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A NEW SPECIES OF *HELLINSIA* FROM THE SOUTHEASTERN UNITED STATES (LEPIDOPTERA: PTEROPHORIDAE)

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ABSTRACT: A new species of *Hellinsia* Tutt, 1905 from the southeastern United States is described and illustrated. Immature stages are also described. Larvae feed exposed on leaves of *Eupatorium compositifolium* Walt.

KEY WORDS: Alabama, Asteraceae, *Eupatorium compositifolium*, Florida, Georgia, larvae, pupae, Pterophoroidea, Pterophorinae

INTRODUCTION

Hellinsia, Tutt, 1905 includes more than 195 species worldwide. The genus is represented in all faunal regions but the majority of species are from the Neotropical and Nearctic Regions, with about 68 and 58 species respectively. A variety of larval forms and habits are enveloped within *Hellinsia*, including flower borers – such as the palearctic type species *Hellinsia osteodactylus* (Zeller) – stem borers, and external foliage feeders. Larvae of most *Hellinsia* feed on species of Asteraceae (Compositae) but a few species are known to feed on Boraginaceae and Solanaceae (Matthews and Lott 2005). In the Nearctic Region, the species currently included in *Hellinsia* were previously listed as *Oidaematophorus* Wallengren, 1862 by Munroe (1983). The wing venation of *Hellinsia* and *Oidaematophorus* is very similar, with some *Hellinsia* differing only by having the origin of forewing vein M_3 more distad of the cell angle. Gielis (1993) revised the genera of Pterophorioidea and separated *Oidaematophorus* from *Hellinsia* based on characters of the male and female genitalia, the principal character being the wide bell-shaped antrum of the female genitalia.

Studies of the Florida fauna by Matthews (1989) and life histories of the Nearctic fauna (2006) include accounts of an unnamed species, listed as *Oidaematophorus* sp. A by Matthews *et al.* (1990). This species is named and described herein.

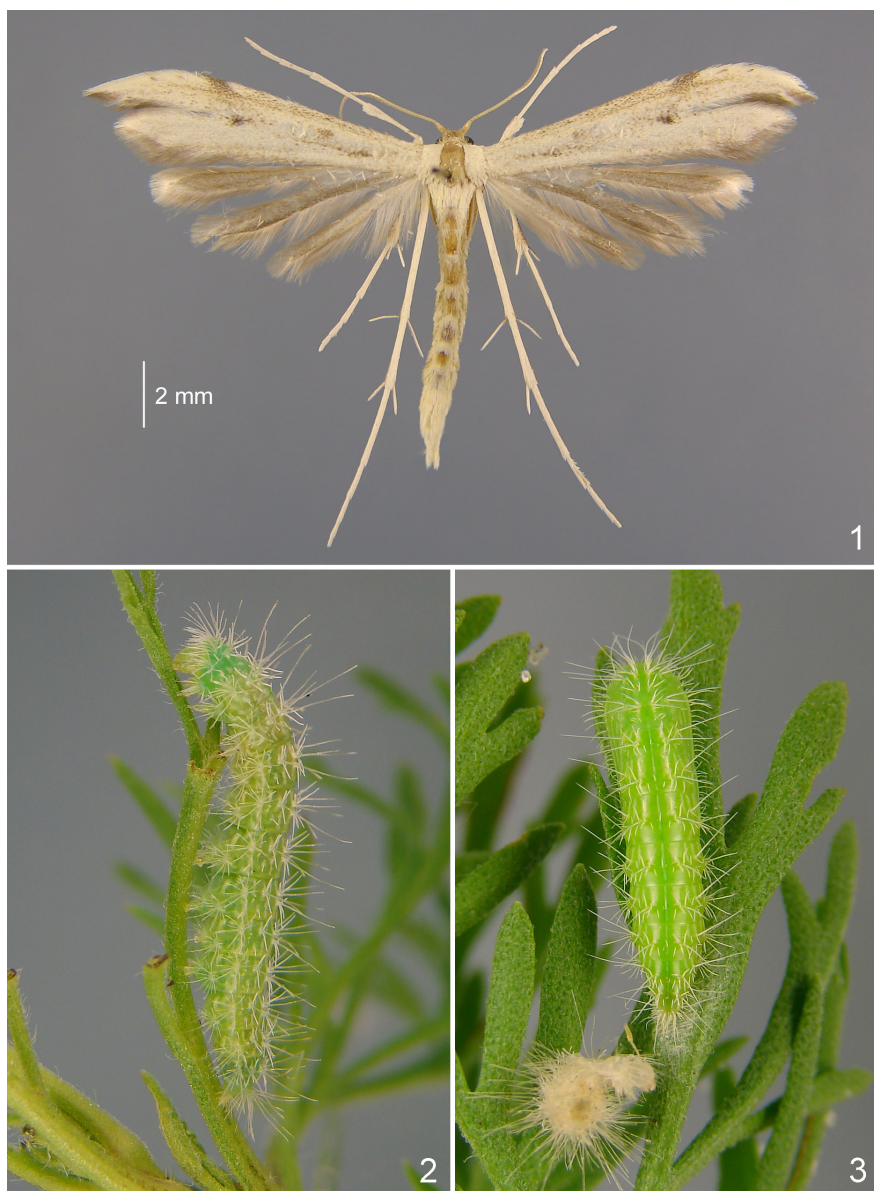
***Hellinisa habecki* Matthews, new species**

Figs. 1 (♂ holotype), 2, 7 (larva), 3, 8 (pupa), 6 (egg), 4 (♂ genitalia), 5 (♀ genitalia)

Diagnosis. This species is distinguished from most other *Hellinisa* occurring in the southeastern United States by the usually white, as opposed to tan, cream, or beige ground scaling of the forewing. *Hellinsia homodactylus* (Walker) and *H. elliottii* (Fernald) have white forewings but do not have darker markings along the costa extending as an oblique dash to the cleft base. The contrast between the fore and hindwings is also greater in *H. habecki*, with the hindwing markedly darker than the forewing. The male genitalia of *H. habecki* are distinguishable from the aforementioned species based on the relative length and curvature of the left valve sacculus; the process elongate and extending longitudinally for at least half the valva length in *H. habecki*, as opposed to a short hook-like process projecting medially. Female genitalia of *H. habecki* have the antrum placed on the left side of the body, like many *Hellinsia* and *Oidaematophorus*, but are unique in having the ostium positioned dorsally.

Description (male, female). Based on holotype (male) and 107 paratypes (62 males, 45 females). HEAD with labial palpi slender, porrect, length equal or just exceeding eye diameter, mottled white and drab-gray. Front and vertex light drab, admixed white scales between antennae. Occiput with tuft of linear white and light drab scales, lengths not reaching eye diameter. Antenna with white scaling dorsally, minutely ciliated ventrally, basal 4–6 segments of flagellum with some drab-gray scales, base with drab-gray scaling medially. THORAX including tegulae white (holotype descaled except tegulae). Foreleg coxa drab to fuscous. Femur drab to fuscous with thin white median longitudinal stripe laterad. Tibia white, flecked with drab scaling mesally, and with white terminal scale tuft. Tarsomeres white, basal segment flecked with drab scaling mesally. Mesothoracic coxa white, femur and tibia dorsum white, venter drab to fuscous. Tibia with one pair of spurs but with a terminal scale tuft at spurs and at middle. Tibial spurs white above, fuscous below, medial spur longest. Tarsomeres white, venter of basal segment with drab stripe. Metathoracic leg with two pair of tibial spurs. Medial spurs longest. Dorsum white, venter white with scattered drab scales and drab to fuscous scales near spurs. Venter of spurs fuscous. FOREWING length – males 10.0 – 12.0 mm, mean 10.84±0.46 mm (n=45), (holotype 11.0 mm); females 10.0 – 13.0 mm, mean 11.56±0.64 mm (n=39). Cleft origin at about 0.63× from wing base. Dorsal ground color white with scattered drab-gray to drab scales, especially along costa. Cleft base with small fuscous spot. Costa with larger, more diffuse fuscous spot distad of costal spot, appearing as oblique dash. Two minute fuscous spots along costa marking terminus of veins R₂ and R₃. A diffuse drab spot in cell, midway between wing base and cleft spot. Vein 1A marked with diffuse line of fuscous scales at basal third of wing. Fringes drab except for narrow white patch at first lobe apex (vein R₄ terminus) and vein R₅ terminus. White fringe scales sometimes present at terminals of second lobe veins but not forming distinct patches. Forewing venter drab, white along costa and lobe apices, fuscous spots at cleft base and along costa as on dorsum. HINDWING drab-gray to drab. Fringes concolorous. Hindwing venter as on dorsum except white scales admixed along anterior margin and on third lobe. Venous scales fuscous. ABDOMEN white, with pair of diffuse variable drab-gray lateral lines and a drab-gray midventral line.

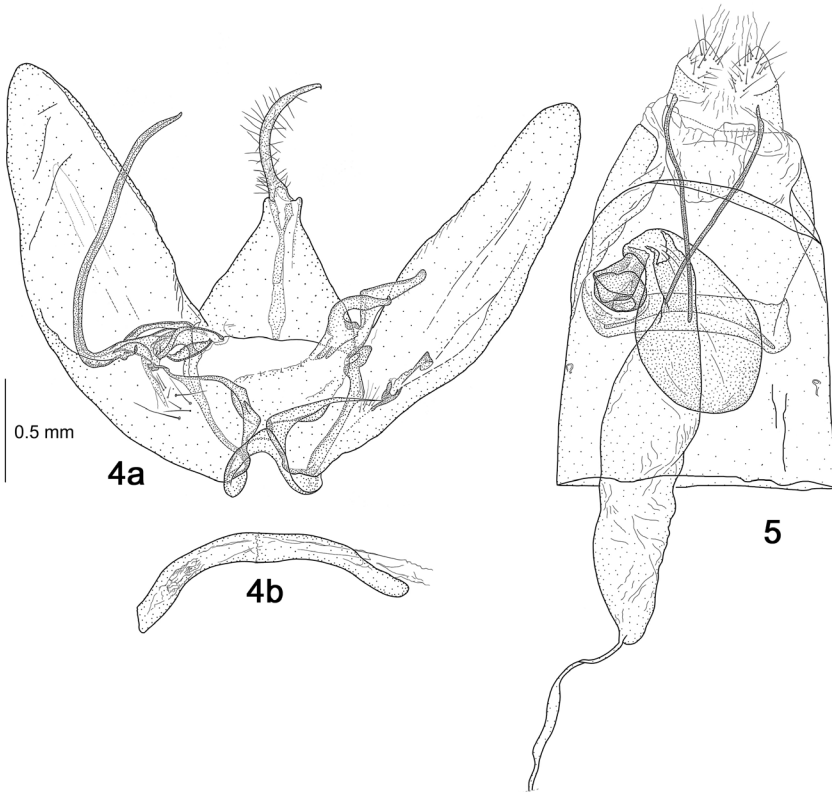
Male genitalia (n = 17). Uncus strongly curved, apex tapered, length about equal to that of tegumen. Tegumen with paired median striae, fused anteriad and extending to



Figures 1–3. Life history of *Hellinsia habecki*: 1) holotype, adult ♂; 2) lateral view of last-instar larva; 3) dorsal view of pupa.

base, area between striae tending to be more heavily sclerotized than surrounding tegumen. Valvae asymmetrical, length about equal and both slightly tapered caudally but left valve broader at middle and with well-developed elongate saccular spine. Spine extending laterad

from thickened base arising near juncture of tegumen and vinculum, then strongly curved posteriad for more than half valva length. Middle part of spine usually slightly bowed toward meson and apical portion tapered to a point and directed mesally. Right valve with pair of minute dentate processes; basal process directed anteriad, distal process projecting caudad. Juxta arms asymmetrical, right arm broader at middle and extending twice the



Figures 4–5. Genitalia of *H. habecki*: 4a) male genitalia with aedeagus removed, slide DM 050; 4b) aedeagus of same individual; 5) female genitalia, slide DM 1505.

distance of left; apices of both arms tapered. Saccus narrow, arched. Aedeagus noticeably curved, length just exceeding one-half length of right valve. Apex blunt, vesica with striae but no distinct cornutus. Coecum penis about one-fifth length of aedeagus.

Female genitalia (n = 9). Papillae anales short, very lightly sclerotized, posterior margins setose. Apophyses posteriores thin, moderately sclerotized, 3.5 – 4.0× length of papillae anales. Venter of segment VIII membranous. Sternite VII with convex posterior margin overriding segment VIII in one or more irregular folds. Tergite VIII narrowed at anterior end with double integument layer forming collar-like anterior marginal band. Marginal band extending beneath tergite VIII; anterior-posterior width about 0.5× length of papillae anales. Apophyses anteriores embedded within marginal band, projecting laterad

at oblique angle toward rounded anterolateral ends of band. Ostium dorsal, just ventrad of marginal band on left side, adjacent to base of left anterior apophysis; round or irregular in shape, diameter about 0.5× widest part of antrum. Ostium lip and antrum lined with minute spiculi. Ductus bursae extending posteriad from antrum, length just exceeding antrum diameter, with paired elongate lateral sclerites (similar to those found in antrum proper of many other *Hellinsia*). Corpus bursae ovoid to oblong, oriented with long axis oblique to body axis, length at least 3× that of ductus bursae, lined with minute spiculi, signa absent. Inception of ductus seminalis at juncture of ductus and corpus bursae. Ductus seminalis basally enlarged and oblong, length about 2.5× corpus bursae, oriented with long axis of body, anterior end tapered with subapical filamentous connection leading to oviduct.

Comments. While it is possible to stretch and extend the ductus bursae and antrum anterior as seen in earlier slide preparations by the author, the natural orientation, as observed during several recent dissections, is with the antrum and ductus bursae directed posteriad from the ostium, with the corpus bursae and ductus seminalis directed anterior. The antrum is somewhat folded in this position and difficult to characterize. The paired sclerites of the antrum are lightly sclerotized and situated more distally than in other *Hellinsia* species examined. The marginal band of tergite VIII, with the embedded apophyses anteriores, exhibits noticeable asymmetry in accommodating the unique dorsal position of the ostium.

Types. **HOLOTYPE** ♂ - USA: FLORIDA: Liberty Co.: intersection of C.R. 270 & 271 along road 24.iv.1993 T. Lott & D. Matthews, leaves of *Eupatorium compositifolium* Walt., prepupa 9.v.1993, pupa 10.v.1993, adult 22.v.1993. The holotype and reared paratypes include final instar larval and pupal exuviae in gelatin capsules on the same double mount pin with the adults. Pupation and emergence dates for reared specimens are included on a second specimen label and are listed for each specimen in Matthews (2006). Dates given below for reared paratypes include the larval collection day only. **PARATYPES** 62 ♂ and 45 ♀ as follows: same location and larval collection date as holotype, 21 ♂ (slide DM 1501), 20 ♀ (slides DM 1500, DM 1504); ALABAMA: Henry Co.: Hwy 10, 1.3 mi. E of Abbeville 31.v.1994 D. Matthews & T. Lott, adults resting on *E. compositifolium* 5 ♂ (slide DM 1502), 2 ♀ (slide DM 1503); GEORGIA: Cook Co.: SR 37 S of Ellenton 31.v.1994 T. Lott & D. Matthews, adults resting on *E. compositifolium* 2 ♂ (slide DM 1506), 1 ♀ (slide DM 1505); FLORIDA: Alachua Co.: Austin Cary Memorial Forest 26.v.1977 G.B. Fairchild & H.V. Weems, Jr., C.P. Kimball Collection, 3 ♂ (slides DM 646, DM 647, DM 651); behind Gainesville Airport 21.v.1987 P.E. Skelley, 1 ♀ (slide DM 045); Edgecliff Subdivision, 3.v.1983 D. H. Habeck, DHH rearing A-3202d *Eupatorium capillifolium*, 1 ♀ (slide DM 044); San Felasco Hammock 29.iv.1977 G. B. Fairchild & H. V. Weems, Jr., C.P. Kimball Collection, 1 ♂ (slide DM 644); same data except 23.v.1977, 2 ♂ (slides DM 643, DM 645); 0.8 mi. S of E CR1474 on SE 245 St., 29.iii.2003 D. Matthews, T. Lott, A. Lott, ex. larva on leaves of *E. compositifolium*, 3 ♀; Escambia Co.: Pensacola 16.v.1963 H.O. Hilton, 1 ♂ (slide DM 1498); Liberty Co.: 1.7 mi. S of CR 271 on CR 270, 24.iv.1993, T. Lott & D. Matthews, leaves of *E. compositifolium* 3 ♂ (slides DM 601), 1 ♀; Torreya State Park 16.v.1968 H. V. Weems, Jr., C.P. Kimball Collection, 1 ♂ (slide DM 648); same location, 25.v.1986 H. D. Baggett, 1 ♂ (slide DM 041); same location and collector 31.v.1988 MVL, 1 ♀ (slide DM 048); same location 29.v.1988 T. Lott & D. Matthews 1 ♂ (slide DM 050); same location, 23–25.iv.1993 D. Matthews & T. Lott, leaves of *E. compositifolium*, 5 ♂, 4 ♀; Marion Co.: East Silver Springs Shores 26.vi.1991 J. S. Kutis, MVL, 1 ♀, same location, 22.v.1993 D. Matthews & T. Lott, on leaves of *E. compositifolium*, 2 ♂; Putnam Co.: 3 mi. SE Hawthorne near Little Orange Lake 8.iv.1995 T. Lott & C. Gielis, reared from larva on

leaves of *E. compositifolium* 8 ♂, 2 ♀ (slide DM 1075); same location & host, 9.iv.1995 D. Matthews, A. Lott, T. Lott & C. Gielis, 1 ♀; same location & host, 25–26.iv.2009 D. Matthews & T. Lott, 1 ♂, 4 ♀; W of Johnson, off CR 20A, 106 Sunnyside Dr. 6.v.2005 D. Matthews, leaves of *E. compositifolium* 2 ♀; same data but 30.iii.2006, 2 ♂, 1 ♀ (slide DM 1499); Suwannee Co.: Suwannee River State Park 31.v.1983 H. D. Baggett, MVL, 1 ♂ (slide DM 046); same location and collector, 21–23.v.1986, 2 ♂ (slides DM 042, DM 047).

The holotype and 14 paratypes are deposited in the McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History, Gainesville, Florida [MGCL]. Additional paratypes will be deposited as follows: 12, National Museum of Natural History, Washington D.C. [USNM], 8, Essig Museum of Entomology, University of California, Berkeley, California, 12, Cees Gielis Collection, Lexmond, Netherlands (ultimate disposition, Nationaal Natuurhistorisch Museum, Leiden, Netherlands), 7, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts (C. P. Kimball Collection) [MCZ]. The remaining paratypes are currently held in the author's collection for later distribution. Material previously held in museum collections includes only the C. P. Kimball specimens from MCZ and one specimen, leg. H. O. Hilton, found in MGCL.

Immature material examined. L = larva, LS = larval skin, P = pupa, PC = pupal case (exuvium). Specimens are currently held in the author's collection unless noted otherwise. Additional voucher samples will be deposited at MGCL and other institutions. All specimens from leaves of *Eupatorium compositifolium* unless otherwise indicated. USA: FLORIDA: USA: ALABAMA: Henry Co.: 1.3 mi. E of Abbeville on Hwy 10 31.v.1994 D. Matthews & T. Lott (1 LS, 3 PC); FLORIDA: Alachua Co.: behind Gainesville Airport 21.v.1987 P. E. Skelley, 30 ova ex. f (8 ova examined with SEM, 11 1st instar larvae dissected from ova); Gainesville, Millhopper area, Univ. Fla. Hort. Unit 14.iv.1965 D. H. Habeck, "on ragweed" (3 L) [USNM]; same data (5 L, 1 P) [MGCL]; Clay Co.: SR 21 & Deer Spring Rd., 2.4 mi NE of SR 100 29°48'46"N 82°00'18"W 29.iv.1995 D. Matthews, T. Lott, A. Lott (5 L, 1 P); same location 27.iv.1996 (2 L, 4 LS, 5 P); Levy Co.: 3.8 mi SW of Archer, SR 24, 4.v.1988 J. Watts (1 LS, 1 P, pinned); Liberty Co.: 1.7 mi. S of CR 271 on CR 270 24.iv.1993 D. Matthews & T. Lott (8 L); intersection of CR 270 & 271 along road 24–25.iv.1993 D. Matthews & T. Lott (147 L, 15 LS, 14 P); Torreya State Park 23.iv.1993 D. Matthews & T. Lott (16 L); same data, preserved 20.i.v.1993 (1 L, 6 LS, 6 P); Marion Co.: East Silver Springs Shores 22.v.1993 D. Matthews & T. Lott (2 PC, pinned); Putnam Co.: 2.5 mi. SE of Hawthorne, nr. Little Orange Lake, along Ashley St. 8.iv.1995 T. Lott, D. Matthews, C. Gielis (6 L, 23 LS, 5 P); 3 mi. S of Melrose, SR 21, 0.7 mi. E of SE 245th St. on ECR 1474 (CR 234) 29.iii.2003 D. Matthews, T. Lott, A. Lott (12 L, 1 LS, 1 P); GEORGIA: Cook Co.: S of Ellenton off SR 37 31.v.1994 D. Matthews & T. Lott (1 LS, 1 P).

Type locality. USA: Florida: Liberty County. The holotype was reared from a larva collected on the host which was growing along roadside easement near the intersection of county roads 270 & 271 (northern branch of CR 270), southeast of the park entrance road to Torreya State Park. This specific location borders pine plantation and is periodically mowed. In April, 1993 the easement was lined with hostplants and supported and unusually dense infestation of larvae. The general area includes bluffs and ravines along the Apalachicola River with relict hardwoods and other plants of the southern Appalachian Mountains as well as typical native pine forest with sandy soils.

Etymology. This species is named in honor and recognition of Dale H. Habeck who first collected the larvae of this plume moth in 1965. His numerous contributions to the taxonomy and knowledge of the life histories of Lepidoptera in Florida are of particular

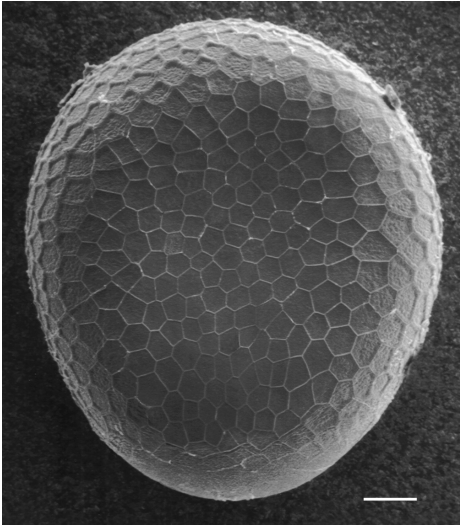


Figure 6. Scanning electron micrograph of egg. Line = 50 μ m.

significance to Lepidoptera research, especially to biodiversity and biological control studies.

Life history. Larvae feed externally on leaves of *Eupatorium compositifolium* Walt. and may be locally abundant.. There is one record for *E. capillifolium* (Lam.) Small and larvae will feed on this plant if no choice is given in lab rearings. Five instars were determined by Matthews (2006) based on head capsule measurements. The host is perennial, growing individually, or in clumps or colonies, and reaching up to 6 feet in height. The plants die back to the roots in winter, with the dead stalks breaking away or still standing by spring. The new stalks are about 1–2 feet high by the time larvae are full size. Pupae are attached to the underside of the leaves, sometimes close to the base of the plants. The cryptic pupae

are easiest to find by searching damaged plants for the contrasting white cast larval skin of the final instar. The larval skin is usually adjacent or a few inches away and adheres to the sticky leaves. The pupal stage lasts about 9–14 days. This species probably spends several months, possibly overwintering, within the relatively thick egg chorion. Ova obtained from a captive wild-caught female (21.v.1987) produced pharate first instar larvae within 2 weeks which survived and were observed to move within egg chorions for up to 2 months before dehydrating.

Egg (Fig. 6). Maximum length 0.45 mm (30 ova, 8 examined with SEM, Matthews 1989). Ovoid, somewhat flattened. Chorion surface reticulated, ridges forming polygonal cells. Aeropyles visible at ridge junctures except near middle where ridges are finer. Narrow end smooth, without reticulations and with no distinct micropyle.

Larva (final instar, Figs. 2, 7). Maximum length 15.5 mm, width 2.47 mm. Head greenish-yellow. Body rich green, suffused with olive on dorsum. Posterior margins edged with greenish-yellow on some segments. Middorsal line white to pale green, thin and well defined, with a tiny eyelet at the center of T2–A7. Dorsal line incorporating D tubercles, width about 3 \times middorsal line, margins more diffuse. Subdorsal and stigmatal lines thin, broken. Setae clear, appearing bright white in live specimens; simple, with smooth shafts and pointed tips. Short to minute setae more blunt-tipped. Primary setae mostly long, distinct and central on elevated verruca-like tubercles with shorter secondary setae. Lateral and subventral tubercles with more secondary setae, appearing like true verrucae. Longest primary setae, SD1 on T3–A7, SD1 and SD2 on A9, and D2 on A9, up to 2.64 mm (1.07 \times maximum body width).

Head: Width 0.79–1.13 mm (n=128). Adfrontals extending dorsad nearly to epicranial notch, ventrad along dorsal 0.6 \times of lateral adfrontal suture. Lateral adfrontal suture about 2.5 \times epicranial suture. Pore AFa present. Seta AF1, C2, A2 subequal, shorter than AF2; AF2, F1 and C1 subequal, about 0.5 \times clypeal width. Seta A1 length about 1 \times clypeal width;

P1 about $0.67\times$ clypeal width. Setae A1, A2, and pore Aa aligned with Aa dorsad of A2. Stemmata with raised ridges forming cells (SEM observation). Stemmata 1 and 6 lacking ridges and flattened. Stemma 1 with largest diameter. Labrum large, rectangular, without notch; anterior margin straight or curved very slightly (inward). Four setae present; M1 shorter than and dorsad of M2. Mandible length about $1.3\times$ width. Mandible 6-toothed, sixth tooth arising from ridge of first tooth. Teeth 2 and 3 longest. Distal seta absent, proximal

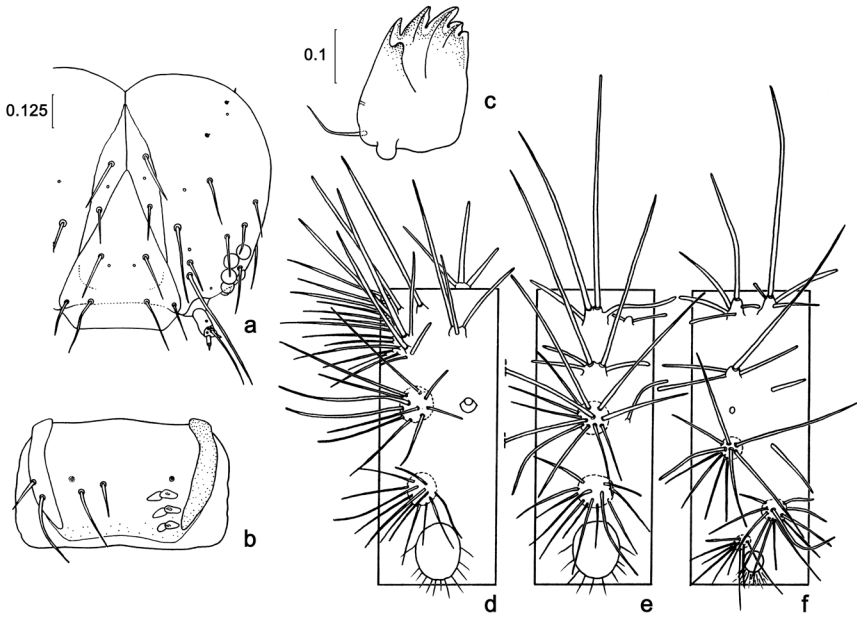


Figure 7. Larva of *H. habecki*: **a)** head, frontal view; **b)** labrum, epipharyngeal surface on right; **c)** right mandible; **d)** chaetotax map of segment T1; **e)** segment T2; **f)** segment A3.

seta length about $0.6\times$ mandible width.

Thorax: Prothorax without shield. Anterior margin with long primary XD and SD setae and short to moderate length secondary setae on elongate verruca, in near transverse alignment with seta SD2 laterad of SD1. Secondary setae consisting of a medium length seta directly posteriad of SD1, a short seta posteriad or laterad of SD2, and about 8–14 (each side) short to medium fringe setae directed over head. Seta D1 solitary on tubercle, posteriad of and as long as XD1. Seta D2 as long or slightly shorter than D1, on tubercle with 2 shorter medium length setae flanking D2 posteriad. Middorsal process with 2 medium setae and sometimes a short seta posteriad, setae longitudinally aligned along midline. Spiracle round, exserted, peritreme light. Lateral verruca with about 10–16 short to long setae. Subventral verruca with 10–13 short to medium setae. Segments T2–T3 with D1 and D2 on 1 tubercle. Seta D2 longer than D1, D2 on T3 slightly longer than on T2. Seta D2 usually longer on both T2–T3 than on A1–A8. Seta D1 with 1–3 minute to short setae anteriorad on tubercle and directed anteriorad close to body. Seta D2 with 1 short seta posteriad, directed posteriad. Minute seta posteriad of D tubercle, seta directed posteriad close to body, a second shorter erect or anteriorly-directed seta sometimes present on the same tubercle. Subdorsal tubercle

with SD1 longer than SD2. Seta SD1 with 2 short anteriorly projecting setae anterior on tubercle. Seta SD2 with 1 short posteriorly projecting seta posterior on tubercle. Lateral verruca as on T1 but longest seta longer than on T1. Short curved secondary seta posterior of L verruca, a second minute seta sometimes present posterior of short seta but on the same tiny tubercle, minute seta directed posterior. Subventral verruca as on T1.

Abdomen: Segments A1–A8 with D1 and D2 on separate but approximate elevated tubercles; tubercles longitudinally aligned. Seta D2 longer than D1. Seta D1 with 3 setae anterior on tubercle - a medium length seta flanked by 2 short setae. Posterior side of tubercle with 1 or 2 minute setae. Seta D2 with 2 short setae posterior, and 1 minute seta anterior on tubercle. Subdorsal tubercle on A1–A7 with SD as long as D2 or longer; 2 short setae anterior on tubercle and 1 seta posterior. Subdorsal tubercle on A8 with seta SD1 shorter than on A7 and with only 1–2 short setae anterior (posterior seta usually absent). A minute, posteriorly directed secondary seta posterior of SD tubercle on A1–A7. Spiracles on A1–A8 round, not exerted, peritremes light. Lateral (L1–L2) verruca on A1–A8 round, with 8–10 short to long setae. A short seta posterior of L1–L2 verruca on A1–A7 with a minute seta sometimes also present on the same tubercle. Verruca L3 with about 8–12 short to moderately long setae on A1–A7, 3–4 setae on A8. Subventral verruca with 7–12 minute to short setae on A3–A6, smaller, with 3–8 setae on the other segments. Proleg length about 2.75× width. Mesopenellipse with 8–9 crochets. Multiple minute V setae present mesad at proleg base. Seta V1 minute, solitary or with 1–2 subequal setae on the other segments. Segment A9 differing from A8 in having D1 and D2 tubercles fused, 1 minute seta anterior of D1, and 2–3 short to minute setae posterior of D2. Subdorsal tubercle with 2 long subequal setae (SD1, SD2) central on tubercle with 1 short seta anterior and 1–2 posterior. Verruca L3 absent. Anal plate with D and SD verruca-like tubercles on caudal margin, dorsum otherwise bare; D tubercle with about 11 short to long setae, SD tubercle with about 7 short to long setae. Anal proleg with 9–12 crochets. About 7–10 short setae posterior on proleg, several minute setae anterior.

Pupa (Figs. 3, 8). Maximum length 11 mm, width about 2.64 mm at mesothorax. Light green with numerous long to short white setae, wing cases changing from light green to white to grey prior to emergence. Setae grouped, most long setae with shorter associated setae nearby or on the same verruca or verruca-like prominence. A solitary short middorsal seta present on A1–A8. Lateral setae of A2–A6 projecting in a fan on flange-like, crescent-shaped verrucae. Lateral row of setae present along forewing.

Head: Ventral surface flat. Front lacking conspicuous protrusions, cephalic margin fringed with row of setae which is continued along antenna. Four to 5 short setae on front cephalic margin. Two medium-length AF setae just posterior of cephalic margin near antenna base and with 1 associated short seta. Dorsum of front (and prothorax) more darkly sclerotized than mesothorax. Seta F1 short to minute. Frontoclypeal suture distinct. Clypeus with 1 short to minute seta. Pilifers distinct, triangular shaped with 1 point at meson so that labial palpa, pilifer, and clypeus converge at meson. Gena smooth, 1 minute seta near maxilla base. Sculptured eyepiece with 2 short setae along lateral margin. Maxilla base exposed to a point about even with A2 posterior margin. Distal tip of maxilla exposed beyond tip of T1 leg. Antenna extending to tip of foreleg, with about 20 setae along cephalic and lateral margin near base. Setae short at base, gradually becoming minute posterior. Setae spaced about even with adult flagellum segments.

Thorax: Pronotum with 5 long setae: XD1 near anterior margin, D1 near center, D2 along posterior margin between midline and spiracle, and SD1 and SD2 approximate

at lateral angle. Two very short setae between XD1 and D1 and 1 adjacent to SD setae. Foreleg reaching posterior margin of A5, just short of forewing tip. Coxa of foreleg exposed. Mesonotum with 4 long setae, D1 and D2 with setal tubercles joined at base; SD1 and SD2 likewise with tubercles basally joined. Subdorsal setae marking dorsal margin of adult tegula. Mesonotum lacking distinct dorsal ridge but 12 short setae present in a loose row along with the 2 long D setae (5 setae associated with D tubercle). Some specimens with 1 short seta between and sometimes posteriad of long D and SD setae. Four short setae

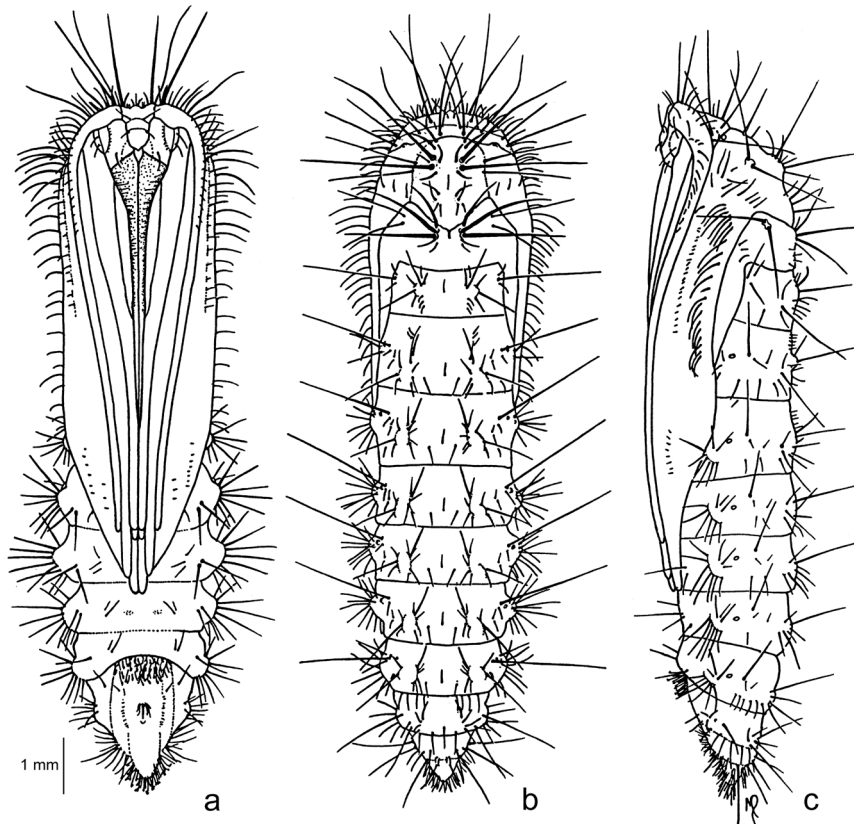


Figure 8. Pupa of *H. habecki*: **a)** ventral view; **b)** dorsal view; **c)** lateral view.

on wing base and a lateral row of 20–25 medium to short setae extending along wing. A second row about 20 short to minute setae ventrad of lateral row in some specimens. A few other minute setae marking adult veins near wing tip. Forewing extending to tip of midleg. Midlegs not touching throughout length. Both T2 leg and forewing usually extending to caudal margin of A5. Spiracle small, on anterior margin of T2 between subdorsal and lateral long setae of prothorax. Metathorax with 2 pair of long setae (D and SD) as on T2 but with D1 usually slightly shorter than D2. Dorsal setae on slight rise. Two medium length setae associated with long D setae and 5–9 short to minute setae also forming dorsal row. Two to 3 short or minute setae at hindwing base. Hindwing extending to 0.5× length of A2. Tip of hindleg exposed between midlegs and extending slightly beyond midlegs.

Abdomen: Dorsum of A1–A9 with 3 primary setae, D1 medium length, distinct on A1–A3, more difficult to distinguish from secondary setae on subsequent segments. Seta D1 anterior of D2 [A1–A7]. Three short to medium secondary setae in line anterior of D1 on A1, 5 on A2–A3. Five minute to medium secondary setae in line posterior of D1 on A1, 4 on A2, 3 on A3. Seta D1 and secondary setae in line on slightly elevated elongate verruca-like ridge. Segments A4–A6 with 5 minute to medium length setae in dorsal line including D1. Segments A1–A8 with a short middorsal secondary seta and similar sized posteriorly projecting secondary seta between middorsal seta and D1 setal row. Seta D2 long, with 1 short to medium anterior and 1 posterior secondary seta on A1–A8. Seta D2 and associated seta on slightly elevated area contiguous with D1 verruca-like ridge. Seta D2 directed laterad to gradually posterior on subsequent segments. Seta SD1 anterior of D1 and D2 seta on A1–A9, laterally projecting on A1 and A7–A9, directed anterior on A2–A6. Seta SD1 with a short anterior and a medium posterior associated secondary seta on A1, posterior associated secondary seta present on remaining segments. Segments A1–A7 with a short anteriorly-directed secondary seta and posteriorly-directed seta between D2 and SD setae. Segment A1 with 1 minute secondary seta posterior of SD setae, A2 with 2 short setae posterior of SD setae and A3 with 3 short setae posterior of SD setae. Segments A4–A6 with 1 short seta posterior of SD group, A7–A9 likewise with 2 setae. Spiracles on A2–A7 small, elliptical, smaller but discernible on A8. Segments A3–A7 with lateral crescent-shaped, flange verruca with fan of 5–7 short to medium length setae. Flange most developed on A4–A6. A second group of setae on anterior end of flange but dorsad of the lateral setae fringe. This second group with 2 setae on A3, 2 or 3 on A4–A7. Two (sometimes 3) setae in similar position adjacent to forewing margin on A2. One to 3 medium to short setae on tubercle ventrad of lateral flange on A4–A7 (only 1 apparent on A7). Subventral area with a group of 1–3 short setae on A5–A7. Proleg scars visible. Segment A8 with about 6 setae in similar position to lateral flange on A7. One seta in L3 position. Eight or more short setae along lateral margin of A9–A10 ventral plate. Segment A10 with a patch of about 30 fine hooked anterior hamuli and numerous hooked posterior hamuli present at tip of abdomen.

Distribution and phenology. This species is single brooded. Larvae have only been collected from the end of March through the end of May with the adults emerging mid April through the second week of June. The known distribution includes Florida, Alabama, and Georgia but the hostplant extends north into southern North Carolina and west into eastern Texas. Most of the records of the moth in Florida are from the northern counties with the exception of two specimens from Collier County. The host is especially common in well-drained sandy soils of pinelands and relict sand dune habitats.

DISCUSSION

Aside from its apparently limited distribution and seasonal occurrence in a part of the Nearctic Region where continuous brooded species are common, *H. habecki* is perhaps most remarkable in the morphology of the female genitalia. While wing venation and morphology of the larvae and pupae are consistent with that of other externally feeding *Hellinisa* and *Oidaematophorus*, the dorsal placement of the ostium is previously unknown within these genera and unusual if not unknown, in Lepidoptera. As in many other *Hellinisia* species, the antrum is located on the left side of the body, as opposed to central, corresponding with the asymmetry of the male genitalia. Male *Hellinisia* typically have an enlarged left valva bearing a well-developed saccular process. While there is some variation within species, the

relative length and shape of the saccular process is generally the most consistent diagnostic feature of the male genitalia. The differences in the shape of the saccular process may be subtle, but useful in combination with other characters such as wing maculation.

Within this large and diverse genus, there is no obvious closest relative to *H. habecki*. Among similar species which feed externally as larvae, *H. elliottii* and *H. homodactylus* have bright white scaling on the forewing but few markings and a short hook-shaped saccular process in the males (Barnes and Lindsey 1921, plate LIII, fig. 5). Worn or pale specimens of *H. citrites* (Meyrick) have similar forewing maculation but a short thorn-like saccular process. The tubular as opposed to bell-shaped antrum of female *H. habecki* along with the uncoiled ductus seminalis exclude this species from *Oidaematophorus*. The saccular process of the left valve in male *H. habecki* is generally similar, however, to that of several species of *Oidaematophorus* such as *O. cretidactylus* (Fitch), *O. occidentalis* (Walsingham), and *O. mathewianus* (Zeller), but these species can be distinguished on the basis of color, tibial scale tufts, and wing maculation.

Of known larvae, *H. habecki* keys closest to *H. helianthi* (Walsingham), a species found in the western United States and Canada. The larvae of the latter are distinguished by the absence of secondary setae associated with T1 primary D2 setae and seta SD2 on T2–T3 (Matthews 2006). The pupa of *H. habecki* is similar to that of *O. balsamorrhizae* McDunnough, differing in the relative lengths of the SD1 setae on A2–A6, that of *H. habecki* greater than half the corresponding segment width. As the morphology of larvae and pupae as well as the female genitalia of more species of *Hellinsia* are studied, and molecular data for correctly identified material become available, the relationships among and between species and species groups of both *Hellinsia* and *Oidaematophorus* will merit future study.

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