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PALATABILITY OF SEVEN BUTTERFLY SPECIES (NYMPHALIDAE) TO TWO TYRANT FLYCATCHERS IN BRAZIL

Additional key words: color patterns, Tyrannidae, foraging behavior, predators.

Palatability of butterflies to predators that hunt visually generally is related to patterns of coloration. Thus unpalatable species tend to have brightly colored wings that advertise to predators their distasteful properties, whereas palatable ones tend to be cryptic (Fisher 1930). In spite of recent investigations (Chai 1986), we estimate that only about 30 of the 3000 described species of Nymphalidae have been tested for palatability. Most previous studies focused on the palatability of temperate species to captive animals (almost always to birds and lizards). Few field data on the interactions between butterflies and predators have been reported (e.g., Brower 1984).

In this paper we investigate the palatability of free flying individuals of *Callicore astarte astarte* Cramer, *Catacore kolyma connectens* (Talbot), *Diaethria clymena clymena* (Cramer), *Pyrrhogyra neaera arge* Gosse, *Marpesia norica* (Hewitson), *Marpesia chiron* (Fabricius), and *Temenis laothoe* (Cramer) (all Nymphalidae: Nymphaliinae) to wild individuals of two tyrant flycatchers, *Hirundinea ferruginea* Sclater and *Tyrannus melanocholicus* Vieillot (Tyrannidae). The first three butterfly species exhibit warning coloration patterns (on the upper surface of the wings) when flying, with a predominance of red, black, blue, and yellow; such coloration suggests that they are unpalatable. The other four species (which do not exhibit such colors) were tested as controls.

Field work was conducted in July 1988 in the Serra dos Carajás (5°54'-6°33'S; 49°53'-50°34'W) in the southern portion of the State of Pará, Brazil. Butterflies were caught in lowland forest (Pojuca, <100 m elevation) characterized by *Mimosa* spp., grasses, and small patches of dry forest, and many tyrant flycatchers. Butterflies were released 10 to 30 m upwind of the birds, always near the end of the afternoon when the predators feed (Fitzpatrick 1980). Palatability tests with *H. ferruginea* were conducted using a single pair of birds near their nest site. A combination of different butterfly species was offered

TABLE 1. Responses of two wild tyrant flycatchers, *Hirundinea ferruginea* (H.f.) and *Tyrannus melancholicus* (T.m.), to seven species of free-flying butterflies (n = 63 individuals).

Butterfly	Bird	Observation from perch	Pursuing without capture	Capture and release	Capture and eating
<i>Callicore astarte</i>	H.f.	12	—	2	—
	T.m.	2	3	2	2
<i>Catacore kolyma</i>	H.f.	1	—	—	—
	T.m.	2	—	—	—
<i>Diaethria clymena</i>	H.f.	5	1	—	—
	T.m.	1	1	1	1
<i>Pyrrhogyra neaerea</i>	H.f.	3	—	—	2
	T.m.	—	—	—	4
<i>Marpesia norica</i>	H.f.	—	—	—	3
	T.m.	1	—	—	5
<i>Marpesia chiron</i>	H.f.	—	—	—	1
<i>Temenis laothoe</i>	H.f.	—	—	—	8
Total		27	5	5	26

sequentially to the birds. In the case of *T. melancholicus*, the number of birds involved in the experiment was nearly the same as the number of butterflies offered (n = 25).

The birds' responses (Table 1) were pooled into four categories: (1) "Observation from perch," when a bird observed a butterfly and moved only its head. Butterflies that did not elicit this response were considered as not sighted by the birds. (2) "Pursuing without capture," when a bird flew near a butterfly for closer observation, but did not attempt to capture it. (3) "Capture and release," when a bird followed and captured a butterfly and released it afterwards. (4) "Capture and eating," when a butterfly was swallowed after capture. The first two responses were considered to be sight-rejection of the butterfly; the last two were considered to be taste-test in which butterflies were rejected (released) or accepted (eaten).

The response of the birds to butterflies offered are presented in Table 1. The brightly colored species *C. astarte*, *D. clymena*, and *C. kolyma* were considerably less attractive to the birds than the other species. Of all individuals of these three species tested, 78% (n = 36) were rejected on sight by the birds, 14% were rejected after taste trials (especially *C. astarte* and *D. clymena*), and 8% were eaten. Butterflies rejected were released alive without apparent injury, as they flew to a safer place after release by birds.

Conversely, 85% (n = 27) of butterflies showing other color patterns (i.e., *M. norica*, *M. chiron*, *T. laothoe*, and *P. neaerea*) were attacked quickly by the birds and consumed (including the wings). *Pyrrhogyra neaerea* sometimes was sight-rejected by *H. ferruginea*, but it always was eaten by both bird species when captured.

Our palatability data agree with those described by Chai (1986) for *M. chiron*, *T. laothoe*, and many other species in the genera *Callicore*, *Diaethria*, *Marpesia*, and *Pyrrhogyra* that were tested with jacamars (*Galbula ruficauda*; Galbulidae). The unpalatability we found for *Callicore astarte* suggests that the similarities of color patterns among several species in this genus may be mimetic.

Individuals of *H. ferruginea* and *T. melancholicus* responded similarly in their acceptance and rejection of each butterfly species. Even so, there were slight differences: *H. ferruginea* rejected more butterflies on sight than *T. melancholicus*, which also captured and ate some of the butterflies considered unpalatable. Such differences may be

due to the more generalized habits of *T. melancholicus*, which is found in a greater variety of habitats and probably has a more generalized diet.

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AN OVERLOOKED RECORD OF *LACINIPOLIA RODORA* (NOCTUIDAE) FROM THE UNITED STATES

Additional key words: Mexico, national record, United States.

Lacinipolia rodora (Dyar) (Noctuidae) was described as *Polia rodora* Dyar (1911) from a single female from Mexico City, Mexico. The type specimen (Type No. 12958), collected by R. Mueller, is deposited in the collection of the United States National Museum (USNM), Smithsonian Institution, Washington, D.C. It has long been recognized by several noctuid workers that *Lacinipolia rodora* ranges into southwestern United States, but owing to unfortunate circumstances, this information has never been published in a formal manner.

In the early 1960's, Lloyd Martin began a taxonomic study of the genus *Lacinipolia* McDunnough, based primarily on material in the collection of the Natural History Museum of Los Angeles County (LACM). The subsequent loss of his notebook with photographs of all the type specimens and extensive descriptive notes, caused Martin to abandon his study. In 1975, Charles Selman completed a revision of *Lacinipolia* as his doctoral dissertation at Ohio State University. Selman's (1975) study was a complete taxonomic revision, including descriptions, photographs, and genitalic drawings. Due to the length of the document and unforeseen difficulties, Selman's dissertation was never published. Required copies of his dissertation were deposited in the library of Ohio State University. Photocopies have been made available, but minimal distribution of photocopies does not satisfy the requirements for formal publication as identified in the International Code of Zoological Nomenclature (Stoll et al. 1961).

Selman (1975) proposed the new combination *Lacinipolia rodora* in his dissertation,