KEYS TO SPECIES OF INDIAN *LOPHOCERAOXYIA*

**MALES AND MALE GENITALIA**

1. Palpus with finger-like basal process; Dorsal lobe of lateral plate of phallosome represented by a slender, simple, apical beaklike process; ventral lobe very prominent ........................................... *Fraudatrix* Group 3
   Palpus without finger like process; Dorsal lobe of lateral plate of phallosome represented by a large denticulate or tuberculate external process and with or without a simple, spine-like internal process; ventral plate reduced and not distinct .................................................................2

2. Antennal pedicel with spiculose prominence; lateral plate of phallosome bowl-shaped, with a partially denticulate or tuberculate external process and a simple, spine-like internal process .......... *Mammilifer* Group 15
   Antennal pedicel without spiculose prominence; lateral plate of phallosome compact, barrel-shaped, with a broad, heavily denticulate external process ................................................................. *Wilfredi* Group 26

3. Antennal flagellomeres 7 and 8 with tufts of modified, stout spine-like or bristle-like setae; subapical lobe of basimere of genitalia without leaflet .................................................................4
   Antennal flagellomeres 5-10 or 6-10 with modified tufts of scales and setae; subapical lobe of basimere of genitalia usually with 1 or 2 leaflets ..................................................................................5

4. Dorsal process of the phallosome with reticular markings on the entire surface .................................................................................................................. *infantulus*
   Dorsal process of the phallosome stout and simple .................................................................................................................. *minutissimus*
5. Modified tufts of scales poorly developed and restricted to antennal flagellomeres 6-10; apical half of proboscis without dorsal sinuous setae ..........................................................seniori *

Modified tufts of scales well developed on antennal flagellomeres 5-10; apical half of proboscis usually with sinuous setae ......................6

6. Basimere with prominent submarginal setae in a patch ............cinctellus
   Basimere with prominent submarginal seta in 1 or 2 rows ......................7

7. Dorsal process of lateral plate of phallosome anvil-shaped with numerous tooth-like ridges .................................................inculus
   Dorsal process of lateral plate of phallosome beak-like and simple ........8

8. Modified tuft of antennal flagellomere 5 rather inconspicuous, consisting of narrow, flattened, fine tipped setae only; integument of the scutum often with a reddish tint ...........................................rubithoracis
   Modified tuft of antennal flagellomere 5 very conspicuous, consisting of some broad, dark scales and fine tipped, flattened setae; integument of the scutum not reddish .........................................................9

9. Antennal flagellomere 5 with 6 or less dorsal scales along with hairlike setae that vary in length and are slightly pointed or acuminate ..........10
   Antennal flagellomere 5 with 8 or more dorsal scales which are subequal and blunt tipped ..................................................................................12

10. Basimere with a prominent row of 7-9 submarginal setae ..........quadripalpis
    Basimere with only 2 or 3 submarginal setae..........................................11

11. Dorsal beaklike process of lateral plate of phallosome slender, thin and remarkably long; antennal flagellomere 7 with well developed comb-shaped tuft of modified setae ..........................................aculeatus
    Dorsal beaklike process of lateral plate of phallosome stout and relatively short; antennal flagellomere 7 with poorly developed comb-shaped tuft of modified setae ...........................................paraculeatus
12. Basal finger like process of palpus long, equal to segment 1; F-5 with only dorsal and ventral scales and without hair like yellowish or white scales on more ventral region ........................................macdonaldi

Basal finger like process of palpus distinctly shorter than segment 1; F-5 along with dorsal and ventral scales yellowish or whitish hair like scales in the more ventral region ........................................13

13. Rods a-c of subapical lobe smoothly curved medially; F-8 long filamentous towards apex; F-5 with most ventral hair like scales longer than the dorsal scales .......................................................... variatus

Rods a-c of subapical lobe strongly curved; F-8 moderately long and not filamentous towards apex; F-5 with most ventral hair like scales shorter or equal to dorsal scales ........................................14

14. Rod c characteristically elbow shaped; anterior margin of fossa of mesonotum with a dense patch of long setae; leaflet g1 very prominent, long as equal to rods of subapical lobe ............................................cubitatus

Rod c strongly bent above middle; anterior margin of fossa of mesonotum without a dense patch of long setae; leaflet g1 not prominent ..............................................gracicornis

15. Palpal segments 2 and 3 with prominent lateral rows of numerous fine hair like setae; internal process of phallosome distinctly short ............................................................(flavicornis complex) 16

Palpal segments 2 and 3 without prominent fine hair like setae; internal process of phallosome about as long as or longer than apex of external process ..........................................................18

16. Basimere large, swollen at base; apex of distimere modified ..................17

Basimere small, normal; apex of distimere normal ......................lasiopalpis
17. Palpal segment 5 about 2 times of segment 4; leaflet g1 with a characteristic median expansion with spiculose margins, curved sharply distally and ending bluntly apically .........................................................flavicorns
   Palpal segment 5 slightly longer than 4; g1 broad, bent, like a triangular process .................................................................raghavani

18. Antennal F-5 with a conspicuous tuft of 1-4 long broad scales ...........19
    Antennal F-5 with small, inconspicuous short setae only or absent ..........21

19. Antennal F-9 without modified setae ..............................................uniformis
    Antennal F-9 with modified tuft of bristle-like setae ..........................20

20. Internal process of phallosome long, projecting beyond apex of external process; basimere with 6-8 submarginal setae ....................mammilifer
    Internal process of phallosome shorter, not reaching beyond the apex of external process; basimere with 3-4 submarginal setae ..........pholeter

21. Antennal F-5 absent or not developed ..............................................22
    Antennal F-5 with short, acute or flattened setae only ......................24

22. Basimere without submarginal seta; rod a of subapical lobe prominent, sclerotized and curved medially ......................................singhbumensis
    Basimere with a row of submarginal setae; rod a not so ....................23

23. Lower mesepimeral bristle absent; internal process of phallosome reaching the base of apical lobe of external process .......................bengalensis
    Lower mesepimeral bristle present; internal process of phallosome not reaching the base of external process ...............................peytoni

24. Basimere with 2 irregular rows of submarginal setae; internal process projecting beyond apex of external process ......................demissus*
    Basimere with a row of submarginal setae; internal process not projecting beyond apex of external process ..................................25
25. Proboscis moderate to strongly swollen in basal half, with many strong, prominent setae on lateral and ventral surfaces  
Proboscis uniformly thick, without numerous strong setae on lateral and ventral surfaces  

……………bicornutus

……………minor

26. Proboscis with 2-4 long setae on ventral surface distad of false joint; anterior surface of forefemur with 10-12 strong setae forming prominent tuft in apical 0.25-0.5  
Proboscis without any long setae on ventral surface; anterior surface of forefemur usually with 20 or more strong setae forming prominent tuft in apical 0.5 or above  

……………pilifemoralis

……………wilfredi

LARVAE

1. Seta 7-P triple; seta 1-M 0.25-0.50 of the length of seta 3-M; generally breed in ground pools  
Seta 7-P double; seta 1-M usually as long as seta 3-M; breed in rock pools, tree holes, bamboos or sometimes ground pools  

……………Fraudatrix Group.3

……………2

2. Seta 14-P double; usually breed in rock pools, tree holes, bamboos  
Seta 14-P single, breed in ground pools only  

……………Mammilifer Group 11

……………Wilfredi Group 21

3. Seta 2-VIII single; 14-P double…….(Minutissimus Subgroup) minutissimus, infantulius
Seta 2-VIII double; 14-P usually single  

………….(Fraudatrix Subgroup) 4

4. Seta 4-P single; 5-C double  
Seta 4-P double; 5-C single to triple  

……………5

……………7

5. Seta 5-C single  
Seta 5-C double  

……………inculus

……………6
6. Seta 3-P usually double; pecten with 6-7 graded denticles \ldots...\textit{aculeatus}
   Seta 3-P usually single; pecten with 2 strong and 7-9 graded denticles
   \ldots...\textit{quadripalpis}

7. Seta 5-C triple  \ldots...\textit{cinctellus}
   Seta 5-C double or single  \ldots...8

8. Seta 3-P at least 3-5 branched; 7-I single  \ldots...\textit{rubithoracis}
   Seta 3-P single or double; 7-I double \ldots...9

9. Seta 9-C longer than 8-C and placed at a considerable distance cephalad of the latter
   \ldots...\textit{macdonaldi}
   Seta 9-C subequal to 8-C and placed slightly cephalad of the latter \ldots...10

10. Seta 3-P always single; pecten teeth with 1-2 basal denticles, strong and well differentiated
    \ldots...\textit{variatus}
   Seta 3-P always double; pecten teeth with 1-2 basal denticles, moderately strong and not differentiated
    \ldots...\textit{cubitatus}

11. Seta 2, 3–A placed subapically; habitats: tree holes, bamboos, rock pools,
    sometimes ground pools \ldots...\textit{(Mammilifer Subgroup)}12
   Setae 2, 3-A placed apically; habitats: pitcher plants \ldots...\textit{(Brevipalpus subgroup)} Not present in India.

12. Thorax and abdomen heavily spiculate, spicules large, setiform and very distinct under low magnification \ldots...13
    Thorax and abdomen unspiculate or lightly spiculate, spicules weak, dotlike, not distinct as above \ldots...14

13. Seta 5-C 3-5 branched; 8-P minute, inconspicuous, 3-5 branched \ldots...\textit{uniformis}
    Seta 5-C double; 8-P strong, long and subequal to 7-P \ldots...\textit{raghavani}

14. Setae 1-III-VI single; seta 8-P usually minute, inconspicuous, same magnitude as seta 14-P \ldots...\textit{pholeter}
Setae 1-III-VI double or many branched; 8-P strong, distinct, subequal to 7-P

15. Seta 8-P double .................................................................16
    Seta 8-P single .............................................................18

16. Seta 14-P single; 1-M short or as long as 3-M .......................17
    Seta 14-P double; 1-M longer than 3-M  .........................bengalensis*

17. Siphon with 3 pairs of subventral tufts; comb scales 30-50
    .............................................................mammilifer and lasiopalpis
    Siphon with 4 pairs of subventral tufts; comb scales 50 or more
    .............................................................flavicornis

18. Comb scale with pointed apical fringe, or terminated into a strong median
    spine; siphon with 3 pairs (total 6) of subventral tufts
    .............................................................minor and bicornutus
    Comb scales with round apical fringe of evenly fine spicules; siphon with 4, 5
    pairs (total 8-10) of subventral tufts  .........................19

19. Siphon with 5 pairs (total 9, 10) of subventral tufts; 6-C single
    .............................................................singhbhumensis
    Siphon with 4 pairs (total 8) of subventral tufts; 6-C double ........20

20. Subventral tufts weak, as long as siphonal width at point of attachment; pecten
    teeth with graded denticles  .......................................demiissus
    Subventral tufts strong, 1.5-2.0 times as long as siphonal width at the point of
    attachment; pecten teeth with 1-2 strong basal denticles  .....peytoni

21. Seta 6-III-VI 3, 4 branched; seta 2-X usually triple ..................wilfredi*
    Seta 6-III-VI 5 branched; seta 2-X usually double ..............pilifemoralis*
**PUPAE**

1. Seta 5-IV 4-7 branched; pinna of trumpet with slit extending into meatus  …2
   Seta 5-IV double (except *mammilifer, bengalensis*); Pinna of trumpet with or without slit extending into meatus  ……………*Mammilifer Group*.10

2. Seta 8-C single or double  ……………………………. *Fraudatrix Group* 3
   Seta 8-C 4, 5 branched  …………………………….. *Wilfredi Group*.20

3. Seta 6-III-IV 5, 6 branched  …………………………. *(Minutissimus Subgroup)*
   minutissimus, infantulus
   Setae 6-III-IV usually 1-4 branched  ………………… *(Fraudatrix Subgroup)* 4

4. Seta 9-C usually 3, 4 branched; seta 11- C single  ……………………. *cinctellus*
   Seta 9-C single or double; 11-C double  …………………………….5

5. Seta 5-V usually 5, 6 branched; 6-IV-VI usually 4-6 branched  ………6
   Seta 5-V usually double or at most 4 branched; 6-IV-VI usually 2-4 branched
   ……………………………………………………………………………………………………7

6. Seta 7-II usually triple; 9-VII usually 4-6 branched  …………………. *quadripalpis*
   Seta 7-II usually double, 9-VII usually triple  ……………………. *aculeatus*

7. Seta 1-C double; seta 5-II 5 branched; 5-III 4, 5 branched  ……….. *cubitatus*
   Seta 1-C triple or 4 branched; 5-II and 5-III not so  ……………………8

8. Integument dark brown or with striking pattern of dark and light areas; seta 5-
   IV usually 7 branched; cephalothorax and abdomen with pattern of dark brown and pale areas  …………………………. *rubithoracis*
   Integument more or less uniformly pale yellowish or without striking pattern of dark and light areas; seta5-IV usually 6 branched  …………………9

9. Margin of mid-dorsal ridge of cephalothorax strongly folded or very irregular;
   seta 4- VIII usually double  …………………………. *macdonaldi*
Margin of mid-dorsal ridge of cephalothorax weakly folded or more or less regular; 4-VIII usually triple; 5-V 3, 4 branched ..........*variatu*s

10. Pinna of trumpet with slit extending to meatus; setae 6-III-VI usually 3-5 branched, (except *pholeter*); usually breed in ground pools or sometimes rock pools ..................................................11
Pinna without slit extending to meatus; setae 6-III-VI usually 1-3 branched; breeds in tree holes, bamboos, rock pools .................................16

11. Seta 5-C double, strong, about 2 times as long as 7-C ..........*pholeter*
Seta 5-C 4-6 branched, as long as or shorter than 7-C .................12

12. Seta 8-C usually 3, 4 branched; 5-IV double, or triple; apex of paddle pointed or rounded .................................................................13
Seta 8-C usually double; 5-IV 5, 6 branched; apex of paddle rounded ..15

13. Seta 10-C double; apex of paddle rounded .........................*lasioplapis*
Seta 10-C 3, 4 branched; apex of paddle pointed ..........................14

14. Trumpet widened distally; 9-C usually single .................*raghavani*
Trumpet cylindrical, tubular; 9-C usually 3 branched ..........*flavicorns*

15. Seta 4-VIII usually triple; 6-IV-VI usually 5 branched ........*mammilifer*
Seta 4-VIII usually double; 6-IV-VI usually 4 branched ...........*bengalensis*

16. Seta 11-C usually single; 6-III-V usually double ...............*peytoni*
Seta 11-C usually double and strong; 6-III-V usually triple ...........17

17. Seta 5-IV usually triple .................................................*demiissus*
Seta 5-IV double ..............................................................18

18. Seta 5-C usually 4 branched .........................................*uniformis*
Seta 5-C usually double ....................................................19
19. Seta 9-C double .............................................minor, bicornutus
    Seta 9-C single .............................................singhbumensis

20. Setae 8-C usually 4, 5 branched ................................wilfredi*
    Setae 8-C usually double ..........................................pilifemoralis*

* Materials not examined in this study
Fig. 1 *minutissimus*

Phallosome

Head

Pecte
Fig. 2 *infantulus*

Phallosome

Head

siphon

Comb

Pecten
Fig. 3 cinctellus

Phallosome
Proctiger

Head

siphon

Comb
Papillen
Fig. 5. *inculus*
Fig. 9 *variatus*

- **Proctiger**
- **Phalosome**

**Head**

- **Pecten**
- **Comb**
Fig. 10 cubitatus

Head

siphon

Pecten

Comb
Fig. 11 *gracicornis*
Fig. 12 macdonaldi
Fig. 13 *uniformis*

**Head**

**Siphon**

**Phallosome**

**Pecten**

**Comb**
Fig. 14 *mammilifer*

Phallosome

Head

siphon

Comb

Pecten
Fig. 15 *demissus*
Fig. 16 *minor*

Head

Siphon

Comb

Pecten
Fig. 17 bicornutus
Fig. 18 *bengalensis*

Phallosome
Fig. 19 *peytoni*
Fig. 21 *flavicornis*

Head

siphon

Comb
Pecten

0.1mm

0.5mm
Fig. 23 *lasiopalpis*
Fig. 24 *singhbhumensis*

Phallosome

Head

Siphon

Comb

Pecten
Fig. 25 *wilfredi*

Fig. 26 *pilifemoralis*
CURRENT STATUS OF SUBGENUS *LOPHOCERAOMYIA* IN INDIA

This revision of subgenus *Lophoceraomyia* in India was done based on the examination of about 3180 specimens (891 males, 684 females, 491 larvae, 688 larval skins and 425 pupal skins). This included 290 adults with associated larval and pupal skins and 21 adults with associated larval skins only. Of the total specimens examined, 2879 (765 males, 605 females, 459 larvae, 647 larval skins and 403 pupal skins, with 279 of the adults having associated larval and pupal skins and 18 adults having associated larval skins only) were collected during this study while the rest were material available mostly from earlier collections in the Vector Control Research Centre, Pondicherry, and a few from the Centre for Research in Medical Entomology, Madurai and Regional Medical Research Centre, Dibrugarh. Specimens collected in the present study came from 15 States and 2 Union Territories of the country and from which 25 species were recognized. Together with specimens of 1 species examined from material that was available and 1 species known from literature, the subgenus *Lophoceraomyia* in India is now considered to include 27 species.

The subgenus is represented in India by all the three known groups namely, *Fraudatrix* Group, *Mammilifer* Group and *Wilfredi* Group. Except for the *Brevipalpus* Subgroup of the *Mammilifer* Group, all the other subgroups are also represented in the country. The species occurring in each of the groups, subgroups and complexes thereof are as follows.

**FRAUDATRIX GROUP**

*Minutissimus* Subgroup

1. *minutissimus* (Theobald)
2. *infantulus* Edwards

*Fraudatrix* Subgroup

*seniori* complex

3. *seniori* Barraud

*cinctellus* complex

4. *cinctellus* Edwards

*rubithoracis* complex
5. *rubithoracis* (Leicester)

*inculus* complex

6. *inculus* Colless

*quadripalpis* complex

7. *quadripalpis* (Edwards)
8. *aculeatus* Colless
9. *paraculeatus* Sirivanakarn

*variantus* complex

10. *variantus* (Leicester)
11. *cubitatus* Colless
12. *gracicornis* Sirivanakarn
13. *macdonaldi* Colless

**MAMMILIFER GROUP**

*Mammilifer* Subgroup

*traubi* complex

14. *uniformis* (Theobald)

*mammilifer* complex

15. *mammilifer* (Leicester)
16. *demissus* Colless

*minor* complex

17. *minor* (Leicester)
18. *bicornutus* (Theobald)
19. *bengalensis* Barraud

*peytoni* complex

20. *peytoni* Bram and Rattanarithkul

*pholeter* complex

21. *pholeter* Bram and Rattanarithkul

*flavicornis* complex

22. *flavicornis* Barraud
23. *lasiopalpis* Srivanakarn

*singhbhumensis* complex

25. *singhbhumensis* n. sp.
Prior to this revision, the number of species in subgenus *Lophoceraomyia* known to occur in India was 21. From collections made in this study 5 species namely, *aculeatus, cubitatus, demissus, gracicornis* and *paraculeatus* were recorded for the first time in India forming new country records and 1 new species, *singhbhumensis* has been described from India.

The subgenus *Lophoceraomyia* is richly represented in Malaysia where 42 species are present, followed by 34 species in Indonesia, 31 species in Thailand and 28 species in Papua New Guinea. The present record of 27 species in India places the country in the fifth position. For these 27 species, Malaysia is type locality for 12 species, Thailand for 2 species, Singapore for 2 species, Sri Lanka for 3 species, China for 2 species, Myanmar for 1 species and for the rest of the 5 species, namely, *bengalensis, flavicornis, raghavani, seniori* and *singhbhumensis* n. sp., India is the type locality. The subgenus now is also the most predominant amongst the different subgenera of genus *Culex* in India. Genus *Culex* is represented in India by subgenera *Culex, Culiciomyia, Eumelanomyia, Lophoceraomyia, Maillotia* and *Oculeomyia*. Of these, subgenus *Culex* was predominant with 23 species, but following the present revision, subgenus *Lophoceraomyia* with 27 species has become the predominant subgenus in the country. The other subgenera are poorly represented, *Eumelanomyia* by 9 species, *Culiciomyia* by 8 species, *Oculeomyia* by 4 species and *Maillotia* by only 1 species. In worldwide distribution of mosquitoes, amongst these 6 subgenera of genus *Culex*, subgenus *Lophoceraomyia* ranks second with 111 species, next only to subgenus *Culex* with 201 species.

Of the 27 species of *Lophoceraomyia* present in India, 23 species are common to the Southeast Asian region as 19 species are known to occur in Malaysia, 18 in Thailand, 13 in Indonesia, 10 in Philippines, 9 in China and Vietnam, 8 in Sri Lanka, 6 in Singapore, 4 in Japan, 2 in Myanmar, Maldives and Cambodia, and 1 in Taiwan, Korea, Nepal, Bangladesh and Pakistan. Thus the species composition of *Lophoceraomyia* in India predominantly includes species occurring in the Southeast Asia. However, 3 species namely, *flavicornis, raghavani* and *seniori* are known only
from India and together with *singhbumensis*, new species described now, a total of 4 species of *Lophoceraomyia* are unique to India as they are not known to occur in any of the other countries. Incidentally the type locality for all these 4 species is India.

**Distribution of species of subgenus Lophoceraomyia in India**

The distribution of the 27 species of subgenus *Lophoceraomyia* recognized for India in the different States and Union Territories of the country and the physiographic zones of Rao (1981) in which they fall is presented in Table 1, with the species listed in the order of Groups, Subgroups and Complexes. The most widely distributed species are *minutissimus, infantulus, bicornatus* and *rubithoracis*, occurring in at least 4 to 7 of the 9 physiographic zones of the country. In Statewise distribution also, these species are found to be widespread with *minutissimus* occurring in 13 States, followed by *bicornatus* in 11 States, *infantulus* in 10 States while *mammilifer* occurs in 8 States and *rubithoracis* and *uniformis* in 7 States. Most of the other species occur only in any one zone or one State.

Among the different physiographic zones, the Brahmaputra Valley (zone 7) that includes the Northeastern States of Assam, Meghalaya and Manipur, the East Central India (zone 5) that includes the States of Chattisgarh, Jharkhand, parts of Orissa and Andhra Pradesh, and the Western zone (zone 2) that includes the States of Kerala, and parts of Karnataka and Tamilnadu, are richly represented by subgenus *Lophoceraomyia* as about 11 to 14 of the 27 species occur in each of these 3 zones. All these zones are characterized by hilly forested regions with heavy rainfall. The Andaman and Nicobar Islands, considered as Outlying Areas (zone 9) closely follow in species richness with 9 species occurring there. These regions where majority of the species occur have similarities in topographical and climatic conditions to that of the Southeast Asian countries where considerable number of species of subgenus *Lophoceraomyia* occur. This is also reflected in the species composition of *Lophoceraomyia* in India that predominantly includes species occurring in the Southeast Asia.

The States in Peninsular India are endowed with both a coastal area and interior hilly forested areas while those in east central and north eastern regions are mostly with hilly forested areas. Among the States, Assam with 14 species ranks first
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Species</th>
<th>Physiographic zones</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Rajasthan</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>1</td>
<td>minutissimus</td>
<td>Gujarat (north)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maharashtra (west)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Goa</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kerala</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tamilnadu (W. Ghats)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Karnataka (north)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Madhya Pradesh</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Andhra Pradesh</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Punjab</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chattisgarh</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jharkhand</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Orissa (part)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Andhra Pradesh (part)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Orissa (Icoastal)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Andhra Pradesh (coastal)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tamilnadu (coastal)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pondicherry</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Assam</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Meghalaya</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manipur</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W. Bengal (Darjeeling)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Arunachal Pradesh</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Andaman &amp; Nicobar Is</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Species</td>
<td>Zone 1</td>
<td>Zone 2</td>
<td>Zone 3</td>
<td>Zone 4</td>
<td>Zone 5</td>
<td>Zone 6</td>
<td>Zone 7</td>
<td>Zone 8</td>
<td>Zone 9</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>-----------------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td><em>bengalensis</em></td>
<td>X</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td><em>peytoni</em></td>
<td></td>
<td>X</td>
<td></td>
<td>x</td>
<td>x</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td><em>pholeter</em></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td><em>flavicorns</em></td>
<td>x</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td><em>lasiopalpis</em></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td><em>raghavani</em></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td><em>singhbhumensis</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td><em>wilfredi</em></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td><em>pilifemoralis</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 - North Western Zone; 2 - Western Zone; 3 - Deccan Plateau; 4 - Gangetic Valley; 5 - East Central India; 6 - Southeastern Coastal Areas; 7 - Brahmaputra Valley; 8 - Himalayan Zone; 9 - Outlying Areas; X - Collected in the present study; x - Known from literature
Table 2. Species of subgenus *Lophoceraomyia* recorded in different larval habitats in India

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Species</th>
<th>ground pool</th>
<th>seepage pool</th>
<th>elephant foot print</th>
<th>seepage canal</th>
<th>stream</th>
<th>stream pool</th>
<th>crab hole</th>
<th>pond</th>
<th>riverbed pool</th>
<th>roadside pool</th>
<th>irrigation canal</th>
<th>paddy field</th>
<th>swamp</th>
<th>rock pool</th>
<th>rock hole</th>
<th>bamboo</th>
<th>tree hole</th>
<th>well</th>
<th>cement tank</th>
<th>metal barrel</th>
<th>clay pot</th>
<th>coconut shell</th>
<th>log</th>
<th>plastic container</th>
<th>discarded tyre</th>
<th>latex collecting cup</th>
<th>cocoa shell</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>minutissimus</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>infantulus</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>cinctellus</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>rubithoracis</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>quadripalpis</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>aculeatus</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>paraculeatus</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>variatus</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>cubitatus</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>macdonaldi</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>uniformis</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>mammilifer</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>demissus</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>minor</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>bicornutus</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>bengalensis</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>peytoni</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>flavicornis</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>raghavani</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>singhbhumensis</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
in the distribution of *Lophoceraomyia* species, followed by Orissa with 13 species, Tamilnadu with 10 species, Kerala and, Andaman and Nicobar Islands with 9 species each and Karnataka with 7 species. Only 1 to 4 species were found to occur in most of the other States.

In India the Western Ghats spread along the States of Kerala, Tamilnadu and Karnataka is one of the biodiversity hotspot. Similarly the northeastern States such as Assam, Arunachal Pradesh and Meghalaya; the Eastern Ghats region spread across the States of Andhra Pradesh, Orissa, Chattisgarh and Jharkhand, and the Andaman and Nicobar Islands are considered as rich in biodiversity because of the wealth of both flora and fauna. With regard to the distribution of *Lophoceraomyia* also, this is found to be valid, as 14 species are found to occur in the Northeast, followed by 11 species each in the Western Ghats and the Eastern Ghats, and 9 species in the Andaman and Nicobar Islands.

Besides the number of species occurring in each zone or State, and the distribution of each of the species in different States, there seems to be a perceptible pattern in the species composition from east to west of the country with regard to the major groups of the subgenus *Lophoceraomyia*. Of the *Fraudatrix* Group, other than the *minutissimus* and *infantulus* belonging to the *Minutissimus* Subgroup that are very widely distributed, the *Fraudatrix* Subgroup is almost confined to the eastern part of India with 9 of the species, *seniori*, *inculus*, *quadripalpis*, *aculeatus*, *paraculeatus*, *variatus*, *cubitatus*, *gracicornis* and *macdonaldi* occurring only there, and only *cinctellus* and *rubithoracis* extending up to the Western region. The *Mammilifer* Group, represented only by the *Mammilifer* Subgroup in India, the other subgroup *Brevipalpus* being absent, is a more widespread group with many of the species extending up to the western part of the country and few of the species such as *flavicorns*, *raghavani* and *lasiopalpis* confined only to the west. This pattern of distribution of the major groups is reflective of the situation in the worldwide distribution as the *Fraudatrix* Group though common in the Oriental region (Southeast Asia), is found mostly in the Papuan part of the Australasian region, the South Pacific, Australia, the western and central Pacific in Micronesia and Japan, while the *Mammilifer* Group exhibits a rather distinctive pattern of distribution, being confined largely to the Indomalayan parts of the Oriental region (Sirivanakarn 1977).
The overall distribution of subgenus *Lophoceraomyia* in India thus indicates that the *Fraudatrix* Group is mostly present in the eastern part of the country while the *Mammilifer* Group has exploited the western part as well. The central part of the country is almost left unrepresented by the members of the subgenus, resulting in an apparently discontinuous distribution of the subgenus. In relation to a similar type of distribution seen in the case of Anopheline species in India Christophers (1933) had observed that on the whole the fauna of the Indian area appears to change somewhat gradually from east to west and this type of distribution is probably largely determined by the physiographical and meteorological features. Forest and shade loving species are likely to be restricted to the heavily forested tracts, and thus show a continuous or discontinuous distribution in the east and south and in the area of heavy precipitation on the west coast. This appears to be valid for the subgenus *Lophoceraomyia* in India, and is probably governed by the types of larval habitats that the two groups exploit.

**Larval habitats of subgenus *Lophoceraomyia* in India**

Of the 27 species of subgenus *Lophoceraomyia* recognized, larvae were obtained for 19 species in collections made during the study and for 1 species larval material was available in the VCRCMM. The different larval habitats in which each of these 20 species occurred is presented in Table 2. Six of the other species, *inculus*, *gracicornis*, *pholter*, *lasiopalpis*, *wilfredi* and *pilifemoralis* had been collected only as adults while no material was collected for *seniori*.

The different types of larval habitats recorded could be broadly divided into two categories, namely, ground water habitats and container habitats. The flowing waters such as streams, irrigation canals and seepage canals; the shallow temporary pools such as the ground pools, seepage pools, stream pools, riverbed pools, roadside pools, paddy fields and elephant foot prints; and shallow permanent habitats such as the swamps and ponds constituted the ground water habitats (Plates 1-3). The container habitats (Plates 4-5) were either natural constituted of the rock holes, rock pools, bamboos, tree holes, coconut shells, cocoa shells and fallen logs, or artificial constituted by varied types such as cement tanks, metal barrels, clay pots, plastic
Plate 1. Ground water larval habitats: Ground pool above and Elephant foot print below
Plate 2. Ground water larval habitats: Forest stream above and Riverbed pool below
Plate 3. Ground water habitats: Swamp above and Roadside pool below
Plate 4. Natural container habitats: Tree hole above and Bamboos below.
Plate 5. Natural container habitat: Rock hole above and Artificial container: Latex collecting cup in rubber plantation below.
containers, discarded tyres and latex collecting cups in the rubber plantations, together with the wells that are considered as artificial subterranean waters (Laird 1988).

A wide variety of habitats were exploited by *minutissimus*, *infantulus* and *bicornutus*, as larvae of these three species occurred in about 8 to 11 types of habitats in both the categories. Species of the *Fraudatrix* Subgroup were very typical in that they were found only in ground water habitats, particularly in ground pools, seepage pools and swamps. None of these species occurred in the container habitats. Species of the *Mammilifer* Subgroup, however, occurred in both the categories, inhabiting the ground waters such as ground pools, seepage pools, stream pools; natural containers such as the bamboos, tree holes, coconut shells, and other artificial containers, except for *mammilifer* that was found only in ground pools. A rare occasion of *mammilifer* from tree hole in India has been reported by Tewari et al. (2007) similar to the findings of Sirivanakarn (1977) in leaf axils of nipa palm and cut bamboos or bamboo stumps lying close to the ground in Southeast Asia.

Sirivanakarn (1977) considered the larval habitats as one of the important characteristics of the three groups of subgenus *Lophoceraomyia*. Accordingly he used this character in the larval key for separating these groups, with *Fraudatrix* Group considered to breed in general ground pools, the *Mammilifer* Group considered to usually breed in rock pools, tree holes, bamboos, leaf axils and ground pools. The *Brevipalpus* Subgroup of the *Mammilifer* Group was however, restricted to the pitcher plants. This characteristic feature related to the larval habitat was very evident in the present study with the *Fraudatrix* Group found only in ground pools, and the *Mammilifer* Subgroup found in both container habitats and ground pools.

In India, the distribution of pitcher plants is restricted to the State of Meghalaya where it is represented by only one species *Nepenthes khasiana*. In the present study searches were made in the pitcher plants in this region, but no larva of subgenus *Lophoceraomyia* was found. Bhattacharyya et al. (2009) who described a new species of *Armigeres* from pitcher plants in this region have stated that during their search no other mosquito species was found to breed in association with this species. It is reasonable to confirm that species of the *Brevipalpus* Subgroup of subgenus *Lophoceraomyia* is absent in India (Plate 6).
Plate 6. Search in Pitcher plants in Meghalaya State to confirm the absence of *Brevipalpus* Subgroup in India.
The success of *minutissimus*, *infantulus* and *bicornutus* in exploiting a wide variety of larval habitats could be considered as one of reasons for their widespread distribution in the country. Similarly, the preference of larval habitats may be a contributing factor for the distribution of the species of *Fraudatrix* Subgroup being mostly confined to the eastern parts while the species of the *Mammilifer* Subgroup extend up to the western end of the country. Though both the regions are characterized by hilly forested areas with high rainfall, the eastern region have vast areas that are conducive for ground pools preferred by the *Fraudatrix* Subgroup, while the west coast is narrow and steep in slope due to the presence of the Western Ghats, and offer more of the container habitats that are preferred by the *Mammilifer* Subgroup facilitating their distribution up to the western part of the country.

**DNA Barcode for identification of species**

In 2003, researchers at the University of Guelph in Ontario, Canada proposed “DNA Barcoding” as a way to identify species. These Barcodes are short DNA sequences of about 600 base pairs belonging to a 5’ region of the most conserved gene of mitochondrial genome viz., cytochrome c oxidase subunit I (COI) (Hebert et al. 2003). Species belonging to diverse categories of taxonomical hierarchies have been barcoded and taxonomically identified under the Consortium for the Barcode of Life (Hebert et al., 2004, Hajibabaei et al. 2006). Pradeep Kumar et al. (2007) have shown that DNA Barcodes can distinguish species of Indian mosquitoes. As a part of this approach to DNA barcoding of mosquitoes of India, species of subgenus *Lophoceraomyia* collected in this study have also been barcoded for the first time.

In the *Fraudatrix* Group, 2 species of the *Minutissimus* Subgroup, *minutissimus* and *infantulus*, and 6 species of the *Fraudatrix* Subgroup, namely, *rubithoracis*, *quadripalpis*, *aculeatus*, *paraculeatus*, *variatus* and *gracicornis* have been barcoded, while 4 species in the *Mammilifer* Subgroup of the *Mammilifer* Group, namely, *uniformis*, *mammilifer*, *bicornutus*, and *flavicornis* have been barcoded. The barcode sequences for these 12 species of subgenus *Lophoceraomyia* have been deposited in the GenBank.