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## CONTRIBUTION TOWARDS THE STUDY OF THE PYRALINAE (PYRALIDAE): HISTORICAL REVIEW, MORPHOLOGY, AND NOMENCLATURE

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**ABSTRACT.** The monophyly of the Pyralinae and the two tribes, Pyralini and Endotrichini, is reviewed based on an analysis of previously used morphological characters of the adult and larva. Characters previously used to define these groups are plesiomorphic (i.e., they are not valid) or highly homoplastic (i.e., they are not reliable) to support the taxa as monophyletic, or both. We describe the male genitalia and present characters to support the monophyly of the Endotrichini, but the Pyralini is likely a paraphyletic taxon. Larval characters did not provide evidence to support or reject monophyly for either group. Based on male genitalic morphology we reassign genera, and make additions or changes within these taxa in recently published checklists. In the Neotropical fauna: *Perforadix* Sein is transferred to the Pyraustinae and is a **new synonym** of *Sufetula* Walker; a lectotype is designated for *Perforadix sacchari* Sein; *Micronix* Amsel is transferred from the Pyralinae to the Crambinae; and *Micromastra* Schaus and *Taboga* Dyar, revised status, remain in the Pyralinae. In addition, *Sufetula pygmaea* Hampson, presently in the Crambidae, is transferred to the Noctuidae: *Nola pygmaea* Hampson (Nolinae), **new combination**. In the Australian fauna *Macna* Walker is transferred from the Pyralinae to the Chrysauginae. A list of the subfamilies and tribes of the Pyralidae worldwide and of the species of the Pyralini of the Western Hemisphere are included.

**Additional key words:** Endotrichini, Pyralini, Neotropics, Australia, larval morphology.

Within the Pyraloidea, the Pyralinae are a large group of about 900 species that are more diverse in Africa and Asia than in the Western Hemisphere. This subfamily includes the worldwide stored-product pest species *Pyralis farinalis* Linnaeus, also known as the meal moth. A complete study to investigate the monophyly of the Pyralinae has never been conducted. However, Solis and Mitter (1992) proposed a character to define the Pyralinae and hypothesized it to be the sister group to the phycitine + epipaschiine clade (Table 1). In this paper we integrate previous findings in the Pyralinae and our observations to facilitate future studies on these moths.

Presently, there are two tribes in the Pyralinae, the Endotrichini and Pyralini (Table 1). The Endotrichini includes 7 genera, *Endotricha* Zeller being the largest genus with about 70 species. Based on our morphological and label data observations, the tribe is distributed

only in Asia and Africa. The Pyralini include 118 genera, with the vast majority of the species distributed in Africa and Asia, although some occur worldwide. The two tribes have been defined by two states of a hindwing venational character (Endotrichini = Rs anastomosed with Sc+R<sub>1</sub>; Pyralini = Rs not anastomosed with Sc+R<sub>1</sub>) and they have been shifted between tribal and subfamilial rank based on the importance placed on this character by various authors (e.g., Ragonot 1891, Hampson 1896, Whalley 1961, Minet 1982). We dispute the validity of the use of the hindwing venational character at suprageneric levels. We also explore the literature and investigate the morphology of larval stage as an independent character set.

Recent publication of two checklists (Shaffer et al. 1996, Shaffer & Solis 1995) of the Pyralini and Endotrichini of Australia and the Neotropics, and the previous publication of the checklist of the Pyraloidea

TABLE 1. Higher classification of the Pyralidae; current tribal names in use, although most tribes have not been shown to be monophyletic.

Pyralidae Latreille
<b>Chrysauginae</b> Lederer
<b>Galleriinae</b> Zeller
<b>Galleriini</b>
<b>Megarhthridiini</b>
<b>Tirathabini</b>
<b>Cacotherapiini</b>
<b>Pyralinae</b> Latreille
<b>Pyralini</b>
<b>Endotrichini</b>
<b>Epipaschiinae</b> Meyrick
<b>Phycitinae</b> Zeller
<b>Cryptoblabini</b>
<b>Phycitini</b>
<b>Cabniini</b>
<b>Anerastiini</b>
<b>Peoriini</b>

of North America north of Mexico (Munroe 1983) have laid the groundwork for studies on the systematics of the Pyraloidea. A large number of taxon transfers, and even misplaced taxa between superfamilies, have been documented in the recently published checklists. We herein explain how assignments in recent Australian (Shaffer et al. 1996) and Neotropical (Shaffer & Solis 1995) checklists were made based on our observations on male genitalic morphology and larval morphology. We also list corrections to the tribal and subfamilial headings of the recently published checklists, and list additions or changes made since their publication.

#### MATERIALS AND METHODS

The collections at The Natural History Museum (BMNH), London, England; the National Museum of Natural History (USNM), Washington, D.C., USA; the Cornell University Collection (CU), Ithaca, New York, USA; and Zoologische Staatssammlung (ZSBS), Munich, Germany were studied to determine taxa not included in recently published checklists. Type specimens were examined and dissected when necessary. If the type specimen could not be located, the original descriptions and genitalic illustrations were used to place the species generically. Genitalia slides of non-type specimens were prepared, studied, and compared when type specimens were not available, or when type specimens were not in suitable condition for study.

Larvae from alcohol collections of the USNM and BMNH of *Endotricha flammealis* (Denis & Schiffermüller), *Pyralis farinalis* Linnaeus, *Aglossa caprealis* Hübner, and *Herculia psammioxantha* Dyar were examined with a stereomicroscope to verify the literature on larval morphology.

Adult and larval characters of the other subfamilies of the Pyralidae, Chrysauginae, Galleriinae, Phycitinae, Epipaschiinae, were used for outgroup comparison purposes based on a phylogenetic analysis by Solis and Mitter (1992) (Table 1).

#### HISTORICAL REVIEW AND ANALYSIS OF PREVIOUSLY USED CHARACTERS

Meyrick (1890) first brought the character of the veins 7 [=Rs] and 8 [=Sc+R<sub>1</sub>] in the hindwing to attention, and since Ragonot (1891) the Pyralini and Endotrichini have been separated and defined primarily by two character states of the hindwing venation: in the Pyralini Rs and Sc+R<sub>1</sub> approach each other (Fig. 5), but do not anastomose; in the Endotrichini the two veins anastomose for at least part of their length (Fig. 6). We propose that this character is not reliable in the separation or definition of taxa at suprageneric levels in the Pyralinae and in the following historical review we use italics to draw attention to these two character states in descriptions.

Meyrick (1890) included *Endotricha* in the Pyralinae. He included the Pyralinae and Epipaschiinae in the Pyralididae and did not recognize them as separate subfamilies. Meyrick defined (and spelled) the Pyralididae as follows:

"Ocelli present, often concealed by scales. Tongue well-developed, or sometimes obsolete. Maxillary palpi well-developed, or rarely rudimentary. Fore wings with vein 1 usually shortly or obscurely furcate at base, sometimes simple, 4 and 5 closely approximated at base or often stalked, 7 and 8 out of 9. Hind wings without defined pecten of hairs on lower margin of cell, veins 4 and 5 closely approximated at base or from a point or stalked, 7 [=Rs] out of 6 near origin or rarely separate but closely approximated, free or sometimes anastomosing with 8 [=Sc+R<sub>1</sub>]" (Meyrick 1890:433) [italics ours].

He used head and wing venational characters occurring in other groups (i.e., plesiomorphic characters) to define the Pyralididae. The presence of the ocelli and maxillary palpi are plesiomorphic characters, the proboscis is secondarily lost, the forewing venation is highly variable at lower taxonomic levels (and hence not used by most later workers), and the lack of a hindwing pecten is plesiomorphic.

Ragonot (1891) was the first to separate the Pyralinae and Endotrichinae based on the veins 7 [=Rs] and 8 [=Sc+R<sub>1</sub>] of the hindwing in a key: "Nervures 7 et 8 soudées aux inférieures, très rarement séparées" ["Veins 7 and 8 fused in the hindwings"] keyed to the Chrysauginae and Endotrichiinae and "Nervures 7 et 8 séparées" ["Veins 7 and 8 separate"] keyed to the Pyralidinae (Ragonot 1891:446).

Hampson (1896) included only the Phycitinae, Chrysauginae, Epipaschiinae, Endotrichiinae, and Pyralinae in his concept of the Pyralidae and used some of

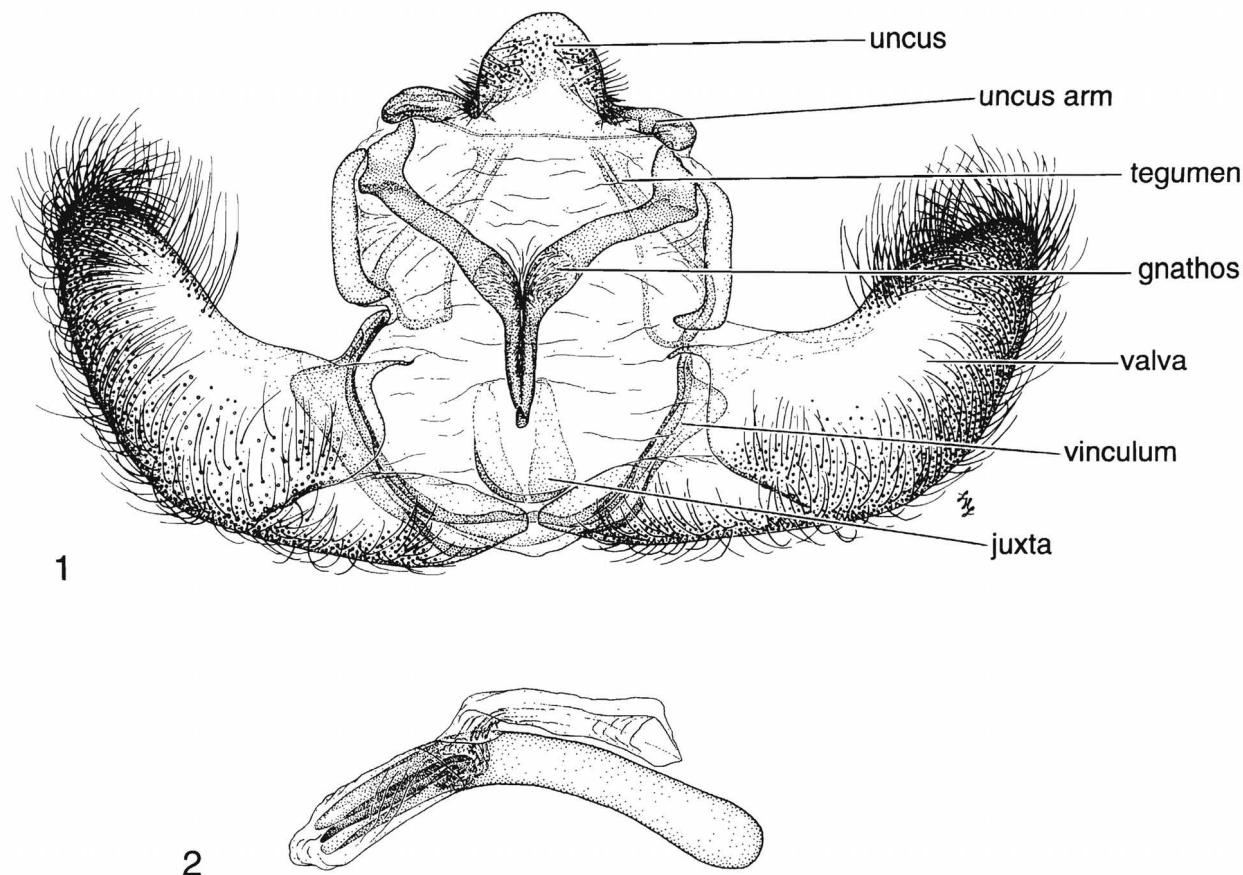


FIG. 1. *Pyralis farinalis* Linnaeus, type species; characteristic male genitalia of Pyralini. FIG. 2. *Pyralis farinalis* Linnaeus, aedeagus.

the same plesiomorphic characters as Meyrick (1890). But he grouped the Epipaschiinae, Endotrichinae and Pyralinae based on the following two characters:

"The three subfamilies of the Pyralidae, the Epipaschiinae, Endotrichinae, and Pyralinae, of which a classification is here attempted, all belong to the group of Pyralidae which have the median nervure of the hindwing non-pectinate on upperside, and vein 7 [=Rs] of the forewing stalked with 8 [=Sc+R<sub>1</sub>]" (Hampson 1896) [italics ours].

The lack of a hindwing pecten is plesiomorphic, and he used the same character (stalked veins 7 [=Rs] and 8 [=Sc+R<sub>1</sub>]) of Ragonot to define the Endotrichinae and Chrysauginae.

The relationship and definition of the endotrichines and pyralines was not addressed again until Whalley (1961), who did not provide characters to define the Pyralinae or the Pyralini. To define the Endotrichini he used the same plesiomorphic characters used by Hampson (1896), with the exception of the presence of the chaetosema, but this state is plesiomorphic as well. The Endotrichinae of Hampson (1896) was described as follows:

"Proboscis well developed; maxillary palpi present; build slender. Forewing with vein 7 stalked with 8, 9 (7 absent in *Hendecasis*).

Hindwing with median nervure non-pectinate; vein 7 [=Rs] anastomosing with 8" [italics ours].

The Endotrichini of Whalley (1961) was described as follows:

"Proboscis well developed, maxillary palps present. Chaetosema present. Forewing with vein R<sub>5</sub> stalked with R<sub>4</sub> and R<sub>3</sub>. Hind wing with median vein non-pectinate. Vein Rs anastomosing with Sc+R" [italics ours].

Munroe and Shaffer (1980) revised three large genera in the Pyralini (Pyralinae). Their definition of the Pyralinae is basically a combination of Hampson's (1896) definition of the Endotrichinae and Pyralinae from a key with Whalley's (1961) rank of tribes. The Pyralinae of Hampson (1896) was described as follows:

"Proboscis usually well-developed; maxillary palpi present and usually filiform. Forewing with vein 7 stalked with 8,9. Hindwing with the median nervure non-pectinate; vein 8 [=Sc+R<sub>1</sub>] free" [italics ours].

The Pyralinae of Munroe and Shaffer (1980) was described as follows:

"The three genera can now be defined as belonging to the Pyralinae from the following characters: chaetosema present; maxillary palpus present; proboscis well developed; fore wing with R5 stalked with R4 and R3; hind wing with Rs not anastomosed with Sc+R<sub>1</sub> (*Pyralini*), or

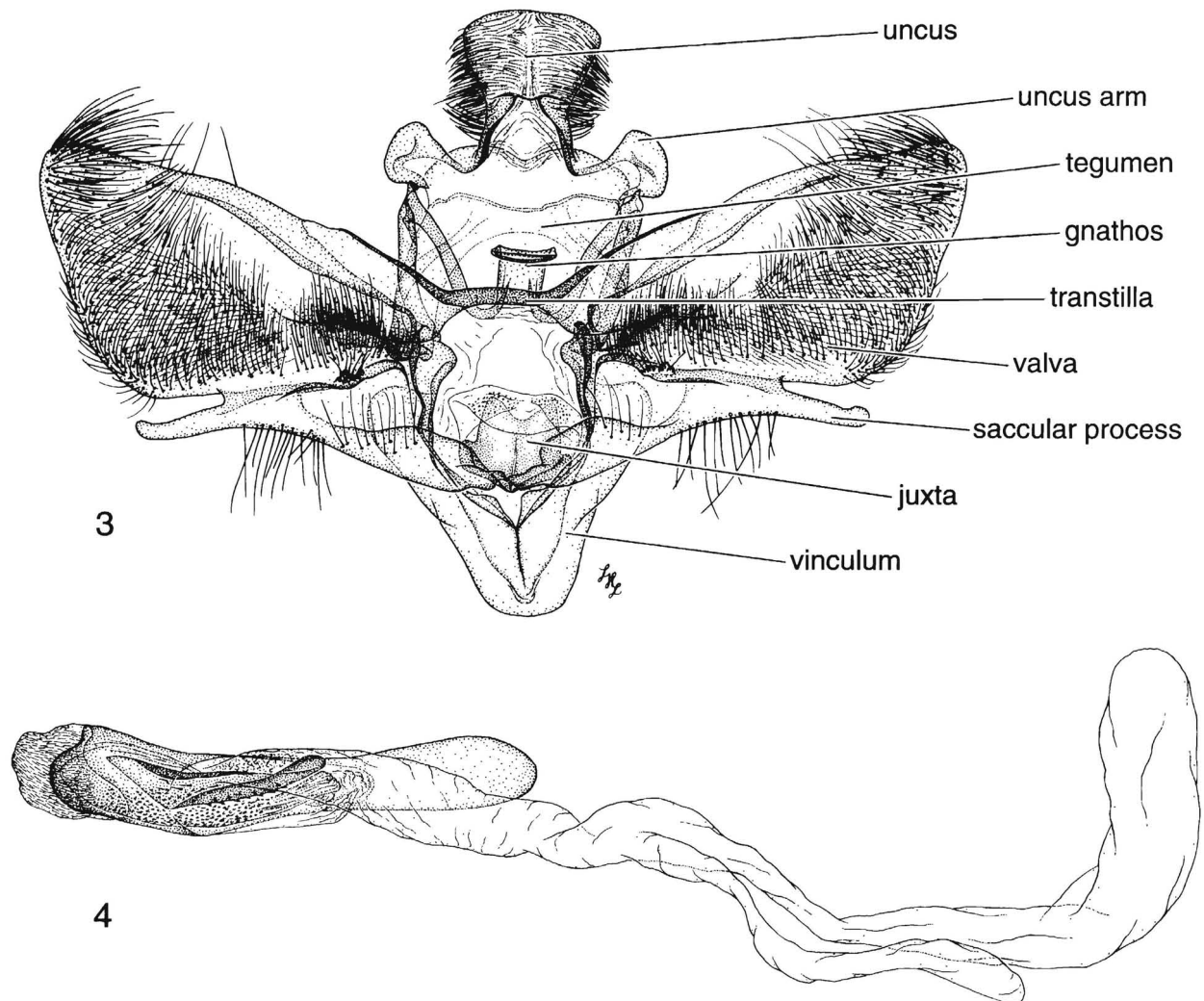


FIG. 3. *Endotricha flammealis* (Denis & Schiffermüller), type species characteristic male genitalia of Endotrichini. FIG. 4. *Endotricha flammealis* (Denis & Schiffermüller), aedeagus.

*Rs* anastomosed with *Sc+R<sub>1</sub>* (*Endotrichini*); median vein non-pectinated" [italics ours].

Whalley (1961) recognized the problem with the definition of the hindwing character that separated the two groups: "In several cases they have been said to anastomose where, as close examination shows, they merely run very close together (e.g., *Rostripalpus* Hampson)." The lack of anastomosis of *Rs* and *Sc+R<sub>1</sub>* varies in other groups within the Pyraloidea besides the Pyralini, and it has been documented as highly homoplasious at the generic level among the genera of the *Pococera* complex of the Epipaschiinae (Solis 1993) and at the species level (Shaffer & Solis 1994). Other groups where the majority of the taxa lack the anastomosis of *Rs* and *Sc+R<sub>1</sub>* but where there are examples where the two veins barely anastomose have

been observed in representatives of the New World Cacotherapiini (Galleriinae) and some genera in the Crambinae (e.g., *Pseudoschoenobius* Fernald). Based on our observations of the distribution of this hindwing character in other groups within the Pyraloidea, distribution of the hindwing character within the Pyralinae, and lack of concurrence with the characters of the male genitalia, we propose that the hindwing venational character is not reliable in the separation or definition of taxa at suprageneric levels in the Pyralinae.

Minet (1982, 1985) was the first to maintain that the Pyralinae were paraphyletic because characters used by past workers were plesiomorphic. He stated: "Les Pyralinae semblent paraphylétiques par rapport à des taxa tels que les Endotrichinae, les Chrysauginae ou les Epipaschiinae (dont ils ne diffèrent que par un en-

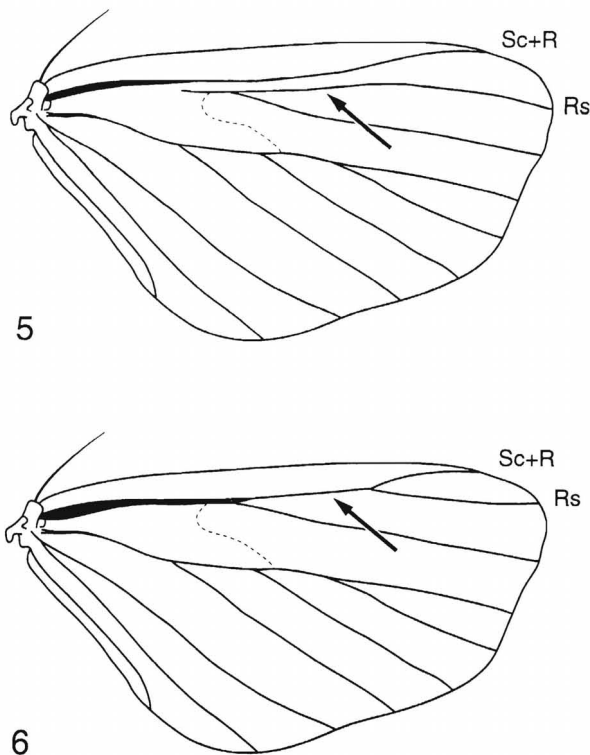


FIG. 5. Wing venation (idealized); arrow indicates lack of anastomosis. FIG. 6. Wing venation (idealized); arrow indicates anastomosis.

semble de caracteres plesiomorphes: palpes maxillaires bien développés, ailes antérieures sans écailles hérissées, etc.)” [“The Pyralinae appear to be paraphyletic in comparison with taxa such as the Endotrichinae, the Chrysauginae or the Epipaschiinae (in that they share a group of plesiomorphic characters: maxillary palpi well developed, forewings without raised scales, etc.)”] but he retained pyralines and endotrichines at the subfamily level. Whalley (1963), in his study of *Endotricha*, found that the retention of Ragonot's concept of the Endotrichinae as a subfamily was not warranted and proposed the Endotrichinae as a tribe of the Pyralinae. He did not offer a reason or characters to support this conclusion. Solis and Mitter (1992) agreed with Minet that previous characters used to define the two taxa were plesiomorphic states, but they treated the endotrichines as a tribe within the Pyralinae according to Whalley (1961) because Minet (1985), in his study of the tympanal organs, presented no apomorphies for the Pyralinae, Pyralini, or Endotrichini. Solis and Mitter (1992) proposed one character of the female genitalia as a synapomorphy for the Pyralinae, but proposed none for the Pyralini or Endotrichini.

## RESULTS

**Adult genitalic morphology.** Previous authors (Whalley 1961, 1963, Munroe & Shaffer 1980) did not use genitalic characters to define the Pyralinae, Pyralini, or Endotrichini, although they used genitalic morphology at the species level for their studies. Solis and Mitter (1992) proposed a character of the female genitalia (corpus bursae barely extending cephalad beyond segment 7) to support the monophyly of the Pyralinae. This study, however, was based on a small sample size, a character that remains untested.

### Pyralini (Figs. 1, 2, 7):

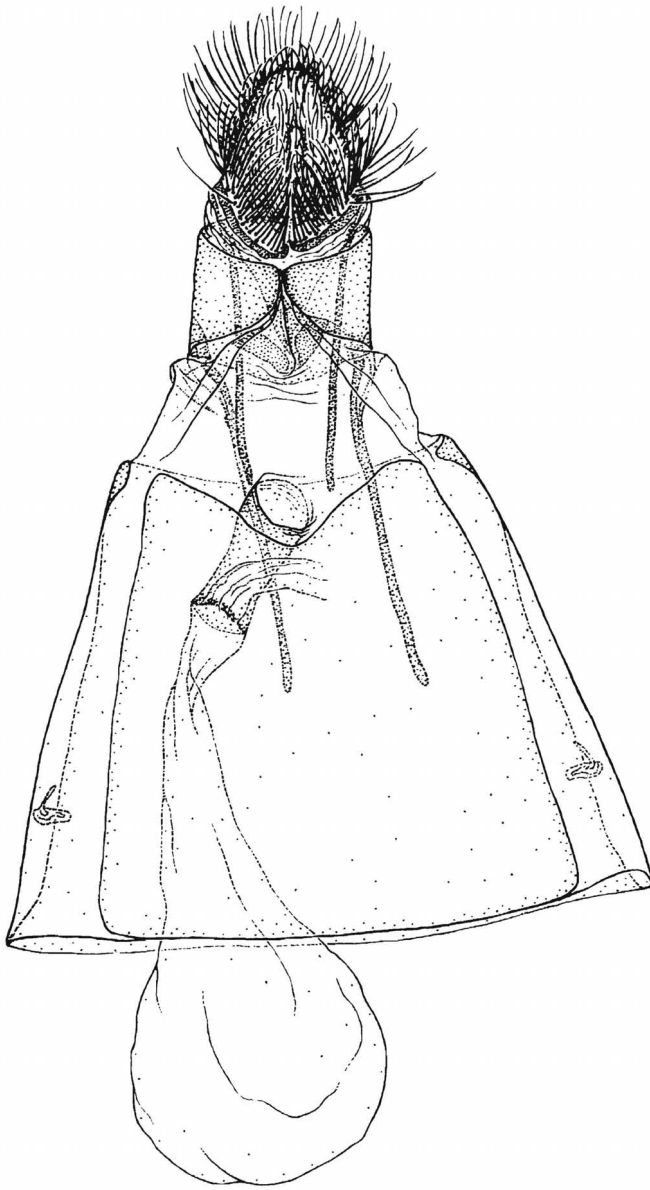
**Description:** Male: Uncus same width throughout or less narrow than the base, flat or spatulate, ventrally with spine clusters absent; uncus arms laterally not large and earlike; downcurved gnathos with arms strongly developed, with well-developed medial, narrow spike terminating in a small dorsally curved hook; tegumen strongly sclerotized; vinculum well developed; juxta simple, rarely heavily sclerotized, spiny catena (baso-medial portion of anellus) present or absent or laterally sclerotized, and heavily spined, sometimes anellus reflexed with heavy sclerotization; transtilla absent or, if present, membranous, rarely well developed and heavily sclerotized; valva variable in shape, same width to apex or more narrow distally, basal and costal process absent or present, if present well developed or not, without saccular process, ventral surface of valva bearing hairlike setae not arranged in radiating rows, costal setae absent; vesica of aedeagus with or without clusters of spinelike cornuti, vesica sometimes spined, reflexed with heavy sclerotization, or with broad bands of sclerotization its entire length. Female: Segment 8 and associated membranes either short, or long and extensible; apophyses anteriores and posteriores long, stout or slender; ostial end of ductus bursae membranous, with small, well-sclerotized to large, heavily sclerotized compact pouches present or absent; ductus bursae long and narrow with areas of minute spines immediately below antrum or other sclerotized areas; corpus bursae large, signum variable, absent, or if present from scobinate patches, usually within single large area, to long and spinelike.

### Endotrichini (Figs. 3, 4, 8):

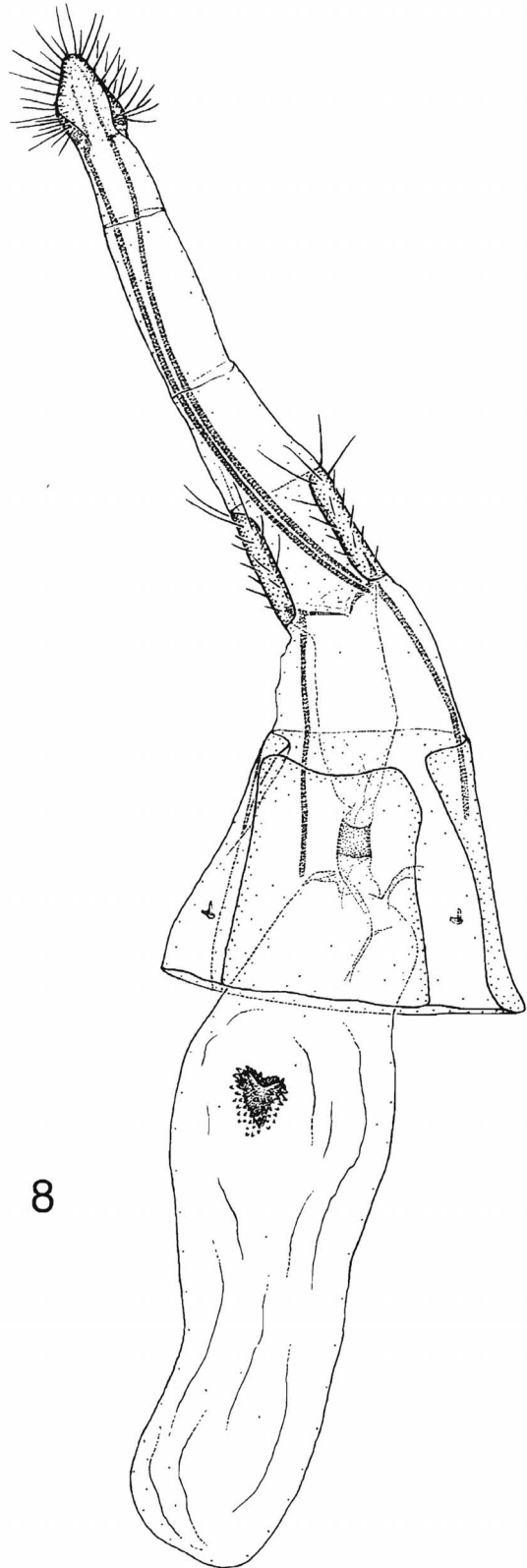
**Diagnosis:** Uncus broadest at apex; uncus arms laterally large, earlike; gnathos medially broad, spatulate, platelike.

**Description:** Male: Uncus broadest at apex, ventrally with spine clusters present or absent (uncus process of Whalley); uncus arms laterally large, earlike [socii of Whalley; socii, according to Klots (1956) are paired processes on either side of the base of the uncus; these structures are not socii, but the most lateral elements of the uncus arms of the Pyralidae (Solis & Mitter 1992)]; downcurved gnathos arms strongly or weakly developed, usually with a well-developed medial, broad, spatulate, and upturned central plate; weakly sclerotized tegumen; vinculum well developed; juxta simple, sometimes with spiny manica; transtilla present, usually heavily sclerotized; valva usually same width to apex, may bear basal process and saccular process; ventral surface bearing hairlike setae in rows pointing toward base of valva; prominent, reflexed, sometimes spear-shaped costal setae may be present arising from costa near apex; aedeagus with vesica bearing sticklike or clublike cornutus varying in shape and length. Female genitalia: Segment 8 and associated membranes long and extensible; apophyses anteriores and posteriores long and slender; ostial end of ductus bursae minutely spined, without pouches; antrum sclerotized; ductus bursae short, minutely spined, or very long and membranous; corpus bursae large with signum scobinate.

Although we can provide synapomorphies in states of the uncus and gnathos (see diagnosis above) for the Endotrichini in the male



7



8

FIG. 7. *Pyralis farinalis* Linnaeus, type species; characteristic female genitalia of Pyralini. FIG. 8. *Endotricha flammealis* (Denis & Schiffmüller), type species; characteristic female genitalia of Endotrichini.

genitalia, we were unable to find synapomorphies for the Pylalini where the states are either shared with the Endotrichini or with related subfamilies. The genitalic characters of the Pylalinae are either variable at lower taxonomic levels or plesiomorphic, i.e., found in all related subfamilies. We provide a description of the genitalia for Endotrichini and Pylalini because a concept based on the morphology of the male genitalia was used to assign taxa in the Endotrichini and Pylalini in the Australian and Neotropical checklists.

**Larval morphology.** Comparison of the caterpillars of *Endotricha flammalis* with *Pylalis farinalis*, *Aglossa caprealis*, and *Herculia psammioxantha* (with caterpillars of other subfamilies of the Pylalidae as outgroups) did not result in any apomorphic characters to support the monophyly of the Pylalinae, Pylalini, or Endotrichini. Historically, the Hasenfuss (1960) concept of the Pylalinae consisted of present-day galleriines, pyralines, and phycitines (he did not include chrysaugines or epipaschiines in his study); he considered *Endotricha* as a pyraline.

The larvae of *Endotricha* have a pinaculum ring on SD1 of A9, a synapomorphy for the Pylalidae (the plesiomorphic state, the absence of the pinaculum ring on SD1 of A9, occurs in the Crambidae). In sum, we found that *E. flammalis* larvae lack the unique characters assigned to other subfamilies and have the same plesiomorphic setal character states assigned to the larvae of the Pylalinae. The Epipaschiinae and Pylalinae both lack a pinaculum ring on any other segment other than A9 (in comparison to the presence of a pinaculum ring on T2 of the Phycitinae, T3 of the Chrysauginae, and A1 of the Galleriinae; presence in each segment is the derived state, although the pinaculum has been secondarily lost in several genera and/or species of each subfamily). Based on work by Hasenfuss (1960) and Allyson (1977) the Epipaschiinae and Pylalinae are separated from each other by the distance between the ventral setae on A7 and A9. In the Epipaschiinae the two ventral setae are closer together on A7 than those on A9 and in the Pylalinae the two ventral setae on A7 and A9 are equidistant (the plesiomorphic condition shared by other subfamilies of the Pylalidae).

**Taxonomic placement of genera.** Recently, genera from southeast Asia and Australia previously placed in the Endotrichinae with anastomosed Rs and Sc+R<sub>1</sub> in the hindwing, but with genitalic characteristics of the Pylalini were transferred to the Pylalini in the Australian checklist (Shaffer et al. 1996) based on the genitalia morphology. Those genera transferred from the Endotrichinae to the Pylalinae were based on the genitalia morphology: *Gauna* Walker, *Curena* Walker, *Arescoptera* Walker, *Scenedra* Meyrick, *Tanyethira* Turner, *Scenidiopsis* Turner, *Perisseretma* Warren, and *Perula* Mabilie.

According to the definition based on genitalic morphology given above, there are no known species of Endotrichini in the Western Hemisphere, but four genera, *Perforadix* Sein, *Micronix* Amsel, *Micromastra* Schaus, and *Taboga* Dyar have been historically placed within the Endotrichinae due to the anastomosing of Rs and Sc+R<sub>1</sub> in the hindwing. *Perforadix*, *Micronix*, and *Micromastra* were inadvertently excluded from the Neotropical Pylaloidea checklist (Shaffer & Solis 1995). *Taboga* was included in the Neotropical checklist, but needed to have its position in the Pylalinae verified. We found that *Perforadix* belongs in the Pyraustinae and *Micronix* belongs in the Crambinae, both hereby transferred, and, of the four, only *Micro-*

*mastra* and *Taboga* remain in the Pylalinae. Table 2 is a complete list of the Pylalinae (Pylalini) of the Western Hemisphere (Munroe 1983, Shaffer & Solis 1995).

Sein (1930) placed *Perforadix sacchari* Sein, commonly known as the Sugarcane root caterpillar, in the Endotrichinae. This species is a major pest of sugar cane in Puerto Rico and nearby islands. Sein (1930) illustrated the morphology of all life stages in great detail and described its biology and methods of control. The author failed to designate types or even list type specimens, but we found seven specimens each with a small label "P.R./Sein" and a red label "Cotype/Cornell U. No. 6087" at Cornell University. According to Sein (1930), W. T. M. Forbes, who was at Cornell University at the time, identified the material and presumably he also labelled the material as cotypes. We designate one specimen (male) as the lectotype and the other 6 specimens as paralectotypes (material in poor condition, abdomens are missing), and they are labelled as such in the collection at Cornell University. We studied additional material collected by Sein, identified by H. G. Dyar, as stated by Sein (1930), and dissections by Carl Heinrich at the USNM and found that *Perforadix* is a synonym of *Sufetula* Walker, **new synonymy**, in the Pyraustinae. We discovered that based on the morphology of the tympanal organs (i.e., crambid "open" tympanal organs with a praecinctorium) it belongs in the Crambidae. Based on the external and genitalic morphology after comparison with other species in the genus, including the type species, it belongs in the genus *Sufetula* Walker. It is interesting to note that *P. sacchari* was originally identified for Sein by H. G. Dyar as *Sufetula grumalis* Schaus, a species presently placed in *Sufetula* (Munroe, 1995:76). We also examined another species, *Sufetula pygmaea* Hampson, and found it does not belong in the Pylaloidea, but in the Noctuidae (Nolinae): *Nola pygmaea* (Hampson), **new combination**.

Amsel (1956) described *Micronix nivalis* in the Endotrichinae. Nothing is known about the biology of this Venezuelan species. We were unable to locate the type, a male, but Amsel provided a photograph of the adult and poor line drawings of the male genitalia and wings. The hooded uncus and the costal process of the male genitalia characteristic of crambines are very evident in the illustration; therefore, we transfer this monotypic genus to the Crambinae. Although we cannot determine its placement within the Crambinae, we suggest that it belongs in the tribe Crambini.

Schaus (1940) placed *Micromastra isoldalis* in the Endotrichinae. Nothing is known about the biology of this Puerto Rican species. Dyar (1914) described *Taboga inis* in the Endotrichinae. The type series is from

TABLE 2. Pyralini (Pyralidae: Pyralinae) of the Western Hemisphere

<b>Aglossa</b> Latreille, [1796]	<b>Hypsopygia</b> Hübner, [1825]
<i>Euclita</i> Hübner, [1825]	<i>costalis</i> (Fabricius, 1775)( <i>Phalaena</i> )
<i>Agriope</i> Ragonot, 1894	<i>fimbrialis</i> ([Denis & Schiffermüller], 1775)( <i>Pyralis</i> )
<i>acallalis</i> Dyar, 1908	<i>purpurana</i> (Thunberg, 1784)( <i>Tortrix</i> )
<i>baba</i> Dyar, 1914	<i>hyllalis</i> (Walker, 1859)( <i>Pyralis</i> )
<i>cacamica</i> (Dyar, 1913) ( <i>Pyralis</i> )	<b>Mapeta</b> Walker, 1863
<i>caprealis</i> (Hübner, [1800–09])( <i>Pyralis</i> )	<i>Homalochroa</i> Lederer, 1863
<i>capreolatus</i> Haworth, 1809	<i>cynosura</i> Druce, 1895
<i>cuprealis</i> Hübner, [1825], missp.	<i>omphephora</i> Dyar, 1914
<i>aenalis</i> (Costa, 1836)( <i>Pyralis</i> )	<i>schausi</i> Druce, 1895
<i>domalis</i> Guenée, 1854	<i>xanthomelas</i> Walker, 1863
<i>incultella</i> (Walker, [1866])( <i>Acrobasis</i> )	<i>aestivalis</i> (Lederer, 1863)( <i>Homalochroa</i> )
<i>enthealis</i> (Hulst, 1886)( <i>Tetralopha</i> )	<i>divisa</i> (Boisduval, 1870)( <i>Pyralopsis</i> )
<i>cuprialis</i> Heinrich, 1931, missp.	<b>Micromastra</b> Schaus, 1940
<i>costiferalis</i> (Walker, 1886) ( <i>Pyralis</i> )	<i>isoldalis</i> Schaus, 1940
<i>costigeralis</i> (Walker, [1865] ( <i>Pyralis</i> ), preocc. (Walker, 1862)	<b>Neodavisia</b> Barnes & McDunnough, 1914
<i>cuprina</i> (Zeller, 1872) ( <i>Pyralis</i> )	<i>Davisia</i> Barnes & McDunnough, 1913, preocc (Del
<i>disciferalis</i> (Dyar, 1908) ( <i>Pyralis</i> )	<i>guercio</i> , 1909 [Hemiptera])
<i>electalis</i> Hulst, 1866	<i>melusina</i> Ferguson, Blanchard, & Knudson, 1984
<i>furva</i> Heinrich, 1931	<i>singularis</i> (Barnes & McDunnough, 1913)( <i>Davisia</i> )
<i>gigantalis</i> Barnes & Benjamin, 1925	<b>Ocrasa</b> Walker, [1866]
<i>oculalis</i> Hampson, 1906	<i>Parasopia</i> Möschler, 1890
<i>pinguinialis</i> (Linnaeus, 1758)( <i>Pyralis</i> )	<i>nostralis</i> (Guenée, 1854)( <i>Pyralis</i> )
<i>marmorella</i> (Geoffroy, 1785)( <i>Tinea</i> )	<i>helenensis</i> (Wollaston, 1879)( <i>Pyralis</i> )
<i>marmoratella</i> (Villers, 1789)( <i>Tinea</i> )	<i>tenuis</i> (Butler, 1880)( <i>Pyralis</i> )
<i>pinguiculatus</i> (Haworth, 1809)( <i>Crambus</i> )	<i>dissimilalis</i> (Möschler, 1890)( <i>Parasopia</i> )
<i>guicciardii</i> Constantino, 1922	<i>sordidalis</i> (Barnes & McDunnough, 1913)( <i>Herculia</i> )
<b>Arispe</b> Ragonot, 1891	<i>psammioxantha</i> (Dyar, 1917)( <i>Herculia</i> )
<i>Uscodys</i> Dyar, 1909	<i>venezuelensis</i> (Amsel, 1956)( <i>Herculia</i> )
<i>cestialis</i> (Hulst, 1886)( <i>Anerastia</i> )	<i>tripartitalis</i> (Herrich-Schäffer, 1871)( <i>Asopia</i> )
<i>atalis</i> (Dyar, 1908)( <i>Uscodys</i> )	<b>Pseudasopia</b> Grote, 1873
<i>concretalis</i> Ragonot, 1891	<i>cohortalis</i> (Grote, 1878)( <i>Asopia</i> )
<i>ovalis</i> Ragonot, 1891	<i>florencealis</i> (Blackmore, 1920)( <i>Herculia</i> )
<b>Catocrocis</b> Ragonot, 1891	<i>intermedialis</i> (Walker, 1862)( <i>Pyralis</i> )
<i>Catocrocis</i> Ragonot, 1892, missp.	<i>sodalis</i> (Walker, 1869)( <i>Pyralis</i> )
<i>lithosialis</i> Ragonot, 1891	<i>squamealis</i> Grote, 1873
<b>Dolichomia</b> Ragonot, 1891	<i>phoezalis</i> (Dyar, 1908)( <i>Herculia</i> )
<i>amoenalis</i> (Möschler, 1882) ( <i>Asopia</i> )	<b>Pyralis</b> Linnaeus, 1758
<i>isidora</i> (Meyrick, 1936)( <i>Pyralis</i> )	<i>Aletes</i> Rafinesque, 1815, nom. nud.
<i>binodulalis</i> (Zeller, 1872)( <i>Asopia</i> )	<i>Ceropsina</i> Rafinesque, 1815, nom. nud.
<i>craspedalis</i> (Hampson, 1906) ( <i>Tegulifera</i> )	<i>Spyrella</i> Rafinesque, 1815, repl. name
<i>datames</i> (Druce, 1900)( <i>Pyralis</i> )	<i>Asopia</i> Treitschke, 1828
<i>decectialis</i> (Druce, 1900)( <i>Pyralis</i> )	<i>Sacatia</i> Walker, 1863
<i>graafialis</i> (Snellen, 1875)( <i>Asopia</i> )	<i>Eutrichodes</i> Warren, 1891
<i>impurpuratalis</i> (Dognin, 1910)( <i>Pyralis</i> )	<i>farinalis</i> Linnaeus, 1758
<i>nigrapuncta</i> (Kaye, 1901)( <i>Pyralis</i> )	<i>domesticalis</i> (Zeller, 1847)( <i>Asopia</i> )
<i>olinalis</i> (Guenée, 1854)( <i>Pyralis</i> )	<i>fraterna</i> Butler, 1879
<i>trentonalis</i> (Lederer, 1863)( <i>Asopia</i> )	<i>manihotalis</i> .- Matsumura, 1900 (not Guenée, 1854)
<i>himonialis</i> (Zeller, 1872)( <i>Asopia</i> )	<i>meridionalis</i> Schmidt, 1934
<i>infimbrialis</i> (Dyar, 1908)( <i>Herculia</i> )	<i>orientalis</i> Amsel, 1961
<i>phanerostola</i> (Hampson, 1917)( <i>Paractenia</i> )	<i>manihotalis</i> Guenée, 1854
<i>planalis</i> (Grote, 1880)( <i>Asopia</i> )	<i>vetusalis</i> Walker, [1859]
<i>enniculalis</i> (Hulst, 1886)( <i>Asopia</i> )	<i>gerontesalis</i> Walker, [1859]
<i>occidentalis</i> (Hulst, 1886)( <i>Asopia</i> )	<i>laudatella</i> (Walker, 1863)( <i>Sacatia</i> )
<i>plumbeoprunalis</i> (Hampson, 1917)( <i>Herculia</i> )	<i>despectalis</i> Walker, [1866]
<i>resectalis</i> (Lederer, 1863)( <i>Asopia</i> )	<i>miseralis</i> Walker, [1866]
<i>thymetusalis</i> (Walker, 1859)( <i>Botys</i> ) <b>New combination</b>	<i>achatina</i> Butler, 1877
<i>devialis</i> (Grote, 1875)( <i>Asopia</i> )	<i>haematalis</i> (Saalmüller, 1880)( <i>Asopia</i> )
<i>vernaculalis</i> (Berg, 1874) ( <i>Asopia</i> )	<i>gerontialis</i> (Meyrick, 1888)( <i>Asopia</i> ), emend.
<b>Herculia</b> Walker, 1859	<i>centripunctalis</i> (Gaede, 1916)( <i>Endotracha</i> )
<i>Buzala</i> Walker, 1863	<i>pupalis</i> Strand, 1919
<i>Cisse</i> Walker, 1863	<i>compsobathra</i> Meyrick, 1932
<i>Bejuda</i> Walker, [1866]	<b>Taboga</b> Dyar, 1914
<i>Bleone</i> Ragonot, 1890	<i>inis</i> Dyar, 1914
<i>Herculea</i> Amsel, 1956 [index], missp.	
<i>tabidalis</i> (Warren, 1891)( <i>Pyralis</i> )	



Panama. Study of the genitalia of the type series at the USNM of both of these species confirm their placement within the Pylalini, and not in the Endotrichini.

In the Australian checklist (Shaffer et al. 1996:173) the headings of the Endotrichini and Pylalini were mislabeled and difficult to change at proof stage. The Endotrichinae should have been titled the Endotrichini and placed under the heading of the Pylalinae. In addition, the genus *Macna* Walker was inadvertently included in the Pylalinae (Pylalini), but it should have been placed in the Chrysauginae. In the Neotropical checklist (Shaffer & Solis 1995:80) the Pylalini should have been included as a subheading under Pylalinae to indicate the tribal placement of the genera found in the Western Hemisphere.

#### DISCUSSION

The Pyraloidea, one of the larger superfamilies of the Lepidoptera, has over 15,000 described species, yet much remains to be done in taxonomy, and, more so, with the phylogenetic relationships. A taxonomic study usually begins with a checklist or a catalogue of described species as an inventory to document those that have already been described. A checklist may refine the placement of taxa and can clearly mark taxon transfers, as well as provide other information, such as misplaced taxa. By definition, a checklist or catalog does not adequately state or discuss the taxonomic problems solved or those that remain to be solved.

We have described the morphological reasons for the placement of taxa in the Pylalini or Endotrichini in two checklists (Shaffer et al. 1996, Shaffer & Solis 1995). We have also summarized the taxonomic and phylogenetic status of the two tribes included in the Pylalinae. The genitalia of the Endotrichini are clearly different from those of the Pylalini, but authors have dealt only with a few genera in both taxa and, as we have shown, have used the same plesiomorphic or homoplasious characters since Meyrick (1890) to define higher level taxa. We retain the two tribes in the classification system for the sake of stability and retention of character information, but acknowledge that the Pylalini is likely a paraphyletic group. Moreover, a preliminary study of an independent character set, the larval stage, provides no obvious synapomorphies for the Pylalinae or the Pylalini.

Our observations of the genitalia and larvae of the Pylalini and Endotrichini are made with the expectation that they may prove useful in a future phylogenetic study of the Pylalini genera that includes an entire suite of adult and immature characters. Any future study should also include pupal and perhaps behav-

ioral characters, although caution is suggested concerning the latter due to the convergent nature of behavioral characters. A phylogenetic analysis of the genera of the Pylalini would be the first attempt to test the paraphyly of the Pylalini with respect to the Endotrichini, with the possibility that results may also invalidate the traditional tribal concept. Such a study may also provide characters to support the monophyly of the Pylalinae.

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### MANUSCRIPT REVIEWERS, 1998

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