Degeneration and Loss of the Eye in the Amphipod *Gammarus chevreuxi* Sexton. Part I.

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With 7 Figures in the Text and Plates III, IV, 5, and 6.

CONTENTS.

This paper is divided into two parts. The first, written in 1921, when holding the Ray Lankester Investigatorship, contains a description of an irregular coloured-eye strain which developed in the original stock of *Gammarus chevreuxi*. This Stock, now known as Stock I, was brought into the Laboratory from the wild in June, 1912.

In the second part, to appear later, a résumé will be given of the occurrence of eye-irregularity in the family Gammaridæ, as far as it can be traced up to the present time.

PART I.

1. IRREGULARITY IN THE COLOURED-EYE.

The eyes in the wild specimens of *Gammarus chevreuxi* are always black, reniform in shape, and convex. They are composed of a number of ommatidia arranged in rows, the number increasing at each growth-stage from about 10 in the newly-hatched to 70 or 80 in the full-grown. The structure is similar to that of the Gammarus eye described by

Parker (**1**, pp. 66–73). Briefly, each ommatidium consists of a two-celled cone, and 5 pigmented retinular cells, four large and one small, arranged around a central axis, the rhabdome. The space between the ommatidia is filled with the " accessory pigment-cells," rather large cells containing an opaque white pigment. Viewed from the surface, the white pigment gives the effect of a network over the eye, with the ommatidia showing as black spots in the meshes.

Several mutations have arisen. The first one (*Red-eye*), affecting the retinal pigment, was the appearance in the retinal cells of red pigment instead of black. The red proved to be a simple mendelian recessive (**2**, p. 22, Pl. I, Fig. 3).

In another mutation (*No-white*), affecting the accessory pigment, the superficial white pigment was absent. This, too, proved another mendelian recessive (**3**, pp. 326–341, Pl. VII, Fig. 5).

A third mutation (*Albino*) affected the structure of the eye, and was the most striking of all, involving the loss of the coloured retinal cells, and the breaking up of the ommateum. The whole eye presented a degenerate appearance, only the cones of a few ommatidia were left, scattered irregularly in a mass of the accessory pigment. The shape of the white mass and the number of cones varied not only in each individual, but very often in the eyes of the same individual (**2**, Pl. I, Figs. 9 and 10 ; **3**, p. 274).

This mutation also was shown to be heritable, the perfect coloured form being dominant over the imperfect albino form. The albino condition was always linked with the imperfect shape and structure.

Besides these variants from the normal, another has arisen which seems heritable in some degree, but which, so far, cannot be interpreted in any simple mendelian way. " *Spotted*," the name given to this variant, refers to the presence of spots, patches, or streaks of the white accessory pigment found, apart from the eye itself, on the cephalon, less frequently on the first peræon-segment, sometimes but rarely on the second peræon-segment. The spots, while differing considerably in size and shape, are usually situated in certain definite positions, either along the lateral line often deep in the tissues, or on the dorsum and superficial (**4**, pp. 352–366). They may remain in the same position through life, or they may change in place, as well as size and shape, at each moult (see Text-fig. 7, p. 365).

The interesting point about this variant is that it seems to be connected with any marked departure from the normal ; for example, in the Albinos, where the eye is degenerate and reduced, the spots are large and of very frequent occurrence, whilst in the perfect-eyed normals spots are not often developed, and when present are small. They occur also with the No-white mutation, and it is specially noteworthy that in the so-called " One-sided No-whites " (animals which have one eye normal, i.e. with

the retinal colour and the superficial white pigment, and one eye No-white, i.e. with the retinal colour but without the white pigment) there are, almost without exception, large spots and patches of white on the same side as the No-white eye. Even when a One-sided No-white animal is spotted on both sides, the spots are much larger on the No-white side.

Amongst the mutants the Albino-eye was the only one in which the structure was affected, the degree of degeneracy extending as far as the loss of the retinular cells. Attempts made from time to time to produce an imperfect coloured eye (i.e. an eye in which the factors controlling the organisation of the ommateum could be affected without inhibiting the production of the retinular cells) met with little success until a mating (CN.1*b*) was made in which " Spotted " was combined with the three recessive types, Red, No-white, and Albino.

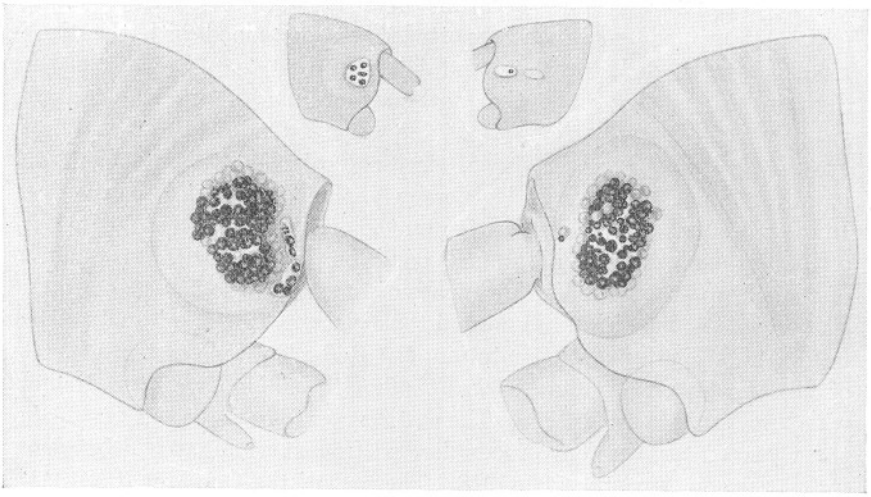
From this mating came the most extraordinary range of variation yet recorded for any marine form. The range extended from the perfect eye—perfect in structure, shape, size, and pigmentation, through an infinite number of stages of degeneracy to the complete loss of the eye. In view of all that has been written on the origin of the blind fauna it is a significant fact that blind animals could be produced within the limits of a single species in such a short space of time and in so few generations. The first departure from the normal took place in 1912, and was, as has been said, a change in pigmentation, the Red-eye ; the most important of all, affecting the structure, was that of the Albino-eye—the first of which appeared in June, 1915. The mating now to be described was made three years later, the four broods derived from it were hatched between October 1 and November 25, 1918. The first of the One-eyes (CN.183*h*) appeared in the F_3 on February 19, 1920 ; the first of the No-eyes (7 in CN.228 brood) on May 11, 1920, so that within 8 years of the bringing in of the first pair from the wild, the No-eyed form had arisen.

There were other irregularities in this stock besides the irregularity of the eyes described below, e.g. (*a*) the shape of the head was frequently abnormal, almost always so in those animals with one or both eyes missing. As will be seen in the figures (Plates IV, 5 and 6) where this malformation occurred the shape of the brain was altered, and the front margin of the head looked as if a slice had been cut off, sometimes so far back as to expose the bases of the Second Antennæ, always hidden in the normal (*cf.* Text-fig. 7).

(*b*) Another malformation found in a good number of specimens was caused by the loss of the First Antennæ, and the consequent sinkage of the anterior portion of the head. The shape of the eye was usually, though not always, affected (Plate III, Fig. 1). This peculiarity, sporadic through the stock, was probably pathological in origin. It did not appear to be heritable. No-antenna pairs gave normal-antenna offspring, and,

though some of these lost their first antennæ later, yet there is no case recorded through the generations, of a single animal hatched without antennæ. The figure given on Plate 6, No. 22 of Brood CN.349, appears at first glance to contradict this statement. The young one at birth had no first antenna on the right side, but that this must have been due to an accident while hatching was shown on examining it after its moult, when the antenna could be distinctly seen regenerating.

(*c*) And finally, there was a marked irregularity in the reproductive organs. Many cases of sterility were noted, in particular a No-antenna



TEXT-FIG. 1.—CN.228*f* ♂. Upper figure shows the right and left sides of the head at birth, May 11, 1920. A month later the Right eye had 2 ommatidia separate, the Left eye had increased in size, but was much smaller than the right, triangular in shape with the spot almost coalesced. The lower figure was taken just after maturity had been reached—July 27, 1920. ×45.

Black ♂ M. III (CN.126), and many intersexes of differing degrees of intersexuality developed (**5**, pp. 510 and 544; also details in the List, appended).

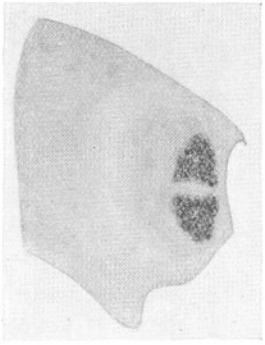
The figures given in the List are correct for the amount of irregularity at birth, but it is not possible to estimate the amount which could develop later, or to obtain any adequate data for investigation of the inheritance. The chief difficulty is that the mortality amongst the abnormals is very much higher than in the normals, so much so indeed that hardly any of the extreme types survived the first moult, and of these only one or two lived to mate. One fact comes out very clearly in this work and that is, that the farther removed an animal is from the normal, the lower is its viability. Another difficulty consequent on this is that while we know

that irregularity frequently develops in animals born normal, we have no means of judging to what extent, owing to the small proportion of survivors.

1. Types of Irregular Coloured-eyes.

Some of the different types of eyes are shown in the figures and may be briefly defined as follows :—

(*a*) *Reduction in size*, (see Brood 349, Plates IV, 5, and 6) of very usual occurrence in this strain, varies from 1 to 2 ommatidia less than normal, to a mere speck of colour (Plate 6, Fig. 20). These reduced eyes are often wedge-shaped on hatching (Text-fig. 1) and may remain so more or less



Text-fig. 2. Divided eye. Black No-white ♂. July 7, 1920. ×45.

through life (cf. right eye of CN.210*c* on p. 365) or they may alter completely as in this specimen.

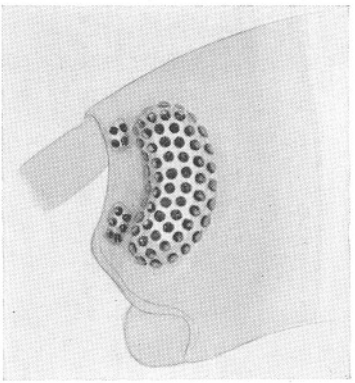
(*b*) *Increase in size* is also frequent. In some cases the eyes are larger than normal at birth (Plate 5, Fig. 15), in others the size increases disproportionately at each moult ; in others again it is due to the loss of the first antennæ, and the consequent alteration in the shape of the head (see Plate III, Fig. 1).

(*c*) *Divided eye* (Text-fig. 2) represents a Black No-white ♂ from the same No-white strain as the ♂ CN.1*b* used in this mating. The division may be transverse, as in the figure ; or longitudinal ; or the ommateum may be so divided as to look like two separate eyes (Plate 5, Fig. 16) ; or the two parts may be one behind the other as in the CN.210*n* described below. Another instance of this last type is CN.293—a Black that became Intersex and developed great irregularity, especially in the left eye, which grew to more than twice the size of the right. The right eye was of normal size, deeply indented on both margins with a small

" cluster " separate ; the left looked like two large eyes, joined together, with the ommatidia of different sizes.

(*d*) *Lobed eyes*, much less frequent than the divided, though evidently not far removed structurally. In one instance, CN.289*f*, both eyes were lobed on the front margin ; in another, CN.285*c*, the right eye had the hind margin cut into two equal lobes, while in a third, HN.69*c*, the front margin of the right eye was lobed.

(*e*) *Ommatidia separate* from the ommateum, either singly or in clusters.



TEXT-FIG. 3.—CN.157(2). Intersex 5 months old. July 7, 1920. ×45.

The clusters may be of any size, and may lie in any position near the eye (Text-fig. 3). This is of frequent occurrence.

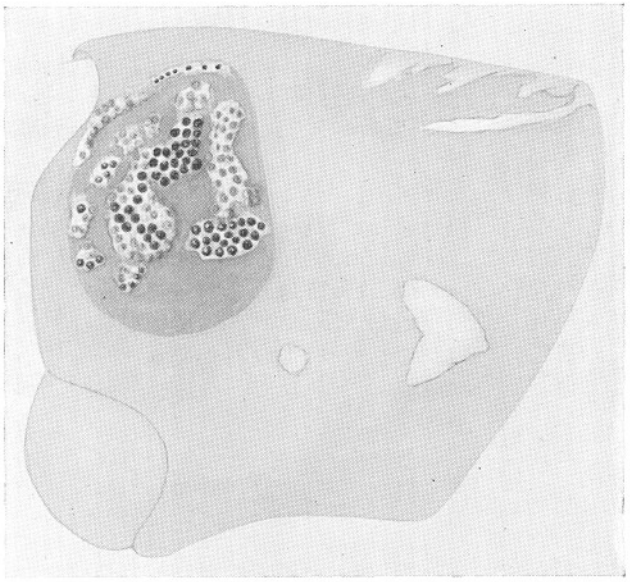
(*f*) *Scattering of the ommateum* (Text-fig. 4) shows the type (*e*) carried to the extreme, with the whole eye broken up.

(*g*) *Mosaic eye*, a term applied to an eye in which part of the retinal cells are of one colour, and part of another. There may be black, red, and colourless ommatidia in the same eye (See Plate IV for black and red ; Text-figs. 4 and 5 for black and colourless ; **2**, Plate I, Fig. 7, for red and colourless). The Figure 2 on Plate III is taken from another Stock, TB Stock III described on p. 315 of this Journal (Vol. XVIII).

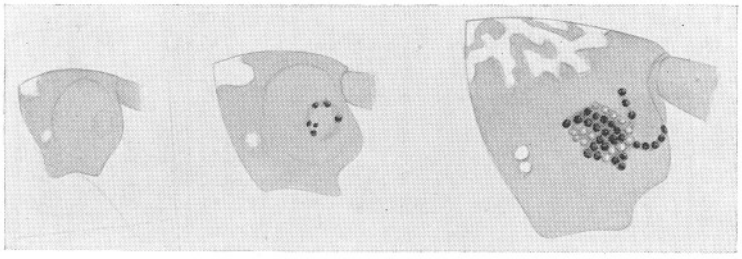
2. Loss of One or Both Eyes.

In all, 40 animals were hatched with eyes missing, 22 with one eye, and 18 with both eyes. In the F_3 generation in which they first appeared, the One-eyes numbered 12, 5 with the right eye, and 7 with the left missing, all with large spots, and 8 with dorsal patches also. Of those with No-right eye, four (CN.183*h*, 199*d*, 249*c*, and 220*b*) had an irregular eye on the

left side, while in one, CN.199*e*, the eye was reduced to one speck of reddish colour. Two of the No-left eyes also (CN.209*d*, and 228*n*) had only a speck of reddish colour on the right side, in CN.210*c*, *f*, and *n*



TEXT-FIG. 4.—CN.379*b*. ♂ hatched January 31, 1921. Died February 15, 1922, and figured. At birth, the left eye was very small, round, with 5 microscopic ommatidia, pigment dilute ; large triangular white patch behind. ×45.



TEXT-FIG. 5.—CN.220*b*. Head, right side. ×45.

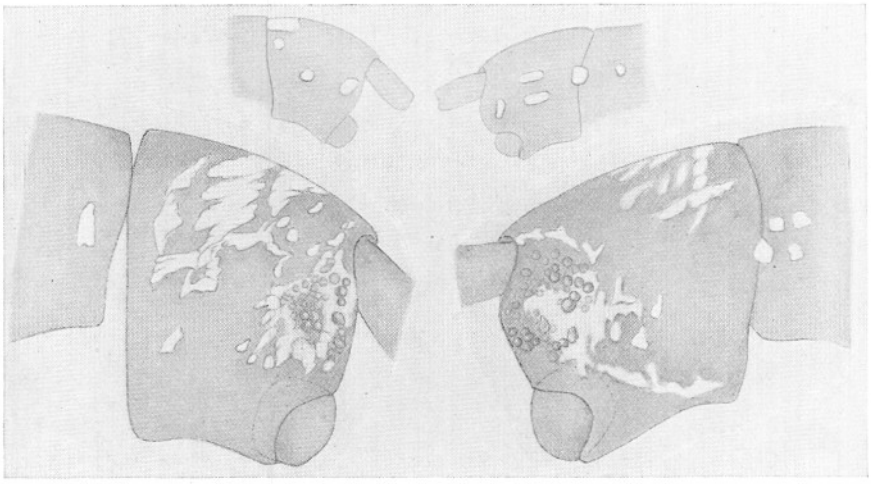
(p. 366), the right eye was irregular, in CN.228*h* it was almost normal, and in CN.269*e* quite normal.

Only four came to maturity ; one CN.210*c* (Text-fig. 7) remained unchanged, no second eye being produced ; in the other three, CN.210*f*, 210*n*, and 220*b*, a very irregular one gradually developed. An illustration

is given of CN.220*b* in Text-fig. 5, showing three stages of its growth, at birth, May 11, 1920 ; at the age of a month, on June 8, when the developing right eye was first noted ; and again on July 27, just before maturity was reached. Later on, September 8 and October 13, it was seen that the eye had greatly increased in size, and scattered, with many colourless ommatidia joined to the two curving lines of black ones. The dorsal patch then covered most of the head. The left eye at the same stages was very small at first, consisting of only 2 reddish black ommatidia ; on June 8, it was round and flat with 8 ommatidia ; on July 27 triangular, and almost No-white.

There were 10 One-eyes in the F_4 generation, all from one family ; CN.339*g* and *o* had No-right eye, and a microscopic left eye. The other 8 were in Brood CN.349, and are figured in Plate IV, Figs. 5 and 10 ; Plate 5, Figs. 15 and 18 ; and Plate 6, Figs, 19, 20, 23, and 24.

The No-eyes in the F_3 generation numbered 11, 6 from one family, CN.228*e*, *g*, *j*, *m*, *p*, and *r* ; 261*b* and *h* ; 257*c* and *d* ; and 269*f*, all spotted except one. Only 2 lived to maturity, both females,



TEXT-FIG. 6.—CN.228*m* ♀. Two stages shown. At birth May 11, 1920, at maturity August 6, 1920. ×45.

CN.228*m* and *p*, and both developed in the same way. Two stages of CN.228*m* are shown in Text-fig. 6, at birth and at maturity. In July a few colourless cones were seen, which increased in number after the next moult. It died on August 6, 1920.

In the F_4 generation 7 No-eyes were found in the same family : 3 in CN.339 (*c*, *d*, and *k*) and 4 in CN.349 (see Plate 6, Figs. 21, 22, 25, and 26).

II. DETAILS OF THE MATING (CN.1*b*) WHICH PRODUCED THE IRREGULAR COLOURED-EYES.

The male used in this mating was a Black No-white, heterozygous for red, from pure No-white unspotted stock; the female was an Albino dorsally spotted, descended from dorsally spotted ancestry for four generations. It was derived from the C.17*b* family of Albinos previously referred to (**4**, p. 350), in which one Black perfect-eyed young appeared amongst its 248 Albino imperfect-eyed offspring—the only instance ever seen of a coloured-eye occurring amongst the Albinos in the hundreds of families kept under observation.

The pair CN.1*b* had 4 broods, comprising 107 young, of which 75 were normals, 31 spotted, and 1 was a Black No-white. The appearance of a recessive in the F_1 generation was the first departure from the normal in this family.

In the F_2 generation, the first irregular coloured-eyes appeared. There were only a few, 8 out of the 1,391 young hatched, in which a definite irregularity was found, all Black eyes, all affected on one side only, 4 with the right eye and 4 with the left eye irregular; six were spotted, five on the same side as the irregularity, and one with the left eye affected had the spots on the right side. Two others, No-whites, 1 Black and 1 Red (in XXII), had a slight irregularity in the left eyes.

Compared with the remarkable developments in the succeeding generation, the irregularity in the F_2 was trifling, being shown chiefly in the uneven and indented margin of the ommateum. Only in one instance was it marked; in that animal (169*d*) the right eye was much smaller than the left, irregular in outline, and in the arrangement of the ommatidia, with the pigment very dilute, reddish, and faint; the left eye was of normal size and intensely black.

Besides these 8 definitely irregular-eyed animals, a few others were not quite normal: 5 in IX as follows: 2 Albino No-whites, spotted, one with very large spots on both sides of the cephalon, and on the first peræon-segment, the other with a small spot on the right side; 2 others, Black ♂ and Black No-white ♀ with the first antennæ missing, eyes normal; and 1 Black No-white which developed irregularity. In XIX there were 3, as follows: 1 Black One-sided No-white, spotted, with the left eye No-white and large patches and spots on each side; 1 Black No-white with the right eye much smaller than the left; and 1 Albino, spotted dorsally, with the left eye transversely divided into two pieces. In XXII 1 Albino, spotted, had the right eye almost in two pieces.

It is noteworthy that the irregularities were given by only three or four of the animals breeding. In Brood IX the 4 irregular-eyed, and the 5 others just mentioned were from one male mated with three females of its

own brood. In Brood XIX, the 4 irregular-eyed were from one female, as well as the divided-eye Albino, and the Black No-white with different-sized eyes.

All of these died without offspring, most of them before reaching maturity.

In the F_3 generation, 1,879 young were hatched. The development of the irregularity in the eyes increased enormously (see List, p. 383). It is safe to say that all the families were affected, the individual members differing only in degree. Certain families showed it in every brood, others in some of the broods, often the later ones. In a few families only, all the offspring were normal-eyed at birth, but in these also irregularity developed, as shown in the few that survived.

It was amongst the offspring of Family 2 of the Brood IX referred to above (in which 4 irregular-eyed animals appeared in the F_2) that irregularity developed to the greatest extent in the F_3 generation.

The young produced by its inter-matings numbered 237; only 130 were normal-eyed at birth (43 spotted), all the other 107 being abnormal. Of the 107, 86 had irregular eyes as follows: 82 Blacks, 31 with both eyes irregular, 27 spotted, 4 unspotted; 32 with the right eye irregular, 23 spotted, 9 unspotted; and 19 with the left eye irregular, 11 spotted, 8 unspotted; and 4 Black No-whites, 3 with the right eye affected, and 1 with the left.

The remaining 21 are the most remarkable animals that have yet appeared in this species. They all had *one or both eyes missing*, frequently accompanied by malformation of the brain and of the head, particularly of the front margin, which in some cases was so retracted as to expose the proximal joints of the second antennæ, normally covered by the lateral angles (see Text-fig. 7, and Brood 349). All but 2 of the animals were spotted. Those with both eyes missing numbered 10. Of the One-eyed, 5 had the right eye missing, 6 the left; all were spotted, most with the one eye irregular. All died without offspring, except one, CN.210*n*, a One-eye which gradually developed the second eye.

The 210 brood, in which this animal appeared, is described in detail to show the range of variation, and the changes undergone in growth.

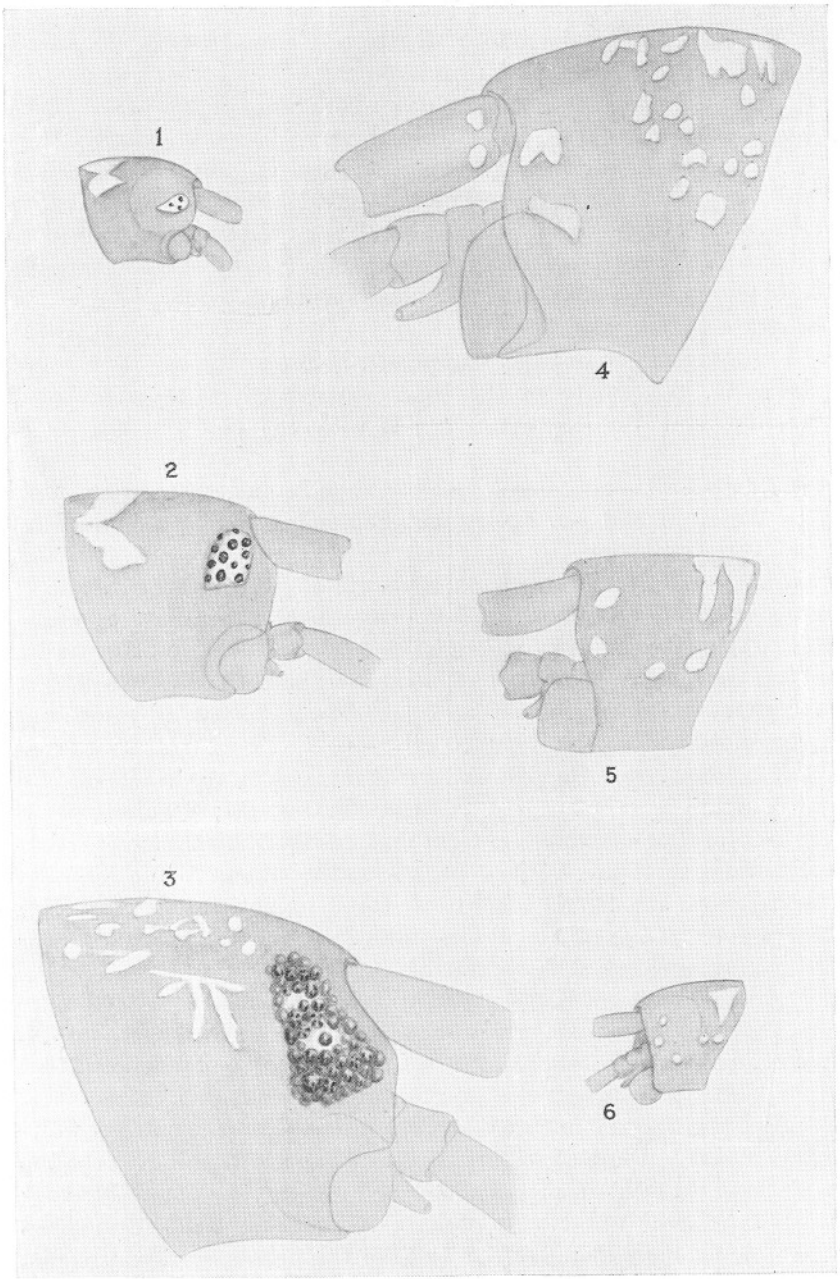
It consisted of 17 Black-eyed, extruded on April 18 and 19, 1920:—

(*a*) 1, normal eyes unspotted; and 1, normal but reticulation uneven:

(*b*) 1, with right eye normal; left eye irregular, wedge-shaped, drawn out behind; spot above position 4.*

(*bb*) 1, normal eyes; very deep spot pos. 4, and dorsal streak far back. Its growth was unusually slow, 4 months being taken instead of 6 weeks to reach maturity, a ♀. A male was added and they mated; ♀ eaten.

* See **4**, p. 353, for a diagram of the usual positions of spots. Position 4 is on the head, in the mid-lateral line, just over the anterior end of the stomach.



TEXT-FIG. 7.—CN.210*c* One-eye. 1 Right side of head, 6 Left side, on hatching April 18, 1920; 2 and 5 on June 21; and 3 and 4 at maturity September 10, 1920. ×45.

(*c*) 1, with the *left eye missing ;* (Text-fig. 7) head greatly malformed on the left side, the basal joints of the second antenna being exposed ; 3 white spots along the front margin on the left side and 2 in pos. 4 ; very large dorsal patch extending down both sides of the head ; right eye wedge-shaped, and drawn out behind, very small with only 3 ommatidia ; small spot low down on first peræon-segment. It was examined at intervals. No eye was developed on the left side through life ; the white superficial spot nearest the " eye-position " remained unchanged till after maturity was reached, when it divided into two pieces. The dorsal patch also broke up into streaks and spots and spread all over the top of the head down to the eye level.

The right eye grew very large, triangular in form, with very little white reticulation. The shape of the head was normal on the right side, very abnormal still on the left, but with the post-antennal angle produced.

This animal was a ♀ ; a male was added on September 7, mating took place, the ♀ moulted and laid eggs on September 10 and was killed by the male the same day.

(*d*) 1, normal eyes, a ♀, with a large white streak right side, pos. 4, and uneven reticulation in the left eye. Slight irregularity appeared later in the left eye. An Albino No-white ♂ was added on August 19, and eggs were laid August 20. Two broods were hatched (CN.315 and 330), 20 in all, of which 7 were irregular-eyed. The ♀ was eaten by a ♂ after moulting on October 4.

(*dd*) 1, normal eyes ; large dorsal streak far back on the head.

(*e*) 1, right eye irregular in shape, with 5 ommatidia ; 2 white spots at the base of the maxillipeds. Left eye nearly normal, large, about 8 ommatidia, spot, pos. 4. This one, a ♀, mated with an Albino No-white ♂, and had one brood (CN.338) of 10, 4 of them irregular-eyed. As it grew older it developed great irregularity in its eyes, in the shape, and in the size and arrangement of the ommatidia.

(*f*) *Left eye missing ;* large patch, pos. 4, and 2 streaks extending to dorsal. Right eye small, irregular, with 4 ommatidia ; spot, pos. 4. This animal was examined at intervals, and on July 5 it was noted that a small almost microscopic eye was growing on the left side. It consisted of 1 black speck, and 3 minute colourless ommatidia. The patch of white had increased and formed large masses of white streaks all over the top of the head ; the head margin was very irregular, and cut so far back that the eye-speck was close to position 4, in fact the width of the head was not much more than half the width of the right side. The irregular right eye had become triangular in shape. The animal, a ♂, moulted with difficulty on August 21, a very thin moult, and died on August 30.

(*g*) 1, normal eyes, with a large streak left side, pos. 4, and a deep spot

at the same point, right side ; a spot in the lateral position, right side, and 1 below and behind the eye.

(*gg*) 1, normal eyes, spotted left side. This one reached maturity, a ♂ ; it was very weakly, and died on July 29.

(*h*) 1, with the right eye small, irregular, drawn out behind wedge-shape with only 4 ommatidia ; a spot each side in pos. 4.

(*j*) 1, with very irregular right eye, microscopic, consisting of only 1 ommatidium surrounded by white, with a reddish spot behind ; and a very large drawn-out patch of white at pos. 4. Left eye normal, a small spot pos. 4.

It was examined on May 1 ; the right eye now had 2 or 3 black ommatidia, no white reticulation. Examined again on July 1 after a moult ; right eye very irregular, about 4 ommatidia, long, practically No-white, colour dilute, some ommatidia purplish, others colourless. Left eye normal in shape, and number, size, colour, and arrangement of the ommatidia. Spots unchanged. It was slow in reaching maturity, and died on August 13, a ♂.

(*l*) 1, with right eye irregular ; reticulation of left eye uneven ; unspotted.

This one, a ♀, mated first with an Albino No-white ♂, and had 2 broods (CN.337 and 348) consisting of 19 young, 4 irregular-eyed ; then with a ♂ (CN.259) of the same family and had one brood of 8 (CN.370), 6 of them irregular-eyed. It died January 20, 1921.

(*m*) 1, normal eyes, right with uneven reticulation, and small spot. Reached maturity, a ♀, and was tried with two males ; no mating ; died on October 6, 1920.

(*n*) 1, *with left eye missing ;* large white spot, pos. 4, with a smaller one in front of it ; right eye exceedingly irregular with very uneven reticulation, and small spot just behind the eye.

The animal was examined at intervals. On June 9, the beginning of an eye on the left side was noted, 3 tiny black specks on the upper edge of the ommateum, and 7 or 8 black ommatidia around the margin ; the spots had broken up into 3 large round masses, and a great number of red globules were seen in the cephalon around the œsophagus and the anterior end of the alimentary canal. Right eye much larger, still very irregular in shape, spot coalesced with the eye.

Examined on October 13 ; the left eye now very large with about 40 ommatidia, exceedingly irregular in shape, almost as if composed of two eyes, a small round regular eye of 16 ommatidia with a large crescent-shaped one fitting closely around it posteriorly. It was tried with several males, including the CN.220*b* (which, hatched a One-eye, also developed the second eye), but no mating took place. With Albino No-white males it mated twice, and had 2 broods, with one a brood of 8 (CN.321), 5

irregular-eyed ; with the other, a brood of 12 (CN.379), all irregular-eyed (one of these is figured in Text-fig. 4). It was eaten by the ♂ after moulting on February 11, 1921.

(*o*) 1, with right eye irregular, 4 ommatidia ; left eye normal, unspotted.

In the F_4 generation 1,001 young were produced of which 410 came from this Family 2, IX. The total number of irregular-eyed out of the 410 was 120 : 76 Black, of which 29 were irregular in both eyes, 23 spotted, 6 unspotted : 20 had right eye irregular, 12 spotted, 8 unspotted : and 27 had left eye irregular, 17 spotted and 10 unspotted : and 1 Red unspotted had left eye irregular.

The remaining 43 are of great interest.

41 (CN.339 and 349) came from a mating of a Black No-white ♂, CN.257, with a Black normal-eyed ♀, CN.249 (see List, p. 389), 2 regular-eyed animals from the Family 2, IX, in which the greatest amount of irregularity occurred. (The pair from which the female was derived gave 20 normals to 32 irregulars, 9 No-eyes and 4 One-eyes.) All the young from the mating were irregular-eyed, with no two eyes alike, 7 were No-eyes, 4 of them spotted, 10 were One-eyed, 7 with the right eye missing, and 3 with the left. Brood 349 is figured on Plates IV, 5, and 6.

The other 2 (CN.336) came from a mating of irregular-eyed Black ♂ and ♀ from brood CN.259. The male's eyes were both irregular, the right very large and almost square in outline, the left narrow, very uneven reticulation, ommatidia not in rows, and the colour dilute. The ♀ had the left eye large and square, and the right practically normal. It became an Intersex, but whether intersexuality developed after the brood was hatched or before, it is impossible to say ; the previous moults were examined but only tiny fragments were left, nothing to show the condition of the animal at the time.

The eyes in these 2 young were very extraordinary at birth :—

(*a*) is the only one yet seen which had eyes of different colour when hatched. On the right side was an elongate patch of white exactly like an ordinary Albino in appearance, but the young one was too delicate to keep out of water long enough to make certain if any cones were present. The left eye was Black, very small and flat with a marked difference in the size of the ommatidia, 4 larger and 3 microscopic. Eight weeks later this eye had the shape of an Albino, large and scattered with no definite outline to the ommateum, broken reticulation, numerous black ommatidia, many separate above. In the right eye black ommatidia had appeared above the white patch, in a small No-white cluster, with 2 apart. The animal was a ♀, exceedingly small and delicate. No male could be found with a sufficiently good record to place with it, and it died at 6 months unmated.

(*b*) This specimen looked as if it also had an Albino-eye on the right side, broken into three patches, but under a high-power an almost imperceptible speck of colour could be seen in each patch ; a large mass of white behind at pos. 4. Left eye Black, small (6 ommatidia), and flat, with a white spot behind and a very long and very large dorsal streak extending down the side of the head. Eight weeks later a minute Black eye, almost No-white, had developed in front of the patches, right side. The head was so much malformed on that side as to form a deep depression in which the eye lay. Left eye large, and roughly triangular with the wide end below. It died just before reaching maturity.

SUMMARY.

A description has been given of a mating which produced a great range of eye-irregularity in the offspring. Not only were the size, shape, and pigmentation affected, but the eye-structure itself, many cases occurring in which one eye or even both eyes were missing at birth.

This experiment adds another proof to the statement that the farther removed from the normal an animal is, the lower its viability. The mortality was much higher amongst the abnormals, and breeding experiments with the survivors were exceedingly difficult on account of the trouble experienced not only in rearing them to maturity, but in finding suitable mates. The cannibalism of the males of this stock made it almost impossible to use them, and small, not too vigorous, males had to be sought in the Albino No-white strain.

In three of the One-eyes, i.e. those in which one eye was present at birth, and no trace of a second could be seen (even with a high power), a very imperfect second eye developed later, after several moults had taken place. An example, CN.220*b*, is illustrated in Text-fig. 5 (List, p. 384).

In one case and one only of the One-eyed animals which survived several moults, the missing eye was never developed. The specimen CN.210*c* is figured in Text-fig. 7.

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EXPLANATION OF THE PLATES.

PLATE III.

FIG. 1.—Red ♀, R.E. 106, showing the "No-antenna" condition and the irregularity of the eye. ♀ just mature, laid eggs, and died April 11, 1920. ×58.

FIG. 2.—TB.814*c*. ♂ from Stock III, p. 315 of this Journal, showing the "mosaic" eye. 8 months old, August 10, 1925. ×58.

PLATE IV.

Brood 349, see p. 368 for ancestry. Hatched October 26, 1920. ×58.

FIG. 1.—Right eye tiny, with 2 round black ommatidia and 1 long red one. Left eye large. Died trying to moult on November 5.

FIG. 2.—R. eye microscopic, 1 black ommatidium surrounded by a thin line of white, 2 minute reddish ones behind. L. eye small, 2 long black omm., very large dorsal patch. Died November 5.

FIG. 3.—R. eye large, irregular, with a reddish cone at the top and one at lower margin; no white pigment. L. eye minute, only 2 tiny B. omm. each surrounded by a clear space. Died in moulting November 5.

FIG. 4.—Both eyes exceedingly small, 3 omm. in clear space, with dark reddish patch below, adjoining eye: no white in eye, but a small, very deep white spot on edge of brain lobe. L. eye round, with 4 microscopic cones. This one lived to February 10, 1921, when both eyes were about the same size, the left one lobed, the right square. It moulted on November 10, but hardly grew at all, measuring only 1·75 mm. at death. A normal animal would have been mature at that age.

FIG. 5.—*No eye* right side, head and lobe malformed. Left eye exceedingly small, 1 B. omm. and 1 faint reddish spot behind. Died in trying to moult November 5.

FIG. 6.—Head malformed, both eyes very small and irregular, the left with 1 reddish omm. and 2 black. This one was spotted on the first peræon-segment. It moulted on November 10, died January 20, 1921.

FIG. 7.—Eyes very small. Right with 1 B. omm. and 4 microscopic colourless ones, white retic. L. eye with 2 large B. omm. and 2 small above, reddish patch behind eye, deep; spotted.

FIG. 8.—BN. Looks like 2 eyes on RS. L. eye as if 2 eyes were joined together, one behind reddish. Died in moulting November 5.

FIG. 9.—BN. Large R. eye, 7 omm. L. eye also large but very irregular, looks like 1 round B. spot surrounded by a clear reddish space, with 1 B. omm. separate above. Died trying to moult November 5.

FIG. 10.—*No eye* R. side. L. eye BN., small, round, with light reddish patch behind, as large as eye. Died November 5 trying to moult.

PLATE 5.

From a Painting. ×58.

Normal Black eye of newly hatched young, for comparison.

FIG. 11.—R. eye microscopic, 1 B. omm. surrounded by white with tiny deep B. spot in front and 1 behind, deeper than eye. A huge white spot in lateral position, much larger than the eye. L. eye very large. Lived till May 9, 1921, and was then only 2·5 mm. in length. (Only 10 joints. in flagellum, Ant, 1 ; 3 in access. flag., and 7 in flagellum, Ant. 2.)

FIG. 12.—Both eyes large, but irregular in shape and number of omm. Much spotted, with large dorsal patch. Died in moulting November 5.

FIG. 13.—R. eye minute, with a little white streak at lower edge of lobe. Head malformed, and lobe deeply dented, touching the margin. Tiny eye L.S. with white retic. and only 3 micro. omm. Dead on November 8.

FIG. 14.—Both eyes exceedingly small, with reddish omm. and hardly any white. L. eye oval, with 2 minute reddish lenses.

FIG. 15.—*No eye* L.S. Lobe malformed. R. eye very large, drawn out, ommatidia of different sizes.

FIG. 16.—2 distinct eyes on Right side. 1 with fair-sized B. omm. in eye-position and 2 smaller omm., white pigment, and spots ; 1 lateral with 2 omm. L. eye large. Died in moulting November 6.

FIG. 17.—Both eyes very small. R. with only 2 omm., 1 large and irregular and 1 small. Practically No-white. Died after moulting November 5.

FIG. 18.—*No eye* L.S. Huge triangular patch pos. 4 ; dorsal patch. Head on R. side greatly malformed and eye reduced to 2 B. specks. Died in moulting November 8.

PLATE 6.

From a Painting. ×58.

FIG. 19.—*No eye R,S.* Head greatly malformed. L. eye far back in lobe, in lateral position, may be due to malformation, eye very minute. Died after moult November 8.

FIG. 20.—*No eye L.S.* Lobe and head malformed. R. eye reduced to 1 tiny B. speck, slightly drawn out backwards. Moulted November 15 and died November 27.

FIG. 21.—*No eyes.* Head and lobes malformed. Much spotted. Moulted November 10, died November 27.

FIG. 22.—*No eyes.* Head greatly malformed. R. ant. missing at birth, probably through an accident. Moulted and died November 10. The antenna was regenerating. Figure taken from moult.

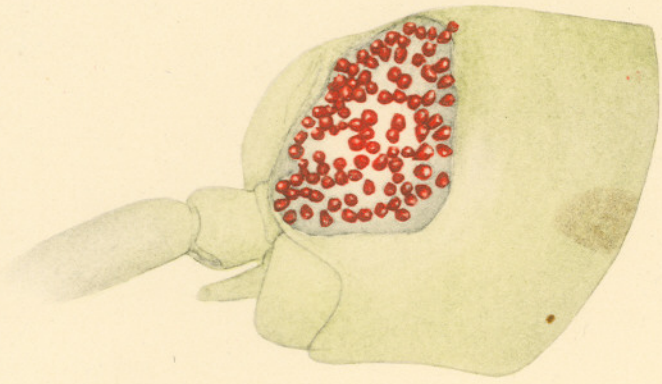
FIG. 23.—*No eye R.S.* Head malformed. L. eye microscopic, 2 omm. Moulted November 15 and died November 18.

FIG. 24.—*No eye R.S.* On L.S. a tiny speck of B. in middle of lobe, lateral position, represents eye. Died November 15.

FIG. 25.—*No eyes.* Head malformed, more so on L.S. Patches of white very deep. Moulted November 10, died December 13.

FIG. 26.—*No eyes.* Unspotted. Moulted November 11, died November 15.

PLATE III.



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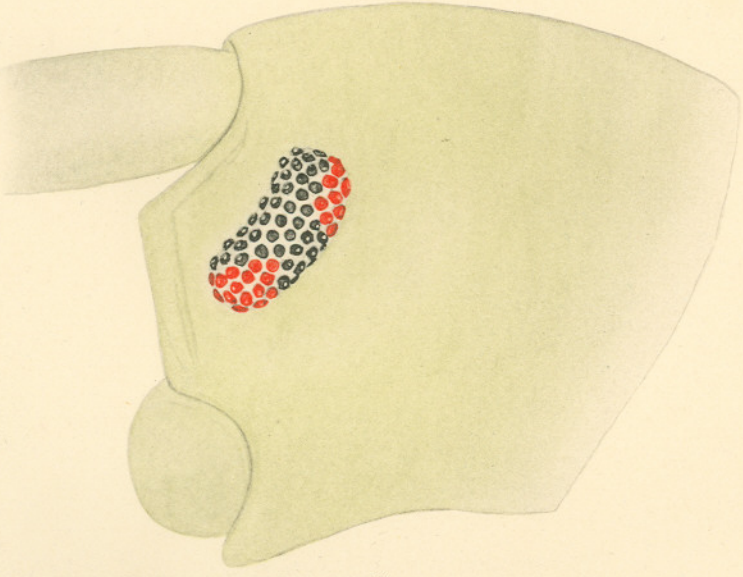

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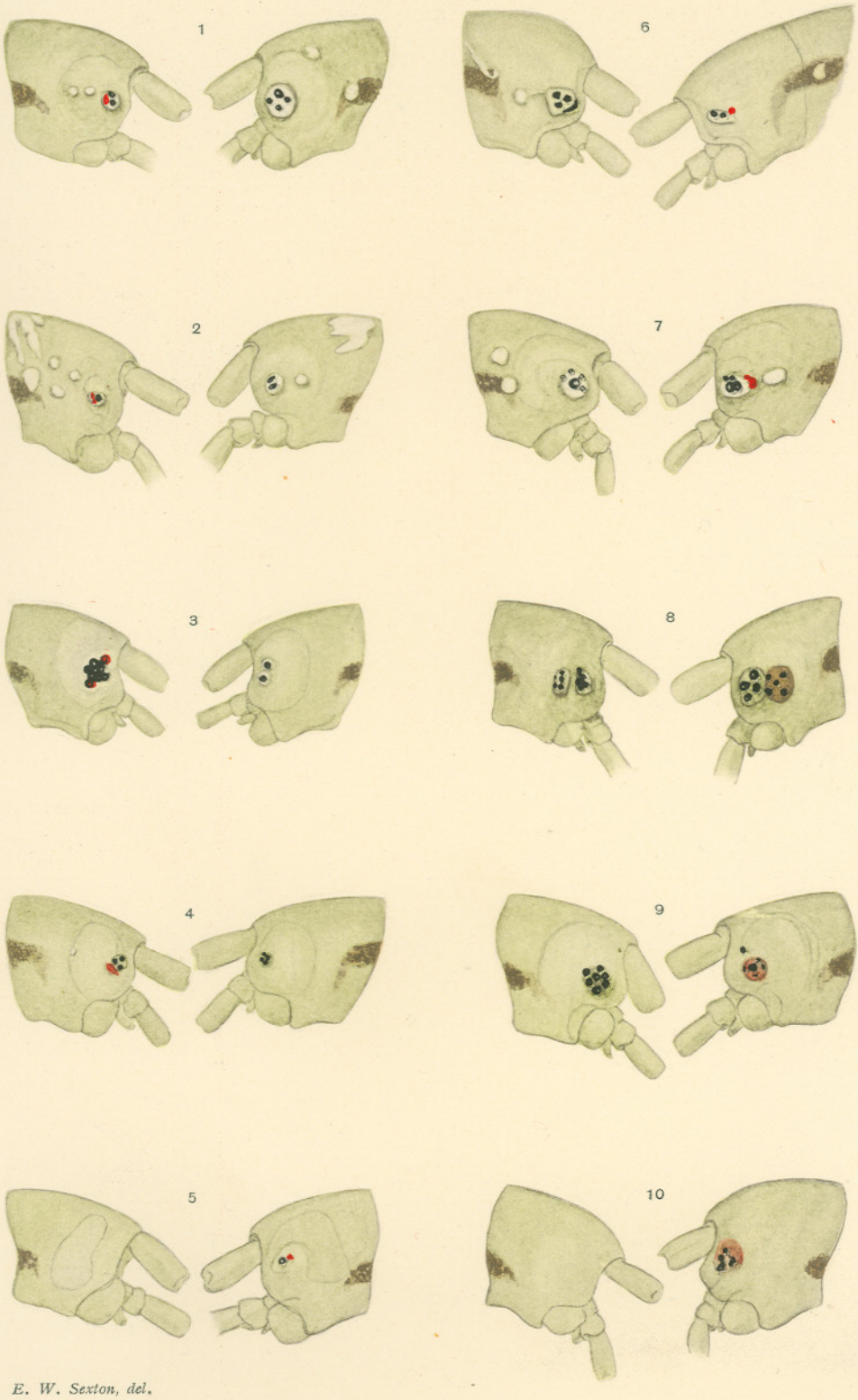

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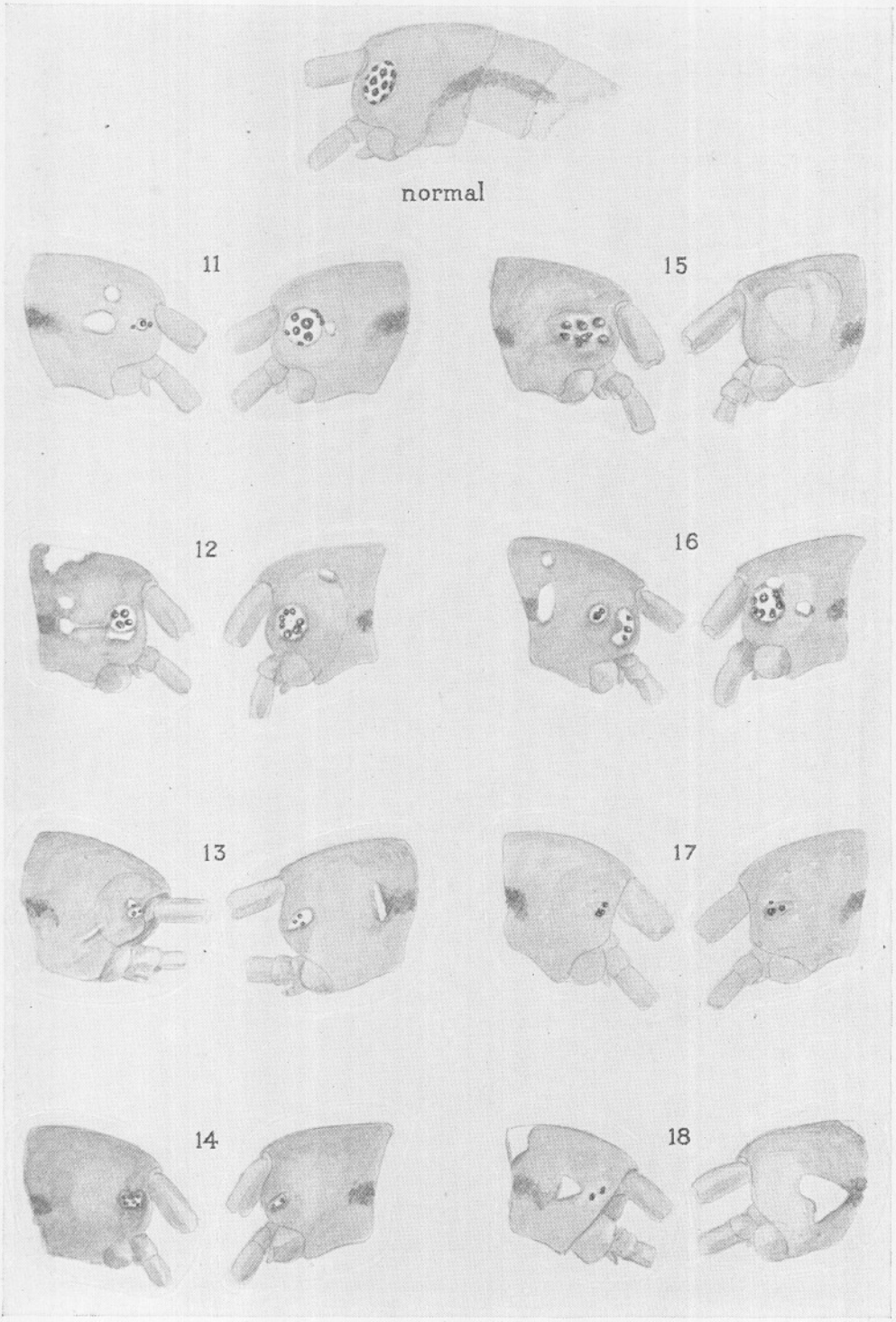
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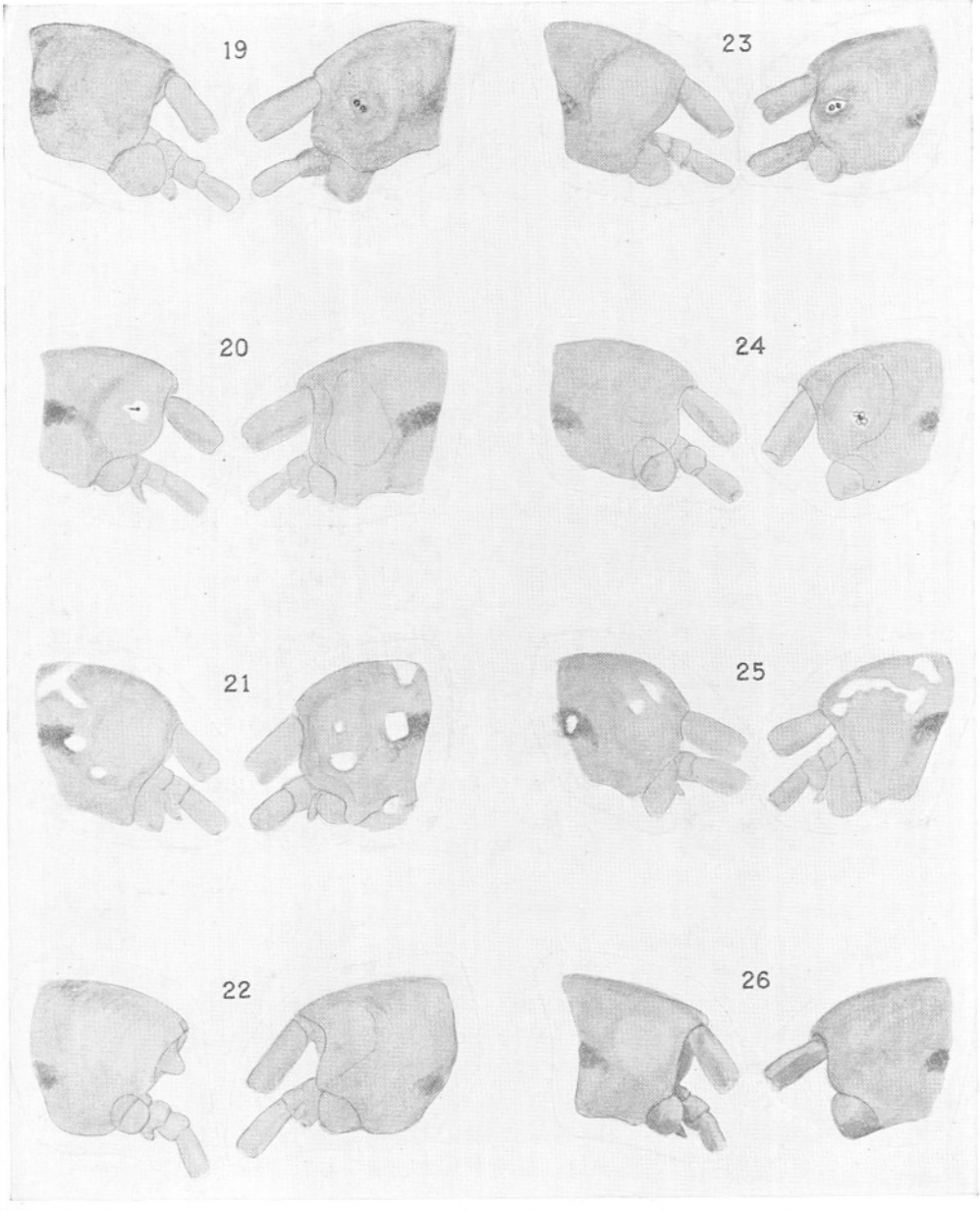
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III. LIST SHOWING THE OCCURRENCE OF THE IRREGULAR-EYE CHARACTER IN THE OFFSPRING FROM THE MATING CN.1*b*.

The abbreviations used are as follows:—B, Black; BN, Black No-white; R, Red; RN, Red No-white; A, Albino; AN, Albino No-white; R, right when used with "eye"; RS, right side; L, left; and LS, left side.

Brood Number.	Number in Class.	Description.	Black. Unspotted.	Black. Spotted.	Black. No-white.	Red. Unspotted.	Red. Spotted.	Red. No-white.	Albino. Unspotted.	Albino. Spotted.	Albino. No-white.	Notes.
F_1 Generation.												
IX	24	Normals	19	5	–							
XIV	38	,,	25	13	–							
XIX	32	,,	19	12	1							Recessive appearing in the F_1 generation.
XXII	13	,,	12	1	–							
F_2 Generation.												
IX.												
Family 1.	B ♂ 1 with B ♀ 1*a*.											
46	7	Normals	1	–	1	1	–	–	2	1	1	
55	11	Normals	3	2	2	1	–	1	1	1	–	
	2	*Irregulars*	–	2	–	–	–	–	–	–	–	*1 with irregular R eye; 1 with L eye.*
65	18	Normals	4	3	4	1	1	–	–	2	*3	*1 of the AN, very spotted.
Family 2.	Same ♂ with B ♀ 1*b*.											
103	22	Normals	9	2	3				3	1	*4	*1 of the AN with a spot.
112	27	,,	10	5	4				2	4	2	
Family 3.	Same ♂ with B ♀ 1*c*.											
119	6	Normals	2	2	–				–	–	2	
126	31	,,	14	7	6				2	2	–	1 B ♂ No antenna=M III in records, p. 358.
129	28	,,	13	2	9				2	–	2	
131	10	,,	4	2	1				1	1	1	
140	22	,,	9	1	5				3	3	1	
145	18	,,	6	4	4				1	3	–	
156	21	Normals	11	3	3				3	1	2	1 BN ♀ No antenna.
	2	*Irregulars*	–	2	–				–	–	–	*Both with irregular L eye.*
158	25	Normals	12	5	3				3	2	–	
166	32	,,	9	6	6				5	5	1	1 BN developed irregularity.
175	28	,,	14	3	5				2	2	2	
Family 4.	B ♂ 2 with B ♀ 2.											
45	6	Normals	2	–	2				–	–	2	
53	15	,,	6	1	4				4	–	–	
63	20	,,	13	1	1				3	1	1	
73	29	,,	12	–	11				3	1	2	
79	27	,,	15	1	4				2	3	2	
84	34	,,	13	–	7				9	3	2	
93	28	,,	17	1	1				5	1	3	
100	28	,,	11	1	8				3	1	4	
109	18	,,	12	–	3				3	–	–	
117	9	,,	4	–	2				1	2	–	
Family 5.	B ♂ 4 with B ♀ 4.											
58	10	Normals	5	1	1	1	–	–	1	–	1	
68	19	,,	9	1	1	4	–	–	4	–	–	
76	21	,,	9	–	2	4	–	1	4	–	1	
85	8	,,	1	–	1	3	–	1	2	–	–	
Family 6.	Matings in brood-bowl.											
35	1	Normal	–	–	1				–	–	–	
38	4	Normals	2	–	1				–	1	–	
39	4	,,	4	–	–				–	–	–	
40	5	,,	1	1	–				2	1	–	

Brood Number.	Number in Class.	Description.	Black. Unspotted.	Black. Spotted.	Black. No-white.	Red. Unspotted.	Red. Spotted.	Red. No-white.	Albino. Unspotted.	Albino. Spotted.	Albino. No-white.	Notes.
XIV.												
44	6	Normals	1	3	1				–	1	–	
47	4	,,	1	–	–				3	–	–	
51	6	,,	3	–	2				–	1	–	
XIX.												
Family 1.		B ♂ 1 with B ♀ 1*a*.										
59	5	Normals	4	–	1				–	–	–	
70	1	Normal	–	–	–				1	–	–	
Family 2.		Same ♂ with B ♀ 1*b*.										
80	14	Normals	10	–	3				1	–	–	
Family 3.		Same ♂ with B ♀ 1*c*.										
102	4	Normals	3	–	1				–	–	–	
111	37	,,	12	5	4				6	8	2	
116	12	,,	8	1	1				–	–	2	
124	25	,,	8	3	8				3	2	1	
133	14	Normals	6	3	2				–	1	2	
	2	*Irregulars*	*1*	*1*	–				–	–	–	*Both with R eye irregular*
134	5	Normals	1	3	–				–	1	–	
	2	*Irregulars*	*1*	*1*	–				–	–	–	*1 with R eye irregular; and 1 spotted with L eye.*
135	30	Normals	12	3	5				6	*2	2	*1 Spotted Albino with L eye divided into 2 pieces.
Family 4.		♂ 2 with ♀ 1*c*.										
169	11	Normals	1	–	1	1	–	2	1	3	2	
	1	*Irregular*	–	–	*1*	–	–	–	–	–	–	*This BN had R eye much smaller than L.*
Family 5.		♂ 2 with ♀ 5.										
122	21	Normals	10	3	4	–	–	–	1		–	
Family 6.		B ♂ 2 with B ♀ 2.										
61	5	Normals	2	1	1	–	–	–	–	–	1	
69	13	,,	5	–	2	4	–	–	1	–	1	
78	18	,,	5	–	4	3	–	3	1	1	1	
83	13	,,	3	–	1	3	–	2	4	–	–	
Family 7.		B ♂ 3 with B ♀ 3.										
67	4	Normals	1	–	1				2	–	–	
77	11	,,	9	–	–				2	–	–	
82	20	,,	11	–	2				3	1	3	
90	22	,,	8	1	7				1	2	3	
95	21	,,	9	1	5				2	2	2	
105	17	,,	9	1	–				5	1	1	
114	25	,,	12	–	5				6	1	1	
Family 8.		B ♂ 5 with B ♀ 5.										
87	7	Normals	2	2	2				–	–	1	
92	8	,,	2	*2	2				1	1	–	*1 was a One-sided No-white LS.
99	9	,,	2	–	4				1	1	1	
108	11	,,	4	–	4				1	2	–	
Family 9.		B ♂ 6 with B ♀ 6.										
81	5	Normals	1	3	–				1	–	–	
89	9	,,	3	2	–				3	–	1	
96	16	,,	8	2	2				2	1	1	
106	17	,,	7	2	4				1	2	1	
Family 10.		B ♂ 6 with ♀ 1*c*.										
88	12	Normals	7	2	1				1	–	1	
Family 11.		Matings in brood-bowl.										
52 ♀ 1	4	Normals	*4	–	–							*The one survivor was an Intersex (**5**, p. 516).
71 ♀ 5	5	,,	3	–	1				–	–	1	
75 ♀ 4	9	,,	4	–	1				2	1	1	
XXII												
Family 1.		B ♂ with B ♀ 1.										
66	17	Normals	3	–	2	3	–	1	1	5	2	
Family 2.		Same ♂ with B ♀ 2.										
94	22	Normals	8	1	5	1	–	1	2	2	2	
101	29	,,	5	2	6	6	–	1	3	3	3	
110	24	,,	9	1	2	3	1	2	2	2	2	

Brood Number.	Number in Class.	Description.	Black. Unspotted.	Black. Spotted.	Black. No-white.	Red. Unspotted.	Red. Spotted.	Red. No-white.	Albino. Unspotted.	Albino. Spotted.	Albino. No-white.	Notes.
Family 3.		Same ♂ with B ♀ 3.										
118	13	Normals	2	2	2	1	1	–	2	2	1	
	1	*Irregular*	–	–	*1*	–	–	–	–	–	–	*L eye irregular.*
125	21	Normals	7	1	2	5	2	–	1	2	1	
128	9	,,	5	–	–	–	–	1	1	–	2	
138	8	,,	2	2	3	–	–	–	–	1	–	The 3 BN are reddish black.
141	18	,,	6	3	2	3	1	–	1	2	–	
149	4	,,	1	–	–	1	–	–	1	–	1	
155	15	,,	6	–	4	1	–	1	1	2	–	
162	17	,,	5	2	3	3	–	3	1	–	–	
168	25	,,	9	1	3	5	1	2	1	–	3	
178	15	,,	3	1	2	1	1	–	3	3	1	
186	22	,,	4	1	4	5	–	1	2	3	2	1 of the Spotted Albino with R eye almost in 2 pieces.
194	17	,,	6	3	5	–	1	–	1	1	–	The Spotted Albino with R eye rather irregular.
224	12	,,	6	–	3	1	–	1	–	1	–	
258	15	Normals	7	1	2	1	1	2	–	–	1	
	1	*Irregular*	–	–	–	–	–	*1*	–	–	–	*L eye irregular.*
Family 4.		Same ♂ with B ♀ 4.										
56	9	Normals	6	1	1	–	–	–	1	–	–	

F_3 Generation.

IX

Family 1
Brood 65 B ♀, with ♂ 126, Fam. 3.

Family 2.
Brood 103 Pair 1 B ♂ with B ♀.

164	5	Normals	2	2	1	
172	6	,,	5	1	–	
183	13	Normals	4	4	*5	*1 Intersex (183*m*, **5**, p. 532).
	9	*Irregulars*	–	**8*	*1*	**1 Intersex (183*c*, **5**, p. 538) both eyes irregular ; 2 others irreg. both eyes ; 5 R eye irregular.*
	1	**One-eye**	–	*1*	–	**Right eye missing.**
190	6	Normals	1	2	3	1 of the spotted had the head malformed.
	11	*Irregulars*	*5*	*6*	–	Unspotted. *1 with R eye irregular ; 4 with L eye (1 of these was No-white RS).* Spotted : *2 with both eyes irregular ; 2 with R eye ; 2 with L eye (1 of these had only 1 microscopic speck of colour).*
209	7	Normals	4	2	1	
	5	*Irregulars*	*2*	*3*	–	Unspotted : *Both eyes irregular.* Spotted : *2 with both eyes irreg. 1 with L eye.*
	1	**One-eye**	–	*1*	–	**Left eye missing,** *and R eye only a tiny speck of red.*
Brood 103 B ♂ 2 and B ♀.						
174	4	Normals	–	3	–	
Brood 103 B ♂ 2 and B ♀ 3.						
173	9	Normals	5	**4*	–	**1 developed irregularity in L eye.*
	7	*Irregulars*	*1*	*6*	–	Unspotted : *both eyes irregular.* Spotted : *3 with both eyes irregular ; 2 with R eye ; 1 with L eye.*
210	8	Normals	2	6	–	1 unspotted, and 3 spotted with very irregular white pigment ; 1 spotted developed slight irregularity LS.
	6	*Irregulars*	*2*	*4*	–	Unspotted : *R eye irregular.* Spotted : *3 with R eye ; 1 with L eye.*
	3	**One-eyes**	–	*3*	–	**Left eyes missing** ; *R eye irregular in all and much spotted.* (*One Figured* on p. 365.)
259	7	Normals	6	1	–	
	9	*Irregulars*	*3*	**6*	–	**Intersex (**5**, p. 521) with L eye irregular.* Unspotted : *2 with R eye irreg. ; 1 with L eye.* Spotted : *2 with both eyes ; 4 with L eye, including Intersex ; (one of these developed irregularity in R eye).*

Brood Number.	Number in Class.	Description.	Black. Unspotted.	Black. Spotted.	Black. No-white.	Red. Unspotted.	Red. Spotted.	Red. No-white.	Albino. Unspotted.	Albino. Spotted.	Albino. No-white.	Notes.
Brood 103 B ♂ 2 with BN ♀ 112*b*.												
199	8	Normals	–	5	–				1	2	–	
	11	*Irregulars*	*1*	***10**	–							*Intersex *with 2 truncate spines.* Unspotted : *1 with L eye irregular.* Spotted : *2 with both eyes (1 with a lateral coloured spot) ; 8 with R eye.*
	2	**One-eyes**	–	*2*	–							**Right eye missing** *in both ; left eye very irregular (1 had only a microscopic speck of colour).*
228	9	*Irregulars*	*2*	*7*	–							Unspotted : *1 with both eyes irreg. ; 1 with L eye.* Spotted ; *all 7 with both eyes irregular.* (Text-fig. 1.)
	8	**Eyes missing**	–	*2*	–							**6 No-eyes** (Text-fig. 6), *(1 with microscopic speck of colour in the lateral position RS) ; 2 with* **Left eye missing** *(1 had R eye normal, in the other there was only a speck of colour).*
249	8	Normals	6	1	–				–	1	–	
	1	*Irregular*	–	*1*	–				–	–	–	*Both eyes irregular.*
	1	**One-eye**	–	–	–				–	*1*	–	**Right eye missing.**
261	4	Normals	2	2	–							
	11	*Irregulars*	*5*	*6*	–							Unspotted : *4 with R eye irregular ; 1 with L eye.* Spotted : *3 with both eyes ; 2 with R eye ; and 1 with L eye.*
	2	**No-eyes**										**2 No-eyes spotted.**
Brood 112 Pair 1 B ♂ and B ♀.												
198	3	Normals	1	–	1				1	–	–	
	2	*Irregulars*	–	*1*	*1*							*L eyes irregular.*
220	3	Normals	2	–	1							
	1	*Irregular and* **One-eye**	–	*1*	–							**Right eye missing,** *L eye irregular.*
241	16	Normals	8	1	3				2	2	–	Nearly all with thin or uneven reticulation.
	3	*Irregulars*	–	*2*	*1*				–	–	–	Spotted : *1 with both eyes irregular ; 1 with R eye.* BN *with R eye irregular.*
257	17	Normals	9	1	3				3	***1**	–	*Intersex (**5**, p. 534).
	2	**No-eyes**										**2 No-eyes,** *unspotted.*
268	6	Normals	3	1	1				1	–	–	
	2	*Irregulars*	–	*1*	*1*							B spotted, *both eyes irregular :* BN *with R eye.*
Family 3.												
Brood 126 B ♂ with B ♀ 65 of Fam. 1.												
200	17	Normals	5	8	–				–	4	–	All with reticulation uneven and irregular.
	4	*Irregulars*	*1*	*1*	–				–	*2*	–	B unspotted : *L eye irregular.* Spotted : *R eye.* A *with L eye irregular.*
211	29	Normals	19	4	–				–	6	–	
	4	*Irregulars*	–	*4*	–				–	–	–	*1 with both eyes irregular ; 3 with L eye.*
231	17	Normals	8	6	–				–	3	–	1 of the B unspotted had part of the ommateum separate LS ; it joined together in 3 months.
	5	*Irregulars*	*1*	*1*	–				–	*3*	–	B unspotted : *R eye irregular.* Spotted : *L eye.* A, spotted : *1 with divided R eye ; 2 with minute L eye.*
248	23	Normals	9	9	–				2	3	–	All with very uneven reticulation.
	4	*Irregulars*	–	–	–				–	*4*	–	*1 with very minute irregular eyes ; 1 with R eye, and 2 with L eye microscopic.*
260	3	Normals	1	1	–				–	1	–	
	2	*Irregulars*	*1*	*1*	–				–	–	–	*R eyes irregular.*
269	24	Normals	11	***11**	–				–	2	–	*2 Intersexes.
	4	*Irregulars*	–	*1*	–				–	*3*	–	B spotted : *both eyes irregular.* A *1 with R eye and 1 with L eye very irregular.*
	1	**No-eyes**										**No-eyes.** *No cones seen, but specks of white.*
277	18	Normals	6	8	–				3	1	–	
	13	*Irregulars*	*4*	*8*	–				–	*1*	–	B unspotted : *1 with both eyes irregular ; 1 with R, and 2 with L eye.* Spotted : *4 with both eyes irregular; 1 with R, and 3 with L eye.* A spotted : *R eye irregular.*

Brood Number.	Number in Class.	Description.	Black. Unspotted.	Black. Spotted.	Black. No-white.	Red. Unspotted.	Red. Spotted.	Red. No-white.	Albino. Unspotted.	Albino. Spotted.	Albino. No-white.	Notes.
286	23	Normals	12	8	–				1	2	–	
	4	*Irregulars*	–	*3*	–				–	*1*	–	B *all with L eye irregular* : A *with R eye.*
299	6	Normals	2	2	–				1	1	–	1 of the B spotted had a very malformed head ; the other had a spot joined on outer margin of eye.
	1	*Irregular*	–	*1*	–				–	–	–	*R eye irregular.*
314	15	Normals	7	*5	–				2	1	–	*Intersex.
	4	*Irregulars*	*1*	*3*	–				–	–	–	Unspotted : *L eye irregular.* Spotted : *2 with R eye ; 1 with L eye. All slightly.*
Brood 126*a* Pair 1 B ♂ and B ♀.												
182	6	Normals	2	–	1				1	–	2	
	1	*One-sided No-white*	–	–	–				–	*1*	–	A spotted, *with L eye no-white.*
Brood 126*a* Pair 2 B ♂ and B ♀.												
181	4	Normals	2	–	–				1	1	–	
Brood 156 B ♂ and 112 BN ♀ from Fam. 2.												
310	3	Normals	–	–	2				–	–	1	1 BN developed irregularity in both eyes.
Brood 166*b* B ♂ and ♀ spotted.												
254	7	Normals	2	3	–				–	2	–	Albinos with very small eyes and large spots.
262	7	Normals	4	1	–				–	2	–	
	1	*Irregular*	–	*1*	–							*L eye irregular.*
Family 4. Mating in 63 bowl.												
123	6	Normals	5	–	–				1	–	–	
Family 5. No F_3 offspring.												
Family 6. No F_3 offspring.												
XIV. No F_3 offspring.												
XIX.												
Families 1, 2, and 3. No F_3 offspring.												
Family 4.												
Brood 169 Red ♂ and B ♀.												
216	14	Normals	11	*1	2							*Intersex. Mated (**5**, p. 527).
226	21	Normals	18	1	2							
	2	*Irregulars*	–	*1*	*1*							B *with L eye slightly irregular.* BN *with R eye slightly.*
Family 5. No F_3 offspring.												
Family 6.												
Brood 69 Red ♂ 3 and Red ♀ 2.												
189	21	Normals				18	3	–				
196	28	,,				23	5	–				
208	25	,,				24	1	–				
225	17	Normals				16	1	–				
	1	*One-sided No-white*				–	*1*	–				*L side no-white.*
233	36	Normals				35	1	–				Spotted Red developed irregularity in both eyes.
	2	*Irregulars*				*1*	*1*	–				*Both with R eye irregular.*
Brood 69 Same Red ♂ 3 and B ♀.												
127	13	Normals	10	3	–							
130	15	,,	14	1	–							
132	23	,,	19	4	–							
136	20	,,	19	1	–							
139	18	,,	14	4	–							
142	21	,,	16	5	–							
151	23	Normals	16	7	–							
	1	*Irregular*	–	*1*	–							*Both eyes irregular.*
157	28	Normals	*22	6	–							*2 Intersexes, both of which developed irregularity (**5**, pp. 520 and 534).
165	21	Normals	16	5	–							
	3	*Irregulars*	3	–	–							*2 with R eye irregular ; 1 with L eye.*

Brood Number.	Number in Class.	Description.	Black. Unspotted.	Black. Spotted.	Black. No-white.	Red. Unspotted.	Red. Spotted.	Red. No-white.	Albino. Unspotted.	Albino. Spotted.	Albino. No-white.	Notes.
Brood 69 Same Red ♂ 3, with B ♀ 96 of Fam. 9.												
265	25	Normals	*18	*7	–							*2 Intersexes (5, pp. 526 and 530).
	1	*Irregular*	*1*	–	–							*R eye irregular.*
274	35	Normals	30	5	–							1 spotted B developed irregularity in both eyes.
	4	*Irregulars*	*3*	*1*	–							*1 unspotted with R eye irregular; the others with both eyes irregular.*
284	36	Normals	*31	5	–							*Intersex. The largest (5, p. 531) : 1 of the unspotted almost No-white.
	1	*Irregular*	*1*	–	–							*R eye irregular.*
293	24	Normals	*24	–	–							*2 Intersexes (5, pp. 519 and 542), one of which developed irregularity in both eyes. Left eye twice size of Right, as if 2 eyes were placed one behind the other. Another B developed irregularity, portion separate.
	1	*Irregular*	–	*1*	–							*R eye irregular.*
Brood 69 Red ♀ 2 in brood bowl.												
115	8	Normals	2	1	5							
Brood 69 Same Red ♀ 2 with A bino ♂												
121	9	Normals	3	2	4							
Family 7												
Brood 105 Pair 1 B ♂ and B ♀.												
163	1	Normal	1	–	–							
170	19	Normals	16	3	–							
179	23	,,	20	3	–							
187	32	,,	20	12	–							
195	37	,,	35	2	–							
204	41	,,	30	11	–							
223	20	Normals	7	13	–							Unspotted : 2 with malformed head. Spotted : 1 with patchy reticulation.
	1	*Irregular*	–	*1*	–							*L eye irregular.*
Family 8. No F_3 offspring.												
Family 9.												
Brood 96 B ♀ mated in Fam. 6.												
Brood 106. Matings in bowl.												
143	35	Normals	*18	6	–				5	6	–	*Intersex : 1 unspotted A developed irregularity.
146 ♀ 1	19	,,	10	1	–				4	4	–	
148 ♀ 2	16	,,	7	3	–				4	2	–	
Brood 106 Pair 1 B ♂ and B ♀.												
152	13	Normals	5	5	–				3	–	–	
	1	*Irregular*	*1*	–	–				–	–	–	*R eye irregular.*
159	13	Normals	9	1	–				1	2	–	
Brood 106 Pair 2 B ♂ spotted dorsally and B ♀.												
154	2	Normals	2	–	–							
171	10	,,	6	4	–							
180	10	,,	7	3	–							
188	25	,,	20	5	–							
197	27	Normals	19	8	–							
	2	*Irregulars*	–	*2*	–							*1 with R eye No-white and irregular, 1 with R eye practically No-white.*
205	34	Normals	21	13	–							
	3	*Irregulars*	*2*	*1*	–							Unspotted : *1 with both eyes irregular; 1 with L eye.* Spotted : *R eye irregular.*
218	35	Normals	26	*9	–							*Intersex (5, p. 543), developed slight irregularity.
Families 10 and 11. No F_3 offspring.												
XXII.												
Family 1. No F_3 offspring.												

Brood Number.	Number in Class.	Description	Black. Unspotted.	Black. Spotted.	Black. No-white.	Red. Unspotted.	Red. Spotted.	Red. No-white.	Albino. Unspotted.	Albino. Spotted.	Albino. No-white.	Notes.
Family 2.												
Brood 101 B ♂ 2 and Red ♀												
160	1	Normal	1	–	–							
167	15	Normals	9	6	–							Unspotted: 1 developed irregularity and lost its antennæ.
177	19	,,	8	11	–							
185	17	,,	13	4	–							
192	16	,,	12	4	–							
203	28	,,	15	13	–							
215	14	,,	12	2	–							
Brood 110 B ♂ and B ♀.												
176	1	Normal	–	–	1	–	–	–				
184	2	Normals	1	–	–	–	–	1				
191	10	Normals	3	1	3	2	–	1				
	1	*Irregular*	*1*	–	–	–	–	–				*L eye slightly irregular.*
214	9	Normals	2	5	1	1	–	–				Red one developed irregularity.
	2	*Irregulars*	–	*2*	–	–	–	–				*1 with both eyes irregular; 1 with R eye.*
245	18	Normals	7	3	2	3	–	3				
Family 3.												
Brood 125. Red ♂ and ♀.												
150	1	Normal	–	–	–	1	–	–				
Family 4. No F_3 offspring.												
Cross-matings.												
IX. Fam. 3. 166*c* *No antenna* A ♂ × XIX Fam. 9. B ♀ 159.												
238	12	Normals	11	1	–							
263	20	Normals	14	6	–							
	2	*Irregulars*	*1*	*1*	–							Unspotted: *L eye slightly irregular, almost No-white.* Spotted: *L eye irregular.*
271	15	Normals	9	6	–							
	4	*Irregulars*	*4*	–	–							*2 with both eyes irregular; 1 with R eye; and 1 with L eye.*
280	10	Normals	10	–	–							
290	24	Normals	17	7	–							
	1	*Irregular*	–	*1*	–							*R eye irregular.*
301	35	Normals	27	8	–							
327	4	,,	3	1	–							
328	8	,,	*8	–	–							*Intersex (**5**, p. 544).
IX. Fam. 3. 156 B ♂ × XXII. Fam. 3. B ♀ 141.												
243	4	Normals	2	–	–	–	1	–	–	1	–	
253	20	,,	4	2	1	5	1	1	1	4	1	
XIX. Fam. 6. 121 BN ♂ × XXII. Fam. 3. B ♀ 141 (sister to the above).												
255	25	Normals	10	9	–	2	2	–	–	2	–	
IX. Fam. 3. 166*d* BN ♂ *irregular eyes* × BN ♀ 113 from CN.1*c* (similar mating to CN .1*b*=same ♂ and dorsally spotted A ♀.												
267	4	Normals	–	–	4							
276	21	,,	–	–	21							
287	13	,,	–	–	13							
295	8	,,	–	–	8							
IX. Fam. 3. 166*a* *No antenna* A ♂ × AN ♀ C 132 from AN+R stock.												
239	9	Normals							2	7	–	Unspotted: 1 developed spots.
275	14	,,							8	6	–	
IX. Fam. 3. 175*d* AN ♂ + B × Red ♀ M13 from Original Red Stock.												
RF.1	6	Normals	*6	–	–							*Intersex (**5**, p. 533).
IX. Fam. 2. 112 B ♂ 1 × B ♀♀ 223 Fam. 7, XIX.												
347	16	Normals	12	4	–							
363	1	Normal	1	–	–							
IX. Same 112 B ♂ × B ♀ 232 spotted. Fam. 6 XIX.												
353	15	Normals	12	3	–							
358	9	Normals	9	–	–							
	3	*Irregulars*	*2*	*1*	–							Unspotted: *1 with R eye; 1 with L eye irregular.* Spotted: *1 with R eye.*
366	3	Normals	3	–	–							

Brood Number.	Number in Class.	Description.	Black. Unspotted.	Black. Spotted.	Black. No-white.	Red. Unspotted.	Red. Spotted.	Red. No-white.	Albino. Unspotted.	Albino. Spotted.	Albino. No-white.	Notes.
IX. Same 112 B ♂ × Red ♀ from M13. Original stock.												
357	3	Normals	2	1	–							
	2	*Irregulars*	*1*	*1*	–							Unspotted: *R eye irregular, developed irregularity in L eye.* Spotted: *both eyes irregular.*
373	5	Normals	3	2	–							

F_4 Generation.

IX. Family 2.
Brood*164. No F_4 offspring.

Brood 172. (1) B ♂ × B ♀ 171. Fam. 9, XIX.

242	3	Normals	2	1	–							
285	23	Normals	*26	3	–							*Intersex (**5**, p. 542)
	1	*Irregular*	*1*	–	–							*R eye irregular.*

Brood 172 (2) B ♂ × B ♀ (2) 171. Fam. 9, XIX.

230	6	Normals	4	2	–							
	1	*Irregular*	*1*	–	–							*R eye irregular.*
251	1	Normal	1	–	–							
279	18	Normals	16	2	–							
288	16	Normals	14	2	–							
	1	*Irregular*	*1*	–	–							*R eye irregular.*
356	18	Normals	13	5	–							

Brood 183. No F_4 offspring.
Brood 190. No F_4 offspring.
Brood 209 B ♂ × B ♀ 206b, *irregular* with L eye much smaller; became normal and eyes same size. Fam. 6, XIX.

304	12	Normals	9	3	–							

Same 209 B ♂ × B ♀ 246 (F_3). Fam. 3. IX.

305	6	Normals	6	–	–							
	1	*Irregular*	–	*1*	–							*R eye irregular.*
323	19	Normals	*12	7	–							*2 Intersexes (**5**, p. 536).
	2	*Irregulars*	*1*	*1*	–							Unspotted: *L eye irregular.* Spotted: *R eye irregular.*

Brood 174. No F_4 offspring.
Brood 173 B ♂ × B ♀.

236	2	Normals	1	1	–							
247	10	Normals	4	6	–							
	4	*Irregulars*	–	*4	–							*Intersex, *both eyes irregular* (**5**, p. 529); *2 with both eyes irregular and 1 with R eye.*
278	4	Normals	–	4	–							
	1	*Irregular*	–	*1*	–							*L eye irregular.*
289	6	Normals	*4	2	–							*Intersex (**5**, p. 528); Spotted: 1 lost both First Antennae, and developed great irregularity in both eyes; lobed; the other developed irregularity in R eye.
	6	*Irregulars*	*1*	*5*	–							*Intersex (**5**, p. 533); Unspotted: *R eye irregular, developed in L also* Spotted: *2 with both eyes, 1 with R eye, and 2 with L eye irregular (one of these became irregular in R eye and intersex).*
298	17	Normals	11	6	–							
	4	*Irregulars*	*2*	*2*	–							*All with both eyes irregular.*

Same ♂ 173 × A ♀ 169. Fam. 4. XIX.

235	3	Normals	3	–	–							
	7	*Irregulars*	*1*	*6*	–							Unspotted: *R eye irregular.* Spotted: *1 with both eyes, 1 with R, and 4 with L eye irregular (the one with R eye irregular, developed irregularity in L eye also.*
237	2	Normals	2	–	–							
	4	*Irregulars*	*3*	*1*	–							Unspotted: *2 with both eyes irregular, and 1 with R.* Spotted: *R eye irregular.*

Brood Number	Number in Class.	Description.	Black. Unspotted.	Black. Spotted.	Black. No-white.	Red. Unspotted.	Red. Spotted.	Red. No-white.	Albino. Unspotted.	Albino. Spotted.	Albino. No-white.	Notes.
Brood 173 B ♂ dorsal spot, *developed irregular L. eye* × B ♀ 171. Fam. 9. XIX.												
246	15	Normals	11	4	–							
Brood 173*h* B ♀ *both eyes irregular* × BN ♂ *Divided-eye* (see text-fig. 2)												
296	15	Normals	10	5	–							
302	7	,,	6	1	–							
312	11	Normals	9	2	–							
	2	*Irregulars*	–	2	–							*Both eyes irregular; (one with R eye divided in 2 pieces).*
318	18	Normals	18	–	–							
	5	*Irregulars*	4	1	–							Unspotted: *all with L eye irregular.* Spotted: *both eyes irregular.*
Brood 210*d* B ♀ spotted, developed *irregular L eye* × AN ♂ II.												
315	3	Normals	3	–	–							
	4	*Irregulars*	1	3	–							Unspotted: *L eye irregular.* Spotted: *1 with both eyes; 2 with L eye irregular.*
330	10	Normals	6	4	–							
	3	*Irregulars*	–	3	–							*1 with R eye, 2 with L eye irregular.*
Brood 210*l* B ♀ *R eye irregular* × AN ♂ V.												
337	4	Normals	4	–	–							
	2	*Irregulars*	–	2	–							*1 with both eyes, 1 with R eye irregular*
348	11	Normals	7	4	–							Unspotted: 1 survivor developed irregularity in both eyes.
	2	*Irregulars*	–	2	–							*Both with L eye irregular.*
Brood 210*e* B ♀ *irregular both eyes* × AN ♂ V.												
338	6	Normals	1	2	–	2	1	–				
	4	*Irregulars*	1	2	–	1	–	–				B unspotted: *both eyes irregular.* Spotted: *1 with both eyes, 1 with R eye irregular.* Unspotted: R, *with L eye.*
Brood 210*n* **One-eye** *left eye missing, and R eye irregular* × AN + R ♂ II.												
321	3	Normals	1	2	–							
	5	*Irregulars*	3	2	–							Unspotted: *1 with R eye, 2 with L eye irregular.* Spotted: *1 with both eyes, and 1 with L eye irregular.*
Brood 210*n*, **One-eye** same B ♀ × AN + R ♂ from same stock as II and V.												
379	12	**All irregular**	3	9	–							Unspotted: *1 with both eyes, 2 with L eye irregular.* Spotted: *6 with both eyes, 2 with R, and 1 with L eye irregular.*
Brood 210*l* B ♀ as above × B ♂ 259*j*, same family, *L eye irregular at birth, R eye developed irregularity later.*												
370	2	Normals	1	1	–							
	6	*Irregulars*	3	3	–							Unspotted: *both eyes irregular* Spotted: *1 with R eye, 2 with L eye irregular.*
Brood 259*h* B ♂ and B ♀ (♂ *both eyes irregular,* ♀ *left eye very irregular, became Intersex).*												
336	2	**Irregulars** (see p. 368 for description).										
Brood 199. No F_4 offspring.												
Brood 228. No F_4 offspring.												
Brood 249 B ♀ × BN ♂ 257 of this same family.												
339	15	**All Irregular** All eyes different.	4	3	and 3	unspotted B or BN?						
		No-eyes	3 (2 spotted).									
		One-eyes	2 Both with **Right eye missing** *and*						*Left eye microscopic.*			
349	26	**All Irregulars,** all with different eyes. Figured on Plates IV, 5 and 6.										
		No-eyes	4 (2 spotted).									
		One-eyes	8 (5 with **Right eye missing** and 3 with **Left eye missing**).									
Brood 261. No F_4 offspring.												
Brood 198. No F_4 offspring.												
Brood 220 B ♂ **One-eye,** developed the second eye (See Text-fig. 5) × AN ♀ from C. stock.												
319	19	Normals	3	–	1	2	1	2	4	1	5	=9 Coloured: 10 Albino (one ♂ lost its First Antennae).
Brood 241. No F_4 offspring.												
Brood 257. 1 BN ♂ (see Brood 249 above).												
Brood 268. No. F_4 offspring.												

Brood Number.	Number in Class.	Description.	Black. Unspotted.	Black. Spotted.	Black. No-white.	Red. Unspotted.	Red. Spotted.	Red. No-white.	Albino. Unspotted.	Albino. Spotted.	Albino. No-white.	Notes.
IX. Family 3.												
Brood 200.		A ♂ and A ♀ both spotted.										
283	3	Normals							2	1	–	
292	11	,,							4	7	–	
303	16	,,							9	7	–	
311	6	,,							4	2	–	
320	8	,,							4	4	–	
345	16	Normals							9	7	–	
	3	*Irregulars*							–	*3*	–	*1 with R eye, and 2 with L eye very irregular.*
Brood 211c		B ♂ spotted dorsally, *L eye irregular* × B ♀.										
351	3	Normals	3	–	–							
Brood 211e		B ♂ spotted dorsally, *irregular L eye*				*which became normal* × B ♀ unspotted from Brood 245. Fam. 2, XXII.						
344	10	Normals	5	2	–				–	3	–	
	1	*Irregular*	*1*	–	–				–	–	–	*L eye slightly irregular.*
Brood 231		B ♂ and B ♀ both spotted.										
359	9	Normals	5	1	–	2	1	–				
	3	*Irregulars*	*1*	*2*	–	–	–	–				Unspotted: *L eye irregular.* Spotted: *1 with R eye, and 1 with L eye irregular.*
365	14	Normals	6	1	–	4	3	–				B spotted with L eye No-white.
	3	*Irregulars*	*1*	*2*	–	–	–	–				Unspotted: *L eye irregular.* Spotted: *1 with R eye, 1 with L eye irregular.*
Brood 248		B ♂ × Red ♀, 243 dorsally spotted (same family).										
355	13	Normals	7	–	–				2	4	–	
Brood 260.		No F_4 offspring.										
Brood 269		B ♀ spotted × RN ♂ from No-white Stock.										
368	22	Normals	3	–	6	4	1	8				
	1	*Irregular*	*1*	–	–	–	–	–				*R eye slightly irregular*
Brood 269b		B ♂ spotted × BN ♀ from No-white Stock.										
369	3	Normals	3	–	–							
Broods 277: 286: 299: 314: 212: 181: 182						254: 262: 310:			and 123. No F_4			offspring.
XIX. Family 4.												
Brood 216.		No F_4 offspring.										
Brood 226.		No F_4 offspring.										
Family 6.												
Broods 189: 196: 208: and 225.		No F_4 offspring.										
Brood 233		Red ♂ × Red ♀.										
339a	3	Normals				3	–	–				
Broods 127 and 130.		No F_1 offspring.										
Brood 132		Pair 1 B ♂ and B ♀.										
207	22	Normals	12	4	–	5	1	–				
234	5	,,	1	3	–	–	1	–				
256	37	,,	16	11	–	8	2	–				
266	27	Normals	14	5	–	7	1	–				
	4	*Irregulars*	*1*	*1*	–	*2*	–	–				Unspotted: B *and* R *with L eye irregular.* Spotted: B *with R eye irregular.*
273	18	Normals	13	–	–	5	–	–				
Brood 132 B		B ♀ × B ♂ 142 (same family).										
206	3	Normals	–	1	–	–	2	–				
	4	*Irregulars*	–	*2*	–	–	*2*	–				Spotted: B *1 with both eyes irregular, 1 with L eye*; R *1 with both eyes irregular, and 1 with R eye.*
217	11	Normals	6	5	–							
	6	*Irregulars*	*3*	*2*	–	–	*1*	–				Unspotted: *2 with R eye irregular, 1 with L.* Spotted: B, *1 with R, and 1 with L*; R, *1 with R eye irregular.*
240	4	Normals	2	2	–							
	2	*Irregulars*	*1*	*1*	–							Unspotted: *R eye irregular.* Spotted: *L eye irregular.*
264	13	Normals	8	3	–	1	1	–				
272	12	Normals	7	2	–	2	1	–				
	2	*Irregulars*	*1*	–	–	–	*1*	–				Unspotted: B *with both eyes irregular.* Spotted: R *with R eye.*

Brood Number.	Number in Class.	Description.	Black. Unspotted.	Black. Spotted.	Black. No-white.	Red. Unspotted.	Red. Spotted.	Red. No-white.	Albino. Unspotted.	Albino. Spotted.	Albino. No-white.	Notes.
282	16	Normals	8	4	–	4	–	–				All with very flat eyes, not convex as is normal.
	3	*Irregulars*	*1*	*2*	–	–	–	–				Unspotted: *L eye irregular*. Spotted: *2 with both eyes irregular*.
291	5	Normals	3	1	–	1	–	–				Pigment almost red.
	1	*Irregular*	–	*1*	–	–	–	–				*R eye irregular*.
Brood 136 Pair 2, B ♂ and B ♀.												
193	*1*	*Irregular*	*1*	–	–							*Both eyes irregular*.
Brood 136 Pair 3, B ♂ and B ♀.												
201	5	Normals	5	–	–							
	1	*Irregular*	*1*	–	–							*R eye irregular*.
213	6	Normals	6	–	–							
	7	*Irregulars*	*4*	*1*	–	*1*	*1*	–				Unspotted: B, *1 with both eyes irregular, 2 with R eye, and 1 with L eye*; R, *1 with R eye*. Spotted: B *with L*, R *with R eye*.
229	10	Normals	7	2	–	1	–	–				
	15	*Irregulars*	*3*	**7*	–	–	*5*	–				*Intersex (5, p. 523). Unspotted: *1 with R, 2 with L eye*. Spotted: B, *2 with both eyes, 3 with R, 2 with L eye*; R, *1 with both eyes irregular, 1 with R eye, and 3 with L eye*.
Brood 139. No F_4 offspring.												
Brood 142. 1 B ♂ mated with ♀ 132 (see above).												
Brood 151 B ♂ × B ♀ 105*a* (same family).												
219	12	Normals	7	5	–							
	4	*Irregulars*	*2*	*2*	–							Unspotted: *R eye irregular*. Spotted: *1 with R, 1 with L eye*.
232	37	Normals	31	6	–							
	1	*Irregular*	*1*	–	–							*R eye irregular*.
Brood 157. No F_4 offspring.												
Brood 165*d* B ♂ dorsally spotted × B ♀ spotted.												
227	2	Normals	–	1	–				1	–	–	
	1	*Irregular*	*1*	–	–				–	–	–	*R eye irregular*.
250	7	Normals	3	2	–	2	–	–				
	1	*Irregular*	–	*1*	–	–	–	–				*R eye irregular*.
Brood 165 B ♂ *R eye irregular* × Red ♀ RE 66 from Original Stock.												
244	10	Normals	3	–	–	7	–	–				
Brood 265. 1 B ♂ spotted.												
Brood 274. 1 B ♀ spotted and *developed irregularity*. 265 B ♂ × 274 B ♀.												
342	6	Normals	2	3	–	1	–	–				
	17	Normals	9	4	–	4	–	–				
Broods 284: 293: and 115. No F_4 offspring.												
Brood 121. 1 B ♂ with B ♀ 141 (XXII).												
Family 7. Broods 163: 170: 179: 187: 195: and 204.						No F_4 offspring.						
Brood 223. 2 ♀♀ with ♂ 112. IX.												
Family 9. Brood 143 B ♂ × B ♀ 105. Fam. 7. XIX.												
222	10	Normals	8	2	–							
Broods 146: 148: and 152. No F_4 offspring.												
Brood 159 B ♂ and B ♀.												
221	10	Normals	10	–	–							
Brood 154. No F_4 offspring.												
Brood 171. 2 ♀♀ put with Brood 172. Fam. 2. IX. Broods 180: 188: 197: 205: and 218. No F_4 offspring.												
XXII. Family 2. Broods 160: 167: and 177. No F_4 offspring.												

Brood Number.	Number in Class.	Description.	Black. Unspotted.	Black. Spotted.	Black. No-white.	Red. Unspotted.	Red. Spotted.	Red. No-white.	Albino. Unspotted.	Albino. Spotted.	Albino. No-white.	Notes.
Brood 185c B ♂ and B ♀-both dorsally spotted.												
252	11	Normals	2	5	1	–	2	1				
270	5	,,	2	1	–	1	–	1				
281	10	,,	2	5	2	–	–	1				
Broods 203 : 215 : 176 : 184 : and 191. No F_4 offspring.												
Brood 214 BN ♂ and B ♀ *irregular eyes.*												
294	10	Normals	4	1	–				–	2	3	
Brood 214 same BN ♂ and B ♀ spotted.												
297	2	Normals	2	–	–							
Brood 245 B ♀ × A ♂ 253*b*. Fam. 3. IX.												
341	2	Normals	1	1	–							
	3	*Irregulars*	*1*	*2*	–							Unspotted : *R eye irregular.* Spotted: *L eyes irregular.*
Brood 245 B ♀ × B ♂ 211c. Fam. 1. IX.												
344	10	Normals	5	2	–				–	3	–	
	1	*Irregular*	*1*	–	–							*L eye very slightly irregular.*
Brood 245 R ♀ × BN ♂ *divided eye* (Text-fig. 2).												
343	21	Normals	5	3	4	4	–	5				
	2	*Irregulars*	–	*1*	–	–	–	1				*Both with L eye irregular.*
Family 3.												
Brood 150. No F_4 offspring.												
Cross matings.												
Broods 238 : 263 : and 271. No F_4 offspring.												
Brood 280 B ♂ and B ♀.												
324	3	Normals	2	1	–							
Broods 290 : 301 : 327 : 328 : and 243. No F_4 offspring.												
Brood 253 with Brood 245 (above).												
Broods 255 : 267 : 276 : 287 : and 295. No F_4 offspring.												
Brood 239c A ♂. very spotted × Red ♀ from Original Stock.												
306	5	Normals	2	–	–	3	–	–				
Broods 275 : 347 : 353 : 358 : 357 : 373 : 363 : 366. No F_4 offspring.												

F_5 Generation.

IX. Family 2.												
Broods 230 : 251 : 279 : 288 : 242 : and 285. No F_5 offspring.												
Brood 356 B ♂ and B ♀.												
419	1	Normal	1	–	–							
434	10	Normals	10	–	–							
447	8	,,	7	1	–							
Broods 304 : 305 : and 323. No F_5 offspring.												
Brood 236 B ♂ × A ♀ dorsally spotted *very irregular* from Albino Stock.												
300	11	Normals	7	4	–							
Brood 236 same B ♂ × Red ♀ 233 *irregular.* Fam. 6. XIX.												
307		**All Irregulars**	*1*	*3*	–							Unspotted : *L eye irregular.* Spotted : *2 with both eyes, and 1 with L eye irregular.*
		One-eye	–	*1*	–							**Left eye missing.**
Brood 236 same B ♂ × Red ♀ 233 (2) *irregular.* Fam. 6. XIX.												
308	12	Normals	5	7	–							
	2	*Irregulars*	*1*	*1*	–							Unspotted : *R eye irregular.* Spotted: *both eyes irregular.*
322	7	Normals	4	3	–							
	1	*Irregular*	1	–	–							*L eye irregular.*
331	27	Normals	25	2	–							
Broods 247 and 278. No F_5 offspring.												
Brood 289*f* B ♀ *eyes very irregular, and lobed. No antenna* × BN ♂ *No antenna developed*												*irregularity* from CN 224 Fam. 3. XXII.
380	6	Normals	4	2	–							
	2	*Irregulars*	–	*2*	–							*1 both eyes irregular, 1 with L eye irregular.*
394	11	Normals	10	1	–							

Brood Number.	Number in Class.	Description.	Black. Unspotted.	Black. Spotted.	Black. No-white.	Red. Unspotted.	Red. Spotted.	Red. No-white.	Albino. Unspotted.	Albino. Spotted.	Albino. No-white.	Notes.
Brood 298 B ♂ and B ♀.												
421	12	Normals	6	1	–	5	–	–				2 have slightly irregular pigment.
Broods 235 and 237. No F_2 offspring.												
Brood 246 B ♀ spotted × B ♂ 209 same stock (see						under ♂).						
Brood 296 B ♂ and B ♀.												
354	2	Normals	2	–	–							
360	6	,,	4	1	1							
367	7	,,	6	–	1							1 unspotted B with slightly irregular pigment.
Broods 302 and 312. No F_5 offspring.												
Brood 318 B ♂ and B ♀.												
372	4	Normals	–	–	2				1	1	–	
	2	*Irregulars*	2	–	–				–	–	–	*Both eyes slightly irregular.*
Broods 315 : 330 : 337 : 348 : 338 : and 321. No F_5 offspring.												
Brood 379*b* B ♂ (Text-fig. 4) × B ♀ 394 (F_3 gen.) fro						m 289 *No antenna*			mating (above).			
429	10	Normals	2	4	2				1	–	1	
Broods 370 : *336 : 339 : 349 :* and 319. No F_5 o						ffspring.						
Family 3.												
Broods 283 : 292 : 303 : 311 : 320 : 345 : 351 : 3						44 : 359 : 365 : 3			55 : 368 : and 3			69. No F_5 offspring.
XIX. Family 6.												
Broods 339*a* : 307 : 207 : 234 : 256 : 266 : and 27						3. No F_5 offsprin			g.			
Brood 206*b* B ♀ spotted, *very irregular eyes which bec*						*ame normal* × B ♂			209 Fam. 2, IX.			
304	12	Normals	9	3	–							
Brood 206*b*. Same B ♀ × B ♂ 217*b* dorsally spotted,						same family.						
313	6	Normals	–	1	–	4	1	–				
	1	*Irregular*	–	–	–	–	*1*	–				*Both eyes irregular*
317	9	Normals	8	1	–	–	–	–				
332	21	,,	14	4	–	3	–	–				
335	13	,,	9	2	–	2	–	–				
Brood 206*a* R ♀ *irregular eyes* × same B ♂ 217*b*.												
333	3	Normals	2	–	–	1	–	–				
346	11	,,	8	2	–	–	1	–				
Brood 240. No F_5 offspring.												
Brood 264 Red ♂ and B ♀.												
329	4	Normals	3	–	–	1	–	–				
Broods 272 : 282 : 291 : 193 : 201 : 213 : and 229						. No F_5 offspring			.			
Brood 219 B ♀ *clusters of ommatidia sep. in both eyes*						× B ♂ 223 spotted			(XIX).			
325	1	Normal	1	–	–							
326	4	Normals	4	–	–							
340	7	,,	5	2	–							
Brood 232 (see under ♂ 112) : 227 : and 250.						No F_5 offspring.						
Brood 244 B ♂ *No antenna* × Red ♀ from Pure Red						Stock.						
350a	6	Normals	3	–	–	3	–	–				
350b	13	,,	3	1	–	9	–	–				
Broods 342 and 352. No F_5 offspring.												
Family 9.												
Brood 222. No F_5 offspring.												
XXII. Family 2.												
Broods 252 : 270 : 281 : 294 : and 297. No F_5 off						spring.						
Brood 343 RN ♂ *spotted* and RN ♀.												
378	4	Normals	–	–	–	–	–	4				
Broods 341 : and 344. No F_5 offspring.												
Cross matings												
Broods 324 : and 306. No F_5 offspring.												