A New Species of *Harmandia* (Diptera: Cecidomyiidae) Damaging Leaves of Allegheny Chinkapin in Eastern United States and a Redescription of the Genus[1]

Raymond J. Gagné and Jerry A. Payne[2]

Systematic Entomology Laboratory, PSI, USDA-ARS
c/o U. S. National Museum NHB 168
Washington, DC 20560

J. Entomol. Sci. 27(4):383-391 (October 1992)

ABSTRACT A new species of gall midge, *Harmandia amisae* (Diptera: Cecidomyiidae), is described and illustrated. It infests leaves of Allegheny chinkapin, *Castanea pumila* (L.) Mill. (Fagaceae), in eastern North America. The genus *Harmandia* is redescribed and distinguished from *Macrodiplosis*, a genus restricted to oaks. The American species formerly and currently placed in *Harmandia* are reviewed. *"Cecidomyia" castaneae* Stebbins is newly combined with *Harmandia*. *Harmandia reflexa* (Felt) is considered a junior synonym of *Harmandia hudsoni* (Felt). The new species is distinguished from its other American congeners on *Populus* and *Castanea*.

KEY WORDS *Harmandia,* Cecidomyiidae, Chinkapin, *Harmandia amisae, Harmandia reflexa, Harmandia hudsoni.*

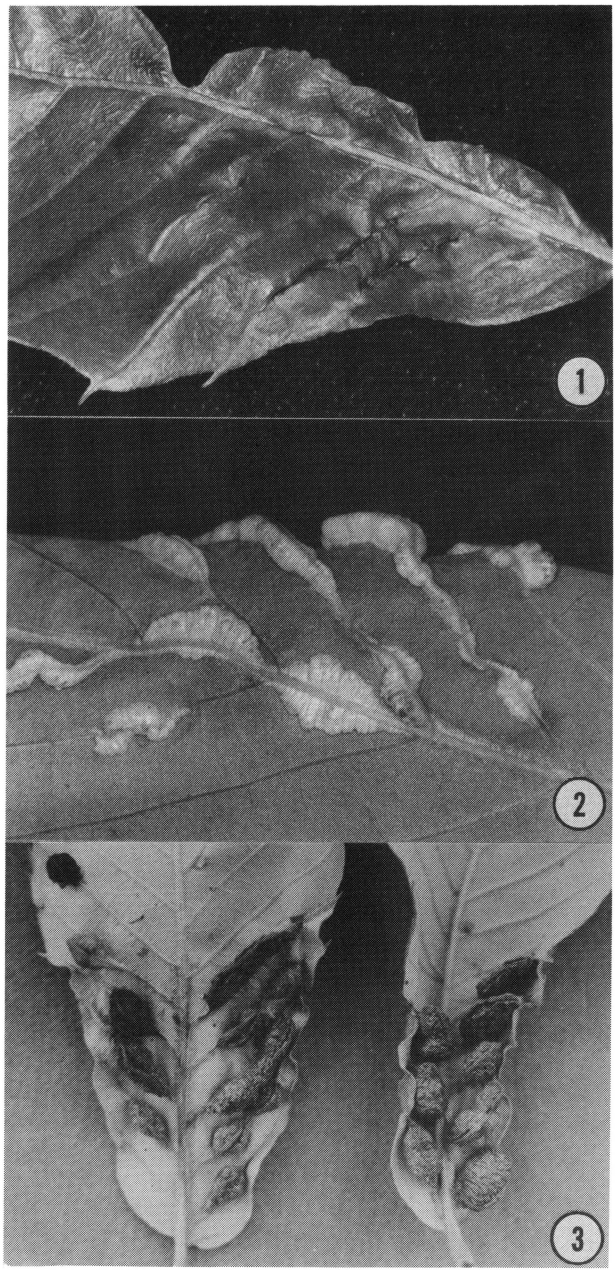
Allegheny chinkapin, *Castanea pumila* (L.) Mill. (Fagaceae), is a shrub or small tree found in dry sandy woods and thickets from southern New Jersey and Pennsylvania to Indiana and Missouri, south to Florida and Texas. The common name is also spelled "chinquapin," and the plant is sometimes called dwarf or bush chestnut. The Allegheny chinkapin is known for its sweet, edible nuts. It is a source of wood for charcoal, fence posts, and railroad ties and food for wildlife (Payne et al. 1982; Porcher 1970).

A gall midge (Diptera: Cecidomyiidae) causes tight, swollen folds along the major leaf veins of chinkapin in Georgia and Maryland. These galls (Figs. 1-3) are present as early as late March in central Georgia (Peach County) after the leaves have fully expanded. One to several larvae are present in a single fold. In late April to mid May the white, full-grown larvae leave the galls through a slit on the upper surface of the leaves. They burrow into the soil where they remain until next spring. Heavily infested leaves, those with six to eight galls (Fig. 3) rapidly deteriorate after the larvae exit. Severely infested leaves drop prematurely, especially if the galls are at the base of the leaves near the petioles. Larvae remain in the soil through the winter and pupate the following spring. There is one generation per year.

The gall is formed by a new species of *Harmandia*. This is a Holarctic genus of the tribe Cecidomyiini previously associated only with blister or hemispherical leaf galls of *Populus* spp. (Salicaceae) (Gagné 1989). We enlarge

[1] Accepted for publication 13 August 1992.

[1] Southeastern Fruit and Tree Nut Research Laboratory USDA-ARS, P.O. Box 87, Byron, GA 31008.



Figs. 1-3. Leaf galls of *Harmandia amisae* on chinkapin. 1, Leaf from above showing folds along veins. 2, Leaf from below. 3, Leaves from below with severe infestations, typical of leaves that drop prematurely after larvae exit.

the definition of *Harmandia* to include the new species and *"Cecidomyia" castaneae* Stebbins, which also forms galls on *Castanea.* Gagné (1989) recently placed *"C." castaneae,* known only from galls, in *Macrodiplosis* based on the resemblance of larvae of the new species to those of *Macrodiplosis.* This seemed reasonable at the time because chestnuts and oaks are both Fagaceae. But in 1990, when we succeeded in rearing adults of the new species, it was clear from adult morphology that the new species belonged to *Harmandia*. We place *"C." castaneae* in *Harmandia* also, based on host evidence.

Methods

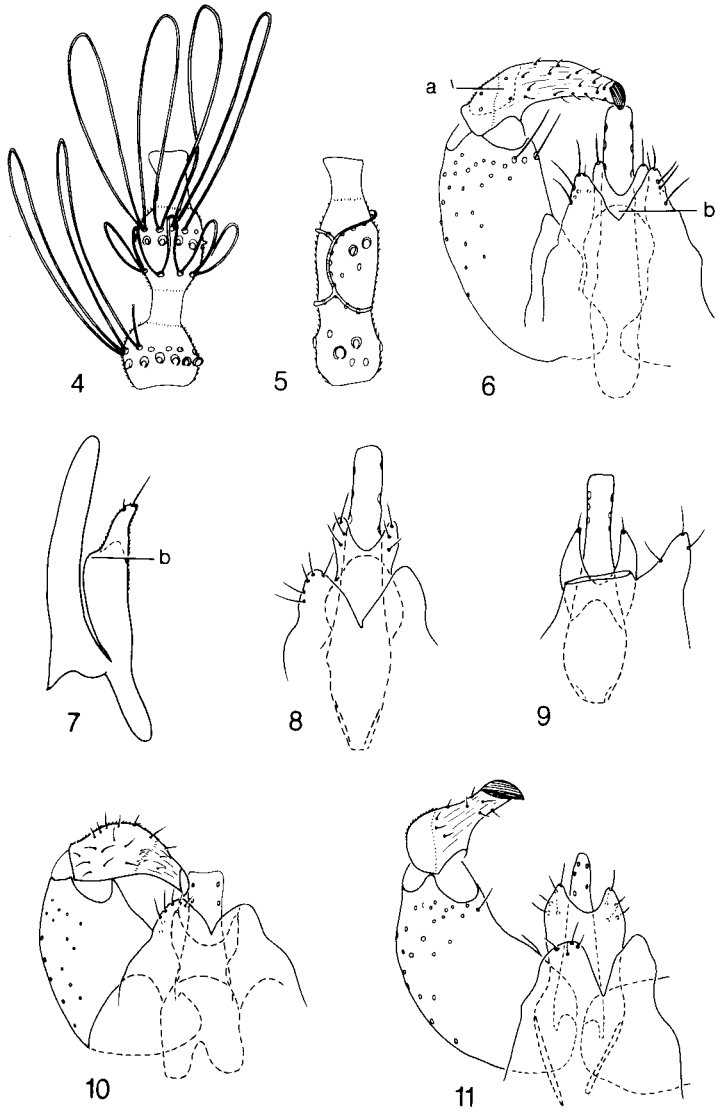
Infested chinkapin leaves with apparently mature larvae were collected on April 30, 1989, and placed in pots filled with damp peat moss kept moistened by periodic watering. After the larvae left the galls and entered the peat, the pots were placed in a covered cardboard shoebox. A 5-dram, lipped, glass vial was inserted in one end of the box to attract emerging adults to the light (Gagné 1989). No adults emerged during the remainder of 1989, so the pots were removed from the cardboard shoebox and placed in an outdoor coldframe for the winter. They were replaced in a new covered shoebox early in the following spring. Adults emerged soon after and congregated in the glass vial. All specimens were killed and stored in 70% ethanol. Some larvae and adults were mounted for microscopic study in Canada balsam using the method outlined in Gagné (1989). All specimens of the new species are in the National Museum of Natural History, Washington, DC. In the descriptions that follow, anatomical terminology of the adult stage follows usage in McAlpine et al. (1981) and that of the larval stage follows that in Gagné (1989). The new species is to be attributed to Gagné.

Redescription of *Harmandia* Kieffer (1896)

Adult. – Head: Eyes 6-12 facets long at vertex, connate; facets circular to nearly hexagonal, either equally adjacent or slightly farther apart on lateral part of eye. Vertex of occiput rounded, without dorsal protuberance. Frons with 4-6 setae. Labella short, bilaterally flattened, pointed apically, each with 4-6 lateral setae. Palpus 4 segmented. Male antennal flagellomeres (Fig. 4) binodal with internode and neck shorter than preceding node, tricircumfilar, loops of the first and third circumfila long, those of the second short, their bases in a horizontal row. Female flagellomeres (Fig. 5) with appressed circumfila.

Thorax: Scutum with 2 lateral and 2 dorsocentral rows of setae. Scutellum with a group of setae on each side. Mesanepisternum extensively covered with scales. Mesepimeron with 10-20 setae. Wing with R_5 curved apically to join C posterior to wing apex, C broken at juncture with R_5, Sc not evident beyond basal third, Rs weak, situated slightly less than midway between arculus and apex of R_1, M_{3+4} evident. Claws toothed or untoothed, as long as empodia (Figs. 14-15).

Male abdomen (Figs. 6-10): First through sixth tergites entire, rectangular, with single, uninterrupted, posterior row of setae, as many as 10 lateral setae on each side near midlength, and pair of trichoid sensilla on anterior margin; seventh tergite unsclerotized mesocaudally, caudal setal row present only at



Figs. 4-11. *Harmandia amisae.* 4, Male third flagellomere (circumfila only partly drawn). 5, Female third flagellomere. 6, Male genitalia (dorsal). 7, Aedeagus and hypoproct (lateral). Fig. 8. *H. hudsoni,* cerci, hypoproct and aedeagus (dorsal). Fig. 9. *H. helena,* same as fig. 8 (part of one cercus removed). Fig. 10. *H. reginae,* male genitalia (dorsal). Fig. 11. *Macrodiplosis* sp., probably *erubescens* (Osten Sacken), male genitalia (dorsal). The letter **a** indicates the area on the gonostyli enclosed by dashes that is more darkly pigmented than the remainder; the letter **b** indicates the ventral prominence of the hypoproct.

lateral corners; eighth tergite not sclerotized on posterior half, without setae other than anterior pair of trichoid sensilla; pleura without scales; second through seventh sternites rectangular, with double posterior row of setae and many scattered scales; eighth sternite as for seventh except not sclerotized on anterior half. Cerci broadly rounded or triangular, with several setae along posterior margin; hypoproct with ventral prominence at midlength and divided caudally into 2 long, narrow lobes; aedeagus elongate, parallel sided, blunt tipped, with several sensilla; gonocoxites stout, unlobed; gonostyli robust, narrowing gradually from base to apex, variably setulose, striated at least at apex, and basally with or without a dark-pigmented area.

Female abdomen (Figs. 12-13): First through sixth tergites and second through seventh sternites generally as for male, but setae more numerous; seventh tergite similar to sixth; eighth tergite sclerotized only anterolaterally, with scattered setae posteriorly. Ovipositor protrusible, attenuate, about twice length of seventh tergite; cerci elongate-ovoid, completely setulose and covered with setae, each with pair of more elongate sensory setae apically; hypoproct short, undivided.

Third instar – Integument rugose to spiculose. Spatula (Fig. 17) clove shaped. All papillae basic for supertribe present (Gagné 1989); terminal papillae (Figs. 16, 18) with setae as follows: lateral and mesal pairs with short, variable setae; remaining pair corniform and recurved.

Remarks. This description is based on the available specimens of four of the five American species we now include in the genus, the descriptions of Kieffer (1913), Rübsaamen and Hedicke (1926-1939), and Möhn (1955), and drawings of the European *Harmandia globuli* (Rübsaamen) made for us through the kindness of K. M. Harris from specimens in The Natural History Museum [formerly British Museum (Natural History)], London. Characters that distinguish *Harmandia* and that we consider shared and derived are the unequal loops of the male circumfila (Fig. 4), the shape of the male hypoproct with its elongate, narrow lobes and ventral prominence at midlength (Fig. 7), and the long, parallel-sided and blunt-tipped aedeagus (Figs. 8-10). The tarsal claws are simple or toothed; both states appear in many genera of the supertribe Cecidomyiidi, so that is not unusual. The five European *Harmandia* species (Skuhravá, 1986), all reared from leaf galls of *Populus* spp., have toothed claws, as has the one American species reared from *Populus*. *Harmandia* is closely similar to *Macrodiplosis*. The two genera have similarly shaped tarsal claws, although they are always simple in *Macrodiplosis*. Both genera lack a dorsal prominence behind the eyes and have an elongate ovipositor with discrete cerci and generally similar male genitalia and larvae. *Macrodiplosis* is distinct from *Harmandia* in having male circumfilar loops of similar length, shorter, more abruptly tapered gonostyli (Fig. 11), a more tapered aedeagus, and no ventral prominence on the hypoproct.

Besides the new species, four other North American species now belong to *Harmandia*. These are:

castaneae Stebbins 1910: 17 (*Cecidomyia*); from leaf galls of American chestnut, *Castanea dentata* (Marsh) Borkh., Springfield, Massachusetts, USA; NEW COMBINATION.

helena Felt 1912: 245 (*Dicrodiplosis*); from leaf galls of aspen, *Populus tremuloides* Michx., Magnolia, Massachusetts, USA.

hudsoni Felt 1907: 39 (*Cecidomyia*); caught on red cedar, Poughkeepsie, New York, USA.

reflexa Felt 1913: 146 (*Itonida*); no host reported, Hampton, New Hampshire; NEW JUNIOR SYNONYM of *hudsoni.*

reginae Felt 1921: 196 (*Itonida*); no host reported, Northwest Territories, Canada.

Harmandia amisae Gagné, new species

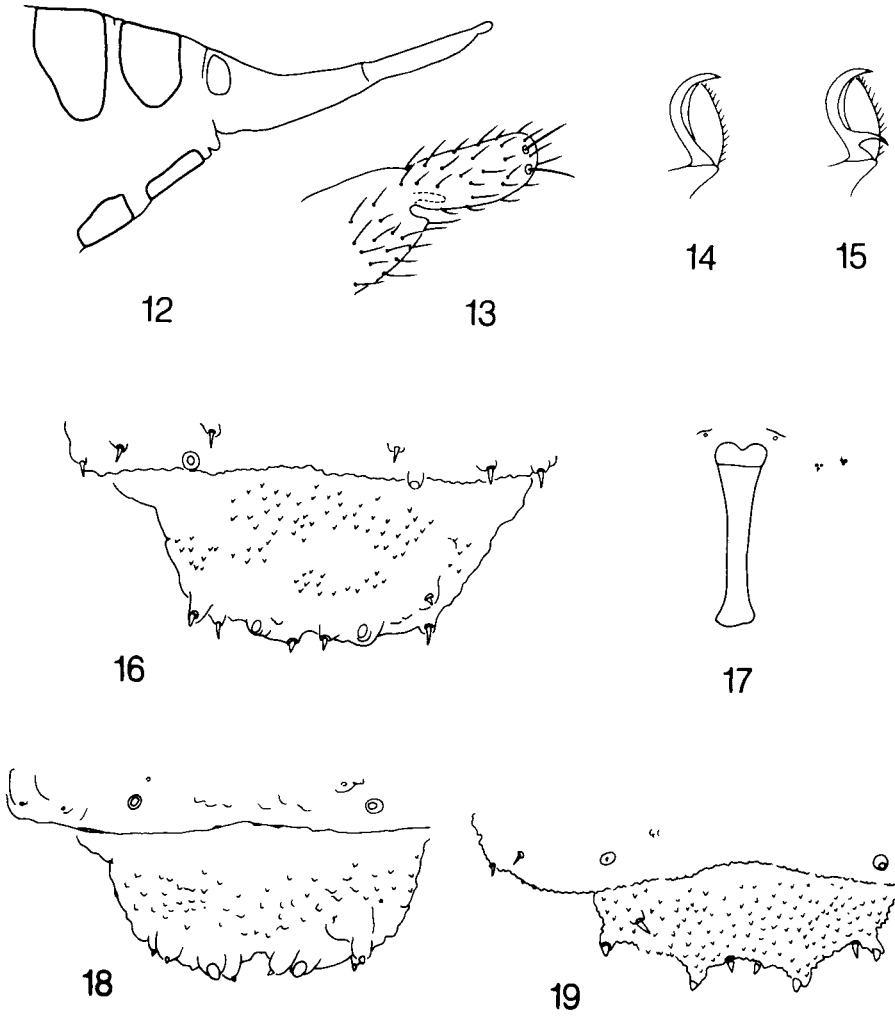
Adult. – Wing length, 2.5 - 3.5 mm. Male third flagellomere as in Fig. 4; female third flagellomere as in Fig. 5. Tarsal claws simple, empodia as long as claws (Fig. 14). Male genitalia (Figs. 6-7): cerci triangular; hypoproct barely widened beyond the ventral prominence at midlength, the caudal lobes each with a terminal seta and occasionally 1 or 2, more anterior, weak setae; gonostyli setulose only at base, striated beyond setulae to apex, and strongly pigmented basally. Female postabdomen as in Fig. 12, cerci as in Fig. 13.

Third instar. – Spatula and associated papillae as in Fig. 17. Eighth and terminal segments as in Fig. 16.

Holotype. – Male, collected as larva from *Castanea pumila* leaf galls, 30-IV-1989, Byron, Peach Co., Georgia, J. A. Payne, emerged IV-1990, deposited in the National Museum of Natural History, Washington, DC. Paratypes: 14 males, 17 females, same data as holotype, and 4 larvae, same essential data as holotype, except collected 17-V-1970. Other material examined: galls on *C. pumila,* 20-V-1985, Wheaton Park, Montgomery Co., Maryland, R. J. Gagné.

Etymology. – The name of this species honors Ann Amis, Entomologist, Southeastern Fruit and Tree Nut Research Laboratory, Byron, GA in grateful recognition of her interest and help in the study of fruit and nut insects.

Discussion. – We expect that the new species will be congeneric with *H. castaneae.* We have seen no specimens of *H. castaneae* and know of none. The species is based solely on a leaf gall of American chestnut. It may seem odd to some readers that a name is based on a gall, but such names are valid if described before 1931 (ICZN 1985). One of us (RJG) has seen the type gall in the Springfield, MA, Natural History Museum. Besides being on a different species of chestnut, the galls are different from those of *H. amisae*. An illustration in Gagné (1989) shows both kinds. Instead of being hard and deeply ridged as the gall made by *H. amisae*, that of *H. castaneae* is succulent (when fresh, reportedly), smooth, and bulbous. In the absence of specimens of *H. castaneae,* we consider the two kinds of galls to be formed by different species. Galls of both kinds occur on American chestnut: Felt (1940) shows a photograph of a gall like that of *H. amisae* on American chestnut. Both kinds of galls grew and possibly still do on sprouts of American chestnuts, but we do not know whether *amisae* is also responsible for the similar gall on American chestnut. Galls similar to both types can be found also on oaks, but each yields its own species of *Macrodiplosis*.



Figs. 12-19. *Harmandia amisae*. 12, Female postabdomen. 13, Female left cercus and hypoproct. 14, Tarsal claw and empodium. Fig. 15, *H. helena,* tarsal claw and empodium. Figs. 16-17, *H. amisae*. 16, Larval terminal segments. 17, Spatula and associated papillae. Fig. 18, *Harmandia* sp. from leaf gall on *Populus deltoides,* New York, larval terminal segments. Fig. 19, *Macrodiplosis* sp. from leaf gall on *Quercus palustris,* Maryland, larval terminal segments.

Of the three remaining North American *Harmandia* species, *H. hudsoni* is the only one to share with *H. amisae* the character of simple tarsal claws. *H. hudsoni* is known from two males caught in flight, one of them the holotype of *H. reflexa.* The latter species is synonymized here under *H. hudsoni* because of the lack of character differences. The genitalia of the two specimens are identical. Their genitalia are only generally similar to those of the new species: the hypoproctal lobes of *H. hudsoni* (Fig. 8) are more splayed than in *H. amisae* and have three long setae each. It is possible that *H. hudsoni* is also from chestnut and, further, that it is the same as *H. castaneae.* In 1906 when these specimens were caught in New York and New Hampshire, American chestnut was a common tree. One can still find plants there, but only as sprouts that are killed by the chestnut blight before they can bear fruit.

The other two Nearctic species of *Harmandia* are each known from a single male: *H. helena* from leaf galls of poplar in Massachusetts and *H. reginae* from an unknown host in western Canada. They differ from *H. amisae* and *H. hudsoni* by the presence of teeth on the tarsal claws (Fig. 15) and from them and one another by genitalic differences (Figs. 9-10). Their hypoprocts are much more deeply lobed than in the species with simple claws. Additionally, the gonostyli of *H. reginae* are shorter and more extensively setulose than that of *H. helena.* A further difference is that galls on *Populus* in both North America and Europe have a single larva, while those on *Castanea* may have one or more larvae.

Acknowledgments

We are grateful to K. M. Harris, Director of the International Institute of Entomology, London for kindly sending us his detailed drawings of gall midges pertinent to this study, P. Malikul for preparing the microscopic slides, S. Grupp for inking the illustrations, and A. S. Menke, A. L. Norrbom, E. Sylvén, J. Yukawa, and an anonymous reviewer for their comments on drafts of the manuscript.

References Cited

Felt, E. P. 1907. New Species of Cecidomyiidae. Albany, N.Y. 53 pp.
1912. Studies in Itonididae. J. N. Y. Entomol. Soc. 20: 236-248.
1913. The gall midge fauna of New England. Psyche 20: 133-147.
1921. A study of gall midges, VII. N. Y. State Mus. Bull. 231-232: 81-240, pls. 8-20.
1940. Plant Galls and Gall Makers. Comstock Pub. Co., Ithaca, NY. vii and 364 pp.
Gagné, R. J. 1981. Cecidomyiidae. Pp. 257-292. *In* McAlpine, J. F., B. V. Peterson, G. E. Shewell, H. J. Teskey, J. R. Vockeroth, and D. M. Wood, Eds. *Manual of Nearctic Diptera,* vol. 1. Research Branch, Agric. Canada, Monogr. 27. vi + 674 pp.
1989. The Plant-Feeding Gall Midges of North America. Cornell Univ. Press, Ithaca, N.Y. xiii and 355 pp and 4 pls.
ICZN (International Commission on Zoological Nomenclature). 1985. Third Edition. International Code of Zoological Nomenclature. International Trust for Zoological Nomenclature, London. xx and 338 pp.
Kieffer, J.-J. 1896. Quatre nouveaux genres du groupe *Diplosis.* Miscellanea Entomologica. 4: 4-5.
1913. Diptera. Fam. Cecidomyidae. Genera Insectorum 152: 346 pp. and 15 pls.

McAlpine, J. F., B. V. Peterson, G. E. Shewell, H. J. Teskey, J. R. Vockeroth, and D. M. Wood, eds. 1981. Manual of Nearctic Diptera: Vol. 1. Research Branch, Agric. Canada. Monogr. No. 27. vi and 674 pp.

Möhn, E. 1955. Beiträge zur Systematik der Larven der Itonididae (= Cecidomyiidae, Diptera). 1. Teil: Porricondylinae and Itonidinae Mitteleuropas. Zoologica 105 (1 & 2): 1-247, 30 pls.

Payne, J. A., J. D. Dutcher, and B. W. Wood. 1982. Chinkapins: a promising nut crop in the South? Ann. Rept. of the Northern Nut Growers Assoc. 73: 23-26.

Porcher, F. P. 1970. Corylaceae (the nut tribe). Pp. 233-265. *In* Resources of the Southern Fields and Forests, Medicinal, Economical, and Agricultural. Arno Press, New York.

Rübsaamen, E. H., and H. Hedicke. 1926-1939. Die Zoocecidien, durch Tiere erzeugte Pflanzengallen Deutschlands und ihre Bewohner. Band II: Die Cecidomyiden (Gallmücken) and ihre Cecidien. Zoologica 77: 1-350, 42 pls.

Skuhravá, M. 1986. Family Cecidomyiidae. Pp 72-297. *In* Soós, A. Catalogue of Palaearctic Diptera. 4. Sciaridae - Anisopodidae. Akademiai Kiado, Budapest. 441 pp.

Stebbins, F. A. 1910. Insect galls of Springfield, Massachusetts, and vicinity. Springfield Mus. Natur. Hist. Bull. 2: 1-139.