THE MOSQUITOES OF NEPAL: THEIR IDENTIFICATION, DISTRIBUTION AND BIOLOGY[1]

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ABSTRACT. Three mosquito-borne diseases are prevalent in Nepal, i.e., malaria, Japanese encephalitis and filariasis. The former, transmitted by anopheline mosquitoes, has had health authorities concerned for many years, while the latter two, primarily spread by culicine mosquitoes, have only recently received national attention. In order to understand the epidemiology and control of these diseases, it is imperative that the vectors be identified. This was the motivation for the present work. Keys for the identification of anophelines have existed for many years, but were in need of revision, while none had been composed for culicine mosquitoes.

There are now 130 species and subspecies in 14 genera known from Nepal. They are all included in keys to the adult females and fourth instar larvae. Furthermore, the distribution and biology of each taxon is given as well as a glossary which will aid the user in comprehending the morphological characters in the keys.

INTRODUCTION

In Nepal 3 mosquito-borne diseases are prevalent and cause much morbidity and mortality. They are malaria (Peters et al. 1955, Brydon et al. 1961, Johnson 1966, Pradhan et al. 1970, Shrestha and Parajuli 1980, Parajuli et al. 1981, Shrestha et al. 1988), Japanese encephalitis (JE)(Pradhan 1981, Khatri et al. 1983, Henderson et al. 1983) and filariasis (Kessel 1966, Jung 1973). One of the motivations for this work has been the epidemiological necessity to identify the species transmitting these diseases in Nepal.

From 1958 to 1978 Nepal joined the world-wide effort first, to eradicate, then to adequately control, malaria. During that time it was the only vector-borne disease receiving national attention. Thus entomological work was confined to the genus *Anopheles*. Identification was accomplished by keys which we composed in 1963 (Darsie and Pradhan, unpublished data).

The other 2 diseases, JE and filariasis, are transmitted principally by culicine mosquitoes, although anophelines do play a secondary role in their spread. It has been only in the past 10 years that interest in studying and controlling these diseases has grown. With this increased attention has come the need for accurate identification of the non-anopheline mosquitoes of Nepal.

In this work, we have included our original anopheline keys with some additions and revisions, plus keys for the identification of the culicine mosquitoes. All mosquito taxa known from Nepal are incorporated in the keys.

A study of the mosquitoes of Nepal began only recently. Puri (1955) and Peters et al. (1955) were the first to report species of *Anopheles*, while Peters and Dewar (1956) were the first to record certain culicine species occurring in Nepal. Brydon et al. (1961) increased the number of anophelines to 31 species and Joshi et al. (1964) added *An. kochi*. In the following year, Joshi et al. (1965) made a major contribution by reporting 59 species of Culicinae, including 28 new country records. An extensive review of the mosquito fauna of Nepal was published by Shrestha (1966). He reported 97 species, including 36 anophelines and 61 culicines. Similar records of Nepal anophelines were included by Ramachandra Rao (1981). No new additions to the fauna were recorded until 1989, when we published 13 new country records (Pradhan and Darsie 1989). We are reporting 7 more herein, partially the result of new collections by one of us (SPP) in 1988. The species are *Aedes pulchriventer, Ae. subalbopictus, An. fragilis, An. dravidicus, Armigeres durhami, Culex infula* and *Cx. pseudovishnui*.

Over the years, various treatments of specific genera, subgenera or species groups, some of which mention Nepal, have been very useful in constructing the identification keys. They are: Abercrombie (1977), Bram (1967), Delfinado (1966), Harbach (1988), Harrison (1980), Harrison and Scanlon (1975), Huang (1972, 1977, 1979), Knight (1968), Mattingly (1957a, 1957b, 1959, 1961, 1965, 1970, 1971), Peyton (1977), Reid (1962, 1968), Reinert (1973, 1974, 1984), Sirivanakarn (1972, 1976, 1977a, 1977b), Thurman (1959), Tyson (1970) and Zavortink (1968, 1971).

Publications dealing with the mosquito fauna of India, especially that of northern India, have been helpful in interpreting the findings in Nepal. Some more recent works are Wattal et al. (1958), Ramachandra Rao et al. (1973), Bhat (1975), Das et al. (1987), Malhotra (1987) and Nagpal and Sharma (1987).

Table 1 contains a systematic list of the mosquitoes presently recorded from Nepal, i.e., 130 taxa in 14 genera and 26 subgenera. Since the last published list (Shrestha 1966), there have been added 3 new genera, *Coquillettidia, Mimomyia* and *Tripteroides* and 9 new subgenera, *Verrallina, Coquillettidia, Eumelanomyia, Heizmannia, Etorleptiomyia, Mimomyia, Topomyia, Pseudoficalbia* and *Uranotaenia*. Furthermore, the subgenera *Mochthogenes* Edwards and *Neoculex* Dyar have been deleted. The former was synonymized under *Eumelanomyia* and *Cx. brevipalpis*, formerly assigned to *Neoculex*, was transferred to *Eumelanomyia* (Sirivanakarn 1971, 1972). The genus *Tripteroides* is not on the list, since specific determination has not yet been made (Chetwyn, unpublished data).

Certain species have been included in the Nepal mosquito fauna through the courtesy of N. Burgess, Department of Military Entomology, Royal Army Medical College, Millbank, London, who collected mosquitoes in Nepal from 1983 to 1988. They are: *Ae. khazani, An. indefinitus, An. nivipes, Ar. annulitarsis, Ar. aureolineatus, Ar. dentatus,*

Table 1. Systematic list of the mosquitoes of Nepal.

***Anopheles* Meigen**
Subg. *Anopheles* Meigen
ahomi Chowdhury
aitkenii James
annandalei Prashad
barbirostris van der Wulp
barbumbrosus Strickland and Chowdhury
bengalensis Puri
fragilis (Theobald)[1,2]
gigas gigas Giles
gigas var. *baileyi* Edwards
gigas var. *simlensis* (James)
interruptus Puri
lindesayi lindesayi Giles
lindesayi nilgiricus Christopher
nigerrimus Giles
peditaeniatus (Leicester)
sinensis Wiedemann
Subg. *Cellia* Theobald
aconitus Doenitz
annularis van der Wulp
culicifacies Giles
dirus Peyton and Harrison
dravidicus Christophers[1]
filipinae Manalang
fluviatilis James
indefinitus (Ludlow)[3]
jamesii Theobald
jeyporiensis James
karwari (James)
kochi Doenitz
maculatus Theobald
majidi Young and Majid
minimus Theobald
nivipes (Theobald)[3]
pallidus Theobald
philippinensis Ludlow
pseudojamesi Strickland and Chowdhury
pseudowillmori (Theobald)
splendidus Koidzumi
stephensi Liston
subpictus Grassi
tessellatus Theobald
theobaldi Giles
turkhudi Liston
vagus Doenitz
varuna Iyengar
willmori (James)

***Aedes* Meigen**
Subg. *Aedimorphus* Theobald
caecus (Theobald)
pallidostriatus (Theobald)
pipersalatus (Giles)
punctifemoris (Ludlow)
vittatus (Bigot)
Subg. *Christophersiomyia* Barraud
annulirostris (Theobald)
thomsoni (Theobald)
Subg. *Finlaya* Theobald
albolateralis (Theobald)
assamensis (Theobald)
aureostriatus var. *greenii* (Theobald)
chrysolineatus (Theobald)
dissimilis (Leicester)
gubernatoris (Giles)
khazani Edwards[3]
pseudotaeniatus (Giles)
pulchriventer (Giles)[1]
Subg. *Mucidus* Theobald
scatophagoides (Theobald)
Subg. *Neomelaniconion* Newstead
lineatopennis (Ludlow)
Subg. *Stegomyia* Theobald
albopictus (Skuse)
gardnerii imitator (Leicester)
subalbopictus Barraud[1,2]
unilineatus (Theobald)
w-albus (Theobald)
Subg. *Verrallina* Theobald
indicus Theobald

***Armigeres* Theobald**
Subg. *Armigeres* Theobald
aureolineatus (Leicester)[3]
durhami Edwards[1]
kesseli Ramalingam[3]
kuchingensis Edwards
subalbatus (Coquillett)
Subg. *Leicesteria* Theobald[3]
annulitarsis (Leicester)[3]
dentatus Barraud[3]
dolichocephalus (Leicester)[3]
magnus (Theobald)

***Heizmannia* Ludlow**
Subg. *Heizmannia* Ludlow
himalayensis Edwards
reidi Mattingly

***Culex* Linnaeus**
Subg. *Culex* Linnaeus
barraudi Edwards
bitaeniorhynchus Giles
edwardsi Barraud
epidesmus (Theobald)
fuscocephala Theobald
gelidus Theobald
hutchinsoni Barraud
infula Theobald[1]
jacksoni Edwards
mimeticus Noe
mimulus Edwards
pseudovishnui Colless[1]
quinquefasciatus Say
sinensis Theobald
theileri Theobald
tritaeniorhynchus Giles
vagans Wiedemann
vishnui Theobald
whitei Barraud
whitmorei (Giles)
Subg. *Culiciomyia* Theobald
nigropunctatus Edwards
pallidothorax Theobald
viridiventer Giles
Subg. *Eumelanomyia* Theobald
brevipalpis (Giles)
foliatus Brug
malayi (Leicester)
Subg. *Lophoceraomyia* Theobald
infantulus Edwards
Subg. *Lutzia* Theobald
fuscanus Wiedemann
halifaxii Theobald

***Culiseta* Felt**
Subg. *Culiseta* Felt
niveitaeniata (Theobald)

***Mimomyia* Theobald**
Subg. *Etorleptiomyia* Theobald
luzonensis (Ludlow)
Subg. *Mimomyia* Theobald[3]
chamberlaini Ludlow[3]
hybrida (Leicester)[3]

***Coquillettidia* Dyar[3]**
Subg. *Coquillettidia* Dyar[3]
crassipes (van der Wulp)[3]

***Mansonia* Blanchard**
Subg. *Mansonioides* Theobald
annulifera (Theobald)

[1]New country record.
[2]Deposited in the British Museum (Natural History).
[3]Species reported by Burgess (unpublished data).

Table 1. (continued)

indiana Edwards
uniformis (Theobald)
Orthopodomyia Theobald
anopheloides Giles
Malaya Leicester
genurostris Leicester
Topomyia Leicester
Subg. *Topomyia* Leicester
aureoventer (Theobald)
Uranotaenia Lynch Arribalzaga
Subg. *Pseudoficalbia* Theobald
luteola Edwards
maculipleura Leicester
recondita Edwards
stricklandi Barraud
Subg. *Uranotaenia* Lynch Arribalzaga
annandalei Barraud
campestris Leicester
edwardsi Barraud
macfarlanei Edwards
sp. near *testacea*
Toxorhynchites Theobald
Subg. *Toxorhynchites* Theobald
splendens (Wiedemann)

Ar. dolichocephalus, Ar. kesseli, Ar. magnus, Cq. crassipes, Mi. chamberlaini, Mi. hybrida.

The systematic list is followed by the keys to adult females and fourth instar larvae. The keys have been arranged with the generic key first followed by the specific keys in alphabetical order by genus. It is gratifying to note that all adult females have been adequately described; however, immature stages of 6 species are unknown. A glossary of morphological terms used in this work, including illustrations, will be found just following the keys.

There are a number of species for which there is doubt that they occur in Nepal. They are:

***Anopheles (Anopheles) mangyanus* (Banks).** Brydon et al. (1961) and Shrestha (1966) reported this species but, since it is known only from the Philippines, the record must be a misidentification. Reid (1968) suggested that it might be *An. pampanai* Buettiker and Beales while Harrison (1980) speculated that it was a variant of *An. minimus*. We believe that it is not found in Nepal.

***Anopheles (Anopheles) pseudosinensis* Baisas.** Shrestha (1966) recorded this species from the Janakpur area, but because it is known only from the Philippines and closely related to *An. nigerrimus*, it probably was misidentified. We do not accept its occurrence in Nepal.

***Anopheles (Anopheles) umbrosus* Theobald.** It was listed by Brydon et al. (1961) and Shrestha (1966) but it is found primarily in southern Thailand, Malaysia and Indonesia. Christophers (1933) and Harrison and Scanlon (1975) reported a single female from India (Assam) and the latter authors considered the Nepal record questionable; therefore, we are deleting it pending further study.

***Anopheles (Cellia) pulcherrimus* Theobald.** It was mentioned by Shrestha(1966) but both he and Ramachandra Rao (1981) stated that it is a doubtful record in the absence of voucher specimens. It pertains to the Middle East fauna and we do not accept it.

***Armigeres (Leicesteria) flavus* Brunetti.** Specimens from Morang District were identified as this species and reported by Shrestha (1966). Since we have not seen the specimens we are not including it in the Nepal fauna pending further investigation.

***Culex (Lophoceraomyia) minutissimus* (Theobald).** Genitalia of male specimens labelled as this species were found to be *Cx. infantulus* Edwards (Sirivanakarn 1977). We are excluding it at present awaiting further confirmation.

KEYS TO THE ADULT FEMALE MOSQUITOES OF NEPAL

KEY TO THE GENERA[4]

1. Proboscis long, recurved; posterior border of wing emarginate just beyond tip of vein Cu_2 ..... *Toxorhynchites splendens*
Proboscis not only slightly curved, if at all; posterior border of wing evenly rounded or only slightly emarginated 2

2(1). Scutellum evenly rounded, with setae evenly distributed; maxillary palpi about as long as proboscis ..... *Anopheles*
Scutellum trilobed, with setae in 3 distinct groups; maxillary palpi shorter than proboscis 3

[4]Adapted from Mattingly (1971).

3(2). Proboscis with flexible joint, swollen near tip, with long setae ..... *Malaya genurostris*
Proboscis only slightly swollen near tip, if at all, with neither flexible joint nor long setae apically 4

4(3). Scutum with median longitudinal stripe of broad, white or silvery flat scales; prespiracular setae present ..... *Topomyia aureoventer*
Scutum with other pattern; prespiracular setae present or absent 5

5(4). Cell R_2 of wing always shorter than vein R_{2+3}; anal vein ending apically before fork of veins Cu_1 and Cu_2 ..... *Uranotaenia*
Cell R_2 at least as long as vein R_{2+3}; anal vein ending apically distal to fork of veins Cu_1 and Cu_2 6

6(5). Prespiracular area with setae or covered with scales 7
Prespiracular area bare 8

7(6). Abdominal terga with basal pale bands or patches dorsally; subcostal vein with patch of setae ventrally near base ..... *Culiseta niveitaeniata*
Abdominal terga entirely dark-scaled; subcostal vein without setae ventrally near base ..... *Tripteroides*[5]

8(6). Mesopostnotum with setae; scutum clothed with bright, metallic decumbent scales ..... *Heizmannia*
Mesopostnotum without setae; scutum with another type of scales 9

9(8). Fore- and midtarsomeres 1 distinctly longer than other 4 tarsomeres combined, tarsomere 4 on fore- and midlegs short, about as long as wide ..... *Orthopodomyia anopheloides*
Fore- and midtarsomeres 1 shorter than other 4 tarsomeres combined, tarsomere 4 of fore- and midlegs much longer than wide 10

10(9) Postspiracular setae present 11
Postspiracular setae absent 13

11(10). Dorsal surface of wing with broad scales; abdomen bluntly rounded apically ..... *Mansonia*
Dorsal surface of wing with narrow scales; abdomen more or less pointed apically 12

12(11). Proboscis rather stout, laterally compressed and curved; occiput with broad decumbent scales ..... *Armigeres*
Proboscis fairly slender, not compressed nor notably curved; occiput usually with at least some decumbent scales narrow (except in subgenus *Stegomyia*) ..... *Aedes*

13(10). Alula bare or with flat decumbent scales ..... *Mimomyia*
Alula fringed with narrow scales 14

14(13). Pulvilli present; tarsal claws unusually small ..... *Culex*
Pulvilli absent; tarsal claws prominent ..... *Coquillettidia crassipes*

KEY TO THE ADULT FEMALES OF THE GENUS *AEDES*[6]

1. Hindtarsomeres without pale-scaled bands 2
At least some hindtarsomeres with basal and/or apical pale-scaled bands 8

2(1). Mid- and hindfemora, tibiae and tarsomere with distinct anterior and posterior pale-scaled stripes ..... *pallidostriatus*
Mid- and hindlegs without distinct pale-scaled stripe 3

3(2). Scutum with longitudinal stripes or large patch of yellow to golden scales 4
Scutum with other pattern 5

4(3). Scutum with broad lateral stripes of yellow to golden scales; abdominal sterna with dark and pale scales; lower mesanepimeral setae present ..... *lineatopennis*
Scutum with large anterior patch of golden scales; abdominal sterna largely clothed with orange scales; lower mesanepimeral setae absent ..... *pulchriventer*

[5] No species of *Tripteroides* have been determined (Chetwyn, unpublished data).
[6] Adapted from Barraud (1934), Huang (1977), Knight (1968), Reinert (1973,1984) and Tyson (1970).

5(3). Scutum with 2 pairs of distinct submedian spots of broad white scales, 1 pair on anterior promontory and other on scutal angle; mid- and hindfemora and tibiae speckled ..... *punctifemoris*
Scutum without distinct white-scaled spots, with other pattern; mid- and hindfemora and tibiae not speckled, with other pattern of dark and pale scales 6

6(5) Abdominal terga III-IV, and occasionally V, with subbasal, pale-scaled bands; scutum largely covered with dark scales ..... *indicus*
Abdominal terga II-V dark-scaled, or with narrow basal pale bands; scutum with patches of silvery or golden scales 7

7(6). Scutum with patch of silvery scales on anterior 0.66, sometimes divided by median black-scaled stripe; hindfemur with apical 0.33 entirely dark-scaled ..... *albolateralis*
Scutum with dark scales mixed with golden scales dorsally, with patches of broad, flat, silvery scales in front of wing root; hindfemur with apical ring of silvery scales ..... *dissimilis*

8(1). At least some hindtarsomeres with both basal and apical pale-scaled bands 9
Hindtarsomeres with basal pale-scaled bands on at least some segments 12

9(8). Abdominal sterna with long scale tufts; postpronotum without scales ..... *khazani*
Abdominal sterna without such tufts; postpronotum with scales 10

10(9). Abdominal terga without basal pale-scaled bands ..... *assamensis*
Abdominal terga II-VII with narrow to moderately broad, basal bands 11

11(10). Scutum with golden scales varying from large anterior patch to longitudinal lines, background of dark brown scales; fore- and midfemora broadly pale-scaled in basal 0.5 ..... *aureostriatus* var. *greenii*
Scutum with white to creamy scales forming lyre-shaped pattern; fore- and midfemora with narrow anterior longitudinal lines of pale scales ..... *pseudotaeniatus*

12(8). Proboscis with distinct pale-scaled band near middle 13
Proboscis entirely dark-scaled or at most pale-scaled ventrally 18

13(12). Scutum with distinct spots of pale scales on dark-scaled background; femora with preapical pale-scaled bands ..... *vittatus*
Scutum with other scale pattern; femora without preapical pale bands 14

14(13). Abdomen mostly covered with pale yellow scales; scutum with tufts of brown and white scales mixed ..... *scatophagoides*
Abdomen dark-scaled with white to golden scales in various patterns; scutum without scale tufts 15

15(14). Scutum with narrow median and submedian longitudinal stripes of golden scales; hindtarsomeres 4,5 entirely dark-scaled ..... *chrysolineatus*
Scutum ornamented with pattern of gray-white to silvery scales; at least hindtarsomere 4 with pale scales 16

16(15). Wings with spots of pale scales; all femora and fore- and midtibiae with many white-scaled bands ..... *pipersalatus*
Wings without pale-scaled spots; femora and fore- and midtibiae with at most subbasal white-scaled bands 17

17(16). Hindtibia with pale-scaled band in basal 0.5; metameron with white scales ..... *thomsoni*
Hindtibia mostly dark-scaled, without basal pale band; metameron bare ..... *annulirostris*

18(12). Hindtarsomeres with narrow basal pale-scaled bands on at least some segments; fore- and midlegs with claws toothed 19
Hindtarsomeres with broad basal pale-scaled bands on at least some segments; fore- and midlegs with claws simple 20

19(18). Abdominal terga usually with median pale-scaled patches, not forming complete transverse bands; scutum with large pale-scaled patch anteriorly ..... *gubernatoris*
Abdominal terga with complete pale-scaled transverse bands; scutum with pale scales at scutal angles ..... *caecus*

20(18). Dorsocentral setae present 21
Dorsocentral setae absent 23

21(20). Scutum without patch of broad flat white scales over wing root ..... *subalbopictus*
Scutum with patch of broad flat white scales over wing root 22

22(21). Scutum with small patch of white scales on scutal angle; midfemur with scattered white scales on anterior surface ..... *unilineatus*
Scutum without patch of white scales at scutal angle; midfemur without scattered pale scales on anterior surface ..... *albopictus*

23(20). Scutum with anteromedian white-scaled patch wider than long, reaching scutal fossae laterally; some white scales in antealar area broad, flat ..... *gardnerii imitator*
Scutum with anteromedian white-scaled patch longer than wide, not reaching to scutal fossae; all white scales in antealar area narrow ..... *w-albus*

KEY TO THE ADULT FEMALES OF THE GENUS *ANOPHELES*[7]

1. Wing with 3 or fewer dark spots on costa, involving costa and vein R or wings all dark-scaled (subgenus *Anopheles*) 2
Wing with 4 or more dark spots on costa, involving costa and vein R, wing never all dark-scaled (subgenus *Cellia*) 15

2(1). Wings without definite pale-scaled markings ..... *aitkenii*
..... *bengalensis*
..... *fragilis*
Wings with some pale-scale markings 3

3(2). Palpi entirely dark-scaled 4
Palpi with pale-scaled band 8

4(3). Hindfemur with broad white-scaled band 5
Hindfemur without broad white-scaled band 6

5(4). Hindfemur with pale scales ventrally on basal 0.33; apical portion of at least 3 wing veins pale (veins R_2, 1A and at least one other) ..... *lindesayi lindesayi*
Hindfemur not pale ventrally on basal 0.33, at most with narrow circular pale band at base; apical portion of only wing veins R_2 and 1A pale-scaled ..... *lindesayi nilgiricus*

6(4). Abdominal sterna with scattered pale scales ..... *barbirostris*
Abdominal sterna without pale scales 7

7(6). Pale fringe spot on wing opposite vein R_2 ..... *barbumbrosus*
No pale fringe spot on wing opposite vein R_2 ..... *ahomi*

8(3). Hindfemoro-tibial joint with prominent tuft of black and white scales 9
Hindfemoro-tibial joint without such a tuft 10

9(7). Subcostal pale spot absent on wing ..... *annandalei*
Subcostal pale spot present ..... *interruptus*

10(8). Basal 0.25 of costa with presector, humeral and prehumeral pale spots interrupting black scales 11
Basal 0.25 of costa completely dark-scaled or at most with scattered pale scales (Hyrcanus Group) 13

11(10). Wing vein 1A with pale scales in apical 0.5; midfemur without large pale-scaled spot dorsally near apex ..... *gigas gigas*
Wing vein 1A entirely dark-scaled; midfemur with large pale-scaled spot dorsally near apex 12

[7] Adapted from Puri (1958) and Harrison and Scanlon (1975) and Rattanarithikul and Green (1987).

12(11). Pale spots in wing fringe opposite apices of vein R_{4+5}, usually vein M_1 and sometimes other veins, but variable, in addition to the usual large pale spot between veins Cu_2 and A ..... *gigas* var. *simlensis*
Wing fringe dark opposite vein R_{4+5} and with no other pale spots except the large one between veins Cu_2 and A ..... *gigas* var. *baileyi*

13(10). Basal dark spot on wing vein Cu small, separated by its own length from middle dark spot on anal vein; apical pale-scaled bands on hindtarsi narrow, tarsomere 4 without basal pale band ..... *sinensis*
Basal dark spot on vein Cu large, separated from middle dark spot on anal vein by less than its own length; pale-scaled bands on hindtarsi moderately to very broad, tarsomere 4 usually with basal pale band 14

14(13). Pale band at apex of hindtarsomere 3 and base of 4 seldom longer than length of hindtarsomere 5; abdominal tergum VIII usually with narrow scales ..... *nigerrimus*
Pale band at apex of hindtarsomere 3 and base of 4 longer than length of hindtarsomere 5; abdominal tergum VIII seldom with scales ..... *peditaeniatus*

15(1). Femora and tibiae speckled with pale and dark scales 16
Femora and tibiae not speckled 29

16(15). Some or all of hindtarsomeres 3-5 pale-scaled 17
Hindtarsomeres 3-5 entirely dark-scaled 27

17(16). Hindtarsomere 5 with basal dark-scaled band; abdominal sterna with row of conspicuous black-scaled tufts; palpi with 4 distinct pale-scaled bands, including apical band ..... *kochi*
Hindtarsomere 5 completely pale-scaled; abdominal sterna without scale tufts; palpi with 3 distinct pale bands, including apical band 18

18(17). Hindtarsomere 5 and part of 4 completely pale-scaled 19
Hindtarsomere 5, all of 4 and at least part of 3 completely pale-scaled 24

19(18). Abdominal terga II,III largely or posteriorly covered with pale scales; dark scales usually on posterolateral corners of terga IV-VIII 20
Abdominal terga II,III without scales or with some pale falcate and/or few narrow spatulate scales on posteromedian area; dark scales usually only on posterolateral corners of terga VII and/or VIII 21

20(19). Anterior surface of forecoxa with patch of dark scales at base; vein R_{4+5} with 3 dark spots, median spot occasionally absent or very long and nearly touching subbasal spot ..... (in part) *dravidicus*
Anterior surface of forecoxa with patch of pale and dark scales at base, at times entirely pale; vein R_{4+5} with 2 dark spots, or with a median spot rarely present ..... *willmori*

21(19). Abdominal terga V-VII without scales, except infrequently VII with 1-3 pale scales laterally; vein R_{2+3} forks distally at level of proximal end of preapical dark spot on vein R_1, occasionally within proximal 0.33; vein R_2 long, usually more than 2.0 length of vein R_{2+3} ..... *pseudowillmori*
Abdominal terga V-VII with numerous pale scales, but occasionally only on VII; vein R_{2+3} forks distally at level of or apical to proximal 0.33 of preapical dark spot on vein R_1; vein R_2 short, usually less than 2.0 length of vein R_{2+3} 22

22(21). Vein R_{4+5} with 3 dark spots on at least one wing ..... (in part) *dravidicus*
Vein R_{4+5} with 2 dark spots on both wings 23

23(22). Abdominal tergum IV without scales or with few posteriorly in middle; posterolateral corners of terga VII and/or VIII, rarely also tergum VI, with patch of dark scales ..... *maculatus*
Abdominal tergum IV sparsely covered with pale scales on apical 0.5-0.75; dark scale patches usually on posterolateral corners of terga IV-VII, sometimes also on III ..... (in part) *dravidicus*

24(18). Hindtarsomere 5, all of 4 and part of 3 pale-scaled ..... *theobaldi*
Hindtarsomeres 3-5 completely pale-scaled 25

25(24). Palpi speckled, apical and subapical pale-scaled bands equal in length ..... *splendidus*
Palpi unspeckled, apical and subapical pale-scaled bands unequal 26

26(25). Abdominal terga VII,VIII covered with golden scales; wing with basal 0.25 and apical 0.33 of costa mostly pale-scaled ..... *jamesii*
Abdominal terga VII,VIII with dark scales only; wing with basal 0.25 and apical 0.33 chiefly dark-scaled ..... *pseudojamesi*

27(16). Palpi with 3 pale-scaled bands, usually speckled, and apical and subapical pale bands equal ..... *stephensi*
Palpi with 4 pale-scaled bands, apical and subapical pale bands unequal 28

28(27). Hindlegs with tibiotarsal joint broadly and conspicuously banded with white scales ..... *dirus*
Hindlegs without such tibiotarsal band ..... *tessellatus*

29(15). Some or all of hindtarsomeres 3-5 pale-scaled 30
Hindtarsomeres 3-5 not pale-scaled 35

30(29). Only hindtarsomere 5 and part of 4 pale-scaled 31
Hindtarsomeres 3-5 pale-scaled 32

31(30). Palpi with 3 pale-scaled bands ..... *majidi*
Palpi with 4 pale-scaled bands ..... *karwari*

32(30). Wing vein Cu mainly dark-scaled, with dark spot at bifurcation of Cu_1 and Cu_2 ..... *annularis*
Vein Cu mainly white-scaled, with no dark spot at bifurcation of Cu_1 and Cu_2 33

33(32). Apical part of hindtarsomere 1 dark-scaled; abdominal sterna with scattered broad white scales; scales present on abdominal terga III-VII; scales also on mesokatepisternum; wing scales paler, dark spot at apex of vein R_{4+5} about as long as fringe scales ..... *pallidus*
Apical part of hindtarsomere 1 with some pale scales; pale scales on abdominal sterna VI,VIII and occasionally V; scales present on abdominal terga VI, VII and sometimes V; mesokatepisternum without scale patch; wing scales darker, dark spot at apex of vein R_{4+5} about 2.0 length of fringe scales 34

34(33). Presector dark spot on vein R usually extending basally at least to level of humeral dark spot on costa ..... *nivipes*
Presector dark spot on vein R usually not extending basally to level of humeral dark spot on costa ..... *philippinensis*

35(29). Foretarsomeres with broad, pale-scaled bands 36
Foretarsomeres entirely dark-scaled, or with very narrow pale bands 38

36(35). Subapical dark band on palpi short, usually 0.33 or less length of apical pale band; proboscis with subapical pale-scaled patch near tip ..... *vagus*
Subapical dark band on palpi usually more than 0.33 length of apical pale band; proboscis usually all dark-scaled 37

37(36). Subapical pale band on palpi usually 0.5 or more length of subapical dark band; subapical dark band commonly 0.33-0.45 length of apical pale band ..... *indefinitus*
Subapical pale band on palpi 0.33 or less length of subapical dark band; subapical dark band more than 0.5 length of apical pale band ..... *subpictus*

38(35). Apical 0.6 of palpomere 5 dark-scaled ..... *turkhudi*
Palpomere 5 pale-scaled 39

39(38). Vein R with dark spot opposite humeral crossvein; wing vein R_{4+5} mainly dark-scaled ..... *culicifacies*
Vein R opposite humeral crossvein pale-scaled; wing vein R_{4+5} mainly pale-scaled 40

40(39). Center of scutum with pale scales extending to scutellum; tarsomeres with distinct apical white bands; foretarsomere 1 with pale band 2.0 width of tarsomere ..... *jeyporiensis*
Scutum usually without scales, except on anterior promontory; foretarsomeres dark-scaled or with narrow bands or patches of pale (not white) scales 41

41(40). Palpi usually with subapical pale band much shorter than apical pale band and subapical dark band 3.0 longer than subapical pale band ..... *fluviatilis*
Palpi with subapical pale band subequal to apical pale band and subapical dark band no more than 2.0 longer than subapical pale band, usually subequal or smaller 42

42(41). Proboscis entirely dark-scaled 43
Distal 0.5 of proboscis with pale or flavescent scales on dorsal and ventral aspects or confined to ventral patch 45

43(42). Vein 1A with 3 small dark spots ..... *filipinae*
..... *aconitus*
Vein 1A with small basal and long apical area of dark scales 44

44(43). Foretarsomeres 1-4 with small dorsoapical pale patches; base of costa with presector pale spot consisting of at least 1-2 scales; vein Cu_1 with 2 dark spots ..... *minimus*
Foretarsomeres entirely dark-scaled; costa without presector pale spot; vein Cu_1 usually with 1 long dark-scaled area ..... *varuna*

45(42). Fringe on wing with pale spot opposite vein 1A; vein R_2 with pale spot near middle; vein 1A with 3 dark-scaled spots ..... *aconitus*
Fringe of wing without pale spot opposite vein 1A; vein R_2 dark-scaled near middle; vein 1A with 1 short and 1 long dark-scaled area 46

46(45). Foretarsomeres with small dorsoapical pale patches; proboscis with flavescent scales restricted to ventral patch; base of costa with presector pale spot consisting of at least 2 scales; vein Cu_1 with 2 dark-scaled spots ..... *minimus*
Foretarsomeres entirely dark-scaled; proboscis with flavescent scales usually on dorsum as well as venter; base of costa without presector pale spot; vein Cu_1 usually with 1 long dark-scaled area ..... *varuna*

KEY TO THE ADULT FEMALES OF THE GENUS *ARMIGERES*[8]

1. Postspiracular area with setae and scales; palpi no longer than 0.33 length of proboscis; scutum normal, not compressed nor produced over head (subgenus *Armigeres*) 2
Postspiracular area with dark and pale scales only; palpi longer than 0.33 length of proboscis; scutum normal or laterally compressed, but produced over head (subgenus *Leicesteria*) 6

2(1). Sterna II-VI entirely pale-scaled ..... *kuchingensis*
Sterna III-VI with dark-scaled apical bands 3

3(2). Scutum with pair of submedian longitudinal golden-scaled lines and curved golden supraalar lines; lateral pale-scaled patches of abdominal terga extending onto dorsum ..... *aureolineatus*
Scutum without golden lines, without golden supraalar scales; lateral pale-scaled patches of abdominal terga not extending onto dorsum 4

4(3). Abdominal sternum II mostly dark-scaled, sterna II, IV dark-scaled with basolateral pale patches, sternum V sometimes with apical 0.5 pale-scaled; scutum with lateral line of pale scales interrupted or absent ..... *durhami*
Abdominal sternum II pale-scaled, sterna III-V pale, with narrow to broad apical dark-scaled bands; scutum with distinct lateral line of pale scales 5

[8] Adapted from Thurman (1959) and Macdonald (1960).

5(4). Hindfemur with pale-scaled longitudinal stripe narrowing toward apex; abdominal sterna III-VI with broad dark-scaled apical bands ..... *subalbatus*
Hindfemur with pale-scaled longitudinal stripe broad to apex; abdominal sterna III-VI with narrow dark-scaled apical bands ..... *kesseli*

6(1). Abdominal terga with median basal yellow-scaled markings ..... *magnus*
Abdominal terga with other markings 7

7(6). Hindtarsi entirely dark-scaled ..... *dentatus*
Hindtarsi with pale-scaled bands 8

8(7). Clypeus with scales; palpi with pale scales apically ..... *annulitarsis*
Clypeus bare; palpi entirely dark-scaled ..... *dolichocephalus*

KEY TO THE SUBGENERA OF THE GENUS *CULEX* BASED ON THE ADULT FEMALES[9]

1. Four or more strong lower mesepimeral setae present; relatively large species ..... *Lutzia*
Lower mesepimeral setae absent, or if present, with only 1,2 weak setae; small to medium species 2

2(1). Pleuron with distinct scale patches at least on upper and lower mesokatepisternum and anterior mesepimeron ..... *Culex*
Pleuron without distinct scale patches 3

3(2). Acrostichal setae well developed ..... (in part) *Eumelanomyia*
Acrostichal setae not well developed except at anterior promontory and rarely near prescutellar space 4

4(3). Lower mesepimeral seta absent; decumbent scales on occiput narrow ..... (in part) *Eumelanomyia*
Lower mesepimeral seta present; decumbent scales on occiput broad, if only on ocular line 5

5(4). Thoracic pleuron with broad dark integumental band extending from postpronotum to mesanepimeron or with prominent dark spots ..... *Culiciomyia*
Thoracic pleuron concolorous, without broad dark integumental band ..... *(Lophoceraomyia) infantulus*

KEY TO THE ADULT FEMALES OF THE SUBGENUS *CULEX*[10]

1. One or 2 lower mesepimeral setae present; proboscis without distinct pale-scaled band; tarsomeres without pale bands at joints 2
Lower mesepimeral setae absent; proboscis with distinct pale-scaled band; tarsomeres with basal and apical pale bands 6

2(1). Anterior surface of midfemur without median longitudinal pale-scaled stripe 3
Anterior surface of midfemur with median longitudinal pale-scaled stripe 5

3(2). Abdominal terga without basal transverse, pale-scaled bands; pleuron with striking pattern of dark and pale integumental stripes ..... *fuscocephala*
Abdominal terga with basal transverse pale-scaled bands; pleuron without striking pattern of dark and pale integumental stripes 4

4(3). Integument of thoracic pleuron with dark stripe across mesokatepisternum and mesepimeron; scutal integument reddish brown ..... *hutchinsoni*
Integument of thoracic pleuron without dark stripe; scutal integument yellowish or pale brown ..... *quinquefasciatus*

5(2). Postspiracular area and base of prealar knob without pale-scaled patches ..... *vagans*
Postspiracular area and base of prealar knob with distinct pale-scaled patches ..... *theileri*

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[9] Adapted from Bram (1967).
[10] Adapted from Sirivanakarn (1976).

6(1). Wing without pattern of pale-scaled spots or streaks 7
Wing with pattern of pale-scaled spots or streaks on at least 2 areas of costa and 1 area on other veins 19

7(6). Abdominal terga II-VII largely clothed with yellowish or golden scales ..... *epidesmus*
Abdominal terga dark-scaled, with or without pale-scaled bands 8

8(7). Abdominal terga II-VI entirely dark-scaled, without pale bands or apicolateral pale patches ..... (in part) *whitei*
Abdominal terga II-VI with bands or patches of pale scales 9

9(8). Abdominal terga II-VI with apical or apical and basal pale-scaled bands 10
Abdominal terga II-VI with basal pale-scaled bands only 12

10(9). Wing with dark scales on all veins; hindtarsomeres with pale bands at bases longer than those at apices ..... *sinensis*
Wing with mixed pale and dark scales; hindtarsomeres with apical and basal pale bands about same length 11

11(10). Abdominal terga II-IV without complete apical bands of pale scales; abdominal terga not speckled with pale scales ..... *infula*
Abdominal terga II-IV with broad apical bands of pale scales; abdominal terga heavily speckled with pale scales ..... *bitaeniorhynchus*

12(9). Erect scales in center of vertex of head whitish; anterior 0.7 of scutum covered with white scales 13
Erect scales in center of vertex pale yellow, dingy white or all dark; anterior 0.7 of scutum covered with beige, yellow, golden or dark scales 14

13(12). Anterior surface of fore- and midfemora without speckling of pale scales; white-scaled patch on scutum dense, extending to wing root, dark-scaled posterior to that; wing veins R_1, R_{4+5} and Cu with narrow scales ..... *gelidus*
Anterior surface of fore- and midfemora extensively speckled with pale scales; pale-scaled patch on scutum thinner, grayish-white, extending posterior to wing root in 4 lines; wing veins R_1, R_{4+5} and Cu with broad scales ..... *whitmorei*

14(12). Midfemur with longitudinal stripe of pale scales on anterior surface; postspiracular area with small patch of semi-erect scales on lower anterior aspect 15
Midfemur entirely dark-scaled or speckling of pale scales not forming definite stripe; postspiracular area without scales on lower anterior aspect 16

15(14). Longitudinal pale-scaled stripe on anterior surface of midfemur broken into small spots at middle; costal vein entirely dark-scaled ..... *barraudi*
Longitudinal pale-scaled stripe on anterior surface of midfemur complete; pale scales present on base of costa at least to humeral crossvein ..... *edwardsi*

16(14). Anterior surface of fore- and midfemora with speckling of several pale scales at least on apicodorsal surface ..... (in part) *whitei*
Anterior surface of fore- and midfemora entirely dark-scaled 17

17(16). Erect scales on vertex mostly dark; anterior surface of hindfemur pale-scaled with narrow black-scaled ring apically; scutum covered with dark coppery gold scales ..... *tritaeniorhynchus*
Erect scales on vertex pale yellow in center, dark-scaled posterolaterally; hindfemur marked otherwise; scutum with scales paler 18

18(17). Speckling of pale scales usually present on femora and proboscis; scutum with scales brown and pale mixed in varying degrees; hindfemur without dark-scaled apical band, usually with dark subapical band extending basally to form stripe ..... *vishnui*
Femora and proboscis never speckled with pale scales; scutum with yellow to silvery scales; hindfemur with dark band apically, contrasting with pale-scaled areas ..... *pseudovishnui*

19(6). Basalmost pale-scaled costal spot involves C, Sc, R, and sometimes R_s and Cu; basal pale bands of abdominal terga narrow, usually less than 0.25 length of segment ..... *mimulus*
Basalmost pale-scaled costal spot involves only veins C and Sc; basal pale bands of abdominal terga broad, at least 0.25 length of segment 20

20(19). Scutal scales predominantly brownish; midtibia with longitudinal stripe of pale scales on anterior surface ..... *jacksoni*
Scutal scales predominantly pale; midtibia without longitudinal pale stripe on anterior surface ..... *mimeticus*

KEY TO THE ADULT FEMALES OF THE SUBGENUS *CULICIOMYIA*[11]

1. Integument of mesopleuron with prominent dark spot dorsally on mesepimeron; light brown spot on integument dorsally on mesokatepisternum ..... *nigropunctatus*
Integument of mesopleuron with brown stripe extending from postpronotum to mesepimeron 2

2(1). Narrow scales on vertex brown; cell R_2 of wing about 2.25 length of vein R_{2+3}; abdominal sterna clothed with white scales ..... *pallidothorax*
Narrow scales on vertex creamy; cell R_2 about 3.0 length of vein R_{2+3}; abdominal sterna covered with light greenish scales ..... *viridiventer*

KEY TO THE ADULT FEMALES OF THE SUBGENUS *EUMELANOMYIA*[12]

1. Acrostichal setae and lower mesepimeral seta absent ..... *brevipalpis*
Acrostichal setae and usually lower mesepimeral seta present 2

2(1). Decumbent scales on anterior margin of vertex broad, white or gray, those in central part broad and dark ..... *malayi*
Decumbent scales on vertex narrow, fine, mostly pale yellow ..... *foliatus*

KEY TO THE ADULT FEMALES OF THE SUBGENUS *LUTZIA*[13]

Abdominal terga V-VIII entirely pale-scaled or with very broad apical pale-scaled bands; terga II-VI entirely dark-scaled, or with very narrow apical pale bands; median pale band of proboscis broad, extending to near apex ..... *fuscanus*
Abdominal terga entirely dark-scaled or with apical pale bands narrow, of about same width; median pale band on proboscis restricted to basal 0.6 ..... *halifaxii*

KEY TO THE ADULT FEMALES OF THE GENUS *HEIZMANNIA*[14]

Cell R_2 2.0-2.5 length of vein R_{2+3}; hindfemur with dark dorsal stripe reaching to base ..... *reidi*
Cell R_2 3.0-3.5 length of vein R_{2+3}; hindfemur with dark dorsal stripe not reaching to base ..... *himalayensis*

[11] Adapted from Barraud (1934) and Bram (1967).
[12] Adapted from Sirivanakarn (1972).
[13] Adapted from Bram (1967).
[14] Adapted from Mattingly (1970).

KEY TO THE ADULT FEMALES OF THE GENUS *MANSONIA*[15]

1. Scutum with at least 4 distinct pale-scaled spots; rather broad flat pale scales on midlobe of scutellum ..... *annulifera*
   Scutum without distinct pale spots, if present, only faint and lightly colored; midlobe of scutellum with narrow scales 2

2(1). Scutum with sublateral longitudinal lines of greenish scales; basal pale-scaled bands on hindtarsomeres complete; middle group of spines on abdominal tergum VIII separated from lateral groups ..... *uniformis*
   Scutum with at most ill-defined spots of pale scales; basal pale-scaled bands on hindtarsomeres incomplete; middle group of spines on abdominal tergum VIII continuous with lateral spines ..... *indiana*

KEY TO THE ADULT FEMALES OF THE GENUS *MIMOMYIA*[16]

1. Wing with numerous scattered yellow scales; cell R_2 at least 4.0 length of vein R_{2+3} (subgenus *Etorleptiomyia*) ..... *luzonensis*
   Wing scales dark, except sometimes pale scales at base of vein Sc; cell R_2 at most 2.0 length of vein R_{2+3} (subgenus *Mimomyia*) 2

2(1). Hindtarsomeres without pale-scaled bands, except occasionally at base of tarsomere 1; dorsocentral setae on scutum few but strongly developed ..... *hybrida*
   Hindtarsomeres with prominent pale-scaled bands at joints; dorsocentral setae weak, more numerous ..... *chamberlaini*

KEY TO THE ADULT FEMALES OF THE GENUS *URANOTAENIA*[17]

1. Alula bare; erect scales on dorsum of head usually absent, when present, linear in shape, restricted to few on vertex and few on occiput; prealar area separated from mesokatepisternum by suture (subgenus *Uranotaenia*) 2
   Alula with few dorsomarginal scales or erect scales on dorsum of head expanded apically, numerous, covering most of vertex; prealar area not separated from mesokatepisternum by suture (subgenus *Pseudoficalbia*) 6

2(1). Hindtarsomeres with some pale scales 3
   Hindtarsomeres entirely dark-scaled 4

3(2). No pale scales on wings; hindtarsomeres 4,5 and part of 3 with pale scales ..... sp. near *testacea*
   Pale scales present on wings; hindtarsomere 5 entirely pale-scaled, 2-4 with basal pale patches only ..... *edwardsi*

4(2). No pale or blue broad flat scales along lateral margin of scutum ..... *annandalei*
   Some pale or blue broad flat scales along lateral margin of scutum 5

5(4). Abdominal terga II-IV, VI with lateral patches of pale scales; scutum with mixed dark brown and ochraceous scales ..... *macfarlanei*
   Abdominal terga II-IV, VI without lateral patches of pale scales; scutum covered with bronzy dark brown scales ..... *campestris*

6(1). Abdominal terga II-VII with bands of yellow to ochraceous scales 7
   Abdominal terga entirely dark-scaled 8

7(6). Integument of pleura uniformly light brown ..... *luteola*
   Integument of pleura yellowish, marked with conspicuous dark brown patches ..... *stricklandi*

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[15] Adapted from Wharton (1962).
[16] Adapted from Mattingly (1957a).
[17] Adapted from Barraud (1934) and Peyton (1977).

8(6). Approximately dorsal 0.5 of thoracic pleural integument dark, remainder straw-colored ..... *maculipleura*
Pleural integument uniformly pale yellow, except for postpronotum and small spot on upper mesokatepisternum ..... *recondita*

KEYS TO THE FOURTH INSTAR LARVAE OF THE MOSQUITOES OF NEPAL

KEY TO THE GENERA[18]

1. Respiratory siphon absent; seta 1 usually palmate on some abdominal terga ..... *Anopheles*
Respiratory siphon present; seta 1 on abdominal terga not palmate 2

2(1). Siphon short, attenuated, with saw-toothed process near apex, adapted for piercing plant tissue 3
Siphon not so modified, with cylindrical shape, but if attenuated apically, then without saw-toothed process 4

3(2). Setae 2,3-A about same length as flagellum; saddle bearing 3 or 4 robust setae ventrally ..... *Mansonia*
Setae 2,3-A much shorter than length of flagellum; saddle with at most 2 small, weak setae ..... *Coquillettidia crassipes*

4(2). Seta 4-X (ventral brush) with single pair of setae 5
Seta 4-X consisting of 3 or more pairs of fan-like setae 7

5(4). Setae 5,6-P normal, not fan-shaped; seta 6- and/or seta 7-M usually stout spine ..... *Tripteroides*[19]
Setae 5,6-P fan-shaped, large; setae 6,7-M not spine-like 6

6(5). Abdominal segments IV-VI with stellate setae OR maxillae with horns OR siphon index at least 6.0 ..... *Topomyia*
Abdominal segments IV-VI without stellate setae; maxillae without horns; siphon index at most 4.0 ..... *Malaya genurostris*

7(4). Siphon without pecten 8
Siphon with pecten 10

8(7). Lateral palatal brushes composed of few curved stout rods; comb scales absent .... *Toxorhynchites splendens*
Lateral palatal brushes usually composed of numerous thin, simple or pectinate filaments; comb scales present 9

9(8). Abdominal segment VIII with dorsal sclerotized plate; siphon index 3.5 or more; seta 1-A much longer than width of antenna at point of attachment .. *Orthopodomyia anopheloides*
Abdominal segment VIII without dorsal plate; siphon index 3.2 or less; seta 1-A no longer than width of antenna at point of attachment ..... *Armigeres*

10(7). Siphon with basal subventral pair of setae and row of hair-like pecten spines distally ..... *Culiseta niveitaeniatus*
Siphon with setae attached distally, usually distal to pecten, pecten without hair-like spines 11

11(10). Distal segment of antenna freely articulated, setae 2,3-A attached at joint ..... *Mimomyia*
Antenna without joint distally; setae 2,3-A attached apically or subapically 12

12(11). Siphon with 3 or more pairs of setae ..... *Culex*
Siphon with single pair of setae 13

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[18] Adapted from Mattingly (1971); the larvae of *Topomyia aureoventer* and *Heizmannia reidi* are unknown.

[19] No species of *Tripteroides* has yet been determined (Chetwyn, unpublished data).

13(12). Comb scales usually attached to comb plate; head longer than wide; setae 5,6-C often spine-like ..... *Uranotaenia*
Comb scales not borne on comb plate; head wider than long; setae 5,6-C normal, not spine-like 14

14(13). Seta 4-C well developed, multibranched, almost equal in size to seta 7-C ..... *Heizmannia himalayensis*
Seta 4-C small, variously branched, less than 0.5 length of seta 7-C, if 4-C longer, then head is subquadrate *(Mucidus)* or seta 4-C closer to seta 6-C than to seta 5-C *(Stegomyia)* ..... *Aedes*

KEY TO THE FOURTH INSTAR LARVAE OF THE GENUS *AEDES*[20]

1. Pecten with some apical spines, widely spaced 2
Pecten with spines more or less evenly spaced 7

2(1). Siphon spiculate apically and sometimes with patches of aculeae dorsally and ventrally ..... *caecus*
Siphon smooth .....

3(2). Setae 5,6-C single; comb scales 50 or more ..... *scatophagoides*
Setae 5,6-C with 3 or more branches; comb scales usually no more than 25 4

4(3). Siphon short, index 3.0 or less; comb scales 6-8 5
Siphon long, index at least 5.0; comb scales 14 or more 6

5(4). Setae 5,6-C 3-branched, with 1 branch noticeably longer and stouter, others shorter, weaker ..... *indicus*
Setae 5,6-C with branches about equal in length and thickness, usually with 4 or more branches ..... *lineatopennis*

6(4). Comb scales evenly fringed with subequal spicules; siphon index 5.0-5.6 ..... *pipersalatus*
Comb scales with prominent apical spine and small basolateral spicules; siphon index 7.0 or greater ..... *pallidostriatus*

7(1). Comb scales with prominent apical spine 8
Comb scales fringed apically with subequal spinules 13

8(7). Seta 1-A with 4-6 branches, well developed; seta 1-X shorter than saddle ..... *vittatus*
Seta 1-A single, short, usually stout; seta 1-X longer than saddle 9

9(8). Seta 4-C long, almost as long as seta 6-C 10
Seta 4-C small, much shorter than seta 6-C 11

10(9). Seta 4-X attached to poorly developed grid, basal-most seta short, about 0.5 length of seta 1-X ..... *gardnerii imitator*
Seta 4-X attached to well developed grid, basal-most seta almost as long as seta 1-X ..... *w-albus*

11(9). Abdominal segments with some stellate setae ..... *unilineatus*
Abdominal segments without stellate setae 12

12(11). Saddle completely encircling abdominal segment X, seta 2-X usually single ..... *subalbopictus*
Saddle not encircling segment X; seta 2-X usually double ..... *albopictus*

13(7). Comb with fewer than 16 scales in single row 14
Comb with 22 or more scales in double row or triangular patch 16

14(13). Seta 6-C with 4-10 branches; comb scales with apical spine more than 10 times length of subapical spicules ..... *albolateralis*
Seta 6-C with at most 3 branches; comb scales with apical spine only 2-4 times length of subapical spicules 15

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[20] Partially adapted from Barraud (1934), Huang (1977), Knight (1968), Reinert (1973) and Tyson (1970). The larva of *Ae. punctifemoris* is unknown.

15(14). Seta 6-C single, 2.0 or more length of seta 5-C; seta 10-VII double; median filaments of lateral palatal brush pectinate ..... *annulirostris*
Seta 6-C double or triple, less than 2.0 length of seta 5-C; seta 10-VII single; median filaments of lateral palatal brushes simple ..... *thomsoni*

16(13). Siphon with seta 1-S arising within pecten 17
Siphon with seta 1-S arising distal to pecten 18

17(16). Seta 1-A single; comb with 40 or more scales ..... *pseudotaeniatus*
Seta 1-A with 2-3 branches; comb with 27 or fewer scales ..... *chrysolineatus*

18(16). Siphon index 3.0-5.0; comb with 60 or more scales 19
Siphon index less than 3.0; comb with no more than 45 scales 20

19(18). Siphon index about 3.0; seta 7-C with 7-8 branches ..... *dissimilis*
Siphon index 4.0 or more; seta 7-C with 2-3 branches ..... *aureostriatus* var. *greenii*

20(18). Seta 1-C stout, apically blunt 21
Seta 1-C fine, long, attenuated apically 22

21(20). Seta 2-X double ..... *assamensis*
Seta 2-X with 4 or more branches ..... *khazani*

22(20). Setae 4,5,6-C placed far forward on dorsal apotome, in transverse line, usually with 3 or more branches ..... *pulchriventer*
Setae 4,5,6-C placed about in middle of dorsal apotome, not in transverse line, usually single ..... *gubernatoris*

KEY TO THE FOURTH INSTAR LARVAE OF THE GENUS *ANOPHELES*[21]

1. Setae 2-C more or less close together, distance between their alveoli less that that between those of setae 2 and 3; seta 1-A single or branched (subgenus *Anopheles*) 2
Setae 2-C well separated, distance between their alveoli much more than that between those of setae 2 and 3; seta 1-A single (subgenus *Cellia*) 17

2(1). Seta 1-A single, arising from dorsolateral surface of antenna; most of setae 5-7-C very short, sometimes single 3
Seta 1-A branched, arising from mesal surface of antenna; setae 5-7-C always long and branched 4

3(2). Setae 9,10-M and 9,10-T single ..... *annandalei*
Setae 9,10-M and 9,10-T sparsely aciculate ..... *interruptus*

4(2). Seta 3-C dentritic 5
Seta 3-C single, double or with few short branches 10

5(4). Seta 1-P with 6-8 branches, arising from near base 6
Seta 1-P simple, double or triple in outer 0.5 (Hyrcanus Group) 8

6(5). Seta 3-C with 12-36 thin attenuated branches, usually spread out ..... *barbumbrosus*
Seta 3-C with 19-95 thick branches, usually stiff, crowded together 7

7(6). Seta 2-C always simple ..... *barbirostris*
Seta 2-C aciculate ..... *ahomi*

8(5). Seta 4-M sinuate, with horizontally spreading branches arising from base, small, 0.33 length of seta 3-M ..... *peditaeniatus*
Seta 4-M with branches erect, not sinuate, at least 0.5 length of seta 3-M 9

9(8). Setae 5,7-VI with 6-11 branches; setae 8,9-C with 8-13 branches ..... *sinensis*
Setae 5,7-VI with 2-5 branches; setae 8,9-C with 12-24 branches ..... *nigerrimus*

[21] Adapted from Puri (1960), Harrison and Scanlon (1975) and Harrison (1980). The larvae of *An. dravidicus* and *An. pseudowillmori* are unknown.

10(4). Seta 2-C with 2-5 branches, bases not so close together 11
Seta 2-C simple, bases nearly touching 13

11(10). Seta 2-C usually single, sometimes double or triple but with many aciculae especially in middle 0.3 ..... *fragilis*
Seta 2-C with 2-9 branches, without aciculae 12

12(11). Seta 2-C with 2 branches from near base ..... *aitkenii*
Seta 2-C with 2-9 branches from about middle ..... *bengalensis*

13(10). Setae 1-II-VII and seta 3-T a well developed palmate 14
Setae 1-III-VII well developed palmates; seta 3-T not palmate 15

14(13). Seta 1-P with about 10 branches; seta 6-III plumose, with well developed branches ..... *lindesayi lindesayi*
Seta 1-P with 13-15 branches; seta 6-III aciculate, without long branches ..... *lindesayi nilgiricus*

15(13). Seta 6-V single ..... *gigas* var. *baileyi*
Seta 6-V with 2-5 branches 16

16(15). Seta 3-C with 2-6 branches; seta 4-C simple, rarely double ..... *gigas gigas*
Seta 3-C usually single; seta 4-C with 2-5 branches ..... *gigas* var. *simlensis*

17(1). Anterior tergal plates on abdominal terga III-VII very broad, with convex posterior border, extending to about middle of segment, enclosing accessory tergal plate, at least on V-VII 18
Anterior tergal plates on abdominal terga III-VII of moderate size, with concave posterior border, never enclosing accessory tergal plate 21

18(17). Seta 2-C simple; setae 0-II-VII not attached to anterior tergal plate ..... *minimus* ..... *fluviatilis*

aa. Leaflets of palmates with shoulder of blade almost truncate, filament arising from center ..... *fluviatilis*[22]
Leaflets of palmates with shoulder of blade diagonally slanted apically toward filament ..... *minimus*[22]

Seta 2-C with 1 to many lateral aciculae; setae 0-II-VII borne on or just at the margin of anterior tergal plate 19

19(18). Seta 4-C single ..... *varuna*
Seta 4-C forked or branched 20

20(19). Seta 3-C with 1-9 lateral aciculae, rarely smooth; leaflets of seta 3-T with blunt apices ..... *aconitus*
Seta 3-C simple or forked, without lateral aciculae; leaflets of seta 3-T with apices fine, attenuated ..... *filipinae*

21(17). Setae 2,3-C simple or finely aciculate 22
Setae 2,3-C with conspicuous lateral branches 32

22(21). Seta 1 only palmate on abdominal terga III-VII; setae 9,10-M and 9,10-T simple on both sides 23
Seta 1 palmate on more or fewer abdominal terga than III-VII; setae 9,10-M and 9,10-T simple, pectinate or plumose 24

23(22). Seta 1-P with 2-4 branches, not attached to setal support plate; seta 3-T a weakly developed palmate seta ..... *tessellatus*
Seta 1-P with 11-18 branches, attached to setal support plate; seta 3-T not palmate ..... *dirus*

24(22). Seta 1 only palmate on abdominal terga IV-VI, small; setae 9,10-M plumose ..... *turkhudi*
Seta 1 palmate on more than abdominal terga IV-VI; setae 9,10-M single or pectinate 25

25(24). Setae 1-I-VII palmate, those on I,II often smaller; setae 9,10-M both single, occasionally bifid or plumose 26
Setae 1-II-VII palmate, those on II often smaller; seta 9-M single, seta 10-M plumose 31

[22] Provisional separation.

26(25). Setae 9,10-M and 9,10-T simple; leaflets of palmate setae with blunt filaments; seta 2-C faintly aciculate, about 4.0 length of seta 3-C ..... *kochi*
Some of setae 9,10-M and 9,10-T plumose; leaflets of palmate setae with sharply pointed filaments; seta 2-C less than 4.0 length of seta 3-C 27

27(26). Seta 3-T not palmate; setae 9,10-P simple or occasionally 2,3-branched; setae 9,10-T plumose; seta 1-P not attached to setal support plate 28
Seta 3-T palmate; seta 9-P plumose; setae 10-P and 9-T simple; seta 10-T plumose; seta 1-P attached to setal support plate 30

28(27). Setae 3,4-C about 0.33 length of seta 2-C; seta 4-C located mesally close to seta 2-C ..... *vagus*
Setae 3,4-C more than 0.33 length of seta 2-C; seta 4-C not close to seta 2-C 29

29(28). Seta 1-P usually with 13 or more branches; seta 4-M triple, seldom double; seta 1-I usually with 9 or more leaflets ..... *indefinitus*
Seta 1-P usually with 12 or fewer branches; seta 4-M double, seldom triple; seta 1-I mostly with fewer than 9 leaflets ..... *subpictus*

30(27). Setae 2-C about 0.5 length of dorsal apotome; leaflets of palmate setae with filaments only about 0.25 length of blade ..... *majidi*
Setae 2-C not long, less than 0.5 length of dorsal apotome; leaflets of palmate setae with filaments about 0.5 or more length of blade ..... *culicifacies*

31(25). Seta 3-C always and seta 2-C usually simple; seta 4-I with 3-5 branches; seta 3-T never palmate ..... *stephensi*
Setae 2,3-C finely aciculate; seta 4-I with 6-8 branches; seta 3-T palmate or not ..... (in part) *maculatus*
..... *willmori*
..... *theobaldi*

32(21). Seta 3-C with long branches, often about as long as stem 33
Seta 3-C with short branches, never more than 0.25 length of stem 37

33(32). Seta 8-C single or forked near tip 34
Seta 8-C with 2-8 branches from near base 35

34(33). Seta 1-I palmate; live larvae usually appear dark green, often with 2-3 silvery spots ..... *annularis*
Seta 1-I with hair-like branches, not palmate; live larvae usually dirty pale yellow, without conspicuous spots ..... *jamesii*

35(33). Seta 4-C with 2-5 branches; leaflets of palmate setae with filaments about 0.5 length of blade; setae 1-3-P on common setal support plate ..... *pallidus*
Seta 4-C with 4-10 branches; leaflets of palmates with filaments about 0.25 length of blade; setae 1-3-P not attached to common setal support plate 36

36(35). Leaflet of palmate setae with filaments 0.5 length of blade, lightly but evenly pigmented; sum of branches of all setae 8,9-C minus branches of both setae 3-C usually 15 or more ..... *nivipes*
Leaflets of palmate setae usually with filaments 0.33 length of blade, with mottled pattern distally; sum of branches of all setae 8,9-C minus branches of both setae 3-C usually less than 15 ..... *philippinensis*

37(32). Seta 3-C pinnate or plumose; seta 9-T single; seta 3-T well developed palmate ..... *jeyporiensis*
Seta 3-C with few scattered branches; setae 9,10-T plumose; seta 3-T not palmate, if so, poorly developed 38

38(37). Seta 2-C exceptionally long, about 0.5 length of dorsal apotome; seta 11-P stout, somewhat truncate, with lateral spine-like branches ..... *pseudojamesi*
Seta 2-C much shorter than 0.5 length of dorsal apotome; seta 11-P hair-like, with 2-4 branches 39

39(38). Seta 8-C with 2-4 branches; seta 3-C often branched distally, with 3-7 short lateral branches; leaflets of palmates with filaments very broad at base, with blunt apex, about 0.33 length of blade ..... *splendidus*
Seta 8-C simple; seta 3-C with few fine lateral branches; leaflets of palmates with filaments not broad at base, may be blunt or sharp-pointed at apex 40

40(39). Setae 6-V-VI with 6-16 long branches; leaflet of palmates with filaments blunt ..... *karwari*
Setae 6-V-VI with 3-5 branches; leaflets of palmates with filaments sharp pointed ..... (in part) *maculatus*
..... *willmori*
..... *theobaldi*

KEY TO THE FOURTH INSTAR LARVAE OF THE GENUS *ARMIGERES*[23]

1. Abdominal segment X with both dorsal and ventral sclerotized plates ..... (in part) *magnus*
Abdominal segment X with dorsal sclerotized plate only 2

2(1). Comb scales fan-shaped with subequal spicules apically 3
Comb scales with large apical spine, fringed with tiny spicules or smooth 4

3(2). Comb scales 5,6 ..... (in part) *magnus*
Comb scales 18-25 ..... *annulitarsis*

4(2). Seta 1-X stout, simple, equal in length to saddle, inserted on saddle ..... *kuchingensis*
Seta 1-X minute, about 8-branched, arising from integument posterior to saddle 5

5(4). Seta 5-VIII small, with about 12 branches; setae 1,6-III,IV arising from setal support plates ..... *dolichocephalus*
Seta 5-VIII stout, single or double; setae 1,6-III-IV not borne on setal support plates 6

6(5). Most comb scales with prominent bare apical spine and small basolateral spicules ..... *dentatus*
Comb scales fringed in apical half with tiny spicules 7

7(6). Setae 5-,6-C separated by 2.0 more than distance between setae 4,6-C 8
Setae 4-,5,6-C equidistant, forming equilateral triangle 9

8(7). Seta 1-VII short, not reaching base of siphon; setae 2-P at least 2.0 length of seta 3-P ..... *durhami*
Seta 1-VII long, strong, reaching base of siphon; seta 2-P subequal to seta 3-P ..... *kesseli*

9(7). Comb scales 6-18; seta 5-C minute, double or triple ..... *subalbatus*
Comb scales 5 or 6; seta 5-C prominent, 4- or 5-branched ..... *aureolineatus*

KEY TO THE FOURTH INSTAR LARVAE OF THE SUBGENERA OF THE GENUS *CULEX*[24]

1. Pecten extending to near apex of siphon; lateral palatal brushes composed of laminated plates; seta 1-A short, single, inserted in proximal 0.5 of antenna ..... *Lutzia*[24]
..... *(halifaxii, fuscanus)*
Pecten restricted to basal 0.5 of siphon; lateral palatal brushes composed of filaments; seta 1-A usually multi-branched, inserted in distal 0.3 (except in most species of *Culiciomyia*) 2

2(1). Seta 4-X with 4 pairs of fan-like setae inserted on grid; seta 1-A attached near middle of antenna; seta 3-P shorter than 1-P, usually 0.5 its length, mostly double ..... *Culiciomyia*
Seta 4-X with 5 or more pairs of fan-like setae inserted on grid; seta 1-A attached to distal 0.33 of antenna; setae 1,3-P subequal in size or seta 3-P shorter than seta 1-P 3

3(2). Seta 3-P always single and subequal to seta 1-P ..... *Culex*
Seta 3-P single or branched, thinner and usually less than 0.5 length of seta 1-P 4

4(3). Seta 5-C shorter than seta 6-C ..... *Eumelanomyia*
Seta 5-C as long as or longer than seta 6-C ..... *(Lophoceraomyia) infantulus*

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[23] Adapted from Thurman (1959) and Macdonald (1960).

[24] Adapted from Bram (1967); larvae of *Cx. halifaxii* and *Cx. fuscanus* are similar and cannot be separated.

KEY TO THE FOURTH INSTAR LARVAE OF THE SUBGENUS *CULEX*[25]

1. Median labral plate of head capsule distinct from dorsal apotome 2
Median labral plate fused with dorsal apotome 17

2(1). Seta 1-C slender, distally attenuated, filamentous 3
Seta 1-C dark, stout, spiniform or foliform, pointed or blunt apically 5

3(2). Setae 5,6-C double; dorsomentum with 6 or 7 denticles on either side of median tooth ..... *fuscocephala*
Setae 5,6-C with 3 or more branches; dorsomentum with 10-12 denticles on either side of median tooth 4

4(3). Setae 2,3-A inserted apically on antenna or nearly so; siphon index less than 5.0 ..... *quinquefasciatus*
Setae 2,3-A inserted distinctly subapically; siphon index 5.0 or more ..... *vagans*

5(2). Individual comb scales fan-shaped, bordered apically by subequal spicules or with median spicule slightly longer than lateral spicules 6
At least some individual comb scales with median spine distinctly longer and broader than lateral spicules 11

6(5). Siphon fusiform, with strong subapical spine dorsally; setae 1-M,T long, multi-branched, 1-M as long as seta 3-M, 1-T about as long as seta 2-T ..... *hutchinsoni*
Siphon usually cylindrical, tapering apically, without subapical spine; setae 1-M,T short, weak, usually single to triple, shorter than setae 3-M and 2-T, respectively 7

7(6). Siphon expanded medially, index 3.0-4.0; siphonal setae in straight line ..... *gelidus*
Siphon more or less cylindrical, index 5.0 or greater; at least 1 siphonal seta dorsally out of line 8

8(7). Seta 1-IV,V long, longer than its respective segment, as long as seta 6-IV,V, usually single or double 9
Seta 1-IV,V no longer than its respective segment, shorter than seta 6-IV,V, with 3-5 branches 10

9(8). Setae 4-P and 7-I double or triple ..... (in part) *whitei*
Setae 4-P and 7-I single ..... *mimulus*

10(8). Spiracular apodeme of siphon without ventral prolongation; posterolateral spiracular lobe of spiracular apparatus small, dark brown ..... *tritaeniorhynchus*
Spiracular apodeme with ventral prolongation; posterolateral spiracular lobe of spiracular apparatus large, blackish ..... *barraudi*
..... *edwardsi*

11(5). Comb scales 5-12; siphon lightly to strongly curved dorsoapically 12
Comb scales 20 or more; siphon usually straight, gradually tapering distally 13

12(11). Siphon setae strong, 3-4 times width of siphon at point of attachment, with 2-3 branches; seta 1-IV-VI weak, not reaching apical border of its segment ..... *whitmorei*
Siphon setae weaker, 2 times or less width of siphon at point of attachment, 4- to 6-branched; seta 1-IV-VI long, reaching beyond apical border of its segment ..... *pseudovishnui*

13(11). Apical 0.5 of siphon with prominent spines on ventrolateral margin ..... *jacksoni*
Siphon without such spines 14

14(13). Comb scales 35 or more, median apical spine usually weak; seta 1-III-V long, strong simple, as long as seta 6-III-V ..... (in part) *whitei*
Comb scales 30 or fewer, with strong median apical spine; seta 1-III-V weak to moderately strong, shorter than seta 6-III-V, usually with 2-4 branches 15

[25] Adapted from Sirivanakarn (1976); the larva of *Cx. epidesmus* is unknown.

15(14). Seta 7-I double; siphon setae no longer than width of siphon at point of attachment ..... *theileri*
Seta 7-I single; siphon setae longer than width of siphon at point of attachment 16

16(15). Seta 4-P double; integument of thorax aculeate; siphon setae only slightly longer than width of siphon at point of attachment, apical 4 pairs placed close together ..... *vishnui*
Seta 4-P single; integument of thorax glabrous; siphon setae at least 2.0 width of siphon at point of attachment, apical 4 pairs more widely spaced ..... *mimeticus*

17(1). Seta 2,3-A located 0.5 distance from attachment of seta 1-A to apex of antenna; seta 4-P short, weak ..... *sinensis*
Seta 2,3-A located near to apex of antenna; seta 4-P long, strong 18

18(17). Siphon index 4.7-5.4 ..... *Culex* sp. 1
Siphon index 6.3-9.0 19

19(18). Seta 4-V with 5-8 branches; seta 4-VI with 3-5 branches; siphon usually with 8 subventral setae ..... *bitaeniorhynchus*
Seta 4-V with 10-12 branches; seta 4-VI with 6 or 7 branches; siphon with 6 subventral setae ..... *infula*

KEY TO THE FOURTH INSTAR LARVAE OF THE SUBGENUS *CULICIOMYIA*[26]

1. Siphon with false joint, an irregular ring distal to middle due to lack of sclerotization ..... *nigropunctatus*
Siphon without false joint 2

2(1). Siphon swollen in middle; pecten spines 7-10 ..... *pallidothorax*
Siphon not swollen, tapering gradually from base to apex; pecten spines 14-18 ..... *viridiventer*

KEY TO THE FOURTH INSTAR LARVAE OF THE SUBGENUS *EUMELANOMYIA*[27]

1. Setae 2,3-A inserted apically; siphon index greater than 7.0, setae small, no longer than width of siphon at point of attachment ..... *brevipalpis*
Setae 2,3-A inserted subapically; siphon index about 6.0, setae long, longer than width of siphon at point of attachment 2

2(1). Some comb scales with apical spine, others fringed apically with subequal spicules; seta 4-P strong, subequal to seta 3-P ..... *malayi*
Comb scales all fringed with subequal spicules; seta 4-P weak, not as long nor as strong as seta 3-P ..... *foliatus*

KEY TO THE FOURTH INSTAR LARVAE OF THE GENUS *MANSONIA*[28]

1. Basal 0.5 of antenna darkly pigmented, apical 0.5 light in color; precratal setae on saddle single ..... *annulifera*
Antenna with narrow dark band at base and another at level of seta 1-A; precratal setae on saddle mostly double 2

2(1). Saddle length 2 times width; seta 4-P with about 10 branches ..... *indiana*
Saddle length less than 2 times width; seta 4-P with about 4 branches ..... *uniformis*

[26] Adapted from Barraud (1934) and Bram (1967).
[27] Adapted from Sirivanakarn (1972).
[28] Adapted from Wharton (1962).

KEY TO THE FOURTH INSTAR LARVAE OF THE GENUS *MIMOMYIA*[29]

1. Siphon attenuated, without saw-toothed process; flagellum of antenna long, about 0.75 length of base ..... *hybrida*
Siphon normal cylindrical shape; flagellum of antenna about 0.25 length of base 2

2(1). Siphon index 6.0-7.0; lobes of spiracular apparatus small, without long setae; pecten absent; seta 4-X with 6 pairs of setal tufts ..... *luzonensis*
Siphon index about 5.0; lobes of spiracular apparatus large, with long setae; pecten present; seta 4-X with 8 pairs of setal tufts ..... *chamberlaini*

KEY TO THE FOURTH INSTAR LARVAE OF THE GENUS *URANOTAENIA*[30]

1. Setae 5,6-C very stout, spike-like, attached posteriorly on head, 5-C approaching middle of head; grid of abdominal segment X joined to saddle (subgenus *Uranotaenia*) 2
Setae 5,6-C not stout nor spike-like, usually attached far forward on head; grid of segment X not joined to saddle (subgenus *Pseudoficalbia*) 3

2(1). Seta 1-A foliform; comb plate on abdominal segment VIII continuous over dorsum ..... *annandalei*
Seta 1-A hair-like; comb plates on VIII separated dorsally ..... *macfarlanei*
..... *campestris*

3(1). Seta 1-C minute, often inapparent, inserted on rounded apical process of median labral plate; comb scales with apical point devoid of spicules ..... *maculipleura*
Seta 1-C prominent, blade-like or foliform, on less prominent apical process of median labral plate; comb scales with apex fringed with spicules 4

4(3). Seta 1-C blade-like, not widening apically ..... *stricklandi*
Seta 1-C foliform, widening apically ..... *recondita*

GLOSSARY OF TERMS EMPLOYED IN THE KEYS TO THE MOSQUITOES OF NEPAL[31]

ADULT FEMALE STRUCTURES[32]

Acicula - minute spine-like process.

Acrostichal setae - setae located in the mid-longitudinal line of the scutum.

Alula - a lobe on the posterior basal portion of the wing between the upper calypter and the base of the anal vein.

Anal vein - the sixth longitudinal vein of the wing; see wing illustration.

Antealar area - the part of the scutum laterally just in front of the wing root.

Anterior promontory - a broad median area at the extreme anterior end of the scutum.

Apex - the terminal end of a structure.

Apical - refers to the apex or free end of a structure.

Apicolateral - toward the apex and on the side of any structure.

Basal - refers to the part of a structure nearest the body or nearest the center of the body.

Basal dark spot - area of the costal vein of the wing at its base.

Base - the part of a structure attached to the body, or nearest the center of the body.

Cell R2 - the cell of the wing enclosed by veins R_2 and R_3.

Clavate - form of a structure which gradually thickens toward the distal end.

Claw - the hook-like structure at the apices of the legs. They can be toothed or simple. They are also called unguis.

Clypeus - sclerite of the facial area, situated below the bases of the antennae and dorsal to the base of the proboscis.

Costa - the longitudinal vein on the anterior edge of the wing.

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[29] Adapted from Mattingly (1957a).

[30] Adapted from Barraud (1934) and Peyton (1977); larvae of *Ur. edwardsi, Ur. luteola* and *Ur.* sp. (near *testacea*) are unknown.

[31] References: Harbach and Knight (1980) and Nichols (1989).

[32] See Figs. 1-4.

Costal vein - see costa.
Decumbent scales - those which are lying flat against the body surface.
Distal - part of a structure farthest from the base or body.
Dorsal - refers to the uppermost part of a structure.
Dorsocentral setae - the setae located on submedial longitudinal lines on either side of the acrostichal setae.
Dorsum - the upper surface of a structure.
Emarginate - having a notch or indentation.
Femora - plural of femur; see femur.
Femorotibial joint - the part of the leg around the union of the femur and tibia.
Femur - the third division of the leg, attached basally to the trochanter and apically to the tibia.
Flagellomere - name for the segments of the flagellum of the antenna.
Fossa - a gentle depression; usually referring to the scutal fossa, an anterolateral depression of the scutum.
Hindtarsomere - refers to the tarsal segments of the hindleg.
Integument - the exoskeleton of an insect, that is the outer covering, usually partially or entirely covered with scales or setae or both in mosquitoes.
Integumental - adjectival form of integument; see integument.
Lateral - refers to the sides of a structure.
Linear - having a form long and narrow with parallel sides.
Maxillary palpus - appendage of the maxilla located on either side of the base of the proboscis.
Medial - refers to the middle of a structure.
Median - same as medial.
Mesepimeral - adjectival form of mesepimeron; see mesepimeron.
Mesepimeron - sclerite of the mesothoracic pleuron posterior to the mesokatepisternum, rectangular in shape.
Mesokatepisternum - a large, pear-shaped sclerite on the pleuron of the mesothorax (formerly called sternopleuron).
Mesomeron - a small triangular sclerite between the mid- and hindcoxae.
Occiput - the posterior part of the dorsum of the head just posterior to the vertex but not distinctly separated from it.
Palpi - plural of palpus.
Palpomere - name for the segments of the palpus.
Palpus - refers to the maxillary palpus; see maxillary palpus.
Pleuron - the lateral aspect of a thoracic segment, composed of several sclerites.
Postpronotum - a sclerite of the prothorax, just ventral to the scutum and anterior to the mesothoracic spiracle.
Postspiracular area - part of the anterior mesanepisternum just posterior to the mesothoracic spiracle.
Postspiracular seta - seta occurring on the postspiracular area.
Prealar area - a knob-like structure just above the mesokatepisternum and just anterior to the wing root.
Preapical - refers to a location just before the apex of a structure.
Preapical dark spot - area of dark scales on the costal vein just behind its apex.
Prescutellar area - refers to the medial part of the scutum just anterior to the scutellum.
Presector dark spot - refers to a spot of dark scales on the anterior edge of the wing just behind the sector pale spot.
Prespiracular area - a small triangular area just anterior to the mesothoracic spiracular and just posterior to the postpronotum.
Prespiracular seta - seta occurring in the prespiracular area.
Proboscis - the appendage on the front of the head which contains the mouthparts extended into stylets encased in the labial sheath.
Pulvilli - plural of pulvillus.
Pulvillus - pad-like structures attached to the terminus of the legs, one arising below the base of each claw.
Scale - a modified seta composed of a slender stalk and a flattened distal part, usually widest apically.
Sclerite - a sclerotized plate of the exoskeleton limited by sutures, or divisions between sclerites.
Scutal angle - the angular projection of the scutal margin about in the middle of the scutum.
Scutal fossa - a depression in the scutum in the anterolateral third of the sclerite.
Scutellum - the strap-like division of the dorsum of the mesothorax, just posterior to the scutum.
Scutum - the largest sclerite of the dorsum of the mesothorax, preceeded by the antepronota and followed by the scutellum.
Seta - a projection from the integument, arising from an alveolus and usually becoming thinner apically.
Squama - see upper calypter.
Sterna - plural of sternum.
Sternum - the ventral sclerite of a body segment.
Subcosta - the subcostal or second vein of the wing.
Subcostal pale spot - spot of pale scales at the junction of costal and subcostal veins.
Supraalar area - area of the scutum just dorsal to the base of the wing.
Tarsi - plural of tarsus.
Tarsomere - name for any segment of the tarsus.
Tarsus - collective name for the 5 tarsal segments of the leg.
Terga - plural of tergum.
Tergum - refers to the dorsal sclerite of a body segment.
Tibia - segment of the leg between the femur and tarsus.
Tibiotarsal joint - the junction of the tibia and tarsus.
Toothed - refers to a projection from a structure, especially the tarsal claw.

Transverse - term meaning extending across a structure from side to side, from the middle to the lateral borders.
Upper calypter - lobe of the base of the wing, basal to the alula.
Vein - the longitudinal thickenings of the wing.
Vein Cu - the fifth longitudinal or cubital vein.
Vein R_{2+3} - basal part of the second longitudinal vein.
Vertex - the anterior part of the dorsum of the head, bordering the occiput behind, with no visible division between them.
Wing root - the base of the wing where it is attached to the thorax.

FOURTH INSTAR LARVA STRUCTURES[33]

Abdomen - the third major body region, consisting of 10 segments.
Accessory tergal plate - in anopheline larvae, small median or submedian sclerites located posterior to the tergal plate on some abdominal segments.
Acicula - a small, slender thorn-like spicule.
Alveoli - plural of alveolus.
Alveolus - a socket surrounded by a ring, bearing a seta.
Anal segment - the tenth segment of the abdomen.
Antenna - the appendage of the head attached anterolaterally, lateral to the lateral palatal brushes, in some genera consisting of 2 segments.
Articulating - refers to segments united by moveable joints.
Attenuated - becoming very slender toward apex.
Blade - the flat surface of a leaflet of a palmate seta.
Comb plate - a sclerotized plate located on the lateral aspect of abdominal segment VIII, to which comb scales are attached.
Comb scale - specialized spicule on the lateral aspect of abdominal segment VIII forming a comb, of varying forms.
Concave - the border is curved inward.
Convex - the border is curved outward like a sphere.
Dendritic - branching resembling the branching of a tree, having a main stem and many irregular or dichotomous branches.
Denticle - a tooth-like projection.
Dorsal apotome - the large sclerite on the dorsal aspect of the larval head (formerly called frontoclypeus).
Dorsoexternal - externally on the dorsal side of a structure.
Filament of leaflet - the apical projection from the blade of a leaflet of a palmate seta.
Filamentous - thread-like.
Flagellum - the second or apical portion of the larval antenna, found in certain genera.
Foliform - leaf-like.
Fusiform - swollen in the middle and tapering toward base and apex.
Grid - the network of sclerotized bars which make up the support for the attachment of the fan-like setae of the ventral brush.
Head - the first main body division, composed of 6 united segments.
Head capsule - the sclerotized exoskeleton forming the integument of the head.
Lateral palatal brush - the pair of brushes composed of numerous filaments, borne anterolaterally on the head (formerly called mouth brushes).
Leaflet of palmate seta - the flattened branches of the palmate seta, composed of the blade and the filament.
Maxilla - appendage of the mouthparts, usually bearing a lobe-like palpus, or sometimes a prominent "horn."
Median labral plate - dorsal sclerite of the labrum, usually separated from the dorsal apotome by the clypeolabral suture.
Mesothorax - the second segment of the thorax.
Metathorax - the third segment of the thorax.
Mouth brush - see lateral palatal brush.
Palmate - a seta with flattened branches, radiating from a common stem.
Pecten - a row of short spines on the ventroalateral aspect of the siphon.
Pectinate - having branches only on one side of a setal stem, like the teeth of a comb.
Plumose - having branches on both sides of a setal stem, but not so many as in a pinnate seta.
Precratal seta - seta of the ventral brush (seta 4-X) attached anterior to the grid, not actually attached to the grid.
Prothorax - the first segment of the thorax.
Saddle - a prominent sclerite in abdominal segment X, sometimes completely encircling the segment.
Sclerotized - hardening of the integument to form rigid structures.
Setal support plate - a small sclerotized plate to which one or more setae are attached.
Siphon - the appendage attached to abdominal segment VIII in culicine mosquitoes, used for respiration and bearing the spiracular apparatus apically.
Siphon index - the length divided by the width at the base.
Siphonal seta - seta attached to the siphon.
Spiculate - bearing spicules
Spicule - a projection on the integument continuous with the cuticle.

[33] See Figs. 5-8.

Spine - a large, stout immovable spicule.
Spinule - a minute spine-like spicule.
Spiracular apparatus - a structure consisting of 5 valves which surround the spiracular openings; sessile in anophelines and located at the apex of the siphon in culicines.
Stellate - seta with numerous branches radiating from a single base.
Tergal plate - in anopheline larvae a small plate located in the dorsal midline of abdominal segments.
Truncate - structure which is square at apex, not sharp pointed.
Ventral brush - group of setal tufts located ventrally on abdominal segment X, composed of cratal setae attached to the grid and sometimes precratal setae not on the grid but attached anterior to it (seta 4-X).

ABBREVIATIONS OF ADULT FEMALE MORPHOLOGY

FIGURE 2

A - antenna
C - coxa
CE - compound eye
Cl - claw
Clp - dorsal apotome
Fe - femur
Fl - flagellum
Fr - frons
Flm - flagellomere
La - labellum
MPlp - maxillary palpus
Occ - occiput
P - proboscis
Pe - pedicel
Plp - palpomere
Sc - scape
Ta - tarsus
Ta_{1-5} - tarsomeres
Ti - tibia
Tr - trochanter
V - vertex

FIGURE 3

Illustrations A and B
AcS - acrostichal setae
Ap - antepronotum
C-I - forecoxa
DS - dorsocentral setae
Mpn - mesopostnotum
Ppn - postpronotum
PrA - prescutellar area
Ps - proepisternum
Scu - scutum
SF - scutal fossa
Stm - scutellum
W - wing

Illustration C (Wing)
A - anal vein
A - anal cell
C - costal vein
C - Costal cell
Cu - cubital vein
Cu_1 - anterior branch of
Cu_1 - cubital cell
Cu_2 - posterior branch of cubital vein
Cu_2 - cubital$_2$ cell
FS - fringe scales
h - humeral crossvein
M - medial vein
M - medial cell
M_{1+2} - anterior branch of medial vein
M_2 - medial$_2$ cell
M_{3+4} - posterior branch of medial vein
M_4 - medial$_4$ cell
m-cu - mediocubital crossvein
R - radial vein
R - radial cell
R_1 - anteriormost branch of radial vein
R_s - radial sector vein
R_2 - anterior branch of radial sector vein
R_2 - radial$_2$ cell
R_{2+3} - connector vein of radial sector vein
R_3 - median branch of radial sector vein
R_3 - radial$_3$ cell
R_{4+5} - posterior branch of radial sector vein
R_5 - radial$_5$ cell
r-m - radiomedial crossvein
Sc - subcostal vein
Sc - subcostal cell

Illustration D (Wing spots)

A - apical pale spot
Ad - apical dark spot
as - accessory sector pale spot
Bd - basal dark spot
bs - border scales
f - fringe scales
fs - fringe spot
H - humeral pale spot
Hd - humeral dark spot
P - preapical pale spot
Pd - preapical dark spot
Ph - prehumeral pale spot
Phd - prehumeral dark spot
pi - pale interruption
Ps - presector pale spot
Psd - presector dark spot
S - sector pale spot
Sc - subcostal pale spot
Sd - sector dark spot

FIGURE 4

Ab-I - abdominal segment I
Ap - antepronotum
C-I - forecoxa
C-II - midcoxa
C-III- hindcoxa
Ce - cercus
DS - dorsocentral setae
Hl - halter
Mm - mesepimeron
Mem - metameron
Mks - mesokatepisternum
Mpn - mesopostnotum
MS - mesothoracic spiracle
Msm - mesomeron
Mtm - metepimeron
Mtn - metanotum
Mtpn - metapostnotum
Mts - metepisternum
MtS - metathoracic spiracle
PA - postspiracular area
PaS - prealar setae
PMe - pleural membrane
Ppn - postpronotum
PpS - postpronotal setae
Ps - proepisternum
PS - postspiracular setae
PsA - prespiracular area
PsS - prespiracular setae
S - sternum of abdomen
SaS - supraalar setae
Scu - scutum
SF - scutal fossa
Stm - scutellum
Te - tergum of abdomen
W - wing

ABBREVIATIONS OF FOURTH INSTAR LARVAL MORPHOLOGY

FIGURES 5, 6 AND 7

A - antenna
APP - anal papilla
ASL - anterior spiracular lobe
C - head
CS - comb scales
G - grid
IST - inner spiracular tooth
LSL - anterolateral spiracular lobe
M - mesothorax
Mx - maxilla
OST - outer spiracular tooth
P - prothorax
PP - pecten plate
PSL - posterolateral spiracular lobe
PSP - posterior spiracular plate
Pt - pecten
S - siphon
Sa - saddle
SA - siphon acus
SaA - saddle acus
SAd - spiracular apodeme
SAp - spiracular apparatus
SAW - saw
SOp - spiracular opening
T - metathorax
VII - abdominal segment VII
VIII - abdominal segment VIII
X - abdominal segment X
2-S - seta 2 of siphon

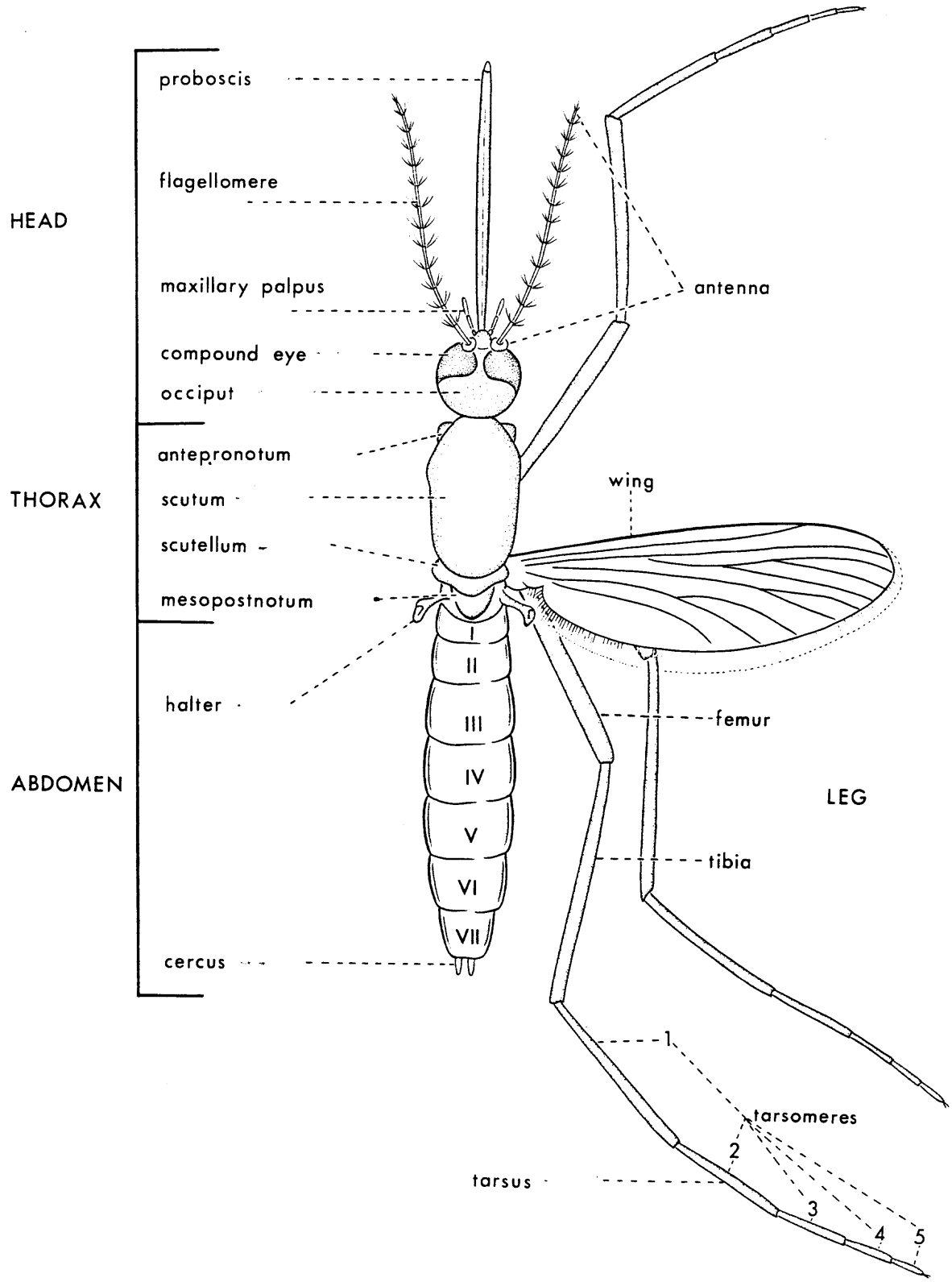

Fig. 1. Diagram of adult female mosquito.

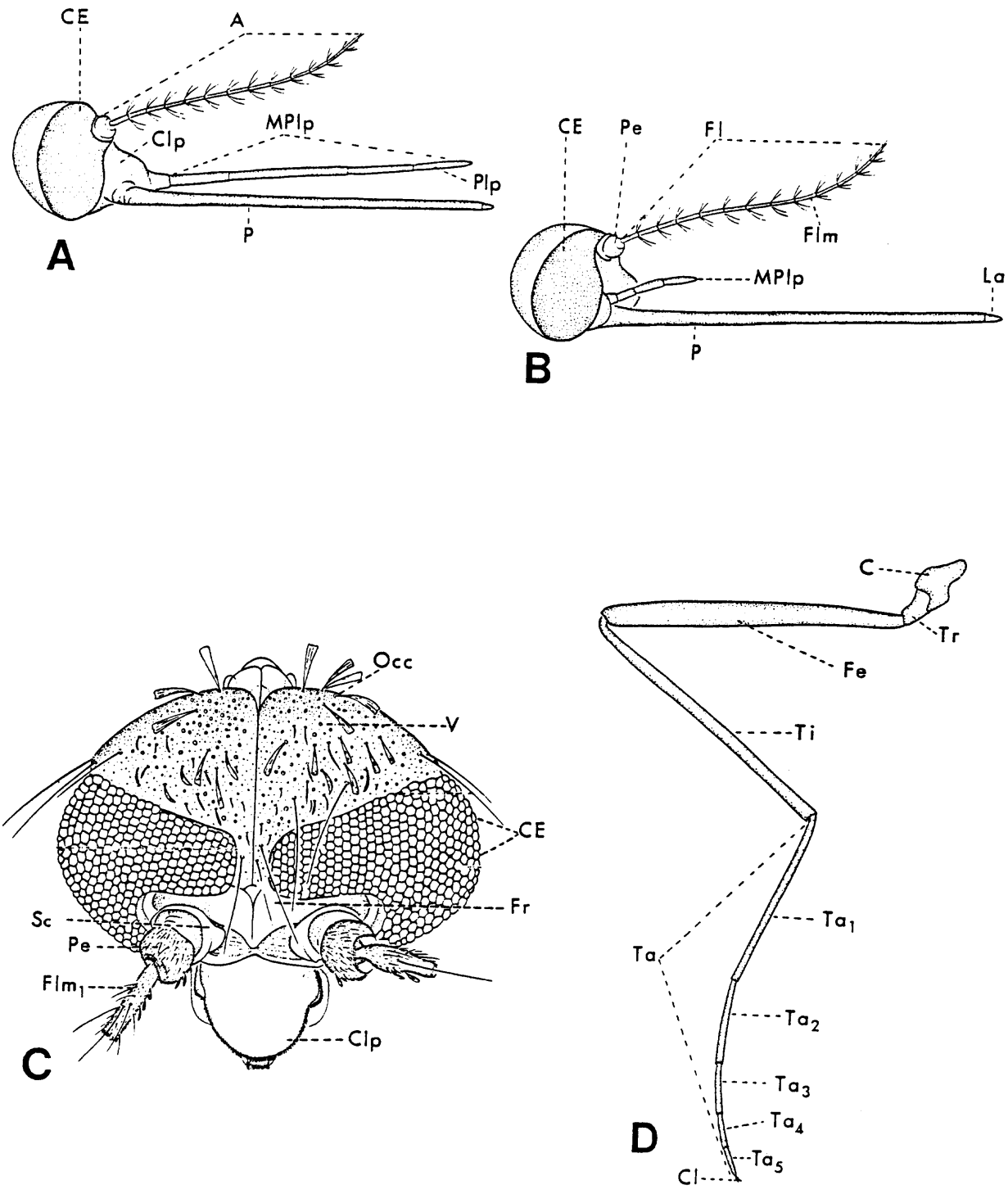

Fig. 2. Head and leg of adult female mosquito. A. Lateral view of anopheline head. B. Lateral view of culicine head. C. Dorsal view of culicine head. D. Lateral view of leg.

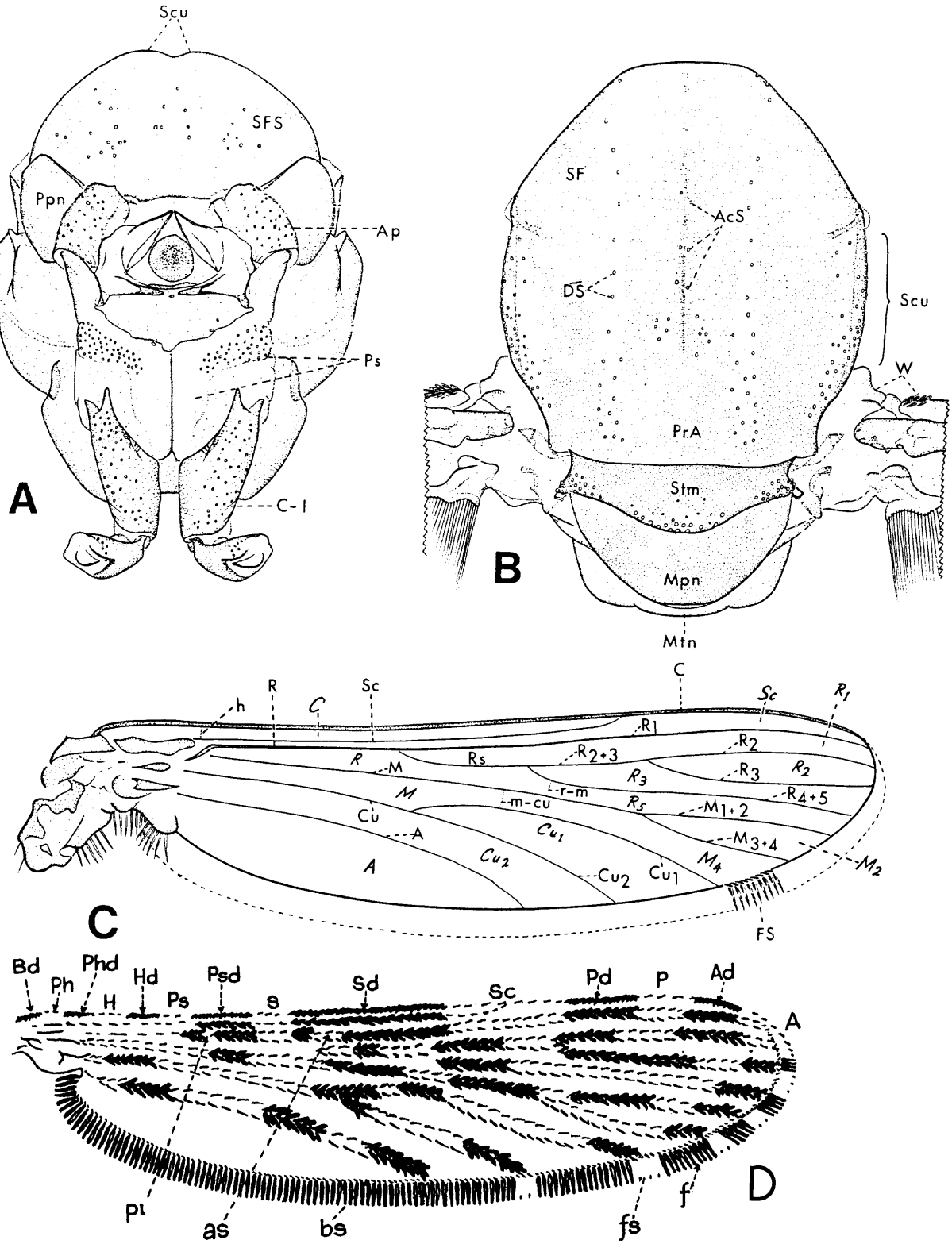

Fig. 3. Thorax and wing of adult female mosquito. A. Anterior view of thorax. B. Dorsal view of thorax. C. Dorsal view of wing; longitudinal veins designated in Roman letters, cells in italics. D. Wing scale spots on anopheline wing.

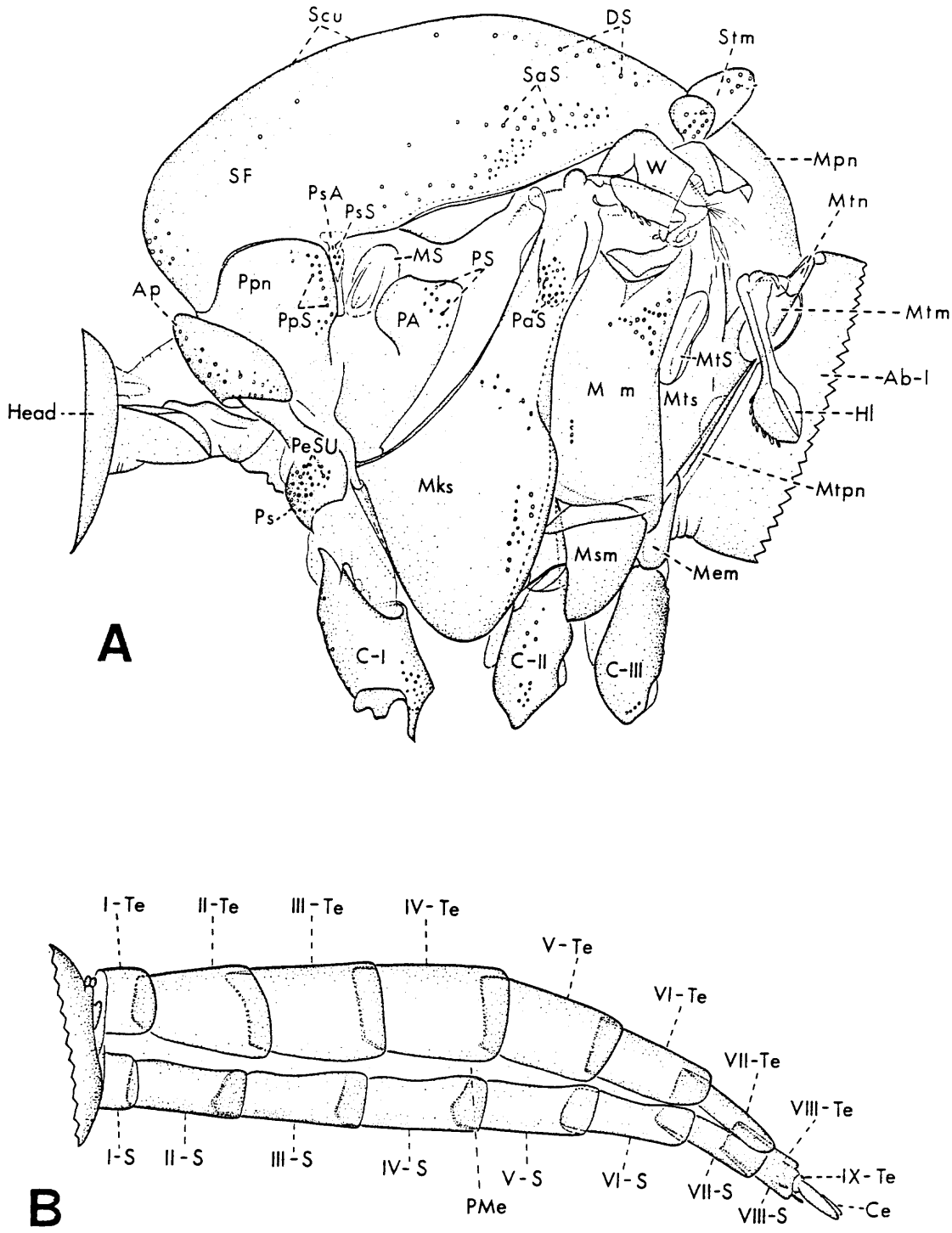

Fig. 4. Thorax and abdomen of adult female mosquito. A. Lateral view of thorax. B. Lateral view of abdomen.

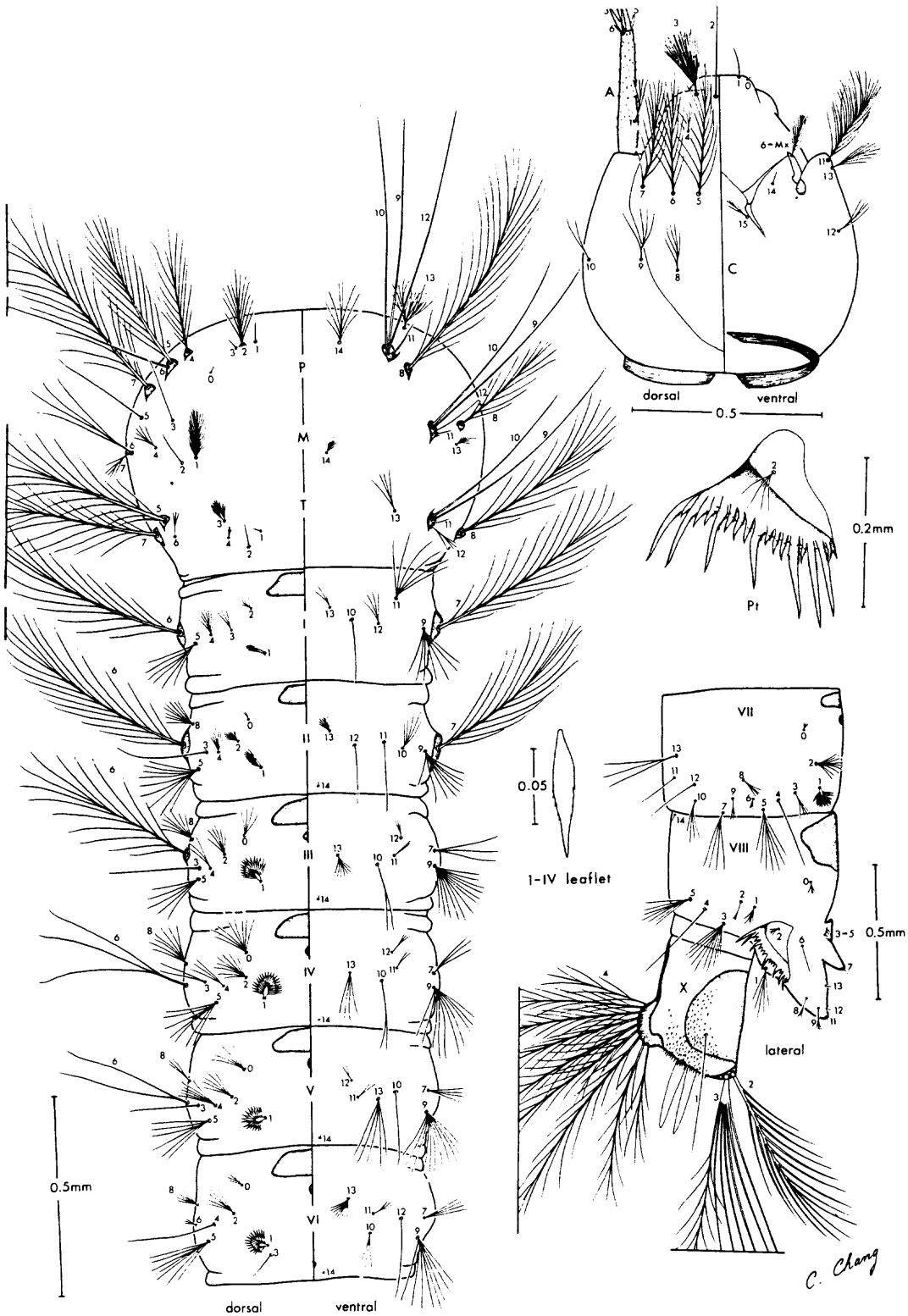

Fig. 5. Fourth stage anopheline larva; dorsal left, ventral right.

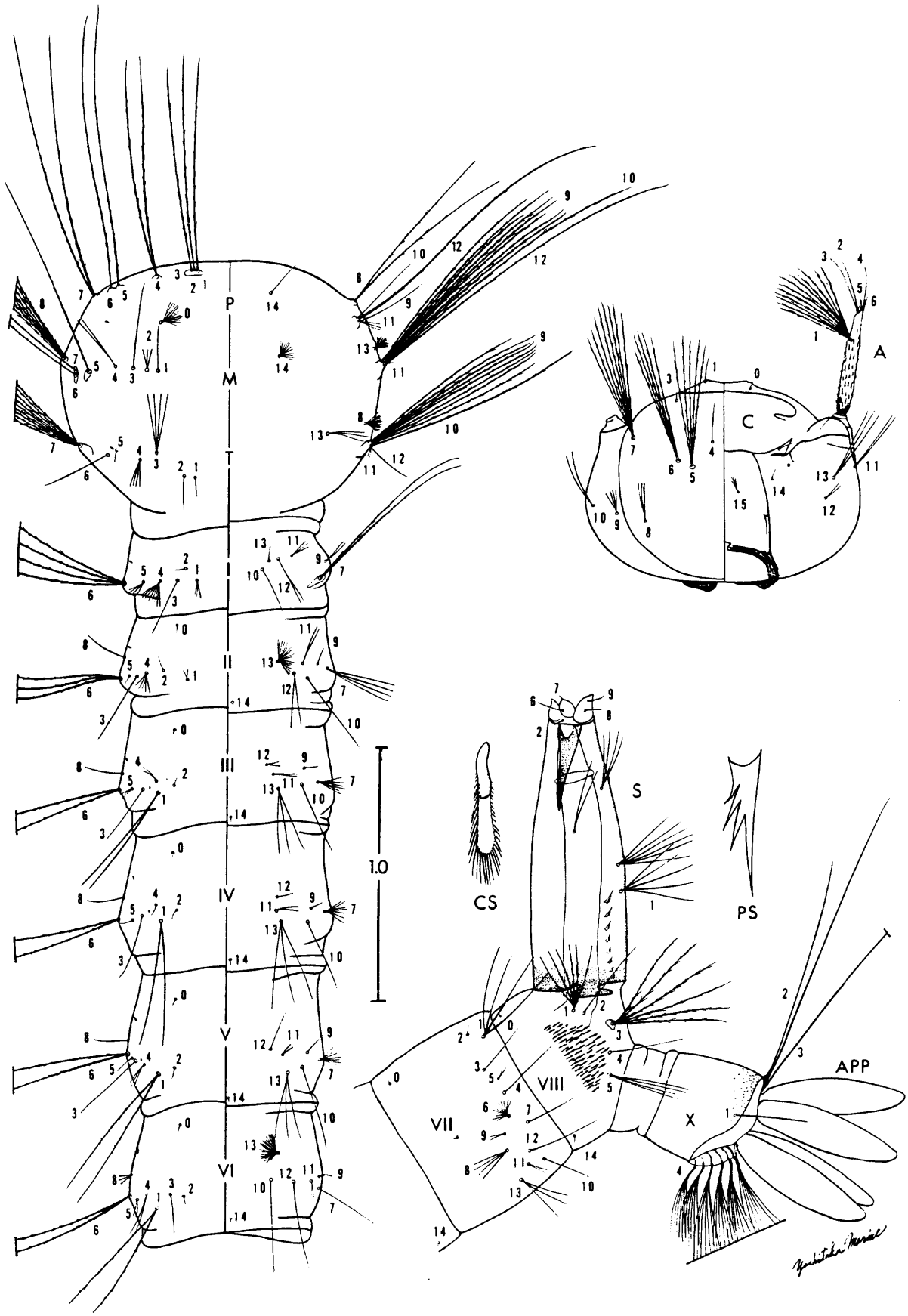

Fig. 6. Fourth stage culicine larva; dorsal left, ventral right.

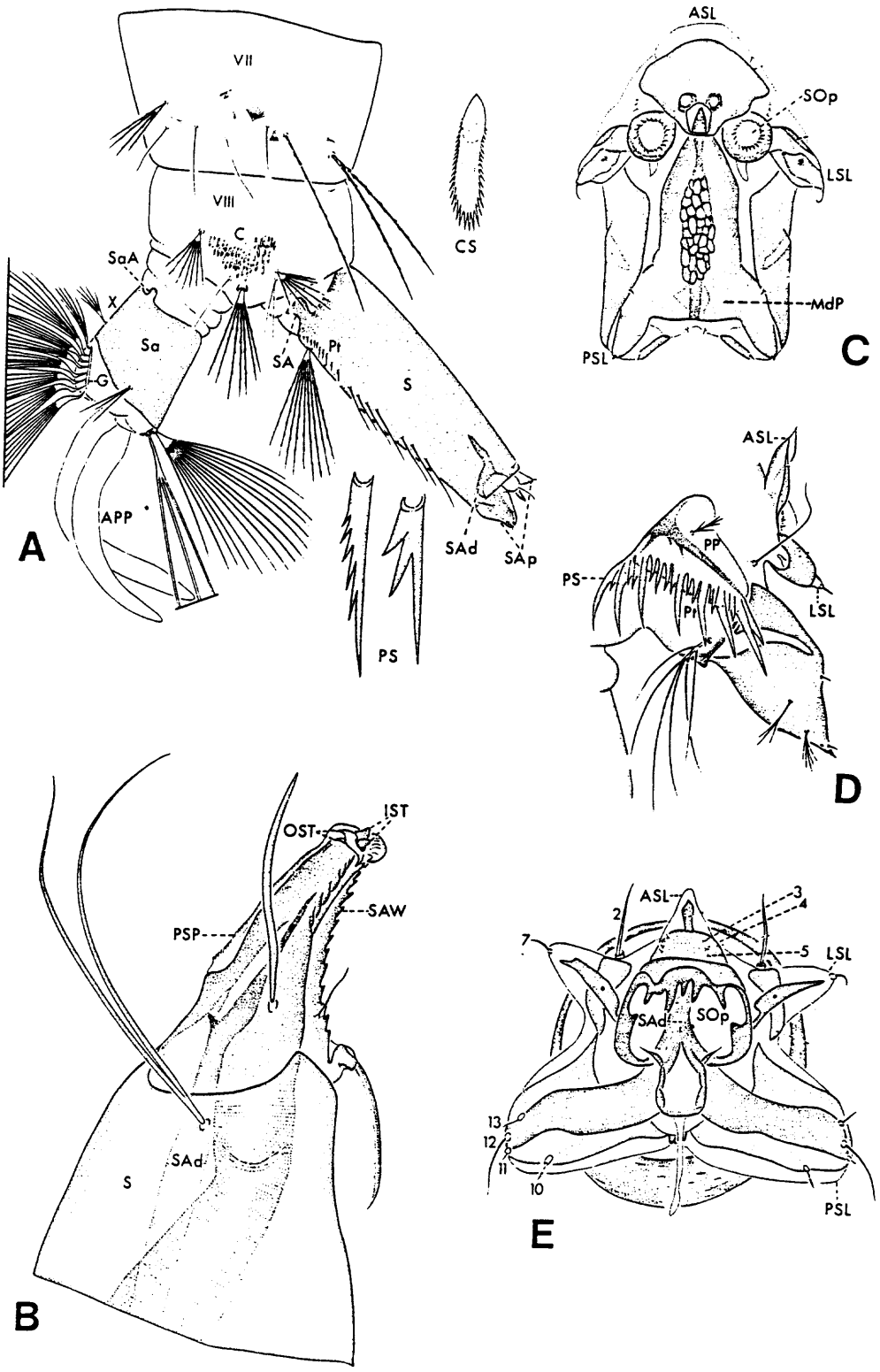

Fig. 7. Morphology of terminal abdominal segments of mosquito larvae. A. segments VII-X of *Culiseta*. B. Siphon and spiracular apparatus of *Mansonia*. C. Spiracular apparatus of *Anopheles*, dorsal view. D. Spiracular apparatus of *Anopheles*, lateral view. E. Dorsal view of spiracular apparatus of *Culex*.

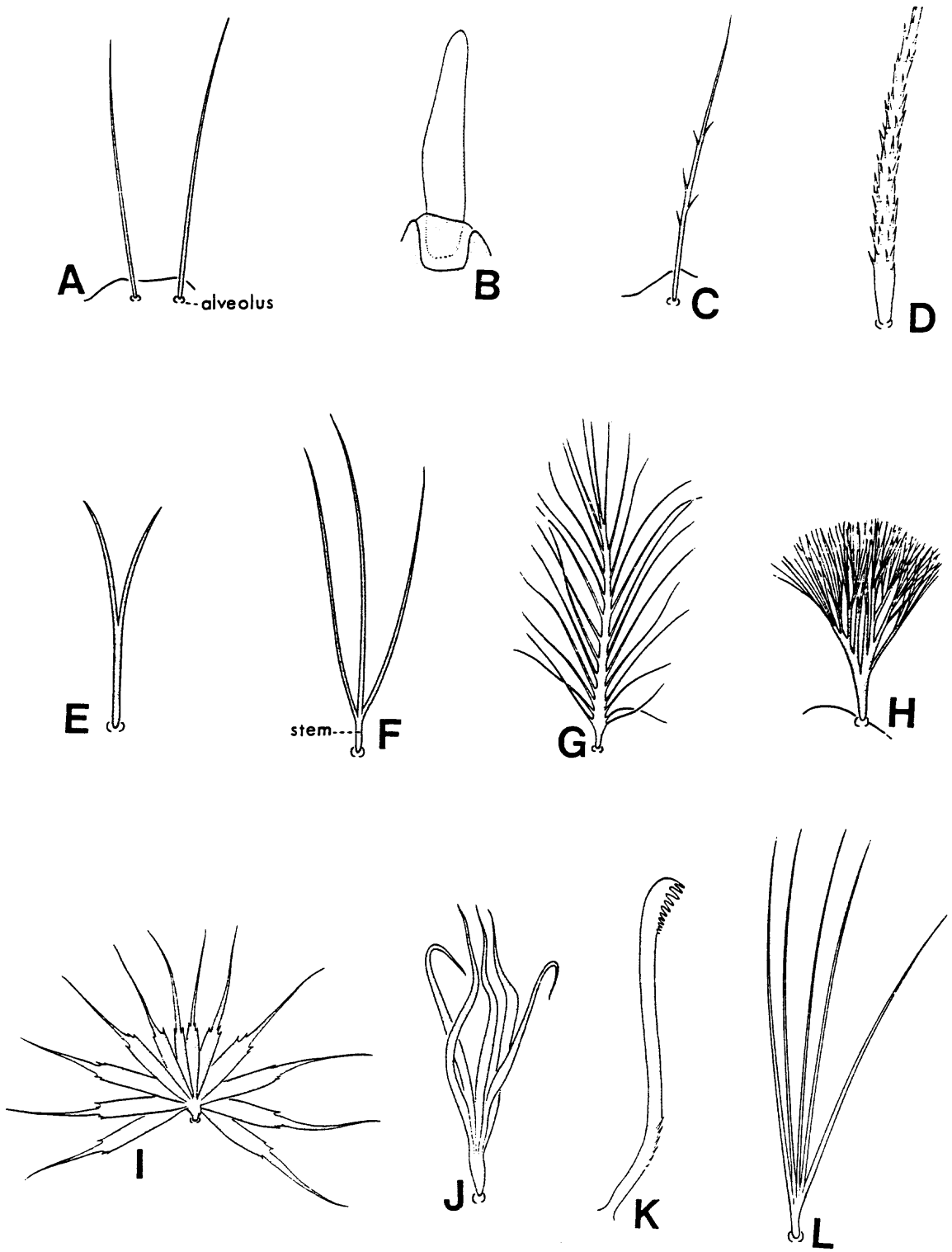

Fig. 8. Examples of kinds of setae found in mosquito larvae. A. Unbranched smooth setae. B. Spiniform seta. C. Unbranched aciculate seta. D. Spinulate spiniform seta. E. Forked seta. F. Branched seta. G. Plumose seta. H. Dendritic seta. I. Palmate seta, fully developed. J. Palmate seta, 0.5 developed. K. Comb-tipped filament. L. Fanlike seta of ventral brush.

DISTRIBUTION AND BIOLOGY OF THE MOSQUITOES OF NEPAL

INTRODUCTION

This section deals with the distribution and biology of the mosquito species known to occur in Nepal. Every effort has been made to accumulate all known records on the geographical distribution of each species within Nepal and to include a general extent of its distribution outside that country. The distributional data sources have been the personal collections of the authors, especially the junior author, collections by staff members of the Nepal Malaria Eradication Organization (NMEO), records from the literature, reports of specimens collected by the staff of the Department of Military Entomology, Royal Army Medical College, London and specimens in the British Museum (Natural History) (BMNH) and the Museum Support Center, National Museum of Natural History, Smithsonian Institution, Washington, DC.

The data listed under each species are as follows: Zone in capital letters, Development District, and locality where known, date of collection with the month given in Roman numerals (in some cases only the month and year are known), and specimens collected, i.e., ♀ - adult female, ♂ - adult male, Ad - adult, P - pupa, L - larva, RA - associated rearing. The final initials are those of the collectors. The ones listed in the distribution data are: BBP - B.B. Pradhan, DBS - D.B. Shrestha, GLS - G.L. Shrestha, GPJ - G.P. Joshi, KPU - K.P. Upadhya, RFD - R.F. Darsie, RGV - R.G. Vaidya, SBS - S.B. Shrestha, SPP - S.P. Pradhan, SRS - S.R. Shrestha, TS - T. Shrestha, WP - W. Peters. Specimens referred to in the Nepal distribution are to be found in one of 5 collections: Smithsonian Institution, Washington; British Museum (Natural History), London; Nepal Malaria Eradication Organization or the private collection of S.P. Pradhan, Kathmandu; and the International Center for Public Health Research, University of South Carolina, McClellanville.

More details for those species cited from the literature may be obtained by consulting the reference. For 19 species, taxonomic notes are given which discuss their taxonomic status. In most cases it was necessary to explain changes which have been made in the names, the validity of various taxa or supraspecific category assignments.

The details given under biology briefly review the larval breeding habitat and adult habits and behavior where known. Our biological notes include many interesting facts on the behavior of the different mosquito species since the fauna is so diverse. However, they are primarily from other countries within the species' range where it has been studied.

To aid in finding the geographical citations in Nepal, see the map, Figure 9. A term often mentioned in the distributional data for Nepal is "terai." It refers to the lowland belt bordering India on the south. The "inner terai" is defined as valleys at low elevation just north of the first range of mountains, the Churia Range.

GENUS *AEDES*

AEDES (AEDIMORPHUS) CAECUS (THEOBALD)

Distribution in Nepal. GANDAKI, Kaski, Pokhara, VI-56, 6L, SPP.

First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966), Reinert (1973).

Distribution outside Nepal. Widely distributed in the Oriental Region from India east to the Philippines and south to Indonesia.

Biology. Larvae have been found in temporary pools of fresh turbid water among bamboo or in forested areas, also in hoof prints and artificial containers in partial shade or full sun. Adults feed on domestic animals and man (Reinert 1973).

AEDES (AEDIMORPHUS) PALLIDOSTRIATUS (THEOBALD)

Distribution in Nepal. JANAKPUR, Mahottari, Pipara, VII-7-84, 2♀, SPP; MAHAKALI, Kanchanpur, Haldu Khal, VII-3-86, 14♀, 2♂; Musepani, VIII-13-87, 16♀, 7♂, SPP; KOSI, Morang, Lohandra, VII-12-87, 17♀, SPP.

First record for Nepal. Pradhan and Darsie (1989).

Distribution outside Nepal. From Pakistan east to China and south to Malaysia.

Biology. Larvae have been found in ground pools, rice paddies, ditches and borrow pits. Adults feed on cattle and man. Females have been found naturally infected with larvae of *Brugia malayi* (Reinert 1973).

AEDES (AEDIMORPHUS) PIPERSALATUS (GILES)

Distribution in Nepal. MAHAKALI, Kanchanpur, Badaipur, VIII-14-87, 3♀; Musepani, VIII-25-87, 8♀, 3♂, SPP.

First record for Nepal. Pradhan and Darsie (1989).

Distribution outside Nepal. From Pakistan east to Kampuchea.

Biology. Larvae have been collected from ground pools, ditches and forest pools. Adults have been captured feeding

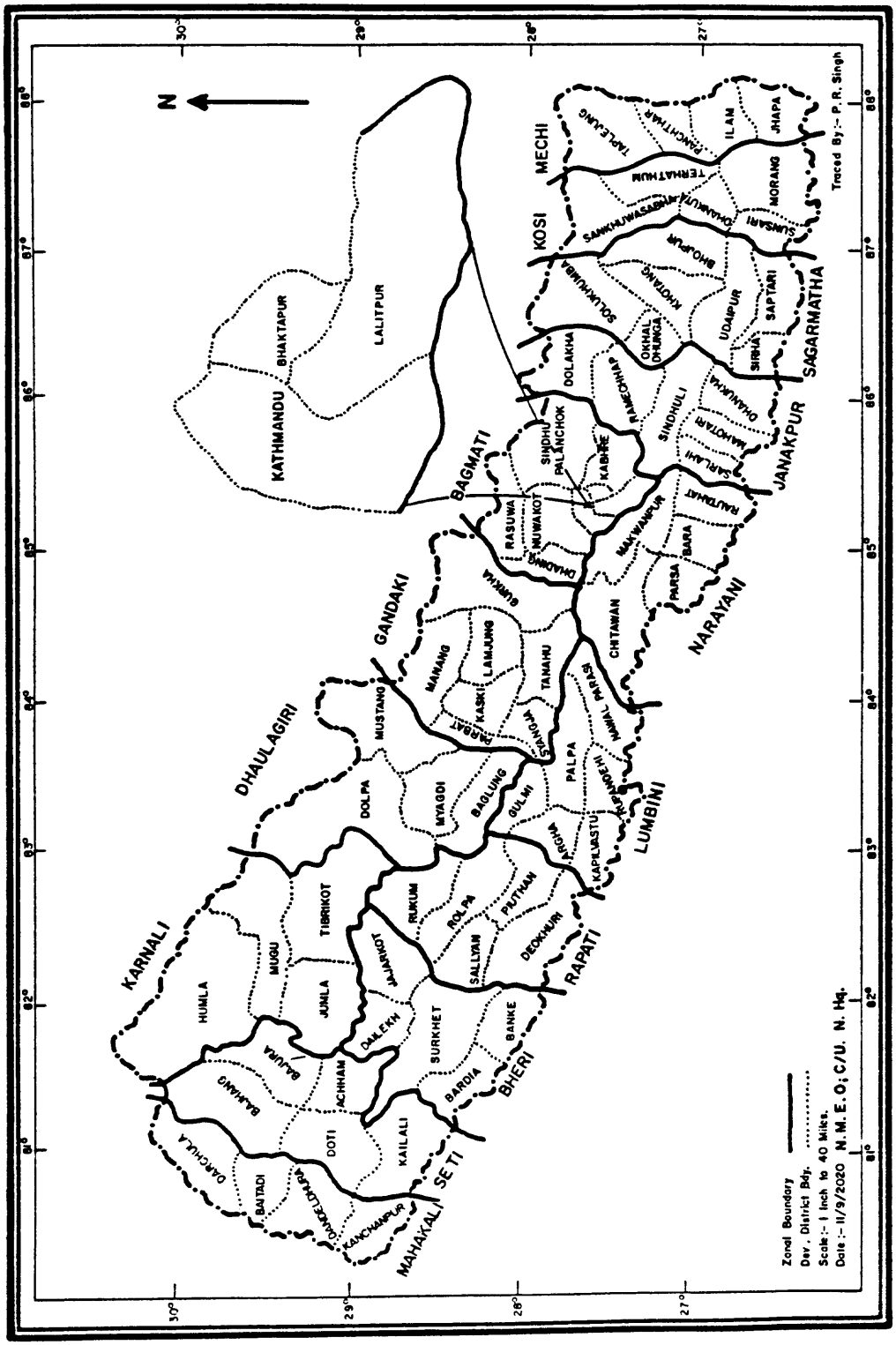

Fig. 9. Map of Nepal showing Zones and Districts.

on carabao at night, in animal-baited traps or attracted to man diurnally outdoors. Larvae of *Brugia malayi* have been recovered from females (Reinert 1973).

AEDES (AEDIMORPHUS) PUNCTIFEMORIS (LUDLOW)

Distribution in Nepal. SETI, Kailali, Kailali, Geeta Gate, IX-10-83, 2♀, SPP; MAHAKALI, Kanchanpur, Haldu Khal, VIII-3-87, 22♀; Musepani, VIII-13-87, 7♀, SPP.

First record for Nepal. Pradhan and Darsie (1989).

Distribution outside Nepal. India, Bangladesh and the Philippines.

Biology. Immatures unknown. Adults have been taken feeding on cattle at night, were attracted to humans and seen resting on vegetation near human dwellings. Adults are abundant during June and July (Reinert 1973).

AEDES (AEDIMORPHUS) VITTATUS (BIGOT)

Distribution in Nepal. KOSI, Sunsari, Dharan, VIII-61, 1♀, 1♂, SPP; NARAYANI, Makwanpur, Pokhara, I-V-55, 3♀, 2♂ (Peters and Dewar 1956); MAHAKALI, Kanchanpur, Musepani, IX-10-88, 1♀, SPP.

First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966).

Distribution outside Nepal. Widely distributed in Oriental, Middle Eastern, Mediterranean and Ethiopian Regions.

Biology. Immature stages have been found mainly in rock pools and holes, especially where soil and dead leaves were present. Adult females feed freely on man.

Taxonomic note. The species was transferred from subgenus *Stegomyia* to subgenus *Aedimorphus* by Huang (1977).

AEDES (CHRISTOPHERSIOMYIA) ANNULIROSTRIS (THEOBALD)

Distribution in Nepal. KOSI, Sunsari, Dharan, VI-61, 1♀, SPP; NARAYANI, Makwanpur, Hetaura, I-V-55, Ad, L, P (Peters and Dewar 1956).

First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966).

Distribution outside Nepal. India, Sri Lanka and Thailand.

Biology. Immatures have been taken from small tree holes and stump holes in secondary deciduous forest. Adult biology unknown (Abercrombie 1977).

AEDES (CHRISTOPHERSIOMYIA) THOMSONI (THEOBALD)

Distribution in Nepal. SETI, Kailali, Kailali, Geeta Gate, IX-10-83, 1♀, SPP.

First record for Nepal. Pradhan and Darsie (1989).

Distribution outside Nepal. Pakistan, India and Thailand.

Biology. Larvae have been collected from tree holes during the monsoon season. Adult females fed on pigs and were also attracted to humans in the daytime (Abercrombie 1977).

AEDES (FINLAYA) ALBOLATERALIS (THEOBALD)

Distribution in Nepal. BAGMATI, Kathmandu, Guheswari, VII-60, 1♀; Lalitpur, Godavari, VII-63, 5L, VI-23-82, 1♀, SPP; NARAYANI, Bara, forest, VII-14-84, 4♀, SPP; Makwanpur, Hetaura, I-V-55, ♀ (Peters and Dewar 1956).

First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966).

Distribution outside Nepal. India and Sri Lanka east to China and south to Indonesia.

Biology. Larvae inhabit tree holes and bamboo stumps. Adult biology unknown (Barraud 1934).

AEDES (FINLAYA) ASSAMENSIS (THEOBALD)

Distribution in Nepal. NARAYANI, Makwanpur, Nayagaon, I-V-55, 1♀ (Peters and Dewar 1956).

First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966).

Distribution outside Nepal. India east to China and south to Java.

Biology. Larvae have been found in tree holes (Barraud 1934).

AEDES (FINLAYA) AUREOSTRIATUS VAR. *GREENII* (THEOBALD)

Distribution in Nepal. KOSI, Sunsari, Dharan, III-61, 3L, SSP.

First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).

Distribution outside Nepal. India, Sri Lanka, Malaysia and Indonesia.

Biology. Larvae were taken from tree holes and bamboo nodes. Adults were common in forested areas (Barraud 1934).

AEDES (FINLAYA) CHRYSOLINEATUS (THEOBALD)

Distribution in Nepal. BAGMATI, Lalitpur, Godavari, VII-63, 6L, SSP.

First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).

Distribution outside Nepal. India and Sri Lanka east to Vietnam and south to Indonesia.

Biology. Larvae have been reported from tree holes, rock holes in mountain streams, bamboo stumps, roof gutters and leaf axils. Nepal specimens were collected from a cistern. Adult females attack man in forested areas (Knight 1968).

AEDES (FINLAYA) DISSIMILIS (LEICESTER)

Distribution in Nepal. KOSI, Morang, Baukajhora, IX-61, 1♀, 1♂; Sunsari, Dharan, VIII-61, 3♀, SSP.
First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).
Distribution outside Nepal. India, China and Malaysia.
Biology. Larvae have been taken from tree holes. Adult females feed in forested areas (Barraud 1934).

AEDES (FINLAYA) GUBERNATORIS (GILES)

Distribution in Nepal. KOSI, Sunsari, Dharan, VIII-61, 2♀, SPP; BAGMATI, Kathmandu, Wholchowk, VIII-63, 1♀, SSP.
First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).
Distribution outside Nepal. India and Sri Lanka.
Biology. Larvae have been found in tree holes and rock pools (Barraud 1934).

AEDES (FINLAYA) KHAZANI EDWARDS

Distribution in Nepal. KOSI, Sunsari, Dharan, IX-X-84, 1♀ (Burgess, unpublished data).
First record for Nepal. Burgess (unpublished data).
Distribution outside Nepal. India east to Indochina.
Biology. Larvae have been found in tree holes (Barraud 1934).

AEDES (FINLAYA) PSEUDOTAENIATUS (GILES)

Distribution in Nepal. KOSI, Sunsari, Dharan, VIII-61, 2♀, SPP; BAGMATI, Kathmandu, Sunderijal, X-58, 2L, SPP; Lalitpur, Godavari, VII-63, 12♀, 5♂, 10L, SPP.
First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).
Distribution outside Nepal. India, Sri Lanka and Burma.
Biology. Larvae have been found in tree holes, rock pools, cisterns and artificial containers (Barraud 1934).

AEDES (FINLAYA) PULCHRIVENTER (GILES)

Distribution in Nepal. KARNALI, Jumla, Neure, VI-6-88, 7L, SPP, TS and KPU; JANAKPUR, Sindhuli, Ranibas, XI-3-88, 1♀, SPP.
NEW COUNTRY RECORD
Distribution outside Nepal. India and Tibet.
Biology. Larvae have been taken from a ground pool near Nayougard River at 3,000 m. It is a common mosquito in the higher Himalayan Mountains. It has been collected in rock holes, mud pools, barrels, tree stump holes in sunny and shaded habitats. Females have been captured from human bait at dusk (Bhat 1975).

AEDES (MUCIDUS) SCATOPHAGOIDES (THEOBALD)

Distribution in Nepal. KOSI, Morang, Baukajhora, VII-61, 3♀; Fimraha, VII-61, 3♀, SPP; Sunsari, Tarahara, XI-26-87, 1♀, SPP, RFD; MAHAKALI, Musepani, VIII-13-87, 1♀; IX-10-88, 2♀; SETI, Kailali, Kailali, IX-10-83, 1♀, SPP.
First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).
Distribution outside Nepal. Pakistan east to China and Vietnam.
Biology. Larvae of the subgenus *Mucidus* are predatory, feeding mainly on other mosquito larvae. They inhabit temporary ground pools, rice paddies and ditches. Adult females have been observed attacking man (Tyson 1970).

AEDES (NEOMELANICONION) LINEATOPENNIS (LUDLOW)

Distribution in Nepal. KOSI, Morang, Baukajhora, VIII-61, 1♀, 3♂; Sunsari, Tarahara, VII-6-81, 2♀; XI-12-84, 1♀; XI-26-87, 2♀, SPP, RFD; NARAYANI, Bara, Nizgarh, VI-63, 1♀, SPP; JANAKPUR, Dhanukha, Sohani, VII-13-88, 1♀, SPP; MAHAKALI, Kanchanpur, Musepani, VIII-13-87, 1♂; IX-10-88, 2♀, SPP.
First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).
Distribution outside Nepal. Widely distributed in the Oriental Region and Queensland, Australia.
Biology. Immatures' habitats are various fresh water ground pools. Adult females are capable of mass migrations and are a considerable pest to man (Mattingly 1961).
Taxonomic note. This species was previously listed as being commonly found in subsaharan Africa (e.g., Linthicum et al. 1985) but Huang (1985) described a new species, *mcintoshi,* which replaces the *"lineatopennis"* of Africa.

AEDES (STEGOMYIA) ALBOPICTUS (SKUSE)

Distribution in Nepal. KOSI, Sunsari, Dharan, VIII-61, 5♀; X-61, 5L, SPP; Morang, Biratnagar, XI-25-87, 1♀, RFD; BAGMATI, Kathmandu, Wholchowk, VIII-63, 3♀, 2♂; Swayambhunath, IX-63, 2♀, SPP; MAHAKALI, Kanchanpur, Musepani, VIII-25-87, 1♀; Khutepani, III-10-89, 1L, SPP; JANAKPUR, Sindhuli, Ranibas, IV-21-88, 15L, SPP; NARAYANI, Makwanpur, Hetaura, I-V-55, Ad (Peters and Dewar 1956).

First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966), Huang (1979).

Distribution outside Nepal. Widely distributed in Oriental and Australasian Regions.

Biology. Larvae occur in tree holes in forested areas, also rain barrels and artificial containers. Adult females are aggressively anthropophagic and are important vectors of dengue viruses (Gould et al. 1968, Huang 1972).

AEDES (STEGOMYIA) GARDNERII IMITATOR (LEICESTER)

Distribution in Nepal. NARAYANI, Makwanpur, Hetaura, I-V-55, Ad (Peters and Dewar 1956).

First record for Nepal. Peters and Dewar (1956) [as *Ae. w-albus*]. Other reports from Nepal - Mattingly (1965), Huang (1979).

Distribution outside Nepal. India east to Hong Kong and south to Malaysia.

Biology. Larvae occur in log and tree holes and cut bamboo nodes. Adults were taken in secondary forest. They will feed on man in their natural habitat (Mattingly 1965).

AEDES (STEGOMYIA) SUBALBOPICTUS BARRAUD

Distribution in Nepal. NARAYANI, Makwanpur, Hetaura, 1♂ (BMNH, Townsend in litt. 1989).

NEW COUNTRY RECORD

Distribution outside Nepal. India.

Biology. Larvae have been found in tree holes and bamboo stumps (Huang 1979).

AEDES (STEGOMYIA) UNILINEATUS (THEOBALD)

Distribution in Nepal. KOSI, Sunsari, Dharan, VIII-61, 1♀, SPP; BAGMATI, Kathmandu, Balaju, X-58, 4L, SPP.

First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).

Distribution outside Nepal. India, Pakistan and East and West Africa.

Biology. Larvae have been taken from tree holes (Barraud 1934).

AEDES (STEGOMYIA) W-ALBUS (THEOBALD)

Distribution in Nepal. KOSI, Sunsari, Dharan, VIII-61, 2♀, SPP; NARAYANI, Bara, forested area, VII-14-84, 2♀; Makwanpur, Hetaura, VIII-29-87, 2♀; MAHAKALI, Kanchanpur, Musepani, IX-10-88, 5♀, SPP.

First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).

Distribution outside Nepal. Pakistan east to Vietnam.

Biology. This species is primarily a forest mosquito, breeding in small tree holes (Huang 1977). Adults in Nepal were collected from human bait in forested areas.

AEDES (VERRALLINA) INDICUS (THEOBALD)

Distribution in Nepal. SETI, Kailali, Geeta Gate, IX-30-87, 1♀, SPP.

First record in Nepal. Pradhan and Darsie (1989).

Distribution outside Nepal. Pakistan, India, Sri Lanka and Thailand.

Biology. Numerous larvae have been taken from fresh, colored or turbid water in small or large shallow ground pools with abundant grass in shaded areas. Although adult females prefer to feed on cattle, they are daytime biters of humans. However, the Nepal specimen was taken at night attracted to human bait.

Taxonomic note. This species was originally placed in *Neomacleaya,* a new subgenus created by Theobald for *indicus,* then into subgenus *Aedes*, back to *Neomacleaya* and finally in its present assignment (Reinert 1974). This species is the only representative of the subgenus in Nepal.

GENUS *ANOPHELES*

ANOPHELES (ANOPHELES) AHOMI CHOWDHURY

Distribution in Nepal. Unknown.

First record for Nepal. Reid (1962). Other reports from Nepal - Shrestha (1966).

Distribution outside Nepal. India.

Biology. Unknown, but presumably similar to *An. barbirostris,* its close relative.

Taxonomic note. Reid (1962) reported seeing specimens from Nepal which he believed could be *ahomi* so we are provisionally listing it in the Nepal fauna. Further confirmation is indicated.

***ANOPHELES (ANOPHELES) AITKENII* JAMES**

Distribution in Nepal. Reported from BAGMATI, Kathmandu; JANAKPUR, Ramechhap; NARAYANI, Bara by Brydon et al (1961), no locality given.

First record for Nepal. Brydon et al. (1961). Other reports from Nepal - Shrestha (1966), Ramachandra Rao (1981).

Distribution outside Nepal. India and Sri Lanka east to China and the Philippines and south to New Guinea.

Biology. Generally found at higher elevations. Larvae inhabit shaded, small pools and seepages, also taken from hill streams, irrigation canals, rock pools and swamps. Adults usually do not feed on humans (Ramachandra Rao 1981).

***ANOPHELES (ANOPHELES) ANNANDALEI* PRASHAD**

Distribution in Nepal. Reported from GANDAKI, Gurkha; NARAYANI, Makwanpur by Brydon et al. (1961), no locality given.

First record for Nepal. Brydon et al. (1961). Other reports from Nepal - Shrestha (1966), Ramachandro Rao (1981).

Distribution outside Nepal. India, Sri Lanka and Indonesia.

Biology. Larvae have been found in tree holes. Adult biology unknown (Ramachandra Rao 1981).

***ANOPHELES (ANOPHELES) BARBIROSTRIS* VAN DER WULP**

Distribution in Nepal. KOSI, Sunsari, Tarahara, XI-29-87, 4L, SPP, RFD; Shrestha (1966) reported it present in all terai and inner terai areas.

First record for Nepal. Brydon et al. (1961). Other reports from Nepal - Shrestha (1966), Ramachandra Rao (1981).

Distribution outside Nepal. Pakistan east to China and Vietnam and south to Timor.

Biology. Immature stages have been collected from a wide variety of habitats: river and stream margins, flowing ditches, temporary and permanent ground pools, rice fields, marshes, seepages, mostly with floating or emergent vegetation, usually in full sun. Adult females are mostly zoophilic but in the absence of their normal host they will feed on man. It is a recognized vector of human filariasis in Indonesia and has been found naturally infected with JE virus in West Bengal (Ramachandra Rao 1981).

***ANOPHELES (ANOPHELES) BARBUMBROSUS* STRICKLAND AND CHOWDHURY**

Distribution in Nepal. NARAYANI, Makwanpur, Hetaura, 1955, 1♀, WP (Reid 1962).

First record for Nepal. Reid (1962).

Distribution outside Nepal. India east to Taiwan and south to Indonesia.

Biology. This species is a forest mosquito preferring clear, cool water containing dead leaves. Immatures have been found in stream pools, rock pools, stream margins, seepage springs, stump holes and rice fields with abundant vegetation. Little is known of adult biology (Harrison and Scanlon 1975).

***ANOPHELES (ANOPHELES) BENGALENSIS* PURI**

Distribution in Nepal. SETI, Kailali, Malaketi, I-19-65, 1♀, RGV; KOSI, Morang, Khokse, IV-13-65, 2♀, BBP; SAGARMATHA, Okaldhunga, IV-3-88, 1♀, SPP.

First record for Nepal. Shrestha et al. (1966).

Distribution outside Nepal. Eastern India to the Ryukyu Islands and the Philippines and south to Malaysia.

Biology. Larvae inhabit shaded stream pools and rock pools containing dead leaves in forests and bamboo groves. There is no record of adult females feeding on man (Harrison and Scanlon 1975).

***ANOPHELES (ANOPHELES) FRAGILIS* (THEOBALD)**

Distribution in Nepal. NARAYANI, Makwanpur, 2♂ (BMNH, Townsend in litt. 1989).

NEW COUNTRY RECORD

Distribution outside Nepal. Thailand, Malaysia, the Philippines and Indonesia.

Biology. Larvae have been found in streams, pools and occasionally swamps in or near forests. Adult biology unknown (Harrison and Scanlon 1975).

***ANOPHELES (ANOPHELES) GIGAS GIGAS* GILES**

Distribution in Nepal. KARNALI, Jumla, Neure, IV-6-88, 8L, SPP.

First record for Nepal. Brydon et al. (1961). Other reports from Nepal - Shrestha (1966).

Distribution outside Nepal. Pakistan, India and Sri Lanka.

Biology. Immatures have been taken from pools along mountain streams, seepages, ponds and springs with peripheral vegetation. It occurs at higher elevations. Little is known about adult behavior (Ramachandra Rao 1981).

ANOPHELES (ANOPHELES) GIGAS VAR. *BAILEYI* EDWARDS

Distribution in Nepal. KOSI, Morang, Baukajhora, III-3-63, 1♀, GLS; LUMBINI, Palpa, Kirtipur, XI-12-67, 1♀, GLS; KARNALI, Jumla, Neure, VI-6-88, 14L, SPP; JANAKPUR, Sindhuli, Khutepani, III-9-89, 3♀, SPP.

First record for Nepal. Shrestha (1966).

Distribution outside Nepal. India, Tibet, Burma, Bangladesh, Indochina and Taiwan.

Biology. Prevalent at higher altitudes, the larvae occur in deep pools, rock pools and springs. Adult behavior unknown (Ramachandra Rao 1981).

ANOPHELES (ANOPHELES) GIGAS VAR. *SIMLENSIS* (JAMES)

Distribution in Nepal. BAGMATI, Kathmandu, Tupek, III-3-61, 3♀; Lalitpur, Godavari, III-23-61, 1♂, DBS; NARAYANI, Chitwan, Jayanangala, XII-6-64, 1♂; JANAKPUR, Sarlahi, Fenehara, IX-9-74, 1♀, RGV; KARNALI, Jumla, Neure, VI-6-88, 6L, SPP.

First record for Nepal. Shrestha (1966). Other reports from Nepal - Ramachandra Rao (1981).

Distribution outside Nepal. India, Sri Lanka and Pakistan.

Biology. Larvae occur at higher elevations in rice paddies, shallow swamps, seepage pools, snow-water pools, and rock holes with clean or polluted water. Adult females have been taken from human bait (Ramachandra Rao 1981).

ANOPHELES (ANOPHELES) INTERRUPTUS PURI

Distribution in Nepal. GANDAKI, Lamjung, Ghanpokhara, XII-59, 2L, SPP; KOSI, Bhojpur, Keurinepani, X-7-63, 6L, RFD.

First record for Nepal. Joshi et al. (1965) [as *An. annandalei interruptus* Puri]. Other reports from Nepal - Shrestha (1966), Ramachandra Rao (1981).

Distribution outside Nepal. India, Sri Lanka, Burma, Thailand, Indochina, China and Malaysia.

Biology. This species inhabits tree holes. It has also been collected from root holes. Adult females do attack man (Harrison and Scanlon 1975). In Nepal it was collected from a large tree hole at a height of 2 m and an elevation of 812 m.

ANOPHELES (ANOPHELES) LINDESAYI LINDESAYI GILES

Distribution in Nepal. JANAKPUR, Khutepani, IX-9-88, 1♀; Ranibas, XI-5-88, 1♀, SPP. It has been collected across the country in the terai forest and in the mountains (Shrestha 1966).

First record for Nepal. Peters et al. (1955). Other reports from Nepal - Brydon et al. (1961), Shrestha (1966) and Ramachandra Rao (1981).

Distribution outside Nepal. Pakistan, India, Burma and USSR.

Biology. The species occurs at higher elevations. Larvae have been taken in stream bed pools, rice paddies, rock pools, and seepage pools in clean water under shade. Females have been observed feeding on birds and man (Ramachandra Rao 1981).

ANOPHELES (ANOPHELES) LINDESAYI NILGIRICUS CHRISTOPHERS

Distribution in Nepal. MAHAKALI, Darchula, Darchula, IX-65, 1♀, RGV; MECHI, Jhapa, Suryanagar, IX-78, 1♀, SRS.

First record for Nepal. Shrestha (1966).

Distribution outside Nepal. India.

Biology. Larvae have been collected in hill streams, ground pools and rock pools. This subspecies usually occurs at higher elevations. Adult biology is little known (Ramachandra Rao 1981).

ANOPHELES (ANOPHELES) NIGERRIMUS GILES

Distribution in Nepal. GANDAKI, Gorkha, Tumlintar, II-61, 2♀, SPP; NARAYANI, Bara, Nizgarh, III-12-63, 4♀, GPJ; SETI, Kailali, Malaketi, IX-28-64, 2♀, RGV; KOSI, Sunsari, Tarahara, XI-26-87, 2♀, SPP, RFD.

First record for Nepal. Pant et al. (1962). Other reports from Nepal - Shrestha (1966), Ramachandra Rao (1981).

Distribution outside Nepal. Pakistan, India and Sri Lanka east to Vietnam and China and south to Indonesia.

Biology. Immatures have been taken from large swamps, large stream pools, rice fields with some floating or emergent vegetation, open sunlight and clean water for they have no tolerance for pollution. Adult females have been found indoors and outdoors feeding on humans, although they are thought to be primarily zoophilic (Harrison and Scanlon 1975).

ANOPHELES (ANOPHELES) PEDITAENIATUS (LEICESTER)

Distribution in Nepal. NARAYANI, Hetaura, 1♀, 1♂ (BMNH, Townsend in litt. 1989); widely distributed in the terai and inner terai (Shrestha 1966).

First record for Nepal. Shrestha (1966). Other reports from Nepal - Harrison and Scanlon (1975), Ramachandra Rao (1981).

Distribution outside Nepal. India and Sri Lanka east to Indochina and China and south to Indonesia.

Biology. Larvae occur primarily in rice fields but have been observed in many other habitats, such as ditches, marshes, seepage pools, ponds, stream margins and shallow wells. Larvae require unshaded, shallow, warm water with some vegetation. Although adult females do attack man, they prefer bovines as hosts (Harrison and Scanlon 1975).

ANOPHELES (ANOPHELES) SINENSIS WIEDEMANN

Distribution in Nepal. KOSI, Sunsari, Tarahara, XI-29-87, 1♀, 5L, SPP, RFD. It is widely distributed in terai and hilly areas (Shrestha 1966).

First record for Nepal. Brydon et al. (1961). Other reports from Nepal - Shrestha (1966), Ramachandra Rao (1981).

Distribution outside Nepal. India, Burma, Thailand, Indochina, China, Taiwan, Japan, Malaysia and Indonesia.

Biology. This species occurs chiefly in open rice-growing areas. Larvae have been found in rice fields, stream margins, ditches, shallow ponds and seepages. These will have fresh water with grasses and direct sunlight. It is primarily a zoophilic mosquito (Harrison and Scanlon 1975).

ANOPHELES (CELLIA) ACONITUS DOENITZ

Distribution in Nepal. KOSI, Sunsari, Tarahara, XI-29-87, 3♀, 14L, SPP, RFD.

First record for Nepal. Peters et al. (1955). Other reports from Nepal - Brydon et al. (1961), Shrestha (1966), Harrison (1980), Ramachandra Rao (1981).

Distribution outside Nepal. India and Sri Lanka east to Indochina and south to Indonesia.

Biology. The larvae inhabit rice fields when the plants are at least 0.5 m high. These habitats have algae and other aquatic plants. Larvae have a predilection for water hyacinth. They also like river bed pools and swamps. Adult females are predominantly zoophilic but will attack man and the species is an important vector of malaria parasites in Indonesia (Ramachandra Rao 1981).

ANOPHELES (CELLIA) ANNULARIS VAN DER WULP

Distribution in Nepal. This species is abundant in the cultivated areas of the terai and inner terai.

First record for Nepal. Puri (1955). Other reports from Nepal - Peters et al. (1955), Brydon et al. (1961), Shrestha (1966), Ramachandra Rao (1981).

Distribution outside Nepal. Afghanistan, Pakistan, India and Sri Lanka east to China and the Philippines.

Biology. Larvae of this species are mainly found in still water with abundant vegetation. Tanks, borrow pits, canals, waste irrigation water and margins of rivers are favored. Rice fields are not generally used. The peak of adult female daily feeding varies from 1700 to 2100 hours, i.e., earlier during the winter months and later in the summer months (Reisen and Aslamkhan 1978). The reader is referred to Ramachandra Rao (1981) for a thorough discussion of adult biology. This species has been found naturally infected with malaria parasites in the terai of Nepal (Shrestha and Parajuli 1980).

ANOPHELES (CELLIA) CULICIFACIES GILES

Distribution in Nepal. This mosquito is common in the terai and inner terai areas of the country.

First record for Nepal. Puri (1955). Other reports from Nepal - Peters et al. (1955), Brydon et al. (1961), Shrestha (1966), Harrison (1980), Ramachandra Rao (1981).

Distribution outside Nepal. From China and Indochina westward to the Middle East.

Biology. Larvae have been found in all types of breeding sites except tree holes, leaf axils and artificial containers. Favorite sites are irrigation channels, wells, waste irrigation water, tanks and borrow pits. The water is clear or slightly turbid, fresh, stagnant or flowing, sunny and without growth of algae or plants. Daily feeding by adult females peaked just after sunset in the winter months, while in the summer, it occurred between 2100 and 0400 hours (Reisen and Aslamkhan 1978). More details on larval and adult biology are given by Ramachandra Rao (1981). It is a major vector of malaria in the lowlands of India and a suspected vector in the cultivated terai of Nepal (Shrestha et al. 1988).

Taxonomic note. Three sibling species of *An. culicifacies* have been described by Miles (1981) and Subbarao et al. (1983). Subbarao et al. (1988) reported that species A is the probable vector of malaria in India.

ANOPHELES (CELLIA) DIRUS PEYTON AND HARRISON

Distribution in Nepal. MECHI, Jhapa, Suryanagar, IX-78, 1♀, SRS.

First record for Nepal. Shrestha (1966) [as *An. balabacensis* Baisas]

Distribution outside Nepal. India and Thailand.

Biology. The species inhabits the foothill forests and their fringes. Larvae inhabit small, shallow, shaded, grassy de-

pressions that may be turbid or slightly polluted. Also larger semipermanent forest pools are used. Adult females feed readily on man mostly late at night. It is an excellent vector of malaria parasites.

Taxonomic note. It has been determined that *dirus* is a complex of sibling species, based on chromosomal and cross mating experiments (Baimai 1981, Hii 1984). Which sibling species occurs in Nepal has not been ascertained.

ANOPHELES (CELLIA) DRAVIDICUS CHRISTOPHERS

Distribution in Nepal. JANAKPUR, Sindhuli, Ranibas, XI-5-88, 7♀, SBS; MAHAKALI, Kanchanpur, Musepani, IX-10-88, 5♀, SPP.

NEW COUNTRY RECORD

Distribution outside Nepal. India, Burma and Thailand.

Biology. Immature stages unknown. Adult biology has not been studied.

Taxonomic note. This species was resurrected from synonymy under *An. maculatus* by Rattanirithikul and Green (1987).

ANOPHELES (CELLIA) FILIPINAE MANALANG

Distribution in Nepal. GANDAKI, Lamjung, Dharampani, Kaymen, XII-12-59, 1♀, SPP.

First record for Nepal. Pradhan and Brydon (1960).

Distribution outside Nepal. Philippines.

Biology. Larvae are found in impounded spring water, flowing irrigation ditches, rivers, clear or muddy streams, pools and lakes, shaded or unshaded and usually with considerable vegetation. Adult females are attracted to humans (Harrison 1980).

Taxonomic note. The record from Nepal is quite removed from the known distribution of this species and Harrison (1980) stated that it may be misidentified. The specimen is located in the collection of the National Institute of Communicable Diseases, New Delhi, India, where it was sent for confirmation. We are provisionally retaining it in the Nepal fauna pending further study.

ANOPHELES (CELLIA) FLUVIATILIS JAMES

Distribution in Nepal. KOSI, Tarahara, XI-29-87, 1L, SPP, RFD; NARAYANI, Makwanpur, Hetaura, 2♀, 1♂ (BMNH, Townsend in litt. 1989). It is found in all terai and inner terai districts and up the mountain valleys to at least 1,344 m (Shrestha (1966).

First record for Nepal. Puri (1955). Other reports from Nepal - Peters et al. (1955), Brydon et al. (1961), Shrestha (1966), Ramachandra Rao (1981).

Distribution outside Nepal. From Arabian Peninsula east to China and Taiwan.

Biology. Larvae prefer flowing water, i.e., streams, field channels, irrigation ditches, especially with grassy margins. They have been found in wells during months with heavy monsoon rains. A thorough discussion of adult biology can be found in Ramachandra Rao (1981). This species is one of the most efficient vectors of malaria in the Indian subcontinent. It is one of the principal vectors in the foothills, lower mountains and high mountain valleys up to 1,344 m in Nepal.

ANOPHELES (CELLIA) INDEFINITUS (LUDLOW)

Distribution in Nepal. KOSI, Sunsari, Dharan, IX-X-85, 2♀; IX-X-86, 6L; Tarahara, IX-X-86, 2♀; Morang, Sonapur, IX-X-88, 2♀, 1L (Burgess, unpublished data).

First record for Nepal. Burgess (unpublished data).

Distribution outside Nepal. Malaysia, Taiwan, the Philippines and Mariana Islands.

Biology. Larvae have been typically found in grassy fresh water pools, ponds and ditches. Adult females feed mainly on bovines (Reid 1968).

ANOPHELES (CELLIA) JAMESII THEOBALD

Distribution in Nepal. JANAKPUR, Sindhuli, Khutepani, IX-3-88, 1♀, 1♂; IX-9-88, 2♀, SPP; Ranibas, XI-5-88, 2♀, SBS.

First record for Nepal. Brydon et al. (1961). Other reports from Nepal - Shrestha (1966), Ramachandra Rao (1981).

Distribution outside Nepal. India and Sri Lanka east to China and Indochina and south to Malaysia.

Biology. Larvae occur mainly in tanks and fallow and growing rice fields, also in waste irrigation water where it is closely associated with *An. annularis*. Adults are found resting in houses and cattle sheds (Ramachandra Rao 1981).

ANOPHELES (CELLIA) JEYPORIENSIS JAMES

Distribution in Nepal. It is distributed generally throughout the terai, inner terai and low hills.

First record for Nepal. Brydon et al. (1961). Other reports from Nepal - Shrestha (1966), Harrison (1980).

Distribution outside Nepal. From India to southern China, Taiwan and Indochina.

Biology. Larvae have been taken from slow flowing streams, river margins, ditches with grassy margins, irrigation canals, rice fields and seepages in the foothills in partial to heavy shade and particularly where bottoms were silty. Females have been collected commonly inside houses. The species is an important vector of malaria in Indochina. It has also been found infected with *Wuchereria bancrofti* (Harrison 1980).

Taxonomic note. Formerly 2 varieties were known from Nepal, the type variety and var. *candidiensis* Koidzumi; in fact the latter was the more common. However, Harrison (1980), after exhaustive study of the taxon throughout its range, has concluded that it is a single variable species and the above varieties have no taxonomic validity.

ANOPHELES (CELLIA) KARWARI (JAMES)

Distribution in Nepal. JANAKPUR, Sindhuli, Ranibas, XI-5-88, 5♀, SPP. It has been found as far west as Makwanpur district in the terai forests (Shrestha (1966).

First record for Nepal. Brydon et al. (1961). Other reports from Nepal - Shrestha (1966), Ramachandra Rao (1981).

Distribution outside Nepal. Widely distributed in the Oriental Region and south to New Guinea.

Biology. The immatures inhabit clear, shaded streams, spring pools, seepages and swamps. Adult females attack man (Ramachandra Rao 1981).

ANOPHELES (CELLIA) KOCHI DONITZ

Distribution in Nepal. MECHI, Jhapa, Kemabarhi, IX-27-63, 5♀; Dhemaldhura, IX-27-63, 2♀, GPJ.

First record for Nepal. Joshi et al. (1964). Other reports from Nepal - Shrestha (1966), Ramachandra Rao (1981).

Distribution outside Nepal. India east to China and the Philippines and south to Indonesia.

Biology. Larvae occur in shallow muddy water in ground pools, hoof prints and fallow rice fields, usually in full sun. Adult females prefer to feed on bovines but will attack man on occasion (Ramachandra Rao 1981).

ANOPHELES (CELLIA) MACULATUS THEOBALD

Distribution in Nepal. It occurs more commonly in the mountains all over the country and much less abundant in the lowland areas (Shrestha 1966).

First record for Nepal. Puri (1955). Other reports from Nepal - Peters et al. (1955), Brydon et al. (1961), Shrestha (1966), Ramachandra Rao (1981), Rattanarithikul and Green (1987).

Distribution outside Nepal. Pakistan, India and Sri Lanka east to Taiwan and south to Indonesia.

Biology. The species is found mainly in or near the hilly areas where larvae occur in springs, seepages and small streams with at least partial sun. They are more numerous where trees have been recently cleared. Adult females readily enter houses and attack man although they prefer bovines. It is an important vector of malaria in Malaysia (Ramachandra Rao 1981).

Taxonomic note. Four members of the Maculatus Complex, as defined by Rattanarithikul and Green (1987) occur in Nepal, i.e., *maculatus, willmori, pseudowillmori* and *dravidicus*. The last is a new country record. The latter 3 were collected as adults at the same time from 2 locations in the terai.

ANOPHELES (CELLIA) MAJIDI YOUNG AND MAJID

Distribution in Nepal. JANAKPUR, Sindhuli, Bardiagoth, IV-28-90, 2♀, SPP; NARAYANI, Makwanpur, Hetaura, 1♀ (BMNH, Townsend in litt. 1989). It has been collected in the terai districts of Nawalparasi, Makwanpur and Dhanusha (Shrestha 1966).

First record for Nepal. Peters et al. (1955). Other reports from Nepal - Shrestha (1966), Ramachandro Rao (1981).

Distribution outside Nepal. India and Burma.

Biology. Larvae are found in slow flowing streams with grassy edges, also in open drains and fallow rice fields. Adult females have been collected in houses and cattle sheds (Ramachandra Rao 1981).

ANOPHELES (CELLIA) MINIMUS THEOBALD

Distribution in Nepal. This species is confined to the forest and forest fringe in the terai and inner terai belts across the whole country (Shrestha 1966).

First record for Nepal. Puri (1955). Other reports from Nepal - Peters et al. (1955), Brydon et al. (1961), Shrestha (1966), Harrison (1980), Ramachandra Rao (1981).

Distribution outside Nepal. From India east to China, Taiwan and the Ryukyu Islands.

Biology. Larvae like margins of streams, rock pools, seepage pools, springs, stream pools and fallow rice fields with flowing water. They need unpolluted water in shaded areas with marginal emergent grasses (Harrison 1980). For

adult biology the reader is referred to Ramachandra Rao (1981). *Anopheles minimus* has been a primary vector of malaria in Nepal. Destruction of its habitat by deforestation, incursions by humans, resultant pollution and increased rice culture have decreased its numbers, so that it no longer is a major vector. This is also occurring in other countries in its range (Harrison 1980).

ANOPHELES (CELLIA) NIVIPES (THEOBALD)

Distribution in Nepal. KOSI, Dhankuta, Mulghat, IX-X-85, 1♀; Sunsari, Dharan, IX-X-85, 1♀; IX-X-87, 2♀; Tarahara, IX-X-85, 1♀, IX-X-86, 1♀; Itahara, IX-X-85, 1♀; Morang, Khanar, IX-X-85, 1♀, IX-X-86, 1♀, IX-X-87, 2♀; Dhubai, IX-X-85, 1♀; Biratnagar, IX-X-85, 2♀ (Burgess, unpublished data).

First record for Nepal. Burgess (unpublished data).

Distribution outside Nepal. Malaysia, Thailand possibly, Burma and India.

Biology. Larvae are sympatric with *An. philippinensis* in clean, still or slow moving water with vegetation, such as rice fields, ponds and irrigation canals. Females are largely zoophilic (Reid 1968).

Taxonomic note. Hybridization experiments by Klein et al. (1984) demonstrated that *nivipes* is distinct from *An. philippinensis.*

ANOPHELES (CELLIA) PALLIDUS THEOBALD

Distribution in Nepal. Widely distributed in the lowlands but never abundant (Shrestha 1966).

First record for Nepal. Brydon et al. (1961). Other reports from Nepal - Shrestha (1966), Ramachandra Rao (1981).

Distribution outside Nepal. Pakistan, India and Sri Lanka east to Indochina and south to Malaysia.

Biology. Larvae prefer stagnant water in ditches, ponds and shallow pools in stream beds with vegetation. Adult females have been collected indoors feeding on humans. It was found infected with malaria parasites and is considered a secondary vector in Bihar State, India (Ramachandra Rao 1981).

ANOPHELES (CELLIA) PHILIPPINENSIS LUDLOW

Distribution in Nepal. KOSI, Morang, Khokse, X-12-63, 1♀, BBP; NARAYANI, Bara, Nizghard, III-27-69, 1♂, GPJ; JANAKPUR, Sindhuli, Khutepani, II-9-89, 1♀, 1♂, SBS. It has been collected in the terai from Rupandehi east to Jhapa District (Shrestha 1966).

First record for Nepal. Brydon et al. (1961). Other reports from Nepal - Shrestha (1966), Ramachandra Rao (1981).

Distribution outside Nepal. India east to China and the Philippines and south to Indonesia.

Biology. Larvae inhabit ponds with dense aquatic vegetation, also tanks, pools in river beds. Adult females are predominantly zoophilic but a proportion feed on man. There is convincing evidence that this species serves as a vector of malaria parasites, but not in all parts of its range (Ramachandra Rao 1981).

ANOPHELES (CELLIA) PSEUDOJAMESI STRICKLAND AND CHOWDHURY

Distribution in Nepal. It is rare in Nepal, having been captured in the districts of Rupandehi, Nawalparasi, Jhapa and Ilam (Shrestha 1966).

First record for Nepal. Brydon et al. (1961). Other reports from Nepal - Shrestha (1966), Ramachandra Rao (1981) [as *ramsayi*].

Distribution outside Nepal. India and Sri Lanka east to Indochina and south to Indonesia.

Biology. Larvae occur in rain water pools, tanks and swamps with heavy vegetation. Adults are found in houses and cattle sheds in small numbers (Ramachandra Rao 1981).

Taxonomic note. Nurul Huda and Harrison (1985) resurrected the name as the proper designation for a taxon previously called *ramsayi* Covell. They ascertained that the issue of the journal in which the original description of *ramsayi* appeared (Indian Journal of Medical Science, April 1927) was actually printed after the journal in which that of *pseudojamesi* was published (Indian Medical Gazette, May 1927). Therefore *pseudojamesi* clearly has priority over *ramsayi.*

ANOPHELES (CELLIA) PSEUDOWILLMORI (THEOBALD)

Distribution in Nepal. MAHAKALI, Kanchanpur, Musepani, IX-10-88, 9♀, SPP; JANAKPUR, Sindhuli, Ranibas, XI-3-88, 4♀, SBS; KOSI, Sunsari, Tarahara, XI-26-87, 2♀, SPP, RFD.

First record for Nepal. Rattanarithikul and Green (1987).

Distribution outside Nepal. India, Thailand, China and Vietnam.

Biology. Immatures unkown; presumably biology is similar to that of *An. maculatus.*

ANOPHELES (CELLIA) SPLENDIDUS KOIDZUMI

Distribution in Nepal. JANAKPUR, Sindhuli, Ranibas, XI-3-88, 10♀, SPP; NARAYANI, Makwanpur, Hetaura, 2♀ (BMNH, Townsend in litt. 1989). Common across the country in the foothills of the terai region and extending up

the mountain valleys to an altitude of 1,980 m (Shrestha 1966).

First record for Nepal. Puri (1955). Other reports from Nepal - Peters et al. (1955), Brydon et al. (1961), Shrestha (1966), Ramachandra Rao (1981).

Distribution outside Nepal. Afghanistan, Pakistan and India east to China and Taiwan.

Biology. Larvae have been taken from hill streams. It is primarily a cattle feeder but does attack man (Ramachandra Rao 1981).

ANOPHELES (CELLIA) STEPHENSI LISTON

Distribution in Nepal. It has been collected infrequently in the districts of Tanahu, Makwanpur, Mahottari and Morang (Shrestha 1966).

First record for Nepal. Brydon et al. (1961). Other reports from Nepal - Shrestha (1966), Ramachandra Rao (1981).

Distribution outside Nepal. Middle East, Afghanistan, Pakistan, India, Burma, Thailand and China.

Biology. This species, which is more prevalent during the cooler months of the year, has invaded urban areas and uses domestic breeding sites such as wells, cisterns, roof gutters, artificial containers and garden pools. In rural areas a wider range of habitats is used. Streams, canals, tanks, ponds, irrigation wells and seepages are occupied. Adult biology is summarized by Ramachandra Rao (1981, pp. 474-479). This species is a major vector of malaria in India, Pakistan, Iran and Iraq, but has not been incriminated in Nepal.

ANOPHELES (CELLIA) SUBPICTUS GRASSI

Distribution in Nepal. NARAYANI, Makwanpur, Hetaura, 1♀ (BMNH, Townsend in litt. 1989). This species is very common in a variety of habitats in all parts of the country except the very high mountains.

First record for Nepal. Puri (1955). Other reports from Nepal - Peters et al. (1955), Brydon et al. (1961), Shrestha (1966), Ramachandra Rao (1981).

Distribution outside Nepal. From Iran and Afghanistan east to China, Mariana Islands and the Philippines and south to New Guinea.

Biology. Immatures are found in practically every type of habitat that is not highly polluted. Examples are wells, borrow pits, irrigation channels, lake margins, ponds, tanks, ground pools, fallow and growing rice fields and cisterns. They can be shaded or unshaded and with or without vegetation. Adults are common in houses and cattlesheds. The females feed mostly on domestic animals. It bites man but not in great numbers (Ramachandra Rao 1981).

ANOPHELES (CELLIA) TESSELLATUS THEOBALD

Distribution in Nepal. JANAKPUR, Sindhuli, Ranibas, XI-5-88, 8♀, 3♂, SBS. It is widely distributed in the terai, inner terai and lower mountains, but never very abundant (Shrestha 1966).

First record for Nepal. Brydon et al. (1961). Other reports from Nepal - Shrestha (1966), Ramachandra Rao (1981).

Distribution outside Nepal. From India and Sri Lanka east to South China, Taiwan and the Philippines and south to New Guinea.

Biology. Larvae have been encountered in rice fields and irrigation canals in both full sun and shade. Occasionally they occur in wells. Adults have been collected from houses, mixed dwellings and cattle sheds. The populations are never very large (Ramachandra Rao 1981). Fairly large numbers were observed resting outdoors in the inner terai of Nepal in the month of April.

ANOPHELES (CELLIA) THEOBALDI GILES

Distribution in Nepal. It has been taken only in the districts of Kaski, Makwanpur and Bara (Shrestha 1966).

First record for Nepal. Brydon et al. (1961). Other reports from Nepal - Shrestha (1966), Ramachandra Rao (1981).

Distribution outside Nepal. Pakistan, India and Burma.

Biology. Little is known about habitats of the immatures or adult behavior.

ANOPHELES (CELLIA) TURKHUDI LISTON

Distribution in Nepal. Shrestha (1966) reports it from the districts of Kabhre, Ramechhapp, Makwanpur, Chitwan and Bara.

First record for Nepal. Brydon et al. (1961). Other reports from Nepal - Shrestha (1966), Ramachandra Rao (1981).

Distribution outside Nepal. India, Pakistan, Middle East, North and East Africa.

Biology. Larvae occur in shallow ground pools among green algae, also in river-bed pools. Adults frequent houses and cattle sheds. This species is found at higher elevations as well. It is not a common mosquito (Ramachandra Rao 1981).

ANOPHELES (CELLIA) VAGUS DOENITZ

Distribution in Nepal. This species is widely distributed in the lowland areas and in the mountains (Shrestha 1966).

First record for Nepal. Peters et al. (1955). Other reports from Nepal - Brydon et al. (1961), Shrestha (1966), Ramachandra Rao (1981).

Distribution outside Nepal. Oriental Region to New Guinea.

Biology. Immatures have been observed in muddy pools, borrow pits, ponds, rain pools, hoof prints and cart tracks in full sun. Adult females are strongly zoophilic and attracted to cattle sheds in large numbers; however, they will invade human dwellings (Ramachandra Rao 1981).

ANOPHELES (CELLIA) VARUNA IYENGAR

Distribution in Nepal. Widely distributed in the terai and inner terai (Shrestha 1966).

First record for Nepal. Peters et al (1955). Other reports from Nepal - Brydon et al. (1961), Shrestha (1966), Harrison (1980), Ramachandra Rao (1981).

Distribution outside Nepal. India, Burma and Sri Lanka.

Biology. Larvae have been found in both stagnant and flowing water. Breeding populations are highest when the water table is lowest, just before the beginning of the monsoon rains. Collections have been made from ponds and wells, small streams, tanks and irrigation canals. Females feed on both man and bovines. The proportion varies in different areas; the anthropophilic index is high in some localities. It is considered a secondary vector of malaria parasites in parts of India (Ramachandra Rao 1981).

ANOPHELES (CELLIA) WILLMORI (JAMES)

Distribution in Nepal. MAHAKALI, Kanchanpur, Musepani, IX-10-88, 8♀, SPP; JANAKPUR, Sindhuli, Ranibas, XI-5-88, 4♀, SBS.

First record for Nepal. Peters et al. (1955) [as *maculatus* var. *willmori*]. Other reports from Nepal - Brydon et al. (1961), Shrestha (1966), Pradhan et al. (1970), Ramachandra Rao (1981), Rattanarithikul and Green (1987).

Distribution outside Nepal. Pakistan, India, Burma and Thailand.

Biology. Immature stages occur in stream bed pools, rice fields, rock holes and roadside ditches (Rattanarithikul and Green 1987). Pradhan et al. (1970) studied adult female behavior in a high mountain valley in Nepal. All adults were captured at the peridomiciliary position. Several were found infected with malaria parasites (8 of 1,283 dissected). The altitude in this valley was 3,170 m and this is the highest known record of malaria transmission.

GENUS *ARMIGERES*

ARMIGERES (ARMIGERES) AUREOLINEATUS (LEICESTER)

Distribution in Nepal. KOSI, Sunsari, Ghopal, IX-X-84, 1L (Burgess, unpublished data).

First record for Nepal. Burgess (unpublished data).

Distribution outside Nepal. India, Sri Lanka, Thailand, Indochina, China and Borneo.

Biology. Larvae have been taken in coconut shells (Barraud 1934).

ARMIGERES (ARMIGERES) DURHAMI EDWARDS

Distribution in Nepal. NARAYANI, Makwanpur, Hetaura, I-90, 1♀, SPP; KOSI, Sunsari, Bhotepur, IX-X-83, 2♀; Manglabre, IX-X-83, 2♀; Morang, Dhubai, IX-X-85, 2♀ (Burgess, unpublished data).

NEW COUNTRY RECORD

Distribution outside Nepal. India, Thailand, Indochina, Malaysia and Indonesia.

Biology. Larvae have been found in tree holes, tree stumps and muddy grassy pools (Thurman 1959).

ARMIGERES (ARMIGERES) KESSELI RAMALINGAM

Distribution in Nepal. KOSI, Dhankuta, Mulghat, IX-X-86, 1♀ (Burgess, unpublished data).

First record for Nepal. Burgess (unpublished data).

Distribution outside Nepal. India, Bangladesh, Thailand, Laos, Malaysia and Indonesia.

Biology. Larvae have been found in artificial containers, coconut shells, bamboo stumps, leaf axils and rotting fruit. It tolerates very high pollution but also is found in clean water. The adults readily bite man. It is a semidomestic species but also occurs in forests (Ramalingam 1987).

ARMIGERES (ARMIGERES) KUCHINGENSIS EDWARDS

Distribution in Nepal. LUMBINI, Rupandehi, Bhairahawa, IV-7-88, 1♂, SPP; NARAYANI, Makwanpur, Hetaura, VI-VII-55, 2♀; Nayagaon, I-V-55, 1♀ (Peters and Dewar 1956).

First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966).
Distribution outside Nepal. India east to Vietnam and south to Malaysia.
Biology. Larvae occur in bamboo internodes (Barraud 1934). Adults were collected in Nepal at human bait and inside houses. Daytime resting on bushes and flowers near human dwellings was observed. It is a persistent daytime biter of humans.

ARMIGERES (ARMIGERES) SUBALBATUS (COQUILLETT)
Distribution in Nepal. BAGMATI, Kathmandu, Siphal, XII-60, 1♀; Kalimati, VI-10-86, 2♂, VI-15-88, 1♂, VII-9-88, 2♂; Kabhre, Sipatinghora, VI-59, 1♀, SPP; KOSI, Sunsari, Dharan, VI-61, 6♀, VII-6-81, 1♂, SPP; NARAYANI, Makwanpur, Hetaura, VII-7-87, 2♂, SPP; LUMBINI, Rupandehi, Bhairahawa, IV-7-88, 21♂, SPP.
First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).
Distribution outside Nepal. Pakistan east to China, Japan, Korea and the Philippines and south to Malaysia.
Biology. Larvae of this species are common in tree holes, bamboo stumps, artificial containers, often in very polluted water (Barraud 1934).
Taxonomic note. Shrestha (1966) listed *Ar. obturbans* (Walker) as part of the Nepal mosquito fauna. This name was listed as a synonym of *subalbatus* by Thurman (1959), but there is great uncertainty about the status of *obturbans* because the holotype has been lost. Knight and Stone (1977) refer to it as a "nomen dubium" and we do not recognize it here.

ARMIGERES (LEICESTERIA) ANNULITARSIS (LEICESTER)
Distribution in Nepal. KOSI, Sunsari, Dharan, IX-X-84, 6♀ (Burgess, unpublished data).
First record for Nepal. Burgess (unpublished data).
Distribution outside Nepal. India, Thailand, Indochina, Taiwan, Malaysia and Indonesia.
Biology. Eggs are laid by the female on her hindlegs and she holds them there for a time before depositing them in the breeding site. Eggs are placed in small holes made by beetle larvae in young bamboo shoots, usually below 3 m in height. Liquid in the nodes is exuded by the plant (Macdonald 1960).

ARMIGERES (LEICESTERIA) DENTATUS BARRAUD
Distribution in Nepal. KOSI, Sunsari, Dharan, IX-X-84, 2♀; IX-X-85, 2♀ (Burgess, unpublished data).
First record for Nepal. Burgess (unpublished data).
Distribution outside Nepal. India, Thailand and Malaysia.
Biology. Presumably females of this species lay their eggs on their hindlegs and hold them for some time before depositing them in the breeding site. Young bamboo shoots recently attacked by beetle larvae which make the holes mostly near ground level are the preferred habitats (Macdonald 1960).

ARMIGERES (LEICESTERIA) DOLICHOCEPHALUS (LEICESTER)
Distribution in Nepal. KOSI, Sunsari, Dharan, IX-X-84, 2♀ (Burgess, unpublished data).
First record for Nepal. Burgess (unpublished data).
Distribution outside Nepal. India, Thailand, Indochina, Malaysia and Indonesia.
Biology. Essentially the same as for *Ar. annulitarsis* (Macdonald 1960).

ARMIGERES (LEICESTERIA) MAGNUS (THEOBALD)
Distribution in Nepal. KOSI, Sunsari, Dharan, IX-X-84, 2♀ (Burgess, unpublished data).
First record for Nepal. Burgess (unpublished data).
Distribution outside Nepal. India and Sri Lanka east to China, Taiwan and the Philippines and south to Indonesia.
Biology. Females lay their eggs on the hindtarsi and hold them for some time before depositing them. The site is an open bamboo stump containing liquid with high organic content. It has also been reported breeding in pitcher plants (Macdonald 1960).

GENUS *COQUILLETTIDIA*

COQUILLETTIDIA (COQUILLETTIDIA) CRASSIPES (VAN DER WULP)
Distribution in Nepal. KOSI, Sunsari, Dharan, IX-X-85, 2♀; IX-X-87, 2♀; Itahari, IX-X-85, 2♀; Morang, Khanar, IX-X-87, 2♀ (Burgess, unpublished data).
First record for Nepal. Burgess (unpublished data).
Distribution outside Nepal. India and Sri Lanka east to China, Ryukyu Islands and the Philippines and south to New Guinea, Australia and the South Pacific Islands.

Biology. The larvae have siphons modified for penetrating the roots of aquatic plants from which they obtain air for respiration. They occur in permanent and semipermanent ponds containing such aquatic plants as *Pistia* spp. and *Eichornia* spp. Adults have been collected in human-baited traps (Toma and Miyagi 1986). Little is known of adult biology.

GENUS *CULEX*

CULEX (CULEX) BARRAUDI EDWARDS

Distribution in Nepal. BAGMATI, Kathmandu, Balaju, VIII-59, 1L, SPP; NARAYANI, Makwanpur, Hetaura, I-V-55, L (Peters and Dewar 1956).

First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966), Bram (1967), Sirivanakarn (1976).

Distribution outside Nepal. India, Sri Lanka, Thailand and Papua New Guinea.

Biology. Larvae have been collected in rice fields and shaded jungle pools. Bram (1967) had collections from a stream and roadside pond. It occurs at higher elevations and females are attracted to man.

CULEX (CULEX) BITAENIORHYNCHUS GILES

Distribution in Nepal. BAGMATI, Kathmandu, Balaju, VII-58, 5L; Kuriagaon, VI-59, 5L; Lalitpur, Harisiddi, VII-63, 4♀, 1♂; Kalimati, VIII-6-86, 2♀, SPP; KOSI, Morang, Baukajhora, XII-61, 1L; Tarahara, XI-26-87, 37♀, 27♂, 28L, SPP, RFD; LUMBINI, Kapilvastu, Kopuwa, IX-62, 1♀, SPP; NARAYANI, Chitwan, Rapti Valley, IV-63, 1♀, 1♂; VI-63, 1♀, 1♂, SPP; Makwanpur, Hetaura, I-V-55, 3♀, 2♂; Bhimpedi, I-V-55, 2♀, 2♂ (Peters and Dewar 1956); KARNALI, Mugu, Chhaina, VI-12-88, 1♀, SPP; JANAKPUR, Sindhuli, Khutepani, IX-3-88, 2♀, 3♂; I-3-88, 11♀, 2♂, 29L, SPP.

First Record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966).

Distribution outside Nepal. Widely distributed in the Oriental Region, extending west to East and West Africa, east to Micronesia, north to Korea and south to Australia.

Biology. The species is found in rural areas in permanent and semipermanent marshes, ditches, rice fields, river beds and canals. The water is fresh, filled with filamentous algae, which are obligatory components of their breeding habitats, and in full sun (Sirivanakarn 1976, Harbach 1988). In Nepal larvae have been collected in fallow rice fields, residual pools in a river bed, and an irrigation ditch all with abundant algal growth. Adults were captured inside houses, a tent and a cattle shed.

CULEX (CULEX) EDWARDSI BARRAUD

Distribution in Nepal. KOSI, Sunsari, Tarahara, XI-27-87, 4♀, 4L, SPP, RFD.

First record for Nepal. Pradhan and Darsie (1989).

Distribution outside Nepal. India, Sri Lanka, New Guinea and Australia.

Biology. Usually taken at higher elevations, above 1,200 m, but we trapped it at the fringe of the forest of tropical hardwoods and in a piggery at 300 m. Larvae have been taken from stream pools and grassy pools. Little is known about its breeding or adult biology (Sirivanakarn 1976).

Taxonomic note. Bram (1967) synonymized this species under *Cx. barraudi* since the 2 species seemed to be so similar in all stages. However, Sirivanakarn (1976) noted several differences which prompted him to resurrect *edwardsi* as a valid species.

CULEX (CULEX) EPIDESMUS (THEOBALD)

Distribution in Nepal. KOSI, Morang, Baukajhora, VI-61, 1♀; NARAYANI, Bara, Nizgarh, VI-63, 1♀; BAGMATI, Kathmandu, Kalimati, VIII-63, 1♀; MAHAKALI, Kanchanpur, Haldu Khal, VIII-3-86, 15♀, SPP.

First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).

Distribution outside Nepal. Pakistan and India.

Biology. The immature stages are unknown but we have a collection of 14 larvae from JANAKPUR, Sindhuli, Khutepani, III-10-89, SPP, from a fresh water seepage area, which we believe may be the larvae of this species. They definitely belong to the Bitaeniorhynchus Group as the larval head does not have the median labral plate separated from the dorsal apotome. Further collecting and individual rearing will be conducted to confirm our suspicion. They have been included in the larval key as *Culex* sp. 1. Adults in Nepal have been captured inside houses and in a pit-shelter, while those in Pakistan came to bovine bait (Reisen 1978).

CULEX (CULEX) FUSCOCEPHALA THEOBALD

Distribution in Nepal. BAGMATI, Lalitpur, Pharping, VIII-58, 2L; Taudaha, XII-58, 1L; Kathmandu, Swayambhunath, XI-58, 1L; Kalimati, VIII-63, 1♀, SPP; KOSI, Sunsari, Tarahara, XI-26-87, 52♀, 42L, SPP, RFD; NARAYANI, Makwanpur, Hetaura, I-V-55, L (Peters and Dewar 1956).

First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966), Bram (1967), Sirivanakarn (1976).

Distribution outside Nepal. Pakistan, India, Sri Lanka east to Okinawa and the Philippines and south to Indonesia.

Biology. Immature stages have been collected in rice fields, ground pools, foot prints and marshes. In Nepal larvae have been dipped from shallow pools in swampy ground and irrigation ditches. Adults are locally very abundant. We found it to be the most common species in piggeries in the month of November. Females prefer bovines and pigs as hosts but do attack man. Japanese encephalitis has been isolated from this mosquito in Thailand (Gould et al. 1974) and is a suspected vector in Nepal.

CULEX (CULEX) GELIDUS THEOBALD

Distribution in Nepal. BAGMATI, Kathmandu, Guheswari, VIII-58, 1L, SPP; KOSI, Morang, Murgatola, X-61, 3♀; Baukajhora, III-62, 4L, Tarahara, XI-26-87, 4L, SPP, RFD; NARAYANI, Bara, Nizgarh, VI-63, 1♀, 2♂, SPP; Makwanpur, Hetaura, I-V-55, Ad (Peters and Dewar 1956).

First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966), Bram (1967).

Distribution outside Nepal. Widespread in the Oriental Region from Pakistan to China and the Philippines, south to Indonesia and New Guinea.

Biology. The species is associated closely with man and his domestic animals. Immatures live in puddles, pools, rice fields and marshy depressions having abundant vegetation. Their preferred hosts are bovines and swine, but they readily attack man (Sirivanakarn 1976). This is a suspected vector of Japanese encephalitis and was the most abundant mosquito collected in Sunsari District during Sept./Oct. 1985 (Leake et al., unpublished data). This virus has been isolated from *Cx. gelidus* in Thailand (Gould et al. 1962).

CULEX (CULEX) HUTCHINSONI BARRAUD

Distribution in Nepal. BAGMATI, Kathmandu, Kalimati, VII-12-87, 1♀, SPP.

First record for Nepal. Pradhan and Darsie (1989).

Distribution outside Nepal. Pakistan east to Vietnam and south to Singapore.

Biology. Larvae occurs in ponds, wells, ditches, rock pools and artificial containers. Little is known of adult biology (Sirivanakarn 1976).

CULEX (CULEX) INFULA THEOBALD

Distribution in Nepal. BAGMATI, Kathmandu, Kalimati, VIII-12-87, 1♀; JANAKPUR, Sindhuli, Khutepani, IX-3-88, 2♀; IX-9-88, 1♀, SPP; KOSI, Sunsari, Tarahara, XI-29-87, 4L, SPP, RFD.

NEW COUNTRY RECORD

Distribution outside Nepal. India and Sri Lanka east to the Philippines and south to Indonesia.

Biology. Larval habitats are apparently restricted to large algae-filled ponds. It is sympatric with *Cx. bitaeniorhynchus*. Adult females have been captured feeding on man and other animals (Sirivanakarn 1976).

Taxonomic note. Sirivanakarn (1973) recognized a number of forms within the taxon, *Cx. bitaeniorhynchus*. Those designated as *tenax* Theobald, *domesticus* Leicester, *ambiguus* Theobald, *taeniarostris* Theobald, *sarawaki* Theobald, and *infula* were lumped and treated as a single species, which by priority was given the name *infula* (Sirivanakarn 1976). We have a collection of adult females which fit the description of *ambiguus* and can be easily separated from the other members of the Bitaeniorhynchus Group. However, we are keeping it as a synonym of *infula* pending further study.

CULEX (CULEX) JACKSONI EDWARDS

Distribution in Nepal. BAGMATI, Lalitpur, Lubhugaon, XII-58, 1L; Godavari, VII-63, 3♀, SPP; JANAKPUR, Sindhuli, Khutepani, IX-9-88, 1♀; Ranibas, XI-5-88, 12♀, SBS.

First record for Nepal. Joshi et al. (1965). Others reports from Nepal - Shrestha (1966).

Distribution outside Nepal. India and Sri Lanka east and north to China, Hong Kong, Taiwan, Korea and Maritime USSR.

Biology. Larvae have been taken from ground pools, irrigation ditches, fallow rice fields and seepage pools. Adult biology is unknown (Sirivanakarn 1976).

Taxonomic note. Joshi et al. (1965) considered *Cx. fuscifurcatus* Edwards as a valid species. However, Sirivanakarn

(1976) synonymized it under *jacksoni* based on the similarity of the male genitalia. He considered the difference in the number of spines on the siphon to be an intraspecific variation.

CULEX (CULEX) MIMETICUS NOE

Distribution in Nepal. BAGMATI, Lalitpur, Taudaha, VII-58, 1L; Godavari, VII-63, 4♀, SPP; KOSI, Sunsari, Tarahara, XI-29-87, 1L, SPP, RFD; KARNALI, Jumla, Neure, VI-6-88, 2L, SPP; JANAKPUR, Khutepani, I-12-88, 1L; II-10-89, 1L, SPP; Ranibas, XI-5-88, 1♀, 5♂, SBS; NARAYANI, Makwanpur, Hetaura, I-V-55, L; Bhimpedi, I-V-55, 2♀, 2♂, L (Peters and Dewar 1956).

First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966), Sirivanakarn (1976).

Distribution outside Nepal. From Spain, France and Italy east to Japan and Korea.

Biology. This is a common species in the Mediterranean Region but uncommon in the Oriental Region. It is usually found at higher elevations inhabiting stream beds, rock pools, shallow ground pools, seepages and ditches where algae are usually present. Adult biology is not well known (Sirivanakarn 1976).

CULEX (CULEX) MIMULUS EDWARDS

Distribution in Nepal. KOSI, Sunsari, Tarahara, XI-29-87, 1L, SPP, RFD; JANAKPUR, Sindhuli, Ranibas, XI-5-88, 2♀, SBS; NARAYANI, Makwanpur, Hetaura, I-V-55, 1♀, 1♂, L (Peters and Dewar 1956).

First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966), Bram (1967).

Distribution outside Nepal. India and Sri Lanka east to China and the Philippines and south to Papua New Guinea and Australia.

Biology. Larvae have been encountered in ground pools, ponds, wells, shaded jungle pools, marshy depressions and stream pools in full sun or shaded. Adults are not known to be attracted to man (Sirivanakarn 1976).

CULEX (CULEX) PSEUDOVISHNUI COLLESS

Distribution in Nepal. BAGMATI, Kathmandu, Kalimati, VIII-6-86, 2♀; VIII-19-86, 1♀; VIII-12-87, 1♀; VIII-13-87, 1♀; MAHAKALI, Kanchanpur, Haldu Khal, VIII-3-86, 1♀; VIII-19-86, 2♀; Musepani, VIII-13-87, 1♀, SPP; JANAKPUR, Sindhuli, Khutepani, IX-9-88, 5♀, III-10-89, 2L, SPP; Ranibas, XI-5-88, 3♀, SBS; KOSI, Sunsari, Tarahara, XI-29-87, 48L, SPP, RFD.

NEW COUNTRY RECORD

Distribution outside Nepal. Pakistan east to Japan and the Philippines and south to Indonesia.

Biology. Immatures were collected from various types of fresh water ground pools, rice fields and stream pools. Reuben (1971b) reported that larvae were not encountered in rice fields until the plants were 0.3 m in height. Females occasionally attack man but prefer bovines, birds and pigs (Sirivanakarn 1976). Biting rhythm of females showed a peak about 1900-2000 hours with a secondary peak at 0500 hours (Reisen and Aslamkhan 1978).

Taxonomic note. This species was described by Colless (1957). Reuben (1969) and Sirivanakarn (1975) elucidated the species of the Vishnui Complex, to which *pseudovishnui* belongs. Reuben's keys and descriptions have been employed in this study to identify members of the complex in Nepal. The other species of the complex found in Nepal are *tritaeniorhynchus* and *vishnui*.

CULEX (CULEX) QUINQUEFASCIATUS SAY

Distribution in Nepal. BAGMATI, Lalitpur, Taudaha, X-58, 1L; XII-58, 1L; Kathmandu, X-58, 5L; XII-58, 1L; Dilli Bazar, XI-58, 1L; Kalimati, VIII-63, 1♀; KOSI, Sunsari, Dharan, III-62, 4L; Tarahara, XI-28-82, 10♀, SPP; NARAYANI, Makwanpur, Chisapani, VIII-7-82, 1♀, SPP; Hetaura, I-V-55, 3♀, 1♂, L (Peters and Dewar 1956); JANAKPUR, Sindhuli, Khutepani, IX-9-88, 2♀, SPP.

First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966).

Distribution outside Nepal. Cosmotropical.

Biology. This is a common domestic species, abundant in human dwellings and animal shelters. Immature stages are found in any type of habitat from fresh and clear to brackish, turbid and polluted waters. It is common in ground pools, ditches, drains, sewage, latrines, septic tanks and artificial containers. Females feed on man at night indoors and outdoors, which is their preferred hosts in the Indonepal subcontinent (Sirivanakarn 1976, Reisen and Boreham 1979). The species is the principal vector of *Wuchereria bancrofti* in Nepal, which is within the endemic zone of filariasis (Jung 1973).

CULEX (CULEX) SINENSIS THEOBALD

Distribution in Nepal. BAGMATI, Kathmandu, Tupek, VIII-60, 1♀; Kathmandu, VII-63, 1♀; Kalimati, VIII-63, 2♀, SPP.

First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).
Distribution outside Nepal. India and Sri Lanka east to Korea, Japan and the Philippines and south to Indonesia.
Biology. Immatures have been found in fresh water ground pools, ponds, ditches, rice fields and stream pools with abundant vegetation, including algae. Adults seem to be peridomestic but their feeding habits are poorly known (Sirivanakarn 1976).

CULEX (CULEX) THEILERI THEOBALD
Distribution in Nepal. BAGMATI, Lalitpur, Taudaha, XII-58, 6L; Swayambhunath, XII-58, 1L.
First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966), Sirivanakarn (1976).
Distribution outside Nepal. Southern Palearctic, Ethiopian and Northern Oriental Regions east to Southern China and Northern Burma.
Biology. This species is restricted to the higher elevations in the Oriental Region. Larvae breed in permanent and temporary bodies of fresh or foul water. They are commonly found in slow moving streams, irrigation ditches, ground pools, ponds, springs and cisterns. In Africa females feed mainly on cattle but are known to enter houses and bite man. This species has been found naturally infected with Sindbis and West Nile viruses (McIntosh et al. 1967).

CULEX (CULEX) TRITAENIORHYNCHUS GILES
Distribution in Nepal. NARAYANI, Bara, Nizgarh, VI-63, 1♀; Chitwan, Rapti Valley, VI-63, 6♀; BAGMATI, Kathmandu, Kalimati, VII-63, 7♀, 1♂, 6L; VII-10-82, 2♀; Kathmandu, VIII-63, 3♀, SPP; KOSI, Sunsari, Tarahara, XI-29-87, 4♀, 31L, SPP, RFD.
First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).
Distribution outside Nepal. Widely distributed in Oriental Region, west to Middle East, Afrotropical Region, Mediterranean Region, north and east to Maritime USSR, Japan and Korea and south to Indonesia.
Biology. It is a common rural species in rice fields, shallow marshes, pools, ponds and ditches containing fresh or polluted water with grass or aquatic vegetation in partial shade or full sun. This species becomes dominant in rice paddies when plants reach 0.3 m in height. Adults are found in cattle sheds and piggeries. They also feed on man and birds (Sirivanakarn 1976). This species exhibits physiological and ecological plasticity throughout its range for it tolerates extremely variable environmental conditions, i.e., from the temperate climate of Japan and Korea to the tropical climate of Thailand and India. *Culex tritaeniorhynchus* is a major vector of Japanese encephalitis virus in many parts of the Oriental Region, including Nepal (Hammon et al. 1949, Hale et al. 1957, Buescher et al. 1959, Reuben et al. 1971a, 1971b; Leake et al. 1986).

CULEX (CULEX) VAGANS WIEDEMANN
Distribution in Nepal. KOSI, Sunsari, Dharan, X-61, 1♂; KARNALI, Jumla, Neure, VI-6-88, 3L, SPP.
First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).
Distribution outside Nepal. Widespread in northeastern Palearctic Region and in India, China, Hong Kong, Japan and Korea.
Biology. It is typically found in ground pools in higher elevations. Larvae have been taken from ground and stream pools, lake margins and ponds, usually containing algae. Little is known about adult biology (Sirivanakarn 1976). Reisen et al. (1982) captured adults resting in the forest.

CULEX (CULEX) VISHNUI THEOBALD
Distribution in Nepal. BAGMATI, Kathmandu, Balaju, VIII-58, 2L; Kalimati, VIII-63, 1♀, SPP; NARAYANI, Chitwan, Rapti Valley, IV-63, 1♀, SPP; Makwanpur, Hetaura, I-V-55, Ad, L (Peters and Dewar 1956); KOSI, Sunsari, Tarahara, XI-29-87, 2L, SPP, RFD.
First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966).
Distribution outside Nepal. India and Sri Lanka east to southern China, Ryukyu Islands and the Philippines and south to Indonesia.
Biology. Typical larval habitats are grassy ditches, pools, ponds, animal tracks, swampy ground and fallow rice fields. In growing rice paddies, it is replaced by larvae of *Cx. pseudovishnui* and *Cx. tritaeniorhynchus* when rice plants reach a height of 0.3 m. The natural hosts of the females are pigs and birds but man and cattle are readily attacked also. Japanese encephalitis virus has been isolated from this species (Reuben 1971a, 1971b; Sirivanakarn 1976).

CULEX (CULEX) WHITEI BARRAUD
Distribution in Nepal. KOSI, Sunsari, Tarahara, XI-26-87, 1♀, 1L, SPP, RFD; NARAYANI, Makwanpur, Hetaura, I-V-55, 2♀, 1♂, P, L (Peters and Dewar 1956).

First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966), Bram (1967).

Distribution outside Nepal. India, Bangladesh, Thailand, Vietnam, Philippines, Malaysia and Indonesia.

Biology. This species likes fresh water pools in dry stream beds containing decaying leaves in partial or heavy shade. Larvae also have been collected in marshy ground or rice fields. Nothing is known about adult biology (Sirivanakarn 1976).

CULEX (CULEX) WHITMOREI (GILES)

Distribution in Nepal. BAGMATI, Kathmandu, Kalimati, VIII-63, 1♀; MAHAKALI, Kanchanpur, Haldu Khal, VIII-3-86, 2♀; VIII-19-86, 1♀, 1♂; Baidaipur, VIII-14-87, 9♀, SPP.

First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).

Distribution outside Nepal. Pakistan, India and Sri Lanka east and north to China, Japan, Korea and Maritime USSR and south to the Philippines and New Guinea.

Biology. Immatures occur in fresh water shallow pools, ponds, puddles and ditches containing a good growth of grasses. It is sympatric with members of the Vishnui Complex and is never very abundant. Females use bovines and man as hosts (Sirivanakarn 1976).

CULEX (CULICIOMYIA) NIGROPUNCTATUS EDWARDS

Distribution in Nepal. KOSI, Sunsari, Tarahara, XI-26-87, 1♂, SPP, RFD.

First record for Nepal. Pradhan and Darsie (1989).

Distribution outside Nepal. India and Sri Lanka east to Hainan Island, Ryukyu Islands and Taiwan and south to Indonesia, the Philippines and Micronesia.

Biology. Larvae are found mainly in rice fields and grassy ground pools, also hoof prints, seepage pools and ditches. Females prefer birds as hosts. There is no record of it feeding on man (Bram 1967).

CULEX (CULICIOMYIA) PALLIDOTHORAX THEOBALD

Distribution in Nepal. JANAKPUR, Sindhuli, Khutepani, I-12-88, 1♀; III-9-89, 5♀, SPP; NARAYANI, Makwanpur, Hetaura, I-V-55, 1♀, 1♂, L (Peters and Dewar 1956).

First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966), Bram (1967).

Distribution outside Nepal. Pakistan, India and Sri Lanka east to China, Japan, Taiwan and the Philippines and south to New Guinea.

Biology. Larvae have been collected in rock holes, rice fields, jungle streams, hoof prints, tree holes and artificial containers. Little is known of adult behavior but some have been observed feeding on man (Bram 1967).

CULEX (CULICIOMYIA) VIRIDIVENTER (GILES)

Distribution in Nepal. KARNALI, Jumla, Neure, VI-6-88, 25L (altitude 3,000 m); JANAKPUR, Sindhuli, Khutepani, III-9-88, 1♀, SPP; MECHI, ? District, Dahawangahary Hills, II-08, 1♀, 1♂ (Barraud 1934).

First record for Nepal. Barraud (1934). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966).

Distribution outside Nepal. India, Bangladesh and Vietnam.

Biology. Larvae have been found in tree holes, ground pools near rivers, rock holes, muddy pools, spring and seepage pools and domestic containers. They tolerate turbidity and pollution. This species is usually encountered at higher elevations (Bhat 1975, Sirivanakarn 1977a).

CULEX (EUMELANOMYIA) BREVIPALPIS (GILES)

Distribution in Nepal. KOSI, Morang, Baukajhora, IX-61, 1♀; Sunsari, Dharan, III-62, 4L, SPP; NARAYANI, Makwanpur, Chisapani, VI-VII-55, 2L (Peters and Dewar 1956).

First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966).

Distribution outside Nepal. India and Sri Lanka east to China, Taiwan and the Philippines and south to Indonesia and the Bismarck Archipelago.

Biology. Larval habitats are mainly tree holes and bamboo nodes. They also have been taken from artificial containers and coconut shells. Adult females are not attracted to man (Sirivanakarn 1972).

CULEX (EUMELANOMYIA) FOLIATUS BRUG

Distribution in Nepal. JANAKPUR, Sindhuli, Khutepani, I-9-88, 1♂; I-12-88, 2♀, SPP; NARAYANI, Makwanpur, Hetaura, I-V-55, ♂ (Peters and Dewar 1956).

First record for Nepal. Peters and Dewar (1956) [as *castrensis* var. *foliatus*]. Other reports from Nepal - Joshi et al. (1965), Shrestha (1966), Bram (1967).

Distribution outside Nepal. India and Sri Lanka east to Hong Kong, Taiwan and the Philippines and south to Indonesia.

Biology. Immatures occur in small pools in stream margins under heavy shade. Adults have been collected resting in the forest near larval habitats but do not attack man (Sirivanakarn 1972).

CULEX (EUMELANOMYIA) MALAYI (LEICESTER)

Distribution in Nepal. NARAYANI, Bara, Nizgarh, VI-63, 1♀, SPP; Makwanpur, Hetaura, I-V-55, P (Peters and Dewar 1956); JANAKPUR, Sindhuli, Ranibas, XI-5-88, 1♀, SPP.

First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966), Bram (1967).

Distribution outside Nepal. India and Sri Lanka east to China and Hong Kong and south to Indonesia.

Biology. This species is one of the most common of the subgenus *Eumelanomyia* in Southeast Asia. Larvae occur principally in ground pools and stream pools in heavy shade. They have also been collected in rock pools, ponds, ditches and crab holes. Adult biology is unknown (Sirivanakarn 1972).

CULEX (LOPHOCERAOMYIA) INFANTULUS EDWARDS

Distribution in Nepal. KOSI, Sunsari, Tarahara, XI-29-87, 5L, SPP, RFD; JANAKPUR, Sindhuli, XI-5-88, 5♀, SPP; NARAYANI, Makwanpur, Hetaura, I-V-55, 5♂, L (Peters and Dewar 1956).

First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966), Bram (1967), Sirivanakarn (1977).

Distribution outside Nepal. India and Sri Lanka east to China, Japan and the Philippines and south to Indonesia.

Biology. The immature stages have been found in small ground pools, ditches, ponds, wells, foot prints, natural and artificial containers and margins of streams. Adults have been collected resting on damp vegetation and stream banks (Sirivanakarn 1977b). Miyagi (1973) colonized this species.

CULEX (LUTZIA) FUSCANUS WIEDEMANN

Distribution in Nepal. BAGMATI, Kathmandu, VIII-60, 2♀; Chauni, VIII-63, 1♂; Kalimati, VI-63, 1♀, VIII-63, 3♀; VIII-12-87, 1♀, 1♂, SPP; KOSI, Sunsari, Dharan, VI-61, 1♀, 1♂; Tarahara, XI-29-87, 1L, 1RA, SPP, RFD; LUMBINI, Kapilvastu, Taulihawa, IX-62, 3♀, SPP.

First record for Nepal. Joshi et al (1965). Other reports from Nepal - Shrestha (1966).

Distribution outside Nepal. Pakistan, India and Sri Lanka northeast to China, Japan, Korea and Maritime USSR, and south to Indonesia and the Philippines.

Biology. Larvae are predatory and are often associated with *Cx. quinquefasciatus* larvae which serve as food. We found it in a ground pool associated with *Cx. fuscocephala, Cx. pseudovishnui* and *Cx. tritaeniorhynchus.* Adult females are avian feeders and do not feed on man (Bram 1967).

CULEX (LUTZIA) HALIFAXII THEOBALD

Distribution in Nepal. BAGMATI, Kathmandu, Lubhu, X-58, 1♂; KOSI, Sunsari, Tarahara, VII-6-81, 1♀, SPP; NARAYANI, Makwanpur, Hetaura, I-V-55, L (Peters and Dewar 1956).

First record for Nepal. Peters and Dewar (1956) [as *vorax* Edwards]. Other reports from Nepal - Joshi et al. (1965), Shrestha (1966), Bram (1967).

Distribution outside Nepal. India and Sri Lanka northeast to China, Japan, Korea, Maritime USSR, east and south to the Philippines, Mariana Islands, Indonesia, New Guinea and Australia.

Biology. The predatory larvae inhabit semipermanent ground pools, rock pools and stream margins as well as artificial containers and tree holes. They prefer water with high organic content. Man is an occasional host for the adult females (Bram 1967).

Taxonomic note. In older literature this species was called *vorax* Edwards. Bram (1967), after extensive study of male genitalia of the 4 Oriental taxa, concluded that only 2 were valid. Therefore, he synonymized *vorax* and *raptor* Edwards with *halifaxii.* He mentioned that the 2 valid species, *fuscanus* and *halifaxii,* have considerable variation in the color patterns of the scutum, legs and abdomen.

GENUS *CULISETA*

CULISETA (CULISETA) NIVEITAENIATA (THEOBALD)

Distribution in Nepal. BAGMATI, Kathmandu, Balaju, III-58, 1L; Guheswari, I-61, 3♀; KOSI, Morang, Fimraha, X-61, 1♀, 1♂, SPP.

First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).

Distribution outside Nepal. India, Tibet, China and Taiwan.

Biology. Larvae occur in the mountains usually above 1,600 m. Their habitats include ditches, seepages, artificial containers, and ground pools in clear or polluted water. Females feed on bovines and man (Dobrotworsky 1971).

GENUS *HEIZMANNIA*

HEIZMANNIA (HEIZMANNIA) HIMALAYENSIS EDWARDS

Distribution in Nepal. KOSI, Sunsari, Dharan, VIII-61, 1♀; MAHAKALI, Kanchanpur, Musepani, IX-15-88, 1♀, SPP.

First record for Nepal. Joshi et al (1965). Other reports from Nepal - Shrestha (1966).

Distribution outside Nepal. India.

Biology. Larvae have been found in tree holes and bamboo stumps (Barraud 1934). Adults were collected in Nepal outdoors in the forest.

HEIZMANNIA (HEIZMANNIA) REIDI MATTINGLY

Distribution in Nepal. NARAYANI, Makwanpur, Hetaura, I-V-55, 1♀ (Peters and Dewar 1956).

First record for Nepal. Peters and Dewar (1956) [as *Hz. indica* (Theobald)]. Other reports from Nepal - Joshi et al. (1965), Shrestha (1966).

Distribution outside Nepal. India, Burma, Malaysia, Vietnam and Taiwan.

Biology. Immatures have been taken from tree holes, bamboo nodes, ground pools, rock holes and crab holes. Adults have been collected from human bait.

Taxonomic note. Mattingly (1957b) determined that the holotype of *Hz. indica* (Theobald) did not agree with the description of this species by Barraud (1934) and others, therefore a new name, *reidi,* was required. According to Mattingly (1970), *indica* does not occur in the Indian subcontinent, so that all previous references to it from that region are referable to *reidi*.

GENUS *MALAYA*

MALAYA GENUROSTRIS LEICESTER

Distribution in Nepal. LUMBINI, Rupandehi, Jogikuti, VIII-62, 1♀, SPP.

First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).

Distribution outside Nepal. India and Sri Lanka east to south China, Taiwan, the Philippines and south to Indonesia and New Guinea.

Biology. In Nepal an adult was captured resting under a log near an ant colony. Adults obtain food from ants of the genus *Cremastogaster.* The adults feed from the open mouth of the ant while it is being held between the front legs of the mosquito. Larvae live in tree holes and water holding leaf axils (Thurman 1959).

GENUS *MANSONIA*

MANSONIA (MANSONIOIDES) ANNULIFERA THEOBALD

Distribution in Nepal. LUMBINI, Kapilvastu, Taulihawa, IX-62, 5♀; JANAKPUR, Mohattari, Pipara, VII-7-84, 3♀, SPP.

First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).

Distribution outside Nepal. Oriental Region south to New Guinea.

Biology. Larvae have been found in ponds and lake margins where suitable aquatic plants abound. They attach to the main roots of *Pistia* spp. and *Eichornia* spp. from which they obtain air for respiration. When disturbed larvae readily detach, some coming to the surface to rest before reattaching. Adult females are strongly anthropophilic and the species is an important vector of *Brugia malayi* in India (Burton 1960).

MANSONIA (MANSONIOIDES) INDIANA EDWARDS

Distribution in Nepal. KOSI, Morang, Baukajhora, IX-61, 3♀; JANAKPUR, Mohattari, Pipara, VII-26-87, 1♀, SPP.

First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).

Distribution outside Nepal. India and Sri Lanka east to Indochina and south to Indonesia.

Biology. Swamps and ponds with abundant aquatic vegetation constitute larval habitats (Barraud 1934).

MANSONIA (MANSONIOIDES) UNIFORMIS (THEOBALD)

Distribution in Nepal. KOSI, Morang, Baukajhora, VIII-61, 4♀; LUMBINI, Kapilvastu, Taulihawa, VIII-62, 3♀; JANAKPUR, Mohattari, Pipara, VII-7-84, 2♀, SPP; NARAYANI, Makwanpur, Nayagaon, I-V-55, 4♀ (Peters and Dewar 1956).

First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966).

Distribution outside Nepal. Afrotropical, Oriental and Australasian Regions, Japan, Ryukyu Islands.

Biology. Larvae occur in open swamps and pools with thick aquatic vegetation. Larvae attach their siphons to roots in order to obtain air for respiration. They attach to the main roots up near their bases. They will not detach easily when disturbed. Adult females readily feed on man and are major vectors of filariasis in many parts of its range (Delfinado 1966).

GENUS *MIMOMYIA*

MIMOMYIA (ETORLEPTIOMYIA) LUZONENSIS (LUDLOW)

Distribution in Nepal. KOSI, Sunsari, Tarahara, XI-25-87, 1♀, SPP, RFD; JANAKPUR, Sindhuli, Bardiagoth, IV-28-90, 2♀, SPP.

First record for Nepal. Pradhan and Darsie (1989).

Distribution outside Nepal. India and Sri Lanka east to Taiwan, Okinawa and the Philippines and south to Java.

Biology. Larvae have been found in ponds with *Pistia* spp., artificial containers and roadside ditches. Adult females in Nepal were collected feeding on pigs (Mattingly 1957a; Delfinado 1966).

MIMOMYIA (MIMOMYIA) CHAMBERLAINI LUDLOW

Distribution in Nepal. KOSI, Morang, Dhubai, IX-X-85, 2♀ (Burgess, unpublished data).

First record for Nepal. Burgess (unpublished data).

Distribution outside Nepal. Pakistan, India and Sri Lanka east and south to Thailand, Indonesia, New Guinea and Australia.

Biology. Larvae have been collected from ditches with vegetation and algae, also in fish ponds and tanks. Adult habits are unknown (Delfinado 1966).

MIMOMYIA (MIMOMYIA) HYBRIDA (LEICESTER)

Distribution in Nepal. KOSI, Sunsari, Tarahara, IX-X-85, 2♀; Morang, Khanar, IX-X-85, 2♀; Sonapur, IX-X-85, 2♀ (Burgess, unpublished data).

First record for Nepal. Burgess (unpublished data).

Distribution outside Nepal. India and Sri Lanka east and south to Thailand, Indonesia and New Guinea.

Biology. Larvae have been associated with ground pools containing *Pistia* spp. They have attenuated siphons adapted for piercing roots of these aquatic plants to obtain air for respiration (Mattingly 1957a).

GENUS *ORTHOPODOMYIA*

ORTHOPODOMYIA ANOPHELOIDES (GILES)

Distribution in Nepal. GANDAKI, Lamjung, Ghanpokhara, XII-59, 3L; KOSI, Sunsari, Dharan, X-61, 1♀, 5♂, 12L; BAGMATI, Kathmandu, Wholchowk, VIII-63, 3♂; JANAKPUR, Sindhuli, Khutepani, I-12-88, 17L, III-3-89, 3L, SPP; NARAYANI, Makwanpur, Chisapani, VI-VII-55, 1L (Peters and Dewar 1956).

First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966), Zavortink (1968).

Distribution outside Nepal. Pakistan east to China and Japan and south to Indonesia.

Biology. Immatures have been found in tree holes, bamboo internodes, artificial containers and rock holes. Adults were collected resting in forested areas (Macdonald 1958, Zavortink 1968). In Nepal larvae were collected from tree holes associated with *Ae. albopictus, Ae. gubernatoris, An. interruptus* and *Cx. brevipalpis.*

GENUS *TOPOMYIA*

TOPOMYIA (TOPOMYIA) AUREOVENTER (THEOBALD)

Distribution in Nepal. NARAYANI, Makwanpur, Jyamere, VIII-62, 1♀, SPP.

First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).

Distribution outside Nepal. India.

Biology. Immature stages unknown.

GENUS *TOXORHYNCHITES*

TOXORHYNCHITES (TOXORHYNCHITES) SPLENDENS (WIEDEMANN)

Distribution in Nepal. KOSI, Sunsari, VIII-61, 2♂, 1L; LUMBINI, Rupandehi, Jogikuti, VIII-62, 1♂; JANAKPUR, Sindhuli, Khutepani, IX-3-88, 2♂, SPP.
First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966).
Distribution outside Nepal. Oriental Region, New Guinea, Fiji and Rotuma Islands.
Biology. Larvae are predatory and occupy tree holes. In Nepal they have been taken associated with *Ae. albopictus, Or. anopheloides* and *Ae. albolateralis.*

GENUS *URANOTAENIA*

URANOTAENIA (PSEUDOFICALBIA) LUTEOLA EDWARDS

Distribution in Nepal. NARAYANI, Makwanpur, Jyamere, VIII-62, 2♀, 2♂, SPP.
First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).
Distribution outside Nepal. India, Andaman Islands and Hainan Island.
Biology. Immatures and adult biology unknown.

URANOTAENIA (PSEUDOFICALBIA) MACULIPLEURA LEICESTER

Distribution in Nepal. NARAYANI, Makwanpur, Jyamere, VIII-62, 2♀, 1♂, SPP.
First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).
Distribution outside Nepal. India, Malaysia and Taiwan.
Biology. Larvae have been collected in tree holes and artificial containers (Peyton 1977).

URANOTAENIA (PSEUDOFICALBIA) RECONDITA EDWARDS

Distribution in Nepal. KOSI, Sunsari, Tarahara, XI-26-87, 1♀, SPP, RFD.
First record for Nepal. Pradhan and Darsie (1989).
Distribution outside Nepal. India, Sri Lanka, Thailand and Hainan Island.
Biology. Larvae have been taken from tree holes. Adult biology unknown (Barraud 1934).

URANOTAENIA (PSEUDOFICALBIA) STRICKLANDI BARRAUD

Distribution in Nepal. MAHAKALI, Kanchanpur, Haldu Khal, VIII-19-86, 1♀, SPP.
First record for Nepal. Pradhan and Darsie (1989).
Distribution outside Nepal. India and Thailand.
Biology. Larvae have been collected from rock pools and from a small ground pool in a seepage area (Peyton 1977).

URANOTAENIA (URANOTAENIA) ANNANDALEI BARRAUD

Distribution in Nepal. NARAYANI, Makwanpur, Hetaura, I-V-55, Ad (Peters and Dewar 1956).
First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966).
Distribution outside Nepal. India, Burma, China, Ryukyu Islands, Taiwan and the Philippines.
Biology. Larvae inhabit shaded forest streams, forest pools, rock pools and jungle swamps (Barraud 1934).

URANOTAENIA (URANOTAENIA) CAMPESTRIS LEICESTER

Distribution in Nepal. NARAYANI, Bara, Nizgarh, VI-63, 1♀, SPP; Makwanpur, Hetaura, I-V-55, Ad, P, L (Peters and Dewar 1956).
First record for Nepal. Peters and Dewar (1956). Other reports from Nepal - Joshi et al. (1965), Shrestha (1966).
Distribution outside Nepal. India, Sri Lanka, Thailand, Malaysia and Indonesia.
Biology. Larvae occur in shallow forest pools. Adults were collected resting near these pools (Peters and Dewar 1956). Larvae also have been found in streams and springs (Barraud 1934).

URANOTAENIA (URANOTAENIA) EDWARDSI BARRAUD

Distribution in Nepal. NARAYANI, Chitwan, Rapti Valley, IV-63, 1♀, SPP.
First record for Nepal. Joshi et al. (1965). Other reports from Nepal - Shrestha (1966).
Distribution outside Nepal. India, Thailand, Malaysia and Hainan Island.
Biology. Immatures and adult biology unknown.

URANOTAENIA (URANOTAENIA) MACFARLANEI EDWARDS

Distribution in Nepal. KOSI, Sunsari, Tarahara, XI-25-87, 8♀, SPP, RFD.

First record for Nepal. Pradhan and Darsie (1989).

Distribution outside Nepal. India, China, Ryukyu Islands, Taiwan, Malaysia and Indonesia.

Biology. Larvae have been collected from small leafy pools, from sandy bottom pools in a hill stream and from a pool in a cave. Larvae lie almost horizontal to water surface. Adults have been taken in damp areas close to streams (Bohart and Ingram 1946). In Nepal, they were captured in a CDC light trap.

URANOTAENIA (URANOTAENIA) SP. NEAR *TESTACEA* THEOBALD

Distribution in Nepal. KOSI, Sunsari, Tarahara, XI-26-87, 3♀, 1♂, SPP, RFD.

First record for Nepal. Pradhan and Darsie (1989).

Distribution outside Nepal. India, Burma, Thailand, Kampuchea, Vietnam and Malaysia (Peyton, pers. comm.).

Biology. Unknown, but may be similar to *Ur. testacea* whose larvae breed in forest streams, hoof prints in jungle and shaded rock pools with abundant scum and surface litter (Delfinado 1966).

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