

New insight on the phylogenetic relationships within Mydidae and its relationship to Apioceridae (Diptera: Asiloidea)

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Apioceridae - flower-loving flies

- ◇ Imagines flower-feeders
- ◇ Larvae predatory
- ◇ 141 species in a single genus *Apiocera*
- ◇ Four subgenera
 - Anypenus* - Argentina & Chile
 - Apiocera* - Australia
 - Pyrocera* - western North America
 - Ripidosyrma* - Southern Africa
- ◇ Morphologically similar to Asilidae
- ◇ Oldest putative fossil 130 Million years old



Apiocera moerens, Queensland, Australia © Peter Chew 2004

Mydidae - mydas flies

- ◇ Imagines flower-feeders - some species with vestigial mouthparts
- ◇ Larvae predatory
- ◇ \approx 500 species in 65 genera
- ◇ 11 subfamily taxa
- ◇ World-wide but only in arid regions
- ◇ Morphologically very distinct
- ◇ Oldest fossil 110 Million years old

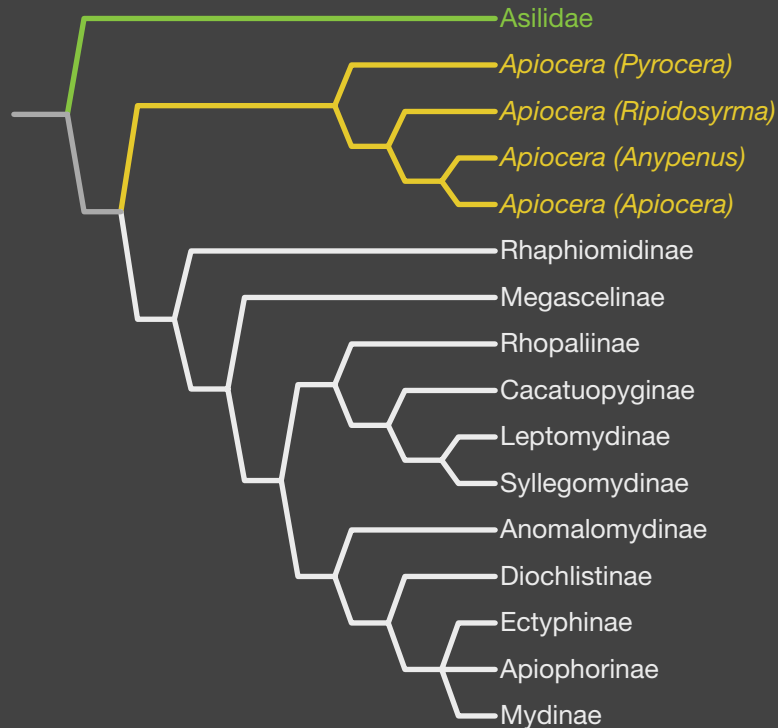


Opomydas townsendi, Arizona, USA

Taxon	Genera	Species	Afr	Aus	Nea	Neo	Ori	Pal
<i>Apiocera (Anypenus)</i>		4				×		
<i>Apiocera (Apiocera)</i>		70		×				
<i>Apiocera (Pyrocera)</i>		64			×			
<i>Apiocera (Ripidosyrma)</i>		3	×					
Anomalomydinae	1	2		×				
Apiophorinae	5	30		×		×		
Cacatuopyginae	1	1					×	
Diochlistinae	3	24		×		×		
Ectyphinae	4	17	×		×			
Leptomydinae	6	56	×		×	×	×	×
Megascelinae	3	14	×	×		×		
Mydinae	12	103			×	×		
Rhaphiomidinae	1	22			×			
Rhopaliinae	4	22	×			×		×
Syllegomydinae	25	203	×				×	×

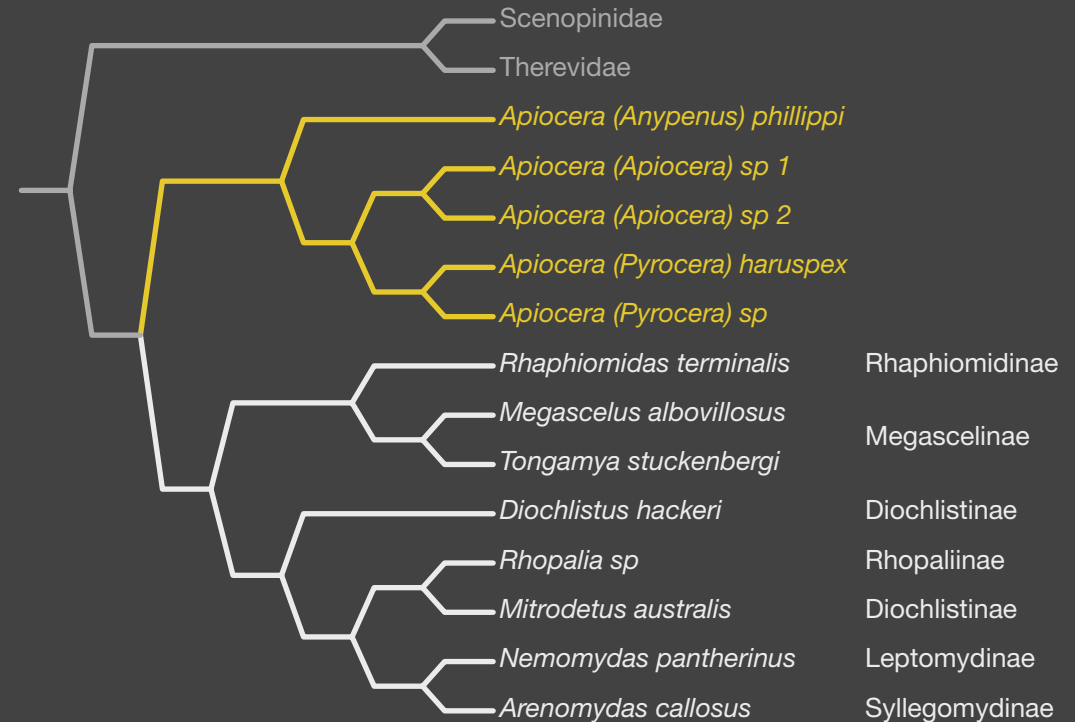
Taxon	Papavero & Wilcox 1974	Yeates & Irwin 1996	mol study	morph study
<i>Apiocera (Anypenus)</i>	Apioceridae	Apioceridae		
<i>Apiocera (Apiocera)</i>	Apioceridae	Apioceridae	1 species	
<i>Apiocera (Pyrocera)</i>	Apioceridae	Apioceridae	2 species	2 species
<i>Apiocera (Ripidosyrma)</i>	Apioceridae	Apioceridae		
Anomalomydinae	Mydidae	Mydidae		
Apiophorinae	Mydidae	Mydidae	1 species	
Cacatuopyginae	Mydidae	Mydidae		
Diochlistinae	Mydidae	Mydidae	1 species	1 species
Ectyphinae	Mydidae	Mydidae	1 species	1 species
Leptomydinae	Mydidae	Mydidae	2 species	2 species
Megascelinae	Apioceridae	Mydidae		1 species
Mydinae	Mydidae	Mydidae	1 species	1 species
Rhaphiomidinae	Apioceridae	Mydidae	1 species	1 species
Rhopaliinae	Mydidae	Mydidae		
Syllegomydinae	Mydidae	Mydidae	6 species	1 species

Yeates & Irwin 1996 morphology



- parsimony (successive weighting)

Irwin & Wiegmann 2001 28S rDNA



- maximum likelihood

List of morphological apomorphies for taxa

◇ Apioceridae + Mydidae

- Hennig (1973) was undecided about adelphotaxon relationships
- Woodley (1989)
 - › wing veins R5 + M1 strongly curved anteriorly
 - › supernumerary rectal papillae

◇ Apioceridae

- Woodley (1989) did not postulate any autapomorphy
- Yeates & Irwin (1996) – several autapomorphies

◇ Mydidae

- Woodley (1989) – two autapomorphies for *Mydidae s. str.*
- Yeates & Irwin (1996) – several autapomorphies

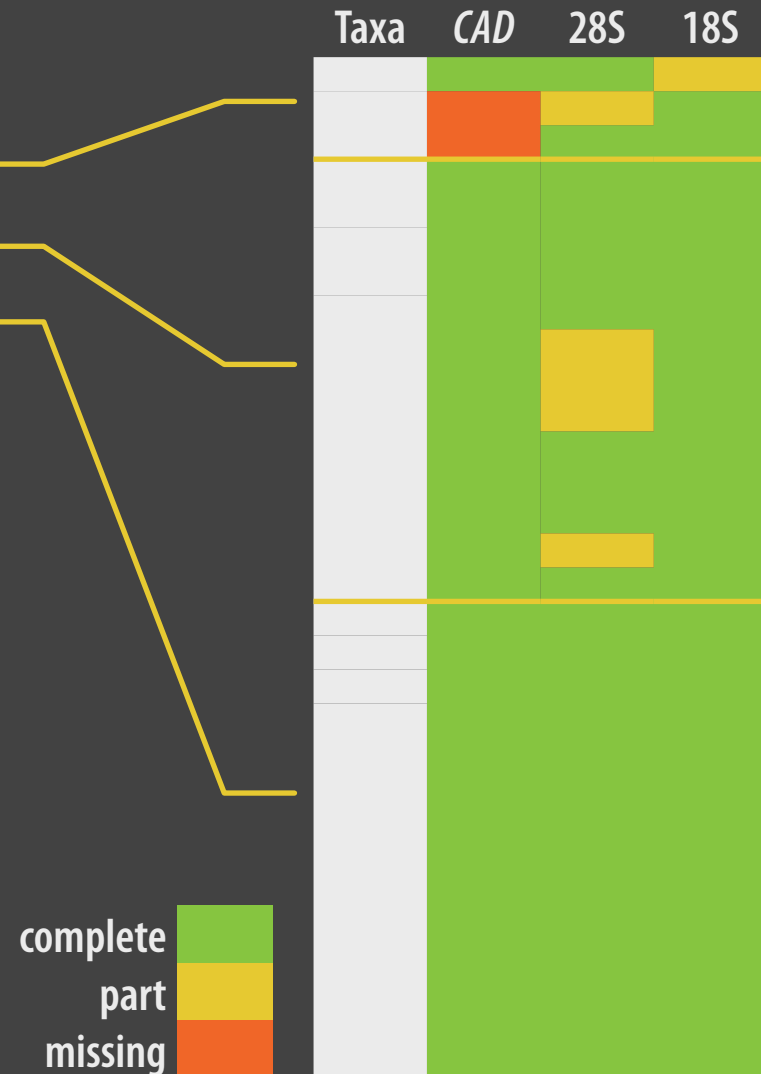
Molecular Analysis

◇ Taxon sampling

- 3 *Apiocera* species
- 13 Mydidae species (7 subfamily taxa)
- 15 Asiloidea species as outgroup taxa

◇ Genes

- *CAD* \approx 900 bp
- 28S rDNA \approx 2,200 bp
- 18S rDNA \approx 2,000 bp



Molecular Analysis

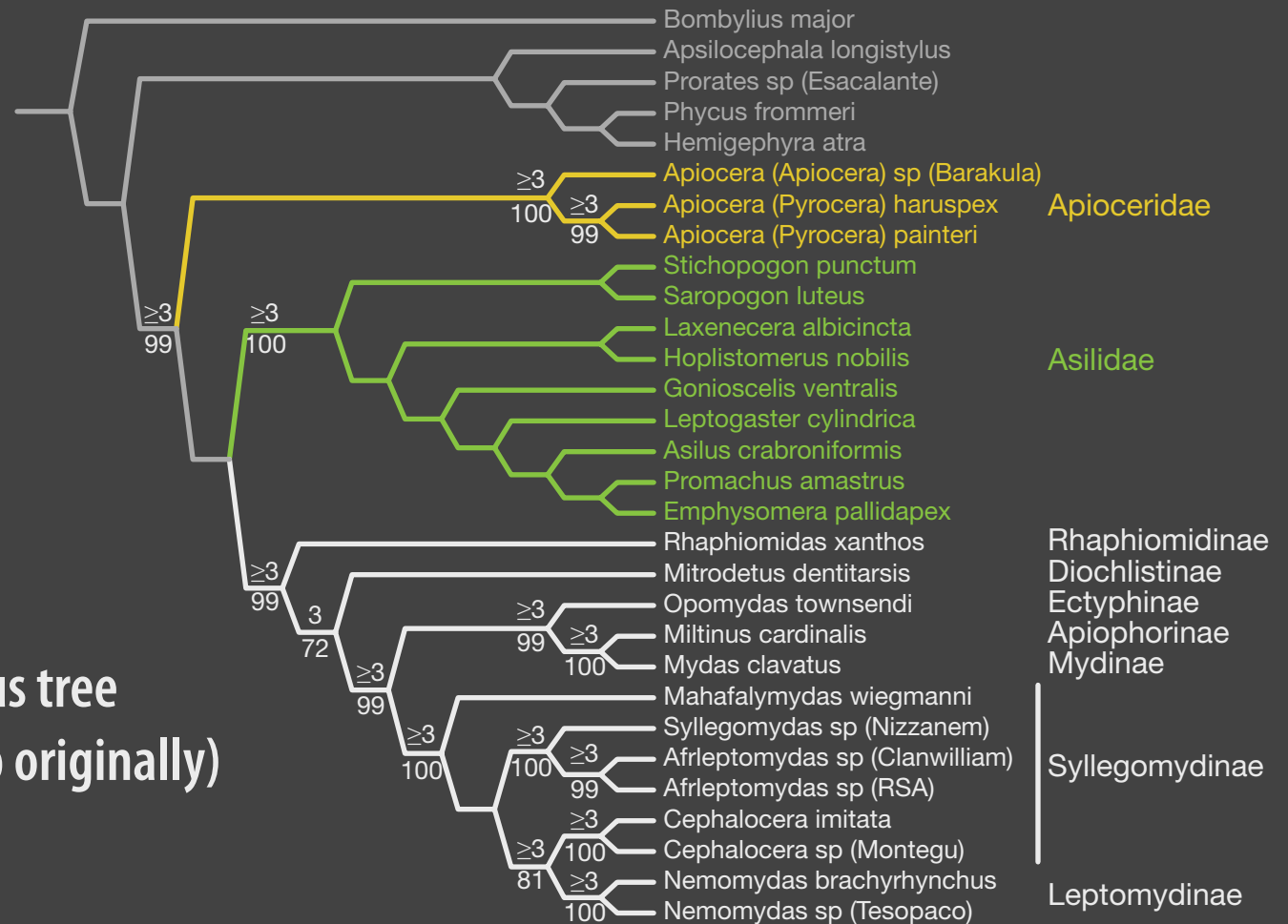
◇ Parsimony analysis in POY

- new version POY4 (alpha testing stage)
- dual core Mac mini
- 30 RAS+TBR followed by Ratchet
- sequences partitioned – *CAD* 1 fragment, 28S 3 fragments, 18S 4 fragments

◇ TNT (version 1.0)

- Bremer values
 - incremental search 1 – 8 steps longer
 - above branches
- Jackknife values
 - 2000 replications
 - below branches

Molecular Hypothesis



- single most parsimonious tree
- 5246 bp length (5144 bp originally)
- 4246 steps
- $Ci = 0.45$ $Ri = 0.50$

Morphological Analysis

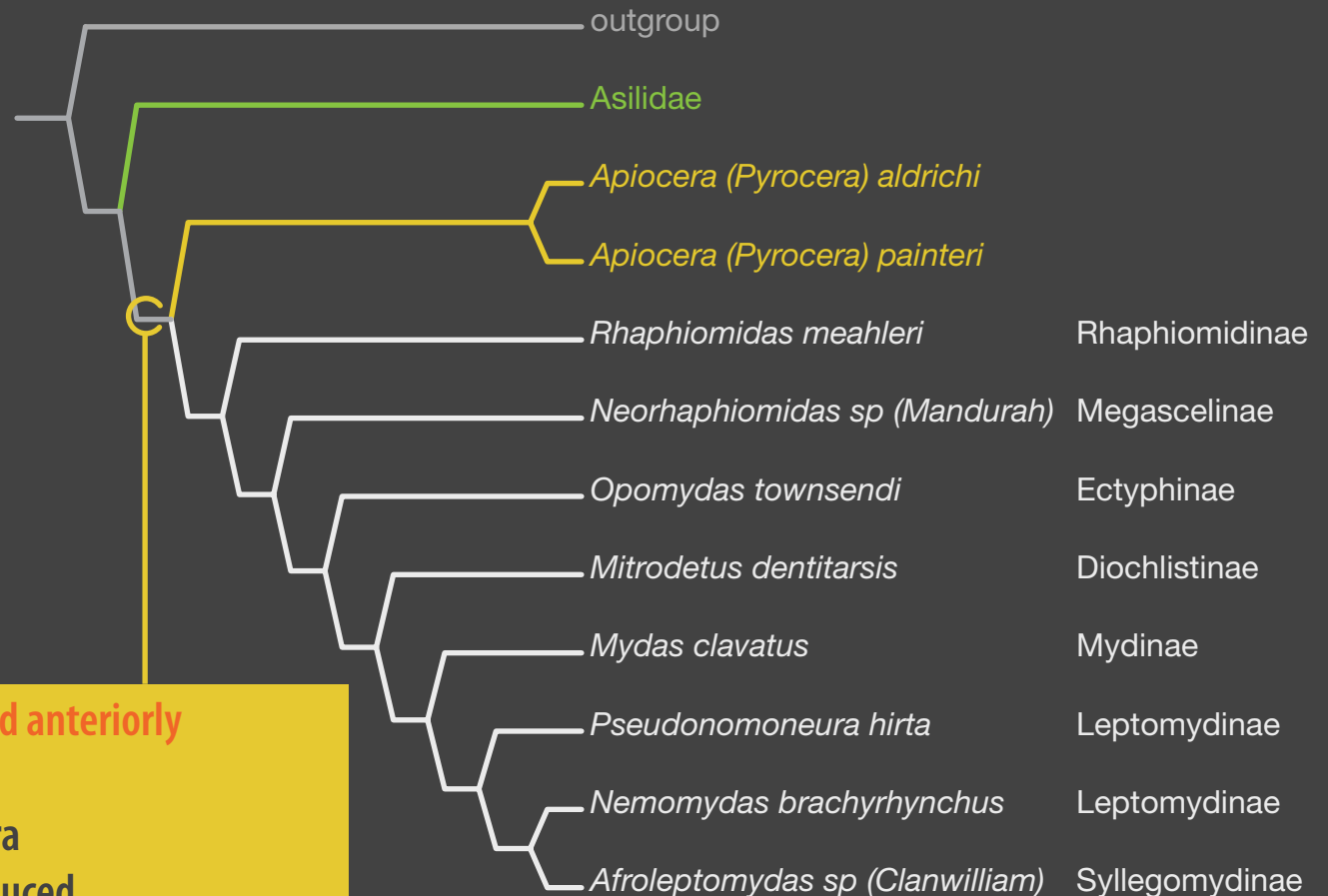
- ◇ Morphology matrix from Asilidae phylogeny
- ◇ Taxon sampling
 - 2 *Apiocera* species
 - 8 Mydidae species (7 subfamily taxa)
- ◇ 220 discrete, parsimony informative characters
- ◇ Parsimony analysis in TNT



Mydas sp, Illinois, USA

© Fritz Geller-Grimm 2002

Morphological Hypothesis - Apioceridae + Mydidae



Bremer ≥ 8 ; Jack 93

◊ anterior ocelli separated, situated anteriorly

◊ a single ridge on pulvilli

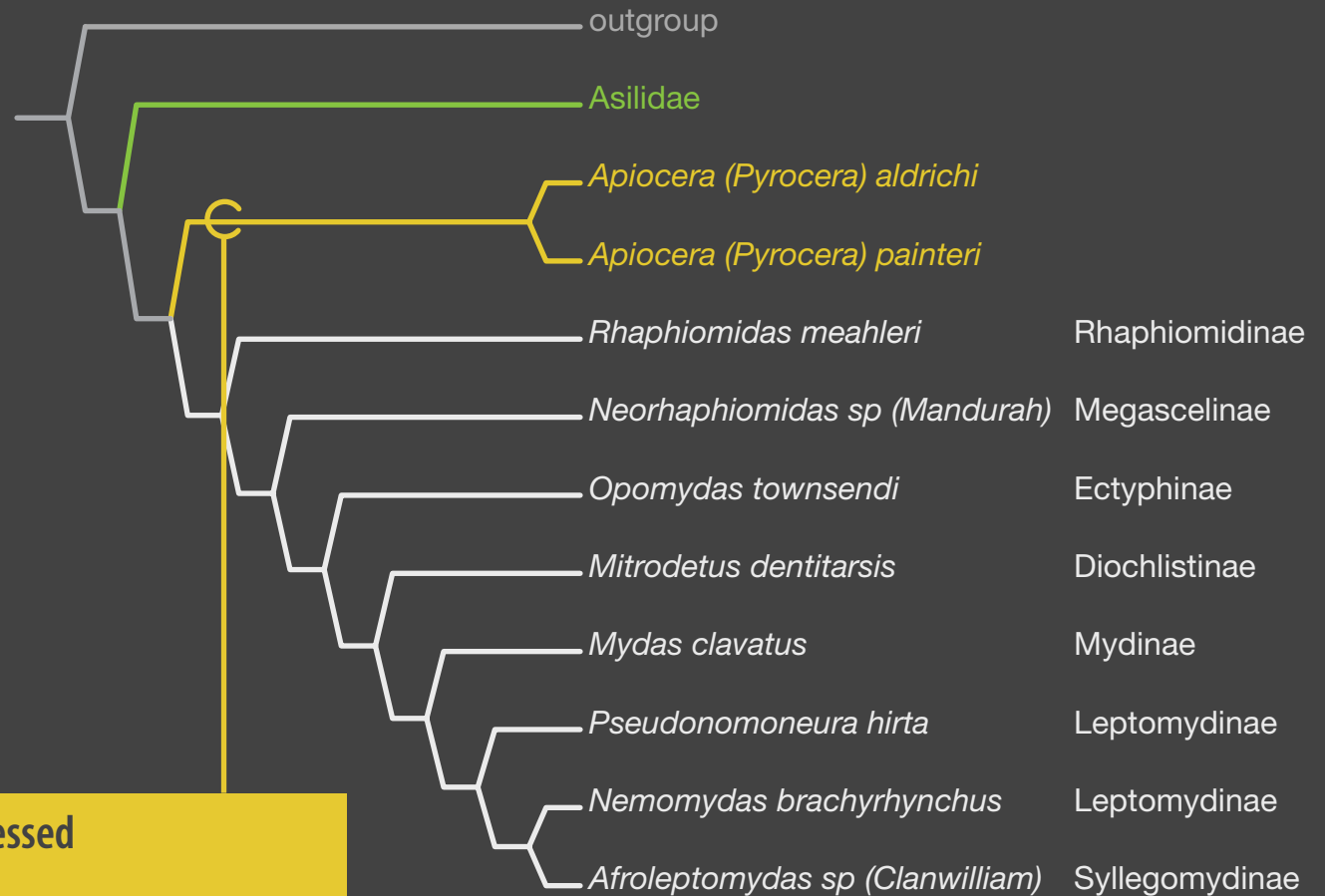
› macrosetae on ventral met femora

› empodium minute or entirely reduced

› M1 apex terminating anterior to wing apex

› ♀ T10 with acanthophorite spurs

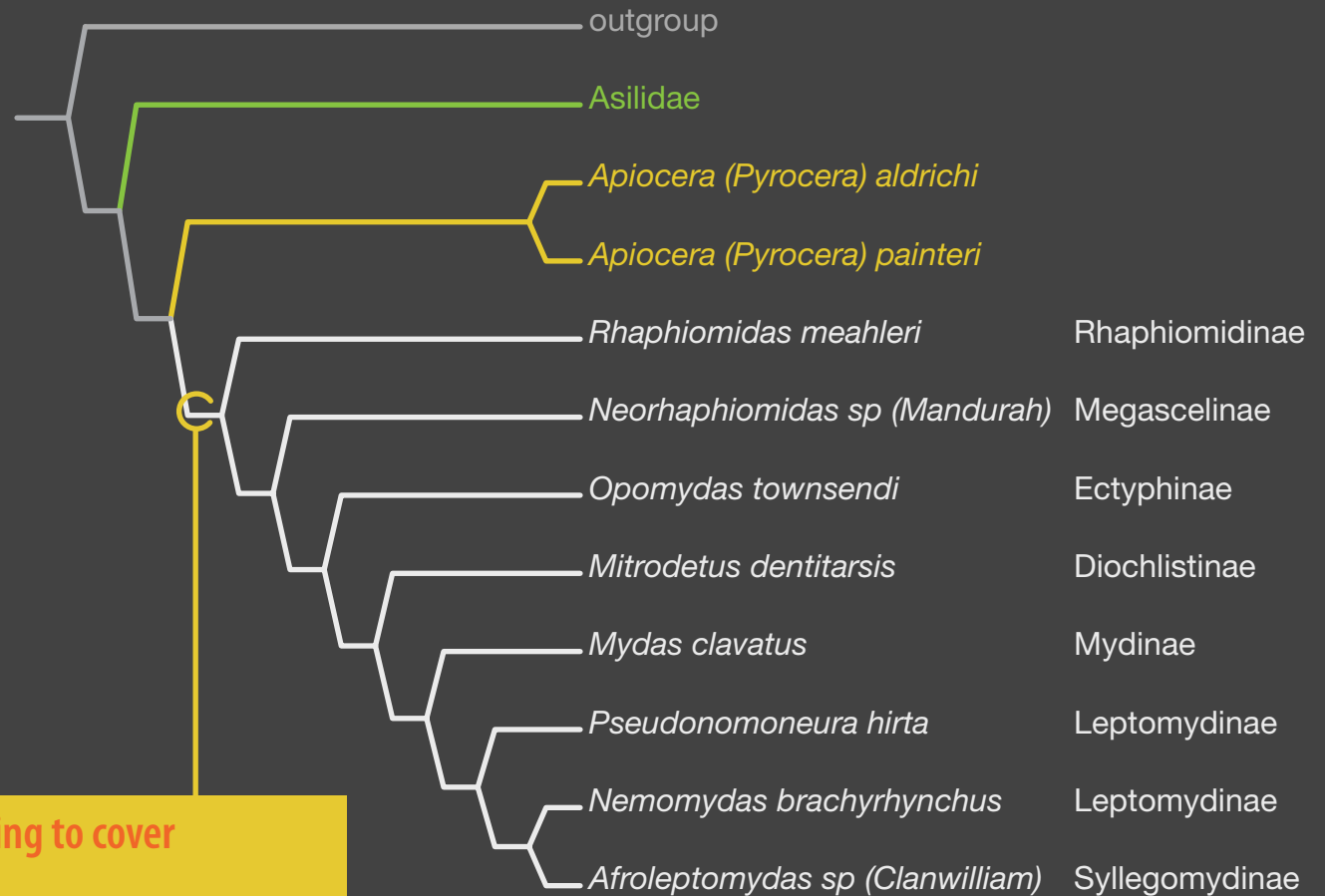
Morphological Hypothesis - Apioceridae



Bremer ≥ 8 ; Jack 97

- › distal palpomere laterally compressed
- › stipites fused entirely medially
- › prosternum and proepimeron separated
- › ♂ sperm sac entirely free, sheath short

Morphological Hypothesis - Mydidae



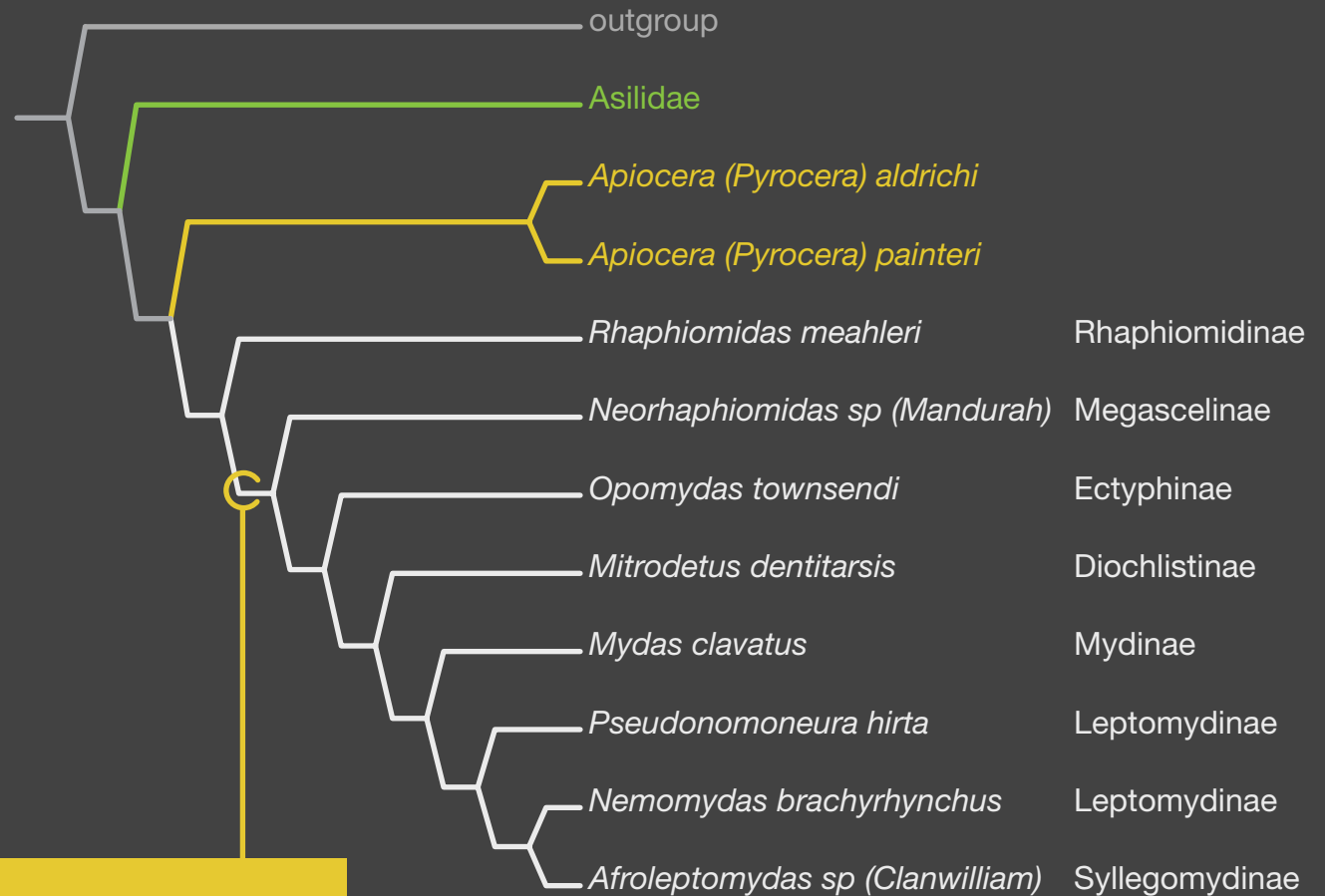
Bremer ≥ 8 ; Jack 97

◇ cervical sclerite laterally expanding to cover proplesternum partly

◇ M2+M3 closing cell d

◇ ♂ gonostyli absent

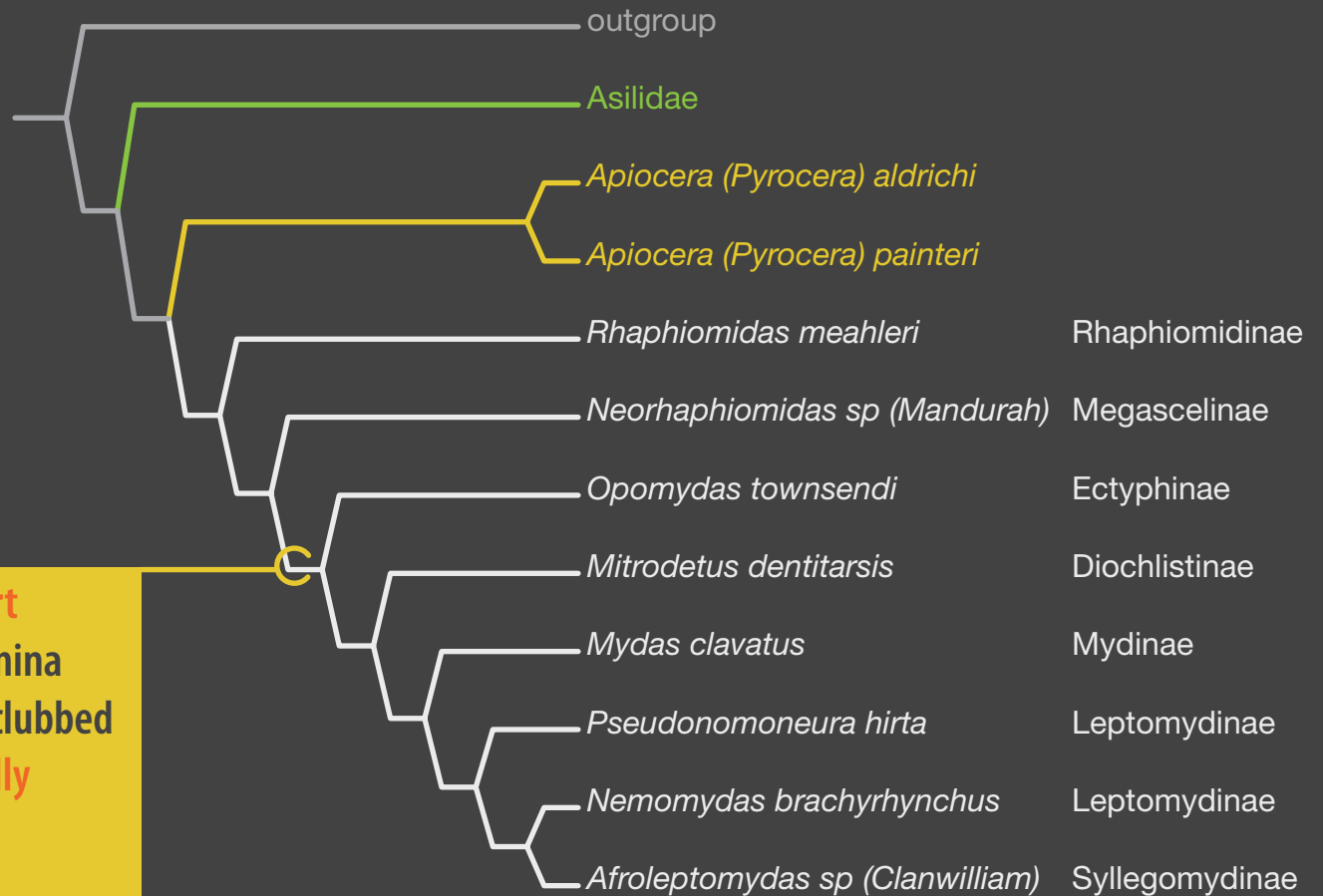
Morphological Hypothesis - position of Megascelinae



Bremer ≥ 8 ; Jack 98

- ◇ transverse suture absent
- ◇ cell r4 closed
- ◇ apex of R4 & R5 not reaching C

Morphological Hypothesis - Mydidae



Bremer ≥ 8 ; Jack 99

- ◇ face divided, ventral & dorsal part
- ◇ occipital foramen with two foramina
- ◇ postpedicel elongate, distinctly clubbed
- ◇ postpedicel unsclerotised medially
- ◇ posterior ocelli elongate
- ◇ propresternum triangular
- ◇ T2 with bullae
- ◇ ♂ T3–T8 with two lateral apodemes

Summary & Conclusions

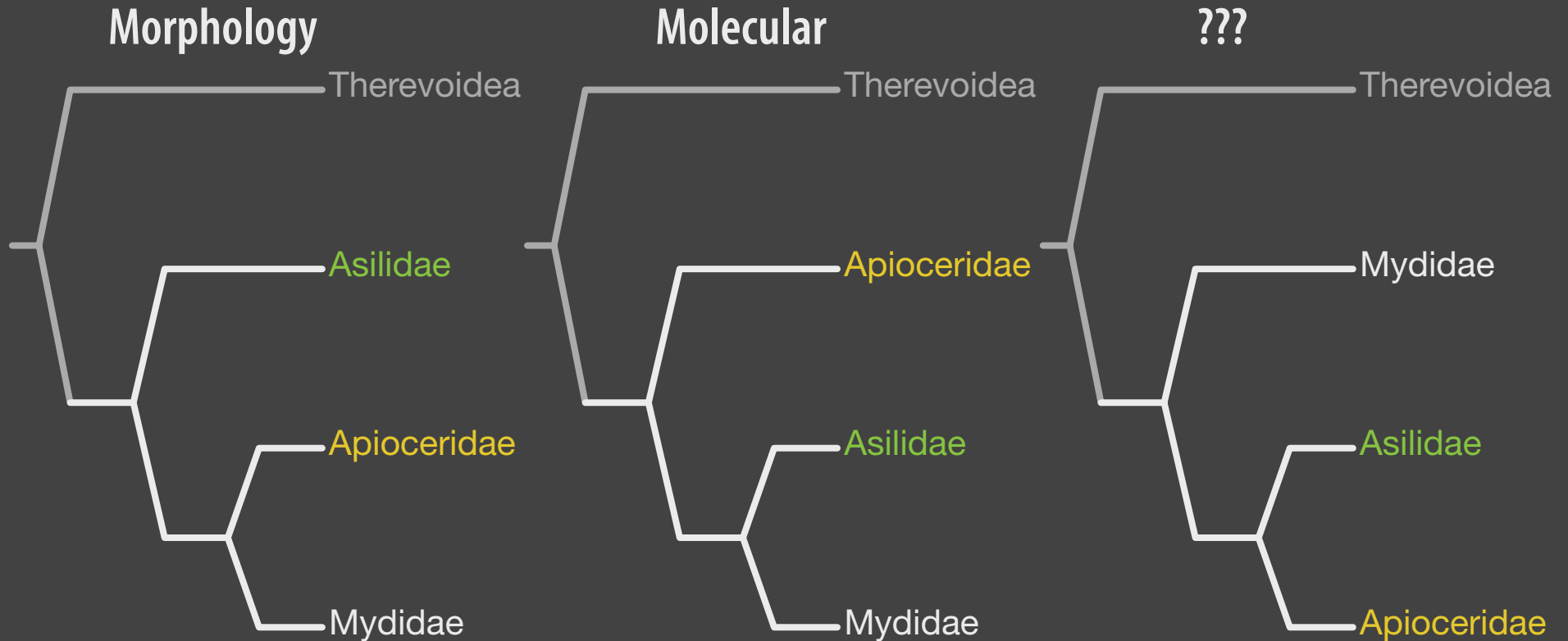
- ◇ Apioceridae (*Apiocera*) monophyletic
- ◇ Mydidae monophyletic
- ◇ Relationship to Asilidae ambiguous
- ◇ Future research:
 - expanded molecular matrix
 - detailed morphological matrix
 - total-evidence analysis



Miltinus viduatus, South Australia, Australia

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Sister-group relationships



Acknowledgements

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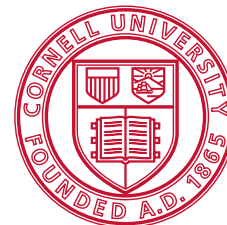
◇ Laboratory

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◇ Analysis

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