TWO NEW SPECIES OF CLEARWING MOTHS (SESIIDAE) FROM EASTERN NORTH AMERICA CLARIFIED BY SEX PHEROMONES

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Recently, J. H. Tumlinson and colleagues (1974) and Yonce et al. (1974) identified chemical compounds from females of *Sanninoidea exitiosa* (Say) (peachtree borer) and *Synanthedon pictipes* (Grote & Robinson) (lesser peachtree borer), which may prove to be major components of the female sex pheromone systems of the Sesiidae as a whole. Males of the peachtree borer respond to a mixture containing mostly the Z,Z isomer of 3,13-octadecadien-1-ol acetate (Z,Z ODDA), while responses of the lesser peachtree borer males are inhibited by the presence of even small quantities of the above isomer (Karandinos et al., 1977). The E,Z isomer of ODDA is the major sex attractant for males of the lesser peachtree borer.

Since the initial isolation of the two pheromones, studies have been, and are continuing to be, conducted utilizing the geometric isomers of ODDA singly and in various combinations in traps in a variety of environments, mostly in Florida, Georgia, South Carolina, Ohio, Wisconsin, Washington and California. Cross attraction of different species to individual isomers or combinations has been demonstrated (Nielson & Balderston, 1973; Nielson et al., 1977; Karandinos et al., 1976). Most of the accumulated data on cross attractancy is still unpublished, but in summary, about 30% (42 species to date) of the known North American sesiid fauna north of Mexico, representing the full phylogenetic range of the family, have been captured in traps baited with the pheromones. In addition, a number of sesiid species have been captured using the pheromones in such widely differing areas as Mexico, Brazil, Costa Rica, Japan and Portugal (specific data as yet unpublished).

While the major impetus for research in sesiid pheromone identification and field screening has been the development of control measures for pest species, it is becoming increasingly apparent that a valuable new tool for improving our general understanding of sesiid biology and evolution has been discovered. There are significant gaps in our knowledge of sesiids, particularly in regard to distribution of species, relative abundance, seasonal periodicity, species diversity, etc., primarily due to

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the diurnal flight period and fugitive behavior of the adults, coupled with the endophagous boring habit of the larvae. Through the use of pheromones for field sampling of adult males it is now possible to more readily detect the presence of sesiids in a given habitat and greatly enhance the investigation of life cycles, behavior, and related phenomena.

In addition to the obvious benefits afforded by the use of sesiid sex pheromones for sampling purposes, it is important not to overlook the fundamental nature of pheromone systems in the evolution of the group. Clearwing moths are remarkably homogeneous structurally (Duckworth & Eichlin, 1974) and distinguishing closely related species is frequently difficult. Also, as our knowledge of distributions improves, many species previously thought to be allopatric are proving to be at least partially overlapping in their ranges. In instances where closely related species occur sympatrically, chemical compatibility may play a critical role in achieving reproductive isolation. For example, two very closely related sesiid species which attack *Viburnum*, *Synanthedon viburni* Engelhardt and *S. fatifera* Hodges, occur sympatrically in Wisconsin. Recent investigations (Karandinos, per. com.; Roelofs & Comeau, 1969) suggest that reproductive isolation is achieved, at least in part, by each species utilizing a different isomeric pheromone system. This phenomenon for isolation is probably also operative in areas of probable sympatry (i.e., Georgia and South Carolina) of *Synanthedon kathyae* n. sp. and the closely related species *S. alleri* (Engelhardt) which are discussed later in this paper. While it is overly simplistic to assume that pheromone systems alone have determined reproductive isolation in sesiid populations, it seems reasonable to assume that they are of increased importance in sympatric species where habitat preference, circadian and seasonal cycles, geographic distribution and other isolating mechanisms are less effective.

Biological studies on various sesiid species have been initiated as a result of information initially gained through field testing of sesiid sex pheromones. These studies are also contributing to our understanding of the systematics of sesiids. For example, Nielsen & Purrington (1975) present data on flight periods of *Podosesia syringae* (Harris) in Ohio which suggests the existence of a previously undescribed, sympatric species of *Podosesia* which is temporally isolated from *P. syringae* but virtually indistinguishable structurally. Similarly, pheromone studies in South Carolina by R. L. Holloway, Clemson University, have uncovered the presence of a previously unknown species and helped to clarify the status of another undescribed species, both of which are described in this paper.

As was the case in previous publications by the authors (Duckworth & Eichlin, 1973 and 1976), the following descriptions result from con-

tinuing revisionary studies on the Western Hemisphere Sesiidae and preparations for a fascicle on the Sesiidae for publication in *The Moths of America North of Mexico.*

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Genus *Synanthedon* Hübner

Synanthedon kathyae Duckworth & Eichlin, **n. sp.**

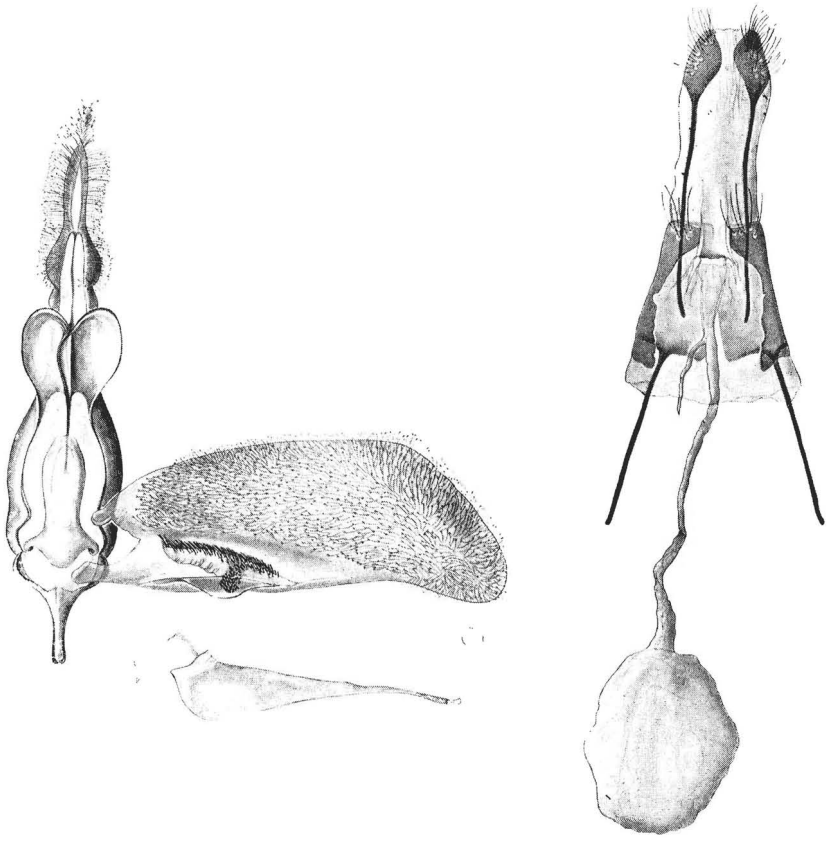
Male: Antenna blue-black, clavate, tufted with scales apically, ciliate ventrally. Proboscis well-developed. Labial palpus smooth, yellow. Head with vertex blue-black, front blue-black, white lateroventrally, occipital fringe yellow. Thorax blue-black, with subdorsal yellow stripes, and mostly yellow laterally beneath wings. Abdomen blue-black, dorsally with segments four and five yellow, ventrally yellow except segments two and three blue-black, anal tuft elongate, blue-black. Prothoracic leg mostly yellow, some blue-black often medially on coxa; mesothoracic leg blue-black, tarsi yellow; metathoracic leg with femur blue-black, tibia yellow with blue-black at base and on apical one-third, tarsi yellow. Forewing mostly hyaline, with very narrow margins, veins and discal spot blue-black, lightly powdered yellow on costal and anal margins dorsally, ventrally more strongly powdered yellow on margins and between veins apically. Hindwing hyaline, with narrow blue-black margins, costa yellow, fringe blue-black, becoming yellow at wing base. Male genitalia as in Fig. 1, typical of species placed in the genus *Thamnosphecia* (= *Synanthedon*) Spuler by Engelhardt (1946). Wing length of both sexes, 8–11 mm.

Female: Antenna as for male but lacking ventral cilia. Scale patterns like the male, with slightly broader apical margin on forewing and anal tuft brush-like. Female genitalia as in Fig. 2.

Host: Unknown.

Distribution: Halifax, Nova Scotia; Lewisboro, Westchester Co. and Long Island, New York; and near Oconee State Park, Oconee Co., South Carolina.

Types: Holotype: ♂, Halifax, Nova Scotia, summer 1965, J. A. Godbout, Genitalia Slide ♂, by T. D. Eichlin, USNM 76020, deposited in Nova Scotia Museum, Halifax. Paratypes 5: 1 ♀ with same data as holotype, Genitalia Slide ♀, by T. D. Eichlin, USNM 76036, in Nova Scotia Museum, Halifax; 1 ♀, Babylon, L.I., N.Y., 17.VII.37,



Figs. 1–2. Ventral view, genitalia of *Synanthedon kathyae*: (1, left) male (left valve removed); (2, right) female.

F. S. Blanton, Cornell University; 1 ♀, N.Y., Lewisboro, Westchester Co., 24-VII-1971, M. & T. M. Favreau, Genitalia Slide By M. R. Papp, CDA 225, in AMNH; 2 ♂, Oconee County, SC, ZZ ODDA Pheromone, Date: 25-VI-76, R. L. Holloway Coll., one specimen labeled, Genitalia Slide By M. R. Papp, CDA 221, in NMNH.

Discussion: On the basis of similar male genitalia, this species is closely related to *Thamnosphecia alleri* Engelhardt. The latter is known from Georgia, Florida, Alabama and Mississippi and differs from *Synanthedon kathyae* by having the forewings mostly opaque and the yellow markings replaced with orange.

R. L. Holloway captured two specimens of *S. kathyae* in South Carolina in traps baited with Z,Z ODDA. By contrast, both J. L. Sharp in Florida and C. E. Yonce in Georgia have been collecting *Thamnosphecia alleri* in nearly all months of the year (57 captures in 1975–76) using the E,Z isomer only.

Nothing is known of the biology of *kathyae* or *alleri*; Engelhardt (1946) believed the habitat of *alleri* to be open woodlands bordering on swamps.

This species is known only from the six specimens of the type series. It is named for Kathy Eichlin, who plays a continuing supportive role in all of the sesiid studies.

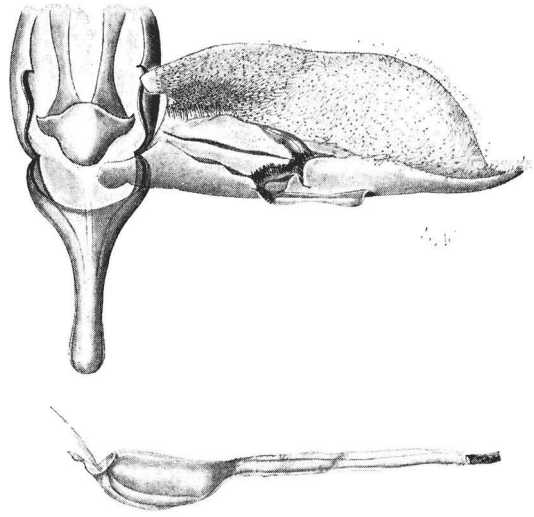


Fig. 3. Ventral view, male genitalia (left valve and tegumen-uncus complex removed) of *Carmenta odda*.

Genus *Carmenta* Edwards

Carmenta odda Duckworth & Eichlin, **n. sp.**

Male: Antenna clavate, tufted with scales apically, ciliate ventrally, brown-black and with yellow dorsally. Proboscis well-developed. Labial palpus yellow dorsally. Head with vertex brown-black, mixed with yellow anteriorly, front rubbed on type, probably brown-black with white laterally, occipital fringe yellow, rubbed dorsally. Thorax brown-black, yellow subdorsal stripes, yellow beneath wings and on metathorax dorsally. Abdomen brown-black, dorsally with all segments narrowly banded posteriorly with yellow except third, fourth with widest band, ventrally with segments one and two solid pale yellow, four banded yellow, others with some yellow on posterior margin, anal tuft rubbed off. Legs missing from this specimen except forecoxae which are brown-black with yellow on lateral one-half. Forewing mostly hyaline but opaque costal margin spreading apically to cover area to below M_1 at wing margin, basal one-half with wing powdered orange on veins and margins, outer one-half of discal spot yellow-orange, yellow-orange more extensive ventrally but apparently not powdered in apical area. Hindwing hyaline, very narrow margins, some yellow powdering on costa. Male genitalia as in Fig. 3. Wing length, 9 mm.

Host: Unknown.

Distribution: Trenton, Edgefield Co., South Carolina.

Holotype: ♂, Edgefield Co., SC., VI-11-1975, Coll. R. L. Holloway, ZZ pheromone, Genitalia Slide By T. D. Eichlin, CDA 179, (U.S.N.M. No. 73592); in NMNH.

Discussion: This species is described from a male specimen taken in a pheromone trap coated with a sticky adhesive which resulted in the poor condition. However, this capture represents the first new species in the U.S. to be discovered by the use of the sesiid pheromone, Z,Z 3,13-octadecadien-1-ol acetate and is named after this useful survey tool.

Carmenta odda superficially resembles *Ramosia arizonae* (Beutenmüller), *Synanthedon arkansasensis* Duckworth & Eichlin, and *S. refulgens* (Edwards) (see Duck-

worth & Eichlin, 1973: Engelhardt, 1946), but the structure of the saccular ridge on the valva of *C. odda* is unlike any known species of Sesiidae in North America.

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