

Notes on certain Californian Diurnals.

It has probably been remarked by all who have collected on the Pacific coast that the fauna changes most strikingly with a change of level. At times, in the mountainous districts, a walk of five or six kilometres will suffice to transport the collector into a faunal region more distinct from the one just left than any that might be found in a journey of many hundred kilometres along the coast. This circumstance is so noticeable that it leaves the impression that more than ordinary differences of climate must be at work to accomplish such marked results; a little calculation, however, will show that the climatic alteration due to elevation alone is sufficient to account for all the changes that we see.

A journey due north of five thousand kilometres from central California would bring the explorer to hyperborean regions, while a rise of 4500 metres would cause an equivalent change in external conditions of life; and I think that it will not be far wrong to assume that the changes for each 300 metres elevation are equivalent to, though of course not identical with, the changes which would be noted in a journey of 325 kilometres along the coast or at a uniform level.

Though there is not such a sharply defined limit to the truly alpine fauna as we find in the Rocky Mountains, where this is coincident with the timber line, usually at about 3350 metres above the sea, yet in the Sierra Nevada we can trace a pretty distinct line below which the sub-alpine species rarely stray in any numbers, and this limit at the Yo Semite valley is at from 1800 to 2100 metres above the sea. It is somewhat remarkable that in this valley the line should be traceable at all, for the cliffs are so high that it would take but little fluttering for a butterfly to descend a thousand metres, in many places, to the floor of the valley. It is impossible to doubt that this often occurs; thus *Parnassius baldur* Edw., which usually inhabits a sub-alpine district, was occasionally found flying over the meadows, at the base of the cliffs, and *Papilio indra*, which seems most at home at an elevation of 2750 to 3000 metres, was several times observed and captured one and a half kilometres beneath its usual level.

Papilio zolicaon is found at all elevations, being smaller in high alpine districts, where it flies in company with *P. indra*. In these situations an umbelliferous plant, resembling a wild carrot, is abundant, and doubtless serves as the food-plant of both species. Their flight is high and wild in such situations: often the males of *P. indra* will rise, buffeting each other, for a hundred metres in the air, descending almost as abruptly, and not infrequently alighting on bare rocks to sun themselves. I took, altogether, nine males of *P. indra*, but was not rewarded by the capture of a female, although I was very anxious to obtain one to "set" for eggs.

Of all the Papilios, *P. eurymedon* was the most abundant, the males often congregating by dozens at muddy places in the road, at moderate elevations, although occasional specimens were met with as high as 2750 metres. *P. rutulus* was rather less common in similar situations. One female of this species, tied in a large bag upon a branch of wild cherry, laid twenty eggs. The young caterpillars decidedly resemble those of *P. turnus*, but seem more difficult to raise than that species. Mine died when past the first moult. Mr. Henry Edwards informs me that he has repeatedly found larvæ of this species, but invariably lost them before they changed to chrysalis. There is more difficulty in obtaining the egg than with *P. turnus*, for this same female had been confined in a smaller bag with the food-plant for some days previously and had utterly refused to lay. About half a dozen other females of *P. rutulus* were placed in the large bag from time to time, but none of these laid any eggs. Eggs of *P. eurymedon* were obtained; they are slightly smaller than those of *P. rutulus*, and of a clearer, less yellowish green. Under a lens the surface of both is seen to be slightly roughened.

Parnassius clodius I did not meet with, but eight females and one male of *P. baldur* were taken around the Yo Semite valley late in June, most of them at an elevation of about 2100 metres, although two, as before mentioned, were taken 900 metres lower down in the valley. The disproportion between males and females is remarkable, for in all other places I

have found the males of this species and of *P. smintheus* apparently to outnumber the females by about five to one.

Some of these females of *P. baldur* readily laid eggs upon Sedum. The shape of the eggs is similar to that of the eggs of *P. smintheus*, but the color is a rather light chocolate brown, instead of a chalky white as in that species. The color seems to be due to some liquid which smears the eggs when they are laid. Later in the season I met with more of *P. baldur*, 325 kilometres north, near Lake Tahoe. Here they were flying over the granite rocks at an elevation of 1800 metres, in company with the variety *behrii* of *P. smintheus*.

Most of the rock formation in this vicinity is of conglomerate, which seems rather easily affected by the weather, and does not give a congenial foothold to a species of Sedum which abounds in the crevices of the granitic rocks.

It may be remarked that the coloration of Parnassius is eminently protective in such situations as these; their flight is slow and they alight frequently, thus becoming an easy prey to the collector. The case of *P. behrii* is very curious. Numbers of this form have been taken by various collectors, and I succeeded in capturing over forty, yet in none of them was there any trace of the crimson color almost invariably found in fresh specimens of *P. smintheus*, but all had yellow or orange-yellow ocelli. It is difficult to conceive of any influence which should induce so complete a change, while failing in any way to affect the color of the corresponding spots in *P. baldur*, this being always crimson in fresh specimens.

I obtained eggs of *P. behrii*; they are white as in the true *P. smintheus*, and like the others were laid on Sedum.

I have found a little device very convenient, on excursions where only a limited amount of baggage can be carried, for inducing butterflies to lay eggs. I had a number of wire frames made, each consisting of two rings about thirteen centimetres in diameter, connected by wire uprights about twenty centimetres high, the joints being all soldered. These frames will fit in, side by side, so as to require only a moderate amount of room. Then I had a similar number of round tin box-covers made, differing in size sufficiently to nest

together. A few cylindrical flat-bottomed bags of gauze, of suitable size to fit over the rings, completed the apparatus. If the food-plant is not too large, it may be transplanted to one of the box-covers, otherwise a suitable branch may be placed in a bottle of water within one of these cages, and the female introduced. In this simple way the eggs of more than a score of Diurnals were obtained during the summer.

Among the Pieridae, a number of interesting facts were gleaned regarding the early stages of species, both of *Pieris* and *Anthocharis*.

Twenty-four hours were spent at Mojave station in the midst of the Mojave Desert, a tract of land about 160 kilometres north of Los Angeles, which is said to blossom as the rose during the two or three months of greatest rainfall, but is a barren waste during the remainder of the year.

At the time of my visit it did not seem an inviting field to the lepidopterist; the ground was nearly covered with the dried remains of some low herb which bristled with stinging prickles; a sparse growth of sage-brush alternated with a few other shrubby composite and cruciferous plants along the dry and parched water courses; the only trees were the strange "Yucca-Palms," with their numerous stiff heads of bristling green bayonets, lifted up five to ten metres upon a branching trunk, which seemed entirely composed of coarse interlacing fibres. Even in this wilderness a few now leafless wild tulips lifted their glowing scarlet heads above the sandy surface of the soil, and butterflies were not entirely lacking. The ubiquitous *Pyrameis cardui*, a species which seems to defy every climatic extreme of heat and cold, was abundant, some being fresh from chrysalis. A few of the delicate *Anthocharis sara* were to be seen flying about; and worn specimens of the rarity *Pieris beckerii*. Careful search upon the cruciferous plants revealed caterpillars of this butterfly in various stages, as well as those of *P. protodice*, and one or two which I think must belong to *P. occidentalis*. Some three weeks previously, when the train stopped at Mojave station, I alighted for a moment, and found a caterpillar of *Anthocharis ausonides*. This is almost exactly like that of *P. protodice*, therein differing very widely from the caterpillar

of the otherwise very closely allied *A. hyantis*, while the chrysalids of the two *Anthocharis* are alike, and totally different from those of *Pieris*.

The *P. beckerii* larvæ, when mature, were about 32 mm. long, in color greenish white, thickly marbled or sprinkled with gray, and with a very distinct orange-yellow belt between the segments. The head is also tinged with yellow. In addition to the dark gray sprinkling, each segment has sixteen or eighteen jet black tubercles, which taper into bristles about 1.5 mm. long.

The chrysalis is of much the same general shape as that of *P. protodice*, but less angulated; the point is terminated by a blunt tubercular point; the cephalic portion of the chrysalis is rounded, with uneven surface, and, like the dorsal surface of the thorax, is dark grayish brown. The ridge above the wing-cases, which is quite conspicuous in *P. protodice*, is absent in this species. The remainder of the chrysalis is gray, nearly white upon the wing-covers and on the ridges of the two abdominal segments; these segments form a sort of hump, which has no dorsal ridge like that on the thoracic hump, and hence is lower. A pale spiracular streak extends from the margin of the wing-covers to the tail, and there are four black dots in a line across the back at the dorsal boundary between thorax and abdomen. The chrysalis state lasts about 18 days.

During the month of June, one or more eggs or larvæ of *Anthocharis hyantis* Edw. might be found on almost every cruciferous plant growing upon the talus at the base of the walls of the Yo Semite valley, and up to a height of perhaps 450 metres above the floor of the valley. The full-grown larva is 32 mm. long; head and body apple-green, very minutely dotted with black, with a pure white stigmatal line or stripe. There are no bristled tubercles on the mature larva, though such are present in the earlier stages. Just before the change to chrysalis, the caterpillar turns dull purple; the chrysalis retains this color for a day or two, and then gradually assumes a waxy grayish-white color. In shape and general appearance it is like the chrysalis of *A. ausonides* (figured in Edwards' Butterflies of N. A., v. 2).

At different times during June, I found in the Yo Semite valley a few caterpillars which I feel certain are those of *A. lanceolata*. When mature they were 32 mm. long; head rounded, pale

green, thickly dotted with black; body rather elongated, tapering somewhat posteriorly from the sixth segment; back apple-green, shading off laterally into pale blue, which is bounded by a distinct bright yellow line just above the spiracles; next to the yellow line is a slightly broader line of pure white; venter and legs apple-green, assuming a slight bluish tint in the middle. Each segment above is covered with fine black points arranged in transverse rows; on each segment are six minute black tubercles, from which fine black bristles arise; these stand in the position of the points of equilateral triangles with their bases forwards. The chrysalis is somewhat larger than that of *A. hyantis*, and the long palpi-case is bent around backwards into a sickle-shape, giving the pupa a remarkable appearance. In many particulars of shape the pupa is not unlike that of *Terias nicippe*, and I believe that this species is the nearest to *Terias* of all our *Anthocharis*.

I will give a brief description of the larva which I suppose to be that of *P. occidentalis*; it is certainly a *Pieris*, and can hardly be any other species than this.

Head black with white dots; collar distinct, whitish; body striped transversely with yellow, black and white, the yellow predominating. In the middle of each segment (except the second and third, where it is obsolete), is a narrow black cross-line, sometimes faintly lined with whitish in the middle; this black line terminates just above and behind the spiracles, and is surrounded by white, thus giving dorsally two white cross-stripes. In front of the anterior white stripe of each segment is an irregular blotched stripe of black, consisting of a median rounded dot, a constriction on either side, and an irregularly triangular spot, with blunt apex forwards, reaching the segmental fold. The rest of the back and sides of the caterpillar is bright yellow, except a sub-spiracular band of irregular black blotches just above the prolegs. The chrysalis is black with a few lighter points.

This caterpillar is found with those of *A. hyantis*, but is much more subject to the attacks of ichneumon-flies, so that I obtained but two chrysalids and no perfect insects, although I must have taken altogether more than a dozen of the young larvæ.

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