

# PAPILIO.

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COMMENTS ON DR. HAGEN'S PAPER IN NOV.-DEC.  
No. OF PAPILIO, ON P. MACHAON, ETC.

BY W. H. EDWARDS.

My own views on the subjects treated of by Dr. Hagen are so different from his that I cannot let his paper pass without notice, the more especially as now that he has seen the way to the demolition of half a dozen unlucky species of *Papilio*, he is evidently warming to the attack in other quarters. This, as he tells us, is but "a portion of a Preliminary Report on the Butterflies of Washington Territory," and by the sample we judge the piece.

My learned friend, whose great attainments in biology and in general entomology we all recognize, is also a specialist, and his specialty is not the Lepidoptera. In Neuroptera or Hymenoptera he is high authority, in fact, in the former, the highest we have, but it is no disparagement to him to say, that in Lepidoptera, and especially in the North American Diurnals, he has not been known as an expert. That he should sit down, therefore, to a Report on Butterflies, and be able to give us fifteen printed pages on the first genus treated of, strikes me as something out of the common.

Now, it came to pass last summer that Dr. Hagen was offered the opportunity of accompanying the N. T. Survey, with the privilege of collecting what he could without hindering the purpose of the Survey; but was "expressly prohibited from advancing systematical or biological entomology." It was a great thing to be allowed to collect at all, but a most unfortunate one that not even a butterfly egg could be gotten unless it was picked off a bush, and that would amount to nothing, without violating the conditions of the appointment. Questions have been raised that could easily have been settled by breeding the butterflies from the eggs, laid by the females of the *Papilios* in confinement, but,



as it was, except two mature caterpillars of *Oregonia* discovered, nothing whatever was done towards the biology of any of the species treated of in the Doctor's paper. The entomological party seem to have been in the field ten to fifteen days, from June 24 to July 5, and were on the wing all the time, but brought home a large lot of butterflies of various species. The results of that excursion seem to have aroused in our friend an enthusiasm that will not be restrained, and it is clear he dreams of oversetting the work of a score of lepidopterists who have gone before him, and of constructing on the ruins a sort of Ptolemaic system of arrangement of our species. I would not say a word, if this system were to be based on the preparatory stages of the several species, but that does not enter into it at all. What the system may probably be in its details is shadowed in a remark in a letter to me from the Doctor some time this winter, that after having worked a number of weeks on *Colias*, he "is getting the whole series into three or four species," \* i. e., the North American *Colias*.

As there are something over a couple of dozen species of *Colias* claimed to belong to our fauna, of only two of which, outside of *Cæsonia* and *Eurydice*, are the preparatory stages at all known, this is evidently a weighty piece of work. All I wonder at is, that my good friend should stop at three or four, when it is just as easy to say one, and have all the species rank as varieties of that; as *Colias Primordia*, var. *Eurytheme*; var. *Philodice*. Really, I admire the zeal displayed and sympathise with the enthusiasm, but I must refuse utterly the conclusions reached by the Doctor. I have not much hope, however, that anything I shall say will alter his views. When a Professor of Biology, even with but a moderate acquaintance with butterflies, can deliberately declare that "it is probable that *P. Brevicauda*, *Bairdii*, *Indra*, *Pergamus* and probably *Americus*, belong all to *P. Asterias*," I fear he is past praying for. I write then not so much for him, but for a younger generation, who have grown up under more liberal teaching.

I hold that every permanent form possessed of marked characters which distinguish it from other forms, and which breeds true to its type, so far as appears, or we can know, is to be regarded as a species, at least, till the contrary is proved. And the proof must be actual, not imaginary, facts, not guess-work. That this is directly opposed to the view which can lump species into one,

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\* The lepidopterists of Europe are not agreed as to the position of divers of their own species of *Colias*, though 150 years have passed since Linnæus, during which time many generations of active workers have come and gone in every country. No one can say to-day what are the relations between *C. Palæno* and *C. Pelidne*, or if there be any at all; and, for all that matter, no one will be able to speak with knowledge till both forms have been bred from the eggs laid by the respective females. All investigations which begin and end with the dried butterflies in cases of doubtful and obscure species amount to nothing. One may argue forever from the butterfly and be no whit nearer real knowledge of the facts. And now, what has not been done in Europe in five generations, our earnest friend thinks he can do with the American *Colias* "in course of a number of weeks" inside the walls of the Cambridge Museum. I recommend a tent in the field for a few seasons, and hard work, with much fatigue and many disappointments, but with patience to overcome all; then we shall begin to see results.



when nothing whatever is known of them, except what the dried butterflies show, and after the fashion set forth above with the *Asterias* group, goes without saying.

The attack is opened upon *Papilio Zolicaon*, so named and described by Dr. Boisduval, who was one of the foremost European lepidopterists of this century. Another species, *P. Oregonia*, was recently discovered by Mr. Henry Edwards, and described by myself. On p. 150 we read, "the large number of specimens of both sexes (74) approves the statement that both species *cannot be separated*." And establishing this proposition to his own satisfaction, the Doctor advances to "the knotty question of the American *P. Machaon*." That is, *Machaon*, *van Aliaska*, Scudder. After running through the whole literature of *Machaon*, the peroration has the RING of victory. "Can the separation of the American species" (*Zolicaon*, *Oregonia*, etc.) "be maintained? I answer boldly, NO! After the examination of a hitherto unparalleled series of specimens, showing EVERYWHERE INTERMEDIATE FORMS, they should be considered as local or climatic varieties of one and the same species, of *P. Machaon*." And he closes, to the dismay of some of us, with the announcement that Mr. Pryer has now united eleven, perhaps twelve, species of *Terias* as belonging to one and the same species, which author concludes that "*neither size, shape nor color can be relied on as guides for specific distinction*;" and as he retires, comes this Parthian shot, "I believe that a revision of the North American butterflies *on this basis* is a want." At which I gasp, may heaven forbid that Mr. Pryer, or any of his disciples, should devote their destructive energies to the North American butterflies! I do not know Mr. Pryer, nor what sort of an observer he may be, nor what his facilities for the study of the *Terias* may have been, but this I do know, that unless he has arrived at his conclusion by breeding from the eggs, the assertion above quoted, if it really is intended to mean what the naked words declare, is not worth the paper it was written on. If eggs laid by one of the eleven or twelve species produced the rest, then the assertion might be made good, otherwise it is the sheerest guess-work.

Let us proceed to consider the statements of this paper. It is said, on p. 150, that seventy-four specimens of both sexes were taken in Washington Territory, east of the Cascade Mountains. "The typical *Zolicaon* is represented by half a dozen specimens flying promiscuously with the others." (If they fly at all in the same territory, they fly promiscuously, of course. In one group, by a puddle on the road, I often see *P. Turnus*, *Ajax*, *Troilus* and *Philenor*). "The main part of the specimens belong to *P. Oregonia*." What "true *Zolicaon*" is, the Doctor tells us under four heads. What "true *Oregonia*" is, we are left to infer, and in every case it is something not typical *Oregonia*. One or more characters are constantly modified in the direction of *Zoli-*



*caon*, or, at least, the Doctor thinks that is so. It does not appear from the text that a typical *Oregonia* was seen at all. I have no doubt several were taken, but nothing is said of it. We merely see a lot of nondescripts put down as "true *Oregonia*." We are, to be sure, told on p. 151, what the Doctor's ideas of *Oregonia* are; to wit, that it "is merely a variety of *Zolicaon*, mostly larger in size, more yellow, the black spot connected with the interior anal band, which is somewhat dilated on tip" (what is dilated? the band certainly is not), "the black bands of the abdomen narrower." That is no description of *Oregonia*, and I really have no evidence that the Doctor saw the species at all. What he so describes he says is merely a variety of *Zolicaon*.

These nondescripts, on p. 160, are called "intermediate forms," and the argument is that they connect *Zolicaon* and *Oregonia* in such a manner that the two so-called species cannot be separated, and *Oregonia* being assumed to be a derivation from *Machaon*, the other must be as well. There is a radical difference between "an intermediate form" and "an intergrade." The latter connects two varieties of a species, but a form may be intermediate and connect nothing. A jackal is intermediate between a dog and fox; a short-eared owl is intermediate between a long-eared owl and the great horned owl; and intermediate forms stand in every genus of butterflies. So that to say, that in this series of Papilios are "everywhere intermediate forms," means nothing. The intention is, that everywhere are intergrades linking together the principal forms, so that the latter must be varieties, and not species. Were they species, the intermediate forms would be *hybrids*, not *intergrades*. Whether they be species or not remains to be seen. Besides the "Americans forms," the Doctor gets half a dozen hitherto supposed good species of the old world under the wing of *Machaon*. Of these last I have nothing to say, but I intend to show that the deductions are wholly at fault with the American species, and by inference they are probably so with the others.

I propose, then, to make it apparent:

I. That *Zolicaon* is a distinct species, having no affinity with *Machaon*, and that it never could have been derived from *Machaon*, or the reverse.

II. That *Oregonia*, while nearly all its affinities are with *Machaon*, and it belongs to the same group, yet is distinct from that species and is a species by itself; that neither could have been derived from the other.

III. That *Zolicaon* never could have been derived from *Oregonia*, or the reverse, the two belonging to distinct groups.

We must first discover what are the special characteristics of each of these species or forms.

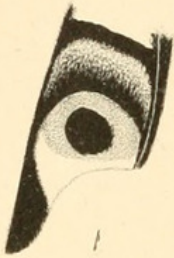
I. What is *Zolicaon*?

i. It is distinguished by a complete ocellus at the anal angle





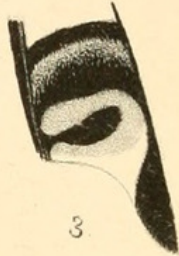




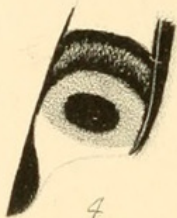
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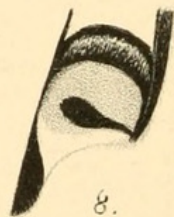
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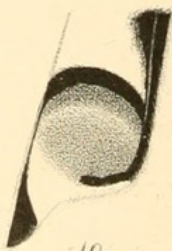
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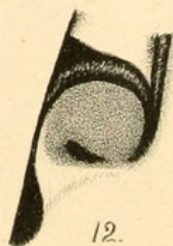
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## EXPLANATION OF PLATE I.

Illustrating the peculiarities of the anal ocellus in four species of *Papilio*, drawn by Mrs. Mary Peart. Figs. 1-3, 9-12 are drawn from nature. Figs. 4, 5 and 6-8 are copied from the plates in *But. N. A.*, vol. 2, for which they were drawn from nature by Mrs. Peart.

1. *Asterias*; fig 1, circular pupil.  
     " 2, oval           "  
     " 3, pupil connecting with the marginal stripe.
2. *Zolicaon*; fig. 4, circular pupil.  
     " 5, pear-shaped, etc.
3. *Oregonia*; " 6, striped ocellus.  
     " 7, 8, club-marked ocellus.
4. *Machaon*; " 9 to 11, blind ocellus, with variations, the  
     stripe extended three-quarters and  
     more around the circle; 11, with bulb  
     at end.  
     " 12, showing the bulb severed.



of the hind wing. This ocellus is fulvous, round, with a narrow black stripe or rim on the side next the inner wing-margin, which stripe or rim ends at half-way down the fulvous ground on that side. In the centre, or sometimes a little out of centre, is a black pupil, usually round in the male, but sometimes oval, especially in the female, and sometimes, most often also in the female, and on the under side, pear-shaped (figs. 4, 5).

2. The cell of fore wings, on under side, is solid black, except for two yellow cross-bars, one on the inner side of the arc, the other a little distance towards the base.

3. The body is black, with a lateral yellow band along the abdomen.

This is the type, as designated by Dr. Boisduval. He expressly says: "It is easily distinguished from *Machaon* by its pupilled ocellus, and the body entirely black on under side." "Body black, with a lateral yellow band." He says it is near *Machaon*, especially the variety *Sphyrus*, but at first sight resembles, likewise, very much, *Sadulus* (P. *Americus*). His description is not at all minute, and he says nothing of the cell, evidently finding the two other chief characters sufficient to separate the species from *Machaon*.

## II. What of *Machaon* in these points?

1. There is an ocellus placed as in *Zolicaon*, and like it, fulvous and round, but without pupil; and the stripe or rim on marginal side passes round the fulvous spot and ends at or beyond the middle of the side which is farthest from base (fig. 9, 10).

2. The cell is yellow, with two black cross-bars, one about at middle, the other half way between that and the arc.

3. The body is yellow, with dorsum black; on the lower part of abdomen are two and four black lines or narrow stripes. Dr. Boisduval, Spec. Gen., 1,329, says of this species: "Body yellow, with a dorsal black band."

Other comparisons might be instituted, but these three points are sufficient.

1. That the ocellus of *Machaon* is blind will be gainsaid by no one. The species is thoroughly well-known. It flies all over the old world, unless in middle and south Africa. If an example were found possessing a black pupilled ocellus like that seen in *Zolicaon*, it would be exceptional, extraordinary. I have before me, as I write, several examples of *Machaon* from Europe and Asia, obtained for me some years ago by Mr. W. F. Kirby, with a view of getting all the prominent varieties of the species. I have also fifteen examples from the frontier of Thibet, and one of same type, sent long ago by Dr. Hagen, from Himalaya, and labeled *Asiaticus*, Mén. I have fourteen of the American form, var. *Aliaska*. All these, European to American, agree in respect to the fulvous, unpupilled ocellus, except that two from Southern Europe have it yellow, as do nearly all the Alaskans. The



American and Himalayan also have no violet above the fulvous or yellow spot.

In all these *Machaon*, and it is characteristic of the species wherever it is found, there is a black line on the outer edge of the fulvous spot, running down the inner margin of the wing; curving around the spot, it usually ends at considerably more than half way along the farther side (from base) of same. If it were continued from  $30^{\circ}$  to  $40^{\circ}$  farther (figs. 11, 12), it would strike the black band of the hind margin and close up the circle. I have no example in which a quarter circle would not fill this gap. This line is often not at all thickened at the end (fig. 10); in some cases it is reduced there to a thread (fig. 9), the reduction taking place abruptly as the line leaves the margin. In some cases the line is thickened at the end into a bulb (fig. 11) of varying diameter. In the American examples there are all these variations, just as in the others. The thickening spoken of, being at the end of the line, is on the lower edge of the fulvous area, and occasionally the bulb is severed from the line, as in one of my examples (fig. 12), and yet forms part of the circle. I call particular attention to this point.

Now, the circular pupil of *Zolicaon*, placed in the middle of the fulvous spot, so as to make a complete ocellus (fig. 4), never originated in a thickened section of the rim. Therefore, this character never was derived from *Machaon*. The pupilled ocellus of *Zolicaon* is as significant as the ocellus in wing of *Satyrus Alope*, or the eye-spot of *Vanessa Io*. It is because it is small that the importance of such a feature is apt to be overlooked. If it covered as much ground as the eye spot of *Telea Polyphemus*, for example, it would at once be allowed to present a specific difference, when compared with another *Telea* having a blind ocellus like that of *Machaon*. Looking over my examples of *Zolicaon*, one female is seen to have an isolated black pupil on the upper side, but on the other, the same pupil is joined to the black rim on the outer edge. It is pear-shaped, and the prolongation of its small end strikes the rim, above its terminus, on the middle of the side at the inner wing-margin (fig. 5). The butterfly I speak of is figured in *But. N. A.*, vol. 2, plate of *Zolicaon*. Dr. Hagen says, p. 150, that among the *Zolicaon* examined by him, is one female from California, "with a continuation of the spot on the under side of the black stripe, which edges the inner margin. Mr. Edwards has figured, pl. 6, *Papilio*, f. 4, exactly the same for the female of *Zolicaon*, without mentioning it in the description." The Doctor refers in this way in order to show that one of the characters attributed to *Zolicaon* is variable in the direction of *Machaon*. If he can establish this point it will so far help to the assertion that *Zolicaon* is derived from *Machaon*. Undoubtedly the pupil in *Zolicaon* more or less often connects with the "black stripe which edges the inner margin," but that is



quite another matter from a thickening of the end of the same stripe such as is seen in *Machaon*. In fig. 5 the apex of the pear-shaped pupil hits the rim in the middle of the outer side of the ocellus and the *rim is prolonged beyond the connection*. I call attention to this last point also, for these little things have a meaning. In *Machaon* the end of the rim or stripe is thickened on the side farthest from base, and this end is  $90^{\circ}$  to  $150^{\circ}$  further round the circle than the end of same stripe in *Zolicaon*.

Now, how came that pupilled ocellus to be a main feature of *Zolicaon*, and a blind ocellus of *Machaon*? If *Zolicaon* is derived from *Machaon*, as Dr. Hagen declares, but cannot prove, how came in that persistent pupil, not found in the parent form? On the other hand, if *Machaon* is derived from *Zolicaon*, and, while guessing prevails, that guess is as good as the other, why do not examples of reversion occur? Why do we merely see a thickening of the end of the rim of the circle in *Machaon*, if there is any change at all from a mere line, and never a pupil?

Without question, every mark on a butterfly wing is variable, and among thousands of examples of a given species, all sorts of varieties might be expected, *but within certain limits*. Something cannot come from nothing, there must be a point or mark, a line to base a variation on. A line may break into spots, or spots may coalesce into a line or band, or bands, by suffusion, may spread all over the surface of the wing. But we never need hope to find in any sport an entirely new mark on a clear ground. There will be no ocellus on *Callidryas Eubule*. Now, I know of no evidence that a pupil was ever seen on the fulvous spot in *Machaon*. If such an example had occurred every collector would have regarded it as a singularity. It would have been treasured, for all collectors are eager to secure any oddity, and, probably, an account of it would have reached one of the entomological journals. In which case, Dr. Hagen, who knows all about the literature of entomology, would certainly have seized upon it and made it conspicuous in his paper. He has discovered two instances in *Machaon* of a cell more or less black; one in a figure by Freyer, "which has the basal part of cell black, except a small paler spot near the base," p. 155; and one in a dwarfed butterfly in the Cambridge Museum, from Switzeland, "which has the basal half of cell black. That he says nothing of variation which shows a pupilled ocellus is the best proof possible that no instance of it is recorded, at least. If, however, such an ocellus ever did appear in *Machaon*, it would fall under what Darwin calls the law of analogous variation, where "varieties of one species mock distinct but allied species," to be explained on the "principle of allied species having descended from one primitive form." That is, it would be a case of reversion.

I think it highly probable, from various reasons, especially from the peculiarities of the caterpillar in its several stages and



in its food plants, and also of the chrysalis, that a remote ancestor of *Machaon* did possess a pupilled ocellus. But if this was so, the pupil was lost so long ago, that, even by reversion, no one can now report an existing example. It is one of the chief points in all the descriptions, and all the figures of *Machaon*, that it has an ocellus without pupil.

2. The black cell in *Zolicaon*, the yellow cell in *Machaon*. I have never seen a *Zolicaon* from California, the metropolis of the species, which has a cell varying from the type. On the other hand, I have never seen a *Machaon* from Europe or Asia which had anything but a yellow cell. Of course, variations may sometimes take place in this character in these species; either the black may, by suffusion, run over the yellow, or yellow over the black. I think, by subjecting chrysalids to cold, I could bring about such varieties, as the colors run under such conditions in many cases. Dr. Hagen finds one instance of a *Machaon*, with cell black at base, another partly black, as before said; but such cases must be extremely rare. And a *Zolicaon* with a yellow cell would be a *rara avis*, as any collector knows.

3. The body of *Zolicaon* is black, with a lateral yellow band; of *Machaon*, yellow, with a dorsal black band.

I have received, during twenty years, a great many *Zolicaon* from California, and, as I carefully preserve for my own collection every variation from the type of any species, the collection to-day would show if there had been any noticeable variation in *Zolicaon* received by me. None such is present. I have applied to several correspondents for their experience. Mr. Henry Edwards, who resided a number of years in San Francisco, and collected butterflies indefatigably all over the State, writes me that *Zolicaon* is very common about San Francisco, that he has not in his collection now, nor does he remember to have seen, an example in or from California which did not possess the three characters I rely on. Mr. B. Neumoegen, who has one of the most extensive collections of American butterflies yet made, knows of no example off type from California. Mr. E. M. Aaron, of Philadelphia, has examined three collections in that city, at my request, one being his own, and one that of the Ent. Soc., of which he is the Curator, with the same results. So that *Zolicaon*, in its metropolis, is remarkably constant to type.\*

It is because *Zolicaon* is not derived from *Machaon* that it presents the remarkable features we are treating of. Where then did they come from? Now, every member of the *Asterias* group which I have seen, and I have before me, as I write, all the species enumerated by Dr. Hagen, except *Pergamus*, (which is represented by an unique specimen in the collection of Mr. H.

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\* While this paper is passing through the press, I have a reply also from Mr. W. G. Wright, of San Bernardino, to whom I wrote on same subject. All his examples of *Zolicaon* are characterized by black bodies, black cells, and pupilled ocelli. He sends me seven of them, and they are all true to type.



Edwards, who described it, and this agrees with the others), has precisely that pupilled ocellus of *Zolicaon*. Not only that; as the pupil varies in *Zolicaon*, so do the pupils in all these species vary. They are larger or smaller, circular or oval, or sub-oval; exactly in the centre, or a little out of centre. And about one-third the examples of each species, where I have several, show exactly the connection between the pupil and the rim which Dr. Hagen calls attention to; and it is usually in the female, on the under side. On the plate of *Brevicauda*, in But. N. A., this peculiarity is shown on under side of male (f. 2). On the plate of *Bairdii* the same is shown in both sexes. The rim runs past the point of connection, which is on the middle of the side on inner wing margin. And just as *Zolicaon* agrees with the *Asterias* group in the pupilled ocellus, so does it in the black cell. That is a special characteristic all through that group. So all the *Asterias* group, unless it is *Americus* female, have the body black. *Indra* has it wholly so, except that in the ♂ there is a bit of yellow on side next last segment; the female has an indistinct stripe of same along the side, distinct at the end. *Asterias* and *Brevicauda* and *Bairdii* have two and three rows of yellow dots on either side of abdomen, which otherwise is black. So does *Americus* male show one of the same lines of spots, the sub-dorsal, while the lower are suppressed. There it is! To get the nearest ally of *Zolicaon*, in the matter of its three chief characteristics, we have to go to a group distinct from the *Machaon*, and there we find not merely the same characters, but in the most important of the three, the ocellus, exactly the same modification of it. Plainly enough, *Zolicaon* has a close connection with the *Asterias* group, and it is open to assert that the two are descended from a common type, which was characterized by a pupilled ocellus, a black cell, and probably, by a black body. I do not think that any one who believes in the derivation of existing species from antecedent ones will refuse to admit that. The ocellus in *Zolicaon* tells its story as clearly as do the bars on the wing of a pigeon. The different species of the *Asterias* group form one branch, and *Zolicaon*, with perhaps *Americus*, another branch, from the same stem; though it may well have been that at one or more steps farther back, this stem and the one from which the *Machaon* group descended found likewise a common ancestor. But *Zolicaon* has no present relations with the *Machaon* group, standing wholly apart from it.

That *Zolicaon* has come to differ from the *Asterias* group in respect to the yellow side-stripe is not more than might be expected if it branched off at all. This stripe would not originate by the introduction of a new character, but by the modification of one already there; to wit, the two lines of yellow dots, one at the verge of the dorsal area, the other on lower half of side. The side stripe of *Zolicaon* occupies the space corresponding to that limited



by these two lines in *Asterias*. We see a modification of the *Asterias* marks in *Indra*, where the yellow dots are suppressed, and in the male a dash of yellow is applied to the side at the last segment; in the female the dash is extended obscurely the length of the abdomen. If it be alleged that, although *Machaon* and *Zolicaon* differ in these three important points, yet they resemble each other in certain other points, just as important; viz, in the size and arrangement of the yellow spots on fore wings, and in the yellow base and disk of hind wings, in both which respects they differ from *Asterias*, I would say:

1. The marginal yellow spots of these several members of the *Asterias* group are very similar to those of *Zolicaon* on both wings and occupy the same positions.

2. The spots of the discal or interior band in the *Asterias* group occupy the same positions on the wings as do the discal spots of *Zolicaon* and *Machaon*. In these two species the spots spoken of are elongated, but *Bairdii* has them much more elongated than *Asterias*, and *Americus* still more. Indeed, this last is very close to *Zolicaon* in this respect. The spots are long, pear-shaped, instead of four-sided, but they cover nearly as much of the surface as do those of *Zolicaon*.\* And what is especially interesting in some examples, is that the whole of the base and disk of hind wings in *Americus* is yellow just as in *Zolicaon*.† We have seen that Boisduval was struck with the resemblance between these two species. Yet, surely, *Americus* stands very near the other species of the *Asterias* group. It has the ocellus, the black cell, and the male has the upper row of yellow dots on body just as in *Asterias*. In the examples before me, the lower row is wanting, and over the side to base of abdomen is a thin coating of yellow, not wholly concealing the black ground. I have 1 ♂ 2 ♀ taken in Arizona and both females have the side yellow-banded. But the bodies are in so crushed and rubbed a condition that I cannot pronounce more definitely on the marks or color of abdomen than this, that the sides are certainly yellow. The male is in excellent condition, and possesses another resemblance to *Asterias* in the orange color of the marginal spots on hind wing below, and in orange on the yellow ground next the black marginal band, in all the interspaces. The spots of the discal band of under fore wings are also orange, as in *Brevicauda*. I have two ♂ from Panama, and Mr. Neumoegen has sent me 1 ♂ from Chiriqui, and the three agree with the Arizona ♂, except that they all have the base of hind wing black. So that we have in *Americus* a species which stands between the *Asterias* group and *Zolicaon*, and which is

\* In the figure of *Sadalis*, by Lucas, Pl. 10, Rev. et Mag. Zool., 1852, apparently a male, these spots, except the two lower ones, are narrow, and lie isolated in the middle of the black interspaces. But in all the examples of this butterfly which I have been able to examine, all the spots of the series are large and pear-shaped, and in breadth extend from nervule to nervule. The female has them larger than the male.

† There is a variation in this respect, some examples having the hind wings crossed by a broad yellow band, the base being black: while the others have the yellow quite up to base.



variable in one important character, the extent of the yellow area of hind wing; some examples resembling therein some members of the *Asterias* group, *Indra* and *Bairdii*, while others resemble *Zolicaon*. But the sum of resemblances between *Americus* and *Zolicaon* is greater than between *Americus* and any other members of the group, and the two fall most naturally into a sub-group. And the remaining species belonging to our fauna naturally fall into other sub-groups; as, 1, *Brevicauda*; 2, *Asterias*; *Bairdii*; 3, *Indra*. I do not believe that any one of these sub-groups has been derived from another, although I have shown how the side stripe of *Zolicaon* might have originated, if there were derivation. I would have every sub-group of equal rank, as alike sprung from same ancestor.

II. We now come to *Oregonia*. This species has a close resemblance to certain Asiatic forms, which may or may not have sprung from *Machaon*, especially *Hippocrates*. The reverse is just as likely, and indeed, more likely, in my opinion, if there was derivation anywhere. The fore wings are largely produced and their hind margins are incurved. The tails are longer in proportion than typical *Machaon*. On the under side, the whole surface is yellow, just as in *Machaon*, the cell of fore wings just the same, the abdomen the same, yellow, with yellow stripes. The most striking distinction is found in the anal ocellus. As in all these species we have had in review, the ocellus is fulvous, but *the rim comes down and ends as in Zolicaon, not as in Machaon*, which has it continued farther by a quarter circle and more; and right at the end there is a bend at right angles, and a continuation of the line is thrown across the fulvous spot a little below the middle thereof. The figures 6, 7, 8 show the peculiar character of this line or mark, and all are copied from But. N. A., plate of *Oregonia*. In fig. 6, under side ♂, we see a tapering, slightly wavy stripe, ending in a point. This simplest form I assume to be the normal one. In fig. 7, under side ♀, there is a modification of the plain stripe, in a long narrow club, reaching quite across the fulvous spot. Fig. 8 represents the upper side of the same female, and the thickening is greater, and the mark, as in other cases, is very long and tapers gradually. Now, this is altogether another sort of mark from the black pupil of *Zolicaon*, whether the latter stands alone in the centre of the field, or whether it strikes the rim. It is the modification of a stripe across the ocellus. Dr. Hagen states, in his specifications of what he thinks is *Oregonia*, p. 151, that "the spot is connected," etc; so that it does not appear that it is ever severed, or ever takes a different shape from that indicated in the figures.\* In that

\* In the original description of *Oregonia*, I said, "anal spot small, yellow below, fulvous above, with a rounded black spot in the middle, and which is connected with the narrow black edge of the margin." I should have said; "with a stripe or a club-shaped spot connected, etc." For my abominable carelessness I stand myself on the stool of repentance and apologise humbly to all concerned; and I thank Dr. Hagen for leading me to study these species as I had not done before.



mark *Oregonia* is curiously near an occasional *Asterias*, as seen in fig. 3; also, perhaps, still nearer to *Bairdii*, as seen on the plate in But. N. A., fig. 4. That is the single approach which *Oregonia* makes to the *Asterias* type, and here is another hint of a remote common ancestor. *Oregonia* certainly never got that peculiar mark from *Machaon*. To show the two together is sufficient. No large number of the former species have yet been taken, but this mark is constant so far, and no case of reversion to a blind ocellus with a *Machaon* rim is reported. On the other hand, no evidence is forthcoming that the *Oregonia* style of ocellus ever has appeared in a *Machaon*, and on both sides there would be cases of reversion had there been derivation.

I do not at all understand why Dr. Hagen did not see fit to institute a careful comparison between the larvæ of *Zolicaon* and *Oregonia*, and both with *Machaon*. All the materials were at his hand, so far as relates to the final stages of the several caterpillars. He says the party took two mature larvæ of *Oregonia*, one of which Mr. Stretch carried to imago, "which proved to be *Oregonia*.\*

Inasmuch as Mr. H. Edwards has this imago and says it is *Oregonia*, I accept the statement. The relation proceeds: "The caterpillar is very similar to that of *Machaon* in form, color and pattern. As I am very well acquainted with the latter, I directly remarked a difference," specifying a single difference in the cross band of second segment, and nothing more. Now, the facts are these: *Asterias*, *Brevicauda*, *Zolicaon* and *Machaon* have their mature larvæ similar in form and color. Therefore, these two features in the comparison may pass for nothing. As to pattern, it is another matter. Fortunately, I have the colored figure of one of these *Oregonia* caterpillars, by Mr. Stretch, who also made the figure of *Zolicaon* caterpillar given in But. N. A. And both the original drawings lie before me. I have a colored figure of the same stage of *Machaon* (of course, typical), executed for me expressly, by Dr. Weismann himself. And I say, that this *Oregonia* larva differs decidedly in the pattern of the markings from either of the other two. *Zolicaon* and *Oregonia* differ between themselves, but both are nearer to *Asterias* than to *Machaon*. I intend to figure the larva of *Oregonia*, in Part XII, But. N. A., Vol. 2, this spring, and on same plate I will put this larva of *Machaon*. Till then I must ask my readers to take my word that they exhibit striking and specific differences. †

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\* All through the paper the Doctor persists in calling this species *Oregonius*, "*Oregonius*, not *Oregonia*, as Mr. Edwards writes," p. 151. I shall file a caveat to protect the name I christened this species with. Why does the Doctor not talk about *Aliaskus*? When I give a species a name I expect it to travel under it henceforth.

† Dr. Hagen gives us much lore about the larva of *Machaon* from the books, to make good his proposition, that, as the imago shows a large variation in color, so the caterpillar and chrysalis "also differ considerably." But the only deviation from the green and typical mature caterpillar shown is a black form, which occasionally appears. That is, the black color of the larval stages which precede the last stage is projected into that; a kind of variation that might be expected. None of the cases cited at all concern *Oregonia* or *Zolicaon*.



III. That *Zolicaon* never could have been derived from *Oregonia* or the reverse follows from the position of the two species in two distinct groups. The latter species is unmistakably allied to the *Machaon* group, the former to the *Asterias* group. I have shown this, and the proposition needs no farther remark.

We now come to the "intermediate forms," which Dr. Hagen would have us understand are intergrades between *Oregonia* and *Zolicaon*. If I have established the position that *Zolicaon* belongs to the *Asterias* group, or at any rate, is nearest to that, and is removed from the *Machaon* group, and I think Lepidopterists will agree that I have, then, inasmuch as it is conceded on all hands that *Oregonia* is a member of the *Machaon* group, these forms cannot be intergrades, because the product of two species is not an intergrade. (I would say here that I have seen none of these famous examples, though more than once, and long ago. Dr. Hagen promised to send me them. I am not at all certain that if I were to see them, I should agree with the Doctor in regarding them as particularly connected with either of the species spoken of, but at present, I have to be governed by what he has told us).

Dr. Hagen tells us that he found all these nondescripts, (with yellow abdomen and black cell; black abdomen and yellow cell, etc.), in a certain district east of the Cascade Mountains, which he says possesses a very different climate from the district to the west of these mountains, "the latter being similar to that of California." He tells us that it is a sage-brush desert, with the least rain fall of any part of the United States, and the heat is excessive, "more than a week above 100°," "where nearly no rain falls through the summer, a sage-brush desert on basaltic soil."

The typical *Zolicaon*, as before said, is common throughout California. It also flies through Oregon, and, at least, into Washington Territory to the west of the Cascade Mountains. Dr. Hagen took half a dozen, true to type, east of these mountains also.

On the other hand, the typical *Oregonia*, with yellow cell, yellow body, and striped or clubbed ocellus, had alone been seen before this excursion into the sage-brush desert. Its habitat, so far as known, was in Western Oregon and Washington Territory. Mr. H. Edwards had also taken one example of *Machaon*, var. *Aliaska*, at the Dalles, W. T.

Taking the relation of Dr. Hagen, just as he gives it, I see no alternative but to assert that he has had the good fortune to fall in with a lot of hybrids in this secluded and infernal sage-brush desert. There is no improbability in this. No one accuses *Colias Philodice* of being a variety of *Colias Eurytheme*, at least, no one has hitherto done so, for I am not at all certain that our friend herein concerned does not embrace both these in one of his three or four species; but I have several orange *Colias*, which appear to



be hybrids, and in two instances undoubted males *Eurytheme*, one of them fiery-red, the other pale, or the *Keewaydin* form, and two yellow females *Philodice*, with which they were taken in copulation. As the red one was so taken by Mr. G. M. Dodge, who gave it to me, there can be no question of the fact of the capture. From what I know of the frenzied eagerness with which certain male butterflies (as I have related in the cases of *Papilio Ajax*, Can. Ent., 13, 209, and *Heliconia Charitonia*, *Papilio* 1, 213), watch the coming of the females from chrysalis, I am confident that they would seize upon the females of any allied species just as readily, if one of their own were not at hand. If such things occur in the mild climate of the Mississippi valley, where females of *Eurytheme* are as common as the males, what may not occur in a sage-brush desert, with no rain fall and the mercury above 100°? The panting male cannot fly over hill and valley, under these conditions, seeking its mate, as we often see male butterflies doing in a Christian country. Nature impels him, and he captures the first female he meets. That this is the fact in multitudes of cases in that arid district is highly probable, and it will account for all these curious nondescripts taken by Dr. Hagen.

My summing up is this: 1. *Zolicaon* is a species subject to little variation. It is a member of the *Asterias* group, forming with *Americus* a sub-group. The other species of the group are divisible into two or more sub-groups, and all these are of equal rank, sprung from a common ancestor.

2. *Oregonia* belongs to the *Machaon* group, and (perhaps with some other species) forms a sub-group of equal rank at least with the sub-group to which the species *Machaon* belongs. It certainly cannot have been derived from the species *Machaon*.

3. *Zolicaon* and *Oregonia* being distinct species, in distinct groups, the supposed "intermediate forms" discovered by Dr. Hagen, in a limited and exceptional district, are not intergrades, but, unless they constitute a distinct species by themselves, are of necessity hybrids, and probably between *Zolicaon* and *Oregonia* (and, perhaps, *Aliaska*).

And, finally, that the grand propositions enunciated by Dr. Hagen: 1. That *Oregonia* and *Zolicaon* cannot be separated: 2. That these forms should be considered as local or climatic varieties of one and the same species, *Machaon*, fall to the ground. *Req. in pace.*

In such cases as that of *Oregonia*, where a well-marked species is only found to exist in a much-restricted area, while its nearest allies flourish exceedingly and occupy a large territory, I hold that the former come of a high antiquity. Any form sprung from an existing one would never have attained specific rank unless specially favored, and it would flourish at the expense of the



parent form. It is because of its powerful vitality that it alone has survived, when all other varieties and any intermediate varieties have perished. Of the class indicated, are *Papilio Brevicauda*, confined to Nova Scotia, Newfoundland, Anticosti and the adjacent main land only, while *Asterias* flies all over North America, to the south and west of these regions, even to Panama; *Satyrus Pegala*, confined to the vicinity of the Gulf of Mexico, in our Southern States, while *Satyrus Alope* flies universally outside that district.

In my experience in breeding butterflies from the egg, and all the years since 1870, I have done it largely, while dimorphism or polymorphism have, in several cases, been established between forms where some sort of connection had been suspected, but of what nature no one could tell, and while what many had supposed to be mere varieties, have turned out to be distinct species, differing in their larval characters decidedly from the supposed parent, yet I do not recollect one instance where the reverse has taken place, and a form with marked characters, which I had assumed, on the strength of the imago only, to be a species, has turned out by breeding to be a mere variety. And yet, on the lumping-of-species theory, that ought constantly to have occurred. The fact is, I apprehend, that a marked difference in the imago carries with it a marked difference in the larva, at least in all species which have larval characters definite enough to seize upon. Even Dr. Hagen observed, and calls attention to, a difference between the larvæ of *Oregonia* and *Machaon*, and, as before stated, he might have found more if he had looked farther. The Doctor even has discovered, p. 160, that there are "differences in the finishing of the detail" of the genital apparatus of the males in the same two species. No doubt there are, and certainly there ought to be.

This paper is already so long that I can add but a few lines about the var. *Aliaska*, and its right by priority to give the name to the Himalayan form of *Machaon*, which has been called *Asiaticus*, Ménétériés, but incorrectly, which right Dr. Hagen disputes. I am not a stickler for priority in names, as is known, and I have long held that a Resolution should be passed by entomologists in convention, by which twenty years undisputed use of a species name should give it a good title. Under this Rule, if it could be had, *Asiatica* (not *Asiaticus*, for the other is the name Ménétériés gave the species), would certainly prevail, both for the Himalayan and the American form, unless where more is known of the latter, greater differences appear than we now discover. But, as M. Ménétériés saw fit to restrict his name with the utmost precision to what is now seen to be a mere aberration, I cannot help it. The name *Aliaska*, Scudder, under the present Rule, applies equally to the Himalayan form. Ménétériés says his var. differs from *Machaon* in the one character, a broad marginal border to hind wing, the



inner edge of which is straight (*droite*, in italics in his text). As he left it, we have to accept it.\*

## NECESSARY RESTITUTION OF THE NAMES GIVEN BY TH. W. HARRIS TO TWO NORTH AMERICAN SPHINGIDÆ.

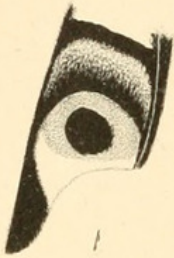
BY DR. H. A. HAGEN.

The arrangement of the biological collection of the Lepidoptera obliged me to compare carefully the literature to ascertain which names I have to adopt. It seems to me that among the Sphingidæ two North American species, first described by Th. W. Harris, should retain his names. *Ceratomia quadricornis*, described 1839, has been changed to *C. amyntor*, Hubn. This species is figured by Huebner Samml. exot. Schm. Vol. III. (not Vol. II., as it is quoted by Messrs. Grote and Robinson, p. 16, which error is repeated by Mr. A. G. Butler, Sphingidæ, p. 621). The date of the plate containing "*Agrius Amyntor*, Pennsylvania," is not sure, but certainly later than, as quoted by Messrs. Grote and Robinson, 1806-1824, and by Mr. Butler, 1806. This plate is No. 46 (numbered by pencil) in the copy of Vol. III. of the Harvard Coll. Library of the fifty-three plates forming the whole volume here and in von Heyden's Library in Frankfort o. M., Europe. Geyer's Necrolog. of Huebner, in Thou's Archiv F. I, p. 30, states, July 1, 1827, that the Samml. exot. Schmett. contains 439 plates. These plates form Vol. I. and Vol. II., but the copy before me, and others compared in Europe, contain only 438. Geyer states further that he has decided to continue the publication of Huebner's works; but in 1827, the plate with *A. Amyntor* had not appeared. Further, on the original wrapper (in the library in Berlin) Sammlung Europ. Schmett., Horda, Vol. VII., 1834, Mr. Geyer states that for the Vol. III., Samml. exot. Schmett. "are now ready thirty-one plates." As *A. Amyntor* is plate forty-six, it is published only *after* 1834, and in any way is not *Amyntor* of Huebner, but of Geyer. Perhaps it may even not antedate Harris.

It is a rule, everywhere accepted, that a figure even named can never antedate a description. Therefore, Mr. Harris, who knew that the copy in Harvard Library arrived here July 20, 1849, has, in a copy of the catalogue of N. A. Sph., presented to Prof.

\* In my paper on the American form of *P. Machaon*, in this Magazine for May, 1882, I stated that the black parts in var. *Alaska* were more intensely colored, etc., than the old world types, but I made an exception in favor of the Himalayan, saying of these, they "resemble the American in this respect." Dr. Hagen says of my statement, p. 157, that it "is not true." "The large material before me proves this statement for the Himalayan specimens, and even for some European ones, to be incorrect." The Doctor misapprehended me.

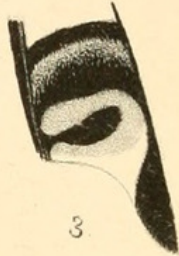




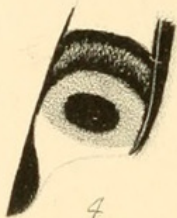
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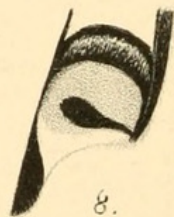
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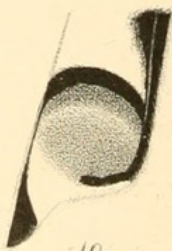
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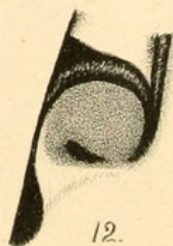
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Edwards, William H. 1883. "Comments on Dr. Hagen's paper in Nov.-Dec. number of *Papilio*, on *Pap. Machaon*, etc." *Papilio* 3(3), 45–61.

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