

NOTES ON *EUPHALERUS NIDIFEX* SCHWARZ AND
RELATED NEST-MAKING, NEW WORLD PSYLLIDS
(HOMOPTERA:PSYLLIDAE)

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ABSTRACT

The lectotype and paralectotypes of *Euphalerus nidifex* Schwarz are indicated, and an adult and nests of the species are illustrated. Non-type specimens previously recorded as *nidifex* are placed, and related species are discussed. A key is presented to the nest-making, New World species of *Euphalerus* Schwarz.

The purpose of this study is to designate a lectotype of *Euphalerus nidifex* Schwarz, to indicate the identity of specimens previously reported as *nidifex*, and to increase the information concerning nest-making, New World psyllids.

Recently Mead (1967) discussed the injuriousness and unusual habits of *nidifex*, mentioned related species, and stated,

"There is some doubt about the distribution of *E. nidifex* because non-U. S. records in the literature may not be valid. . . . It may be that *nidifex* ranges only in the southern tip area of Florida, but until a more comprehensive study is made, caution must be exercised on precisely defining *nidifex*. One problem facing future workers is that the type of *nidifex* is 'supposedly lost'".

Mead's statement accentuated the need for determining whether the type of *nidifex* has disappeared, and for learning the identity and distribution of various specimens that have been reported as *nidifex*. Study of specimens in the U. S. National Museum of Natural History and of literature has enabled me to resolve these problems, and to bring together, and add to, information on *nidifex* and related species.

E. nidifex is of interest because it is injurious to *Piscidia piscipula* (L.) Sarg. (= *Ichthyomethia piscipula* (L.) Hitchc., *I. communis* Blake, *Piscidia erythrina* (L.)), a leguminous tree of potential economic importance and unusual characteristics, and because its nymphs live in waxy nests.

Mead reported that *nidifex* attacks and sometimes kills the new growth of its host plant, and that the tree is seldom used for ornamental or shade purposes because of the injury caused by this and other insects. Martorell (1948: 273) mentioned the hard wood of *P. piscipula* and its durable quality when in contact with the soil. And Bailey (1927: 2648) stated that its leaves and branches, when thrown in water, "intoxicate and stun the fish so that they can be caught readily." Owing to this peculiar characteristic, the tree is known commonly as fishpoison tree and fishfuddle tree. Jamaica dogwood is another common name. Little (1953: 275) gave the distribution of *P. piscipula* as southern Florida, including the Keys, the West Indies, and eastern Mexico (Tamaulipas and San Luis Potosi to Yucatan) south to Honduras.

Euphalerus nidifex, *E. antillensis* Caldwell and Martorell, and *E. ostreoides* Crawford comprise a group of New World psyllids whose nymphs have the unusual habit of making, and living in, firm, waxy nests that resemble the waxy covering of certain scale insects (Coccoidea). Each species was described from a leguminous plant.

Though the great majority of psyllids that produce firm, waxy nests are native to Australia, a few species occur elsewhere. Waxen cells were observed in Texas by Ferris (1926: 15-16), who suggested that they were made by nymphs of *Tetragonocephala flava* Crawford. His opinion was later confirmed by Riemann (1958). Nests made by an undetermined psyllid were noted by Boselli (1929: 212-216) in China, and nests were formed by *Pachypsylla japonica* Miyatake (1968) in Japan. These species were recorded from *Celtis*, family Ulmaceae.

Because their nymphs and host plants are unknown, it is uncertain whether *Euphalerus championi* Laing (1923: 701-702) from Guatemala, *fasciatus* Laing (1923: 700-701) from Mexico, and *certus* Tuthill (1947: 142-144) from Costa Rica, are nest-makers. Laing placed *championi* near *nidifex* and Tuthill stated that *certus* resembled *E. gallicola* Ferris.

Several species that are assigned to *Euphalerus* live in loose, filamentous, webby structures that also have been called waxen cells and nests. These cottony masses are quite dissimilar to the compact, harder nests of *nidifex*.

The nest of *nidifex* was described by Schwarz (1904) as "a nest-like, globular structure of whitish color, usually along the mid-ribs of the fully developed leaves . . . the wall of this structure is . . . composed of fine, cotton-like threads. When inhabited by the larvae the nests are of a sticky nature, but old specimens become brittle in time. They are fastened to the leaves by a broad base so that the larva, in feeding, is forced to push its beak through this space into the parenchyma of the leaf."

Nests of *nidifex* occur on the lower surface of leaves, and Mead also found them on seed pods. Old nests that I have examined (I have not seen newly formed ones) are fairly hard, are quite thick in the center of the convex top portion, and are hollow. Fragments of early nymphal skins may be imbedded in the secretion or may remain within the nests. The sclerotized posterior part of the abdomen of the last instar nymph sometimes projects from a slitlike opening near the bottom of the nest, and the nymph backs out of the nest before the adult emerges from the nymphal skin.

Euphalerus nidifex Schwarz
(Fig. 1)

Psyllid larva, Schwarz 1904:153-154.

Euphalerus nidifex Schwarz 1904:238-240, in part.

Euphalerus nidifex Schwarz, Crawford 1914:119-120, in part.

Euphalerus nidifex Schwarz, Wolcott 1924 (1923): 274, in part.

Euphalerus nidifex Schwarz, Ferris 1928:116, misidentification?

Euphalerus nidifex Schwarz, Wolcott 1936:111, misidentification?

Euphalerus nidifex Schwarz, Tuthill 1937:72.

Euphalerus nidifex Schwarz, Tuthill 1943:520, in part.

Euphalerus nidifex Schwarz, Martorell 1948 (1945):274, 376, misidentification?

Euphalerus nidifex Schwarz, Wolcott 1950 (1948):146, misidentification?

Euphalerus nidifex (!) Schwarz, Caldwell and Martorell 1952 (1951):612, in part.

Euphalerus nidifex Schwarz, Jensen 1957:28, in part.

Euphalerus nidifex Schwarz, Mead 1967:1-2.

"*Euphalerus ficus* (MS) Riley", Crawford 1914:120.

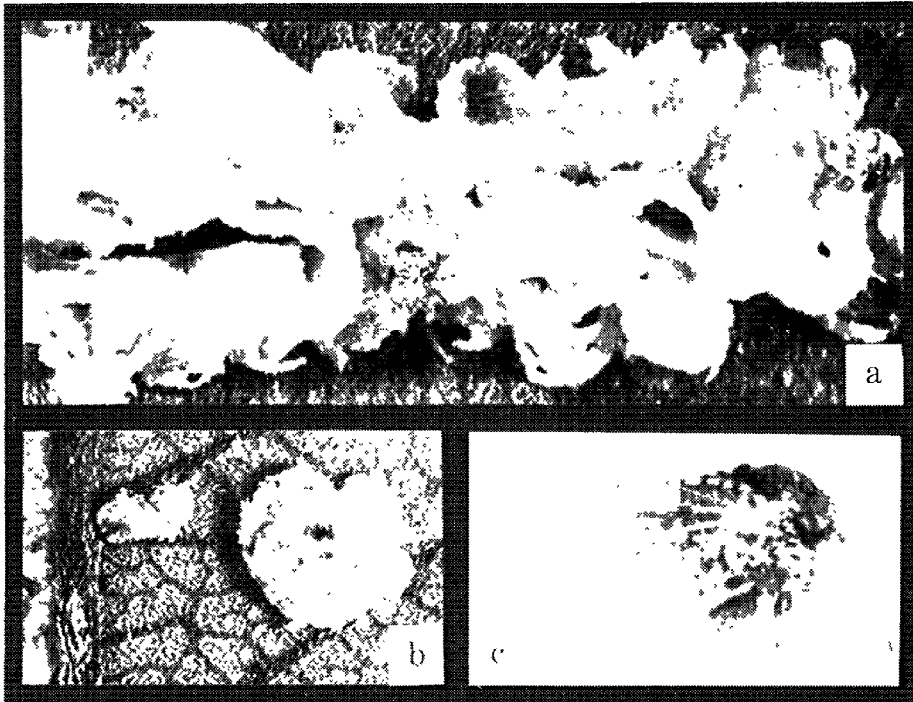


Fig. 1. *Euphalerus nidifex* Schwarz: a) cluster of nests showing escape openings and cast nymphal skins; b) individual nests; c) adult. Photographs courtesy of F. W. Mead.

In his first reference to this nest-making psyllid, Schwarz (1904) wrote ". . . on the leaves or young shoots of *Piscidia erythrina*, . . . at Key West, Florida, and at Cayamas, Cuba. . . . A large number of the adult Psyllids were bred from the specimens from Key West, but unfortunately none of them were in perfect condition, so that the systematic position of the Psyllid . . . remains in doubt."

Later, when he described and named *nidifex* Schwarz (1904:234, 238, 240) stated,

"The following series of descriptions was included in a Synopsis of the North American Psyllidae prepared by myself, at the request of the late Dr. C. V. Riley, in the years 1886 and 1887, but which has never been published . . . it is my intention to revise and publish certain portions thereof. . . ."

"At a previous place in this volume (pp. 153-154) a short characterization . . . will be found of the peculiar habit of the larva of this Psyllid, and

the following lines are copied from a description of the perfect insect drawn up by myself in 1887. . . .

"Originally found by myself on the Island of Key West, Fla., in April, 1887, but subsequently (in 1903) bred in great numbers from larval cases found at the same place and at Cayamas, Cuba. . . .

"*Type*.—No. 8146, U. S. National Museum."

Schwarz's material of *nidifex* consists of variously labeled specimens. One lot has 6 specimens, each with "4109" and one with "Psyllid on Ficus Key West Fla. Apr 20. 87" in one person's handwriting, and one with the latter data in handprinting that apparently was done by another individual. In addition there are 2 specimens with "Euphalerus ficus Riley" hand printed; these and 4 additional specimens each has machine-printed labels, one "Key West Fla" and the other "Hubbard and Schwarz." Each of two other pins bears a "Key West Fla" machine printed label; one pin extends through 6, and the other through 7, pieces of cardboard. The pieces of cardboard contained approximately 92 specimens, including nymphs, cast nymphal skins and adults, before a few were transferred to slides. Then there are 26 additional pins, with 33 specimens, bearing machine printed labels of "Key West Fla" with "4.4.03" in India ink, and a machine printed label with "E A Schwarz Collector." Five of the latter pins bear hand-printed labels, "Piscidia erythrina," and 5 have a "1943 Colln D L Crawford" machine printed label.

In addition to the insects, the USNMNH collection has several leaves with psyllid nests. Every leaf is not labeled, but some state, "on *Piscidia erythrina* Key West Fla 6-iv-03 E A Schwarz Collector."

There are no leaves labeled "*Ficus*" and since Schwarz invariably named *Piscidia erythrina* as the host of *nidifex*, it is likely that some other person, perhaps Riley himself, misidentified the plant and proposed the manuscript name "Euphalerus ficus Riley" for the 2 specimens that bear this name.

The only specimen from Cuba has 3 labels, machine printed except for an incomplete date in India ink: one "Cayamas 2.2 Cuba," one "E A Schwarz Collector," and one "1943 Colln D L Crawford." The specimen is not *nidifex*. There are no leaves or nests that are labeled as being from Cuba.

When the data accompanying the Schwarz specimens of *nidifex* are associated with his statements (1904: 234, 238), it seems certain that the specimens bearing the number 4109 are those that were before Schwarz when he drew up the 1887 Synopsis description. However, the 1903, as well as the 1887, collections were available and undoubtedly were examined by him when he prepared his revised, final draft. Indeed, it must have been necessary for him to study the later collections in order to be able to describe the species that he could not place from the original material.

A type label is not attached to any specimen placed under *nidifex* by Schwarz. In the USNMNH Type Book the name *Euphalerus nidifex* follows 8146, the number that accompanied the published description of *nidifex*, but no data are given for the species. The Type Book does not contain data for the 6 new species and one new variety described with *nidifex*, but type labels bearing the numbers published for them are attached to examples of the others. Indeed, a type label is attached to a pin bearing 12

examples of one species, and a type label is attached to a pin with more than one specimen or identical type labels are attached to two pins in other species. A type label is not attached to a single specimen in any of these instances.

Instead of concluding that the type of *nidifex* has been lost, I consider it likely that a type label has not been associated with a specimen. Accordingly, I am attaching a lectotype label with the name *Euphalerus nidifex* Schwarz, USNM no. 8146, placed by L. M. Russell 1970, on a male labeled "Key West Fla 4-4-03 E A Schwarz Collector." All number 4109 (1887) specimens except one female are totally unacceptable for a lectotype, and since males of this species are more distinctive than females, the lectotype should be the best available male.

Although Schwarz stated (1904: 240) that he bred *nidifex* in great numbers from Cuba, this seems questionable. As I have already indicated, there is only one specimen from Cuba identified as *nidifex* by Schwarz in the USNMNH collection, and there are no leaves with nests from this source. Through the perusal of publications by Howard et al. (1929: 158-159, 165) and Schwarz *in* Sherman (1929: 326-345), I have determined that Schwarz made his first trip to Cuba in 1902 and first journeyed to Cayamas in February 1903, returning in March, and that he went there again in December 1903, returning early in 1904. Psyllids are not mentioned in his published letters written while he was in Cuba and from the accounts of his sojourns, it seems doubtful that he would have bred the insect there, or from nests collected there. Schwarz did not indicate where any rearing from "larval cases" actually took place. It is significant that his first report (1904) did not imply that he had reared specimens from Cuba. It seems likely that all his bred specimens originated in Key West where he first visited in 1887, though he went to other places in Florida in 1875 and 1876. Caldwell and Martorell (1952: 612) assumed that Schwarz did his rearing work in Florida and that the type of *nidifex* was from there.

The single Cayamas, Cuba psyllid now in the USNMNH collection is a female that differs from *nidifex* in color pattern, length of genae, and in the shape of the genitalia, the dorsal valve being more strongly upturned than in *nidifex*. If this specimen is representative of the species Schwarz recorded as *nidifex* from Cuba, his Cuban record is erroneous. I believe this female is *antillensis*, as suggested by Caldwell and Martorell (1952: 612), even though the genae are slightly longer in relation to the vertex and the color pattern on the dorsal surface of the head and thorax differs slightly from that in authentic specimens of *antillensis*.

Crawford (1914: 119-120) redescribed *nidifex* from some of the specimens recorded by Schwarz and from an additional female from Belize, British Honduras. Regarding the Florida and Cuba insects, Crawford wrote, ". . . these are apparently paratypes; they are labelled *Euphalerus ficus* (MS) Riley in the United States National Museum collection—apparently an earlier manuscript name for the species." He did not mention the type of *nidifex*, but noted that the "specimens" from Cuba differed in certain characteristics from those from Florida.

Crawford indicated that "The Belize specimen resembles most closely the Florida forms." In this insect the wings and both valves of the genitalia are broken. The specimen is too fragmentary to be placed with

certainty, but it is closely related to *nidifex* and may be this species. However, I can place the specimen only as *Euphalerus* sp.

Wolcott (1924:274, 1936:111, 1950:146) recorded *nidifex* from various localities in Puerto Rico on *Piscidia piscipula*. Martorell (1948:274, 376) repeated Wolcott's 1924 and 1936 records and referred to the papers by Schwarz and Crawford. Of the specimens recorded as *nidifex* by Wolcott, only 2 males are available. One is *nidifex* and the other *antillensis*. Since at least 2 species occur there, it is impossible to determine whether other Puerto Rican records of *nidifex* are accurate.

Ferris (1928:115-116) discussed 2 species in a rather confusing manner in his description of *E. gallicola*. He described "Adults and nymphs from a tree of the family Rhamnaceae, possibly *Karwinskia humboldtiana*, at Manzanillo, and nymphs only from some plant, possibly of the same family, from near the mouth of the Balsas River, Mexico, (G. F. Ferris.)" Regarding the nymphs, he stated: "Living within galls formed upon the leaves . . . there being a conical portion on the lower side of the leaf and a low prominence on the upper side. . . . Within the gall the nymphs are enclosed in a mass of cottony wax. . . . This species is apparently closest to *E. nidifex*. . . ."

"There occurred upon the same host at Manzanillo nymphs of what is almost certainly another species of *Euphalerus*, perhaps *nidifex* itself, forming the characteristic waxen cells. It is possible that the adult here described belongs with this other nymph, but I think not, for an adult was dissected from one of the gall inhabiting nymphs and this adult agrees entirely with fully developed individuals in all characters that could be compared."

Through the help of D. D. Jensen and the late H. L. McKenzie, of the University of California at Berkeley and Davis, respectively, I have been able to study specimens mounted on slides from each location listed by Ferris. The material consists of adults and nymphs (1 ♂, 2 ♀♀, 8 nymphs, from Manzanillo, Nov. 26, 1925; 4 nymphs from W. of Balsas River between Corizal and La Union, Michoacan) from leaf galls that are *gallicola*. Five nymphs from waxen cells (Manzanillo, Nov. 26, 1925) belong to the *nidifex* complex, but I do not think they are this species.

Plant material with leaf galls and waxen cells from the localities mentioned by Ferris have not been found in his collection. For this reason I cannot determine whether the "mass of cottony wax" within the conical gall is actually a nest within a gall induced and abandoned by another species. This is possible for conical galls resembling those illustrated (1928, Fig. 3 Q) by Ferris are made by other psyllids in Mexico. Also, it cannot be determined whether the host plant was correctly identified as *Karwinskia*, family Rhamnaceae. This is of interest because other nest-making, New World species of *Euphalerus* are known with certainty only from the Leguminosae.

Tuthill (1937:72) had not seen *nidifex* when he discussed it briefly and called it a West Indian species. When he (1943:520) redescribed *nidifex* from specimens seen by Schwarz and Crawford, he added Key Largo, Fla., and the Virgin Islands to the distribution of the species, and stated, "Type, No. 8146 United States National Museum, is missing." His Key Largo record was based on a personal communication from J. S. Caldwell. The

basis for his Virgin Islands record is uncertain though it may have been taken from nymphs and nests in the USNMNH on *Piscidia piscipula*, St. Croix, Feb. 1931, Claud L. Horn.

When Caldwell and Martorell (1952:612) described *Euphalerus antillensis*, they stated that the Schwarz and Crawford records from Cuba, the Tuthill records from Cuba and the Virgin Islands, and the Martorell records from Puerto Rico probably applied to *antillensis* and not to *nidifex*. Their assumption is erroneous in part as is indicated elsewhere.

Jensen (1957:28), presumably on the basis of earlier reports, recorded *nidifex* from Florida, Cuba and the Virgin Islands.

Mead (1967) summarized the records of previous workers and added an unconfirmed host, *Cordia sebestena*, family Boraginaceae.

I have examined examples of *Euphalerus nidifex* as follows: Florida: *Piscidia piscipula*, Key West, 20 Apr. 1887 and 4 Apr. 1903, E. A. Schwarz or Hubbard and Schwarz, lectotype and paralectotypes (adults, nymphs and nests); unnamed host, Key West, 14 Dec. 1938, L. D. Christensen and W. H. Anderson (adults and nymphs); unnamed host, Key Largo, 2 Feb. 1940, 25 March 1951, 11 March 1957, Bonefish Key and Key West, 22 Feb. 1940, Vaca Key, 1 March 1951, J. S. Caldwell (adults); *P. piscipula*, north of Key Largo, 22 March 1968, M. L. Williams (adults, nymphs and nests). Puerto Rico: unnamed host, Yauco, 1923, G. N. Wolcott, P. R. Acc. no. 324 (adult). Jamaica: unnamed host, 5 May 1951, F. D. Bennett (adults, nymphs and nests). Mexico: unnamed host, Los Mochis, Sinaloa, 28 March—10 Apr. 1960, and Ciudad Obregón, Sonora, 20 Apr. 1960, W. W. Gibson (adults).

I have examined nymphs that I believe may be *nidifex* as follows: Florida: unnamed host, Marathon, 1 March 1951; unnamed host, Key West, 14 Nov. 1967, J. Felder (including nests). Puerto Rico: *P. piscipula*, Cartagena Lagoon, Lajas, 11 Oct. 1945, G. N. Wolcott, P. R. Acc. no. 111-45 (early instar nymphs and nests). Virgin Islands: *P. piscipula*, St. Croix, Feb. 1931, Claud L. Horn (♂ and ♀ genitalia within nymphal skins; also including nests); wild shrub, St. Croix, intercepted at Puerto Rico, 16 June 1948, R. G. Oakley, P. R. no. 338 (including nests).

Euphalerus antillensis Caldwell and Martorell

Euphalerus nidifex Schwarz 1904:239-240, in part.

Euphalerus nidifex Schwarz, Crawford 1914:119-120, in part.

Euphalerus nidifex Schwarz, Wolcott 1924 (1923):274, in part.

Euphalerus nidifex Schwarz, Tuthill 1943:520, in part.

Euphalerus antillensis Caldwell and Martorell 1952 (1951):612.

This species was described from specimens collected at Guánica, Puerto Rico, "breeding abundantly on the undersides of the leaves of "gengeno" *Lonchocarpus domingensis*, 8-28-47." This is a different host and locality than had been recorded previously for Puerto Rican specimens.

The authors stated, "Male *holotype*; female *allotype*, and *paratypes*. . . ." One pin in the Caldwell collection, now in the USNMNH, bears a holotype label but the specimen is missing. The remaining specimens, two males and two females, are not individually labeled as to type, but a red label accompanying them is marked "Type Series." Since the identity of the paratypes is unquestionable, the designation of a neotype is unnecessary.

Only one non-type specimen of *antillensis* from Puerto Rico is at hand, a male from Yauco, 1923, P. R. Acc no. 324, G. N. Wolcott, coll. As indicated previously, I believe the single available specimen from Cuba, placed as *nidifex* by Schwarz, is *antillensis*.

Nymphs and nests of *antillensis* are not available, and the nests were not described.

Euphalerus ostreoides Crawford

Psyllideo Tavares 1920: 124 (208)-125 (209).

Psyllideocecidia Tavares 1922: Tab. 19, figs. 3-5.

Euphalerus ostreoides Crawford 1925: 62-63.

Tavares (1920) first described and later (1922) illustrated the nests of this psyllid. He recorded the nests from "Nova Friburgo (Est. do Rio), immediações de Rio de Janeiro, Itu (Est. de S. Paulo), e entre o Rio Vermelho e a cidade da Bahia." He mentioned two hosts, "Papilionáceas" and "Timbó." The common name timbó is now associated with species of *Lonchocarpus*, family Leguminosae.

Crawford (1925) stated that the insects made ". . . very peculiar galls on an undetermined species of Leguminosae." Though he repeated the distribution given by Tavares, he mentioned only 2 males and one female. They are in the USNMNH collection and each is labeled "Itu, S. Paulo Tavares." Since Crawford did not designate a holotype, I have selected a male as the lectotype and have attached a label stating, placed by L. M. Russell 1970.

Nymphs and nests of the species are not available, but it is evident from Tavares' description and illustrations that the nests differ conspicuously from those of *nidifex*. He stated that the gall was elegant, and that it consisted of 2 delicate, coriaceous laminae or valves in the form of a bivalve conch shell with a cavity in which the nymphs live until winged specimens develop, when the valves open naturally.

The following key will assist in the recognition of the nest-making species of *Euphalerus*.

1. Comparatively large insects, measuring approximately 5 mm to tip of folded wings; antennae about 3 times as long as width of head including eyes; known from Brazil *ostreoides* Crawford
- 1'. Comparatively small insects, measuring approximately 2.5 mm to tip of folded wings; antennae slightly longer than width of head including eyes; not known in South America 2
2. ♂ proctiger tapering from base to apex; in lateral view ♂ claspers tapering and curved slightly caudad from distal third, their apices narrow with an inwardly projecting tooth; genae approximately 2/3 length of vertex, quadrate, their inner margins almost contiguous except at apices *nidifex* Schwarz
- 2'. ♂ proctiger lobed, broad at mid-length; in lateral view ♂ claspers broad and of uniform width; their apices truncate with an inwardly projecting tooth at cephalic angle; genae approximately 4/5 length of

vertex, broadly triangular, their inner margins divergent
 *antillensis* Caldwell and Martorell

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