AN INTRODUCTION TO THE IDENTIFICATION OF CATERPILLARS

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Caterpillar Morphology

Larvae of Lepidoptera generally have a distinct, sclerotized head with chewing mouthparts. They usually have short, 3-segmented antennae arising adjacent to the base of the mandibles, and 6 **stemmata**, or simple eyes, arranged in a semicircle adjacent to the antennal sockets (Figure 1).
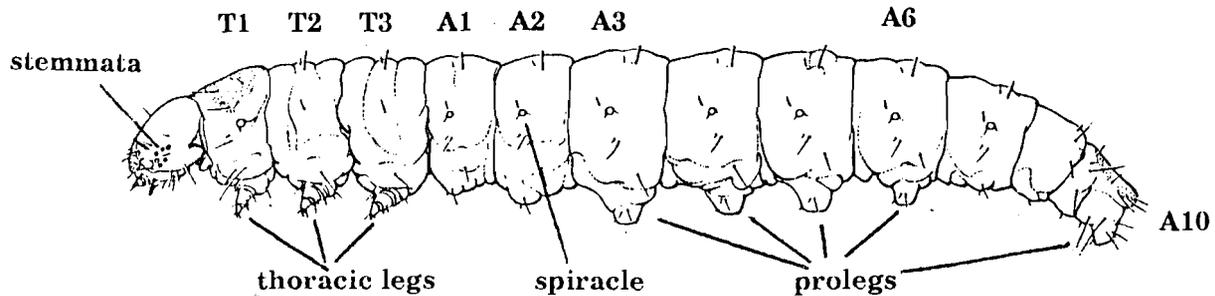

Figure 1. Basic morphological characters of Lepidopteran larvae. Pictured: Glyphipterigidae, *Diploschizia habecki* (from Stehr, 1987).

The caterpillar thorax consists of 3 segments, abbreviated in identification keys as **T1** (prothorax), **T2** (mesothorax), and **T3** (metathorax) (some authors use the notation T_1-T_3). T1 differs from the other 2 in having a pair of spiracles. Each of the 3 typically has a pair of sclerotized legs that follow the standard insectan leg plan and end in claws.

The abdomen is divided into 10 segments, denoted **A1-A10** (or 1A-10A in some references). A pair of **spiracles** appear on segments A1-A8. A3-A6 and A10 usually each bear a pair of **prolegs**, muscled outgrowths of the body wall that function as legs in locomotion and stabilization. Exceptions to the arrangements of prolegs are important in identification of families and other groups.

Caterpillar prolegs consist of 2 basic parts: a **base**, which usually bears hairs, or **setae**, and a distal **planta**, which never bears setae and which usually carries **crochets**, sclerotized hooklike structures arranged in rows or circles. Although there is much variation in the proleg base and planta, Figure 2 is representative.
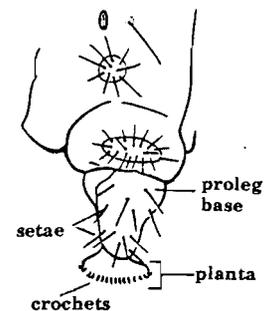

Figure 2. Abdominal proleg (Stehr, 1987).

Diagnostic Characters

The arrangement of crochets is a key character in caterpillar identification. If all the crochets in a circle or row are the same length, they are **uniordinal**. Two alternating lengths are termed **biordinal**, and three are **triordinal** (Figure 3, A-C). A **mesoseries** consists of a single longitudinal row of crochets (Figure 3, I, J) and is characteristic of most leaf feeders. If the crochets in a mesoseries are alike in size and structure throughout, they are **homoideous** (Figure 3, I). When they are *abruptly* shorter at the ends, they are **heteroideous** (Figure 3, J). Other examples of crochet arrangements and terminology are illustrated in Figure 3.
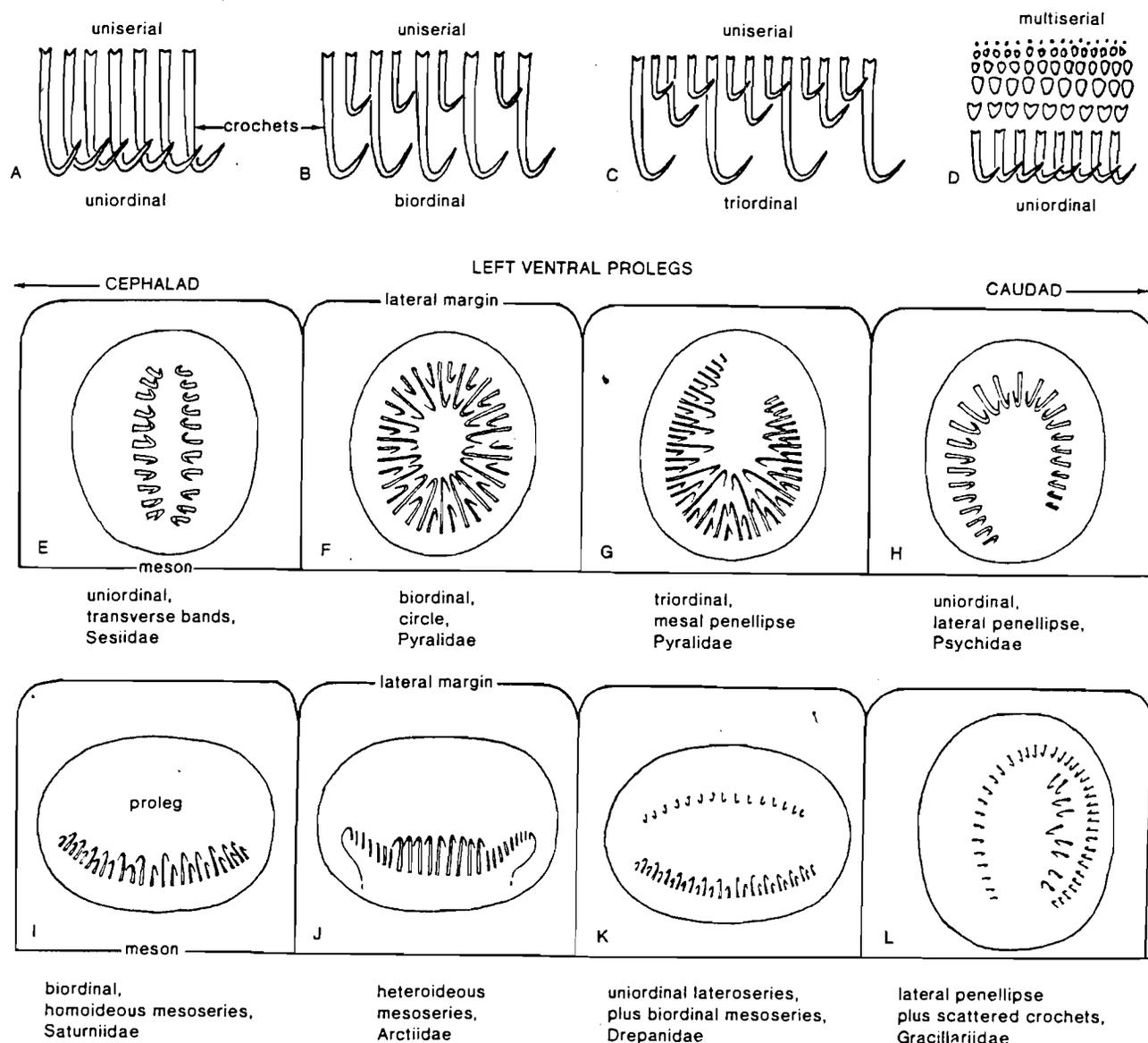

Figure 3. Crochet arrangements and terminology (Stehr, 1987).

Arrangement of setae is another significant caterpillar taxonomic character. Setae are usually simple, i.e., hairlike, but in some taxa are plumose, knobbed, spinelike, or spatulate (i.e., flat, rounded, and broad at the tip, narrow at the base). Terms associated with setal bases and other features of the cuticle, illustrated in Figure 4, include the following:

pinaculum: a sclerotized area around the base of 1 or more setae (Fig. 4A).
chalaza: a sclerotized projection bearing 1 seta (Fig. 4B-C).
scolus: a sclerotized projection bearing >1 seta (Fig. 4D).
verricule: flat, disclike area bearing parallel setae (Fig. 4E).
verrucae: fleshy lobes or convex disks bearing divergent setae (Fig. 4F-G).
hair pencils: narrow clusters of long setae (Fig. 4H)
spinules: minute cuticular spines (Fig. 4I).
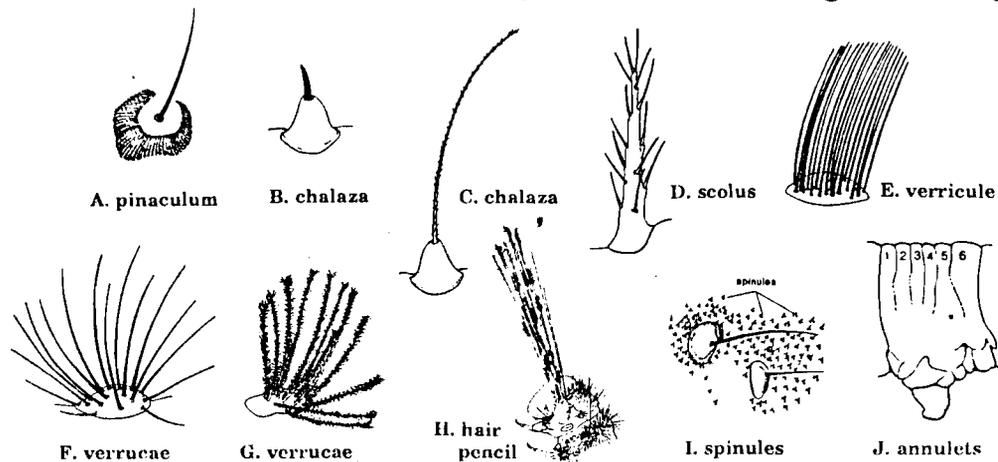**annulets:** dorsal subdivisions formed by creases in the integument (Fig. 4J).

A. pinaculum   B. chalaza   C. chalaza   D. scolus   E. verricule
F. verrucae   G. verrucae   H. hair pencil   I. spinules   J. annulets

Figure 4. Cuticular and setal structures of caterpillars (A-G, I, J: Stehr, 1987; H: Peterson, 1962).

Setal maps are stylized diagrams showing the relative positions and sizes of setae and other structures on the left side of the thorax and abdomen. Each segment is shown as a rectangle, representing the area between middorsal and midventral lines as a flattened surface. Because some segments are virtually identical, setal maps, when used, are customarily drawn for T1, T2, A1, A3 or A6, and A7-A10. As with butterfly wing veins, a number of systems for naming the setae have been proposed. Figure 5 illustrates 2 examples of setal maps that use a system of setal nomenclature designed by Hinton in 1946 and now widely adopted by taxonomists.
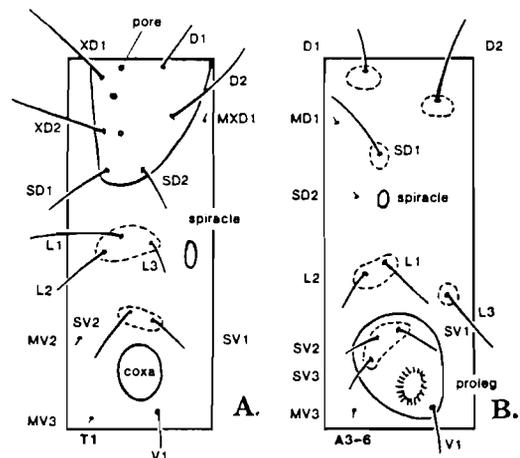

Figure 5. Typical setal maps.
A. T1; **B.** A3-A6 (Stehr, 1987).

DICHOTOMOUS KEY TO SOME COMMON CATERPILLARS

1. Prolegs on A3-A6, A10...2
1.' Prolegs on A6 and A10 only...Geometridae, "inch worms"

2. 6-8 annulets per segment (Fig. 4J), usu. horn on dorsum of A8 ....Sphingidae, hornworms
2.' Lacking the above characters...3

3. Setae long, in tufts or not, spinules lacking..4
3.' Setae sparse, body covered with spinules (Fig. 4I)..8

4. Fleshy middorsal gland on A6 and usu. A7...Lymantriidae.....5
4.' No middorsal gland on A6 or A7...6

5. Black hair pencils on T1 (Fig. 4H) ....Dasychira spp., Orgyia spp., tussock moths
5.' No hair pencils, head with dk brown stripes and numerous brown freckles; red and blue
    verrucae on living specimens.......................................Lymantria dispar, gypsy moth

6. Biordinal crochets (Fig. 3B), setae irregular in length, not in tufts ....Lasiocampidae.....7
6.' Uniordinal crochets (Fig. 3A), dense setae of regular length arising from verrucae (Fig. 4F);
    ≥4 verrucae between coxa and dorsum on T2 and T3...
    ....Arctiidae, Pyrrharctia isabella, banded woolybear

7. Bluish body above spiracles, long silky setae on fleshy lobes above legs, keyhole-shaped
    middorsal spot on each segment, head light blue mottled with black.......................................
    ....Malacosoma disstria, forest tent caterpillar
7.' Continuous intersegmental middorsal yellow-white stripe, head coal-black, long setae in sparse
    tufts...M. americanum, eastern tent caterpillar

8. Crochets arranged in homoideous mesoseries (Fig. 4I)......Noctuidae, Heliothis zea, corn earworm
8.' Crochets on A3-A6 arranged in a complete circle...
    ....Tortricidae, Choristoneura fumiferana, spruce budworm

References

Peterson, A. 1962. *Larvae of Insects,* Part I. Ohio State University, Columbus.
    315 pp.

Stehr, F.W. 1987. *Immature Insects,* vol. 1. Kendall/Hunt Publishing,
    Dubuque, Iowa. xiv+754 pp.