

A review of the genus *Trichoura* Londt, 1994 with the description of a new species from the Northern Cape Province of South Africa and a key to world Willistoninae (Diptera, Asilidae)

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Abstract

The South African assassin-fly genus *Trichoura* Londt, 1994 is reviewed. A new species, *Trichoura pardeos* **sp. n.**, is described from the arid Karoo in north-western South Africa. A new key to all seven recognized species is provided and the distribution and phenology are discussed. The world fauna of Willistoninae is reviewed, a new taxon Sisyronodytini **tribe n.** (type genus *Sisyronodytes* Loew, 1856) is established for *Ablautus* Loew, 1866, *Acnephalomyia* Londt, 2010, *Ammodaimon* Londt, 1985, *Astiptomyia* Londt, 2010, *Sisyronodytes*, and *Sporadothrix* Hermann, 1908 and photographs for all Willistoninae genera are provided.

Keywords

Assassin flies, robber flies, Afrotropical, Nearctic, new tribe, new species

Introduction

The Afrotropical asilid genus *Trichoura* Londt, 1994 is of particular interest. Not only is it currently a South African endemic associated with rather arid environments, but, in an Afrotropical context, it is believed to be most closely related to a number of Afrotropical genera previously included in the Stenopogoninae (Dikow 2009a), some of which are in some respects rather different. Other genera to which *Trichoura* is related are *Willistonina* Back, 1909 and *Ablautus* Loew, 1866 (Dikow 2009a), both known from the Nearctic Region only (E.M. Fisher pers. comm.).

The discovery of a new species requiring description provides an opportunity to review the genus and highlight its interesting taxonomic position.

The taxonomic history of *Trichoura* is short and uncomplicated and can be briefly summarised as follows:

Londt (1994) – Described the genus, placing it within the subfamily Stenopogoninae. Six South African species were included, all being described for the first time (*T. krugeri*, *T. mesochora*, *T. proctomeces*, *T. tankwa*, *T. torynopa*, *T. tyligma*). A key for the identification of Afrotropical Stenopogoninae was provided.

Dikow (2009a) – Included the genus in a phylogenetic study based on morphological characters and allocated it to his new subfamily Willistoninae (previously considered to have the status of a tribe (Willistonini Artigas & Papavero, 1991) within the Stenopogoninae *sensu* Artigas & Papavero (1991) and Geller-Grimm (2004) along with two other Afrotropical genera (*Acnephalum* Macquart, 1838 and *Sisyrnodytes* Loew, 1856). Two Nearctic genera (*Willistonina* and *Ablautus*) were also included in this taxon.

Londt (2009) – Reviewed Afrotropical *Sisyrnodytes*, a primarily Afrotropical genus with a few Palearctic representatives.

Londt (2010) – Reviewed the Afrotropical *Acnephalum* fauna, demonstrating that Afrotropical species were not congeneric with the Palearctic type species (*A. olivieri* Macquart, 1838), and so transferred the Afrotropical species to a new genus, *Acnephalomyia* Londt, 2010. He also re-combined *Acnephalum cylindricum* (Hermann, 1907), the species included in Dikow (2009a) which had been moved into *Acnephalum* by Oldroyd (1974), with *Sporadothrix*.

Londt (2013) – Provided an updated key to the Afrotropical genera of Stenopogoninae, retaining *Trichoura* in the subfamily in the absence of a key to the subfamilies recognised by Dikow (2009a).

Londt and Dikow (submitted) – In reviewing the Afrotropical Asilidae fauna added several genera of Stenopogoninae *sensu* Artigas & Papavero (1991) and Geller-Grimm (2004) to the Willistoninae (*Ammodaimon* Londt, 1985, *Acnephalomyia* Londt, 2010, and *Astiptomyia* Londt, 2010).

Materials and methods

Terminology follows mainly that proposed by McAlpine (1981), Stuckenberg (1999), Cumming and Wood (2009), Wootton and Ennos (1989, wing venation) as well as that used by the senior author in more recent publications. Specimens available for study are housed in the following institutions: KwaZulu-Natal Museum, Pietermaritzburg, South Africa (NMSA); National Museum of Natural History, Washington, DC, U.S.A. (USNM). Label data is cited as it appears on labels, lines of data being separated by a slash (/). While more recently collected specimens are often provided with detailed information relating to locality and habitat, it has been necessary to attempt to establish precise geographic coordinates for older or relatively poorly documented material in order to gain a better appreciation of species distribution. Google Earth and the Internet have been used to accomplish this. Information not appearing on labels is provided in square brackets. A wing was removed, placed in alcohol and flattened between glass microscope slides for photography. Terminalia were excised and macerated in hot Potassium Hydroxide (KOH) before being drawn with the aid of a drawing tube. Photographs of pinned specimens are available in digital format at Morphbank (Collection ID #860612). The distribution map is available in digital format at SimpleMappr (6129 - <http://www.simplemappr.net/map/6129>) and Google Earth (6129 KML file - <http://www.simplemappr.net/map/6129.kml>).

Results

Taxonomy

Trichoura Londt, 1994

Figs 1–8

Type species. *Trichoura torynopoda* Londt, 1994: 93 by original designation.

Diagnosis. Small, brown-yellow, strongly silver pruinose asilids with the following combination of characters: *Head:* Clearly wider than high in anterior view; mystax white, macrosetae tightly packed, confined to a slight gibbosity on lower facial margin; face narrow, frons diverging abruptly from level of antennal sockets; macrosetae on lateral margin of frons; palpi small, 2-segmented. *Thorax:* Anterior anepisternal setae absent; anatergites asetose; postmetacoxal area membranous. *Wing:* Transparent, immaculate, fairly uniformly microtrichose; alula reduced in size; C extends almost entirely around wing margin (weakly after junction of CuA and CuP), cells m_3 , and cua closed and stalked. *Legs:* Pulvilli and empodia well developed; metathoracic coxae with an anteriorly situated protuberance. *Abdomen:* ♂ terminalia unrotated; ♂ epandrium commonly with long, silvery, prone setae masking shape; hypandrium absent or fused with well-developed gonocoxites which are fused medially to form a cup-shaped sclerite supporting gonostyli and other elements of the terminalia.



Figures 1–6. Photographs of *Trichoura*: **1** male *T. tankwa* (USNMENT01115152), dorsal (Morphbank #860636) **2** same, lateral (#860638) **3** same, head anterior (#860640) **4** male *T. torynopoda* (USNMENT01295405) head anterior (#860659) **5** same, dorsal (#860655) **6** same, lateral (#860657). Scale bars: 1 mm.

***Trichoura pardeos* sp. n.**

<http://zoobank.org/62D2536D-3E76-425A-AB5D-0E3D302ECCE4>

Figs 10–12, 15–19

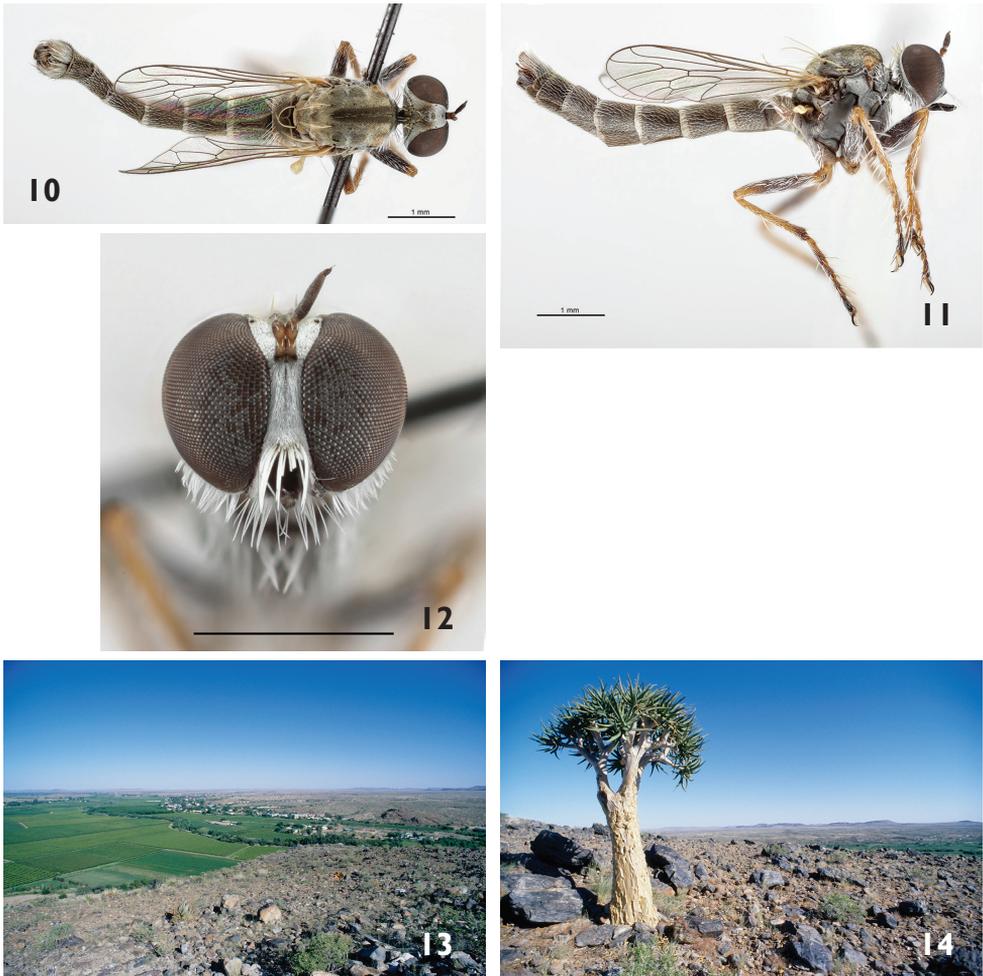
Etymology. Gr. *Pardos* m. – leopard + *oros*, *-eos* n. mountain. Named after the type locality of Tierberg Nature Reserve (Tierberg meaning tiger (= leopard) mountain).



Figures 7–9. Photographs of *Trichoura tankwa* and habitat: **7–8** female fly perching on low, dry branch (Morphbank #860609; #860611) **9** Little Karoo veld habitat at De Zeekoe Guest Farm near Oudtshoorn, Eastern Cape, South Africa (33°37'26"S 022°08'39"E). Photographs by T. Dikow.

Description. Based on all available NMSA material.

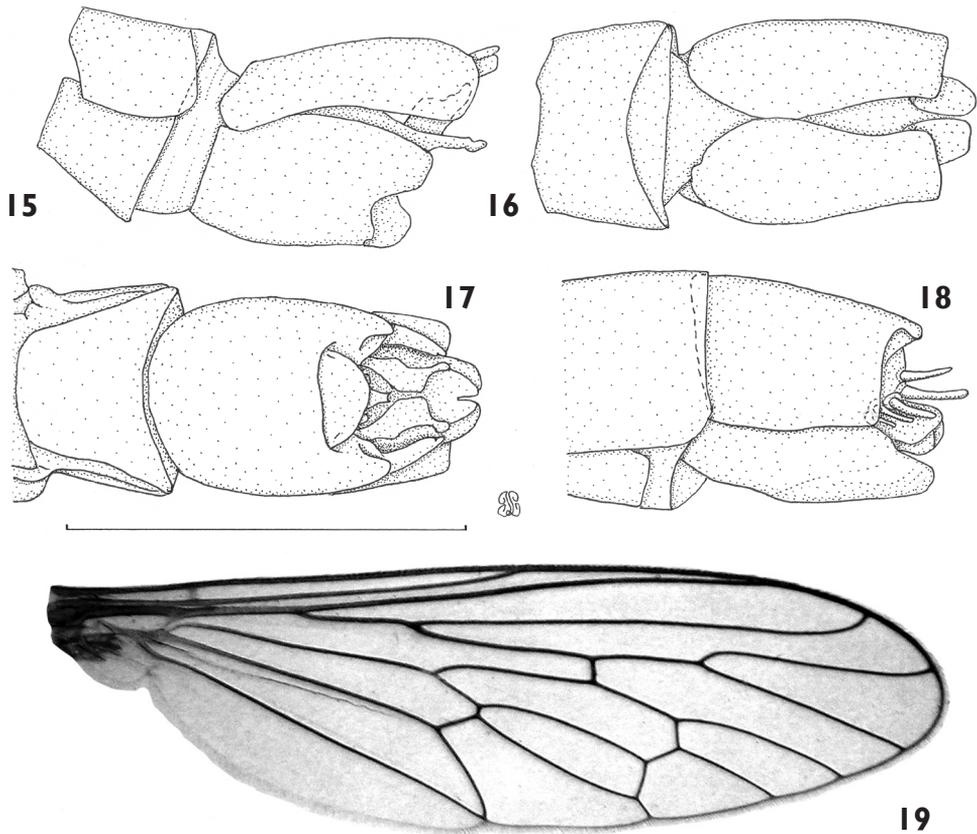
Head: Dark red-brown to black, but colour masked by strong silver and gold pruinescence, white and pale yellow-white setose. Antennal scape and pedicel brown-orange, postpedicel and terminal style dark red-brown, fine silver pruinose, scape and pedicel yellow-white, short setose, style tipped with almost transparent spine-like sensory element. Segmental ratios (scape (as 1) : pedicel : postpedicel : style (segment + sensory element) – 1 : 1.4 : 3.8 : 1.2 (0.8 + 0.3). Face dark red-brown to black, but colour masked by strong silver pruinescence, profile plane except for slight epistomal gibbosity. Mystax shiny white, moderately well-developed, confined to small epistomal gibbosity, setae closely arranged forming a dorsoventrally compressed shield covering proboscis. Face narrow, parallel-sided, width of face: width of head (at widest point) ratio – 1 : 8.2: 2.2. Frons and vertex somewhat divergent, width of face to width of vertex (at level of anterior ocellus) ratio – 1 : 2.2, dark red-brown to black, but colour masked by strong silver (frons) and weak gold pruinescence (vertex). 1 pair of frontal setae. Ocellar tubercle projecting only slightly above vertex, with 2 pairs of small ocellar setae. Postocular (occipital) region dark red-brown to black, but colour masked by strong silver pruinescence. Occiput with short, pale yellow-white macrosetae dorsally,



Figures 10–14. Photographs of *Trichoura pardeos* sp. n. (paratype USNM01115152) and habitat: **10** dorsal (Morphbank #860646) **11** lateral (#860648) **12** head anterior (#860650) **13–14** rocky hill habitat at type locality at Tierberg Nature Reserve, Keimoes, Northern Cape, South Africa (28°43'01"S 020°59'48"E). Habitat photographs by T. Dikow. Scale bars: 1 mm.

short white macrosetae laterally and many fine, shiny white setae ventrally. Palpi dark red-brown, small, 2-segmented, fine pale yellow setose. Proboscis straight, tubular, dark red-brown to black, weakly fine white setose.

Thorax: Dark red-brown to black, but colour masked by silver and silver-gold pruinoscence, pale yellow and fine white setose. Pronotum dark red-brown, silver pruinose, white setose. Mesonotum dark red-brown to black, entirely silver to silver-gold pruinose, fine white setose except for moderately well developed, pale yellow-white lateral macrosetae (2 npl, 1 spal, 2 pal). Scutellum dark red-brown, entirely silver pruinose, asetose except for 1 pair apical macrosetae. Pleura dark red-brown to black, but entirely



Figures 15–19. Male and female terminalia and wing of *Trichoura pardeos* sp. n.: **15** male, lateral **16** male, dorsal **17** male, ventral; **18** female lateral **19** wing. Scale bars: 1 mm.

strongly silver pruinose, almost asetose except for c. 5 white katatergal macrosetae. Anepisternal setae absent. Anatergites uniformly strongly gold pruinose, asetose.

Legs: Coxae red-brown, strongly silver pruinose, white setose; metathoracic coxae with small bulbous protuberance on anterior surface. Femora red-brown with orange distal and proximal ends, white setose. Tibiae and tarsi orange, terminal parts red-brown, white setose. Claws black with brown-orange basal parts, shorter than terminal tarsomere, gently curved. Empodium orange, straight, slightly shorter than claws. Pulvilli pale yellow, longer than empodium. Wings (Fig. 19) length measured from humeral crossvein to tip, breadth at widest level: Holotype 1.3×0.4 mm, paratypes – male (1) 1.4×0.5 mm, females (2) both 1.7×0.6 mm. Venation: C extends around wing margin terminating at junction of CuA+CuP, although it appears to extend weakly around at least part of cell cup. Alula reduced to a small lobe. All peripheral cells open except for m_3 and cua which are closed and stalked. Little variation is evident. Veins mostly dark red-brown except proximally where veins are yellowish, membrane unstained, transparent, much of surface, especially distally, microtrichose.

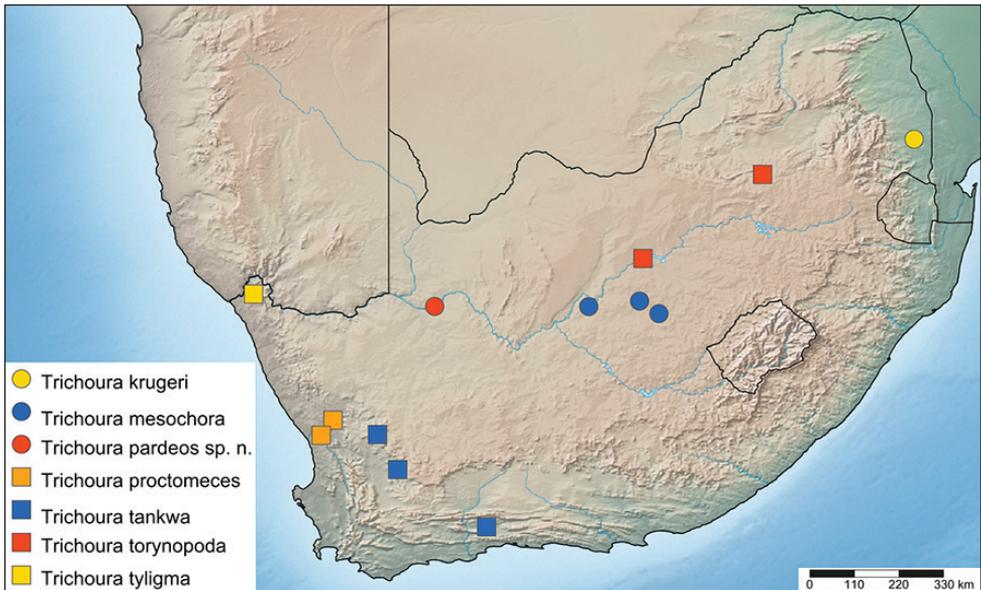


Figure 20. Map of South Africa with elevational relief and distribution of *Trichoura* species. (SimpleMappr 6129 - <http://www.simplemappr.net/map/6129>)

Discussion

All previously described *Trichoura* species have been registered in ZooBank and are listed below with their globally unique identifier, distributional records from Londt (1994) with updated geographic coordinates, and new material that has become available.

Trichoura krugeri Londt, 1994

<http://zoobank.org/9CD32242-681F-425A-8BE5-9B45A0AD83EF>

Fig. 20

South Africa: Mpumalanga Province: Kruger Park, Timbetene Tswiri waterholes, near Skukuza (c. 24°59'40"S, 031°35'40"E c. 290m).

Trichoura mesochora Londt, 1994

<http://zoobank.org/9C8BEFAC-5D2C-4A79-8581-7BFE0FB42342>

Fig. 20

South Africa: Free State Province: 30 km E Boshof (c. 28°35'51"S 025°31'35"E c. 1295m); Krugersdrift Dam (c. 28°52'42"S, 025°57'13"E c. 1245m); Northern Cape Province: 35 km W Kimberley (c. 28°43'11"S, 024°24'10"E c. 1125m).

***Trichoura proctomeces* Londt, 1994**

<http://zoobank.org/D5A4DBFE-D6E5-45F4-8D97-DD58C51C5477>

Fig. 20

South Africa: Western Cape Province: Knersvlakte north Vanrhynsdorp (c. 31°34'57"S, 18°43'40"E c. 125m); Knersvlakte (c. 31°35'15"S, 18°29'15"E c. 105m).

***Trichoura tankwa* Londt, 1994**

<http://zoobank.org/D41CAC5A-77E7-4BFE-BE54-B31D365A5664>

Figs 1–3, 7–8, 20

South Africa: Northern Cape Province: Tankwa Karoo, Waterval (c. 32°21'00"S, 20°10'48"E c. 530m); 12 km S Calvinia (31°34'10"S, 19°43'56"E 1080m).

New records are available for this species that extend the distribution considerably:

5♂ 2♀, 'Sth Africa: N Cape / 12km S of Calvinia / 31°34'10"S, 19°43'56"E / 7.ix.2002 J.G.H. Londt / 1080m Sandy roadside' (NMSA); 3♂ 3♀ 'South Africa: Western Cape: De Zeekoe Guest Farm, 33°37'26"S, 022°08'39"E, 294 m, 2015-12-07 collected p.m. (noon–15:00), Little Karoo veld, perching on low vegetation, Dikow, T.' (USNMENT01115257, USNMENT01115051–USNMENT01115152, USNMENT01136084–USNMENT01136085, USNMENT01115175, USNM).

***Trichoura torynopoda* Londt, 1994**

<http://zoobank.org/38285701-CAFE-43AF-AF8F-1AD9C90369BD>

Figs 4–6, 20

South Africa: North West Province: Bloemhof (c. 27°39'S 25°36'E c. 1235m); Gauteng Province: Pretoria, Waterkloof (c. 25°46'45"S 028°14'41"E c. 1440m).

New records from the same collecting event on which the species was based are available.

4♂, 'Pretoria / Waterkloof / xii.15 / H.K. Munro' (USNMENT01295405–USNMENT01295408, USNM).

***Trichoura tyligma* Londt, 1994** (Fig. 20)

<http://zoobank.org/8B8DD175-D35D-428C-9D76-144F9BF5DA08>

South Africa: Northern Cape Province: 1 km N Kuboes (28°26'32"S, 16°59'32"E 210m).

Key to species of *Trichoura*

- 1 Dorsocentral macrosetae extend anteriorly to transverse suture (Fig. 2); ♂ epandrium with few erect setae that do not mask the shape of distal region of lobes **2**
- Dorsocentral macrosetae limited to area posterior to transverse suture (Fig. 6); ♂ epandrium with many shiny white, prone setae that tend to mask the shape of distal region of lobes **4**
- 2 ♂ proctiger short, bulbous and truncate in lateral view; ♀ unknown ***T. tyligma***
- ♂ proctiger elongate, evenly tapering in lateral view **3**
- 3 ♂ proctiger shorter than epandrial lobes and projecting posteriorly; ♀ known ***T. tankwa***
- ♂ proctiger longer than epandrial lobes and ventrally directed; ♀ unknown ***T. proctomeces***
- 4 ♂ antenna unicolorous; metathoracic tarsomeres 2 and 3 each with a pair of dark red-brown leaf-like setae (Fig. 6) ***T. torynopoda***
- ♂ antennal scape and pedicel paler in colour than postpedicel; metathoracic tarsomeres of more usual development (*e.g.*, Fig. 2) **5**
- 5 Fused gonocoxites of ♂ bilobed distally (best seen in ventral view) **6**
- Fused gonocoxites of ♂ with a single broadly rounded mediobasal lobe ***T. pardeos sp. n.***
- 6 Epandrial lobes of ♂ elongate, pointed in lateral view, projecting beyond all other elements of terminalia ***T. krugeri***
- Epandrial lobes of ♂ short, broadly rounded in lateral view, not projecting beyond proctiger and gonostyli ***T. mesochora***

Relationships

Artigas and Papavero (1991) established Willistonini within their Stenopogoninae primarily based on the narrow face and diverging vertex and included a single genus, *Willistonina* Back, 1909, in it. This monotypic genus is distributed in the western Nearctic Region from British Columbia (Canada) in the north to Baja California (Mexico) in the south (E.M. Fisher pers. comm.). Dikow (2009a) included *Willistonina bilineata* (Williston, 1883) in a morphological phylogenetic study of Asilidae and the species, along with *Ablautus coquilletti* Wilcox, 1935, *Sporadothrix gracilis* Hermann, 1907 (included as *Acnephalum cylindricum*), *Sisyronodytes dasykylon* Londt, 2009 (as *Sisyronodytes* sp. (Gamka)), and *Trichoura pardeos* sp. n. (as *Trichoura* sp. (Tierberg)), did not group within Stenopogoninae in the cladogram, but in a distinct position. This fact along with the establishment of a new, phylogenetic classification for assassin flies warranted the recognition as a separate subfamily Willistonini. This subfamily immediately sparked interest as it included western Nearctic (*Ablautus* and *Willistonina*) and south-

ern Afrotropical (*Sisyrnodytes*, *Sporadothrix*, and *Trichoura*) genera. *Sisyrnodytes* is the only widespread Afrotropical genus that also penetrates the south-western Palaearctic Region (Londt 2009) while the other genera are confined to southern Africa. With the exception of *Sisyrnodytes dasykylon*, all then recognised Willistoninae were included in a molecular phylogenetic study by Dikow (2009b) where the subfamily was not recovered as monophyletic. However, these results were most likely caused by a reduced taxon sampling and the inclusion of only five nuclear genes (Dikow 2009b).

Willistoninae can be delimited by these synapomorphies: only lower facial margin of face slightly developed, prosternum and proepisternum separated and prosternum triangular and pointed dorsally, discal scutellar setae absent, setae on legs dorsoventrally flattened (also regular, circular setae present).

The phylogenetic classification proposed by Dikow (2009a) placed *Trichoura* as sister taxon to *Willistonina* based on the following morphological synapomorphies: mystax restricted to lower facial margin, mystacal setae tightly packed, frons markedly and suddenly diverging laterally, macrosetae present on lateral margin of frons, pro-presternum arrow-like, anterior surface of metathoracic coxa with blunt protuberance, and alula reduced to small lobe. This combination of characters is not found in any other assassin-fly taxon and therefore strong evidence for a close phylogenetic relationship despite the disjunct distribution. These character states can also serve as delimitation of the Willistoninini.

Since the remaining genera included by Dikow (2009a) in Willistoninae and the ones newly placed in it (Londt and Dikow submitted, see key below) are morphologically quite dissimilar, a new tribe Sisyrnodytini is established here. This tribe with its type genus *Sisyrnodytes* includes five Afrotropical genera (*Acnephalomyia* Londt, 2010, *Ammodaimon* Londt, 1985, *Astiptomyia* Londt, 2010, *Sisyrnodytes*, and *Sporadothrix*) and one western Nearctic genus (*Ablautus*) and is chiefly diagnosed by the absence of pulvilli. While no new phylogenetic analysis of the expanded Willistoninae is presented here, we postulate the monophyly of the two tribes.

Willistoninae has its generic diversity in southern Africa with six genera occurring in and four endemic to the area. The western Nearctic has only two genera but a relatively high species diversity as *Ablautus* currently has 13 known species and a revision of the genus is underway with the description of some 11 new species (Herbert and Dikow in prep.).

Key to genera of Willistoninae

The following key, modified from Londt and Dikow (submitted) to incorporate the Nearctic genera, may be useful in separating the eight Willistoninae genera.

- 1 Pulvilli well-developed (Fig. 34, Willistoninini).....2
- Pulvilli minute or absent (Fig. 32, Sisyrnodytini).....3
- 2 Wing with cell m_3 closed and stalked (Fig. 19); vein C extends strongly around wing margin until it reaches confluence of CuA+CuP when it ap-

- pears to terminate or proceed very weakly around cup and alula (Fig. 19); ♂ hypandrium absent or fused with gonocoxites to form a single cup-shaped entity; Afrotropical *Trichoura*
- Cell m_3 open at margin, even if only narrowly (Fig. 33); vein C extends strongly around entire wing margin including cup and alula (Fig. 33); ♂ hypandrium well developed and separated from gonocoxites; Nearctic *Willistonina*
- 3 Vein C extends strongly around entire wing margin including cup and alula; Nearctic *Ablautus*
- Vein C does not extend around entire wing margin 4
- 4 Abdomen cylindrical, not obviously dorsoventrally flattened (width : length ratio of $tg2 < 1.5$, Fig. 31) 5
- Abdomen broad and obviously dorsoventrally flattened (width : length ratio of $tg2 > 2$, Fig. 23) 6
- 5 Small flies (wing length < 3.5 mm, Figs 25–26); empodium absent; supernumerary crossvein (R_3) absent on R_4 ; scutal macrosetae well-developed, many times longer than accompanying setae; Afrotropical *Ammodaimon*
- Larger flies (wing length > 6.0 mm, Figs 31–32); empodium well-developed; supernumerary crossvein (R_3) developed as short stump-vein on R_4 (Fig. 31); scutal macrosetae moderately developed, not many times as long as accompanying setae; Afrotropical *Sporadothrix*
- 6 Vein C terminating before reaching CuA+CuP (Fig. 29); cell r_5 closed and stalked (stalk frequently failing to reach wing margin, Fig. 29); Afrotropical, Palearctic *Sisyrodoytes*
- Vein C terminating at point where CuA+CuP reaches wing margin (Fig. 23); cell r_5 open (Fig. 23) 7
- 7 Cell m_3 open (Fig. 23); supernumerary crossvein (R_3) developed as short stump-vein on R_4 (Fig. 23); pulvilli poorly developed, but clearly discernible (Fig. 24); male hypandrium somewhat flat or only gently concave; Afrotropical *Acnephalomyia*
- Cell m_3 closed and stalked; supernumerary crossvein (R_3) absent on R_4 ; pulvilli minute, difficult to detect (Fig. 28); male hypandrium distinctly cup-shaped; Afrotropical *Astiptomyia*

Phenology and distribution

The phenology of species is summarised in Table 1. Species are active between September and March. As expected, the three species found in winter rainfall areas (*T. proctomeces*, *T. tankwa*, *T. tyligma*) are active in Spring (September to November) while those occurring in summer rainfall areas are active during summer and autumn (December to March). *T. tankwa* has been collected in both November and December.

The distribution of *Trichoura* species is shown in Fig. 20. It is interesting to note that all species are currently confined to a band running across South Africa from sum-



Figures 21–26. Photographs of Willistoniniinae: **21** male *Ablautus* sp. (AAM-004314), dorsal (Morphbank #860664) **22** same, lateral (#860666) **23** male *Acnephalomyia* sp. (USNMENT01115145), dorsal (#860685) **24** same, lateral (#860687) **25** female *Ammodaimon* sp. (USNMENT00995300), dorsal (#860693) **26** same, lateral (#860695). Scale bars: 5 mm.

mer rainfall areas in the north-east down to winter rainfall areas in the south-west of the country. Those found in the winter rainfall region (*T. proctomeces*, *T. tankwa*, *T. tyligma*) possess well developed dorsocentral macrosetae anterior to the transverse suture, while the other four species (*T. krugeri*, *T. mesochora*, *T. pardeos*, *T. torynopoda*) lack these setae. This may be suggestive of two distinct groups. It is highly likely that the genus will eventually be found in Namibia, Botswana, Mozambique and possibly Zimbabwe.



Figures 27–30. Photographs of Willistoniniinae: **27** female *Astiptomyia bikos* Londt, 2010 (NMSA-DIP-66454), dorsal (Morphbank #860701) **28** same, lateral (#860704) **29** female *Sisyrnodytes subater* Oldroyd, 1957 (USNMENT00870084), dorsal (#860710) **30** same, lateral (#860712). Scale bars: 5 mm.



Figures 31–34. Photographs of Willistoniniinae: **31** male *Sporadothrix gracilis* Hermann, 1907 (USNMENT00870183), dorsal (Morphbank #860718) **32** same, lateral (#860720) **33** male *Willistonina bilineata* (Williston, 1883) (UCRCENT80299), dorsal (#860726) **34** same, lateral (#860728). Scale bars: 5 mm.

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