EFFECTS OF THE REFLECTED SOLAR RADIATION ON INSECTS

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The caterpillars of many species of Lepidoptera exposed to the light near a white wall become excited, and if the surface is metallic, collapse in a short time even if the temperature of the air is moderate (1).

Larvae of Pieridae, shut within a box of white paper and exposed to the sun on barren soil, collapse in a short time, but if the box is set in the sun above dense masses of living vegetation most larvae, and chiefly the big ones, are not injured (2).

When the sky is cloudless after a storm the soil dries rapidly in places where the rainfall has been scanty. In such situations we have seen, in several countries, some caterpillars of different species crawling along the paths and on the stems of the bushes, though generally they remained hidden. Returning a few hours later, we perceived some rotten larvae dangling from the stems and others almost carbonized in their living position. This sudden mortality occurred, from our observations, at a moderate temperature. At Lisbon (Portugal), on April 24, 1933, a strong wave of heat arose while the maximum temperature reached only 23.8° (74.8° F.), but the emanation of radiant energy from the ground and buildings was so burning that about a thousand larvae of different species of Pieridae, that we were rearing at home, collapsed in a short time (3). After similar heat-waves, the Lepidoptera in the country always became very scarce. We suppose that the larvae were killed by the combined action of the ionized air and the radiations springing from the soil joining those coming from the sun.

At Philadelphia, Pa., we reared many larvae of Pieridae from May to October, 1932. While the streets around our home remained moist from the showers these caterpillars grew and pupated rapidly, even within a week after hatching, when the temperature was about 32° (89.6° F.). However, as soon as the soil of the city became barren from lack of rain, the larvae in our rooms died at 25° (77.0° F.). In summer rarely the soil remained damp for the seven days that those larvae need to mature, and therefore the mortality in our breeding cages was very high (4).

We tried to prevent the death of some larvae by putting a batch of them, during the hottest periods of each day, within
a half-shut icebox, and another batch into a well shut icebox, but with little ice, in order to keep the temperature moderately low. Invariably, the larvae in the open in our rooms died within a short time, and those in the half-open icebox, where the temperature was about 15° (59° F.), ceased to be active and died in a few days. Only the caterpillars in the other ice-box, into which the burning air of the outside did not penetrate, remained alive (5).

At Salonika (Greece), in 1935, those larvae of Pieridae, which at Philadelphia, during the heat waves, collapsed even in a room at 15° (59° F.), fed actively and pupated within an incubator at 40°-44° (104°-111.2° F.) both in a dry or very wet room. Other larvae of the same species, which remained without care for ten days in an electric thermostat at 38° (100.4° F.), matured there, formed chrysalides and produced butterflies, in spite of the dry heat and lack of light and air, eating up the roots of the dry plants which were in the box (6). During the above recorded trials the sky was cloudy and the ground was always moist from the frequent rains, so that the feeble solar radiations were absorbed by the humidity of the soil, and the larvae developed well as the high temperature compensated for the low radiation.

Eggs and larvae, kept at Philadelphia in a refrigerator at 0° (32° F.), which was opened from time to time to place in or to take out some specimens, died there after some days, both in May and June, during which time it often rained and the soil remained generally wet. On the contrary in July, when the soil was barren, and the strong radiant energy in the air occasionally came into contact with those organisms, though for a short time only and at a low temperature, it supported their vitality for about a month. Also in July, some eggs in an ice house, where the temperature varied from 7° (44.6° F.) to 10° (50° F.), hatched there after two weeks (7). On the other hand, at Lisbon, while the weather was generally cloudy and raining, eggs and larvae of the same species died after some days in a room at 10° (8). In this latter case, the feeble radiations were not sufficient to balance the depressing effects of the rather low temperature.

From what we have recorded it seems that radiations reflected from the ground are an important factor of the climate.

(To be continued)