

Night-Flying “Ghosts” in Your Garden



“Moths”

Janet Knodel
Professor and Extension Entomologist






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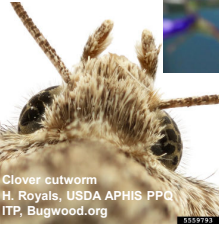


Moths as Pollinators


- Night flying, fast flying
- Better at pollinating than previously thought
- Hairy underbellies
- Food source
 - Bats, frogs, small owls, songbirds, flying squirrels, grizzly bears



Hummingbird Clearwing moth



Clover cutworm
H. Royals, USDA APHIS PPO
ITP, Bugwood.org




Eight spotted forester
(G. Fauske, NDSU)

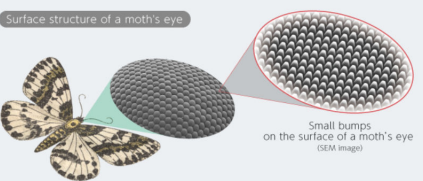
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Moth Eyes

- 2 compound eyes on either side of their head
 - Each containing thousands of individual lenses (called ommatidia)
 - Anti-reflective film
- Detect movements
- See colors
- Some detect ultraviolet light



Surface structure of a moth's eye

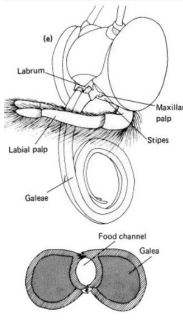


Small bumps on the surface of a moth's eye (SEM image)

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Moth Mouthparts

- Siphoning for probing into a flower and sucking out nectar
- A long, slender proboscis
- At rest, this tubular structure remains coiled beneath the head
- Mouthparts absent (vestigial)



(a)

Labrum, Labial palp, Maxillary palp, Stipes, Food channel, Galeae

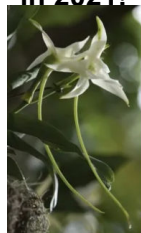


(Image credit: AGD Beukhof)
<https://www.gardeningknowhow.com/garden-how-to/beneficial/common-moth-species>

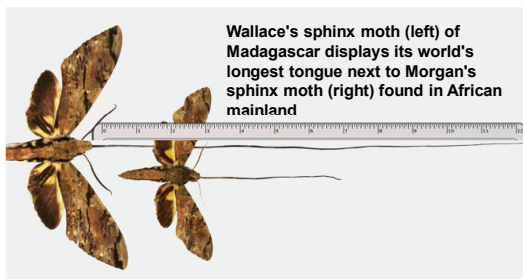
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Longest Moth Tongue

- Wallace's sphinx moth a new species in 2021!



Madagascar star orchid with its extremely long nectar tube. (Source: New York Botanical Garden)



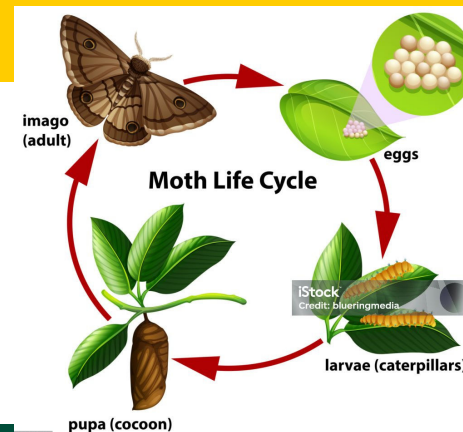
Wallace's sphinx moth (left) of Madagascar displays its world's longest tongue next to Morgan's sphinx moth (right) found in African mainland

Minet et al. 2021

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Moth Life Cycle

- Complete Metamorphosis
- Egg to larval stages to pupa to adult
- Each life stage looks different
- Pupal stage (cocoon)



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Order Lepidoptera: Moths versus Butterflies

Moths

- ≈140,000 known moth species worldwide
- ≈11,000 known moth species in North America
- Night flying, some day flying

Butterflies

- ≈20,000 known butterfly species worldwide
- ≈800 known butterfly species in North America
- Day flying

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Moths versus Butterflies

Moths

- Straight filaments or feathery or branched



Luna moth



Yellow-collared scape moth
S. Ellis, bugwood.org
UGA1566078

Butterflies

- Knobbed antennae



Painted lady butterfly (P. Beauzay, NDSU)

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<https://naturallycuriouswithmaryholland.wordpress.com/2013/07/01/moth-eyes-and-biomimicry/>

Moths versus Butterflies

Moths

- Robust and fuzzy bodied larvae



Virginia Ctenucha
(J. Fauske, NDSU)



Common looper moth
(David Cappaert, Bugwood.org)

Butterflies

- Smooth larvae, slender



Clouded sulfur (J. Fauske)

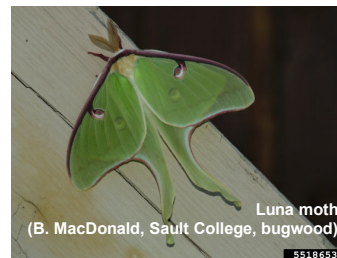


Aphrodite fritillary (J. Fauske)

Moths versus Butterflies

Moths

- Spread out wings at rest



Luna moth
(B. MacDonald, Sault College, bugwood)

Butterflies

- Rest with wings held upright



Monarch
(Pat Beauzay, NDSU)

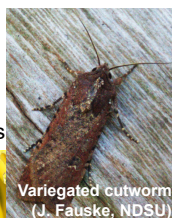
Moths versus Butterflies

Moths

- Dull colors – brown, black, olive green, dark markings on wings, but exceptions



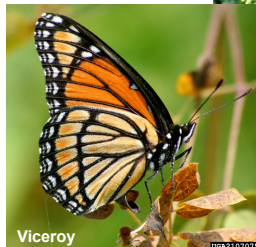
Primrose moth
(J. Yuschok, bugwood)



Variegated cutworm
(J. Fauske, NDSU)

Butterflies

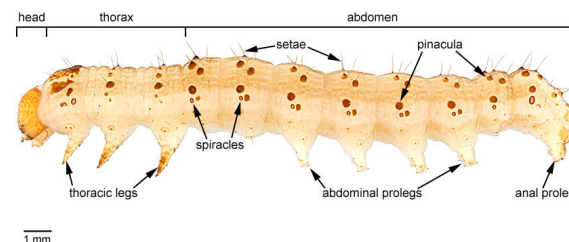
- Colorful and bright



Viceroy



How to Identify a Larva or Caterpillar of Lepidoptera (Moth and Butterflies)

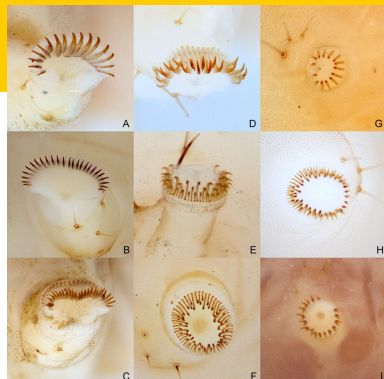


Source: LepIntercept - An identification resource for intercepted Lepidoptera larvae by Todd M. Gilligan and Steven C. Passoa

Larvae – Crochets

Crochet arrangement on abdominal prolegs;

- A: *Helicoverpa armigera* (Noctuidae);
- B: *Mamestra brassicae* (Noctuidae);
- C: *Copitarsia* sp. (Noctuidae);
- D: *Trichoplusia ni* (Noctuidae);
- E: *Diaphania nitidalis* (Crambidae);
- F: *Diatraea lineolata* (Crambidae);
- G: *Crocosema plebejana* (Tortricidae);
- H: *Thaumetotibia leucotreta* (Tortricidae);
- I: *Pectinophora gossypiella* (Gelechiidae)



Source: LepIntercept - An identification resource for intercepted Lepidoptera larvae by Todd M. Gilligan and Steven C. Passoa

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Larvae – How to Identify a Moth Caterpillar

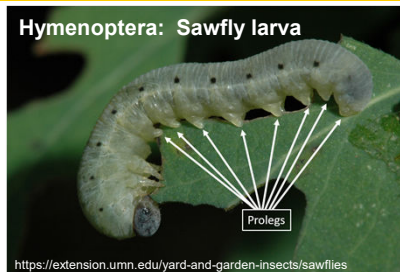
Lepidoptera: Moth larva (caterpillar)



Hermit sphinx moth (Courtesy of J. Fauske, NDSU)

2-5 pairs of prolegs on the abdomen, crochets on prolegs, smooth, hairy or spiny, horn, and vary in size

Hymenoptera: Sawfly larva



<https://extension.umn.edu/yard-and-garden-insects/sawflies>

Six or more pairs of prolegs, smaller prolegs, no crochets on prolegs, smooth, about 1 inch long when mature

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How to Identify a Moth Caterpillar (larva)

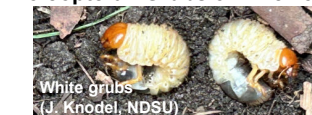
Lepidoptera: Moth larva (caterpillar)



Hermit sphinx moth (Courtesy of J. Fauske, NDSU)

Head capsule, 2-5 pairs of prolegs on the abdomen, thoracic legs behind head, smooth, hairy or spiny, and vary in size

Coleoptera: Grubs or wireworms



White grubs (J. Knodel, NDSU)



Wireworm larva (P. Beauzay, NDSU)

Lack prolegs or have very few, 3 thoracic legs, body shape diverse

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How to Identify a Moth Caterpillar (larva)

Lepidoptera: Moth larva (caterpillar)



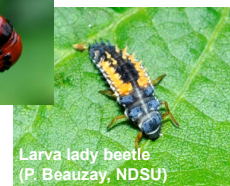
Hermit sphinx moth (Courtesy of J. Fauske, NDSU)

Head capsule, 2-5 pairs of prolegs on the abdomen, thoracic legs behind head, smooth, hairy or spiny, and vary in size

Coleoptera: Larva or wireworms



Larva CPB (J. Knodel, NDSU)



Larva lady beetle (P. Beauzay, NDSU)

Lack prolegs or have very few, 3 thoracic legs, body shape diverse

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How to Identify a Moth Caterpillar (larva)

Lepidoptera: Moth larva (caterpillar)



Hermit sphinx moth (J. Fauske, NDSU)

Head capsule, 2-5 pairs of prolegs on the abdomen, thoracic legs behind head, smooth, hairy or spiny, and vary in size

Diptera: Fly larva (maggot)



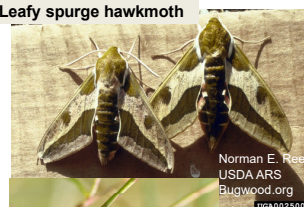
Blow flies (Susan Ellis, Bugwood.org)

No legs and no prolegs, no head capsule, burrow into moist, decaying organic matter or dead animals

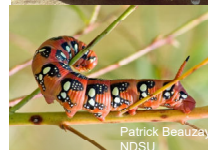
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Common Moth Families Sphingidae - Hornworms, Sphinx, or Hawk moth

Leafy spurge hawkmoth



Norman E. Rees
USDA ARS
Bugwood.org
DGA0025003

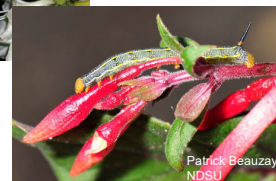


Patrick Beauzay
NDSU



White-lined sphinx

Terry Curtis
Bugwood.org



Patrick Beauzay
NDSU

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Source: <https://extension.sdstate.edu/night-blooming-flowers-and-host-plants-moths>

Common Moth Families Noctuidae – Owlets, Cutworms, Underwings

Winter cutworm or
large yellow underwing



Copyright © 2003 Larry Line
Larry Line, Mostly Moths of
Maryland, Bugwood.org



Gerald Fauske
NDSU

Red-backed
cutworm



John Golwoski
Manitoba Ag

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Common Moth Families – Erebidæ (Lymantriidæ) - Tussock Caterpillars



Whitney Cranshaw, Colorado
State University, Bugwood.org
9401459

Milkweed tussock moth and caterpillars

Pale tussock moth and caterpillar



Mark Dreiling
Bugwood.org



Jon Yuschok
Bugwood.org
5539717

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Common Moth Families - Erebidae (Arctiidae) Tiger moths, Lichen moths

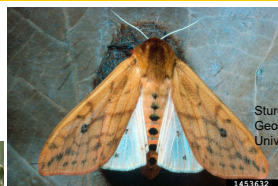


Saltmarsh caterpillar

Whitney Cranshaw, Colorado State University, Bugwood.org



Whitney Cranshaw, Colorado State University, Bugwood.org



Banded woollybear

Sturgis McKeever, Georgia Southern University, Bugwood.org



Whitney Cranshaw, Colorado State University, Bugwood.org

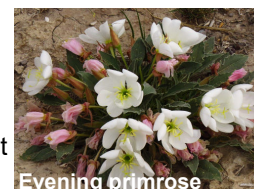
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Host Plants for Moths

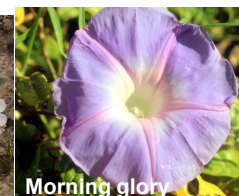
- Typically white or pale in color
 - Datura (*Datura wrightii*)
 - Morning glory (*Convolvulus* spp.)
 - Common evening primrose (*Oenothera biennis*)
- Long tubular flowers with lots of nectar
- Landing platforms/clusters
- Open late afternoon or night
- Plant larval host plants



Datura



Evening primrose



Morning glory

Source: <https://www.xerces.org>

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Food Sources and Host Plants for Moths

- Most nectar generalists
- Some nectar specialists
- Native plants
- Oaks, birch, willows, cherries
- Native flowers and grasses
 - Leadplant
 - Blazing star
 - Joe Pye weed
 - Milkweed



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Source: <https://extension.sdstate.edu/night-blooming-flowers-and-host-plants-moths>

Moon Gardens

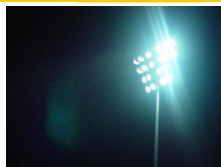
- White or silvery foliage
 - White hydrangeas, moonflowers, white cosmos, white lilies, white phlox
- Night-blooming plants with strong scents (fragrant flowers)
 - Jasmine, night-scented stock
- Soft lighting - moon's light
 - Water features or wind chimes



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ALL MOTHS in Trouble! Help save!

- Turn Out the Lights! **Light pollution**
 - Decline in moths and fireflies
 - Disruptive to bird migrations
- Outdoor lights (rising sun) attract night-flying moths
 - Confuses moth and fly in circles around artificial light
 - LED lights increase the mortality of insects
 - Use warm colors, dim low-voltage lighting
 - Motion-activated lights



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Moth Resources

- Xerces website – “Moths”
 - <https://www.xerces.org/>
- SDSU Extension
 - “Night-Blooming Flower and Host Plants for Moths”
- U.S. Forest Service
 - “Moth Pollination”
- McCormac, J., & Gottfried, C. (2023). [Gardening for Moths: A Regional Guide](#). Ohio University Press.



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Unicorn caterpillar
Schizura unicornis
P. Beauzay, NDSU



Thanks to collaborators:

- Patrick Beauzay
- Dr. Esther McGinnis
- April Johnson

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EXTENDING KNOWLEDGE >> CHANGING LIVES



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