

# Review of the species of *Anevrina* LIOY (Diptera: Phoridae), with a new species and a revised world key

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**Abstract.** The species of *Anevrina* are reviewed, and the following new synonyms noted: *A. rutilipes* BEYER = *A. sphaeropyge* BEYER, *A. simillima* BEYER = *A. unispinosa* (ZETTERSTEDT), *A. spinipes* (COQUILLET) = *A. setigera* (LOEW) and *A. sulcatifemur* BORGMEIER = *A. variabilis* (BRUES). A new species, *A. kozaneki*, is described from Slovakia. The record of *A. urbana* from the Nearctic Region is shown to be erroneous; this species is restricted to the Palearctic Region. Preliminary phylogenetic analysis suggests that *A. setigera* and *A. sphaeropyge* are sister-species, as are *A. curvinervis* and *A. macateei*. A new key to species is provided.

**Key words.** Diptera, Phoridae, *Anevrina*, taxonomy, phylogeny, distribution.

## Introduction

The genus *Anevrina* LIOY (1864) is a group of relatively large phorids whose distribution is restricted to the northern hemisphere. All species probably are scavengers, and some are collected frequently from mammal burrows (HACKMAN, 1963a, b, 1967).

There has been some confusion about the identity of certain species of this genus, especially those described by BEYER (1958) from Burma. In this paper, I deal with these problems, make some preliminary observations on the phylogeny of the group, and present a new key to allow identification of adults.

## Materials

This review is based on my examination of specimens of all described species. Material was either from my collection (LACM – Natural History Museum of Los Angeles County), or borrowed from the following institutions (curators names in parentheses): California Academy of Sciences (P.H.Arnaud, Jr); Canadian National Collection of Insects (J.M.Cumming); UZMH – Finnish Museum of Natural History (P.Vilkamaa); Museum of Comparative Zoology (in the care of the author); United States National Museum (in the care of the author); NMW – Naturhistorisches Museum Wien (R.Contreras-Lichtenberg); Slovak Academy of Sciences (M. Kozánek); Utah State University (W.J.Hanson); ZFMK – Zoologisches Forschungsinstitut und Museum A. Koenig (H.Ulrich).

## *Anevrina* LIOY, 1864

**Notes on synonymy.** A full synonymy for this genus, as well as for the various species, is given by BORGMEIER (1968). No nomenclatural changes have taken place since his work.

**Fossils.** One fossil species is known, the extinct *A. oligocaenica* (BRUES, 1939) from Baltic amber. I examined all of the specimens, and found that the illustration of the hind leg for this species is misleading; in fact, the legs of this species are identical to those of *A. unispinosa*. The two can be separated by the male terminalia; those of *A. unispinosa* are of the type shown

in Fig. 1B, whereas those of *A. oligocaenica* are similar to those of *A. setigera* (Fig. 2), with an elongate, pointed right surstylus.

**Phylogenetic relationships.** This genus belongs in the subfamily Phorinae, hypothesized to be the second most relatively primitive lineage in the Phoridae (BROWN, 1992). Its relationships within this group are unknown.

A full revision of *Anevrina*, with a phylogenetic analysis, is deferred until later. Some characters of the chaetotaxy of the legs can provide preliminary insights into the species-level relationships within this group, however (Fig. 4). Characters were polarized mostly with reference to the Lonchopteridae, Ironomyiidae, and Sciadoceridae, which are the sequential sister-groups of the Phoridae (McALPINE, 1989), as well as the Hypocerinae, the hypothesized relatively most primitive phorid lineage (BROWN, 1992).

**1** Foretibia with two large anterodorsal setae.

I surveyed the primitive-grade phorids and the phorid outgroups (Table 1) to determine the primitive state for this character. Based on outgroup comparison with Lonchopteridae, *Ironomyia nigromaculata* WHITE (Ironomyiidae), Sciadoceridae (*Archiphora patagonica* (SCHMITZ) and *Sciadocera rufomaculata* WHITE), and most hypocerines (including all of the most basal lineages identified by BROWN, 1992), a single anterodorsal seta is the ancestral state. Therefore, I hypothesize that *A. setigera* and *A. sphaeropyge*, which have two foretibial setae, are sister-taxa.

Further phylogenetically useful information can be obtained from this character. Within most groups of primitive-grade phorids, the number of setae on the foretibia is one, suggesting that this is a slowly evolving, conservative character. A few instances of total loss of this seta are known, mostly in groups of "degenerate" flies (those with reduced wings, eyes, sclerites) such as *Billotia* SCHMITZ, *Dicranopteron* SCHMITZ, and some Aenigmatiini. The loss of this seta can be interpreted as a further synapomorphy linking the genera *Postoptica* DISNEY and *Phora* LATREILLE, as I recently proposed (BROWN, 1994). Gains of extra seta on the fore tibia are found in some species of the closely related hypocerine genera *Peromitra* ENDERLEIN and *Trineurocephala* SCHMITZ, whose relationships to each other are uncertain. Extra setae are also found in the aenigmatiine *Dohnrphora*-subgroup of genera (of BROWN, 1992; see DISNEY, 1993 for a dissenting opinion), perhaps providing further support for this group (an exception is the genus *Dicranopteron*, as mentioned above).

**2** Dorsal basal seta on hind tibia lost (Figs. 1B–C).

**3** Apical dorsal seta on hind tibia gained (Figs. 1B, I)

**4** Dorsal seta at basal third of hind tibia gained (Figs. 1G–H, J–L).

The setae of the hind tibia (characters #2–4) are much more variable than those of the fore tibia, and probably evolve much more quickly. Examination of Sciadoceridae and Hypocerinae indicates that the primitive setation for the phorid hind tibia (not including the ventral spurs) is as follows: one dorsal seta at base, one anterior seta at base, and one anterior seta near apex (as in Figs. 1D–F). This type of setation is found in *Archiphora patagonica* and *Sciadocera rufomaculata* as well as in species of *Burmophora* BEYER, possibly the most primitive extant phorid genus (BROWN, 1992). The apical seta of the sciadocerids is somewhat more dorsal in position than in *Burmophora* species, but it presumably is homologous.

Within the relatively primitive Hypocerinae, the setation of the hind tibia varies widely. An analysis of this variation, in the context of the reconstructed phylogeny of the group (BROWN, 1992) is instructive in deciding how much confidence to place in these characters (See Fig. 3 for a representation of these character states). In most genera except *Burmophora*, the dorsobasal seta is lost, so that only two anterior setae remain (as Fig. 1C). All setae are absent from the hind tibia of *Billotia* SCHMITZ. Within the *Borophaga* group of genera (*Borophaga* to *Trineurocephala*; BROWN, 1992) the situation is complex, and needs to be resolved by revising the problematic genus *Peromitra* ENDERLEIN. In general, it seems that the ancestor of the

Table 1. Number of setae on fore tibia.

PLATYPEZIDAE			
various genera	0		
LONCHOPTERIDAE			
<i>Lonchoptera</i>	1		
IRONOMYIIDAE			
<i>Ironomyia</i>	1		
SCIADOCERIDAE			
<i>Archiphora</i>	0–1 (sometimes extremely weak)		
<i>Sciadocera</i>	1		
PHORIDAE			
Hypocerinae		Aenigmatiinae	
<i>Burmophora</i>	1	<i>Diploneura</i>	1
<i>Borophaga</i>	1	<i>Dohrniphora</i>	3–5
<i>Abaristophora</i>	1	<i>Aenictomyia</i>	4
<i>Stichillus</i>	1	<i>Aenigmatias</i>	0
<i>Trineurocephala</i>	1–2	<i>Aenigmatistes</i>	0–2
<i>Peromitra</i>	1–3	<i>Epicnemis</i>	0–2
		<i>Misotermes</i>	0
		<i>Psyllomyia</i>	2–3
Phorinae		Conicerinae	
<i>Phora</i>	0	<i>Ceratusa</i>	0
<i>Postoptica</i>	0	<i>Gymnoptera</i>	1
<i>Spiniphora</i>	1	<i>Contopteryx</i>	1
<i>Chaetopleurophora</i>	1–4	<i>Conicera</i>	1
<i>Neopleurophora</i>	1	<i>Darwiniphora</i>	1
<i>Chaetocnemistoptera</i>	1		
<i>Rhyncomicropteron</i>		Thaumatoxeninae	
<i>Coniceromyia</i>	2–4	<i>Palpiclavina</i>	3
<i>Plethysmochaeta</i>	1–4	<i>Thaumatoxena</i>	0–2
		unplaced genera	
		<i>Kierania</i>	1

*Borophaga* group gained a dorsoapical seta, as found in *Borophaga* ENDERLEIN (except for one species), *Latiborophaga* BROWN, *Stichillus* ENDERLEIN, and *Trineurocephala* SCHMITZ. A reversal to the ancestral state, two anterior setae, is found in *Abaristophora* SCHMITZ, *Antipodiphora* SCHMITZ and some species of *Peromitra*; presumably, these represent secondary losses of the dorsoapical setae.

Other variations occur: for example the anterobasal seta is lost in *Godavaria* BROWN, some species of *Peromitra* have regained the dorsobasal seta, and some *Trineurocephala* have a second anterobasal seta. It is interesting that the two genera with the most divergent fore tibial setation, *Peromitra* and *Trineurocephala*, also have the most divergent and varied setation of the hind tibia.

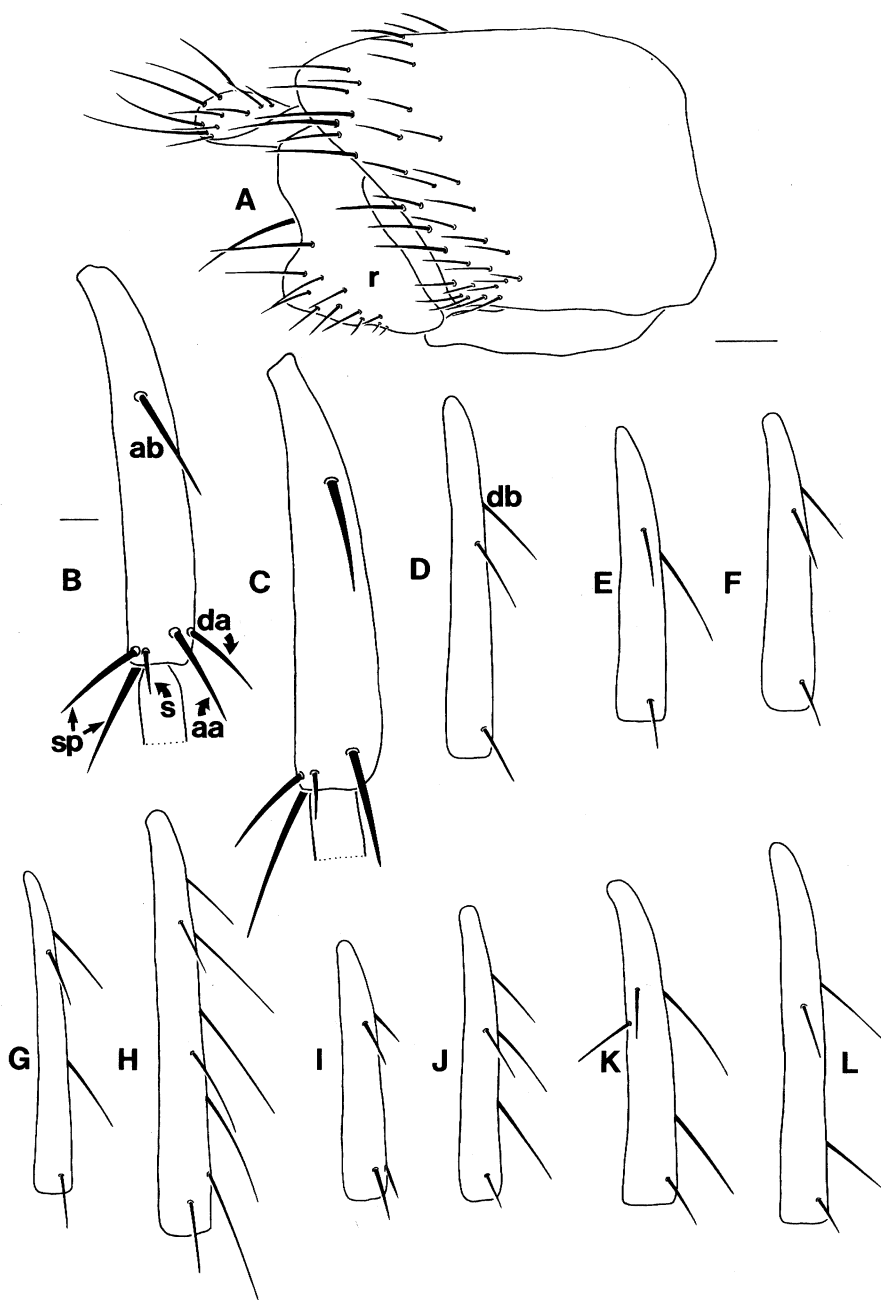


Fig. 1A-L. *Anevrina* species (scale bar = 0.1mm; Figs. B-C to same scale; Figs. D-L modified from BORGMEIER, 1963, scale unknown, tibial spurs omitted). A) *A. kozaneki* new species, male terminalia, right side. Figs. B-L. Left hind tibia. B) *A. kozaneki* new species; C) *A. unispinosa* (ZETTERSTEDT); D) *A. olympiae* (ALDRICH); E) *A. curvinervis* (BECKER); F) *A. macateei* (MALLOCH); G) *A. thoracica* (MEIGEN); H) *A. setigera* (LOEW); I) *A. luggeri* (ALDRICH); J) *A. urbana* (MEIGEN); K) *A. variabilis* (BRUES) ♂; L) *A. variabilis*. Abbreviations: aa - anteroapical seta; ab - anterobasal seta; da - dorsoapical seta; db - dorsobasal seta; r - right surstylus; s - small seta; sp - spurs.

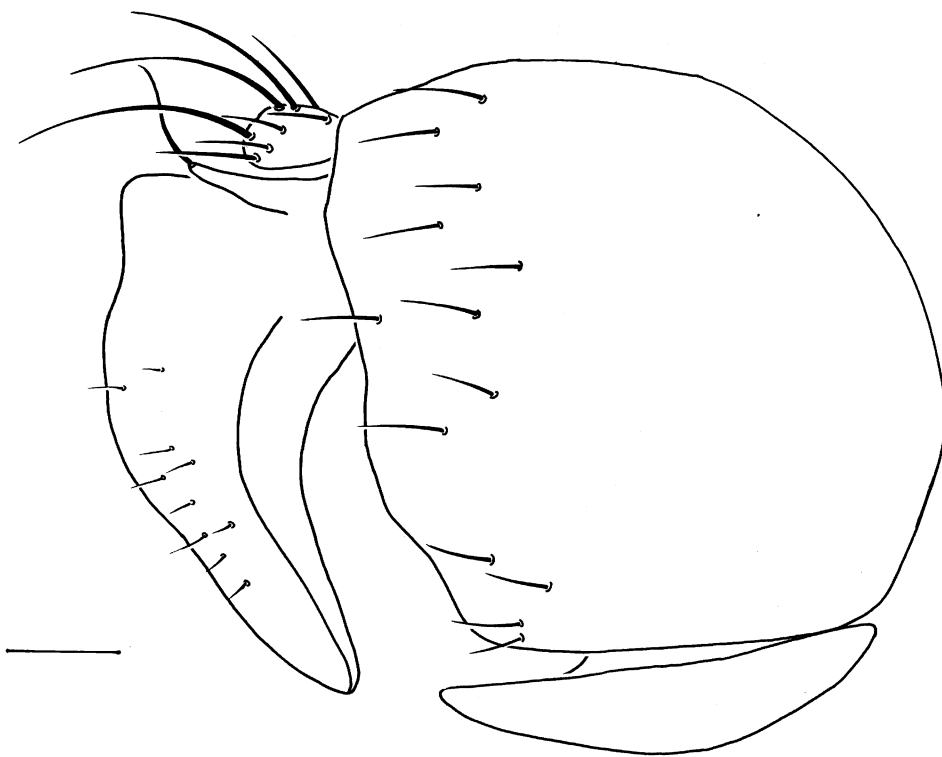


Fig. 2. *Anevrina setigera* (Loew), male terminalia, right side (specimen from Guelph, Ontario, Canada). Scale bar = 0.1mm.

Keeping the situation in the Hypocerinae in mind, the proposal of synapomorphic character states of the hind tibial setation in the Phorinae should be considered tentative. Within *Anevrina* the presumed primitive state is present in *A. curvinervis*, *macateei* and *olympiae*. Two conflicting, potentially synapomorphic derivations from this ground pattern are characters #2 and #3; character state #2 links *A. kozaneki* and *unispinosa*, whereas character state #3 links *A. kozaneki* and *luggeri*. Character state #2 also conflicts with character state #5, as both are present in *A. oligocaenica*. Character state #4 proposes a group that is further supported by the derived condition of character #5 (below). Another synapomorphy that I considered was the presence of a third dorsal seta on the hind tibia in *A. setigera* and *urbana*, but this contradicts synapomorphy #1. Since the setation of the hind tibia seems to be much more variable than that of the fore tibia, I consider the grouping of *A. setigera* with *A. sphaeropyge* (indicated by synapomorphy #1) most reliable.

##### 5 Right surstylus elongate, narrow.

The polarity of this character state is determined by comparison with species of *Phora* (Figured in Gotô, 1984, 1985a, b, c, 1986) and *Burmophora* (Brown, 1990, 1992, Gotô, 1983) which have a relatively truncate, broad right surstylus. Like characters of the setation of the hind tibia, the structure of the surstylus apparently evolves quickly, and can be used only for closely related species. This character state links the same species as does character state #4.

6 Inner face of hind femur of male with stout, peg-like setulae (DISNEY, 1983, fig. 19).

This character state was noted and figured by DISNEY (1983) for *A. curvinervis*. I examined all other species, and found it also in *A. macateei*.

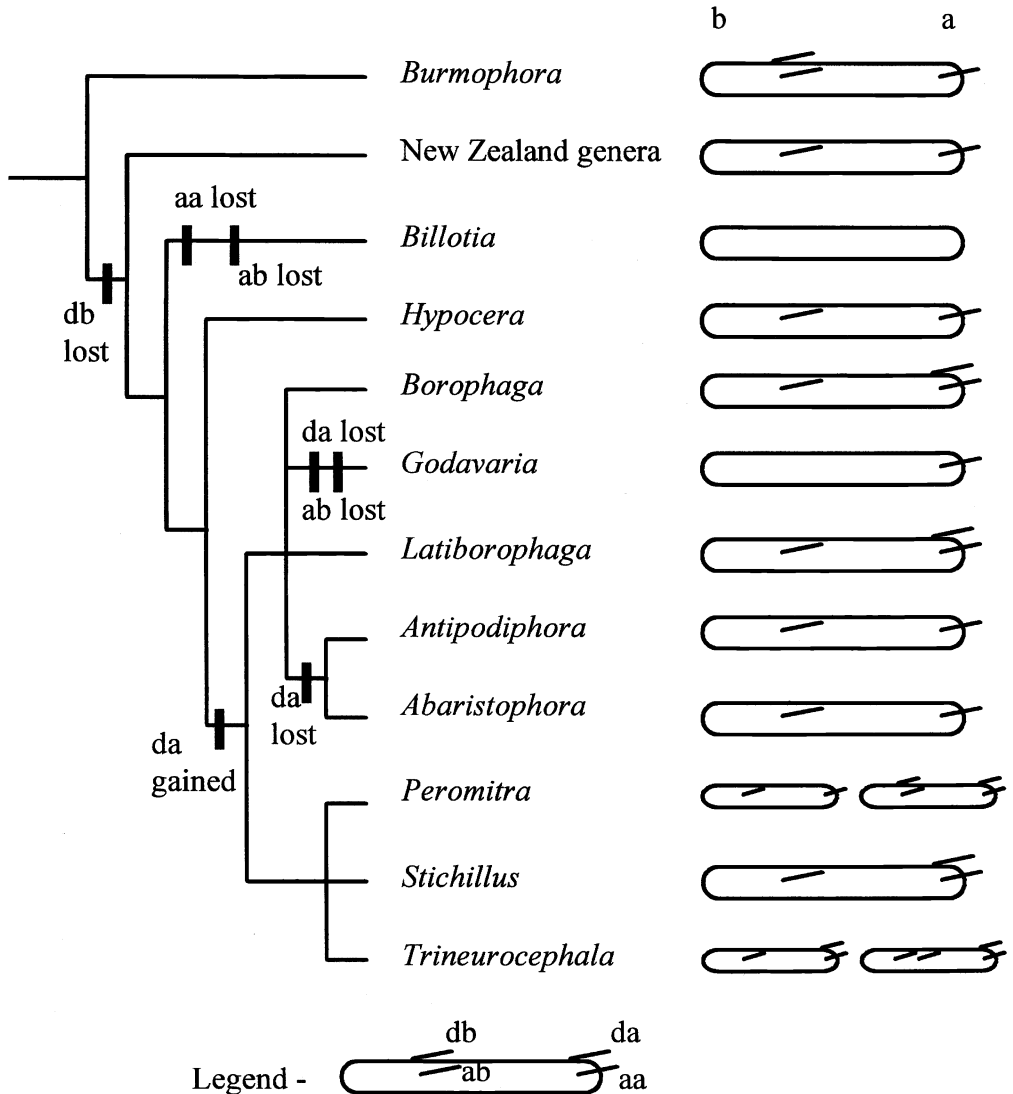


Fig. 3. Character states of stylized hind tibiae, plotted on cladogram of subfamily Hypocerinae. Abbreviations: a – apical end; b – basal end; aa – anteroapical seta; ab – anterobasal seta; da – dorsoapical seta; db – dorsobasal seta.

## Taxonomy

### *Anevrina kozaneki* new species

**Holotype.** ♂, SLOVAKIA: Ivanka pri Dunaji, 48.18–N, 17.27–E, 27.iv.1992, M.Kozánek, Malaise trap (LACM).

**Paratypes.** 6♂, same locality and collector as holotype: 1♂, 3.V.1992, 3♂, 7.V.1992, 1♂, 9.V.1992, 1♂, 13.V.1992 (LACM, MCZ, SAS, USNM).

**Diagnosis.** This species is distinguished from all others by the setation of the hind tibia.

**Description** (male only, female unknown). Body length 2.7–3.0 mm. Body color entirely dark brown, except foretibia and foretarsomeres, which are slightly lighter brown. Mean frontal ratio 0.79. Flagellomere 1 and palp of normal size, not enlarged. Wing with mean costal length 0.59 wing length, range 0.51–0.64. Mean costal sector ratio 3.77 : 1.95 : 1, range 3.35–4.13 : 1.75–2.25 : 1. Halter dark brown. Fore tibia with one dorsal seta at mid length. Mid tibia with one dorsal and one anterior seta near base, and one pre-apical anterior seta. Hind tibia (Fig. 1B) with one anterior seta near base and one apical pair of setae, consisting of one dorsal seta and one anterodorsal seta; also present is a small anterior seta at apex and a pair of long ventral spurs. Male terminalia dark brown, with scattered, relatively uniform setae. Right surstylus ventrally truncate (Fig. 1A).

**Phylogenetic relationships.** Unknown. Conflicting characters link this species with *A. luggeri* or *A. unispinosa*.

### *Anevrina setigera* (LOEW, 1874)

**Notes on synonymy.** The distinction between *A. setigera* and *A. spinipes* (COQUILLET, 1895) has long been questioned. SCHMITZ (1927) believed they could be distinguished by the lighter-colored legs and less strongly bent wing vein M1 reported by COQUILLET (1895) in the original description of *A. spinipes*. Later (SCHMITZ, 1941), he pointed out that *A. spinipes* was a much smaller species, being only one-half the length of *A. setigera*. In examining specimens of both species, however, I find that none of these distinctions are consistent or reliable. A female of *A. setigera* from Europe is within the range of variation of the many specimens (85 in total) of *A. spinipes* I examined. I therefore consider the name *A. spinipes* (COQUILLET) a junior subjective synonym of *A. setigera* (LOEW) (**new synonymy**).

**Phylogenetic relationships.** This species is hypothesized to be the sister-species of *A. sphaeropyge*, based on the presence of two setae on the fore tibia.

### *Anevrina sphaeropyge* BEYER, 1958

**Notes on identification and synonymy.** I examined holotypes of both *A. sphaeropyge* and *A. rutilipes* and conclude that they are identical. Therefore, *A. rutilipes* BEYER is a junior subjective synonym of *A. sphaeropyge* BEYER (**new synonymy**). Adults of *A. sphaeropyge* are similar to those of *A. thoracica*, as noted by BEYER (1958), but differ by having two setae on the foretibia (*A. thoracica* has only one) and by lacking the distinct, oval patch of reduced setulae found on the outer face of the hind tibia in *A. thoracica*.

**Phylogenetic relationships.** See *A. setigera*.

### *Anevrina unispinosa* (ZETTERSTEDT, 1860)

**Notes on synonymy.** I have examined the holotype of *A. simillima* (BEYER, 1958) and found it to be identical with specimens of *A. unispinosa*; therefore the name becomes a junior subjective synonym of *A. unispinosa* (**new synonymy**).

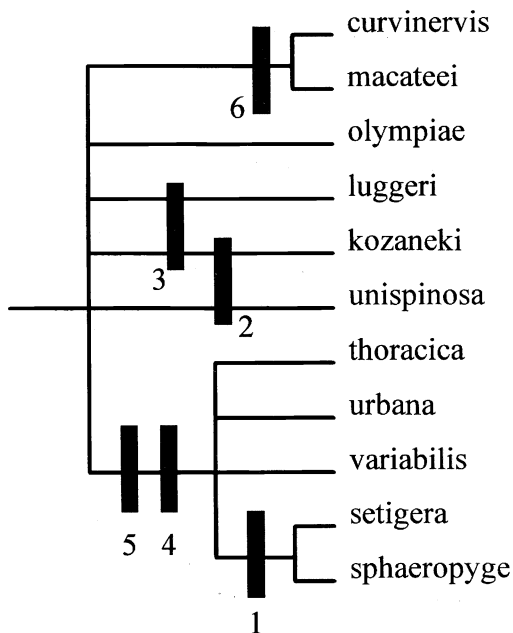


Fig. 4. Preliminary phylogenetic hypothesis for species of *Anevrina* LOY. Character states discussed in text.

### *Anevrina urbana* (MEIGEN, 1830)

**Notes on distribution.** This species was reported from Utah, U.S.A., by SCHMITZ & BEYER (1965). Based on this record, BORGMEIER (1963) included *A. urbana* in his key to North American *Anevrina* species. I examined the single male standing as this species in the USNM, which is from Hooper, Utah, and found it to be a misidentified male of *A. variabilis* (see below). Therefore, in the absence of further Nearctic Region records, I consider *A. urbana* to be restricted to the Palearctic Region.

### *Anevrina variabilis* (BRUES, 1908)

**Notes on synonymy.** In his original description of *A. variabilis*, BRUES (1908) mentioned the variation found in the setation of the hind tibia, for which the species was named. This variation is even more extensive than previously thought, and led BORGMEIER (1963) to describe the male as a separate species, *A. sulcatifemur*.

I have examined many specimens of both species (83 in total) and conclude that they are conspecific, based on overall similarity, the distinctive coloration of the halter, and co-occurrence in Malaise trap samples on several separate occasions. Thus *A. sulcatifemur* BORGMEIER is a junior subjective synonym of *A. variabilis* BRUES (**new synonymy**). It is notable that BORGMEIER (1963) remarked that one of his paratypes of *A. sulcatifemur* was mounted on the same pin as a female of "*varians*" [= *variabilis*]; probably this was a pair collected in copula.

#### Checklist of World *Anevrina* species, with distributions.

- A. curvinervis* (BECKER, 1901) – Holarctic Region
- A. kozaneki* **new species** – Palearctic Region
- A. luggeri* (ALDRICH, 1892) – Nearctic Region

- A. macateei* (MALLOCH, 1913) – Nearctic Region  
*A. oligocaenica* (BRUES, 1939) – Baltic amber (extinct)  
*A. olympiae* (ALDRICH IN BRUES, 1904) – Nearctic Region  
*A. setigera* (LOEW, 1874) – Holarctic Region  
*A. sphaeropyge* BEYER, 1958 – Oriental Region  
*A. thoracica* (MEIGEN, 1804) – Holarctic Region  
*A. unispinosa* (ZETTERSTEDT, 1860) – Palearctic and Oriental Regions  
*A. urbana* (MEIGEN, 1830) – Palearctic Region  
*A. variabilis* (BRUES, 1908) – Nearctic Region

## Key to World *Anevrina*

Note in the following key that the pair of ventral spurs (Fig. 1B, sp) found on each leg do not count as tibial setae; similarly, smaller setae (Fig. 1B, s) are not counted.

- 1 Hind tibia with one seta present distinctly below mid level (Figs. 1C–G) ..... 2  
 – Hind tibia with more than one setae present distinctly below mid level (Figs. 1B, H–L) ... 7  
 2(1) Halter yellow ..... 3  
 – Halter brown ..... 6  
 3(2) Hind tibia with only one dorsal seta, or lacking dorsal setae (Figs. 1B–F) ..... 4  
 – Hind tibia with more than one dorsal setae (Fig. 1G) ..... 5  
 4(3) Hind tibia with only 2 setae, both anterodorsal: one subbasal and one subapical (Fig. 1C) .....  
 ..... *A. unispinosa* (ZETTERSTEDT)  
 – Hind tibia with more than 2 setae (Fig. 1D) ..... *A. olympiae* (ALDRICH)  
 5(3) Fore tibia with one seta; anterior face of hind femur of male with distinct, depressed, oval patch of smaller setulae ..... *A. thoracica* (MEIGEN)  
 – Fore tibia with more than one seta; anterior face of hind femur of male without distinct oval patch ..... *A. sphaeropyge* BEYER  
 6(2) Hind tibia with dorsobasal seta distinctly longer and lower than anterobasal seta (Fig. 1E) ..... *A. curvinervis* (BECKER)  
 – Hind tibia with dorsobasal seta subequal to and higher than anterobasal seta (Fig. 1F) ..... *A. macateei* (MALLOCH)  
 7(1) Halter yellow ..... 8  
 – Halter brown ..... 10  
 8(7) Mid tibia with basal pair and one apical seta; fore tibia with one seta ..... 9  
 – Mid tibia, in addition to usual three setae, with an extra dorsal; fore tibia with more than one seta; setation of hind tibia as Fig. 1H ..... *A. setigera* (LOEW)  
 9(8) Hind tibia with anteroapical and dorsoapical setae at same level, forming distinct pair (Fig. 1I) ..... *A. luggeri* (ALDRICH)  
 – Hind tibia with anteroapical and dorsoapical setae at different levels, not forming distinct pair (Fig. 1J) ..... *A. urbana* (MEIGEN)  
 10(7) Hind tibia with one dorsobasal seta; hind tibia with anteroapical and dorsoapical setae at different levels, not forming distinct pair (Figs. 1K–L) ..... *A. variabilis* (BRUES)  
 – Hind tibia lacking dorsobasal seta; hind tibia with anteroapical and dorsoapical setae at same level, forming distinct pair (Fig. 1B) ..... *A. kozaneki* new species

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