ON WEST AFRICAN TRYPETIDÆ (FRUIT FLIES).

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(PLATES XI.-XIII.)

THE family of the TRYPETIDÆ is of great economic importance, for among its numerous genera are to be found many pests of the orchard and farm. The flies of this family are rarely brought to the notice of Europeans in West Africa, for there farming operations are entirely in the hands of the native population and the amount of damage done by these insects is perhaps insufficiently appreciated by Europeans; but from observations made in my own gardens, during a long West African experience, I believe the loss caused by their attacks must be considerable. The flies which are responsible for the damage observed belong to two genera—*Ceratitis*, MacLeay, and *Dacus*, Fabricius.

CERATITIS, MacLeay.

Small broad-winged flies, measuring from $\frac{3}{16}$ to $\frac{5}{16}$ inch in length.

During life, the eyes of all the local species I have seen are bright emerald-green, sometimes banded, and showing an iridescent play of colour. The wings are hyaline and ornamented with a distinct pattern of bands and spots, the spots being usually found on the basal third of the wing. The flies are found walking about upon the leaves or fruit of certain shrubs or trees, lazily waving their partly extended wings. The yellow head, green eyes and lazy movement of the wings make the flies remarkable objects. They cannot, however, be identified from these distinctions alone, for some species of the ORTALIDÆ resemble them in coloration and in the movements of the wings. From these latter the species of *Ceratitis* may be readily distinguished (among other characters) by the presence of four pairs of fronto-orbital bristles, extending the whole length of the forehead, from the vertex to the antennæ.

The female fly pierces the skin of the fruit with her ovipositor, and then lays her eggs in the fruit-pulp, where they hatch and become larvæ. The larvæ are elongated cream-coloured maggots. About the time that the larvæ are mature the infested fruit becomes rotten, and falls to the ground and usually bursts. The mature larvæ then leave the fruit, leap about upon the

ground, bury themselves in the earth, and become pupæ. The whole of the pupal stage is passed in the earth and lasts about 13 to 14 days. At the end of this time the flies issue from the pupa-cases and make their way up to the surface of the ground, expand and dry their wings, and fly away.

(See figure of *C. anonæ*, larva and pupa, Pl. XII, fig. 3.)

List of West African Species of Ceratitis.

Species.	Habitat.	Fruit Infested.
1. ♂ ♀ <i>C. capitata</i> , Wied., 1824	Almost cosmopolitan.	} Almost any cultivated fruit. Cacao pods.
2. ♂ ♀ <i>C. punctata</i> , Wied., 1824	Tropical Africa.	
3. ♀ <i>C. breuii</i> , Guérin, 1843	Senegal.	?
4. ♀ <i>C. cosyra</i> , Walker, 1849	Congo.	?
5. ♂ <i>C. penicillata</i> , Bigot, 1891	Ivory Coast.	?
6. ♂ ♀ <i>C. anonæ</i> , Graham, 1908	S. Nigeria, Ashanti.	Soursop and guava.
7. ♀ <i>C. stictica</i> , Bezzi, 1909	Ashanti, Congo.	?
8. ♂ ♀ <i>C. nigra</i> , Graham, sp. n.	Ashanti, Lagos.	?
9. ♂ <i>C. inscripta</i> , Graham, sp. n.	Ashanti.	?

From the above table it will be seen how little is known of the West African species of this genus. In more than half the species a single sex only is described, and in most cases the habits of the fly and its larvæ are unknown.

Months of prevalence for Ceratitis in W. Africa (so far as at present known).

- C. anonæ*—July to November.
- C. inscripta*—November, December.
- C. punctata*—June, July.
- C. stictica*—July to November.
- C. nigra*—June to August.

Ceratitis nigra, sp. n. (Pl. XII, fig. 1.)

♀. Body shiny black; dorsum of thorax black, unmarked; abdomen black with one transverse grey band*; femora brown, tibiæ and tarsi yellow; wings hyaline, with brown banding and spotting.

* The additional white spots which appear on the abdomen in the figure, as well as all the white markings on the thorax, are due to reflections of light from the very shiny surface of the insect,

Head. Upper two-thirds of front canary-yellow, ocellar spot black, fronto-orbital bristles black; lower third of front, frontal lunule, and insertion of antennæ brown. Face below antennæ brown, then cream-white to oral margin. Antennæ pale brown, arista dark brown, pale at base, plumose. Eyes dark purple-brown, palpi and proboscis pale brown. The head is coloured thus in dried specimens, but in life the colour scheme is very complicated and brilliant, as shown in the accompanying sketch.

Head of *Ceratitidis nigra*, Graham.

Thorax shiny black; scutellum shiny black, with four black bristles and an indistinct yellow spot on the outer margins. *Abdomen* triangular, shiny black, with a broad transverse grey band occupying the median half of the 4th segment. Ovipositor black, convex above, flattened beneath, apex yellow, as long as the last three abdominal segments. *Legs*: femora dark brown, tibiæ and tarsi yellow. *Wings* hyaline, with a broad dark brown band covering the basal portion and extending along the costa to the apex of the wing, leaving behind a clear triangular area with its base on the posterior margin of the wing. From the apex of this triangle a narrow curved brown band crosses to the apex of the 5th longitudinal vein. Between the costa and the brown band is a clear, very narrow band extending the length of the marginal cell and expanding into two clear spots, where the 2nd vein reaches the costa. The wing is pale at its insertion, and there is a small triangular clear space lying between the humeral cross vein and the apex of the auxiliary vein, its base being on the costa, its apex on the 3rd vein. This space contains a dark spot in the costal cell and projections of brown colour enter the space from the sides, giving it a spotted appearance. *Halteres*, both stem and knob, brown.

Length 5.5 mm., excluding ovipositor; breadth across expanded wings 13 mm.

Taken upon the leaves of the oil-palm at Obuasi, South Ashanti, and at Yaba, Lagos, 2 P.M., 4.viii.09.

Type in the British Museum.

The male resembles the female very closely, but is slightly smaller. The legs are not flattened.

Length 5 mm.; breadth 13 mm.

Taken on window at Yaba, Lagos, 9 A.M., i.v.09.

***Ceratitis inscripta*, sp. n.**

♂. Body black, dorsum of thorax grey, with black spots; abdomen black, with grey **W**-shaped design in middle; wings hyaline, banded and spotted with brown; femora brown, tibiae and tarsi yellow.

Head. Front yellow with a **V**-shaped brown mark connecting the middle fronto-orbital bristles of either side, a black ocellar spot, a brown mark on frontal lunule and black bristles. Face cream-white, palpi buff with black hairs, proboscis brown. *Thorax* grey with shiny black margins, the dorsum with 3 longitudinal interrupted lines, the middle one formed of 3 elongated black spots, the lateral ones of 3 shorter black spots on either side. Humeri with 2 oval black spots outlined with yellow on each side. Scutellum shiny black, divided by yellow looped lines into 7 small areas; 5 along the margin and 2 above and in front. *Abdomen* triangular, black, with grey markings as follows: grey lateral apical spots and a thin grey apical band on the segments; in the median area a pair of triangles outlined in grey upon each segment, the whole series of these triangles forming a large letter **W**, its base standing upon the apical segment. *Legs*: femora brown, tibiae and tarsi yellow. *Wings* hyaline, with brown markings; a broad brown band extends along the costa from slightly within the costal cell to beyond the apex of the wing. This band is interrupted along the costa between the 1st and 3rd longitudinal veins by five hyaline spots nearly equally apart. A broad brown band, nearly at right angles to the costal band, crosses the base of the wing, and passing through the basal half of the discal cell reaches the margin at the 6th longitudinal vein. Between these two bands a hyaline triangle is left, having its base upon the posterior margin of the wing, and its apex near the anterior cross vein. From this apex a narrow brown band crosses the hyaline triangle to the apex of the 5th longitudinal vein. *Halteres* with the stem yellow and the knob brownish.

Length 4 mm.; length of wing 3.5 mm.

Taken on window at Obuasi, South Ashanti, 24.xi.07.

Type in the British Museum.

DACUS, Fabricius.

Wasp-like flies measuring $\frac{1}{4}$ to $\frac{3}{8}$ inch long.

The body is usually brown or black with canary-yellow spots and lines; the wings clear, with usually, in West African species, two brown bands starting from the base of the wing: a broader band extending along the anterior margin, and a narrower one crossing the wing from the base at an oblique angle and ending at the posterior border.

In life the eyes are purple with dull green reflections. In dried specimens they become a dark purple-brown; and the scutellum, with the spots and lines upon the thorax, which in life are a canary-yellow, often become orange or brown, and the fine yellow lines almost disappear. The wasp-like appearance, caused by the spheroidal shape of the abdomen with its contracted waist and by the brown and yellow coloration, together with the clear wings, which are usually banded along the costa (front edge of wing), and the peculiar size and shape of the 2nd basal cell, should enable the flies of this genus to be readily recognised.

The habits of only two of the West African species are known. The females of *D. bipartitus* and *D. vertebratus* may be found, singly or in groups of 3 or 4, walking about upon the surface of young melons or vegetable marrows. Suddenly a fly ceases walking and remains stationary in one spot. If killed she will be found to have inserted her ovipositor through the skin of the fruit and deposited a little pile of eggs within. The eggs hatch into yellowish-white elongated maggots, which burrow in the pulp and grow until they are 10–11 mm. long by 2·5 mm. broad. Their presence causes the melon to rot, and the decay gradually extends outwards until it reaches the skin, appearing as a yellow area. Through the rotten portion, or upon the bursting of the fruit, the larvæ escape; they leap about upon the ground for a minute or two and then rapidly bury themselves, beyond the remains of the rotten fruit, a couple of inches deep in the ground. Here they enter the pupal stage. The pupa is an egg-shaped pale yellow body measuring 6·5 mm. long by 3 mm. broad. After about 15–16 days the flies leave the pupa-cases, make their way to the surface of the ground, expand and dry their wings, and fly away to repeat the process in another melon. The power of leaping possessed by the maggots is considerable and enables them to leap over the cordon of ants which is generally drawn round the rotten fruit. The advantage of this capacity for jumping is well seen by dropping a maggot among ants. Though at once attacked by the ants it usually manages to get rid of its assailants by a few violent leaps. The power may also be useful in enabling the larva rapidly to reach ground which is uncontaminated by the fruit-juices, for such contamination favours the growth of moulds, some of which may cause the death of the pupa.

It is further worthy of remark that the flies of both these species issue from the pupa-cases with unmarked wings, and that the brown banding only gradually appears during the expanding and drying of these organs.

List of West African Species of Dacus.

Species.	Habitat.	Fruit Infested.
1. ♀ <i>D. armatus</i> , F., 1805	Guinea.	
2. ♂ ♀ <i>D. testaceus</i> , Macq., 1835	Senegal.	
3. ♀ <i>D. bivittatus</i> , Bigot, 1858	Gaboon.	
4. ♂ ♀ <i>D. ciliatus</i> , Loew, 1862	Guinea.	
5. ♂ ♀ <i>D. punctulifrons</i> , Karsch, 1887.	Pungo-Adongo.	
6. ♂ <i>D. inornatus</i> , Bezzi, 1908	Congo.	
7. ♂ ♀ <i>D. vertebratus</i> , Bezzi, 1908	Eritrea, Lagos.	} Musk and Blenheim orange-melons.
8. ♂ <i>D. mesomelas</i> , Bezzi, 1908	Congo, Lagos.	
9. ♂ ♀ <i>D. bipartitus</i> , Graham, sp. n. . .	Ashanti, Lagos.	} Musk and Blenheim orange-melons, vegetable marrows, cucumbers.
10. ♀ <i>D. flavicrus</i> , Graham, sp. n. . .	Lagos.	
11. ♀ <i>D. fuscovittatus</i> , Graham, sp. n.	Lagos.	

It will be seen that in more than half of the species one sex only is known, and that the habits of but two species have been recorded. As in the case of *Ceratitis*, the species of this genus are known to attack a great variety of cultivated fruits and vegetables in other parts of the world, as the following list will show :—peach, orange, mango, guava, banana, pineapple, granadilla, olive, tomato, cucumber, melon, marrow and string beans.

In both Ashanti and Lagos the attacks of *Dacus* render it impossible to rear melons or allied vegetables in the open during the rainy season. They can only be grown by protecting the plant with a frame covered with mosquito-netting, or by enclosing the fruit in oiled paper bags. At Yaba (Lagos) Blenheim orange-melons planted in April (beginning of rains) produced uninfected fruit, but of the same kind of melons planted in August not a single one escaped infection.

Months of prevalence for Dacus in West Africa (so far as at present known).

D. bipartitus—August to November.

D. flavicans—March.

D. fuscovittatus—September.

D. mesomelas—March.

D. vertebratus—September, October.

As Professor M. Bezzi's original descriptions of *D. vertebratus* and *D. mesomelas* are in Italian and Latin and unlikely to be accessible to readers in West Africa, I have added translations so as to complete the descriptions of the figures given in the plates.

***Dacus vertebratus*, Bezzi.** (Pl. XIII, figs. 3 & 4.)

Reddish brown, spotted, palpi and antennæ yellowish, face with two broad black spots, front with median spot and three dark orbital spots and a dark mark beneath the eyes on the oral margin. On the dorsum of the thorax three triangular black marks, the marks on the humeri, the mesopleural sutures and the scutellum yellow, and two yellow spots behind the root of the wings. Abdomen rounded, with the apex obtuse; a median longitudinal line and transverse lateral marks black. Legs yellow, with the apex of the femora, the tibiæ and the distal segments of the tarsus darkened. Wings hyaline, with a narrow band along the anterior margin, dilated at the apex into a spot, and a dark band on the anal cell.

♂. The third segment of the abdomen with nine or ten black bristles upon the posterior margin.

♀. Ovipositor short, base swollen, cylindrical.

Length of body 6–7 mm., wings $5\frac{1}{2}$ –6 mm.

***Dacus mesomelas*, Bezzi.** (Pl. XII, fig. 2.)

♂. Black, head and thorax with ferruginous spots. Face below with two circular black spots. Scutellum yellow, with a broad median longitudinal black band. Abdomen with a broad longitudinal ferruginous band divided by a fine black line. Legs yellowish, the posterior tibiæ black. Wings hyaline, with a narrow dark streak along the costa and the anal cell, and a very small dark spot at the apex of the third vein. A single yellow spot on hypopleura. Sides of abdomen without bristles.

Length of body 6.5 mm., wing 5.5 mm.

***Dacus bipartitus*, sp. n.** (Pl. XIII, figs. 1 & 2.)

Brown; head buff; thorax dark brown, with three yellow stripes behind the transverse suture; scutellum yellow; abdomen dark brown, with two yellow transverse bands, the broader being on the apical half of the second segment. Wings hyaline, with broad brown costal and anal bands.

Head. Occiput pale brown, with yellow orbits. Front buff, with three pairs of brown orbital spots and a median brown spot, the four corners of which are connected with the two lower pairs of orbital spots; ocellar spot dark brown; face yellow, with two large black spots and a brown spot

beneath each eye. Eyes in life purple, with a blue-green iridescence. Antennæ pale brown, the third joint darker externally and at the tip; arista brown, with pale base. Palpi and proboscis yellow. *Thorax* dark brown, paler at margins, covered with a greyish tomentum and with three slightly divergent dark striae varying in distinctness in different specimens. Behind the transverse suture the median line is occupied by a canary-yellow stripe not reaching the scutellum and sometimes indistinct; on each side of it is a curved yellow stripe, not reaching the scutellum. Scutellum yellow, with two black bristles. Pleura brown, crossed by a broad yellow band from the end of the transverse suture to the sternopleura, where it ends as a small spot. Hypopleura with two canary-yellow spots of nearly equal size. *Abdomen* dark brown, spheroidal; first segment with a very narrow apical transverse yellow band; second segment with a transverse broad yellow band occupying apical half; an indistinct dorso-median dark line on the third, fourth and fifth segments, and two paler, somewhat depressed, areas upon the apex. Venter with the basal half pale, the apical half brown, and with four brown median spots. *Legs* with the coxæ dark brown; femora yellow, with the apical half brown on the fore and mid pairs and the apical third brown on the hind pair; tibiae brown; first tarsal joint yellow, remaining joints brown. *Wings* hyaline, with dark brown veins. A broad brown band extends along the costa to the tip of the third vein, expanding so as to fill the anterior half of the first posterior cell; a brown band covers the anal cell and overflows into the third posterior cell. *Halteres* with semitransparent greyish knobs and yellow stems.

♀. Ovipositor shiny brown, cylindrical, with dilated base as long as last two abdominal segments.

Length of body 8·5–9 mm., wing 8 mm.

♂. 12 to 16 black bristles upon the apical lateral margins of the third segment.

Length of body 7·5–8 mm., wing 7 mm.

Type in the British Museum.

I have retained for this species the MS. name given to it by Walker in the British Museum collection.

***Dacus flavicrus*, sp. n. (Pl. XII, fig. 4.)**

Brown; head yellow; thorax dark brown, with black markings and yellow bands on the transverse suture; scutellum yellow; abdomen brown, with a black dorso-median line. All femora and 1st tarsal joints yellow; tibiae and tarsi brown. Wings hyaline, with narrow brown costal and anal bands.

♀. *Head*: Occiput pale brown with yellow orbits; front yellow, lower end brownish, with 3 pairs of brown orbital spots, a brown spot on the frontal

lunule, a large black spot on each side of the face and a small brown spot beneath each eye. Eyes purple, with dull greenish sheen. Antennæ pale brown, the third joint buff on internal aspect; arista dark brown with pale base. Palpi and proboscis buff. *Thorax* with the dorsum dark brown with black markings, humeri canary-yellow and a yellow band on each side lying along the outer portions of the transverse suture. Pleura dark brown, crossed by a broad yellow band which ends in a spot on the sternopleura. Hypopleura with two yellow spots, the lower spot being much the larger. Scutellum yellow, with two dark brown bristles. *Abdomen* pale brown, with some darker irregular marks and a dorso-median black line from the third segment to the apex, where it becomes somewhat broader. Venter brown, pale at the apex. *Legs*: femora yellow, tibiæ dark brown, first joint of tarsi yellow, remaining joints brown. *Wings* hyaline, with a brown costal band divided at the base of the wing so as to leave the costal and subcostal cells clear, and then extending between the costa and the 2nd longitudinal vein until it crosses the apex of this vein, when it becomes slightly wider and extends to a short distance beyond the apex of the 3rd longitudinal vein. Anal cell brown to the edge of the wing, the brown colour spreading into the 3rd posterior cell. *Halteres* entirely cream-white.

♀. Ovipositor short, pale brown, flattened.

Length of body 7 mm., wing 5 mm.

Described from a female taken on a window at Yaba, Lagos, 3 P.M., 25.iii.1909.

Type in the British Museum.

***Dacus fuscovittatus*, sp. n. (Pl. XII, fig. 5.)**

Pale brown; head yellow; thorax pale brown with black and yellow markings, scutellum yellow; abdomen dark brown laterally, with a broad median longitudinal yellow band and a black dorso-median line. Legs with the femora yellow with brown spaces; tibiæ brown, tarsi brown with the first joint yellow. Wings hyaline, with a costal brown band, enlarged at the apex, and a narrow anal band.

Head. Occiput brown with yellow orbits; front yellow, with 3 pairs of brown orbital spots and a brown median spot uniting the two lower pairs of orbital spots; vertex dark brown; face yellow, with an oval vertically elongated black spot on each side. Antennæ brown, third joint pale on internal aspect; arista brown with yellow base. Palpi and proboscis yellow. *Thorax* pale brown; in front of the transverse suture is a median broad black band with a triangular black spot on either side and a broad yellow lateral band on each side along the suture towards the root of the wing; behind the suture are 3 yellow stripes, the median one straight, the lateral ones curved

and enclosing a large black mark, divided longitudinally by a stria, on either side of the thorax. Scutellum yellow with 2 black bristles. Pleura dark brown, crossed by a broad yellow band which ends in a nearly circular spot on the sternopleura. Hypopleura with two yellow spots of nearly equal size. *Abdomen* elongate, with obtuse apex; 1st segment dark brown with a yellow apical transverse line; 2nd segment mostly yellow, with brown lateral margins; remainder of abdomen dark brown laterally, with a median broad longitudinal yellowish band to the apex where it expands into a nearly circular pale area. Down the middle of this band runs a dark brown, narrow, longitudinal stripe the whole length of the abdomen. Venter pale brown with 3 median brown spots. *Legs* with the coxæ dark brown, femora yellow with the apical third brown, tibiæ dark brown, tarsi brown with the first joint yellow. *Wings* hyaline with pale brown veins. A brown costal band divides at the base of the wing so as to leave the costal, and half the subcostal, cell clear yellow, it then narrows, leaving the basal half of 1st posterior cell a clear yellow, and then expands into a large brown area covering the apex of the wing and extending across it into the 2nd posterior cell. Anal cell covered by a brown band extending to the edge of the wing and into the 3rd posterior cell. *Halteres*: knob semitransparent white, stem white.

♀. Ovipositor pale brown, cylindrical, with expanded base.

Length of body 8 mm., wing 6.5 mm.

Described from a female taken on a wall in the garden at Yaba, Lagos, at 5 P.M., 12.ix.1909.

Type in the British Museum.

Remedial Measures.

On the subject of prevention a similar statement will apply equally well to both *Ceratitis* and *Dacus*. A fruit infected by these flies cannot be cured, and is a source of infection; it should therefore be destroyed and care should be taken to do so early enough to ensure the destruction of all the contained maggots, before they escape into the earth.

If the native fruits infected by these flies were identified, and when infected destroyed, the flies could be greatly diminished in the course of a couple of seasons.

Infected fruit can be destroyed by burning or boiling. When the amount is large and these means of destruction are not available, it is only necessary to bury the infected fruit deep enough to prevent the fly, when it leaves the pupa-case, from reaching the surface. A depth of two feet should be sufficient to ensure this, especially if the earth filled in over the fruit is well trampled down.

Yaba, 28.v.10.

1. CERATITIS ANONÆ, Graham, ♂. × 5.7.

2. CERATITIS CAPITATA, Wied, ♀. × 6.

3. C. CAPITATA, Wied, ♀. × 6.

4. WING OF C. CAPITATA, Wied. × 6.

5. CERATITIS ANONÆ, Graham, ♀. × 5.7.

WEST AFRICAN FRUIT FLIES
(TRYPETIDÆ).

1. CERATITIS NIGRA, Graham,

♀ · × 4.

2. DACUS MESOMELAS, Bezzi,

♂ · × 4.

3. CERATITIS ANONÆ, Graham.

Larva and Pupa. × 5.

4. DACUS FLAVICRUS, Graham,

♀ · × 4.

W. M. Graham *phot.*

5. DACUS FUSCOVITTATUS, Graham,

♀ · × 4.

WEST AFRICAN FRUIT FLIES
(TRYPETIDÆ).

1. *DACUS BIPARTITUS*, Graham, ♂. × 4.

3. *DACUS VERTEBRATUS*, Bezzi, ♀. × 4.

4. *DACUS VERTEBRATUS*, Bezzi, ♂. × 4.

2. *DACUS BIPARTITUS*, Graham, ♀. × 4.

W. M. Graham *phot.*

**WEST AFRICAN FRUIT FLIES
(TRYPETIDÆ).**

[Probably the most effective remedy for the fruit-fly pest is that devised by Mr. C. W. Mally, Entomologist for the Eastern Province, Cape Colony which aims at destroying the adult flies by means of a sweetened poison, which is very lightly sprinkled over the trees that are liable to attack. The spray fluid recommended by Mr. Mally, after many experiments, is :—

Sugar	2½ lbs.
Paste Arsenate of Lead	3 oz.
Water	4 gallons.

The liquid is applied with an ordinary garden syringe having a very fine spray attachment. Only a very small quantity should be applied, a pint to a pint and a half being sufficient for a large peach tree. Fuller details will be found in the Cape Agricultural Journal for November 1909 ; and as an indication of the practical value of the remedy, it is there stated that “a severe outbreak of the pest in a commercial peach orchard was brought to a sudden and practically complete halt. The infestation of the fruit on the treated trees fell from over 50 per cent. to less than 1 per cent., while that of untreated trees a few hundred yards away increased until practically every fruit was involved.”—ED.]