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WEATHER AND THE REGULATION OF *HYPOTHYRIS EUCLEA* (NYMPHALIDAE): POPULATIONS IN NORTHEASTERN COSTA RICA

Brown and Neto (1976, Biotropica 8: 136–141) found that populations of some ithomiine butterflies (*Hypothyris* and *Mechanitis*) in Brazil are controlled largely by parasitism of eggs and larvae during the wet season. Presumably periods of increased daily precipitation provide increased opportunities for successful parasitic attacks. Characteristically, local adult populations of *Mechanitis* and *Hypothyris* exhibit large fluctuations in numbers throughout the year (Brown & Neto, op. cit.; pers. obs.).

Populations of *Hypothyris euclea leucania* (Bates) exhibit annual periods of sudden, rapid growth of adult populations in northeastern Costa Rica (Young 1977, Pan-Pacif. Entomol. 53: 104–113). It was presumed in that study that the frequency of mating and oviposition and the survival of eggs and larvae were increased during a period of dryness preceding the time of increased population abundance. The purpose of this note is to present further data on *H. euclea* that support my earlier prediction that greatly increased adult numbers, in northeastern Costa Rica, follow dry periods.

At times each year (1971–77), at Finca La Tirimbina, La Virgen, Heredia Province (220 m elev.), very high density concentrations of adult *H. euclea* occur along forest trails and clearing. At these times, many individuals of the larval foodplant, *Solanum rugosum* Dund. (Solanaceae), are heavily defoliated by *H. euclea* larvae feeding a few weeks earlier. Few larvae are present during weeks of high adult abundance. The deposition of many large egg masses on S. *rugosum* results in many larvae and defoliation (Young, op. cit.). Walking along a forest trail flushes out many resting butterflies; from one to 30 adults may be flushed from a five-meter section of trail on a sunny day. Most of these are fresh. At other times of the year, as few as one or two adults occur in about 100 meters of trail. Sometimes adults are conspicuously absent. Adults feed on dead insects and fresh bird droppings. Either adult dispersal or mortality is high over short periods (one week) since, for example, from 40 fresh adults marked during a 20-minute period one day (15 August 1977) at

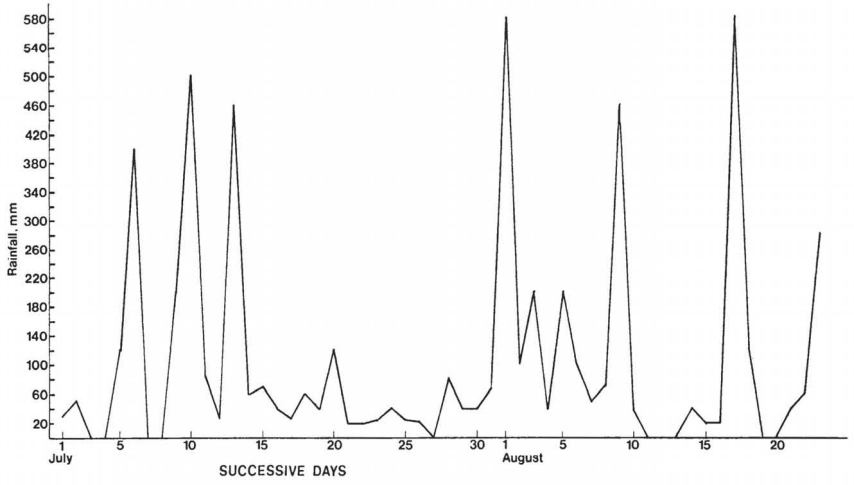

FIG. 1. Daily rainfall levels for July and August 1977 at Finca La Tirimbina, La Virgen de Sarapiqui. Note the two-week dry period in the latter part of July. Data courtesy Dr. J. Robert Hunter.

one spot, only three were recaptured two days later and none a week later. Two-thirds of these butterflies were males. A few weeks later, adult numbers had declined considerably at five different spots where abundances were very high for at least three weeks. Brown and Neto (op. cit.) found that populations of *H. euclea* and *H. daeta* diminish rapidly in size as a result of high dispersal and high longevity of adults. If July–August 1977 is used as an example, August was characterized by heavy daily downpours, both day and night, but this rainy period was preceded by a dry period during the last two weeks of July (Fig. 1).

The life cycle of *H. euclea* at this locality takes about 22 days (Young, op. cit.). Thus frequent deposition of large egg masses at this locality and high survival of eggs and larvae result in a large wave of fresh adults about three weeks later. For example, egg masses deposited during the dry period in July 1977 produced the large adult population present in August. Mortality factors operative on egg rafts and gregarious young larvae may be drastically reduced in frequency and intensity during periods of dry weather (Young, op. cit.). Although the proximal causes of this apparent mortality are unknown, their activity correlates well with wet periods. A broad range of invertebrate predators and pathogenic fungi are very likely involved in the regulation of *H. euclea* populations. Gilbert (1969, Some aspects of the ecology and community structure of ithomiid butterflies in Costa Rica, Organization for Tropical Studies, mimeo report) found ants and wasps to be predators of *H. euclea* larvae. Gilbert also suggests that egg mortality from leaf-patrolling predators is operative in *H. euclea* populations. Waves of pupal and adult flour beetles (*Tribolium* spp.) follow periods of slackened predation (Mertz 1969, Ecol. Mongr. 39: 1–31. Dry weather may also enhance mating and oviposition (Young, op. cit.), thereby "stacking the deck" even further for a large cohort of adults to appear.

These observations suggest that tropical butterfly populations subject to control or regulation by biotic agents may be, in fact, regulated only to the extent to which daily rainfall patterns influence the activity of these agents.

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BOOK REVIEW

PENNINGTON'S BUTTERFLIES OF SOUTHERN AFRICA, edited by C. G. C. Dickson with D. M. Kroon, 1978. Ad. Donker, Johannesburg and London. 671 pp., including frontispiece, 198 plates, 1 text figure and 1 map. Price: R49.00 (approximately $80.00 U.S.).

The manuscript for this book was begun many years ago by K. M. Pennington, but "KMP" never lived to see its appearance. It is a testimony to the heartfelt admiration that his fellow collectors felt toward Pennington that they were determined that KMP's life work would not go unpublished. For the next three years Mr. Dickson and Dr. Kroon revised, updated and added to the manuscript to make it ready for publication. They have done an admirable job and produced in Pennington's honor a truly outstanding book, one that is not duplicated by other regional treatments of a comparably sized fauna.

The 781 species of butterflies found in southern Africa (including South Africa, Southwest Africa and much of adjacent Rhodesia and Mozambique) are treated in the text on pages 33–201. This is a fauna comparable to the rhopaloceran fauna oc-