AN ORCHID ATTRACTANT FOR MONARCH BUTTERFLIES (DANAIDAE)

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In view of the recent spurt of research on insect-flower relationships, and in particular the studies of Dodson and his co-workers on biologically active compounds in orchid fragrances (Dodson et al., 1969), it is especially interesting to discover an orchid which seems to have a practically "irresistible" attraction for monarch butterflies.

The monarch butterfly is unquestionably the best known butterfly species in the United States, and its biology has been the subject of a great deal of attention (Urquhart, 1960). In the Great Lakes states, as elsewhere, the monarch is famous for its swarming behavior preparatory to migration southward to the Gulf Coast and Mexico. Swarming is observed in the latter part of September and early October as a rule, although Moore (1960) reported a swarm in the middle of August, "... thousands of individuals on Seul Choix Point on the north shore of Lake Michigan," and Urquhart points out that migration actually has its beginnings in July.

During the first two weeks of autumn, monarch butterflies are frequent everywhere in the vicinity of Ann Arbor in southeastern Michigan. Their behavior is languid, and they soar slowly across fields and along roadsides, feeding especially upon flowers of various species of asters (e.g. Aster azureus, A. ericoides, A. laevis, A. novae-angliae). In cultivated legume fields the monarchs visit red clover (Trifolium pratense) and alfalfa (Medicago sativa) primarily. In general, butterfly diversity is low at this time during most years—a few sulphurs (Colias philodice, C. eurytheme), some worn swallowtails (Papilio polyxenes especially),
buckeyes (*Precis lavinia*), painted ladies (*Vanessa* spp.), and occasional skippers (esp. *Epargyreus clarus*, *Hesperia leonardus*, and rarely southern migrants such as *Atalopedes campestris*). Angle-wings (*Polygonia comma*, *P. interrogationis*) and mourning-cloaks (*Nymphalis antiopa*) are seen along woods edges and in old orchards. Although Milbert's tortoise shell (*Nymphalis milberti*) may become common in some years, monarchs and sulphurs dominate the picture. Wherever a lepidopterist drives on a warm, sunny day in early fall he finds *Danaus* and *Colias* on roadside asters, indicating a "good day" for butterflies.

On just such a day, 19 September 1970, we encountered an extraordinary circumstance. The greenhouses at the University of Michigan Gardens, located at Dixboro, Washtenaw Co., Michigan (approximately five airline miles from the center of Ann Arbor), were discovered to be "full of monarchs," as reported by one of our students. Looking into the matter we found that more accurately one part of one greenhouse was occupied by the butterflies. But the scene was remarkable; there were at least 200 individuals, as best we could count them. They were flying slowly to-and-fro, banging against the windows. At one corner of the house were five dozen butterflies settled on the glass panes. Something within this unit of the greenhouse was obviously attracting the monarchs. They would fly to the top of the greenhouse from the grounds nearby, and then fly down through the ventilators into the house. On 22 September 1970, the ANN ARBOR NEWS carried a story entitled "A Butterfly Invasion" describing the situation as follows, "More than 100 of the large butterflies are now gliding around the orchid greenhouse, beating their black-striped, orange-brown wings against the glass panes. . . . For some reason the butterflies have neglected adjoining greenhouses with their different plant varieties." The reporter had consulted entomologists for an explanation. One of them commented, "At this point it is anybody's guess why the monarchs have invaded this particular greenhouse. It could be something different about the temperature, or humidity of the air, or some special odor from the greenhouse." It was this last suggestion that we acted upon.

The so-called "orchid greenhouse" actually contained many other kinds of plants besides orchids, including bromeliads, ferns, and certain aroids. We made the assumption that some plant—either its vegetative parts or its flowers—was generating a substance that was so powerful as to attract the insect from the neighboring fields and woods to the roof of the greenhouse and then down through the ventilators. Of all the plants growing there, only one was visited selectively by the monarchs—an orchid. However, the butterflies would only come by casually, stop
briefly, then leave, not to return. This particular orchid species has numerous flowers, but a monarch would come for its brief stop only to a single flower, and then depart. In spite of this seemingly almost random interest in the flower, we moved the orchid plant into another greenhouse in order to observe what effect this might have. We soon learned that there was no question about it: this was the plant. Very soon the monarchs now floated down into this greenhouse, as before they had in the other. And no new monarchs flew into the house where they had previously been attracted.

The orchid has been identified as *Epidendrum paniculatum* Ruiz & Pavon, which is a widespread species (or species-complex) ranging from Central America to Peru. The plant is commonly and readily grown in horticulture for its somewhat fragrant flowers, these about 2 cm. across, brownish to rose-white in color, which are borne in spreading, many-flowered panicles a foot or more in length. Historically this is one of the best-known members of its genus. Over three-quarters of a century ago, it was written (Veitch & Sons, 1887–1894) that this plant is, “One of the first epiphytal orchids known to science, and one of the most widely distributed of the genus. It was discovered more than a century ago by the Spanish botanists Ruiz and Pavon, near Huayaquil (Guayaquil?) in Peru, and has since been gathered by various collectors in many localities in tropical South America widely remote from each other, but always at a considerable elevation on the Cordilleras from Bolivia northwards to Venezuela. As a species it is very variable, due doubtless to diversity of station and its wide distribution . . . .” Dodson has written me of his personal observations in Costa Rica and Ecuador that this species or closely related ones will attract ithomiid butterflies. He suggests that perhaps the substances involved in the attraction of monarchs are pyrolizidine alkaloids. The orchid is, as indicated, widespread in cultivation and therefore readily obtainable for experimental work.

Morrell (1960) reports that heliotrope (*Heliotropium indicum*, Boraginaceae) is attractive to danaids. Plants dried from 48 hours to a fortnight may be used. It should be interesting to determine whether there is a common factor in the substances produced by the orchid described here and the heliotrope.

We were especially curious to learn whether the *Epidendrum* orchid attracted the sexes differentially, so we kept records for two years on the numbers that came into the greenhouses. We also set up what might be called “an obstacle course” to see whether we could entice the monarchs into the court of a large building, forcing them to fly up and over the sides, using the orchid as an attractant.
Both in 1970 and 1971 we missed the main flights. In 1970, on 21 and 22 September there were still numerous butterflies being attracted into the greenhouse (a total of 119 for both days), but the weather became cloudy and the temperatures dropped, so they were considerably less common, the numbers dropping to 0–16 per day. Observations in the field after 22 September indicated that monarchs were either extremely rare or absent; nevertheless, a few kept showing up at the greenhouses. Males were in slight excess—66 males to 51 females from 22 to 30 September inclusive. In 1971, the orchid plant came into bloom rather late, but we kept records for the period 29 September through 5 October inclusive, and counted a total of 47 males and 50 females. The sex ratio of attracted monarchs thus appears to be approximately 1:1.

In 1972 we experimented to find out how much “trouble” the butterflies might undergo to reach the flowers of this orchid by bringing it into the Natural Sciences Building on the Main Campus of the University of Michigan, Ann Arbor. Here in the center of the city, in a building four stories high, the plant was placed in a third floor office near a window opening into the central courtyard. In order for a butterfly to reach the plant it would have to fly over the walls of the building and then select the right window out of over 100 facing the court. So that the butterfly would not see the flowers, the venetian blind was lowered but the window left open. In spite of these seeming obstacles, three males did appear at and entered through the window, indicating that the attractive forces of this orchid for monarchs must be very strong indeed. The period of our “obstacle course” test was 15–17 September, and the butterflies came from 0955–1235. One butterfly appeared each day.

From the evidence that we have seen, Epidendrum paniculatum is a powerful attractant for monarch butterflies. We have made no attempt to identify the compound or compounds which are active in the attraction, but various persons have described their subjective interpretation of the scent of the flowers as “lemony” or “slightly spicy.” It is to be hoped that further studies of this attractant can be made, and also that students of monarch butterfly biology may be able to use the orchid in their research, e.g., for luring migrating specimens into buildings or other enclosures for purposes of marking.

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Literature Cited

ON ORNITHOPTERA PRIAMUS CAELESTIS ROTHSCCHILD,
DEMOPHANES FRUHSTORFER AND BOISDUVALI
MONTROUZIER (PAPILIONIDAE)

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In October and November of 1970 and 1971, the senior author undertook two trips by boat to Trobriand Islands, Louisiades Archipelago and Woodlark Island, to study the life histories of and collect Ornithoptera priamus caelestis Rothschild, O. p. demophanes Fruhstorfer and O. p. boisduvali Montrouzier. This article consists of field notes, descriptions of immature stages and a selection of photographs taken in the field by H. Borch. The young stages are described here for the first time. The taxonomic and phyletic considerations on the imagines are by F. Schmid. The eggs and the first three larval instars are identical in the three forms and likely are very similar to those of other subspecies of priamus; therefore, they are not described here.

Ornithoptera priamus caelestis Rothschild

General Observations

Imagines and immatures were seen and collected on Misima Island (Misima, Liag and Larama), Nimoa Island (Nimoa), Sudest Island, Hemenaehei Island and Moturina Island. The food-plant is Aristolochia tagala. The ova are always laid singly on the food-plant or on any nearby object or plant. An ant, Oecophylla smaragdina (native name, Kura Kum), has been observed preying on the eggs, sometimes sucking dry dozens of them. The newly emerged larvae eat their egg-shells and sometimes turn also to other unhatched eggs and completely devour them.