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First reports of non-phytophagous Nearctic chrysaugine moths (Lepidoptera: Pyralidae)

James E. Hayden
FDACS Division of Plant Industry
1911 SW 34th St.
Gainesville, FL 32608 USA

Lyle J. Buss
University of Florida, Entomology and Nematology Department
P.O. Box 110620
Gainesville, FL 32611 USA

Kyle E. Schnepp
FDACS Division of Plant Industry
1911 SW 34th St.
Gainesville, FL 32608 USA

Lei Xiao
Florida Museum of Natural History, University of Florida
Gainesville, FL 32611 USA

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James E. Hayden
FDACS Division of Plant Industry
1911 SW 34th St.
Gainesville, FL 32608 USA
James.Hayden@FreshFromFlorida.com

Lyle J. Buss
University of Florida, Entomology and Nematology Department
P.O. Box 110620
Gainesville, FL 32611 USA
ljbuss@ufl.edu

Kyle E. Schnepp
FDACS Division of Plant Industry
1911 SW 34th St.
Gainesville, FL 32608 USA
Kyle.Schnepp@FreshFromFlorida.com

Lei Xiao
Florida Museum of Natural History, University of Florida
Gainesville, FL 32611 USA
lxiao@ufl.edu

Abstract. Coprophagy and probable saprophagy are reported for larvae of two species of chrysaugine moths (Lepidoptera: Pyralidae). Larvae of *Parachma ochracealis* Walker are found in rotten pine wood and mulch in North-Central Florida. Larvae of *Basacallis tarachodes* (Dyar) inhabit feces of an unidentified small mammal in a cave in Central Florida and seem to be troglophilic. These behaviors are compared to similar ones in Neotropical chrysaugines such as *Humiphila* Becker and *Cryptoses* Dyar. Saprophagy and coprophagy are predicted to be more general habits among Chrysauginae.

Key Words. Neotropics, bark, sloth moth, troglophily.

Introduction

The first records of larval behavior for two species of North American Chrysauginae (Lepidoptera: Pyralidae) are reported herein. As far as known, these are also the first non-phytophagous records for any Nearctic Chrysauginae. *Parachma ochracealis* Walker (Fig. 1) is common and widely distributed in central and southern North America, from New Jersey and Missouri to Florida, Texas, and Arizona. The uncommon species *Basacallis tarachodes* (Dyar) (Fig. 5), originally described from Panama, is known from the Carolinas and Gulf Coast states to Texas and New Mexico (North American Moth Photographers Group 2016; M.A. Solis, pers. comm.).

Cashatt (1984) revised these same two species. *Parachma* Walker currently comprises *P. ochracealis* in the Nearctic, nine Neotropical species, one on Réunion Island, and *P. borregalis* Dyar from southern Texas, which Cashatt (1984) synonymized with *P. ochracealis* but was reinstated by Solis et al. (1995). Cashatt proposed the separate monotypic genus, *Basacallis* Cashatt, for *Parachma tarachodes* Dyar.

Although saprophagy and coprophagy were previously unknown for Nearctic chrysaugines, feeding habits like these, and even stranger ones, such as nest inquilinism and consuming spines of hemileucine larvae, are known for the Neotropical fauna (Jordan 1926; da Costa Lima 1950; Becker 1974; Waage and Montgomery 1976; Munroe and Solis 1998).

Materials and Methods

Specimens of adult moths were identified by reference to Cashatt (1984) and comparison with specimens in the Florida State Collection of Arthropods (FSCA). Preserved larvae, pupae, and pinned adults were deposited in the FSCA (housed in the McGuire Center for Lepidoptera [MGCL], Florida Museum of Natural History, Gainesville, FL) and in the reference collection of Lyle Buss (University of Florida, Department of Entomology and Nematology). Samples of rodent feces and hair were deposited in the Florida Museum of Natural History Mammalogy Range. Genitalia of *B. tarachodes* were dissected following Robinson (1976) and slide-mounted in Euparal (MGCL slide nos. 3249 male, 3250 female).

Some larvae of *B. tarachodes* were starved for a day to purge gut contents and were preserved in 100% ethanol at -20°C. Total DNA was extracted from each of three larvae of *Basacallis tarachodes* using the QIAGEN DNeasy Blood and Tissue kit. A 687-bp region of the mitochondrial COI gene was amplified with a pair of primers, LepF1 and LepR1 (Hebert et al. 2004), using the following PCR conditions: 94°C for 1 min; 5 cycles of 94°C for 30 s, 45°C for 40 s, and 72°C for 1 min; 35 cycles of 94°C for 30 s, 51°C for 40 s, and 72°C for 1 min; and 72°C for 5 min. Each PCR contained 2 µl DNA, 1× PCR buffer, 2 mM $MgCl_2$, 0.4 mM dNTPs, 0.2 µM of each primer, and 0.2 µl Platinum Taq DNA polymerase (Invitrogen) in a total volume of 20 µl. The PCR products were Sanger sequenced. The COI sequences obtained were edited using Geneious Pro 5.5.3 and deposited in GenBank (accession nos. KU530230–KU530232).

To identify the mammal associated with *B. tarachodes*, hairs were isolated under a microscope from a fecal sample from the cave. DNA was extracted using the OmniPrep Genomic DNA Extraction Kit and dissolved in 30 µl QIAGEN AE Buffer (10 mM Tris-Cl /0.5 mM EDTA, pH 9.0). A 683-bp region of the mitochondrial COI gene was amplified with a pair of primers LCO and HCO (Folmer et al. 1994; Müller et al. 2013). The PCR products were Sanger-sequenced and analyzed using Geneious.

Photographs were taken with 1) the Auto-montage Pro 5.01 system (Synoptics Ltd.) using a JVC digital camera and Leica Z16APO lens and 2) a Nikon D7000 camera with the Nikon AF Micro-NIKKOR 60mm f/2.8D lens plus extension tubes.

Results

***Parachma ochracealis* Walker, 1866.** On two occasions, single larvae of *P. ochracealis* were found in pine bark or pine wood in Gainesville, Florida. On 11 March 2007, the second author (LB) found a larva under pine bark mulch that was on the ground in front of his house in southwest Gainesville. It was 16 mm in length, inhabited a silken tent (Fig. 3), and moved backward when disturbed. It pupated on 15 March and eclosed as an adult on 29 March 2007. Dr. Eileen Buss (UF Entomology) found another larva of the same size in a rotten pine log at Lake Wauberg (Micanopy, FL) on 25 February 2012 (Fig. 2). It started spinning a cocoon or shelter by 26 February, pupated on 29 February, and eclosed on 20 March 2012. LB did not observe the larvae closely enough to see what they were actually feeding on. The shed head capsule of one has the normal complement of six pairs of stemmata (Fig. 4).

***Basacallis tarachodes* (Dyar, 1914).** On 3 November 2015, the third author (KS) and Cal Welbourn (FDACS-DPI) sampled the Trail 10 Cave in Withlacoochee State Forest (Citrus Co., FL) for Coleoptera and Acari. They searched the soil of a latrine of an unidentified small mammal (Fig. 6). The small cave is situated in karst topography and is roughly U-shaped, extending from the entrance down a few meters to a sandy floor before turning upward into a rocky chamber, where the rodent activity was located. The dung was concentrated in an area about 0.3 m wide and was mostly dried and heavily decomposed. A midden characteristic of woodrats, *Neotoma floridana* (Ord), was not observed (i.e. a nest of sticks separate from the latrine). The cave's fauna is not extensive, but it harbors large populations of an uncommon jacobsoniid beetle (Peck 2010).

In the laboratory, KS found lepidopteran larvae in silken tubes in the soil (Fig. 7–8). No larvae emerged from samples of bat guano taken at the same time. Bats had not inhabited the cave for many years, and the guano is very dry and degraded.

The first author (JH) identified the larvae as Chrysauginae based on the sclerotized rings around the D2 seta of the metathorax and the SD1 on the eighth abdominal segment (Neunzig 1987). Last-instar larvae have four pairs of stemmata rather than six (Fig. 13), and earlier instars have three.

Since identification resources for chrysaugine larvae are almost non-existent and the success of raising larvae doubtful, Lei Xiao (LX) PCR-amplified the mtDNA COI "barcode" region and had it sequenced. Sequences KU530230 and KU530232 are identical, and KU530231 differs in one nucleotide, having C where the others have T at position 511. All three are >99% similar to a specimen of *B. tarachodes* from northeastern Texas (specimen no. BIOUG01466-D12, BOLD BIN ABW0892, www.boldsystems.org), which differs in six more positions.

JH preserved some larvae (Fig. 11) and found the gut contents to be soil from the latrine. The rest were kept alive in a glass jar and inspected daily for emergence. They gradually disappeared entirely, the last one seen on 23 December 2015. The feces dried out, so some may have desiccated. On 17 December 2015, KS returned to the cave and collected adult males and females of *B. tarachodes* from the cave walls, some of which were in copula. Many more caterpillars emerged from the latrine soil in a Berlese funnel (Fig. 9–10). KS observed one larva consuming another in this sample, which alternatively explains the attrition in the first sample.

JH separated the larvae individually into small plastic cups and collection vials, ventilated with holes and supplied with enough of the original soil to tunnel in. Larvae were inspected every two or three days. Starting on 29 December 2015, JH moistened the soil with a few drops of purified water every few days. By 4 January 2016, larvae were found in ten containers and absent from four; no bodies were found. Between 4 and 7 January, three more pupated (Fig. 12). Two adults eclosed on 9 and 10 January (Fig. 14), 2 on 11 Jan., 3 by 13 Jan., and a fourth on 15 January.

As in the first sample, the larvae formed silken tubes in the soil. Small to medium-sized larvae could often be found outside the tubes. The largest larvae were always found inside tubes by gently feeling with fingertips. They pupated inside the tubes.

On 20 April 2016, JH and KS photographed moths in the cave. Adults of both sexes perched on the walls near the latrine (Fig. 15). They did not move much in response to motions and lights. A few larvae were found in additional, moderately fresh scat. The only other moth observed in the cave was a large *Idia lubricalis* (Geyer) (Erebidae), the larvae of which are fungivores.

The rodent species could not be identified by sequencing the mitochondrial COI gene from hair. The chromatogram indicated that different COI sequences were likely co-amplified by PCR. It is possible that the hairs in the feces might come from different animals or be contaminated by other species. The LCO and HCO primers are capable of amplifying a variety of species from invertebrates to mammals (Folmer et al. 1994; Müller et al. 2013).

Discussion

The Chrysauginae are a mostly Neotropical radiation notorious for both taxonomic disarray and strange feeding records. The New World fauna comprises about 126 genera for fewer than 400 species (Solis et al. 1995; Nuss et al. 2016). The traditional classification below subfamily level (Hampson 1897) is of little use because it depends on variable external characters. Many larval Chrysauginae feed in the shoots or reproductive structures of Bignoniaceae (Neunzig 1987; Heppner 2003). Others mature in the nests of social insects (Myers 1935; da Costa Lima 1950; Pastrana 1953). Other known records show little pattern. Cashatt (1984), focusing on Nearctic genera, related *Parachma* and *Basacallis* to *Caphys* Walker, *Acallis* Ragonot, and *Zaboba* Dyar. *Caphys biliniata* (Stoll) feeds on seeds of palms (da Costa Lima 1950; Robinson et al. 2016), and *Acallis alticolalis* (Dyar) has been reared from birch leaves (Brower 1983). The habits of most genera are unknown. The chrysaugine fauna of Florida includes seventeen species (Heppner 2003; JH unpubl.). Twelve species are either known phytophages or predicted to be, based on morphological similarities with the known phytophages. The remaining five include the two presently treated species and three other unknowns: *Heliades mulleolella* (Hulst) and two species of *Arta* Grote.

Basacallis tarachodes is uncommon in its range, and its habitat may explain why. It may live specifically in association with rodents, or it may be adapted to live in caves feeding on a wider variety of organic matter.

One possibility is that *B. tarachodes* is primarily a coprophagous inquiline in mammal nests. Coprophagy is uncommon in Lepidoptera because of competition with other insects (Sánchez Piñero

and Pérez-López 1998). Pyraloid larvae make silken tubes in dry scat in concealed places. *Aglossa pinguinalis* (Linnaeus) (Pyralinae) feeds in tubes in dry animal droppings (Pérez-López 2002). *Pyralis manihotalis* Guenée has been raised from bat guano (Munroe and Solis 1998) and occurs with chicken manure (JH, pers. obs.). The chrysaugine "sloth moths," currently in the genera *Cryptoses* Dyar, *Bradypodicola* Spuler, and *Bradypophila* Ihering, may be the best-known cases. Adult moths live in the fur of *Bradypus* Linnaeus species, and the larvae feed on the sloths' dry, buried fecal pellets (Dyar 1907; Waage and Montgomery 1976; Waage 1980; Bradley 1982). Pauli et al. (2014) found that the moths cycle nutrients with the sloths and the algae on the sloths' fur. Moths oviposit on the dung during burial (Young 1981). The feces in the cave, like sloth dung and the scat consumed by *A. pinguinalis*, were dry and in a concealed environment. The mammal's identity could not be confirmed. Initially, it was assumed to be *Neotoma floridana* (Ord) (Eastern Woodrat), but the absence of a midden casts doubt on this. The absence of larvae from the bat guano, which consists of insect cuticle, suggests a preference for substrates containing plant matter. Bat guano has been sampled extensively in North American caves, so if *Basacallis* larvae were associated with it, they would probably already have been discovered (S. B. Peck, pers. comm. Sept. 2016).

Another hypothesis is that *B. tarachodes* is primarily saprophagous, is able to establish populations in caves, and consumes scat opportunistically. The larvae have a reduced number of stemmata (three to four on each side). This can be explained as an adaptation for a troglophilic existence (able to establish a permanent population in a cave). Saprophagy is supported by a probable relationship with *Humiphila paleolivacea* Becker in Central America. The two species are related by genitalic morphology (Cashatt 1984) and also by the peculiar fading wing color of pinned specimens. In *H. paleolivacea*, "[...] it changes from olivaceous to pale in a few months" in the drawer (Becker 1974). Likewise, the gray forewing medial area of *B. tarachodes* turns pink over time. The larvae of *H. paleolivacea* "[...] feed on dead bark of the trunk of *Carapa guianensis* Aublet (Meliaceae). They can also be found in organic matter in the soil at the trunk base" (Becker 1974). If *Basacallis* is closely related to *Humiphila* Becker, saprophagy would be the shared habit.

Parachma ochracealis, like *Humiphila*, also inhabits bark and rotten wood. LB did not directly observe feeding by *P. ochracealis*—the larvae could be fungivorous, detritivorous, or even predatory. The association with pine wood, plus the absence of observations on live plant tissue, suggests that the wood is their natural habitat and that prepupal larvae did not simply wander to the substrate from a different kind of host. The moths can be attracted to light abundantly in pine forests (JH and KS, pers. obs.). The shared microhabitat of decayed wood may be synapomorphic for *Parachma*, *Humiphila*, and *Basacallis*, although the first two genera do not share any unusual morphological characters.

The hypothesized relationships of these three genera must be tested with greater study of the vast tropical fauna. The Chrysauginae need phylogenetic research to delimit genera, to facilitate identification, and to contextualize these unusual behaviors. Feeding-choice tests would inform about diet breadth (Waage and Montgomery 1976). Other Nearctic chrysaugines may be saprophagous or detritivorous, especially where phytophagy has not been reported. From an economic perspective, it is as important to know what taxa do not consume plants as to know those that do.

As a diagnostic addendum, small adult males of *Basacallis* could be confused with some specimens of *Arta*. Female *B. tarachodes* are larger than males and than any Nearctic *Arta* species. In *Arta*, forewing veins M_2 and M_3 are stalked (separate in *Basacallis*) and hind wing CuA_1 is stalked with M_2+M_3 (not stalked in *Basacallis*) (Hampson 1897; JH pers. obs.). Males of *Arta* have narrow, rod-shaped valvae, and in females, the corpus bursae is not reduced. The Nearctic species of *Arta* are not wholly revised, despite clarifications by Cashatt (1984) and Solis et al. (2013). At least two occur in the South: *A. olivalis* Grote and an undescribed one (Cashatt unpubl.). Specimens from Peninsular Florida, especially females, are pinkish orange. Unlike *Basacallis*, the green color of *Arta* specimens does not fade.

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Literature Cited

Becker, V. O. 1974. Studies on the shootborer *Hypsipyla grandella* (Zeller) (Lep., Pyralidae). XXVI. A new genus and three new species of Microlepidoptera (Pyralidae and Gracillariidae) associated with *Carapa*, *Cedrela*, and *Swietenia* in Costa Rica. Turrialba 24(3): 332–335.

Bradley, J. D. 1982. Two new species of moths (Lepidoptera, Pyralidae, Chrysauginae) associated with the three-toed sloth (*Bradypus* spp.) in South America. Acta Amazonica 12(3): 649–656.

Brower, A. E. 1983. A list of the Lepidoptera of Maine, Part 2: the Microlepidoptera, Section I, Limacodidae through Cossidae. Maine Agricultural Experiment Station Technical Bulletin 109: i–xiii, 1–60.

Cashatt, E. D. 1984. Revision of the genus *Parachma* Walker (Pyralidae: Chrysauginae) of North America North of Mexico with description of a new genus. Journal of the Lepidopterists' Society 38(4): 268–280.

da Costa Lima, A. 1950. Ordem Lepidoptera: Superfamília Pyralidoidea. p. 7–106. *In*: A. da Costa Lima (ed.). Insetos do Brasil Vol. 6: Lepidópteros, Part 2. Escola Nacional de Agronomia, Série Didática 8. Rio de Janeiro. 420 p.

Dyar, H. G. 1907. A pyralid inhabiting the fur of the living sloth. Proceedings of the Entomological Society of Washington 9: 142–144.

Dyar, H. G. 1914. Descriptions of new species and genera of Lepidoptera from Mexico. Proceedings of the United States National Museum 47(2054): 365–409.

Folmer, O., M. Black, W. Hoeh, R. Lutz, and R. Vrijenhoek. 1994. DNA primers for amplification of mitochondrial cytochrome *c* oxidase subunit I from diverse metazoan invertebrates. Molecular Marine Biology and Biotechnology 3(5): 294–299.

Hampson, G. F. 1897. On the classification of the Chrysauginae, a subfamily of moths of the family Pyralidae. Proceedings of the Zoological Society of London 1897 (3): 633–692.

Hebert, P. D. N., E. H. Penton, J. M. Burns, D. H. Janzen, and W. Hallwachs. 2004. Ten species in one: DNA barcoding reveals cryptic species in the Neotropical skipper butterfly *Astraptes fulgerator*. Proceedings of the National Academy of Sciences of the United States of America 101: 14812–14817.

Heppner, J. B. 2003. Lepidoptera of Florida. Part 1. Introduction and Catalog. Arthropods of Florida and Neighboring Land Areas Vol. 17. Florida Department of Agriculture and Consumer Services, Division of Plant Industry; Gainesville, FL, USA. x, 670 p.

Jordan, K. 1926. On a pyralid parasitic as larva on spiny saturnian caterpillars at Pará. Novitates Zoologicae 33(3): 367–370.

Müller, L., G. L. Gonçalves, P. Cordeiro-Estrela, J. R. Marinho, S. L. Althoff, A. F. Testoni, E. M. González, and T. R. O. Freitas. 2013. DNA barcoding of sigmodontine rodents: identifying wildlife reservoirs of zoonoses. PLoS ONE 8(11): e80282.

Munroe, E. G., and M. A. Solis. 1998 [1999]. The Pyraloidea. p. 233–256. *In*: N. P. Kristensen (ed.). Lepidoptera, Moths and Butterflies. Volume 1: Evolution, systematics, and biogeography. Handbook of Zoology, Volume IV (Arthropoda: Insecta), Part 35. Walter de Gruyter; Berlin. x, 491 p.

Myers, J. G. 1935. Nesting associations of birds with social insects. Transactions of the Royal Entomological Society of London 83(1): 11–22, 1 pl.

Neunzig, H. H. 1987. Pyralidae (Pyraloidea). p. 462–493. *In*: F. W. Stehr (ed.). Immature Insects, Volume 1. Kendall/Hunt; Dubuque, IA, USA. xiv, 754 p.

North American Moth Photographers Group. 2016. R. Patterson (ed.). Hosted by the Mississippi Entomological Museum, Mississippi State University. (Available at: ~ http://mothphotographersgroup.msstate.edu. Last accessed 10 January 2016.)

Nuss, M., B. Landry, R. Mally, F. Vegliante, A. Tränkner, F. Bauer, J. Hayden, A. Segerer, R. Schouten, H. Li, T. Trofimova, M. A. Solis, J. De Prins, and W. Speidel. 2016. GlobIZ: Global Information System on Pyraloidea. (Available at ~ www.pyraloidea.org. Last accessed 10 January 2016.)

Pastrana, J. A. 1953. Una nueva especie de Chrysaugidae en nidos de avispas. Acta Zoologica Lilloana 13: 201–205.

Pauli, J. N., J. E. Mendoza, S. A. Steffan, C. C. Carey, P. J. Weimer, and M. Z. Peery. 2014. A syndrome of mutualism reinforces the lifestyle of a sloth. Proceedings of the Royal Society B 281: 1–7.

Peck, S. B. 2010. *Derolathrus cavernicolus* n. sp., a beetle family new for North America (Coleoptera: Jacobsoniidae). Annals of the Entomological Society of America 103: 1–6.

Pérez-López, F. J. 2002. La especialización coprófaga en las larvas de *Aglossa pinguinalis* (Linnaeus, 1758) (Lepidoptera: Pyralidae). SHILAP Revista de Lepidopterologia 30(117): 41–48.

Robinson, G. S. 1976. The preparation of slides of Lepidoptera genitalia with special reference to the microlepidoptera. Entomologist's Gazette 27: 127–132.

Robinson, G. S., P. R. Ackery, I. J. Kitching, G. W. Beccaloni, and L. M. Hernández. 2016. HOSTS: a database of the World's Lepidopteran hostplants. Natural History Museum, London. (Available at ~ *http://www.nhm.ac.uk/our-science/data/hostplants* . Last accessed 10 January 2016.)

Sánchez Piñero, F., and F. J. Pérez-López. 1998. Coprophagy in Lepidoptera: observational and experimental evidence in the pyralid moth *Aglossa pinguinalis*. Journal of Zoology 244: 357–362.

Solis, M. A., V. O. Becker, and E. G. Munroe. 1995. Chrysauginae. p. 81–88. *In*: J. B. Heppner (ed.). Atlas of Neotropical Lepidoptera. Checklist: Part 2. Hyblaeoidea - Pyraloidea - Tortricoidea 3. Association for Tropical Lepidoptera and Scientific Publishers; Gainesville, Florida, USA. liv, 243 p.

Solis, M. A., E. D. Cashatt, and B. G. Scholtens. 2013. New North American Chrysauginae (Pyralidae) described by E.D. Cashatt. ZooKeys 344: 55–71.

Waage, J. K. 1980. Sloth moths and other zoophilous Lepidoptera. Proceedings of the British Entomological and Natural History Society (1980): 73–74.

Waage, J. K., and G. G. Montgomery. 1976. *Cryptoses choloepi*: a coprophagous moth that lives on a sloth. Science (New Series) 193(4248): 157–158.

Walker, F. 1866 [1865]. Supplement 4. List of the Specimens of Lepidopterous Insects in the Collection of the British Museum 34: 1121–1533.

Young, O. P. 1981. The utilization of sloth dung in a Neotropical forest. Coleopterists' Bulletin 35(4): 427–430.

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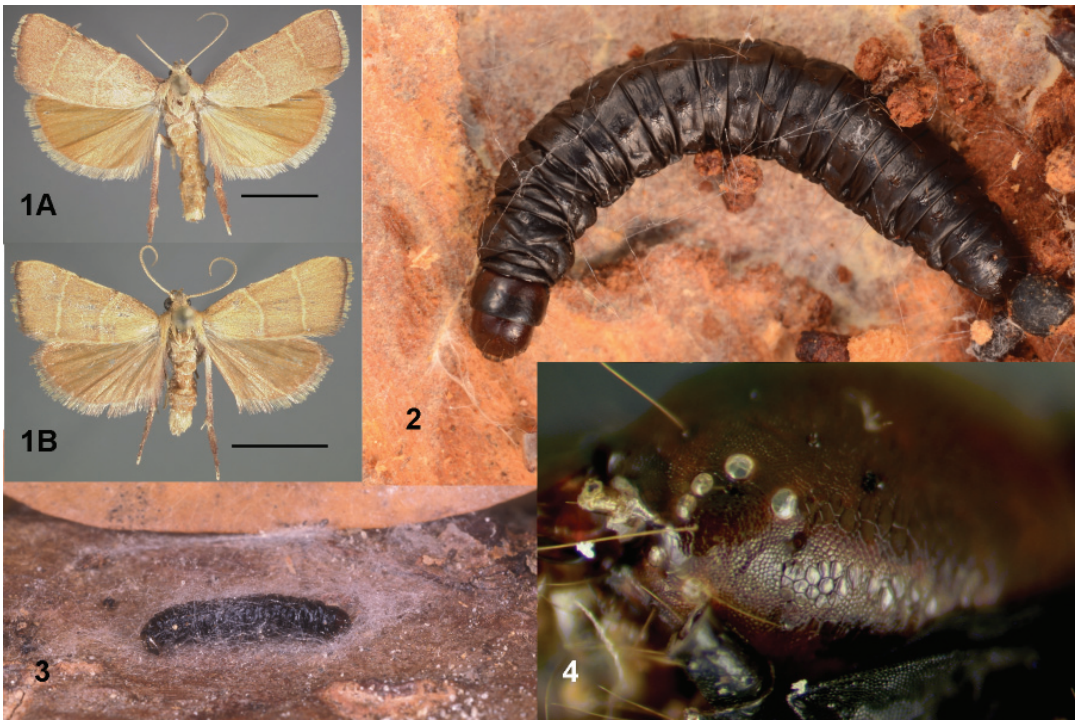
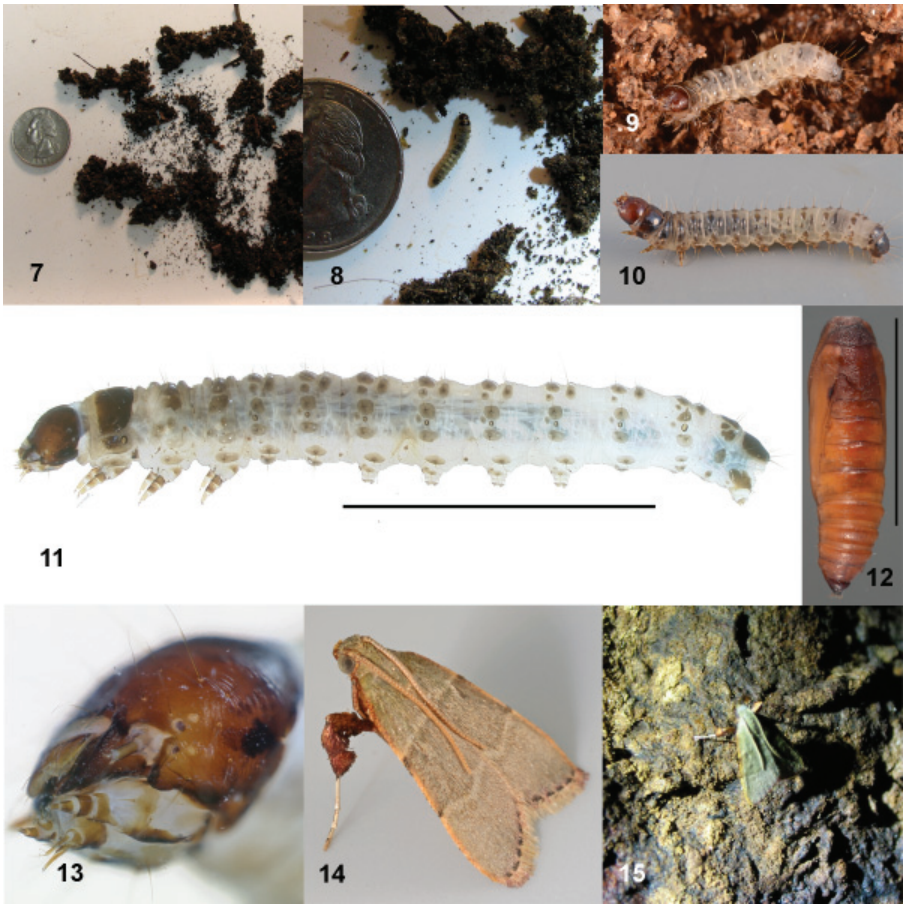


Figures 1–4. *Parachma ochracealis*. **1)** Pinned moths: **A,** female (USA, LA, Webster Parish, 27 May 1979, V.A. Brou, FSCA); **B,** male (USA, FL, Alachua Co. 22 Apr. 1988, H.D. Baggett, FSCA) (scale lines = 5 mm). **2)** Live larva from pine log (133 Regatta Drive, Micanopy, FL, 25 Feb. 2012, E. Buss) (L. Buss). **3)** Larva under silken shelter from bark mulch (Gainesville, FL, March 2007) (L. Buss). **4)** Detail of head capsule of specimen in Fig. 2 (L. Buss).

Figure 5. Pinned adults of *Basacallis tarachodes*. **A,** female (USA, FL, Citrus Co. Withlacoochee State Forest, ex rodent dung, 20 Apr. 2016, K. Schnepp, J. Hayden, C. Werner); **B,** male (same data as female, caught near latrine, 17 Dec. 2015, K. Schnepp). Scale lines = 5 mm.

Figure 6. Rodent latrine (indicated) in Trail 10 Cave, Withlacoochee State Forest, 20 Apr. 2016. Collecting bag for scale.



Figures 7–15. *Basacallis tarachodes*. **7)** Silken tubes of composted feces. **8)** Larva extracted from tube. **9)** Live larva collected 17 Dec. 2015 on substrate, L. Buss. **10)** Same as Fig. 9. **11)** Preserved larva collected 17 Dec. 2015. **12)** Pupa of a larva collected on same date. **13)** Detail of head of Fig. 11 showing four stemmata. **14)** Eclosed adult (10 Feb. 2016). **15)** Live adult on wall of cave (20 Apr. 2016). Scale lines = 5 mm.