CONGREGATION OF BUTTERFLIES AT HILLTOPS

by Geoffrey Beall

Observations by Merritt (1952), and by Rawson (1951), establish fairly clearly that at times butterflies (particularly Anthocaris midea Hbn.) may tend to appear with some frequency—let us say congregate—at hilltops; this is not invariably so, as is shown by the observations of Mather (1952). Since there is no obvious explanation in terms of food plants or other simple attractions, there is thus raised the very interesting question of why they should so congregate. The particular question here raised seems, to the writer, to be involved in the broad question of whether lepidopterists may not seriously and unfortunately ignore certain aspects of the mechanism of insect movement. What is already known about such movement, particularly in the case of the Monarch Butterfly, Danaus plexippus L and of the locust, Schistocerca gregaria Forsk., may be sufficient to explain the congregation of butterflies.

The writer suggests that butterflies, at times, may tend to drift with considerable unanimity up a hillside and then congregate in some measure when such movement is somehow barred at the top of the hill. It is only necessary to suppose that a butterfly engages, to some extent, in what Williams (1930) calls unidirectional flight and that this movement is somewhere interrupted to cause congregation. It is true that Williams is interested in unidirectional flight principally from the viewpoint of migration, i.e., flight long continued predominantly in a single direction and which results in the translocation of whole populations of butterflies. Fairly consistent flight in one direction may, however, occur for short times but be succeeded by other movements so that as a net effect there is no appreciable migration. Unidirectional movement has been noticed by the writer (probably many people have noticed it) in the case of Cabbage Whites which on days of light wind tend to move across country into the wind. He also believes he has noticed it in the case of the Mourning Cloak and various swallow-tails. If such movement ceases when the butterfly meets slightly stiffer wind (as at a hilltop) congregation may occur. The situation is reminiscent of the well-known congregations of Monarch Butterflies and less widely known congregations of Odonata and Muscid flies that frequently occur on the shores of the Great Lakes. Perhaps a closer analogy is the tendency for monarchs, when in the general regions mentioned, to fetch up in the lee of a hillock or clump of trees.

The mechanics of the type of movement just indicated has been discussed at some length by Kennedy (1951) for the Desert Locust, S. gregaria. His observations and deductions were similar to those of the writer (Beall, 1941) in connection with the Monarch Butterfly. Various things may be conceived as happening at a hilltop. An insect may tend to move fairly close to the ground against a moderate wind which is coming fairly directly over a ridge. On obtaining the top, the insect may respond to the problem of increased wind velocity by rising. Such response may be necessary to the insect for a kind of psychological reason, discussed at some length by Kennedy. The response, of course, only increases its tendency to lose ground against the wind so that at its increased height it tends to be forced backward. The tendency subsequently is for the insect to drop so that it is again some distance down the hill and close to the
ground and is able to fly against the wind; it presumably then starts another cycle. There is thus set up a sort of vertical eddy of insects which tends to hold them at the hilltop. Kennedy has described also a case where the wind came across a ridge not directly but at an angle. The movement (of locusts) was then principally up the slope to the crest and then along the ridge just below the crest in a body. Of course, for locusts the situation is complicated by the contagious effect of their necessity to move parallel to one another, but this effect would probably not be important in the case of butterflies. They might meet a wind at an angle by drifting along and down the ridge for a time and subsequently move in the opposite direction along the ridge and then up it. Such behavior would create the kind of horizontal eddies observed by Merritt.

Merritt describes a point where three ridges converge in a small plateau and where there were frequently *A. midea*. This would be a very likely spot for congregation because any wind would almost always be across one of the three ridges. A most serious objection to the present explanations is Merritt's observation that he has seen butterflies on ridges during windless days. The observation would bear checking; perhaps on these days there was a very light wind, that was still sufficient successively to orient and to stop the flight of *A. midea*.

Merritt and Rawson stress the curious fact that congregations at hilltops are principally of males. May we not easily suppose that any tendency towards Williams' unidirectional flight or any tendency to discover barriers of changed stimulus differ for the sexes? Obviously the general character of flight does so differ; thus during the summer female Monarchs tend to fly among the herbage but males above it.

We may note that the tendency for unidirectional flight probably varies according to species and, again, the stimuli necessary to cause or terminate such flight must be specific. We do not know how various is the tendency to move upwind. We might look for it particularly among the Pieridae and Papilionidae that Merritt says have a tendency to congregate at hilltops. Quite obviously the question of what wind is moderate and capable of directing flight—rather than stopping it—must vary with species. We may expect the Papilios to deal with relatively high winds; Merritt says they generally fly at more than eight feet from the ground. We may expect *A. midea*, which he says seldom rises above four feet, to move into a very light wind and be stopped by a comparatively small increase in wind velocity.

It is neither possible nor necessary to explain fully the dynamics of butterfly flight. All that is pleaded is that insects are known to move steadily in some one direction for considerable distances without any reasonable objective but merely in response to some steady stimulus like wind, and that such movement may be terminated by a quantitative change in the stimulus, such as may occur at a hilltop. There the response may easily result in a movement at the crest rather than a continuation of flight over it. Perhaps Merritt and others might consider the general hypothesis suggested here and test it against the actual facts in the field. Let them note cases where such congregation of butterflies occurs and see whether it may probably be explained by such wind barriers as are suggested. The circumstances under which they should anticipate congregation cannot be given; the secret probably lies in observing the character of flight at
hilltops under various conditions of wind. The matter might perhaps be best studied with the Papilios for which the movement might be bold and clear.

References

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PAPILIO ZELICAON AND HILLTOPS

by Richard Guppy

In the southeast parts of Vancouver Island, Papilio zelicaon Lucas is very noticeably commoner on the summits of mountains than in the adjacent valleys. I have regarded this merely as proof that the species prefers the high altitude, but the recent discussion in the Lepid. News on butterflies and hilltops, has prompted me to give this theory a more careful scrutiny.

First, does P. zelicaon really prefer a high altitude, or for that matter is there really such a thing as an alpine butterfly, in the strict sense of the word? I have an idea that it is a matter of climate, rather than altitude. On V. I. there are only two species, Plebeius aquilo Bdv. and Lycaena mariposa Reak. that cannot be taken at or near sea level. Probably both will be found at low altitude further north. P. zelicaon occurs in California; it does not appear to be a species strictly adapted to short summers.

On Mt. Benson, altitude 3300 ft., the collector can depend on finding P. zelicaon flying at the extreme summit, though they are very seldom seen during the climb. Since they are nearly impossible to net, due to their wariness and the precipitous nature of the terrain, I have never been able to catch enough to decide whether any females are present. A host plant could be in the vicinity, but I have not located it. Wherever I have taken female P. zelicaon intent on oviposition, I have always found nearby tall, conspicuous Umbelliferae such as Heracleum lanatum Michx. There are certainly no such plants on Mt. Benson. Any Umbelliferae there must be small and easily overlooked.

Had I collected only on Mt. Benson, I might be tempted to conclude that the butterflies congregate on the mountain top, while mating, and the females, always more difficult to find than the males, later disperse to the valleys to search for their host plants. But further observations do nothing to strengthen this theory. P. zelicaon is a common species above tree line on Mt. Arrowsmith.