V. A NEW ARRANGEMENT OF THE INDIAN *ANOPHELINÆ*.

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The following tabular statement shows (1) the names of the groups or genera in which the anopheline mosquitoes of India are at present arranged by Mr. Theobald, and (2) the characters by which Mr. Theobald identifies the genera and distinguishes them from one another.

Genus.	Abdominal ornamentation.	Thoracic ornamentation.	Form of wing scales.	Form of head scales.
Anopheles, Meigen.	Hair-like curved scales.	Hair like curved scales.	Large and lanceolate.	Upright forked, but no flat scales.
Myzomyia, Blanchard.	,,	,,	Mostly small, long and narrow or slightly lanceolate.	,,
Stethomyia, Theobald.	,,	,,	Lanceolate.	Median area of head with some flat scales.
Pyretophorus, Blanchard	Hairy.	Narrow curved scales.	Small and lanceolate.	Not stated.
Myzorhynchus, Blanchard.	Apical ventral tuft of scales.	Hair-like curved scales	Dense, large, lanceolate.	Not stated.
Nyssorhynchus, Blanchard.	Lateral tufts and small dorsal patches of flat scales.	Narrow curved or spindle-shaped scales.	Not stated.	Not stated.
Cellia, Theobald.	Nearly completely scaled with long irregular scales and with lateral tufts.	With scales.	Not stated.	Not stated.
Neocellia, Theobald.	Similar to *Cellia* but no lateral tufts.	With scales.	Not stated.	Not stated.
Aldrichia, Theobald.	Completely scaled with large flat scales as in *Culex*.	With scales.	Not stated	Not stated.

It has to be noted also that Mr. Theobald has stated that the common Indian species *rossi* cannot be placed in any of these genera and that a genus *Pseudomyzomyia* would be created for its

reception. So far as I am aware the characters of this genus have not yet been published.

A careful examination of the above table will convince the reader that it would be very difficult, if not impossible, correctly to arrange the Indian species generically by its aid. Those who have worked at the subject will be aware also that the defining descriptions can be criticised as being, (1) incorrect (*e.g.*, the description of the abdominal ornamentation in the genus *Nyssorhynchus*; there are no lateral scale tufts in mosquitoes of this genus), or (2) inadequate (*e.g.*, the descriptions of the genera *Cellia* and *Neocellia*), or (3) confusing and indefinite (*e.g.*, the descriptions of the forms of wing scales). The difficulties caused by these defects have led to much criticism of the system of classifying the *Anophelinæ* on a basis of scale and hair covering, but it is probable that the fault lies not so much with the system as with the inadequate and confusing nature of the generic definitions. In this revision I shall try to avoid similar defects, but limits of space prevent me from giving more than a very brief summary of my work; and for the same reason I am prevented from explaining in full why I differ from Mr. Theobald in regard to points of detail.

A consideration of the best way in which to arrange the Indian anophelines according to scale and hair ornamentation is simplified if one starts by separating all the species in two great groups, the first containing those without scales on the abdomen, and the second containing those with scales on some part or the whole of that region of the body. According to the published descriptions of species the following come in the first of these groups.

Species without scales of any kind on the abdomen.
- *aitkeni*, James.
- *immaculatus*, Theobald.
- *culiciformis*, James and Liston.
- *lindesayi*, Giles.
- *gigas*, Giles.
- *culicifacies*, Giles.
- *listoni*, Liston.
- *leptomeres*, Theobald.
- *jeyporiensis*, James.
- *turkhudi*, Liston.
- *punctulata*, James and Liston.
- *elegans*, James.
- *nigrifasciatus*, Theobald.
- *nursei*, Theobald.

These 14 species are at present placed by Mr. Theobald in the following groups or genera:—

In the genus *Anopheles*: *aitkeni*, *immaculatus*, *lindesayi* and *gigas*.
In the genus *Stethomyia*: *culiciformis*.

In the genus *Myzomyia*: *culicifacies*, *listoni*, *leptomeres* and *turkhudi*.
In the genus *Pyretophorus*: *jeyporiensis*, *punctulata*, *elegans*, *nigrifasciatus* and *nursei*.

I have examined many specimens of nearly all these species and the following remarks contain the chief conclusions at which I have arrived. (1) I have carefully examined specimens of *maculipennis*, Meigen, and *bifurcatus*, Linnæus, and taking them as the types of Mr. Theobald's genus *Anopheles*, I am unable to place in this genus any Indian species at present known to me. (2) I find that the distinguishing character of the genus *Stethomyia*, namely, the presence of a few "flat scales" on the head, is not confined to the species placed by Mr. Theobald in that genus. Mr. Theobald found that the original character upon which he founded this genus (namely, the character "mammilated prothoracic lobes") was not distinctive, and now that the second character has been found to be not distinctive the genus should be sunk. Probably all the species now assigned to it would come in my new genus *Neostethopheles*. (3) The use of the shape of wing scales as a means of distinguishing between the genera of this first large group of anophelines appears to me to be open to the objection that it must always be doubtful whether, for example, the wing scales are "large and lanceolate" or whether they are "mostly small, long and narrow, or slightly lanceolate." I find, however, that this character is the only one by which the genera *Anopheles* and *Myzomyia* can be separated, and that unless it is agreed to sink the latter genus under the former we must accept it. The wing scales of *Anopheles maculipennis* are distinctly longer and broader than those of *Myzomyia culicifacies* and *Myzomyia listoni*, but they are only very slightly longer and broader than those of *Myzomyia turkhudi*. The wing scales of *Anopheles bifurcatus* are not so long nor so broad as those of *Myzomyia turkhudi*. If the character is regarded as of general application to all the genera endless confusion ensues. As I do not place any Indian species in the genus *Anopheles* and as I neglect the character of the wing scales for the grouping of the Indian species the subject need not be further considered here, but it is very desirable to find a better character for separating the genera *Anopheles* and *Myzomyia*. (4) I believe that the Indian anophelines without scales on the abdomen can be arranged in groups based on characters much more distinctive and easily recognized than those which Mr. Theobald has chosen.

For the arrangement of the species without scales on the abdomen I retain two of Mr. Theobald's groups, namely, *Myzomyia* and *Pyretophorus*, and create two new groups called respectively *Neostethopheles* and *Patagiamyia*.

The following definitions include the characters by which the four groups in which I arrange the 14 species without scales on the abdomen may be identified and distinguished from one another.

Genus 1. NEOSTETHOPHELES, *nov. gen. Abdomen with hairs but without scales of any kind. Thorax with hairs and as a rule without scales of any kind, but in one or two species a few long, exceedingly narrow,* false *scales*[1] *may be present on the anterior promontory only. Prothoracic lobes with hairs but without scales. Upright forked scales of the head very narrow in their whole length (rod shaped).*

Type of the genus: *aitkeni*, James. The distinguishing characters of the genus are shown in Plate ix, *fig.* 1.

I place the following species in this genus:—

aitkeni, James.
immaculatus, Theobald.
culiciformis, James and Liston.

Genus 2. MYZOMYIA, Blanchard. *Abdomen with hairs but without scales of any kind. Thorax with the dorsum clothed with long, very narrow, sharp-pointed, curved scales more numerous anteriorly and forming on the anterior promontory a bunch projecting over the neck. Nearly all the scales are false scales. Prothoracic lobes with hairs but without a tuft of scales. Upright forked scales of the head of the usual anopheline type, that is broadly expanding from the base to the apex.*

Type of the genus: *culicifacies*, Giles. The distinguishing characters of the genus are shown in Plate ix, *fig.* 2.

I place the following species in the genus:—

culicifacies, Giles.
listoni, Liston (= *christophersi*, Theobald).
culicifacies, variety *punjabensis*.
turkhudi, Liston.
leptomeres, Theobald.[2]*

Genus 3. PATAGIAMYIA, *nov. gen. Abdomen with hairs but without scales of any kind. Thorax with the dorsum clothed with long, narrow, curved, sharp-pointed scales which form on the anterior promontory a thick bunch projecting over the neck. Some of the scales are false scales and some are true scales. Prothoracic lobes with a conspicuous tuft of rather broad true scales projecting anteriorly. Upright forked cephalic scales of the usual broadly expanding type.*

Type of the genus: *gigas*, Giles. At present the only other

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[1] In this revision *false scales* are defined as those without clearly marked striae. There may be an appearance of linear marking, but separate striae cannot be counted. *True scales* always have definite bars or striae passing from the base to the apex of the scale. These striae often project beyond the apex, and when the scale is examined under the microscope they can be easily counted.

[2] When a species is marked with an asterisk it means that I have not examined its scale ornamentation in detail and that it is placed in the genus only provisionally.

Indian species in the genus is *lindesayi*, Giles. The distinguishing generic characters are shown in Plate ix, *fig.* 3.

Genus 4. PYRETOPHORUS, Blanchard. *Abdomen with hairs but without scales of any kind. Thorax and scutellum with moderately broad, rather short, true scales some of which are blunt ended (ob-lanceolate). Prothoracic lobes with hairs and sometimes with two or three scales scattered irregularly, but always without a bunch or tuft of scales. Upright forked cephalic scales of the usual broadly expanding type.*

Type example of the genus: *palestinensis*, Theobald.[1] The generic characters are shown in Plate ix, *fig.* 4.

I place the following species in the genus:—

elegans, James.
jeyporiensis, James.
nigrifasciatus, Theobald.*
nursei, Theobald.*
punctulata, James and Liston.*

I now take up the arrangement of the species which have scales on some part or the whole of the abdomen. Omitting certain varieties and doubtful forms they number 19 in all. At present 17 of these species are usually classified in Mr. Theobald's genera as follows:—

In the genus *Nyssorhynchus*: *maculatus*, Theobald.
fuliginosus, Giles.
jamesi, Theobald.
theobaldi, Giles.
maculipalpis, James and Liston.
karwari, James.
stephensi, Liston.
willmori, James.

In the genus *Myzorhynchus*: *barbirostris*, Van der Wulp.
sinensis, Wiedmann.
nigerrimus, James and Liston.
nigerrimus, Giles.

In the genus *Cellia*: *pulcherrima*, Theobald.

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[1] I name *palestinensis* as my type species because Mr. Theobald on page 71 of vol. iii of his monograph has figured the thoracic scales of this species The figure shows quite broad true scales some of which are blunt ended, and on page 74 Mr. Theobald says that these scales "of quite a different structure to the narrow hair-like scales on *turkhudi*, clearly relegate it to the genus *Pyretophorus*." According to my view a simple definition of the generic characters of *Pyretophorus* would be "with Nyssorhynchus-like thoracic scales but with no scales on the abdomen." *Costalis*, which I have not examined, is sometimes named as the type species of the genus, but if its thoracic scales do not correspond to this simple definition I should remove it.

In the genus *Neocellia*: *indica*, Theobald.
intermedia, Rothwell.
dudgeonii, Theobald.

In the genus *Aldrichia*: *error*, Theobald.

Rossi, Giles, for which Mr. Theobald proposed a genus called *Pseudomyzomyia*, and *halli*, James, which is a new species not yet assigned to a genus, are not included in the list, they will be considered separately in this account.

For the arrangement of the species in this second large group—the group in which scales are present on the abdomen—I retain the names of the groups *Nyssorhynchus*, *Myzorhynchus*, *Cellia*, and *Neocellia*, but I alter Mr. Theobald's definitions of these groups so as to make them represent clearly the scale characters of the groups. In the second place I change the position of one or two species that have been placed in wrong groups, and in the third place I create two new groups, one for *rossi*, the other for *halli*. I am unable to say anything about the genus *Aldrichia*, as I have not seen the species which represents it.

Dealing first with the group *Nyssorhynchus* I agree with Mr. Theobald in regarding the Indian species *maculatus* as a suitable type of a group of anophelines characterized by the presence of scales on only the last one, two, or three segments of the abdomen, and I find that the scale structure of this species agrees in all important respects with that of *fuliginosus*, *jamesi*, *theobaldi*, *maculipalpis* and *karwari*. My definition of the group characters is as follows:

Genus 5. NYSSORHYNCHUS, Blanchard. *Abdomen with the first five or six segments ornamented with hairs only. The last three or two segments and the genital processes carry in addition a number of rather long, blunt-ended true scales on both the dorsal and ventral surfaces. On the 8th segment and the genital processes the scales may be arranged in patches or may cover the surface more or less evenly; but they are never aggregated together to form tufts of any kind. Thorax with the dorsum covered with quite broad true scales usually arranged in more or less parallel lines. On the anterior promontory the scales are long and sharp-pointed and form a small bunch projecting over the neck on each side of the middle line; on the mid region and posteriorly they are broader and some are blunt-ended. The scutellum carries a number of similar scales. Prothoracic lobes without a tuft of scales. Head with the usual kind of upright forked scales.*

Type of the genus, *maculatus*, Theobald. The generic characters are shown in Plate x, *figs.* 1 to 6.

I place the following species in this group:—

maculatus, Theobald.
fuliginosus, Giles.
jamesi, Theobald.
theobaldi, Giles

karwari, James.
maculipalpis, James and Liston.

I have next to consider the species *rossi*, which in its scale ornamentation exhibits some of the characters of the group *Myzomyia* and some of the group *Nyssorhynchus*. An examination of a large number of specimens of this mosquito has shown that although minor differences in the degree and character of the scale ornamentation are common, the chief features, as figured in plate x, *figs.* 7 to 11, can always be made out on unrubbed specimens. I describe them thus :—

Genus 6. NYSSOMYZOMYIA, *nov. gen. Abdomen with the first seven or six segments ornamented with hairs only. The eighth segment (sometimes also the seventh) and the genital processes carry in addition a number of scales similar in character and arrangement to those of the group* Nyssorhynchus. *Thorax with the dorsum clothed with hairs and narrow, curved, sharp-pointed scales of various lengths and quite similar to those of the group* Myzomyia. *In addition there are on each side of the anterior third of the dorsum a few broader blunt-ended Nyssorhynchus-like scales. Prothoracic lobes without a tuft of scales. Head with the usual type of upright forked scales.*

The species is, therefore, representative of a group intermediate between *Myzomyia* and *Nyssorhynchus*, and is nearer to the latter than to the former group. The term NYSSOMYZOMYIA suitably indicates that it possesses the characters of both groups and I therefore apply this name to the genus instead of the name *Pseudomyzomyia* which Mr. Theobald proposed, but the characters of which has not yet described. The characters of the genus *Nyssomyzomyia* are shown in Plate x, *figs.* 7 to 11.

I take up next the group NEOCELLIA, Theobald, several members of which have usually been wrongly placed in the genus *Nyssorhynchus*. The characters of this group are very different from those of the group *Cellia* and the name *Neocellia* is therefore quite misleading. *Neonyssorhynchus* would have been a more suitable name, but the resemblance even to that group is not close.

The type species of the group is the Indian species *indica*, Theobald. I define the group characters thus :

Genus 7. NEOCELLIA, Theobald. *Abdomen with the dorsum of each segment clothed irregularly with hairs and long, rather broad, blunt-ended scales. The scales are not aggregated together to form tufts of any kind, but they are more numerous and thickly set on the last two segments than on the others. On the ventral surface the first five segments are devoid of scales, but on this surface of the 6th, 7th, and 8th segments they are present in considerable numbers, being disposed irregularly but attached chiefly on each side of the mid line and not forming tufts of any kind. Thorax clothed with broad true*

scales. Prothoracic lobes with or without a few scales irregularly disposed, but always without a definite bunch or tuft of scales. Head with the usual type of upright forked scales.

The characters of this genus are shown in Plate xi. I place the following species in it—

indica, Theobald.
stephensi, Liston.
willmori, James.
intermedia, Theobald.* (This perhaps = *stephensi*.)
dudgeonii, Theobald.* (This perhaps = *willmori*.)

Lastly, I have to consider the arrangement of the species in which some of the abdominal scales are disposed so as to form distinct bunches or tufts projecting from the dorso-lateral or from the ventral surface of certain segments. These tufts form conspicuous objects readily seen with a hand-lens, and their presence supplies an easy means of separating the following groups from any of those described above. The Indian species provided with certain of these abdominal tufts of scales are (1) *pulcherrima*, Theobald; (2) *sinensis*, Wiedmann (= *vanus*, Walker); (3) *nigerrimus*, James and Liston (which probably = *sinensis*, Wiedmann, and *vanus*, Walker); (4) *nigerrimus*, Giles; (5) *barbirostris*, Van der Wulp; (6) *halli*, James; and they must be arranged in three quite distinct groups, the names of which are (1) *Cellia*, Theobald; (2) *Myzorhynchus*, Blanchard; and (3) *Christophersia, nov. gen.*

The following are my definitions of these groups:—

Genus 8. CELLIA, Theobald. *Abdomen with the dorsum of each segment clothed with very large and broad orbicular-truncate squared-ended scales which stand out somewhat from the surface and overlap one another. In addition at the postero-lateral corner of each segment from the 1st to the 7th is inserted a bunch of large scales forming a tuft which projects laterally. Six tufts on each side are plainly visible with a weak lens. The ventral surface of each segment is clothed more or less evenly with very broad scales like those of the dorsum, but the clothing is not so thick as on that surface. The postero-lateral tufts of the dorsal surface are visible on each side, but there are no ventral tufts of scales projecting downwards. Thorax clothed with very broad scales. Prothoracic lobes with a few scales projecting forwards.*

Type species of the genus, *pulcherrima*, Theobald. The generic characters are shown in Plate xi.

Genus 9. MYZORHYNCHUS, Blanchard. *Abdomen with the dorsal surface clothed with hairs only. On the ventral surface from the apex of the seventh segment in the middle line a prominent bunch or tuft of rather long, black, true scales projects downwards. On the ventral surface of the 6th, 5th, 4th and 3rd segments a few small white scales may be present; if so, they are arranged somewhat irregularly*

and do not form tufts. Thorax with the dorsum clothed with hairs and narrow, sharp-pointed scales like those in the genus MYZOMYIA. *Prothoracic lobes with a dense tuft of broad true scales projecting anteriorly. Head with short very broadly expanding upright forked scales.*

Type species of the genus, *barbirostris*, Van der Wulp. The generic characters are shown in Plate xii. The other species in the genus are *sinensis*, Wiedmann, *nigerrimus*, James and Liston, and *nigerrimus*, Giles.

Genus 10. CHRISTOPHERSIA, *nov. gen. Abdomen with the dorsum of each segment thickly clothed with hairs and lanceolate and blunt-ended scales which are not aggregated together to form tufts of any kind. The ventral surface of each segment is devoid of scales except that from the apices of six segments in the mid line prominent tufts of long, blunt-ended scales project directly downwards. These tufts resemble the single abdominal tuft present in the genus* MYZORHYNCHUS. *Thorax clothed with rather narrow lanceolate and blunt-ended true scales. Prothoracic lobes with a prominent tuft of true scales. Head with the usual kind of upright forked scales.*

Type of the genus: *halli*, James. The generic characters are shown in Plate xii.

It only remains now to summarize in tabular form the essential differences between the groups I have defined, to indicate briefly how to place an anopheline in its correct genus, and to show in the form of a table the changes made in the generic position of the different Indian species.

How to ascertain the generic position of an anopheline. (1) Using a microscope with a two-thirds inch objective and a high power eyepiece (No. 8 or No. 12), examine the dorsal, lateral, and ventral surfaces of the abdomen of the mosquito. If scales are not immediately seen search carefully the last segment and the genital processes. Upon the decision whether the abdomen carries scales or not depends the accuracy of the subsequent determination. The decision is always very easily made, but especial care should be taken to examine the lateral and ventral aspects of the abdomen as well as the dorsal aspect. If no scales are present, the mosquito belongs to one of the first four genera. (2) In that case next examine the head. It will be seen at once whether the upright forked scales are of the usual broadly expanding type (all the spotted-winged anophelines have scales of this type) or whether the upright forked scales are very narrow in their whole length (linear or rod-shaped). If they are rod-shaped the mosquito belongs to the genus *Neostethopheles*. (3) If the upright forked scales are of the usual broadly expanding type, next examine the prothoracic lobes from the dorsal aspect. To see one of them clearly slant the pin so that the mosquito is turned more or less on its side. A very little practice will overcome any initial difficulty

Table of Generic Characters.

	Genus.	Abdomen.	Thorax.	Prothoracic lobes.	Upright forked scales of the head.
WITHOUT SCALES ON ABDOMEN.	NEOSTETHOPHELES, *nov. gen.*	With hairs but without scales.	With hairs but without scales. (The presence of a few long, sharp-pointed, very narrow scales on the anterior promontory does not exclude a species from this genus.)	With hairs but without scales.	Of a characteristic rod-shaped type not broadly expanding towards the apex.
	MYZOMYIA, Blanchard.	With hairs but without scales.	With long, narrow, sharp-pointed curved scales on the whole dorsal surface, but more numerous anteriorly.	Without a tuft of scales.	Of the usual broadly expanding type.
	PATAGIAMYIA, *nov. gen.*	With hairs but without scales.	With long, narrow, sharp-pointed scales more numerous anteriorly.	With a conspicuous tuft of broad scales.	Of the usual broadly expanding type.
	PYRETOPHORUS, Blanchard.	With hairs but without scales.	With quite broad true scales, many of which are blunt ended.	Without a tuft of scales.	Of the usual broadly expanding type.
WITHOUT ABDOMINAL SCALE TUFTS.	NYSSORHYNCHUS, Blanchard.	The dorsal and ventral surfaces of the last 3 or 2 segments carry true scales which are not aggregated to form tufts.	With quite broad true scales.	Without a tuft of scales.	Of the usual broadly expanding type.
	NYSSOMYZOMYIA, *nov. gen.*	With the last or the last 2 segments carrying true scales as in the genus *Nyssorhynchus*.	With long, narrow, sharp-pointed scales as in the genus *Myzomyia*, and with some broader, short scales.	Without a tuft of scales.	Of the usual broadly expanding type.

WITHOUT ABDOMINAL SCALE TUFTS.	NEOCELLIA, Theobald.	The dorsal surface of every segment carries true scales which do not form tufts. The ventral surface of the last 3 or 2 segments carries scales which do not form tufts.	With broad true scales.	Without a tuft of scales.	Of the usual broadly expanding type.
WITH ABDOMINAL SCALE TUFTS.	CELLIA, Theobald	The dorsal and ventral surfaces of every segment carry very broad scales. In addition tufts of large scales project outwards from the postero-lateral corners of the dorsal surface of each segment. No ventral tufts of scales.	With very broad true scales.	With a few scales projecting forwards.	Of the usual broadly expanding type.
	MYZORHYNCHUS, Blanchard.	The dorsal surface clothed with hairs only. The ventral surface with a conspicuous tuft of true scales projecting directly downwards from the apex of the seventh segment in the mid line.	With long, sharp-pointed scales like those of the genus *Myzomyia*.	With a dense tuft of true scales.	Of the usual broadly expanding type.
	CHRISTOPHERSIA, *nov. gen.*	The dorsal surface of each segment carries lanceolate and blunt-ended scales which do not form tufts. The ventral surface with six prominent tufts of true scales projecting directly downwards from the mid line.	With moderately broad true scales.	With a prominent tuft of scales.	Of the usual broadly expanding type.

Table of Species.

Specific name.	Genus according to Mr. Theobald's Monograph of the Culicidae.	Genus according to the arrangement described here.
aitkeni, James.	*Anopheles.*	*Neostethopheles.*
immaculatus, Theobald.	*Anopheles.*	*Neostethopheles.*
culiciformis, James and Liston.	*Stethomyia.*	*Neostethopheles.*
gigas, Giles.	*Anopheles.*	*Patagiamyia.*
lindesayi, Giles.	*Anopheles.*	*Patagiamyia.*
lindesayi, variety *maculata*, Theobald.	*Anopheles.*	*Patagiamyia.*
culicifacies, Giles.	*Myzomyia.*	*Myzomyia.*
listoni, Liston.	*Myzomyia.*	*Myzomyia.*
culicifacies, variety *punjabensis.*	——	*Myzomyia.*
leptomeres, Theobald.	*Myzomyia.*	*Myzomyia.**
turkhudi, Liston.	*Myzomyia.*	*Myzomyia.*
elegans, James.	*Myzomyia*, 1903.	
	Pyretophorus, 1907.	*Pyretophorus.*
jeyporiensis, James.	*Pyretophorus.*	*Pyretophorus.*
punctulata, James and Liston.	——	*Pyretophorus.**
nigrifasciatus, Theobald.	*Pyretophorus.*	*Pyretophorus.**
nursei, Theobald.	*Pyretophorus.*	*Pyretophorus.**
maculatus, Theobald.	*Nyssorhynchus.*	*Nyssorhynchus.*
fuliginosus, Giles.	*Nyssorhynchus.*	*Nyssorhynchus.*
fuliginosus, variety *nagpori*, J. and L.	——	*Nyssorhynchus.*
fuliginosus, variety *adiei*, James.	——	*Nyssorhynchus.*
jamesi, Theobald.	*Nyssorhynchus.*	*Nyssorhynchus.*
theobaldi, Giles.	*Nyssorhynchus.*	*Nyssorhynchus.*
maculipalpis, James and Liston.	——	*Nyssorhynchus.*
maculipalpis, variety *indiensis*, Theobald.	*Nyssorhynchus.*	*Nyssorhynchus.**
karwari, James.	*Nyssorhynchus.*	*Nyssorhynchus.*
rossi, Giles.	*Myzomyia*, 1903.	
	Pseudomyzomyia, 1907.	*Nyssomyzomyia.*
indica, Theobald.	*Neocellia.*	*Neocellia.*
intermedia, Rothwell.	*Neocellia.*	*Neocellia.**
stephensi, Liston.	*Nyssorhynchus.*	*Neocellia.*
willmori, James.	*Nyssorhynchus.*	*Neocellia.*
dudgeonii, Theobald.	*Neocellia.*	*Neocellia.**
pulcherrima, Theobald.	*Cellia.*	*Cellia.*
barbirostris, Van der Walp.	*Myzorhynchus.*	*Myzorhynchus.*
sinensis, Wiedmann.	*Myzorhynchus.*	*Myzorhynchus.*
nigerrimus, James and Liston.	*Myzorhynchus.*	*Myzorhynchus.*
nigerrimus, Giles.	*Myzorhynchus.*	*Myzorhynchus.*
halli, James.	——	*Christophersia*,
error, Theobald.	*Aldrichia.*	——*

that may be experienced in obtaining a good view of one of these bodies. It will at once be seen whether or not the lobe carries a cocade of scales projecting anteriorly. If the lobe carries such a cocade the mosquito belongs to the genus *Patagiamyia*. (4) If a tuft of scales is not present on the lobe next examine the dorsal surface of the thorax. If the scales are long, sharp-pointed, and very narrow (that is, if it is rather difficult at a first glance to say whether they are scales or hairs) the mosquito belongs to the genus *Myzomyia*. If the scales are short and moderately broad (that is, if it can at once be seen that they are true scales) the mosquito belongs to the genus *Pyretophorus*.

In the second case we shall have detected the presence of scales as well as hairs on one or more of the abdominal segments. In that case proceed as follows: (1) The first point to decide is whether or not some of the scales are aggregated to form tufts. The appearance of these tufts is shown in Plate XII; they are very definite objects and the mistake must not be made of regarding as tufts the irregularly disposed scales that in some species overhang the sides of the terminal abdominal segments. The single tuft projecting downwards from the mid line of the ventral surface of the 7th abdominal segment in anophelines of the genus *Myzorhynchus* is the least easy to detect. In specimens of that genus we usually see no scales during the examination of the dorsal surface, and even when the mosquito has been turned upside down for the examination of the ventral surface, the ventral tuft may not be recognized because its very dark scales are viewed against the equally dark background of the abdomen. It is not until the mosquito has been turned on its side that the ventral tuft is easily seen. That is why it is so important not to neglect the examination of the last abdominal segments from every direction of view. If it is found that the abdomen carries only this single ventral tuft of scales, we can say at once that the mosquito belongs to the genus *Myzorhynchus*. The determination should be confirmed by finding that the thorax carries long, sharp-pointed, myzomyia-like scales, and that the prothoracic lobes carry a cocade of scales. (2) If on examining the dorsal surface we see at once that it is clothed with very broad scales and that tufts of scales project laterally from the sides of each segment, the mosquito belongs to the genus *Cellia*. (3) If on examining the dorsal surface we see that every segment carries scales and that there are no lateral tufts, but that when the mosquito is turned on its side a number of very prominent ventral tufts come into view, the mosquito belongs to the genus *Christophersia*.

If our examination has shown that none of the abdominal scales are aggregated to form tufts, it has to be decided whether all the segments are provided with scales on their dorsal surface or whether only the terminal segments carry scales. In the first case the mosquito belongs to the genus *Neocellia*. In the second case examine the thorax; if the scales are short and broad the mosquito belongs to the genus *Nyssorhynchus*, if they are long,

sharp-pointed, and very narrow, it belongs to the genus *Nyssomyzomyia.*

Hints. (1) When beginning the study of classification by scale ornamentation always select good, *unrubbed* specimens. If mosquitoes bred from larvæ are being used do not kill them until 12 hours have elapsed from the time when they hatched out. The best specimens are those which, bred under favourable conditions from larvæ, have been allowed one meal of blood and then kept in suitable jars until the meal has been digested. (2) Do not use card-discs for mounting the mosquitoes to be used in studying this subject. Cut off the head of the fine silver pin and mount the mosquito on the pin so that an equal length of the pin projects from the dorsum and from the venter. Then stick either the point or the head end of the pin into a small block of pith or of cork. For examination, the mosquito can now be pinned with the dorsal, ventral, or lateral surface uppermost and a proper view obtained. When card-discs are used this cannot be done, because the disc is always in the way and hides the part one desires to examine. (3) A knowledge of whether the scales are false scales or true scales is not necessary for determining the genus, but if it is desired to study this matter thoroughly, the scales must be mounted flat on a slide and examined with a high power objective. It is essential to carry out the same procedure when it is desired to study thoroughly the shape of various scales. (I refer of course to a closer study than is necessary for ascertaining whether the upright forked scales of the head are rod-shaped or broadly expanding, whether the thoracic scales are sharp-pointed and very narrow or blunt-ended and broad, etc.). The following is the simplest method of obtaining the particular scales one wishes to study. Dissect out with a sharp knife the part of the mosquito that carries the scales and place it on a slide under a cover-glass. Tap and press the cover-glass slightly, then remove it and slide the part of the mosquito away with the point of a needle. Replace the cover-glass and fix it with strips of gummed paper. Many scales will have remained on the slide during these manipulations. Examine them with a $\frac{1}{12}$ inch oil immersion lens and draw them with the aid of an eyepiece camera lucida. (4) In describing the shapes of scales it would be of great advantage if all observers were to adopt the exact nomenclature used by botanists in describing the shapes of leaves. This nomenclature is given in all the elementary books on botany and is very applicable to the shapes of scales. The botanical terms acicular, linear, oblong, elliptical, rotundate, orbicular, lanceolate, ovate, oblanceolate, obovate, spatulate, etc., have a definite meaning and significance. "Lanceolate" is a botanical term commonly used by entomologists, but it is used by them indifferently for scales of very various shapes; a lanceolate leaf is broadest at the base and scales with that character are seldom or never seen, though oblanceolate scales are very common. The use of such terms as "slightly lanceolate," "long and narrow," "large and inflated," etc.,

can be criticised not only because these terms are so indefinite, but because it would be easy to find botanical terms that would describe the shape of the scale in a single word that conveys the same meaning to everyone. (5) It is particularly to be noted that no detailed arrangement by scale ornamentation can be made that will apply to both females and males. The scale ornamentation (especially on the last segments of the abdomen and genital process) of male anophelines often differs considerably from that of female anophelines. The arrangement described in this paper applies throughout to the female insect only.

26-5-10.

ADDENDUM.

The issue of vol. v of Mr. Theobald's Monograph while this paper was passing through the Press has made it necessary to add in the form of an appendix the characters of a new genus, NEOMYZOMYIA, described by him. He has created the genus for the reception of *elegans*, James, a species that I have not seen for some years. The generic characters are shown in the following statement :—

Abdomen.	Thorax.	Head.	Prothoracic lobes.
Only the last segment carries scales. They are arranged as in the genus *Nyssorhynchus*.	The anterior promontory carries a group of sharp-pointed curved scales which project over the neck. The remainder of the dorsum is clothed with hairs.	With the usual type of broadly expanding upright forked scales which form dense tufts at the postero-lateral corners.	With a tuft of long out-standing scales.

It will be seen that the genus is distinct from any of those described above. It comes near to the genus *Patagiamyia*, but the presence of scales on the last segment of the abdomen separates it very distinctly and makes us place it in the second of the two great groups. Mr. Theobald says that the scales of the wing are *Myzorhynchus*-like and that the palpi are densely scaled, so that the chief difference between the new genus and the genus *Myzorhynchus* must be that in *Myzorhynchus* the scales of the last abdominal segments are arranged as a ventral tuft while in *Neomyzomyia* they are not aggregated to form a tuft but are disposed irregularly as in the genus *Nyssorhynchus*. The name *Neomyzomyia* is rather misleading.

S. P. J.

5-9-10.