# Insects of American Chestnut: Possible Importance and Conservation Concern

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ABSTRACT.— Literature and field surveys of Lepidoptera (moths) which feed on *Castanea* spp. in North America reveal that in North America at least 60 species have been recorded to feed on *Castanea* spp., with seven species reported as feeding only on *C. dentata.* Some of these insects may now be extinct. Trunk feeders, such as *Synanthedon castaneae* (Sesiidae), are potential dispersal agents of the *Endothia* hypovirulent strain. Other insects, notably wood-boring beetles (Cerambycidae) and solitary bees (Apoidea) are attracted to the fragrant white flowers where they feed on pollen. It is possible *Castanea* species are at least partially reliant upon insects as pollinators.

## AMERICAN CHESTNUT INSECT COMMUNITY

*Species richness.* Trees of the family Fagaceae are well known for the numbers and kinds of insects they support. Tree parts such as leaves, flowers, fruit, bark, twigs, stems and roots, are utilized by some group of insects for food, shelter, or mating site.

A single oak species has been reported as host to 284 herbivorous insects alone ( Southwood, 1961), and the total of all insect species, including predators and parasitoids, would be much greater. No comprehensive insect lists or intensive samplings were made for American chestnut trees before or after chestnut blight destruction, but it may he assumed that the richness of its insect community rivalled that of many oaks.

*Guilds.* Each group of insects which feeds on a given host part in a similar way may be termed a "guild" (Opler, 1974 ). For example, leaf-feeding insects might be divided into chewing, sucking, skeletonizing, leaf-mining, and gall-forming guilds.

*Host specificity.* Every insect has a range of hosts it will feed on in nature, although some may be preferred over others. Insects which feed on but one or two closely related hosts are "monophagous," those which feed on only a few plants with one or rarely a few families are "oligophagous," while those which feed on a wide variety of unrelated plants are "polyphagous." The insects which feed only on *Castanea* are here interpreted as monophagous. Of the Lepidoptera listed in Table 1, 13 (21.7 percent) are monophagous. Species which feed on Fagaceae of more than one genus (rarely a plant in another family) are oligophagous. Eighteen (30 percent) chestnut moths fall into this category (Table 1). The remaining 29 (48.3 percent) chestnut moths are more properly termed polyphagous, although most feed on plants of relatively few families.

The order in which the species are listed in Table 1 generally follows a sequence of primitive to advanced, and also follows a general sequence from smaller to larger species. It is clear that the degree of host specificity is greatest for small, primitive moths and is least for larger, advanced moths.

## SURVIVAL STATUS OF AMERICAN CHESTNUT MOTHS

In considering the survival status of American chestnut moths, I have followed several approaches. Generally, one would expect those species which feed ( or fed) only on *Castanea dentata* (Marsh. ) Borkh. and which rely ( or relied) on some resource or aspect best provided by larger trees to be in the greatest jeopardy. The literature review summa-

rized by Table 1 concerned the first situation. Secondly, an intensive survey of Fairfax County, Virginia, populations of C. *dentata, C. pumila* (L.) Mill., and C. *crenata* Sieb. & Zucc. was conducted during 1976 and 1977, especially for the primitive leaf-mining moths (Eriocraniidae, Nepticulidae, Gracillariidae, Tischeriidae). It was discovered that most miners found on *C. dentata* also fed on *C. pumila* and *C. crenata,* thus, most of these moths recorded in the literature as eating only *C. dentata,* in fact feed on other *Castanea,* so their continued existence is assured as long as some *Castanea* species and populations persist. Some moths, however, may not feed on *Castanea* other than *C. dentata,* and their present existence and survival is uncertain. Those seven species (12 percent) are noted by an asterisk in Table 1. In order to properly assess the present status of those species an intensive survey of C. *dentata* and other *Castanea* would be required.

## INSECTS AS CHESTNUT "BENEFICIALS"

*Dissemination of hypo virulent strains.* It is barely possible that some host-specific ( monophagous) chestnut insect might be useful in spreading hyphae or ascospores of hypovirulent *Endothia parasitica* (Murr.) P. J. and H. W. And. strains. Candidates for such an agent would be best sought among wood-feeding families. Among the lepidoptera surveyed *Synanthedon castaneae* (Busck ) is the most obvious candidate, although this moth may now be extinct (Duckworth and Eichlin, pers. comm.), having been last collected in 1936 ( South Carolina). Other insect families which could include suitable candidates lie within the Coleoptera (beetles) and include the Buprestidae, Cerambycidae and Scolytidae. Upon finding one or more potential insect disseminators, culture could be maintained on artificial media. Most candidates may be expected to have but a single annual generation under natural conditions, so that their diapause (physiological arrest) would need to be broken so as to provide "livestock" for continual experimentation.

*Pollination.* Chestnuts have fragrant, white flowers and are extremely attractive to pollen-collecting or pollen-eating insects. It is possible that such insects at least increase the seed set of trees they visit, and might actually be required as pollinators. In any event, the presence of local insect populations may be important to the maintenance of stable chestnut reproduction.

*The visible shield.* American chestnut populations in their pre-blight condition had an extensive native insect community, co-evolved with their host through countless eons, yet continually changing and adjusting through time. The presence of such communities may act, through competition, as a deterrent to colonization of trees by other insects poorly adapted to chestnuts. Such cases might lead to widely fluctuating levels of defoliation which might be more serious in reducing host fitness than that resulting from the presence of a native or harmonious insect community.

### LITERATURE CITED


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Southwood, T. R. E.
1961. THE NUMBER OF SPECIES OF INSECTS ASSOCIATED WITH VARIOUS TREES. J. An. Ecol. 30:1-8.


**Table 1**
Status of Lepidoptera Known to Feed on *Castanea dentata* (Preliminary Compilation).
* Possibly extinct, X preferred host, ** questionable record

| Species | Family | Host Range | | | |
|---|---|---|---|---|---|
| | | *C. dentata* | other *Castanea* spp. | other Fagaceae | Wide Host Range |
| Dyseriocrania auricyanea | Eriocraniidae | X | X | X | |
| *Ectodemia castaneae | Nepticulidae | X | | | |
| *Ectodemia phleophaga | Nepticulidae | X | | | |
| Nepticula castaneaefoliella | Nepticulidae | X | X | | |
| Nepticula latifasciella | Nepticulidae | X | X | | |
| Nepticula saginella | Nepticulidae | X | X | | |
| Bucculatrix packardella | Lyonetiidae | X | X | X | |
| Cameraria castaneaella | Gracillariidae | X | X | X | |
| Lithocolletis kearfottella | Gracillariidae | X | X | | |
| Tischeria castaneaella | Tischeriidae | X? | ? | X | |
| Tischeria citripennella | Tischeriidae | X | ? | X | |
| Tischeria fuscomarginnella | Tischeriidae | X | ? | X | |
| *Tischeria perplexa | Tischeriidae | X | ? | | |
| Tischeria quercitella | Tischeriidae | X | ? | X | |
| Tischeria zelleriella | Tischeriidae | X | ? | X | |

**Table 1** *(Continued)*

| Species | Family | Host Range | | | | |
|---|---|---|---|---|---|---|
| | | *C. dentata* | other *Castanea* spp. | other Fagaceae | Wide Host Ran | |
| Psilocorsis quercicella | Oecophoridae | X | | X | | |
| Psilocorsis obsoletella | Oecophoridae | X | | X | | |
| Machima tenteriferella | Oecophoridae | X | | X | X | |
| *Coleophora leucochrysella | Coleophoridae | X | | | | |
| *Argyresthia castaneela | Argyresthiidae | X | | | | |
| *Swammerdamia castaneae | Yponomeutidae | X | | | | |
| *Synanthedon castaneae | Sesiidae | X | | | | |
| Paranthrene simulans | Sesiidae | X | ? | X | | |
| Thamnosphecia scitula | Sesiidae | X | | X | X | |
| Proteoteras spp. | Tortricidae | X | ? | ? | ? | |
| Pandemis limitata | Tortricidae | X | ? | X | X | |
| Anchylopera fuscocilliana | Olethreutidae | X | | | X (elm) | |
| Exentera spoliana | Olethreutidae | X | X | | X (1 red maple) | |
| Melissopus latifereanus | Olethreutidae | X | | X | X | |
| Anisota virginiensis | Saturniidae | X | ? | X | X *(Corylus)* | |
| Anisota stigma | Saturniidae | ? | X | X | ? *(? Corylus)* | |
| Eacles imperialis | Saturniidae | X | | X | X | |
| Antheraea polyphemus | Saturniidae | X | | X | X | |
| Actias luna | Saturniidae | X | | X | X | |
| Prionxystus robiniae | Cossidae | X | | X | X *(esp. Robinia)* | |
| Datana contracta | Notodontidae | X | | X | X | |
| Datana ministra | Notodontidae | X | | X | X (esp. Rosaceae | |
| Schizura concinna | Notodontidae | X | | X | X | |
| Prolimacodes badia | Limacodidae | X | X | X | X | |
| Packardia elegans | Limacodidae | X | | X | | |
| Phobetron pithecium | Limacodidae | X | X | | | |
| Thyridopteryx ephemeraeformis | Psychidae | X | X | X | X | |
| **Astala confederata | Psychidae | X | | X | X | |
| Alsophila pometaria | Geometridae | X | | X | X | |
| Palaecrita vernata | Geometridae | X | | X | X (esp. *Malus*) | |
| Diacrisia virginica | Arctiidae | X | | X | X (esp. *Salix*) | |
| Dasychira dorsipennata | Geometridae | X | | X | X (*Corylus*) | |
| Plagodis alcoolaria | Geometridae | X | | X | | |
| Sabulodes crocallata | Geometridae | X | | | X | |
| Amphipyra pyramidoides | Noctuidae | X | | | X (esp. *Tilia*) | |
| Apatela lithospila | Noctuidae | X | | X | X (*Carya*) | |
| Apatela inclara | Noctuidae | X | | X | X *(Betula)* | |
| Acronycta americana | Noctuidae | X | ? | X | X | |
| Dichocrocis punctiferalis | Pyralidae | X | ? | X | X | |
| Anisota senatoria | Saturniidae | X | ? | X | | |
| Hemimene juliana | Olethreutidae | X | ? | X | ? | |

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