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DESCRIPTION OF THE PREPARATORY STAGES OF GRAPTA INTERROGATIONIS, FAB.

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EGG.—Conoidal, the base flattened and rounded ; marked by 8 or 9 vertical ribs, which near the base are low, but on upper third are considerably elevated, increase gradually in prominence and terminate abruptly around a small flat space at summit ; these ribs are thin and their sides are grooved perpendicular to the surface of the egg ; color pale green. Duration of this stage from 3 to 4 days in summer, in April and early May 10 days.

YOUNG LARVA.—Length 24 hours from egg .1 inch ; precisely like *Comma* at same stage ; cylindrical, even from 2 to 7, then tapering slightly to extremity ; on 2 is a chitinous dorsal patch on which are six tubercles, three on either side the medio-dorsal line, each with black hair ; below are two tubercles on either side ; on 3 to 13 are two dorsal rows of large tubercles, one to each segment, on the anterior part of same, each with long curved hair, from 3 to 7 turned forwards, the rest back ; next, a row of small tubercles from 3 to 13 ; on 3 and 4, these stand under the dorsals, but on the other segments they are behind the line ; a third row of small tubercles from 5 to 13, under the dorsals, and on 2 to 4 is an extension of this row below the line of the other segments ; on 3 and 4 is a short row, in line with the spiracles, and a corresponding tubercle appears on 13 ; below spiracles, on the posterior part of each segment from 5 to 13, is a minute tubercle ; and finally, along base of body is a row of minute ones from 2 to 13, on 2 to 4 one to each segment, also on 13, but on the other segments, two to each ; from all these proceed hairs, those of the basal row depressed, but of the other rows, from 2 to 7 they are turned forward, the rest back ; color at first whitish-yellow, semi-translucent, and some examples have the dorsum crossed by brownish patches alternating with the yellow ; as the stage proceeds the body becomes red-brown, with white on dorsum of segments 4, 6, 8, 10, with variation in

this respect ; head rounded ; color shining black ; many black hairs scattered over the face curving downward. Duration of this stage 3 days in May, 2 in summer.

After 1st Molt.—Length .14 inch soon after the moult, in 24 hours .20 inch ; slender, even ; color red-brown, with indistinct whitish lines ; of these, a wavy line runs with second laterals ; from base of each first lateral is an oblique line outward to the front of the segment, and from each dorsal are two such lines, one on either side ; armed with seven rows of spines, one dorsal, and three on either side, disposed as in *Comma* ; these are short, stout, black, beset at top with short branches, with some shorter spines on the sides, each ending in a black bristle ; as the larva approaches second moult, the bases of the dorsal and 1st lateral spines become white or yellow, or reddish-yellow, while the color becomes more red, and the lines become more distinct ; on 2 is a dorsal transverse row of 4 short, simple spines ; legs and feet dark brown ; head rounded, depressed at top, the vertices a little produced, each bearing a stout, thick, black process, with conical spine at top, and shorter ones around the base of this ; color black, with many black hairs. Duration of this stage from 2 to 3 days.

After 2nd Molt.—Length .24 inch ; color black, the lines as before, with the addition of one running with lower laterals, more distinct, often macular ; spines as before, but variable in color ; in some examples, all are black except the dorsals and 1st laterals on 4, 6, 8, 10, where they are reddish-yellow ; some have the spines on these rows light, except on 9, 11 and 12 ; usually the second laterals are black and the lower row is pale yellow ; in all cases the tips are black ; as the stage proceeds the color of body changes to olive-brown, and the lines become more conspicuous ; head as before, much covered with white simple spines. Duration of this stage from 2 to 3 days.

After 3rd Molt.—Length .5 inch ; color black, with cream-white lines, quite macular ; spines very variable ; some examples have every spine of the upper five rows reddish to reddish-yellow, the lower laterals pale yellow ; some have the dorsals and 1st laterals from 3 to 11 red, the rest and all of second laterals black ; some have the body color vinous instead of black, with no black spines, the upper rows very red anteriorly, the lower laterals yellow ; the lines yellow ; head either deep brown-red, or decided red in the vinous larvae, the processes red, with spines both

red and black ; the spines on face yellow or white. Duration of this stage 2 to 3 days.

After 4th Moulting.—Length .9 inch ; color deep black, the spines often very red, from deep red bases ; the surface much covered with tubercles, from small to minute, which are partly white, partly yellow, with many red ; the lines red, or red and yellow. In 2 to 3 days becomes full-grown.

MATURE LARVA.—Length 1.3 to 1.5 inch ; cylindrical, stout ; color dull black, with white and yellow and red tubercles on the cross ridges ; and longitudinal lines and bands of red and yellow, varying greatly in distinctness ; when most distinct, there is a band along the basal ridge ; a stripe running with second laterals, an oblique line from base of each first lateral outwards to the front of the segment, and one from front on either side of dorsals also to front of the segment ; when the lines are obsolescent, the yellow and red tubercles quite cover the surface ; under side black-brown ; spines in seven rows, one dorsal, three on either side, disposed as in *Comma* ; long, slender, tapering, with several branches at top, one being a continuation of the spine, the others arranged about its base somewhat irregularly ; these are of about equal length in the several rows, and others, which are shorter, are found on the sides of the spines, and are particularly numerous on the upper rows of the anterior segments ; the dorsals have 5 main branches, the 1st laterals 6, the 2nd and lower laterals 4 and 5 ; in most examples the dorsals and 1st laterals are red, except on 3, where they are red with black bases, and on 11 and 12, where they are usually black, the red being deepest on anterior segments ; the second laterals are sometimes all red, and the lower row is always yellow ; over the feet from 2 to 10 is a simple red spine ; on 2 is a dorsal row of six simple black spines ; spiracles conspicuous, black in white rings ; head obovoid, rather flattened, deeply cleft, the vertices high, and each bearing a stout and short black process, ending in a long spur, with five others about its base, each hair-tipped ; the face covered with simple spines and tubercles, some minute ; on each side below vertex are four long spines, black, the rest are mostly white, each with hair ; color either deep red-brown, or red, about the ocelli a large black patch. From 4th moult to pupation, 5 to 6 days.

Chrysalis.—Length 1 inch, greatest breadth .3 to .32 inch ; cylindrical ; head case high, compressed transversely, at each vertex a long, conical process ; mesonotum elevated, the carina very prominent, thin, nose-like, more rounded on the anterior side than in *Comma*, followed by a deep

excavation; wing cases raised, flaring at base, compressed in middle, with a prominent point on the margin on dorsal side; on the abdomen three rows of tubercles, those corresponding to the dorsal row of the larva minute, to the first laterals large and conical, the pair on middle of the series particularly prominent; those in the excavation gilded; color variable, in shades of brown from light yellow to dark, often clouded with olivaceous or lilac; sometimes a dark green stripe on the side of abdomen below wing cases. Duration of this stage from 7 to 11 days, according to the weather.

Grapta Interrogationis is found over the entire United States, except on the Pacific slope, flying from Arizona to Montana and through Canada to Nova Scotia. In the northern States, and probably in Canada, it is two-brooded, but in West Virginia there are three broods, and a more or less successful effort for a fourth, depending on the weather late in the fall. In Florida there are at least four broods, and probably five. At Coalburgh, eggs laid by hibernating females give butterflies last of May. This is the first brood of the season. Eggs laid early in June give butterflies early in July—the second brood. Eggs laid last of July give butterflies in September—the third brood. Eggs laid through September give butterflies in October. Individuals of each brood are emerging for some weeks, say for a month, so that the earlier females may be laying eggs while the later members of the same brood are coming from chrysalis. But in case of the fourth brood, it often can be only the earliest hatched larvae which produce butterflies, because by 1st October we are apt to have frost and cold weather, and the food is thereby destroyed. But in some seasons frost holds off till late in the fall, and then the greater part of the larvae might reach chrysalis. As stated in Can. Ent., x, p. 72, I think it probable that the butterflies of the third brood do not hibernate, but that the continuance of the species depends on the individuals of the fourth brood, usually but few in number. This would account for the species being so rare in this district late in the fall and early in spring as compared with *Comma*, which has no fourth brood. The *Comma* butterflies of the third brood are the hibernators, and are to be seen in multitudes before winter, or in November. Whereas *Interrogationis* then is rarely seen. And yet in midsummer it is as common as is the other species.

Interrogationis is a seasonally dimorphic species, the two forms being also very distinct in both shape and coloration. They are figured in Butterflies of N. A., Vol. 1. The hibernating form is *Fabricii*, but in one

instance, and one only, I have seen an *Umbrosa* early in the year, which must have hibernated. The only hibernating female I have been able to breed from was *Fabricii*, from which I got eggs, 28th April, 1877. The result on and just before 4th June was 21 butterflies, all *Umbrosa*, the first brood of the year. Eggs laid by the females of *Umbrosa* of the first brood have repeatedly produced a mixed brood—the 2nd of the year—but with a majority of individuals *Umbrosa*, as :

11	<i>Umbrosa</i>	to	6	<i>Fabricii</i>
26	"	"	no	"
19	"	"	no	"
1	"	"	2	"
14	"	"	no	"
38	"	"	16	"
12	"	"	no	"

Total, 121 *Umbrosa*, 24 *Fabricii*.

Eggs laid by the females *Umbrosa* of the 2nd brood have produced a mixed brood, the 3rd of the year, with a larger proportion of *Fabricii*, as :

63	<i>Umbrosa</i>	to	34	<i>Fabricii</i>
2	"	"	9	"
1	"	"	20	"
1	"	"	5	"
46	"	"	6	"
21	"	"	no	"
Larvae found—65	"	"	4	"
6	"	"	16	"

Total, 205 *Umbrosa* to 94 *Fabricii*.

So that while in the 2nd brood *Umbrosa* has had 80 per cent. of the whole product, in the 3rd brood the same form has had but 60 per cent.

Eggs laid by *Umbrosa* of the 3rd brood have produced *Fabricii* only, the 4th brood, as :

No	<i>Umbrosa</i> ,	25	<i>Fabricii</i> .
Larvae found—No	"	10	"
No	"	4	"
No	"	2	"
No	"	25	"

Also I have recorded in October that no form has been seen by me but *Fabricii*, that many were about, coming to apples in the orchard.

The last brood in Florida, if I may judge by 25 *Fabricii* which emerged from chrysalis, at Coalburgh, in November, 1880, the larvae received from Indian River, as before related, would be all *Fabricii*. It would seem therefore that the species is strictly seasonally dimorphic, the last brood producing *Fabricii*, the hibernating females producing *Umbrosa*, but the intervening broods, like the second brood of *Comma*, producing both forms, but with a majority of individuals *Umbrosa*, or the summer form. This is what might have been expected, when the species became polygoneutic, as the interpolated broods are summer broods. The winter brood holds its own, the summer broods after the first, or original one, are made up of both forms.

In the case of the single *Umbrosa* seen in early spring, of which I have spoken, this may have been an exceptional member of the 4th brood, or a hibernating member of the 3rd.

The larvae, as before described, are very variable. That is, they also are polymorphic, and they may readily be separated into 3 or 4 distinct types, as thus :

1. Body black, finely specked with yellow ; no longitudinal lines on dorsum or upper part of side.
2. Body black, with small spots in place of the specks or dots, the longitudinal lines more or less conspicuous, and either yellow or red, or mixed.
3. Body russet, much covered with yellow spots, giving a pepper and salt appearance, the lines often obsolete.

There are intermediate variations, and there is a great variety in the color of the spines, from deep red and red bases, to yellow, or mixed.

The larvae from Florida were of one of these types only, No. 2, and especially were there none of the russet variety.

The food plants of *Interrogationis* are Hop, Nettle, False Nettle, (*Boehmeria cylindrica*,) Elm, Celtis, and in W. Va. they may be found on all these plants at the same season of the year. But the preference is for Hop and Elm, the first early in the season, the other in August and September. I have near my house many Elm sprouts which are cut down every year, to be replaced in a few weeks by a fresh growth. It is on the tender terminal leaves of these that the female chooses to lay her eggs, either singly or in strings of from 2 to 5 or 6, on the under side of the leaf usually. The egg is not correctly represented in But. N. A., although copied from a drawing made by so good an artist as Mr. Konopicky. It

is too round, and perhaps the example sent for drawing was altered by the alcohol in which it was immersed. The egg really is like that of *Comma* figured on Plate of *Dryas*. The number of ribs varies from 8 to 10. Where a string of eggs is laid, the number of ribs is same in all. It is almost needless to say that the young larvae do not consume their egg shells. A lady correspondent says: "The Graptas scramble through their scuttles in headlong haste, totally regardless as to who may take possession of their late tenements, leaving whole hamlets to prove their presence in the vicinity." The larva attacks the leaf, eating a hole through it, each for itself, and during the first stages feeds about the margin of this hole. During all stages it lives unprotected, except as it lies under the leaf, in contrast with the habit of *Comma*, which after 2nd moult draws the edges of a leaf together at base and finds concealment beneath the awning thus made.

PREPARATORY STAGES OF AGROTIS ANNEXA, Tr.

BY G. H. FRENCH, CARBONDALE, ILL.

Egg.—Diameter .03 inch. Shape globular, the base rather broad, the sides ribbed longitudinally, 12 of these ridges which reach the apex alternating with twice as many more of different lengths. The ridges are connected by slender cross bars, the transverse sides of the included spaces being longer than the longitudinal. The small apical space is punctured. Color white. Duration of this period, 4 days.

Young Larva.—Length .07 of an inch. Color pale grayish-white, a little pinkish on the anterior part. Head and top of joint 1 black. Piliferous spots small, black, the gray hairs arising from each a little longer than the diameter of the body. Legs 16, but the first and second pairs of abdominal, short so that the middle of the body is arched a little in walking. After eating the color of the body is pale grayish green. The piliferous spots, or at least the thoracic, in a single transverse row to each joint. Duration of this period, 8 days.

After 1st Moult.—Length .17 inch. Head brown, the clypeus paler. Color of the body about the same as before, with slight traces of dorsal, sub-dorsal and stigmatal lines, all pale. The piliferous spots regularly arranged, except on the first three joints, where they are in a single transverse row to each joint. Top of joint 1 a little brownish. Legs about as before. Duration of this period, 5 days.