

GENERAL NOTES

THE OCCURRENCE OF *POANES YEHL* (SKINNER) (HESPERIIDAE) IN KENTUCKY

The first known Kentucky specimens of the Yehl skipper, *Poanes yehl* (Skinner), were taken 15 and 16 September 1979, during a field meeting of the Society of Kentucky Lepidopterists. Males and females in condition varying from fresh to slightly worn were collected by Richard A. Henderson, Leroy C. Koehn, John S. Nordin, and the author in two localities in Fulton County, the westernmost of Kentucky counties.

Both sites were within 5 miles of the Tennessee border. The first captures were in and around swampy woods where State Rd. 94 crosses Little Bayou de Chien, 2.5 miles east of Cayce. The butterflies were visiting blossoms of climbing hempweed, *Mikania scandens* (L.) and goldenrod, *Solidago* sp., or resting on foliage near the ground.

The second site was along a dirt road south from State Rd. 1282 in the Reelfoot National Wildlife Refuge. Swampy woodland bordered the dirt road on one side and soybean fields the other. Several *P. yehl* were taken by the author on blossoms of ironweed, *Vernonia* sp., and at rest on vegetation near the ground. The latest taken in the day was after 5:00 P.M., almost at sunset.

Other species of particular interest collected at these localities were *Euphyes dion* (Edwards) and *Lethe portlandia missarkae* Heitzman & dos Passos (both sites), and *Lethe appalachia* R. L. Chermock (common at the first site). These records are the first for these species in September in Kentucky. Collections of these and others of the 46 species recorded during the trip were made by William R. Black, Jr., and James R. Merritt, in addition to those named above.

On 21 June 1980, *P. yehl* was observed in both localities mentioned above by Henderson, Nordin, and Loran Gibson in company with *E. dion* and *Poanes viator* Edwards. The Yehl skipper was seen on flowers of button bush, *Cepha'anthus occidentalis* L., American germander, *Teucrium canadense* L., and red clover, *Trifolium pratense* L.

Finally, the author took 1 female Yehl skipper on mistflower, *Eupatorium coelestinum* L., in Graves County, Kentucky, at a field-woods interface on the Bell farm near Kaler. This record extends the known range about 30 miles northeastward from the Cayce site. That site was also visited on 13 and 14 September 1981, and *P. yehl* were moderately common. Many were seen on late thoroughwort, *Eupatorium serotinum* Michx., as well as flowers listed above for 1979.

These records for *P. yehl* may extend the known range slightly northward in its western extremity. Howe (1975, Butterflies of North America, Doubleday & Co., Inc., Garden City, New York, p. 456) reports it from Tennessee, and J. R. Heitzman (pers. comm.) says it is "very local in extreme southern Missouri." This addition brings the Kentucky state butterfly list to 132 recorded species.

CHARLES V. COVELL, JR., *Department of Biology, University of Louisville, Louisville, Kentucky 40292.*

RESPONSES BY BUTTERFLIES TO SEASONAL CONDITIONS IN LOWLAND GUANACASTE PROVINCE, COSTA RICA

The recent report on *Agrias* in Costa Rica (DeVries, 1978, J. Lepid. Soc. 32: 310) warrants further comment with regard to the locality of capture for *A. amydon* Hew. *Agrias amydon* was captured in the Santa Rosa National Park in the lowlands of the

Guanacaste Province, a region characterized by a strong annual dry season. DeVries did not mention the date of capture, although the dry season in this region generally occurs between December and June, and lasts 6–7 months. However Daniel H. Janzen originally captured this species at the beginning of the dry season in Santa Rosa and subsequent captures have been made later in the dry season here as well as at other localities across the Cordillera Central into the Atlantic lowlands (by P. DeVries). This note will attempt to explain the occurrence of *A. amydon* and other typically wet forest Nymphalidae in highly seasonal lowland tropical regions (such as Guanacaste) throughout the year, and will suggest the existence of two different ecological mechanisms promoting butterfly activity in both wet and dry seasons.

The lowland Guanacaste dry season is a period of considerable environmental stress to both plants and insects, save for riparian forest habitats that remain fairly evergreen (Janzen, 1967, *Evolution* 21: 620–637; 1976, *Brenesia* 8: 29–34). The riparian evergreen forest environment in Guanacaste near the end of the dry season is noticeably cooler, both for air and soil temperatures; has higher relative humidity than nearby deciduous forest habitats (Janzen, 1976, *op. cit.*); and provides a more favorable microclimate for organisms requiring moist conditions for their activity. *Agrias* and the majority of other forest nymphalid butterflies of Neotropical regions attain their highest diversity (defined here as the number of species in a region) in both lowland and montane tropical wet forests (Seitz, 1924, *Macrolepidoptera of the World*, Vol. 5, The American Rhopalocera, A. Kernan, Stuttgart; A. M. Young, *pers. obs.* 1968–1979, in Costa Rica).

On the eastern slopes of the Cordillera Central in Costa Rica, and in the eastern lowlands, the annual dry season is relatively short and slight, and adult nymphalids are generally active throughout the year at the same localities along an altitudinal "transect" from about 1000 m to 90 m above sea level at one latitude (A. M. Young, *pers. obs.*). Nymphalid genera such as *Historis*, *Adelpha*, *Prepona*, *Siproeta*, *Anaea* and many others are active throughout the year along such a transect. Undoubtedly, adults in small, highly fragmented forest populations of *Agrias* are also active throughout the year along the eastern slopes of both the Cordillera Central and Talamanca ranges.

A major feature of the more seasonal lowland Guanacaste region is an explosion of "leafing out" and other forms of vegetative growth in both herbaceous and woody plants at the beginning of the wet season (Janzen, 1967, *op. cit.*). Such conditions provide a greatly expanded food base for herbivores such as larval Lepidoptera. During the severe dry season, small adult populations of typically wet or moist forest butterflies, such as the blue form of *Morpho peleides*, at least two species of *Anaea*, several Papilionidae (including *Parides* and *Battus*) and other butterflies, occur in pockets of evergreen riparian forests, which are like present day refugia. But as the wet season begins and advances these populations increase in size. Furthermore, "corridors" of leafed-out vegetation occur between the lowland and higher elevational forest areas along the western slopes of the Cordillera Central during the wet season, promoting expansions of montane butterfly populations into suitable lowland areas in Guanacaste. During the dry season some butterflies undoubtedly migrate into nearby mountain forests to escape from desiccation in deciduous forest habitats in the lowlands. Paul A. Opler (Office of Endangered Species, Dept. of Interior) has studied seasonal distributions of butterflies in Guanacaste. In the particular case of the pierid *Eurema daira* he has discovered that a "wet season phenotype" of predominantly females migrates into the mountains early in the dry season, to be replaced later in the dry season by a "dry season phenotype" which stays in the lowlands. Both phenotypes are present in riparian forests in the lowlands, the aggregations of the adults shifting continually in response to changes in adult food supplies (Opler, *in prep.*).

Seasonal changes in vegetation and habitats at this time may be less pronounced at higher elevations on the western slopes, thus providing supplemental refugia for many butterflies in addition to lowland evergreen riparian forests. As a result, nymphalids and other butterflies in the northwestern region of Costa Rica have available two different less stressful (in terms of moisture and food resources) environments: lowland evergreen riparian forests and pockets of moist forest higher up on the slopes of the Cordillera Central.

Under the conditions discussed above, the butterfly fauna of the region is in a dynamic state of changing habitat associations and changing localities, both at a given altitude and along an altitudinal gradient (20–1200 m). The captures of *A. amydon* during the Guanacaste dry season by Janzen and DeVries in both forest and open pasture habitats indicates that adults of this species probably pass most, or all, of the long dry season primarily associated with forest refugia. During the dry season, strong-flying *A. amydon* and perhaps other nymphalids undoubtedly forage in open areas, only to return to sheltered retreats in response to thermal stress. Furthermore, the spectrum of forest habitats present at Santa Rosa undoubtedly provides different types of refugia for butterflies during the dry season, perhaps more so than for other localities in Guanacaste. It is expected that not all butterfly species will respond to dry season stress in the same manner; thus, while some species such as *A. amydon* may pass this period associated primarily with forest refugia but with occasional foraging in open pastures near shaded buildings (such as for the site of Janzen's original capture), others may migrate to higher elevations as observed by Opler. In addition to responding to thermal stress and availability of adult food supplies, the degree to which a butterfly species passes the dry season in the Guanacaste lowlands will also be dependent upon the condition of larval host plants and whether or not adults experience reproductive diapause. Species with very deciduous larval host plants will either remain in the lowlands in reproductive diapause or migrate into higher elevations where host plants might still be verdant. Further field studies of many different nymphalids can be conducted to examine these alternative suggestions more critically.

The lesson to be learned from observing butterflies in the tropical dry season, in terms of the ecological features of seasonal tropical environments affecting the survival ability of relatively small poikilotherms, is the need to distinguish between resident and migrant species at particular localities at different times of the year. If done, it may not be unusual to find moist or wet forest butterfly species in highly seasonally variable regions of the American tropics. What appears to be emerging from the fragmentary data gathered to date is that butterfly species occupying lowland tropical regions with specific seasonal changes, such as that exemplified by lowland Guanacaste Province in Costa Rica, may exhibit different strategies for passing the dry season. The strategy of a given species may be of one kind in that adults either occupy riparian forest patches acting as ecological refugia or migrate to less seasonal higher elevation habitats where both adult and larval resources are available. The first strategy also promotes the evolution of reproductive diapause. Or, as indicated by the interesting work of Opler, some species may exhibit a "mixed" strategy in which complex polymorphisms generate different morphs, each a specialist for a different strategy. In some ways the expressed phenotypic polymorphism of a species such as *Eurema daira* (Opler, in prep.) is a generalist strategy, permitting adaptation to the existing dry season conditions of the lowlands, while providing an escape-valve from the resource-depleting effects of the season.

I thank Phil DeVries and Paul A. Opler for sharing with me some of their unpublished data and ideas on Guanacaste butterflies. The comments of an anonymous reviewer were also very helpful.

ALLEN M. YOUNG, *Invertebrate Division, Milwaukee Public Museum, Milwaukee, Wisconsin 53233.*