THE ETHIOPIAN SPECIES OF THE GENUS *MUSCA* LINNAEUS.

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(Plates I—IV.)

In a recent paper [1] in these *Records* I described, in collaboration with Mr. Senior-White, the Oriental species of the genus *Musca*. In writing that paper special attention was paid to the preparation of the keys to the species, and it is gratifying to learn from my friend Professor Mario Bezzi that he has found the keys a helpful guide to the Oriental species. The short descriptions were accompanied by brush drawings of accurately identified specimens, and here again it is pleasing to know that Professor Bezzi has found them useful.

I may here explain that it is absolutely necessary when describing species of this genus to do so with the specimens always held in the same position. In the paper referred to the abdomens were drawn and described with the head of the specimen directed towards the observer; this position has been found, as the result of very extensive experience, to be the best in which to note the body pattern of these muscids. In this genus this pattern is most important for purposes of identification, and it varies in an extraordinary way according to the position in which the observer examines the specimen. In the position noted above the important stripes, bands and shimmering patches, are seen to the best advantage, whereas if the specimen is examined from the side, or with the head directed away from him the pattern is often quite different.

In the present paper I propose describing shortly the Ethiopian species of the genus at present known to me together with illustrations of their abdomens, and giving keys for the determination of the two sexes. As in the case of the paper on the Oriental species I would like to point out that the present paper is not meant to be a final revision of the species from the Ethiopian Region, but only a preliminary contribution with that end in view. It is meant rather as a practical guide to the identification of the species known at present, and is specially written for medical and veterinary officers to whom a knowledge of these flies is of the first importance. My only regret is that the species are at present so incompletely known.

It is now just twenty years since I noted the peculiar haematophagous habits of a species of the genus *Musca*. This fly, *Musca pattoni* Austen, was observed feeding on the sores on the bellies of calves used for the preparation of cow-pox vaccine at the King Institute, Guindy, Madras; both sexes were seen to feed greedily on blood and serum. Since then I have observed and recorded this habit in a number of other species of this genus. These species of *Musca*, as I have repeatedly pointed out, are wild flies, and are only seen on animals in the open, feeding on blood,

[1] *Rec. Ind. Mus.* XXVI, pp. 553-577, pls. xxix-xxxiii (1924).

serum and discharges from cuts, bites of other flies, wounds, diseased eyes, nostrils, etc. Bearing in mind the nature of the food of these species of *Musca* and remembering that they are intermittent feeders, flitting about from animal to animal, it is easy to understand that they are potential carriers of all kinds of pathogenic organisms. It may yet be proved that some of the large hæmatophagous species of the genus are mechanical carriers of trypanosomes in those parts of Africa where *Glossina* is absent, and other biting flies rare. Although there are several of these hæmatophagous species in Africa, and I have seen one of the commonest (*Musca lusoria* Wiedemann) on animals in South Africa, our knowledge of them is still very incomplete, and I regret to say I have not had the opportunity of examining the larvæ of any of the species, and have no information regarding their breeding habits; some of them I feel sure are viviparous in habit. I hope therefore that medical and veterinary officers practising in Africa, as well as Government entomologists, will collect and send me direct to the Department of Zoology, University of Edinburgh, specimens of these flies, and, if possible, endeavour to ascertain their breeding habits; I need hardly say I will always be glad to help in identifying any specimens. I have now seen most of the types and many of the illustrations accompanying this paper are drawn from them.

Before passing on to the keys and the short descriptions of the species, it is necessary to refer briefly to the genus itself; the following definition covers all the species.

Genus **Musca** Linnaeus.

SYNONYMS *Byomya* R.-D.; *Plaxemya* R.-D.; *Placomya* R.-D.; *? Sphora* R.-D. *Philaematomyia* Aust.; *Pristirhynchomyia* Brun.; *Eumusca* Towns.; *Promusca* Towns.; *Viviparomusca* Towns.; *Ptilolepis* Bezzi; *Awatia* Towns.; *Lissosterna* Bezzi.

EARLY STAGES. Species either oviparous or viviparous. Egg elongated, cylindrical, creamy white with one end broader than the other. Dorsal surface of the chorion raised and thickened to form two parallel rib-like ridges which extend the whole length of egg, and in many of the hæmatophagous species project from the end in the shape of an elongated, spine-like process, often hooked and of a dark colour. Length of egg varies from ·8 to 2·2 mm. in length. Larva smooth (without fleshy processes), probably consisting of thirteen segments; development in three stages with two moults. *Two oral hooks* (mandibular sclerites), *the left always smaller than the right.* Pharyngeal sclerites massive in third stage, and deeply incised, the dorsal and ventral cornua long and stout, the latter with a short hump; there are no anterior rod-like prolongations as in the larva of the Calliphorinæ. Posterior stigmatic plates of third stage larva either D-shaped, or rounded with three sinuous breathing slits, and the button area well within the peritreme. Puparium, either mahogany, or creamy white in colour.

ADULT STAGE. Colour greyish with well marked dark stripes and bands, those on the thorax either two or four in number; a few males metallic and without stripes. Eyes of males either contiguous or well separated, the front then about half the width of an eye; either densely

pilose, very sparsely so that the surface must be examined with a high power to detect the hairs, or bare; the upper and middle facets in some species larger than the lower. In the females eyes well separated, the front commonly equal to the width of an eye; parafrontal or orbital bristles arranged either in one, two, three or more rows but always very variable and most unreliable for classification. Eyes in a few species either densely or sparsely pilose. Third segment of antenna in both sexes elongated, from two to four times as long as broad. Sensoria arranged as follows:—(1) Large grape-like sacculus with a comparatively long duct opening into the socket of third segment on its postero-internal aspect. (2) Large postero-external (lateral) sacculus situated near the distal end of the socket. (3) One or more sacculi on the postero-internal border. Sixth segment of antenna with fixed bristles on both dorsal and ventral borders, 9 to 14 on the former, and 5 to 9 on the latter; the first ventral bristle is attached about opposite the 4th to the 6th dorsal bristle; only a small portion of the apical end of segment is bare. Proboscis retractile and labella well developed; prestomal teeth small and numerous, or large and few in number; in the latter case the proboscis is so adapted that the teeth can be used to scratch the skin of the host and draw blood. Thoracic chætotaxy as follows:—Humeral 3; posthumeral 1; notopleural 2; presutural 1; supra-alar 1; intra-alar 1; post-alar 3; dorsocentral 4 to 6, two to three in front of the suture and four behind it, those in front of suture commonly reduced in size and number; acrostical 1 to 3, variable in size and number; mesopleural 6 to 7; sternopleural bristles either entirely wanting, or, if present, always arranged 1 : 2; pteropleural and hypopleural bristles wanting, hairs often present just above third coxa. Venation characteristic; vein R_{4+5} with a few minute bristles on its dorsal and ventral surfaces near the base, those on the latter surface in many species extending to and beyond the radio-medial cross vein; caudal surface of root of radial vein either with one or more hairs. Vein M_{1+2} bending up either at a sharp or rounded angle, and either joining vein R_{4+5} at the margin, or ending at the margin just behind vein R_{4+5}; cell R_5 either closed, or narrowly open. Squamæ either bare, or with a few long hairs on the dorsal surface near the cephalic margin. Male terminalia very variable and without any characters of generic value.

The above definition covers all the species of the genus *Musca* known to me at present. They form a compact group of closely related flies and I can see no satisfactory reason for splitting the genus into genera and subgenera. I do not intend to go into this question here in any detail but will only refer to two species which have been placed in different genera. Two blood-sucking species, *crassirostris* Stein and *inferior* Stein have been removed from the genus *Musca*, and placed in separate genera, the former has been made the genotype of the genus *Philæmatomyia* Austen, and the latter the genotype of *Ptilolepis* Bezzi. Both these species belong to my third group which contains all the blood-sucking forms; these flies obtain their food by scratching the skin of bovines and equines. I have had the opportunity of studying many specimens of the five known species, and the larvæ of three, and have examined critically all the types except that of *crassirostris*, of the

identity of which, however, there is no doubt whatever; the species are as follows :—

Musca crassirostris Stein. *Musca planiceps* Wiedemann.
,, *inferior* Stein. ,, *senior-whitei* Patton.
Musca fletcheri Patton and Senior-White.

Although it is true that in both *crassirostris* and *inferior* the proboscis is adapted for scratching the skin of animals and drawing blood, it is fundamentally similar to the proboscis of *Musca domestica*; anyone can demonstrate this for himself by making caustic potash preparations of the proboscis of each when it will be noted that the differences are merely those of degree. Both *crassirostris* and *inferior* differ in certain other minor characters from *domestica*. In *Musca inferior*, for instance, there are a few fine scattered hairs on the anterior border of the dorsal surface of the squama, and the two presutural dorso-central bristles are very small, and there are only two strongly developed postsutural dorso-central bristles. The presence of the hairs on the squama is said to suggest relationships with the Calliphorinæ, but I can find no other evidence whatever to support this view. There are some genera of the Calliphorinæ, *Lucilia* for instance, in which the squama is bare, and I fail to see that this character is of any phylogenetic importance. On the contrary both these species have two important structural characters which I believe have a deep significance, and clearly demonstrate that both are very closely related to *Musca domestica*, so closely in fact that I for one do not intend to remove them from this genus. These characters are to be found both in the larva and the adult.

I have had the opportunity of examining the last larval skin of *inferior* kindly sent me by Mr. Senior-White from Ceylon. I note that the cephalo-pharyngeal skeleton is typical of the genus *Musca* (*see* definition). The left oral or mandibular sclerite is smaller than the right, there are no anterior rods on the pharyngeal sclerites which are massive and exactly similar to those of the third stage larva of *domestica*, and the stigmatic slits are sinuous and not straight as in the larvæ of the Calliphorinæ. The front of the male is very wide as in the male of *domestica*, and most important and of phylogenetic significance, the third antennal segment has a large grape-like sensorium which opens on the postero-internal aspect of the socket, and an external sacculus which opens by a large pore on the external surface of the segment near the proximal end of the socket. These sensoria, especially the former, are characteristic of the species of the genus *Musca*, and although I have examined typical examples of all the other genera of the Muscinæ, many species of the metallic and non-metallic Calliphorinæ and also the Sarcophaginæ, I have so far not found one antenna in which there is a sense organ opening into the socket of the third segment; the nearest approach to this arrangement is seen in the antenna of the genus *Lyperosia*. I am strongly of opinion that these characters of the third antennal segment are of great significance; I have dealt with their arrangement in the higher Diptera in another paper in collaboration with Miss McGill.

The larva and the adult of *crassirostris* also exhibit these characters, and therefore I cannot see any reason for placing these two species in

separate genera. I attach no importance to the slight differences in chætotaxy in these two species and *domestica* for the more I study the higher Diptera the more I am convinced that chætotaxy is most unreliable and is not of generic importance. The above remarks will suffice for the present. I intend dealing more fully with this question on another occasion. For the sake of those who have not seen the paper on the Oriental species referred to above, I will again draw attention to the more important characters which I have found of great use in identifying the species of this difficult genus. The following is a list of the Ethiopian species known to me at present.

List of Ethiopian species of the Genus Musca.

1. *Musca domestica* L.
2. ,, *vicina* Macq.
3. ,, *nebulo* Fab.
4. ,, *sorbens* Wied.
5. ,, *vetustissima* Walk.
6. ,, *tempestiva* Fall.
7. ,, *tempestatum* Bezzi.
8. ,, *gymnosomea* Rondani.
9. ,, *fasciata* Stein
10. ,, *vitripennis* Meig.
11. ,, *interrupta* Walk.
12. *Musca lucidula* Loew.
13. ,, *albina* Wied.
14. ,, *pulla* Bezzi.
15. ,, *xanthomelas* Wied.
16. ,, *ventrosa* Wied.
17. ,, *lusoria* Wied.
18. ,, *alpesa* Walk.
19. ,, *natalensis* Villeneuve.
20. ,, *gabonensis* Macq.
21. ,, *dasyops* Stein.
22. ,, *conducens* Walk.
23. *Musca crassirostris* Stein.

External Characters of Use in Determining the Species.

General Colour.—The majority of the species of the genus *Musca* are non-metallic, greyish flies with characteristic stripes, bands and shimmering light spots and patches; these vary according to the position and the light in which the specimen is held, and also whether it is or is not a rubbed specimen. For instance in the case of those species with only two, broad, thoracic notal stripes, if looked at with the head facing the observer the stripes are clearly seen, but if looked at in the reverse direction, and from the side in some lights, the most prominent marking on the thorax is not the dark stripes but the broad grey one between them; this appearance gives an entirely false idea of the notal pattern. Many of the older authors, Wiedemann in particular, described their species in these positions.

In the males of a few species for instance *lucidula*, *vitripennis*, *tempestiva* and *albina* the notum is metallic and there are no definite stripes. In the females of these species, however, the notum though often possessing a metallic sheen has stripes.

Head.—The males of most of the species of this genus are either holoptic or sub-holoptic. The male of only one Ethiopian species, *M. domestica* L., is dichoptic; in this species the front is very nearly half the width of an eye. The eyes in this type of front are referred to as widely separated (Plate I, fig. 3). In some males, *e.g.*, *nebulo*, *vicina* and *sorbens* the front

is much narrower, varying from one-fifth to one-eighth the width of an eye; the eyes in this type are referred to as well separated (Plate I, fig. 4). The majority of the males are holoptic, the front being very narrow, the eyes almost meeting in the middl eline; the eyes in this type are referred to as narrowly separated (Plate I, fig. 5).

The eyes of a few species are hairy or pilose, those of the male *vitripennis*, *interrupta*, and of both sexes of *dasyops* are densely hairy, the hairs being easily detected with the ordinary pocket lens. I have not been able to detect even microscopic hairs on the eyes of any other Ethiopian species known to me at present.

The females are all dichoptic, the front is wide, and its width in relation to that of any eye is of some use in separating the species; it should be remembered, however, that this character is very variable. The so-called parafront, in reality the vertex, bears a number of bristles arranged in one, two, three or more rows. In many of the species in which the bristles appear to be arranged in one row it should be noted that there is a second row commencing at the lower end of the frontal stripe; this arrangement is seen in the type of the genus *domestica*. In the female *conducens*, however, there is a single row of bristles down to the lower end of the frontal stripe. In *lusoria* there are three rows of bristles, and in the female *albina* there are four and sometimes even five. In using these bristles in separating the species it is important to remember that they vary both in number and arrangement in the same species and even on the two sides in the same specimen. The characters of the frontal stripe are not of much use in separating the species, the width varies considerably, and if the fly has been pinned before it has hardened the whole front may collapse, and then the stripe may appear very narrow. In the female *albina* the stripe is normally very narrow and the eyes widely separated.

The characters of the palp are not of much use in separating the species. In the majority the palp is black throughout but in *conducens* and *crassirostris* it is either yellow or yellowish. The shape varies little and is of no value in identification.

The proboscis should always be examined, especially when it is extended. In the non-blood sucking species such as *domestica*, *nebulo*, etc., the theca or mentum is not thickened and enlarged, and does not project backwards to any marked extent to form a bulb (Plate I, fig. 13); this type of theca is common to the majority of the species. In the true biting species the proboscis is specially adapted for scratching the skin and in this way they obtain blood. This type of proboscis is well seen in *Musca crassirostris* in which the mentum is enlarged and strongly chitinized forming a shiny black object on the posterior surface of the proboscis when extended (Plate I, fig. 14). The prestomal teeth are not only reduced in number, but are enormously increased in size, and together with the highly developed interdental armature form a most efficient scratching apparatus. But, as already pointed out in the paper on "The Oriental Species of the Genus Musca" this type of proboscis is only a special adaptation to the adoption of the blood-sucking habit in a fly with mouth parts structurally similar to that of the house fly, *Musca domestica*; though superficially suggestive, especially

when extended, of a piercing organ, such as that of *Stomoxys* and allies, the proboscis of *Musca crassirostris* does not penetrate the skin.

Thorax.—Thoracic chætotaxy, though of some use, especially in conjunction with other characters, in identification, must not be relied on too much as the number and arrangement of the bristles is very variable. The arrangement of the bristles is shown in Plate I, figs. 7 and 10. In *Musca domestica* (fig. 10) there are normally three dorso-central bristles in front of the suture and four behind it, and only one pair of acrostical bristles at the posterior end of the notum. This number and arrangement is common to most of the species and is well seen in such large forms as *lusoria*, *natalensis*, etc. But even in these species it is not uncommon to find the first pre-sutural dorso-central bristle absent or much reduced in size; similarly those behind the suture may be absent or much smaller than normal. In some of the species, *crassirostris* for instance, there is a further reduction, there being only two pre-sutural dorso-central and two behind the suture, the former of which can hardly be called a macrochæta; in some of the Oriental species the reduction of the bristles is even more marked as has been noted in the paper referred to above. *Musca albina* exhibits as far as I know at present the extreme limit of reduction of bristles; in this species there is only one dorso-central bristle behind the suture and both the acrostical and sterno-pleural bristles are absent. This together with other characters has led Professor Bezzi to place this species in the genus *Lissosterna*.

Adomen.—If one examines the dorsal surface of the abdomen in *Musca* only four tergites can be made out. But when the abdomen is removed from the thorax, cleared in potash and mounted flat after cutting the tergites down the middle line, it will be noted that there are six spiracular openings in the male and five in the female. There are two spiracles associated with the apparent first tergite, and it is therefore evident that it represents two tergites fused together; the narrow anterior slip is most probably the true first tergite, the sternite of which is not clearly differentiated from the apparent first sternite. It is most probable that the reduction in the number of segments has taken place at the caudal end of the abdomen; it is not possible, however, yet to come to any definite conclusion on this point. To avoid any confusion therefore in the subsequent descriptions of the species given below the word "apparent" is to be understood before the word tergite and sternite.

The markings on the tergites and sternites are of great value in identification especially when they are taken in conjunction with other reliable characters. As already noted it is most important to examine the specimens in one position, and that I have adopted for this group is with the head directed towards the observer; although there is much variation in the colour of the tergites and sternites each species has its more or less characteristically marked abdomen.

I have not been able to discover any characters in either the male or female terminalia for separating the species. The differences are so small and there is so much variation that it is not worth while using these characters in separating the species.

Venation.—The venation common to most of the species is illustrated in Plate I, fig. 8. It will be noted that cell R_5 (1st posterior) is narrowly open ; in one species, *M. lucidula*, it is closed. There is also some variation in the bend of vein M_{1+2} (4th longitudinal), which may be sounded as in *M. tempestiva*, or more or less angled as in *M. domestica*. The relation of the medio-cubital (posterior) cross vein in relation to the bend of vein M_{1+2} is somewhat variable.

The most valuable characters on the wing are to be found in the number and arrangement of the hairs and small bristles on the veins. The hairs on the caudal border of R (Plate I, fig. 6) are fairly constant for each species, and together with other characters are most useful in separating closely allied species. The small bristles on the ventral side of R_{4+5} may be limited to the base of the vein, or they may extend in a row up to and beyond the radio-medial (anterior) cross vein (fig. 6). The characters have been largely used in separating the species in the keys, and with others they are most useful. If there is any doubt as to whether the bristles extend up to and beyond the cross vein it is best to remove one wing, clear it for a short time in clove oil and then mount it in Canada balsam with the ventral surface uppermost. A row of scars (Plate I, fig. 9) will leave no doubt as to whether the species possesses the bristles or not ; it is seldom that one has to make such a preparation as, if the species has these bristles, one or more are nearly always present even in badly rubbed specimens.

No attempt has been made to give a complete description of the species as this would serve no useful purpose and would defeat the object I have in view. The drawings of the abdomens have been executed by Mrs. Patton, and it should be noted that they are not drawn to any scale but are meant to illustrate the colour markings and nothing else ; many of the drawings illustrate the abdomens of types kindly lent me for study.[1]

Key to the Males of the Ethiopian species of the Genus *Musca*.

1.	Species with metallic thorax and without stripes ...	2
	Species with non-metallic thorax and with dark stripes ...	6
2.	Eyes densely hairy	3
	Eyes bare	4
3.	Abdomen light orange ; first tergite black in middle and along anterior border, orange at sides ; second tergite orange with a broad median black stripe and partial dark caudal band ; third and fourth tergites with large median silvery spots. Two well developed presutural dorso-central bristles. Palæarctic. North Africa ...	*vitripennis.*
	Very similar to above ; dark area on second tergite more extensive along cephalic border ; silvery patches on third and fourth tergites smaller ; front distinctly narrower ; presutural dorso-central bristles absent. South Africa	*interrupta.*
4.	Sternopleural bristles absent. Eyes well separated. First abdominal tergite light orange with a median dark spot or band which may spread on to the next tergite ; second tergite with a similar spot often produced forwards to form an incomplete median stripe ; third tergite	

[1] Some of the drawings were used in the paper on the Oriental species.

with a large median silvery patch, and a similar dark spot; fourth tergite with a large median silvery patch and dark admedian spots. Oriental. North Africa, Egypt and East Africa ... ... *albina.*

Sternopleural bristles present and arranged 1 : 2 ... 5

5. Abdomen light orange; first tergite mainly light orange with a dark green metallic spot at middle and extending to cephalic border; second tergite with a somewhat incomplete dark median stripe; third tergite with a bright green patch in the middle, sides orange; fourth tergite entirely green. Thorax green, presutural area greyish in middle with faintly marked stripes. North Africa, Egypt ... ... *lucidula.*

Abdomen greyish green with dark bands and stripes; first tergite entirely black, remaining tergites as in Plate I, fig. 6. Palæarctic. North Africa ... ... *tempestiva.*

6. Eyes densely hairy. Thorax with two broad black stripes. First abdominal tergite black with bluish admedian spots on posterior border. Oriental (China). Kilama N'ajaro *dasyops*

Eyes bare 7

7. Vien R_{4+5} with a few hairs ventrally but none extending to and beyond the radio-medial cross vein 8

Vein R_{4+5} with a row of bristles on the ventral side extending to and beyond the radio-medial cross vein ... 26

8. Species with two broad thoracic stripes 9

Species with four thoracic stripes 13

9. Small species with abdomen mainly greyish green ... 10

Larger species with abdomen mainly orange 12

10. Presutural dorso-central bristles wanting; scutellum greyish green. Distal dark bands on tergites two and three comparatively narrow. North Africa ... ... *tempestatum.*

Presutural dorso-central bristles present 11

11. Eyes narrowly separated. Thorax bluish grey with two broad black stripes. Abdomen greyish; first tergite dark brown to black; second tergite orange with a broad median black stripe and a black basal band; third and fourth tergites similar but median stripes narrow. Malta. North Africa ... ... *gymnosomea.*

Eyes narrowly separated. Thorax bluish grey with two broad black stripes. Scutellum black. Abdomen with a characteristic bluish sheen. First tergite entirely black except for faint suggestions of light spots at sides; second tergite mainly bluish grey with a broad median stripe, a broad basal band, and faint suggestions of admedian stripes; third tergite similar, but stripe and band narrower; fourth tergite bluish grey with a very narrow median dark stripe. Seychelles. Oriental (widely distributed in Malaya). North and Eastern parts of Ethiopian Region, especially in Abysinnia and Somaliland *fasciata.*

12. Thorax bluish. First abdominal tergite orange, sometimes dark orange to black. Eyes narrowly separated. Oriental and Australasian Regions. Widely distributed in Ethiopian Region ... ... *vetustissima.*

Thorax greyish. First tergite orange, sometimes dark orange with a dark median stripe, sometimes entire tergite black. Eyes well separated. Oriental Region. Widely distributed in Ethiopian Region ... ... *sorbens.*

13. Thorax dark (bluish), the four stripes though present difficult to make out. Abdomen entirely orange and without definite markings. Oriental Region. Widely distributed in Ethiopian Region ... ... *ventrosa.*

Thorax mainly grey or greyish green. Abdomen with characteristic stripes, bands and shimmering patches ... 14

14. Presutural portion of inner thoracic stripes narrower than postsutural part, and much narrower than presutural portion of external stripes 15

All parts of thoracic stripes of about equal width and mostly broad 16

15. Palpi black. Proboscis without enlarged theca, not a blood-sucking species. First abdominal tergite black; second tergite dark orange with a broad median black stripe, and silvery adjacent and marginal patches; third tergite similar but median stripe narrower. Oriental Region. East Africa. ... ... *pulla.*

Palpi light orange. Proboscis with enlarged black theca, a blood-sucking fly. Abdomen greyish green; first tergite black, the posterior border grey; second tergite with a narrow median black stripe, extending along the anterior border (T-shaped). Oriental Region. Widely distributed in Ethiopian Region ... ... *crassirostris.*

16. Eyes narrowly separated 17

Eyes widely separated 18

17. First tergite entirely dark orange to black; second tergite with a broad black median stripe widening out cephalad and caudad, silvery patches at sides of stripe and at margins of tergite well marked. Oriental Region. Egypt *xanthomelas.*

First tergite dark orange; second light orange with yellowish white pollinosity and a broad black median stripe; third tergite similar but with a narrower dark median stripe. Proboscis with enlarged theca and prestomal teeth reduced in number and larger. Oriental Region. Widely distributed in Ethiopian Region ... ... *conducens.*

18. Eyes widely separated; front approximately half width of eye. First abdominal tergite mainly orange with a broad median black stripe and black cephalic margin. North and South Africa and at ports ... ... *domestica.*

Eyes well separated; front from one-fifth to one-eighth width of an eye 19

19. Second abdominal tergite light orange with a broad median black stripe and silvery margins; third tergite orange with a narrower median black stripe, admedian dark stripes, and broader intervening and marginal silvery stripes; fourth tergite orange with silvery lateral stripes. Widely distributed in Ethiopian Region but not such a dominant species as the next and not so widely distributed as in the Oriental Region ... ... *nebulo.*

First and second tergites very similar to those of *nebulo*, but third and fourth with dark brown admedian and much darker greyish intervening stripes. Widely distributed in both Oriental and Ethiopian Regions ... ... *vicina.*

20. Species with four broad black thoracic stripes. Abdominal markings as in figure. Widely distributed in Ethiopian Region ... ... *lusoria.*

Species with two broad black thoracic stripes... ... 21

21. First abdominal tergite mainly orange with a narrow median black stripe and black median cephalic patch; second tergite orange with broader median black stripe, T-shaped at cephalic end, admedian and marginal silvery spots well marked; third tergite with much narrower median stripe and well marked silvery spots; fourth tergite with dark median stripe and silvery patches. Mainly in South Africa ... ... *natalensis.*

First abdominal tergite either entirely or mainly black ... 22

22. Second tergite with a broad median black stripe broadly T-shaped at cephalic end and well marked admedian and marginal silvery spots; third tergite similar, the median stripe narrower, dark band at caudal margin and dark admedian stripes, silvery spots and patches similar to the second segment; fourth segment as in figure. Widely distributed in East, West and Central Africa ... *alpena*

Second tergite mainly dark orange with a suggestion of a narrow median dark stripe and a narrow median cephalic band ; third tergite dark orange ; fourth tergite similar but with some white patches. East, Central and South Africa ... ... *gabonensis.*

Key to the Females of the Ethiopian species of the Genus *Musca.*

1. Thorax and abdomen with metallic sheen, the former with four dark stripes 2

   Thorax without metallic sheen and with either two or four dark stripes 4

2. Thoracic stripes not well marked except in fresh specimens. Abdomen metallic, first tergite light orange ; second and third tergites with dark median stripe. Wing membrane very pale and cell R_5 closed. Egypt ... ... *lucidula.*

   Thoracic stripes better marked. Abdomen not so metallic, first tergite black. Wing membrane not markedly pale and cell R_5 narrowly open 3

3. Two presutural dorso-central bristles present. Abdominal markings as in figure. Palæarctic. North Africa ... *vitripennis.*

   Presutural dorso-central bristles absent. Abdominal markings as in figure. South Africa ... ... *interrupta.*

4. Eyes densely hairy. First abdominal tergite black with admedian bluish white spots on caudal border. China. Kilama N'ajaro ... ... *dasyops.*

   Eyes bare 5

5. Sternopleural bristles absent. Abdominal markings as in figure. Egypt, North and East Africa. Oriental ... *albina.*

   Sternopleural bristles present 6

6. Thorax with two black stripes 7

   Thorax with four black stripes 11

7. Stripes very broad and outer pair not divided in front of suture 8

   Stripes not quite so broad and outer pair divided in front of suture 10

8. Presutural dorso-central bristles wanting. Small species with abdominal markings as in figure. North Africa ... *tempestatum.*

   Small species with presutural dorso-central bristles ... 9

9. Thorax bluish grey with two broad black stripes. Abdomen greyish ; first tergite dark brown to black ; other tergites as in figure, the admedian dark stripes very narrow. Malta. North Africa ... ... *gymnosomea*

   Thorax bluish grey with two broad black stripes. Abdomen with a characteristic bluish (steel) sheen ; first tergite black, sometimes with suggestions of light spots at sides ; second and third tergites bluish grey with markings as in figure, the admedian stripes broad. Seychelles. Oriental Region. North and Eastern parts of Ethiopian Region (Abysinnia and Somaliland) .. .. *fasciata.*

10. Thorax greyish. Abdomen also greyish, first tergite dark brown, other markings as in figure. Oriental Region. Widely distributed in Ethiopian Region ... ... *sorbens.*

    Thorax bluish. Abdomen also bluish, first tergite black, other markings as in figure. Oriental and Australasian Regions. Widely distributed in Ethiopian Region ... *vetustissima.*

11. Vein R_{4+5} without bristles extending beyond base or radio-medial cross vein 12

    Vein R_{4+5} with bristles extending beyond radio-medial cross vein 20

12. Inner thoracic stripes in front of suture narrower than the postsutural part, and considerably narrower than the external stripes 13

All parts of thoracic stripes of about equal width and mostly broad 14

13. Palpi black. Proboscis without enlarged theca, not a blood-sucking species. First abdominal tergite black; other tergite markings as in figure. Oriental Region. East Africa ... ... *pulla.*

Palpi light orange. Proboscis with enlarged strongly chitinized black theca, a blood-sucking fly. Abdomen greyish, first tergite mainly greyish green, the cephalic border black and with or without a narrow median stripe; other tergites marked as in figure. Oriental Region. Widely distributed in Ethiopian Region but mainly in North East *crassirostris.*

14. First tergite either black, or dark orange appearing black 15

First tergite either entirely light orange, or mainly light orange 18

15. First abdominal tergite black; second tergite olive green with a broad black median stripe expanding anteriorly and posteriorly to form black cephalic and caudal bands; third tergite olive green with a very narrow median black band. Small species. Palæarctic. North Africa. *tempestiva.*

First abdominal tergite mainly dark orange. Much larger species 16

16. Parafrontal (orbital) bristles in one row throughout ... 17

Parafrontal bristles in one row up to the lower third of the frontal stripe, then in two rows. Markings of tergites as in figure. Palæartic. At most large ports. South Africa ... ... *domestica.*

17. Second abdominal tergite olive green with a narrow dark median stripe expanding anteriorly to form a partial band; third tergite olive green with a very narrow dark median stripe, and narrow though complete cephalic band. Oriental Region. Widely distributed in Ethiopian Region ... ... *conducens.*

Second tergite orange with a comparatively narrow median dark stripe expanding at the caudal end to form a narrow dark band, silvery margins and admedian spots usually well marked. Oriental Region. Egypt ... ... *xanthomelas.*

18. First abdominal tergite entirely light orange except for a small dark spot at extreme cephalic border; remaining tergites orange without any markings. Thorax dark blue. Oriental Region. Widely distributed in the Ethiopian Region ... ... *ventrosa.*

First abdominal tergite mainly orange 19

19. Abdomen greyish-yellow; first tergite dirty orange with a small dark median cephalic spot; remaining tergites marked as in figure ... ... *vicina.*

Abdomen more silvery. Markings as in figure ... *nebulo.*

20. Large species with four broad black thoracic stripes. Abdominal markings as in figure. Widely distributed in Ethiopian Region ... ... *lusoria.*

Large species with two broad black thoracic stripes ... 21

21. First abdominal tergite black; remaining tergites grey with stripe and bands as in figure. East, West and Central Africa ... ... *alpesa.*

First abdominal tergite mainly orange 22

22. Whole abdomen mostly dark orange; second tergite with a faint median dark stripe, incomplete cephalic and fairly broad caudal black bands. East, Central and South Africa ... ... *gibonensis.*

Abdomen orange with well marked black stripes, bands and silvery patches and spots as in figure ... ... *natalensis.*

Short descriptions of the Ethiopian species.

Although the synonymy of the Ethiopian species is tolerably complete, and the types of the species marked with an asterisk have been examined, I recognize that there is still a good deal of doubt regarding several of the species. Their identity will only be cleared up when I have had an opportunity of studying some fresh material.

I am still very doubtful of the identity of *Musca gymnosomea* Rondani, and have unfortunately not been able to see the types, which Professor Bezzi tells me are in Florence. The drawings of the abdomens of the two sexes are from specimens given me by Professor Bezzi, and believed by him to be this species. It may, however, yet be that *gymnosomea* is identical with *sorbens* when of course Wiedemann's name would replace it, and it would sink into the already extensive synonymy of that species.

Professor Bezzi kindly lent me his type male of *Musca tempestatum*, and the abdomen of the female is drawn from what I believe to be the female of this species ; as far as I can see at present *Musca tempestatum* is a good species.

Although I have seen the types of *Musca albomaculata* Macq. and *M. dorsomaculata* Macq., both of which were described in 1843 from Mauritius, I have not included the former in the keys, nor have I been able to get illustrations of the abdomen of the two sexes. Dr. Villeneuve has pointed out that *albomaculata*, *dorsomaculata* and *rufiventris*, all described by Macquart from Africa, are identical and that *albomaculata* is the correct name for the species. I hope some observer in Mauritius, where *albomaculata* is said to occur, will send me some fresh material ; I would not be surprised to find that *Musca fasciata* Stein described from the Seychelles is this species.

There are several of the species of Macquart, for instance *M. pusilla* and *M. senegalensis*, which I have not been able to recognize from his descriptions. It will, I think, be best to drop these names as no types now exist.

I would again urge upon workers in Africa to send me fresh material so that it may be possible to revise this paper at an early date.

1. **Musca domestica** L.

(Plate II, fig. 1 ; pl. III, fig. 24.)

? *Musca aurifacies* R.-D. ;? *Musca riparia* R.-D.; *Musca stomoxidea* R.-D.; ? *Musca campicola* R.-D.; *?Musca vagatoria.*; *?Musca hottentota* R.-D.; *?Musca vicina* R.-D.; *nec* Macq.; *? Musca rivulans* R.-D.; *Musca corvina* F.; *Musca ludifica* F.; *Musca umbraculata* F.; *? Musca frontalis* Rond.; * *Musca minor* Macq.; * *Musca australis* Macq.;? *Musca lateralis* Macq. ; *Musca chiliensis* Macq.; *?Musca pellucens* Macq.; **Musca pampasiana* Big ;?* *Musca vicaria* Walk. ; **Musca antiquissima* Walk.; * *Musca calleva* Walk.

Male.—Front nearly half width of an eye.

Four thoracic stripes, each as wide as the front and complete, *i.e.*, extending the whole length of the scutum.

Abdomen (Plate II, fig. 1) ; first tergite with cephalic half black and caudal half orange with a broad triangular stripe, base upwards; second tergite orange with a broad black median stripe, the cephalic

end spreading out a little along the margin, edged with indistinct silvery stripes and with marginal yellowish white patches; third tergite with a similar median stripe edged with silvery stripes clove brown admedian stripes and silvery margins; fourth tergite similar but all stripes narrower.

Female.—Front almost equal to the width of an eye. Parafrontals broad below but narrowing towards the vertex.

Four thoracic stripes, about half the width of the frontal stripes, complete, the median pair often narrower than the external.

Abdomen (Plate III, fig. 24); first tergite usually dark orange, often appearing black as shewn in figure, sometimes it is not unlike that of the male; second tergite greyish yellow, often with a bluish sheen in fresh specimens, narrow to broad median black stripe spreading out along cephalic border of tergite, and narrow to broad admedian black stripes; third tergite similar but median and admedian stripes narrower; fourth tergite greyish yellow with faint admedian dark stripes.

I have seen specimens from the larger ports such as Dar-Es-Salaam, Durban, Cape Town, Accra and others; there is no doubt whatever that this species is carried in ships from Europe to these ports, but whether it breeds there I have no information, it probably does.

2. *Musca vicina Macquort (nec. R.-D.)

(Plate II, fig. 2; pl. III, fig. 25.)

**Musca flavinervis* Thoms.; *Musca flavifacies* Big.; **Musca flaviqennis* Big.; *?Musca analis* Macq.; *?Musca divaricata* Awati.

Male.—Front less than one-fifth that of an eye, and less than half that of the front of *domestica*. In most other respects very similar to that species.

Abdomen (Plate II, fig 2); all tergites lighter orange than those of *domestica*.

Female.—Very similar to the female *domestica* but parafrontals not narrowed to the same extent.

Abdomen (Plate III, fig. 25); tergites especially the first much lighter orange than in *domestica*.

This species is widely distributed in the Ethiopian Region, and is the common house fly; inland it entirely replaces *M. domestica*. As I have already pointed out I have not seen it in Great Britain; it first appears in the Palæarctic Region in the Mediterranean. The male can easily be distinguished from the male of *domestica* by the much narrower front, but the female is hard to distinguish from that of *domestica*.

3. **Musca nebulo** F.

(Plate II, fig. 3; pl. III, fig. 26.)

**Musca determinata* Walk. *nec* Patton.; *?Musca multispina* Awati.

Male.—Front varying from one-sixth to one-eighth width of an eye, and about less than a quarter width of front of male *domestica*.

Abdomen (Plate II, fig. 3); first tergite light orange, caphalic border black with black median stripe; second tergite light orange with a

broader median black stripe edged with well marked silvery stripes and silvery marginal spots ; third segment similar, the medial stripe narrower ; fourth tergite with a median dark area never forming a complete stripe.

Female.—Front about half, or a little less the width of an eye.

Adbomen (Plate III, fig. 26) ; first tergite light orange, the middle of the anterior border black, no complete median dark stripe, but always with a dark spot at middle of caudal border of tergite ; second tergite silvery with a median black stripe and dark brown admedian stripes, the marginal area often with a bluish tinge ; third tergite similar but with the median dark stripe narrower ; fourth tergite mainly silvery with some brown pacthes.

This species can as a rule be distinguished from *vicina* by noting that the male has a more orange and silvery abdomen, and by the narrower front ; the female has also a much more silvery abdomen.

Musca nebulo is widely distributed throughout the Ethiopian Region ; it is a common bazaar as well as a house fly.

4. *Musca sorbens* Wied.

(Plate II, fig. 4 ; pl. III, fig. 27.)

**Musca humilis* Wd.; **Musca spectanda* Wd.; **Musca latifrons* Wd.; **Musca mediana* Wd.; **Musca angustifrons* Thoms.; **Musca bivittata* Thoms.; **Musca sordidissima* Wlk.; **Musca eutaniata* Big.; *Musca scapularis* Rond.; **Musca dichotoma* Bezzi ; **Musca primitiva* Wlk.; **Musca biseta* Hough.; *Musca conducens* Patt. *nec* Walk.; *?Musca promisca* Awati.

Male.—Front varies from one-sixth to one-eighth width of an eye.

Two broad thoracic stripes not interrupted at suture.

Abdomen (Plate II, fig. 4) ; first tergite either light or dark brown to black ; second tergite with a dark median stripe spreading out along the cephalic border, T-shaped, to fuse with the dark area of the first tergite, edged with broad silvery stripes, and with silvery marginal spots ; third tergite with a narrower dark median stripe often not reaching the caudal border, edged with silvery stripes and with marginal spots ; fourth tergite with an incomplete narrow dark median stripe, narrow dark brown admedian stripes and marginal silvery patches.

Female.—Front about equal to width of an eye.

Two thoracic stripes divided cephalad of the suture.

Abdomen (Plate III, fig. 27) ; first tergite black ; second tergite with wide black median stripe widening out cephalad, T-shaped, and also caudad, edged with bluish white spots, broad admedian dark brown to black stripes widening out caudad to form a narrow black band, marginal greyish yellow spots ; third tergite similar, the median stripe narrower ; the admedian spots and stripes varying in width according to the angle at which the specimen is held ; fourth tergite with a narrow dark median stripe and dark admedian ones.

Musca sorbens is one of the most widely distributed species of the genus in the Old World. It is common in the Mediterranean area along the North African coast, and boards all steamers going East through the Suez Canal. I have not seen any specimens from the larger islands in the Mediterranean, but have a strong suspicion that *Musca gymnosomea*

Rondani from Malta may be but a small example of this ubiquitous fly. This species is of special interest in that it breeds in cowdung as well as in horse and human excrement, and for this reason it is common to find it on animals far from human dwellings. In the Ethiopian, as in the Oriental Region, it abounds in the bazaars, swarming on food stuffs of all kinds. It is also quite common to see it in large numbers feeding on exudation, from cuts, sores, etc., but more especially about the sore eyes of children. From these habits it will be noted that it is a most important carrier of bacteria especially those which cause opthalmia and allied conditions of the eyes.

Musca sorbens is easily distinguished from the next species by its greyer thorax, and in the male by its wider front. It should be remembered, however, that, as Stein has pointed out, the width of the front varies very considerably in a long series from different localities; and this applies also to the female fly.

5. * **Musca vetustissima** Wlk.

(Plate II, fig. 5; pl. III, fig. 28.)

?Musca pumila Macq.; **Musca niveisquama* Thoms.; *Musca humilis* auctt. *nec* Wied.; *Musca corvina* Frog. *nec* F.; *Musca minor* Patt. *nec* Macq.

Male.—Front about one-twelfth width of an eye.

Thorax with two very broad black stripes, the ground colour bluish grey.

Abdomen (Plate II, fig. 5); first tergite black; second orange with a broad black median stripe, broadly edged with silvery stripes, and with marginal silvery spots which often coalesce with the silvery stripes forming a white band as shown in the figure; third tergite with a narrower median black stripe edged with broad silvery stripes, and with broad silvery marginal spots, caudal border often with a narrow dark brown band; fourth tergite with a median dark area and silvery marginal spots.

Female.—Front about equal to the width of an eye.

Thorax with two broad black stripes divided in front of the suture. Ground colour bluish grey.

Abdomen (Plate III, fig. 28); first tergite black; second with a broad black median stripe, broad black caudal band, narrow black admedian stripes, and remainder of segment bluish grey; third tergite similar but stripes narrower, and either with or without a narrow black caudal band; fourth tergite with median dark area and silvery margins.

Musca vetustissima, commonly mistaken for *M. sorbens*, is widely distributed in the Ethiopian Region, and seems to be present in most places with *sorbens*. It breeds mainly in human excrement.

6. **Musca tempestiva** Fallen.

(Plate II, fig. 6; pl. III, fig. 29.)

Musca cuprea Macq.; *?Musca nana* Meig.

Male.—Front very narrow.

Thorax dark with some metallic sheen.

Abdomen (Plate II, fig. 6) ; first tergite all black ; second tergite grey with a broad median black stripe expanding at both ends to form black bands, the caudad the wider ; third tergite with a very narrow black median stripe often incomplete at the caudal end, and sometimes a narrow cephalic black band ; fourth tergite grey often with a dark patch about the middle.

Female.—Front equal to an eye in width.

Thorax grey with four narrow black stripes, inner pair well marked in front of suture, but behind it tending to merge into the outer pair.

Abdomen (Plate III, fig. 29) very similar to that of the male except that the black bands on the second tergite are usually wider, and there is a narrow median black stripe on segment four.

This small species is found mainly in Egypt and along the North African coast.

7. * **Musca tempestatum** Bezzi.

(Plate II, fig. 7 ; pl. III, fig. 30.)

Male.—Front very narrow.

Thorax grey with two broad black stripes.

Abdomen (Plate II, fig. 7) ; first tergite black ; second tergite grey with a broad black median stripe expanding at both ends to form black bands, that at the cephalic end very incomplete, the caudal complete ; third tergite with a narrow median black stripe expanding at the caudal end to form a narrow black band ; fourth tergite grey with a very narrow median black stripe.

Female.—Front about equal to the width of an eye.

Thorax grey with two broad black stripes.

Abdomen (Plate III, fig. 30) ; first tergite black, the caudal border sometimes greyish ; second tergite with a broad black median stripe expanding at both ends to form narrow bands, two narrow dark admedian stripes, intermediate and marginal silvery spots ; third tergite very similar except that stripes and bands are much narrower ; fourth tergite grey with an indistinct median black stripe.

This species has been described by Professor Bezzi from North Africa ; figure 7 is a drawing of the abdomen of the type male. I am not sure of the identity of the female here described and illustrated.

8. **Musca gymnosomea** Rondani.

(Plate II, fig. 8 ; pl. IV, fig. 31.)

Male.—Front very narrow.

Thorax grey with four broad black stripes.

Abdomen (Plate II, fig. 8) ; first tergite black ; second tergite with a broad black median stripe expanding caudad to form a narrow band, dark admedian stripes and silvery intermediate and marginal spots ; third segment very similar but stripes and bands narrower ; fourth tergite grey with narrower stripes as in figure.

Female.—Front about equal to width of an eye.

Thorax with two broad black stripes.

Abdomen (Plate IV, fig. 31) with markings very similar to those of the male as illustrated in figure.

This species was described originally from Malta but has been recorded by Professor Bezzi and others from the North African littoral. As already pointed out I am very doubtful as to whether *gymnosomea* is a good species and think it possibly may yet prove to be *Musca sorbens*. I hope those who have an opportunity of collecting specimens of *Musca* in Malta will send me their material for identification.

9. ***Musca fasciata** Stein.

(Plate II, fig. 9 ; pl. IV, fig. 32.)

Male.—Front very narrow ; eyes narrowly separated.

Thorax bluish grey with two broad black stripes.

Abdomen (Plate II, fig. 9) ; first tergite black ; second tergite bluish grey with a broad median black stripe, and a broad black basal band, sometimes traces of black admedian stripes, otherwise the grey area forms a broad median band ; third tergite very similar except with narrow cephalic and caudal bands and median stripe ; fourth tergite mainly bluish grey with partial narrow black median and narrow cephalic band.

Female.—Front very wide, about equal to width of an eye, greyish with bluish vertex ; parafrontal bristles in a single row.

Thorax with stripes similar to those of the male, occasionally they are divided cephalad of the suture.

Abdomen (Plate IV, fig. 32) very similarly marked to that of the male except that the admedian stripes are better marked.

This small species was described from the Seychelles but it also occurs on the mainland. I have recently seen specimens from Calcutta in the Indian Museum collection and several specimens named by Stein from the Middle East. It should be added to the Oriental fauna. It may yet prove to be identical with *Musca albomaculata* Macq.

10. **Musca vitripennis** Meigen.

(Plate II, fig. 10 ; pl. IV, fig. 33.)

**Musca osiris* Wd.; *?Musca sugillatrix* R.-D.; *?Musca phasiœformis* Meig.

Male.—Front about one-tenth width of an eye. Eyes densely pubescent.

Thorax dark metallic green without any stripes.

Abdomen (Plate II, fig. 10) ; first tergite orange with a broad dark metallic green area ; second tergite brown with a broad dark green median stripe expanding caudad to form a partial band ; third segment dark orange with a large greyish patch occupying the middle of the tergite, and a small dark median spot near the caudal border ; fourth tergite almost entirely greyish with some matallic sheen and some brown spots at caudal margin.

Female.—Front slightly wider than an eye.

Thorax with four dark stripes ; the inner pair narrow, complete ; outer pair forming a dark spot cephalad of suture, behind it indistinct and tending to merge into the admedian stripes ; ground colour of thorax greyish with some metallic sheen.

Abdomen (Plate IV, fig. 33) ; first tergite dark grey to black with some metallic sheen ; second tergite grey with a broad black median stripe expanding caudad to form a narrow band, tergite with some metallic sheen ; third tergite dark grey with a narrower dark median stripe, dark margins and some metallic sheen ; fourth tergite grey without any definite markings.

This small species can always be recognized by its hairy-eyed male and the characteristic abdominal markings. It is not uncommon in Egypt and in parts of the North African littoral.

11. **Musca interrupta** Walker.

(Plate II, fig. 11 ; pl. IV, fig. 34.)

**Musca lasiopthalma* Thomson.

This species is very closely allied to *vitripennis* and only differs from it in minor details. The presutural dorso-central bristles, which are present in *vitripennis*, are absent in *interrupta ;* the front of the male is distinctly narrower ; and there are some differences in the abdominal markings which can best be noted by comparing figs. 10 and 11, and 33 and 34.

Musca interrupta is common in South Africa.

12. **Musca lucidula** Loew.

(Plate II, fig. 12 ; pl. IV, fig. 35.)

Male.—Front narrow.

Thorax dark metallic without any stripes.

Abdomen (Plate II, fig. 12) ; first tergite with a triangular shaped dark median patch and metallic sheen ; second tergite with a narrow dark median stripe expanding a little cephalad where there is a light patch as in figure ; third tergite with a green metallic area and a silvery patch ; fourth tergite green with a larger light patch.

Female.—Front wide, not quite the width of an eye and narrowing towards the vertex ; a single row of parafrontal bristles.

Thorax light metallic green with four rather indistinct, very narrow, dark stripes, the inner pair are incomplete caudad of the suture.

Abdomen (Plate IV, fig. 35) ; first tergite yellow ; remaining tergites light green and without any distinct markings except dark median stripes on two and three as illustrated in figure.

This interesting metallic species with its pale wings and closed cell R_5 is common in Egypt. Professor Bezzi has recently pointed out how similar the male is to the male of *albina.*

13. * **Musca albina** Wiedemann.

(Plate II, fig. 13 ; pl. IV, fig. 36.)

**Musca speculifera* Bezzi ; *Musca beckeri* Schnabl.

Male.—Eyes well separated.

Thorax dark metallic without any stripes.

Abdomen (Plate II, fig. 13) ; first tergite yellowish with a dark median spot on caudal border of segment spreading on to the front

margin of the second segment ; on the second tergite the spot often forms a sort of incomplete band, this tergite also has a small round spot on its caudal border in the middle ; third tergite with a large silvery patch and a dark spot at the middle of the caudal border ; fourth tergite mainly with a large silvery patch and two admedian dark spots.

Female.—Front very wide, equal to width of an eye ; frontal stripe very narrow ; usually four sometimes five rows of small parafrontal bristles.

Thorax silvery with four narrow dark stripes.

Abdomen (Plate IV, fig. 36) ; first tergite yellow with a dark caudal band which may only be limited to the border ; second tergite silvery with a broad median dark stripe widening out caudad to form a wide dark band, narrow admedian dark stripes ; third tergite silvery with a very narrow median dark stripe and two dark spots at caudal margins ; fourth tergite silvery with two small dark admedian spots.

This species is widely distributed in Egypt and in many parts of East Africa ; I hope observers will be on the look-out for it in other parts.

14. ***Musca pulla** Bezzi.

(Plate II, fig. 14 ; pl. IV, fig. 37.)

**Musca craggi* Patton.

Male.—Front narrow, one-seventh to one-eighth width of an eye.

Thorax with four black stripes, the inner pair always much narrower than the external cephalad of the suture.

Abdomen (Plate II, fig. 14) ; first tergite dark brown to black ; second brown with a broad median black stripe expanded a little cephalad, T-shaped, edged with indistinct silvery spots, and with large yellowish white marginal spots ; third tergite brown with a narrower median black stripe edged with silvery spots, sometimes with a narrow caudal band ; fourth tergite dark brown with light marginal spots.

Female.—Front wide, about equal to the width of an eye.

Thorax with four black stripes as in the male, the inner pair narrower than the outer cephalad of the suture.

Abdomen (Plate IV, fig. 37) ; first tergite dark brown to black ; second tergite brown with a dark median stripe expanding both cephalad and caudad to form narrow dark bands, the latter usually the broader, well marked marginal spots ; third tergite similar but stripes and bands narrower ; fourth tergite with light marginal patches.

This species has been recorded by Professor Bezzi from East Africa ; it can readily be recognized by the narrow presutural inner thoracic stripes. It is an Oriental species.

15. ***Musca xanthomelas** Wiedemann.

(Plate II, fig. 15 ; pl. IV, fig. 38.)

Musca albomaculata auct. *nec* Macq.; *Musca dorsomaculata* auct. *nec* Macq.; *Musca convexifrons* auct. *nec* Thoms.

Male.—Front very narrow, eyes narrowly separated ; area of large facets at middle and inner part of eye usually well marked.

Thorax with four broad black stripes.

Abdomen (Plate II, fig. 15); first tergite dark brown to black; second tergite with a broad dark brown median stripe expanding caudad to form a lighter brown band, admedian brown stripes well marked, intervening and marginal silvery spots; third tergite with a much narrower median stripe edged with silvery stripes, a narrower caudad band; fourth tergite light orange with an incomplete narrow median stripe.

Female.—Front wide, equal to width of an eye.

Thorax similar to that of male.

Abdomen (Plate IV, fig. 38); first tergite brown to dark brown with a broad black median stripe and narrow caudad dark band; second tergite similar but median stripe and caudad band narrower; third tergite very similar, the admedian narrow dark stripes better marked; fourth tergite light orange.

This species is widely distributed in Egypt; it is probable *Musca pusilla* Macquart is the species, but it is impossible to be certain of this.

16. ***Musca ventrosa** Wiedemann.

(Plate III, fig. 16; pl. IV, fig. 39.)

**Musca xanthomela* Walker; **Musca pungoana* Karsch; * *Musca nigrithorax* Stein; *Musca kasauliensis* Awati.

Male.—Front very narrow, eyes narrowly separated.

Thorax with four broad black stripes on a dark bluish grey ground; in some lights the thorax appears of a uniform shining black colour.

Abdomen (Plate III, fig. 16) orange throughout without any definite bands or stripes; sometimes there is a faint dark median stripe on the second and third tergites as illustrated in the figure.

Female.—Front a little more than half the width of an eye.

Thoracic and abdominal markings similar to those of the male (Plate IV, fig. 39); semi-digested blood in the alimentary tract must not be confused with stripes or bands.

This strikingly coloured species is widely distributed in the Ethiopian Region; it breeds in cow dung.

17. ***Musca lusoria** Wiedemann.

(Plate III, fig. 17; pl. IV, fig. 40.)

Male.—Front narrow.

Thorax with four broad black stripes.

Abdomen (Plate III, fig. 17); first tergite black; second tergite grey with a broad, black, median stripe expanding T-shaped cephalad, and caudad forming a narrow dark band, broad admedian dark stripes; third tergite very similar but stripes and bands very much narrower; fourth tergite greyish white with indefinite very narrow dark stripes as in figure.

Female.—Front about equal to width of an eye.

Thorax with four broad black stripes as in the male.

Abdomen (Plate IV, fig. 40); first tergite dark with two greyish patches as in figure, these may be less marked; second tergite dark grey

with a black median very narrow stripe, triangular shaped, admedian stripes expanding caudad to form a narrow band; third tergite exactly similar; fourth tergite as in illustration.

Musca lusoria is the common, large hæmatophagous species of the genus in the Ethiopian Region; it is widely distributed. I have had the opportunity of examining a number of specimens from Somaliland wrongly determined by Stein as *Musca corvina* (or more correctly known now as *autumnalis*). *Musca autumnalis* never has any small bristles on the ventral side of vein R_{4+5} extending beyond the radio-medial cross vein; *Musca lusoria* always has.

18. *Musca alpesa Walker.

(Plate III, fig. 18; pl. IV, fig. 41.)

Musca spectanda auct. *nec* Wiedemann; **Musca congolensis* Villeneuve.

Male.—Front very narrow.

Thorax with two broad black stripes.

Abdomen (Plate III, fig. 18); first tergite all black; second tergite with a broad black median stripe expanding cephalad, broadly T-shaped and with well marked silvery intervening and marginal spots, the admedian stripes are broad but not very distinct; third tergite very similar, but median stripe narrower, not expanding cephalad but caudad forming a very distinct band, admedian stripes narrow but well marked, silvery spots also well marked; fourth tergite as in figure.

Female.—Front about the width of an eye.

Thorax as in male.

Abdomen (Plate IV, fig. 41); first tergite all black; remaining tergites as in figure.

This large species with two broad black stripes is fairly widely distributed in the Region. Until I examined the type of *Musca spectanda* I was under the impression it was this species; *spectanda*, however, is the widely distributed *sorbens*.

19. *Musca natalensis Villeneuve.

(Plate III, fig. 19; pl. IV, fig. 42.)

Male.—Front narrow.

Thorax with two broad black stripes.

Abdomen (Plate III, fig. 19); first tergite orange, median cephalic border dark, narrow median black stripe; second tergite with a slightly broader median stripe expanding cephalad to form a T-shaped band, well marked silvery adjacent and marginal spots; third tergite very similar, silvery spots much better marked, the median stripe is much narrower and it expands caudad to form a narrow dark band; fourth tergite as in figure.

Female.—Front equal to width of an eye.

Thorax as in male.

Abdomen (Plate IV, fig. 42); first tergite light orange, cephalic border with a black spot, a line-like median stripe ending in a dark elongated spot in middle of caudad border (the dark line joining the two is often

absent); second tergite with a broad median black stripe expanding T-shaped at cephalic border and caudad forming a narrow dark band, narrow admedian stripes and silvery intermediate and marginal spots; third tergite very similar, the median stripe broader; fourth tergite often with a broad median dark stripe.

This species was described from Durban by Villeneuve; the drawing of the abdomen of the male is from his type in the South African Museum. The female was not known to Dr. Villeneuve. I have seen numerous examples from Natal in the collection of the Zoological Museum, Cambridge, which Dr. Scott kindly lent me for study; the illustration of the abdomen of the female is from one of these.

20. ***Musca gabonensis** Macquart.

(Plate III, fig. 20; pl. IV, fig. 43.)

**Musca ethiops* Stein.

Male.—Front narrow.

Thorax with two broad black stripes.

Abdomen (Plate III, fig. 20); first tergite black or nearly so, part of the caudal border orange; second tergite dark orange with an indistinct median dark stripe and an incomplete cephalic band; third and fourth tergites orange with some silvery patches.

Female.—Front almost the width of an eye.

Thorax dark with two broad black stripes.

Abdomen (Plate IV, fig. 43); all tergites mainly orange with narrow bands and stripes as illustrated in figure.

This species is common in East, Central and South Africa. The illustration of the abdomen of the male is from Stein's type of *Musca ethiops*.

21. ***Musca dasyops** Stein.

(Plate III, fig. 21; pl. IV, fig. 44.)

Male.—Front narrow, eyes densely hairy.

Thorax blackish with two broad black stripes.

Abdomen (Plate III, fig. 21); first tergite black, often with greyish admedian spots near caudal border; other tergites as in figure.

Female.—Front wide, eyes densely hairy.

Thorax and abdomen (Plate IV, fig. 44) almost exactly similar to those of male.

This species was described by Stein from Mount Kilama N'ajaro; Villeneuve has also recorded it from East Africa.

22. ***Musca conducens** Wlk.

(Plate III, fig. 22; pl. IV, fig. 45.)

Pristirhynchomiya lineata Brun.; *Musca sorbens* Patton *nec* Wlk.

Male.—Front very narrow, eyes narrowly separated.

Thorax with four broad stripes, often fused especially cephalad of the suture, the thorax then appears to be two striped.

Abdomen (Plate III, fig. 22) ; first tergite either dark brown or black, if the former the posterior lateral margins are lighter orange ; second tergite yellow with a narrow black median stripe extending along the cephalic border to form a median band ; third tergite similar but median stripe narrower ; fourth tergite as in illustration.

Female.—Front about half width of an eye ; parafrontal bristles in a single row.

Thorax with four black stripes never tending to unite as in the male.

Abdomen (Plate IV, fig. 45) ; first tergite dark orange to black ; second tergite grey with an olive sheen, a narrow median black stripe expanding T-shaped and forming caudad a narrow dark band ; third tergite similar but with a much narrower median dark stripe and caudal band ; fourth tergite as in illustration.

This species is widely distributed in the Region. It is of peculiar interest because, although it has well developed prestomal teeth, it is unable to scratch the unbroken skin sufficiently to draw blood.

23. **Musca crassirostris** Stein.

(Plate III, fig. 23 ; pl. IV, fig. 46.)

Musca modesta Meij.; **Philæmatomyia insignis* Aust.

Male.—Front narrow, eyes well separated.

Thorax with four narrow black stripes.

Abdomen (Plate III, fig. 23) ; first tergite black, the caudal border grey with a greenish tinge ; second tergite greyish green, a narrow median black stripe, extending along the cephalic border T-shaped ; third tergite grey with a narrow black median stripe often not reaching caudal border ; fourth tergite as in illustration.

Female.—Front very wide, almost equal to an eye in width.

Thorax with stripes similar to those of the male.

Abdomen (Plate IV, fig. 46) ; first tergite greyish green, the cephalic border black, a narrow median black stripe or dark area either present or absent, sometimes only showing as an indefinite median black patch on the caudal border ; second tergite grey with a very narrow median black stripe and a black band along the cephalic border ; third tergite grey with a very narrow incomplete median streak-like stripe ; fourth tergite as in illustration.

This species is common in Egypt and in East and Central Africa ; it is a most voracious blood-sucker.

I hope that as soon as some fresh material is available I will be in a position to revise this paper.