TROPICAL LEPIDOPTERA, 4 (Suppl. 4): 1-21

THE CLEARWING BORERS OF FLORIDA (LEPIDOPTERA: SESIIDAE)

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ABSTRACT.– The 41 species of clearwing moths (Sesiidae) recorded from Florida are described and figured. Information is also summarized on life history, hostplants, flight seasons, sex attractants, and diurnal activity patterns of the Florida clearwing borers. The control of pest species is also included.

KEY WORDS: Aceraceae, *Alcathoe*, Aquifoliaceae, behavior, Betulaceae, biology, Canada, Caprifoliaceae, *Carmenta*, Castanaceae, Casuarinaceae, Compositae, Cornaceae, Cucurbitaceae, distribution, Ebenaceae, ecology, *Euhagena*, Europe, Fagaceae, hostplants, Hymenoptera, immature stages, Juglandaceae, larvae, Leguminosae, life history, *Melittia*, Mexico, mimicry, Myricaceae, Nyssaceae, North America, Oleaceae, Onagraceae, *Osminia*, *Paranthrene*, *Pennisetia*, pests, Pinaceae, *Podosesia*, Pompilidae, Ranunculaceae, Rhamnaceae, Rosaceae, Salicaceae, *Sannina*, Saxifragaceae, Solanaceae, *Synanthedon*, taxonomy, Umbelliferae, United States, *Vitacea*, Vitaceae, West Indies.

Clearwing borers (family Sesiidae) attack a wide variety of shrubs, trees, vines and herbaceous plants. They are major pests of fruit trees, shade trees, landscape plants, and certain forest trees. A total of 41 species of clearwing borers have been recorded in Florida. Many of these species cause serious damage, but the damage is often overlooked or underestimated because the symptoms may resemble plant diseases or weakness caused by drought. The purpose of this bulletin is to facilitate identification of the adult moths and present newly available information on their life history and damage. Adults of all 41 known Florida species are illustrated on Plate 2. Species are listed and illustrated alphabetically; see Appendix 1 for a catalog of the species in phylogenetic order.

Sesiidae moths are known as clearwing borers. Adult clearwings resemble wasps and bees, and are often mistaken for them. Their wings are partially or totally devoid of the microscopic scales found in most moths and their bodies are often brightly colored. They also have the ability to hover in one place as do bees and wasps.

The larvae of clearwing moths are white to cream-colored and nearly legless. The caterpillars bore in the stems, trunks, and/or roots of various plants. Damage from the tunneling larvae can be severe and lead to the decline and death of the host trees, especially in younger plants. Damage caused by some species is shown on Fig. 42-45. Typical larvae are illustrated in Fig. 46-48.

Female clearwings release sex attractants called pheromones into the air. These pheromones travel down-wind and stimulate the antennae of receptive males, which then use the sex attractant to locate the signaling female. Males can sometimes detect pheromones as far away as one-half to three-fourths of a mile from the source.

Chemists have identified and synthesized a number of the pheromones released by several species of clearwing moths (Barry *et al.*, 1978; Nielsen *et al.*, 1975; Tumlinson *et al.*, 1974). This allows entomologists to attract the males of many clearwings in large numbers and to study their mating behavior and flight activity. Several types of moth traps can be baited with various pheromones or combinations of pheromones to clarify the life history and seasonal activity of many species of clearwing borers (Snow, Eichlin and Tumlinson, 1985).

This publication is designed to assist in identification of adult male clearwings attracted to pheromone traps and to relate this to hostplants that may need protection from egg-laying adults at specific seasons of the year. Adults of both sexes appear similar in most species; the few in Florida that are more dimorphic have the unusual females also illustrated on Plate 2. Most species of clearwing moths have hatches of adults over a rather narrow time-window, which, if known, make efforts against them much more effective and less expensive than otherwise possible.

LIFE HISTORY

Adults are almost exclusively active during the day and mimic various bees and wasps very closely. Adults of each species emerge during a specific time period, which usually spans only a few weeks. Adults are also active at only certain hours of each day. Exact times vary from species to species, but most are more active before noon.

Females commence "calling" behavior (the act of releasing a sex pheromone to lure males for mating) at the same time each day and males actively fly about during this same time period. Females usually emerge from pupation *at the host plant*, and remain in that vicinity, while males tend to fly much longer distances searching for a calling female.

Oviposition by the females on the host plants begins shortly after mating. Eggs are placed singly or in groups on bark or foliage or in crevices or wounds on the host plant. Most clearwing species have rather narrow host preferences, with species restricted to a single plant genus or plant family. Some are serious pests of landscape and agricultural plants.

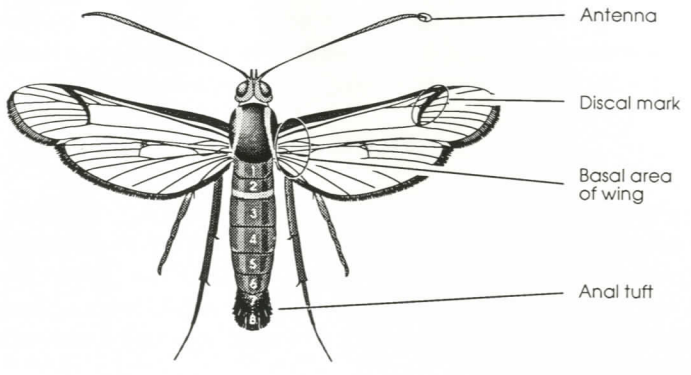
Clearwing species generally require one year to develop from the egg to the adult stage (univoltine). A few require two or more years to complete one life cycle. This is especially true when growing conditions are adverse such as drought or on poor soils.

Prior to pupation, the caterpillar constructs an exit tunnel to the surface of the plant, leaving a thin layer of silk or plant tissue concealing the exit hole. The pupal chamber is silk-lined, and sometimes includes wood particles and larval frass. At the time of emergence, the pupa moves forward and breaks through the material concealing the exit hole. The adult then emerges from the exposed tip of the pupal case, leaving the cast exuviae as clear evidence the plant had been attacked by borers.

IDENTIFYING CLEARWING MOTHS

Approximately 125 species of clearwing borers have been recorded in the United States (Eichlin and Duckworth, 1988), and 40 species are known in Florida. Table 1 is a summary of the clearwing borers of Florida together with food plants, seasonal flight period, pheromone(s), and common names (see Table 1 footnote on common names). Appendix 1 is a catalog of the Florida Sesiidae; Appendix 2 is a cross-index to the clearwing borers occurring on various hosts.

Entomologists use several types of information to identify the male clearwing moths which are attracted to pheromones. These include: 1) coloration and pattern of the body and wings, 2) shape of various body parts, 3) season of year the adults emerge, 4) time of day the males are attracted by pheromones, 5) what specific pheromone attracts the males, and 6) the species of hostplant utilized by each species. Major adult morphology is shown on Plate 1.



Synanthedon pictipes

Plate 1. Morphological characteristics used to identify clearwing borers. Abdominal segments are numbered from 1-8 anterior to posterior. (after Taft, Smitley and Snow, 1991)

SPECIES ACCOUNTS

Alcathoe carolinensis Englehardt Fig. 1

Common Name: Tailed Black Clearwing.

Description: This is the most striking clearwing living in Florida, because of its large size and long black tail. The entire body is blue-black with a metallic-blue iridescence. The black anal appendage (present only in males) extends about one-half inch posteriorly from the abdomen. The wings are opaquely black except for oval-shaped (eye-like) transparent windows near the base of the hindwings. Wing length is 12-15mm.

Life History: Adults have been taken only in October in Florida. Their flying activity peaks around noon each day. The larval stages are unknown. The life cycle probably takes one year.

Range: Recent records have expanded the known range to include Missouri and Indiana in the Midwest, eastward to North Carolina and south to Florida. In Florida, it is recorded only from the northern half of the state.

Hostplants: The roots of *Clematis* spp. (Ranunculaceae) vines.

Comments: This species appears to mimic a black ichneumonid wasp. Most of the Florida specimens were taken in or along the edges of mature floodplain (hydric) forests.

Alcathoe caudata (Harris) Fig. 2

Common Name: Clematis Borer.

Description: This is a strikingly beautiful clearwing, but smaller than *Alcathoe carolinensis*. Antennae and tail appendage are canary-yellow in color. The head, thorax, and abdomen are chestnut-brown. The legs are banded orange-red and black. Forewings are completely black with some light orange powdering at the lateral margins. Hindwings are transparent except for black veins and black margins. Wing length is 7-15mm.

Life History: Adults emerge from May to September. There is one generation per year.

Range: Eastern half of the United States and southern Canada. In Florida, recorded only from the northern portion of the state.

Hostplants: Wild and cultivated *Clematis* spp. (Ranunculaceae) vines; also *Ribes* spp. (Saxifragaceae).

Comments: Adults visit flowers for nectar and are active both morning and afternoon. They often rest on the foliage of the host plant.

Carmenta anthracipennis (Boisduval) Fig. 3

Common Name: Blazingstar Clearwing.

Description: The head, antennae, thorax, and abdomen are black, the latter with posterior golden-orange bands on segments 2 to 7. The anal tuft is black. The thorax has a pair of thin golden-orange subdorsal lines. Forewings are opaquely black, often with a small transparent area proximal and distal to the black discal spots. Often there is a powdering of golden scales near the apex of the forewings. Hindwings are transparent with lateral fringes of black. Wing length is 7-10mm.

Life History: Adults emerge in Florida in September and October. One generation occurs each year.

Range: Eastern two-thirds of the United States and southern Canada. Occurs throughout Florida in xeric sand-hill vegetation

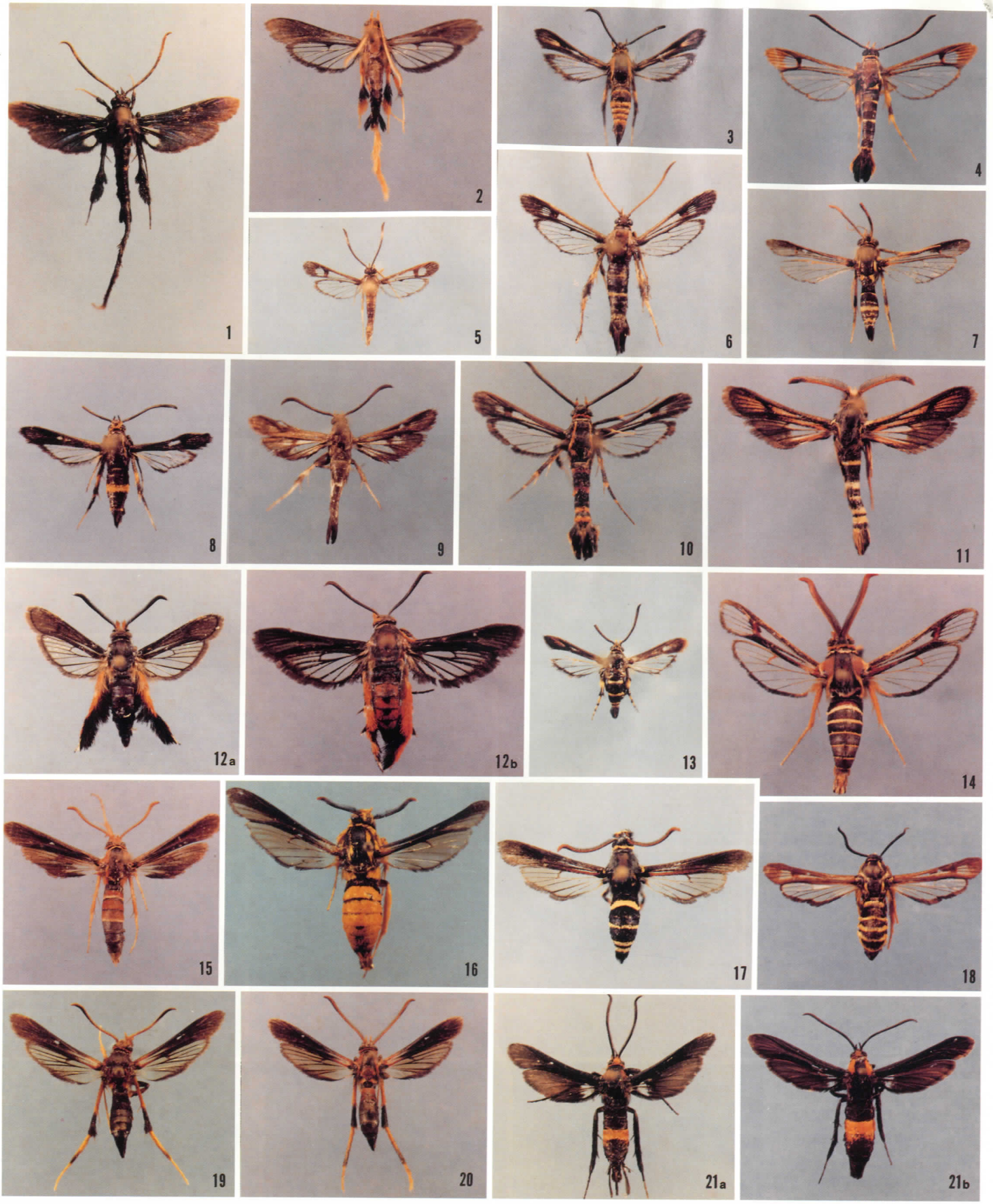


Plate 2. Adults of Florida clearwing moths: 1. *Alcathoe carolinensis*; 2. *Alcathoe caudata*; 3. *Carmenta anthracipennis*; 4. *Carmenta bassiformis*; 5. *Carmenta ithacae*; 6. *Carmenta laurelae*; 7. *Carmenta odda*; 8. *Carmenta pyralidiformis*; 9. *Carmenta suffusata*; 10. *Carmenta texana*; 11. *Euhagena emphytiformis*; 12. *Melittia cucurbitae*, a) ♂, b) ♀; 13. *Osminia ruficornis*; 14. *Paranthrene asilipennis*; 15. *Paranthrene dollii*; 16. *Paranthrene simulans*; 17. *Paranthrene tabaniformis*; 18. *Pennisetia marginata*; 19. *Podosesia aureocincta*; 20. *Podosesia syringae*; 21. *Sannina uroceriformis*, a) ♂, b) ♀.


22 a


22 b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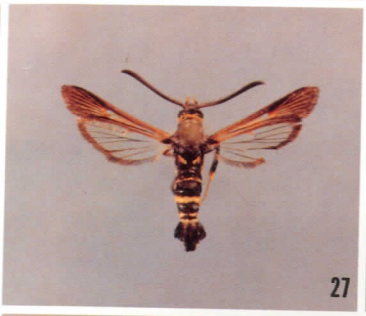
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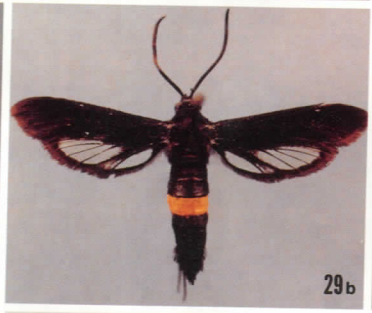
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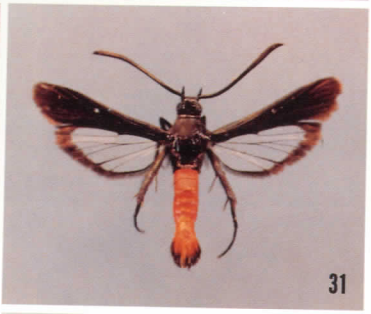
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40b


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and open scrubby woodlands. Active in the afternoon.
Hostplants: Only the roots of blazingstar (*Liatris* spp., Compositae).
Comments: The central and south Florida form of this clearwing has beautiful golden-orange markings compared to the pale yellow banding of more northern populations.

Carmenta bassiformis (Walker) Fig. 4

Common Name: Ironweed Clearwing.
Description: The abdomen is black with each segment narrowly banded in yellow. Anal tuft is brush-like and black with some yellow laterally. Antennae are black. Forewings are mostly transparent with a broad black border. The discal bar is black and there is yellow powdering between the veins of the apical borders. Hindwings are transparent with very narrow black borders. Wing length is 6-12mm.
Life History: Adults emerge from April to August and are active in the late afternoon. Eggs are laid singly at the base of the host plant or on the foliage. Freshly hatched larvae enter the stems, eventually boring to the roots for the winter. In the spring they move back into the stems, often girdling them, causing stems to break off several inches above ground.
Range: Eastern half of the United States. Occurs throughout Florida in weedy fields and open woodlands containing the host plant.
Hostplants: Roots and stems of ironweeds (*Vernonia* spp., Compositae).
Comments: This species is never an agricultural or ornamental pest.

Carmenta ithacae (Beutenmüller) Fig. 5

Common Name: Sneezeweed Clearwing.
Description: The head, thorax, and abdomen are black, the latter having very narrow yellow bands on the posterior edge of segments 2, 4, 6, and 7. The thorax has a pair of thin yellow subdorsal lines. The antennae are black with prominent white scaling just below the tips. The anal tuft forms a broad black fan, edged in white. Forewings are transparent in center with a broad black border and black discal spot. Some yellow powdering occurs apically. Wing length is 6-8mm.
Life History: Adults emerge from May to August and are active in the late morning hours. Larvae bore in the stems, crowns, and roots. Larvae overwinter in the roots and mature in the stems produced in the next growing season.
Range: Eastern three-fourths of the United States and eastern Mexico. In Florida, recorded only in the Panhandle.
Hostplants: The only known host plants are sneezeweed (*Helenium* spp.), oxeye (*Heliopsis* spp.), and dog-flea weed (*Parthenium* spp.) (all Compositae).
Comments: Usually found in open bottomlands and wet meadows where the host plants occur.

Plate 2 (cont.). 22. *Synanthedon acerni*, a) ♂, b) ♀; 23. *Synanthedon acerrubri*; 24. *Synanthedon alleri*; 25. *Synanthedon arkansasensis*; 26. *Synanthedon castaneae*; 27. *Synanthedon decipiens*; 28. *Synanthedon dominicki*; 29. *Synanthedon exitiosa*, a) ♂, b) ♀; 30. *Synanthedon fatifera*; 31. *Synanthedon geliformis*; 32. *Synanthedon pictipes*; 33. *Synanthedon proxima*; 34. *Synanthedon refulgens*; 35. *Synanthedon richardsi*; 36. *Synanthedon rileyana*; 37. *Synanthedon rubrofascia*; 38. *Synanthedon sapygaeformis*; 39. *Synanthedon scitula*; 40. *Vitacea polistiformis*, a) ♂, b) ♀; 41. *Vitacea scepsiformis*.

Carmenta laurelae Brown, Eichlin, & Snow Fig. 6

Common Name: Swamp Clearwing.
Description: Head and thorax are black, the latter with a pair of subdorsal orange-yellow stripes. Antennae are black, powdered with pale yellow dorsally. Abdomen is black, with a narrow orange-yellow band on posterior margin of segment 2 and 7, and a slightly broader orange-yellow band on segment 4. The anal tuft is brush-like and black with orange-yellow lateral edges. Forewings are black from the discal spot apically, except for a small transparent area just distal to black discal spot. Hindwings are transparent. Wing length is 9-10mm.
Life History: Adults fly from mid-May to early June in central Florida and are most active around noon each day. Little else about the life cycle is known.
Range: Collected only in Florida and southern Georgia where it occurs in cypress swamps and adjacent floodplain forests.
Hostplants: Unknown, but has to be some type of hydric tree, shrub, or herb.
Comments: This is a new species discovered as result of studies by the senior author using pheromones to survey clearwings near Tampa, Florida. It always occurs in swampy habitats.

Carmenta odda Duckworth & Eichlin Fig. 7

Common Name: Odda clearwing.
Description: The head and antennae are black and yellow. Thorax is black with a pair of narrow sub-dorsal stripes. The abdomen is black, with all segments narrowly-banded by yellow along posterior margin except segment 3 (segment 4 has the widest yellow band). Forewings mostly transparent except for an opaque black costal margin. Basal half of wing is powdered orange in veins and margins. Discal spot is yellow-orange. Hindwings are transparent. Wing length is 9-10mm.
Life History: Adults fly in May and June and are most active at mid-day. Little else is known of the life cycle.
Range: Southeastern coastal plain from South Carolina to Florida, Georgia and probably Alabama. It is recorded only from the Florida Panhandle thus far.
Hostplants: Unknown.
Comments: Specimens have been collected in open fields surrounded by stands of second growth hardwoods.

Carmenta pyralidiformis (Walker) Fig. 8

Common Name: Eupatorium Clearwing.
Description: Resembles *C. antracipennis* but has two red-orange bands on the abdomen rather than three. The head, antennae, thorax, and abdomen are black, the latter with gold-orange bands on segments 4 (broad) and 7 (narrow). The anal tuft is wedge-shaped and black. Forewings are thickly covered black scales and usually powdered with golden scales toward the base. Hindwings are transparent and broadly bordered in black. Wing length is 5-8mm.
Life History: Adults emerge from August to October. Larvae bore in the roots, but pupate in a chamber with exit hole near the base of the stem of the host plant. One generation occurs per year.
Range: Eastern half of the United States and southern Canada. Recorded from northern Florida.
Hostplants: Restricted to the thoroughwort and fennel groups

TABLE 1. Summary of Florida clearwing moths (Family Sesiidae) with attending biological data for each species.

SCIENTIFIC & COMMON NAMES	*FLIGHT* *FOOD PLANT*	*SEASON*	*DIURNAL* *PHEROMONE**	*ACTIVITY***
1. *Alcathoe carolinensis* (Tailed black clearwing)	*Clematis*	July-Oct	2,2/1(3:1)	MD
2. *Alcathoe caudata* (Clematis borer)	*Clematis*	May-Sept	5,1/2(1:1)	M,A
3. *Carmenta anthracipennis* (Blazingstar clearwing)	*Liatris*	Sept-Oct	1,1/2(1:1)	A
4. *Carmenta bassiformis* (Ironweed clearwing)	*Vernonia*	Apr-Aug	1/4(1:1)	LA
5. *Carmenta ithacae* (Sneezeweed clearwing)	*Helenium*, *Heliopsis*	May-Aug	1,1/2(9-1)	M
6. *Carmenta laurelae* (Swamp clearwing)	Unknown	May-June	1	MD
7. *Carmenta odda* (Odda clearwing)	Unknown	May-June	1,1/2(1:1)	MD
8. *Carmenta pyralidiformis* (Eupatorium clearwing)	*Eupatorium*	Aug-Oct	4/5(1:1)	LA
9. *Carmenta suffusata* (Silver-black clearwing)	Unknown	May-Aug	5	LA
10. *Carmenta texana* (Texas clearwing)	*Artemisia;* Various forbs	Mar-Dec	1,1/2(1:1), 1/5(1:1)	MD
11. *Euhagena emphytiformis* (Gaura clearwing borer)	*Gaura*	July-Sept	1	U
12. *Melittia cucurbitae* (Squash vine borer)@	*Cucurbita*	Apr-Nov	3	MD
13. *Osminia ruficornis* (Minute clearwing)	Unknown	Aug-Sept	6	LA
14. *Paranthrene asilipennis* (Oak clearwing borer)@	*Quercus*	Feb-May	1,7	LA
15. *Paranthrene dollii* (Poplar clearwing borer)	*Populus* *Salix*	Mar-June; Sept-Nov	4/5(1:1)	M,A
16. *Paranthrene simulans* (Golden oak borer)	*Quercus*	Apr-Aug	1,3, 1/2(1:1)	LA
17. *Paranthrene tabaniformis* (Dusky clearwing borer)	*Salix*, *Populus*	Apr-Aug	5	M,A
18. *Pennisetia marginata* (Raspberry crown borer)@	*Rubus*	July-Nov	5	M,A
19. *Podosesia aureocincta* (Banded ash clearwing)@	*Fraxinus*	July-Sept	1	MD
20. *Podosesia syringae* (Ash borer)@	*Fraxinus*, *Syringa*	Dec-July	1,1/4(1:1)	MD

21. *Sannina uroceriformis* (Persimmon borer)[@]	*Diospyros virginiana*	Mar-May	5,4/5(1:1)	M
22. *Synanthedon acerni* (Maple callus borer)[@]	*Acer*	Apr-Sept	1,1/5(9:1)	LA
23. *Synanthedon acerrubri* (Red maple borer)	*Acer*	Apr-Aug	3	U
24. *Synanthedon alleri* (Aller's clearwing)	Unknown	Mar-Dec	5	MD
25. *Synanthedon arkansasensis* (Arkansas clearwing)	Unknown	Apr-Dec	2,5	LA
26. *Synanthedon castaneae* (Chestnut borer)	*Castanea*	Apr-July	5	U
27. *Synanthedon decipiens* (Oak gall borer)	*Quercus* galls	Mar-Nov	1,3, 1/2(1:1)	A
28. *Synanthedon dominicki* (Dominick's clearwing)	Unknown	Mar-Apr	3	A
29. *Synanthedon exitiosa* (Peachtree borer)[@]	*Prunus*	May-Nov	1	MD
30. *Synanthedon fatifera* (Viburnum borer)	*Viburnum*	May-June	1,1/2(9:1)	LA
31. *Synanthedon geliformis* (Red clearwing borer)	Many trees	Mar-Dec	1,1/4(1:1)	LA
32. *Synanthedon pictipes* (Lesser peachtree borer)[@]	*Prunus*	Year-round	3	MD
33. *Synanthedon proxima* (Willow borer)	*Salix*	Apr-July	1	U
34. *Synanthedon refulgens* (Refulgens clearwing)	Unknown	Apr-Sept	3,3/1(99:1)	U
35. *Synanthedon richardsi* (Richard's clearwing)	Unknown	Oct	Unknown	U
36. *Synanthedon rileyana* (Riley's clearwing)	*Solanum carolinense*	June-Sept	5,4/5(1:1)	M
37. *Synanthedon rubrofascia* (Black gum borer)	*Nyssa*	Mar-Nov	1/2(1:1)	A
38. *Synanthedon sapygaeformis* (Florida clearwing)	*Quercus* galls	Year-round	1,1/2(1:1)	MD
39. *Synanthedon scitula* (Dogwood borer)[@]	Many trees	Mar-Oct	1	LA
40. *Vitacea polistiformis* (Grape root borer)[@]	*Vitis*	May-Oct	3	LA
41. *Vitacea scepsiformis* (Lesser grape root borer)[@]	*Vitis Parthenocissus*	July-Nov	1,2, 1/2(1:1)	LA

(*Eupatorium* spp., Compositae) of herbs.
Comments: This species occurs in sand hills, open flatwoods, and open pine-oak woodlands containing the host plants. Florida specimens have red-orange markings rather than the yellow of more northern populations.

Carmenta suffusata Engelhardt Fig. 9

Common Name: Silver-black Clearwing.
Descriptions: This is a small, very stream-lined clearwing with silver and black markings. The head, thorax, antennae, and abdomen are black, the latter with a narrow silver-white band on the posterior margin of segment 4. The ventral side of the abdomen is silver-white. Forewings are opaquely brown-black, and weakly powdered with silver-white scales. The hindwings are also opaquely brown-black, with small transparent windows basally. The anal tuft is a narrow, elongate brush, black in color, with silver-white hair-like setae on the ventral side. Wing length is 5-9mm.
Life History: The adults emerge from May to August with an occasional straggler in the fall. Daily flight activity peaks in the late afternoon between 5:00 and 6:00pm. Very little else is known of the life cycle of this species.
Range: Western Kansas south to Texas and east to Florida. In Florida, only collected from the northern half of the state thus far.
Hostplants: Unknown. The type specimen was reared from the tap root of an unidentified prairie plant in Oklahoma.
Comments: Using the pheromone, (E, Z) 3, 13-ODDOH, large numbers of males have been taken in open turkey-oak pine, sand pine-scrub, and other sand hill plant communities in Florida.

Carmenta texana (H. Edwards) Fig. 10

Common Name: Texas Clearwing.
Description: Head, antennae, and thorax black, the latter with a pair of subdorsal orange stripes. Abdomen is black with orange bands in the posterior margins of segments 2, 4, 6, 7, and occasionally 5 (4 is the widest). The anal tuft is large, truncate, and black with orange lateral edges. Forewings are black, opaque in the distal half, and transparent in the center of the basal half. Discal spot is large, black, and there is a small transparent area distal to the discal spot. Wing length is 6-11mm.
Life History: Adults emerge from March to December, and are most active at mid-day. Larvae bore in the crown roots and stems of the plant. There is one generation per year.
Range: Along the Gulf Coast of United States from Georgia and Florida to Texas. Also, probably occurs in eastern Mexico. Found statewide in Florida.
Hostplants: Sage (*Artemisia* spp.), fennel (*Eupatorium* spp.), ragweed (*Ambrosia* spp.), *Melanthera* spp., *Grindelia* spp., and *Flaveria* spp. (all Compositae); also *Foeniculum* spp. (Umbelliferae).
Comments: This species is very abundant in fields, pastures, and disturbed areas where the food plants occur.

Euhagena emphytiformis (Walker) Fig. 11

Common Name: Gaura Clearwing Borer.
Description: This clearwing somewhat resembles a yellow jacket. The abdomen is banded yellow and black, mixed with varying amounts of burnt-orange. Forewings are black mixed with yellow and burnt-orange between the veins. Hindwings are clear basally and distally colored like the forewings. Wing length is 8-14mm.
Life History: Larvae bore in the perennial main roots of *Gaura* spp. Adults emerge from July to September. It is not known if they require more than one year to mature.
Range: Occurs along the Atlantic and Gulf coastal plains from South Carolina to Texas and Mexico, northward to Colorado and Wyoming, and westward to southern Arizona. Occurs in sand hill and open scrub habitats over much of northern and central Florida.
Hostplants: Only *Gaura* spp. (Onagraceae).
Comments: Since this clearwing attacks only one species of deep-rooted herbaceous perennial, it is not an agricultural pest.

Melittia cucurbitae (Harris) Fig. 12

Common Name: Squash Vine Borer.
Description: This is a robust moth with prominent brush-like red and black scales on the hind legs. The forewings are covered heavily with shiny black scales. The hindwings are transparent with black veins and a heavy black fringe along the posterior border. The antennae are black and white. Wing length is 12-15mm.
Life History: Larvae tunnel in the stems of host plants. Pupation occurs during spring or summer in the soil beneath the food plant, and adults usually emerge from their cocoons the following spring. Females tend to remain at or near the emergence site and begin emitting pheromone to attract a male. In Florida, adults can be taken from April to November indicating strongly there are at least two broods a year.
Range: Eastern two-thirds of the United States and Canada, as well as eastern Mexico. Occurs statewide in Florida.
Hostplants: Stems of squash, pumpkins, and gourds (*Cucurbita* spp., Cucurbitaceae).
Comments: This is a major pest of cultivated squash, pumpkins and gourds. Melons and cucumbers are less often attacked. The leaves of infested plants appear wilted and turn yellow from the base of the plant outward.

TABLE 1 (cont.)

* Pheromones listed are only a general guide; clearwings may be attracted to more than one chemical or blend. Number key to pheromones are:

1. (Z,Z) 3,13-octadecadien-1-ol acetate
2. (E,Z) 3,13-octadecadien-1-ol acetate
3. (E,Z) 2,13-octadecadien-1-ol acetate
4. (Z,Z) 3,13-octadecadien-1-ol alcohol
5. (E,Z) 3,13-octadecadien-1-ol alcohol
6. (E,Z) 2,13-octadecadien-1-ol alcohol
7. (Z) 13-octadeceryl acetate

** Key to the peak time of daily flight period by males are:

M = Morning
MD = Mid-day
A = Afternoon
LA = Late Afternoon

@ The common names for these borers have been approved by the Committee on Common Names of Insects of the Entomological Society of America. All other common names have not been approved and may vary by author. Scientific names should be used for obtaining further information.

Osminia ruficornis (H. Edwards) Fig. 13

Common Name: Minute Clearwing.

Description: This is one of the smallest clearwing moths living in Florida. The head, thorax, and abdomen are shiny black. Abdomen segments 2, 4, 6 and 7 have narrow yellow bands. Forewings are brown-black and hindwings are transparent, except for a narrow dark band at wing margin. Antennae are blue-black above and pale-orange below. Wing length is 4-7mm. Individuals with red abdominal bands rather than yellow have been taken in central Florida.

Life History: Little is known about the life history of this tiny moth. Adult males are collected in August and September each year and fly in the late afternoon.

Range: Occurs from Virginia to Florida and west to Missouri. Disjunct populations occur from southern Arizona to southern Mexico. In Florida it has only been recorded from the northern two-thirds of the state.

Hostplants: Unknown; possibly ?*Galactia* spp. (Leguminosae).

Comments: Little is known about this wide-ranging species. This is the only Florida clearwing which responds heavily to the sex attractant (E,Z) 2,13- octadecadien-1-ol alcohol.

Paranthrene asilipennis (Guérin-Méneville) Fig. 14

Common Name: Oak Clearwing Borer.

Description: This is one of the larger clearwing moths in Florida. Antennae are large, rufous brown, and tipped in orange. The abdomen is robust, and most of the segments have narrow yellow bands. The forewings and hindwings are transparent, but bordered with dark edges. There is a burnt-orange elliptical discal mark on each forewing. Wing length is 12-20mm.

Life History: This is one of the earliest clearwings to emerge in Florida (February through early May). Two years are required to complete the life cycle. The caterpillars make large tunnels deep in the wood. The base of young trees and exposed roots are favored. Cast pupal shells are often found protruding from the base of an infected tree trunk or stump. Pupation occurs in the early spring of the second year.

Range: Eastern half of the United States and Canada. Probably statewide in Florida.

Hostplants: All species of oak trees (*Quercus* spp.; Fagaceae).

Comments: Causes serious damage to young or injured oaks.

Paranthrene dollii (Neumoegen) Fig. 15

Common Name: Poplar Clearwing Borer.

Description: This clearwing is an excellent mimic of the red paper wasp. The abdomen is orange-red and blackish-brown with two narrow yellow bands on segments 2 & 4. All four wings are uniformly black except for small transparent windows in the basal area. The antennae are orange-brown. Wing length is 12-18mm.

Life History: In Florida there appear to be spring and fall hatches of adults. They are more common in even-numbered years, indicating a two-year life cycle. They prefer weak and damaged trees. Larval feeding in the trunk and main limbs causes considerable damage. The pupal chamber is capped with silk but no cocoons are formed.

Range: Southern part of the eastern half of the United States westward to Texas, New Mexico and Arizona, statewide in Florida.

Hostplants: Cottonwoods and poplars (*Populus* spp.), as well as willows (*Salix* spp., Salicaceae).

Comments: Heavy infestations of borers may occur in stressed street plantings and hasten their death.

Paranthrene simulans (Grote) Fig. 16

Common Name: Golden Oak Borer.

Description: This clearwing closely resembles a large golden hornet. In Florida, all specimens appear to be the "*palmii*" form, with golden abdominal segments, having narrow black bands on some. Forewings are brown on the anterior border and possess a red-orange discal mark. The hindwings are transparent. North of Florida there are two color forms, one of which is darker and the gold replaced by yellow. Wing length is 12-18mm.

Life History: Larvae bore in the solid wood of oaks (*Quercus*) and two years is required to complete the life cycle. Pupation occurs in the spring of the second year. The species shows a preference for young or weakened oak trees. Can cause considerable damage to nursery stocks.

Range: Eastern two-thirds of the United States and Canada. Occurs statewide in Florida.

Hostplants: All species of oak trees (*Quercus* spp., Fagaceae) within its range appear to be attacked.

Comments: Heavy infestations have been reported in street, park, and yard plantings in many locations.

Paranthrene tabaniformis (Rottemburg) Fig. 17

Common Name: Dusky Clearwing Borer.

Description: This clearwing somewhat resembles a black potter wasp. The head, thorax, and abdomen are blue-black. The abdomen has four narrow yellow bands (segments 2,4, 6 and 7). The forewings are dusky and the hindwings are transparent. Antennae are black and brown. Wing length is 8-14mm.

Life History: The larvae bore in the roots as well as the main tree trunk and branches. Sometimes they attack exposed roots and galls or swellings caused by cerambycid beetles. There is a two-year life cycle with pupation occurring in the spring of the second year. Adults emerge in the late spring and summer (April to August).

Range: Alaska, southward through Canada and most of the United States (but not west of the Rocky Mountains); described from Europe. Only recorded from northern Florida.

Hostplants: Low-growing shrubby willows (*Salix* spp., Salicaceae); *Populus* spp. (Salicaceae) in Europe.

Comments: Occasionally heavy infestations are reported in landscape plantings and nurseries.

Pennisetia marginata (Harris) Fig. 18

Common Name: Raspberry Crown Borer.

Description: This is a good yellow jacket mimic, having a stout abdomen with yellow/dark brown bands on nearly all segments. The antennae are brown and yellow and the anal tuft is dark brown mixed with yellow. Forewings are transparent with broad dark-brown margins and the discal spots are red-orange. Hindwings are transparent with a lateral fringe of dark-brown. The legs are yellow. Wing length is 8-16mm.

Life History: Eggs are laid on the foliage of the host plant and young larvae move down to feed on the roots. The following year, larger larvae often girdle the stems just above ground level, causing them to wilt or break off. Pupation occurs in the hollow cane stump and adults emerge from July to November. The life cycle takes two or three years.
Range: Found throughout the United States and southern Canada. Occurs statewide in Florida.
Hostplants: Wild and cultivated blackberry, raspberry, boysenberry, and dewberry (*Rubus* spp., Rosaceae).
Comments: A serious pest of cultivated raspberries, blackberries, and boysenberries. Many canes wilt and break off if heavily infested.

Podosesia aureocincta Purrington & Nielsen Fig. 19

Common Name: Banded Ash Clearwing.
Description: This is an excellent mimic of the red paper wasp. The head, antennae, and thorax are rust-brown and black. The abdomen is black or brown-black, somewhat constricted at base, and there is a distinct yellow-orange band on segment 4. The legs are banded rust-brown and yellow along their distal portions. Forewings are opaquely black with rust-red scales near the base. Hindwings are mostly transparent with black veins. Wing length is 10-17mm.
Life History: Adults emerge from mid-July to early December in Florida, so there is very little or no overlap with *P. syringae*. Eggs are deposited on the limbs and tree trunk, and larvae bore in the wood of both. A year is required to complete one life cycle.
Range: Eastern half of the United States from New York south. Occurs over the northern three-fourths of Florida.
Hostplants: Various species of ash (*Fraxinus* spp., Oleaceae).
Comments: Heavy infestations result in swelling and cracking of bark as well as branch dieback in the trees.

Podosesia syringae (Harris) Fig. 20

Common Name: Ash Borer.
Description: This species is almost identical to *Podosesia aureocincta*, except it lacks the yellow abdominal band. The abdomen is entirely black or brown-black and somewhat constricted at the base. The wing and other body parts are colored as in the banded ash borer. Wing length is 10-17mm.
Life History: Adults emerge from mid-December to early July in Florida, so there is very little or no overlap with *P. aureocincta*. Eggs are deposited on the limbs and tree trunks, and larvae bore in the wood of both. One generation occurs each year.
Range: Eastern two-thirds of the United States and southern Canada, plus disjunct populations in central California and the Pacific Northwest. Occurs over the northern three-fourths of Florida.
Hostplants: Larvae bore in various species of ashes (*Fraxinus* spp.), lilacs (*Syringa* spp.), olive (*Olea* spp.), *Ligustrum* spp., and fringe tree (*Chionanthus* spp.) (all Oleaceae).
Comments: This borer causes serious damage to nursery stock and landscape plantings.

Sannina uroceriformis Walker Fig. 21

Common Name: Persimmon Borer.
Description: Adults mimic the large black and red wasp (*Lophopompilus atrox*). The head, antennae, thorax, and abdomen are blue-black, the latter banded with red-orange on segment 4 and often the anterior edge of segment 5. There are also small red-orange markings on the head and lateral thorax. The wings are opaque and blue-black, with small transparent windows at the base. There are five prominent black, hair-pencil anal tufts on the male (2 short lateral, 2 long lateral, and 1 long dorsal). Wing length is 12-17mm.
Life History: Eggs are laid at the base of the tree, and larvae bore as deep as 18 inches into the central root. The life cycle requires two years or occasionally three. The cocoons contain wood chips and frass, and extend out from the base of the tree at ground level. The pupa, if disturbed, drops rapidly back into the larval tunnel. Adults emerge from March to May in Florida and there are occasionally a few stragglers later in the summer.
Range: Eastern two-thirds of the United States from New Jersey southward. Occurs statewide in Florida.
Hostplants: Common persimmon tree (*Diospyros virginiana*, Ebenaceae). Some western records are outside the geographical range of persimmons so there could be a secondary host.
Comments: This borer is a serious pest of young persimmon trees, weakening or killing many of them.

Synanthedon acerni (Clemens) Fig. 22

Common Name: Maple Callus Borer.
Description: This is the only Florida clearwing having a golden thorax and a brown abdomen with a bright-orange anal tuft. All four wings are transparent with light yellow scales near the tips and black discal spots. The head is red-orange and the antennas are dark brown. Wing length is 7-13mm.
Life History: Larvae bore in damaged areas on the trunk and large limbs causing a swelling (calous) or rough area on the surface. The damaged area is reinfested each year and gradually grows larger. Adults fly in the late afternoon, and are one of the few clearwings also attracted to bright lights at night. Each brood matures in one year and adults emerge from April to September.
Range: Eastern half of the United States and Canada. Occurs statewide in Florida.
Hostplants: Various maple (*Acer* spp., Aceraceae) species.
Comments: This is a serious pest of maple trees in nurseries and landscapes.

Synanthedon acerrubri Englelhardt Fig. 23

Common Name: Red Maple Borer.
Description: The abdomen is metallic blue-back on the dorsal side and brick-red ventrally. Segments 2, 4, 5 and 6 are narrowly edged with pale yellow. Antennae are black with white scales near the tips. Forewings are tipped in black and have a black discal bar. Hindwings are transparent and fringed with a black line. The anal tuft is fan-shaped, blue-black above and brick-red beneath. Wing length is 6-10mm.
Life History: Larvae bore under the bark of tree branches causing a slight swelling. They complete the life cycle in one year. Adults emerge from April to August. Eggs are laid at

injured or damaged areas. Cocoons are made of wood chips and frass, just under the bark.
Range: Eastern half of the United States and Canada. In Florida, this species has only been recorded in the Panhandle near the Alabama and Georgia borders.
Hostplants: Various species of maple (*Acer* spp., Aceraceae). In Florida, red maple (*Acer rubrum*) is the main host species.
Comments: This borer is not as widespread or damaging to maples as the maple callus borer (*S. acerni*) in Florida.

Synanthedon alleri (Engelhardt) Fig. 24

Common Name: Aller's Clearwing.
Description: The head, antennae, and thorax are black, the latter with a pair of narrow orange sub-dorsal stripes. The abdomen is black with a metallic blue-green luster and an orange band on the junction of segments 4 and 5. The anal tuft is large, wedge-shaped, and black with the lateral margins white. Forewings are black with orange scales between veins apically. Hindwings are transparent. Wing length is 9-12mm.
Life History: The life cycle is poorly known, but adults emerge from March to December. Numbers peak around noon at pheromone lures. There may be two broods annually in Florida.
Range: Occurs across the Gulf coastal plain from Georgia to Mississippi thus far. Occurs statewide in Florida.
Hostplants: Unknown, but very possibly various species of holly (*Ilex* spp., Aquifoliaceae). Large numbers have been taken in open woodlands, abounding in holly, bordering hydric forests.
Comments: A melanistic color phase of Aller's clearwing is rather common in Florida (about 5% of those captured).

Synanthedon arkansasensis Duckworth & Eichlin

Common Name: Arkansas Clearwing. Fig. 25
Description: Head, antennae, and thorax blue-black, the latter with a pair of narrow yellow sub-dorsal stripes. The abdomen is blue-black with narrow yellow bands on the posterior edge of each segment. Anal tuft is golden- orange. Forewings are two-thirds transparent, the rest black, with orange in the apical areas (between veins and outlining the discal spot). Hindwings are transparent. Wing length is 7-10mm.
Life History: The life cycle is poorly known, but adults emerge from April to December. Numbers peak in the late afternoon at pheromone lures. Like *S. acerni*, adults of this species are often taken at insect lights at night. Apparently one brood per year.
Range: South central and southern United States. In Florida, restricted to the northern portion of the state.
Hostplants: Unknown.
Comments: Appears not to be a pest of any agriculture or nursery species.

Synanthedon castaneae (Busck) Fig. 26

Common Name: Chestnut Borer.
Description: The abdomen is black with a blue-green iridescence and very narrow yellow bands on segment 2, 3, and 4. The thorax, head, and antennae are also black. Forewings and hindwings are transparent, with a small black discal bar on the forewing. Wing length is 10-12mm.
Life History: Larvae bore in the bark of the tree trunk preferring bruised or damaged areas. The life cycle requires one year and adults emerge from late April to June (cocoons are spun in the larval galleries).
Range: Eastern third of the United States from Atlantic coast states southward to Florida. In Florida, recorded only in the Panhandle.
Hostplants: Feed on chestnuts and probably chinquapins (*Castanea* spp., Castanaceae).
Comments: Was thought to be extinct for many years because of demise of the host tree (due to the chestnut blight). Rediscovered in 1985 using pheromones and found to be relatively common in several states. Not a pest today, may be in future if the American chestnut (*Castanea dentata*) makes a comeback.

Synanthedon decipiens (H. Edwards) Fig. 27

Common Name: Oak Gall Borer.
Description: A small species in which the head, antennae, and thorax are black, the latter with a pair of yellow sub-dorsal lines. The abdomen is black with segments 2, 6, and 7 narrowly banded in canary-yellow. Also, segment 4 has a broader yellow band. The black anal tuft is wedge-shaped with lateral margins yellow. Forewings are mostly transparent with black fringes and veins, plus a red discal spot. Hindwings are transparent with black fringes and veins. Wing length is 8-10mm.
Life History: Larvae tunnel in the large woody galls of cynipid wasps or under the bark of trees. Adults emerge from March to November and there appears to be two peaks (one in the spring and another in the fall) in Florida. These borers complete their life cycle in one year.
Range: Eastern two-thirds of the United States and Canada. Occurs statewide in Florida.
Hostplants: Prefers various species of scrub oaks (*Quercus* spp., Fagaceae) but also occurs in larger species of oaks.
Comments: Color forms of this species with reduced yellow abdominal banding have been noted in parts of Florida (especially in small, undernourished specimens).

Synanthedon dominicki Duckworth & Eichlin

Common Name: Dominick's Clearwing. Fig. 28
Description: The head, antennae, and thorax are blue-black, the latter with a pair of dorsal orange stripes. Abdomen is metallic blue-black with a prominent anal tuft which is mainly orange-red except for blue-back on basal one/third. Forewings are transparent in the basal two-thirds and tipped with blue-back and orange scales. Hindwings are transparent. Wing length is 7-10mm.
Life History: Most of the life cycle is unknown. Adults emerge only in March and April. There is one brood per year. Adults are most active at mid-afternoon.
Range: Taken only in North Carolina, South Carolina, Georgia, Florida, and Alabama. Occurs throughout the northern two-thirds of Florida.
Hostplants: Unknown.
Comment: This moth is beautifully marked in both sexes. The female of the species was unknown until fairly recently when one was captured while hovering over and intermittently landing on a small waterlocust (*Gleditsia aquatica*). It was not possible to determine if this is the host species.

Synanthedon exitiosa (Say) Fig. 29

Common Name: Peachtree Borer.

Description: The head is black with yellow dorsally. Antenna, thorax and abdomen are metallic blue-black color with narrow pale-yellow bandin present on most of the segments. The anal tuft is elongated, black, and wedge-shaped. The wings have a transparent amber sheen with black veins and black margins. Wing length is normally 10-15mm.

Life History: The life cycle of this species is probably the best known of any clearwing. Adults emerge from May to November and there is one generation per year. Peak flying and breeding activity occur around noon each day. Larvae bore beneath the bark and cambium in the trunk, just above and below ground level. At pupation, they spin cocoons in the larval galleries or in the soil at the base of trees.

Range: Throughout the United States and southern Canada, excluding most of the Great Plains, Great Basin, and desert Southwest. Occurs statewide in Florida.

Hostplants: Wild and cultivated cherries, peaches, plums, apricots, almonds, nectarines, and other stone fruits of the genus *Prunus*; also *Amelanchier* spp., and *Malus* sp. (all Rosaceae).

Comments: This is one of the most economically destructive clearwings. They cause the decline and death of millions of *Prunus*. Female peachtree borers are black and red-orange in coloration, thus they mimic a different species of wasp (possibly spider wasps, Pompilidae) than males.

Synanthedon fatifera Hodges Fig. 30

Common Name: Arrowwood Borer.

Description: The head, thorax, antennae, and abdomen are metallic blue-black. The anal tuft is elongate, blue-black edged thinly with pale yellow, and wedge-shaped. The wings are transparent, bordered in blue-black. Wing length is 9-11mm.

Life History: Adults emerge in May and June. There is one generation per year, and the larvae bore in the trunk and major branches of the trees. The daily activity period of adults occurs in late afternoon.

Range: Occurs widely east of the Rocky Mountains in the United States and southern Canada. Recorded from the northern half of Florida.

Hostplants: *Viburnum* spp. (Caprifoliaceae) trees and shrubs.

Comments: This borer commonly damages nursery and landscape plants. Adult males are attracted to ZZA, while the nearly identical lesser peach tree borer is attracted to EZA.

Synanthedon geliformis (Walker) Fig. 31

Common Name: Red Clearwing Borer.

Description: The head, antennae, and thorax are black, but the abdomen is entirely orange-red. The anal tuft is red with black along the margins. Forewings are uniformly black and the hindwings are transparent bordered with black. Wing length is 6-9mm.

Life History: Adults can be taken from March to December in Florida. Larvae prefer to tunnel in damaged or injured plant tissues just under the bark. There may be two broods per year in southern areas. The daily activity period of adults occurs in the late afternoon.

Range: The southeastern coastal plains of the United States (South Carolina, Georgia, and statewide in Florida). Also found in the West Indies and eastern Mexico.

Hostplants: One of the few "polyphagous" clearwings, utilizing a number of unrelated host plants including *Carya* spp. (Juglandaceae), *Quercus* spp. (Fagaceae), *Cornus* spp. (Cornaceae), *Ulmus* spp. (Ulmaceae), *Hibiscus* spp. (Malvaceae), and *Casuarina* spp. (Casuarinaceae).

Comments: This borer commonly damages nursery and landscape plants in Florida and adjacent areas. It has been a major pest of elm nursery stock in the Tampa area.

Synanthedon pictipes (Grote & Robinson) Fig. 32

Common Name: Lesser Peachtree Borer.

Description: The head, antenna, and thorax are blue-black, the latter with two subdorsal yellow lines. Abdomen and anal tuft are blue-black with the latter being elongate and wedge-shaped. The wings are transparent with a metallic blue-black fringe and discal bar. Wing length is 8-12mm.

Life History: This species is almost as well studied as the peachtree borer. Adults are on the wing year-round in Florida, but fewer in number during the winter. Daily flight and breeding activities peak around noon. Larvae tunnel under the bark in the twigs and branches of the trees rather than the lower trunk. There are at least two generations per year in Florida.

Range: Eastern half of the United States and southern Canada. Statewide in Florida.

Hostplants: Cultivated and wild peaches, plums and cherries (*Prunus* spp.); also *Amelanchier* spp., apples (*Malus* spp.) and pears *Pyrus* spp. (all Rosaceae).

Comments: This is one of the most economically destructive clearwings. Ornamental (flowering) members of the *Prunus* group are attacked as heavily as the fruiting varieties.

Synanthedon proxima (H. Edwards) Fig. 33

Common Name: Willow Borer.

Description: The head, thorax, and abdomen are metallic blue-black, and the antennae are blue-black with striking white areas near the tips. The anal tuft is wedge-shaped and blue-black with white lateral fringes. The wings are transparent, but the veins, outer margins, and discal bars are metallic black. Wing length is 8-10mm.

Life History: Adults emerge from April to July. Larvae infest branches, canes, or exposed roots of the tree. One year is required to complete the life cycle.

Range: Eastern half of the United States and southern Canada west to Manitoba and eastern Nebraska. In Florida, recorded only from the northern edge of the state.

Hostplants: Various species of willows (*Salix* spp., Salicaceae). They prefer the low-growing bushy types.

Comments: Nursery stocks are occasionally attacked and weakened by this borer, but it is more often found on wild species of willows.

Synanthedon refulgens (H. Edwards) Fig. 34

Common Name: Refulgens Clearwing.

Description: The abdomen is brown-black with segments 2, 4, 6

and 7 banded with yellow (3 and 5 sometimes faintly banded).
Life History: The life cycle is poorly known, but adults emerge from April to September. They respond to the sex attractant mix of (E, Z) 2, 13-ODDA/ZZA at a 99:1 ratio. Wing length is mm.
Range: Eastern half of the United States. Recorded from the northern two-thirds of Florida.
Hostplants: Unknown.
Comments: This species is usually captured in xeric turkey oak-pine or sand pine-scrub forests in Florida.

Synanthedon richardsi (Engelhardt) Fig. 35

Common Name: Richard's Clearwing.
Description: The abdomen is black on the dorsal side and pale yellow and white ventrally. Antennae are black with the apical third powdered white. Forewings are mostly hyaline with broad black outer margins, and strongly orange between the veins. The discal bar is black, and the anal tuft is red orange with some black setae near the base. Hindwings are hyaline with narrow yellow and orange outer margins.
Life History: Almost nothing is known about the life cycle of this rarely-collected clearwing moth. It has been taken in mid-October at Torreya State Park in the Florida Panhandle.
Range: Found throughout the Appalachian Plateau from Maryland south to Georgia and into north Florida, west to Ohio and Kansas.
Hostplants: Unknown, but has been captured on buttonbush (Rubiaceae). This may be only a nectar source.
Comments: Only a single specimen is presently recorded from Florida, taken at Torreya State Park, Liberty County. Research is needed to determine the extent of its range in northern Florida.

Synanthedon rileyana (H. Edwards) Fig. 36

Common Name: Riley's Clearwing.
Description: This is an excellent mimic of the yellow jacket. The stout abdomen is black, banded broadly with yellow in the posterior edge of each segment. Forewings are transparent and boldly marked with a red oval-shaped discal spot. The wings are all bordered with black and the veins are black. Hind legs are covered with long hair-like yellow scales. Wing length is 7-12 mm.
Life History: Adults emerge from June to September and fly in the morning hours. Eggs are deposited in clusters in leaves, stems, or on the ground at the base of the plant. Larvae bore into the roots. There is one brood per year.
Range: Eastern two-thirds of the United States and southern Canada. In Florida it occurs over the northern half of the state.
Hostplants: Horse nettle (*Solanum carolinense*, Solanaceae).
Comments: This is the only borer known to attack a solanaceous plant. This clearwing is incredibly abundant where the host plant is common.

Synanthedon rubrofascia (H. Edwards) Fig. 37

Common Name: Black Gum Borer.
Description: The abdomen is black with a broad brick-red band covering segments 4 and 5 (often some red on segments 6 and 7 also). The thorax, head, and antennae are black. The wings are transparent except for fine black veins, black borders, and a black discal bar. Wing length is 8-11mm.
Life History: Adults emerge from March to November. Larvae tunnel under the bark of mature trees and concentrate in injured areas. There is one or possibly two broods per year in Florida. Flying and breeding activities peak in the afternoon.
Range: Eastern half of the United States. Occurs throughout Florida except the southern tip.
Hostplants: Gum or tupelo trees (*Nyssa* spp., Nyssaceae).
Comments: This species is very numerous in and near gum swamps and/or bayheads throughout Florida. Florida specimens differ from northern specimens in having the forewing margins heavily accented with black scales.

Synanthedon sapygaeformis (Walker) Fig. 38

Common Name: Florida Clearwing.
Description: Head, thorax, and abdomen are blue-black, the latter with brick-red bands on segments 4, 5 and 7 (in some, segment 5 is black). The posterior portion of the thorax is banded brick-red. The anal tuft is a metallic blue-black. Forewings are black with red powdering centrally and on the discal spots. Hindwings are transparent with a broad black fringe. Wing length is 6-10 mm.
Life History: Larvae bore in the large woody galls of cynipid wasps in a life cycle very similar to *S. decipiens*. Adults emerge almost year round (February to December). There is one (or possibly two) broods per year.
Range: Found only in Florida throughout the peninsula as far Range north as Jacksonville, Tallahassee, and Pensacola.
Hostplants: Large woody oak galls and oak trees (*Quercus*, Fagaceae) native to Florida or in cultivation in the state.
Comments: Individuals have been captured which have pale pink, white, yellow, or orange banding on the abdomen rather than brick-red.

Synanthedon scitula (Harris) Fig. 39

Common Name: Dogwood Borer.
Description: A small clearwing with black head, antennae, thorax, and abdomen. There are a pair of thin yellow, subdorsal lines on the thorax. Thin yellow bands also cross segments 2 and 4 of the abdomen. The anal tuft is brush-like and black with yellow lateral fringes. Forewings are mostly transparent but each apex is black with gold powdering between the veins, and there is a black discal bar. Hindwings are transparent. Wing length is 5-9mm.
Life History: Adults emerge from March to October and fly most actively in the late afternoon. Eggs are deposited on damaged areas, wounds, or galls found on a tree or shrub. There is a one-year life cycle.
Range: Eastern half of the United States and southern Canada. Recorded over the northern half of Florida.
Hostplants: This borer attacks the widest range of plants known for the group. Known hosts include dogwood (*Cornus* spp., Cornaceae), oak (*Quercus* spp., Fagaceae), pecan and hickory (*Carya* spp., Juglandaceae), mountain ash (*Crataegus* spp., Rosaceae), beech (*Fagus* spp., Fagaceae), wax myrtle (*Myrica* spp., Myricaceae), cherry (*Prunus* spp., Rosaceae), apple (*Malus* spp., Rosaceae), willow (*Salix* spp., Salicaceae), birch (*Betula*

spp., Betulaceae), *Berchemia* (Rhamnaceae), *Corylus* (Betulaceae), *Cydonia oblonga* and *Physocarpus* (Rosaceae), chestnut (*Castanea* sp. (Castanaceae), *Pinus* (Pinaceae), *Sorbus* (Rosaceae), and *Wisteria* sp. (Leguminosae).

Comments: Can cause serious economic damage to orchards (pecan and apple) as well as to ornamental trees (dogwood and oak).

Vitacea polistiformis (Harris) Fig. 40

Common Name: Grape Root Borer.

Description: This is an excellent mimic of the striped paper wasp. The head and thorax are rust-brown with some yellow laterally. The antenna are rust-brown. The abdomen is rust-brown to mid-brown with two or three narrow yellow bands (segments 2, 4, and sometimes 6). Males possess four anal tufts which are yellow hair-pencils. Forewings are black and the hindwings are transparent. Wing length is 12-19mm.

Life History: Larvae bore in the horizontal roots after eggs are laid by females on the ground, stems, or foliage. Larvae mature the second year, leave the root galleries and pupate in a tough cocoon just under the ground. Adults emerge in summer, 3-4 weeks after pupation.

Range: Eastern United States and Canada from the Great Lakes south to Florida and Texas. Occurs statewide in Florida.

Hostplants: Wild and domestic grapes (*Vitis* spp., Vitaceae).

Comments: Causes serious damage in commercial vineyards. The damage to roots is difficult to detect until severe.

Vitacea scepsiformis (H. Edwards) Fig. 41

Common Name: Lesser Grape Root Borer.

Description: This species is very similar to *V. polistiformis* and likewise a superb mimic of the paper wasp. The abdomen is rust-brown to black-brown with a narrow yellow band on segment 2 and sometimes faintly on 4 and 6. Males have four anal tufts which are brown and yellow hair-pencils. Forewings are black and the hindwings are transparent (a color variation occurs with the outer two-thirds of the hindwings black). Wing length is 12-16 mm.

Life History: Larvae bore in the upper main and horizontal roots, feeding under the bark and avoiding the hard center core. Larvae mature the second year and pupate at the upper end of their galleries in the root. Adults emerge in late summer and fall, 3-4 weeks after pupation.

Range: Eastern United States from New York to Florida and west to Texas, Arkansas, and Missouri. Occurs statewide in Florida.

Hostplants: Domestic and wild grapes (*Parthenocissus* spp. and *Vitis* spp., Vitaceae).

Comments: Causes serious damage to grape vineyards. Root damage is difficult to detect until severe.

CONTROL OF BORERS

Many species of clearwing borers are important or occasional pests of orchard, landscape or yard trees and shrubs. Borer damage to conducting tissue reduces tree vigor or facilitates attack by diseases that may result in tree death. Clearwing females often oviposit on injured or stressed trees and shrubs. They may use volatile odors produced by stressed plants to locate a susceptible host. Trees and shrubs damaged by yard equipment, plant pathogens or other insects or those under water, heat or other site stresses are especially susceptible.

Since the females oviposit on the exterior portions of the host plant, wounds in the bark facilitate entry by the borer larvae into the phloem where they feed. Once the larvae enter the tree, they are difficult to control.

Control strategies should be directed at prevention. Vigorous, healthy trees without injury to their bark are less susceptible to borer attack. Select trees and shrubs that are adapted to the site. When planted, trees and shrubs should be well watered and maintained to reduce the effects of planting stress. Planting trees and shrubs during the dormant season will allow them to become well established before most borers are active.

Three chemical insecticides are currently labeled by EPA for borer control: chlorpyrifos (Dursban), endosulfan (Thiodan) and Lindane. The labels and legal uses of these chemicals may change in the future. It is the responsibility of the user to follow the pesticide label and to use legal materials: THE LABEL IS THE LAW! These three insecticides have a long residual when applied to the bark of trees and shrubs. Thus, no more than one to three applications of the pesticides should be required during the growing season. An exception may be fruit trees (*Prunus* spp.) which can be attacked by the peachtree borer and lesser peachtree borer for much of the year in southern Florida.

Insecticides should be applied to prevent entry into the tree by the larvae. Therefore, timing is critical for successful borer control. Application of insecticides to infested trees may kill some of the borer larvae in the tree or the adults as they emerge. This may prevent further damage to other trees in the area. However, the damage will already be done to the infested tree. Some entomophagous nematodes have shown promise for borer control and may be available soon.

While clearwing borers can be trapped using pheromones, such traps collect only the males and do not remove the females. Pheromone traps may indicate the presence and flight period of the adults to more precisely time insecticide applications. Most synthetic pheromones attractive to male clearwing borers are attractive to more than one species making correct identification critical. However, just the occurrence of male borers in traps is not indicative of the risk of female attack to valuable trees. Combining proper selection of trees and shrubs with appropriate cultural and management practices that insure vigorous, healthy trees is the best strategy for successful control of those species that are serious economic pests.

ACKNOWLEDGMENTS

Special thanks go to the following persons who aided and assisted in the various research tasks that led to this paper: Curtis Brown, Kathy Scarborough, Marilyn Brown, Tom Eichlin, Caleb Brown, Wesley Brown, and Wendell Snow. We thank Dr. G. Liebee and Dr. R. Baranowski for helpful comments on an earlier draft of the manuscript. This work is University of Florida Agricultural Experiment Station Journal Series No. R-02965.

Fig. 42-45. Damage from clearwing borers: 42. *Synanthedon scitula*, damage to dogwood; 43. *Synanthedon exitiosa*, damage to peach tree trunk (with exposed larvae); 44. *Synanthedon pictipes*, damage to peach tree branch; 45. *Synanthedon geliformis*, damage to drake elm tree trunk.

APPENDIX 1 Catalog of Florida Sesiidae (species numbers refer to MONA numbers; see Eichlin and Duckworth, 1988). (from Heppner *et al.* manuscript, *Lepidoptera of Florida*)

SESIOIDEA
SESIIDAE
TINTHIINAE
PENNISETIINI

PENNISETIA Dehne, 1850
Bembecia.– auct. (not Hübner, [1819])
Anthrenoptera Swinhoe, 1892
Lophocnema Turner, 1917
Diapyra Turner, 1917
Glossecia Hampson, 1919
2513 **marginata** (Harris, 1839) (McD 8684)
pleciaeformis (Walker, 1856)
odyneripennis (Walker, 1856)
rubi (Riley, 1874)
flavipes (Hulst, 1881)
var. *albicoma* (Hulst, 1883)

PARANTHRENINAE
PARANTHRENINI

PARANTHRENE Hübner, [1819]
Memythrus Newman, 1832
Paranthrena Herrich-Schäffer, 1846, emend.
Sciapteron Staudinger, 1854
Tarsa Walker, 1856
Pseudosesia C. Felder, 1861
Pseudosetia Boisduval, 1875, missp.
Pramila Moore, 1879
Fatua H. Edwards, 1882, preocc. (Dejean, 1833)
Sciapterum Bartel, 1912, emend.
Paranthrenella Strand, 1916
Pseudosecia Dalla Torre & Strand, 1925, missp.
Nokono Matsumura, 1931
Leptocimbicina Bryk, 1947
2522 **asilipennis** (Guérin-Méneville, 1832) (McD 8800)
denudatum (Harris, 1839)
vespipenne (Herrich-Schäffer, 1854)
vespipennis (Boisduval, 1875)
championi (Druce, 1883)
2523 **dollii** (Neumoegen, 1894) (McD 8802)
var. *castaneum* (Beutenmüller, 1897)
f. *fasciventris* Engelhardt, 1946
2524 **tabaniformis** (Rottemburg, 1775) (McD 8792/8793)
asiliformis.– ([Denis & Schiffermüller], 1775), misid. (not Rottemburg, 1775)
vespiformis.– (Newman, 1832), misid. (not Linnaeus, 1761)
tricincta (Harris, 1839)
serratiformis (Freyer, 1842)
denotata (H. Edwards, 1882)
f. *oslari* Engelhardt, 1946
2527 **simulans** (Grote, 1881) (McD 8798/8799)
palmii (H. Edwards, 1887)
luggeri (H. Edwards, 1891)

VITACEA Engelhardt, 1946
2530 **polistiformis** (Harris, 1854) (McD 8796/880l)
seminole (Neumoegen, 1894)
f. *huron* Engelhardt, 1946
2531 **scepsiformis** (H. Edwards, 1881) (McD 8797)

EUHAGENA H. Edwards, 1881
Larunda H. Edwards, 1881, preocc. (Leach, 1815)
Gaea Beutenmüller, 1896, repl. name
2534 **emphytiformis** (Walker, 1856) (McD 8771/8722)
solituda (H. Edwards, 1881)

SESIINAE
MELITTIINI

MELITTIA Hübner, [1819]
Eumallopoda Wallengren, 1858
Parasa Wallengren, 1863, preocc. (Moore, 1858)
Pansa Wallengren, 1865, repl. name
Poderis Boisduval, 1875, nom. nud.
Melitha Kirby, 1879, missp.
Melitta Druce, 1892, missp.
Premelittia LeCerf, 1916
Neosphecia LeCerf, 1916
Melittina LeCerf, 1917
2536 **cucurbitae** (Harris, 1828) (McD 8776/8777)
satyriniformis Hübner, [1827-31]
ceto (Westwood, 1848)
amoena H. Edwards, 1881

OSMINIINI

OSMINIA LeCerf, 1917
Signaphora Engelhardt, 1946
2545 **ruficornis** (H. Edwards, 1881) (McD 8739/8757)
minuta (H. Edwards, 1881)
candescens (H. Edwards, 1882)
marcia (Druce, 1889)

SYNANTHEDONINI

SYNANTHEDON Hübner, [1819]
Conopia Hübner, [1819]
Austrosetia C. Felder, 1874
Teinotarsina C. Felder, 1874
Pyrrhotaenia Grote, 1875
Ichneumenoptera Hampson, 1893
Vespamima Beutenmüller, 1894
Sanninoidea Beutenmüller, 1896
Thamnosphecia Spuler, 1910
Canopia Wileman & South, 1918, missp.
Scabisa Matsumura, 1931
Ramosia Engelhardt, 1946
Sylvora Engelhardt, 1946
Synathedon Wolfsberger, 1961, missp.
Tipulia Kràlícek & Povolný, 1977

2546 **acerrubri** Engelhardt, 1925 (McD 8706)
2547 **geliformis** (Walker, 1856) (McD 8752)
2548 **richardsi** (Engelhardt, 1946)
2549 **scitula** (Harris, 1839) (McD 8731/8733)
gallivorum (Westwood, 1854)
hospes (Walsh, 1867)
corusca (H. Edwards, 1881)
aemula (H. Edwards, 1883)
2550 **pictipes** (Grote & Robinson, 1868) (McD 8720)
inusitata (H. Edwards, 1881)
2552 **rileyana** (H. Edwards, 1881) (McD 8696)
brunneipennis (H. Edwards, 1881)
hyperici (H. Edwards, 1881)
austini (Englehardt, 1946)
2554 **acerni** (Clemens, 1860) (McD 8726/8727)
acericolum (Germadius, 1874)
tepperi (H. Edwards, 1881)
race *buscki* (Engelhardt, 1946)
2555 **fatifera** Hodges, 1962
2557 **alleri** (Engelhardt, 1946) (McD 8715.1)
2562 **dominicki** Duckworth & Eichlin, 1973
2566 **refulgens** (H. Edwards, 1881) (McD 8703/8743/8744)
marica (Beutenmüller, 1899)
seminole (Beutenmüller, 1899)
marcia (Dyar, [1903]), missp.
2567 **rubrofascia** (H. Edwards, 1881) (McD 8715)
2571 **decipiens** (H. Edwards, 1881) (McD 8734/8735)
imperfecta (H. Edwards, 1881)
nicotianae (H. Edwards, 1881)
rubrostigma (Kellicott, 1892)
2572 **proxima** (H. Edwards, 1881) (McD 8723, part)
modesta (Kellicott, 1892)
2573 **sapygaeformis** (Walker, 1856) (McD 8751/8753)
floridensis (Grote, 1875)
2575 **arkansasensis** Duckworth & Eichlin, 1973
2577 **castaneae** (Busck, 1913) (McD 8722)
2583 **exitiosa** (Say, 1823) (McD 8691/8692/8693)
persica (Thomas, 1824)
pepsidiformis (Hübner, [1827-31])
xiphiaeformis (Boisduval, 1875)
graefi (H. Edwards, 1881)
opalescens (H. Edwards, 1881)
var. *fitchii* (H. Edwards, 1882)
pacifica (Riley, 1891)
var. *luminosa* (Neumoegen, 1894)
var. *edwardsii* (Beutenmüller, 1900)
graefii (Beutenmüller, 1900), missp.
var. *barnesii* (Beutenmüller, 1900)
fitchi (Dalla Torre & Strand, 1925), missp.

PODOSESIA Möschler, 1879, repl. name
Grotea Möschler, 1876, preocc. (Cresson, 1864)
2588 **aureocincta** Purrington & Nielsen, 1977
2589 **syringae** (Harris, 1839) (McD 8768/8769)
longipes (Möschler, 1876)
fraxini (Lugger, 1891)

SANNINA Walker, 1856
Saunina Boisduval, 1875, missp.
Sospita H. Edwards, 1882, preocc. (Rafinesque, 1815)
Phemonoe H. Edwards, 1882, repl. name
2590 **uroceriformis** Walker, 1856 (McD 8765)
quinquecaudata (Ridings, 1862)
uroceripennis Boisduval, 1875

CARMENTA H. Edwards, 1881
2591.1 **laurelae** L. Brown, Eichlin & Snow, 1986
2592 **anthracipennis** (Boisduval, [1875]) (McD 8707/8712/8756)
sanborni H. Edwards, 1881
morula (H. Edwards, 1881)
2596 **bassiformis** (Walker, 1856) (McD 8704/8728)
lustrans (Grote, 1880)
aureopurpura (H. Edwards, 1880)
bolli (H. Edwards, 1881)
sexfasciata (H. Edwards, 1881)
consimilis (H. Edwards, 1881)
eupatorii (H. Edwards, 1881)
imitata (H. Edwards, 1881)
aureopurpurea (J. B. Smith, 1891), missp.
bollii (J. B. Smith, 1891), missp.
2600 **ithacae** (Beutenmüller, 1897) (McD 8732)
koebelei (H. Edwards, 1881)
2603 **odda** Duckworth & Eichlin, 1977
2608 **pyralidiformis** (Walker, 1856) (McD 8755)
nigella (Hulst, 1881)
var. *aurantis* Engelhardt, 1946
2612 **suffusata** Engelhardt, 1946
2614 **texana** (H. Edwards, 1881) (McD 8742)
wittfeldii (H. Edwards, 1883)
wittfeldi (McDunnough, 1939), missp.

ALCATHOE H. Edwards, 1882
Alcalthoë Riley & Howard, 1891, missp.
Alcothoe Patch, 1908, missp.
2622 **carolinensis** Engelhardt, 1925 (McD 8686)
autumnalis.– auct. (not Engelhardt, 1946
2623 **caudata** (Harris, 1839) (McD 8685)
var. *walkeri* Neumoegen, 1894
race *annettella* Engelhardt, 1946

APPENDIX 2 Hostplant Index

ACER spp. (Aceraceae)
- *Synanthedon acerni* - 22
- *Synanthedon acerrubri* - 23

AMBROSIA spp. (Compositae)
- *Carmenta texana* - 10

AMELANCHIER spp. (Rosaceae)
- *Synanthedon exitiosa* - 29

ARTEMISIA spp. (Compositae)
- *Carmenta texana* - 10

BERCHEMIA spp. (Rhamnaceae)
- *Synanthedon scitula* - 39

BETULA spp. (Betulaceae)
- *Synanthedon scitula* - 39

CARYA spp. (Juglandaceae)
- *Synanthedon geliformis* - 31

CASTANEA spp. (Castanaceae)
- *Synanthedon castaneae* - 26
- *Synanthedon scitula* - 39

CASUARINA spp. (Casuarinaceae)
- *Synanthedon geliformis* - 31

CHIONANTHUS spp. (Oleaceae)
- *Podosesia syringae* - 20

CLEMATIS spp. (Ranunculaceae)
- *Alcathoe carolinensis* - 1
- *Alcathoe caudata* - 2

CORNUS spp. (Cornaceae)
- *Synanthedon geliformis* - 31
- *Synanthedon scitula* - 39

CORYLUS spp. (Betulaceae)
- *Synanthedon scitula* - 39

CRATAEGUS spp. (Rosaceae)
- *Synanthedon scitula* - 39

CUCURBITA spp. (Cucurbitaceae)
- *Melittia cucurbitae* - 12

CYDONIA OBLONGA (Rosaceae)
- *Synanthedon scitula* - 39

DIOSPYROS VIRGINIANA (Ebenaceae)
- *Sannina uroceriformis* - 21

EUPATORIUM spp. (Compositae)
- *Carmenta pyralidiformis* - 8
- *Carmenta texana* - 10

FAGUS spp. (Fagaceae)
- *Synanthedon scitula* - 39

FLAVERIA spp. (Compositae)
- *Carmenta texana* - 10

FOENICULUM spp. (Umbelliferae)
- *Carmenta texana* - 10

FRAXINUS spp. (Oleaceae)
- *Podosesia aureocincta* - 19
- *Podosesia syringae* - 20

?GALACTIA spp. (Leguminosae)
- *Osminia ruficornis* - 13

GAURA spp. (Onagraceae)
- *Euhagena emphytiformis* - 11

?GLEDITSIA AQUATICA (Leguminosae)
- *Synanthedon dominicki* - 28

GRINDELIA spp. (Compositae)
- *Carmenta texana* - 10

HELENIUM spp. (Compositae)
- *Carmenta ithacae* - 5

HELIOPSIS spp. (Compositae)
- *Carmenta ithacae* - 5

HIBISCUS spp. (Malvaceae)
- *Synanthedon geliformis* - 31

ILEX spp. (Aquifoliaceae)
- *Synanthedon alleri* - 24

LIATRIS spp. (Compositae)
- *Carmenta anthracipennis* - 3

LIGUSTRUM spp. (Oleaceae)
- *Podosesia syringae* - 20

MALUS spp. (Rosaceae)
- *Synanthedon exitiosa* - 29
- *Synanthedon pictipes* - 32
- *Synanthedon scitula* - 39

MELANTHERA (Compositae)
- *Carmenta texana* - 10

MYRICA spp. (Myricaceae)
- *Synanthedon scitula* - 39

NYSSA spp. (Nyssaceae)
- *Synanthedon rubrofascia* - 37

OLEA spp. (Oleaceae)
- *Podosesia syringae* - 20

PARTHENIUM spp. (Compositae)
- *Carmenta ithacae* - 5

PARTHENOCISSUS spp. (Vitaceae)
- *Synanthedon scepsiformis* - 41

PHYSOCARPUS spp. (Rosaceae)
- *Synanthedon scitula* - 39

PINUS spp. (Pinaceae)
- *Synanthedon scitula* - 39

POPULUS spp. (Slicaceae)
- *Paranthrene dollii* - 15
- *Paranthrene tabaniformis* - 17

PRUNUS spp. (Rosaceae)
- *Synanthedon exitiosa* - 29
- *Synanthedon pictipes* - 32
- *Synanthedon scitula* - 39

QUERCUS spp. (Fagaceae)
- *Paranthrene asilipennis* - 14
- *Paranthrene simulans* - 16
- *Synanthedon decipiens* - 27
- *Synanthedon geliformis* - 31
- *Synanthedon sapygaeformis* - 38
- *Synanthedon scitula* - 39

RIBES spp. (Saxifragaceae)
- *Alcathoe caudata* - 2

RUBUS spp. (Rosaceae)
- *Pennisetia marginata* - 18

SALIX spp. (Salicaceae)
- *Paranthrene dollii* - 15

Paranthrene tabaniformis - 17
Synanthedon proxima - 33
Synanthedon scitula - 39
SOLANUM CAROLINENSE (Solanaceae)
Synanthedon rileyana - 36
SORBUS spp. (Rosaceae)
Synanthedon scitula - 39
SYRINGA spp. (Oleaceae)
Podosesia syringae - 20
ULMUS spp. (Ulmaceae)
Synanthedon geliformis - 31
VERNONIA spp. (Compositae)
Carmenta bassiformis - 4
VIBURNUM spp. (Caprifoliaceae)
Synanthedon fatifera - 30
VITIS spp. (Vitaceae)
Synanthedon polistiformis - 40
Synanthedon scepsiformis - 41
WISTERIA spp. (Leguminosae)
Synanthedon scitula - 39
UNKNOWN
Carmenta laurelae - 6
Carmenta odda - 7
Carmenta suffusata - 9
Osminia ruficornis - 13
Synanthedon arkansasensis - 25
Synanthedon dominicki - 28
Synanthedon refulgens - 34
Synanthedon richardsi - 35

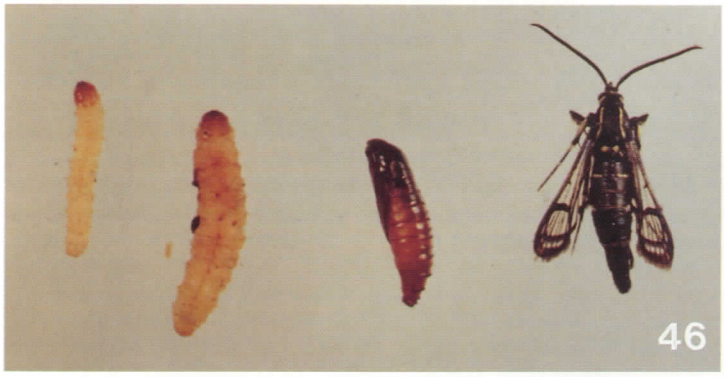

Fig. 46-48. Biology and collecting techniques for sesiids: 46. Development stages of *Synanthedon pictipes*; 47. Pupal shell protruded after emergence of an adult *S. pictipes*; 48. Trap used for pheromone monitoring of clearwing moths.

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