

A new genus of Agathidinae with the description of a new species parasitic on *Samea multiplicalis* (Guenée)

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Abstract

A new genus of Agathidinae (Hymenoptera, Braconidae), *Neothlipsis*, is proposed to include 10 species. Nine of these species were formerly included in the polyphyletic genus *Therophilus* Wesmael 1837, formerly referred to as *Basus*. A new species, *Neothlipsis parysae*, parasitic on *Samea multiplicalis* (Guenée), is described. The ten described species transferred to *Neothlipsis* are: *Neothlipsis agathoides* **comb. n.** for *Basus agathoides* Newton & Sharkey 2000; *Neothlipsis agilis* **comb. n.** for *Basus agilis* Cresson, 1868; *Neothlipsis brevicauda* **comb. n.** for *Basus brevicaudus* Muesebeck, 1932; *Neothlipsis californica* **comb. n.** for *Basus californicus*, Muesebeck 1927; *Neothlipsis cincta* **comb. n.** for *Microdus cinctus* Cresson, 1873; *Neothlipsis coleophorae*, **comb. n.** for *Basus coleophorae* Rowher, 1915; *Neothlipsis discolor* **comb. n.** for *Microdus discolor* Cresson, 1873; *Neothlipsis nigricoxa* **comb. n.** for *Microdus nigricoxus* Provancher, 1886; *Neothlipsis petiolate* **comb. n.** for *Basus petiolatus* Muesebeck 1932; *Neothlipsis taeniiventris* **comb. n.** for *Microdus taeniiventris* Enderlein, 1920. Phylogenetic analyses support the sister relationship between the new genus and *Camptothlipsis*. The type material of the new species is deposited at the Hymenoptera Institute Collection at the University of Kentucky, the United States National Museum, the Florida State Collection of Arthropods, and the Louisiana State Arthropod Museum.

Keywords

parasitoid wasps, *Neothlipsis*, Lepidoptera, taxonomy, systematics

Introduction

The primary objective of this paper is to describe a new species of agathidine braconid parasitic on *Samea multiplicalis* (Guenée), which was discovered by the junior author, KAP. A secondary objective is to propose a new genus to include this species and nine others formerly included in the polyphyletic genus *Therophilus* Wesmael, 1837, referred to as *Bassus* Fabricius, 1804 in most recent publications (see Sharkey et al. 2006, 2009).

Methods

Regions D2-D3 of 28S rDNA were sequenced using the following primers: 28SD-2hymF 5' - AGAGAGAGTTCAAGAGTACGTG - 3' and 28SD3hymR 5' - TAGTTCACCATCTTTTCGGGTC - 3'. Sequences were edited using Geneious Pro v4.7.5 (Drummond et al. 2009) and aligned based on a secondary structure model for Ichneumonoidea developed by Yoder and Gillespie (2004) and Gillespie et al. (2005). Regions of expansion and contraction (REC), regions of slipped-strand compensation (RSC), and short regions of alignment ambiguity were further aligned/corrected by eye.

Phylogenetic trees were constructed using maximum parsimony (MP) and Bayesian analyses. Maximum parsimony analyses were performed using TNT (Goloboff et al., 2008). A traditional search with 5000 random addition sequences followed by branch-swapping, saving 5 trees per replication, was performed. Symmetric resampling (Goloboff et al., 2003) of the aligned sequences was carried out with TNT, using 1,000 replicates. The Bayesian analysis was performed using MrBayes v3.1.2 (Ronquist and Huelsenbeck 2003). Best-fitting DNA substitution models were determined using MrModeltest2.2 (Nylander 2004). The general time reversible model of evolution with a parameter for invariant sites and rate heterogeneity modeled under a gamma distribution (GTR+I+G) was determined as the best-fitting model.

Each Bayesian analysis consisted of two independent Bayesian MCMC runs initiated from different random starting trees. The analysis ran for 2,000,000 generations, reaching a topological similarity criterion of 0.005; trees were sampled every 200 generations. Twenty-five percent of the trees from each run were removed as burn-in upon topological convergence.

Abbreviations. Abbreviations used for institutions for where specimens are deposited are as follows:

- FSCA** Florida State Collection of Arthropods, Gainesville, Florida, USA.
- HIC** Hymenoptera Institute Collection, University of Kentucky, Department of Entomology, Lexington, Kentucky, USA.
- LSAM** Louisiana State Arthropod Museum, Baton Rouge, Louisiana, USA
- USNM** National Museum of Natural History, Smithsonian Institution, Washington DC, USA.

Taxonomy

Neothlipsis, gen. n.

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<http://species-id.net/wiki/Neothlipsis>

Type species. *Microdus cinctus* Cresson, 1873, deposited in the Academy of Natural Sciences, Philadelphia, Type # 1718.1.

Description. **Head:** Lateral carina of frons lacking (Fig. 3b); gena rounded posteroventrally (Fig. 3a); interantennal space raised to converge on single point anteromedially; antennal depressions shallow (Fig. 3b); labial palp with four segments, third segment reduced; apical antennomere rounded. **Mesosoma:** Mesoscutum with sculptured notauli (Fig. 3b); posteroscutellar depression absent; median areola of metanotum surrounded by well defined carinae laterally and posteriorly; propodeum areolate rugose with granulate microsculpture (Figs. 2b, 3c, 4c); propleuron mildly convex to flat; metapleuron granulate (Fig. 3a); propodeal pseudosternite appearing as a narrow band separating hind coxal cavities from metasomal foramen. **Legs:** Fore tibial spur not elongate, fore tibia lacking pegs; tarsal claws simple or with a rounded basal lobe; midtibia with apical and subapical pegs; hind tibia with apical pegs. **Wings:** (Figs. 3d, 4d): Rs+Ma vein of fore wing incomplete and not tubular throughout; second submarginal cell of fore wing reduced and triangular or absent; fore wing 3RSb straight to slightly sinuate; hind wing crossveins r and r-m absent; hind wing Cub present as nebulous or spectral vein and sometimes as a short tubular stub. **Metasoma:** Median tergite 1 distinctly granulate and lacking pair of longitudinal carinae (Figs. 2b, 3c, 4c); median syntergum 2+3 weakly granulate to smooth, with transverse depression separating terga 2 and 3; ovipositor varying from length of metasoma to slightly longer than body.

Hosts and biology. A wide range of hosts is recorded, mostly in the Lepidopteran families Tortricidae, Crambidae, Pyralidae, and Coleophoridae.

Distribution. Widespread in the Nearctic and northern Neotropical regions.

Etymology. From the Greek, *neo* (new), and *thlipsis* (pressure or constriction). The name refers to the sistergroup relationship with the Old World genus *Camptothlipsis* and the fact that it is restricted to the New World. The genus is feminine.

Phylogenetic considerations. Members of the genus are very similar to those of *Camptothlipsis*. The only obvious differences are that a small second submarginal cell is present in most species of *Neothlipsis* and is the ground plan for the genus, whereas it is absent in all *Camptothlipsis*. Furthermore *Neothlipsis* is restricted to the New World and *Camptothlipsis* to the Old World.

The cladogram in Fig. 1 is produced from a subset of data from a much larger data set of 28S rDNA. We conducted analyses of numerous permutations of the data set with *Camptothlipsis* and *Neothlipsis* always obtained as sister groups. Figure 1 represents a semi-strict consensus tree of the Bayesian majority rule tree and the unique maximum parsimony tree. The trees did not contradict each other at any node; however, some branches were supported in one analysis and not the

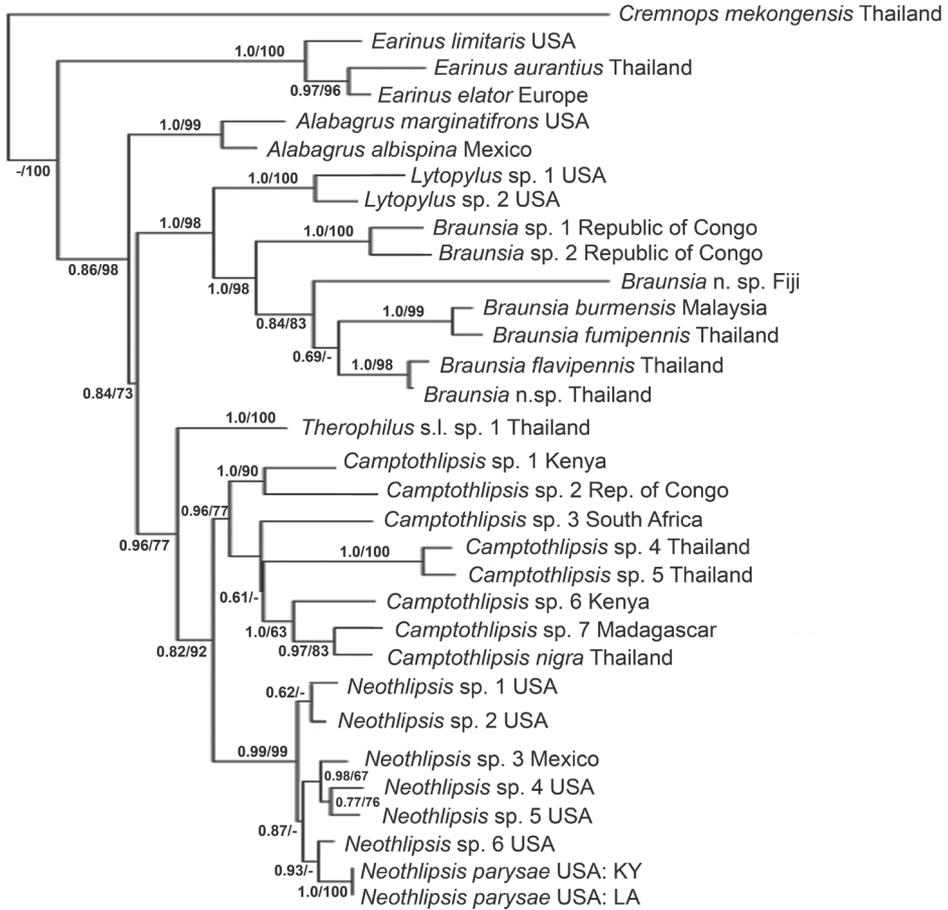


Figure 1. Semistrict consensus tree of two trees inferred from 28SrDNA sequence data aligned by secondary structure, one the majority rule tree using Bayesian methods and the other the unique tree produced using maximum parsimony. Bayesian analysis runtime = 2 million generations (25% burnin). Branch support: Bayesian posterior probabilities / symmetric resampling (1,000 replicates). (-) indicates branch support below 0.5 / 50.

other. The granulate sculpture of the first metasomal median tergite (T1) combined with the lack of lateral longitudinal carinae on T1 are apparent morphological synapomorphies supporting the relationship. *Neothlipsis parysae* and *N. agathoides* are unique amongst members of the genus in that their tarsal claws are simple, lacking a basal lobe. As indicated in Fig. 1, *N. parysae* is well nested within *Neothlipsis*. There are no obvious morphological synapomorphies for members of *Neothlipsis*. They share several synapomorphies with *Camptothlipsis*, e.g., presence of granulate sculpture on the first median metasomal tergite (Fig. 3c), lack of a pair of longitudinal carinae on first median metasomal tergite (Fig. 3c), and the reduced size of the second submarginal cell (Figs 3d and 4d). Since members of

Camptothlipsis are restricted to the Old World, those of *Neothlipsis* may be distinguished from other agathidines occurring in the New World using the three aforementioned character states.

Ten described species are here transferred to *Neothlipsis*, i.e., *Neothlipsis agathoides* **comb. n.** for *Bassus agathoides* Newton & Sharkey, 2000; *Neothlipsis agilis*, **comb. n.** for *Bassus agilis* Cresson, 1868; *Neothlipsis brevicauda* **comb. n.** for *Bassus brevicaudus* Muesebeck, 1932; *Neothlipsis californica* **comb. n.** for *Bassus californicus* Muesebeck, 1927; *Neothlipsis cincta* **comb. n.** for *Microdus cinctus* Cresson, 1873; *Neothlipsis coleophorae* **comb. n.** for *Bassus coleophorae* Rowher, 1915; *Neothlipsis discolor* **comb. n.** for *Microdus discolor* Cresson, 1873; *Neothlipsis nigricoxa* **comb. n.** for *Microdus nigricoxus* Provancher, 1886; *Neothlipsis petiolate* **comb. n.** for *Bassus petiolatus* Muesebeck, 1932; and *Neothlipsis taeniatiiventris* **comb. n.** for *Microdus taeniatiiventris* Enderlein, 1920. All holotypes of the species listed above have been examined by the senior author.

***Neothlipsis parysae* Sharkey, sp. n.**

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http://species-id.net/wiki/Neothlipsis_parysae

Figs. 2, 3

Diagnosis. Similar to *N. agathoides* (Newton and Sharkey, 2000) in that both species share the same host and both are unique amongst members of the genus in possessing simple tarsal claws. The two species can be differentiated as follows:

N. parysae: 1. Hind femur melanic in apical third (Fig. 2a). 2. Head always mostly melanic (Figs. 2a, 3a). 3. Ovipositor distinctly shorter than body (Fig. 2a). 4. Body length less than 3.6 mm. 5. Second submarginal cell of fore wing usually present (80%) (Fig. 3d).

N. agathoides. 1. Hind femur entirely pale or melanic in less than apical fifth (Fig. 4a, b). 2. Head color usually pale at least in ventral half (Fig. 4b), rarely mostly melanic (Fig. 4a). 3. Ovipositor as long as body (Fig. 4a, b). 4. Body length more than 3.6 mm. 5. Second submarginal cell of fore wing usually absent (95%) (Fig. 4d).

Description. Holotype female: Length: 3.4 mm (3.2–3.5 mm).

Color: (Figs. 2, 3). Flagellomeres (with antennae directed anteriorly) dark brown dorsally, fading to dark orange ventrally (ventrally ranging from entirely black to yellow, rarely flagellum pale in basal third); anterior orbit of eye black, the posterior orbit orange (ranging to entirely black); mouthparts pale yellow with black highlights, remainder of head black dorsally with orange patches laterally (ranging from entirely black to mostly orange with dark highlights); fore leg orange with tarsus darkened distally; middle leg orange with tibia darkened distally, tarsomeres mostly dark; hind coxa dark orange (ranging to nearly black, especially in males); hind femur dark orange (ranging to black with some orange, especially in males); basal black band present on hind tibia; hind tibia black in distal half, otherwise orange; wings hyaline; mesosoma black with orange tegula (ranging from black with black tegula to black with orange

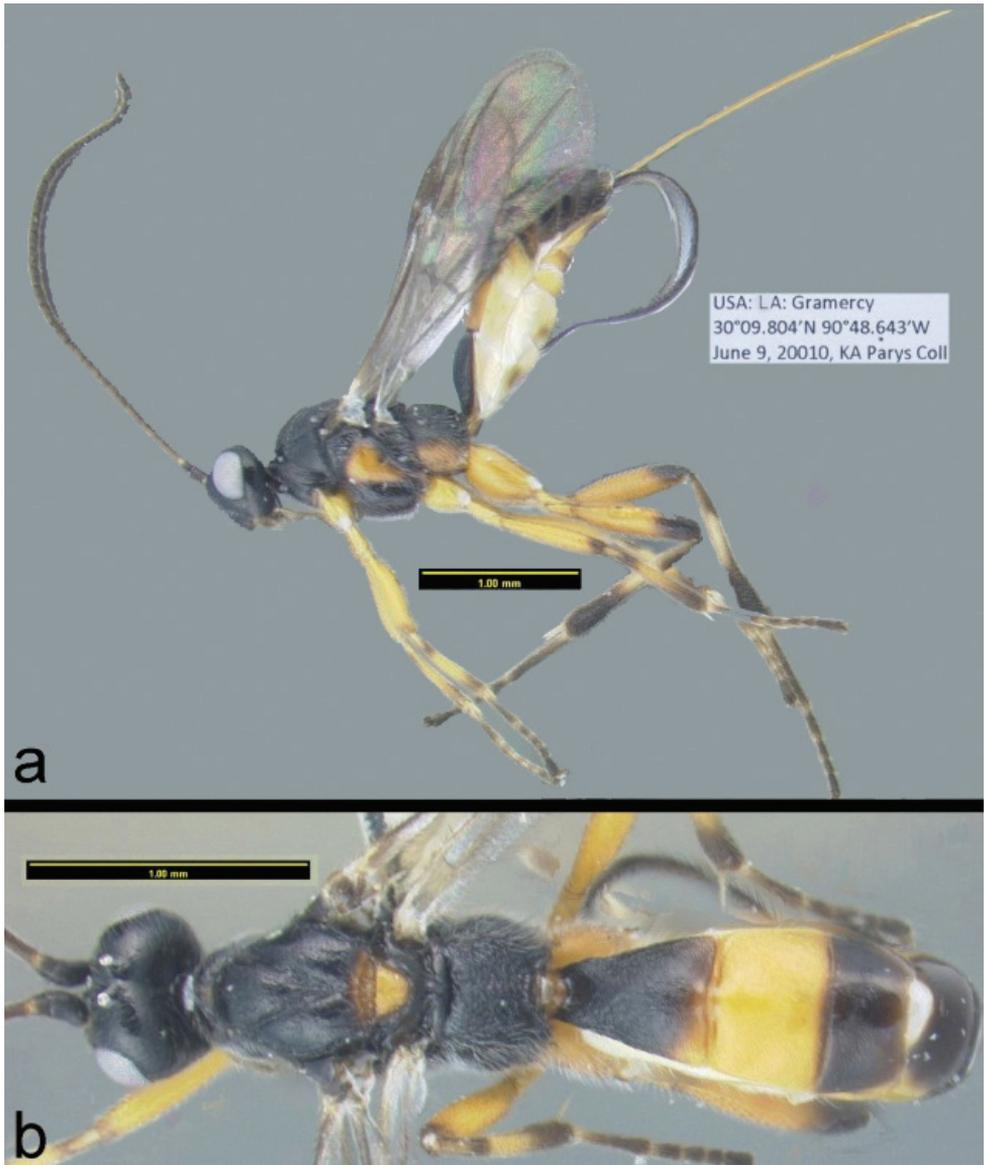


Figure 2. *Neothlipsis parysae* **a** Lateral habitus **b** Dorsal habitus.

highlights, often with an orange spot on the mesopleuron); metasoma pale yellow ventrally (ranging to dark orange); with tergum 1 entirely black, tergum 2 black in the posterior half and orange anteriorly (or black with only the anterior margin orange), tergum 3 black with orange posterior margin, remaining terga orange with dark highlights. **Head:** Number of flagellomeres = 26; ratio, distance between ocellus and compound eye to distance between lateral ocelli = 1.7; temple not bulging as viewed dorsally; ratio, malar space to eye height = 0.53. **Legs:** Midtibia with eight spines; hind

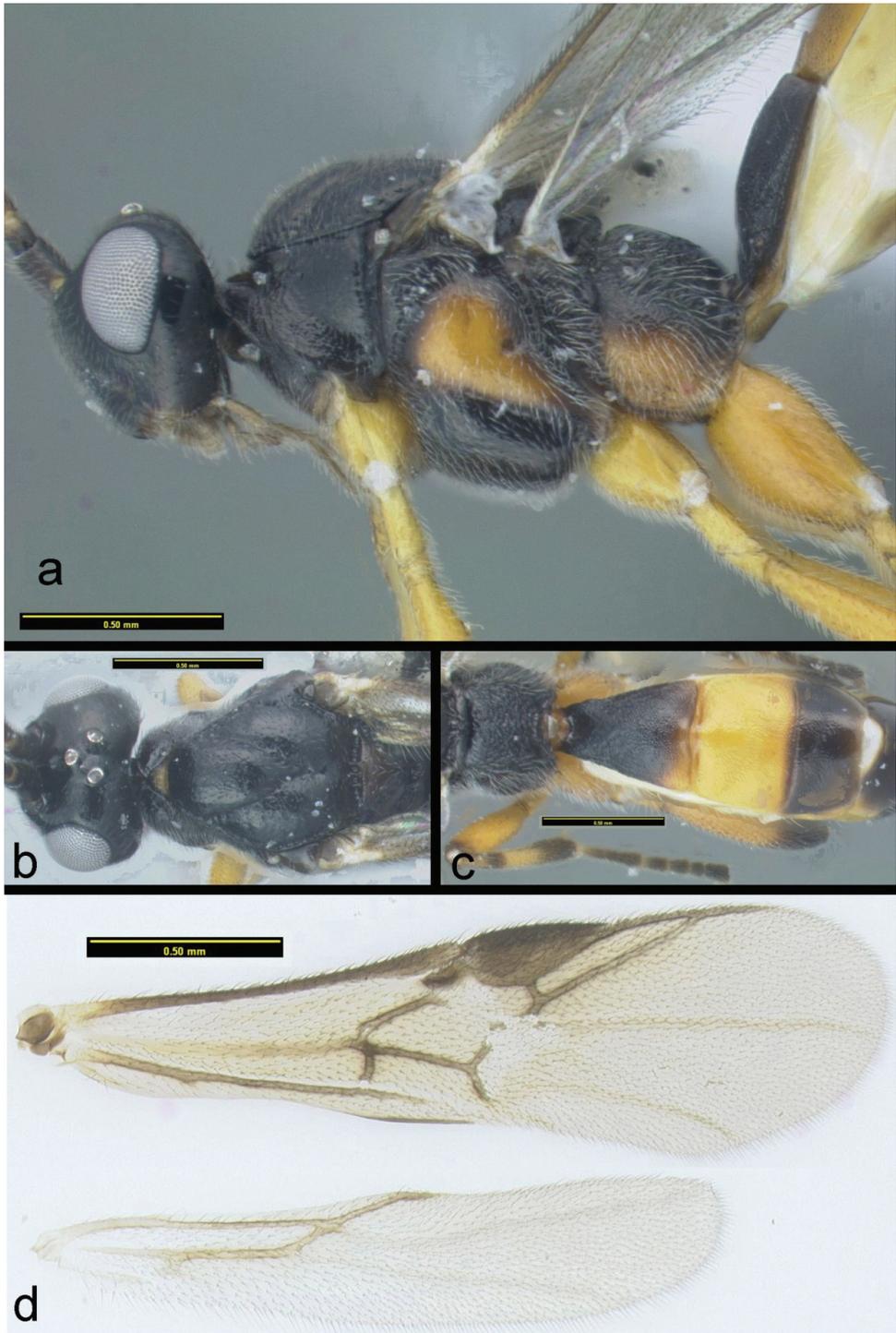


Figure 3. *Neothlipsis parysae* **a** Lateral head and mesosoma **b** Dorsal head and thorax **c** Dorsal propodeum and metasomal terga 1–3 **d** Wings.

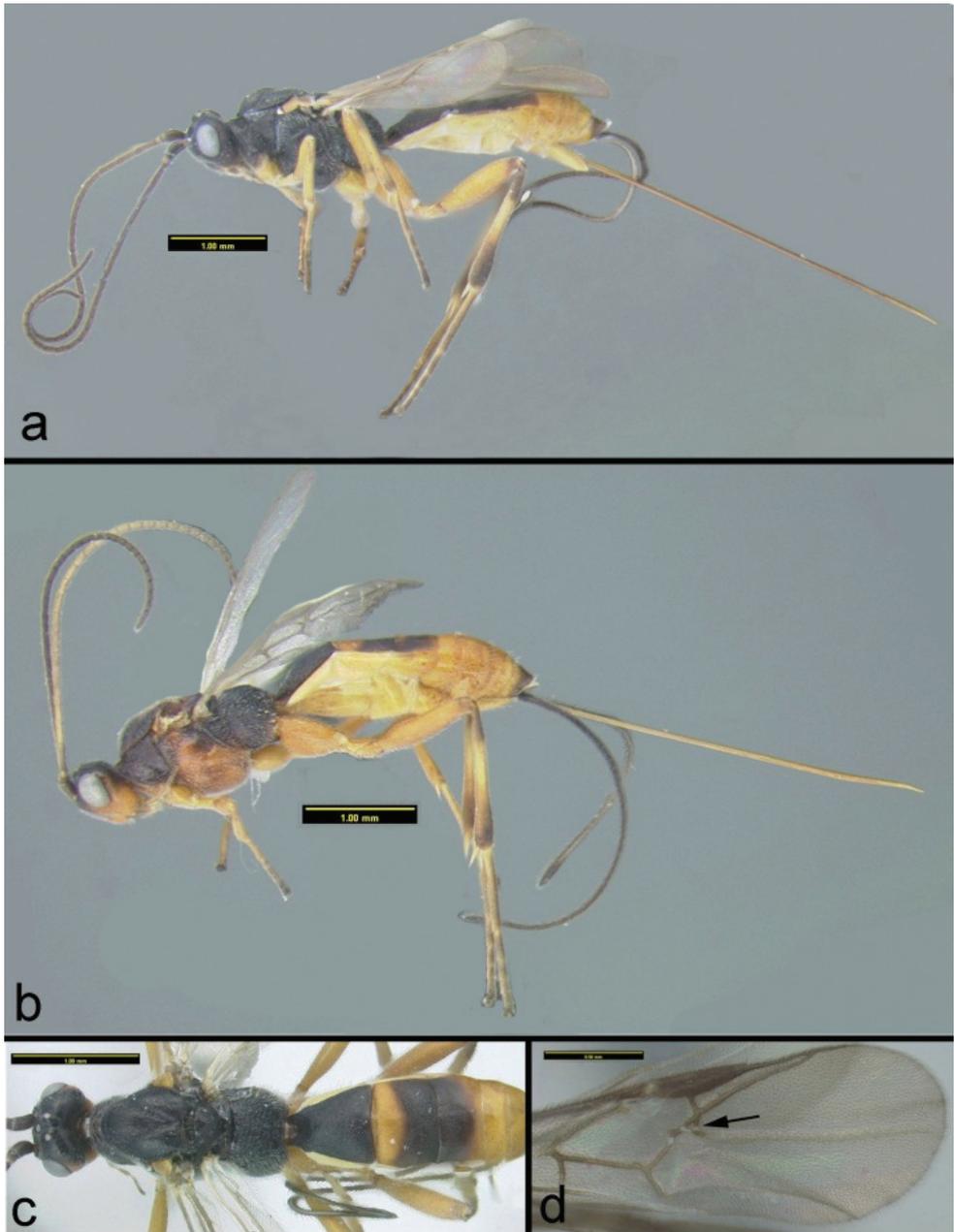


Figure 4. *Neothlipsis agathoides* **a** Lateral habitus of a melanic specimen **b** Lateral habitus of a pale specimen **c** Dorsal habitus **d** Fore wing, arrow pointing to second submarginal vein.

tibia with eight spines (6–10); tarsal claws simple, basal lobe absent. **Wings:** Second submarginal cell of fore wing absent (Fig. 3d) (or rarely very small). **Metasoma:** (Figs. 2b, 3c). Ratio, length of median tergum 1 to apical width of median tergum 1 = 1.13; median terga 1, 2, and 3 granulate; ovipositor slightly shorter than body.

Hosts and biology. *Samea multiplicalis* (Guenée) (Lepidoptera: Crambidae) occurs in the southeastern United States and south to Argentina (Knopf and Habeck 1976). Large populations of the adult moth are often found at lights in Louisiana and are one of the most common species observed (Landau and Prowell 1999). The larva is a natural control agent and generalist herbivore that feeds on a variety of aquatic plants including salvinia (*Salvinia minima* Baker, *S. molesta* Mitchell, and *S. auriculata* Aublet), water hyacinth (*Eichornia crassipes* (Mart.) Solms), waterlettuce (*Pistia stratiotes* L.), water fern (*Azolla caroliniana* Willd., and *Azolla pinnata* R. Brown) (Knopf and Habeck 1976, Sands and Kassulke 1984, Tewari and Johnson 2011).

Groups of approximately 50 *S. multiplicalis* larvae were collected by hand from mats of common salvinia (*Salvinia minima* Baker) at four field locations across southern Louisiana several times during 2006 and brought back to the lab (for a total of 13 sampling points). Individuals were reared individually in diet cups and provided with fresh vegetation until pupation. Parasitism rates of *N. parysae* varied between sites, ranging from 0% to 38% with an average parasitism rate of 9.9% for all larvae reared (S. Tewari, unpublished data). Several other hymenopteran parasitoids have been described from *S. multiplicalis* populations in Florida, but we have only reared *N. parysae*. First instar caterpillars of *S. multiplicalis* are attacked, and the parasitoid pre-pupa emerges from the last larval instar of the host (G.S. Wheeler, unpublished data). Individual wasps are frequently observed in Louisiana on aquatic vegetation during the late spring and early summer. Collections of insects associated with *S. minima* were taken from May to November 2009 in Gramercy, Louisiana, and individuals of *N. parysae* were most abundant from May to July but persisted in low numbers until September.

Etymology. The species is named after Katherine Parys in recognition of her discovery of the species.

Material examined. HOLOTYPE: Female, USA: Louisiana: Ascension Parish, 30°09.804N, 90°48.643W, swamp, 9.vi.2010 (HIC). PARATYPES: 88 males, 37 females, same locality data as holotype with dates from June to September of 2009 and June 2010. 10 females, Kentucky, Hopkins Co. Thomas Farm, 37°20.36N, 087°41.26W, Malaise trap, swamp, viii-ix.2010. Paratypes are deposited in the USNM (9 ♀, 15 ♂), FSCA (9 ♀, 15 ♂), LSAM (15 ♀, 39 ♂) and HIC (14 ♀, 19 ♂).

Neothlipsis parysae USA: KY, 13-29.viii.2010, HIC. GenBank accession number JF297971 and *Neothlipsis parysae* USA: LA, 9.vi.2009, HIC. GenBank accession number JF297972 (Fig. 1).

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