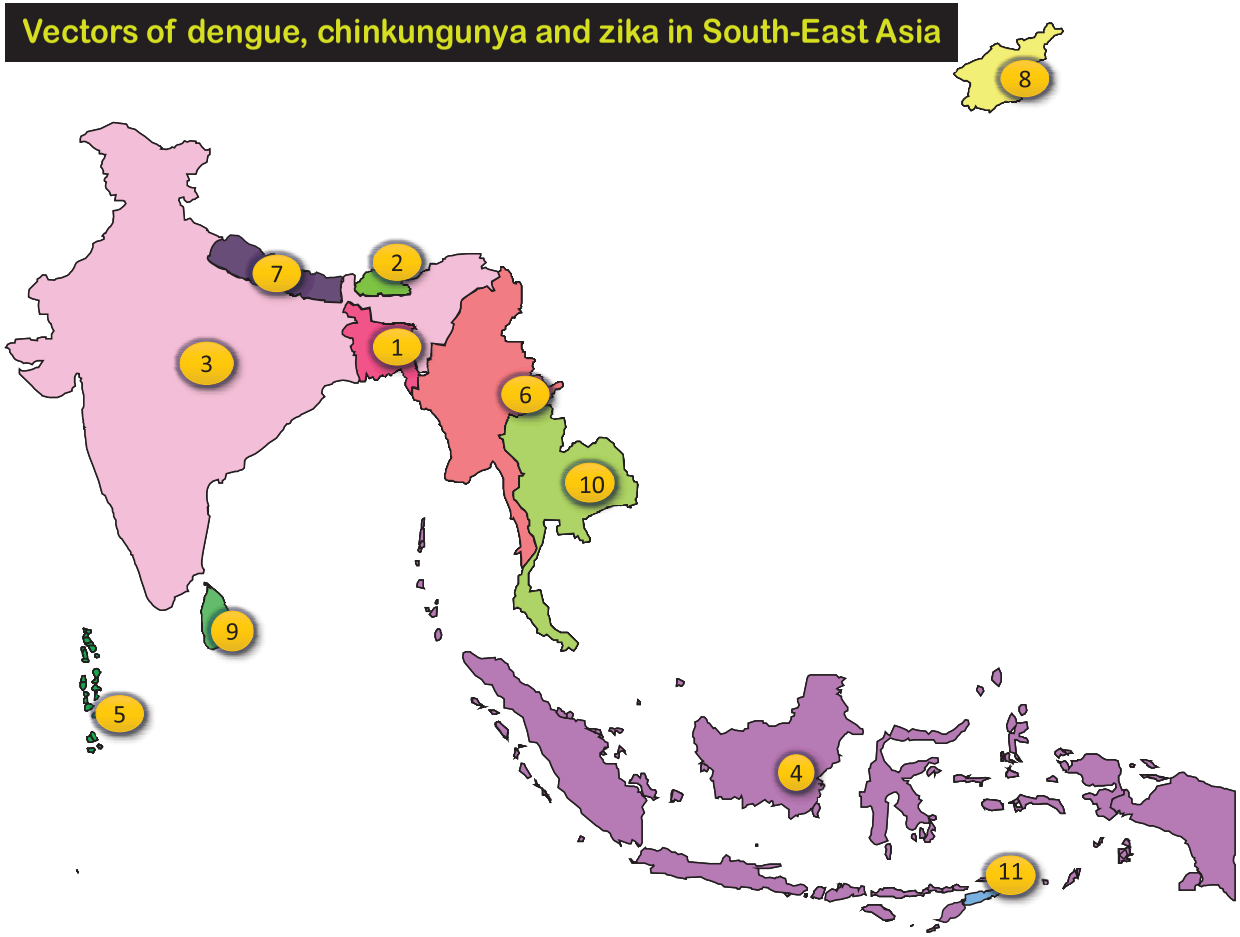
8 DPR Korea
An. koreicus
An. lesteri
An. lindesayi
An. sinensis
An. sineroides
An. yatsushiroensis

9 Sri Lanka
An. aconitus
An. annularis
An. barbirostris
An. culicifacies
An. nigerrimus
An. pallidus
An. peditaeniatus
An. subpictus
An. tessellatus
An. vagus
An. varuna

10 Thailand
An. baimaii
An. dirus
An. dravidicus
An. epiroticus
An. maculatus
An. minimus
An. philippinensis
An. pseudowillmori
An. sawadwongporni

11 Timor-Leste
An. barbirostris
An. subpictus
An. vagus

Vectors of dengue, chinkungunya and zika in South-East Asia



1 Bangladesh
Ae. aegypti
Ae. albopictus

2 Bhutan
Ae. aegypti

3 India
Ae. aegypti
Ae. albopictus
Ae. vittatus

4 Indonesia
Ae. aegypti
Ae. albopictus

5 Maldives
Ae. aegypti
Ae. albopictus

6 Myanmar
Ae. aegypti
Ae. albopictus

7 Nepal
Ae. aegypti
Ae. albopictus

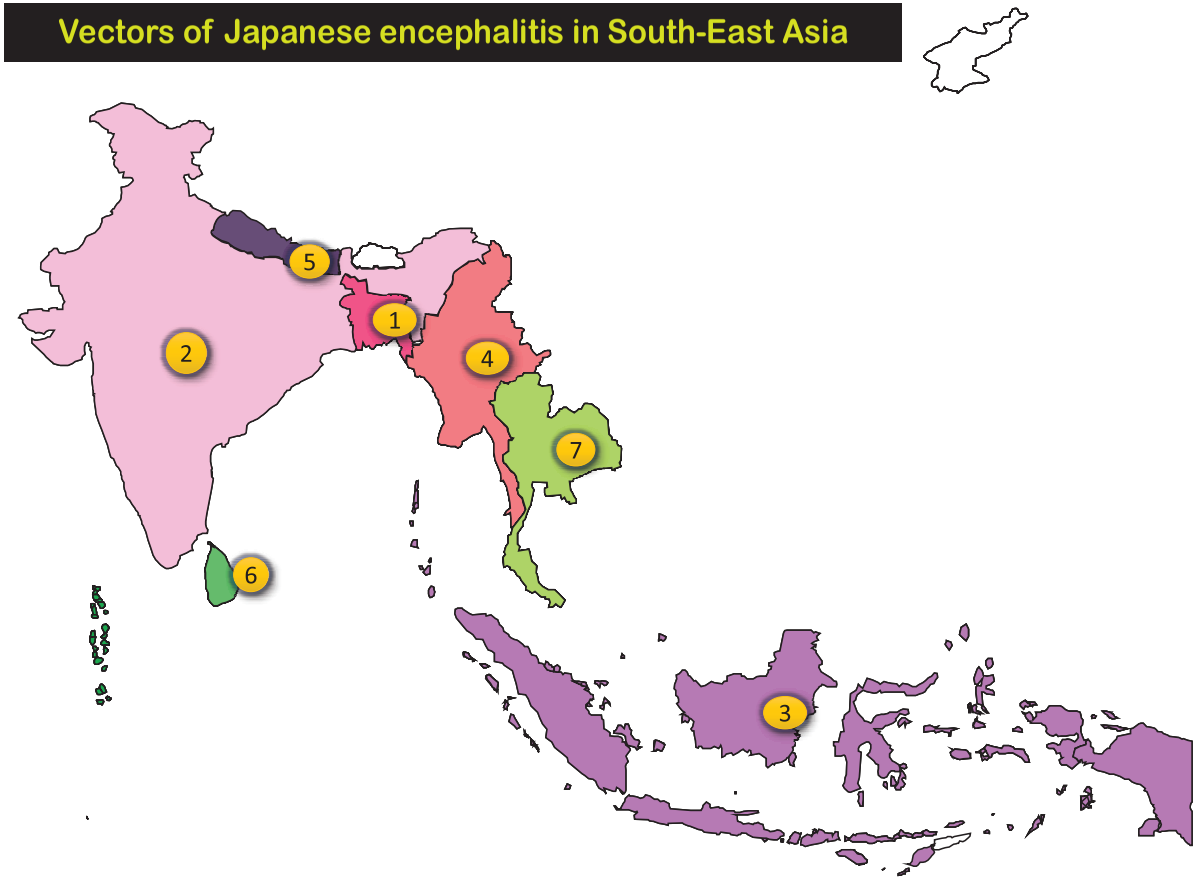
8 DPR Korea
Ae. albopictus

9 Sri Lanka
Ae. aegypti
Ae. albopictus
Ae. vittatus

10 Thailand
Ae. aegypti
Ae. albopictus

11 Timor-Leste
Ae. aegypti
Ae. albopictus

Vectors of Japanese encephalitis in South-East Asia



1 Bangladesh

Cx. bitaenorhynchus
Cx. fuscocephala
Cx. gelidus
Cx. pseudovishnui
Cx. quinquefasciatus
Cx. tritaeniorhynchus
Cx. vishnui
Cx. whitmorei

2 India

Cx. bitaenorhynchus
Cx. fuscocephala
Cx. gelidus
Cx. perexiguus
Cx. pseudovishnui
Cx. quinquefasciatus
Cx. tritaeniorhynchus
Cx. vishnui
Cx. whitmorei

3 Indonesia

Cx. bitaenorhynchus
Cx. fuscocephala
Cx. gelidus
Cx. pseudovishnui
Cx. quinquefasciatus
Cx. tritaeniorhynchus
Cx. vishnui
Cx. whitmorei

4 Myanmar

Cx. bitaenorhynchus
Cx. gelidus
Cx. Quinquefasciatus
Cx. Vishnui
Cx. fuscocephala
Cx. perexiguus
Cx. tritaeniorhynchus
Cx. whitmorei

5 Nepal

Cx. bitaenorhynchus
Cx. fuscocephala
Cx. gelidus
Cx. pseudovishnui
Cx. quinquefasciatus
Cx. tritaeniorhynchus
Cx. vishnui
Cx. whitmorei

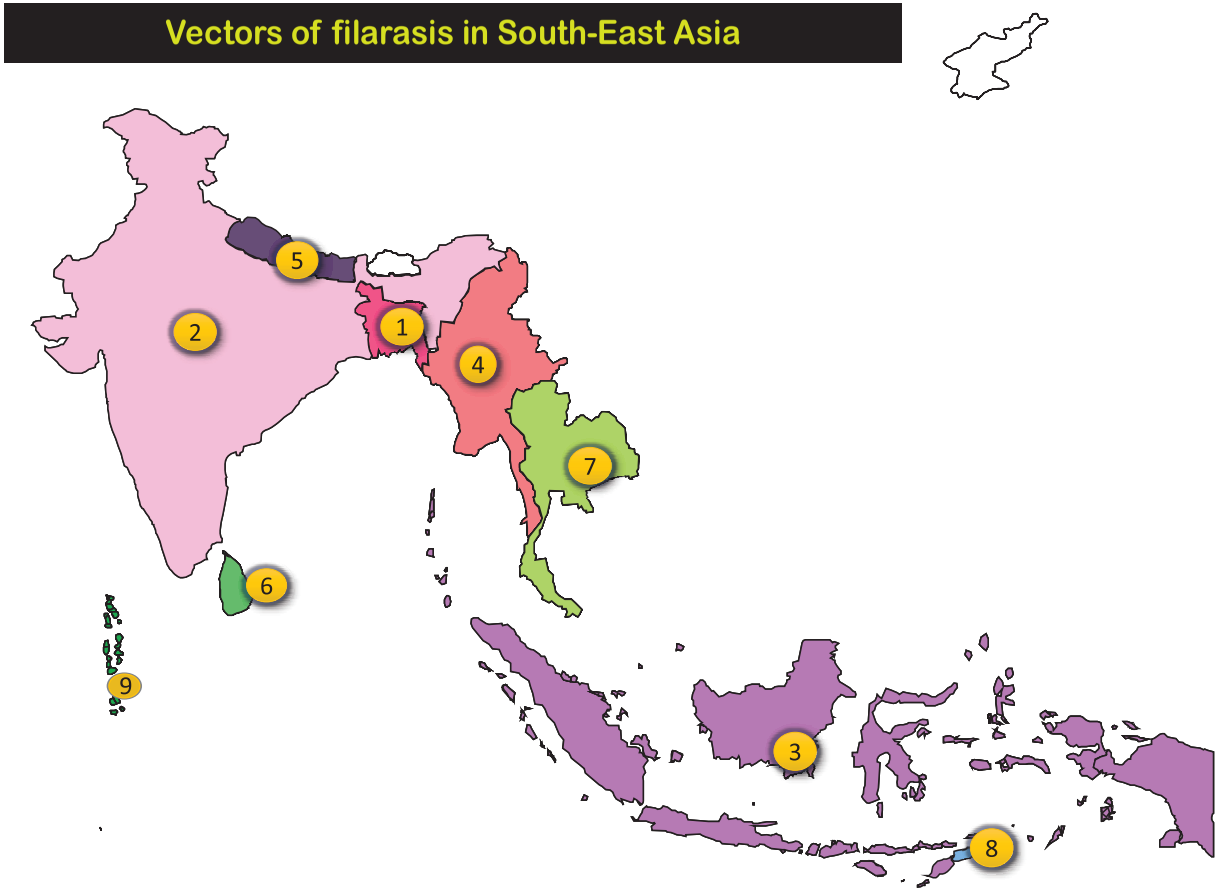
6 Sri Lanka

Cx. bitaenorhynchus
Cx. fuscocephala
Cx. gelidus
Cx. pseudovishnui
Cx. quinquefasciatus
Cx. tritaeniorhynchus
Cx. vishnui
Cx. whitmorei

7 Thailand

Cx. bitaenorhynchus
Cx. fuscocephala
Cx. gelidus
Cx. pseudovishnui
Cx. quinquefasciatus
Cx. tritaeniorhynchus
Cx. vishnui
Cx. whitmorei

Vectors of filarasis in South-East Asia



1 Bangladesh

An. barbirostris
Cx. quinquefasciatus
Ma. annulifera
Ma. uniformis

2 India

Ae. niveus
An. barbirostris
Cx. quinquefasciatus
Ma. annulifera
Ma. indiana
Ma. uniformis

3 Indonesia

An. barbirostris
Cx. quinquefasciatus
Cx. bitaeniorhynchus
Ma. annulifera
Ma. indiana
Ma. uniformis

4 Myanmar

An. barbirostris
Cx. quinquefasciatus
Ma. uniformis

5 Nepal

An. barbirostris
An. vagus
Cx. fuscocephala
Cx. quinquefasciatus
Cx. vishnui
Ma. uniformis
An. nigerrimus
An. willmori
Cx. gelidus
Cx. tritaeniorhynchus
Ma. indiana

6 Sri Lanka

Ae. niveus
An. barbirostris
Ma. indiana
Ma. uniformis

7 Thailand

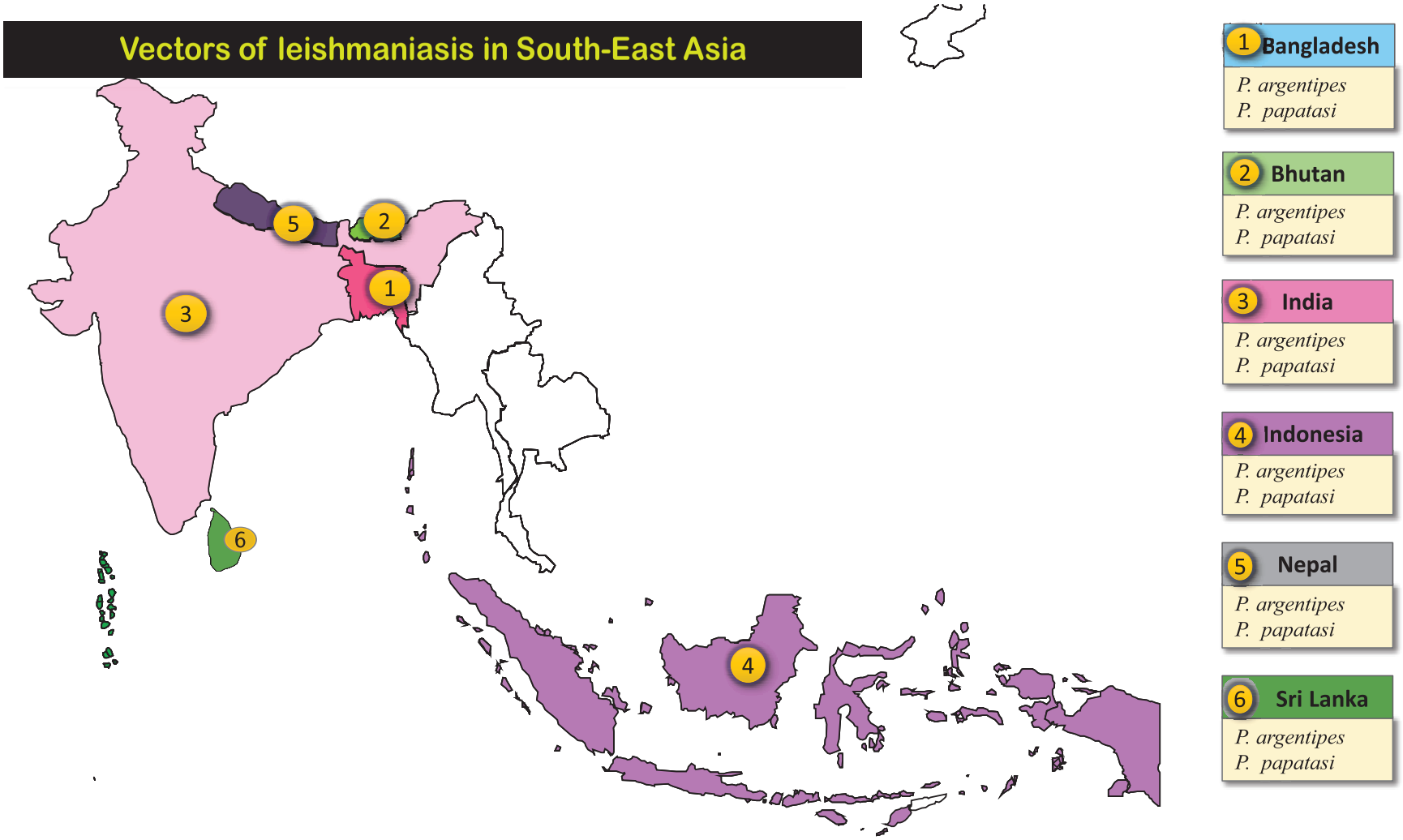
An. argyropus
An. barbirostris
An. crawfordi
An. nigerrimus
An. peditaeniatus
An. pursati
An. vagus
An. willmori
Cx. quinquefasciatus
Ma. annulifera

8 Timor-Leste

Ae. albopictus
Ae. aegypti
An. barbirostris
An. vagus
Cx. quinquefasciatus

9 Maldives

Cx. quinquefasciatus


Vectors of leishmaniasis in South-East Asia
1 Bangladesh
P. argentipes
P. papatasi
2 Bhutan
P. argentipes
P. papatasi
3 India
P. argentipes
P. papatasi
4 Indonesia
P. argentipes
P. papatasi
5 Nepal
P. argentipes
P. papatasi
6 Sri Lanka
P. argentipes
P. papatasi

How to use key for identification of vectors

This Pictorial Identification Key of important vectors in the WHO South-East Asia Region identifies 76 species belonging to the genera *Anopheles, Aedes, Culex* and *Mansonia* of mosquitoes and genus *Phlebotomus* of sandflies. The pattern of identification adopted by this pictorial key differs from the formal couplet method and offers more clear and precise identification. In using this *Key* for identification, the page numbers indicated at various places should be followed for morphological characters and drawings.

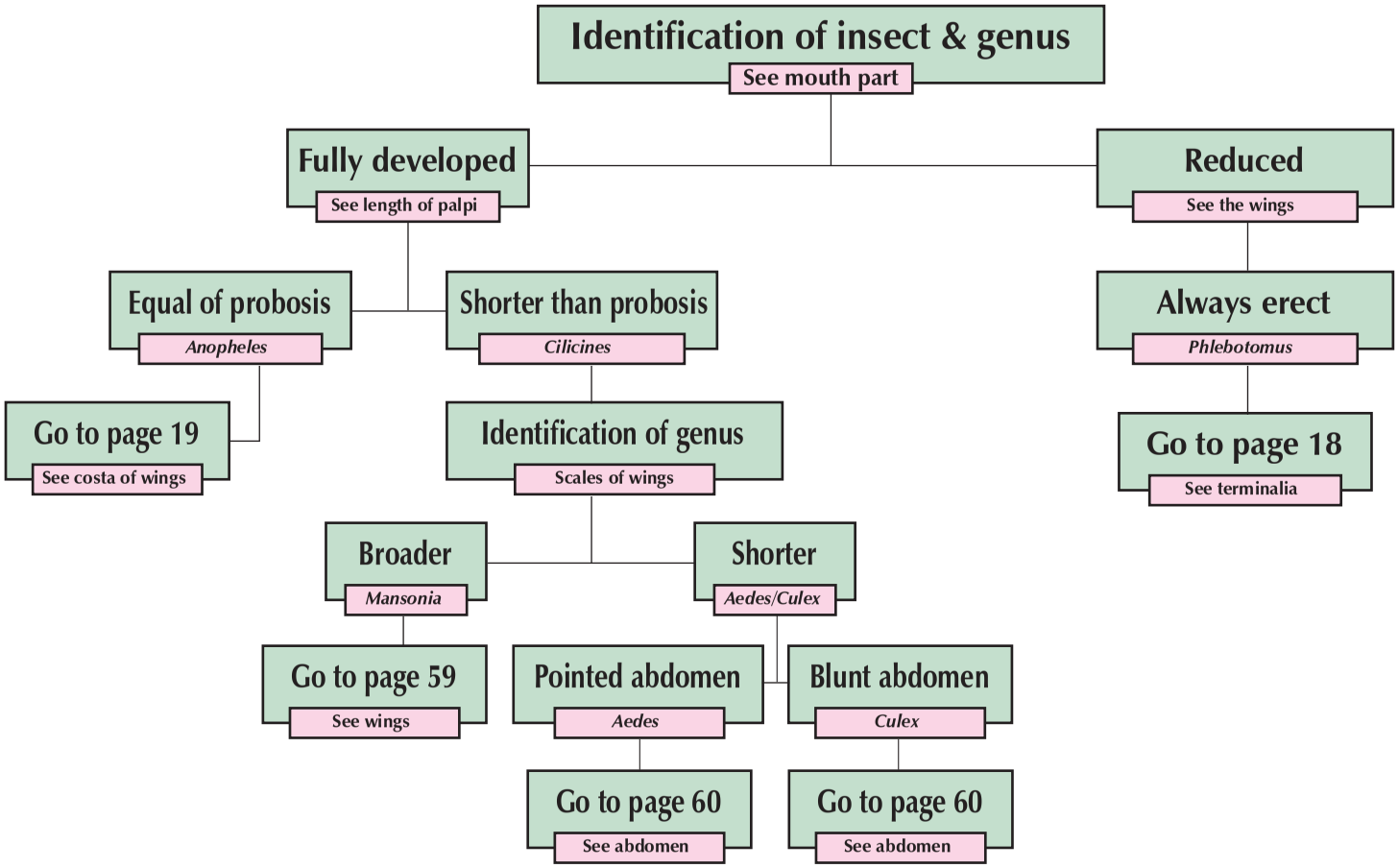
The first character of an insect to be checked under the microscope or hand-lens is the mouthparts. In the case of the mosquito the proboscis is long and needle-shaped whereas in the case of the *Phlebotomus* (sandfly) it is reduced. The other morphological characteristic is that the mosquito is bigger than the sandfly in size and the wings of sandflies are always erect.

For further identification of genera of mosquitoes, the length of the palpi is taken into account. In case of genus *Anopheles*, the size of the palpi in males and females is equal to the proboscis but in males palpi are club-shaped. In the case of the genera *Culex*, *Aedes* and *Mansonia* the size of the palpi is one fourth to half of the proboscis in the female whereas in males it is longer than the proboscis. In all male mosquitoes the antenna is plumose in appearance. Flow charts and diagrams under each genus have been provided for further identification up to species level.

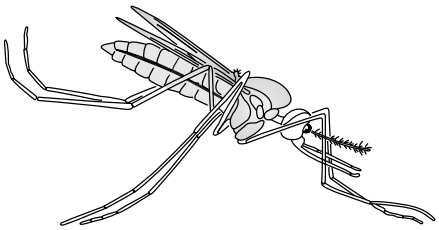
Seventy-four vector species of mosquitoes are divided into four genera, namely *Anopheles, Aedes, Culex* and *Mansonia,* and their species based on morphological characters of mouth parts, wings, legs and abdomen. For sandflies, characteristics of terminalia, pharynx and spermatheca are mainly used to identify species.

This pictorial key provides the vector distribution, morphological characters and brief biology (breeding habits and adult bionomics) of each vector prevalent in the WHO SEA Region. It also contains a bibliography of literature consulted and a glossary of related taxonomic terms.

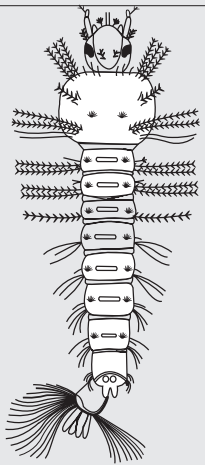
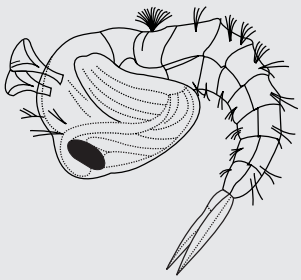
Put the insect under the dissecting microscope/hand-lens to identify the insect up to genus level as given below:



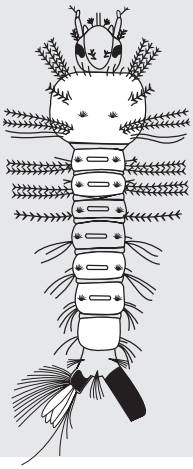
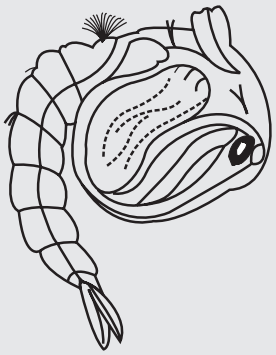
Stages of the insect vector

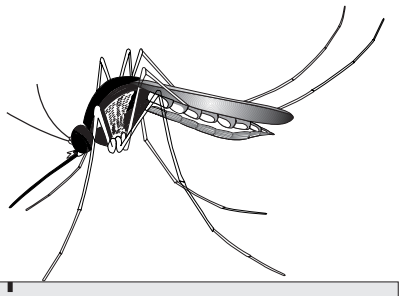


Anopheles mosquito

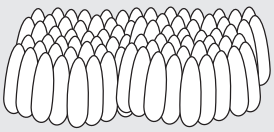
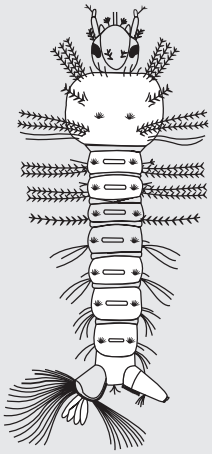
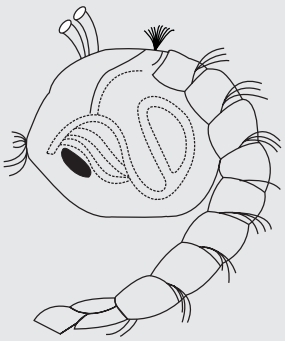
Eggs	Larva	Pupa
		

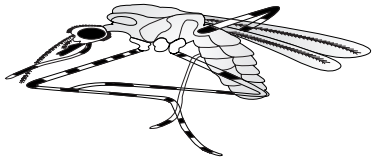
Aedes mosquito

Eggs	Larva	Pupa
		

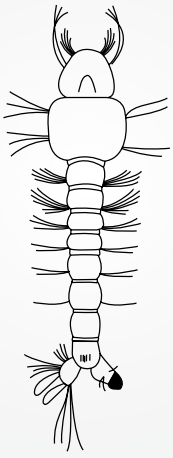
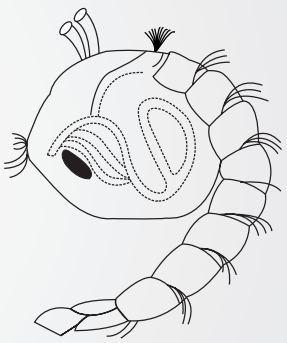


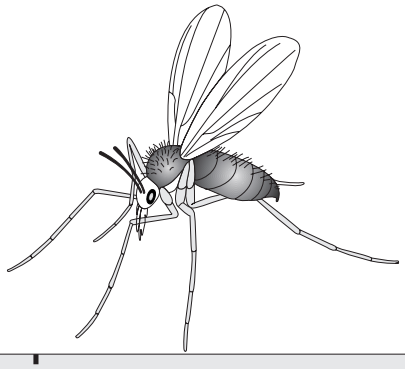
Culex mosquito

Eggs	Larva	Pupa
		

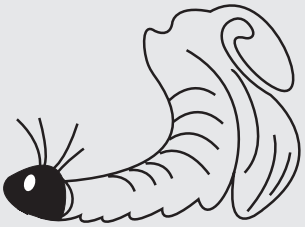


Mansonia mosquito

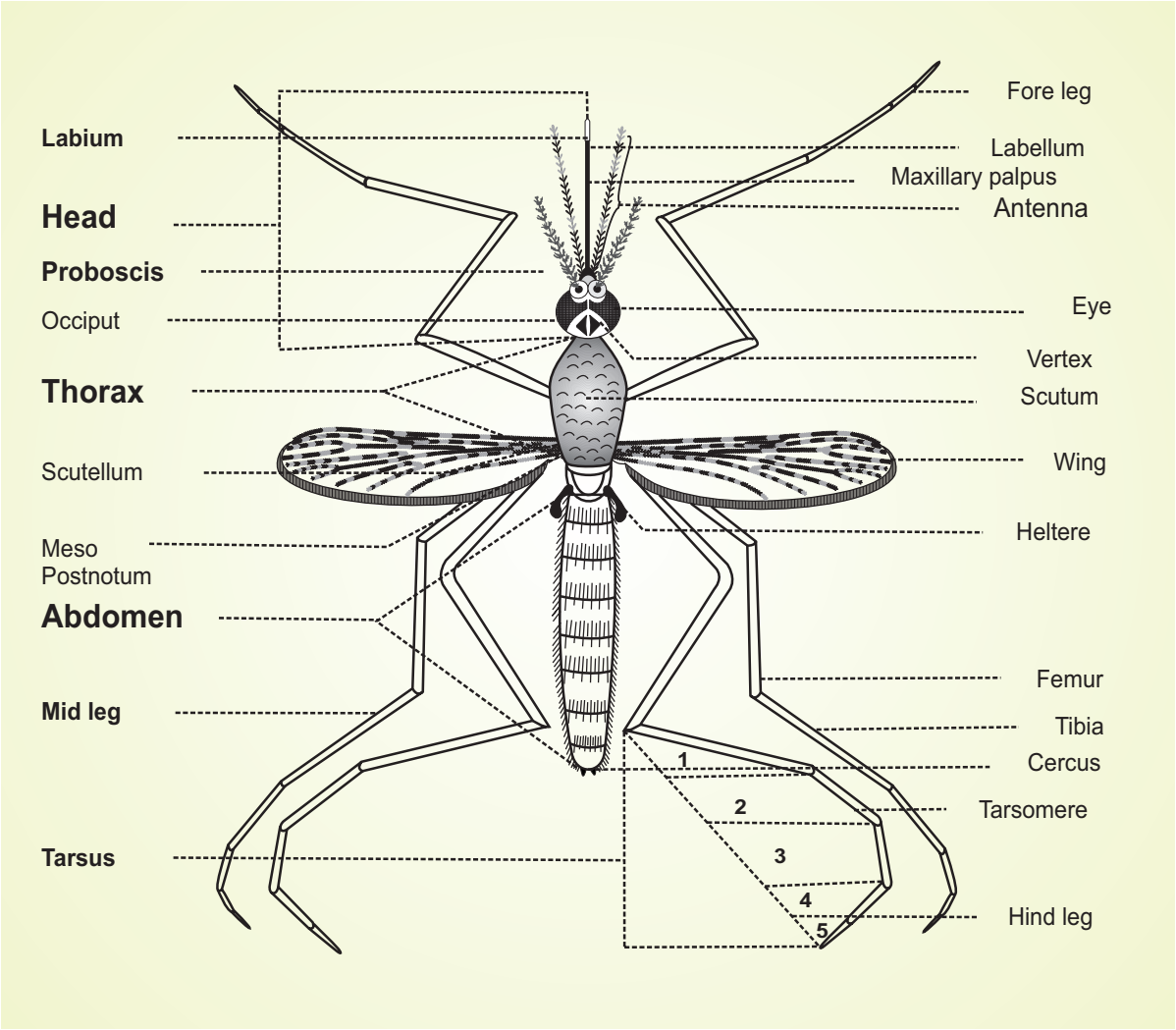
Eggs	Larva	Pupa
		



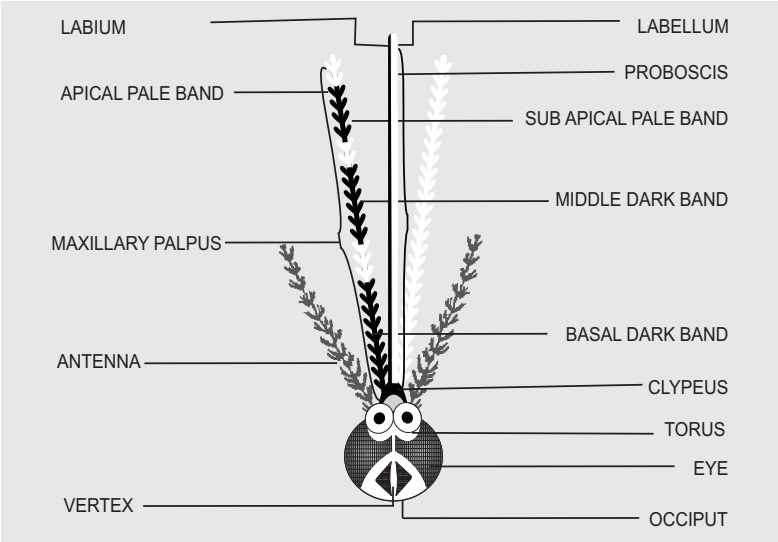
Phlebotomus (sandfly)

Eggs	Larva	Pupa
		

Generalized diagram of a female adult *Anopheles* mosquito

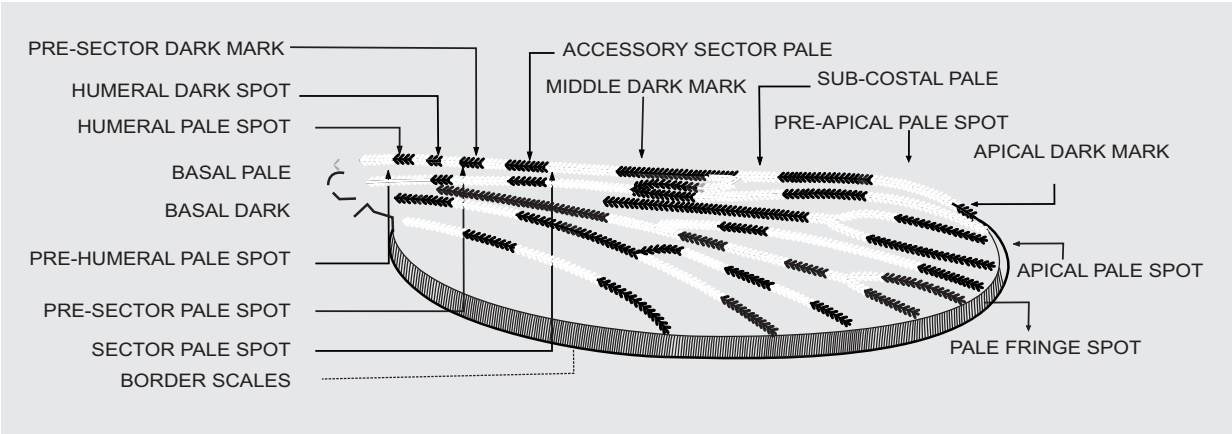


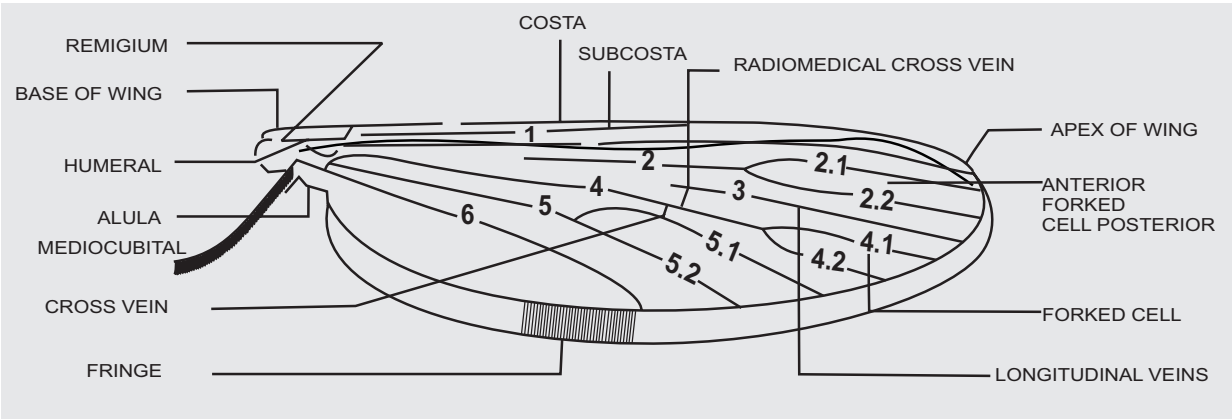
Body parts of *Anopheles* mosquito



HEAD

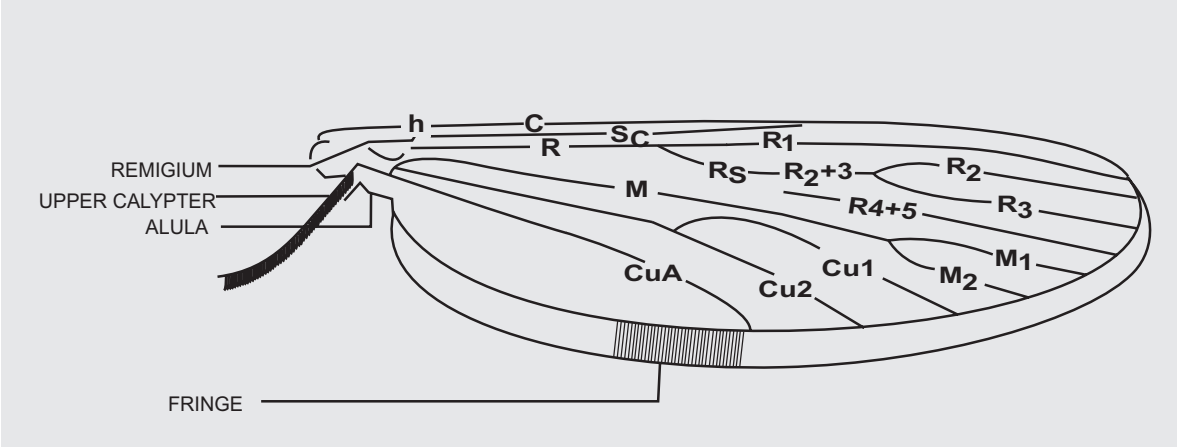
WINGS





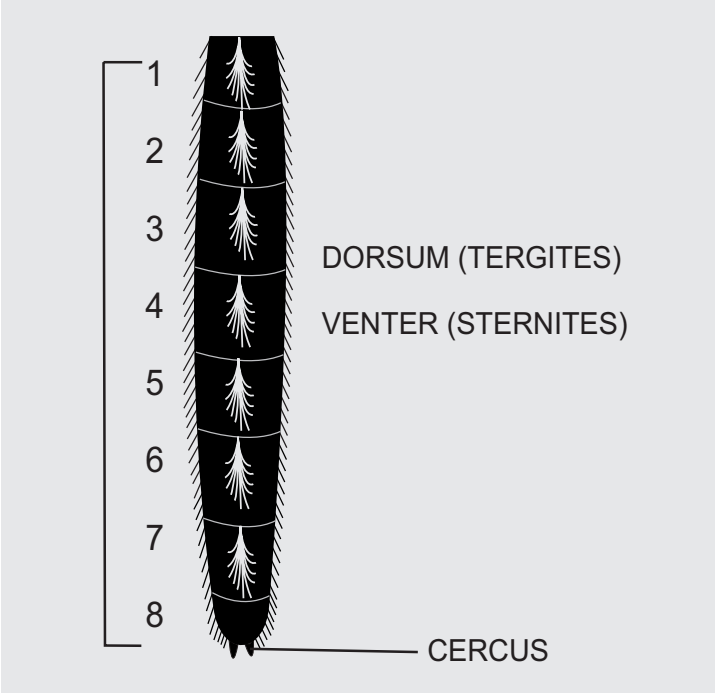
Body parts of *Anopheles* mosquito

WINGS



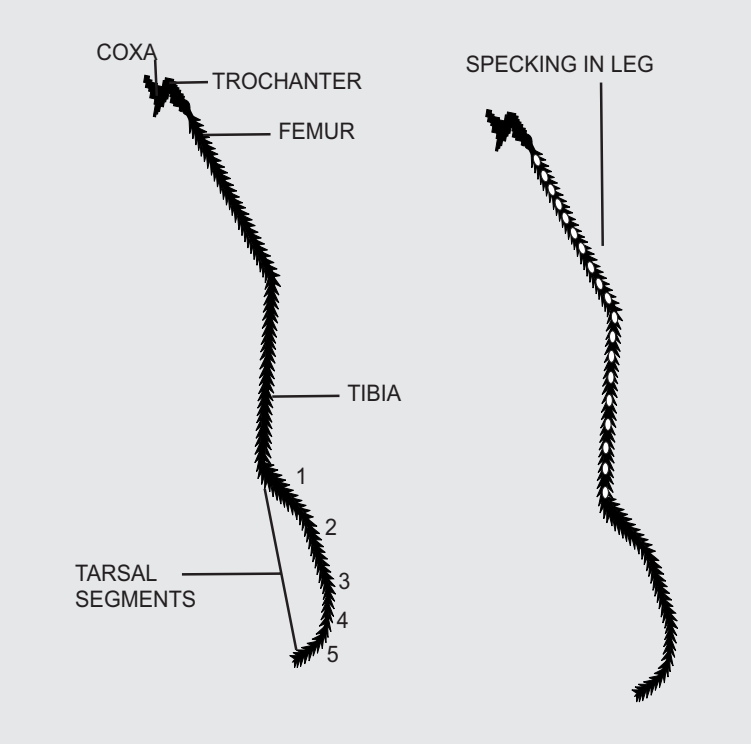
R1- radius (1st longitudinal vein); Rs - 2nd longitudinal vein; R2 - upper or anterior branch of 2nd longitudinal; R3 - lower or posterior branch of 2nd longitudinal vein; R4 + 5 - 3rd longitudinal vein; M - media, 4th longitudinal vein; M1 - upper or anterior branch of 4th longitudinal; M2 - lower or posterior branch of 4th longitudinal vein; Cu - 5th longitudinal vein; Cu1 - upper or anterior branch of 5th longitudinal vein; Cu2 - lower or posterior branch of 5th longitudinal vein; CuA (Anal) 6th longitudinal vein; C - costa; SC - Subcosta; h - humeral dark/pale sport.

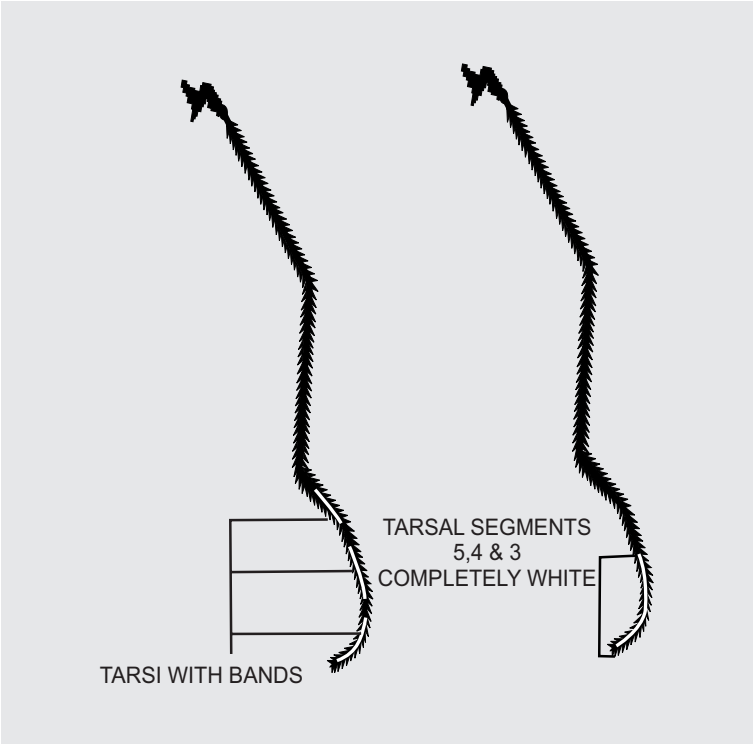
ABDOMEN



Body parts of *Anopheles* mosquito

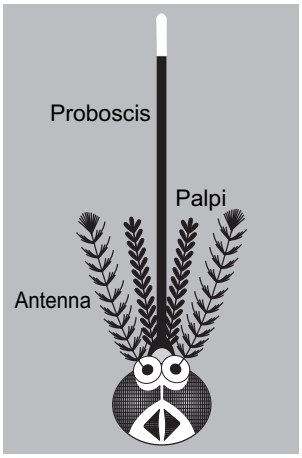
LEGS



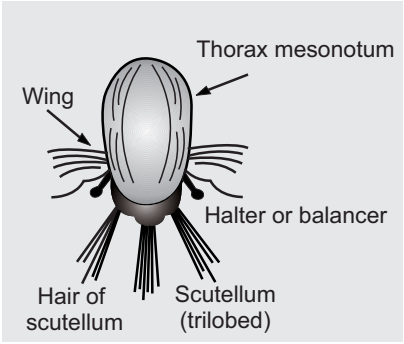


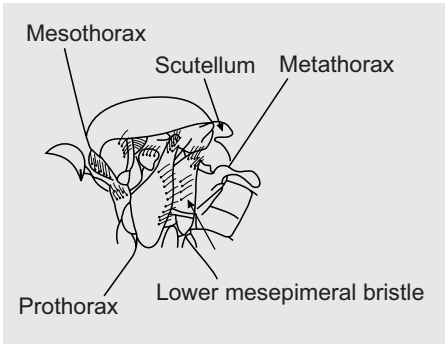
Body parts of *culicine* mosquitoes

Culicines
Genus: *Culex, Aedes, Mansonia*

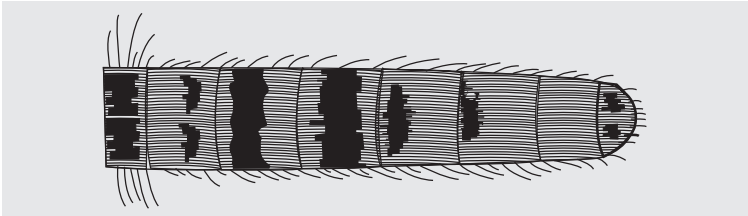


HEAD

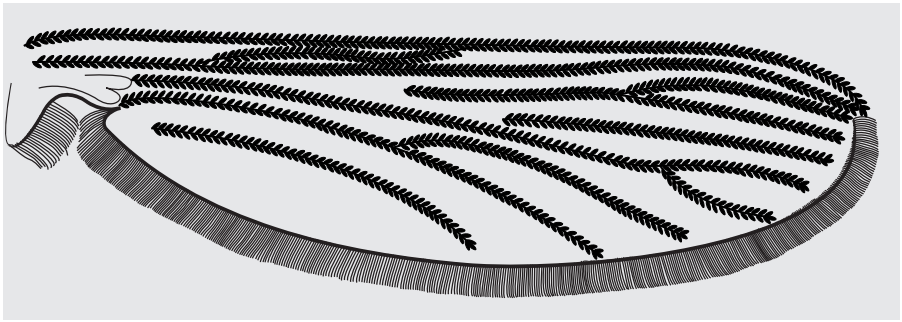




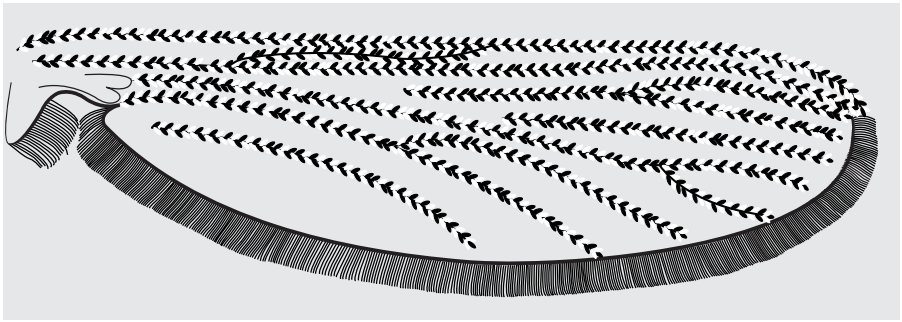
Thorax of *Culex* showing scutellum and halter (dorsal view)



ABDOMEN



WINGS

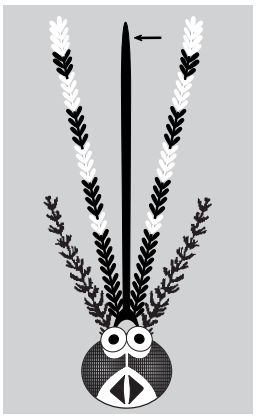


LEG

Identification key of insect vector

Put the insect under the dissecting microscope/hand-lens and look for the mouth parts

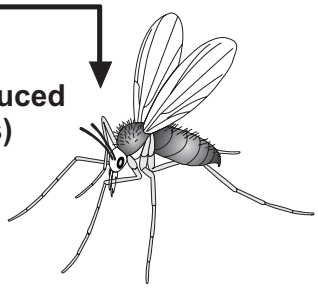
Proboscis long and needle shape



Mosquito

mouth parts are reduced (specially proboscis)

wings always erect



Phlebotomus (Sandfly)

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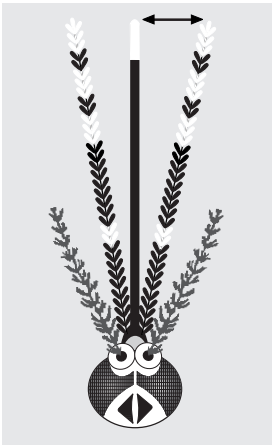
See palpi

Palpi equal to proboscis and slender in shape

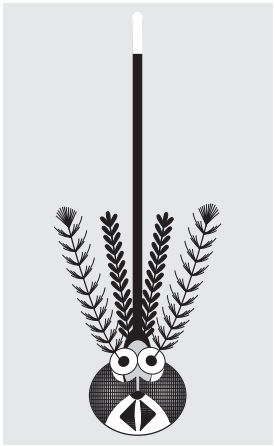


Palpi of Female *Anopheles*

Palpi of Male *Anopheles*

Go to Page 19

Palpi 1/4 to half of the proboscis and slender in the shape (female) and longer than the proboscis (male)

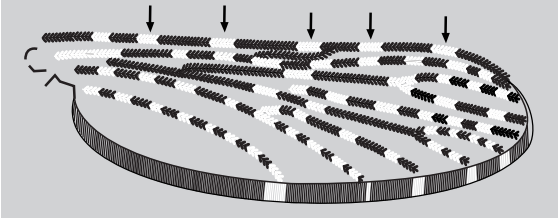


Palpi of Female *Culex, Aedes* and *Mansonia*

Palpi of Male *Culex, Aedes* and *Mansonia*

Go to Page 59

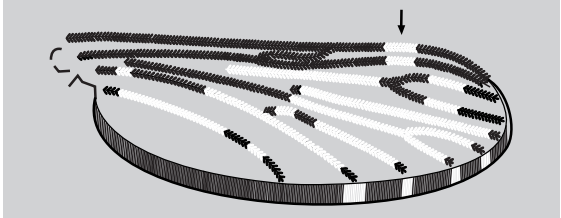
Anopheles
Focus the wing and count the pale area on costa and subcosta including vein 1



Pale area ≥ 4

Group A **Subgenus *Cellia***

1. *An. aconitus*
2. *An. annularis*
3. *An. balabacensis*
4. *An. baimaii*
5. *An. culicifacies*
6. *An. cracens*
7. *An. dirus*
8. *An. dravidicus (maculatus)*
9. *An. farauti (puncalatus)*
10. *An. fluviatilis*
11. *An. hackeri*
12. *An. introlatus*
13. *An. jamesii*
14. *An. jeyporiensis*
15. *An. karwari*
16. *An. kochi*
17. *An. koliensis (puncultatus)*
18. *An. latens (leucosphyrirus)*
19. *An. maculatus*
20. *An. macarthuri*
21. *An. minimus*
22. *An. nivipes*
23. *An. notanandai (maculatus)*
24. *An. pallidus*
25. *An. philippinensis*
26. *An. pseudojamesi*
27. *An. pseudowillmori*
28. *An. pujutensis*
29. *An. punctulatus*
30. *An. scanloni*
31. *An. splendidus*
32. *An. stephensi*
33. *An. subpictus*
34. *An. sundaicus*
35. *An. sawadwongporn (maculatus)*
36. *An. tessellatus*
37. *An. theobaldi*
38. *An. vagus*
39. *An. varuna*
40. *An. willmorei*

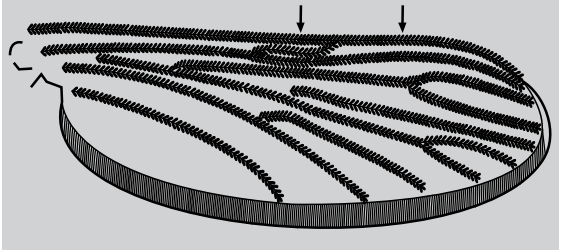


< 4 (Less than 4)

Group B **Subgenus *Anopheles***

1. *An. argyropus*
2. *An. barbirostris*
3. *An. barbumbrosus*
4. *An. crawfordi*
5. *An. koreicus*
6. *An. lesteri*
7. *An. lindesayi*
8. *An. nilgiricus*
9. *An. nigerrimus*
10. *An. nitidus*
11. *An. paraliae (sinensis)*
12. *An. peditaeniatus*
13. *An. sineroides*
14. *An. pursati*
15. *An. sinensis*
16. *An. umbrosus*
17. *An. yatsushiroensis*

Group C **Subgenus *Anopheles***



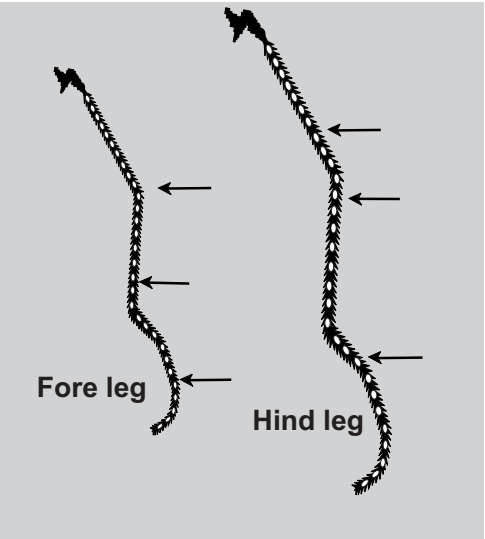
Wing completely dark

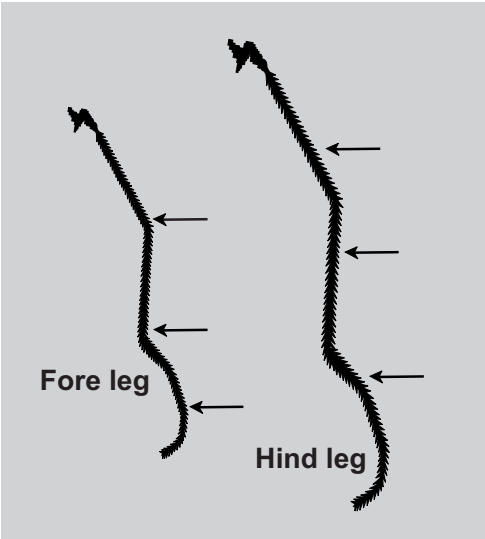
1. *An. bengalensis*

Group A (Subgenus Cellia)

An. aconitus, An. annularis, An. baimaii, An. balabacensis, An. cracens, An. culicifacies, An. dirus, An. dravidicus, An. farauti, An. fluviatilis, An. hackeri, An. introlatus, An. jamesii, An. jeyporiensis, An. karwari, An. kochi, An. koliensis, An. latens, An. macarthuri, An. maculatus, An. minimus, An. nivipes, An. notanandai, An. pallidus, An. philippinensis, An. pseudojamesi, An. pseudowillmori, An. pujutensis, An. punctulatus, An. scanloni, An. splendidus, An. stephensi, An. subpictus, An. sundaicus, An. sawadwongporn An. tessellatus, An. theobaldi, An. vagus, An. varuna, An. willmorei

Specking in legs





Present

1. *An. baimaii*
2. *An. balabacensis*
3. *An. cracens*
4. *An. dirus*
5. *An. dravidicus*
6. *An. farauti*
7. *An. hackeri*
8. *An. introlatus*
9. *An. jamesii*
10. *An. kochi*
11. *An. koliensis*
12. *An. latens*
13. *An. maculatus*
14. *An. macarthuri*
15. *An. notanandai*
16. *An. pseudojamesi*
17. *An. pseudowillmori*
18. *An. pujutensis*
19. *An. punctulatus*
20. *An. scanloni*
21. *An. splendidus*
22. *An. stephensi*
23. *An. sundaicus*
24. *An. sawadwongporn*
25. *An. tessellatus*
26. *An. theobaldi*
27. *An. willmorei*

Go to Page 21

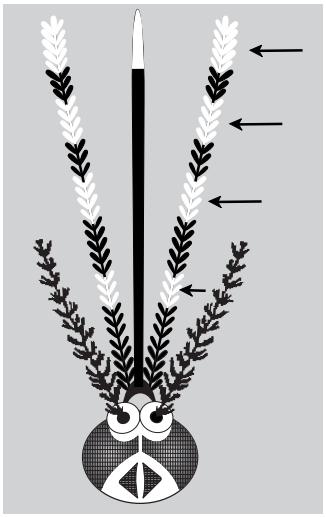
Absent

1. *An. aconitus*
2. *An. annularis*
3. *An. culicifacies*
4. *An. fluviatilis*
5. *An. jeyporiensis*
6. *An. karwari*
7. *An. minimus*
8. *An. nivipes*
9. *An. pallidus*
10. *An. philippinensis*
11. *An. subpictus*
12. *An. vagus*
13. *An. varuna*

Go to Page 36

An. baimaii, An. balabacensis, An. cracens, An. dirus, An. dravidicus, An. farauti, An. hackeri, An. introlatus, An. jamesii, An. kochi, An. koliensis, An. latens, An. macarthuri, An. maculatus, An. notanandai, An. pseudojamesi, An. pseudowillmori, An. pujutensis, An. punctulatus, An. scanloni , An. splendidus, An. stephensi, An. sundaicus, An. sawadwongporn, An. tessellatus, An. theobaldi, An. willmorei

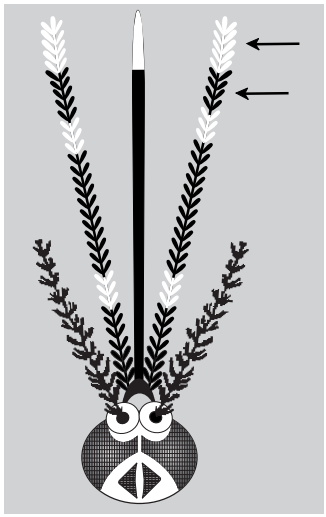
Banding pattern of palpi



4 banded palpi

1. *An. baimaii*
2. *An. balabacensis*
3. *An. cracens*
4. *An. dirus*
5. *An. farauti*
6. *An. hackeri*
7. *An. introlatus*
8. *An. kochi*
9. *An. koliensis*
10. *An. latens*
11. *An. macarthuri*
12. *An. pujutensis*
13. *An. punctulatus*
14. *An. scanloni*
15. *An. tessellatus*

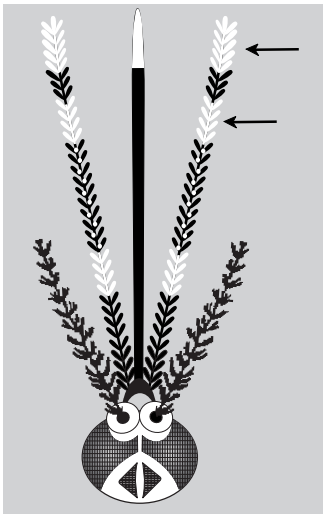
Go to Page 22



Apical pale band nearly equal to the pre apical dark band

1. *An. jamesii*
2. *An. pseudojamesi*
3. *An. sundaicus*

Go to Page 31



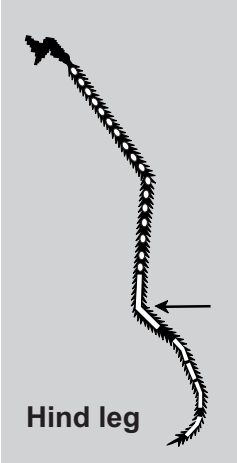
Apical pale band nearly equal to the sub apical pale band

1. *An. dravidicus*
2. *An. notanandai*
3. *An. maculatus*
4. *An. pseudowillmori*
5. *An. sawadwongporn*
6. *An. splendidus*
7. *An. stephensi*
8. *An. theobaldi*
9. *An. willmorei*

Go to Page 33

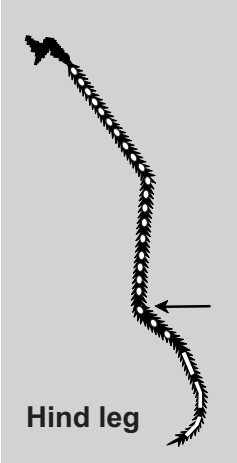
An. baimaii, An. balabacensis, An. cracens, An. dirus, An. farauti, An. hackeri, An. introlatus, An. kochi, An. koliensis, An. latens, An. macarthuri, An. pujutensis, An. punctulatus, An. scanloni, An. tessellatus

A big white spot at the tibiotarsal joint of hind leg



Present

1. *An. baimaii*
2. *An. balabacensis*
3. *An. cracens*
4. *An. dirus*
5. *An. hackeri*
6. *An. introlatus*
7. *An. latens*
8. *An. macarthuri*
9. *An. pujutensis*
11. *An. scanloni*

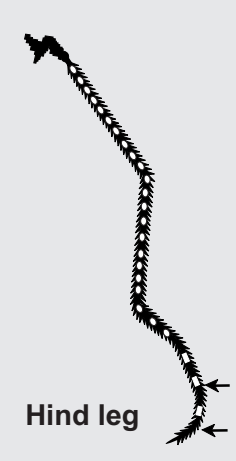


Absent

1. *An. farauti*
2. *An. kochi*
3. *An. koliensis*
4. *An. punctulatus*
5. *An. tessellatus*

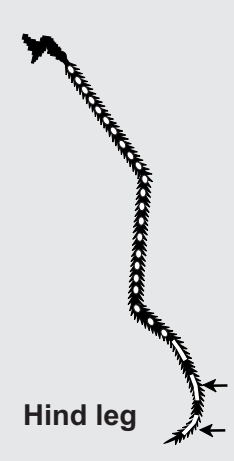
An. farauti, An. kochi, An. koliensis, An. punctulatus , An. tessellatus

Banding on hind leg tarsomeres



Narrowly banded

An. tessellatus

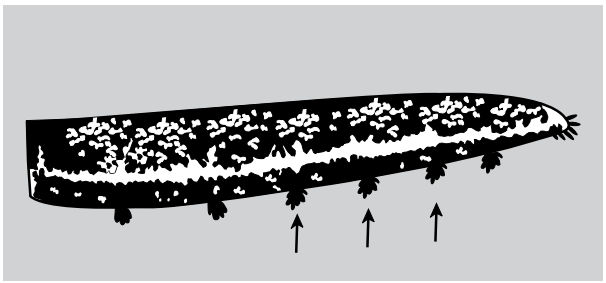


Joints with broad pale bands

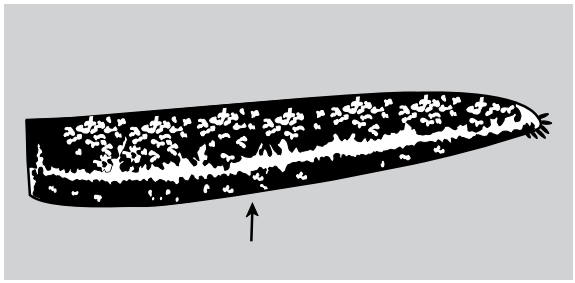
An. kochi, An. farauti, An. koliensis, An. punctulatus

An. farauti, An. kochi, An. koliensis, An. punctulatus

Tufttop black scale on each segment of the abdomen

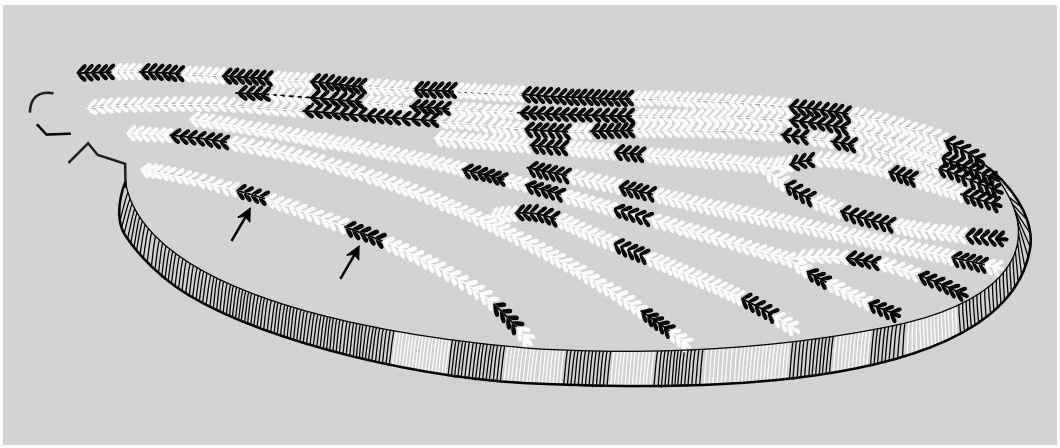


Present
An. kochi



Absent
1. *An. farauti*
2. *An. koliensis*
3. *An. punctulatus*

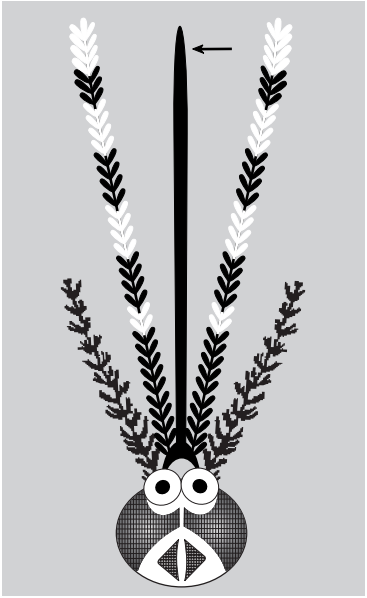
Other important characters for *An. kochi*



Vein 6 (anal) with three small dark areas and inner costa interrupted

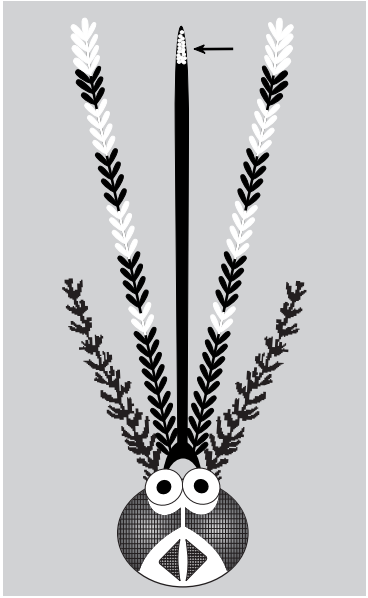
An. farauti, An. koliensis, An. punctulatus

See proboscis



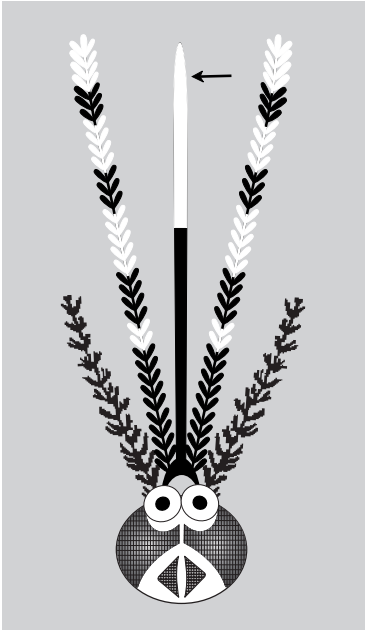
Completely dark

An. farauti



White patch of scales on the ventral surface towards the apex

An. koliensis

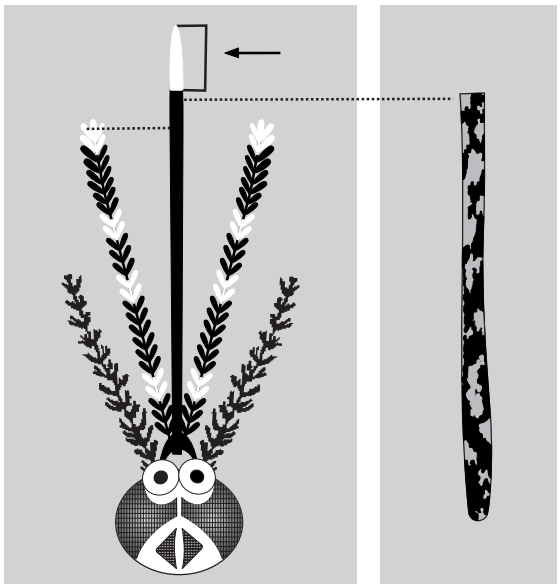


Apical half of the proboscis white scale

An. punctulatus

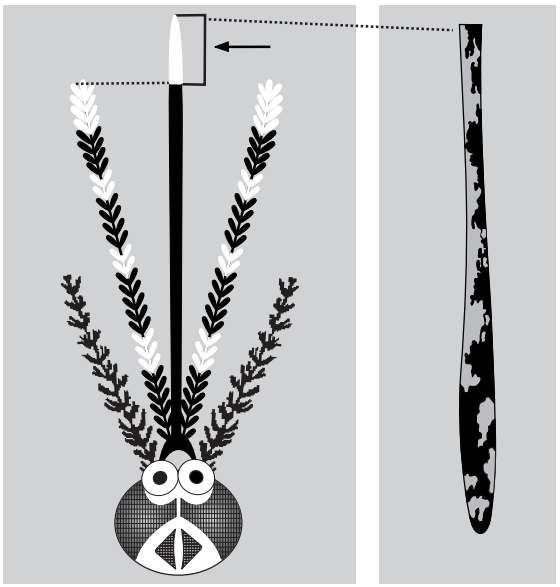
An. baimaii, An. balabacensis, An. cracens, An. dirus, An. hackeri, An. introlatus, An. latens, An. macarthuri, An. pujutensis, An. scanloni

Length of proboscis



Distinctly longer than the fore femur

1. *An. hackeri*
2. *An. pujutensis*



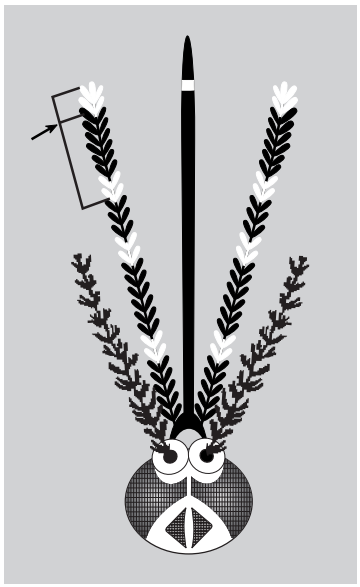
Slightly longer than the fore femur

1. *An. baimaii*
2. *An. balabacensis*
3. *An. cracens*
4. *An. dirus*
5. *An. introlatus*
6. *An. latens*
7. *An. macarthuri*
8. *An. scanloni*

An. hackeri & An. pujutensis

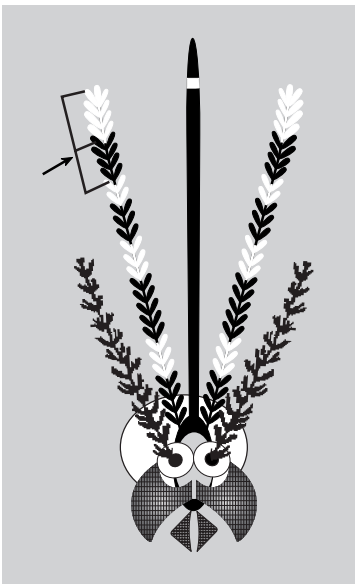
Apical pale band on the palpi

Much smaller than the preapical dark band



An. hackeri

Nearly equal to the preapical dark band

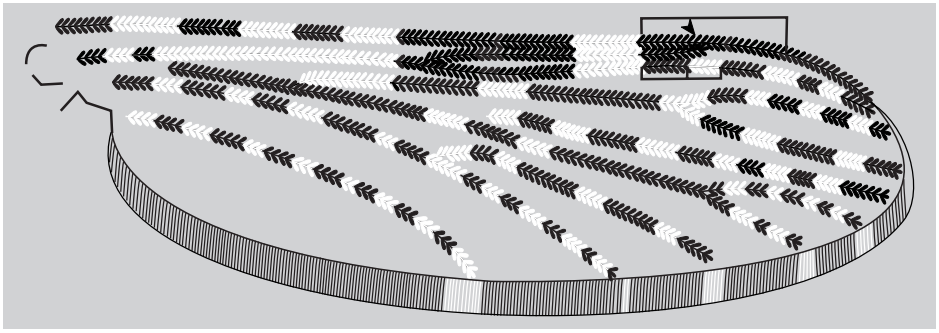


An. pujutensis

Other important characters for *An. hackeri* & *An. pujutensis*

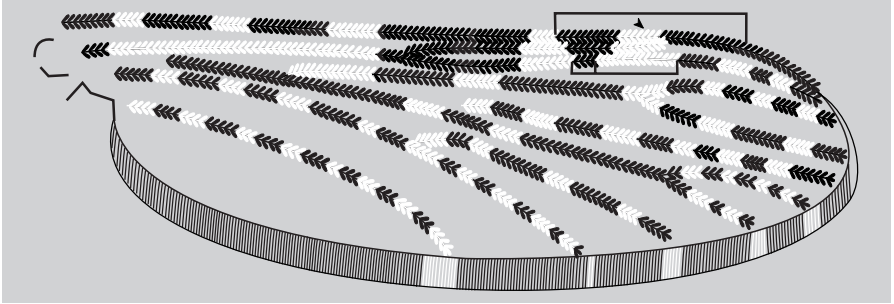
Accessory sector pale spot on vein R

Small and shorter than basal dark spot



An. hackeri

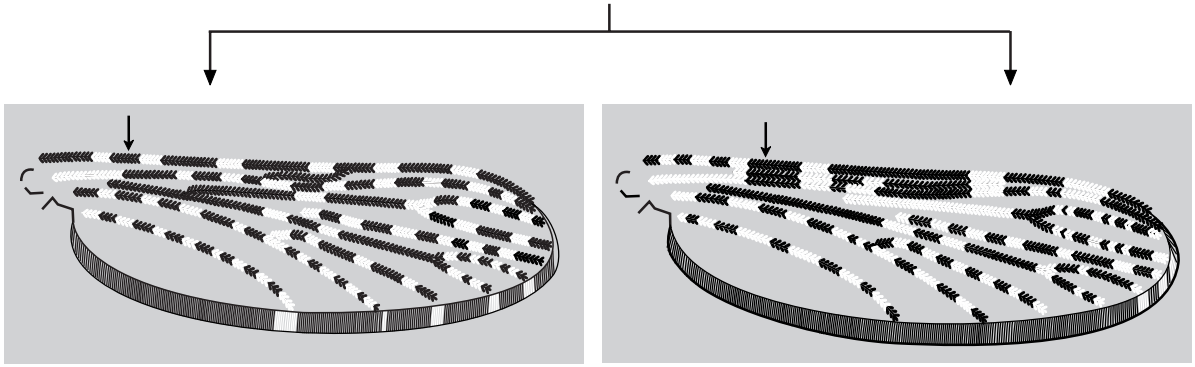
Longer than basal dark spot



An. pujutensis

An. baimaii, An. balabacensis, An. cracens, An. dirus, An. introlatus, An. latens, An. macarthuri, An. scanloni

Presector dark mark spot on vein R



Present

1. *An. baimaii*
2. *An. balabacensis*
3. *An. cracens*
4. *An. dirus*
5. *An. introlatus*
6. *An. latens*
7. *An. scanloni*

Absent

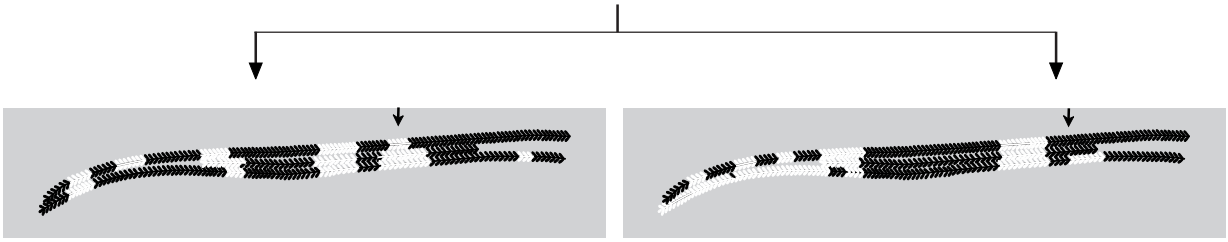
An. macarthuri

Other characters for *An. macarthuri*

Hind tibia with narrow apical extension of dark scales on ventral surface

An. baimaii, An. balabacensis, An. cracens, An. dirus, An. introlatus, An. latens, An. scanloni

Accessory sector pale (ASP) spot on costa



Present

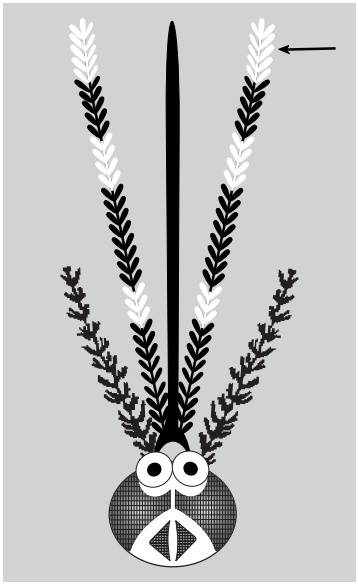
1. *An. introlatus*
2. *An. latens*

Absent

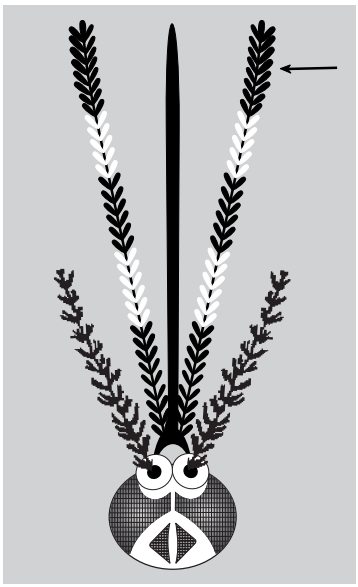
1. *An. baimaii*
2. *An. balabacensis*
3. *An. cracens*
4. *An. dirus*
5. *An. scanloni*

An. introlatus, An. latens

Apical pale band of palpi



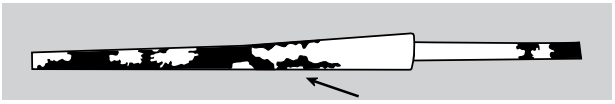
Pale band present
An. introlatus



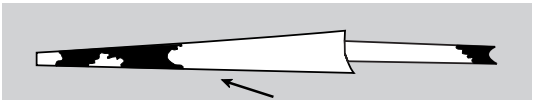
Pale band absent
An. latens

An. baimaii, An. balabacensis, An. cracens An. dirus, An. scanloni

Apical pale band of hind tibia with dark linear extension onto basal portion on ventral surface



Present
An. scanloni

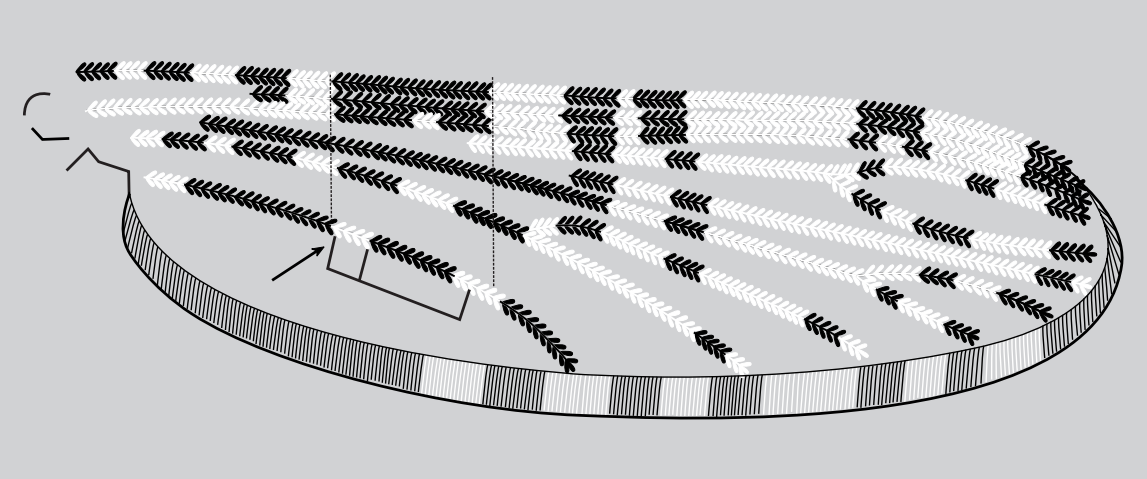


Absent

1. *An. baimaii,*
2. *An. balabacensis*
3. *An. cracens*
4. *An. dirus*

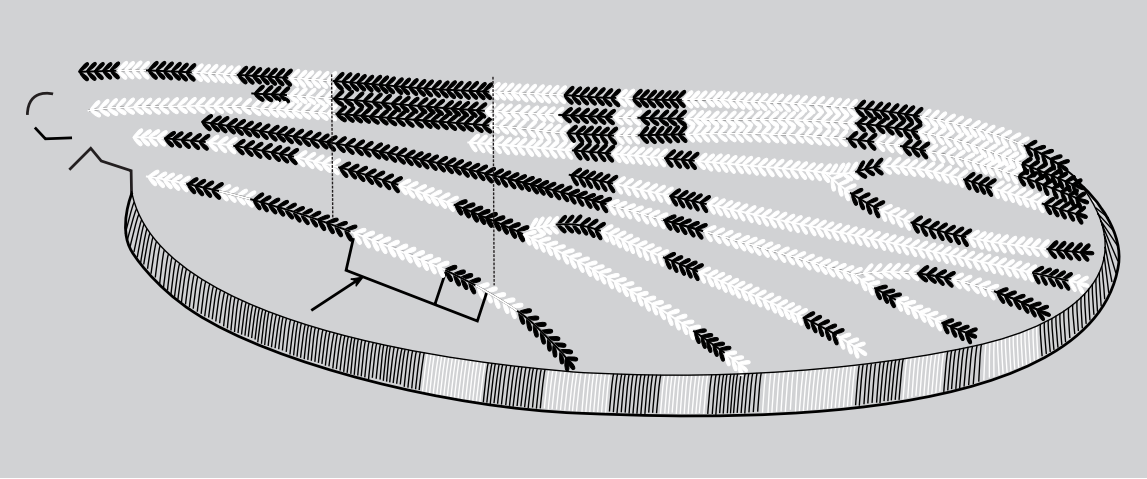
An. baimaii, , An. balabacensis , An. cracens , An. dirus

A long pale spot on vein 6 at level of presector dark spot (PSD) of costa



Present

An. baimaii

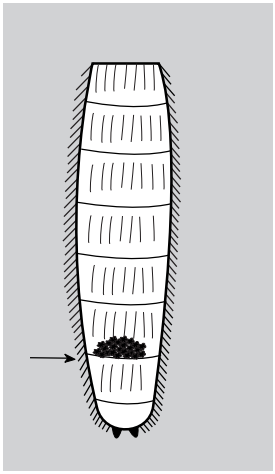


Absent

1. *An. balabacensis*
2. *An. cracens*
3. *An. dirus*

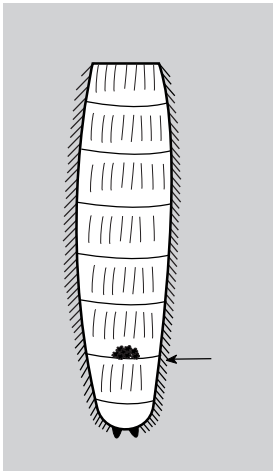
An. balabacensis, An. cracens, An. dirus

Posteromedical patch of dark scales on abdominal sternum VI



Broad

An. cracens

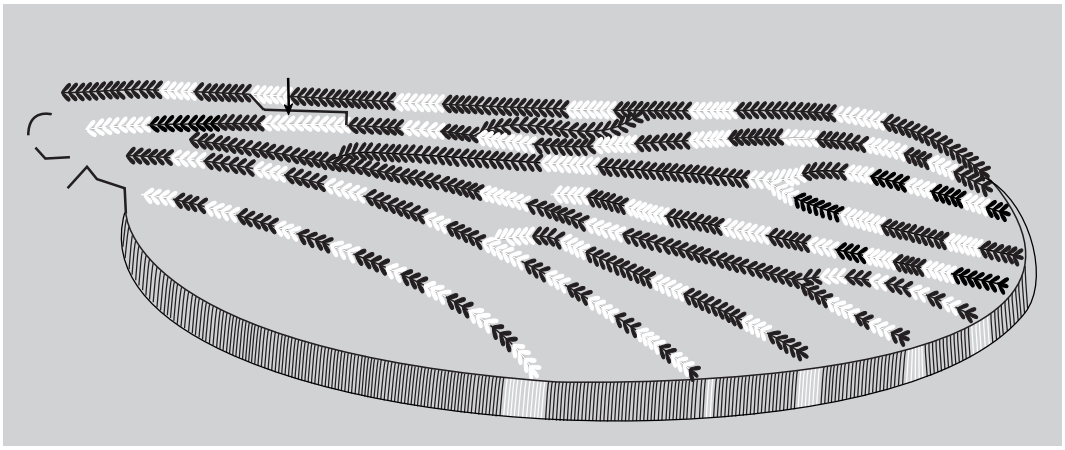


Reduced

1. *An. balabacensis*
2. *An. dirus*

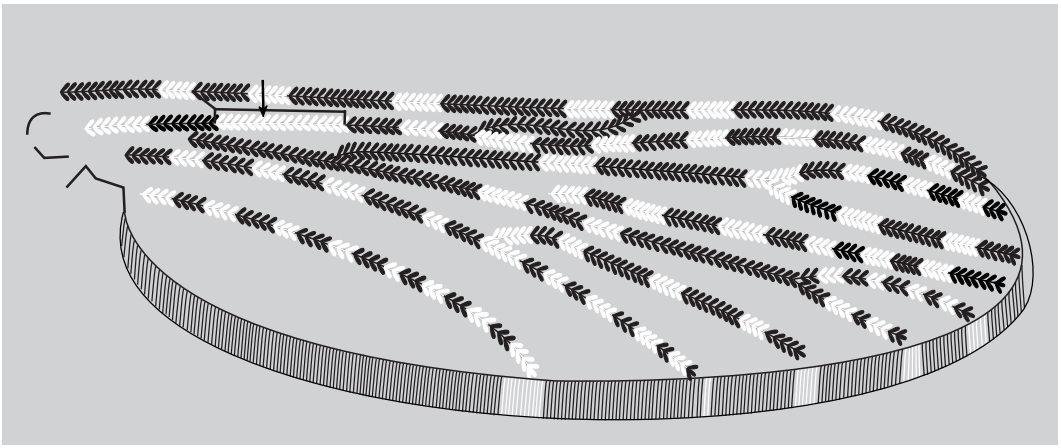
An. balabacensis, An. dirus

A pale spot at the level of presector dark mark on vein 1



Extended basally but not reaching up to the distal end of humeral dark mark on the costa

An. balabacensis

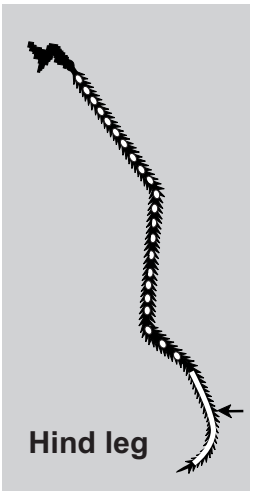


Extended basally but reaching up to the distal end of humeral dark mark on the costa

An. dirus

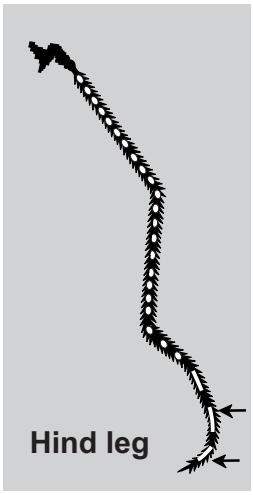
An. jamesii, An. pseudojamesi and An. sundaicus

Hind tarsomeres 5, 4 and 3



Completely pale

1. *An. jamesii*
2. An. *pseudojamesi*

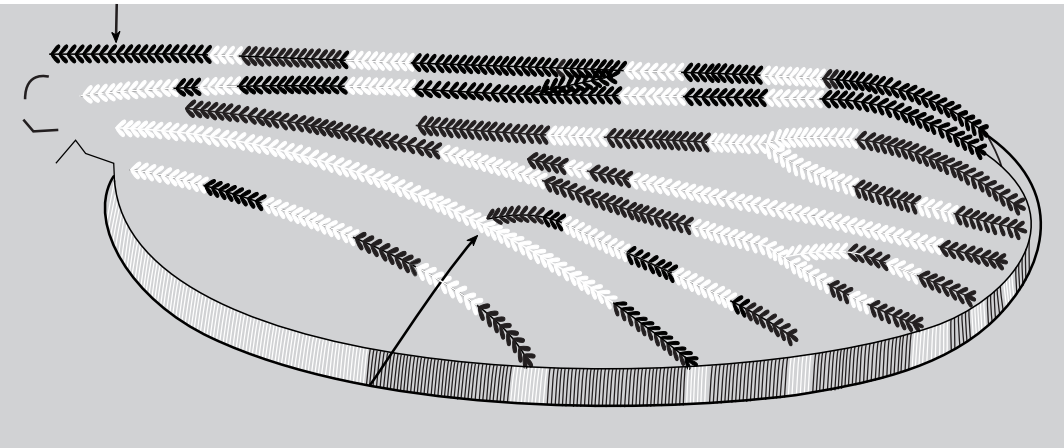


Small bands at the joints

An. sundaicus

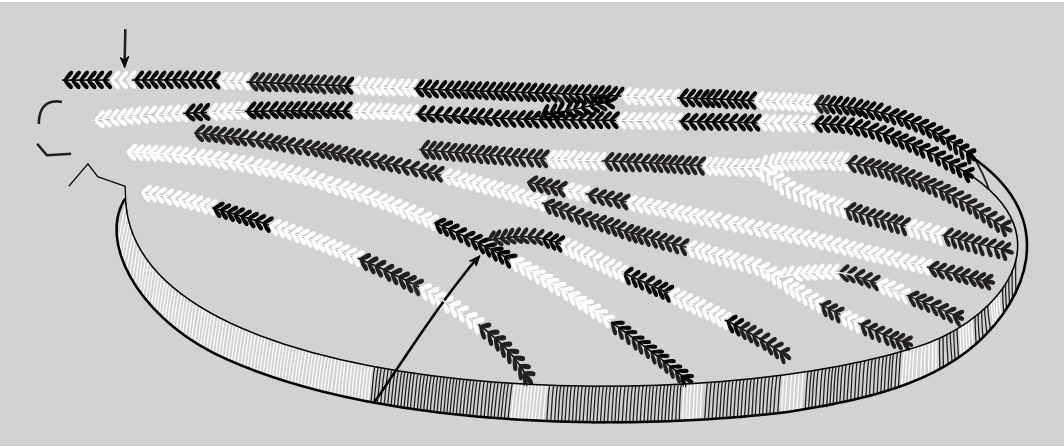
An. jamesii and An. pseudojamesi

Area at the bifurcation of wing vein 5 (Cu) and inner costa



Pale and inner costa mainly dark

An. jamesii

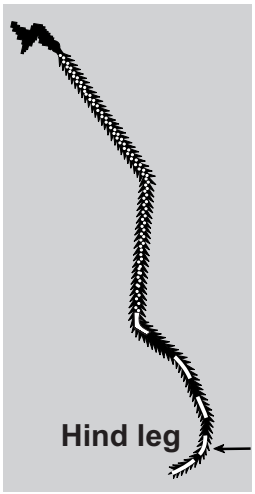


Dark and inner costa interrupted

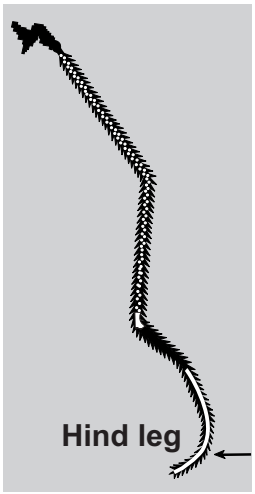
An. pseudojamesi

An. dravidicus, An. maculatus, An. notanandai, An. pseudowillmori, An. sawadwongporni, An. splendidus, An. stephensi, An. theobaldi, An. willmori

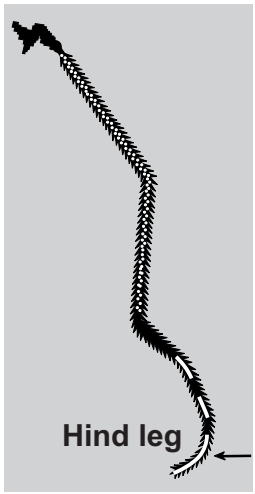
Dark band at 4th tarsomere of hind leg



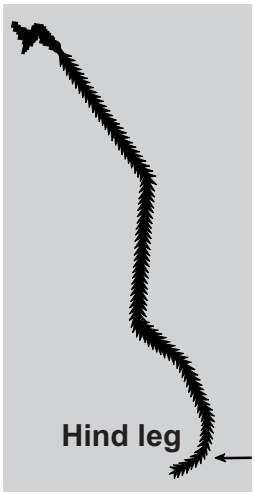
Present
1. *An. dravidicus*
2. *An. maculatus*
3. *An. notanadai*
4. *An. pseudowillmori*
5. *An. sawadwongporni*
6. *An. willmori*



Completely white
An. splendidus



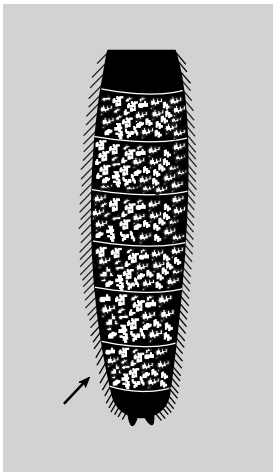
Absent
An. theobaldi



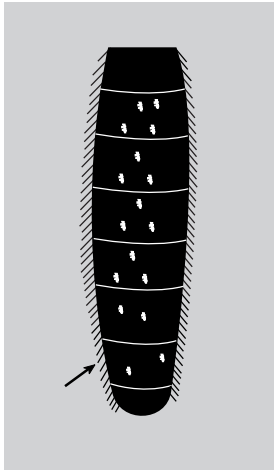
Completely black
An. stephensi

An. dravidicus, An. maculatus, An. notanandai, An. pseudowillmori, An. sawadwongporni, An. willmori

Narrow to broad scales on abdomen II to VI

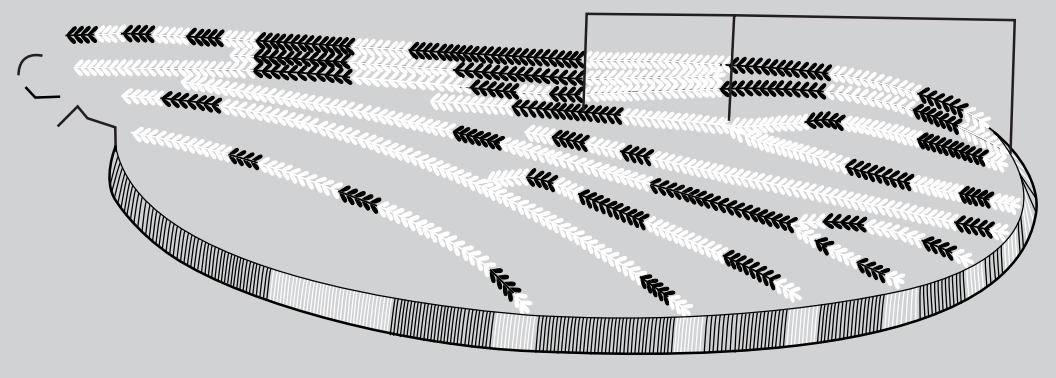


Present
1. *An. dravidicus*
2. *An. maculatus*
3. *An. notanandai,*
4. *An. sawadwongporni*
5. *An. willmori*



Absent
An. pseudowillmori

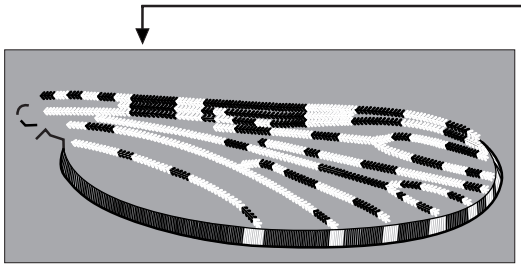
Other important characters for *An. pseudowillmori*



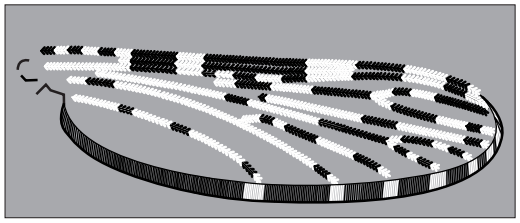
Vein 2 longer than vein R2+3 (about double the length)

An. dravidicus, An. maculatus, An. notanandai, An. sawadwongporni, An. willmori

Number of dark sport on vein 3

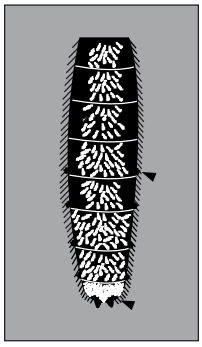


3 dark spots
An. dravidicus



2 dark spots
1) An. maculatus 2) An. notanandai,
3) An. sawadwongporni 4) An. willmori

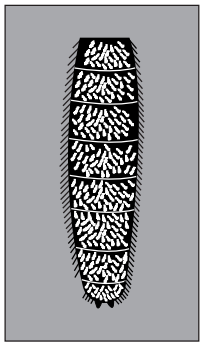
Others characters for An. dravidicus



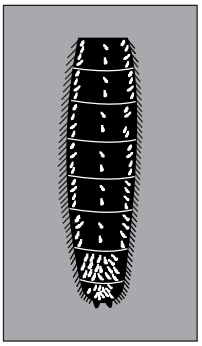
Abdominal terga IV-VIII with dark scales on posterolateral corners, sometimes on III

An. maculatus, An. notanandai, An. sawadwongporni An. willmori

Broad sqatulate pale scales abdominal terga II-VI



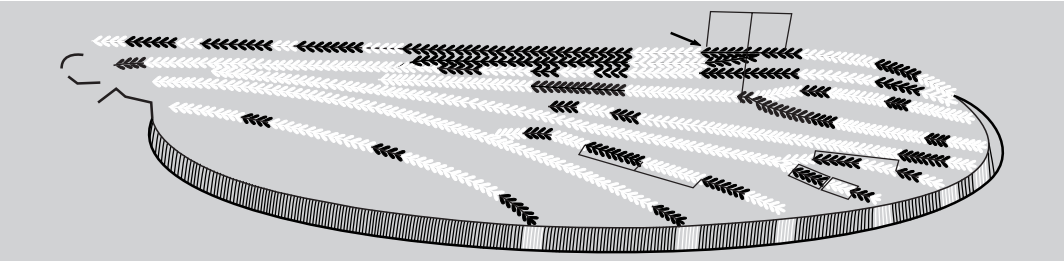
Present
An. willmori



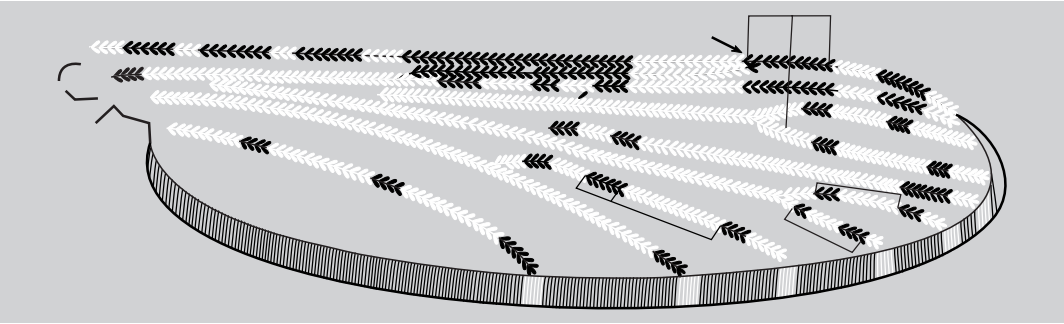
Absent
1) An. maculatus
2) An. notanandai,
3) An. sawadwongporni

An. maculatus, An. notanandai, An. sawadwongporni

Black and pale spots on vein 5.1, 4.2 and division on vein 2.1



Equal
An. notanandai

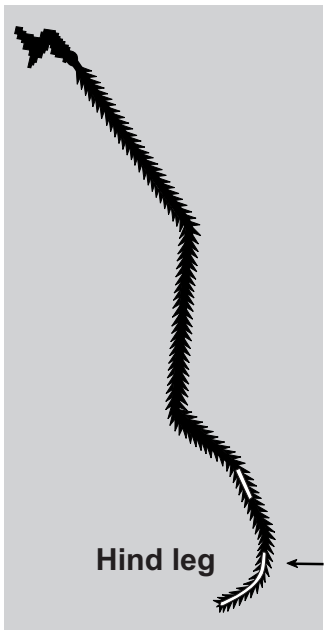


Longer
An. sawadwongporni and An. maculatus**

** Further identification based on egg characters*

An. aconitus, An. annularis, An.culicifacies, An. fluviatilis, An. jeyporiensis, An. karwari, An. minimus, An. nivipes, An. pallidus, An. philippinensis. An. subpictus, An. vagus and An. varuna

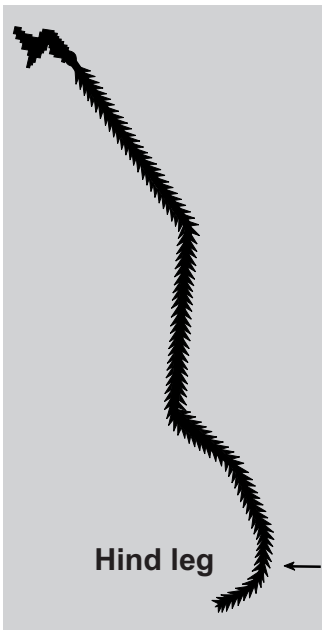
Hind leg tarsomeres 5, 4 and 3



Completely pale

1. *An. annularis*
2. *An. nivipes*
3. *An. pallidus*
4. *An. philippinensis*

Go to Page 37



Dark

1. *An. aconitus*
2. *An. culicifacies*
3. *An. fluviatilis*
4. *An. jeyporiensis*
5. *An. karwari*
6. *An. minimus*
7. *An. subpictus*
8. *An. vagus*
9. *An. varuna*

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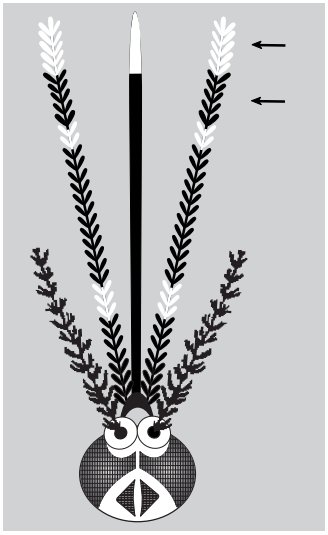
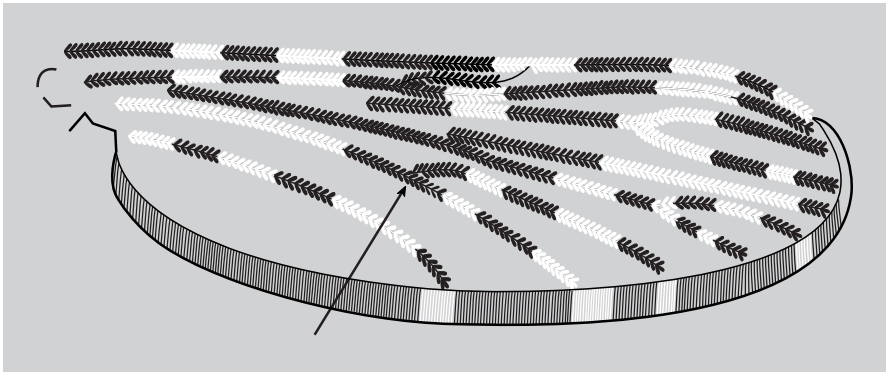
An. annularis, An. nivipes, An. pallidus and An. philippinensis

Apical pale band nearly equal to preapical dark band

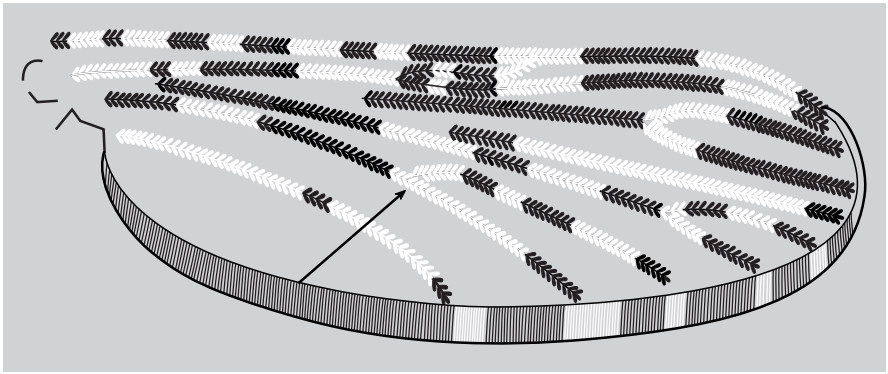


Area at the bifurcation of wing vein 5 (Cu)



Dark

An. annularis

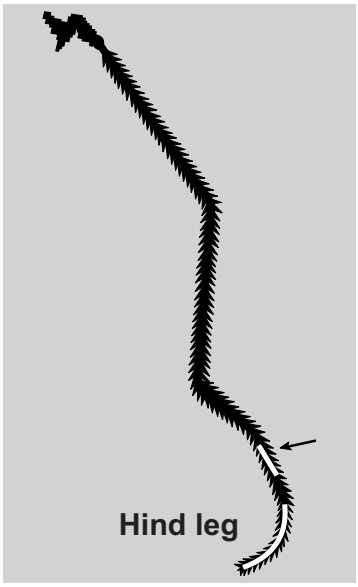


Pale

1. *An. nivipes*
2. *An. pallidus*
3. *An. philippinensis*

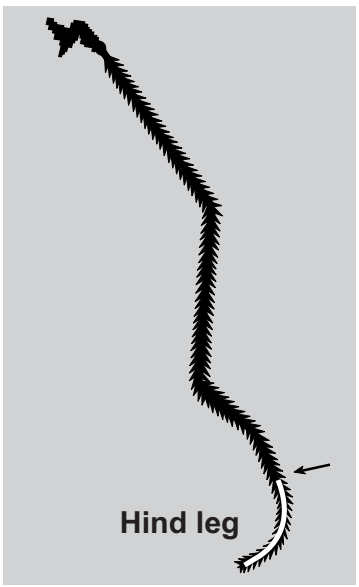
An. nivipes, An. pallidus and An. philippinensis

Apex of hind tarsomere 1



With small pale band

1. *An. nivipes*
2. *An. philippinensis*

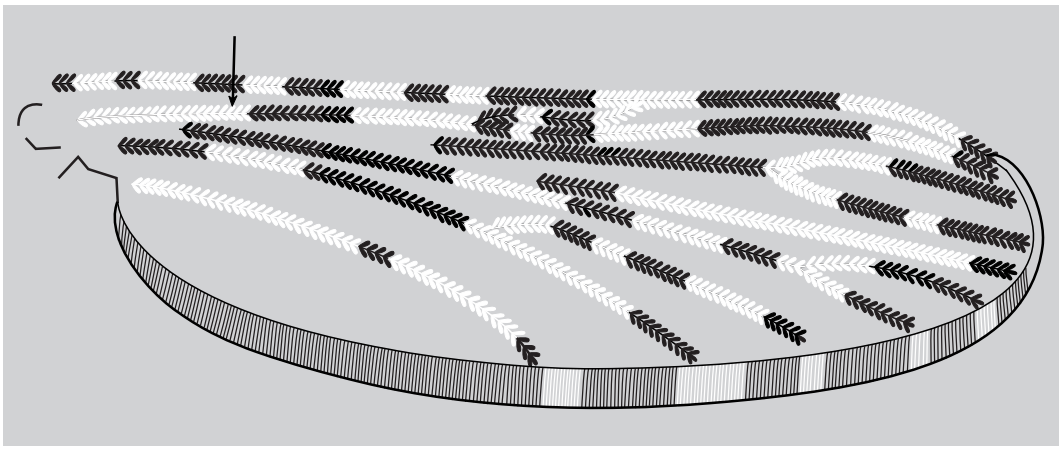


Without any pale band

An. pallidus

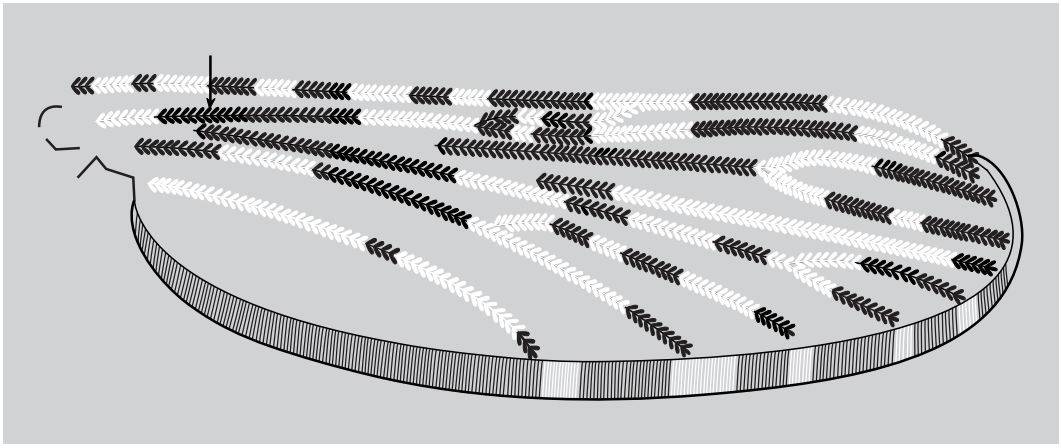
An. nivipes and An. philippinensis

Pre-sector dark mark of vein 1 (R1)



Not reaching up to the distal end of humeral dark mark on the costa

An. philippinensis

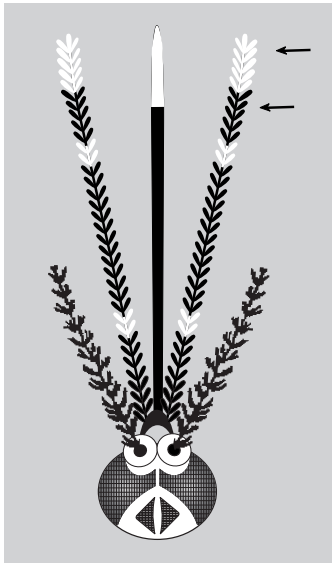


Reaching beyond the distal end of humeral dark mark of the costa

An. nivipes

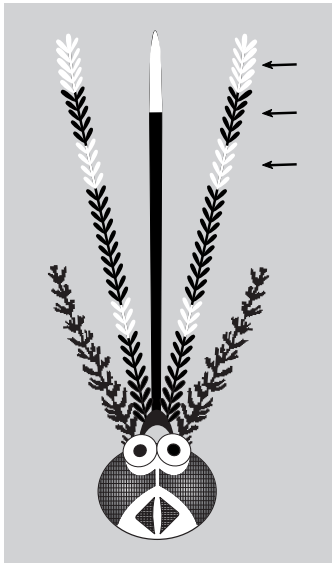
An. aconitus, An. culicifacies, An. fluviatilis, An. jeyporiensis, An. karwari, An. minimus, An. subpictus, An. vagus and An. varuna

Banding pattern of palpi



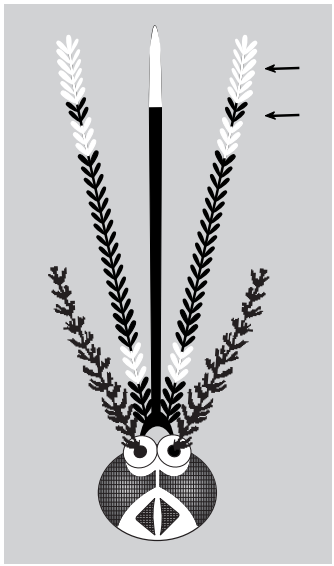
Apical pale band nearly equal to the pre-apical dark band

1. *An. culicifacies*
2. *An. fluviatilis*
3. *An. jeyporiensis*
4. *An. subpictus*

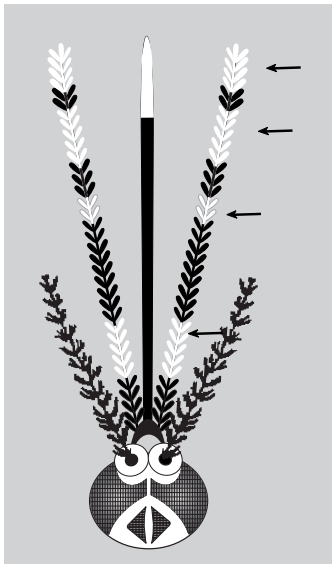


Apical and sub-apical pale band equal and separated by a small or same sized dark band called intervening dark band

1. *An. aconitus*
2. *An. minimus*
3. *An. varuna*

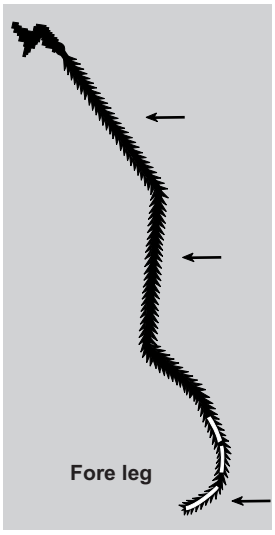


Pre-apical dark band 1/4 or 1/5 of the apical pale band
An. vagus



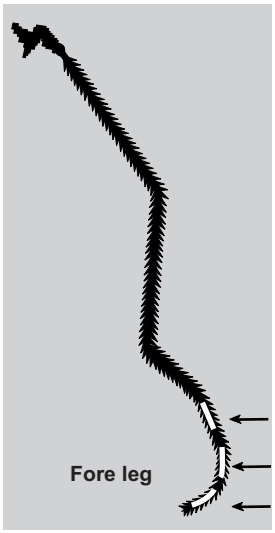
Four banded palpi
An. karwari

Other important characters for *An. karwari*



- Legs without specking
- 5th tarsomere of hind leg pale

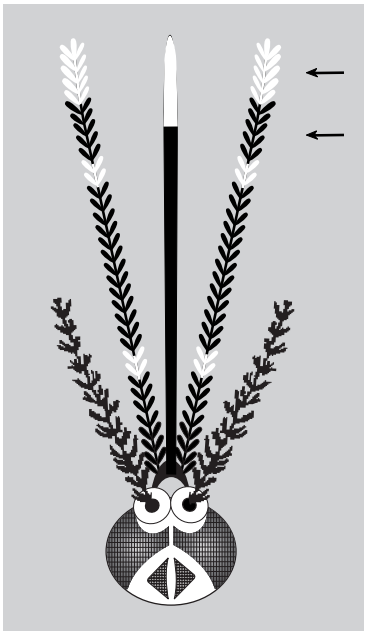
Other important characters for *A. vagus*



Broad band on tarsomeres

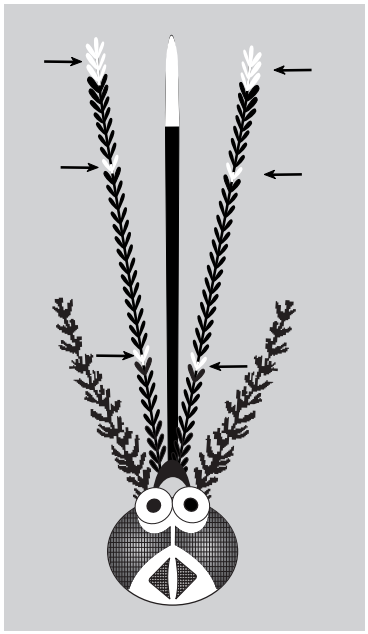
An. culicifacies, An. fluviatilis, An. jeyporiensis and An. subpictus

Banding pattern of palpi



Apical pale band nearly equal to the pre-apical dark band

An. culicifacies, An. fluviatilis and An. subpictus

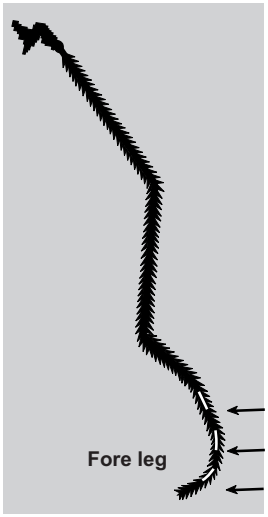


Apical pale band smaller than pre-apical dark band and thin palpi

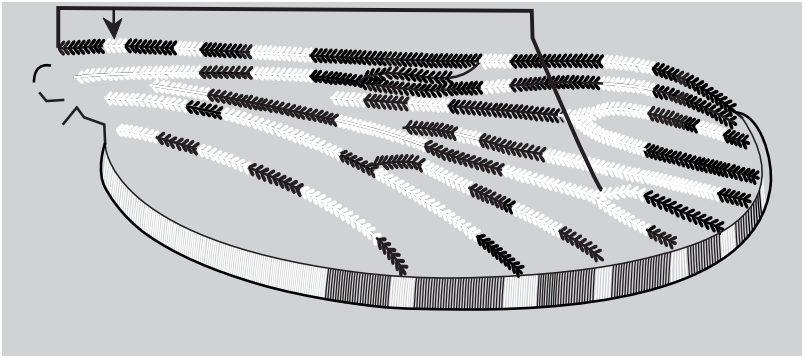
An. jeyporiensis

Other important characters for *An. jeyporiensis*

Small bands on fore leg tarsomeres

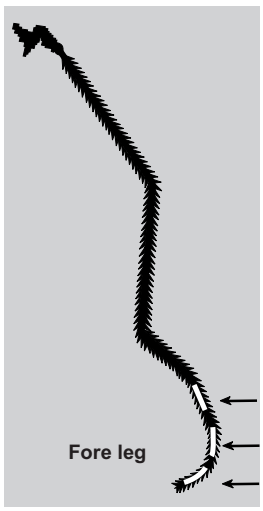


Distance of the anterior forked cell from the base of the costa compared to that of posterior forked cell is less



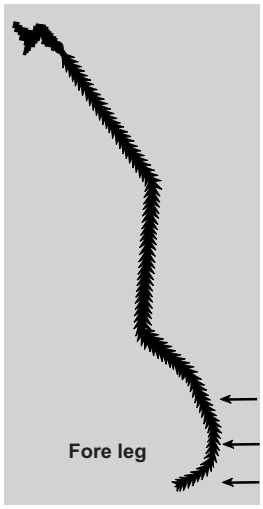
An. culicifacies, An. fluviatilis and An. subpictus

Broad pale bands on the foreleg tarsal segments



Present

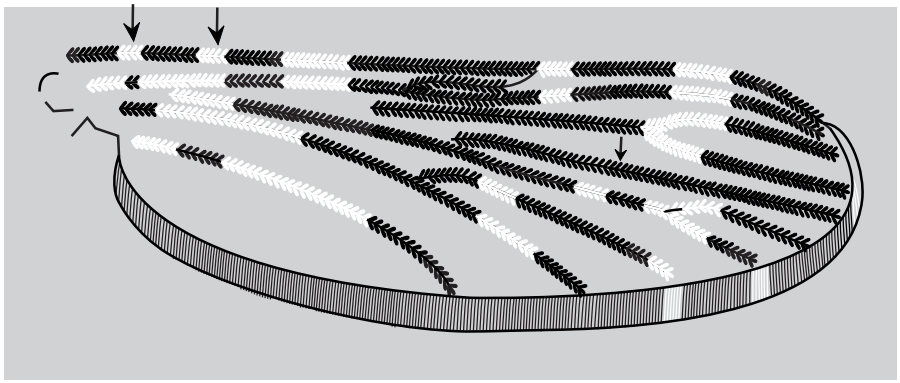
An. subpictus



Absent

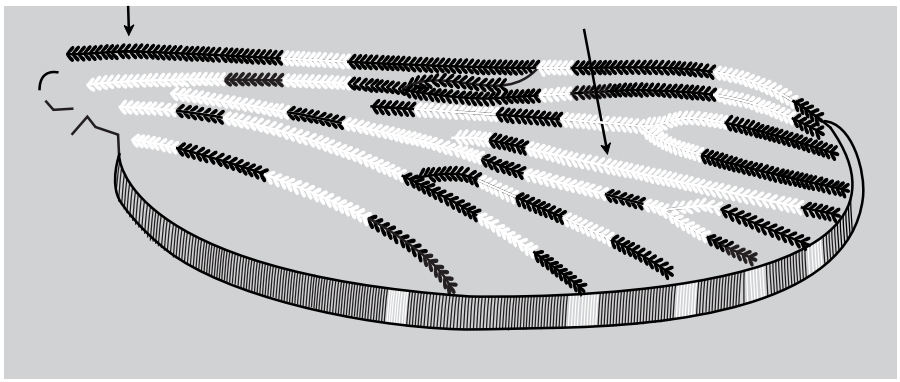
An. culicifacies, An. fluviatilis

Wing vein 3 (R4+5) and inner costa



Mostly dark and inner costa interrupted

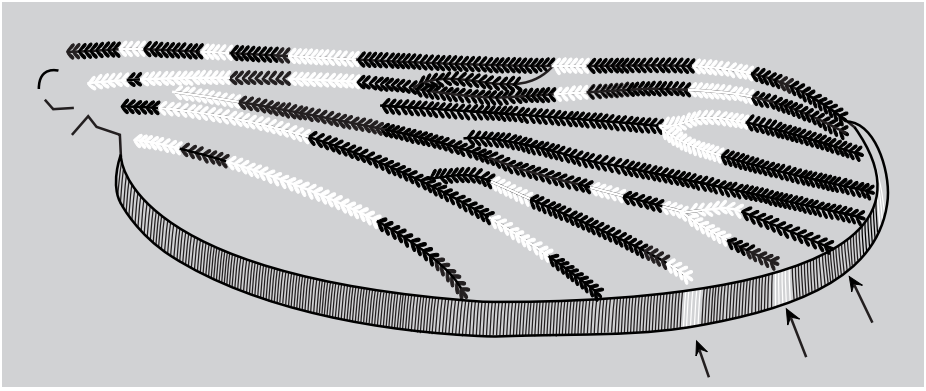
An. culicifacies



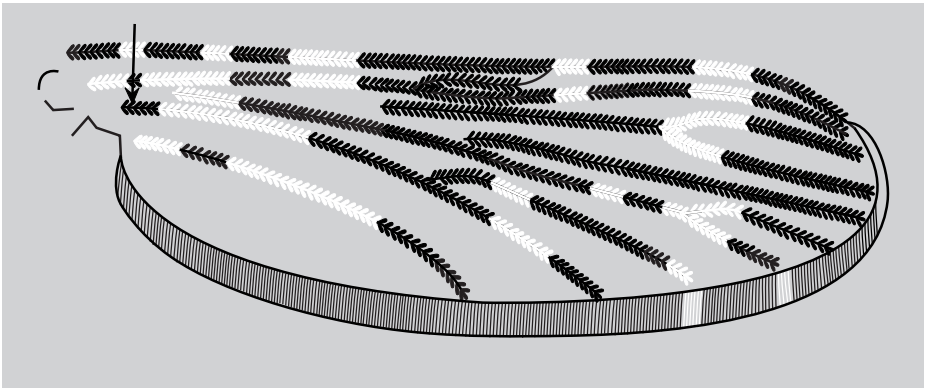
Mostly pale and inner costa dark

An. fluviatilis

Other important character for *An. culicifacies*

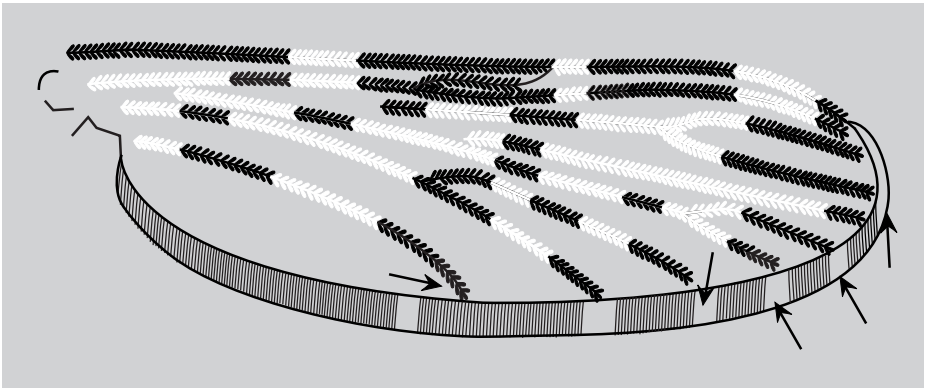


Vein 2.1 (R2), 2.2 (R3), 4.2 (M2) and 5.1 (Cu1) with fringe spots



Interruption by a dark spot at basal area of vein 1 (R1)

Other important character for *An. fluviatilis*



Fringe spot present on all the veins except vein 6 (anal)

An. aconitus, An. minimus and An. varuna

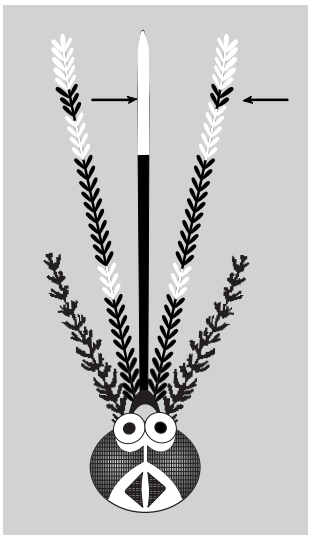
Intervening dark band on the palpi

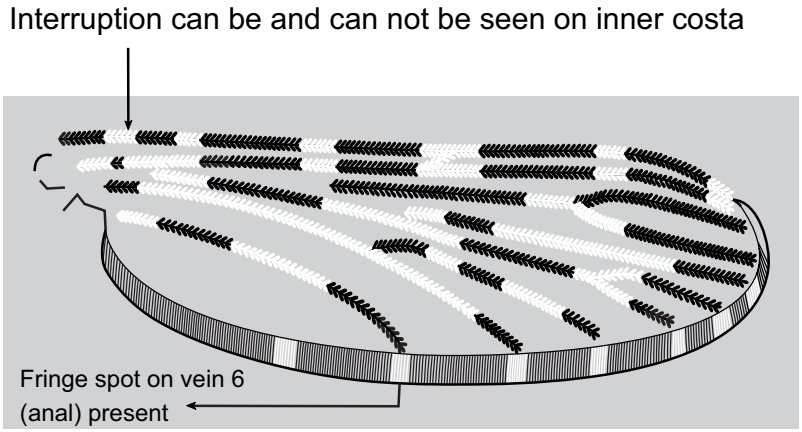
Very small (in most of the specimens dark band absent)
An. aconitus

Nearly equal to the pre-apical dark band
1. *An. minimus*
2. *An. varuna*

Other important characters for *An. aconitus*

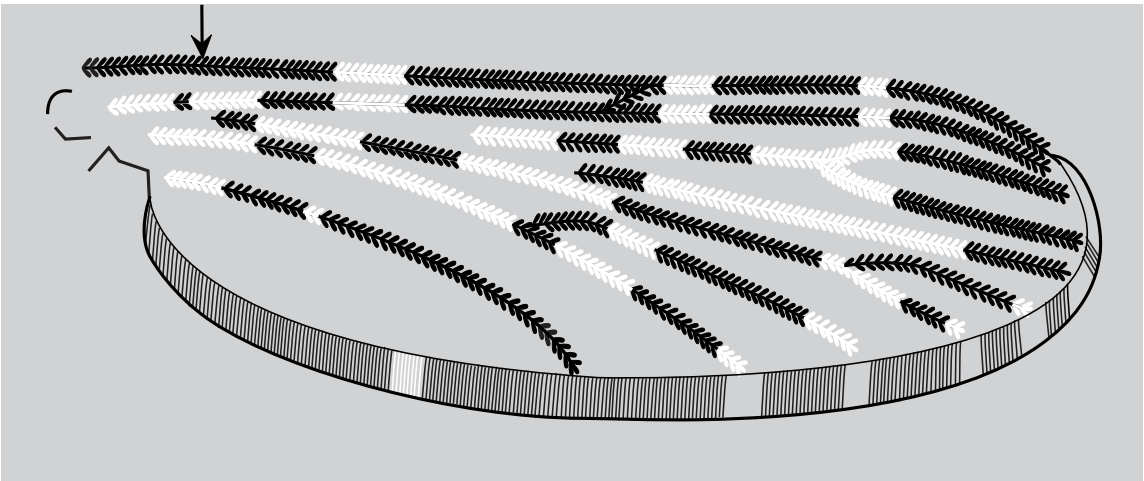
Apical half of the proboscis light yellow (fluorescent)





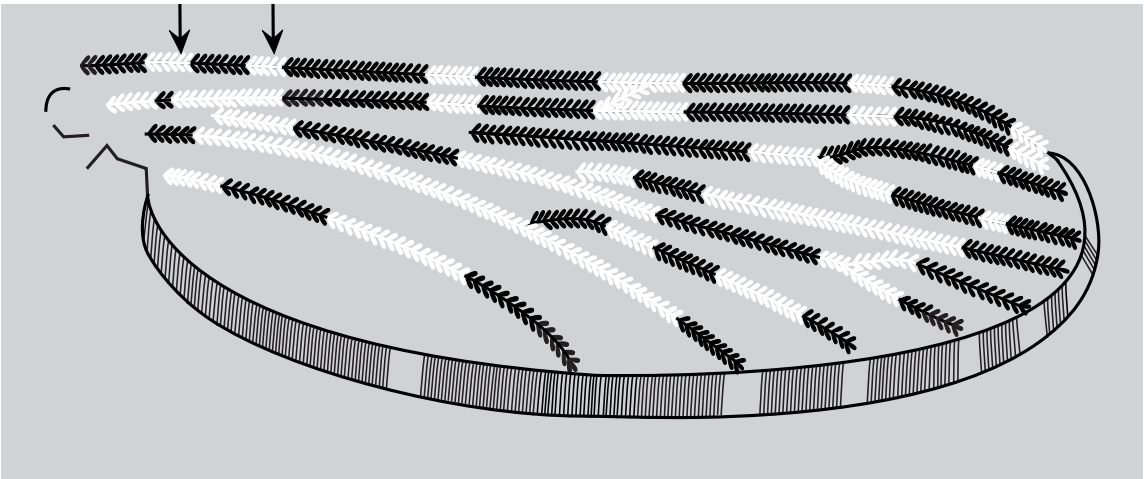
An. minimus, An. varuna

Inner costa



Dark

An. varuna

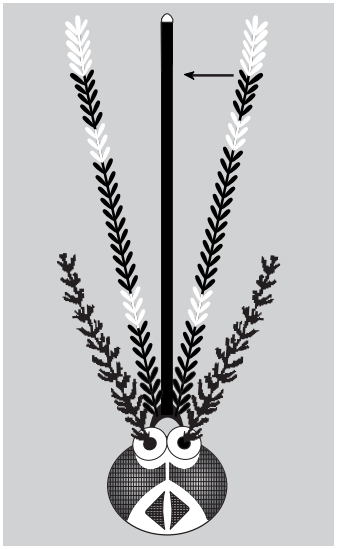


Interruptions can be seen at least in one wing

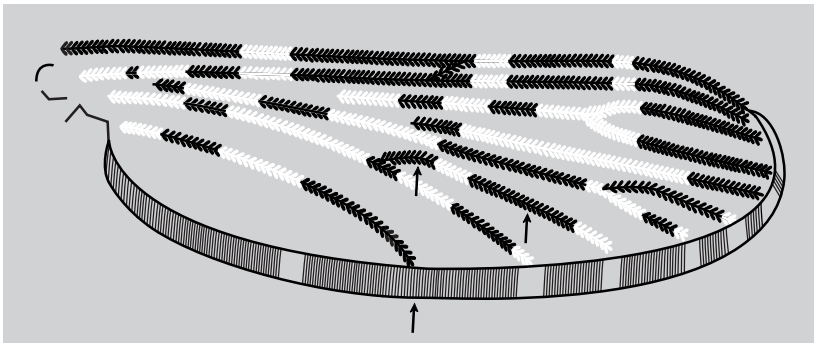
An. minimus

Other important characters for *An. varuna*

- Proboscis generally dark, some time half of its yellow



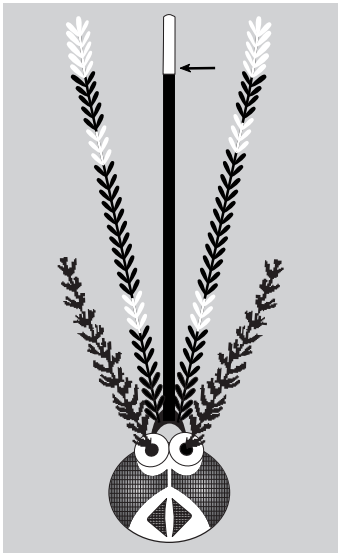
-Vein 5.1 (Cu 1) with two dark areas



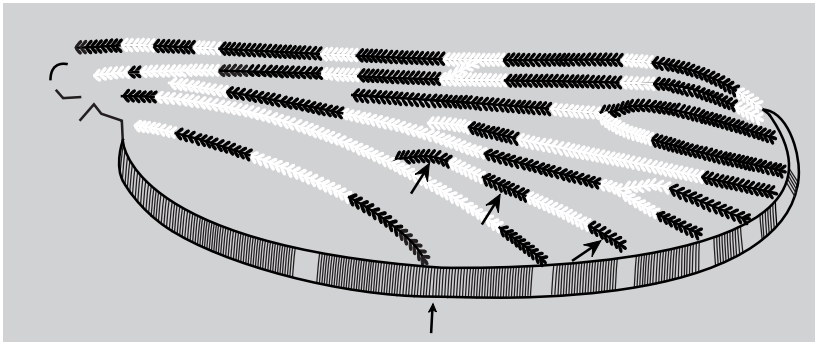
- Fringe spot absent on vein 6 (anal)

Other important characters for *An. minimus*

- Proboscis generally dark, some time fluorescence can be seen towards lower side



- Vein 5.1 (Cu 1) with three dark areas

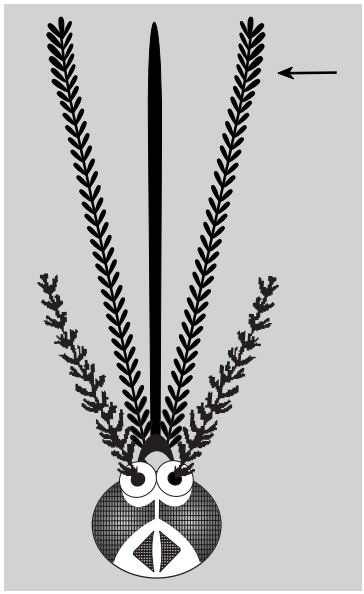


- Fringe spot absent on vein 6 (anal)

Group-B (Subgenus *Anopheles*)

An. argyropus, An. barbirostris, An. barbumbrosus, An. crawfordi, An. koreicus, An. lensteri, An. lindesayi. An. nilgiricus, An. nitidus, An. nigerrimus, An. paraliae, An. pursati, An. peditaeniatus, An. sinensis, An. sineroides, An. umbrosus and An. yatsushiroensis

Banding pattern of palpi



Completely dark

1. *An. barbirostris*
2. *An. barbumbrosus*
3. *An. koreicus*
4. *An. lindesayi*
5. *An. nilgiricus*
6. *An. umbrosus*

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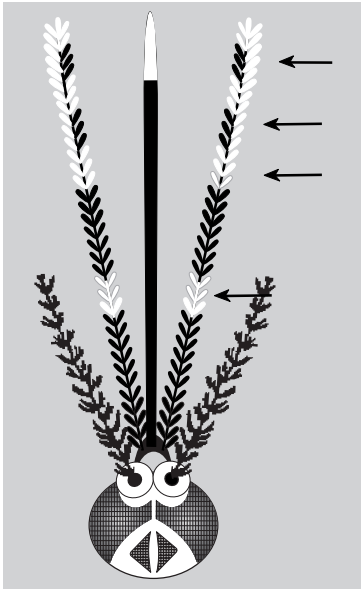

Small pale bands at the joints

An. yatsushiroensis

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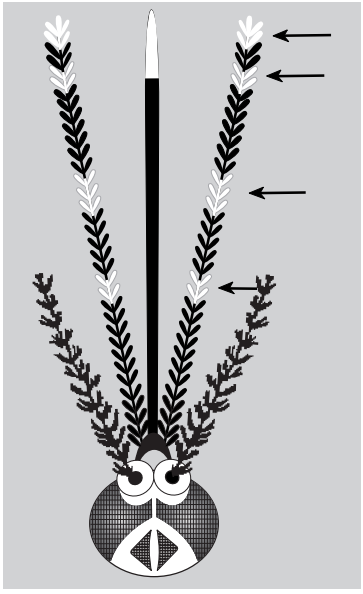

Four banded palpi (tip of the palpi pale)

1. *An. argyropus*
2. *An. crawfordi*
3. *An. lasteri*
4. *An. nitidus*
5. *An. nigerrimus*
6. *An. paraliae*
7. *An. pursati*
8. *An. peditaeniatus*
9. *An. sinensis*
10. *An. sineroides*

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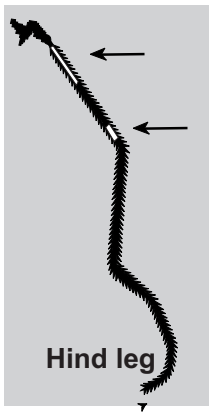
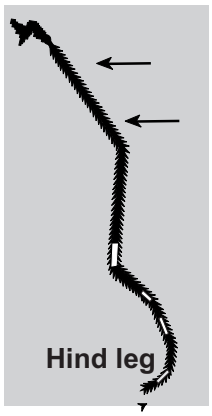
An. barbirostris, An. barbumbrosus, An. koreicus, An. lindesayi, An. nilgiricus, An. umbrosus

Hind femur with pale area



Present

1. *An. lindesayi*
2. *An. nilgiricus*

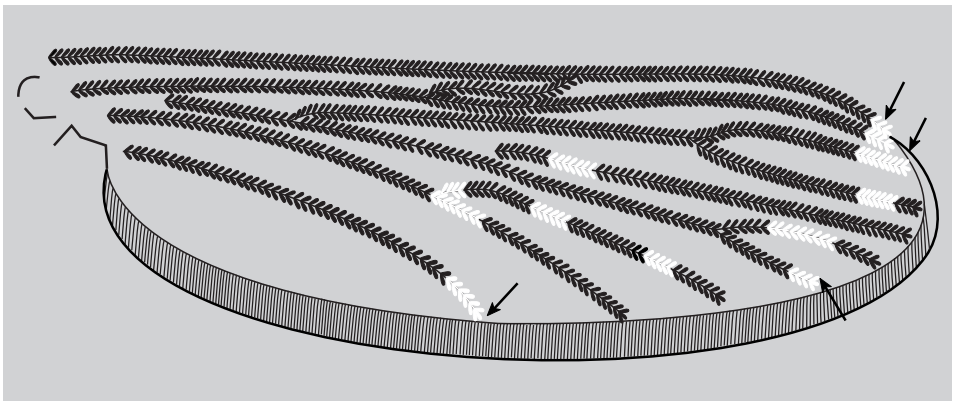


Absent

1. *An. barbirostris*
2. *An. barbumbrosus*
3. *An. koreicus*
4. *An. umbrosus (An. letifer)*

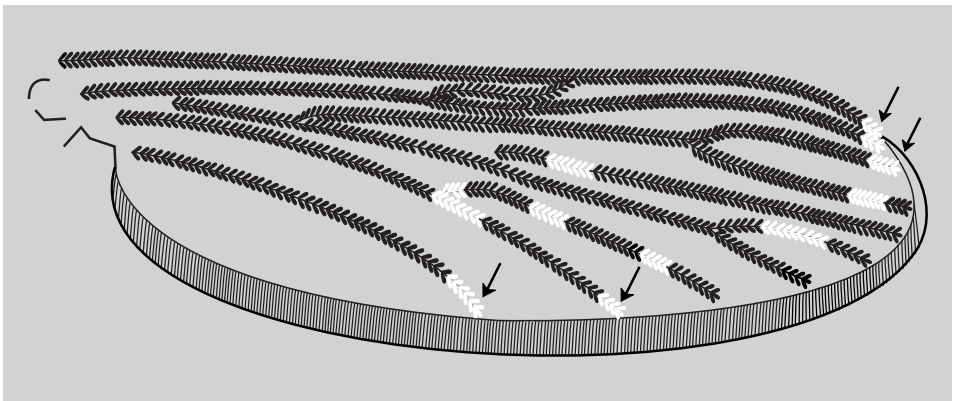
An. lindesayi, An. nilgiricus

Pale area on the tip of wing veins



Pale area present on the tip of veins 1 (R1), 2.1 (R2), 4.2 (M2) and 6 (anal)

An. lindesayi

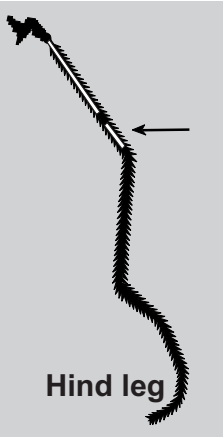


Pale area present on the tip of veins 1 (R1), 2.1 (R2), 6 (anal) and sometime 5.2 (Cu2)

An. nilgiricus

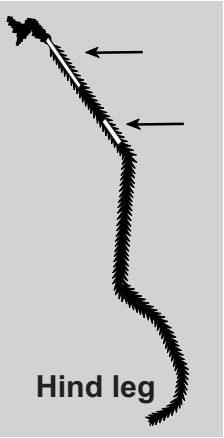
Other important characters for *An. nilgiricus*

Hind femur: a pale ring present nearly equal to the femur



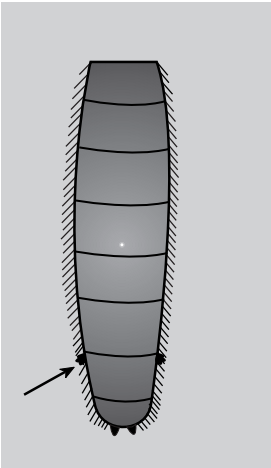
Other important characters for *An. lindesayi*

Hind femur: with basal pale ring occupying 1/5 of the femur

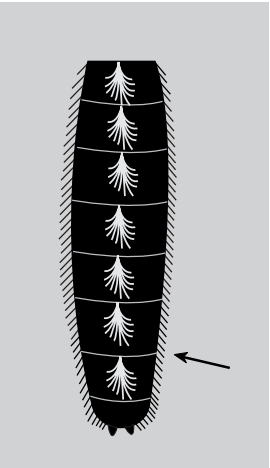


An. barbirostris, An. barbumbrosus, An. koreicus, An. umbrosus

Ventral side of 7th abdominal segment



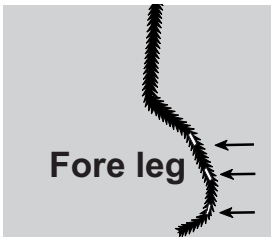
With tuft of dark scales
An. umbrosus



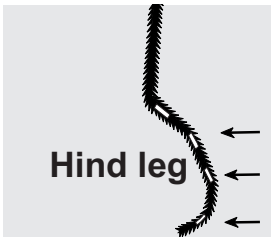
Without any tuft
1. *An. barbirostris*
2. *An. barbumbrosus*
3. *An. koreicus*

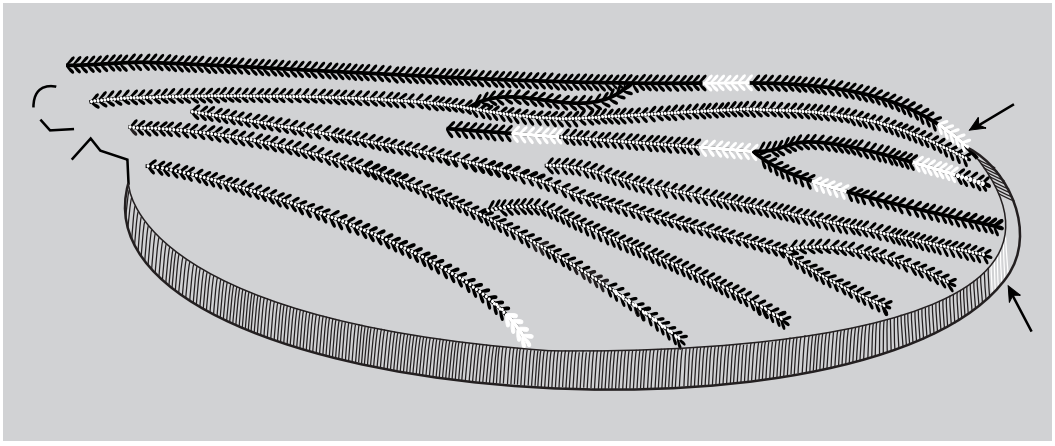
Other important characters for *An. umbrosus*

Foreleg tarsomeres with narrow pale bands



Hind leg tarsomeres with bands at the joints

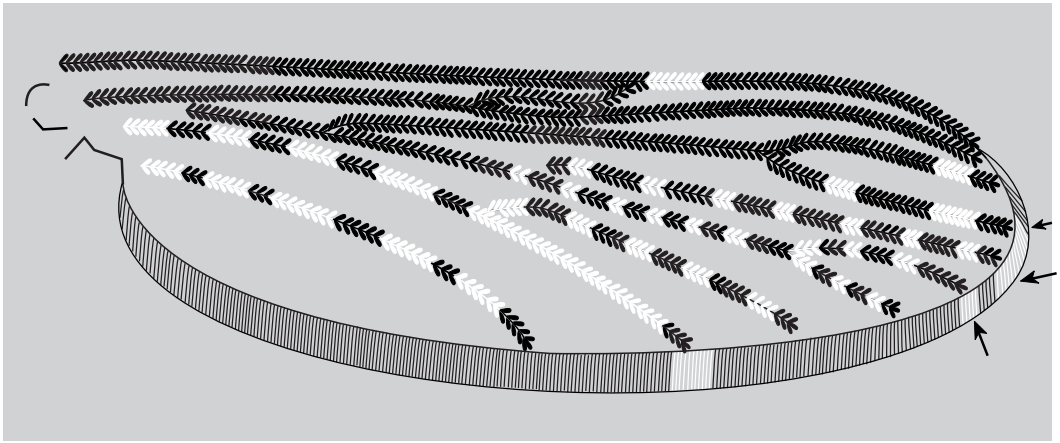




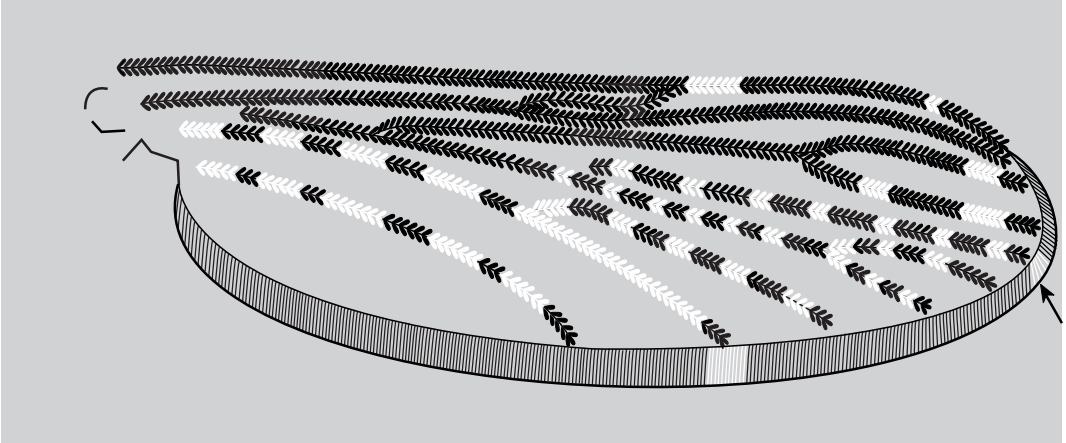
Fringe spot present on vein 1 (R1) and 3 (R4+5)
An. umbrosus

An. barbirostris, An. barbumbrosus, An. koreicus

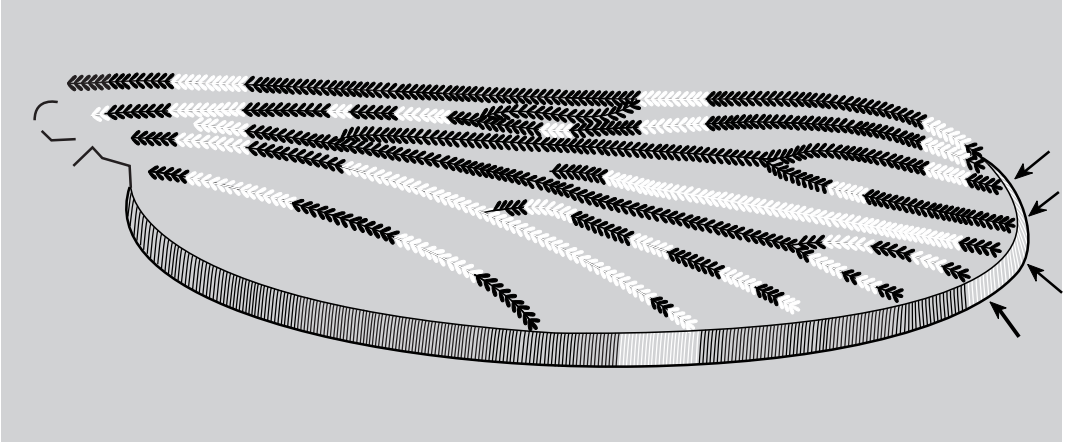
Fringe spot on vein 2.1 (R2), 2.2 (R3), 3 (R4+5) and 4.1 (M1)



Fringe spot present on vein 2.2, 3, & 4.1 the veins, sternie without scales
An. barbumbrosus

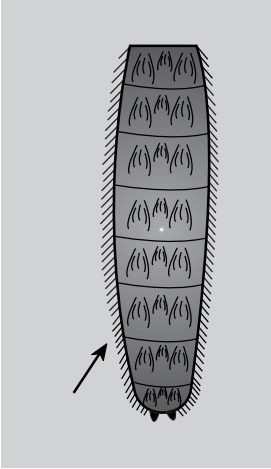


Fringe spot present on vein 3 (R4+5) only,
An. barbirostris

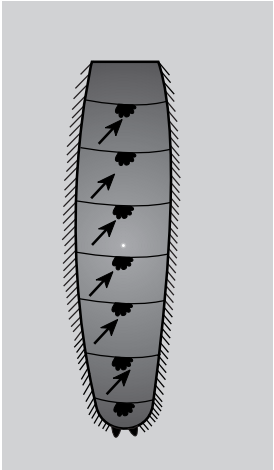


Fringe spot present on vein 2.1 (R2), 2.2 (R3), 3 (R4+5) and 4.1 (M1)
An. koreicus

Other important characters for *An. barbumbrosus & An. barbirostris*

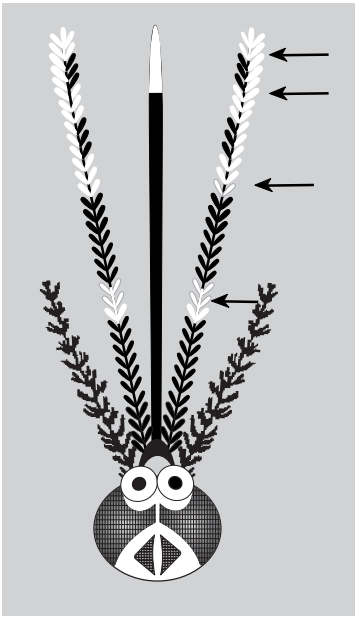


Sternie without tuft of scales
An. barbumbrosus



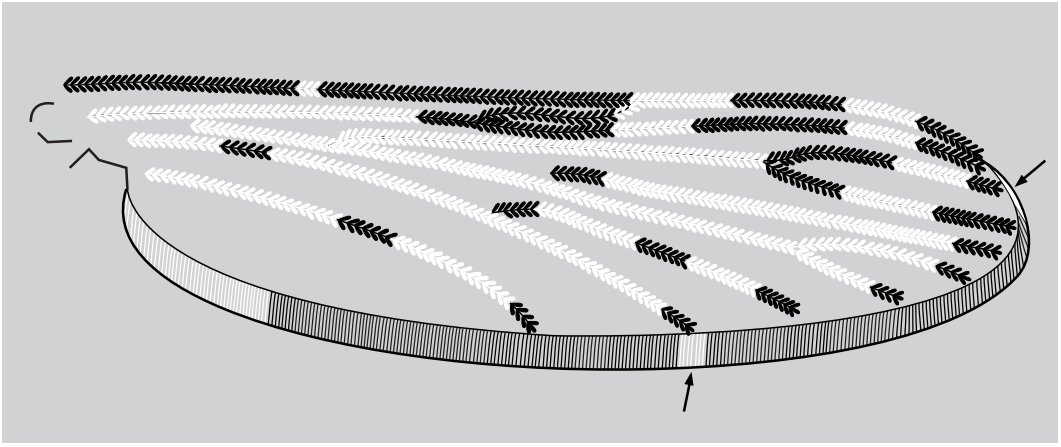
Sternie with tuft of scales
An. barbirostris

An. yatsushiroensis



Apical pale band present laterally

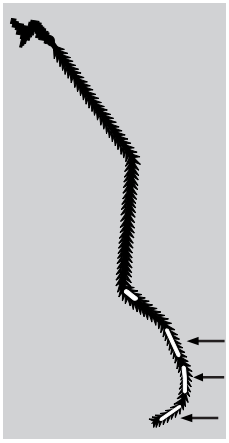
Other important characters for *An. yatsushiroensis*



Fringe spot present on wing 2.1 (R2) & 5.2 (Cu2)

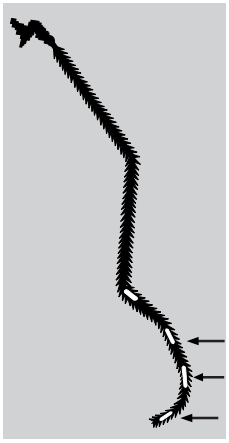
An. argyropus, An. crawfordi, An. lasteri, An. nitidus, An. nigerrimus, An. paraliae, An. pursati, An. peditaeniatus, An. sinensis, An. sineroides

Basal & apical pale bands on hind tarsomeres



Present

1. *An. argyropus*
2. *An. nitidus*
3. *An. nigerrimus*
4. *An. peditaeniatus*

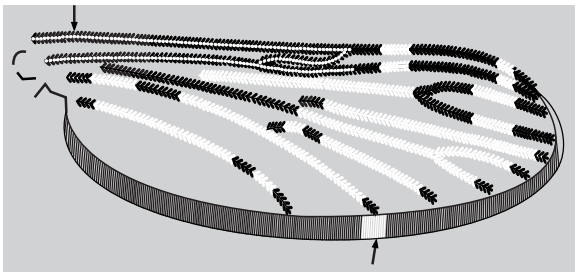


Absent

1. *An. crawfordi*
2. *An. lasteri*
3. *An. pursati*
4. *An. paraliae*
5. *An. sinensis*
6. *An. sineroides*

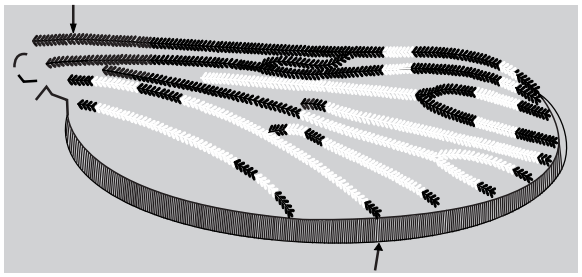
An. argyropus, An. nitidus, An. nigerrimus, An. peditaeniatus

Pale scale on inner costa and fringe spot on vein 5.2 (Cu2)



Present

1. *An. nigerrimus*
2. *An. nitidus*

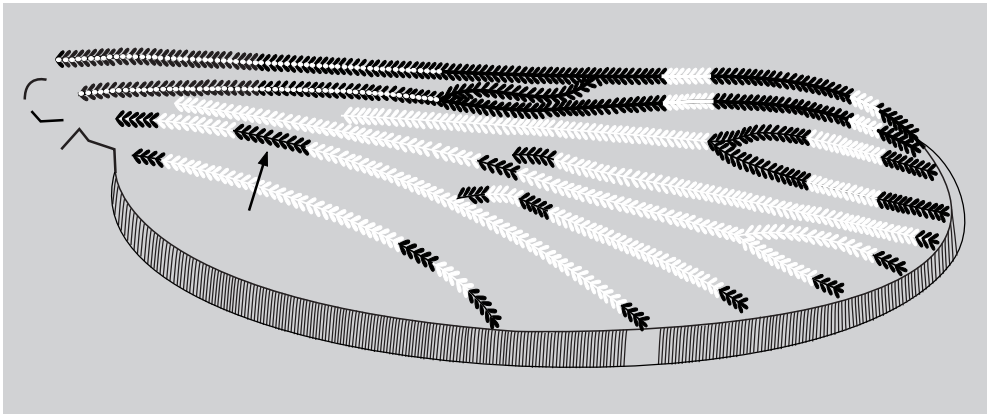


Absent

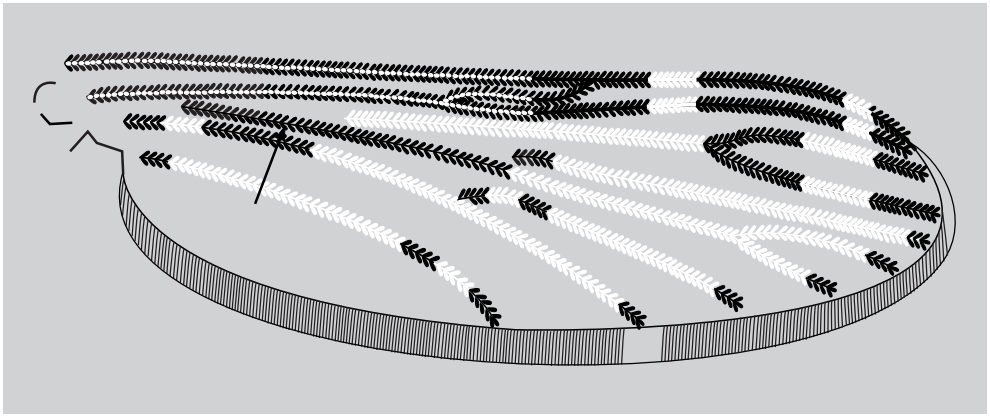
1. *An. argyropus*
2. *An. peditaeniatus*

An. nigerrimus, An. nitidus

Size of basal dark mark on wing vein 5 (Cu)



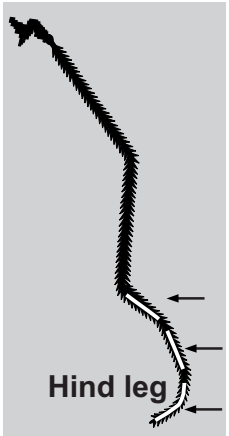
Small (0.2 x length of Cu stem)
An. nitidus



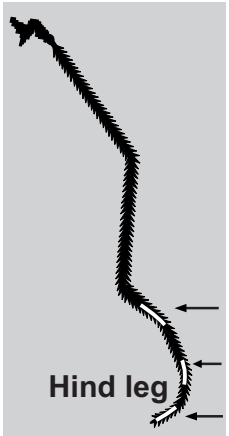
Long (0.4 x length of Cu stem)
An. nigerrimus

An. argyropus, An. peditaeniatus

Size of pale bands on hind leg tarsomeres



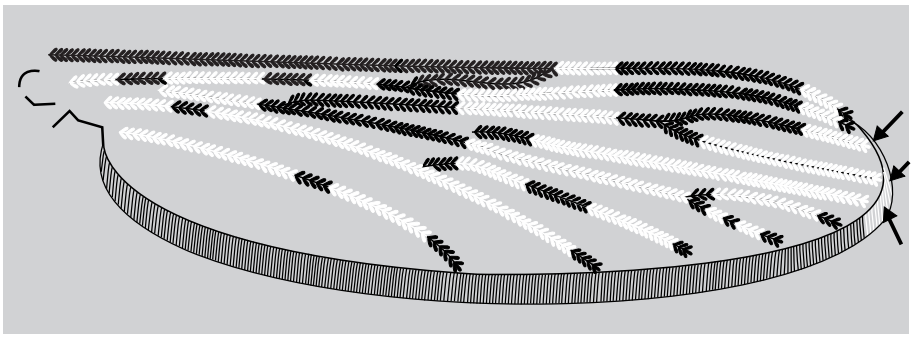
Broad
An. argyropus



Small
An. peditaeniatus

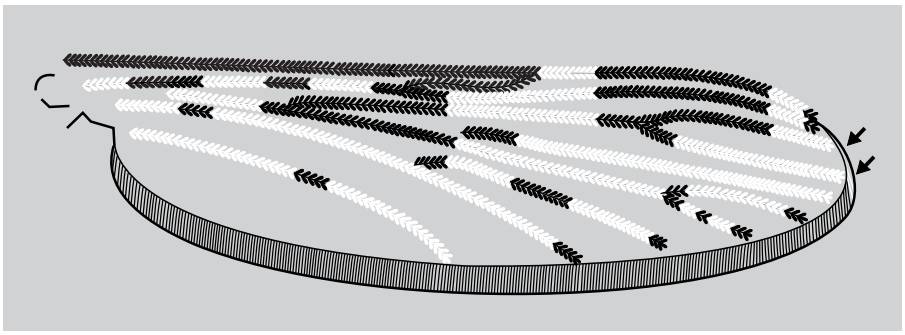
An. crawfordi, An. lesteri, An. pursati, An. paraliae, An. sinensis, An. sineroides

Fringe spot on vein 2.1 (R2), 2.2 (R3) and 3 (R4+5)



Present in all the 3 veins

1. *An. lesteri*
2. *An. sinensis*
3. *An. sineroides*
4. *An. crawfordi*

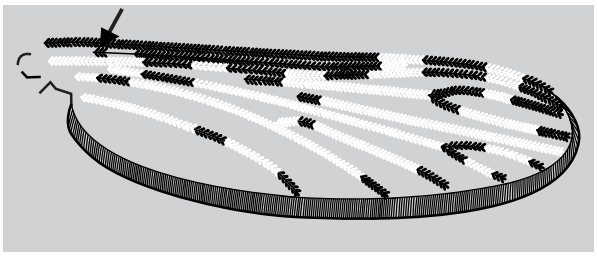


Present only on 2.1, 2.2 veins

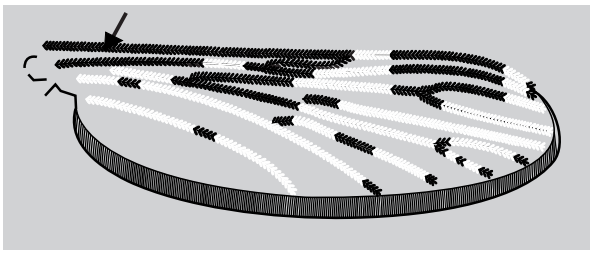
1. *An. pursati*
2. *An. paraliae*

An. pursati, An. paraliae

Humeral cross vein with dark scales



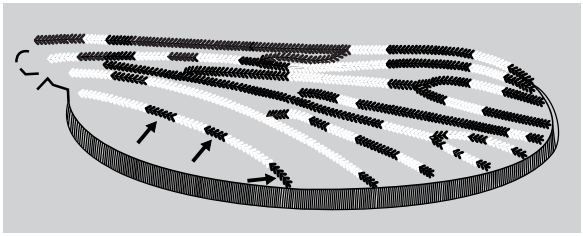
Present
An. pursati



Absent
An. paraliae

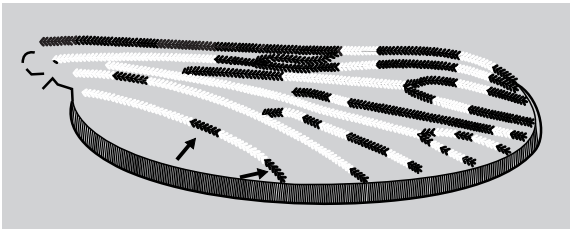
An. lesteri, An. sinensis, An. sineroides and *An. crawfordi*

Vein 6 (anal) with 3 dark spots



Present

An. sineroides

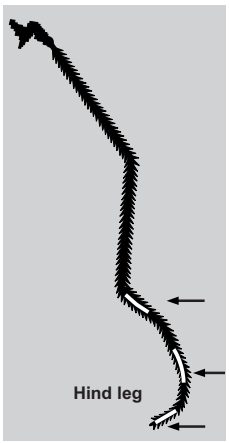


Absent

1. *An. lesteri*
2. *An. crawfordi*
3. *An. sinensis*

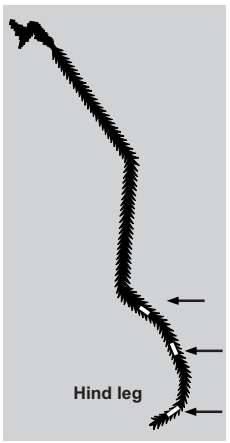
An. lesteri, An. sinensis, An. crawfordi

Size of pale bands on hind leg tarsomeres



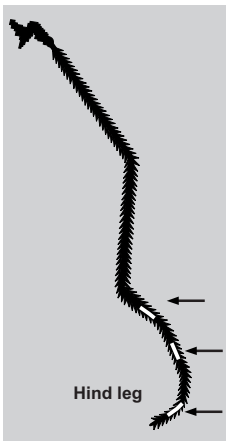
Medium

An. crawfordi



Very small

An. lesteri

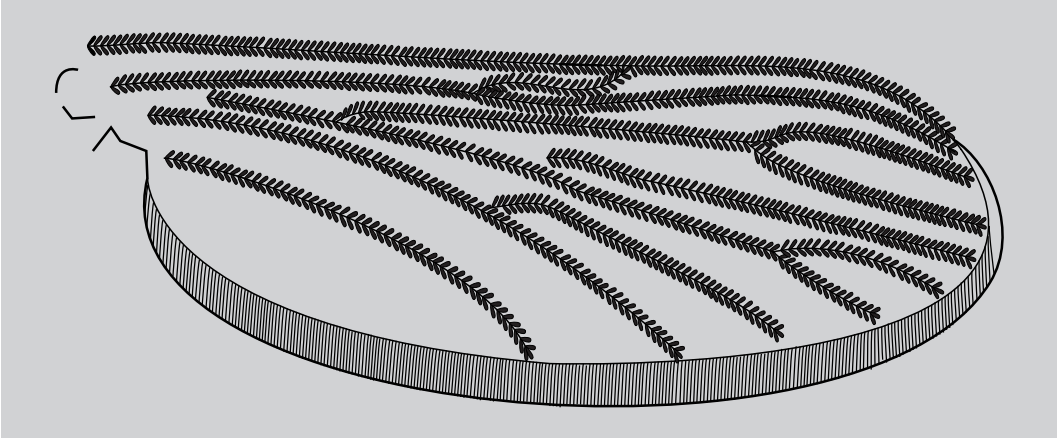


Small

An. sinensis

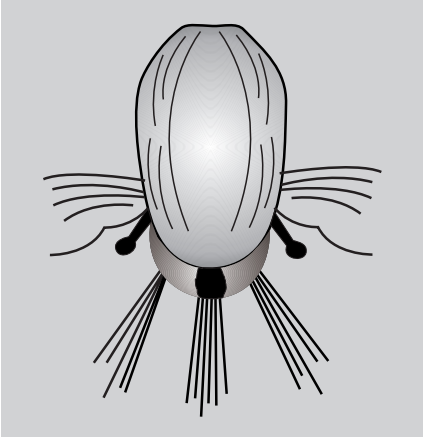
Group C (Subgenus *Anopheles*)

An. bengalensis



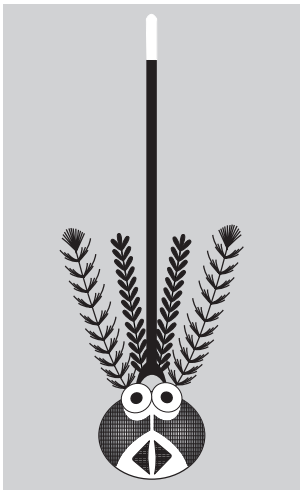
Wing completely dark

Other important characters for *An. bengalensis*

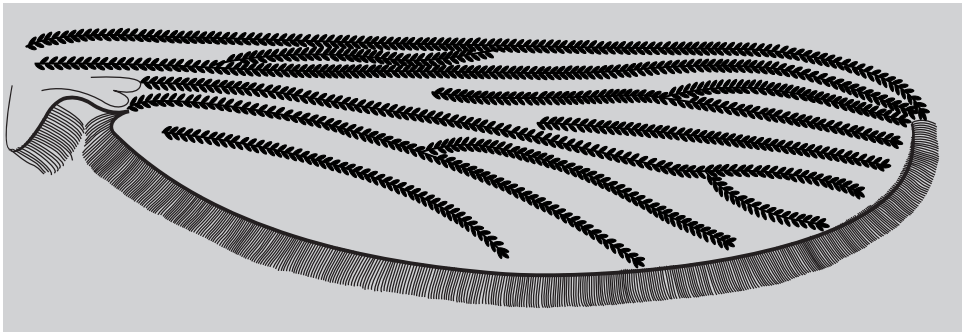


Prescuttlar space of thorax without setae

Genus: *Culex, Aedes and Mansonia*



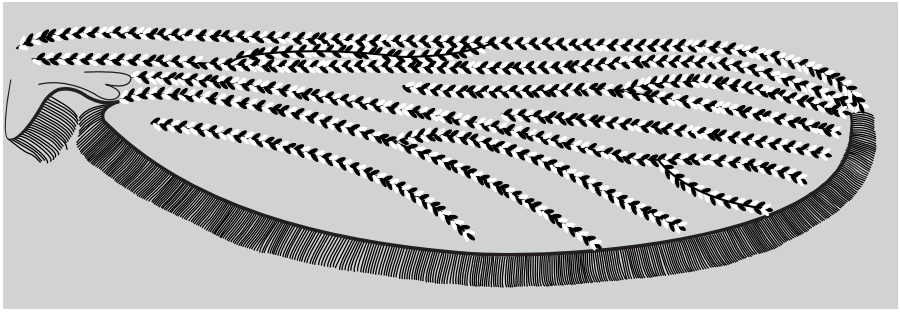
See wing



Scales small & black

Aedes & Culex

Go to Page 60



Broad black and pale scales

Mansonia

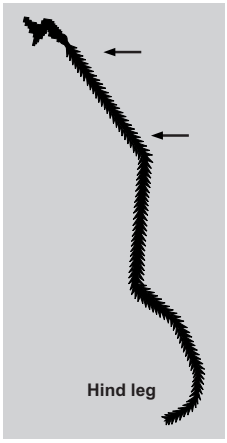
Go to Page 65

Culex and Aedes

See abdomen and leg

Blunt, leg generally without white band

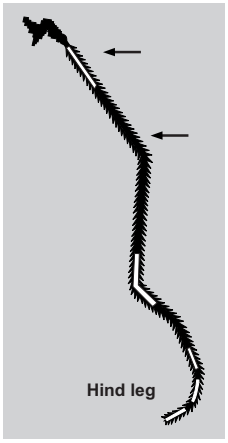
***Culex* species**



Cx. bitaeniorhynchus, Cx. fuscocephala, Cx. gelidus, Cx. perexiguus, Cx. pseudovishnui, Cx. quinquefasciatus, Cx.tritaeniorhynchus, Cx. vishnui, Cx. whitmorei

Pointed, legs with white bands

***Aedes* species**



Ae. aegypti , Ae. albopictus, Ae. niveus, Ae. vittatus

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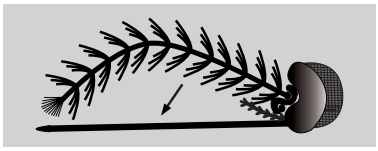
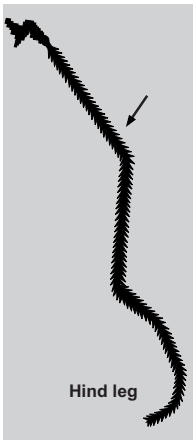
Proboscis and tarsi

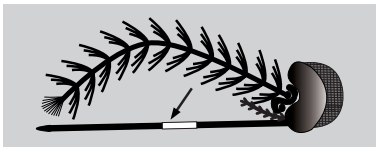
Proboscis and tarsi without band

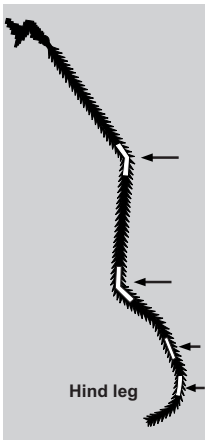




1. *Cx. fuscocephala*
2. *Cx. perexiguus*
3. *Cx. quinquefasciatus*

Proboscis & tarsi with bands

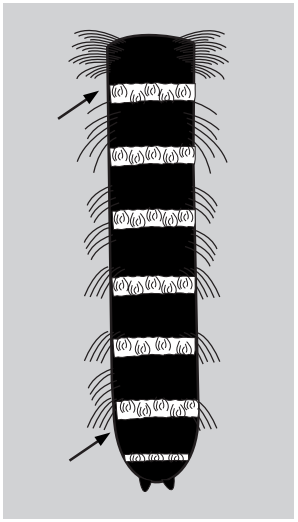




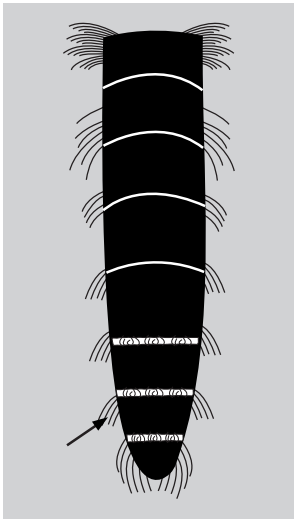
1. *Cx. bitaeniorhynchus*
2. *Cx. gelidus*
3. *Cx. pseudovishnui*
4. *Cx. tritaeniorhynchus*
5. *Cx. vishnui*
6. *Cx. whitmorei*

Cx. fuscocephala, Cx. perexiguus and *Cx. quinquefasciatus,*

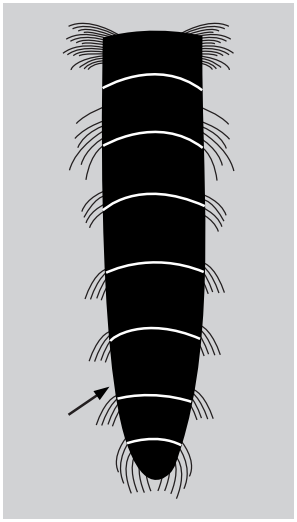
pale bands on abdominal terga



Cx. quinquefasciatus



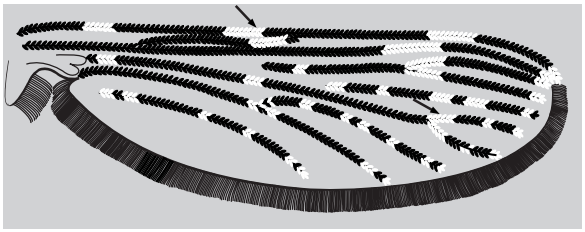
Cx. perexiguus



Cx. fuscocephala

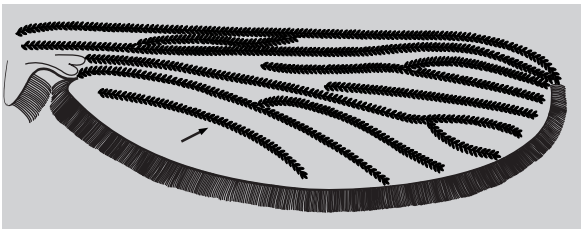
Cx. bitaeniorhynchus, Cx. gelidus, Cx. pseudovishnui, Cx. tritaeniorhynchus, Cx. vishnui, Cx. whitmorei

White spots on wings



Present

Cx. bitaeniorhynchus

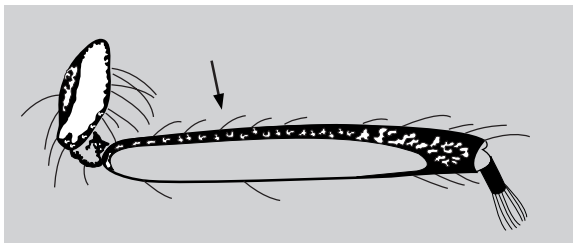


Absent

1. *Cx. gelidus*
2. *Cx. pseudovishnui*
3. *Cx. tritaeniorhynchus*
4. *Cx. vishnui*
5. *Cx. whitmorei*

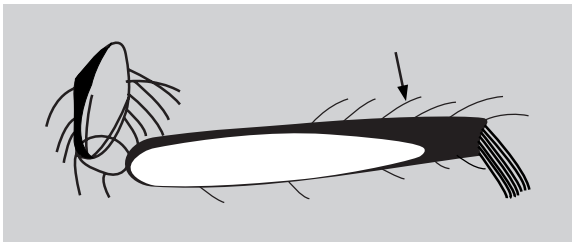
Cx. gelidus, Cx. pseudovishnui, Cx. tritaeniorhynchus, Cx. vishnui and Cx. whitmorei

Dark pale scaled area on hind femur



Present

Cx. vishnui

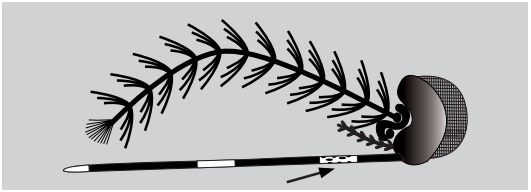


Absent

1. *Cx. gelidus*
2. *Cx. pseudovishnui*
3. *Cx. tritaeniorhynchus*
4. *Cx. whitmorei*

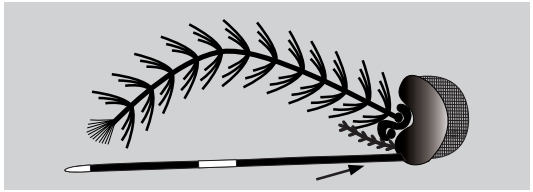
Cx. gelidus, Cx. pseudovishnui, Cx. tritaeniorhynchus, Cx. whitmorei

Proboscis with accesssory pale patches



Present

Cx. tritaeniorhynchus

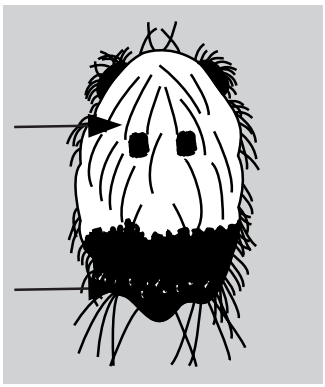


Absent

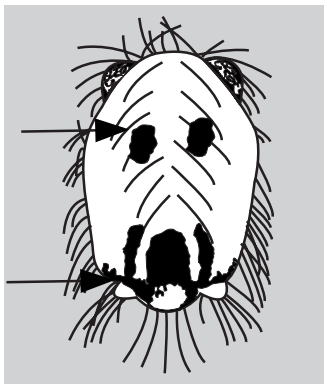
1. *Cx. gelidus*
2. *Cx. pseudovishnui*
3. *Cx. whitmorei*

Cx. gelidus, Cx. pseudovishnui, Cx. whitmorei

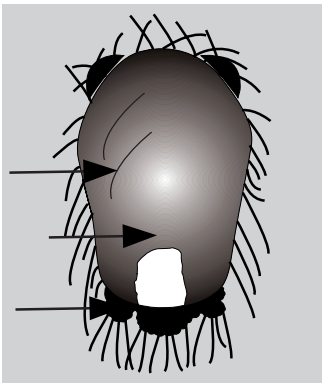
See pattern of scales on mesonotum & scutellum



Cx. gelidus



Cx. whitmorei

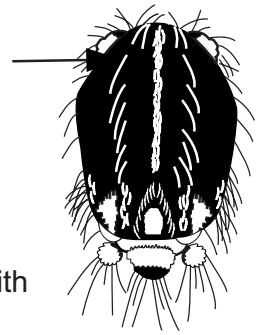


Cx. pseudovishnui

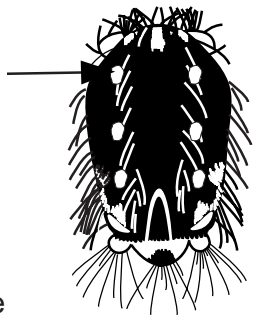
Ae. aegypti , Ae. albopictus, Ae. niveus and *Ae. vittatus*

See thorax

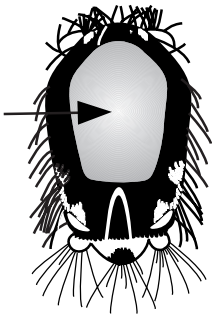
Mesonotum marked with a pair of lateral curved white lines (Half moon shape)
Ae. aegypti



Mesonotum with narrow median silvery white line
Ae. albopictus

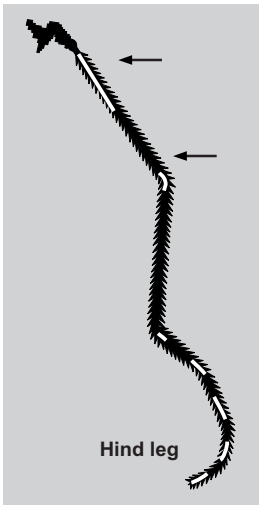


Mesonotum with 4 to 6 small white spots
Ae. vittatus

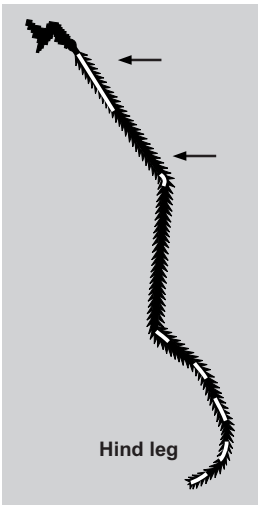


Mesonotum covered with white scales
Ae. niveus

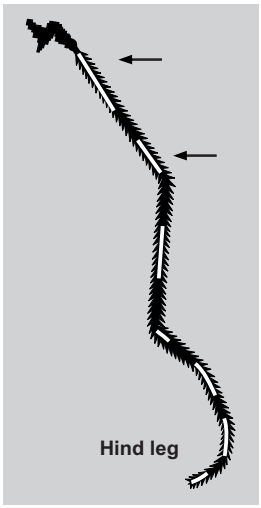
Other important characters for *Ae. aegypti* , *Ae. albopictus, Ae. vittatus, and Ae. niveus*



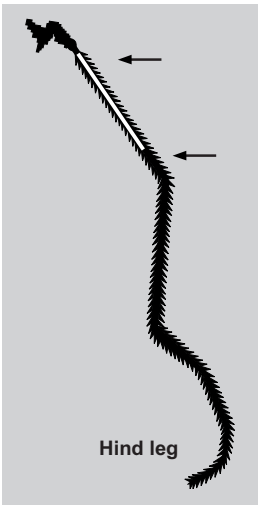
Ae. aegypti



Ae. albopictus



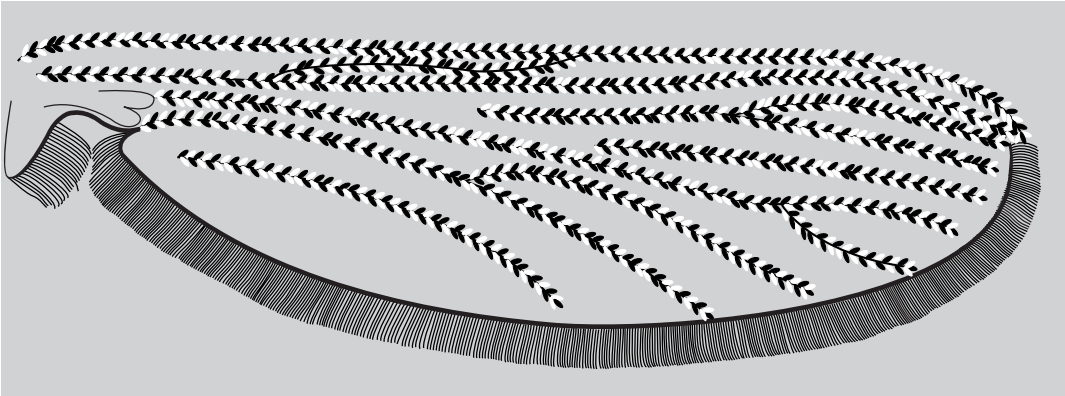
Ae. vittatus



Ae. niveus

Mansonia

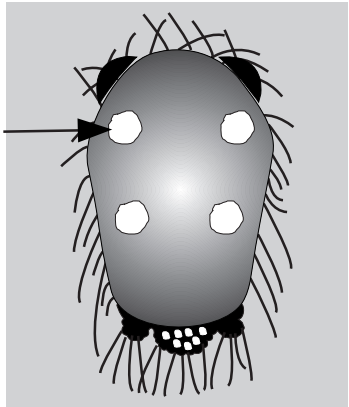
Ma. annulifera, Ma. uniformis and Ma. indiana



Wing with broad, often asymmetrical scales; dark and pale scales intermixed

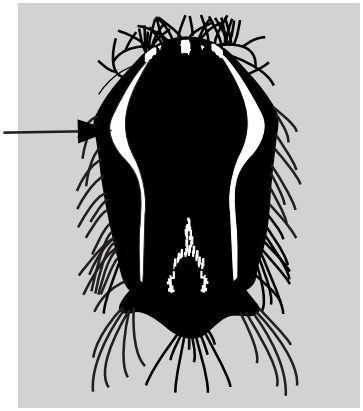
Mansonia

See mesonotum and scutellum



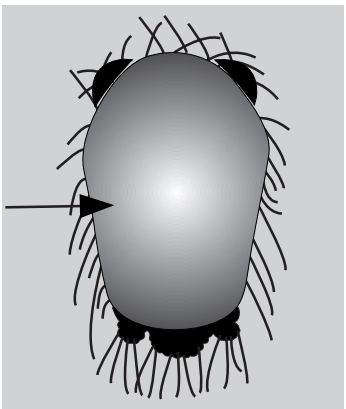
Mesonotum with 4 round white spots and mid-mode of scutellum with broad white scales

Ma. annulifera



Mesonotum marked with a pair of sublateral greenish stripes and scutellum black

Ma. uniformis



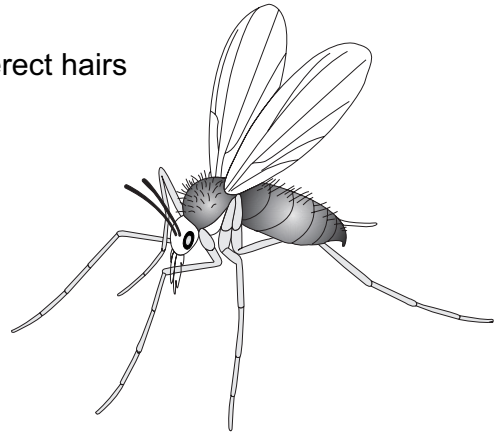
Mesonotum dark brown with same white scales scutellum black

Ma. indiana

Sandfly (*Phlebotomus*)

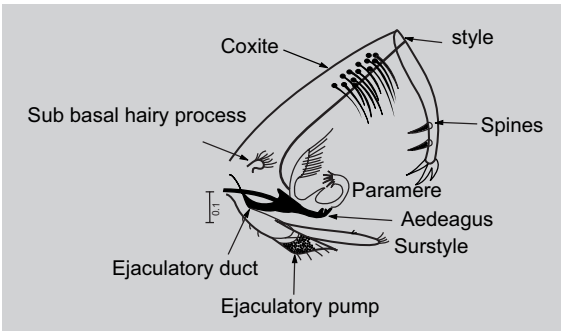
identification of genus *Phlebotomus*, Subgenus *Phlebotomus*, *Euphlebotomus* and their species is based on morphological characters and male or female genitalia

1. Abdominal tergites 2-6, uniformly erect hairs
2. Cibarium without teeth
3. Wings always erect

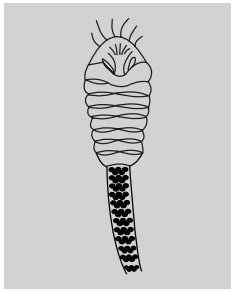


Subgenus: *Phlebotomus*

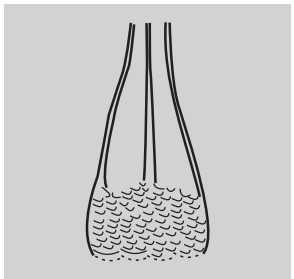
1. Terminalia very long. paramere with 2 long dorsal processes
2. Style long with 5 short spines
3. Coxite with long and thick setae in distal part and very small basal process
4. Surstyles with short spines



Terminalia



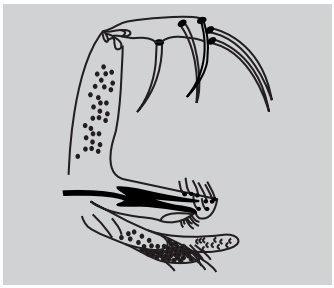
Spermatheca



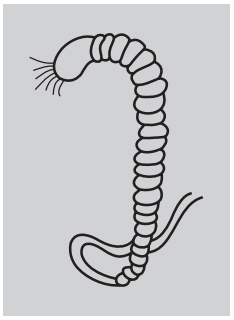
Base of pharynx

Subgenus: *Euphlebotomus*

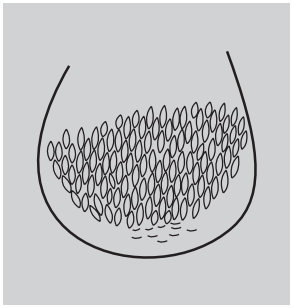
1. Style with 5 -6 spines
2. Coxite with basal process
3. Paramere with 1-2 ventral process or a tubercle
4. Short aedeagus with long lateral spine



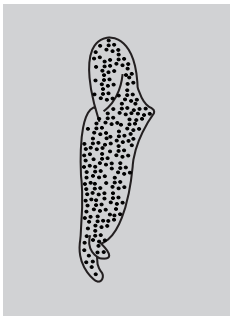
Terminalia



Spermatheca



Base of pharynx



Haltere of male

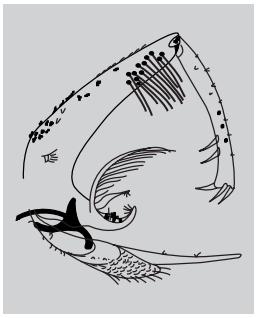
Species identification

***P. papatasi* male/female**

1. Distal part of parameres strongly curved up
2. Second dorsal process long and thin.
3. Surstyle with two or three similar spines
4. Pharynx with uniform squamae
5. Spermatheca cylindrical (female)

***P. argentipes* male/female**

1. Paramere with 2 ventral long processes
2. Coxite wide
3. Spermatheca short with about 15-17 segment (female)



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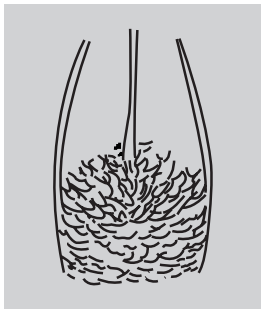
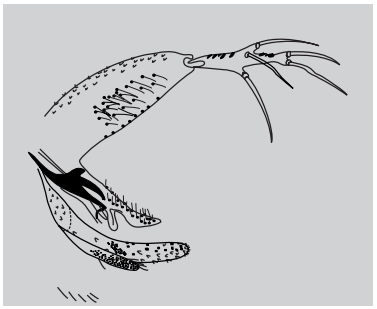
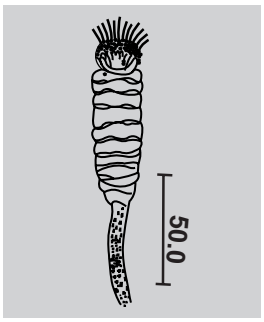


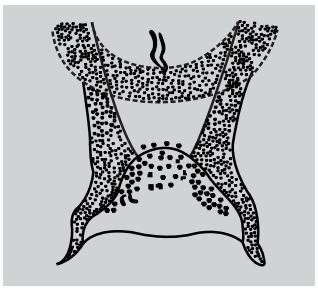
Base of pharynx (Female)



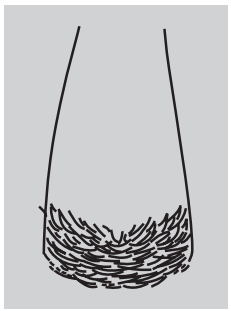
Terminalia



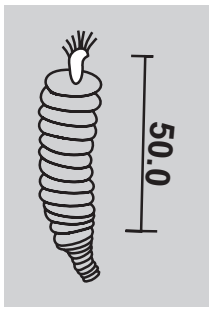
Spermatheca cylindrical (female)



Cibarium (female)



Base of Pharynx (female)



Spermatheca cylindrical (female)

Bionomics of vectors

Knowledge of vector biology plays a very important role in developing cost-effective vector control strategies. Therefore, breeding, resting, feeding and biting habits of 74 species of mosquitoes and 2 species of sandfly are given in the table below.

S.No	Vector Species	Breeding Habitats	Bionomics
A	**Vector of malaria (*Anopheles*)**		
1	*An. aconitus*	Cultivated rice fields and swampy areas. Other natural and human-made larval sites include lakes, swamps, marshes, flooded grassland, shallow ponds, ground depressions, pools in rocks, creeks and river beds, irrigation channels, fish ponds, roadside storm water drains, open ditches and tanks (reservoirs) with grassy margins.	Females feed on humans both inside and outside houses and in varying proportions, depending on location, generally with no strong preference reported. Feeding can occur throughout the evening, typically beginning at dusk, with the majority of females feeding on humans before midnight. Common human-made resting sites are found in and around animal shelters.
2	*An. annularis*	Stagnant water with thick grassy edges in permanent ponds, ground pits, tanks, swamps, stagnant drains and rice fields.	Adults zoophilic, Females enter human dwellings and animal shelters. They are primarily zoophilic but are known to bite humans even in the presence of cattle.
3	*An. argyropus*	Rice fields and swamps	Rest in cattle sheds and houses. It seems to be more attracted to cattle than human.
4	*An. baimaii*	Rock pools along the banks of thickly shaded streams, in cut bamboo stumps animal footprints, wheels and cart tracks along paths and roads, animal wallows, seepage pools, shallow streams, ditches, and rice paddies.	Considered very anthropophilic in their blood feeding preference and demonstrate both exophagic and endophagic behaviors, and in some cases greater tendency toward exophily
5	*An. balabacensis*	Forest inland areas in shaded temporary pools, muddy animal wallows and hoof-prints.	The biting activity of *An. balabacensis* is strongly exophagic in the mountainous area of Indonesia where biting activity was highest from 19:00 and 21:00 and gradually decreased toward morning.
6	*An. barbirostris*	Ditches, Ponds, Rice fields, Tyre trail.	Females of *An. barbirostris* s.l. bite humans but generally prefer to feed on other animals, especially bovids. Feeding apparently takes place outdoors, but adults have been collected resting inside houses and animal shelters as well as outside.
7	*An. barbumbrosus*	Partially shaded and sunlit fresh and slowly running water, grass-fringed streams to stagnant water pools and man-made place like rice fields	Outdoor mosquito species, rarely found indoor places.

S.No	Vector Species	Breeding Habitats	Bionomics
8	*An. bengalensis*	Seepage springs/slow running streams with clear water, isolated pools along a stream, animal hoof-prints, bamboo grooves	Found at altitudes between 500 m and 2000 m
9	*An. cracens*	Breeds in stagnant (or very slowly flowing) water, such as pools, puddles, small pits , animal footprints, wheel ruts, hollow logs, streams and even wells in forests and fruit or rubber plantations.	Anthropophilic species with peak biting at 1900–2100 hours
10	*An. crawfordi*	Marshes and ground pools	It is more attracted towards man than monkeys.
11	*An. culicifacies*	fresh (unpolluted) water, artificial water containers and unused swimming pools, river-bed pools, rain water collections, streams, rice- fields, seepage water, borrow pits, irrigation channels.	Adult biting activity occur during the first half of the night in cooler months (November-March) and during the second and third quarters of the evening in the warmer months (September-October), although peak biting activity has also been reported as occurring around 23:00 to midnight. Post-feeding behaviour of the species showed a higher tendency for resting indoors, mainly in cattle sheds
12	*An. dirus*	Breeds in small, shallow, usually temporary, mostly shaded bodies of fresh, stagnant (or very slowly flowing) water, such as pools, puddles, small pits (e.g. gem pits), animal footprints (e.g. elephant footprints), wheel ruts, hollow logs, streams and even wells located in primary, secondary evergreen or deciduous forests, bamboo forests and fruit or rubber plantations.	Highly anthropophilic, exophagic as well as endophagic, and exophilic. in Thailand, *An. dirus* has a tendency to bite between 20:00 and 23:00
13	*An. dravidicus*	Permanent or semi-permanent bodies of clean water that are often exposed to direct sunlight, including ponds, lakes, swamps, ditches, wells, different types of pools i.e. grassy, sandy, ground, flood, stream	Female mosquito is attracted more towards cattle than human. Peak biting time 18:00-21:00
14	*An. farauti*	Forest inland areas in shaded temporary pools, muddy animal wallows and hoof-prints	*An. farauti* s.s. readily bites humans. Feeding of *An. farauti* s.l. is mainly nocturnal and continues throughout the evening, however, daytime biting can occur. Females readily attack humans inside and outside houses. Indoor resting behaviour occurs before and after feeding, but habits are varied.

S.No	Vector Species	Breeding Habitats	Bionomics
15	*An. fluviatilis*	Slow-flowing streams or river margins, in direct or diffuse sunlight, rice fields, often in low numbers, possibly washed into the fields from the irrigation channels where they tend to be found in higher densities.	The most anthropophilic and endophilic species. Biting activity begins around 19:00 and peaks between 20:00 and 21:00, but may also occur throughout the night until dawn without an apparent peak.
16	*An. hackeri*	Split bamboo, cavities of leaf bases	Generally bites macaques, exophilic and early biters
17	*An. introlatus*	Prefers to breed in shaded rocky pools, ground pools, in jungle areas and also breeds in rocky stream pools, wheel ruts, hoofprints and elephant footprints.	Attracted to monkeys at canopy level compared to humans. Rest and feed outdoor
18	*An. jamesii*	Prefers to breed mainly in tanks, fallow and growing rice fields	Rests inside houses and cattle sheds during day time.
19	*An. jeyporiensis*	Along margins of slow-moving streams and channels with grassy edges, pools, ponds, swamps and terraced rice fields.	It's an early biter, generally anthropophilic. The species is found in large numbers in cattle sheds and to a lesser extent inside houses.
20	*An. karwari*	Shady areas including marshes, small, slow-moving streams, seepages, ground and rock pools, springs, and rice fields.	Females are generally anthropophilic. Rests inside houses and cattle sheds during day time.
21	*An. kochi*	Breeds in shallow muddy collections of water, ground pools with or without grass, hoof- prints, rice fields.	The adults rest mainly outdoors. It is found more at night times in houses. The female bites man readily.
22	*An. koliensis*	Forest inland areas in shaded temporary pools, muddy animal wallows and hoof-prints	Females are generally strongly anthropophilic although they also feed on animals (birds, dogs and pigs). This species readily bites outdoors and freely enter houses to feed but does not rest indoors for long periods of time either before or after feeding, only rarely being found resting inside dwellings throughout the evening and/or during the day. Biting occurs throughout the night both indoors and outdoors with the greatest activity often occurring later in the evening between midnight and dawn.

S.No	Vector Species	Breeding Habitats	Bionomics
23	*An. koreicus*	Larvae are found more frequently in low mountain regions in relatively cool water, such as springs and stream bed pools.	It is anthropophilic mosquito species, primarily exophilic.
24	*An. latens*	Ground pools and stream margins, turbid water in grounds	Found in forest fringes and dense jungles. Female bites throughout the night. Peak biting time is from 24:00- 2:00
25	*An. lesteri*	The larvae occur in marshes, ground pools, ponds, rice fields and other impounded waters	Rest in cool and shaded places, and have been collected in cow sheds and houses. *Anopheles lesteri* populations reach their peak in August. Regarded as anthropophilic, readily attacks humans. Peak biting activity is from 22:00 and 23:00
26	*An. lindesayi*	Ground pools, rocky pools in mountain streams, stream bed pools, paddy fields, rock holes, seepage pools. Hoofprints, seepage pools in rock with decaying leaves, grass, muddy pools, truck trail pools, wooden wells etc.	It is a high altitudes species. Adults feed throughout day time.
27	*An. macarthuri*	Breed in clean seepage pools, side pools of the stream, river, roadside pools, elephant foot prints, flood pools and seepage spring in the forest area.	Species is exophilic and exophagy and bites more to animals.
28	*An. maculatus*	Clear moving water, permanent or semi-permanent bodies of clean water that are often exposed to direct sunlight, including ponds, lakes, swamps, ditches, wells, different types of pools (grassy, sandy, ground, flood, stream), margins along small, slow-flowing streams, gravel pits along stream margins, seepages, springs, rice fields	Females are more strongly attracted to cattle than humans, but freely bite people both inside and outside houses. *Anopheles maculatus* early biter and peak occur between 18:00 and 21:00.
29	*An. minimus*	Breeds in streams, canal with slow running clear and cool water in foothills areas. It also breeds in ditches, channels in tea garden, borrowpits, rice fields and seepages. The species prefers to breed in shady places.	Females of *An. minimus* mainly bite humans but the degree of anthropophily/zoophily depends on the availability of alternative hosts (e.g. cattle). *Anopheles minimus* tends to bite later, with peak activity occurring around 22:00

S.No	Vector Species	Breeding Habitats	Bionomics
30	*An. nigerrimus*	Deep, cool, semi-open large bodies of water with some emergent or floating vegetation in open sunlight to moderate shade. Habitats include canals, large open marshes, large stream pools and rice fields	It is zoophilic mosquito but bites human also and primarily exophilic.
31	*An. nilgiricus*	Cement tanks, lakes, mud pools, paddy field, hoofprints	It is a species of high altitudes. Adults feeding throughout day time.
32	*An. nitidus*	Commonly breeds in rice fields, tanks, pits, stream pools	Outdoor resting
33	*An. nivipes*	Marshy lands, Ponds, Rice fields with good vegetation	Host seeking behaviour relatively high in the early evening and then declined, but they increased again in the early morning.
34	*An. notanandai*	Ponds, lakes, swamps, ditches, wells, pools	Most commonly attracted to cattles than humans.
35	*An. pallidus*	Stagnant waters, Ditches, Ponds with vegetation, shallow pools in beds of stream.	Exhibits opportunistic blood-feeding behavior, in that they prefer to feed on accessible hosts, either human or animal.
36	*An. paraliae*	Marshes, ground pools, ponds, rice fields and other impounded waters	Forest fringe area. Anthropophilic, readily attacks humans. Peak biting activity is from 22:00 to 23:00
37	*An. peditaeniatus*	Ditches, Ponds, Rice fields, Tyre trail	Bites both indoor (20:00-2100 h) and outdoors (18:00-20:00 h)
38	*An. philippinensis*	Marshy lands, Ponds, Rice fields with good vegetation	*An. philippinensis* appears to be mostly anthropophilic and available in broken forest areas. It's a mid night biter, mainly exophagic and exclusively exophilic
39	*An. pseudojamesii (An. ramsayi)*	Rain water pools, tanks and swamps with heavy growth of vegetation	Rests inside houses and cattle sheds in small numbers. Bites between 19:00-21:00 h
40	*An. pseudowillmori*	Ground Pools, Streams and Rice Fields.	*An. pseudowillmori* prefers to bite out doors. Biting activity peak in the mid-night

S.No	Vector Species	Breeding Habitats	Bionomics
41	*An. pujutensis*	Breeds in small, shallow, usually temporary, mostly shaded bodies of fresh, stagnant (or very slowly flowing) water, such as pools, puddles, small pits (e.g. gem pits), animal footprints (e.g. elephant footprints), wheel ruts, hollow logs, streams and even wells located in primary, secondary evergreen or deciduous forests, bamboo forests and fruit or rubber plantations.	Highly anthropophilic, exophagic as well as endophagic, and exophilic. In Thailand, it has a tendency to bite between 20:00 and 23:00
42	*An. punctulatus*	Forest inland areas in shaded temporary pools, muddy animal wallows and hoof-prints	Females readily attack humans outdoors and also enter houses in search of hosts. Individuals that feed in houses may rest indoors for the entire evening and daytime but the vast majority of females leave before dawn to rest outdoors. Peak activity occurring around or after midnight in some areas.
43	*An. pursati*	Rice field in plain, but also has many manmade canals and ponds	Considered also as an economic pest of cattle because of its vicious biting-behavior
44	*An. sawadwongporni*	Permanent or semi-permanent bodies of clean water that are often exposed to direct sunlight, including ponds, lakes, swamps, ditches	Freely bite human both inside and outside houses. Appear to be the least zoophilic species and exhibit early biting activity, peaking between 18:00 and 21:00 h.
45	*An. scanloni*	Standing and slowly moving water in deep forest. Also breeds in pools connected with streams, rock pools, in the bed of rivers, Gem pits, wells in forest areas	Found in evergreen forest, deciduous forest. Highly anthropophilic and exophagy and endophagy depend upon area to area. Rest mostly outdoors. Bites in the mid night.
46	*An. sinensis*	Stagnant waters, rice fields and swampy areas, lowland, shallow, fresh-water habitats with emergent and/or floating vegetation in open agriculture lands (mainly rice fields). They also utilise stream margins, irrigation ditches, ponds, marshes, swamps, bogs, pits, stump ground holes, grassy pools, flood pools, stream pools, rock pools, seepage- springs and wheel tracks.	Feed throughout the night, with peak activity apparently occurring at different hours depending on locality. Under normal circumstances, females are predominantly zoophilic and exophilic, infrequently biting humans in the presence of their preferred hosts (buffalo and cattle)

S.No	Vector Species	Breeding Habitats	Bionomics
47	*An. sineroides*	Breeds in ponds and ground pools, also from rock holes, fresh clean water in well , shaded margins of small streams, ditches and ground pools.	Occurs more frequently at higher elevations than in lowlands. Bites before mid night.
48	*An. splendidus*	Breeds in Hill streams, jungles, ponds, pools with algal vegetation and also tanks and lake margins with vegetation.	It is found in small numbers in houses and cattle sheds. Primarily a cattle feeder but may occasionally bite man.
49	*An. stephensi*	*An. stephensi* larvae utilise fresh-water pools, stream margins and stream beds, catch basins, seepage canals, wells and domestic water- storage containers.	*Anopheles stephensi* is generally considered to be an endophilic and endophagic species even though it bites outdoors during the warmer/summer months due to greater outdoor activity of humans and domestic animals.
50	*An. subpictus*	Natural larval habitats include ponds, well, borrowpits, lagoons, shallow ponds, marshes, slow-flowing rivers, natural pools and margins of small streams, also highly associated with rice fields and irrigation schemes, etc.	*Anopheles subpictus* appears overall to exhibit an endophilic resting habit. It is generally zoophilic. Bites throughout the night but peak biting occurs in early hours i.e. 18:00-20:00 h.
51	*An. sundaicus*	Breeds in natural fresh and brackish water impoundments, often with dense aquatic vegetation in coastal areas.	Females are mainly anthropophilic and exhibit both endophagic and exophagic feeding habits. Peak biting activity typically occurs between 20:00 and 03:00 depending on locality.
52	*An. tessellatus*	Larval habitats are collections of dirty stagnant water in sun or shade.	Adults primarily zoophilic but will enter houses to bite man.
53	*An. theobaldi*	Found more frequent in streams than still water	Females are more strongly attracted to cattle than humans.
54	*An. umbrosus*	Larvae found in still, shaded, dark, acidic water with emergent vegetation or numerous leaves in the water. Habitats include freshwater swamps, jungle pools, large isolated stream pools. Swamp forest edge in ditches with vegetation.	Adults are exophagic and mid night biters.
55	*An. vagus*	Breeds in Ditches, Ponds, pools, rainwater collection, Rice fields, Tyres, Animal hoof print, Puddle and also breed in muddy water collection.	*An. vagus* are zoophilic, exophilic and exophagic in nature. Bites early hours i.e. 18:00 - 20:00 h.
56	*An. varuna*	Breeds primarily in a natural stream that also doubled as an irrigation conveyance canal, streambed pools.	Generally regarded as anthropophilic mosquito, readily collected in houses and cattle sheds. Indoor biting between mid night and dawn. Also outdoor resting.

S.No	Vector Species	Breeding Habitats	Bionomics
57	*An. willmori*	Breeds in slow running stream margins, rice fields, pits and wells	Anthropophilic and opportunistic feeding behavior, freely bite people both inside and outside houses. Exhibit early biting activity
58	*An. yatsuschiroensis*	Paddy fields, irrigation ditches, creeks and so forth;	Adult populations are highest in June and October. Peak biting activity is from 21:00 to 22:00
B.	**Vectors of Filariasis and Japanese encephalitis *(Culex)***		
59	*Cx. bitaeniorhynchus*	Larvae are restricted to ground water habitats containing *Spirogyra*.	Females are blood feeders of birds and sometimes humans.
60	*Cx. fuscocephala*	Breeds in ground pools and rice- fields and in highly polluted water such as drains, cesspool and bamboo pits.	Bites both human and animal. Rest both outdoor and indoor.
61	*Cx. gelidus*	Ground Pools, usually those containing much weed, Rice- fields and marshy tracts	Females are vicious biters, preferring large domestic animals to man
62	*Cx. perexiguus*	Standing water bodies, including container habitats, generally away from human habitations, and can tolerate some salinity	Believed to feed mainly on birds, females discovered to take bovine blood. Occasionally, females enter houses and bite humans
63	*Cx. pseudovishnui*	Edges of rice fields, puddles, wells	Rest in cow sheds and human habitations.
64	*Cx. quinquefasciatus*	Bodies of water containing a high degree of organic pollution and close to human habitation including stagnant drains, cesspools, septic tanks with leaks, borrow pits	Females readily enter houses at night and bite man in preference to other mammals
65	*Cx. tritaeniorhynchus*	Ground pools, rice fields, marshes, and small, stable collections of clean water around cultivated fields, ground pools, ditches	Most abundant in July, August, and September in subtropical and temperate climates. The adult females do not rest in houses or animal shelters in the daytime except in small numbers. Entry and resting at night in houses and animal shelters have been observed, but feeding probably takes place most often in the open. Feeding activity is greatest during the first hour after sunset.
66	*Cx. vishnui*	Ground Pools, Rice- fields, puddles, ditches, ponds, animal and wheel tracks and salt marshes	Females feed primarily on pigs and birds, but in their absence will readily bite man

S.No	Vector Species	Breeding Habitats	Bionomics
67	*Cx. whitmorei*	Fresh water ground pools, including ditches and puddles in rice fields containing numerous grasses	Prevalence of adults show a peak usually towards the end of rainy season. Adults attracted mainly towards cattles, but also to pigs, birds and man.
C	**Vectors of dengue, chikungunya and Zika *(Aedes)***		
68	*Ae. aegypti*	Breeds in areas of stagnant water, containers such as flower vases, uncovered barrels, buckets, and discarded tyres, overhead tanks, curing tanks and toilet tanks and is known as container breeder.	Most commonly feed at dusk and dawn, indoors, in shady areas, or when the weather is cloudy, they can bite and spread infection all year long and at any time of day. Lifespan of an adult *Ae. aegypti* is two to four weeks, eggs can be viable for over a year in a dry state.
69	*Ae. albopictus*	Tree holes, particles of plants and artificial containers, rock holes, hollow bamboo stumps and leaf axils	Typically flies and feeds in the daytime in addition to at dusk and dawn. They are strongly attracted to bite humans, but also feed on cats, dogs, squirrels, deer and other mammals, as well as birds. They bite outdoors and indoors, but are usually found outside.
70	*Ae. vittatus*	Boats, wells, tree trunks, tree holes, bamboo cups and pots, occasional utensils, rock pools, rock holes, in pools, in rock outcrops or river beds	It is a voracious biter of humans
71	*Ae. niveus*	Immatures are found in tree holes and bamboo stumps.	Females are day biter and mostly zoophilic
D	**Vector of Filariasis *(Mansonia)***		
72	*Ma. annulifera*	Pools, permanent marshy area	It is an endophilic species, prefer to rest indoor places. Adults normally active after midnight and before dawn. It shows high affinity for human biting. The biting tendency is relatively more indoors (endophagic).
73	*Ma. indiana*	Several marshy, water-logged areas suitable for the growth of *Pistia stratiotes, Salvinia auriculata, Eichhornia speciosa* etc	The biting tendency is relatively more indoors (endophagic). It shows a predilection towards cattle, with varying degrees of zoophily.
74	*Ma. uniformis*	Open swamps formed when forest is clear in which the vegetation is dominated by the swamp grasses	The biting tendency is outdoors (exophagic) for *Ma. uniformis*. It shows a predilection towards cattle, with varying degrees of zoophily.

S.No	Vector Species	Breeding Habitats	Bionomics
E	***Vector of Leishmaniasis (Phlebotomus)***		
75	*P. argentipes*	Organic soils at the junction of the floor and walls of cattle sheds and earthen houses, mud-plastered walls with cracks, and damp floors in constructions close to small water bodies and vegetation	Bites at night during 9 pm and 1 am with its peak time 11–12 pm
76	*P. papatasi*	Rodent burrows, the deep and relatively cool and humid cracks with cut roots and branches between the large cracked soil	Have a relatively long flight range and does not always stay near breeding sites

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Glossary

Abdomen The abdomen is composed of 10 segments but externally only eight segments can be seen, the last two being modified into genital organs

Accessory sector pale spot The group of pale scales sometimes occurring on the radius at or just distad of the splitting of radius-one and the radial sector

Antennae Antennae are sense organs which arise on the front of the head between the eyes and consist of a flagellum of 13 flagellomeres in females and 14 flagellomeres in males

Anterior and posterior forked cells The areas of the wing enclosed by the branches of veins 2(RS) and 4(M) are known as anterior and posterior forked cells respectively

Anthropophillc showing a preference for feeding on man even when non-human hosts are available. A relative term requiring qualification so as to indicate the extent of this preference

Apical pale band The pale or the white band which is away from the head, i.e., towards the distal end

Bands on legs There are two types of bands: (1) very narrow bands confined to the apices, i.e., towards the tips only and leaving the bases dark and (2) broad bands spreading across the joints on the bases of the next segment

Basal band third band, which is towards the basal side, is known as the basal or proximal pale band.

Costa and Subcosta The thickened anterior border of the wing is known as costa and parallel to it is the subcostal, which fuses the costa in the middle of the anterior border of the wing.

Ecology The study of the interaction between organisms and their environment

Endophily Tendency of Mosquitoes to rest indoors, whether by day or by night

Exophagy Tendency of mosquitoes to feed outdoors

Exophily Tendency of mosquitoes to rest outdoors, whether by day or by night

Fauna The animal life of a region

Female genitalia Female genitalia have no special characters which can help in the species identification, but they may be of use in the separation of species belonging to subgenus *Anopheles* from subgenus Cellia

Head The head is the smallest part of the mosquito body, is almost spherical, and is connected to the thorax through a narrow, membranous neck.

Identification The determination of the taxonomic identity of an individual

Key, taxonomic List of distinguishing morphological characters so arranged as to facilitate identification of species. The commonest form is the dichotomous key, in which the characters are displayed as pairs of alternatives ("couplets")

Labium The proboscis also consists of a sheath-like structure, known as labium, enclosing a group of six styles.

Legs

There are three pairs of legs originating from the lower side of the thorax: the forelegs, midlegs and hindlegs. Each leg consists of conical coxa, a small hinge-like trochanter, a long femur, a slender tibia, and a five- segmented tarsus

Longitudinal veins

There are six longitudinal veins known as veins 1 (R1), 2{RS), 3{R4 +5), 4(M), 5(Cu) and 6{Anal); Veins 1{R1), 3(R4 + 5). and 6(Anal) are undivided and veins 2(RS), 4(M), and 5(Cu) are bifurcated and their numbers designated 2{RS). 2.1(R2), 2.2(R3), 4(M), 4.1{M1). 4.2(M2), 5(Cu), 5.1(Cu1), 5.2{Cu2). Veins 2(RS) and 4(M) and subcosta are concave and prominent on the under surface of the wing and veins 1 (R1), 3{R4 + 5). 5(Cu). and 6(Anal)

Male genitalia

The male genitalia is also known as external genitalia, terminalia, or hypopygium-a copulatory apparatus

Palpi

A pair of palpi arises from the lower front margin of the head near the either side of proboscis.

Pre-apical dark band

The dark band between the apical and subapical pale bands is known as the pre-apical dark band or intervening dark band.

Pre-sector dark spot

The group of dark scales occurring between the presector pale and sector pale spots

Proboscis

The proboscis projects downwards and forwards from the lower front margin of the head and generally is continuously dark in colour, except the labellum, which is light yellow

Pupa

Stage between the larva and the imago in the development of the mosquito, during which it is aquatic and active but does not feed. When the larva undergoes metamorphosis into a pupa ("pupation") the fourth and last larval skin is cast off.

Resistance

1. Ability of a parasite strain to multiply or to survive in the presence of concentration of a drug that normally destroy parasites of the same species or prevent their multiplication. Such resistance may be relative (yielding to increased doses of the drug tolerated by the host.)
2. Ability in population of insects to tolerate doses of an insecticide which would prove lethal to the majority of individuals in a normal population of the same species; developed as a result of selection pressure by the insecticide. Simultaneous resistance to one or more insecticides of two different group is known as double insecticide resistance (not to be confused with insecticide cross-resistance)

Species

Group of organisms capable of exchanging genetic material with one another and incapable, by reason of their genetic constitution, of exchanging such material with any other group of organisms. The limits of species are indicated by the comparative study of morphological and other characters

Speckling in legs

Presence of scattered and irregular patches of pale spot on the femur, tibia and some tarsal segments

Susceptibility	1. Liability in a population of insects to be killed by a particular insecticide. The average susceptibility of a species or population of mosquitoes is usually measured in terms of the median lethal concentration (LC50). 2. Liability of species of mosquito to become infected when fed on a person known to be infectious; usually measured in relation to the liability of infection of another species fed at the same time on the same person 3. Liability of a person to become infected. The lower the immunity, the higher the susceptibility
Systematics	The science dealing with the diversity of organisms
Taxonomy	The theory and practice of classifying organisms
Tergites and sternites	The dorsal part of the abdomen is called dorsum and the segments are known as tergites; the ventral side is known as venter and segments are called sternites
Thorax	The thorax is the middle part of the body. It bears two pairs of wings and three pairs of legs and has three distinct parts-pronotum, scutum, and metanotum-each part consisting of one pair of legs
Vector	In malaria, any species of mosquito in which the *Plasmodium* completes its sexual cycle in nature and which is thus able to transmit the disease
Vector principal	Species mainly responsible for transmitting malaria in any particular circumstance. Principal vector may overlap or may alternate seasonally
Vector, secondary	Species thought to play a minor role in transmission in association with a principal vector and to be capable of maintaining malaria at a reduced level in the absence of the latter.
Wings	A pair of wings arises from the scutum and bears a number of important characters which help to identify the subgenus and species.
Zoophilic	Term applied to mosquitoes showing a relative preference for non- human blood even when human hosts are really available

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