Faunal richness and the checklist of Indian mosquitoes (Diptera: Culicidae)

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ABSTRACT: A review of published studies revealed that the Indian mosquito fauna comprises 393 species in 49 genera and 41 subgenera. The subfamily Anophelinae contains 61 species in one genus followed by Culiciniae with 332 species in 11 tribes and 48 genera. The tribe Aedini (subfamily Culiciniae) contains the highest number of species (176 species in 33 genera and two groups of incertae sedis; i.e., “Aedes” sensu auctorum and “Ochlerotatus” sensu auctorum). With the recent taxonomic changes in tribe Aedini, the Indian mosquito genera have gone up from 22 to 49. Changes to the Indian Aedini fauna subsequent to the reclassification of tribe Aedini are discussed. A total of 31 species are currently recognized in India for transmitting various mosquito-borne agents of human diseases. A checklist for the Indian mosquito species is presented and the need for a comprehensive study is emphasized.

DOI: 10.15560/10.6.1342

INTRODUCTION
Mosquitoes, belonging to family Culicidae and order Diptera, are a large group of insects present throughout the temperate and tropical regions and even beyond the Arctic Circle of the world (Harbach 2007). The Oriental Region, which includes India, is regarded as one of the richest biogeographic regions for mosquitoes of the world, along with the Neotropics (Gaston and Hudson 1994). At present, a total of 3,540 recognized mosquito species, divided between two subfamilies and 112 genera, are recorded in the world (Harbach 2014). A three to five-fold increase of the present numbers can be foreseen with more discoveries and naming of species mainly in Anophelinae, as a result of application of DNA-based methods (Harbach 2007). India is ranked fifth in terms of mosquito biodiversity after Brazil, Indonesia, Malaysia and Thailand (Foley et al. 2007). After the monumental works of Christophers (1933) and Barraud (1934), not many comprehensive biosystematics studies of Indian Culicidae have been undertaken. Since that time, many changes have taken place in the mosquito taxonomic literature. However, in the absence of any up-to-date monograph on Indian Culicidae, entomologists in India are still compelled to use these two books. In this context, as mentioned by Reuben et al. (1993), it needs to be emphasized that publications on the Southeast Asian Mosquito Project are very useful for the identification of Indian mosquito species. Berlin (1972) rightly proposed for a systematic study of Indian Culicidae because of increasing mosquito-borne diseases, changing ecology and advances in mosquito systematics. The online systematic catalog of Culicidae listed 356 species in India (Gaffigan et al. 2014). Although fewer in numbers, since the 1980s some faunistic surveys carried out in various parts of India detected many species which are new additions to the mosquito fauna of India. It seems that some of these records did not reach the mosquito catalog. As such, an up-to-date check list of mosquitoes of India is still not available, and the actual number of species present in India, has to be approximated. Moreover, with the advancement of molecular biology, many researchers from non-entomology backgrounds are now working with mosquitoes, and there is confusion about the informal taxonomic series, groups and subgroups to which mosquito species belong. Confusion seems to have increased after the changes made to the classification of tribe Aedini (Reinert et al. 2004, 2006, 2008, 2009) as journals are using two systems of classification. Reclassification of the tribe Aedini brought major changes raising the number of genera in this tribe from 11 to 81 along with changes to the spelling of names of some species in accordance with provisions of the International Code of Zoological Nomenclature. Hence, a checklist seems essential for the entomologists and public health personnel working in India to reflect changes to nomenclature to promote familiarity with the new names. Considering this, an up-to-date check list of the mosquito species of India based on the current classification is provided. The present status of the mosquito fauna of India and need for future work are also discussed.

MATERIALS AND METHODS
Information was collected from two online resource databases, namely systematic catalog of Culicidae and mosquito taxonomic inventory and published materials.

RESULTS AND DISCUSSION

Records indicate that the Indian mosquito fauna includes 393 species divided among 49 genera and 41 subgenera. Subfamily Anophelinae contains 61 species in one genus followed by subfamily Culiciniae with 332 species in 11 tribes and 48 genera. Tribe Aedini of subfamily Culiciniae contains the highest number of species (176 species in 33 genera and two groups of incertae sedis, i.e., “Aedes” sensu auctorum, “Ochlerotatus” sensu auctorum) (Table 1). The check list of the Indian Culicidae is presented as Appendix 1. In India, 31 species are currently recognized for transmitting various mosquito-borne pathogens; these are listed in Table 2.

Subfamily Anophelinae: Subfamily Anophelinae has three genera globally. Indian species are confined to genus Anopheles, with 61 formally named species divided between subgenera Anopheles and Cellia. However, the number of species will increase with the naming or recognition of synonymous names of sibling species in several groups or complexes. In India, subgenus Anopheles contains 26 species. In this subgenus, the assemblage of species in two most important groups (Hyrcanus and Barbirostris Groups) is still uncertain in India. The Hyrcanus Group is a highly complex group, which includes 30 closely related species distributed widely in the Oriental and Palaearctic regions, with some species playing important role in transmission of malaria and filariasis (Ma and Xu 2005). This Group was also incriminated as a vector of Japanese encephalitis in India and neighboring countries. Only seven species of this Group were recorded from India in comparison to 25 species recorded in China (Ma et al. 1998, 2000a, 2000b). Morphological identification of these species in adult stage seems to be very difficult or impossible unless accompanied by associated immature skins (Harrison and Scanlon 1975). Many anopheline surveys carried out in India recorded An. nigrinus of Hyrcanus Group to be the most predominant, seemingly because their identification was based on adult stage (Malhotra et al. 1987; Nagpal and Sharma 1987). However, surveys carried out in north-east India and Western Ghats of South India, where species identification was done using adult as well as associated larval and pupal characters, recorded An. petitaeniatius as the most prevalent and An. nigrinus as rather uncommon species (Khan et al. 1998; Tewari et al. 1987). Immature surveys carried out in upper Brahmaputra valley detected An. crawfordi, An. paraliae, An. petitaeniatius and An. sinensis of Hyrcanus Group from the north-east India, but did not collect any specimen of An. nigrinus (Khan et al. 1998). A few specimens identified as An. paraliae in these surveys were collected as immatures from a forest fringe area of Assam. Earlier considered as a subspecies of An. lestari, An. paraliae was later elevated to species status by Harrison et al. (1990), but more recently it has been synonymized with lestari by Taai et al. (2013), hence it is listed as lestari here. However, distribution of this species is restricted to low elevation coastal areas of Malayasia, Brunei, Vietnam and Thailand (Harrison and Scanlon 1975). This species is also easily misidentified with An. purtsati. Hence, record of this species in India needs further investigation, incorporating DNA-based analysis similar to China, where, ITS2 marker of r-DNA was used to differentiate member species of An. hyrcanus group (Ma et al. 1998, 2000a, 2000b). Recently, ITS2 sequencing of some specimens of Hyrcanus Group confirmed the presence of An. crawfordi, An. petitaeniatius and An. sinensis in the north-east India (Regional Medical Research Centre, Dibrugarh, Assam, India; unpublished data). Similarly Barbirostris Group which includes 11 species globally also has uncertain distribution records for most of the species, particularly in Indonesia and Indian sub-region, mainly because of identification difficulties (Harrison and Scanlon 1975). Four species were recognized in this group from India. An. hodgkinii was detected from Assam during larval collections (Khan et al. 1998).

Subgenus Cellia containing 35 species encompasses all important vectors of human malaria in India. Recently, two new species have been described from this subgenus from India. An. pseudosundaicus belonging to Pyretophorus Series was described from coastal areas of Kerela (Tyagi et al. 2009). Another species belonging to Maculatus Group of the Neocellia Series named as An. krishnai was described (Sathe and Jagtap 2012). However, Harbach (2014) noted the lack of credible evidence to support the recognition of this proposed species. Hence, krishnai is regarded as nomen nudum and is not included in our list of Indian Anopheles. Anopheles dthalii and Anopheles superpictus have been known only from extreme north-west (Baluchistan) which is not part of India. They have also not been recorded subsequently in India and therefore not included in the present checklist.

Several anopheline taxa recognized earlier to be medically important are now found to be complexes or groups of morphologically indistinguishable species (Rattanarithikul et al. 2006). Some important complexes and groups recorded in India are, An. annularis (species A and B), An. culicifacies (species A, B, C, D and E), An. dirus (species X), An. fluviatilis (species S, T, U and V), An. subpictus (species A, B, C, and D) and the An. sundaicus (cytotype D) complexes (Walton et al. 1999; WHO 2007). With the advances in mosquito taxonomy several species belonging to such groups or complexes are now formally named. An. maculatus, recognized as one such species group, includes nine formally named species (Harbach 2014; Somboon et al. 2011). A recent study revealed the
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**Table 1** Member species of Culicidae in India.

Total of each taxonomic level:

| 2 | 11 | 49 + 2 sensu auctorum | 41 + 1 sensu auctorum | 393 |
presence of six member species of the Maculatus Group in the north-east India, with detection of An. rampae constituting a new country record (Singh et al. 2012). Such studies may be extended to other areas where Maculatus Group is present. Similarly, species X of the Dirus Complex, reported earlier from Yunnan province of China, was also detected in Haflong area of Assam in the north-east India (Prakash et al. 2010).

Subfamily Culicinae: Subfamily Culicinae is comprised of 332 species divided into 11 tribes and 48 genera in India.

Tribe Aedemomyini: A single genus Aedeomymia is included in this tribe. This genus is not listed in the mosquito catalog under the Indian mosquito fauna. However, Tyson (1970) reported Andaman Islands as one of the distribution localities for Aedeomymia cataxica. This species was also reported from mainland India from Assam and Western Ghat (Khan et al. 1998; Reuben et al. 1993) and in the mangrove forests of Sunderbans, West Bengal (Rajavel et al. 2005a).

Tribe Aedini: In the earlier classification the tribe Aedini contained 11 genera (Knight and Stone 1977 and its supplements). Recent reclassification of this tribe has raised the number of genera to 81 (Reinert et al. 2004, 2006, 2008, 2009). Reinert (1999, 2000a) earlier resurrected Verrallina and Ayurakitta to generic rank. Revision of tribe Aedini resulted in the elevation of many former subgenera of Aedes to generic status (Reinert et al. 2004). Downsiomyia was elevated to genus level from synonymy with Finlaya. Further examination and revision of Finlaya and allied taxa and Ochlerotatus and allied taxa (Reinert et al. 2006, 2008), followed by comprehensive phylogenetic study of tribe Aedini (Reinert et al. 2009) resulted in recognition of more genera and rearrangement of taxa.

As per the current classification, Indian fauna of tribe Aedini includes 176 species in 33 genera and two groups of incertae sedis species ("Aedes" sensu auctorum-4 and "Ochlerotatus" sensu auctorum-5). Indian species belonging to subgenus Finlaya genus Aedes are now placed in 12 genera (Bruceharrisonius, Collessius, Downsiomyia, Danielsia, Finlaya, Gilesius, Hopkinsius, Hulecoetomyia, Himalaius, Jhiliensius, Ochlerotatus and Phagomyia). Similarly species of the subgenus Diceromyia of India are now placed in three genera Dendroskusea, Petermattingliyius and Tewarius. Illustrated keys of these new genera present in Thailand were provided by Rattanarithikul et al. (2010). Further details are available in the website of mosquito taxonomic inventory. Kaur (2003) provided updated distribution maps of Indian Aedini fauna.

Genus Aedimorphus: Earlier recognized as a subgenus of genus Aedes, Aedimorphus is now elevated to generic rank (Reinert et al. 2009). Mostly Oriental in distribution, of the 67 species recognized in this genus, 15 species were recorded from India.

Genus Armigeres: Distributed mainly in the Oriental region and also in the Palearctic and Australasian regions, the genus Armigeres is represented by 20 species in India, between two subgenera Armigeres and Leiciesterea. Rajput and Singh (1987c) reported the detection of Ar. dolichocephalus from Manipur state. Ar. joloensis, a rare mosquito species, was detected from upper Assam (Bhattacharyya et al. 2000). Recently a new species Ar. mahantai collected as immatures from endemic pitcher plant Nepenthes khasiana of Meghalaya state in the north-east India was described (Bhattacharyya et al. 2009). Ar. palithorax, described from Yunnan, China was detected from Namsai, Arunachal Pradesh (Rajavel et al. 2011).

Genus Ayurakitta: This genus is represented by only two species detected from mountainous areas of western Thailand (Reinert 1972). Recently, occurrence of this genus was reported for the first time from India as larvae collected form Pandanus axis in Meghalaya, north-east India and reared to adults, were found to be Ayurakitta peytoni (Rajavel and Natarajan 2011).

Genus Bruceharrisonius: An earlier subgenus of genus Ochlerotatus (Reinert 2003) Bruceharrisonius was later elevated to generic rank (Reinert et al. 2006). This genus includes four species in India. Three species earlier in Aureostriatus Subgroup (Aureostriatus Group) and one species of Auronitens Subgroup (Alboannulatus Group) of subgenus Finlaya genus Aedus (Knight and Marks 1952) are now placed in genus Bruceharrisonius.

Genus Christophersiomyia: A former subgenus of genus Aedes, now elevated to generic rank (Reinert et al. 2004), Christophersiomyia includes five species, of which, four occur in India. Cr. gombakensis, reported for the first time from Western Ghat, is a new country record (Reuben et al. 1993).

Genus Cancraedes: Cancraedes was elevated to genus from former subgenus of Aedes (Reinert et al. 2009). Of the total ten species included in this genus from Oriental Region, only two species occur in India.

Genus Collessius: A newly recognized genus Collessius (Reinert et al. 2006) includes species formerly in Pseudotaeniatus Subgroup of Mediavittatus Group, subgenus Sinlaya of genus Aedes (Knight and Marks 1952). In India this genus is represented by four species divided into two subgenera.

Genus Danielsia: Danielsia was elevated to generic rank from synonymy with Finlaya and included three taxa (Reinert 2009b). In India this genus is comprised of two species formerly in Alboannulatus Subgroup of subgenus Finlaya, genus Aedes.

Genus Dendroskusea: All five species included in genus Dendroskusea are found in India. These species were earlier placed in subgenus Diceromyia of genus Aedes.

Genus Downsiomyia: Downsiomyia as a genus was resurrected from synonymy with Finlaya (Reinert et al. 2006; Reinert and Harbach 2006). This genus is represented by six species in India which were earlier placed in the Niveus Subgroup of subgenus Finlaya. The species Do. nivea (Ae. niveus) has been incriminated as a vector of diurnally subperiodic Wuchereria bancrofti in the Nicobar islands (Tewari et al. 1995). Tewari and Hiriyyan (1995) redescribed this species from Andaman and Nicobar Islands.

Genus Edwardsaedes: Comprising of three species, the genus Edwardsaedes is represented by only one species in India.

Genus Finlaya: In the earlier classification Finlaya was one of the largest subgenus of genus Aedes comprising of 42 species in India. However, in the current classification, the genus Finlaya includes species only from Kochi Group.
of subgenus *Finlaya* (Reinert et al., 2004, 2006; Reinert and Harbach 2005). Two species of *Finlaya* are found in India. *Fl. flavipennis* was reported for the first time from mangrove forest ecosystem of Andaman and Nicobar Islands (Rajavel and Natarajan 2006).

Genus *Fredwardsius*: *Fredwardsius vittatus* is the only species included in this genus, which is present in India.

Genus *Gilesius*: Of the two species included in this genus, only one species occurs in India.

Genus *Heizmannia*: This genus is represented by 13 species in India, 11 species under subgenus *Heizmannia* and two species under subgenus *Mattinglyia*. Rajput and Singh (1987b) first reported the occurrence of *Hz. aureochaeta* in India from Manipur state. Similarly *Hz. chengi* was reported for the first time from Jeypore hill tracts of Orissa (Rajavel et al. 2005b).

Genus *Himalus*: Two species representing this genus are found in India.

Genus *Hopkinsius*: *Hopkinsius* contains two subgenera, *Hopkinsius* and *Yamada*. Only one species belonging to subgenus *Yamada* occurs in India.

Genus *Hulecoeteomyia*: Reinert et al. (2006) resurrected *Hulecoeteomyia* to generic status from synonymy with *Finlaya*. Five species included in this genus from India were earlier placed in Chrysolineatus Subgroup of subgenus *Finlaya*.

Genus *Jihlienius*: Of the three species recognized in this genus, only one is found in India.

Genus *Kenknightia*: *Kenknightia* comprised of 12 species of which only two species represent this genus in India.

Genus *Lorrainea*: Presence of *Lo. amesi* and *Lo. fumidus* belonging to genus *Lorrainea* were first reported from India based on collections made in mangrove forests of Sundarban, in West Bengal (Rajavel et al. 2005a), Bhaktarkanika in Orissa (Rajavel et al. 2005c) and Andaman Nicobar Islands (Rajavel et al. 2004). Previously, species of this genus were reported from Thailand, Philippines and Solomon Islands.

Genus *Mucidus*: Reinert (2000b) earlier treated *Mucidus* as a subgenus of newly elevated genus *Ochlerotatus*. However, in the later classification *Mucidus* was elevated to generic rank (Reinert et al. 2004). Three species of *Mucidus* are known to exist in India. Confirmed occurrence of *Mu. langier* was reported from two forest areas of Assam, north-east India (Bhattacharyya et al. 2005).

Genus *Neomelaniconion*: Mainly distributed in Afrotropical region, only one species *Neomelaniconion lineatopenne* represent this genus in the Oriental region including India.

Genus *Ochlerotatus*: This genus includes only one species in India.

Genus *Paraedes*: Subgenus of the genus *Aedes* in the earlier classification, *Paraedes* has been raised to genus level (Reinert et al. 2004) and is represented by four species in India. In this genus the confirmed presence of *Pr. ostentatio* was reported from a tropical forest zone of Dibrugarh district, Assam (Bhattacharyya et al. 2002). Barraud (1934) earlier reported this species from Malabar Coast of Kerala on the basis of female specimens. Reinert (1981) on resurrection of *Pr. chrysoscuta* from *Pr. ostentatio* considered Barraud’s Indian record under distribution of *Pr. chrysoscuta*, but pointed that Mattingly (1958) questioned the records from India. Until evidence is available otherwise, we retain Barraud’s record as *Pr. chrysoscuta* and include it in the present checklist.

Genus *Petermattinglyius*: *Petermattinglyius* comprises of two species in India. These two species were earlier placed in subgenus *Diceromyia*. *Pe. franciscol* was reported for the first time from mangrove forest ecosystem of Orissa (Rajavel et al. 2005c).

Genus *Phagomyia*: *Phagomyia* was elevated to generic status from synonymy with *Finlaya* and includes species formerly in Gubernatoris Subgroup of subgenus *Finlaya* (Reinert et al. 2006). *Phagomyia* includes 11 species in

**Table 2. Vectors of mosquito-borne diseases in India.**

<table>
<thead>
<tr>
<th>Disease</th>
<th>Mosquito Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaria</td>
<td><em>Anopheles</em> (Cellia)culicifacies* s.l. <em>Anopheles</em> (Cellia) baimai <em>Anopheles</em> (Cellia) flaviorum s.l. <em>Anopheles</em> (Cellia) minimus s.l. <em>Anopheles</em> (Cellia) stephensi <em>Anopheles</em> (Cellia) sudaicus s.l. <em>Anopheles</em> (Cellia) annularis s.l. <em>Anopheles</em> (Cellia) jeyporiensis <em>Anopheles</em> (Cellia) philippinensis <em>Anopheles</em> (Cellia) eivipes <em>Anopheles</em> (Cellia) varuna <em>Anopheles</em> (Cellia) maculatus s.l. (WHO 2007; Bhattacharyya et al. 2010; Rao 1984)</td>
</tr>
<tr>
<td>Japanese encephalitis</td>
<td><em>Culex</em> (Culex) vilunai <em>Culex</em> (Culex) pseudovilunai <em>Culex</em> (Culex) tritaeniorynchus <em>Culex</em> (Culex) fuscoccephala <em>Culex</em> (Culex) quinquefasciatus <em>Culex</em> (Culex) gelidus <em>Culex</em> (Culex) whitmorei <em>Culex</em> (Oculeomyia) bitaeniorynchus <em>Culex</em> (Oculeomyia) infalsa <em>Culex</em> (Oculeomyia) epidesmus <em>Anopheles</em> (Anopheles) barbicornis s.l. <em>Anopheles</em> (Anopheles) peditaeniatus <em>Anopheles</em> (Cellia) subpictus s.l. <em>Mansonia</em> (Mansoniaoides) annulifera <em>Mansonia</em> (Mansoniaoides) indiana <em>Mansonia</em> (Mansoniaoides) uniformis (Kanojia 2007)</td>
</tr>
<tr>
<td>Dengue</td>
<td><em>Stegomyia</em> (Stegomyia) aegypti <em>Stegomyia</em> albopticata (Kaul et al. 1998; Das et al. 2004)</td>
</tr>
<tr>
<td>Chikungunya</td>
<td><em>Stegomyia</em> (Stegomyia) aegypti <em>Stegomyia</em> albopticata (Mourya et al. 2001)</td>
</tr>
<tr>
<td>West Nile</td>
<td><em>Culex</em> (Culex) vilunai <em>Culex</em> (Culex) quinquefasciatus (Paramasivan et al. 2003)</td>
</tr>
<tr>
<td>Filarisis</td>
<td><em>Culex</em> (Culex) quinquefasciatus <em>Mansonia</em> (Mansoniaoides) annulifera <em>Mansonia</em> (Mansoniaoides) uniformis <em>Bittium</em> (Bittium) nivea (Agarwal and Sashindran 2006; Tewari et al. 1995)</td>
</tr>
</tbody>
</table>
India. *Ph. feegradei* was new addition to the mosquito fauna of India from the mangrove forest ecosystem of Orissa (Rajavel et al. 2005c).

Genus *Rhinoskusea*: *Rhinoskusea* comprises of three species in India. In this genus one new species *Rh. portonovoenisi* was described from mangrove forest of the east coast (Tewari and Hiryan 1991). The detection of *Rh. wardi* from mangrove forests of Andaman and Nicobar Islands is a new country record (Rajavel and Natarajan 2006). Reinert (2000b) earlier treated *Rhinoskusea* as a subgenus of genus *Ochlerotatus*. However, in the later classification *Rhinoskusea* was elevated to generic status (Reinert et al. 2004).

Genus *Scutomyia*: *Scutomyia* includes only one species in India.

Genus *Stegomyia*: The medically important genus *Stegomyia* includes 19 species in India. In this genus *St. krombeini*, earlier placed in Scutellaris Group of genus *Aedes* and subgenus *Stegomyia* (Huang 1979), was detected first from south India (Tewari et al. 1987) and later from north-east India (Bhattacharyya et al. 2008). Huang (1975) reported this species to be very common in Sri Lanka, which probably remained undetected as it was mistaken for another common species, *St. albopicta*. Hence careful observations during entomological surveys are necessary to differentiate *St. krombeini* from *St. albopicta*, especially in rural and forest areas of India. The records of *St. flavopicta* in Assam, western Himalayas and Coorg (Barraud 1934) was not considered by Huang (1972) who restricted its distribution to Japan and Korea. Its inclusion by Kaur (2003) in Indian species is based on Barraud (1934). While *St. pseudalbopictus*, *St. subalbopictus* and *St. novalbopictus* have been recorded in collections made in several parts of the country, *St. flavopicta* has not been obtained and hence it is not included in the present checklist. At present of the eight new subgenera recognized for this genus, only eight Indian species are placed in five subgenera. Remaining 11 species under this genus are still without subgeneric placement.

Genus *Tewarius*: Of the four species included in this genus, three are found in India. Reinert (2006) placed *Te. agastyai, Te. reubena* and *Te. nummatus* of subgenus *Diceromyia* to a new genus *Tewarius*. *Te. agastyai* and *Te. reubena* were described from Western Ghats (Tewari and Hiryan 1992).

Genus *Udaya*: *Udaya* includes three species from the Oriental region, of which two are found in India.

Genus *Verrallina*: Divided into three subgenera this genus contains 23 species in India. Subgenus *Neomacleaya* contains most of the species (16) followed by *Harbachius* (four) and *Verrallina* (three). A new species *Ve. assamensis* was described from Assam (Bhattacharyya et al. 2004a) and *Ve. consonensis* was recorded for the first time from Andaman and Nicobar Islands (Rajavel and Natarajan 2006). *Ve. ceylonica* was recently collected from Kerela state (Vector Control Research Centre, Puducherry, India unpublished report).

Incertae sedis species: Nine species belonging to two groups “*Aedes* sensu auctorum” and “*Ochlerotatus* sensu auctorum,” regarded to be of uncertain taxonomic position, are now under this head. Though, not considered as their formal status, the genus and subgenus of these species are now kept as provided by the authors. Four new species of undetermined subgenus (*Aedes kolhapuriensis, Aedes sangitae, Aedes panchgangee* and *Aedes sangiti*) were described from Kolhapur district of Maharashtra (Girhe and Sathe 2001; Sathe and Girhe 2001). However, descriptions of these species were inadequate and mainly based on adult female characters. Comparisons with closely related species were not available in the descriptions. Hence, collections of all life stages may be required for comparing with other related species to establish their validity and placing them in relevant genera and subgenera. Genus *Aedes* is now restricted mainly in the Palaearctic and Nearctic Regions. We retained these species in the checklist as they were already in the list of mosquito catalog and mosquito taxonomic inventory. Similarly, five species retained in genus “*Ochlerotatus*” and subgenus “*Finlaya*” (*Oc. auronitens, Oc. oreophilus, Oc. sintoni, Oc. suffusus and Oc. versicolor”) are yet to be placed in relevant genera in the current classification.

Tribe Culicini: Culicini includes 81 species in two genera and seven subgenera in India.

Genus *Culex*: Genus *Culex* is represented by 77 species in six subgenera in India with *Lophoceraomyia* being the predominant subgenus with 28 species, followed by subgenus *Culex* with 23 species. This genus contains many important vectors of Japanese encephalitis (JE) virus and microfilariae in India. In subgenus *Culex*, Vishnui Subgroup contains three most important vectors (*Cx. tritaeniorynchus, Cx. vishnui* and *Cx. pseudovishnui*) of JE in India. Presence of another three members in this subgroup i.e. *Cx. alienus, Cx. perplexus* and *Cx. whitei*, which can only be identified distinctively from other members on the basis of larval, pupal and male phallosome characters (Sirivanakarn 1976), can create diagnostic problem in JE vector surveillance in areas of their occurrence. Barraud (1934) earlier collected larvae of *Cx. whitei* from Haflong area of Assam. Few larvae of *Cx. alienus* which is regarded as one of the uncommon members by Sirivanakarn (1976) within this subgroup were collected from Assam. *Cx. perplexus* earlier known only from Andaman Islands was also reported from mangrove forests of Orissa (Rajavel et al. 2005c).

In subgenus *Culicomymia*, Rajput and Singh (1987a) first reported *Cx. harrisoni* from Senapati district of Manipur. *Cx. spatiruficura* was reported for the first time during a mosquito faunistic study in a mangrove forest ecosystem of Tamil Nadu (Rajavel et al. 1998). *Cx. scanloni* known earlier from Indonesia, Malaysia, Thailand and Vietnam was detected from Nagarhole National Park, Karnataka (Rajavel et al. 2011).

Subgenus *Eumelanomyia* is now represented by 10 species in India. One species *Cx. hinglungsensis* was reported first time from Manipur state of India (Rajput and Singh 1989).

In subgenus *Lophoceraomyia* one new species *Cx. singhbhumensis* was described from Orissa (Natarajan and Rajavel 2009). Several other species were also recorded from various parts of India such as *Cx. lasiopalis* and *Cx. pholter* from south India (Reuben et al. 1993), *Cx. quadripalpis* from the northeast India (Bhattacharyya et al. 2003) and *Cx. piliferoralis* and *Cx. wilfredi* from Jeyapore hills, Orissa (Rajavel et al. 2005b). are new addition to
the mosquito fauna of India. Similarly *Cx. aculeatus*, *Cx. paraculisus* and *Cx. gracilicorne* from Assam, *Cx. cubitatus* from Andaman and Nicobar Islands and *Cx. incus* and *Cx. demissus* from Orissa are new country records (Rajavel et al. 2011). *Cx. wardi* previously known only from Sri Lanka was recently collected from Kerela state (Vector Control Research Centre, Puducherry, unpublished report).

The subgenus *Maillotia* is represented by only one species in India.

Tanaka (2004) resurrected Oculeomyia from synonymy as a new subgenus of genus *Culex*, which includes species earlier placed in the Bitaniorhynchus Subgroup of subgenus *Culex*. This subgenus includes 6 species in India. Under this subgenus two females of *Cx. luzonensis* resting on vegetation were collected from Alwar, Rajasthan (Rajavel et al. 2011).

Genus *Lutzia*: It contains four species all in subgenus *Metalutzia*. A new species *Lt. agronensis* was described by Singh and Prakash (2008).

Tribe Culisetini: This tribe includes a single genus. Three species under two subgenera were recorded from India.

Tribe Ficalbiini: The tribe includes two genera i.e. *Ficalbia* and *Mimomyia*. One species of *Ficalbia* and six species of *Mimomyia* are found in India.

Tribe Hodgesini: Tribe Hodgesini includes a single genus and represented by only one species in India.

Tribe Mansonini: Two genera are included in this tribe. The genus *Coquillettidia* includes three species and genus *Mansonia* is represented by four species in India.

Tribe Orthopodomyiini: Only one genus is included in this tribe which is represented by five species in India.

Tribe Sabethinini: Sabethinini includes 14 genera of which three (Malaya, *Topomyia* and *Tripteroides*) are found in India. Genus *Malaya* is represented by two species and *Tripteroides* by eight species in India. Our experience indicates that genus *Tripteroides* requires further studies in India, especially in bamboo forested areas of the northeast India. Oriental in distribution (Thurman 1959), the genus *Topomyia* was represented by only one species in India, till Bhattacharyya et al. (2007) added three more species from Arunachal Pradesh. Further collections in high rainfall forested areas may increase the number of species in this genus.

Tribe Toxorhynchitini: Only one genus is included in this tribe. The genus *Toxorhynchites* includes nine species in India. *Tq. tyagi* is a new species described from Nilgiri hills, Western Ghats, southern India (Krishnamoorthy et al. 2013).

Tribe Uranotaeniini: *Uranotaenia* is the only genus in this tribe represented by 28 species (15 in subgenus *Pseudoficalbia* and 13 in subgenus *Uranotaenia*) in India. *Ur. micans* was first reported from India from Manipur state (Rajput and Singh 1990). Subsequently, *Ur. ohamaei* was recorded from Western Ghats, South India (Reuben et al. 1993). *Ur. digubaghenis* is a new species described from Dibrugarh district of Assam (Bhattacharya et al. 2004b). *Ur. rutherfordi* reported only from Sri Lanka was recently collected from Kerela state (Vector Control Research Centre, Puducherry, unpublished report).

At least 31 species are recognized in India for transmitting various pathogens to humans (Table 2).

Mosquito taxonomy provides essential inputs for vector control. In Vietnam, non-vector species *An. varuna* was misidentified as *An. minimus* and targeted as vector (Bortel et al. 2001). *An. fluvialitis*, a recognized primary vector of malaria in the north-east India (Mohanpatra et al. 1998) is now found to be a seasonal variant of *An. minimus* (Singh et al. 2010). In respect of malaria vectors, Manguin et al. (2008) suggested that vector control in a region is dependent on the numbers and complexity of the primary and secondary vectors and hence, requires study of the whole anopheline fauna in order to integrate the diverse information about vector system to formulate appropriate and effective control strategy. Besides, sylvatic cycles of some unknown arboviruses capable of spreading to humans may thrive in our forest ecosystem. The history of Chikungunya virus available in the web resource database of Chikungunya Virus Net suggested this virus to be originally circulated in the sylvatic cycle between forest dwelling mosquitoes and non-human primates, has now spread to different parts of the world including India. These facts clearly signify the importance of mosquito fauna study.

Limited studies carried out in some parts of India since the 1980s detected several new species and many new country records. With the increasing mosquito borne diseases and changing ecology there is a need for the reassessment of Indian Culicidae fauna. Comprehensive surveys with the incorporation of DNA-based methods such as DNA barcoding of mosquitoes (Pradeep Kumer et al. 2007) need to be undertaken on a large scale.

**Acknowledgements**: Researchers working in the Malariology department of Regional Medical Research Centre (RMRC), Dibrugarh are gratefully acknowledged for their assistance in the preparation of this checklist.

**Literature Cited**


APPENDIX 1. Systematic checklist of mosquitoes of India.

Subfamily Anophellinae

Genus Anopheles Meigen, 1818

Subgenus Anopheles Meigen, 1818

ANGUSTICORN SECTION

Anopheles Series

Aitkenii Group

Anopheles (Anopheles) aitkenii James, 1903
Anopheles (Anopheles) bengalensis Puri, 1930
Anopheles (Anopheles) insulasefallorum (Swellengrebel & Swellengrebel de Graaf, 1920)
Anopheles (Anopheles) pinjauresis Barraud, 1932

Caliciforinis Group

Anopheles (Anopheles) caliciforis Cogill, 1903
Anopheles (Anopheles) sintoni Puri, 1929

Lindesayi Group

Gigas Complex

Anopheles (Anopheles) baileyi Edwards, 1929
Anopheles (Anopheles) gilesi Gunes, 1901
Lindesayi Complex

Anopheles (Anopheles) lindesayi Gases, 1900
Anopheles (Anopheles) nitigosus Christophers, 1924

Plumbeus Group

Anopheles (Anopheles) bariannensis James, 1911

Lophoscelomyia Series

Asiacicus Group

Anopheles (Anopheles) annandalei Prasad, 1918

Interruptus Subgroup

Anopheles (Anopheles) interruptus Puri, 1929

LATICORN SECTION

Myzorhynchus Series

Barbirostris Group

Barbirostris Subgroup

Anopheles (Anopheles) barbirostris van der Wulp, 1884
Anopheles (Anopheles) hodgkini Reid, 1962

Vanus Subgroup

Anopheles (Anopheles) ahomi Chowdhury, 1929
Anopheles (Anopheles) barbambrosus Strickland & Chowdhury, 1927

Hyrcanus Group

Anopheles (Anopheles) argyropus (Swellengrebel, 1914)
Anopheles (Anopheles) sinensis Wiedemann, 1828

Lesteri Subgroup

Anopheles (Anopheles) crawfordi Reid, 1953
Anopheles (Anopheles) lesteri Baiss & Hu, 1936
Anopheles (Anopheles) petitaeniatous (Leicester, 1908)

Nigerimus Subgroup

Anopheles (Anopheles) nigerimus Giles, 1900
Anopheles (Anopheles) nititus Harrisoaon, Scanlon & Reid, 1973

Umbrusus Group

Letifer Subgroup

Anopheles (Anopheles) roperi Reid, 1950

Umbrusus Subgroup

Anopheles (Anopheles) umbrusus (Theobald, 1903)

Subgenus Cellia Theobald, 1902

Myzomyia Series

Anopheles (Cellia) majidi Young & Majid, 1928

Funestus Group

Anopheles (Cellia) jeyporiensis James, 1902

Aconitus Subgroup


RECEIVED: January 2014
ACCEPTED: October 2014
PUBLISHED ONLINE: December 2014
EDITORIAL RESPONSIBILITY: Marco Gottschalk
Appendix 1. Continued.

Anopheles (Cellia) acinutis Donitz, 1902
Anopheles (Cellia) varuna Iyengar, 1924
Culicifacies Subgroup
Anopheles (Cellia) culicifacies Giles, 1901 (species A, B, C, D and E)
Minimus Subgroup
Fluviatilis Complex
Anopheles (Cellia) fluviatilis James, 1902 (species S, T, U and V)
Minimus Complex
Anopheles (Cellia) minimus Theobald, 1901

Neocellia Series
Anopheles (Cellia) harvari (James, 1903)
Anopheles (Cellia) moghulensis Christophers, 1924
Anopheles (Cellia) pulcherrimus Theobald, 1902
Anopheles (Cellia) stephenst Liston, 1901
Anopheles (Cellia) theobaldi Giles, 1901

Annularis Group
Anopheles (Cellia) annularis van der Wulp, 1884 (species A and B)
Anopheles (Cellia) pallidus Theobald, 1901
Anopheles (Cellia) philippinensis Ludlow, 1902

Nivipes Complex
Anopheles (Cellia) nivipes (Theobald, 1903)

Jamesii Group
Anopheles (Cellia) jamesii Theobald, 1901
Anopheles (Cellia) pseudojamesi Strickland & Chowdhury, 1927
Anopheles (Cellia) splendidus Koidzumi, 1920

Maculatus Subgroup
Anopheles (Cellia) dravidicus Christophers, 1924
Anopheles (Cellia) maculatus Theobald, 1901

Sawadwongporni Subgroup
Anopheles (Cellia) sawadwongporni Rattanarithikul & Green, 1987
Anopheles (Cellia) rampae Harbach & Somboon, 2011

Neomyzomyia Series
Kochi Group
Anopheles (Cellia) kochi Donitz, 1901
Leucosphyrus Group
Hackeri Subgroup
Anopheles (Cellia) mirans Sallum & Peyton, 2005
Leucosphyrus Subgroup
Dirus complex
Anopheles (Cellia) baimaii Sallum & Peyton, 2005
Anopheles (Cellia) elegans (James, 1903)

Tessellatus Group
Anopheles (Cellia) tessellatus Theobald, 1901

Paramyzomyia Series
Cinereus Group
Anopheles (Cellia) turkhudi Liston, 1901
Pyretophorus Series
Anopheles (Cellia) pseudosundaicus (Tyagi, Hiriyen, Tewari, Ayanar, Samuel, Arunachalam, Paramesivam, Krishnamoorthi, Dhanaegyan, Leo & Rajendran, 2009)
Anopheles (Cellia) vagus Donitz, 1902
Subpictius complex
Anopheles (Cellia) subpictius Grassi, 1899 (species A, B, C and D)
Sundaicus Complex
Anopheles (Cellia) sunaicus (Rodenwaldt, 1925) (cytotype D)

Subfamily Culicinae

Tribe Aedimorphini

Genus Aedeomyia Theobald, 1901
Subgenus Aedeomyia Theobald, 1901
Aedeomyia (Aedeomyia) catastica Knab, 1909

Tribe Aedini

Genus "Aedes" sensu auctorum
Aedes kolhapuriensis Sathe & Girhe, 2001
Aedes panchgangee Sathe & Girhe, 2001
Aedes sangitee Sathe & Girhe, 2001
Aedes sangiti Girhe & Sathe, 2001

Genus Aedimorphus Theobald, 1903
Aedimorphus alboscutellatus (Theobald, 1905)
Aedimorphus caecus (Theobald, 1901)
Aedimorphus culicinus (Edwards, 1922)
Aedimorphus jamesi (Edwards, 1914)
Aedimorphus lowisii (Theobald, 1910)
Aedimorphus nigrorstriatus (Barraud, 1927)
Aedimorphus pallidostriatus (Theobald, 1907)
Aedimorphus pampangensis (Ludlow, 1905)
Aedimorphus piperata (Giles, 1902)
Aedimorphus punctifemoris (Ludlow, 1921)
Aedimorphus stenoetrus (Theobald, 1907)
APPENDIX 1. Continued.

Aedimorphus syntheticus (Barraud, 1928)
Aedimorphus tanniorhynchoides (Christophers, 1911)
Aedimorphus trimaculatus (Theobald, 1905)
Aedimorphus vexans (Meigen, 1830)

Genus Armigeres

Theobald, 1901

Subgenus Armigeres

Theobald, 1901
Armigeres (Armigeres) albofasciatus (Leicester, 1908)
Armigeres (Armigeres) durhami (Edwards, 1917)
Armigeres (Armigeres) joloensis (Ludlow, 1904)
Armigeres (Armigeres) kesseli Ramalingam, 1987
Armigeres (Armigeres) kuchingensis Edwards, 1915
Armigeres (Armigeres) mahantai Bhattacharyya, Prakash, Mohapatra & Sarma, 2009
Armigeres (Armigeres) pallithorax Dong, Zhou & Dong, 2004
Armigeres (Armigeres) subalbatus (Coquillett, 1898)
Armigeres (Armigeres) theobaldi Barraud, 1934

Subgenus Leicesteria

Theobald, 1904
Armigeres (Leicesteria) annulipalpis (Theobald, 1910)
Armigeres (Leicesteria) annulitaris (Leicester, 1908)
Armigeres (Leicesteria) cingulatus (Leicester, 1908)
Armigeres (Leicesteria) denticollis Barraud, 1927
Armigeres (Leicesteria) digitatus Edwards, 1914
Armigeres (Leicesteria) dolicocephalus (Leicester, 1908)
Armigeres (Leicesteria) flavus (Leicester, 1908)
Armigeres (Leicesteria) inchoatus Barraud, 1927
Armigeres (Leicesteria) longipalpis (Leicester, 1904)
Armigeres (Leicesteria) magnus (Theobald, 1908)
Armigeres (Leicesteria) omisus (Edwards, 1914)

Genus Ayurakitia

Thurman, 1954
Ayurakitia peytoni (Reinert, 1972)

Genus Bruceharrisonius

Reinert, 2003
Bruceharrisonius auroestratus (Doleschall, 1857)
Bruceharrisonius christophersi (Edwards, 1922)
Bruceharrisonius doonioi (Wattal, Bhatia & Kalra, 1958)
Bruceharrisonius greenii (Theobald, 1903)

Genus Christophersiomia

Barraud, 1923
Christophersiomia annulirostris (Theobald, 1905)
Christophersiomia gombakensis (Mattingly, 1959)
Christophersiomia ibis (Barraud, 1931)
Christophersiomia thomsoni (Theobald, 1905)

Genus Cancraedes

Edwards, 1929
Cancraedes cancricomes (Edwards, 1922)
Cancraedes simplex (Theobald, 1903)

Genus Collessius

Reinert, Harbach & Kitching, 2006

Subgenus Collessius

Reinert, Harbach & Kitching, 2006
Collessius (Collessius) eliae (Barraud, 1923)
Collessius (Collessius) macdougalli (Edwards, 1922)
Collessius (Collessius) shortti (Barraud, 1923)

Subgenus Alloeomyia

Reinert, Harbach & Kitching, 2008
Collessius (Alloeomyia) pseudotaeniatus (Giles, 1901)

Genus Danielsia

Theobald, 1904
Danielsia albotextiata (Leicester, 1904)
Danielsia lepchania (Barraud, 1923)

Genus Dendroskusea

Edwards, 1929
Dendroskusea kanarensis (Edwards, 1934)
Dendroskusea micropyga (Giles, 1901)
Dendroskusea periskelata (Giles, 1902)
Dendroskusea ramachandrai (Reuben, 1967)
Dendroskusea reginae (Edwards, 1922)

Genus Downsiomyia

Vargas, 1950
Downsiomyia albolateralis (Theobald, 1908)
Downsiomyia albonivea (Barraud, 1934)
Downsiomyia mahani (Knight, 1969)
Downsiomyia nivea (Ludlow, 1903)
Downsiomyia niveoides (Barraud, 1934)
Downsiomyia novonivea (Barraud, 1934)

Genus Edwardsaedes

Belkin, 1962
Edwardsaedes imprimens (Walker, 1861)

Genus Finlaya

Theobald, 1903
Finlaya flavipennis Giles, 1904
Finlaya pocillia Theobald, 1903

Genus Fredwardsius

Reinert, 2000
Fredwardsius vittatus (Bigot, 1861)

Genus Gilesius

Reinert, Harbach & Kitching, 2006
Gilesius pulchreventer (Giles, 1901)

Genus Himalaius

Reinert, Harbach & Kitching, 2006
Himalaius gilli (Barraud, 1924)
Himalaius similis (Edwards, 1922)

Genus Heizmannia

Ludlow, 1905

Subgenus Heizmannia

Ludlow, 1905
Heizmannia (Heizmannia) aureochaeta (Leicester, 1908)
Appendix 1. Continued.

Heizmannia (Heizmannia) chandi Edwards, 1922
Heizmannia (Heizmannia) chengi Lien, 1968
Heizmannia (Heizmannia) complex (Theobald, 1910)
Heizmannia (Heizmannia) covelli Barraud, 1929
Heizmannia (Heizmannia) funerea (Leicester, 1908)
Heizmannia (Heizmannia) greennis (Theobald, 1905)
Heizmannia (Heizmannia) himalayensis Edwards, 1922
Heizmannia (Heizmannia) indica (Theobald, 1905)
Heizmannia (Heizmannia) reidi Mattingly, 1957
Heizmannia (Heizmannia) viridis Barraud, 1929

Subgenus Mattinglyia Lien, 1968
Heizmannia (Mattinglyia) discrepans (Edwards, 1922)
Heizmannia (Mattinglyia) tripunctata (Theobald, 1908)

Genus Hopkinsius Reinert, Harbach & Kitching, 2008
Subgenus Yamada Reinert, Harbach & Kitching, 1908
Hopkinsius (Yamada) albolineatus (Barraud, 1924)

Genus Hulecoeteomyia Theobald, 1904
Hulecoeteomyia chrysolineata (Theobald, 1907)
Hulecoeteomyia formosensis (Yamada, 1921)
Hulecoeteomyia harveyi (Barraud, 1923)
Hulecoeteomyia paliorosinis (Edwards, 1922)
Hulecoeteomyia saxicola (Edwards, 1922)

Genus Jhiilenius Reinert, Harbach & Kitching, 2006
Jhiilenius unicinctus Edwards, 1922

Genus Kenknightia Reinert, 1990
Kenknightia dissimilis (Leicester, 1908)
Kenknightia karwarai (Barraud, 1924)

Genus Lorrainea Belkin, 1962
Lorrainea amesi (Ludlow, 1903)
Lorrainea famida (Edwards, 1928)

Genus Mucidus Theobald, 1901
Subgenus Mucidus Theobald, 1901
Mucidus (Mucidus) laniger (Wiedemann, 1820)
Mucidus (Mucidus) quasiferinus (Mattingly, 1961)
Mucidus (Mucidus) scatophagoides (Theobald, 1901)

Genus Neomelaniconion Newstead, 1907
Neomelaniconion lineatopenne (Ludlow, 1905)

Genus Ochlerotatus Lynch Arribalzaga, 1891
Ochlerotatus pullatus (Coquillett, 1904)

Genus "Ochlerotatus" sensu auctorum
Subgenus 'Finlaya' sensu auctorum
Ochlerotatus (Finlaya) auronitens Edwards, 1922
Ochlerotatus (Finlaya) oerophilus Edwards, 1916
Ochlerotatus (Finlaya) sintoni (Barraud, 1924)
Ochlerotatus (Finlaya) suffusus (Edwards, 1922)
Ochlerotatus (Finlaya) versicolor (Barraud, 1924)

Genus Paraedes Edwards, 1934
Paraedes barraudi Edwards, 1934
Paraedes chrysoscota (Theobald, 1910)
Paraedes menoni Mattingly, 1958
Paraedes ostentatia Leicester, 1908

Genus Petermattinglyius Reinert, Harbach & Kitching, 2009
Subgenus Petermattinglyius Reinert, Harbach & Kitching, 2009
Petermattinglyius (Petermattinglyius) francisci (Mattingly, 1959)
Petermattinglyius (Petermattinglyius) xengar (Edwards, 1923)

Genus Phagomyia Theobald, 1905
Phagomyia assamensis (Theobald, 1908)
Phagomyia cacharana (Barraud, 1923)
Phagomyia cogilli (Edwards, 1922)
Phagomyia deccana (Barraud, 1923)
Phagomyia feegradei (Barraud, 1934)
Phagomyia gubernatoris (Giles, 1901)
Phagomyia inquinata Edwards, 1922
Phagomyia khaana (Edwards, 1922)
Phagomyia lophoventralis (Theobald, 1910)
Phagomyia prominens (Barraud, 1923)
Phagomyia stevensoni (Barraud, 1923)

Genus Rhinoskusa Edwards, 1929
Rhinoskusa longirostris (Leicester, 1908)
Rhinoskusa portonovoensis (Tewari & Hiriyyan, 1992)
Rhinoskusa wardi (Reinert, 1976)

Genus Scutomyia Theobald, 1904
Scutomyia albolineata Theobald, 1904
Scutomyia albolineata Theobald, 1904

Genus Stegomyia Theobald, 1901
Subgenus Actinothrix Reinert, Harbach & Kitching, 2009
Stegomyia (Actinothrix) edwardsi Barraud, 1923
Stegomyia (Actinothrix) seampi (Huang, 1974)

Subgenus Heteraspis Reinert, Harbach & Kitching, 2009
Stegomyia (Heteraspis) annandalei Theobald, 1910
Stegomyia (Heteraspis) craggy Barraud, 1923
**APPENDIX 1. Continued.**

**Subgenus Huangmyia** Reinert, Harbach & Kitching, 2009  
*Stegomyia (Huangmyia) mediopunctata* Theobald, 1905  
*Stegomyia (Huangmyia) perplexta* Leicester, 1908

**Subgenus Stegomyia** Theobald, 1901  
*Stegomyia (Stegomyia) aegypti* (Linnaeus, 1762)

**Subgenus Xyle** Reinert, Harbach & Kitching, 2006  
*Stegomyia (Xyle) desmotes* Giles, 1904  
Species without subgeneric placement  
*Stegomyia w-alba* Theobald, 1905  
*Stegomyia gardneri* Ludlow, 1905  
*Stegomyia albopicta* (Skuse, 1895)  
*Stegomyia novalbopicta* (Barraud, 1931)  
*Stegomyia patriciae* (Mattingly, 1954)  
*Stegomyia pseudalbopicta* Borel, 1928  
*Stegomyia subalbopicta* (Barraud, 1931)  
*Stegomyia unilineata* (Theobald, 1906)  
*Stegomyia krombeini* (Huang, 1975)  
*Stegomyia malayensis* (Calless, 1962)  
*Stegomyia scutellaris* (Walker, 1858)

**Genus Udaya** Thurman, 1954  
*Udaya argyurus* (Edwards, 1934)  
*Udaya subsimilis* (Barraud, 1927)

**Genus Tewarius** Reinert, 2006  
*Tewarius agastyai* (Tewari & Hiriyan, 1992)  
*Tewarius numnatus* (Edwards, 1923)  
*Tewarius reubenae* (Tewari & Hiriyan, 1992)

**Genus Verrallina** Theobald, 1903  
**Subgenus Harbachius** Reinert, 1999  
*Verrallina (Harbachius) abditus* (Barraud, 1931)  
*Verrallina (Harbachius) consonens* (Reinert, 1973)  
*Verrallina (Harbachius) uniformis* (Theobald, 1910)  
*Verrallina (Harbachius) yusafi* (Barraud, 1931)

**Subgenus Neomacleaya** Theobald, 1907  
*Verrallina (Neomacleaya) agrestis* (Barraud, 1931)  
*Verrallina (Neomacleaya) andamanensis* (Edwards, 1922)  
*Verrallina (Neomacleaya) assamensis* Bhattacharyya, Tewari, Prakash, Mohapatra & Mahanta, 2004  
*Verrallina (Neomacleaya) atra* (Barrued, 1928)  
*Verrallina (Neomacleaya) cauta* (Barraud, 1928)  
*Verrallina (Neomacleaya) ceylonica* (Edwards, 1917)  
*Verrallina (Neomacleaya) clavata* (Barraud, 1931)  
*Verrallina (Neomacleaya) comata* (Barraud, 1931)  
*Verrallina (Neomacleaya) indica* (Theobald, 1907)  
*Verrallina (Neomacleaya) pseudodiurna* (Theobald, 1910)  
*Verrallina (Neomacleaya) pseudomediofasciata* (Theobald, 1910)  
*Verrallina (Neomacleaya) rami* (Barraud, 1928)  
*Verrallina (Neomacleaya) seculata* (Menon, 1950)  
*Verrallina (Neomacleaya) unca* (Theobald, 1901)  
*Verrallina (Neomacleaya) vallisiris* (Barraud, 1928)  
*Verrallina (Neomacleaya) yerburyi* (Edwards, 1917)

**Subgenus Verrallina** Theobald, 1903  
*Verrallina (Verrallina) butleri* (Theobald, 1901)  
*Verrallina (Verrallina) dux* (Dyar & Shannon, 1925)  
*Verrallina (Verrallina) lugubris* (Barraud, 1928)

**Tribe Culicini**

**Genus Culex** Linnaeus, 1758  
**Subgenus Culex** Linnaeus, 1758  
*Pipiens Group*  
*Culex (Culex) nigiricus* Edwards, 1916  
*Pipiens Subgroup*  
*Culex (Culex) quinquefasciatus* Say, 1823  
*Theileri Subgroup*  
*Culex (Culex) theileri* Theobald, 1903  
*Triflatus Subgroup*  
*Culex (Culex) hutchinsoni* Barraud, 1924  
*Culex (Culex) vagans* Wiedemann, 1828  
*Univittatus Subgroup*  
*Culex (Culex) fuscocephala* Theobald, 1907  
*Culex (Culex) perexiguus* Theobald, 1903  
*Stiens Group*  
*Barraudii Subgroup*  
*Culex (Culex) barraudii* Edwards, 1922  
*Culex (Culex) edwardsi* Barraud, 1923  
*Gelidus Subgroup*  
*Culex (Culex) gelidus* Theobald, 1901  
*Mimeticus Subgroup*  
*Culex (Culex) jacksoni* Edwards, 1934  
*Culex (Culex) mimeticus* Noe, 1899  
*Culex (Culex) mimuloides* Barraud, 1924  
*Culex (Culex) mimulus* Edwards, 1915  
*Culex (Culex) murrelli* Lien, 1968
Appendix 1. Continued.

Subgenus Lophoceraomyia Theobald, 1907
- *Lophoceraomyia* (Sirivanakarn, 1977)
- *Lophoceraomyia* (Theobald, 1905)
- *Lophoceraomyia* (demissus)
- *Lophoceraomyia* (Leicester, 1908)
- *Lophoceraomyia* (Lophoceraomyia)

Subgenus Eumelanomyia Theobald, 1907
- *Eumelanomyia* (Sirivanakarn, 1977)
- *Eumelanomyia* (Theobald, 1905)
- *Eumelanomyia* (Leicester, 1908)
- *Eumelanomyia* (lasiopalpis)
- *Eumelanomyia* (flavicornis)
- *Eumelanomyia* (infantulus)
- *Eumelanomyia* (minutissimus)
- *Eumelanomyia* (ramakrishnii)
- *Eumelanomyia* (scanloni)
- *Eumelanomyia* (ramakrishnii)
- *Eumelanomyia* (pallidothorax)
- *Eumelanomyia* (bailyi)
- *Eumelanomyia* (viridiventer)

Subgenus Culiciomyia Theobald, 1907
- *Culiciomyia* (Sirivanakarn, 1977)
- *Culiciomyia* (singhbhumensis)
- *Culiciomyia* (whitei)

Subgenus Eumelanomyia Theobald, 1909
- *Eumelanomyia* (Sirivanakarn, 1977)
- *Eumelanomyia* (theobaldi)
- *Eumelanomyia* (brahmacayanan)
- *Eumelanomyia* (swarupi)
- *Eumelanomyia* (shaba)

Subgenus Culex (Theobald, 1901)
- *Culex* (brevipalpis)
- *Culex* (mohani)
- *Culex* (tenuipalpis)
- *Culex* (pluvialis)
- *Culex* (ludlowi)
- *Culex* (pallidothorax)
- *Culex* (scolopari)
- *Culex* (alpinus)
- *Culex* (scolopari)
- *Culex* (rhabdites)
- *Culex* (pallidothorax)
- *Culex* (quadrinotatus)
- *Culex* (quadripalpis)
- *Culex* (nigropunctatus)
- *Culex* (nigropunctatus)
- *Culex* (stigmatomyia)
- *Culex* (whitei)
- *Culex* (sitiens)
- *Culex* (tritaeniorhynchus)
- *Culex* (pseudovishnui)
- *Culex* (vishnui)
- *Culex* (perplexus)

Subgenus Lophoceraomyia Theobald, 1905
- *Lophoceraomyia* (Fraudiard, 1903)
- *Lophoceraomyia* (nigropunctatus)
- *Lophoceraomyia* (ramakrishnii)
- *Lophoceraomyia* (spathifurca)
- *Lophoceraomyia* (castrens)
- *Lophoceraomyia* (hinglungensis)
- *Lophoceraomyia* (castrensis)
- *Lophoceraomyia* (pallidothorax)
- *Lophoceraomyia* (bailyi)
- *Lophoceraomyia* (viridiventer)

Subgenus Eumelanomyia Theobald, 1909
- *Eumelanomyia* (Edwards, 1922)
- *Eumelanomyia* (Edwards, 1914)
- *Eumelanomyia* (Edwards, 1926)
- *Eumelanomyia* (Edwards, 1922)
- *Eumelanomyia* (Edwards, 1901)
- *Eumelanomyia* (Edwards, 1901)
- *Eumelanomyia* (Edwards, 1915)
- *Eumelanomyia* (Edwards, 1922)
- *Eumelanomyia* (Edwards, 1914)
- *Eumelanomyia* (Edwards, 1922)
- *Eumelanomyia* (Edwards, 1926)

Subgenus Culex (Theobald, 1901)
- *Culex* (brevipalpis)
- *Culex* (mohani)
- *Culex* (tenuipalpis)
- *Culex* (pluvialis)
- *Culex* (ludlowi)
- *Culex* (pallidothorax)
- *Culex* (scolopari)
- *Culex* (alpinus)
- *Culex* (scolopari)
- *Culex* (rhabdites)
- *Culex* (quadripalpis)
- *Culex* (nigropunctatus)
- *Culex* (nigropunctatus)
- *Culex* (stigmatomyia)
- *Culex* (whitei)
- *Culex* (sitiens)
- *Culex* (tritaeniorhynchus)
- *Culex* (pseudovishnui)
- *Culex* (vishnui)
- *Culex* (perplexus)
APPENDIX 1. Continued.

Minor complex

*Culex* (Lophoceraomyia) bengalensis Barraud, 1934
*Culex* (Lophoceraomyia) bicornutus (Theobald, 1910)
*Culex* (Lophoceraomyia) minor (Leicester, 1908)

Peytoni complex

*Culex* (Lophoceraomyia) peytoni Bram & Rattanarithikul, 1967

Pholeret complex

*Culex* (Lophoceraomyia) pholeret Bram & Rattanarithikul, 1967

Wilfredi Group

*Culex* (Lophoceraomyia) piliferimalis Wang & Feng, 1964
*Culex* (Lophoceraomyia) wilfredi Colless, 1965

**Subgenus Maillotia** Theobald, 1907

Hortensis Group

*Culex* (Maillotia) hortensis Ficalbi, 1889

**Subgenus Oculeomyia** Theobald, 1907

Biaeniorhynchus Complex

*Culex* (Oculeomyia) biaeniorhynchus Giles, 1901
*Culex* (Oculeomyia) infala Theobald, 1901
*Culex* (Oculeomyia) luzonensis Sirivanakarn, 1976

Sinensis Complex

*Culex* (Oculeomyia) cornutus Edwards, 1922
*Culex* (Oculeomyia) epidemus (Theobald, 1910)
*Culex* (Oculeomyia) sinensis Theobald, 1903

**Genus Lutzia** Theobald, 1903

**Subgenus Metalutzia** Tanaka, 2000

*Lutzia* (Metalutzia) agranensis Singh & Prakash, 2008
*Lutzia* (Metalutzia) fuscona Wiedemann, 1820
*Lutzia* (Metalutzia) halifaxii Theobald, 1903
*Lutzia* (Metalutzia) vorax Edwards, 1921

**Tribe Culisetini**

**Genus Culiseta** Felt, 1904

**Subgenus Aallotheobaldia** Brolemann, 1919

*Culiseta* (Aallotheobaldia) longiareolata (Macquart, 1838)

**Subgenus Culiseta** Felt, 1904

*Culiseta* (Culiseta) alaskaensis (Ludlow, 1906)
*Culiseta* (Culiseta) niveitaeniata (Theobald, 1907)

**Subgenus Oculotheobaldia** Brolemann, 1919

*Culiseta* (Aallotheobaldia) longiareolata (Macquart, 1838)

**Tribe Culiseta**

**Genus Culiseta** Felt, 1904

*Culiseta* (Culiseta) alaskaensis (Ludlow, 1906)
*Culiseta* (Culiseta) niveitaeniata (Theobald, 1907)

**Subgenus Metalutzia** Tanaka, 2000

*Lutzia* (Metalutzia) agranensis Singh & Prakash, 2008
*Lutzia* (Metalutzia) fuscona Wiedemann, 1820
*Lutzia* (Metalutzia) halifaxii Theobald, 1903
*Lutzia* (Metalutzia) vorax Edwards, 1921

**Tribe Ficalbinii**

**Genus Ficalbia** Theobald, 1903

Ficalbia minima (Theobald, 1901)

**Genus Mimomyia** Theobald, 1903

**Subgenus Etorleptiomyia** Theobald, 1904

*Mimomyia* (Etorleptiomyia) luzonensis (Ludlow, 1905)

**Subgenus Mimomyia** Theobald, 1903

*Mimomyia* (Mimomyia) aurea (Leicester, 1908)
*Mimomyia* (Mimomyia) chamberlaini Ludlow, 1904
*Mimomyia* (Mimomyia) hybrida (Leicester, 1908)
*Mimomyia* (Mimomyia) intermedi (Barraud, 1929)

**Subgenus Ingramia** Edwards, 1912

*Mimomyia* (Ingramia) fusca (Leicester, 1908)

**Genus Hodgsoni** Belkin, 1962

Hodgsonia bailyi Barraud, 1929

**Tribe Mansoniini**

**Genus Coquillettidia** Dyar, 1905

**Subgenus Coquillettidia** Dyar, 1905

*Coquillettidia* (Coquillettidia) crassipes (van der Wulp, 1881)
*Coquillettidia* (Coquillettidia) novochracea (Barraud, 1927)
*Coquillettidia* (Coquillettidia) ochracea (Theobald, 1903)

**Genus Mansonia** Blanchard, 1901

**Subgenus Mansonioides** Theobald, 1907

*Mansonia* (Mansonioides) annulifera (Theobald, 1901)
*Mansonia* (Mansonioides) dives (Schiner, 1868)
*Mansonia* (Mansonioides) indiana Edwards, 1930
*Mansonia* (Mansonioides) uniformis (Theobald, 1901)

**Tribe Orthopodomyiini**

**Genus Orthopodomyia** Belkin, Heinemann & Page, 1970

Orthopodomyia alibipes Leicester, 1904
Orthopodomyia anopheloides (Giles, 1903)
Orthopodomyia andamanensis Barraud, 1934
Orthopodomyia flavicosta Barraud, 1927
Orthopodomyia flavithorax Barraud, 1927

**Tribe Sabethini**

**Genus Malaya** Leicester, 1908

*Malaya* genrostris Leicester, 1908
*Malaya* jacobsoni (Edwards, 1930)

**Genus Topomyia** Leicester, 1908

**Subgenus Suaymyia** Thurman, 1959

*Topomyia* (Suaymyia) cristata Thurman, 1959

**Subgenus Topomyia** Leicester, 1908

*Topomyia* (Topomyia) bifurcata Dong, Wang & Lu, 1995
APPENDIX 1. Continued.

Genus Tripteroides

Subgenus Rachionotomyia

Toxorhynchites

Tribe Uranotaeniini

Genus Uranotaenia

Theobald, 1905

Tribe Toxorhynchitini

Genus Toxorhynchites

Theobald, 1901

Subgenus Toxorhynchites

Section B

Maxima Series

Uranotaenia (Pseudoficalbia) maxima Leicester, 1908

Bimaculata Series

Uranotaenia (Pseudoficalbia) annandalei Barraud, 1926

Recondita Series

Uranotaenia (Pseudoficalbia) alboannulata Theobald, 1905

Uranotaenia (Pseudoficalbia) annandalei Barraud, 1926

Uranotaenia (Pseudoficalbia) campestris Leicester, 1908

Uranotaenia (Pseudoficalbia) christophersi Barraud, 1926

Uranotaenia (Uranotaenia) edwardsi Barraud, 1926

Uranotaenia (Uranotaenia) hebes Barraud, 1931

Uranotaenia (Uranotaenia) lateralis Ludlow, 1905

Uranotaenia (Uranotaenia) longirostris Leicester, 1908

Uranotaenia (Uranotaenia) micans Leicester, 1908

Uranotaenia (Uranotaenia) macfarlanei Edwards, 1914

Uranotaenia (Uranotaenia) orientalis Barraud, 1926

Uranotaenia (Uranotaenia) rutherfordi Edwards, 1922

Uranotaenia (Uranotaenia) testacea Theobald, 1905

Uranotaenia (Uranotaenia) aureoventer (Theobald, 1910)

Uranotaenia (Uranotaenia) hirtusa Gong, 1989