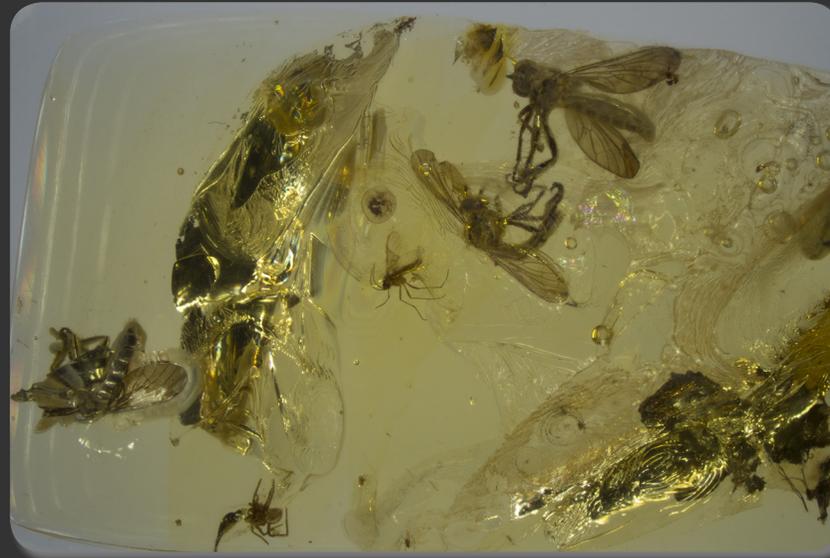


Review and phylogenetic placement of Asilidae (Diptera) in Tertiary: Eocene ambers



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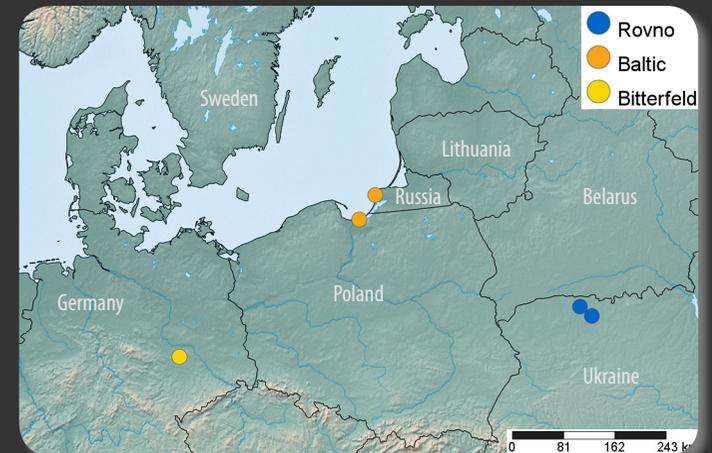
@TDikow #asiloidflies

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- ◇ well-known amber from the Bay of Gdansk (Poland) of the southern Baltic Sea
- ◇ 45 – 50 Million years old (myo)
- ◇ very rich in insect inclusions particularly Diptera
 - › Hoffeins & Hoffeins 2003. *Studia dipterologica* 10(2): 381 – 392
- ◇ Baltic, Bitterfeld, and Rovno ambers most probably same fauna
 - › but see Penney 2010. *Biodiversity of fossils in Amber from the major world deposits*. Siri Scientific Press, Manchester
- ◇ Willi Hennig studied Diptera inclusions extensively
 - › Acalypterae, Acroceridae, Bombyliidae, Lower Brachycera, Therevidae
 - › recorded several acalypterae families believed to be Southern Hemisphere endemics



- ◇ adult flies and larvae predatory
- ◇ size = 5 – 60 mm
- ◇ > 7,500 extant species in 541 genera
- ◇ 58 fossil species in 32 genera [catalog URL](#)
- ◇ oldest definitive assassin fly – †*Araripogon axelrodi*
 - › Cretaceous Crato Formation of Brazil, ≈ 112 myo
 - › Grimaldi 1990 [open-access link](#)
- ◇ rare in any amber due to life history
 - › 2x Burmese Amber (100 myo) – †*Burmapogon bruckschi*
 - › 1x Raritan Amber (92 myo) – †*Cretagaster raritanensis*
 - › Dikow & Grimaldi 2014 [open-access link](#)
 - › 18x Dominican Amber (20 – 25 myo) – Dikow & Fisher in prep.

†*Araripogon axelrodi* ♀†*Burmapogon bruckschi* ♂ – Morphbank #832135

- ◇ Loew 1850 [BHL link](#)
 - › †*Asilus angustifrons*, †*Asilus trichurus*, †*Dasypogon (Holopogon) pilipes*
 - › species nomina nuda

- ◇ Meunier 1899 [BHL link](#), 1908 [BHL link](#)
 - › †*Asilus trichurus* Meunier, 1899
 - › †*Asilus (Lophonotus) klebsi* Meunier, 1908

- ◇ Hennig 1967
 - › unable to locate any of the above type specimens

- ◇ Schumann 1984
 - › Bitterfeld Amber
 - › †*Protolewinella keilbachi*

- ◇ Geller-Grimm 1998
 - › recorded †*Protolewinella keilbachi* from Baltic Amber

- ◇ 25 amber pieces with assassin-fly inclusions
- ◇ primarily from Coll. Hoffs (Hamburg, Germany) and AMNH
 - › amber beautifully enhanced through cutting and embedding in “modern” resin
- ◇ photography
 - › Zeiss SteREO Discovery.V12, PlanApo S 0.63x or 1x lens (5x to 10x magnification)
 - › mixed LED lighting: Bright Field, Dark Field, and Transillumination
 - › Olympus micro Four-Thirds mirrorless E-PL 5, RAW image
 - › manual “slicing” – rendered with HeliconFocus
- ◇ morphological matrix [TreeBase PURL](#) from Dikow 2009 [open-access link](#)
 - › TNT 1.1 (February 2014) Goloboff *et al.* 2008 [doi link](#)
 - › exhaustive search of tree space (MacPro 3.5 GHz 6-core Intel Xeon E5, 64 GB RAM)
 - › Bremer support Bremer 1988 [doi link](#)
 - › character analysis Mesquite (3.01) and WinClada/Asado (1.08)

- ◇ Laphriinae: Atomosiini
- ◇ now known from Baltic, Bitterfeld, and Rovno ambers
- ◇ most abundantly preserved assassin fly (10 pieces with 13 enclosed specimens)



†*Protolewinella keilbachi* ♀ coll. Hoffeins 938-3 left



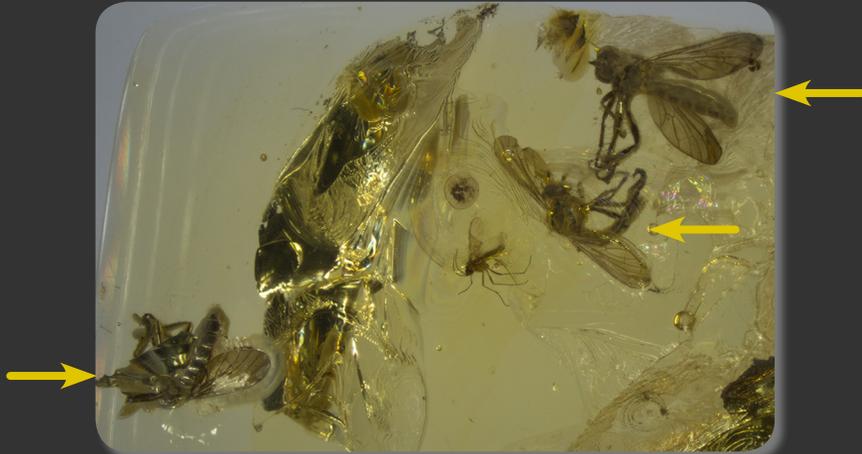
†*Protolewinella keilbachi* ♀ coll. Hoffeins 938-3 right

◇ Atomosiini

- › tree trunks or vegetation as perching sites
- › relatively small and “weak” assassin flies



Atomosia puella © M. Thomas



3x †*Protolewinella keilbachi* coll. Hoffeins 1038-2 dorsal

- ◇ Atomosiini: morphologically similar, but distinct from †*Protolewinella keilbachi*
 - › antennal stylus longer, abdominal tergites less microrugose



†Atomosiini ? gen. nov. sp. nov. ♀ coll. Hoffeins 1392-1 dorsal



†Atomosiini ? gen. nov. sp. nov. ♀ coll. Hoffeins 1392-1 ventral



†Atomosiini ? gen. nov. sp. nov. ♀ coll. Hoffeins 1392-1 left



†Atomosiini ? gen. nov. sp. nov. ♀ coll. Hoffeins 1392-1 right

- ◇ †Asilinae gen. nov. A sp. nov.
 - › 1 female specimen
 - › similarities with *Astochia*, *Neoitamus*, some *Promachus*

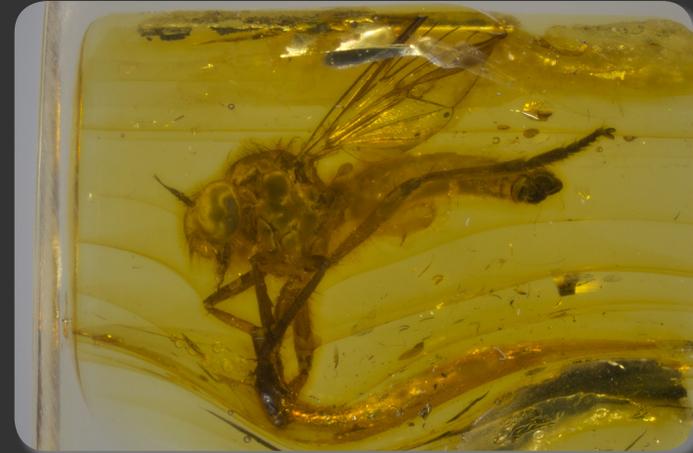


†Asilinae gen. nov. A sp. nov. ♀
coll. Hoffeins 1453-1 right



†Asilinae gen. nov. A sp. nov. ♀
coll. Hoffeins 1453-1 left

- ◇ †Asilinae gen. nov. B sp. nov.
 - › 6 specimens (4 males, 2 females)
 - › similarities with *Neomochtherus*



†Asilinae gen. nov. B sp. nov. ♂ coll. Hoffeins 938-1 left



†Asilinae gen. nov. B sp. nov. ♂ coll. Hoffeins 938-1 right

- ◇ †Laphriinae gen. nov. sp. nov.
 - › 1 male specimen
 - › similarities with *Nusa*

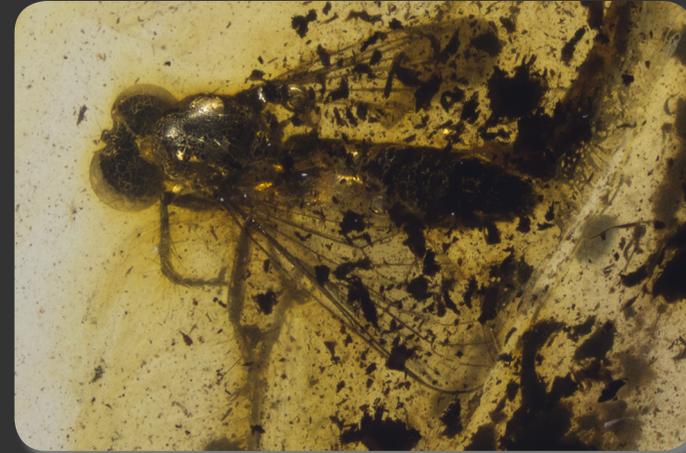


†Laphriinae gen. nov. sp. nov. ♂ coll. Hoffeins 1305-1 dorsal

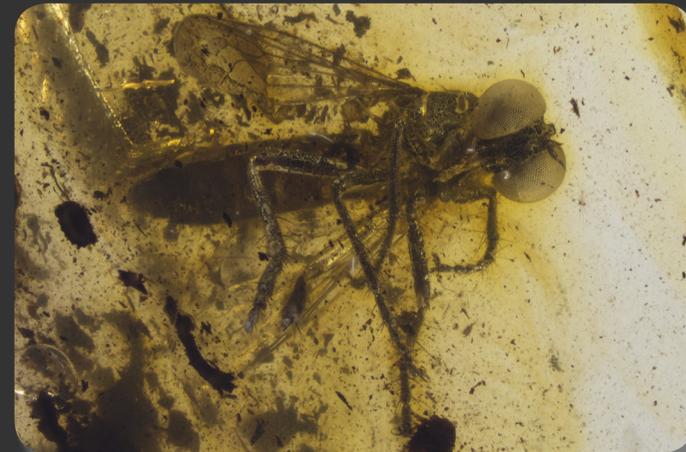


†Laphriinae gen. nov. sp. nov. ♂ coll. Hoffeins 1305-1 ventral

- ◇ †"Stenopogoninae" gen. nov. sp. nov.
 - › 1 male and 1 female



†"Stenopogoninae" gen. nov. sp. nov. ♀ coll. Hoffeins 632-2 dorsal



†"Stenopogoninae" gen. nov. sp. nov. ♀ coll. Hoffeins 632-2 ventral

- ◇ †Leptogastrinae gen. nov. sp. nov.
 - › 1 male specimen
 - › similarities with *Leptogaster*

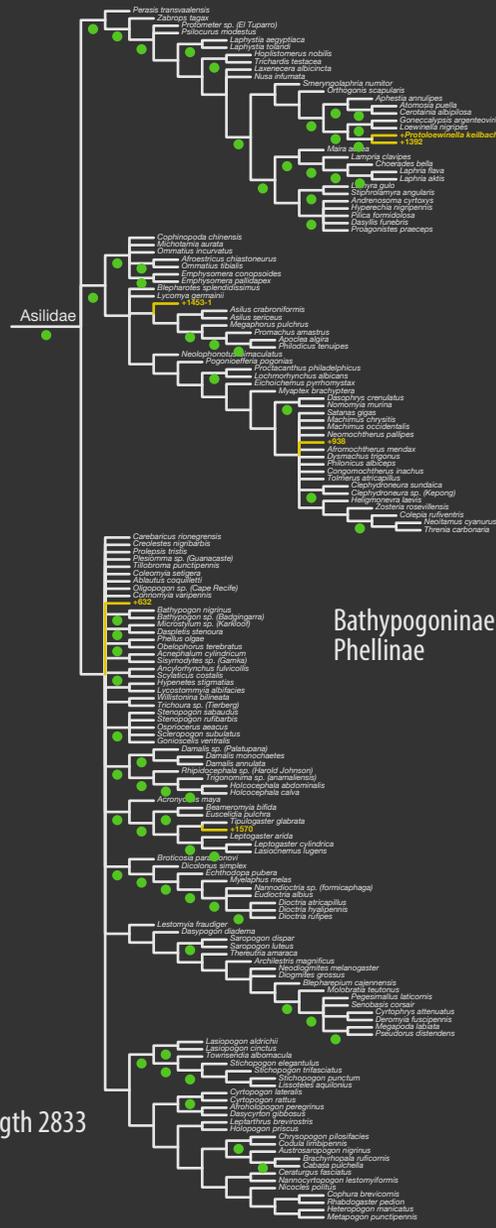


†Leptogastrinae gen. nov. sp. nov. ♂ coll. Hoffeins 1570 dorsal



†Leptogastrinae gen. nov. sp. nov. ♂ coll. Hoffeins 1570 ventral

included fossil taxa	% missing characters (of 220 characters)
†Asilinae A	43
†Asilinae B	28
† <i>Protolewinella</i>	36
†Atomosiini	36
†Leptogastrinae	48
†"Stenopogoninae"	30



Laphriinae

Ommatiinae

Asilinae

Bathypogoninae
Phellinae

Trigonomininae

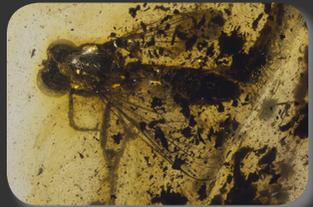
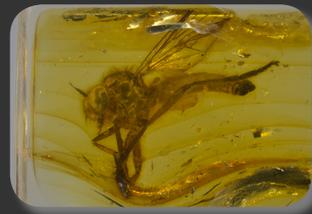
Leptogastrinae

Dioctriinae

Dasyopogoninae

Stichopogoninae

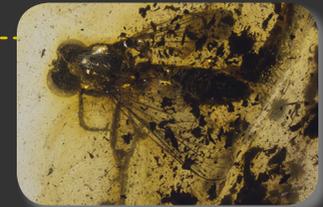
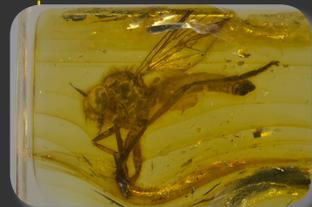
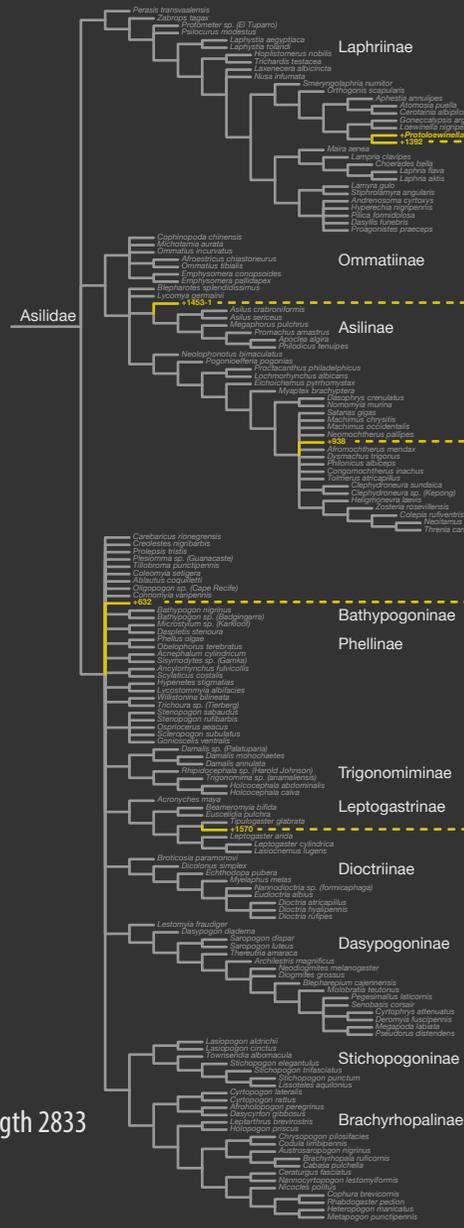
Brachyrhopalinae



strict consensus topology of 348 most parsimonious trees of length 2833

● Bremer ≥ 5

- › relationships among taxa less-resolved
- › Asilinae resolution improved
- › Stenopogoninae, Tillobromatinae, and Willistoninae non-monophyletic
- › fossil taxa can be easily placed – except for †“Stenopogoninae”
- › all Atomosiini specimens represent †*Protolewinella keilbachi*



strict consensus topology of 348 most parsimonious trees of length 2833

- ◇ Fritz Geller-Grimm
- ◇ Christel and Hans-Werner Hoffeins and David Grimaldi for specimens
- ◇ U.S. National Science Foundation REVSYS [DEB-0919333](#)



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