

Morphology of Adult and Larval Mosquitoes



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Form and function of the adult mosquito body

Adult mosquitoes, like other insects, have three body regions: the head, the thorax, and the abdomen. Each of these regions is further subdivided into segments, which may or may not be discernible as distinct units. In the head and thorax the segments are mostly fused and not easily distinguished. Segments of the abdomen are generally evident. The mosquito head is the body's sensory center. The head is nearly spherical in shape and is dominated by two large compound eyes, which are excellent visual organs, even in low-light situations. The surface of the eye is divided into many small units, called facets. The paired antennae arise between the eyes and serve as both chemosensory and mechanosensory (sound-detecting) organs. The antenna is divided into three regions. The flagellum is the long, segmented, whip-like portion of the antenna. Each segment of the flagellum (flagellomere) bears a whorl of sensory setae. The pedicel is basal to the flagellum and appears as a swollen or bulbous segment. Neurosensory cells within the pedicel receive vibratory signals from sensory setae of the flagellum. The scape is the ring-like or cup-like basal segment of the antenna. Below the antennae is the clypeus, which covers the forward-projecting portion of the head that gives rise to the paired maxillary palps and the proboscis. The maxillary palps (often referred to simply as the palps), are jointed chemosensory and mechanosensory sensory appendages that flank the proboscis. In most mosquitoes, the palps are shorter in the females than in the males. The proboscis is the conspicuous elongate projecting mouthparts of the adult mosquito. It is composed of a ventral sheath, which holds the styliform (needlelike) elements that pierce host flesh, deliver mosquito saliva and transport blood. At the tip of the proboscis are the labella, two sensory lobes (usually appearing fused) that mosquitoes use to locate host blood vessels.

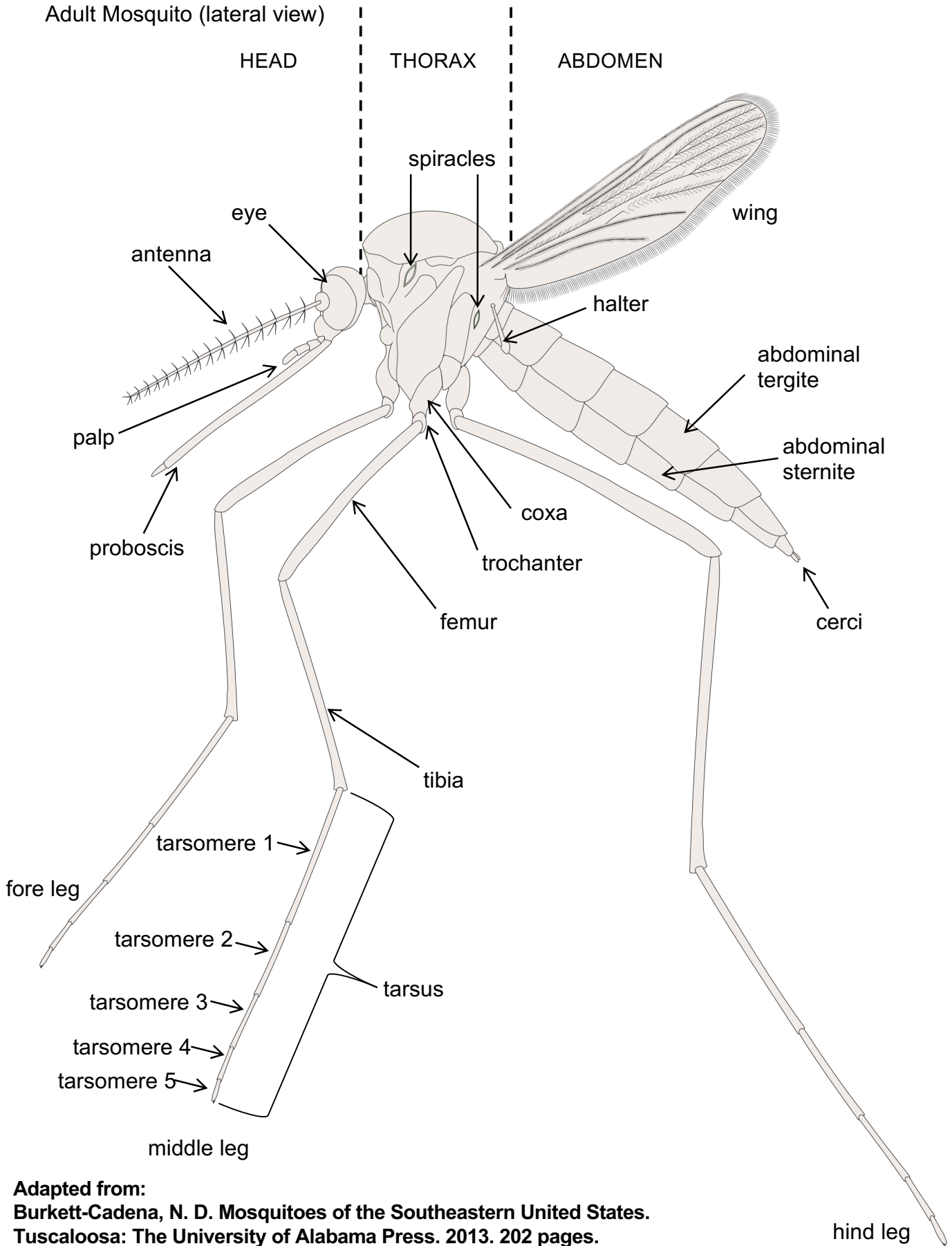
The thorax, located between the head and the abdomen, bears the legs and wings, and is therefore the locomotory center of the adult mosquito. Adult mosquitoes have six legs, of which the hind legs are the longest. The legs are divided into five segments. The coxa is the basal segment, and is followed by the trochanter, the femur, the tibia and finally the tarsus (plural tarsi). The tarsus is further divided into five subunits, called tarsomeres. The apical tarsomere terminates in a claw. Mosquitoes technically have four wings, but only the front wings of mosquitoes are used for flying. The hind wings, called "halteres", are small and do not resemble true wings at all. The halteres are short and knoblike and used to help maintain balance during flight. The front wings have long thickenings, called veins, which give the wing rigidity. The veins are covered with scales, which can be dark or light in coloration. There are six major veins, with several subdivisions and crossveins. The major veins are the Costal, Subcostal, Radial, Medial, Cubital and Anal veins. The membranous portions of the wing between the veins are called cells, and are named after the vein that they follow, for example, radial cell, costal cell. The apical tip and posterior margins of the wings are bordered with long, narrow setae, called (collectively) the wing fringe. The major dorsal portion of the thorax is the scutum. The scutum of some mosquitoes is covered in dark and light scales that can form striking patterns. Posterior to the scutum is the scutellum, and posterior to the scutellum is the mesopostnotum. The lateral portion of the thorax is the pleuron. The pleuron has several exoskeletal plates, called sclerites. Two of the larger sclerites are the mesokatepisternum and mesepimeron. The arrangements of setae and scales on the mesokatepisternum and mesepimeron are often used in mosquito identification. The pleuron also bears two large spiracles, openings in the exoskeleton through which the adult mosquito breathes.

The abdomen, the posterior-most region of the body, is the primary site for digestion, excretion and reproduction. It is divided into ten segments, each composed of a dorsal and ventral plate. The dorsal plates are called tergites, and the ventral plates are called sternites. Tergites and sternites are connected by membranous exoskeleton that can expand and stretch during feeding. The abdomen terminates in two finger-like appendages, the cerci, which function in egg laying and copulation. In *Aedes* and *Psorophora* females, the cerci are visible, protruding from the tip the abdomen. In many other genera, the cerci are retracted within the body and are not visible.

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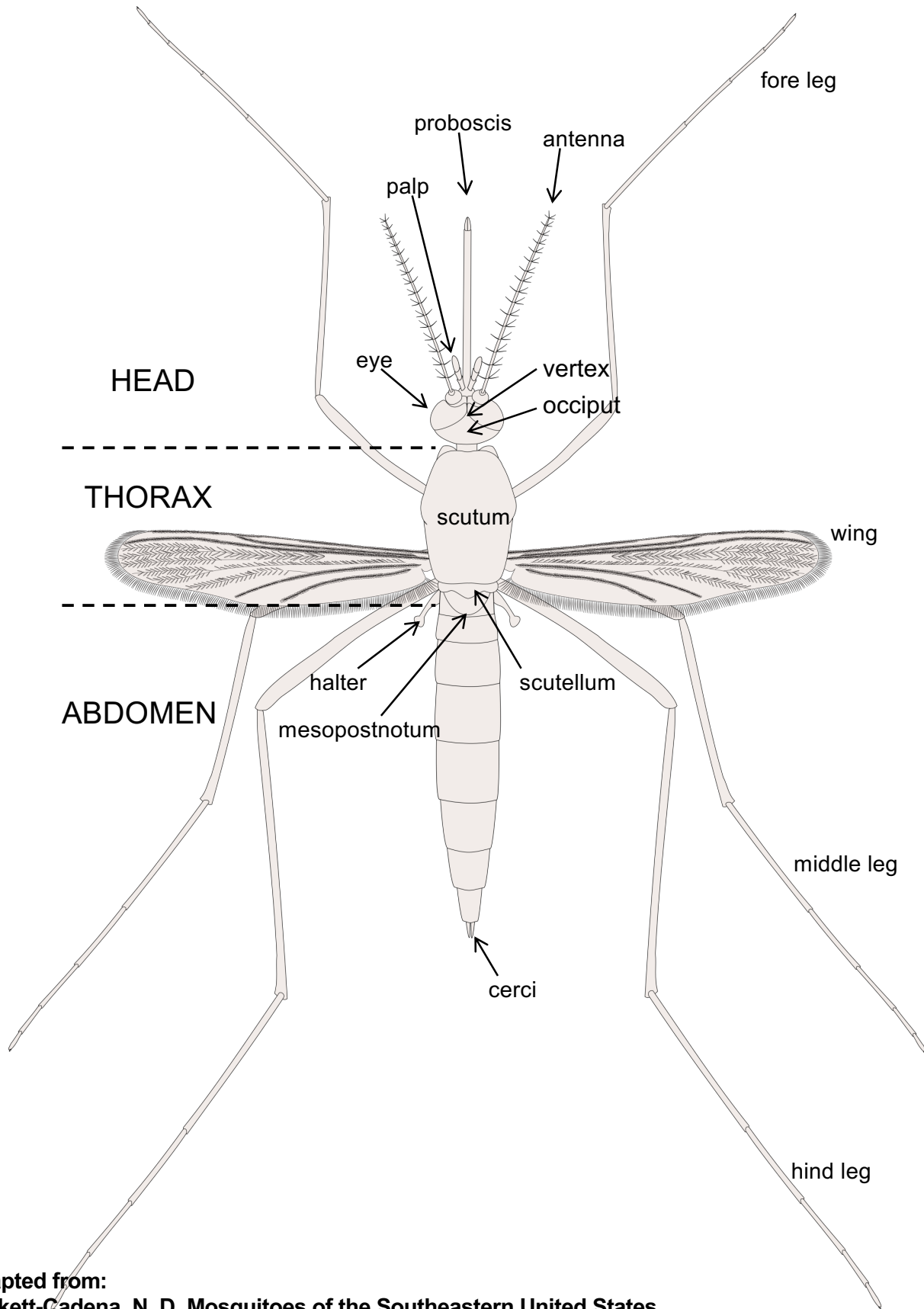
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Adult Mosquito (lateral view)



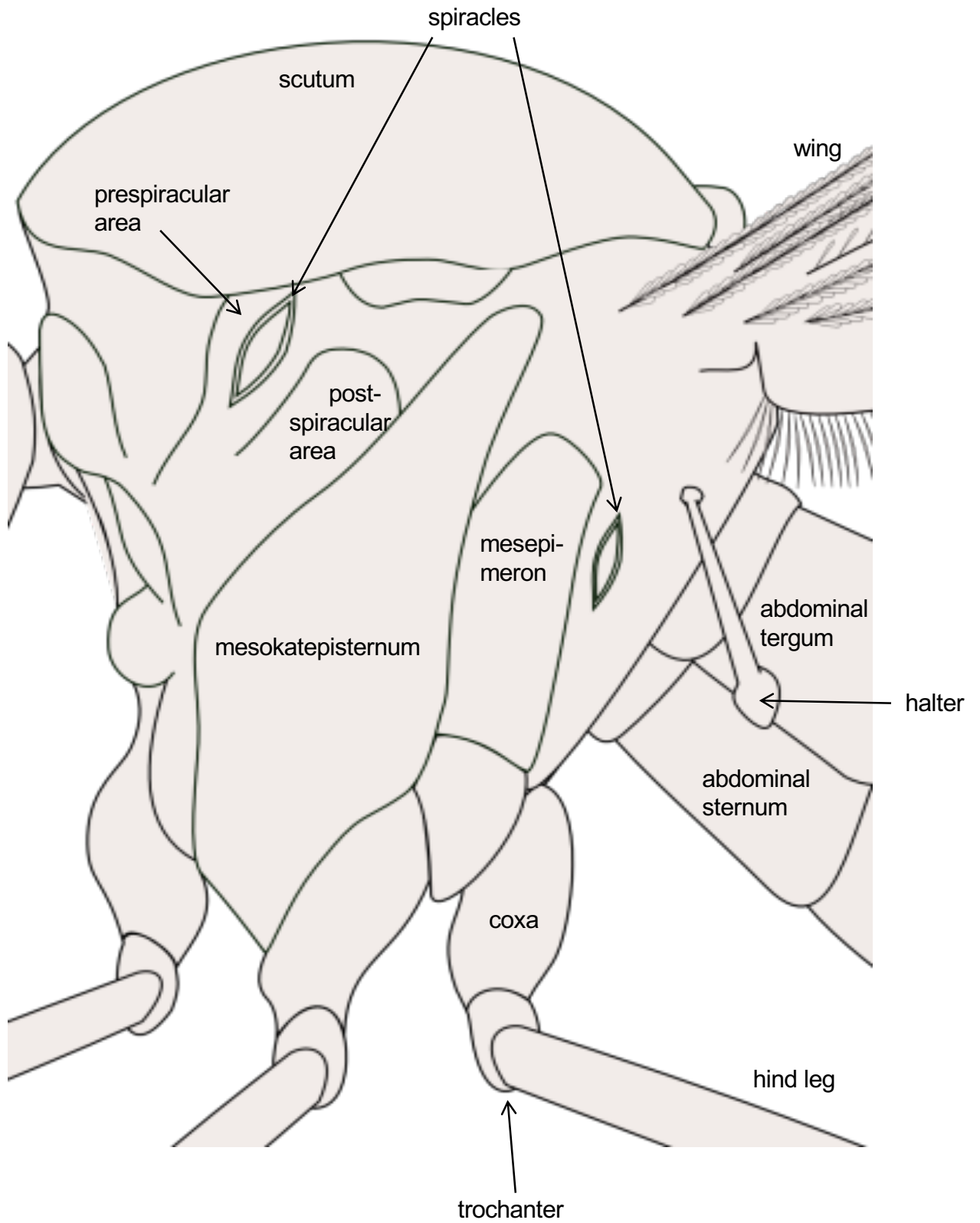
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Adult Mosquito (dorsal view)



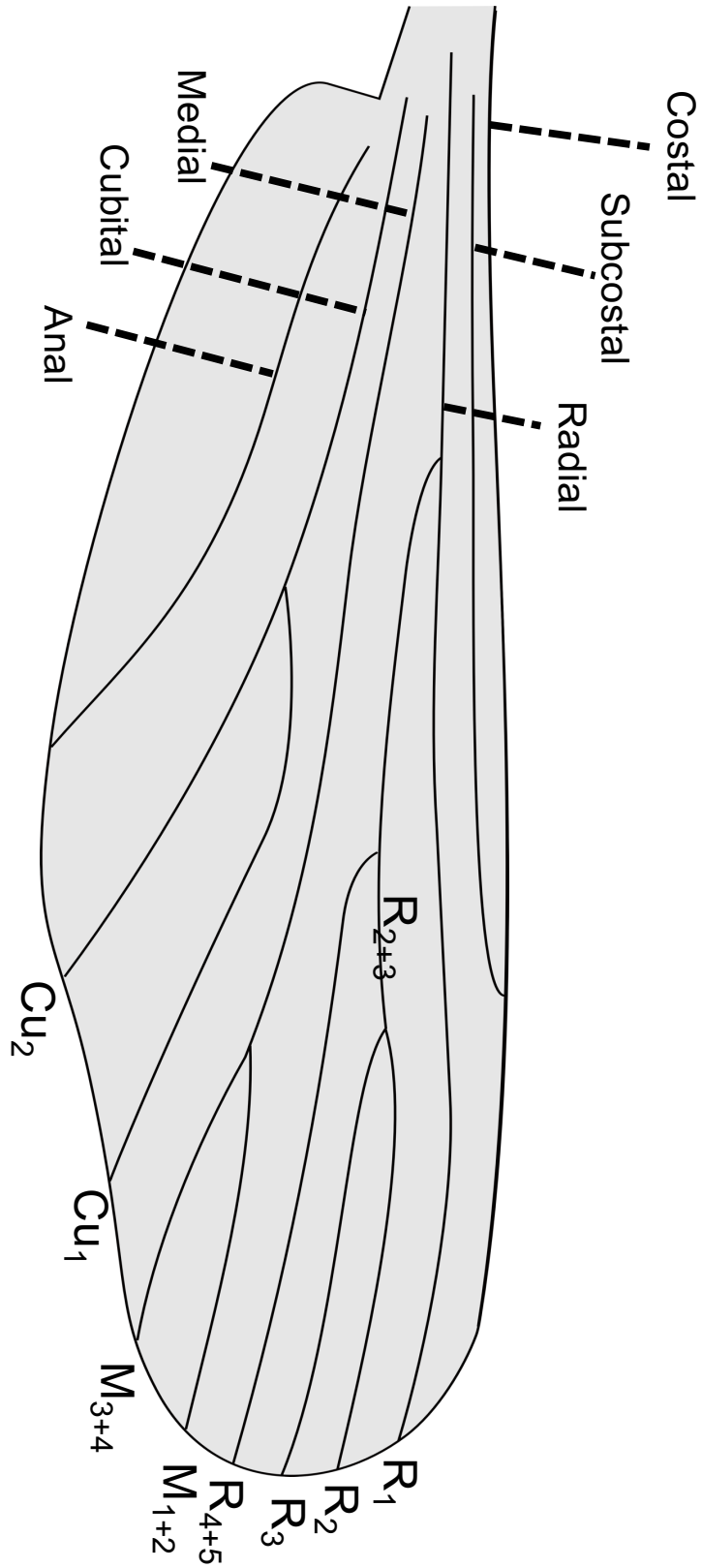
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Adult Mosquito Thorax (lateral view)



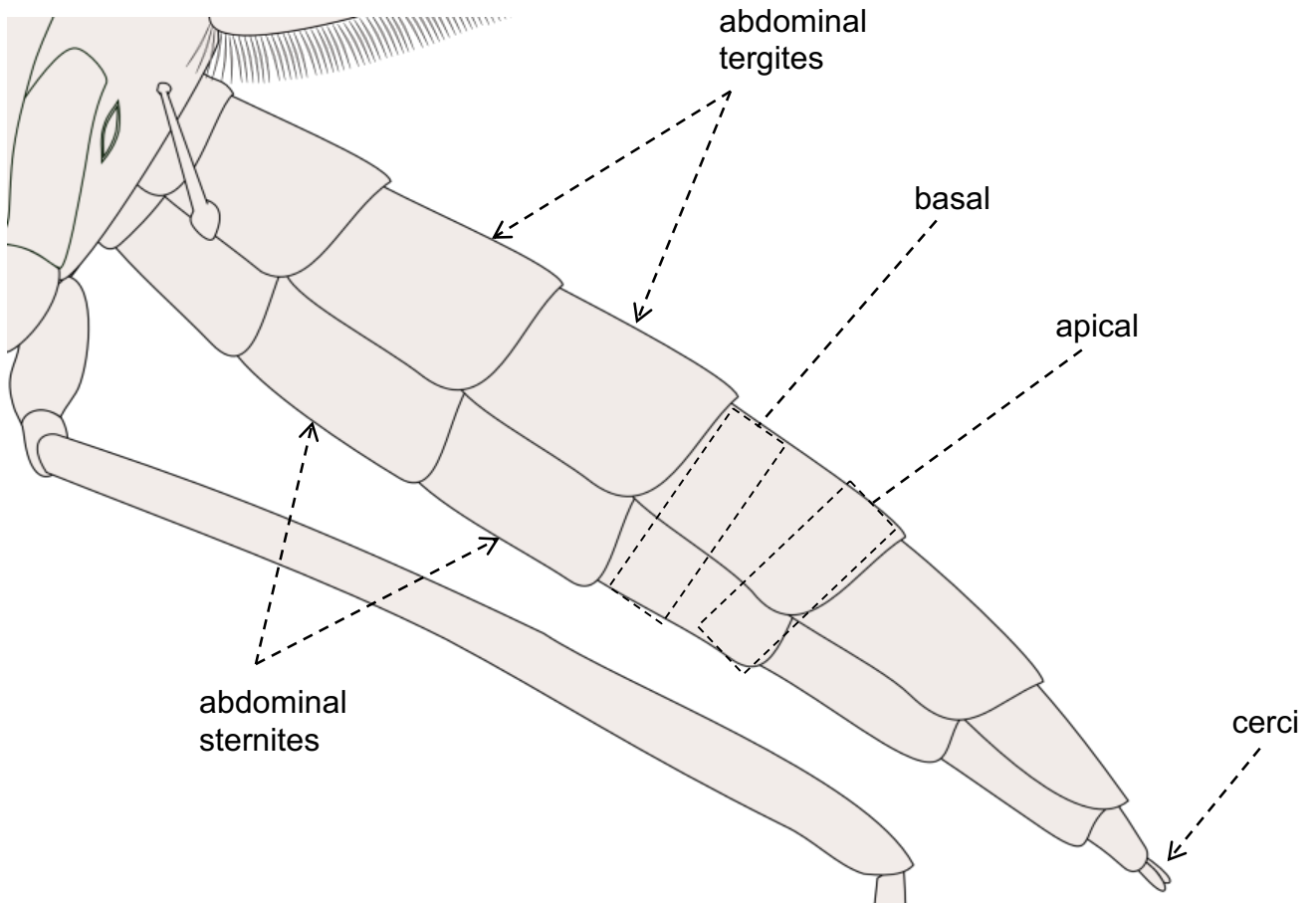
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Adult Mosquito Wing



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Adult Mosquito Abdomen (lateral view)



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Form and function of the larval mosquito body

Like adults, mosquito larvae also have three body regions: the head, thorax, and abdomen. However, larval mosquitoes are aquatic and worm-like. They lack the legs, wings, and proboscis that are characteristic of adults.

The head of mosquito larvae is large and sclerotized (made of hardened exoskeleton). The shape of the head may be elongate (as in *Anopheles* and *Uranotaenia*) or broad (*Aedes* and *Culex*). The head bears two eyes, two antennae and brush- or comb-like mouthparts. The eyes are generally small, simple (not compound) and are found on either side of the head. The antennae are quite variable, and may be very short to quite long. One or more setae are borne usually along the length of the antenna and may be branched or unbranched. The mouthparts are composed of articulating appendages of the mandible and maxilla. Setae of the head are numerous and variable in length and form. The arrangement, length, branching and shape of head setae are used in the identification of larvae.

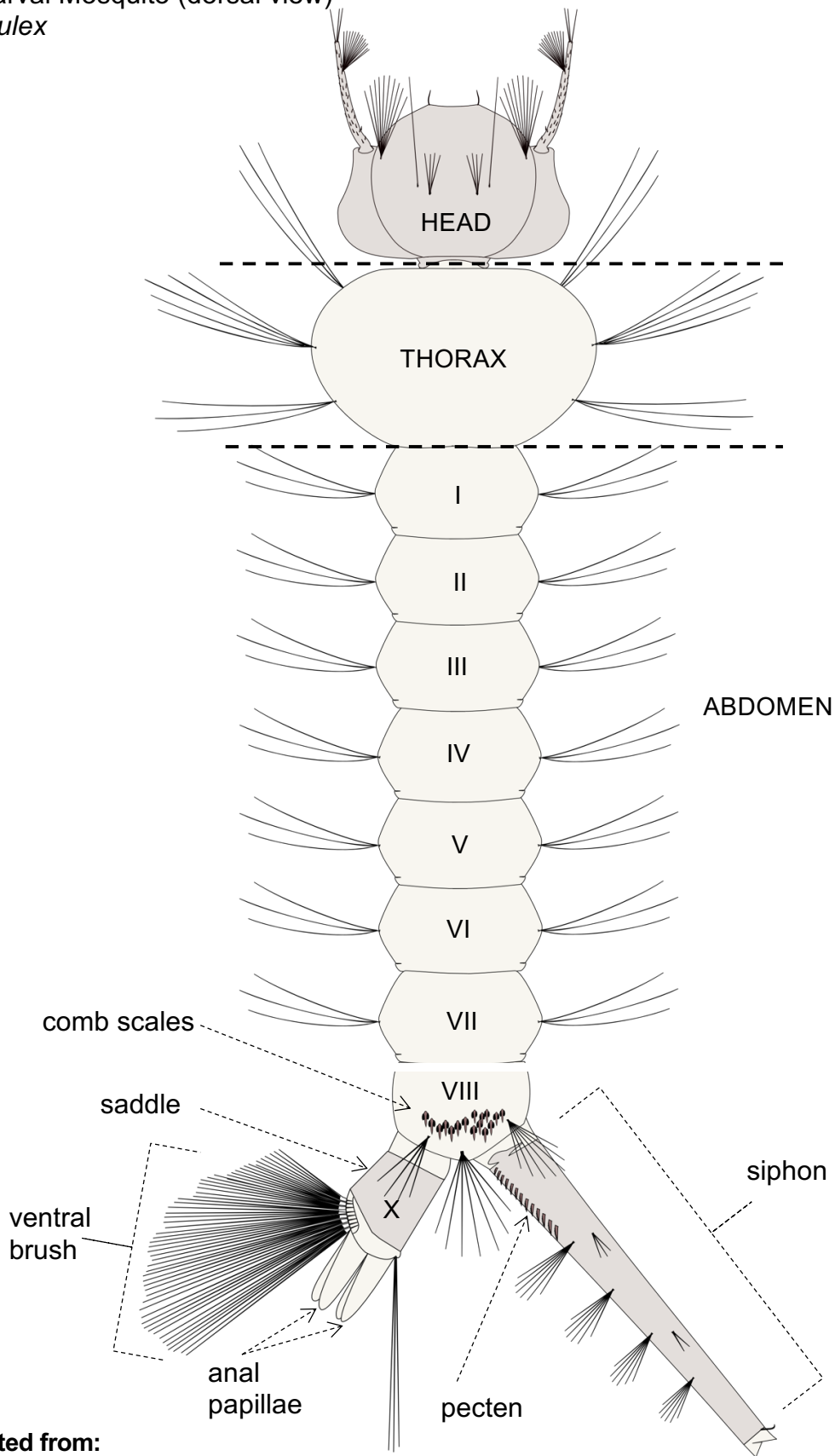
The thorax is elliptical in shape, usually wider than the head, and lacks appendages. The numerous setae of the thorax are arranged in three rows, which correspond to the three subdivisions of the thorax. Thoracic setae are often useful in identification of mosquito larvae.

The abdomen is elongate, cylindrical and is made up of ten segments. Segments of the abdomen are denoted in Roman numerals, beginning with the most anterior segment (Segment I) and terminating in the anal segment (Segment X). Segments I – VII are fairly uniform in size and shape and together constitute the bulk of the worm-like body. Segment VIII is usually smaller than the seven preceding segments, roughly pentagonal in shape, and bears the comb scales (when present) and the respiratory siphon (when present). The comb scales are spine-like projections that occur in a row or patch, and are sometimes borne on a sclerotized plate, called the comb plate (as in *Uranotaenia*). The number, shape and arrangement of comb scales are useful in identification of larvae, but often require high magnification (>50x) to examine in detail. The respiratory siphon (or simply siphon) is a sclerotized dorsal breathing tube that bears the respiratory spiracles. In most mosquito species of our region, the siphon bears a pecten, a row of spines (spicules) extending from the ventral base of the siphon to some point along its length. The size, shape and length of the siphon and the pecten vary from one species to the next and are very useful in genus and species-level mosquito larva identification. Members of the genus *Anopheles* have no siphon, but breathe through a flattened spiracular apparatus on segment VIII. Segment IX is reduced in mosquito larvae and is not discernible as a distinct segment. The anal segment (Segment X) bears the anal papillae, saddle, and ventral brush. The anal papillae are bulbous, membranous protrusions of the exoskeleton that primarily function in osmoregulation. The saddle, a sclerotized plate, may cover only the dorsal portion of the anal segment, or may encircle it completely. The ventral brush is a row of paired setae extending along the ventral midline of the anal segment.

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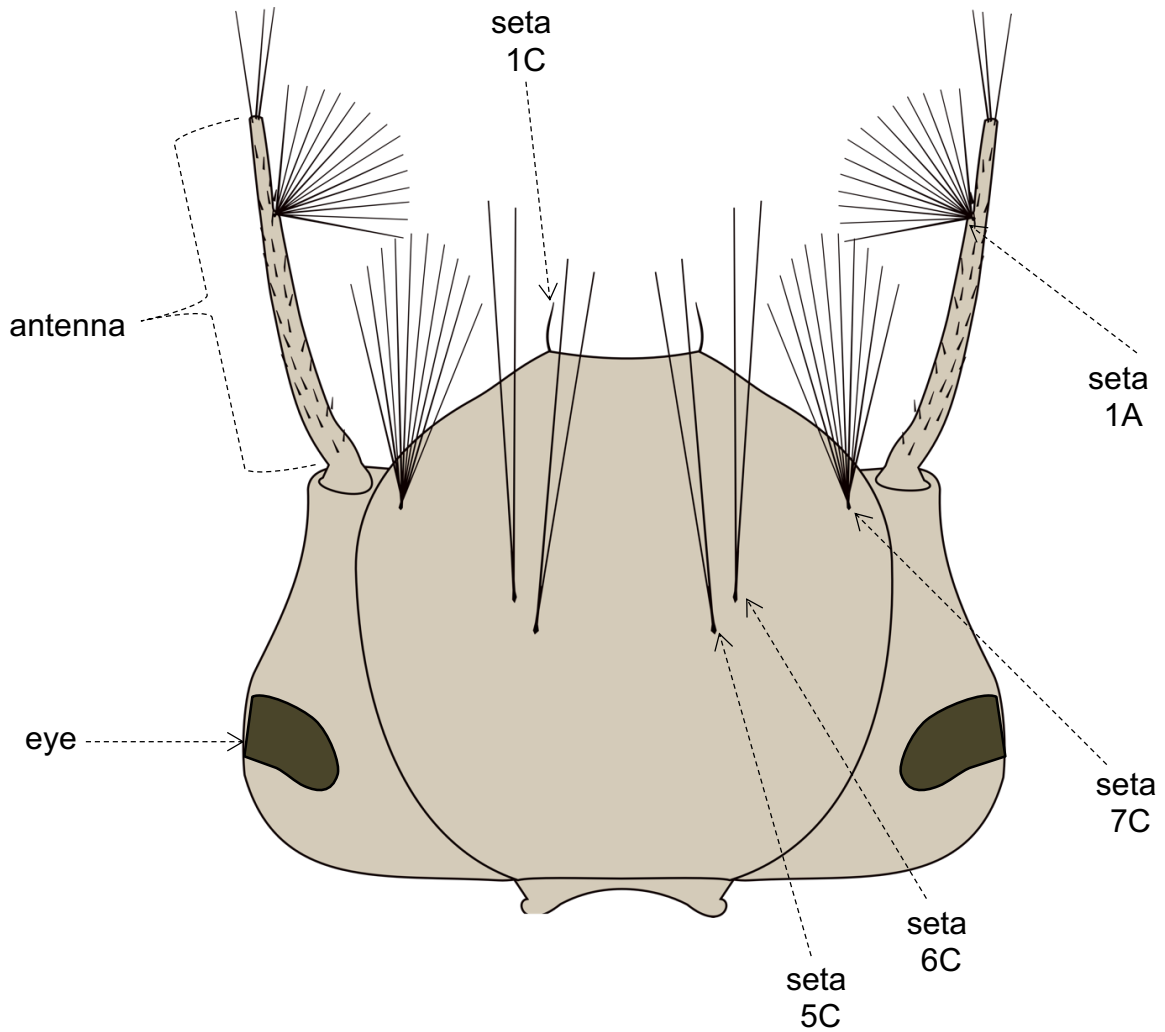
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Larval Mosquito (dorsal view)
Culex



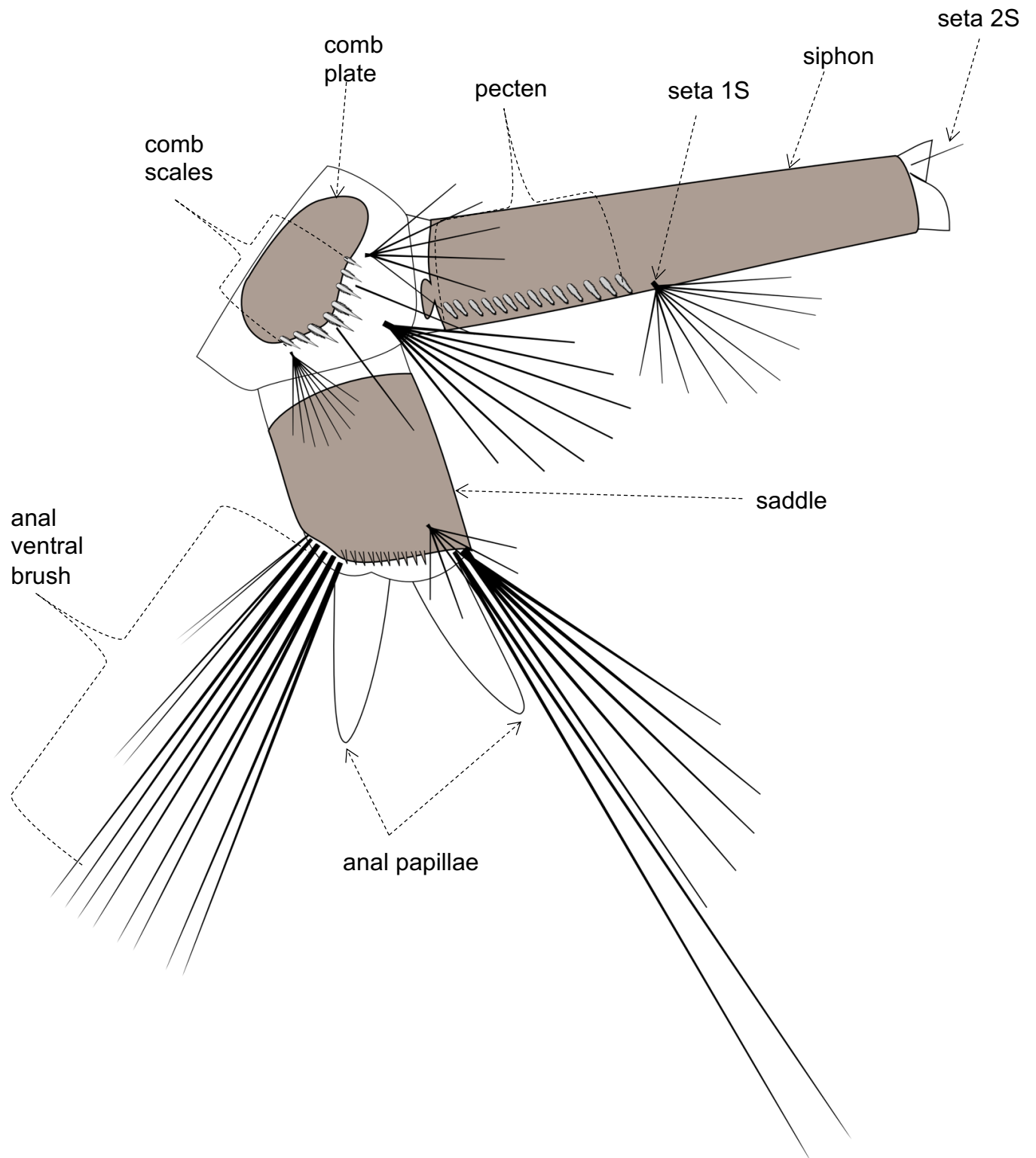
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Mosquito larva head (dorsal view)
Culex



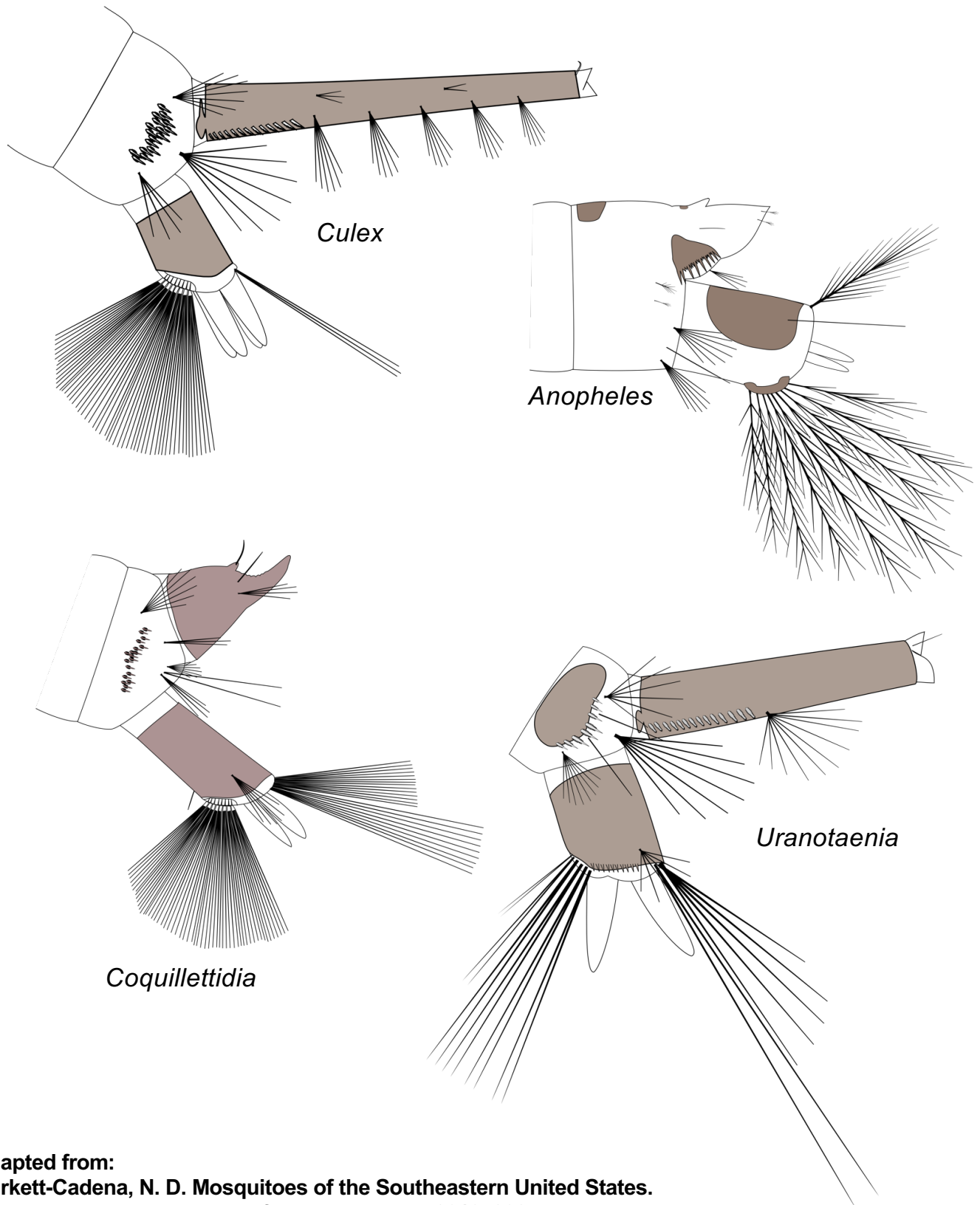
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Larval Mosquito terminal abdominal segments (lateral view)
Uranotaenia



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Larval Mosquito terminal abdominal segments (lateral view)



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Glossary of useful terms in mosquito identification

acrostichal	the median longitudinal area of the scutum (situated in the highest rank or row)
anterior	in front
anteroventral	in front and on the underside
apex	end of any structure - part of the segment farthest from the body
apical	at or near the apex of any structure
apicolateral	located apically and to the side
appressed	to press against; closely applied
arcuate	arched or bowlike
attenuated	gradually tapering apically
basal	at or pertaining to the base or point of attachment or nearest the main body
basalmost	closest to the base
basolateral	located basally and to the side
decumbent	bent downward, flat against the integument
distal	near the free end of any appendage; that part of a segment farthest from the body
dorsal	in the direction of the dorsum or top
dorsocentral	longitudinal area of the scutum on each side of the acrostichal area
dorsolateral	toward the front and side
dorsoposterior	toward the rear of the top
dorsum	the upper surface
emarginate	notched at the margin
fossa	a pit
fringe	an edging of hair, scales, or other processes extension well beyond a margin
fusiform	spindle-shaped, broader in the middle and narrowing towards the ends
integument	the outer layer of an insect, comprising the epidermis and the cuticle
iridescent	having or reflecting colors of the iris or rainbow
knee spot	group of (usually pale) scales at the terminations of the femur
lateral	pertaining to the side
median	at the middle
metallic	having the appearance of metal; applied to a surface or color
middorsally	in the midline of the upper surface
obovate	inversely ovate; with narrower end downward
ovate	egg-shaped, with broader end at the base
penultimate	next to the last
piliform	hair-like
pleura	sclerotization of lateral area of a body segment
plumose	feather-like
posterior	hind or rear; hindmost
posteromedial	center of the rear part
preapical	just before the apex
promontory	a protuberance on an organ or other structure in the body
recurved	curved upward, downward or backward
sclerite	any plate of the body wall bounded by membranes or sutures
sclerotized	hardened integument of outer surface
spatulate	rounded and broad at the tip, attenuate at base; spoon shaped
spiniforms	in the form or shape of a spine
sternum (sterna)	the entire ventral division of any segment; ventral sclerotization of a body segment
subapical	located just before the apex
subequal	similar, but not quite equal in size, form, or length
submedian	located near but not on the median
supraalar	lateral area of the scutum just above and in front of the wing
sutures	a seam produced by the union of two areas of sclerotization, appearing as a groove
terga	the upper or dorsal surface of any body segment of an insect
terminal	situated at the tip or extremity
transverse	broader than long; running across; at right angles to the longitudinal axis
truncate	cut off squarely at the tip
ventrad / ventral	toward or pertaining to the ventral or under surface
ventrolateral	toward the side of the under surface

Pronunciation of Florida Mosquito Names

by C Roxanne Connelly and Charlie D Morris, revised by N. Burkett-Cadena

Aedes

aegypti uh-gyp-tie
albopictus al-bow-picked-us
atlanticus at-lan-tick-cuss
bahamensis ba-ha-men-sis
canadensi can-uh-den-sis
mathesoni math-a-son-e-eye
cinereus sigh-near-e-us
dupreei doo-pre-eye
fulvuspallens full-vus-pal-lens
hendersoni hen-der-son-eye
infirmatus in-fir-mate-us
mitchellae mitch-ell-lee
sollicitans soul-liss-uh-tans
sticticus stick-tick-us
taeniorhynchus tee-knee-or-ink-us
thelcter thelk-ter
thibaulti the-balt-eye
tormentor tore-ment-or
tortillis tore-till-us
triseriatus try-ser-e-a-tuss
vexans vex-ans

Anopheles

albimanus alba-main-us
atropos at-ro-pose
barberi barber-eye
bradleyi brad-lee-eye
crucians crew-shans
diluvialis die-loo-vee-al-us
georgianus george-ee-anus
inundatus in-un-date-us
maverlius mav-er-lee-us
perplexens per-plex-ens
punctipennis punk-tah-pen-iss
quadrimaculatus quad-dra-mac-you-lay-tuss
smaragdinus smar-ag-dine-us
walkeri walk-er-eye

Coquillettidia

perturbans

coke-wall-uh-tid-ee-uh

per-tur-bans

Deinocerites

cancer

die-no-sir-eye-tees

can-sir

Mansoni

dyari

titillans

man-sown-e-uh

die-er-eye

tit-ill-ans

Culex

atratus ah-trait-us
bahamensis ba-ha-men-sis
biscaynensis bisk-kay-nin-sus
cedecei see-dee-see-eye
coronator core-a-nate-or
declarator deck-la-rate-or
erraticus err-at-uh-cuss
iolambdis eye-oh-lamb-dis
mulrennani mull-wren-an-eye
nigripalpus nye-gra-pal-puss
peccator peck-a-tor
pilosus pie-low-sus
quinquefasciatus kwink-wa-fash-e-a-tus
restuans rest-you-ans
salinarius sal-uh-nare-e-us
tarsalis tar-sal-us
territans tear-ah-tans

Orthopodomyia

alba
signifera

or-tho-po-do-my-uh

al-ba
sig-niff-er-ah

Psorophora

ciliata
columbiae
cyanescens
discolor
ferox
horrida
howardii
johnstonii
mathesoni
pygmaea

sore-off-er-uh

silly-ah-ta
co-lum-bee-ah
sigh-ah-ness-ens
dis-color
fair-ox
whore-ah-da
howard-ee-eye
john-stone-ee-eye
math-eh-son-eye
pig-may-uh

Toxorhynchites

rutilus
septentrionalis

tox-oh-wren-kite-ease

root-ill-us
sep-ten-try-o-nal-us

Uranotaenia

lowii
sapphirina

you-ran-oh-tee-knee-uh

low-e-eye
saff-er-eye-na

Wyeomyia

mitchellii
smithii
vanduzeei

why-oh-my-uh

mitt-chell-ee-eye
smith-ee-eye
van-do-see-eye