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CORNELL UNIVERSITY
AGRICULTURAL EXPERIMENT STATION

THE LEPIDOPTERA OF NEW YORK AND NEIGHBORING STATES

Primitive Forms
Microlepidoptera
Pyraloids
Bombyces

WILLIAM T. M. FORBES

ITHACA, NEW YORK
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CONTENTS

SUPERFAMILY **NEPTICULOIDEA**

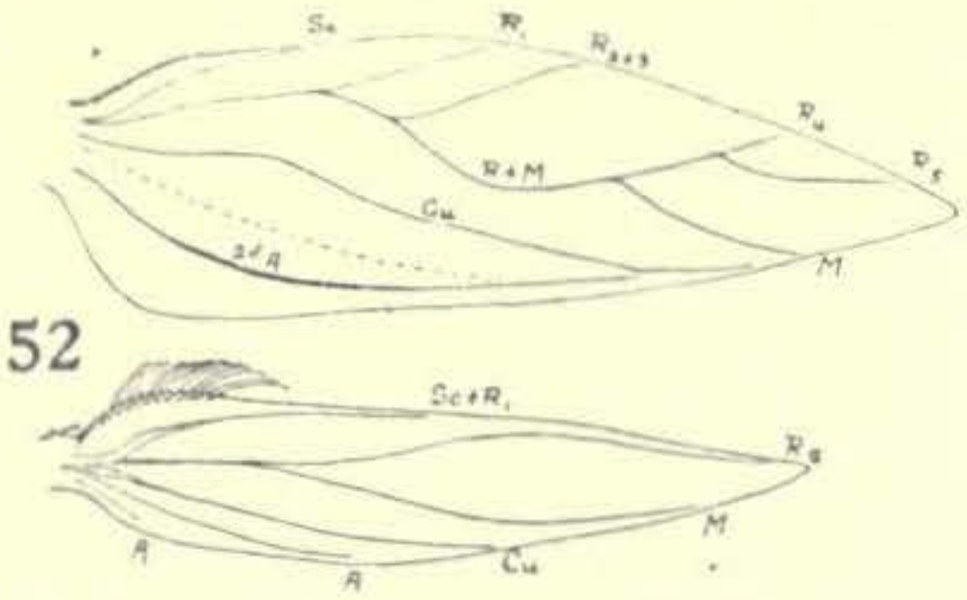
Family 5. **NEPTICULIDÆ**

Annette F. Braun

Head and face tufted. Antennæ not exceeding three-fourths of wing length, rather thick, with basal segment enlarged and concave beneath to form an eye-cap. Labial palpi short, porrect or drooping. Maxillary palpi long, filiform, folded. Tongue rudimentary. Posterior tibiae with bristles above. Wing membrane aculeate. *Fore wings* (fig. 52) with media coalescing with radius from base to beyond middle of wing, so that all the branches of radius and media appear to arise from one stem; or coalescing with cubitus for a short distance from base, then, either passing obliquely outward to radius just beyond $\mathbf{R}_{2+3}$, and anastomosing with radius to beyond middle of wing, as before, or remaining separate from radius, in which case (Trifurcula) $\mathbf{R}_{4+5}$ is absent. $\mathbf{R}_{2+3}$ coincident. $\mathbf{R}_{4+5}$ separating beyond **M**, or coalescing to apex. Cubitus unbranched, sometimes coincident with **M** or becoming obsolete beyond its point of separation from **M**. Second anal vein very prominent. Crossveins absent. A fibula (jugum) present in females of the more primitive genera. *Hind wings* (fig. 52) with subcosta and $\mathbf{R}_1$ coincident; **Rs** and **M** coalescing to about the middle of the wing. Media one- or two-branched. Cubitus unbranched. No crossveins. Frenulum of male consisting of a single strong spine; of female, rudimentary, of several minute spines. The function of the frenulum is performed, in the female, by a series of curved spines along base of costa. Hind wing one-half to almost as broad as the fore wing.

The moths, because of their minute size and retired habits, and very rapid and irregular flight, are not frequently seen. Early in the spring, some species may be collected resting in the crevices of bark. Later, moths may sometimes be found on leaves, usually those of their food plants. Occasionally, because of the peculiarity of all the individuals of a single generation maturing and emerging at the same time, great numbers of moths may be seen on leaves of the food plant and neighboring plants. To secure an adequate representation of the group, however, rearing of the moths from larvæ is necessary.

With the exception of several gall-making species of Ectœdemia, the larvæ of all species of which the life history is known, are miners within the tissues of leaves or in bark (rarely in fruits). They show a preference for trees and shrubs, but not a few mine leaves of herbaceous plants. When full grown, the larva, with few exceptions, leaves the mine, and, dropping to the ground, spins a dense, flattened cocoon amongst the rubbish or in the loose surface soil.



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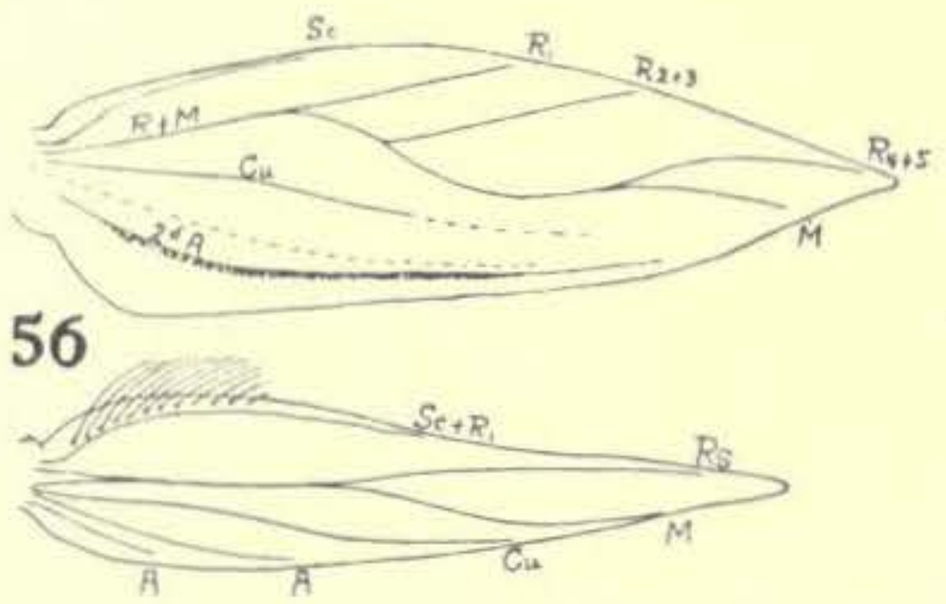

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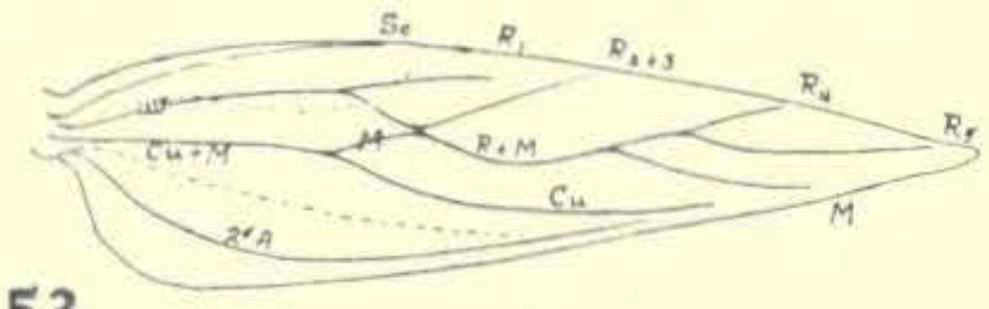

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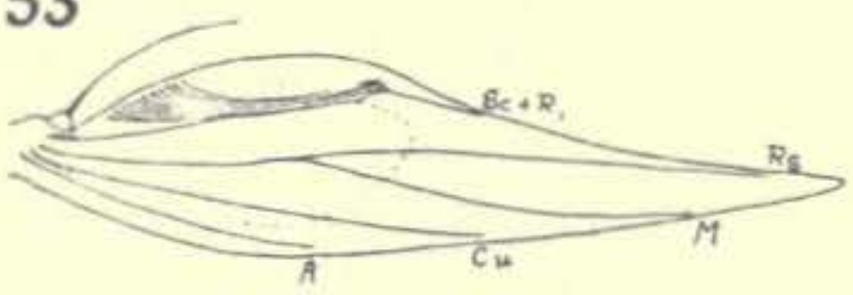

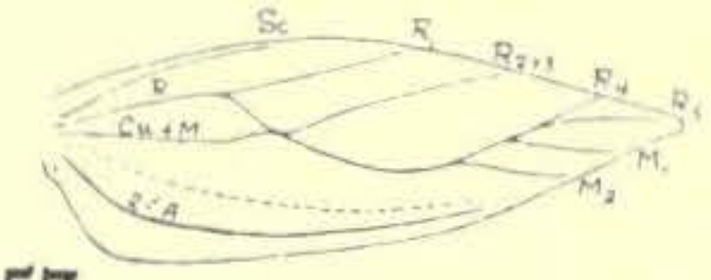

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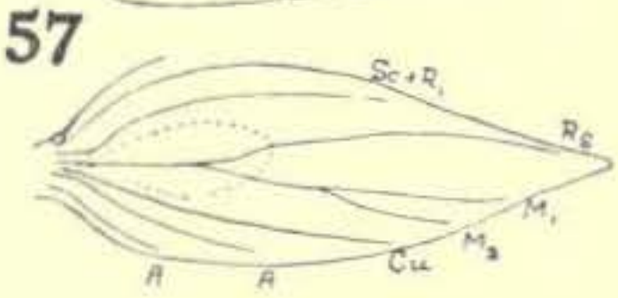

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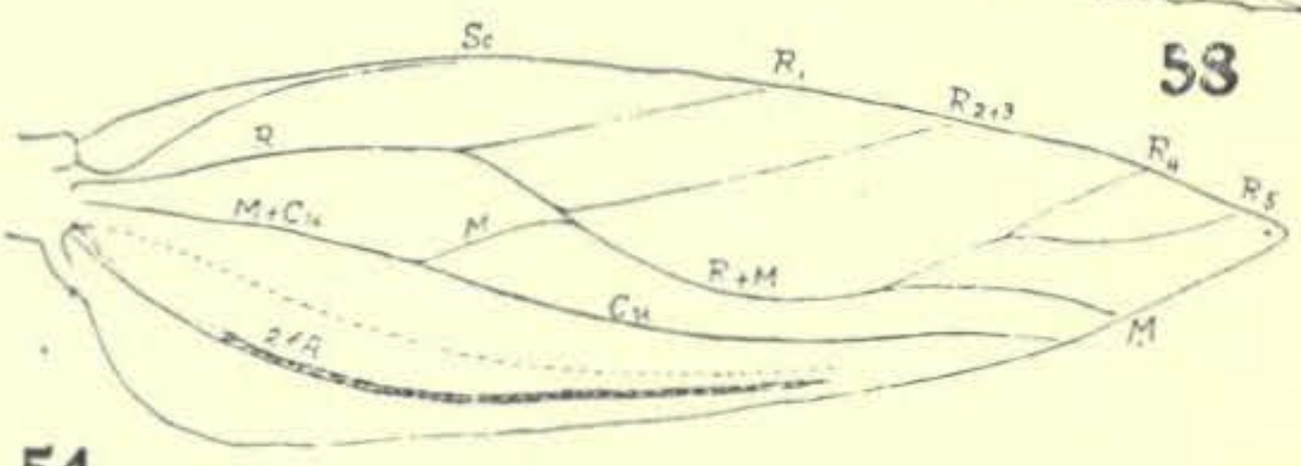

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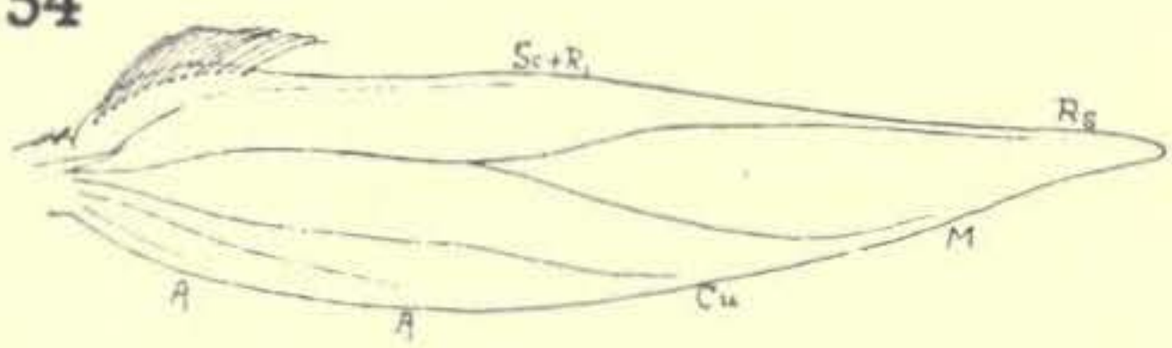

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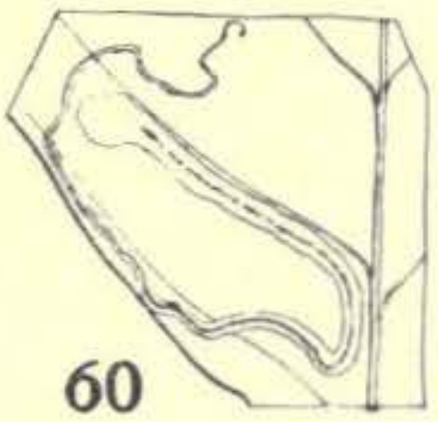

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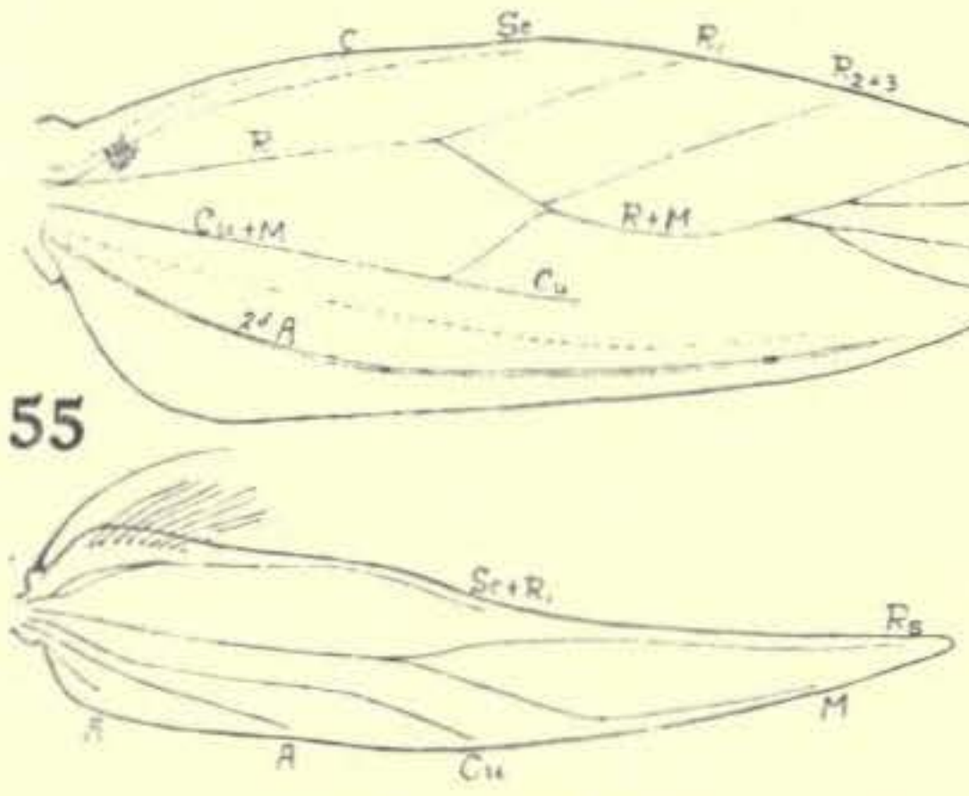

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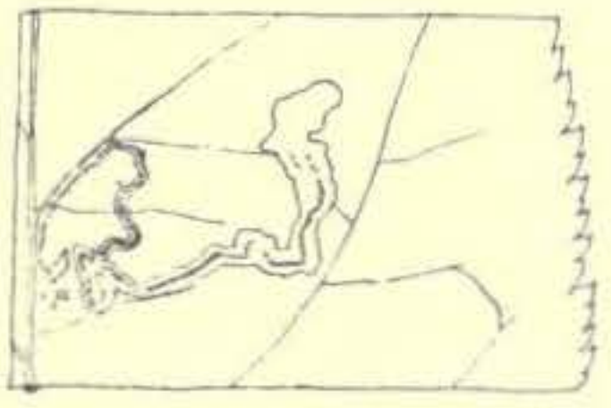

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FIGS. 52–61. NEPTICULIDÆ (Annette F. Braun)

52, Wings of *Nepticula nyssaefoliella,* female; **53,** wings of *Nepticula nyssaefoliella,* male; **54,** wings of *Ectoedemia heinrichi,* female; **55,** wings of *Obrussa ochrefasciella,* male; **56,** wings of *Nepticula terminella,* female; **57,** wings of *Glaucolepis saccharella,* male; **58,** mine of *Nepticula pallida;* **59,** mine of *Nepticula nyssaefoliella;* **60,** mine of *Nepticula saginella;* 61, mine of *Nepticula pomivorella*

The egg is a minute oval body attached to the surface of the leaf or bark by a minute, glistening speck of cement, which renders its location visible even to the naked eye.

The larva of Nepticula upon hatching eats directly into the leaf, and makes a very narrow, linear mine (figs. 58 to 61), which is at first often difficult to discern, since in its early stages, the larva consumes but a small part of the leaf tissue. This mine may continue as a linear mine, gradually broadening throughout its course, or it may at some period abruptly enlarge into a blotch. In the latter parts the mine is semitransparent and easily visible. The mine of any one species is very constant and characteristic in appearance, and, in most instances, serves for immediate identification of the species. The species of Ectœdemia are gall-producers or bark-miners in forest trees.

The larva is slightly flattened, with the head deeply retracted into the prothorax, due to the lengthening of the dorsal side of the head. Locomotor organs are represented by mere roughened protuberances; such rudimentary feet are present on segments three and four, on segments six to eleven, inclusive, and sometimes on the last segment in Nepticula; in Ectœdemia there are sometimes one or two additional pairs of rudimentary processes.

The cocoon is spun of dense brown or yellowish silk, flattened oval in general outline, but usually broader at its anterior end, around which a fissure extends, guarded by the smooth projecting edges of the two halves of the cocoon. Through this fissure the pupa is thrust at emergence. In some species, the flat, projecting edges form a rim extending entirely around the cocoon.

The pupa is flattened ovate; all the appendages are free and segmented; and segments one to seven inclusive of the abdomen are free. The pupa shows in some respects a resemblance to that of the primitive Eriocraniidae.

The moth is active almost immediately after emergence, running rapidly up and down the sides of the breeding jar, and in an incredibly short time has the full use of its wings. When at rest, the wings lie almost horizontal, meeting in a line down the middle of the back.

Key to the genera

(European genera in brackets)

A. R_5 of fore wing present.
  B. Media of fore wing with three branches (**Scoliaula**).
  BB. Media of fore wing with one or two branches.
    C. Media of fore wing two-branched.
      D. Media of hind wing two-branched.....1. **Glaucolepis.**
      DD. Media of hind wing single-branched.....2. **Obrussa.**
    CC. Media of fore wing single-branched.
      D. Middle spurs of posterior tibiæ in or above the middle....4. **Nepticula.**
      DD. Middle spurs of posterior tibiæ below the middle.....3. **Ectœdemia.**

1. *GLAUCOLEPIS* Braun

Eye-cap large. Middle spurs of posterior tibiæ in the middle. Fore wings elongate ovate; hind wings nearly equaling the fore wings in breadth, in the male; three-fourths of the width of the fore wing in the female. Fore wings (fig. 57); cubitus coincident with media, which anastomoses with radius from $\mathbf{R}_{2+3}$ to beyond middle of wing; $\mathbf{M}_3$ absent; $\mathbf{M}_2$ arising before separation of **M** and **R**. Hind wings: media two-branched.

1. **G. saccharella** Braun. Tuft brownish ocherous, eye-caps bluish white. Thorax and basal fourth of fore wing blue or purple metallic; remainder of wing black with a broad, bluish silvery fascia just beyond middle; cilia pale bluish. Hind wings of male with oval, yellow patch of *androconia*. 4 mm.

Very long serpentine mines in leaves of maples.

2. *OBRUSSA* Braun

Eye-cap large. Labial palpi well developed. Middle spurs of the posterior tibiæ above the middle. Fore wings elongate ovate, with fibula in the female; hind wings a little over one-half the breath of the fore wings. Fore wings (fig. 55); media coalescing with cubitus at base, then passing obliquely to radius beyond $\mathbf{R}_{2+3}$, and anastomosing with radius to beyond middle of wing. $\mathbf{R}_4$ separate. $\mathbf{M}_1$ and $\mathbf{M}_2$ coalescing for a short distance beyond separation of **M** and **R**. $\mathbf{M}_3$ absent. Cubitus becoming obsolete beyond its separation from **M**. Hind wings: media single-branched.

Represented by a single species whose early stages are entirely unknown.

1. **O. ochrefasciella** Chambers. Tuft ochraceous; eye-caps buff. Fore wing blackish brown with a pale ocherous fascia at basal third; scattered ocherous scales at two-thirds, forming indistinct transverse line in female. Last row of scales at apex and cilia pale ocherous. Underside of wing of male with androconia. 6.5–8 mm.

3. *ECTŒDEMIA* Busck

Basal segment of antennae enlarged and concave beneath to form an eye-cap. Labial palpi somewhat longer than in Nepticula. Middle spurs of posterior tibiae below the middle. Fore wings elongate ovate, pointed; fibula present in the female; hind wings two-thirds to three-fourths as wide as fore wings; nearly as long as the fore wings. Fore wings (fig. 54); media coalescing with cubitus at base, then passing obliquely to radius beyond $\mathbf{R}_{2+3}$, and anastomosing with radius to beyond middle of wing. $\mathbf{R}_4$ separate. Media single-branched. Cubitus reaching margin. Hind wings: media single-branched.

The position of the middle spurs on the posterior tibiae, the relatively smaller eye-caps, and the broader wings will distinguish this genus from those species of Nepticula which have identical venation.

The larvæ of the species whose life history is known form galls on twigs or petioles, or are miners in the bark of twigs. The egg is somewhat more circular in outline than that of Nepticula. There is but a single generation of the moths a year, as would be expected from the peculiarities of the life history.

In all but the unicolorous *E. populella*, the fore wings are mottled with fuscous scales, or with dark-tipped scales. Ill-defined markings are formed by the grouping of these dark scales in patches. The markings differ from those species of Nepticula which resemble Ectœdemia most in structural characters.

Key to species

a. Fore wings unicolorous.....1. *populella.*
aa. Fore wings mottled.
b. Dark-tipped scales evenly distributed.....2. *castaneæ.*
bb. Dark-tipped scales more or less collected into patches.
c. Base of fore wing with scattered dusting, except near costa..5. *obrutella.*
cc. Dusting dense near base of wing.
d. A poorly defined, pale fascia at basal third.....4. *heinrichi.*
dd. No fascia at basal third.....3. *phleophaga.*

1. **E. populella** Busck. Tuft reddish ocherous, eye-caps pale yellowish. Fore wings shining coppery brown, with green and violet iridescence. 7–8.5 mm.

The larvæ form almost globular galls, of the size of a pea, on the petioles of leaves of poplar. The larva is full-grown in October. The moth appears in May.

2. **E. castaneæ** Busck. Tuft black above; eye-caps creamy-white. Fore wing clothed with bluish white scales, which are mostly deeply tipped with blackish brown, so that the wing is almost uniformily densely dusted. 7.5–8 mm.

The larvae form cylindrical galls encircling young twigs of chestnut.

3. **E. phleophaga** Busck. Tuft ocherous. Thorax and basal half of fore wing dark bluish fuscous, outer half paler, bluish with dark-tipped scales; an ill-defined, ocherous costal and an opposite dorsal patch at apical third. 9–10 mm.

Serpentine mines in bark of chestnut; larva full grown in April and May; imago in September.

4. **E. heinrichi** Busck. Tuft black, eye-caps creamy-white. Fore wing pale ocherous, densely dusted with blackish fuscous scales, which tend to form patches. The dark dusting is usually absent or scattered at the extreme base of wing except along costa and on two poorly defined, transverse fasciae, one at basal third, the other at apical third; the second fascia sometimes almost obliterated by dusting. 9-10 mm.

The larva forms a characteristic, flattened-oval, spiral mine in the bark of young branches of pin oak (*Quercus palustris*). The larvæ are full-grown in October and early November, producing moths in May and June of the following year.

5. **E. obrutella** Zeller. Differs from the two preceding species chiefly by the scattered dusting of the basal half of wing. Food plant unknown, thus far recorded only from Texas.

4. *NEPTICULA* von Heyden

Basal segment of antennæ dilated and concave beneath to form a large eye-cap. Middle spurs of posterior tibiæ in or above the middle. Fore wings elongate ovate, pointed; hind wings one-half to two-thirds as wide as fore wings. Fore wings (figs. 52, 53, 56); media coalescing with radius from base to beyond middle of wing, or coalescing with cubitus at base and passing obliquely to radius beyond R_{2+3} and anastomosing with radius to beyond middle of wing as before. R_4 sometimes coincident with R_5. Media single-branched. Cubitus usually reaching nearly to margin. Hind wings: media single-branched.

As far as is known, the larvæ of all of the North American species are miners within the tissues of leaves. The egg is placed on either the upper or under surface of the leaf, often along the side of a vein, and the larva passes directly into the interior of the leaf. The larva usually mines just beneath the upper epidermis, consuming the palisade layer of cells, and in later stages, some of the spongy parenchyma cells. In thin leaves, the mine seems more transparent, because of the originally smaller number of these cells and the looseness of their arrangement. Where the upper or lower surface is mined indiscriminately, as is done by *N. populetorum* in the leaves of poplar, the cross section of the leaf shows palisade

cells on either side. Some species mine different sides of the leaf at different periods of larval life. The mine may be a linear tract, gradually increasing in breadth to its end, or it may at some point suddenly enlarge into a blotch. A change in the character of the mine usually indicates the beginning of a new instar. There are four larval instars. The mine formed during the first instar is very short, rarely exceeding a few millimeters in length. The large, conspicuous part is made during the last larval instar, in the few days preceding the escape of the larva from the mine. The larva leaves the mine by a semi-circular slit in the upper or the lower epidermis and spins the characteristic cocoon, usually brownish, but occasionally yellowish or whitish, in the surface soil or amongst rubbish, often near the base of the tree; occasionally it spins on the twigs or branches. Pupation does not take place immediately; in the summer generations it occurs a few days before emergence, in the overwintering generation it may be delayed until spring.

A few species have but one generation a year; most species have two or three; a few of the oak-feeding species may have as many as four generations. The length of the life cycle is approximately six weeks, except in the single-generation species, where several months may elapse between oviposition and the attainment of full growth by the larva. The moths from the over-wintering generation of larvæ emerge in May and June, a few species, however, appearing in April.

Key to the species

a. Fore wings with pale spots or fasciæ.
  b. A silvery or pale golden metallic spot at, or very near, the base of the wing.
    c. A median fascia.
      d. A costal and a dorsal spot at three-fourths.....3. *pteliaeella.*
      dd. No such spots at three-fourths.
        e. Thorax and extreme base of wing purple.....1. *argentifasciella.*
        ee. Thorax and extreme base of wing golden.....2. *scintillans.*
    cc. No median fascia.....4. *quadrinotata.*
  bb. Without such a spot.
    c. Basal third of wing buff.....9. *cerea.*
    cc. Basal third of wing not buff.
      d. A pale costal spot at one-third.....5. *trinotata.*
      dd. Without a pale costal spot at one-third.
        e. Two pale fasciæ.
          f. Thorax creamy buff.....8. *rhamnicola.*
          ff. Thorax dark.
            g. Head black.....7. *intermedia.*
            gg. Head ochraceous.....6. *bifasciella.*
        ee. One pale fascia.
          f. Fascia more or less interrupted.
            g. Male with a chitinous plate from base to near middle of costa of hind wing.
              h. Fascia silvery.....32. *platanella.*
              hh. Fascia not silvery; male with long hair-pencil from base of costa of hind wing.....34. *similella.*
            gg. No such chitinous plate in male.....33. *clemensella.*
          ff. Fascia complete.
            g. Fascia before the middle; wing lusterless.
              h. Whitish costal and dorsal spots at three-fourths. 35. *thoracealbella.*
              hh. No such spots at three-fourths.....40. *latifasciella.*

gg. Fascia in or beyond middle of wing.
h. Apex white .....24. *apicialbella.*
hh. Apex not white (sometimes with white apical cilia).
i. Fore wing almost lusterless; fascia not more shining than remainder of wing.
j. Cilia, creamy white.....**31. *ulmella.***
jj. Cilia gray .....30. *fuscotibiella.*
ii. Fore wing almost lustreless; fascia shining white, silvery, or golden.
j. Collar white .....25. *tiliella.*
jj. Collar not conspicuously paler than the head.
k. Apical cilia white; marginal line defined.
l. Expanse 4 mm.....26. *rubifoliella.*
ll. Expanse 5 to 6 mm.....27. *nyssaefoliella.*
kk. Apical cilia not white; marginal line not defined.
l. Head paler behind.....28. *slingerlandella.*
ll. Head not paler behind.....29. *rosaefoliella.*
iii. Fore wing with a metallic luster; fascia silvery or golden.
j. Fascia preceded by a purple or deep golden brown band.
15. *purpuratella.*
jj. No such band.
k. Fascia the only pale marking.
l. Basal halt of wing metallic golden or bronzy; fascia ill-defined internally.
m. Entire apical area deep purple....14. *unifasciella.*
mm. Costal half of apical area purple.
13. *resplendensella.*
ll. Fascia well-defined internally, contrasting with ground color.
m. Wing purple before the fascia, brown beyond.
19. *altella*
mm. Wing not as above.
n. Fascia noticeably beyond the middle.
o. Fascia indistinct.....16. *obscurella.*
oo. Fascia distinct.
p. Entire tuft ochraceous....17. *ostryæfoliella.*
pp. Tuft ochraceous behind only..18. *paludicola.*
nn. Fascia at or near the middle.
o. Tuft black .....22. *quercipulchella.*
oo. Tuft reddish or ccherous.
p. Ground color bronzy.
q. Collar pale yellowish (usually).
21. *opulifoliella.*
qq. Collar not pale.....20. *corylifoliella.*
pp. Ground color purplish black.
23. *juglandifoliella.*
kk. With additional silvery or golden markings.
l. A semi-elliptical, golden, metallic spot on dorsum proximal to fascia.....10. *rhoifoliella.*
ll. Metallic markings along termen or at apex.
m. Termen margined with silvery scales from dorsum to apex .....11. *terminella.*
mm. Apex golden metallic, concolorous with fascia.
12. *villosella.*

aa. Fore wings without pale spots or fasciæ.
b. Ground color pale ocherous or yellowish.
c. A purplish fuscous band across apex of fore wing.
d. Fore wing dusted with fuscous scales.
e. A dark brown spot at base of dorsal margin.....42. *nigriverticella.*
ee. No such spot.....43. *populetorum.*
dd. Fore wing not dusted.....41. *crataegifoliella.*
cc. No such band; wing dusted.
d. Tuft fuscous or blackish.....44. *saginella.*
dd. Tuft ocherous .....45. *pallida.*
bb. Ground color, brown with purple or bronzy luster.
c. Fore wing with metallic bronzy or golden reflections.
d. Wing deep reddish or purplish bronzy.....36. *pomivorella.*
dd. Wing paler, with greenish golden reflections.....37. *chalybeia.*
cc. Fore wing dark brown, with faint purple reflections.
d. Tarsi of middle and hind legs pale ocherous.....38. *flavipedella.*
dd. Tarsi of middle and hind legs whitish.....39. *castaneæfoliella.*

1. **Nepticula argentifasciella** Braun. Tuft black behind, ochraceous in front; eye-caps silvery white. Thorax and base of fore wings dark purple. Fore wings dark brown, with metallic reflections. At the basal fifth of the wing is a brilliant silvery fascia, sometimes broadening so considerably on dorsum as almost to reach the base of the wing. At the middle of the wing a second fascia; at extreme apex a silvery patch of scales of variable extent. 4 to 4.5 mm.

Larva in leaves of basswood (*Tilia americana*). Mine narrow serpentine, expanding into a blotch. Cocoon reddish.

There are two or three generations a year. The larvæ become full-grown toward the end of June, in August, and in the latter part of September.

2. **Nepticula scintillans** Braun. Tuft and collar black; eye-caps silvery white. Thorax and base of fore wing golden. Fore wing, except at the base, very dark purple with a silvery fascia across the middle, broadest on the dorsal margin. A second silvery fascia across the apex of the wing. The cilia at the extreme apex dark brown, elsewhere silvery gray. 3 mm. Ohio. Narrow serpentine mines in leaves of haw apple (*Crataegus mollis*); two generations.

3. **Nepticula pteliaeella** Chambers. Tuft dark brown; eye-caps white. Thorax and base of fore wing at the dorsum silvery; a silvery fascia before the middle, a costal and opposite dorsal spot at three-fourths, on a dark brown ground color. Cilia silvery around the apex, becoming brown toward the dorsum. Hind wings dark brown. 4 to 4.5 mm. Kentucky; Ohio.

The larva is a miner in the leaves of the hop tree (*Ptelea trifoliata*); the mine (fig. 12), which is everywhere much contorted, is at first very indistinct, and sometimes blotch-like; later it becomes more distinct.

There are two generations a year. The larvæ may be collected in July and in August and September.

4. **Nepticula quadrinotata** Braun. Head dark brown; eye-caps silvery white. Thorax and fore wings dark brown; markings silvery white, consisting of an elongate spot at base of dorsum, a small spot on the costa before the middle, a larger triangular spot at the tornus, and a similar spot on the costa nearer the apex. 4 to 5 mm. Ohio; Kentucky.

The larva mines leaves of hornbean (*Carpinus caroliniana*) and hazel (*Corylus americana*). The mine is at first linear, usually closely following the midrib or one of the lateral veins; later doubling on itself for a short distance before it expands into an irregular, pale brownish blotch.

There are two generations a year: The larva mines in July and from late August to the middle of October, but is never common.

5. **Nepticula trinotata** Braun. Tuft ocherous, eye-caps whitish. Fore wings with deep blue reflections in the basal third, velvety back beyond, and somewhat irrorated in the apical third, the scales here having pale bluish iridescent bases. At the basal third on the costa is a white spot of variable size, faintly tinted with lilac in some lights. At the apical third there is a costal and an opposite dorsal spot, each shining white and larger than the spot at the basal third. 4.5 to 5 mm. Ohio.

The larvæ form blotch mines on *Carya cordiformis* and occasionally on *C. ovata*

The mine is at first an extremely narrow, linear tract, expanding into a broader tract, which, in turn, becomes a blotch.

There are two generations a year, the mines of the first appearing during the early part of July and those of the second generation, at the beginning of September.

6. **Nepticula bifasciella** Clemens. Tuft ochraceous; eye-caps shining, cream color. Thorax and base of fore wings to the first fascia dark purple; beyond the first fascia, wings dark brown with bronzy reflections; the fasciæ silvery or golden according to the light, the first fascia at one-third, the second at two-thirds of the wing length. 4 to 4.5 mm.

The larva is a miner in leaves of wild cherry (*Prunus serotina*), and occasionally on wild plum (*Prunus americana*). The mine is much contorted, especially at first, often, by confluence, forming a blotch; later distinct. The leaf of wild cherry is discolored and reddish around the mine.

This species is one of the earliest to appear in the spring, the larvæ become full-grown by the middle of May; later generations appear in June and July and in September.

7. **Nepticula intermedia** Braun. Head black; eye-caps silvery white. Thorax bronzy, base of fore wing plum-purple, followed by a shining silvery or golden fascia. Beyond this fascia wing dark brown, with but faint bronze reflections. A second silvery or golden fascia crossing the wing at two-thirds. 3 to 3.5 mm. Ohio; Kentucky.

This species makes serpentine mines on leaves of sumac (*Rhus* spp.). Usually there are but two generations a year, the larvæ maturing in July usually overwintering, but occasionally a third generation appears.

8. **Nepticula rhamnicola** Braun. Tuft ocherous in the summer generation, black in the overwintering generation. Thorax creamy buff, patagia dark brown. Fore wings brown, the tips of the scales blackish. At the basal third of the wing a cream-colored fascia with its edges often indented by dark scales. At two-thirds of the wing length a more shining silvery fascia. 4.5 to 5.5 mm. Ohio.

The larvæ are found in the leaves of *Rhamnus lanceolata;* the mine is at first linear, contorted, and on lower surface; later it crosses to the upper side where it finally becomes a blotch. There are three generations; the mines are most abundant in October.

9. **Nepticula cerea** Braun. Head buff; eye-caps a little paler. Thorax and base of fore wings to just beyond one-third, creamy buff. From the base a few fuscous scales extending along the costa to the middle of the pale area, where they join a small, triangular, fuscous spot which is sometimes faintly connected with the dorsum by a few scattered fuscous scales. Following the pale basal area, a broad dark-brown band across the wing, succeeded by a narrower, silvery white fascia. The apical third of the wing dark brown, except for the pure white cilia at the apex. 3.5 mm. Ohio; Pennsylvania.

10. **Nepticula rhoifoliella** Braun. Head black; eye-caps silvery white. Thorax blackish purple. Fore wings very lustrous, base of the costa plum-purple. A large, semi-elliptical patch of scales just beyond the base of the wing and resting on the dorsum, but not reaching to the extreme costa, of deep, brilliant golden,

shading along its edges into reddish bronze. Beyond this, wing deep purple with bronze reflections; wing crossed at three-fifths its length by a straight, shining, silvery or pale golden fascia. 3.5 mm.

Ohio; Kentucky; Missouri.

The larvæ make contorted, serpentine mines on the upper side of leaves of poison ivy (*Rhus toxicodendron*).

There are three generations; mature larvæ may be found in June, toward the end of July, and in September.

11. **Nepticula terminella** Braun. Tuft on the face dull brownish, on the vertex and head black; collar and eye-caps shining white, with a very faint yellow tinge. Thorax bronzy. Costal half of the fore wing to the fascia, blue-purple, the blue predominating at the extreme edge; below the costa the wing shading into a deep, brilliant, golden color, becoming more bronzy as it nears the fascia. Fascia situated just beyond the middle of the wing, almost straight, and with a brilliant, silvery luster. Apical third of the wing blue-purple, blue predominating. Just below the apex a double row of silvery scales margining the termen, becoming a single row toward the dorsum, and sometimes connected with the fascia. 5 to 5.5 mm.

Ohio; Kentucky; Pennsylvania.

The mine is seen on various species of oak, though most commonly on red oak (*Quercus rubra*) and pin oak (*Q. palustris*), it is a pale greenish, gradually broadening, linear tract, 3.5 mm. wide at the end. The larva is yellow, even when very young. Thus this mine can early be distinguished from the other linear mines on oak.

There are three generations a year, and in favorable seasons, a fourth.

12. **Nepticula villosella** Clemens. Tuft orange-ochraceous; eye-caps pale golden. Thorax and fore wings to the fascia brilliant, metallic bronzy, somewhat purple at the base of costa; fascia at two-thirds golden. Wing beyond the fascia blue-purple, with a large spot at the apex and the apical cilia golden, concolorous with the fascia. 4.5 mm.

The larva is a miner in leaves of blackberry (*Rubus* spp.) and occasionally wild raspberry (*Rubus occidentalis*). The mine is a tortuous, brown, linear tract scarcely broader than the pale brownish larva within.

There are three generations.

This is distinguished from all other species by the metallic golden apex.

13. **Nepticula resplendensella** Chambers. Palpi whitish, tuft pale reddish saffron. Fore wings, including cilia, with a brilliant metallic luster, golden or silvery, except the basal half of the costal margin, and a large spot extending along the base of the costal cilia nearly to the tip and more than half way across the wing, which is deep purple. Tips of tarsi pale yellowish. 6 mm.

Kentucky.

14. **Nepticula unifasciella** Chambers. Head orange-ochraceous; eye-caps silvery white. Upper surface of thorax and basal two-thirds of fore wing brilliant metallic bronzy or golden, except toward the costal margin where the color shades into purple, so that a silvery or golden fascia at the apical third is scarcely defined internally. Behind the fascia, wings deep purple. Cilia purple, golden at their tips. 4.5 mm.

Kentucky; Texas; Ohio.

15. **Nepticula purpuratella** Braun. Tuft ochraceous or orange; eye-caps silvery white. Thorax deep bronzy or golden. Extreme base of the fore wing concolorous with the thorax, shading outwardly to a paler, lustrous, golden color, and this, at the outer limits of the basal third, followed by a deep, bronzy band with purple and reddish reflections varying in intensity, and occupying approximately the middle of the wing. This followed by a brilliant, silvery fascia. Apical area beyond the fascia deep bronzy, usually suffused with brilliant purple. The purple

reflections sometimes almost entirely absent, so that the dark band preceding the fascia and the apical area are deep bronzy-golden. 4.5 to 4.8 mm.

Pennsylvania.

16. **Nepticula obscurella** Braun. Tuft ocherous, eye-caps whitish. Fore wings shining golden brown, tinged with bronze along the extreme costa and in the apex. Just beyond two-thirds of the wing-length, an indistinct, narrow, whitish fascia, broadest in the middle of the wing and fading out toward the ends. Viewed from some angles, this fascia scarcely visible. Cilia of the general hue, their tips around the apex paler. however, and concolorous with the fascia. 3.5 mm.

New Jersey; New York.

The mine is a narrow serpentine track on the upper side of bayberry (*Myrica carolinensis*). There are two generations a year.

17. **Nepticula ostryaefoliella** Clemens. Tuft ochraceous; eye-caps and collar shining cream-colored. Thorax and fore wings shining brown with faint bronzy and purple reflections, which become deeper toward the predominantly purple apex. At two-thirds of the wing length is a shining silvery fascia. Cilia tipped with white around the apex. 4 mm.

Pennsylvania; Ohio; Kentucky; North Carolina; British Columbia.

The mine is a rather broad, serpentine track, gradually increasing in breadth to the end, where it measures about 2 millimeters across; it occurs on various species of birch (*Betula* spp.) and on hop hornbeam (Ostrya).

18. **Nepticula paludicola** Braun. Distinguished from the preceding species by the following characters: tuft clay-colored or fuscous on the face, shading to buff or cchraceous on the head; fascia slightly nearer the base. 3.5 to 4.5 mm.

New Jersey; Ohio.

The mine is a serpentine track on leaves of cranberry (*Oxycoccus macrocarpus*).

19. **Nepticula altella** Braun. Tuft orange-ochraceous in front, becoming pale behind; eye-caps creamy white. Thorax dark purplish brown. Fore wings before the fascia purple-brown, beyond it brown with purple reflections; general color to the naked eye deep purple before the fascia and brown beyond it. A silvery fascia crosses the wing at three-fifths, and is usually a little broader on the margins of the wings. 6.5 to 7 mm.

Southwestern Ohio, locally in pin-oak forests.

The species has but one generation a year, the moths appearing in May. The mines are found only on the first leaves of the pin oak (*Quercus palustris*) that appear in the spring, never on the leaves that come later. The mine, which may best be regarded as a lower-side mine, is at first much contorted, winding and twisting within a small area, and causing a brownish discoloration of the surrounding leaf. This part of the mine seems to be formed early in the season, and the leaf around it is always dead when, in October, further feeding is resumed. At this time the larva starts out to mine into the fresh, green part of the leaf, where the mine is more distinct, due to the larva's partial eating of the leaf substance. The larva then becomes full-fed in a week or ten days and leaves the mine to spin a dark brown cocoon. The mine is extremely long but measures only 1 to 1.5 mm. in width at its end. The larva is yellow, with a row of dark brown dashes along the mid-ventral line.

This species may be separated from all other species by the fact that the wing is purple before the fascia and brown beyond, the reverse being true in all other cases where there is a difference in color before and behind the fascia.

20. **Nepticula corylifoliella** Clemens. Tuft ocherous to orange-ochraceous. Eye-caps silvery white, sometimes shading to fuscous outwardly. Thorax and fore wings bronzy brown, with blue-purple reflections toward the costa and in the entire apical part of the wing beyond the fascia, the color being there predominantly purple. The purple reflections sometimes entirely lacking proximal to the fascia. Fascia situated just beyond middle of wing, rather broad, narrowing toward the costa. Cilia silvery-tipped at the apex. 3.5 mm.

The food plants of *N. corylifoliella* include hazel (*Corylus americana*), hop hornbeam (*Ostrya virginiana*), hornbeam (*Carpinus carolinina*), and black birch (*Betula lenta*). The mine is a long, very narrow, winding tract, scarcely broader than the larva. The larvæ may be found in June and early July, and from late August until October.

21. **Nepticula opulifoliella** Braun. Tuft ochraceous; collar usually pale yellowish; eye-caps pale, shining buff, sometimes fuscous outwardly. Thorax dark fuscous, with purple and blue reflections. Fore wings with pronounced purple and blue reflections toward the costa and beyond the fascia, shading to bronzy green below the fold. At three-fifths of the wing length a broad, very shiny, silvery fascia with faint, golden luster. 3.5 to 4 mm.

Ohio; North Carolina.

The larvæ form brownish, much contorted, serpentine mines in leaves of Opulaster (*Physocarpus opulifolius*). There are two generations, the larvæ appearing in July and September.

This species is very close to *N. corylifoliella*, from which it is difficult to distinguish it. The pale collar, when present, is a reliable character. The more yellowish eye-caps, and the less lustrous wing, with the absence of reddish tints, will aid in distinguishing this species from *N. corylifoliella*.

22. **Nepticula quercipulchella** Chambers. Head black; collar and eye-caps yellowish white, silvery; thorax and fore wings deep blue-black, bronzed, and with purple and violet reflections; the fascia behind the middle, silvery white and a little the widest on the dorsal margin; wing behind the fascia darker than before it, but cilia paler and less lustrous than wing. Under surface of wing, abdomen, and legs cupreous black. 4 mm.

Kentucky.

The above description is essentially that given by Chambers. According to him "the larva is bright green, with a deeper green line of contents; it makes a long, narrow, winding, and gradually widening track, similar to that of *N. quercicastanella* Chambers in leaves of *Quercus alba*." Chambers asserts that the larva from which he bred the type specimen formed a new mine when nearly grown, a fact, if true, at variance with all observations on this group.

23. **Nepticula juglandifoliella** Clemens. Tuft ochraceous, eye-caps and collar shining creamy white. Thorax and fore wings deep purplish black, uniformly purple beyond the fascia which is situated just beyond the middle; silvery white and broadest on the dorsum. 3.5 to 3.8 mm.

The mine is a serpentine track, usually whitish, and is found on various species of hickory and on walnut and butternut. The larva is pale green (almost white when feeding on walnut).

There are three generations. Full-grown larvæ may be found in the middle of June, the latter part of July, and in late August and early September.

The purple fore wings and white collar distinguish this species from its nearest allies.

24. **Nepticula apicialbella** Chambers. Tuft ochraceous, collar creamy white, eye-caps white. Thorax dark purplish brown. Fore wings dark brown, with a faint, purple luster. Beyond the middle of the wing is a narrow, oblique white fascia, convex outwardly and reaching the margin farther from the base on the dorsum. The scales at extreme tip of wing white, forming, with the whitish apical cilia, a very distinct pale patch. 4 mm.

Kentucky; Ohio.

The larvæ make upper-side, serpentine mines on elm. The mine is brownish in color, with a conspicuous line of frass through the middle.

There are three generations. The full-grown larvæ are found in mid-June, late July, and in August and September.

The oblique fascia and white apex distinguish this species from all others.

25. **Nepticula tiliella** Braun. Tuft ochraceous, collar white. Antennæ black, eye-caps shining white. Fore wings almost black, with a very faint, purple luster. At the middle of wing a shining, pure white fascia, slightly oblique and a little convex outwardly. Cilia gray on the dorsum, shining white from the tornus to the costa. 3.5 mm.

Ohio; Kentucky.

The larvæ make serpentine mines on the upper side of leaves of basswood (*Tilia americana*). The mine is characterized by the tendency toward a spiral form, with either the early or the later part inside, and by the frequency of angular turns.

There are two generations, the full-grown larvæ appearing in early July and late August.

The pure white fascia and the white cilia, against which the outermost row of black scales is sharply defined, distinguish this species.

26. **Nepticula rubifoliella** Clemens. Head ocherous; eye-caps silvery white. Thorax and fore wings almost black, with a shining silvery, or faintly golden, fascia at the middle of the wing; fascia convex outwardly and somewhat narrowed at its middle, sometimes almost interrupted. Cilia whitish, so that the marginal line of scales is defined. 4 mm.

The larvæ mine leaves of blackberry, forming at first very narrow, linear mines, which closely follow a vein or the margin of the leaf before enlarging into an irregular blotch.

Mines containing the larvæ may be collected in July and September.

27. **Nepticula nyssæfoliella** Chambers. Tuft ochraceous; eye-caps shining white. Thorax and fore wings black with very faint, purple reflections. In the middle of the wing a shining silvery, or pale golden, fascia, slightly convex outwardly. Cilia around the apex white, with marginal line of scales defined. Hind wings pale gray, with an oval patch of androconia in the male. 4.5 to 6 mm.

The larvæ mine in the leaves of sour gum (*Nyssa sylvatica*), forming narrow, linear mines (fig. 59) which abruptly enlarge into blotches measuring 2 cm. or more in length, with an average width of 5 or 6 mm. There are two or three generations a year, the larvæ of the first generation becoming full-grown in June.

This is one of the most abundant species; moths may often be collected in great numbers in the vicinity of the food plant.

From *N. rubifoliella*, its nearest ally, it is distinguished by its larger size and the equal breadth of fascia throughout.

28. **Nepticula slingerlandella** Kearfott. Tuft ochraceous, becoming paler behind, where it merges into the pale ocherous or whitish collar. Eye-caps white. Thorax and fore wings black with a faint bronzy luster, somewhat irrorated beyond the shining white fascia situated just beyond the middle of the wing. Cilia pale gray. 3.5 to 5 mm.

New York; Ohio.

The larvæ mine leaves of cultivated plums and prunes, wild plum (*Prunus americana*), and occasionally sweet cherry, forming narrow, linear mines which abruptly enlarge into irregular blotches. This species attains economic importance in the plum orchards of northern New York, where its ravages have been the subject of a bulletin by C. R. Crosby, in which are given further details of its life history, together with numerous figures. There is a single generation of moths in New York, and the larvæ which are full grown in July do not produce moths until the following year. Farther south, a second brood of larvæ may usually be collected in September.

29. **Nepticula rosæfoliella** Clemens. Tuft ochraceous; eye-caps shining creamy white. Fore wings almost black, with a very faint, dark blue and bronzy luster. Just beyond the middle of the wing is a rather broad, straight, silvery, or very pale, golden fascia. Cilia of the general hue, scarcely paler tipped opposite the apex. 4.5 mm.

The larva mines the leaves of various species of rose. The mine is serpentine, usually much contorted, and frequently closely follows the edge of the leaf in its early course. A broad line of frass is visible. The mine at its end measures 1.5 to 2 mm. across. There are three generations, the larvæ being full-grown in June and early July, in August, and in October. Mines containing larvæ may, however, be found at almost any time during the summer and fall up to November.

This species may be distinguished from *N. slingerlandella* by the darker head, dark cilia, and somewhat broader wings.

30. **Nepticula fuscotibiella** Clemens. Tuft ochraceous; eye-caps whitish. Thorax and fore wings fuscous, faintly purple, with the scales before the fascia paler at their bases, so that this part of the wing is somewhat irrorated and paler than that beyond the fascia where the wing is dark fuscous purple. Fascia just beyond the middle, dull white, sometimes a little convex and broadening on the dorsum. Cilia gray, pale gray around the apex. 4 to 4.5 mm.

The larvæ mine leaves of various species of willow. The mine is a gradually broadening, linear tract, sometimes straight, but often bent back on itself toward the end. Occasionally (on *Salix discolor*) its latter part is a more or less spiral blotch. There are at least three generations a year. The larvæ may be collected from June until the end of October.

31. **Nepticula ulmella** Braun. Tuft ocherous on face, tinged with red above, and sometimes with a few dark brown scales behind. Antennæ creamy white, broadly banded above with dark brown, so that only a narrow line of the pale color appears between the annulations. Eye-caps creamy white. Thorax brownish, somewhat peppered. Scales of the fore wing creamy white, shading to dark brown at their tips, except where they form a creamy white, oblique fascia at the middle of the wing. The general color of the fore wing is thus a somewhat mottled, dark brown. Fascia, from the middle of the wing on the costa, extending to dorsum somewhat behind the middle, and sometimes broken with a few, dark-tipped scales. Cilia creamy white. 4 to 5 mm.

The larvæ are miners in leaves of red elm and cork elm (*Ulmus fulva* and *U. racemosa*). The mine starts as a very fine brown, or, rarely, whitish, line, abruptly enlarging to a breadth of 1 mm., then increasing gradually in width, until it attains a breadth slightly in excess of 2 mm. The broad portion of the mine is usually so much contorted that it is not possible to trace the course of the mine, the whole having the appearance of an irregular blotch.

There are two generations, the mature larvæ being found in July and in September.

The creamy white fascia and cilia, together with the pale bases of the scales, distinguish this species.

32. **Nepticula platanella** Clemens. Tuft pale ocherous to ochraceous; eye-caps silvery white. Thorax and fore wings dark brown with a bluish luster. At middle of costal margin a small oblique silvery streak, and opposite it on the dorsal margin is a similar streak, usually larger than the costal streak and broader on the margin. Rarely both spots are very minute. Occasionally these two streaks meet, forming a more or less interrupted concave fascia. Last row of scales around the apex pale yellowish at their bases, thus forming a dark line in the whitish cilia. Hind wings yellowish fuscous, in the male with a sword-shaped, yellowish, chitinous plate on the upper side from base to near middle of costa, margined along the costa with bristly black scales. Beyond this costa excised. 5.5 to 7 mm.

The mines are abundant on leaves of sycamore (*Platanus occidentalis*) and begin as slender, linear tracks usually filled with frass. Several days before pupation, the mine is abruptly enlarged into a large, usually almost circular blotch, which in many instances covers the linear part of the mine.

There are three generations of larvæ, the earliest being found during June.

There is considerable variation in the size of the white spots and it is but rarely that they form a fascia. Females may be distinguished from specimens of *N. clemensella* by their larger size, and the males from that species and all others except *N. similella*, by the peculiar chitinous plate along the costa of the hind wing.

33. **Nepticula clemensella** Chambers. Tuft ochraceous; eye-caps silvery white. Fore wings bluish black. A narrow, oblique, silvery streak on the middle of the costa (rarely inconspicuous) and an opposite dorsal streak, usually meeting in the male to form a narrow, oblique fascia. Cilia silvery with a brown line formed by the dark tips of the terminal row of scales around the apex. Hind wings yellowish fuscous, similar in both sexes. 4.5 to 5.2 mm.

The larva mines in the leaves of sycamore (*Platanus occidentalis*), forming a linear mine which gradually increases in breadth. Its terminal portion expands into a small blotch, three or four times the diameter of the end of the linear mine. There are three generations a year.

This species is much less common than *N. platanella* and uniformly smaller, the largest specimens scarcely attaining the expanse of the smallest *N. platanella*.

34. **Nepticula similella** Braun. Tuft ocherous to ochraceous; eye-caps silvery white, occasionally tinged with ocher. Thorax and fore wings deep bluish black, the extreme bases of the scales more or less iridescent blue, especially in the apical half of the wing. At the middle of the wing an oblique narrow, costal streak, shining white but not silvery, usually meets the apex of a shorter, broader, dorsal streak. Tips only of the last row of scales around apex dark, thus forming a dark line in the white cilia. Hind wings gray; in the male with a narrow, chitinous plate from base to one-third of costa, with a long, yellowish, costal hair-pencil lying along it. 5 to 6 mm.

Ohio; Kentucky.

The larva makes a characteristic mine in the leaves of pin oak (*Quercus palustris*) and occasionally of chestnut. The early part of the mine is very narrow, completely filled with frass, and bent several times in close, S-shaped curves. The larva next mines just above the lower epidermis, forming a blotch scarcely visible above except for occasional spots here and there toward the edges of the blotch, where the leaf substance is more fully consumed. During the last stage, a conspicuous large blotch is formed, where the mine is transparent and whitish, with the frass accumulated toward the beginning of the blotch.

Females of this species can only be distinguished from those of *N. platanella* by their less shining costal and dorsal spots; the males differ in the yellowish costal hair-pencil of their hind wings.

35. **Nepticula thoracealbella** Chambers. Tuft ochraceous on the face, becoming reddish brown on the vertex; eye-caps white. Thorax white, with a few, scattered, dark brown scales in occasional specimens. Fore wings dark brown, slightly irrorated; a creamy white, irregular fascia just before the middle, concave toward the base and usually wider on the dorsal margin; at the apical fourth a distinct, creamy-white, costal spot, and an opposite dorsal spot, whose apices occasionally touch; cilia creamy white, sometimes grayish on the dorsum. 4 to 5 mm.

Kentucky; Ohio; Pennsylvnia.

36. **Nepticula pomivorella** Packard. Tuft orange-ochraceous; eye-caps and collar shining pale buff. Thorax and fore wings shining bronzy, with strong purple and blue reflections increasing toward the apex. 5 mm.

The larvæ make long, narrow, serpentine tracks (fig. 61) in the leaves of apple, gradually widening the mine to 2 or 2.5 mm. at the end.

37. **Nepticula chalybeia** Braun. Tuft ocherous, sometimes shading to reddish brown above; collar yellowish white; antennæ fuscous; eye-caps yellowish white. Thorax steel-gray. Fore wings very narrow, steel-gray with faint, greenish golden reflections. 3.5 to 4 mm.

Ohio.

The larvæ mine leaves of wild pear (*Pyrus communis*) and cultivated pear, making rather short, serpentine tracks, often not exceeding 2 cm. but sometimes reaching 3 cm. in length, and broadening to 1.5 to 2 mm. across at the end. There are three generations a year. Mined leaves may be collected in early June, in July, and during the last part of August.

Its paler color, with the absence of purple, the narrow wings, and its smaller size distinguish this species from *Nepticula pomivorella*.

38. **Nepticula flavipedella** Braun. Tuft usually dark brown, collar creamy white; rarely tuft reddish ocherous on the face, and brown on the vertex; eye-caps creamy white. Thorax dark purplish brown. Fore wings dark brown, with dark blue and purple reflections; cilia with silvery tips. Fore legs, except the femora, dark brown; middle legs pale silvery, tarsi pale ocherous; hind legs silvery, tibiæ dark brown, tarsi pale ocherous. 3.5 to 4.5 mm.

Ohio; Kentucky.

The mine is a very characteristic linear tract, found most commonly on pin and swamp white oak, but occasionally on other species of oak. The larva, for the first few millimeters, mines near the upper surface, making a very narrow indistinct mine. Then the mine is slightly but abruptly enlarged and for a length of 8 or 9 mm., the leaf substance is entirely consumed and the mine rendered transparent. Then follows another enlargement, and the mine, often much contorted, increases very gradually in breadth to the end where it measures 2 mm. across. The latter part of the mine is not transparent, but the mine is distinctly visible.

There are three generations a year. Mined leaves may be collected during early June, the latter half of July, and the early part of September.

Though very distinct in larval work, this species in the imaginal state is almost indistinguishable in appearance from *N. castaneæfoliella*. The yellowish middle and hind tarsi and the deeper purple suffusion of the fore wings are, however, constant differences.

39. **Nepticula castaneæfoliella** Chambers. Tuft black; collar, eye-caps, and palpi creamy white. Thorax and fore wing dark brown, with slight bronzy and purple reflections; tips of scales somewhat darker, so that under a lens the wing is slightly irrorated, especially toward the apex. Cilia silvery at the tips. Posterior tibiæ and fore legs, except the femora, dark brown; legs otherwise whitish. 4 to 4.5 mm.

Kentucky; Ohio; Virginia.

The larvæ form very long, much contorted, linear mines in the leaves of chestnut (*Castanea dentata*) and oak. They measure but little over 1 mm. in width at the end, and have a fine, central line of frass.

40. **Nepticula latifasciella** Chambers. Tuft on the face ocherous, dark brown on the vertex; collar and eye-caps creamy. Thorax and extreme base of fore wings creamy-buff. Remainder of fore wing deep purple-brown, with a very broad, creamy-buff fascia just before the middle; two or three creamy-buff scales at the extreme apex, forming with the creamy-white cilia around the apex, a conspicuous pale spot. Cilia elsewhere gray. 4 to 4.5 mm.

The larvæ mine leaves of oaks, and probably chestnut. Although the mine varies in length from 3 to 5 cm. on different species of oak, with a breadth of about 1.5 mm. at its end it has in general the same appearance. The frass is at first deposited in a broad, blackish line through the center, later dispersed across the entire breadth, and, toward the end, collected into a broad band.

This is one of the earliest species to appear in the spring; the moths may be found resting on tree trunks during the latter part of April. Mines may be found in June, the latter part of July, in September, and often during late October.

41. **Nepticula cratægifoliella** Clemens. Tuft ocherous, faintly tinged with red above. Antennæ ocherous, partly suffused with fuscous; eye-caps ocherous. Thorax

and fore wings ocherous, the extreme edge of the costa near the base purplish fuscous, and a broad, purplish fuscous band at the apex of the wing. The cilia, beyond this band, pale ocherous, giving the appearance of an ocherous apex preceded by a dark band. Cilia opposite the ends of the band concolorous with it. 3.5 to 4.5 mm.

Pennsylvania; Ohio; Kentucky.

The mines occur on several species of hawapple. The mine is comparatively short, rapidly increasing in diameter and measuring about 2 mm. in width in the later part of its course.

There are two generations a year. Larvæ may be collected in early July and at the beginning of September.

This species is distinguished from all others with yellowish ground color by its entire absence of dusting. The much broader mine and bright green larva distinguish it, in its early stages, from *N. scintillans.*

42. **Nepticula nigriverticella** Chambers. Face ochraceous, tuft above dark brown; collar and eye-caps pale ocherous, antennal stalk fuscous. Thorax and fore wings pale ocherous, dusted with purplish black scales. At the base of the dorsal margin a purplish black spot extending halfway across the wing, and occasionally, as a narrow line, reaching the costa, which is often dark brown near the base. At the beginning of the cilia a broad, purplish-black fascia; beyond it cilia pale ocherous. 5 mm.

Kentucky; Ohio; Texas.

43. **Nepticula populetorum** Frey and Boll. Tuft ocherous, becoming dark brown behind. Collar and eye-caps pale creamy. Thorax and fore wings buff or pale ocherous, more or less densely dusted with purplish fuscous scales. These scales form a purplish fuscous fascia at the beginning of the cilia. Cilia pale gray, whitish around apex. 5 mm.

Texas; Ohio; Kentucky; California.

The larvæ mine the leaves of several species of poplar, commonly the leaves of cottonwood (*Populus deltoides*). The mine is indiscriminately placed on the upper or the lower side of the leaf. It is whitish, gradually broadening, linear track, 2 to 2.5 mm. in width at its extremity.

This species differs from the preceding in the absence of the dark spot at the base of the dorsum.

44. **Nepticula saginella** Clemens. Face ocherous or pale buff, head, above, dark brown; collar and eye-caps pale ocherous. Thorax and fore wings pale ocherous, buffish, or even whitish, and dusted with fuscous scales, often more densely dusted toward the outer half of the wing, where the dark scales are either evenly distributed or collected into spots, but never form a band. Cilia pale ocherous. 4 to 5.5 mm.

The mine (fig. 60) is a whitish, linear tract on various species of oaks and on chestnut; it varies in length and width, but is usually about 1.5 to 2 mm. wide at its extremity. The larvæ are found from June to October.

45. **Nepticula pallida** Braun. Tuft ocherous; the scales on the vertex tipped with orange; antennæ pale ocherous, eye-caps whitish. Fore wings very pale buff, evenly dusted with purplish gray, a little more densely toward the apex of the wing. Cilia very pale buff. 4 mm.

Cedar Point, Ohio.

The food plant of *N. pallida* is willow, *Salix* sp. The mine (fig. 58) is made on the lower side of the leaf and is extremely narrow at first, extending along the midrib, later doubling on itself once or twice, and gradually and evenly increasing in breadth to its end, where it measures a scant 1.5 mm. across. The entire length of the mine is approximately 4.5 cm.

The pale head distinguishes this species from *N. saginella.*

In addition to the above species, there are several species, namely *N. amelanchierella, N. anguinella* and *N. platea,* which are still known only in the larval state. Their mines are described in the *Synopsis of species by food plants.*

Synopsis of species by food plants

Salix spp., willow:
(1) *N. pallida*; mine linear, narrow at the end.
(2) *N. fuscotibiella*; mine linear, gradually broadening, club shaped at the end, sometimes blotch-like toward the end.

Populus grandidentata, poplar:
(1) *E. populella*; globular swelling of petiole close to leaf.

Populus deltoides, cottonwood:
(1) *N. populetorum*; whitish mine, gradually increasing to a breadth of 2 to 2.5 mm. at end.

Myrica carolinensis, bayberry:
(1) *N. obscurella*; mine serpentine, very narrow.

Juglans cinerea, butternut:
(1) *N. juglandifoliella.*

Juglans nigra, walnut:
(1) *N. juglandifoliella;* serpentine mine, very gradually increasing in breadth.

Carya spp., hickory:
(1) *N. juglandifoliella*; serpentine mine, very gradually increasing in breadth.
(2) *N. trinotata*; linear track, expanding into a blotch.

Corylus americana, hazel:
(1) *N. corylifoliella*; very narrow, serpentine mine, scarcely broader than the larva.
(2) *N. quadrinotata*; narrow linear mine, expanding into an irregular blotch.

Ostrya virginiana, hop hornbeam:
(1) *N. corylifoliella*; very narrow, serpentine mine, scarcely broader than the larva.
(2) *N. ostryæfoliella*; linear track, gradually reaching a breadth of 2 mm., at the end.

Carpinus caroliniana, hornbeam:
(1) *N. corylifoliella*; very narrow, serpentine mine, scarcely broader than the larva.
(2) *N. quadrinotata*; narrow linear mine, expanding into an irregular blotch.

Betula spp., birch:
(1) *N. corylifoliella*; very narrow, serpentine mine, scarcely broader than the larva.
(2) *N. ostryæfoliella*; linear track, gradually reaching a breadth of 2 mm. at the end.

Castanea dentata, chestnut:
(1) *N. castaneæfoliella*; long, contorted mine, with central line of frass; larva green.
(2) *N. saginella*; shorter, whitish mine, with frass in a central line or dispersed; larva green.
(3) *N. latifasciella*; serpentine mine; frass at first in a broad line, later, dispersed, and toward end gathered into a band; larva green.
(4) *N. similella*; see under Quercus (8).
(5) *E. castaneæ*; larva makes a gall encircling twig.
(6) *E. phleophaga*; larva makes a serpentine track in the bark.

Quercus spp., oaks:
(1) *N. terminella*; mine a broadening, linear tract, 3.5 mm. wide at the end; larva yellow.
(2) *N. saginella*; whitish, linear mine with frass in a central line or dispersed; larva green.
(3) *N. latifasciella*; serpentine mine; frass at first in a broad line, later, dispersed, and toward the end gathered into a band; larva green.
(4) *N. flavipedella*; linear mine; a short, indistinct part followed by a transparent area, and then a gradually broadening, serpentine track, not transparent, but easily visible above; larva green.

(5) *N. anguinella* Clemens, Proc. Ent. Soc. Phila., vol. 1, p. 85, 1861; Tin. No. Am., 175, 1872. "May be found in the leaves of oaks early in October and in the latter part of June. The mine is a very narrow serpentine tract, *which is filled or discolored throughout its length by blackish excrement.* The larva fits the mine closely, in color lemon-yellow, with ten square dark brown or blackish spots on the ventral surface."

It should be possible to recognize this species, when found, from Clemens' description of the larva.

(6) *N. platea* Clemens, Proc. Ent. Soc. Phila., vol. 1, p. 85, 1861; Tin. No. Am., 175, 1872. "Mines oaks early in October. The mine is a moderately broad, winding tract, with a broad line of dispersed grains of excrement. The larva is purplish, with a pale green vascular line and a row of reddish-brown dorsal dashes. The mine is much broader than that of the preceding miner."

The statement that the larva is purple cannot be regarded as conclusive, since such color is often produced in larvæ feeding on leaves with autumnal coloration.

Quercus alba, white oak:

(7) *N. quercipulchella*; long, narrow, winding and gradually widening track; larva bright green.

Quercus palustris, pin oak:

(8) *N. similella*; linear mine, expanding into an underside blotch, followed by a large, conspicuous, nearly transparent blotch; larva pale green.

(9) *N. altella;* lower-side, very long, serpentine mine, not distinctly visible; larva yellow with row of dark brown dashes.

(10) *E. heinrichi;* flattened-oval, spiral mine in bark of young branches.

Ulmus spp., elms:

(1) *N. apicialbella*; narrow, serpentine mine.

(2) *N. ulmella*; narrow, linear track, enlarging into an irregular blotch.

Platanus occidentalis, sycamore:

(1) *N. platanella*; narrow, linear mine, abruptly enlarging into a large blotch.

(2) *N. clemensella*; linear mine, gradually broadening with terminal portion expanded into a small blotch.

Physocarpus opulifolius, Opulaster:

(1) *N. opulifoliella*; brownish, contorted, serpentine mine.

Pyrus communis, pear:

(1) *N. chalybeia*; serpentine mine.

Pyrus malus, apple:

(1) *N. pomivorella*; serpentine mine, usually broadening to 2 or 2.5 mm.

Amelanchier canadensis, service berry:

(1) *N. amelanchierella* Clemens, Proc. Ent. Soc. Phila., vol. 1, p. 84, 1861; Tin. No. Am., 174, 1872. "In the leaves of service-berry or June-berry, *Amelanchier canadensis*, in June and July. The mine rather a broad tract, sometimes much contorted, with rather irregular edges, placed most often towards the base of the leaf and having a rather broad "frass" line of a dark brown color."

This species seems to be distributed wherever its food plant occurs; mines observed in Ohio, Kentucky, North Carolina.

Cratægus spp., hawapple:

(1) *N. cratægifoliella*; serpentine mine, with a breadth of about 2 mm. at the end.

(2) *N. scintillans*: contorted, serpentine mine, scarcely exceeding 1 mm. in breadth.

Rubus spp., blackberry, raspberry:
(1) *N. villosella*; narrow, serpentine mine.
(2) *N. rubifoliella*; short, narrow, linear mine, expanding into a blotch.
Rosa spp., rose:
(1) *N. rosæfoliella*; serpentine mine.
Prunus serotina, wild black cherry:
(1) *N. bifasciella*; narrow, serpentine mine.
Prunus americana, wild plum:
(1) *N. bifasciella*; narrow, serpentine mine.
(2) *N. slingerlandella*; narrow, linear mine, abruptly enlarging into an irregular blotch (also on cultivated plums and prunes, and sweet cherry).
Ptelea trifoliata, hop tree:
(1) *N. pteliævella*; very long, much contorted, narrow, serpentine mine.
Rhus toxicodendron, poison ivy:
(1) *N. rhoifoliella*; narrow, contorted, serpentine mine.
Rhus spp., sumac:
(1) *N. intermedia*; narrow, contorted, serpentine mine.
Acer saccharum, sugar maple:
(1) *Glaucolepis saccharella*; very long, linear mine.
Acer rabrum, red maple:
(1) *Glaucolepis saccharella*; very long, linear mine.
Rhamnus lanceolata, buckthorn:
(1) *N. rhamnicola*; linear mine, expanding into an irregular blotch.
Tilia americana, basswood:
(1) *N. tilliella*; serpentine mine.
(2) *N. argentifasciella*; indistinct, linear mine, expanding into a blotch.
Nyssa sylvatica, sour gum or pepperidge:
(1) *N. nyssœfoliella*; linear mine, abruptly expanding into a blotch.
Oxycoccus macrocarpus, cranberry:
(1) *N. paludicola*; serpentine track, in part following the margin of the leaf.