

DIFFERENCE BETWEEN MOTHS' AND BUTTERFLIES' SCALE BASE

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ABSTRACT

Examination of nonmarginal scales of anterior wings of Lepidoptera showed that those of the butterflies were auriculate basally and those of moths were cuneate.

Key Words: Scales difference, moths and butterflies, Lepidoptera.

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INTRODUCTION

Through the use of various methods, including scanning electronmicroscopy, several kinds of scales have been described for Lepidoptera (Hering 1926; Kellogg 1894). In these scales, two types of bases were present. The first was auriculate or cordate (Fig. 1); an auricle, as defined by Downey and Allyn (1975) is a small earlobe-like basal extension on the proximal margin of the scale blade near its juncture with the pedicel or petiole. The second type was the cuneate or attenuate (Fig. 2, 3), in which the scale tapers gradually into a slender basal petiole.

A brief and simple replica technique was recently described for the study of the cuticle surface (Khalaf 1980). The technique gives much higher magnification than that secured by direct stereoscopic microscope examination, increases resolution, and allows for more detailed examination of surface structures. Unlike scanning electronmicroscopy and conventional slide mounts, the simplicity of the process makes it suitable for routine taxonomic studies. This method was used in this research for the preparation of impressions of the dorsal surface of the anterior wings of Lepidoptera. The species studied are listed in Table 1. Photography was accomplished under 600 × magnification.

RESULTS

The bases of nonmarginal scales of all butterflies and skippers examined were auriculate or cordate (Fig. 1). On the other hand, the bases of nonmarginal scales of all moths studied were cuneate (attenuate) (Fig. 2-7). This type of base seems to be primitive. The micrograph given by Kristensen (1970) for the scales of *Micropteryx calthella* L. lends support to this conclusion since Micropterygidae is one of the most primitive families in this order. The scales were cuneate. Moreover, according to his description, the base of the scales of *M. thunbergella* Fabricius seemed to be similar.

Hering distinguished the two types of bases and stated that the auriculate type was predominant among "day Lepidoptera." He did not focus, however, on the nonmarginal scales of the front wings; hence, he was unable to notice the sharp difference between moths' and butterflies' scales. In future investigations, even if exceptions to this theory are encountered, it is anticipated that such a prominent morphological difference should continue to be useful in classification.

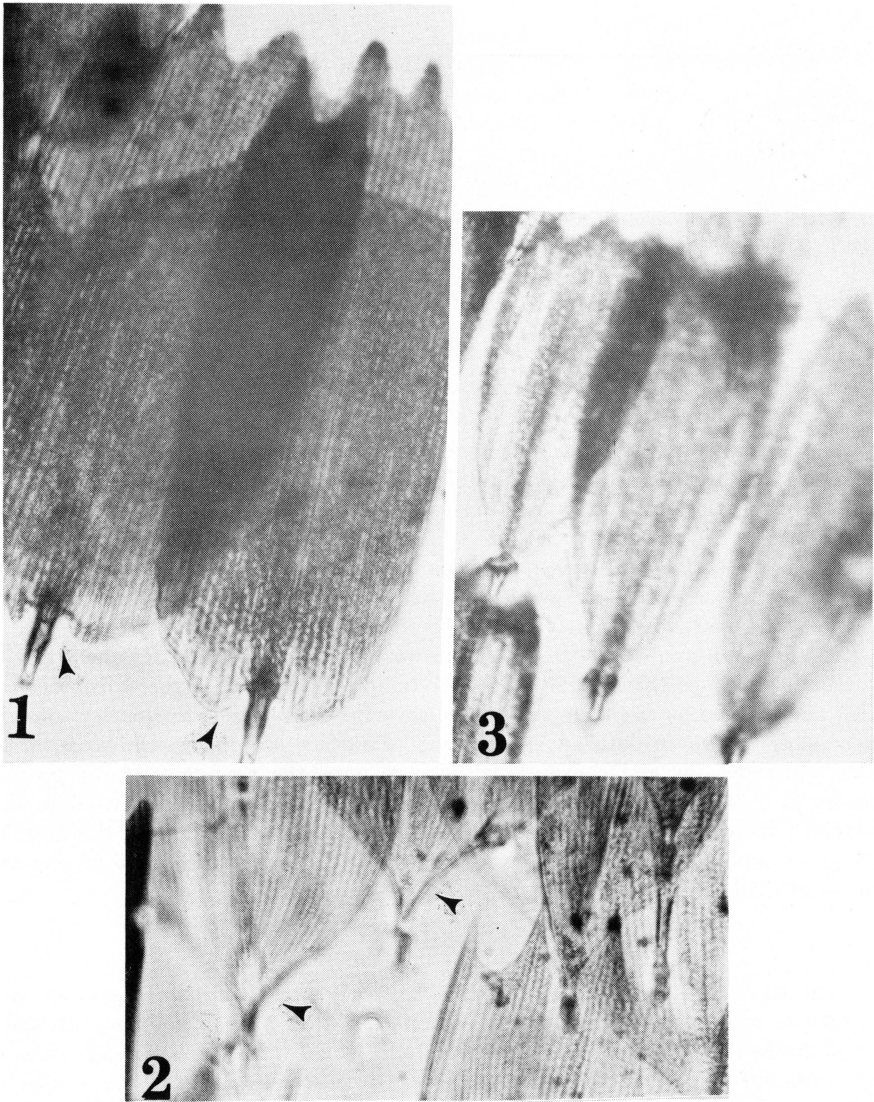


Fig. 1-3. Light micrographs of replicas of the front wing nonmarginal scales of Lepidoptera: 1, *Papilio glaucus* L. 2, *Sibine stimulea* (Clemens). 3, *Ecpantheria scribonia* (Stoll). Arrow heads mark butterfly-type (Fig. 1) and moth-type (Fig. 2) scale base. Total magnification 600 \times .

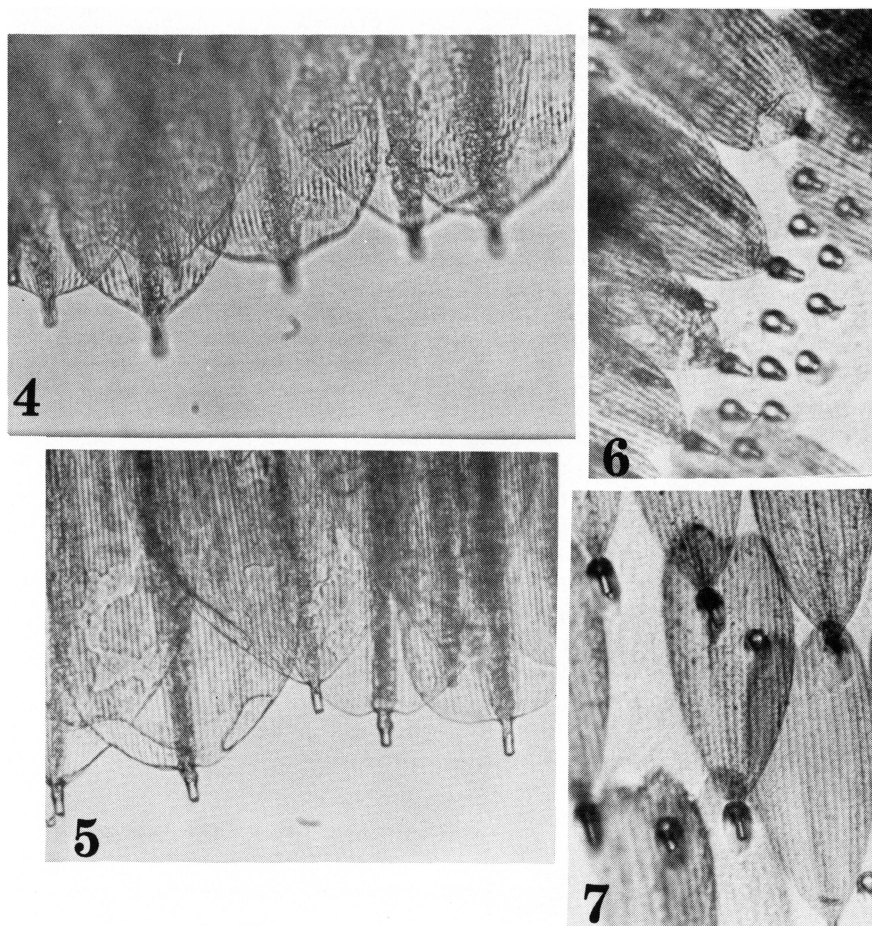


Fig. 4-7. Light micrographs of replicas of the front wing nonmarginal scales of moths: 4, *Pseudaletia unipuncta* (Haworth). 5, *Peridroma saucia* (Hubner). 6, *Atteva punctella* (Cramer). 7, *Cisseps fulvicollis* (Hubner). Total magnification 600 X.

Table 1. The species of Lepidoptera that were studied.

Family	Species
Megalopygidae	<i>Megalopyge opercularis</i> (J. E. Smith)
Cochlidae	<i>Sibine stimulea</i> (Clemens)
Pyralidae	<i>Glyphodes pyloalis</i> (Walker)
	<i>Galleria mellonella</i> (L.)
	<i>Evergestis rimosalis</i> (Guenee)
Arctiidae	<i>Apantesis</i> sp.
	<i>Diacrisia virginica</i> (Fabricius)

Table 1. Continued

Family	Species	
Noctuidae	<i>Estigmene acrea</i> (Drury)	
	<i>Epantheria scribonia</i> (Stoll)	
	<i>Hyphantria cunea</i> (Drury)	
	<i>Spodoptera latifascia</i> (Walker)	
	<i>Xanthopastis timais</i> (Cramer)	
	<i>Zale lunata</i> (Drury)	
	<i>Heliothis zea</i> (Boddie)	
	<i>H. virescens</i> (Fabricius)	
	<i>Anticarsia gemmatalis</i> Hubner	
	<i>Pseudaletia unipuncta</i> (Haworth)	
	<i>Agrotis ipsilon</i> (Hofnagel)	
	<i>Peridroma saucia</i> (Hubner)	
	<i>Eudryas unio</i> (Hubner)	
Agaristidae	<i>Alypia octomaculata</i> (Fabricius)	
Ctenuchidae	<i>Cisseps fulvicollis</i> (Hubner)	
Yponomeutidae	<i>Atteva punctella</i> (Cramer)	
Liparidae	<i>Hemerocampa leucostigma</i> (J. E. Smith)	
Saturniidae	<i>Hemileuca maia</i> (Drury)	
	<i>Automeris io</i> (Fabricius)	
	<i>Antheraea polyphemus</i> (Cramer)	
Papilionidae	<i>Actias luna</i> (L.)	
	<i>Papilio polyxenes asterius</i> Stoll	
	<i>Papilio glaucus glaucus</i> L.	
	<i>P. g. canadensis</i> Rothschild and Jordan	
Libytheidae	<i>Libytheana bachmanii</i> (Kirtland)	
Danaidae	<i>Danaus plexippus</i> (L.)	
Heliconiidae	<i>Agraulis vanillae</i> (L.)	
Nymphalidae	<i>Limenitis archippus</i> (Cramer)	
	<i>Phyciodes</i> sp.	
	<i>P. batesii</i> (Reakirt)	
	<i>P. campestris</i> (Behr)	
	<i>Vanessa virginiensis</i> (Drury)	
	<i>V. atalanta</i> (L.)	
	<i>V. cardui</i> (L.)	
	<i>Boloria bellona jenistae</i> Stallings and Turner	
	<i>Proclossiana eunomia dawsoni</i> (Barnes and McDunnough)	
	<i>Occidryas colon wallacensis</i> (Gunder)	
	<i>Nymphalis antiopa</i> (L.)	
	<i>Speyeria nokomis apacheana</i> (Skinner)	
	<i>Polygonia comma</i> (Harris)	
	Satyridae	<i>Oeneis chryxus chryxus</i> (Doubleday and Hewitson)
		<i>O. c. strigulosus</i> McDunnough
<i>O. jutta alaskensis</i> Holland		
<i>Erebia epipsodea epipsodea</i> Butler		
<i>E. e. freemani</i> Ehrlich		

Table 1. Continued.

Family	Species
Pieridae	<i>Phoebis sennae eubule</i> L.
	<i>Colias eurytheme</i> Boisduval
	<i>C. philodice</i> Godart
	<i>Pieris rapae</i> (L.)
	<i>P. napi oleracea</i> Harris
	<i>P. virginiensis</i> Edwards
	<i>Euchloe olympia rosa</i> (Edwards)
	<i>Eurema</i> sp.
Lycaenidae	<i>Strymon melinus</i> (Hubner)
	<i>Satyrium acadica acadica</i> (Edwards)
	<i>Epidemia dorcas</i> (Kirby)
	<i>Glaucopsyche lygdamus couperi</i> Grote
	<i>Agriades franklinii megalis</i> (McDunnough)
	<i>A. f. bryanti</i> (Leussler)
	<i>Incisalia polios</i> Cook and Watson
	<i>Mitoura gryneus gryneus</i> (Hubner)
	<i>Calycopis</i> sp.
Riodinidae	<i>Calephelis borealis</i> (Grote and Robinson)
Hesperiidae	<i>Urbanus proteus</i> (L.)
	<i>Calpodis ethlius</i> (Stoll)
	<i>Hylephila</i> sp.
	<i>Pyrgus communis</i> (Grote)

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LITERATURE CITED

- Downey, J. C., and A. C. Allyn. 1975. Wing-scale morphology and nomenclature. *Bull. Allyn Mus.* 31: 1-32.
- Hering, Martin. 1926. *Biologie der schmetterlinge*. Verlag von Julius Springer, Berlin. 480 p.
- Kellogg, Vernon L. 1894. The taxonomic value of the scales of the Lepidoptera. *Kansas Univ. Quart.* 3(1): 45-89.
- Khalaf, K. T. 1980. Micromorphology of beetle elytra, using simple replicas. *Florida Entomol.* 63(3): 307-40.
- Kristensen, N. P. 1970. Morphological observation on the wing scales in some primitive Lepidoptera (Insecta). *J. Ultrastructure Res.* 30: 402-10.