

**SYSTEMATICS OF THE SHOOT FLY SUBGENUS
ATHERIGONA S. STR. (DIPTERA: MUSCIDAE) OF
SOUTH AFRICA**

by

Burgert Smith Muller

Submitted in accordance with the requirements for the MAGISTER SCIENTIAE degree in the Faculty of Natural and Agricultural Sciences, Department of Zoology and Entomology at the University of the Free State, Bloemfontein.

July 2014

Supervisor: Prof. S. vdM. Louw

Co-Supervisor: Dr R. M. Miller

I declare that this thesis hereby handed in for the qualification **MAGISTER SCIENTIAE** at the University of the Free State is my own independent work and that I have not previously submitted the same work for qualification in/at another University/Faculty. I further more cede copyright of the dissertation in favour of the University of the Free State.

Burgert Smith Muller

TABLE OF CONTENTS

| | | |
|---|---|------|
| ABSTRACT | | vi |
| UITTREKSEL | | viii |
| ACKNOWLEDGEMENTS | | x |
| CHAPTER 1 – Introduction to the taxonomy of the Afrotropical species of the subgenus <i>Atherigona sensu stricto</i> (Diptera: Muscidae) | | 11 |
| 1.1 | Taxonomic history and systematics of Afrotropical <i>Atherigona s. str.</i> | 12 |
| 1.2 | Taxonomic significance of morphological structures | 15 |
| 1.2.1 | A note on colour | 16 |
| 1.2.2 | Head | 16 |
| 1.2.3 | Thorax | 18 |
| 1.2.4 | Abdomen | 20 |
| 1.3 | Female <i>Atherigona s. str.</i> | 21 |
| 1.4 | Economic importance of the group | 22 |
| 1.5 | Study aim | 23 |
| CHAPTER 2 – Illustrated key and systematics of <i>Atherigona sensu stricto</i> (Diptera: Muscidae) | | 24 |
| 2.1 | Abstract | 25 |
| 2.2 | Introduction | 25 |
| 2.3 | Material and Methods | 26 |
| 2.4 | An illustrated key to the South African <i>Atherigona s. str.</i> | 28 |
| 2.5 | Revision of South African <i>Atherigona s. str.</i> | 39 |
| 2.5.1 | <i>Atherigona albicornis</i> sp. n. | 40 |
| 2.5.2 | <i>Atherigona angulata</i> Deeming, 1971 | 41 |
| 2.5.3 | <i>Atherigona angustiloba</i> van Emden, 1956 | 42 |
| 2.5.4 | <i>Atherigona aster</i> van Emden, 1940 | 43 |
| 2.5.5 | <i>Atherigona aurifacies</i> van Emden, 1940 | 43 |
| 2.5.6 | <i>Atherigona bedfordi</i> van Emden, 1940 | 43 |
| 2.5.7 | <i>Atherigona bimaculata</i> Stein, 1910 | 44 |
| 2.5.8 | <i>Atherigona binubila</i> van Emden, 1940 | 44 |
| 2.5.9 | <i>Atherigona budongoana</i> van Emden, 1940 | 45 |
| 2.5.10 | <i>Atherigona capitulata</i> sp. n. | 46 |
| 2.5.11 | <i>Atherigona chirinda</i> Dike, 1989 | 47 |
| 2.5.12 | <i>Atherigona chrysohypene</i> sp. n. | 47 |
| 2.5.13 | <i>Atherigona cinarina</i> Séguy, 1938 | 49 |
| 2.5.14 | <i>Atherigona convexa</i> sp. n. | 49 |
| 2.5.15 | <i>Atherigona danielssoni</i> sp. n. | 50 |

| | | |
|--------|---|----|
| 2.5.16 | <i>Atherigona decempilosa</i> Dike, 1989 | 52 |
| 2.5.17 | <i>Atherigona divergens</i> Stein, 1913 | 52 |
| 2.5.18 | <i>Atherigona erectisetula</i> sp. n. | 53 |
| 2.5.19 | <i>Atherigona falcata</i> (Thomson, 1869) | 55 |
| 2.5.20 | <i>Atherigona falkei</i> Deeming, 1981 | 55 |
| 2.5.21 | <i>Atherigona flavifinis</i> sp. n. | 55 |
| 2.5.22 | <i>Atherigona flaviheteropalpata</i> sp. n. | 57 |
| 2.5.23 | <i>Atherigona gilvifolia</i> van Emden, 1940 | 58 |
| 2.5.24 | <i>Atherigona griseiventris</i> van Emden, 1940 | 58 |
| 2.5.25 | <i>Atherigona heteropalpata</i> sp. n. | 59 |
| 2.5.26 | <i>Atherigona humeralis</i> (Wiedemann, 1830) | 60 |
| 2.5.27 | <i>Atherigona hyalinipennis</i> van Emden, 1959 | 61 |
| 2.5.28 | <i>Atherigona kirkspriggsi</i> sp. n. | 61 |
| 2.5.29 | <i>Atherigona laevigata</i> (Loew, 1852) | 63 |
| 2.5.30 | <i>Atherigona latibasilaris</i> sp. n. | 65 |
| 2.5.31 | <i>Atherigona libertensis</i> sp. n. | 66 |
| 2.5.32 | <i>Atherigona lineata</i> ssp. <i>lineata</i> (Adams, 1905) | 67 |
| 2.5.33 | <i>Atherigona lineata</i> (Adams) ssp. <i>torrida</i> Deeming, 1971 | 68 |
| 2.5.34 | <i>Atherigona lineata</i> (Adams) ssp. <i>ugandae</i> van Emden, 1940 | 69 |
| 2.5.35 | <i>Atherigona londti</i> sp. n. | 70 |
| 2.5.36 | <i>Atherigona longifolia</i> van Emden, 1940 | 71 |
| 2.5.37 | <i>Atherigona marginifolia</i> van Emden, 1940 | 72 |
| 2.5.38 | <i>Atherigona matilei</i> Deeming, 1977 | 73 |
| 2.5.39 | <i>Atherigona mitrata</i> Séguy, 1955 | 74 |
| 2.5.40 | <i>Atherigona naqvii</i> Steyskal, 1966 | 74 |
| 2.5.41 | <i>Atherigona ndumoensis</i> sp. n. | 75 |
| 2.5.42 | <i>Atherigona nesshurstensis</i> sp. n. | 76 |
| 2.5.43 | <i>Atherigona nigrapicalis</i> Deeming, 1979 | 77 |
| 2.5.44 | <i>Atherigona oblonga</i> sp. n. | 78 |
| 2.5.45 | <i>Atherigona occidentalis</i> Deeming, 1971 | 79 |
| 2.5.46 | <i>Atherigona ochracea</i> Deeming, 1981 | 80 |
| 2.5.47 | <i>Atherigona parviclivis</i> sp. n. | 80 |
| 2.5.48 | <i>Atherigona parvihumilata</i> sp. n. | 81 |
| 2.5.49 | <i>Atherigona perfida</i> Stein, 1913 | 82 |
| 2.5.50 | <i>Atherigona piscatoris</i> sp. n. | 83 |
| 2.5.51 | <i>Atherigona pulla</i> (Wiedemann, 1830) | 85 |
| 2.5.52 | <i>Atherigona rimapicis</i> sp. n. | 85 |
| 2.5.53 | <i>Atherigona rubricornis</i> Stein, 1913 | 86 |
| 2.5.54 | <i>Atherigona ruficornis</i> Stein, 1913 | 87 |

| | | |
|---|--|-----|
| 2.5.55 | <i>Atherigona secrecauda</i> Séguy, 1938 | 88 |
| 2.5.56 | <i>Atherigona soccata</i> Rondani, 1871 | 89 |
| 2.5.57 | <i>Atherigona steeleae</i> van Emden, 1940 | 89 |
| 2.5.58 | <i>Atherigona stuckenbergi</i> sp. n. | 89 |
| 2.5.59 | <i>Atherigona tetrastigma</i> Paterson, 1956 | 91 |
| 2.5.60 | <i>Atherigona theodori</i> Hennig, 1963 | 91 |
| 2.5.61 | <i>Atherigona tigris</i> sp. n. | 92 |
| 2.5.62 | <i>Atherigona trapezia</i> van Emden, 1940 | 93 |
| 2.5.63 | <i>Atherigona tritici</i> Pont & Deeming, 2001 | 93 |
| 2.5.64 | <i>Atherigona umbonata</i> sp. n. | 94 |
| 2.5.65 | <i>Atherigona univittata</i> Deeming & Overman, 1987 | 95 |
| 2.5.66 | <i>Atherigona valida</i> (Adams, 1905) | 95 |
| 2.5.67 | <i>Atherigona vernoni</i> sp. n. | 96 |
| 2.5.68 | <i>Atherigona zulu</i> sp. n. | 97 |
| 2.6 | Illustrations | 99 |
| CHAPTER 3 – Distribution of <i>Atherigona</i> Rondani <i>sensu stricto</i> | | |
| (Diptera: Muscidae) in South Africa | | |
| 3.1 | Abstract | 108 |
| 3.2 | Introduction | 108 |
| 3.3 | Material and Methods | 110 |
| 3.4 | Results and Discussion | 110 |
| 3.5 | Conclusion | 113 |
| 3.6 | APPENDIX: Distribution of <i>Atherigona</i> s. str. (Diptera: Muscidae) in South Africa | 114 |
| CHAPTER 4 – Concluding remarks and future research | | |
| 4.1 | Concluding remarks | 125 |
| 4.2 | Summary | 126 |
| CHAPTER 5 – References | | |
| 128 | | |



ABSTRACT

Atherigona Rondani, 1856, is considered one of the most speciose genera of Muscidae, with 131 species presently known from the Afrotropical Region. The genus has been studied by numerous taxonomists since the 1800s, with some species having been described as part of *Anthomyia* Meigen, 1803 and *Coenosia* Meigen 1826. Historically it was placed as part of the Coenosiinae due to the presence of some similar diagnostic characters. It was later provisionally placed in the Phaoniinae, as a separate tribe Atherigonini, on the basis of its many autapomorphies. The unique morphology of its puparial form and affinities of the larvae to the Reinwardtiinae (=Azeliinae: Reinwardtiini) have further warranted it being placed in its own separate subfamily, Atherigoninae. Its two subgenera can easily be distinguished, with males of *Atherigona s. str.* having a trifoliate process and in most cases also a hypopygial prominence, and females a pair of anterior plates on tergite 8. These structures are absent from the other subgenus *Acritochaeta* Grimshaw, 1901.

Over the past 188 years 39 papers have been published dealing with shoot fly species occurring in the Afrotropical Region in which 125 new species of *Atherigona s. str.* have been described, 43 of which are included in the present study (Chapter 2). Not much is known of South African species in terms of taxonomy and distribution, as most species described from the country were included in past revisions by happenstance. This phenomenon is the main justification for the present study.

Species of *Atherigona s. str.* are known to occur on graminaceous plants, such as certain crops, *i.e.* sorghum, wheat, millet and barley, as well as wild grasses. Due to the wide distribution of their host plants, the flies obviously also have a wide distribution and have been recorded throughout most of Africa (Chapter 3), and in many parts of the world where graminaceous crops are grown.

Whilst the majority of species are not considered pests, several species are damaging. The most serious pest species is the sorghum shoot fly, *A. soccata* Rondani, 1871. The larvae damage the growth points of crop seedlings, leading to typical dead heart symptoms. This severely stunts the growth phenology of the plants, leading to considerable yield loss.

Sixty-eight South African species of the subgenus *Atherigona s. str.* are treated within this study (Chapter 2) including 25 new species based on male specimens. These are *A. albicornis* sp. n., *A. capitulata* sp. n., *A. chrysohypene* sp. n., *A. convexa* sp. n., *A. danielssoni* sp. n., *A. erectisetula* sp. n., *A. flavifinis* sp. n., *A. flaviheteropalpata* sp. n., *A. heteropalpata* sp. n., *A. kirkspriggsi* sp. n., *A. latibasilaris* sp. n., *A. libertensis* sp. n., *A. londti* sp. n., *A. ndumoensis* sp. n., *A. nesshurstensis* sp. n., *A. oblonga* sp. n., *A. parviclivis* sp. n., *A. parviumilata* sp. n., *A. piscatoris* sp. n., *A. rimapicis* sp. n., *A. stuckenbergi* sp. n., *A. tigris* sp. n., *A. umbonata* sp. n., *A. vernoni* sp. n. and *A. zulu* sp. n. *Atherigona hancocki* van Emden, 1940 is designated as junior synonym of *A.*

divergens Stein, 1913. The known diversity for the South African region is increased from approximately 35 to 43 species. An illustrated key to identify the males of the subgenus is also included in the chapter.

The distribution of *Atherigona* s. str. within South Africa is determined through the use of recorded and georeferenced specimen record localities (Chapter 3). A regression analysis is performed to determine the degree of sampling bias, using calculated species richness and species occurrence grid data. It is determined that there is 74.47 % correlation between the two variables, indicating a reasonably high sampling bias. The maps generated also showed that Tier 1 protected areas within the savanna and grassland biomes have the highest species richness, which highlights the importance of these areas for the preservation of the country's natural heritage, but also the effect that these areas have with regard to sampling bias.

KEY WORDS: Afrotropical Region; South Africa; Muscidae; *Atherigona*; shoot flies; systematics; taxonomy; new species; males; distribution; coefficient of determination.



UITTREKSEL

Atherigona Rondani, 1856 word beskou as een van die mees spesie-ryke genera binne die Muscidae, met 131 spesies huidiglik opgeteken as afkomstig vanaf die Afrotropiese streek. Die genus is al deur menige taksonome sedert die agtienhonderds bestudeer, met sommige spesies wat binne die genera *Anthomyia* Meigen, 1803 en *Coenosia* Meigen, 1826 beskryf is. *Atherigona* het oorspronklik deel uitgemaak van die Coenosiinae, hoofsaaklik as gevolg van ooreenkomste in verband met sekere kenmerkende eienskappe. Dit is later voorlopig in die Phaoniinae as 'n aparte tribus, teweete Atherigonini, op grond van sy menige outapomorfieë geplaas. Die unieke morfologie van die papie-stadium, asook die larwale verwantskappe met die van die Reinwardtiini (Azeliinae), het die plasing van *Atherigona* in sy eie subfamilie, Atherigoninae, geregverdig. Twee subgenera kan binne die genus onderskei word. Die manlike eksemplare van *Atherigona s. str.* het 'n drie-loof proses, sowel as a hypopygiale uitsteeksel in meeste spesies, terwyl die wyfies 'n paar anterieure plate op tergiet 8 besit. *Acritochaeta* Grimshaw, 1901, besit egter geen van die voorafgenoemde kenmerke nie.

Oor die afgelope 188 jaar is 39 artikels met betrekking tot die stamvlieg spesies wat in die Afrotropiese streek voorkom, gepubliseer, waarin 125 nuwe *Atherigona s. str.* spesies beskryf word. Drie-en-veertig van die voorafgenoemde spesies word gedurende die huidige studie behandel (Hoofstuk 2). Bittermin inligting is beskikbaar rakende die taksonomie en verspreiding van Suid-Afrikaanse spesies, aangesien die meerderheid van spesies wat beskryf was toevallig deel uitgemaak het van die voorafgenoemde hersienings.

Spesies wat tot *Atherigona s. str.* behoort is bekend daarvoor dat hulle grasagtige gewasse, teweete sorghum, koring, manna en gars, asook wilde grasse as gashere kan benut. Ingevolge die wye verspreiding van hul gashere, is stamvlieë net so wyd verspreid. As sulks kom stamvlieë dus omtrent regoor die hele Afrika kontinent, (Hoofstuk 3), asook in wêrelddele waar gepaste gewasse verbou word, voor.

Alhoewel die oorgrootte meerderheid van spesies nie as skadelik beskou word nie, is daar verskeie spesies wat wel as plae voorkom. Die mees skadelike voorbeeld hiervan is die sorghum stamvlieg, *A. soccata* Rondani, 1871. Hul larwes beskadig die groeipunte van jong gewas-saailinge, wat tot direkte opbrengs verliese kan lei, aangesien tot 90% van saailinge besmet kan wees.

Agt-en-sestig Suid-Afrikaanse spesies van *Atherigona s. str.* is gedurende hierdie studie (Hoofstuk 2) behandel, insluitende 25 nuwe spesies gebaseer op mannetjies. Die nuwe spesies is naamlik *A. albicornis sp. n.*, *A. capitulata sp. n.*, *A. chrysohypene sp. n.*, *A. convexa sp. n.*, *A. danielssoni sp. n.*, *A. erectisetula sp. n.*, *A. flavifinis sp. n.*, *A. flaviheteropalpata sp. n.*, *A. heteropalpata sp. n.*, *A. kirkspriggsi sp. n.*, *A. latibasilaris sp. n.*, *A. libertensis sp. n.*, *A. londti sp. n.*, *A. ndumoensis sp. n.*, *A.*

nesshurstensis sp. n., *A. oblonga* sp. n., *A. parviclivis* sp. n., *A. parvihumilata* sp. n., *A. piscatoris* sp. n., *A. rimapicis* sp. n., *A. stuckenbergi* sp. n., *A. tigris* sp. n., *A. umbonata* sp. n., *A. vernoni* sp. n. en *A. zulu* sp. n. *Atherigona hancocki* van Emden, 1940 is ook aangewys as 'n nuwe junior sinoniem van *A. divergens* Stein, 1913. Die huidige kennis rakende die diversiteit van die Suid-Afrikaanse streek is ook uitgebrei vanaf die vooraf berekende 35 spesies na 43 spesies. 'n Geïllustreerde sleutel vir die manlike Suid-Afrikaanse spesies van *Atherigona* s. str. is ook in die hoofstuk ingesluit.

Die verspreiding van *Atherigona* s. str. in Suid-Afrika is deur gebruik te maak van aangetekende, sowel as geografies berekende, lokaliteite bereken (Hoofstuk 3). 'n Regressie analise is, om die graad van versameling-vooroordeel te bepaal, uitgevoer. Dit is moontlik gemaak deur die gebruik van spesies-rykheid en spesies-teenwoordigheid rooster data. Dit is bevind dat daar 'n ongeveer 74.47% verband tussen die twee veranderlikes is, wat daarop dui dat daar 'n duidelike versamelings- vooroordeling met betrekking tot veldwerk bestaan. Die verspreidingskaart wat gegenereer is, het getoon dat Vlak 1 beskermde gebiede, veral dié wat binne savanna- en grasland-biome val, die grootste spesies rykheid gehad het. Dit beklemtoon egter nie net die belang van beskermde gebiede met betrekking tot die bewaring van Suid-Afrika se natuurlike erfenis nie, maar ook die invloed van sulke gebiede met betrekking tot veldwerk en enige versamel-partydigheid wat daarmee gepaard mag gaan.

SLEUTELWOORDE: Afrotropiese streek; Suid-Afrika; Muscidae; *Atherigona*; stamvlieë; sistematiek; taksonomie; nuwe spesies; mannetjies; verspreiding; bepaling koëfisient.



ACKNOWLEDGEMENTS

I would like to express my sincerest gratitude to the following people and institutions:

All the researchers, curators and technicians at the various collections for their assistance and hospitality during my visits to their institutions.

I would like to thank Dr John Deeming, for his mentorship during my visit to the National Museum of Wales. His knowledge of Afrotropical *Atherigona* and Diptera in general is truly incredible.

Dr Ashley Kirk-Spriggs for always being willing to share techniques and help me grow as a dipterist.

My supervisors, Prof. Schalk Louw and Dr Ray Miller, for all their advice, patience and persistence.

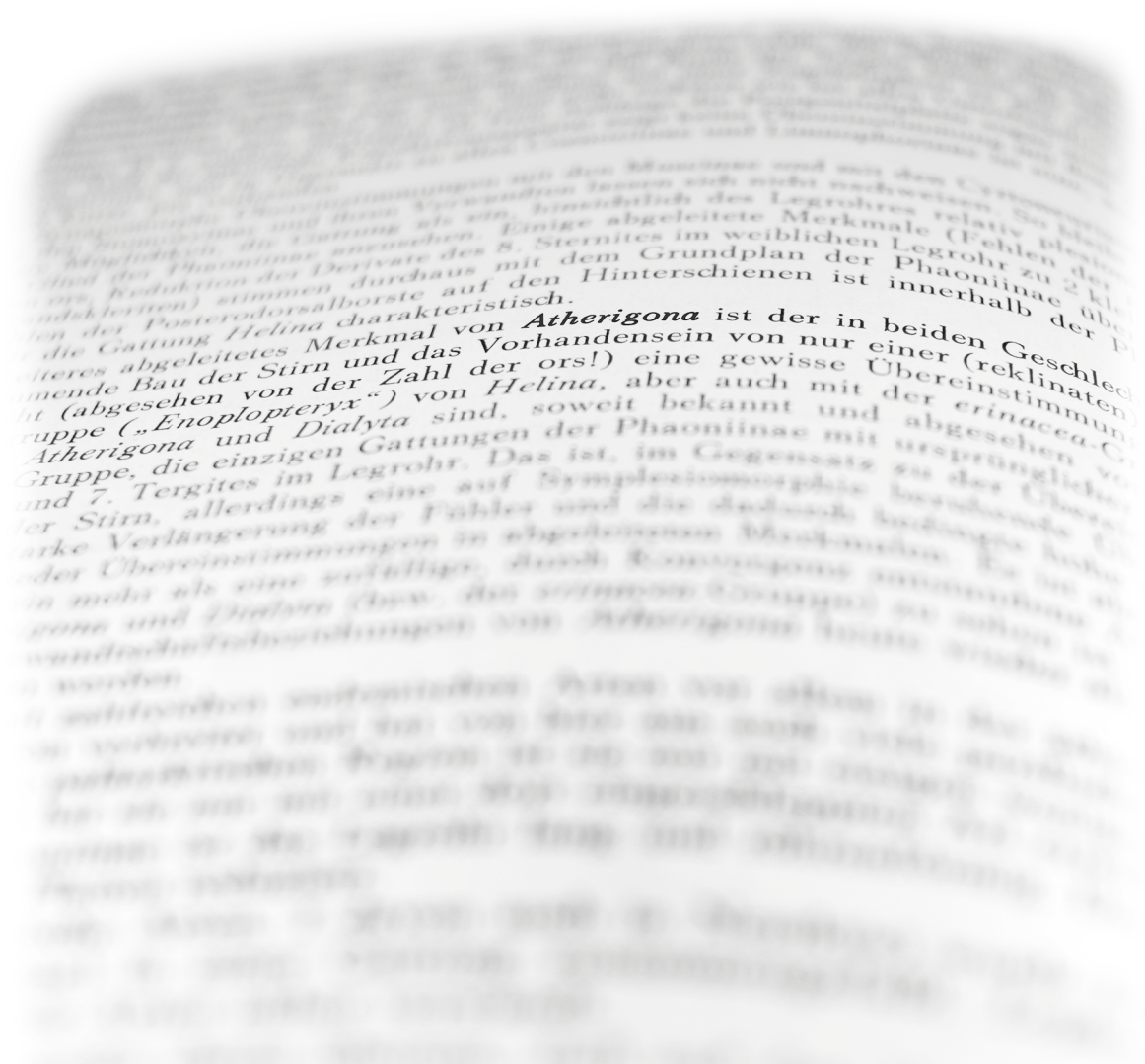
The management and staff of my institution, The KwaZulu-Natal Museum, for their support and assistance.

My “ex-boss”, Dr Mike Mostovski, for introducing me to the world of Diptera, and for encouraging me to embark on this shoot fly journey.

My partner in crime, aka wife, Daleen, for all the support and cups of coffee, and most importantly: Emma for always smiling.



CHAPTER 1



Hennig 1965

**Introduction to the taxonomy of the Afrotropical species
of the subgenus *Atherigona* s. str. (Diptera: Muscidae)**

1.1 Taxonomic history and systematics of Afrotropical *Atherigona* s. str.

Atherigona Rondani, 1856 is one of the most speciose genera of muscids in the world with just under 300 recognised and described species, of which 131 are presently known from the Afrotropical Region (Dike 2003; Couri *et al.* 2006).

The genus has had quite an interesting chresonomy. *Orthostylum rufipes* Macquart, 1851 (synonym of *Coenosia pulla*, Wiedemann, 1830 [= *Atherigona pulla* (Wiedemann, 1830)]) was described and designated as type species of *Orthostylum* Macquart, 1851. Five years later *Atherigona* Rondani, 1856 was established with *Anthomyia varia* Meigen, 1826 designated as type species. *Acritochaeta* Grimshaw, 1901 followed with designated type species *Acritochaeta pulvinata* Grimshaw, 1901 [= *Atherigona orientalis* Schiner, 1868].

The genus comprises two subgenera, the aforementioned *Atherigona sensu stricto* and *Acritochaeta*, with 117 and 14 respective species known from the Afrotropical Region.

For many years *Atherigona* was placed within the Coenosiinae (Muscidae) due to its one pair of reclinate orbital setae, the placement of the three katepisternal setae and the broad male frontal vitta (Pont 1986). Literature at the time dealing with the genus and other muscids all treated it as such, with notable examples being van Emden (1940, 1956, 1958, 1959) and Paterson (1956). Hennig (1965) was the first to provide important arguments for removing it from the Coenosiinae and provisionally placing it in the Phaoniinae. This assignment was based on the primitive structure of the cerci and the reduction of sternite 8 (Pont 1986).

Pont (1972, 1977, 1980, 1986) placed the genus in its own tribe, the Atherigonini, within the Phaoniinae: "... purely on the typological basis of its many autapomorphies". *Atherigona* is unquestionably monophyletic and Pont (1986) provided an excellent list of 13 apomorphic characters compared to the ground plan of Phaoniinae. The most easily recognisable characters in combination also being diagnostic for the genus, are (1) head angular in profile, with parafacial and post-pedicel very long; (2) one pair of reclinate orbital setae; (3) the three katepisternal setae arranged in the shape of an equilateral triangle and (4) hind tibia without calcar.

Skidmore (1985) remarked that whilst the eggs of *Atherigona* were phaoniiform, the larvae had a form that suggested a close relationship to that of the Reinwardtiinae (= Azeliinae: Reinwardtiini). He further noted that the puparial form of all species was unique, and never before seen in Muscidae. On the basis of these observations, he treated it as a distinct subfamily, Atherigoninae.

The adults of the two subgenera of *Atherigona* are also quite easy to distinguish from one another morphologically, with *Atherigona* s. str. males always having a structure generally referred to as the "trifoliate process", although in some cases an even more elaborate structure is present. An example being the quinquefoliate process (Chapter 2:

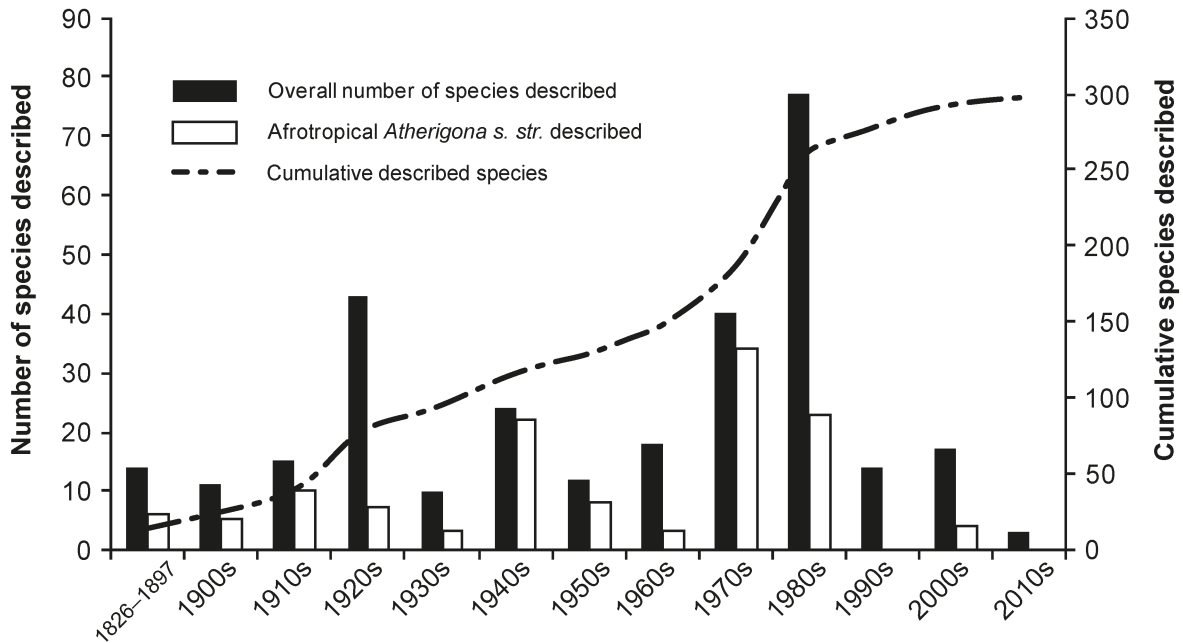


Figure 1: Overall number of *Atherigona* species described versus that of *Atherigona sensu stricto*, along with the cumulative number of species since 1826.

Fig. 1) of amongst others, *Atherigona divergens* Stein, 1913; herein synonymised with *A. hancocki* van Emden, 1940 (Chapter 2.5.17), and with the exception of only a few species, a hypopygial prominence; while the females have a pair of small anterior plates on tergite 8 of the ovipositor. Conversely adult *Acritochaeta* males lack a trifoliate process and hypopygial prominence, and females lack a pair of anterior plates on tergite 8 of the ovipositor.

Malloch (1923) noted the lack of attention to the genital structures of *Atherigona s. str.* species, although, ironically, he did not illustrate them himself, but only described them, which left much room for error in interpretation. It did, however, lead to a major increase in the number of species described for the genus as soon as this vital diagnostic character in species discrimination was introduced (Fig. 1).

Van Emden (1940) stated that *Atherigona* is without doubt the most “difficult” of the Coenosiiinae. At first he assumed that the colours, as well as the shape of the hypopygial prominence, would present a “considerable amount of variation”. He, however, found that the combination of colour, hypopygial prominence type and trifoliate process shape were the same for similar forms, and admitted that there would be a “great number of species”. The character combinations also seemed to be constant over wide distributions [indeed, for example Nigerian specimens of *A. laevigata* (Loew, 1852) match South African specimens almost perfectly]. At this stage in the taxonomic history of the group, no authors [including van Emden] had been able to find concrete structural differences between the females of the species. Instead, van Emden relied

Table 1: The number of new and revised species of Afrotropical *Atherigona* s. str. recorded by author and reference source.

| New species | Revised species | Reference | New species | Revised species | Reference |
|-------------|-----------------|-----------------------|-------------|-----------------|--------------------------|
| 1 | | Meigen 1826 | 1 | | Paterson 1956 |
| 2 | | Wiedemann 1830 | 1 | 1 | Emden 1958 |
| 1 | | Maquart 1851a | 1 | | Emden 1959 |
| 1 | | Loew 1852 | 1 | | Hennig 1963 |
| 1 | | Thomson 1869 | 1 | | Steyskal 1966 |
| 1 | | Rondani 1871 | 1 | | Pont 1969 |
| 1 | | Karsch 1888 | 21 | 31 | Deeming 1971 |
| 1 | | Stein, in Becker 1903 | 1 | | Deeming 1972a |
| 2 | | Adams 1905 | | 2 | Deeming 1975 |
| 1 | | Stein 1906 | 2 | | Deeming 1977 |
| 1 | | Bezzi 1908 | 10 | 7 | Deeming 1979 |
| 3 | | Stein 1910 | 9 | 7 | Deeming 1981 |
| 7 | | Stein 1913 | 1 | | Deeming & Overman 1987 |
| 1 | | Stein 1914 | 6 | 4 | Deeming 1987 |
| 1 | | Villeneuve 1922 | 4 | | Dike 1989a |
| 3 | 5 | Malloch 1923 | 3 | | Dike 1989b |
| 3 | | Séguy 1938 | | 2 | Deeming 2000 |
| 23 | 5 | Emden 1940 | 1 | 1 | Pont & Deeming 2001 |
| 1 | | Séguy 1955 | 3 | | Couri, Pont & Penny 2006 |
| 3 | 2 | Emden 1956 | | | |

on the use of colour to distinguish between females of different species; a practice made much more difficult by the fact that males and females of the same species can have very different coloration, and multiple species can occur within a small area. Reliable identification would thus greatly rely on collecting both during copula.

Several new species were described following van Emden (1940), although these were only small papers, mostly with singular new species (Table 1). The current knowledge of Afrotropical *Atherigona* is due in large part to J.C. Deeming, who published a major work on northern Nigerian *Atherigona* (Deeming 1971). Deeming focussed on revising and describing not just new, but also redescribing some older species which he deemed problematic due to the type specimens not matching the original descriptions. He further went on to describe the shape of the eighth tergite in females,

as this is of great taxonomic value. He did, however, state that attempting to determine the identity of species on females alone is inadvisable, especially when dealing with the subgenus *Atherigona s. str.* Nevertheless he was able to describe numerous female eighth tergites, larvae and puparia of many new and known species, greatly expanding the knowledge of the group. He treated over 50 species of *Atherigona s. str.* (of which 21 were new species) in his 1971 paper. Deeming (1972b) also reviewed African shoot flies (including various other families damaging on sorghum). He continued working on *Atherigona*, describing a further 30 species up to the present.

Following on Deeming's very comprehensive work, Pont (1980) summarised the taxonomy in the Catalogue of the Diptera of the Afrotropical region, listing 93 valid species and 16 junior synonyms. Since publication of the catalogue, another 27 species of *Atherigona s. str.* have been described to date (Table 1).

Skidmore (1985) studied the larval and pupal morphology of 6 species of *Acritochaeta* and 29 species of *Atherigona s. str.* and provided a key for identification.

Dike (1987) did excellent work in his Ph.D. dissertation on the taxonomy of Afrotropical shoot flies. He described seven new species and two subspecies, later publishing these in Dike (1989b). He also examined highly variable species, in particular *A. lineata* (Adams, 1905) and *A. secrecauda* Séguy, 1938, identifying 10 and 12 variant forms for the two species respectively. Furthermore, he did excellent work regarding scanning electron microscopy images of various trifoliate processes of three species, showing their ultrastructure and discussing mating behaviour (Dike 1992) – discussed briefly in section 1.2.4. Dike (1989a) provided a key to the males of the Afrotropical species of *Atherigona*, which he incorporated nicely into the key from Deeming (1971), as well as into another key on the Nigerian species in Dike (1990a, 1990b), adding all the newly described species over the two previous decades. Following Dike, only three more taxonomic papers on *Atherigona* were published relevant to the Afrotropical region, one of which dealt with Madagascan species (Couri, Pont & Penny 2006), another dealing with *Atherigona* from the Brandberg Massif (Deeming 2000) and a description of a new pest species, *A. tritici* Pont and Deeming, 2001. There has never been a specific, encompassing focus on southern Africa, and most material from this region used in revisions has been serendipitous.

1.2 Taxonomic significance of morphological structures

Initial descriptions of *Atherigona s. str.* were heavily reliant on colour (Wiedemann 1830; Rondani 1871; Adams 1905). Having been considered to be part of *Coenosia* (and by association *Coenosiinae*), also meant that early 20th century descriptions focussed on head, thoracic, leg and abdominal chaetotaxy, along with coloration. Head chaetotaxy, with the exception of the vibrissae colour, can be quite variable within a species, with asymmetrical, unpaired arrangements of head setae present in some

specimens of a species, whilst in others of the same species it is symmetrical and paired. The discovery of interspecific trifoliate process and hypopygial prominence shapes together with colour combinations of specific structures gave a solid framework to base species descriptions on, and directly led to the rapid increase of reliable species descriptions. The main characters of taxonomic importance and their associated terminologies are discussed below.

1.2.1 A note on colour

The use of colour to describe species remains an effective method of adding extra descriptors to species treatments; if it is mostly consistent within a species. *Atherigona* s. str. spp. are quite uniform in their coloration between species, with the only true difference being colour combinations and the degree to which they occur in conjunction with the trifoliate process and hypopygial prominence shapes.

The only descriptive colour wording that truly needs extra explanation is the use of the word “infuscated” throughout the manuscript. More recently, authors have taken to using “black” instead of infuscated to describe the colouring of various characters such as legs, frontal vitta and the antenna. The use of black, however, can be problematic. The degree of blackness of a character can be variable within and between species. Teneral specimens are frequently collected and due to the cuticle not having sclerotised and subsequently entirely darkened, the colours for a series of specimens could differ for a species with regards to saturation (Hackman 1953). For this reason infuscated is used, meaning “darkened with a black or brownish tinge”, as it encompasses all forms of “black” that the specimen might display.

1.2.2 Head

Occiput

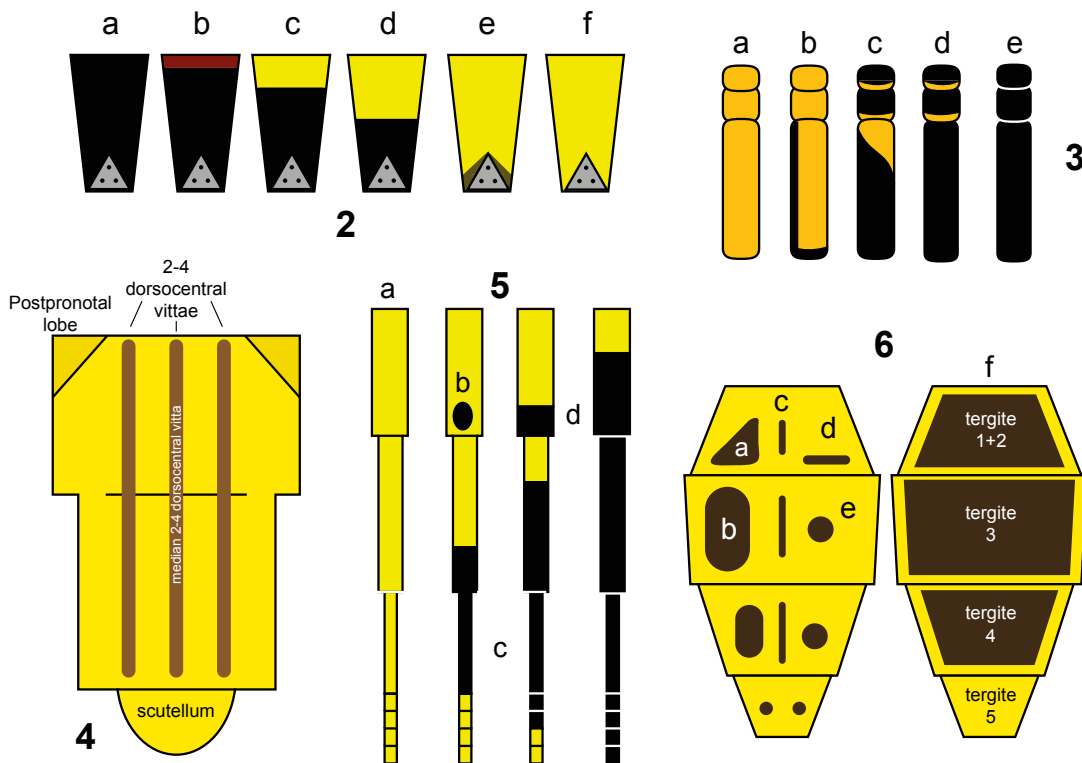
The colour of the occiput is a consistent character for use in species description and discrimination. The appearance of the occiput, *i.e.* glossy or dusted with median part glossy is, even though consistent, a character state that can be interpreted incorrectly and care should be taken when evaluating it.

Frontal vitta (Fig. 2)

The colour of the frontal vitta serves as a useful method to separate species for easier keying out. The coloration can be split into either yellow or infuscated with varying combinations.

Frontal plate

The frontal plate has three states, namely dusted (having a degree of pruinosity, *i.e.* being dusted), entirely glossy or only glossy around the bases of the frontal and orbital setae.



Figures 2–6: Character states for coloration in *Atherigona* spp. (2) Frontal vitta: (a) entirely infuscated; (b) infuscated, but with a dull reddish apical suffusion; (c) yellow on at least apical third; (d) yellow on at least apical half; (e) yellow, except for darker area surrounding ocellar triangle; (f) entirely yellow. (3) Antenna coloration: (a) entirely ferruginous/yellow; (b) postpedicel infuscated on dorsal and apical margins; (c) postpedicel infuscated except for basal area; (d) scape and pedicel infuscated with ferruginous/yellow margins; (e) antenna entirely infuscate. (4) Scutum coloration, showing the 2-4 dorsalcentral vittae. (5) Leg coloration: (a) leg/segment entirely yellow; (b) femur with only a dark infuscated mark; (c) tarsal segments and tibia with varying degrees of infuscation; (d) femur with varying degrees of infuscation. (6) Abdominal tergite appearance: (a) large triangular or trapezoidal dark mark; (b) oblong dark mark; (c) dark longitudinal median vitta; (d) thin transverse dark mark; (e) small round mark/spot; (f) dorsal surface covered by dark mark.

Parafacial

The parafacial is important with regard to its width relative to other head structures, such as the arisal base. The colour is of lesser importance, ranging from grey to gold, or combinations thereof. It is always dusted.

Antenna (Fig. 3)

The colours of the scape, pedicel and especially the postpedicel are very important characters, and exhibit great interspecific, but very little intraspecific variability.

Palpus

The shape of the palpus has been an important diagnostic character for *Atherigona* s. str. with the males having a strongly dilated and truncated palpus, compared to the females which have it straplike, and comparative to that of *Acritochaeta*.

Two male exceptions, however, have surfaced with *A. heteropalpata* sp. n. (Chapter 2.5.25) and *A. flaviheteropalpata* sp. n. (Chapter 2.5.22) which uncharacteristically have straplike palpi, that are strikingly similar to *A. (Acritochaeta) orientalis* Schiner, 1868. Likewise, two species of *Acritochaeta*, namely *A. yorki* Deeming, 1971 and *A. tau* Pont, 1981 have palpi similar to *Atherigona* s. str. These species are, however, at present the only ones known to have overlapping characteristics.

Vibrissae

The appearance of the vibrissae is an important colour characteristic, with species having either infuscated or golden/yellow setae and setulae.

1.2.3 Thorax (Figs 4, 7)

Katepisternum

The arrangement of the katepisternal setae in the shape of an equilateral triangle is an important diagnostic character. Also the distance of the posterior setae in relation to the other two has been an important historical character [and one I find far too subjective in the absence of morphometrics].

Proepisternum

The number of seta and setulae (usually two well developed setae and one hair-like setula) and shape of the proepisternum is in most cases very consistent in appearance across species. There are however some species (such as *A. divergens* Stein, 1913) that have four very well developed setae on a knoblike process as opposed to the usually inconspicuous process.

Scutum

The colour of the scutum and the appearance of the 2-4 dorsocentral vittae (Fig. 4) are important. The majority of species have the scutum grey dusted, but some, such as *A. parviumilata* sp. n., have it infuscated and dusted, whereas *A. stuckenbergi* sp. n. has it dark brown and glossy. Others, such as a form of *A. budongoana* van Emden, 1940, have it golden dusted. The appearance of the 2-4 dorsocentral vittae ranges between very weak and barely visible to dark brown and prominent (a feature that has very little intraspecific variability). In some species such as *A. albicornis* sp. n. and *A. theodori* Hennig, 1963, the dorsocentral vittae of the scutum can run onto the surface of the scutellum, although in most species they do not.

Legs (Fig. 5)

One of the most important characters with regards to species discrimination is that of leg coloration and tarsal chaetotaxy. The colour of the foreleg is particularly important, with the mid and hind leg usually yellow for most species. The tarsal chaetotaxy of some species are regarded as specialised, with arrangements, such as very long hair-like setulae on the 3rd and 4th tarsal segments (*A. vernoni* sp. n.) or with dorsal setulae

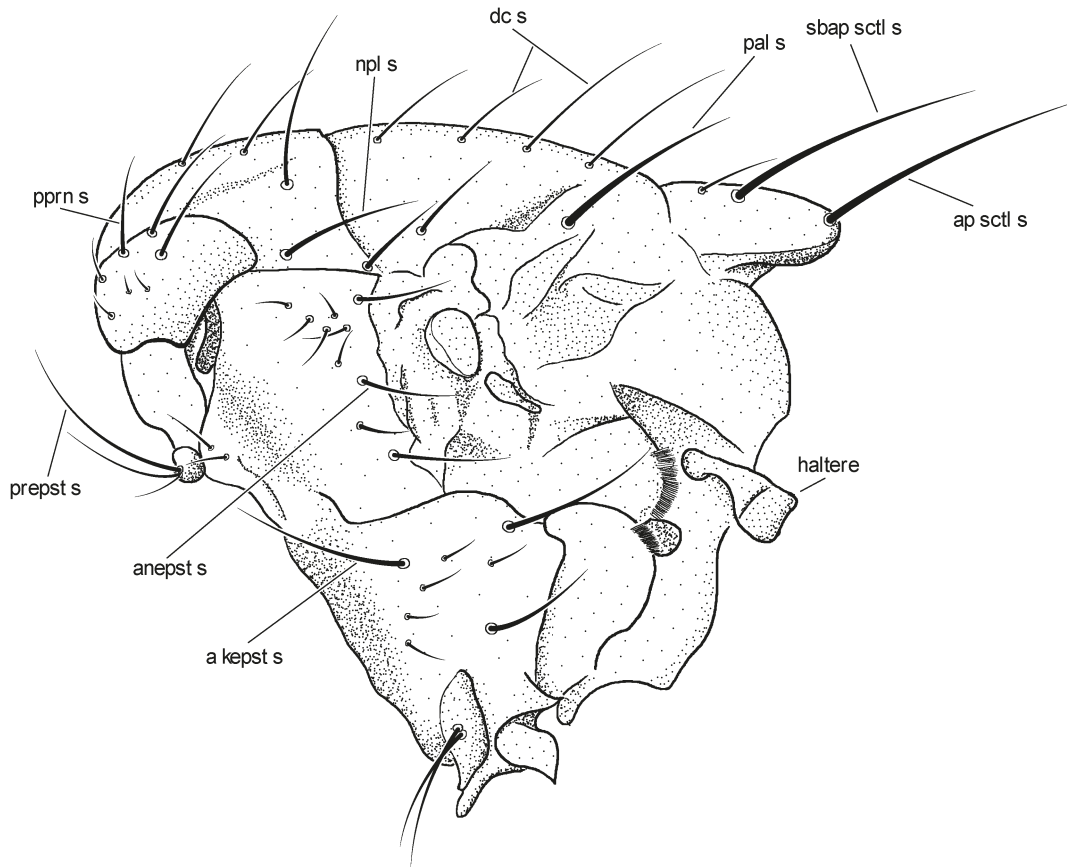


Figure 7: Illustration of a generalised thorax of *Atherigona s. str.*, with major setae illustrated. Abbreviations: *a kepst s* – anterior katepisternal seta; *anepst s* – anepisternal seta; *ap sctl s* – apical scutellar seta; *dc s* – dorsocentral seta; *npl s* – notopleural seta; *pal s* – postalar seta; *pprn s* – postpronotal seta; *prepst s* – proepisternal seta; *sbap sctl s* – subapical scutellar seta.

on the apical three tarsal segments (*A. rimapicis* sp. n.). In a few species, however, the specialised chaetotaxy of males can be either absent or present, although importantly there are no intermediate states. An example of this can be observed in *A. pulla* (see Deeming 1979). In *A. tomentigera* van Emden, 1940, the West African males always have such specialisation, whereas those occurring in the East African highlands can be with or without such specialisation (Deeming pers. comm.).

Wings

The wings can be used quite readily for descriptive purposes, as they are usually either hyaline, or with brown, smoky suffusions (appearing as diffused brown markings) over the humeral crossvein and Sc-R₁ wing areas, as well as the apex of the wing. The suffusion is usually quite prominent, although in some specimens it could be much lighter. The r-m crossvein relative to cell dm, *i.e.* the ratio of sector 3 of the M vein (distal to r-m) to sector 2 of the M vein (proximal to r-m), can be used to discriminate between individual species where external morphological characteristics are nearly

indistinguishable, by comparing the measured ratio of individuals to that of the species' average.

1.2.4 Abdomen

Tergites (Fig. 6)

The naming of the abdominal tergites follows the terminology of McAlpine (1981). Previous authors have also followed the terminology used in Venturi (1968). This distinction is important to take into consideration when using older published keys, as tergite 5 in McAlpine equals tergite 7 in Venturi.

Tergite 1+2 has been used in past keys (immaculate or with darker marking), whereas the presence of dark markings on tergites 3 and 4 is significant. The appearance of tergite 5 (immaculate or with two small paired spots) is also of use in keying out species. Care should, however, be taken in treating this character state as absolute, seeing that the small paired spots can sometimes be difficult to discern.

The presence of lateral dark markings should be seen as unusual, with *A. bimaculata* Stein, 1910 being the only known South African occurring species with such markings. Chaetation within the margins of these dark markings is also a useful diagnostic character.

Hypopygial prominence

The hypopygial prominence is one of the most important characters in species discrimination when its appearance is combined with the aforementioned characters and the trifoliate process. In rare cases the hypopygial prominence is absent, such as the case with *A. divergens* and *A. tetrastigma* Paterson, 1956. Otherwise, the prominence can be subdivided into four main categories (as figured in Chapter 2.6): Simple – or reduced (Figs 3 & 4); knoblike (Figs 7, 8 & 9) – including stalked (Fig. 23), truncated (Fig. 43) and projecting (Fig. 17); tridentate – or trilobate (Fig. 31); bifurcate – deep (Fig. 59), shallow (Fig. 55), emarginate (Fig. 50) or bilobate (Fig. 64).

Trifoliate process

The trifoliate process (Fig. 8) can be highly variable between species, but also very similar in closely related species. It would, thus appear as though the trifoliate process is important in sexual selection, with Clearwater *et al.* (1981) and Deeming (1979) recording that males wave it in front of the female's right eye, and that copulation only occurs once the female has recognised the process. A combination of characters should always be used to identify and describe a species, with the trifoliate process being the final confirmation if the other combinations of characters are not unique enough (mainly due to the unwanted maceration of the abdomen to view the process in some specimens). The shape of the median piece, lateral plates, chaetotaxy and colour are the main characters. The structure should at least be evaluated for each

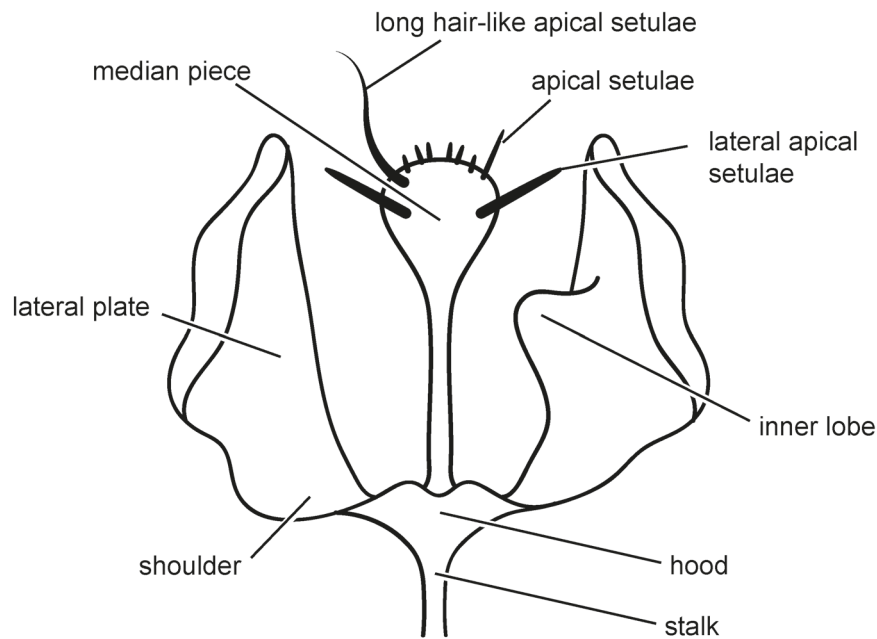


Figure 8: Schematic illustration of the trifoliate process of *Atherigona s. str.*, showing all of the primary terminologies used during descriptions.

series of specimens from a locality to confirm final identification, as two seemingly identical specimens could be deemed different species after dissection.

Clearwater *et al.* (1981) and Dike (1987, 1992) researched the ultrastructure of the trifoliate process of five and three species respectively, using scanning electron microscopy. The results revealed that the ultrastructure of especially the lateral plates were significant in establishing species relationships, with Dike (1992) showing a close relationship between *A. bedfordi* van Emden, 1940 and *A. secrecauda* Séguy, 1938, with the outer surface of the lateral plates having short, fine rods, compared to those of *A. hyalinipennis* van Emden, 1959, which were long and sinuate. Even the stem of the trifoliate process, which in general was never considered of true taxonomic importance varies between these two groups, with *A. bedfordi* and *A. secrecauda* having the surface glabrous and granulate, compared to that of *A. hyalinipennis* which has spots of hairlike setulae and a non-granulate surface. The significance of this ultrastructure should not be discounted, and it is recommended that future research be aimed at describing this structure as well, especially when cladistic analysis for the genus is attempted.

1.3 Female *Atherigona s. str.*

Traditionally, taxonomic descriptions have been based on males of *Atherigona s. str.* Due to this, many species' females are entirely unknown. This is not helped by the fact that numerous species have females nearly identical from an external morphological

perspective. In many cases females can only be accurately identified through either collecting them in copula or rearing from host plants. Future DNA-barcoding is also a possibility, although, most museum specimens are too old to yield satisfactory extraction results, and as such, fresh specimens would again be needed. The most important taxonomic character for females, apart from external coloration, is the shape of the two anterior plates on tergite 8 of the ovipositor.

1.4 Economic importance of the group

Many species of *Atherigona* Rondani, 1856 are well known as major economic pests of various grasses and cereals. Larvae of *Atherigona s. str.* tend to be pests of various Poaceae, whilst the majority of *Achritochaeta* are regarded as facultative predators in organic matter, with a few exceptions, such as *A. orientalis*, which is a widespread pest of bell peppers, tomato and sorghum in various African countries and southern Asia. *Atherigona s. str.* has a greater number of obligate phytophagous species, with many causing economic loss in especially sorghum and millet throughout Africa.

Sorghum (*Sorghum bicolor* (L.) Moench) and millet (*Pennisetum glaucum* (L.) R. Br.), are very important crops throughout the arid regions of the tropics and subtropics (Atokple 2003). This holds especially true for West Africa where sorghum and millet make up approximately 70% of annual crops (Axtell 1998). More than 150 species of insects are known as pests of sorghum, with *A. soccata* being particularly important, causing crop losses in Africa, Asia and Latin America by damaging the growth points of seedlings, leading to typical dead heart symptoms (Young & Teetes 1977; Sherwill *et al.* 1999). In extreme instances, up to 90% of sorghum seedlings may be infected by *A. soccata* when late sowing occurs. The decaying plant material serves as a food source for later instars. Severely infested seedlings can form tufts, which seldom grow taller than 30 cm and never produce ears (Matthee 1974). In southern Africa, *A. soccata* is known to exceed economic thresholds with regard to damage. Economically important levels of shoot fly infestation have been reported in Tanzania, Zambia (Leuschner 1988) and Swaziland (Sithole *et al.* 1987). Infestation levels as high as 80% were reported in Malawi (Chikonda 1988), with up to 30% infestation being reported in rural areas of Zimbabwe (Sithole 1987). Sherwill *et al.* (1999) investigated shoot fly species occurrence in Mpumalanga province, South Africa. *A. soccata* was overall found to be the most abundant shoot fly during the aforementioned study period, and was also the only species found on one-week-old seedlings. In late plantings up to 43% infestation has been recorded (Van Rensburg & Van den Berg 1992; Sherwill *et al.* 1999). Its numbers did, however, not show it to be the dominant species, with *Scoliophthalmus trapezoides* Becker (Chloropidae) having an abundance close to that of *A. soccata*. *A. hyalinipennis* is known to damage Rhodes grass (*Chloris gayana*) in Oman (Deeming pers. comm.) Various other species of *Atherigona s. str.*, such as *A. tritici*, *A. naqvii*

Steyskal, 1966, *A. falcata* (Thomson, 1869) and *A. lineata*, are also known to damage cereal crops, with *A. tritici* being quite destructive on wheat, causing up to 10% loss (Pont & Deeming 2001).

1.5 Study aim

The aim of this study was twofold. First, and foremost, the objective was to revise the known systematics of *Atherigona s. str.* in South Africa and provide a key to their identification. To accomplish this, one could not look at South African species in isolation (as evident from the literature and material examined). Many species are pan-African and due to the limited historical focus on South African and southern African species, very little is known with regard to the species composition of the subgenus, apart from economically important species and specimens collected by chance and deposited in overseas institutions. Due to this, it would not have been feasible to unequivocally state which species are endemic to South Africa and which are not.

The second objective was to determine the distribution of the subgenus using specimen records from the early 1900s to the present and to supplement these with fieldwork. Compiling and determining a known distribution range for species is of the utmost importance for future studies, as it will enable researchers to determine under-sampled areas for future collecting trips. It is essential to understand the distribution of the numerous species, as several are of economic importance, not only throughout South Africa, but also, and especially, throughout the rest of the Afrotropical Region.



CHAPTER 2



Habitus: *Atherigona soccata* Rondani, 1871

**Illustrated key and systematics of
Atherigona sensu stricto (Diptera: Muscidae)**

2.1

Abstract

A key to the male species of the subgenus *Atherigona s. str.* is provided and all species known to occur in South Africa are treated. The number of previously described species known to occur in South Africa is increased to 43 from the approximate previous 35, and an additional 25 new species are described: *A. albicornis* sp. n., *A. capitulata* sp. n., *A. chrysohypene* sp. n., *A. convexa* sp. n., *A. danielssoni* sp. n., *A. erectisetula* sp. n., *A. flavifinis* sp. n., *A. flaviheteropalpata* sp. n., *A. heteropalpata* sp. n., *A. kirkspriggsi* sp. n., *A. latibasilaris* sp. n., *A. libertensis* sp. n., *A. londti* sp. n., *A. ndumoensis* sp. n., *A. nesshurstensis* sp. n., *A. oblonga* sp. n., *A. parviclivis* sp. n., *A. parviumilata* sp. n., *A. piscatoris* sp. n., *A. rimapicis* sp. n., *A. stuckenbergi* sp. n., *A. tigris* sp. n., *A. umbonata* sp. n., *A. vermoni* sp. n. and *A. zulu* sp. n. *A. hancocki* van Emden is designated as junior synonym to *A. divergens* Stein.

2.2

Introduction

Van Emden (1940) was one of the first to examine Afrotropical *Atherigona* Rondani in detail as part of his work on the Coenososiinae collected during the then British Museum (Natural History) expedition to the Ruwenzori range in East Africa, specimens received from other various East African sources and those examined in the British Museum. He described 23 new species of *Atherigona s. str.* and greatly contributed to the knowledge of the group. The next major revision of the group was that of Deeming (1971), who described 21 new species, and who continues to work on this group (albeit to a lesser degree) to this day, having described another 30 species since 1971. Deeming initially focussed on West African fauna, with his 1971 paper and 21 new species focussing solely on specimens collected throughout northern Nigeria. His later work did include some more East and West African specimens, and to a lesser degree southern African specimens (although these were mostly specimens from the Natural History Museum in London which were collected throughout the 1900s). Dike (1989a) published a key on the Afrotropical species of *Atherigona* and combined the knowledge up to that time into a very usable key, building upon the layout and structure of Deeming (1971).

Upon embarking on this revision, it was found that many specimens in the KwaZulu-Natal Museum collection did not key to any known species; or if they did key, they did not completely match descriptions of types from East and West African countries. A degree of geographical variation is expected and as such it was therefore necessary to incorporate the South African fauna (known and presently unknown) into a local revision.

This will facilitate possible future southern African revisions, leading to a much needed Afrotropical revision, as much of the continent is undersampled with regard to especially *Atherigona s. str.* It will ultimately also be crucial to sort out the taxonomy of the female specimens of the subgenus, as at present their identities are tentative

at best. This will, however, require widespread, targeted fieldwork, as most museum specimens are too degraded for molecular work to yield significant results. Live rearing is an option, and has yielded some excellent results in the past with many species (Deeming 1971); but this approach has been mostly only used in species which are of agricultural importance (and these are in the minority). The systematic overview and treatment that follows incorporates many geographically widespread species, as well as some species which are only known from southern Africa.

2.3 Material and Methods

The specimens examined during this study emanate from three main preservation methods: pinning, point mounting and preservation in 70–96 % ethanol.

While specimens of *Atherigona s. str.* can be keyed to species using external morphological characteristics, this is only reliable up to a point, and dissection or relaxation of dry specimens to examine the trifoliate process is necessary to verify determinations in most cases. Freshly collected specimens' trifoliate processes should be teased out directly after being killed by pulling down on the abdomen of each male specimen using fine forceps (alternatively this can also be done if the specimens are in ethanol). Unfortunately most historical museum specimens studied were only pinned and not readied in this manner and required destructive dissection.

The dissection process involved first noting all important characters (especially coloration and markings) and taking measurements before separating the abdomen from the rest of the specimen, and placing it in a heated solution of 10 % potassium hydroxide (KOH) for approximately 5 minutes. KOH is a strong base and an effective means of dissolving soft tissue and clearing the abdomen, leaving only cuticle behind, allowing the trifoliate process and genitalia to be studied clearly. It also has an added advantage in that it dissolves and removes concentrated sugars present in the abdomen of the flies (due to adults feeding on nectar). The sugars from the digestive tract leech out into the surrounding tissue, making it impossible to note markings, sometimes even changing the entire colour appearance of a specimen. After clearing in KOH, the abdomen is transferred to glacial (100 %) acetic acid for another 5 minutes before removing and rinsing with distilled water. Thereafter it is transferred to 96 % ethanol for viewing under a microscope.

Measurements were made using a micrometer eye-piece and calibration slide. All measurements given are the averages for each species.

Whilst there is generally no shortage of females in collected field-samples or museum collections, it is virtually impossible to associate females with males of the same species unless the specimens were collected in copula, or reared from host plants (for which no information is available with regards to the newly described species). For this reason species descriptions and diagnoses are based on male specimens only, as

this is most comparable to existing species knowledge, making a comparison between new and already existing species possible.

Material examined during this study are deposited at the following institutions:

| | | |
|------|---|---|
| AMGS | – | Albany Museum, Grahamstown, South Africa; |
| BMNH | – | The Natural History Museum, London, United Kingdom; |
| BMSA | – | National Museum, Bloemfontein, South Africa; |
| MNHN | – | Muséum national d’Histoire naturelle, Paris, France; |
| MRAC | – | Musee Royal de l’Afrique Centrale, Tervuren, Belgium; |
| MZLU | – | Museum of Zoology, Lund University, Lund, Sweden; |
| NMSA | – | KwaZulu-Natal Museum, Pietermaritzburg, South Africa; |
| NMWC | – | National Museum of Wales, Cardiff, United Kingdom; |
| SAMC | – | Iziko South African Museum, Cape Town, South Africa; |
| SANC | – | South African National Collection of Insects, Pretoria, South Africa; |
| SMNS | – | Staatliches Museum für Naturkunde, Stuttgart, Germany; |
| ZMHB | – | Museum für Naturkunde, Berlin, Germany. |

Photographs of terminalia used for some of the illustrations were taken using a Zeiss Stemi 2000-C stereo microscope with an attached camera. Habitus photographs were taken with a Nikon D3200 DSLR using a reversed 28 mm prime lens with three extension tubes, for a total length of 100 mm. Images were then stacked using Adobe Photoshop CS5.

The trifoliate process and hypopygial prominence of each species were drawn using a drawing tube attached to a Wild M5 stereo microscope. Illustrations were done in pencil, scanned and digitally “inked” using Adobe Illustrator CS5 and finalised in Adobe Photoshop CS5.

I undertook travel to six overseas institutions (BMNH, MNHN, MRAC, NMWC, SMNS & ZMHB) during November 2009. The main purpose of this visit was to examine and make comparative notes on the numerous types of *Atherigona s. str.* In all, I examined 51 type specimens and recorded all morphological characters needed for future comparison.

Apart from specimens borrowed during that initial trip, I also borrowed from two other institutions (*i.e.* AMGS & MZLU) *via* post and visited three South African Institutions (BMSA, SAMC, SANC) and was able to draw heavily from my own institution (NMSA). Overall, just over 1200 male specimens were extracted from the various collections’ drawers. All non-type material examined (unless stated otherwise) was determined by myself, either through use of keys, or through comparison with type material. Afrotropical distributions listed for species are incorporated from the literature, specifically Pont (1980) and Dike (2003), as well as from previously unrecorded specimen records.

Authors have used mixed terminologies in the past with regard to the naming of morphological characters and the numbering of abdominal tergites, with Deeming (1971, 1972a, 1978, 1979, 1981) utilising the numbering of Venturi (1968). McAlpine (1981) has arguably made one of the biggest contributions to standardising dipteran morphological terms, and for this reason the manuscript follows terminologies from that publication, with the only exception being that of the 3rd antennal segment, which is referred to here as the “postpedicel” as in Stuckenberg (1999), and not as antennal flagellomere 1 [which I find much too cumbersome]. Morphological structures, their character states, associated descriptions and taxonomic significance were discussed in detail in Chapter 1.2.

Abbreviations used in Chapter 2.6 figures: trifoliolate process: tp_{pv} – posterior view, tp_{lv} – lateral view (profile); hypopygial prominence: hp_{av} – anterior view, hp_{lv} – lateral view (profile), hp_{dv} – dorsal view.

2.4 An illustrated key to South African *Atherigona* s. str. males

- 1 Hypopygial prominence absent, frontal plate infuscated, glossy 2
- Hypopygial prominence present, frontal plate appearance variable 3
- 2 Proepimeron strongly differentiated, prominence with four equal length setae; trifoliolate process complex, quinquefoliate (Fig. 1a).....
..... **divergens** Stein (syn. n. **hancocki** van Emden)
- Proepimeron weakly differentiated, with two setae and one hair-like setulae; trifoliolate process trident shaped (Fig. 2a).....**tetrastigma** Paterson
- 3 Hypopygial prominence simple or reduced, sometimes appearing conical in posterior view 4
- Hypopygial prominence developed otherwise, *i.e.* emarginate, knoblike, bifurcate, bilobate or tridentate 5
- 4 Median piece of trifoliolate process filiform in posterior view (Fig. 3a), greatly dilated in profile (Fig. 3b), being almost as wide as lateral plates; lateral plates without inner lobes; hypopygial prominence convex at apex (Fig. 3c, d).....
..... **parviclavis** sp. n.
- Median piece of trifoliolate process with a slight apical dilation in both posterior view and profile (Fig. 4a, b), lateral plates at least 3× as wide as median piece in profile (Fig. 4b); hypopygial prominence much reduced with a slightly emarginated apex, almost appearing bifurcate (Fig. 4c) **parvhumilata** sp. n.
- 5 Hypopygial prominence emarginated (Fig. 5c), knoblike (Fig. 7c) or truncated with projecting tubercles at apex (Figs 17c–e; 18c) 6
- Hypopygial prominence bifurcate (Figs 38c, 45c), bilobate (Figs 64c, 68c) or tridentate (Fig. 31c, 34c) 33

- 6 Vibrissae golden or yellow; hypopygial prominence emarginate apically 7
 – Vibrissae infuscated; hypopygial prominence variable 8
- 7 Median piece of trifoliate process in profile with a right-angled bend medially (Fig. 5b); filiform in posterior view, with an abrupt apical dilation; dilation with a shallow emargination (Fig. 5a); lateral plates without inner lobes in posterior view **angulata** Deeming
 – Median piece of trifoliate process in profile hardly bent (Fig. 6b); median piece with medial dilation, as well as strong apical dilation; apex appearing convex and obtuse angled; lateral plates with inner lobes in posterior view (Fig. 6a) **pulla** (Wiedemann)
- 8 Hypopygial prominence in the shape of a rounded or truncated knob, not projecting (Fig. 7c)..... 9
 – Hypopygial prominence with projecting tubercles (Figs 18c, 25c) 18
- 9 Frontal plate with glossy appearance; frontal vitta infuscated, sometimes yellow on at least apical third 10
 – Frontal plate with dusted appearance; frontal vitta appearance variable..... 12
- 10 Frontal vitta, frontal plate and postpedicel entirely infuscate 11
 – Frontal vitta infuscated with apical third yellow, frontal plate glossy grey-brown; postpedicel infuscated except for narrow basal margin; wing entirely hyaline; tergites 4 and 5 with only dorsal spots and without setae on their posterior margins; hypopygial prominence in the shape of a rounded knob (Fig. 7c) **laevigata** (Loew)
- 11 Hypopygial prominence in the shape of a rounded knob (Fig. 8c); wing with dark brown smoky suffusions over humeral crossvein and Sc-R₁; tergites 4 and 5 each with a pair of lateral longitudinally lengthened markings in addition to the dorsal pairs; tergite 5 with a strong seta on the posterior margin of each dorsal spot; trifoliate process filiform in posterior view (Fig. 8a)..... **bimaculata** Stein
 – Hypopygial prominence in the shape of a truncated knob (Fig. 9c–f); wing entirely hyaline; tergites 4 and 5 without any lateral longitudinal markings; trifoliate process greatly dilated apically, appearing almost circular in posterior view (Fig. 9a) **univittata** Deeming & Overman (in part)
- 12 Palpus yellow 13
 – Palpus infuscated..... 14
- 13 Fore femur entirely yellow; frontal vitta yellow; hypopygial prominence doorknob-shaped in posterior view (Fig. 10c); surstylus black on apex, with a small spot on posterior angle **nigrapicalis** Deeming (Fig. 10)
 – Fore femur infuscated on apical half to third; frontal vitta infuscated, at most with a dull ferruginous suffusion at apex; hypopygial prominence small and subtruncate

- (Fig. 11c), somewhat angular in general shape when viewed dorsally (Fig. 11d); surstylus without any infuscation **longifolia** van Emden (Fig. 11)
- 14 Hypopygial prominence truncate knob-shaped, with apex slightly or broadly emarginate 15
- Hypopygial prominence truncate knob-shaped, but without any emargination.. 16
- 15 Hypopygial prominence with slightly emarginated apex; median piece of trifoliate process in profile narrow throughout its length, with gradual apical dilation; nowhere throughout its length is it more than $\frac{1}{5} \times$ as broad as it is long (Fig. 12a, b); tergite 3 usually immaculate or with only some brownish shadows, although in some specimens with a darker marking on dorsum..... **aurifacies** van Emden
- Hypopygial prominence broadly emarginated at apex; median piece of trifoliate process in profile very strongly dilated along most of its length, although much less so towards apex (Fig. 13b), piece almost half as wide medially as it is long.. **griseiventris** van Emden
- 16 Wing with brown smoky suffusions at humeral crossvein and at Sc-R₁; median piece of trifoliate process at most with only a slight median dilation in profile; lateral plates wider than median piece in profile 17
- Wing entirely hyaline; median piece of trifoliate process noticeably dilated from base to just before apex; lateral plates narrow in profile, with a backwards twisted appearance (Fig. 14b)..... **capitulata** sp. n.
- 17 Brown smoky suffusion on wing weakly visible; scutellum uniformly grey dusted; median piece of trifoliate process strongly dilated, with a clear median emargination and four strong erect setae in posterior view (Fig. 15a); surstylus without dark markings **umbonata** sp. n.
- Brown smoky suffusion on wing clearly visible; scutellum grey dusted except for apical margin which is yellow; median piece of trifoliate process with slight apical dilation, apex convex without any emarginations and four setae weakly developed (Fig. 16a); surstylus with dark markings **flavifinis** sp. n.
- 18 Palpus shaped like that of subgenus *Achritochaeta*, *i.e.* straplike, not truncated or dilated at all (Fig. 17f); trifoliate process hyaline except for lateral margins of lateral plates which are infuscated, entire surface of process sculptured (Fig. 17a) **heteropalpata** sp. n.
- Palpus at least with some degree of truncation or dilation; trifoliate process surface usually smooth 19
- 19 Hypopygial prominence with a blunt central tubercle and four sharply defined tubercles quadrately arranged (Fig. 18b, c); trifoliate process with median piece apically dilated, convex at apex (Fig. 18a)..... **aster** van Emden

- Hypopygial prominence less complex, at most with only two projecting tubercles; trifoliate process variable 20
- 20 Frontal vitta yellow on at least apical third 21
- Frontal vitta entirely infusate 26
- 21 Frontal vitta infuscated, except for yellow apical third; postpedicel ferruginous for the most part, only infuscated on half of dorsal edge and apex; trifoliate process with median piece club-shaped in posterior view, having a pair of well-developed setae (Fig. 19a, b).....**marginifolia** van Emden
- Frontal vitta entirely yellow; postpedicel infuscated for the most part, only ferruginous on basal margin; trifoliate process variable..... 22
- 22 Legs with some degree of infuscation..... 23
- All legs yellow; trifoliate process appearance variable..... 24
- 23 Hypopygial prominence stalklike with anterior projections weakly developed, appearing almost lobate (Fig. 20c–e); trifoliate process infuscated with a club-shaped median piece, the apex of which is either convex or slightly emarginated in some specimens, with four erect setulae; lateral plates with inner lobes present, plates with a hyaline centre (Fig. 20a)**erectisetula** sp. n.
- Hypopygial prominence more truncated, with anterior projections moderately more developed (Fig. 21c); trifoliate process club-shaped in posterior view with three weak setulae on each “lobe” of the emarginated apex; lateral plates without inner lobes (Fig. 21a)**humeralis** (Wiedemann)
- 24 2-4 dorsocentral vittae (Chapter 1.2 Fig. 4) strong and clearly visible; scutum and scutellum golden dusted, only grey in immediate area surrounding the vittae and on centre of scutellum; hypopygial prominence truncated with extended lateral ridges leading towards anteriorly projecting tubercles (Fig. 22c–d); median piece of trifoliate process greatly dilated in profile except for extreme apex, wider than lateral plates (Fig. 22b) **budongoana** van Emden (in part)
- 2-4 dorsocentral vittae weak and barely visible; uniformly grey dusted, scutellum variable; hypopygial prominence stalked, apically dilated with anteriorly developed lobes/projecting tubercles; median piece of trifoliate process at most apically dilated apically 25
- 25 Palpus apically dilated, truncated area diameter half the length of the entire palpus; parafacial golden dusted; median piece of the trifoliate process short, stout, with gradual dilation from base to the apex; lateral plates without any inner lobes (Fig. 23a).....**falcata** (Thomson)
- Palpus apically dilated, truncated area diameter much smaller than half the length of the entire palpus; parafacial grey dusted; median piece of trifoliate process

- club-shaped; lateral plates with inner lobes present (Fig. 24a).....
 **ndumoensis** sp. n.
- 26 Foreleg infuscated on at least apical third of tibia; palpus entirely infuscated, yellow
 or infuscated on at least basal third 27
- Foreleg entirely yellow; palpus yellow.....
 **budongoana** van Emden (in part) (Fig. 22)
- 27 Palpi entirely infuscate 28
- Palpi yellow on at least apical half 32
- 28 Fore femur infuscated on at least apical half 29
- Fore femur entirely yellow 31
- 29 Frontal plate glossy black; wing entirely hyaline; trifoliate process apically greatly
 dilated, appearing almost circular in posterior view (Fig. 9a).....
 **univittata** Deeming & Overman (in part)
- Frontal plate dusted; other characters variable..... 30
- 30 Dorsum of abdomen without any median vittae; tergite 1+2 immaculate; tergites
 3 and 4 with small equal sized round markings; median piece of trifoliate process
 apically dilated and slightly bifid; basal-lateral area of lateral plates angular in
 posterior view (Fig. 25a) **decempilosa** Dike
- Dorsum of abdomen with median vitta, except for tergite 5 which is immaculate;
 tergites 3 and 4 each with interrupted median vitta; tergite 3 with large dark marks,
 tergite 4 with small spots; median piece of trifoliate process dilated medially and
 apically; lateral plates narrow and curved in posterior view, with a long emargination
 in basal third of outer margin (Fig. 26a)..... **binubila** van Emden
- 31 Foreleg tarsi without any specialised chaetotaxy; trifoliate process with median
 piece filiform in posterior view, except for extreme apex (Fig. 27a), and quite
 strongly uncurved in profile, the apex appearing almost fishhook-like with a pair of
 long setulae (at least 5× as long as the secondary pair of setulae) (Fig. 27b)
 **piscatoris** sp. n.
- Foreleg with apical three tarsal segments having long dorsally positioned setulae,
 at least as long as segments are wide; trifoliate process with median piece having
 an elongated dilation in posterior view (Fig. 28a), boomerang shaped in profile
 (Fig. 28b), having four equal length setulae at apex..... **oblonga** sp. n.
- 32 Surstylus with dark markings at base and at apex; trifoliate process hyaline over most
 of surface except for lateral margins of lateral plates which are infuscated; median
 piece with long hyaline setulae that are as long as piece itself (Fig. 29a, b)
 **libertensis** sp. n.
- Surstylus immaculate; trifoliate process entirely infuscated, without any long
 setulae, only short black ones (Fig. 30a) **angustiloba** van Emden

- 33 Hypopygial prominence tridentate (Figs 31c–37c), with three apparent lobes or processes..... 34
 – Hypopygial prominence otherwise developed 40
- 34 Dark species with all legs entirely infuscated; palpus infuscated; apical half of median piece of trifoliate process hyaline (the rest infuscate), with a pair of long hyaline setulae (longer than entire piece) (Fig. 31a); surstylus infuscate
 **albicornis** sp. n.
 – At least mid and hind legs with majority of surface yellow; rest of characters variable 35
- 35 Palpus entirely infuscate 36
 – Palpus yellow on majority of surface, in some cases with bases somewhat infuscate..... 37
- 36 Median piece of trifoliate process with a flattened y-shaped dilation in posterior view (Fig. 32a); fore femur with no more than apical third infuscated; tergite 3 immaculate..... **occidentalis** Deeming
 – Median piece of trifoliate process apically dilated in posterior view, appearing cordiform, apex with an emargination (Fig. 33a), although in some specimens much less pronounced; fore femur with apical two-thirds infuscated; tergite 3 with dark markings **kirkspriggsi** sp. n.
- 37 Foreleg yellow; trifoliate process with median piece having only short setulae at apex 38
 – Foreleg infuscated on apical third of femur, half of tibia and majority of tarsi; trifoliate process with median piece having long setulae at apex, at least half the length of the median piece..... 39
- 38 Frontal vitta infuscated, at most with a dark reddish suffusion at apex; lateral plates of trifoliate process largely yellow, infuscated on lateral margins, median piece with gradual dilation towards apex, no emargination, hyaline on basal half; trifoliate process hood quite prominent (Fig. 34a)..... **perfida** Stein
 – Frontal vitta appearing dirty yellow, medially darker than the rest; median piece of trifoliate process infuscated, filiform except for dilated, emarginated apex; trifoliate process hood reduced (Fig. 35a) **chirinda** Dike
- 39 Frontal vita infuscated on basal half, yellow on apical half; postpedicel yellow with infuscation on dorsal and apical margins; palpus entirely yellow; trifoliate process with median piece wider at base than apex in profile (Fig. 36b), piece and lateral plates with fine setulae on surface (Fig. 36a); apex of median piece with a pair of long setulae..... **cinarina** Séguy

- Frontal vitta appearing dark, dirty yellow, with no clear black-yellow division towards apex; palpus yellow with base infuscated; trifoliate process with median piece apically dilated in profile and posterior view (Fig. 37a, b); process without fine surface setulae; apex of median piece with a pair of long setulae as in *A. cinarina* **naqvii** Steyskal
- 40 Frontal vitta yellow or ferruginous on at least apical half to third 41
- Frontal vitta entirely infuscated, at most with dull lighter suffusion at apex 53
- 41 Foreleg with femur infuscated on apical half to third..... 42
- Foreleg with femur yellow throughout, at most with dark marking at apex 44
- 42 Antenna infuscated, at most with margins of scape and pedicel, and base of postpedicel ferruginous..... 43
- Antenna appearing entirely ferruginous; hypopygial prominence strongly bifurcate (Fig. 38c); trifoliate process with median piece entirely filiform in posterior view (Fig. 38a), strongly dilated in profile (Fig. 38b)**ruficornis** Stein
- 43 Palpus yellow, appearing straplike; hypopygial prominence with only a slight emargination apically, giving process a bilobed appearance (Fig. 39c); trifoliate process with median piece strongly dilated in posterior view with a clear emargination at apex, making piece appear cordiform (Fig. 39a), uniformly developed in profile with no clear dilation (Fig. 39b) **flaviheteropalpata** sp. n.
- Palpus yellow, apically dilated and truncated; hypopygial prominence with a deep rounded bifurcation with apex pointing towards anterior (Fig. 40c); trifoliate process with median piece apically dilated in posterior view, deeply bifid (Fig. 40a), piece greatly dilated at base in profile, almost 2x as wide as lateral plates (Fig. 40b)....
..... **latibasilaris** sp. n.
- 44 Fore tibia and tarsi entirely yellow, without any infuscation 45
- Fore tibia infuscated on at least apical third; fore tarsi infuscated on at least one segment 47
- 45 Head longer than deep; parafacialia very wide, at widest longer than horizontal length of eye, at narrowest still wider than postpedicel.....**mitrata** Séguy (Fig. 41)
- Head deeper than long 46
- 46 Hypopygial prominence in the shape of two fused pointed triangles when viewed dorsally (Fig. 42c); trifoliate process with median piece having a strong apical dilation, which is emarginated at apex, even more pronounced in profile (Fig. 42 a, b); lateral plates infuscated **bedfordi** van Emden
- Hypopygial prominence truncated and bifurcated (Fig. 43c); trifoliate process with lateral plates at least two thirds as long as median piece in profile (Fig. 43b), with median piece dilated and convex at apex; lateral plates infuscated on apical half (Fig. 43a)..... **ochracea** Deeming

- 47 Frontal vitta infuscated on at most basal two thirds 48
 – Frontal vitta entirely yellow 50
- 48 Scutum grey dusted, with very weak and barely visible 2-4 dorsocentral vittae; frontal plate grey dusted; postpedicel yellow/ferruginous, in some cases with dorsal margins slightly infuscated; hypopygial prominence not deeply bifurcate, but shallow or bilobate 49
 – Scutum entirely yellow, undusted, with one clear median 2-4 dorsocentral vitta running to apex of scutellum; frontal plate glossy; postpedicel infuscated except for basal margin which is ferruginous; hypopygial prominence with a deep bifurcation running all the way down to base (Fig. 44b) **theodori** Hennig
- 49 Vibrissae infuscated; trifoliolate process with median piece entirely filiform in posterior view (Fig. 45a); club-shaped in profile (Fig. 45b); lateral plates at least 2× as wide as median piece in profile; hypopygial prominence bifurcate
 **rubricornis** Stein
 – Vibrissae golden; trifoliolate process with median piece strongly dilated at apex in both posterior view and profile (Fig. 46a, b); lateral plates at most as wide as median piece in profile; hypopygial prominence bilobate (Fig. 46c–e)
 **chrysohypene** sp. n.
- 50 Tergite 5 with a pair of small dark spots; hypopygial prominence with a wide, shallow bifurcation (Fig. 47c); trifoliolate process with median piece having a gradual apical dilation in posterior view (Fig. 47a) **tritici** Pont & Deeming
 – Tergite 5 immaculate; other characters variable 51
- 51 Hypopygial prominence with a shallow emargination between two lobes (Fig. 48c); trifoliolate process with median piece apically dilated, having only a shallow emargination as well, apex with two small setulae on each “lobe” and four strongly projecting setulae, one pair lateral and the other anteriorly placed (Fig. 48a); lateral plates with inner lobes **londti** sp. n.
 – Hypopygial prominence with two apically truncated lobes in the shape of two fused triangles when viewed from above; trifoliolate process with a strong apically dilated median piece 52
- 52 Trifoliolate process with a strong apically dilated median piece in posterior view, emarginated at apex (Fig. 49a); lateral plates of trifoliolate process at least twice as wide as median piece in profile, also, with inner lobes; hood inconspicuous in profile (Fig. 49b) **hyalinipennis** van Emden
 – Trifoliolate process with median piece emarginate apically, with three short setulae on each “lobe” (Fig. 50a); lateral plates only slightly wider than median piece in profile, without inner lobes; hood appearing winged in posterior view
 **secrecauda** Séguy (in part)

- 53 Palpus infuscated, at most with surface of truncation lighter than the rest 54
 – Palpus yellow, at most with base infuscate 57
- 54 Fore femur infuscated on at least apical third 55
 – Fore femur yellow, at most with a dark mark apically 56
- 55 Fore femur infuscated on apical third; hypopygial prominence bifurcated with short pointed processes (Fig. 51c, f) **lineata lineata** (Adams)
 – Fore femur infuscated on apical two thirds; hypopygial prominence bifurcated with rounded processes, appearing truncated (Fig. 52c) **lineata torrida** Deeming
- 56 Hypopygial prominence in the shape of two fused triangles when viewed from above, *i.e.* bilobate (Fig. 50c)..... **secrecauda** (in part)
 – Hypopygial prominence strongly and in some cases widely bifurcate (Fig. 53c)...
 **lineata ugandae** van Emden
- 57 Hypopygial prominence bifurcate..... 58
 – Hypopygial prominence otherwise developed 65
- 58 Bifurcation with bases of processes close together, appearing “v” or “u” shaped..
 59
 – Bifurcation with bases of processes widely separated, at least twice width of processes themselves (Fig. 54c) **soccata** Rondani
- 59 Tergite 1+2 with large dark markings or if absent then tergite 5 with at least a pair of small round spots..... 60
 – Tergites 1+2 and 5 not as above..... 61
- 60 Tergite 1+2 with two large dark markings and an expanded median vitta, giving it a triangular appearance; tergite 5 immaculate; trifoliate process with lateral plates having well-developed inner lobes, median piece apically emarginated (Fig. 55a) **nesshurstensis** sp. n.
 – Tergite 1+2 immaculate; tergite 5 with two small dark round spots; trifoliate process with lateral plates without inner lobes, median piece apically convex (Fig. 56a) ...
 **vernoni** sp. n.
- 61 Palpus infuscated on basal half; scape and pedicel entirely infuscated; trifoliate process with median piece apically dilated and convex at apex with numerous minute hairs (Fig. 57a, e); hypopygial prominence with moderately deep, rounded bifurcation (Fig. 57c, g) **convexa** sp. n.
 – Palpus entirely yellow; scape and pedicel ferruginous; trifoliate process and hypopygial prominence variable 62
- 62 Hypopygial prominence with a deep, “v” shaped bifurcation (Fig. 58c); trifoliate process with a strongly dilated median piece, having a deep cleft at apex (Fig. 58a); median piece almost bent at an angle in profile (Fig. 58b) **rimapicis** sp. n.

- Hypopygial prominence with a more rounded or “u” shaped bifurcation; median piece of trifoliate process with only a slight to moderate apical dilation; appearance of the median piece in profile variable, but never bent 63
- 63 Trifoliate process with median piece apically dilated, at least 2× as wide as rest of structure, having two projecting setulae on ventral surface of apex (Fig. 59a); lateral plates at least 2× as wide as median piece in profile; median piece filiform in profile, not dilated (Fig. 59b); epandrium and surstyli with dark markings **falkei** Deeming
- Trifoliate process barely dilated apically in posterior view; lateral plates no more than 1.5× as wide as median piece in profile; median piece either dilated or filiform in profile; epandrium and surstyli with or without dark markings..... 64
- 64 Scutum and postpronotal lobe uniform in appearance, grey dusted; hypopygial prominence processes noticeably projecting anteriorly (Fig. 60d, e); trifoliate process with median piece approximately same width as lateral plates in profile (Fig. 60b)..... **danielssoni** sp. n.
- Scutum grey dusted and postpronotal lobe gold to golden-silver dusted; hypopygial prominence processes barely projecting anteriorly (Fig. 61d); trifoliate process with median piece dilated in profile along almost entire length (Fig. 61b) **tigris** sp. n.
- 65 Dorsal surfaces of tergites entirely uniformly infuscated up to lateral margins, with no individual markings or spot except for tergite 5 which is immaculate; scutum dark brown **stuckenbergi** sp. n. (Fig. 62)
- Dorsal surfaces of tergites never entirely infuscated, but with only large marks or smaller spots, which never take up more than two thirds of an individual segment surface 66
- 66 All legs yellow; hypopygial prominence subcordiform in anterior view (Fig. 63c); trifoliate process with median piece apically dilated and apex slightly emarginate in posterior view (Fig. 63b)..... **steeleae** van Emden
- At least foreleg with some degree of infuscation; hypopygial prominence and trifoliate process variable 67
- 67 Frontal plate dusted in appearance; wing appearance variable; trifoliate process variable 68
- Frontal plate rather glossy in appearance; wing with brown smoky suffusions over humeral crossvein and Sc-R1; trifoliate process with median piece apically dilated, apex with quite a deep “u” shaped emargination (Fig. 64a)..... **matilei** Deeming
- 68 Trifoliate process infuscated over majority of surface 69
- Trifoliate process hyaline over majority of surface, with only the apex of the

- median piece and stem infuscated; median piece entirely filiform in posterior view (Fig. 65a) **gilvifolia** van Emden
- 69 Tergite 1+2 with broadly developed infuscated markings; hypopygial prominence stalked, with lateral lobes (Fig. 66c, d); median piece of trifoliate process rather filiform, with only a slight apical dilation (Fig. 66a), piece somewhat dilated throughout in profile (Fig. 66b) **trapezia** van Emden
- Tergite 1+2 immaculate; trifoliate process with median piece having a clear apical dilation, in profile only dilated at apex (if at all); hypopygial prominence without lateral lobes, but rather lobes appearing to be fused or projecting 70
- 70 Trifoliate process with median piece convex at apex, without any emargination (Fig. 67a), without dilation in profile (Fig. 67b) **valida** (Adams)
- Trifoliate process with median piece almost roundly dilated with well-defined emargination at apex (Fig. 68a), somewhat apically dilated in profile (Fig. 68b) ...
..... **zulu** sp. n.



2.5 Revision of South African *Atherigona s. str.* males

TAXONOMY

Family Muscidae

Subfamily Atherigoninae

Tribe Atherigonini

Genus *Atherigona* Rondani, 1856

Diagnosis: *Atherigona* can be distinguished from other genera of South African Muscidae by the very characteristic angular head shape, its elongated parafacial, and long postpedicel (third antennal segment) which extends past the middle height of the eye; in some species almost extending to the lower facial margin. Only one pair of reclinate orbital setae present, the proclinate orbital pair being absent. The katepisternum with three setae arranged in the shape of an equilateral triangle and the hind tibia has no calcar present.

Subgenus *Atherigona* Rondani, 1856

Orthostylum Macquart, 1851b: 246 (273) (as genus). Type species: *Orthostylum rufipes* Macquart, 1851 [= *Coenosia pulla* Wiedemann, 1830], by original designation.

Atherigona: Rondani 1856: 97 (as genus). Type-species: *Atherigona varia* Meigen, 1826, by original designation.

Diagnosis: Males of *Atherigona s. str.* can easily be distinguished from members of the subgenus *Acritochaeta* Grimshaw by the presence of a stemmed trifoliate process, extending from the epandrium; and in most species a hypopygial prominence on the dorsal surface of tergite 7+8 (some species, such as *A. divergens* Stein, 1913 and *A. tetrastigma* Paterson, 1956, have it absent). Female *Atherigona s. str.* can be distinguished by having paired anterior plates on tergite 8. The male palpal shape has also served as diagnostic in the past, with the male palpus being short, apically dilated and usually with a degree of truncation, in contrast to the female palpus which is more straplike. There are, however, two new species described in this study (*A. heteropalpata* sp. n. and *A. flaviheteropalpata* sp. n.) with the males having straplike palpi, resembling those of the females of the subgenus.

Description remarks: The following leg characters are common to all species of *Atherigona s. str.* and not repeated in the descriptions – Fore femur with one row of posterodorsal setae, one preapical seta; fore tibia with one ventral, one dorsal and one posterodorsal preapical seta. Mid femur with one preapical posterodorsal seta; mid tibia with one median posterior seta, apically with one antero- and one posteroventral as well as one ventral seta. Hind femur with one row of anterodorsal setae; hind tibia with one median anterodorsal seta, preapically with one dorsal seta, apically with

one anteroventral and one ventral seta, submedially with one anteroventral and one posterodorsal seta.

2.5.1 *Atherigona albicornis* sp. n.

Fig. 31

Etymology: From the Latin *albus* (white) and *cornu* (horn), *i.e.* “white-horned” referring to the characteristically white apical half of the trifoliate process with median piece having two long hyaline setulae appearing as horns.

Diagnosis: This species is most similar to *A. flavifinis* sp. n. and *A. binubila* van Emden, 1940 and also keys to the latter in Deeming (1971) and Dike (1989a). It differs, however, in having its trifoliate process’ median piece dilated, with long white apical setulae and having its lateral plates expanded (Fig. 31a), compared to that of *A. binubila* (Fig. 26a) which appear narrow. *A. albicornis* also has a tridentate hypopygial prominence (Fig. 31c) compared to that of *A. binubila* (Fig. 26c).

Male.

Description:

Body length: 3.38 mm; wing: 2.87 mm; r-m crossvein ratio: 0.447.

Head: Ground colour dark. All head setae and setulae infuscated. Occiput grey dusted posteriorly and laterally with narrow median part glossy. Ocellar triangle grey dusted, sub-shining. Frontal vitta wholly infuscated. Frontal plate grey dusted, sub-shining around bases of three pairs of proclinate frontal and two pairs of orbital setae; first pair of frontal setae only two thirds the length of the other two pairs. Parafacial silver-grey dusted, narrow. Scape, pedicel, postpedicel and arista infuscated. Palpus infuscated; apically dilated and truncated, with hyaline setulae.

Thorax: Ground colour dark. Postpronotal lobe grey dusted, with three setae and 13 setulae. Pleura grey dusted, except for area where anepisternum, anepimeron and katepisternum meet which is golden dusted. Proepisternum not conspicuously protruding. Scutum grey dusted, with three dark and clearly visible 2-4 dorsocentral vittae, extending and merging over a third the width of the scutellum. Scutellum grey dusted; one pair of basal setae, one pair of discal setae and nine discal setulae; one pair of subbasal setae and one pair of apical setae, equal in length.

Legs: All legs entirely infuscated.

Leg chaetotaxy: Apical three fore tarsal segments with long dorsal setulae, at least as long as segments are wide.

Wings: Hyaline, except for slight brown smoky suffusion at apex of Sc-R₁ and around humeral cross-vein. Veins dark brown. Knob of halteres white with stalk yellow. Calypters white.

Abdomen: All tergites yellow, grey dusted on all dorsal surfaces; tergite 1+2 with dark-brown median trapezoidal mark, reaching the apical margins, appearing to flow into tergite 3 markings; tergite 3 with two large dark-brown oblong marks taking up two thirds of dorsum width; dark clearly visible median vitta that extends to basal-half of tergite 4; tergite 4 with two small round markings, taking up a third of dorsal surface; tergite 5 with two faint small brown markings. Hypopygial prominence tridentate, with two anterior projecting processes and one medial, somewhat upwards directed process. Trifoliate process stem 2.5× the length of the apical process, hyaline on basal half, infuscated on apical half with the exception of the area surrounding the hood which is also hyaline; median piece hyaline on apical half, with slight rounded bifurcation, dilated in both posterior and lateral views, with one pair of long hyaline setulae (longer than median piece); lateral plates infuscated, wider than median piece in profile, inner lobes present. Surstylus infuscated on majority of dorsal surface.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *KwaZulu-Natal*: Royal Natal National Park, Tiger Falls area, 28°41.341'S 28°56.047'E, *Protea caffra* woodland, 17–18.ii.2010, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 19841). Paratypes 1♂: Giant's Castle Game Reserve - Injasuti area, 29°07'08.57"S 29°26'19.60"E, 5–11. xii.1983, J.G.H. Londt (NMSA).

Distribution: South Africa. Appendix 3.6 – Fig. 5A (in Chapter 3).

2.5.2 *Atherigona angulata* Deeming, 1971

Fig. 5

Atherigona angulata Deeming, 1971: 157, figs 54, 55; Deeming 1981: 105.

Diagnosis: This species can be distinguished from others by its golden/yellow vibrissae and yellow palpi and frontal vitta. Its hypopygial prominence is knoblike with an apical emargination. The trifoliate process has its median piece bent at a right-angle when viewed in profile.

Type material examined: Holotype ♂: "N. Nigeria: Zaria, Samaru, 16.ii.1969, m.v. trap (J.C. Deeming)" (BMNH).

Other material examined: 1♂ BOTSWANA: Tlokweng, Sorghum field, 6–13.iii.1990, J.M. Mashonja, Malaise trap (NMSA); NAMIBIA: 1♂ Warmbad, [-28.448034 18.734433], Koakoveld, ii.1925, SAMC Expedition (SAM-DIP A013851); 1♂ Zesfontein, ii.1925, SAMC Expedition (SAM-DIP A013846); SOUTH AFRICA: *Eastern Cape*: 3♂ 3 km NW Grahamstown, Strowan farm, Acacia grassland, 1–2.i.1986, J.G.H. Londt (NMSA); 1♂ Resolution, Grahamstown, i–iv.1928, Miss. Walton (SAM-DIP A013860); *Free State*: 3♂ Brandfort, Florisbad Research Station, 28°46.039'S 26°04.234'E, Acacia Savanna, 4–6.iv.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 05536, 05575, 05595); 3♂ Brandfort, Soetdoring Nature Reserve, Kruger's Drift, 28°51.303'S 26°02.302'E, Acacia Savanna, 5–6.iv.2009, A.H. & M.K. Kirk-Spriggs, Malaise trap (BMSA(D) 05462, 05494, 05504); *KwaZulu-Natal*: 1♂ Cathedral Peak, Didima, 28°57.000'S 29°14.395'E, 1422 m, 14–16.xii.2005, M.B. Mostovski (NMSA); 1♂ Royal Natal National Park, 28°41.362'S 28°56.327'E, 1425 m, stream, y-wood, 10–13.xii.2004, M.B. Mostovski, Malaise trap

(NMSA); 1♂ *Limpopo*: Mogol Nature Reserve, Ellisras Dist., 23°58'S 27°45'E, 19–23.xi.1979, S.J. van Tonder, C. Kok, G.L. Prinsloo & M.W. Mansell (SANCS); 1♂ *Western Cape*: 10 km S Bredasdorp, 34°37'S 20°03'E, 12.x.1994, R. Danielsson (MZLU).

Distribution: Botswana, Nigeria, South Africa. Appendix 3.6 – Fig. 5B (in Chapter 3).

2.5.3 *Atherigona angustiloba* van Emden, 1956

Fig. 30

Atherigona angustiloba van Emden, 1956: 521, figs 7, 8.

Diagnosis: This species can be distinguished from others by its infuscated frontal vitta, front half of tibia and basal two tarsal segments. Its palpi is yellow and tergite 5 is immaculate. The hypopygial prominence is knoblike with two posteriorly projecting tubercles at its apex. The trifoliate process is infuscated, with the median piece strongly dilated apically.

Type material examined: Holotype ♂: "Urundi: Bururi, 1800-2000m, 5–12.III.53. (P. BASILEWSKY) ♂ type" (MRAC).

Other material examined: *Eastern Cape*: 1♂ Grahamstown (plot 5280), Three Chimneys farm, 33°18.542'S 26°29.846'E, 2–13.iii.2008, A.H. Kirk-Spriggs, Malaise trap (AMGS); 1♂ Hogsback, North of Alice, 2–3.xi.1964, B.R. Stuckenberg & P. Stuckenberg (NMSA); 2♂ Plaatbos Forest, 33°57.863'S 23°54.484'E, 300 m, 31.iii–1.iv.2009, A.H. Kirk-Spriggs & S. Otto (BMSA(D) 05600 & 05602); 2♂ Tsitsikamma National Park, below Sleepkloof hut, 33°56.974'S 23°54.926'E, Indigenous forest, 20–22.i.2009, A.H. Kirk-Spriggs & S. Otto, Malaise trap (BMSA(D) 03272 & 03273); 1♂ *Free State*: Harrismith, Scotland farm, 27°58'59.5"S 29°37'09.8"E, dense *Leucosidea* [*Leucosidea*] dominated scrub, 10–12.xi.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 12759); *KwaZulu-Natal*: 1♂ Bulwer, Home Rule, [29.82333°S 29.6825°E], 1–2.iii.1986, A.E. Whittington (NMSA); 1♂ Cathedral Peak area, [29°00'04"S 29°16'30"E], Forest & Grassland, 14–18.ix.1982, D. Barraclough & C. Barraclough (NMSA); 1♂ Cathedral Peak area, [29°00'04"S 29°16'30"E], 4–11.iv.1977, J.G.H. Londt, ex. Malaise (NMSA); 2♂ Cathedral Peak, Didima, 28°57.000'S 29°14.395'E, 1422 m, 13–16.xii.2004, M.B. Mostovski (NMSA); 10♂ Giant's Castle [Game Reserve], 29°15.955'S 29°31.228'E, 1710 m, 8–10.xii.2004, M.B. Mostovski (NMSA); 1♂ Giant's Castle Game Reserve - Injasuti area, 29°07'08.57"S 29°26'19.60"E, 5–11.xii.1983, J.G.H. Londt (NMSA); 1♂ Karkloof Nature Reserve, 29°18'10"S 30°13'40"E, 1260 m, Mixed Podocarpus Forest Edge, 10.xii.1987, J.G.H. Londt & H. Londt (NMSA); 1♂ Midlands, Howick, 29°29'S 30°13'E, 1060 m, Streamside vegetation, 10.viii.1991, A.E. Whittington (NMSA); 1♂ Royal Natal National Park, 28°41'S 28°56'E, 1440 m, Forest margin, 23–28.iii.1991, J.G.H. Londt, Malaise trap (NMSA); 29♂ Royal Natal National Park, Thendele, 28°42.378'S 28°56.083'E, 1600 m, *Leucosedes* [*Leucosidea*] dominated scrub, 15–17.ii.2010, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 19557, 19737, 19563, 19629, 19564, 19627, 19589, 19784, 19741, 19652, 19549, 19612, 19615, 19574, 19703, 19587, 19687, 19595, 19731, 19773, 19767, 19593, 19743, 19635, 19646, 19752, 19764, 19640, 19793); 2♂ Royal Natal National Park, Thendele, 28°42.378'S 28°56.083'E, 1600 m, *Protea caffra* w/land gully, 15–17.ii.2010, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 19823 & 19826); 1♂ Royal Natal National Park, Thendele, 28°42.378'S 28°56.083'E, 1600 m, Afromontane forest fragment, 15–17.ii.2010, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 19840); 1♂ *Western Cape*: Big Tree Forest, 33°55'S 22°40'E, 400 m, Woodville, 9.ix.1993, D. Barraclough & C. Barraclough (NMSA); 1♂ Cape Town, NE of Houtbay, 34°02'S 18°20'E, 3.x.1994, R. Danielsson (MZLU).

Distribution: Burundi, South Africa. Appendix 3.6 – Fig. 5C (in Chapter 3).

2.5.4 *Atherigona aster* van Emden, 1940

Fig. 18

Atherigona aster van Emden, 1940: 117, figs 24, 46; Deeming 1981: 104, figs 13 (female tergite 8).

Diagnosis: This species can be distinguished from others by the combination of its yellow frontal vitta and very distinctly shaped hypopygial prominence which has a blunt central tubercle and four sharply defined tubercles that are quadrately arranged.

Type material examined: Holotype ♂ KENYA: Naivasha, vii.1937 (H.J.A. Turner) (BMNH).

Paratype ♂ Same label data as Holotype (BMNH).

Other material examined: 1♂ SOUTH AFRICA: *KwaZulu-Natal*: Mkuze Reserve, 3–11.x.1977, J.G.H. Londt, ex. Malaise (NMSA); 1♂ SWAZILAND: 13 km N of Ngogolo, Panata Ranch, 26°19'S 31°38'E, 300 m, Bushveld, 22–24.iv.1991, J.G.H. Londt & L. Schoeman (NMSA).

Distribution: Democratic Republic of the Congo, Kenya, South Africa (new), Swaziland (new). Appendix 3.6 – Fig. 5D (in Chapter 3).

2.5.5 *Atherigona aurifacies* van Emden, 1940

Fig. 12

Atherigona aurifacies van Emden, 1940: 136, figs 9, 40; Deeming 1971: 176, figs 127–129.

Diagnosis: This species can be distinguished from others by its infuscated antennae, frontal vitta and palpi. The hypopygial prominence is in the shape of a truncated knob with its apex emarginated. The trifoliolate process has its median piece narrow throughout its length in profile, with only a slight apical dilation. Tergite 3 is immaculate or with only slight brownish shadows.

Type material examined: Holotype ♂ UGANDA: Ruwenzori Range: xii.1924–i.1935. B.M.E. Afr. Exp. B.M. 1935-203; Kilembe; 4500ft; F.W. Edwards (BMNH).

Other material examined: 1♂ KENYA: Rift Valley, Ol Arabe Gorge, 11.xi.1988, R.K. Butlin, leg. Deeming (NMSA) (Previously NMW.Z.1988–167); 1♂ SOUTH AFRICA: *Western Cape*: 5 km SW Swellendam, Breede river, Rocky slope above Breede river, 24.ix.1979, J.G.H. Londt, leg. B.S. Muller (NMSA).

Distribution: Burkina Faso, Burundi, Cameroon, Kenya, Nigeria, Rwanda, South Africa, Uganda. Appendix 3.6 – Fig. 6A (in Chapter 3).

2.5.6 *Atherigona bedfordi* van Emden, 1940

Fig. 42

Atherigona bedfordi van Emden, 1940: 120, figs 27, 55; Deeming 2000: 284.

Atherigona humeralis (Wiedemann, 1830), (synonymy reversed): Deeming: 1979.

Diagnosis: This species can be distinguished from others by its yellow frontal vitta, palpi and legs. The postpedicel is also mainly ferruginous. The hypopygial prominence

is in the shape of two fused triangles. The trifoliolate process has its median piece emarginated and strongly dilated apically.

Type material examined: Holotype ♂ [SUDAN]: Shendi; A.H. Husein; 14.xi.28; Bred on ?Pura? (BMNH).

Other material examined: 1♂ SAUDI ARABIA: Aseer, Maraba, 1–30.v.2004, H.A. Dawah, Malaise trap (NMSA); 1♂ SOUTH AFRICA: *KwaZulu-Natal*: Ndumu [Ndumo] Game Reserve, Camp & Riverine bush, 4–9.x.1982, J.G.H. Londt (NMSA).

Distribution: Angola, Chad, The Gambia, Kenya, Madagascar, Mali, Namibia, Nigeria, Senegal, Seychelles, South Africa (new). Appendix 3.6 – Fig. 6B (in Chapter 3).

2.5.7 *Atherigona bimaculata* Stein, 1910

Fig. 8

Atherigona bimaculata Stein, 1910: 157; van Emden 1940: 116, figs 6, 34; van Emden 1956: 519; Deeming 1971: 153, figs 30–32.

Diagnosis: This species can be distinguished from others by the very unique setal arrangement on tergite 5 – a strongly developed seta is present on the posterior margin of each dorsal spot. Its wings have dark smoky suffusions over the humeral crossvein and Sc-R₁. The frontal plates of the head are glossy, shining black. The hypopygial prominence is in the shape of a rounded knob.

Type material examined: Lectotype ♂ [REPUBLIC OF SEYCHELLES]: Silhouette' 08 Seychelles Exp.; Seychelles Is.; Prof J.S. Gardner; 1914-537 (BMNH).

Paralectotype ♂ Fundorte. Seychelles: Ziemlich zahlreich auf silhouette VIII. 1908 und Mahé (Morne Blanc, X., XI. 1908, Cascade Estate, I. 1909) (ZMHB).

Other material examined: 1♂ MALI: Yanfolila, 9.ix–7.x.1986, J. Durham, leg. Deeming (NMSA) (Previously NMW.Z.1987–144); SOUTH AFRICA: *KwaZulu-Natal*: 1♂ 15 km SE Ingwavuma, Bushy area with big trees, 21.ii.1979, J.G.H. Londt, ex Malaise trap (NMSA); 1♂ Ndumo Game Reserve, main road, 26°54.288'S 32°17.974'E, Sand and broad-leaved deciduous forest, 4–8.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 17954); 1♂ Port Edward, 31°03'S 30°13'E, 8.vi.1997, K.R. Cradock, Malaise trap (NMSA); 1♂ Ramsgate, Riverine bush, 11–20.i.1985, J.G.H. Londt, Malaise trap (NMSA); 1♂ Ramsgate Butterfly Sanctuary, 30°53.3'S 30°20.4'E, 26–29.iv.2004, M.B. Mostovski, light trap (NMSA); 1♂ Zululand, Ndumu [Ndumo] Game Reserve, 26.x.1972, M.E. Irwin (NMSA).

Distribution: Cameroon, Congo, Democratic Republic of the Congo, Kenya, Madagascar, Mali, Mauritius, Nigeria, Rwanda, Senegal, Seychelles, South Africa (new). Appendix 3.6 – Fig. 6C (in Chapter 3).

2.5.8 *Atherigona binubila* van Emden, 1940

Fig. 26

Atherigona binubila van Emden, 1940: 138, fig. 10; Deeming 1971: 180, figs 151, 152; 1979: 48, fig. 46.

Diagnosis: This species can be distinguished from others by its infuscated frontal vitta and palpi. The wings have brownish suffusions over the humeral crossvein and Sc-R₁.

The hypopygial prominence is knoblike, with two strongly projecting tubercles and the trifoliate process has its median piece and lateral plates narrow.

Type material examined: Holotype ♂: KENYA: “Van Someren, Nairod[b]i, ix. 1937” (BMNH).

Distribution: Kenya, Mali, Nigeria, South Africa, Zimbabwe (No South African map data).

2.5.9 *Atherigona budongoana* van Emden, 1940

Fig. 22

Atherigona bundongoana van Emden, 1940: 131, figs 23, 59; Deeming 1971: 176, figs 125, 126; Deeming 1979: 45, fig. 34 (female tergite 8).

Diagnosis: This species can be distinguished from others by the combination of either yellow or infuscated (see below) frontal vitta, yellow palpi and legs. The hypopygial prominence is truncated with extended lateral ridges leading towards anteriorly projecting tubercles. The trifoliate process has the median piece greatly dilated in profile, being wider than the lateral plates.

Type material examined: Holotype ♂: UGANDA: Budongo Forest, 7–8.ii.1935, F.W. Edwards. B.M. 1935-203 (BMNH).

Other material examined:

Infuscated frontal vitta: SOUTH AFRICA: 1♂ *Eastern Cape*: Hogsback, Tyume Forest, 32°36.174'S 26°56.303'E, 1166 m, Indigenous Afromontane forest, 10.iv.2010, A.H. Kirk-Spriggs & V. Swart, Malaise trap (BMSA(D) 20085); *KwaZulu-Natal*: 1♂ Cathedral Peak area, 7–12.iv.1982, J.G.H. Londt, ex. Malaise (NMSA); 1♂ Cathedral Peak, Didima, 28°57.000'S 29°14.395'E, 1422 m, 13–16.xii.2004, M.B. Mostovski (NMSA); 1♂ Cathedral Peak, Didima, 28°57.000'S 29°14.395'E, 1422 m, 14–16.xii.2005, M.B. Mostovski (NMSA); 30♂ Royal Natal National Park, Mahai campsite area, 28°41.386'S 28°56.288'E, Straddling Mahai River, 17–18.ii.2010, A.H. Kirk-Spriggs & V. de Swart, Malaise trap (BMSA(D) 19814, 19820, 19677, 19676, 19693, 19717, 19571, 19718, 19551, 19824, 19775, 19643, 19546, 19783, 19697, 19721, 19756, 19667, 19576, 19613, 19789, 19716, 19672, 19639, 19778, 19644, 19732, 19769, 19688, 19560); 1♂ Royal Natal National Park, Tugela Valley, 3.iv.1951, Brinck & Rudebeck (MZLU); 1♂ Weenen Nature Reserve, 28°51'S 29°59'E, Thornveld, 1–4.x.1990, A.E. Whittington, Malaise trap (NMSA); 1♂ *Mpumalanga*: White River, 5.iii.1953 (BMNH); 1♂ *North West Province*: Rustenburg Nature Reserve, 25°40'S 27°12'E, 17–20.iii.1980, C.D. Eardley, W.A. Harrop & C.G. Moolman, Malaise trap (SANC).

Yellow frontal vitta: SOUTH AFRICA: *KwaZulu-Natal*: 2♂ Royal Natal National Park, Thendele, 28°42.378'S 28°56.083'E, 1600 m, *Leucosedes* [*Leucosidea*] dominated scrub, 15–17.ii.2010, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 19605, 19568). 1♂ Louwsberg, iGwala Gwala, 27°34'S 31°17.9'E, 1090 m, 2–3.vi.2005, M.B. Mostovski, YPT (NMSA); 1♂ Cathedral Peak, Didima, 28°57.000'S 29°14.395'E, 1422 m, 13–16.xii.2004, M.B. Mostovski (NMSA); 1♂ *Mpumalanga*: Baberton, xii.1978, C.D. Eardley (SANC).

Distribution: Burkino Faso, Democratic Republic of the Congo, Kenya, Nigeria, South Africa (new), Uganda. Appendix 3.6 – Fig. 6D (in Chapter 3).

Remarks: The specimens with yellow frontal vitta would key to near *A. pallidipleura* Deeming, 1971 when using the key to Afrotropical species in Dike (1989a), but differ from it in having the frontal vitta yellow instead of infuscated. Also the trifoliate process shape did not match. If run through the key as having the frontal vitta infuscated, they key to *A. budongoana*. This then is the first record of variation in frontal vitta colour for this species.

2.5.10

Atherigona capitulata sp. n.

Fig. 14

Etymology: From the Latin *capitulatus* (ending in a small head), referring to the size of the apex of the median piece in comparison to the rest of the structure when viewed in profile.

Diagnosis: This species is most similar to *A. griseiventris* van Emden, 1940, and also keys to it in Deeming (1971) and Dike (1989a). The median piece (Fig. 14a, b) of the trifoliate process looks quite similar in profile to that of *A. griseiventris* (Fig. 13a, b), but lacks the apical dilation when viewed posteriorly; the lateral plates are also shaped entirely different, appearing twisted (Fig. 14b), compared to that of *A. griseiventris* (Fig. 13a). Furthermore, the hypopygial prominence of *A. capitulata* is without any apical emargination, compared to *A. griseiventris*.

Male.

Description:

Body length: 3.844 mm; wing: 3.344 mm; r-m crossvein ratio: 0.392.

Head: Ground colour dark. All head setae and setulae infuscated. Occiput silver-grey dusted posteriorly and laterally with narrow median part glossy. Ocellar triangle silver-grey dusted. Frontal vitta infuscated. Frontal plate silver-grey dusted with three pairs of proclinate frontal setae and two pairs of orbital setae. Parafacial silver-grey dusted on upper and gold dusted on lower half, slightly wider than arisal base. Scape and pedicel infuscated with ferruginous margins, postpedicel and arista entirely infuscated. Palpus entirely infuscated; apex truncated and dilated, with hyaline hairs and yellow vertex.

Thorax: Ground colour dark. Postpronotal lobe gold dusted, with three setae and 10 setulae. Pleura silver-grey dusted. Proepisternum inconspicuous, gold dusted. Scutum grey dusted, with three 2-4 dorsocentral vittae, stopping before scutellum. Scutellum grey dusted; one pair of basal setae, one pair of discal setae and 8 discal setulae, one pair of subbasal setae, being 0.75× the one pair of apical setae.

Legs: All legs yellow except for foreleg with apical half of tibia and entire basitarsus infuscated.

Leg chaetotaxy: Fore tarsi with apical three segments having erect setulae on dorsal surface.

Wings: Hyaline. Veins brown. Halteres white. Calypters white.

Abdomen: All tergites yellow; tergite 1+2 with dark wide marking taking up most of dorsal surface; tergite 3 with two medium sized dark-brown marks taking up just over two thirds of dorsal surface; tergite 4 with two small round markings, taking up a third of dorsal surface; tergite 5 immaculate. Hypopygial prominence knoblike. Trifoliolate process stem 2.8× the length of the apical process; entire trifoliolate process infuscated; median piece linear in posterior view, very broad in profile, almost shaped like an axe-head, much wider than lateral plates; lateral plates without inner lobe, narrow in both posterior view and profile. Surstylus with dark markings at base dorsally.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *KwaZulu-Natal*: Louwsberg, iGwala Gwala, 27°34'S 31°17.9'E, 1090 m, 2–3.vi.2005, M.B. Mostovski, YPT [yellow pan trap] (NMSA).

Paratypes: 15♂ same data as Holotype (NMSA).

Distribution: South Africa. Appendix 3.6 – Fig. 6E (in Chapter 3).

2.5.11 *Atherigona chirinda* Dike, 1989

Fig. 35

Atherigona chirinda Dike, 1989b: 75, figs 6, 7.

Diagnosis: This species can be distinguished from others by the combination of its yellow frontal vitta, palpi and legs, infuscated postpedicel, tridentate hypopygial prominence and trifoliolate process with median piece filiform except for a dilated, emarginated apex. The trifoliolate process also has its hood reduced.

Type material examined: Holotype ♂: [ZIMBABWE]: “Mt. Chirinda, Mashonaland; 3800ft; 12.6.11; C.F.M. Swynnerton; 1912–117” (BMNH).

Distribution: Zimbabwe. Known distribution erroneously given by Dike (2003) as South Africa (No South African map data).

2.5.12 *Atherigona chrysohypene* sp. n.

Fig. 46

Etymology: From the Greek *chrysops* (golden) and *hypene* (moustache), referring to the very characteristic golden yellow vibrissae on the jowls.

Diagnosis: This species has golden yellow vibrissae, similar to that of *A. angulata* (Fig. 5) and *A. pulla* (Wiedemann, 1830) (Fig. 6) and keys to *A. marginifolia* van Emden, 1940 (Fig. 19) in Deeming (1971) as well as Dike (1989a), but differs greatly in the overall structure and colouring of the trifoliolate process and shape of the hypopygial prominence (Fig. 4).

Male.

Description:

Body length: 3.162 mm; wing: 2.8 mm; r-m crossvein ratio: 0.403.

Head: Ground colour dark. All head setae and setulae infuscated except for vibrissae which are all golden yellow. Occiput grey dusted with narrow median part glossy, laterally golden dusted. Ocellar triangle grey dusted. Frontal vitta infuscated in basal and yellow in apical half. Frontal plate entirely grey dusted with three pairs of proclinate frontal setae and two pairs of orbital setae. Parafacial golden dusted, wider at narrowest than arisal base. Scape, pedicel and postpedicel ferruginous (some paratypes with dorsal margins of postpedicel infuscate). Arista brown. Palpus yellow; apex truncated and dilated, with hyaline hairs.

Thorax: Ground colour dark. Postpronotal lobe golden dusted, with three setae and 11 setulae. Pleura golden dusted except for meron which is grey dusted. Proepisternum inconspicuous and gold dusted. Scutum grey dusted, with three very faint, barely visible 2-4 dorsocentral vittae, stopping before scutellum. Scutellum grey dusted; one pair of basal setae, one pair of discal setae and six discal setulae, one pair of subbasal setae and one stronger pair of apical setae (subbasal 0.7× apical).

Legs: All legs yellow except for fore tibia and tarsi which are entirely infuscated.

Leg chaetotaxy: All fore tarsi except for basitarsus with long dorsal setulae.

Wings: Hyaline, except for slight brown smoky suffusion at areas surrounding Sc-R₁ and the humeral crossvein. Veins dark brown. Knob of halteres white with stalk yellow. Calypters white.

Abdomen: All tergites yellow; tergite 1+2 immaculate; tergites 3 and 4 with a pair of small dark spots, taking up a third of dorsal surface; tergite 5 immaculate. Hypopygial prominence bilobate. Trifoliate process stem 2.5× the length of the apical process; stem and hood lighter than rest of process which is infuscated, lateral plates and median piece infuscated; median piece apically dilated, cordiform, wider than lateral plates in posterior view; lateral plates without inner lobes. Surstylus without dark markings.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *Free State:* Brandfort, Florisbad Research Station, 28°46.039'S 26°04.234'E, Acacia Savanna, 4–6.iv.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 05557).

Paratypes: 4♂ same data as Holotype (BMSA(D) 05522, 05523, 5546, 05566).

Other material examined: SOUTH AFRICA: 2♂ *Eastern Cape:* Grahamstown (plot 5280), Three Chimneys farm, 33°18.542'S 26°29.846'E, 2–13.iii.2008, A.H. Kirk-Spriggs, Malaise trap (AMGS); 1♂ *Free State:* 42 km SW of Winburg, 28°45'S 26°45'E, 1500 m, Grassland & bushes, 20.iii.1991, J.G.H. Londt & A.E. Whittington (NMSA); 2♂ *Gauteng:* Johannesburg, 18.i.1953, Paterson (BMNH); 1♂ Johannesburg, 26.xii.1946, F. Zumpt (BMNH); 1♂ Pretoria, 26.ii.1916, C.J. Swierstra (NMSA); 1♂ Royal Natal National Park, 28°41.362'S 28°56.327'E, 1425 m, stream, y-wood, 10–13.xii.2004, M.B. Mostovski, Malaise trap (NMSA).

Distribution: South Africa. Appendix 3.6 – Fig. 6F (in Chapter 3).

2.5.13*Atherigona cinarina* Séguy, 1938

Fig. 36

Atherigona cinarina Séguy, 1938: 371; van Emden 1956: 520, figs 5, 6.

Diagnosis: This species can be distinguished from others by the combination of its frontal vitta being infuscated on the basal half and yellow on apical half, postpedical yellow with infuscated dorsal and apical margins and yellow palpi. The trifoliate process has its median piece wider at its base than at apex when viewed in profile, and the process has a pair of long setulae apically. The median piece and lateral plates also have distinctive fine setulae on their surfaces.

Type material examined: Holotype ♂: KENYA: Mars; Kitale; Uashin Gishu; 2100m (MNHN).

Distribution: Burundi, Ethiopia, Kenya, Nigeria, Rwanda, South Africa, Uganda (No South African map data).

2.5.14*Atherigona convexa* sp. n.

Fig. 57

Etymology: From the Latin *convexus* (arched outward), referring to the convex apex of the median piece of the trifoliate process.

Diagnosis: This species is very similar to *Atherigona oryzae* Malloch, 1925, with *A. oryzae* keying to *A. convexa* in this manuscript key. However, *A. convexa* differs from *A. oryzae* in the following aspects: fore femur immaculate vs. having a dark marking apically; median piece of the trifoliate not membraneous as in *oryzae*; the stem of the trifoliate process linear compared to being swollen in *A. oryzae*; *A. convexa* with wing without a dark marking in area surrounding Sc-R₁.

Male.

Description:

Body length: 3.08 mm; wing: 2.64 mm; r-m crossvein ratio: 0.426.

Head: Ground colour dark. All head setae and setulae infuscated. Occiput silver-grey dusted throughout with narrow median part glossy, also laterally silver-grey dusted. Ocellar triangle grey dusted. Frontal vitta infuscated with dull reddish suffusion. Frontal plate silver-grey dusted throughout with three pairs of proclinate frontal setae and two pairs of orbital setae. Parafacial golden-silver dusted, at narrowest only slightly wider than arista base. Scape and pedicel infuscated with ferruginous margins, postpedicel infuscated except for very narrow basal area. Arista brown. Palpus yellow on apical half, infuscated on basal half, apex truncated and dilated with hyaline hairs.

Thorax: Ground colour dark. Postpronotal lobe gold dusted anteriorly and silver-grey posteriorly, with three setae and 10 setulae. Pleura entirely silver-grey dusted;

Proepisternum inconspicuous and gold dusted. Scutum grey dusted throughout, with three faint 2-4 dorsocentral vittae, stopping before scutellum. Scutellum grey dusted; one pair of basal setae, one pair of discal setae and nine discal setulae, one pair of subbasal setae and one pair of apical setae (subbasal and apical setae equal).

Legs: All legs yellow except for apical third of fore tibia and fore basitarsus together with following tarsal segment, which are infuscated.

Leg chaetotaxy: Fore tarsi without any specialised chaetotaxy.

Wings: Hyaline. Veins brown. Knob of halteres white with stalk yellow. Calypters white.

Abdomen: All tergites yellow; tergite 1+2 immaculate; tergite 3 with a pair of large oblong marks, taking up two thirds of dorsal surface, with the rest being grey dusted; tergite 4 with small round markings, taking up a third of dorsal surface; tergite 5 immaculate. Hypopygial prominence bifurcated. Trifoliate process stem 3× the length of the apical process; lateral plates infuscated, all other parts brown; median piece strongly dilated at apex in profile and in posterior view; lateral plates appearing just as wide as median piece dilation in profile, with small inner lobes in some specimens, in some other difficult to perceive. Surstylus not infuscated.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *KwaZulu-Natal*: Ndumo Game Reserve, Shokwe area, 26°52.125'S 32°13.731'E, Ficus forest, 30.xi–4.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 16351).

Paratype ♂: SOUTH AFRICA: *KwaZulu-Natal*: Ndumo Game Reserve, main road, 26°54.288'S 32°17.974'E, Sand and broad-leafed deciduous forest, 4–8.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 17545).

Other material examined: 2♂ *Gauteng*: Johannesburg, 18.i.1953, Paterson (BMNH); 1♂ *Free State*: Brandfort, Florisbad Research Station, 28°46.039'S 26°04.234'E, Acacia Savanna, 4–6.iv.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 05584).

Distribution: South Africa. Appendix 3.6 – Fig. 7A (in Chapter 3).

2.5.15

Atherigona danielssoni sp. n.

Fig. 60

Etymology: Named after the collector of the holotype, Dr Roy Danielsson.

Diagnosis: This species keys to *Atherigona ochripes* Deeming, 1981 in Dike (1989a). *A. danielssoni* differs, however, in having the hypopygial prominence weakly bifurcated and projecting compared to truncated and emarginated in *A. ochripes*. The trifoliate process of the new species also differs in coloration as well as structure, most notably in having inner lobes on its lateral plates compared to that of *A. ochripes* that do not.

Male.

Description:

Body length: 3.379 mm; wing: 2.52 mm; r-m crossvein ratio: 0.411.

Head: Ground colour brown. All head setae and setulae infuscated. Occiput grey dusted throughout with narrow median part glossy, laterally silver-grey dusted. Ocellar triangle grey dusted. Frontal vitta infuscated, slightly ferruginous apically. Frontal plate grey dusted with three pairs of proclinate frontal setae and two pairs of orbital setae. Parafacial silver-grey dusted, as wide as arisal base at narrowest. Scape and pedicel ferruginous, postpedicel infuscated except for extreme basal area. Arista brown. Palpus yellow, apex truncated and dilated with hyaline hairs.

Thorax: Ground colour dark. Postpronotal lobe grey dusted, with three setae and 13 setulae. Pleura entirely grey dusted, Proepisternum inconspicuous and grey dusted. Scutum grey dusted throughout, with three very faint and barely visible 2-4 dorsocentral vittae, stopping before scutellum. Scutellum grey dusted; one pair of basal setae, one pair of discal setae and eight discal setulae, one pair of subbasal setae and one pair of apical setae (cannot compare subbasal and apical due to damage to the latter).

Legs: All legs yellow except for fore basitarsus and extreme apex of fore tibia which appears darker than the rest of legs.

Leg chaetotaxy: Fore femur with one submedial posteroventral seta; dorsal surface of fore tarsi, except for basitarsus with long setulae (at least as long as width of segments).

Wings: Hyaline. Veins light brown. Knob of halteres white with stalk yellow. Calypters white.

Abdomen: All tergites yellow; tergite 1+2 immaculate; tergite 3 with a pair oblong dark markings taking up two thirds of dorsal surface; tergites 4 with a pair of small brown spots taking up a third of dorsal surface; tergite 5 immaculate. Hypopygial prominence bifurcated. Trifoliate process stem 3× the length of the apical process; entirely infuscated except for apical third of stem which is hyaline, and the hood and centres of the lateral plates which are much lighter than the rest; median piece gradually dilated towards apex, appearing somewhat club-like in posterior view, linear in profile with an overall curved appearance; lateral plates with inner lobes, appearing wider than median piece in profile and posterior view. Surstylus slightly infuscated at base and entire apex.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *KwaZulu-Natal*: 17 km NE Empangeni, Nseleni River, 28°42'S 32°01'E, 24.x.1994, R. Danielsson (MZLU).

Distribution: South Africa. Appendix 3.6 – Fig. 7B (in Chapter 3).

2.5.16 *Atherigona decempilosa* Dike, 1989

Fig. 25

Atherigona decempilosa Dike, 1989b: 76, figs 8–10.

Diagnosis: This species can be distinguished from others by its infuscated frontal vitta, antennae and palpi in combination with its legs having some degree of infuscation on all segments. The trifoliate process and hypopygial prominence appearing as in the redescription below and Fig. 25.

Redescription: Upon inspection of the Holotype, I found that the figures for the hypopygial prominence used in Dike (1989a, 1989b) were incorrect and illustrated an entirely different shape, differing from the holotype material in that the hypopygial prominence was figured as plain knoblike, where in reality it is knoblike with a pair of lateral anteriorly projecting processes. The hood of the trifoliate process was also illustrated as simplified and not figured as well-developed and without an emargination at its posteroventral edge.

Type material examined: Holotype ♂: *KwaZulu-Natal*: Giants Castle Res. Natal Drakensberg, S. Africa. 5800ft. B. & P. Stuckenberg, 18–23 Sept. 1961 (NMSA); NMSA type nr. 1724.

Paratypes: 4♀ same label data as Holotype (NMSA).

Other material examined: SOUTH AFRICA: 2♂ *Free State*: Harrismith, Scotland farm, 27°58'59.5"S 29°37'09.8"E, dense *Leucosidea* [*Leucosidea*] dominated scrub, 10–12.xi.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 12781, 12783); *KwaZulu-Natal*: 1♂ Cathedral Peak area, Forest & Grassland, 14–18.ix.1982, D. Barraclough & C. Barraclough (NMSA); 1♂ Cathedral Peak, Didima, 28°57.000'S 29°14.395'E, 1422 m, 13–16.xii.2004, M.B. Mostovski (NMSA).

Distribution: South Africa. Appendix 3.6 – Fig. 7C (in Chapter 3).

2.5.17 *Atherigona divergens* Stein, 1913

Fig. 1

Atherigona divergens Stein, 1913: 532; Deeming 1971: 183.

Atherigona hancocki van Emden, 1940: 113, **syn n.**

Diagnosis: This species is easily distinguishable from others by its projecting and knobshaped proepisternum with 4 equally developed and strong setae, and its very complex and uniquely shaped quinquefoliate “trifoliate process” (Fig. 1).

Type material examined:

Holotype ♂ of *A. divergens*: SOUTH AFRICA: *KwaZulu-Natal*: Durban, F. Muir (ZMHB).

Holotype ♂ of *A. hancocki*: UGANDA: Kampala; G.L.R. Hancock; 18.iv.1926. Van Emden 1940 (MRAC).

Other material examined: SOUTH AFRICA: *KwaZulu-Natal*: 1♂ Drakensberg Garden Caravan Park, 29°45'S 29°15'E, ca. 1750 m, On Cassine flowers, 6–11.i.1988, J.G.H. Londt (NMSA); 5♂ Empangeni, 28°38'S 31°42'E, 5–15.i.1990, P.E. Reavell, Malaise trap (NMSA); 1♂ Port Edward, 31°03'S 30°13'E, 9.iv.1997, K.R. Cradock, Malaise trap (NMSA); 1♂ Royal Natal National Park, 28°41.362'S 28°56.327'E,

1425 m, stream, y-wood, 10–13.xii.2004, M.B. Mostovski, Malaise trap (NMSA); 4♂ Royal Natal National Park, Thendele, 28°42.378'S 28°56.083'E, 1600 m, *Leucosedes* [*Leucosidea*] dominated scrub, 15–17.ii.2010, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 19729, 19592, 19742, 19797).

Distribution: as *A. divergens*: South Africa; as *A. hancocki*: Burkina Faso, Cameroon, Kenya, Rwanda, South Africa, Tanzania, Uganda. Appendix 3.6 – Fig. 7D (in Chapter 3).

Discussion: *A. hancocki* van Emden has since its initial description been one of the stranger species within the subgenus, with it being the only species with a quinquefoliate “trifoliate process”. One could be excused for thinking it impossible that it could actually become a junior synonym. *A. divergens* Stein is currently housed in the ZMHB, after being thought lost together with numerous other *Atherigona* types until its “rediscovery” in the early 2000s. *A. divergens* has a relatively incomplete description (as do most species described at that time), but I was fortunate enough to have been able to examine both *A. divergens* and *A. hancocki*, and was able to compare the holotype of *A. divergens* to the original description of *A. hancocki*, as well as the holotype, and it is identical to many of the diagnostic features of *A. hancocki*, viz. the proepisternum knobshaped with four equally developed and strong setae; the hypopygial prominence absent; the frontal plates infuscated and glossy; the frontal vitta dull infuscated. Unfortunately the trifoliate process of *A. divergens* is missing so that cannot be compared. From the combination of characters (many considered unique to *A. hancocki*), *Atherigona hancocki* is hereby designated as a junior synonym of *Atherigona divergens*.

2.5.18

Atherigona erectisetula sp. n.

Fig. 20

Etymology: From the Latin *erectus* (erect) and *setula*, bringing attention to the four erect setulae at the apex of the trifoliate process’ median piece.

Diagnosis: This species keys close to *A. hyalinipennis* and *A. pharalis* in both Deeming (1971) and Dike (1989a), but the shape and appearance of its trifoliate process as well as hypopygial prominence differs from that of *A. pharalis*, as it has four erect setae at the apex of a club-shaped median piece of the trifoliate process compared to a y-shaped median piece. The trifoliate process also has no visible tomentum compared to that of *A. pharalis* which is tomentose. *A. erectisetula* differs from *A. hyalinipennis* in having its postpedicel infuscated as opposed to being only infuscated along the dorsal margins. *A. erectisetula* furthermore has its median piece of the trifoliate process much narrower in posterior view, with the entire process much more infuscated compared to that of *A. hyalinipennis* which has the basal third of the lateral plates hyaline (Fig. 20 vs. Fig. 49).

Male.

Description:

Body length: 3.193 mm; wing: 2.741 mm; r-m crossvein ratio: 0.442.

Head: Ground colour brown. All head setae and setulae infuscated. Occiput silver-grey dusted posteriorly and laterally with narrow median part glossy. Ocellar triangle silver-grey dusted. Frontal vitta yellow. Frontal plate silver-grey dusted with three pairs of proclinate frontal setae and two pairs of orbital setae. Parafacial silver-grey dusted, at narrowest wider than arista base. Scape and pedicel darkly ferruginous, postpedicel infuscated, ferruginous basally. Arista brown. Palpus entirely yellow; apex truncated and dilated, with hyaline hairs.

Thorax: Ground colour dark. Postpronotal lobe gold dusted, with three setae and nine setulae. Pleura silver-grey. Proepisternum inconspicuous and gold dusted. Scutum grey dusted, with three very faint, barely visible 2-4 dorsocentral vittae, stopping before scutellum. Scutellum grey dusted; one pair of basal setae, one pair of discal setae and four discal setulae, one pair of subbasal setae and one stronger pair of apical setae (almost equal in length).

Legs: All legs yellow except for forelegs with apical third of femur with dark mark, apical half to third of tibia and tarsi infuscated.

Leg chaetotaxy: Fore tarsi without any specialised chaetotaxy.

Wings: Hyaline. Veins light brown. Knob of halteres white with stalk yellow. Calypters white.

Abdomen: All tergites yellow; tergite 1+2 immaculate; tergite 3 with small dark-brown marks taking up less than a third of dorsal surface; tergite 4 with two small round markings, taking up a third of dorsal surface; tergite 5 immaculate. Hypopygial prominence knoblike, apically appearing bilobate in anterior view, appearing almost tridentate in apical view. Trifoliate process stem 2.5× the length of the apical process; stem and hood hyaline, lateral plates and median piece infuscated; median piece with gradual dilation towards apex in both profile and posterior view (club shaped), narrower than lateral plates, with four conspicuous setulae at apex; lateral plates with inner lobes. Surstylus without dark markings.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *Eastern Cape:* Grahamstown, Albany Museum grounds, 33°18.822'S 26°31.315'E, 15–23.x.2007, A.H. Kirk-Spriggs, Malaise trap (AMGS).

Paratypes: *Eastern Cape:* 2♂ same data as Holotype (AMGS); 1♂ Baviaanskloof Nature Reserve, Bergplaas trail hut, 33°38.075'S 24°29.306'E, grassy fynbos, 28.i.2009, A.H. Kirk-Spriggs & S. Otto, Sweeping (BMSA(D) 04574); *KwaZulu-Natal:* 1♂ Ndumo Game Reserve, Shokwe area, 26°52.125'S 32°13.731'E, Ficus forest, 30.xi–4.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 15751); 3♂ *Western Cape:* De Hoop Nature Reserve, 34°27'S 20°25'E, 0–200 m, 10–13.x.1994, R. Danielsson (MZLU); 2♂ Malgas, 34°20'S 20°30'E, 40 m, 11–13.x.1994, R. Danielsson (MZLU). 1♂ *North West*

Province: S.A. Lombaard Nature Reserve, 27°36'05"S 25°28'51"E, 1230 m, Rhus, Acacia savanna, 11.iii.2003, J.G.H. Londt, Malaise and light traps (NMSA).

Distribution: South Africa. Appendix 3.6 – Fig. 7E (in Chapter 3).

2.5.19 *Atherigona falcata* (Thomson, 1869)

Fig. 23

Coenosia falcata Thomson, 1869: 560.

Atherigona nudiseta Malloch, 1923: 186.

Atherigona falcata: Deeming 1975: 2, figs 1–2.

Diagnosis (Based on Pont 1986): This species can be distinguished from others with yellow frontal vitta and palpi by the entirely yellow fore femur and specialised chaetotaxy (short erect anterodorsal hairs on tarsomeres 2 or 3–5 of the fore leg). The species further has a very distinct trifoliate process (Fig. 23a).

Type material: Holotype material housed in CNCI, but not seen.

Other material examined: 1♂ NAMIBIA: Caprivi Park, Kwando Meander, Kwando River, 17°50'49"S 23°18'53"E, Swept from floating vegetation, mainly grasses, 5.xii.1999, D.J. Mann, Sweep net (NMSA).

Distribution: Namibia, South Africa (No South African map data).

2.5.20 *Atherigona falkei* Deeming, 1981

Fig. 59

Atherigona falkei Deeming, 1981: 106, figs 21–23.

Diagnosis (based on original description): Similar to *A. nigeriensis* Deeming, 1971 in having the frontal vitta entirely infuscated, but differs in having the palpi wholly yellow. Median piece of trifoliate process is also narrow throughout its length in profile and the lateral plates have a toothlike inner lobe.

Type material: Holotype material housed in CNCI, but not seen.

Other material examined: SOUTH AFRICA: 1♂ *Mpumalanga*: White River, 5.iii.1953 (BMNH).

Distribution: South Africa, Uganda. Appendix 3.6 – Fig. 7E (in Chapter 3).

2.5.21 *Atherigona flavifinis* sp. n.

Fig. 16

Etymology: From the Latin *flavus* (yellow) and *finis* (boundary), for the scutellum being yellow on its apical edge.

Diagnosis: This species is very similar to *A. binubila* and *A. albicornis* sp. n. in general appearance, having similar smoky patches on wings (also tergite 1+2 appearing very similar in *A. albicornis* sp. n.). It differs from them, however, in the shape of the trifoliate process and hypopygial prominence (Fig. 16 vs. Figs 26 and 31).

Male.

Description:

Body length: 4.028 mm; wing: 3.16 mm; r-m crossvein ratio: 0.369.

Head: Ground colour dark. All head setae and setulae infuscated. Occiput silver-grey dusted posteriorly and laterally with narrow median part glossy. Ocellar triangle silver-grey dusted. Frontal vitta infuscated. Frontal plate silver-grey dusted with three pairs of proclinate frontal setae and two pairs of orbital setae. Parafacial silver-grey dusted, narrower than arista base. Scape and pedicel darkly ferruginous, postpedicel and arista infuscated. Palpus entirely infuscated; apex truncated and dilated, palpus appearing almost straplike.

Thorax: Ground colour dark. Postpronotal lobe gold dusted, with three setae and 10 setulae. Pleura golden dusted. Proepisternum inconspicuous. Scutum grey dusted, with three weak and barely visible 2-4 dorsocentral vittae, stopping before scutellum. Scutellum grey dusted; one pair of basal setae, one pair of discal setae and 8 discal setulae, one pair of subbasal setae, being 0.8× the one pair of apical setae.

Legs: All legs yellow except for forelegs with femur having dark apical marks laterally, tibia with apical third infuscated as well as tarsi.

Leg chaetotaxy: Fore tarsi without any specialised chaetotaxy.

Wings: Hyaline, except for prominent dark brown smoky suffusion in area surrounding Sc-R₁ and around humeral crossvein Veins dark brown. Knob of halteres white with stalk yellow. Calypters white.

Abdomen: All tergites yellow, with tergite 3 and 4 grey dusted. Tergite 1+2 with dark wide marking taking up most of dorsal surface; tergite 3 with two medium sized dark-brown marks taking up just over two thirds of dorsal surface; tergite 4 with two small round markings, taking up a third of dorsal surface; tergite 5 immaculate. Hypopygial prominence knoblike, widening apically. Trifoliate process stem 3× the length of the apical process; entire process infuscated, the stem and the area surrounding hood somewhat slightly lighter; median piece linear in posterior view except for some apical dilation, linear in profile; much narrower than lateral plates; lateral plates without inner lobe; hood somewhat expanded, forming platform structure. Surstylus with dark markings dorsally.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *KwaZulu-Natal:* Ndumo Game Reserve, Main camp, 26°54.652'S 32°19.719'E, Broad-leaved deciduous woodland, 27–30.xi.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 14515).

Paratypes: 3♂ Same data as Holotype (BMSA(D) 14290, 14297, 14476); 1♂ Ndumo Game Reserve, main road, 26°52.125'S 32°13.731'E, Ficus forest, 30.xi–4.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 15818); 2♂ Ndumo Game Reserve, main road, 26°54.288'S 32°17.974'E, Sand and broad-leaved deciduous forest, 4–8.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 17535, 17938); 1♂ Ndumo Game Reserve, Shokwe area, 26°52.125'S 32°13.731'E, Ficus forest, 30.xi–4.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 15745).

Other material examined: 1♂ *Mpumalanga*: White River, 5.iii.1953 (BMNH); 1♂ *KwaZulu-Natal*: Rietspruit farm, 13 km NE Pietermaritzburg, 29°23'27"S 30°29'04"E, Wetland & dam, 13.iii.1990, A.E. Whittington (NMSA).

Distribution: South Africa. Appendix 3.6 – Fig. 8A (in Chapter 3).

2.5.22 *Atherigona flaviheteropalpata* sp. n.

Fig. 39

Etymology: From the Latin *flavus* (yellow), *heteros* (different) and *palpus* (feeler), pertaining to the unique colour and shape combination of the palpi.

Diagnosis: This species and *A. heteropalpata* sp. n. are very similar to each other due to the unique and diagnostic palpal shape (straplike compared to the usual dilated and truncated appearance of the subgenus' palpi). *A. flaviheteropalpata*, however, differs from *A. heteropalpata* in that it has yellow palpi compared to the other's infuscated palpi. The trifoliate process and hypopygial prominence of each species is also markedly different from one another (Fig. 17 vs. Fig. 39).

Male.

Description:

Body length: 3.596 mm; wing: 3.152 mm; r-m crossvein ratio: 0.398.

Head: Ground colour dark. All head setae and setulae infuscated. Occiput grey dusted with narrow median part glossy, laterally silver-grey dusted. Ocellar triangle grey dusted. Frontal vitta yellow. Frontal plate entirely silver-grey dusted with three pairs of proclinate frontal setae and two pairs of orbital setae. Parafacial silver-grey dusted, wider at narrowest than arista base. Scape, pedicel and arista ferruginous, postpedicel infuscated except for narrow basal area. Palpus yellow; straplike (not truncated and dilated as in most species), with hyaline hairs.

Thorax: Ground colour dark. Postpronotal lobe golden dusted, with three setae and 12 setulae. Pleura grey dusted. Proepisternum inconspicuous and gold dusted. Scutum grey dusted, with three very faint, barely visible 2-4 dorsocentral vittae, stopping before scutellum. Scutellum grey dusted; one pair of basal setae, one pair of discal setae and six discal setulae, one pair of subbasal setae and one stronger pair of apical setae (subbasal 0.75× apical).

Legs: All legs yellow except for apical halves of fore femur and tibia appearing slightly infuscated

Leg chaetotaxy: Fore tarsi without any specialised chaetotaxy.

Wings: Hyaline. Veins light brown. Knob of halteres white with stalk yellow. Calypters white.

Abdomen: All tergites yellow; tergite 1+2 with brown marking; tergites 3 and 4 with dorsal surfaces entirely covered by dark markings; tergite 5 with two small spots.

Hypopygial prominence weakly bilobate. Trifoliate process stem 1.5× the length of the apical process; stem and hood lighter than rest of process (with the exception of the apical third of stem) which is infuscated, lateral plates and median piece infuscated; median piece apically very strongly dilated, bifurcate, appearing curved in profile; lateral plates with apparent double inner lobes; base of process wider than median piece in profile. Surstylus without dark markings.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *Western Cape*: 9 km ESE George, Kaaimansrivier, 33°59'S 22°33'E, 13.x.1994, R. Danielsson (MZLU).

Distribution: South Africa. Appendix 3.6 – Fig. 8B (in Chapter 3).

2.5.23 *Atherigona gilvifolia* van Emden, 1940

Fig. 65

Atherigona gilvifolia van Emden, 1940: 125, figs 28, 52; Deeming 1971: 168, figs 96–100; Deeming 1979: 44; Deeming 1987: 19.

Diagnosis: This species can be distinguished from others with yellow palpi and infuscated frontal vitta by its very striking trifoliate process which is hyaline except for the extreme apex of the median piece.

Type material examined: Holotype ♂: NIGERIA: Ibadan, 19.x.1935 (BMNH).

Other material examined: KENYA: 1♂ Rift Valley, Ol Arabe Gorge, 11.xi.1988, R.K. Butlin (NMSA) (Previously NMW.Z.1988–167); 1♂ Nairobi: Karura State Forest, 5 km NE of Nairobi, 01°15'S 36°53'E, 1700 m, 19.xi.1992, J.G.H. Londt & A.E. Whittington, Indigenous forest/edges (NMSA); SOUTH AFRICA: *KwaZulu-Natal*: 1♂ Durban Treasure Beach, 29°56'26"S 30°59'48"E, Grassland & scrub, 04.vii.1990, Natal Museum Ent. Dept. (NMSA); 1♂ Ndumo Game Reserve, main road, 26°54.288'S 32°17.974'E, Sand and broad-leaved deciduous forest, 4–8.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 18219); 1♂ Pietermaritzburg, Blackridge area, Grass on road margin, 20.iv.1982, D.A. Barraclough (NMSA); 1♂ Port Edward, 31°03'S 30°13'E, 9.iv.1997, K.R. Cradock, Malaise trap (NMSA); 1♂ SWAZILAND: 13 km N of Ngogolo, Panata Ranch, 26°19'S 31°38'E, 300 m, Bushveld, 22–24.iv.1991, J.G.H. Londt & L. Schoeman (NMSA).

Distribution: Democratic Republic of the Congo, Kenya, Mauritius, Nigeria, South Africa (new), Swaziland (new), Tanzania, Uganda. Appendix 3.6 – Fig. 8C (in Chapter 3).

2.5.24 *Atherigona griseiventris* van Emden, 1940

Fig. 13

Atherigona griseiventris van Emden, 1940: 140, figs 12, 38; Deeming 1979: 48.

Diagnosis: This species can be distinguished from others with similar infuscated palpi and frontal vitta by the shape of the median piece of the trifoliate process which is greatly dilated in profile up to just before the apex, and thin and linear in posterior view except for the apex, which appears almost round.

Type material examined: Holotype ♂ KENYA: Aberdere Range; x.1934; B.M.E. Afr. Exp. B.M. 1935-203.; Mt. Kinangop; 8000ft; F.W. Edwards. Det. Emden 1939 (BMNH).

Distribution: Kenya, Nigeria, South Africa, Uganda (No South African map data).

2.5.25 *Atherigona heteropalpata* sp. n.

Fig. 17

Etymology: From the Latin *heteros* (different) and *palpus* (feeler), pertaining to the unique shape of the palpus, which is different from all other known species in the subgenus, except for *A. flaviheteropalpata* sp. n. with similar but yellow palpi.

Diagnosis: This species and *A. flaviheteropalpata* sp. n. are very similar to each other due to the unique and diagnostic palpal shape (straplike compared to the usual dilated and truncated appearance of the subgenus' palpi). *A. heteropalpata*, however, differs from *A. flaviheteropalpata* in that it has infuscated palpi compared to the other's yellow palpi. The trifoliate process and hypopygial prominence of each species are also markedly different from one another (Fig. 39 vs. Fig. 17).

Male.

Description:

Body length: 4.526 mm; wing: 3.92 mm; r-m crossvein ratio: 0.400.

Head: Ground colour dark. All head setae and setulae infuscated. Occiput silver-grey dusted throughout with narrow median part glossy, laterally silver-grey dusted. Ocellar triangle silver-grey dusted. Frontal vitta infuscated. Frontal plate silver-grey dusted throughout with three pairs of proclinate frontal setae and two pairs of orbital setae. Parafacial silver-grey dusted, at narrowest just as wide as arista base. Scape and pedicel infuscated with ferruginous margins, postpedicel and arista infuscated. Palpus brown, straplike in appearance, with hyaline setulae at apex.

Thorax: Ground colour dark. Postpronotal lobe gold dusted, with three setae and 11 setulae. Pleura entirely grey dusted; Proepisternum inconspicuous and gold dusted. Scutum grey dusted throughout, with three faint, barely visible 2-4 dorsocentral vittae, stopping before scutellum. Scutellum grey dusted; one pair of basal setae, one pair of discal setae and 7 discal setulae, one pair of subbasal setae and one pair of apical setae (subbasal pair equal to apical pair).

Legs: All legs yellow, except for the apical halves of fore femur and fore tibia, and the entire fore tarsi which are infuscated.

Leg chaetotaxy: Fore tarsi without any specialised chaetotaxy.

Wings: Hyaline. Veins brown. Knob of halteres white with stalk yellow. Calypters white.

Abdomen: All tergites yellow; tergite 1+2 immaculate; tergite 3 two small round markings taking up a third of dorsal surface; tergite 4 with small round markings, taking up a third

of dorsal surface. tergite 5 immaculate. Hypopygial prominence knoblike, with a pair of anteriorly projecting tubercles, and anteriorly with two slight lobe-like dilations. Trifoliate process stem 1.6× the length of the apical process; trifoliate process entirely hyaline, except for the lateral margins of the lateral plates which are infuscated; median piece filiform except for apical dilation, with four setulae, the two centre setulae projecting and the two outer setulae strongly curved and at least 2× as long as dilation is high, median piece appearing filiform in profile; lateral plates appearing almost angular in posterior view, rounded in profile, not smooth but with a rough textured surface, also wider than median piece in profile, without inner lobes. Surstylus without infuscation.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *KwaZulu-Natal*: Royal Natal National Park, Thendele area, 28°40'46"S 28°55'13"E, Sourveld, 16–18.iii.1990, A.E. Whittington (NMSA).

Paratypes: 1♂ Cathedral Peak area, 4–11.iv.1977, J.G.H. Londt, ex. Malaise (NMSA); 1♂ Cathedral Peak area, Forest Reserve, 1800 m, 4–11.iv.1977, J.G.H. Londt, ex. Malaise (NMSA); 1♂ Cathedral Peak, Didima, 28°57.000'S 29°14.395'E, 1422 m, 13–16.xii.2004, M.B. Mostovski (NMSA); 1♂ Royal Natal National Park, Mahai Camp, 28°41'S 28°57'E, 1440 m, Grassland, 2–4.iv.1993, J.G.H. Londt (NMSA); 1♂ Royal Natal National Park, Mahai campsite area, 28°41.386'S 28°56.288'E, 1440 m, Malaise trap (1) straddling Mahai river, 17–18.ii.2010, J.G.H. Londt, Malaise trap (NMSA); 1♂ Royal Natal National Park, Thendele, 28°42.378'S 28°56.083'E, 1600 m, *Leucosedes* [*Leucosidea*] dominated scrub, 15–17.ii.2010, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 19586); 2♂ Royal Natal National Park, Tiger Falls area, 28°41.341'S 28°56.047'E, *Protea caffra* woodland, 17–18.ii.2010, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 19803, 19804).

Distribution: South Africa. Appendix 3.6 – Fig. 8D (in Chapter 3).

Remarks: The males of this species and *A. flaviheteropalpata* sp. n. are currently not matching the diagnosis of the subgenus *Atherigona* s. str. due to the straplike, thin appearance of their palpi. They do, however, both have a trifoliate process and hypopygial prominence. This would mean that the diagnosis of the subgenus would need to be updated, as the thin appearance of the palpi is not diagnostic for just the males of *Acritochaeta*.

2.5.26 *Atherigona humeralis* (Wiedemann, 1830)

Fig. 21

Coenosia humeralis Wiedemann, 1830: 441.

Atherigona humeralis: Deeming 1971: 157, figs 49–53.

Atherigona ferruginea van Emden, 1940: 116, fig. 14; Deeming 1971: 153, fig. 33; Deeming 1979: 36; Deeming 1987: 18.

Diagnosis: This species is very similar to *A. bedfordi* but differs from it in having an infuscated postpedicel and having the fore legs infuscated to some degree. The trifoliate process has the median piece club shaped apically, but not greatly expanded laterally. The hypopygial prominence is truncated with anteriorly projecting tubercles.

Type material examined: Paralectotype ♂ “Nubien” (ZMHB).

Other material examined: ETHIOPIA: 1♂ Alemaya, vii–viii.1986, T. Mesfin (NMSA) (Previously NMW.Z.1986–118); SOUTH AFRICA: *Eastern Cape*: 1♂ Grahamstown, Albany Museum grounds, 33°18.822'S 26°31.315'E, 15–23.x.2007, A.H. Kirk-Spriggs, Malaise trap (AMGS); 1♂ Jeffrey's Bay, Humansdorp area, 3.xii.1967, B.R. Stuckenberg & P. Stuckenberg (NMSA); 2♂ Ottersford Forestry Reserve, Hankey area, 1–10.xii.1967, B.R. Stuckenberg & P. Stuckenberg (NMSA); 1♂ Port St. Johns, 20–25.xi.1961, B.R. Stuckenberg & P. Stuckenberg (NMSA); 1♂ Storms River Pass, Tsitsikama area, 8.xii.1967, B.R. Stuckenberg & P. Stuckenberg (NMSA); 1♂ *Free State*: Brandfort, Florisbad Research Station, 28°46.039'S 26°04.234'E, Acacia Savanna, 4–6.iv.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 05540); 1♂ *Limpopo*: Louis Trichardt [Makhado], i–ii.1928, R.F. Lawrence (SAM-DIP A013859); 1♂ *Western Cape*: Wilderness National Park, 17 km SE George, 33°59'S 22°39'E, 14.x.1994, R. Danielsson (MZLU).

Type remarks: Holotype female housed in SMF (Senckenberg Forschungsinstitut und Naturmuseum, Frankfurt), but not seen.

Distribution: Cape Verde, Chad, Egypt, Ethiopia (new), Madagascar, Nigeria, Rwanda, South Africa (new), Sudan, Uganda. Appendix 3.6 – Fig. 8E (in Chapter 3).

2.5.27 *Atherigona hyalinipennis* van Emden, 1959

Fig. 49

Atherigona hyalinipennis: van Emden 1958: 7, *Nomen nudum*.

Atherigona hyalinipennis van Emden, 1959: 193; Deeming 1971: 160, figs 67–69.

Diagnosis: This species can be distinguished from others with a yellow frontal vitta by its fore legs having a slight infuscation on the femur, and the tibia being infuscated on its apical half. It is very similar to *A. bedfordi* and *A. humeralis*, but differs in the structure of the trifoliate process and hypopygial prominence (Fig. 48 vs. Figs 21 & 42).

Type material examined: Holotype ♂: ERITREA: on road below Arbaroba, 6800ft, 12.x.1952 (BMNH)

Other material examined: 1♂ BOTSWANA: Tlokweng, Sorghum field, 6–13.iii.1990, J.M. Mashonja, Malaise trap (NMSA); 1♂ NAMIBIA: Kaoko Otawi, iii.1995, SAMC Expedition (SAM-DIP A013853); 1♂ SOUTH AFRICA: *KwaZulu-Natal*: Royal Natal National Park, 28°41.362'S 28°56.327'E, 1425 m, stream, y-wood, 10–13.xii.2004, M.B. Mostovski, Malaise trap (NMSA).

Distribution: Botswana, Burkina Faso, Cape Verde, Chad, Eritrea, Ethiopia, The Gambia, Kenya, Namibia, Nigeria, Senegal, South Africa (new), Sudan, Uganda, Zimbabwe. Appendix 3.6 – Fig. 8F (in Chapter 3).

2.5.28 *Atherigona kirkspriggsi* sp. n.

Fig. 33

Etymology: Named in honour of the collector of the holotype and the majority of the paratypes, Dr Ashley Kirk-Spriggs.

Diagnosis: This species keys close to *A. lineata torrida* Deeming, 1971 when Deeming (1970) and Dike (1989a) are used, but differs from it in having the hypopygial prominence tridentate and not bifurcate. Also, the mid and hind leg tarsi are infuscated compared to that of *A. lineata torrida* which appears brown. *A. kirkspriggsi* also has a submedial posteroventral seta on the front femur. *A. kirkspriggsi* is also similar to *A. occidentalis* Deeming, 1971 but differs from it significantly with regards to the overall structure of the trifoliate process and hypopygial prominence (Fig. 33 vs. Fig. 32).

Male.

Description:

Body length: 4.06 mm; wing: 3.255 mm; r-m crossvein ratio: 0.380.

Head: Ground colour dark. All head setae and setulae infuscated. Occiput grey dusted posteriorly and laterally with narrow median part glossy. Ocellar triangle grey dusted, sub-shining. Frontal vitta wholly infuscated, appearing velvety. Frontal plate silver-grey dusted, sub-shining around bases of the posterior pair of proclinate frontal and two pairs of orbital setae; three pairs of frontal setae and two weak pairs of frontal setulae half the length of setae; Parafacial silver-grey dusted, slightly wider than arista base; jowls appearing gold dusted. Scape, pedicel and postpedicel infuscated. Arista dark brown. Palpus infuscated; slight apical dilation with very subtle truncation, with hyaline setulae.

Thorax: Ground colour dark. Postpronotal lobe gold dusted, with three setae and 12 setulae. Pleura golden-grey dusted. Proepisternum somewhat protruding compared to other species. Scutum grey dusted, with three weak and barely visible 2-4 dorsocentral vittae, stopping before scutellum. Scutellum grey dusted; one pair of basal setae, one pair of discal setae and eight discal setulae; one pair of subbasal setae and one pair of apical setae, equal in length.

Legs: Forelegs infuscated except for basal half and extreme apex of femur and base of tibia which are yellow. Mid and hind legs yellow except for infuscated tarsi.

Leg chaetotaxy: Fore femur with one submedial posteroventral seta; fore tarsi without any specialised chaetotaxy.

Wings: Hyaline. Veins dark brown. Halteres wholly yellow. Calypters white.

Abdomen: All tergites yellow, grey dusted on dorsolateral surface of tergite 3; tergite 1+2 with two large dark-brown trapezoidal markings with a median longitudinal vitta running between them down to tergite 4 (large markings absent in some specimens), only interrupted at the start of each new tergite; tergite 3 with two large dark-brown almost teardrop shaped marks taking up entire length of dorsum; tergite 4 with two small round markings, taking up a third of dorsal surface; tergite 5 immaculate. Hypopygial prominence tridentate, with each lobe equal in size, anteriorly with faint setulae. Trifoliate process stem 3× the length of the apical process, entire process including stem infuscated with the exception of a hyaline area which consist of the

hood and its surroundings; median piece apically dilated in posterior view (wider than lateral plates) as well as in profile, although more gradual and less pronounced; lateral plates only somewhat wider in profile than median piece, posteriorly in the shape of a boomerang, inner lobes absent; hood reduced in size. Surstylus not infuscated.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *Free State*: Geluksdal farm, 27°54'7.05"S 29°23'31.9"E, sparse *Leucosedes* [*Leucosidea*] dominated scrub, 9–10.xi.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 13290).

Paratypes: *Eastern Cape*: 1♂ Grahamstown (plot 5280), Three Chimneys farm, 33°18.542'S 26°29.846'E, 2–13.iii.2008, A.H. Kirk-Spriggs, Malaise trap (AMGS); 1♂ Grahamstown, Albany Museum grounds, 33°18.822'S 26°31.315'E, 15–23.x.2007, A.H. Kirk-Spriggs, Malaise trap (AMGS); *Free State*: 1♂ Geluksdal farm, 27°54'7.05"S 29°23'31.9"E, sparse *Leucosedes* [*Leucosidea*] dominated scrub, 9–10.xi.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 13287); 1♂ Harrismith, Mooihoekkop, 28°18'50.0"S 29°10'51.1"E, 1800 m, *Leucosedes* [*Leucosidea*] dominated scrub, 14–16.ix.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 09851); 5♂ Harrismith, Scotland farm, 27°58'59.5"S 29°37'09.8"E, dense *Leucosedes* [*Leucosidea*] dominated scrub, 10–12.xi.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 12774, 12765, 12775, 12782, 12772); *KwaZulu-Natal*: 1♂ Newcastle, 27°44'21"S 29°52'34"E, xii.1952 (BMNH); 1♂ Royal Natal National Park, Thendele, 28°42.378'S 28°56.083'E, 1600 m, *Leucosedes* [*Leucosidea*] dominated scrub, 15–17.ii.2010, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 19760); 1♂ *North West Province*: Brits, 25°38'5"S 27°46'48"E, 25.x.1952, Paterson (BMNH).

Distribution: South Africa. Appendix 3.6 – Fig. 9A (in Chapter 3).

2.5.29 *Atherigona laevigata* (Loew, 1852)

Fig. 7

Coenosia laevigata Loew, 1852: 660 [1862: 28].

Atherigona laevigata: van Emden 1940: 113, figs 6, 56; Deeming 1971: 148, figs 13–18.

Atherigona scutellaris Stein, in Becker 1903: 110.

Atherigona minuta Schnabl & Dziedzicki, 1911: 183.

Diagnosis: This species can easily be recognised by its glossy frontal plate and half-yellow, half-infuscated frontal vitta in combination with its knoblike hypopygial prominence.

Type material examined: Syntypes: MOZAMBIQUE: 1♂2♀ Ost Afrika, Inhambana, Peters S (ZMHB).

Other material examined: KENYA: *Baringo*: 9♂ Lake Bogoria Nature Reserve, Fig Tree camp site, 00°11'N 36°08'E, 1100 m, 21.xi.1992, J.G.H. Londt & A.E. Whittington, South end of reserve (NMSA); *Nairobi*: 3♂ Karura State Forest, 5 km NE of Nairobi, 01°15'S 36°53'E, 1700 m, 19.xi.1992, J.G.H. Londt & A.E. Whittington, Indigenous forest/edges (NMSA); 1♂ N. NIGERIA: Zaria, Samaru, *Cynodon dacylon* collected 22.xi.1972, 4.xii.1972, J.C. Deeming, ex. Shoot (NMSA); NAMIBIA: 1♂ Swakopmund, 26–30.i.1972, southern African Expedition, Swept vegetation around sewage farm settling tanks (BMNH); 2♂ Warmbad, [-28.448034 18.734433], Koakoveld, ii.1925, SAMC Expedition (SAM-DIP A013851); 5♂ Warmbad, [-28.448034 18.734433], Koakoveld, ii.1925, SAMC Expedition (SAM-DIP A013850); 4♂ Zesfontein, ii.1925, SAMC Expedition (SAM-DIP A013846); 1♀ SAUDI ARABIA: Abha, Madenate

Ameer Sultan, 25.ii–25.v.2002, H.A. Dawah (NMSA); SOUTH AFRICA: *Eastern Cape*: 3♂ 3 km E Grahamstown, Belmont Valley, 2&5.i.1986, J.G.H. Londt & B. Londt, Malaise trap (NMSA); 1♂ 35 km SE of Maclear, 31°12'S 28°36'E, 1400 m, Grass slopes & ravine, 3.ii.1992, Natal Museum Expedition (NMSA); 1♂ 8 km NW. Addo, 3–4.xi.1978, J.G.H. Londt & R.M. Miller (NMSA); 6♂ Grahamstown (plot 5280), Three Chimneys farm, 33°18.542'S 26°29.846'E, 2–13.iii.2008, A.H. Kirk-Spriggs, Malaise trap (AMGS); 2♂ Grahamstown, Albany Museum grounds, 33°18.822'S 26°31.315'E, 15–23.x.2007, A.H. Kirk-Spriggs, Malaise trap (AMGS); 1♂ Hluleka Nature Reserve, 21–25.vii.1981, R.F. Fregona (NMSA); 3♂ Hogsback, 32°35.7'S 26°56.172'E, 850 m, 28.xii.2004, M.B. Mostovski (NMSA); 1♂ Hogsback area, Forest margins, 18–19.i.1984, D. Barraclough & C. Barraclough (NMSA); 3♂ Pirie Dam, ii. 1944, J. Omer Cooper (BMNH); 1♂ Port St. Johns, 10–22.ii.1955, A.J.T. Janse (NMSA); 1♂ Wilderness National Park, 33°59'S 22°66'E, c100 m, Forest margins, 7.ix.1993, D. Barraclough & C. Barraclough (NMSA); 1♂ Xuka River, 10 km E Engcobo, river bank, 26.x.1978, J.G.H. Londt & R.M. Miller (NMSA); *Free State*: 3♂ Brandfort, Florisbad Research Station, 28°46.039'S 26°04.234'E, Acacia Savanna, 4–6.iv.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 05524, 05529, 05535); 2♂ Brandfort, Soetdoring Nature Reserve, Kruger's Drift, 28°51.303'S 26°02.302'E, Acacia Savanna, 5–6.iv.2009, A.H. & M.K. Kirk-Spriggs, Malaise trap (BMSA(D) 05469, 05472); *Gauteng*: Pretoria, Emerged from jar with army worm, Parasite?, 22.iv.1919 (SANC DIPT01491); *KwaZulu-Natal*: 1♂ 15.5 km N. Vryheid, 29.xi.1976, R.M. Miller, Old quarry (NMSA); 5♂ 17 km NE Empangeni, Nseleni River, 28°42'S 32°01'E, 24.x.1994, R. Danielsson (MZLU); 1♂ Botanical Gardens Durban, 16.x.1920, C.P. van der Merwe (SAM-DIP A013849); 1♂ Croc Valley Nature Reserve, nr. Sheffield Beach, 29°28'37"S 31°15'04"E, 60 m, In patch of swamp forest, 12.vi.2001, J.G.H. Londt (NMSA); 1♂ Dukuduku between St. Lucia & Matubatuba, Zululand, 7–8. iv.1960, B.R. Stuckenberg & P. Stuckenberg (NMSA); 1♂ Durban, 6.ix.1960 (BMNH); 1♂ Giant's Castle [Nature] Reserve, Drakensberg Mts., 18.x.1971, B.R. Stuckenberg & M.E. Irwin (NMSA); 3♂ Ladysmith, xii.1952 (BMNH); 1♂ Lynnfield Park, 13 km SE Pietermaritzburg, 29°41'S 30°29'E, Acacia thornveld area, 31.iii.1989, A.E. Whittington (NMSA); 1♂ Ndumo Game Reserve, pan, 26°54.288'S 32°17.974'E, Grassy flood plain, 9–10.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 19476); 1♂ Ndumo Game Reserve, Shokwe area, 26°52.125'S 32°13.731'E, Ficus forest, 30.xi–4.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 15826); 3♂ Ndumo [Ndumo] Game Reserve, Camp & Riverine bush, 4–9.x.1982, J.G.H. Londt (NMSA); 1♂ New Hanover, 29.xi.1914, C.B. Hardenberg (SANC); 2♂ Port Edward, 31°03'S 30°13'E, 8.vi.1997, K.R. Cradock, Malaise trap (NMSA); 16♂ Richards Bay, 28°46'S 32°04'E, 24.x.1994, R. Danielsson (MZLU); 1♂ Royal Natal National Park, 7–11.iv.1951, Brinck & Rudebeck, insect trap (MZLU); 1♂ St. Martin's-on-the-Shore, 5.vi.1976, R.M. Miller (NMSA); 1♂ Ukulinga Research Farm, University of KwaZulu-Natal, 29°40'S 30°24'E, 12.iii.2009, R.M. Miller (NMSA); *Limpopo*: 2♂ Louis Trichardt [Makhado], i–ii.1928, R.F. Lawrence (SAM-DIP A013858); 1♂ Plat River, Waterberg distr., C.J. Swierstra (NMSA); 1♂ *Mpumalanga*: 7 km N Hazyview, Sabie River, 6.xii.1976, R.M. Miller (NMSA); *Western Cape*: 1♂ 3 km E Kaap Agulhas, 34°49'S 20°01'E, 12.x.1994, R. Danielsson (MZLU); 1♂ De Hoop Nature Reserve, 34°27'S 20°25'E, 0–200 m, 10–13.x.1994, R. Danielsson (MZLU); 1♂ Knysna C.C., x.1916, L. Peringuey (SAM-DIP A013857); 4♂ Malgas, 34°20'S 20°30'E, 40 m, 11–13.x.1994, R. Danielsson (MZLU); 2♂ ZIMBABWE: N. Vumba, S. Rhodesia 22.vi.1964, D. Cookson (NMSA).

Distribution: Angola, Comores, Egypt, Ethiopia, Kenya, Madagascar, Mozambique, Nigeria, Rwanda, Saudi Arabia, Seychelles, South Africa, Tanzania, Uganda, Yemen, Zambia, Zimbabwe (new). Appendix 3.6 – Fig. 9B (in Chapter 3).

2.5.30

***Atherigona latibasilaris* sp. n.**

Fig. 40

Etymology: From the Latin *latus* (broad or wide) and *basilaris* (at the base), describing the basal area of the median piece where it meets the hood.

Diagnosis: This species is most similar to *A. londti* sp. n. in terms of coloration, but differs greatly from it and others species due to the very distinct shape of the trifoliate process that has the basal area where the median piece and hood meet very wide when viewed in profile.

Male.**Description:**

Body length: 3.503 mm; wing: 2.688 mm; r-m crossvein ratio: 0.400.

Head: Ground colour dark. All head setae and setulae infuscated. Occiput grey dusted with narrow median part glossy, laterally grey dusted. Ocellar triangle grey dusted. Frontal vitta yellow, darker at base and area surrounding ocellar triangle. Frontal plate grey dusted with three pairs of proclinate frontal setae and two pairs of orbital setae. Parafacial silver-grey dusted, narrower than arista base at narrowest. Scape pedicel and arista ferruginous, postpedicel infuscated except for ferruginous basal area. Palpus yellow; truncated and dilated with hyaline hairs.

Thorax: Ground colour dark. Postpronotal lobe golden dusted, with two setae and ten setulae. Pleura grey dusted. Proepisternum inconspicuous and gold dusted. Scutum grey dusted, with three weak barely visible 2-4 dorsocentral vittae, stopping before scutellum. Scutellum grey dusted except for yellow apex; one pair of basal setae, one pair of discal setae and nine discal setulae, one pair of subbasal setae and one pair of apical setae (equal in length).

Legs: All legs yellow except for dark marking on apex of fore femur, with apical half of fore tibia and fore tarsi infuscated.

Leg chaetotaxy: Fore tarsi without any specialised chaetotaxy.

Wings: Hyaline, except for slight brown smoky suffusion at areas surrounding Sc-R₁ and the humeral crossvein. Veins light brown. Knob of halteres white with stalk yellow. Calypters white.

Abdomen: All tergites yellow; tergite 1+2 immaculate; tergite 3 with a pair of small teardrop shaped dark markings, taking up a third of dorsal surface; tergite 4 with two small dark spots, taking up a third of dorsal surface; tergite 5 immaculate. Hypopygial prominence with deep rounded bifurcation. Trifoliate process stem 3× the length of the apical process; trifoliate process hyaline except for apical half of median piece and lateral plates; base of median piece and connecting hood area conspicuously expanded in profile; median piece club shaped with gradual apical dilation in posterior

view, c-shaped in profile; lateral plates without inner lobes, appearing linear in profile; surstylus without dark markings.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *KwaZulu-Natal*: Umfolozi Game Reserve, Masinda camp, 28°17'S 31°57'E, 200 m, 25–28.xi.1993, J.G.H. Londt, Malaise (NMSA).

Distribution: South Africa. Appendix 3.6 – Fig. 9C (in Chapter 3).

2.5.31 *Atherigona libertensis* sp. n.

Fig. 29

Etymology: From the Latin *libertes* (freedom), named for the province in which the type locality is situated, *i.e.* the Free State.

Diagnosis: This species is similar to *A. angustiloba* in terms of general appearance and shape of the hypopygial prominence. *A. libertensis* differs, however, with regards to the shape and colour of the trifoliate process, which is entirely hyaline compared to the entirely infuscated process of *A. angustiloba* (Fig. 29 vs. Fig. 30). The trifoliate process is visually similar to those of *A. naqvii* Steyskal, 1966 and *A. cinarina* due to the coloration and the presence of a pair of long hyaline setulae at the apex of the median piece, but differs overall structurally, not having any emargination at the apex as with the other two species (Fig. 29 vs. Figs 36 & 37).

Male.

Description:

Body length: 3.84 mm; wing: 3.12 mm; r-m crossvein ratio: 0.405.

Head: Ground colour dark. All head setae and setulae infuscated. Occiput grey dusted posteriorly with narrow median part glossy, laterally also dusted. Ocellar triangle grey dusted, sub-shining. Frontal vitta infuscated, apical 1/3 appearing ferruginous. Frontal plate silver-grey dusted on apical two thirds, basally grey dusted, with three pairs of proclinate frontal and two pairs of orbital setae, bases of setae appearing slightly glossy. Parafacial silver-grey dusted, only somewhat wider than arista base. Scape and pedicel infuscated with ferruginous apex. Postpedicel infuscated. Arista infuscated. Palpus yellow except for infuscated basal third; apically dilated and truncated, with hyaline setulae.

Thorax: Ground colour dark. Postpronotal lobe grey dusted except for ventrolateral margins which are golden dusted, lobe with three setae and eight setulae. Pleura grey dusted, except for area where katapisternum, anepisternum and anepimeron converge. Proepisternum not conspicuous. Scutum grey dusted, with three faint and barely visible 2-4 dorsocentral vittae, not extending to the scutellum; Scutellum grey dusted; one pair of basal setae, one pair of discal setae and six discal setulae, one

pair of subbasal setae and one pair of apical setae, comparison between subbasal and apical pair not possible due to damage.

Legs: All legs yellow with the exception of the fore femur having a dark mark on apical posterior surface, and apical third of fore tibia and entire fore tarsi which is infuscate.

Leg chaetotaxy: apical three fore tarsal segments with long dorsal setulae, at least as long as segments are wide.

Wings: Hyaline, except for slight brown smoky suffusion at apex of Sc-R₁. Veins brown. Halteres with white knob and yellow stalk. Calypters white.

Abdomen: All tergites yellow; tergite 1+2 with faint median vitta, not reaching the apical margins; tergite 3 with two large dark-brown oblong marks taking up just over two thirds of surface, vitta present and same length as large marks; tergite 4 with two small round markings, taking up a third of dorsal surface, with dark vitta that spans the entire length of segment; tergite 5 immaculate. Hypopygial prominence knob-shaped with two anteriorly projecting tubercles. Trifoliate process stem 2.9× the length of the apical process; trifoliate process and all setulae hyaline except for the edges of lateral plates and lateral edges of hood which are infuscated; median piece with slight club-like appearance, same shape in profile, apically with two long hyaline setulae (approximately the same length as entire median piece) and two smaller setulae at centre; lateral plates obavate in profile, no inner lobes present. Surstylus not infuscated.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *Free State*: Harrismith, Scotland farm, 27°58'59.5"S 29°37'09.8"E, dense *Leucosidea* [*Leucosidea*] dominated scrub, 10–12.xi.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 12760).

Distribution: South Africa. Appendix 3.6 – Fig. 9D (in Chapter 3).

2.5.32 *Atherigona lineata* ssp. *lineata* (Adams, 1905) **spp. stat. rev.**

Fig. 51

Coenosia lineata Adams, 1905: 208.

Atherigona lineata: van Emden: 1940: 103, figs 16, 36; Deeming 1971: 178, figs 139–148.

Atherigona nigripalpis Stein, 1913: 539.

Diagnosis: *A. lineata* and its subspecies can be distinguished from other species with infuscated frontal vitta by the combination of infuscated palpi and a bifurcated hypopygial prominence. *A. lineata lineata*, *A. lineata torrida* Deeming, 1971 and *A. lineata ugandae* van Emden, 1940 can be distinguished from one another on the following grounds: *A. lineata lineata* and *A. lineata torrida* have the fore femur infuscated on at least the apical third (compared to *L. lineata ugandae* that has it entirely yellow) and the two former species differ from one another in terms of the shape of their trifoliate processes' lateral lobes (Fig. 51a vs. Fig. 52a) and the depth of the hypopygial

prominence bifurcation. *A. lineata lineata* and *A. lineata torrida* again differ from *A. lineata ugandae* in that *ugandae* has the hood area of the trifoliate process infusate compared to hyaline for the other two subspecies, and also *ugandae* has a much deeper, wider and pronounced bifurcation.

Type material: Housed in the University of Kansas, Museum of Natural History (UKMNH), but not seen.

Other material examined: SOUTH AFRICA: *KwaZulu-Natal*: 1♂ Ramsgate Butterfly Sanctuary, 30°53.3'S 30°20.4'E, 26–29.iv.2004, M.B. Mostovski, light trap (NMSA); *North West Province*: 1♂ S.A. Lombaard Nature Reserve, 27°37'S 25°29'E, 1250 m, Sand, Acacia and thornveld, 12.iii.1991, J.G.H. Londt & A.E. Whittington (NMSA).

Distribution: Angola, Botswana, Burkina Faso, Cameroon, Chad, Democratic Republic of the Congo, The Gambia, Kenya, Madagascar, Malawi, Mali, Mozambique, Namibia, Nigeria, Seychelles, South Africa, Tanzania, Uganda, Zimbabwe. Appendix 3.6 – Fig. 9E (in Chapter 3).

2.5.33 *Atherigona lineata* (Adams) ssp. *torrida* Deeming, 1971

Fig. 52

Coenosia lineata Adams, 1905: 208.

Atherigona torrida Deeming, 1971: 180, figs 153, 154; Deeming 1979: 47.

Diagnosis: See diagnosis for *Atherigona lineata lineata* (section 2.5.32).

Type material examined: Holotype ♂: N. NIGERIA: Zaria, Samaru, 30.viii.1969, m.v. trap, J.C. Deeming (BMNH).

Other material examined: 1♂ KENYA: *W. Kakamega*: Kakamega Forest Reserve, 00°22'N 34°53'E, 1620 m, Indigenous forest paths, 24.xi.1992, A.E. Whittington & J.G.H. Londt (NMSA); SOUTH AFRICA: *Eastern Cape*: 1♂ 3 km E Grahamstown, Belmont Valley, 2&5.i.1986, J.G.H. Londt & B. Londt, Malaise trap (NMSA); 2♂ Grahamstown (plot 5280), Three Chimneys farm, 33°18.542'S 26°29.846'E, 2–13.iii.2008, A.H. Kirk-Spriggs, Malaise trap (AMGS); 8♂ Pirie Dam, ii. 1944, J. Omer Cooper (BMNH); 1♂ Tsitsikamma National Park, Storms River mouth, 34°01.239'S 23°53.744'E, 5.iv.2008, A.H. Kirk-Spriggs, Sweeping (BMSA(D) 03044); 1♂ *Free State*: Harrismith, Nesshurst farm, 28°26'53.3"S 29°09'14.2"E, *Leucosidea* [*Leucosidea*] -scrub & stream bed, 17–18.ix.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 11069); 1♂ *Gauteng*: Johannesburg, 26.xii.1946, F. Zumpt (BMNH); *KwaZulu-Natal*: 8♂ Ashburton 15 km SE of Pietermaritzburg, Grassland, 19–25.ii.1977, J.G.H. Londt, Malaise trap (NMSA); 3♂ Cathedral Peak area, 4–11.iv.1977, J.G.H. Londt, ex. Malaise (NMSA); 2♂ Cathedral Peak, Didima, 28°57.000'S 29°14.395'E, 1422 m, 13–16.xii.2004, M.B. Mostovski (NMSA); 1♂ Empangeni, 28°45'S 31°54'E, Garden of Reavell, 01–12.i.1993, P.E. Reavell, Malaise trap (NMSA); 1♂ Giant's Castle Game Reserve - Injasuti area, 5–11.xii.1983, J.G.H. Londt (NMSA); 2♂ Himeville, 3–5.iii.2004, M.B. Mostovski, light trap (NMSA); 1♂ Itala Game Reserve, 27°31'S 31°12'E, 780 m, Doornkraal Campsite, 4–6.xi.1997, J.G.H. Londt & A. Londt (NMSA); 2♂ Kamberg Nature Reserve, 1–6.x.1978, J.G.H. Londt, Malaise trap (NMSA); 1♂ Lynnfield Park [nr. Pietermaritzburg], 6–8.iv.1989, A.E. Whittington, Malaise trap (NMSA); 1♂ Ndumo Game Reserve, pan, 26°54.288'S 32°17.974'E, Grassy flood plain, 9–10.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 19475); 2♂ Ndumo [Ndumo] Game Reserve, Camp & Riverine bush, 4–9.x.1982, J.G.H. Londt (NMSA); 1♂ Port Edward, 31°03'S 30°13'E, 9.vi.1997, K.R. Cradock, Malaise trap (NMSA); 1♂ Ramsgate Butterfly Sanctuary, 30°53.3'S 30°20.4'E, near stream., 10.vii–8.viii.2004,

M.B. Mostovski, Malaise trap (NMSA); 2♂ Ramsgate Butterfly Sanctuary, 30°53.3'S 30°20.4'E, 26–29.iv.2004, M.B. Mostovski, light trap (NMSA); 1♂ Royal Natal National Park, 28°41.362'S 28°56.327'E, 1425 m, stream, y-wood, 10–13.xii.2004, M.B. Mostovski, Malaise trap (NMSA); 1♂ Royal Natal National Park, Riverine bush, montane slopes, 6–10.xiii.1984, J.G.H. Londt (NMSA); 1♂ Royal Natal National Park, 7–11.iv.1951, Brinck & Rudebeck, insect trap (MZLU); 1♂ Royal Natal National Park, Tendele [Thendele] area, 28°40'46"S 28°55'13"E, Sourveld, 16–18.iii.1990, A.E. Whittington, Mercury vapour light trap (NMSA); 29♂ Royal Natal National Park, Thendele, 28°42.378'S 28°56.083'E, 1600 m, *Leucosedes* [*Leucosidea*] dominated scrub, 15–17.ii.2010, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 19751, 19559, 19720, 19681, 19649, 19774, 19777, 19660, 19680, 19699, 19830, 19763, 19599, 19692, 19651, 19679, 19727, 19771, 19792, 19664, 19683, 19750, 19744, 19748, 19794, 19588, 19781, 19581, 19698); 1♂ St. Lucia Nature Reserve, Coastal bush & forest, 18–20.xii.1981, J.G.H. Londt & B.R. Stuckenberg (NMSA); 1♂ Tugela River, Royal Natal National Park, 15.iii.1954 (BMNH); 1♂ Umfuli, 28°50'S 31°28'E, 9–11.ix.1994, K.R. Cradock, Malaise trap (NMSA); 1♂ Vernon Crookes Nature Reserve, near Umzinto, 19–23.x.2006, G.B.P. Davies (NMSA); 1♂ Weenen Nature Reserve, 28°51'S 29°59'E, Thornveld, 1–4.x.1990, A.E. Whittington, Malaise trap (NMSA); 1♂ Zinkwasi Conservancy, 29°17'S 31°27'E, 10 m, Margins Dune Forest, 10.vi.1998, J.G.H. Londt (NMSA); 1♂ Mpumalanga: White River, 5.iii.1953 (BMNH); 1♂ North West Province: Pilanesberg National Park, Bakubung, 25°20'25"S 27°03'51"E, 1100 m, Gate, 12–19.xi.1999, J.G.H. Londt (NMSA).

Distribution: Kenya, Nigeria, South Africa. Appendix 3.6 – Fig. 9F (in Chapter 3)

Remarks: *Atherigona lineata torrida* has been treated as a variant form of *A. lineata* by authors in the past. I, however, feel that it sufficiently different and readily distinguishable from the other subspecies of *A. lineata* to warrant that it be recognised as a valid subspecies.

2.5.34 *Atherigona lineata* (Adams) ssp. *ugandae* van Emden, 1940

Fig. 53

Atherigona lineata ssp. *ugandae* van Emden, 1940: 137, figs 18, 39. Deeming 1971: 177, figs 134–138; Deeming 2000: 285.

Diagnosis: See diagnosis for *Atherigona lineata lineata* (section 2.5.32).

Type material examined: Holotype ♂: UGANDA: "Mabungo Camp, 6000ft, J. Ford, Uganda, Kigezi dist. Xi.1934. B.M.E. Afr. Exp. B.M. 1935-203" (BMNH).

Other material examined: 2♂ BOTSWANA: Martins Drift, Bechuanaland, [22.5719°S 28.4663°E], ii.1953 (BMNH); 1♂ MALAWI: Kasungu National Park, Lifupa Camp, 1000 m, Brachystegia, 9–10.xii.1980, B.R. Stuckenberg & J.G.H. Londt (NMSA); NAMIBIA: 2♂ Bethanien Dist. 15 km W Goageb, 1100 m, Sandy river bed, 19.ii.1974, M.E. Irwin (NMSA); 1♂ Kaross, ii.1925, SAMC Expedition (SAM-DIP A013856); 1♂ Lüderitz Dist. Agate Beach, 10 km N Lüderitz, 3 m, Low coastal vegetated dunes, 18.ii.1974, M.E. Irwin & B.J. Irwin (NMSA); 1♂ Maltahöhe Dist. Aandster Farm, 1000 m, Vegetated dune and grassland, 16.ii.1974, M.E. Irwin (NMSA); 2♂ Namib Desert Park, Kuiseb River at Gobabeb, 400 m, Riverine forest and sand, 12.ii.1974, M.E. Irwin & B.J. Irwin (NMSA); 3♂ Okahanja, Camping Place, Riverside vegetation, 4.ii.1972, Malaise trap (BMNH); 4♂ Otjikoko Süd Fm [Farm], 33 mi. ENE Omaruru, 10–13.ii.1972 (BMNH); 5♂ Otjitambi Fm. [Farm], 27 mi. ESE Kamanjab, at light, 13–15.ii.1972 (BMNH); 11♂ Swakopmund Dist. Swakop River Mouth, 8 m, Coastal and riverbed dunes, 9.ii.1974, M.E. Irwin & B.J. Irwin (SANC); 3♂ Warmbad, [-28.448034 18.734433], Koakoveld, ii.1925, SAMC Expedition (SAM-DIP

A013851); 1♂ Windhoek Dist. Auasberge, 21 km S Windhoek, 1800 m, Sandy wash in mountains, 31.i.1974, M.E. Irwin (NMSA); 2♂ Windhoek Dist. Windhoek, 1800 m, Sandy wash, 3.ii.1974, M.E. Irwin (NMSA); 1♂ Windhoek Dist. Windhoek, 1600 m, Sandy river bottom, 3.ii.1974, M.E. Irwin (NMSA); 1♂ Zesfontein, ii.1925, SAMC Expedition (SAM-DIP A013846); SOUTH AFRICA: *Free State*: 10♂ Brandfort, Florisbad Research Station, 28°46.039'S 26°04.234'E, Acacia Savanna, 4–6.iv.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 05553, 05519, 05590, 05589, 05586, 05530, 05551, 05538, 05534, 05544); 10♂ Brandfort, Soetdoring Nature Reserve, Kruger's Drift, 28°51.303'S 26°02.302'E, Acacia Savanna, 5–6.iv.2009, A.H. & M.K. Kirk-Spriggs, Malaise trap (BMSA(D) 05437, 05478, 05459, 05476, 05471, 05481, 05486, 05484, 05475, 05502); 2♂ *Gauteng*: Johannesburg, 16.i.1953, Paterson (BMNH); *KwaZulu-Natal*: 1♂ Himeville, 3–5.iii.2004, M.B. Mostovski, light trap (NMSA); 1♂ Ndumo Game Reserve, main road, 26°54.288'S 32°17.974'E, Sand and broad-leafed deciduous forest, 4–8.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 18236); 1♂ Ndumo Game Reserve, pan, 26°54.288'S 32°17.974'E, Grassy flood plain, 9–10.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 19484); 3♂ Ramsgate Butterfly Sanctuary, 30°53.3'S 30°20.4'E, 26–29.iv.2004, M.B. Mostovski, light trap (NMSA); 1♂ Royal Natal National Park, 28°41'S 28°56'E, 1440 m, Caravan park environs, 23–28.iii.1991, J.G.H. Londt (NMSA); 1♂ *Western Cape*: Gt. Wint-hoek [Greater Winterhoekberge] Tulbach, 4500 ft, xi. 1916, Lightfoot (SAM-DIP A013855).

Distribution: Botswana, Kenya, Malawi, Namibia, South Africa, Uganda: Appendix 3.6 – Fig. 10A (in Chapter 3).

2.5.35

Atherigona londti sp. n.

Fig. 48

Etymology: Named after the collector of the holotype and some paratype material, Dr Jason Londt.

Diagnosis: This species is very similar to *A. flavifinis* and *A. latibasilaris* in having the apex of the scutellum yellow, but differs greatly in terms of the shape of the trifoliate process and hypopygial prominence. It keys close to *A. hyalinipennis* and *A. secrecauda* Séguy, 1938 in both Deeming (1971) and Dike (1989a) but the trifoliate process of *A. londti* lacks the wing-like projections of the hood in *A. secrecauda* and cordiform median piece of *A. hyalinipennis*.

Male.

Description:

Body length: 3.317 mm; wing: 2.944 mm; r-m crossvein ratio: 0.429.

Head: Ground colour dark. All head setae and setulae infuscated. Occiput silver-grey dusted with narrow median part glossy, laterally silver-grey dusted. Ocellar triangle silver-grey dusted. Frontal vitta yellow. Frontal plate silver-grey dusted with three pairs of proclinate frontal setae and two pairs of orbital setae. Parafacial silver-grey dusted, narrower than arista base at narrowest. Scape and pedicel ferruginous, postpedicel infuscated except for ferruginous basal area. Arista brown. Palpus yellow; truncated and dilated with hyaline hairs.

Thorax: Ground colour dark. Postpronotal lobe golden dusted, with three setae and eight setulae. Pleura grey dusted. Proepisternum inconspicuous and gold dusted. Scutum grey dusted, with three weak, barely visible 2-4 dorsocentral vittae, stopping before scutellum. Scutellum grey dusted except for yellow apex; one pair of basal setae, one pair of discal setae and three discal setulae, one pair of subbasal setae and one pair of apical setae (subbasal 0.8× apical).

Legs: All legs yellow except for dark marking on apex of fore femur, with fore tibia and fore tarsi infuscated.

Leg chaetotaxy: Fore tarsi without any specialised chaetotaxy.

Wings: Hyaline. Veins brown. Knob of halteres white with stalk yellow. Calypters white.

Abdomen: All tergites yellow; tergite 1+2 immaculate; tergite 3 with a pair of small dark markings, taking up a third of dorsal surface (absent in some paratypes); tergite 4 with two small dark spots, taking up a third of dorsal surface; tergite 5 immaculate. Hypopygial prominence slightly bifurcate. Trifoliate process stem 1.6× the length of the apical process; stem brown except for apical third which is hyaline, hood also hyaline, rest of process infuscated; median piece club shaped with gradual apical dilation, curved in profile, but linear, with two pairs of forward projecting setulae; lateral plates with inner lobes. Surstylus without dark markings.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *Eastern Cape*: Boesmansriviermond, Hill above caravan park, 27–31.xii.1985, J.G.H. Londt (NMSA).

Paratypes: 1♂ 3 km E Grahamstown, Belmont Valley, 2&5.i.1986, J.G.H. Londt & B. Londt, Malaise trap (NMSA); 3♂ Grahamstown (plot 5280), Three Chimneys farm, 33°18.542'S 26°29.846'E, 2–13.iii.2008, A.H. Kirk-Spriggs, Malaise trap (AMGS); 2♂ Grahamstown, Albany Museum grounds, 33°18.822'S 26°31.315'E, 15–23.x.2007, A.H. Kirk-Spriggs, Malaise trap (AMGS); 1♂ Port Elizabeth, Cape Recife area, Reserve, 22–27.xii.1985, J.G.H. Londt (NMSA); 1♂ *Western Cape*: Cape Town, NE of Houtbay, 34°02'S 18°20'E, 3.x.1994, R. Danielsson (MZLU).

Distribution: South Africa. Appendix 3.6 – Fig. 10B (in Chapter 3).

2.5.36

Atherigona longifolia van Emden, 1940

Fig. 11

Atherigona longifolia van Emden, 1940: 130, figs 25, 32; Deeming 1971: 171, figs 111–113.

Diagnosis: This species can be distinguished from others with an infuscated frontal vitta by its yellow palpi, the fore femur being infuscated on apical half to third and the hypopygial prominence being small and subtruncate, the margins appearing almost angular when viewed dorsally. The median piece of the trifoliate process is also entirely filiform in posterior view and “boomerang” shaped in profile.

Type material examined: Holotype ♂: Kilembe, 4500 ft, F.W. Edwards, Uganda, Ruwenzori Range, xii.1934–i.1935, B.M.E. Afr. Exp., B.M. (BMNH).

Other material examined: 1♂ BENIN: (DAHOMÉY): Aborney-Calavi. C. 25 km B of Cotonou, xii.1988, J.S. Noyes (NMSA); 1♂ KENYA: *W. Kakamega*: Kakamega Forest Reserve, 00°22'N 34°53'E, 1620 m, Indigenous forest paths, 24.xi.1992, A.E. Whittington & J.G.H. Londt (NMSA); SOUTH AFRICA: *KwaZulu-Natal*: 2♂ Mkuzi Game Reserve, Main Camp and Caravan Park area, 27°35'S 32°13'E, 100 m, 1.ii.1988, J.G.H. Londt (NMSA); 12♂ Ndumo Game Reserve, Main camp, 26°54.652'S 32°19.719'E, Broad-leafed deciduous woodland, 27–30.xi.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 14483, 14477, 14467, 14057, 14511, 14484, 14047, 14488, 14048, 14479, 14475, 14298); 60♂ Ndumo Game Reserve, main road, 26°54.288'S 32°17.974'E, Sand and broad-leafed deciduous forest, 4–8.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 18201, 18204, 18227, 18190, 17533, 17523, 17958, 17555, 17554, 17550, 17543, 18626, 18194, 18188, 18185, 17959, 17541, 17936, 17945, 17949, 18261, 18260, 18255, 18251, 18246, 18240, 18198, 18199, 18242, 17539, 18263, 17521, 17510, 17526, 17547, 18195, 18206, 18258, 18215, 18210, 18235, 17513, 18228, 18203, 18197, 18209, 18229, 18252, 18259, 14480, 18232, 18220, 17538, 17548, 17522, 18208, 18211, 17516, 18221, 18226); 4♂ Ndumo Game Reserve, pan, 26°54.288'S 32°17.974'E, Grassy flood plain, 9–10.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 19485, 19469, 19472, 19482); 6♂ Ndumo Game Reserve, Shokwe area, 26°52.125'S 32°13.731'E, Ficus forest, 30.xi–4.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 15821, 15748, 16484, 16353, 15817, 15742); 2♂ Zululand, 20 mi S Ndumu [Ndumo] Game Reserve Camp, 320 ft., Dry scrub forest, 29.xi.1971, M.E. Irwin & B.J. Irwin (NMSA).

Distribution: Benin (new), Kenya, Mali, Nigeria, Senegal, South Africa (new), Tanzania, Uganda. Appendix 3.6 – Fig. 10C (in Chapter 3).

2.5.37

Atherigona marginifolia van Emden, 1940

Fig. 19

Atherigona marginifolia van Emden, 1940: 122, figs 44, 13; Deeming 1971: 163, figs 77, 78; Deeming 1979: 40, figs 20–22.

Diagnosis: This species has a very characteristic trifoliate process and hypopygial prominence which combined with its one third yellow to two thirds infuscated frontal vitta and ferruginous postpedicel with half infuscated dorsal edge and apex make it quite distinct. The median piece of the trifoliate process has a pair of well-developed apical setae and the hypopygial prominence as in Figure 19c, d.

Type material examined: Holotype ♂: [UGANDA]: Busana; 22.x.1933; (*T. W. Chorley*) (BMNH).

Other material examined: 1♂ MALI: Mourdiah, 13–25.viii.1986, M. Matthews (NMSA) (Previously NMW.Z.1987–144); SOUTH AFRICA: *Eastern Cape*: 24♂ Grahamstown (plot 5280), Three Chimneys farm, 33°18.542'S 26°29.846'E, 2–13.iii.2008, A.H. Kirk-Spriggs, Malaise trap (AMGS); 1♂ Xuka River, 10 km E Engcobo, river bank, 26.x.1978, J.G.H. Londt & R.M. Miller (NMSA); *Free State*: 2♂ Brandfort, Florisbad Research Station, 28°46.039'S 26°04.234'E, Acacia Savanna, 4–6.iv.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 05532, 05596); 7♂ Brandfort, Soetdoring Nature Reserve, Kruger's Drift, 28°51.303'S 26°02.302'E, Acacia Savanna, 5–6.iv.2009, A.H. & M.K. Kirk-Spriggs, Malaise trap (BMSA(D) 05485, 05487, 05451, 05466, 05461, 05474, 05429); 1♂ Brandfort, Soetdoring Nature Reserve, train camp, 28°50.934'S 26°01.996'E, Acacia Savanna thicket, 5–6.iv.2009, A.H. & M.K. Kirk-Spriggs, Malaise trap (BMSA(D) 05493); 2♂ Harrismith, Mooihoekkop, 28°18'50.0"S 29°10'51.1"E, 1800 m, *Leucosedes* [*Leucosidea*] dominated scrub, 14–16.ix.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 09850, 10251); 1♂ Harrismith, Scotland farm, 27°58'59.5"S 29°37'09.8"E, dense *Leucosedea*

[*Leucosidea*] dominated scrub, 10–12.xi.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 12767); 2♂ *Gauteng*: Johannesburg, 23.xi.1951, Paterson, ex. Carrion (BMNH); *KwaZulu-Natal*: 3♂ Ashburton 15 km SE of Pietermaritzburg, Grassland, ii.1977, J.G.H. Londt, Malaise trap (NMSA); 2♂ Giant's Castle Game Reserve - Injasuti area, 5–11.xii.1983, J.G.H. Londt (NMSA); 1♂ Ingwavuma, Zululand, 10.xii.1963, B.R. Stuckenberg & P. Stuckenberg (NMSA); 2♂ Pietermaritzburg, Town Bush, ix.1976, R.M. Miller (NMSA); 2♂ Richards Bay, 28°46'S 32°04'E, 24.x.1994, R. Danielsson (MZLU); 1♂ Umfolozi Game Reserve, Masinda camp, 28°17'S 31°57'E, 200 m, 25–28.xi.1993, J.G.H. Londt, Malaise (NMSA); 3♂ Weenen Nature Reserve, 28°51'S 29°59'E, Thornveld, 1–4.x.1990, A.E. Whittington, Malaise trap (NMSA); 6♂ Weenen Nature Reserve, Uthombe, 28°51'S 29°59'E, Thornveld, 1–4.x.1990, A.E. Whittington, Sweep net (NMSA); *Limpopo*: 2♂ 23 mi. NW of Naboomspruit, 20.ii.1949 (BMNH); 2♂ Behind Cloud's End Hotel, 23°00'S 29°55'E, 3500 ft, Mixed woodland with stream, 21.xi.1997, D.A. Barraclough & S. James (NMSA); 1♂ Louis Trichardt [Makhado], i–ii.1928, R.F. Lawrence (SAM-DIP A013858); 2♂ Mabula Game Reserve, 24°44.29'S 27°54.45'E, 1230 m, Main lodge area and Bushveld, 15–18.ix.2009, J.G.H. Londt & A. Londt (NMSA); 1♂ Nylsvley [Nature] Reserve, Naboomspruit, 10.xi.1976, P. Ferrar (BMNH); 1♂ Nylsvley [Nature] Reserve, Naboomspruit, 28.xi.1978, P. Ferrar (BMNH); 3♂ Nylsvley [Nature] Reserve, Naboomspruit, 8.ii.1977, P. Ferrar (BMNH); 6♂ Nylsvley Nature Reserve, 24°39'S 28°42'E, 1095 m, ix.1978, G. Ferreira, Malaise trap (SANC); 1♂ Ofcolaco, Selati River, 7–8.xii.1976, R.M. Miller (NMSA); 1♂ Tshakoma, Zpbg [Zoutpansberg], xi.1931, G. van Son (NMSA); *North West Province*: 1♂ Potchefstroom, 16.xii.1952, Paterson (BMNH); 4♂ Potchefstroom, 18.xii.1952, Paterson (BMNH); 5♂ Potchefstroom, 7.ii.1953, Paterson (BMNH); 8♂ Rustenburg Nature Reserve, 25°40'S 27°12'E, 17–20.iii.1980, C.D. Eardley, W.A. Harrop & C.G. Moolman, Malaise trap (SANC); 1♂ Rustenburg Nature Reserve, 25°40'S 27°12'E, 23–26.ii.1981, I.M. Millar, Malaise trap (SANC); 2♂ ZIMBABWE: , 6–10. iv.1954, A.J.T. Janse (NMSA).

Distribution: Burkina Faso, Chad, Ghana, Mali, Nigeria, Senegal, South Africa, Uganda, Zimbabwe. Appendix 3.6 – Fig. 10D (in Chapter 3).

2.5.38 *Atherigona matilei* Deeming, 1977

Fig. 64

Atherigona matilei Deeming, 1977: 148, figs 8–12; Deeming 1987: 20.

Diagnosis: This species has the frontal plate glossy in appearance, brown smoky suffusions on the wing and the trifoliate process with the median piece being strongly dilated, having a deep “u” shaped emargination. The hypopygial prominence appears quite complex (Fig. 64d) when viewed dorsally.

Type material examined: Holotype ♂: E. Africa; Mt. Kenya; Ragati; 6800ft; 25.viii.1949; J.A. Riley (BMNH).

Other material examined: SOUTH AFRICA: *KwaZulu-Natal*: 1♂ 10 mi. N Jozini, 800 ft., Dry forest, 28.xi.1971, M.E. Irwin & B.J. Irwin (NMSA); 1♂ Umhlatuzi, 6.iii.1954 (NMSA).

Distribution: Angola, Cameroon, Kenya, Madagascar, Nigeria, South Africa (new), Uganda. Appendix 3.6 – Fig. 10E (in Chapter 3).

2.5.39 *Atherigona mitrata* Séguy, 1955

Fig. 41

Atherigona mitrata Séguy, 1955: 164; Deeming 1971: 156, figs 42–46.

Diagnosis: This species is very easily distinguished from other species by its very distinct and characteristic head, which is much longer than it is deep, with its parafacialia at its widest being longer than the horizontal length of the eye, at narrowest still wider than the postpedicel. It also has a hyaline trifoliate process with the median piece and lateral lobes very slim (Fig. 41).

Type material examined: Lectotype ♂: CAMEROON (Originally French Cameroun): Garoua, xii.1954, obtenu de larves trouvees dans les mines des tiges de Riz sauvage, M. Descamps (BMNH).

Distribution: Cameroon, Namibia, Nigeria, South Africa, Zambia, Zimbabwe (No South African map data).

2.5.40 *Atherigona naqvii* Steyskal, 1966

Fig. 37

Atherigona naqvii Steyskal, 1966: 53; Deeming 1971: 160, figs 61–66.

Diagnosis: This species has a similarly coloured trifoliate process to that of *A. libertensis* and *A. cinarina*, and also a pair of hyaline apical setulae on the median piece. *A. naqvii* differs, however, from the aforementioned species by the combination of a yellow frontal vitta and the hypopygial prominence appearing tridentate (Fig. 37c). The trifoliate process is also without fine surface setulae as in *A. cinarina*.

Type material examined: None. Type material housed in National Museum of Natural History – Smithsonian Institution (NMNH), but not seen.

Other material examined: 3♂ BOTSWANA: Tsessebe, Bechuanaland, i.1956, F. Zumpt (BMNH); 1♂ MALAWI: Viphya Mtns [Mountains], Chikangawa, 1700 m, Forest edge & grassland., 5–8.xii.1980, B.R. Stuckenberg & J.G.H. Londt (NMSA); NAMIBIA: 1♂ Gobabis, ii/iii.1971 (BMNH); 1♂ Kamanyab, iii.1995, SAMC Expedition (SAM-DIP A013847); 2♂ Kaoko Otawi, iii.1995, SAMC Expedition (SAM-DIP A013853); 1♂ Karibib, ii.1978, C. Kok & S.J van Tonder (SANC); ♀ Maltahöhe Dist. Aandster Farm, 930 m, sandy to gravel grass-covered plain, 17.ii.1974, L. Lyneborg (NMSA); ♂ Namib Desert Park, Kuiseb River at Gobabeb, 400 m, Riverine forest and sand, 12.ii.1974, L. Lyneborg (NMSA); 8♂ Okahanja, Camping Place, Riverside vegetation, 4.ii.1972, Malaise trap (BMNH); 1♂ Onguma Fm. 55 mi. NW. Tsumeb, 17–19.ii.1972, at light (BMNH); 7♂ Otjikoko Süd Fm [Farm], 33 mi. ENE Omaruru, 10–13.ii.1972 (BMNH); 3♂ Otjitambi Fm. [Farm], 27 mi. ESE Kamanjab, at light, 13–15.ii.1972 (BMNH); 1♂ Outjo, i.1925, SAMC Expedition (SAM-DIP A013854); 3♂ Sesriem Farm, Maltahoe Distr., 19–20.i.1972, general sweeping (BMNH); 1♂ Warmbad, [-28.448034 18.734433], Koakoveld, ii.1925, SAMC Expedition (SAM-DIP A013851); 2♂ Windhoek, Hoffnung Fm., Lucerne fields, 7.ii.1972 (BMNH); 1♂ Windhoek, Race-Course, 2–4.ii.1972 (BMNH); 1♂ Windhoek, Race-Course, Low vegetation, 5.ii.1972 (BMNH); 3♂ Windhoek, Regenstein Mt., 7000 ft, Montane vegetation, 8.ii.1972 (BMNH); 1♂ Zesfontein, ii.1925, SAMC Expedition (SAM-DIP A013846); SOUTH AFRICA: *Free State*: 1 km SW of Paul Roux, 28°18'S 27°27'E, 1700 m, Rocky hill and farmland, 11.iii.1991, J.G.H. Londt & A.E. Whittington (NMSA); 1♂ Brandfort, Florisbad Research Station, 28°46.039'S 26°04.234'E, Acacia Savanna, 4–6.iv.2009, A.H.

Kirk-Spriggs, Malaise trap (BMSA(D) 05548, 05550, 05555); 9♂ Brandfort, Soetdoring Nature Reserve, Kruger's Drift, 28°51.303'S 26°02.302'E, Acacia Savanna, 5–6.iv.2009, A.H. & M.K. Kirk-Spriggs, Malaise trap (BMSA(D) 05430, 05445, 05468, 05460, 05448, 05452, 05436, 05470, 05441). 1♂ Brandfort, Soetdoring Nature Reserve, train camp, 28°50.934'S 26°01.996'E, Acacia Savanna thicket, 5–6.iv.2009, A.H. & M.K. Kirk-Spriggs, Malaise trap (BMSA(D) 05531); 2♂ *KwaZulu-Natal*: Ozabeni-Manzimbomvu Section, Greater St. Lucia Wetland Park, 27–28.v.2006, G.B.P. Davies (NMSA); 2♂ Richards Bay, 28°46'S 32°04'E, 24.x.1994, R. Danielsson (MZLU); ♂ *North West Province*: Mafikeng Game Reserve, Kolobe Drinking Pond, 25°50'59"S 25°43'10"E, 1320 m, *Rhus lancea* savanna, 16.iii.2003, J.G.H. Londt (NMSA); 1♂ Swartfontein, Vryburg, 26°54'S 24°45'E, 1240 m, Mixed bushveld-grass, 12.iii.1991, J.G.H. Londt & A.E. Whittington (NMSA); 1♂ *Western Cape*: 3 km E Kaap Agulhas, 34°49'S 20°01'E, 12.x.1994, R. Danielsson (MZLU); 1♂ SWAZILAND: 2 km N Loyengo, 26°33'S 31°11'E, 25.x.1994, R. Danielsson (MZLU).

Distribution: Afrotropical: Botswana (new), Burkina Faso, Ethiopia, Kenya, Malawi (new), Mali, Namibia, Nigeria, Oman, Saudi Arabia, South Africa, Swaziland (new), Yemen. Appendix 3.6 – Fig. 10F (in Chapter 3). Non-Afrotropical: Australia, Canary Islands, India, Pakistan, Philippines, Sri Lanka.

2.5.41 *Atherigona ndumoensis* sp. n.

Fig. 24

Etymology: Named for the type locality Ndumo Game Reserve, KwaZulu-Natal, South Africa.

Diagnosis: This species is most similar to *A. falcata*, but differs from it in having the truncated apical area of the palpus much smaller than half the length of the entire palpus (as is the case in *A. falcata*). *A. ndumoensis* further has its parafacial area grey dusted compared to *A. falcata* that has it golden dusted. The trifoliate process also differs in shape (Fig. 24a vs. Fig 23a).

Male.

Description:

Body length: 3.286 mm; wing: 2.88 mm; r-m crossvein ratio: 0.477.

Head: Ground colour brown. All head setae and setulae infuscated. Occiput grey dusted throughout with narrow median part glossy, laterally silver-grey dusted. Ocellar triangle silver-grey dusted. Frontal vitta yellow, somewhat darker around ocellar triangle. Frontal plate silver-grey dusted throughout with four pairs of proclinate frontal setae and two pairs of orbital setae. Parafacial silver-grey dusted, at narrowest just as wide as arista base. Scape and pedicel ferruginous, postpedicel infuscated except for base which is ferruginous. Arista brown. Palpus yellow, apex truncated and dilated with hyaline hairs.

Thorax: Ground colour brown. Postpronotal lobe gold dusted, with three setae (one appearing as setulae) and six setulae. Pleura entirely silver-grey dusted; Proepisternum inconspicuous and gold dusted. Scutum grey dusted throughout, with three faint 2-4

dorsocentral vittae, stopping before scutellum. Scutellum grey dusted; one pair of basal setae, one pair of discal setae and eight discal setulae, one pair of subbasal setae and one pair of apical setae (subbasal pair equal to apical pair).

Legs: All legs yellow.

Leg chaetotaxy: Fore tarsi without any specialised chaetotaxy.

Wings: Hyaline. Veins light brown. Knob of halteres white with stalk yellow. Calypters white.

Abdomen: All tergites yellow; tergite 1+2 immaculate; tergite 3 with two small round markings (quite faint compared to most other species) taking up a third of dorsal surface; tergite 4 with small round markings, taking up a third of dorsal surface; tergite 5 immaculate. Hypopygial prominence knoblike, apically dilated with a pair of anteriorly projecting tubercles. Trifoliate process stem 1.8× the length of the apical process; trifoliate process infuscated except for hood and majority of stem which are light brown (stem apically hyaline); median piece dilated towards apex (appearing clublike), same general shape in lateral view, having four strong projecting setulae at apex; lateral plates 3× as wide as median piece in profile, with inner lobes. Surstylus without infuscation.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *KwaZulu-Natal*: Ndumo Game Reserve, Main camp area, 26°54.652'S 32°19.719'E, Broad-leaved deciduous woodland, 27–30.xi.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 14295).

Distribution: South Africa. Appendix 3.6 – Fig. 11A (in Chapter 3).

2.5.42

Atherigona nesshurstensis sp. n.

Fig. 55

Etymology: Named for the type locality Nesshurst farm, near Harrismith in the Free State, South Africa.

Diagnosis: This species is similar to *A. dentifolia* Dike, 1989, but differs from it by having a bifurcate hypopygial prominence compared to that of *A. dentifolia* which is bilobate. The trifoliate process has its median piece strongly dilated on apical half in posterior view and somewhat dilated throughout its length in profile, compared to *A. dentifolia* which has its median piece filiform throughout.

Male.

Description:

Body length: 3.596 mm; wing: 2.816 mm; r-m crossvein ratio: 0.338.

Head: Ground colour dark. All head setae and setulae infuscated. Occiput grey dusted throughout with narrow median part glossy, also laterally silver-grey dusted. Ocellar triangle grey dusted. Frontal vitta infuscated. Frontal plate silver-grey dusted

throughout with three pairs of proclinate frontal setae and two pairs of orbital setae. Parafacial silver-grey dusted, at narrowest wider than arista base. Scape and pedicel ferruginous, postpedicel and arista infuscated. Palpus yellow, apex truncated and dilated with hyaline hairs.

Thorax: Ground colour dark. Postpronotal lobe gold dusted, with three setae and 10 setulae. Pleura entirely grey dusted; Proepisternum inconspicuous and gold dusted. Scutum grey dusted throughout, with three 2-4 dorsocentral vittae, stopping before scutellum. Scutellum grey dusted; one pair of basal setae, one pair of discal setae and four discal setulae, one pair of subbasal setae and one pair of apical setae (subbasal pair 0.75× apical pair).

Legs: All legs yellow except for fore femur with dorsal dark marking near apex, fore tibia entirely infuscated except for extreme base and fore basitarsus together with following tarsal segment, which are also infuscated.

Leg chaetotaxy: Fore tarsi without any specialised chaetotaxy.

Wings: Hyaline. Veins brown. Knob of halteres white with stalk yellow. Calypters white.

Abdomen: All tergites yellow; tergite 1+2 with two large dark markings and a very much expanded median vitta that touches the inside edges of both, giving it an almost triangular appearance; tergite 3 two large dark oblong markings taking up over two thirds of dorsal surface, also with expanded median vitta that is almost touching the inside edges of other markings; tergite 4 with small round markings, taking up a third of dorsal surface, basal edge of tergite having a wide dark marking across most of surface; tergite 5 immaculate. Hypopygial prominence bifurcated. Trifoliate process stem 2× the length of the apical process; trifoliate process infuscated except for hood and stem which are light brown; median piece strongly dilated at apex posterior view, linear in lateral view; lateral plates 2× as wide as median piece in profile, with inner lobes. Surstylus with slight infuscation at base, and as strongly infuscated at apex as trifoliate process.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *Free State*: Harrismith, Nesshurst farm, 28°26'53.3"S 29°09'14.2"E, *Leucosidea* [*Leucosidea*] -scrub & stream bed, 17–18.ix.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 11073).

Distribution: South Africa. Appendix 3.6 – Fig. 11B (in Chapter 3).

2.5.43 *Atherigona nigrapicalis* Deeming, 1979

Fig. 10

Atherigona nigrapicalis Deeming, 1979: 36, figs 13–15.

Diagnosis: This species can be separated from others with an infuscated frontal vitta by its surstylus that is infuscated apically and on posterior angle. The mesonotum also lacks 2-4 dorsocentral vittae.

Type material examined: Holotype ♂: NORTHERN NIGERIA: Zaria, Samaru, 9.iv.1971, J.C. Deeming (BMNH).

Other material examined: SOUTH AFRICA: *Gauteng*: 1♂ Johannesburg, 18.i.1953, Paterson (BMNH); *KwaZulu-Natal*: 1♂ Mkuzi Game Reserve, 27°38'20"S 32°09'30"E, ca. 140 m, 8–15.x.1990, J.G.H. Londt, MV light & Malaise (NMSA); 2♂ Ndumo Game Reserve, pan, 26°54.288'S 32°17.974'E, Grassy flood plain, 9–10.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 19465, 19470).

Distribution: Nigeria, South Africa, Zimbabwe. Appendix 3.6 – Fig. 11C (in Chapter 3).

2.5.44

***Atherigona oblonga* sp. n.**

Fig. 28

Etymology: From the Latin *oblongus* (longer than broad), referring to the shape of the median piece of the trifoliate process.

Diagnosis: This species is very similar to *A. fililoba* Deeming, 1979, *A. piscatoris* sp. n. and *A. zariaensis* Deeming, 1979, with regards to the shape of its hypopygial prominence as well as general coloration. It differs, however, from the first two species by having the median piece of the trifoliate process markedly oblong and dilated in apical half in posterior view, compared to that of *A. fililoba* and *A. piscatoris* that is filiform for most of its length. Whilst *A. zariaensis* also has a dilated median piece, it is not oblong, and the lateral lobes are also not constricted medially.

Male.

Description:

Body length: 4.433 mm; wing: 3.038 mm; r-m crossvein ratio: 0.333.

Head: Ground colour dark. All head setae and setulae infuscated. Occiput grey dusted posteriorly and laterally (with the exception of bottom of occiput which is gold dusted) with narrow median part glossy. Ocellar triangle grey dusted. Frontal vitta infuscated with slight reddish suffusion at apex. Frontal plate silver-grey dusted except for area surrounding the apical pair of the three pairs of frontal setae which is gold dusted, also with two pairs of orbital setae. Parafacial golden-yellow dusted, as wide as arista base. Scape, pedicel and arista darkly ferruginous, postpedicel wholly infuscated. Palpus infuscated except for ventral part of apex which is yellow; apex strongly dilated and truncated with hyaline setulae.

Thorax: Ground colour dark. Postpronotal lobe gold dusted, with three setae and 13 setulae. Pleura golden dusted. Proepisternum inconspicuous. Scutum grey dusted, with three weak and barely visible 2-4 dorsocentral vittae, stopping before scutellum. Scutellum grey dusted; one pair of basal setae, one pair of discal setae and nine discal setulae; one pair of subbasal setae and one pair of apical setae, equal in length.

Legs: All legs yellow except for forelegs with apical two thirds of tibia and all tarsi infuscated.

Leg chaetotaxy: Fore femur with one submedial posteroventral seta; apical three fore tarsal segments with long dorsal setulae, at least as long as segments are wide.

Wings: Hyaline, except for slight brown smoky suffusion at apex of Sc-R₁ and around humeral crossvein. Veins dark brown. Knob of halteres white with stalk yellow. Calypters white.

Abdomen: All tergites yellow; tergite 1+2 immaculate; tergite 3 with two medium sized dark-brown almost teardrop shaped marks taking up two thirds of dorsum length; tergite 4 with two small round markings, taking up two thirds of segment length; tergite 5 immaculate. Hypopygial prominence knoblike, with two anteriorly projecting tubercles at apex. Trifoliate process stem 3× the length of the apical process, entire process including stem infuscated with the exception of the basal third of stem which is hyaline; median piece bifurcated and dilated on apical quarter in posterior view, and boomerang shaped in profile, almost angular; lateral plates narrow in posterior view, medially constricted in profile; inner lobes absent; hood not very pronounced. Surstylus not infuscated.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *KwaZulu-Natal*: Umfolozi Game Reserve, Masinda camp, 28°17'S 31°57'E, 200 m, 25–28.xi.1993, J.G.H. Londt, Malaise (NMSA).

Paratype ♂: Umlalazi Nature Reserve, Dune forest & edges, 2–10.x.1982, J.G.H. Londt (NMSA).

Distribution: South Africa. Appendix 3.6 – Fig. 11D (in Chapter 3).

2.5.45 *Atherigona occidentalis* Deeming, 1971

Fig. 32

Atherigona occidentalis Deeming, 1971: 177, figs 132, 133; Deeming 1979: 49, figs 53–55.

Diagnosis: This species can be distinguished from others with the frontal vitta, palpi and antennae infuscated by its tridentate hypopygial prominence and y-shaped median piece of the infuscated trifoliate process.

Type material examined: Holotype ♂: NORTHERN NIGERIA: Zaria; Samaru; 26.ix.1968; J.C. Deeming; m.v. trap; det Deeming 1969 (NMWC).

Other material examined: 1♂ BOTSWANA: Tsessebe, Bechuanaland, i.1956, F. Zumpt (BMNH); 1♂ BURKINA FASO: Matourkou, on Sorghum shoots, vii–viii.1987, J. Zongo, leg. J.C. Deeming (NMSA) (Previously NMW.Z.1988–092).

Distribution: Botswana (new), Burkina Faso, Cameroon, Mali, Nigeria, South Africa (No South African map data).

2.5.46 *Atherigona ochracea* Deeming, 1981

Fig. 43

Atherigona ochracea Deeming, 1981: 106, figs 19, 20.

Diagnosis: This species can be distinguished from others with a yellow frontal vitta and mostly yellow antennae by its bifurcated hypopygial prominence and trifoliate process with apical half of lateral lobes and entire median piece infuscated.

Type material examined: Holotype ♂: SOUTH AFRICA: *KwaZulu-Natal*: Durban: Natal; vii.1948; J.C. Faure (BMNH).

Distribution: South Africa. Appendix 3.6 – Fig. 11E (in Chapter 3).

2.5.47 *Atherigona parviclivis* sp. n.

Fig. 3

Etymology: From the Latin *parvus* (small) and *clivus* (mountain or hill) pertaining to the small hill-shaped hypopygial prominence.

Diagnosis: This species keys to *A. ochripes* in (Dike 1989a), but differs from it due to having a very distinctly reduced hypopygial prominence, compared to a truncated and emarginated one. *A. parviclivis* also has its trifoliate process with a much expanded median piece, appearing almost semi-circular (Fig. 3b) in profile, entirely filiform in posterior view and the entire process infuscated except for the base, compared to *A. ochripes* which has it slightly dilated in posterior view, not semi-circular in profile and having the process hyaline for the most part.

Male.

Description:

Body length: 3.689 mm; wing: 3.072 mm; r-m crossvein ratio: 0.365.

Head: Ground colour dark. All head setae and setulae infuscated. Occiput grey dusted posteriorly and laterally (with the exception of bottom of occiput which is gold dusted) with narrow median part glossy. Ocellar triangle grey dusted. Frontal vitta infuscated. Frontal plate silver-grey dusted except for area surrounding the apical two pairs of the three pairs of proclinate frontal setae which is gold dusted, also with two pairs of orbital setae. Parafacial golden dusted, wider than arista base. Scape and pedicel darkly ferruginous, postpedicel infuscated except for narrow basal inner area. Arista infuscated. Palpus entirely yellow; apex weakly truncated with minimal dilation, palpus appearing almost straplike.

Thorax: Ground colour dark. Postpronotal lobe gold dusted, with three setae and 12 setulae. Pleura golden dusted. Proepisternum inconspicuous. Scutum grey dusted, with three weak and barely visible 2-4 dorsocentral vittae, stopping before scutellum. Scutellum grey dusted; one pair of basal setae, one pair of discal setae and an unknown

number of discal setulae (due to specimen damage); one pair of subbasal setae and one pair of apical setae (comparison not possible due to damage).

Legs: All legs yellow except for forelegs with apical half of tibia and all tarsi infuscated.

Leg chaetotaxy: Fore tarsi without any specialised chaetotaxy.

Wings: Hyaline. Veins light brown. Knob of halteres white with stalk yellow. Calypters white.

Abdomen: All tergites yellow; tergite 1+2 immaculate; tergite 3 with two medium sized dark-brown marks taking up a third of dorsal surface; tergite 4 with two small round markings, taking up a third of dorsal surface; tergite 5 immaculate. Hypopygial prominence simple, appearing as a conical protrudence. Trifoliate process stem 3× the length of the apical process, entire process infuscated except for hyaline stem and hood; median piece linear and without dilation in posterior view, greatly dilated in profile, just as wide as lateral plates, almost semi-circular in appearance, without inner lobes; lateral plates in the shape of an upside-down teardrop when viewed in profile. Surstylus not infuscated.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *KwaZulu-Natal*: Ndumo Game Reserve, main road, 26°54.288'S 32°17.974'E, Sand and broad-leaved deciduous forest, 4–8.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 18183).

Paratype ♂: *North West Province*: Moselekaatsnek [Silkaatsnek], 10.i.1923, C.J. Swierstra (NMSA).

Distribution: South Africa. Appendix 3.6 – Fig. 11F (in Chapter 3).

2.5.48 *Atherigona parviumilata* sp. n.

Fig. 4

Etymology: From the Latin *parvus* (small) and *humilis* (humble), referring to the size and shape of the hypopygial prominence.

Diagnosis: This species is similar to other species that have the frontal plate and occiput glossy in combination with an infuscated frontal vitta, but differs from them in that it has the entire dorsal surface of the abdomen uniformly infuscate. *A. stuckenbergi* sp. n. has a similar abdominal coloration, but has its hypopygial prominence bilobate instead of weakly developed and somewhat bifurcated as in *A. parviumilata*.

Male.

Description:

Body length: 2.697 mm; wing: 2.48 mm; r-m crossvein ratio: 0.365.

Head: Ground colour dark. All head setae and setulae infuscated. Occiput infuscated with dark brown-grey pruinosity with rest of occiput glossy. Ocellar triangle infuscated with dark brown-grey pruinosity. Frontal vitta infuscated. Frontal plate entirely glossy

with three pairs of proclinate frontal setae and two pairs of orbital setae. Parafacial dark brown-grey dusted, narrower at bottom than arista base. Scape, pedicel postpedicel and arista infuscated. Palpus infuscated; apex truncated and dilated, with hyaline hairs. *Thorax*: Ground colour dark. Postpronotal lobe infuscated, with three setae and six setulae (four of which are very strongly developed almost appearing to be setae). Pleura grey dusted. Proepisternum inconspicuous and gold dusted. Scutum infuscated, with three strong 2-4 dorsocentral vittae, stopping before scutellum. Scutellum infuscated; one pair of basal setae, one pair of discal setae and nine discal setulae, one pair of subbasal setae and one stronger pair of apical setae (equal in length).

Legs: Forelegs and as well as mid and hind leg tarsi entirely infuscated, mid and hind legs otherwise yellow.

Leg chaetotaxy: Fore tarsi without any specialised chaetotaxy.

Wings: Hyaline, except for slight brown smoky suffusion at areas surrounding Sc-R₁ and the humeral crossvein. Veins dark brown. Knob of halteres white with stalk yellow. Calypters white.

Abdomen: All tergites infuscated; tergites 1+2, 3, 4 and 5 entirely covered by a seemingly singular dark mark, but is broken between tergite 4 and 5. Hypopygial prominence reduced, with a slight emargination at apex, almost appearing bifurcate. Trifoliate process stem 2.8× the length of the apical process; stem and hood lighter than rest of process which is infuscated, lateral plates and median piece infuscated; median piece linear, narrower than lateral plates; lateral plates without inner lobes. Surstylus without dark markings.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *Eastern Cape*: Lower Elandsbos river, on river bank, 33°58.007'S 23°46.492'E, Indigenous forest, 3–5.iv.2008, A.H. Kirk-Spriggs, Malaise trap (AMGS).

Paratypes: 2♂ same data as Holotype (AMGS).

Distribution: South Africa. Appendix 3.6 – Fig. 12A (in Chapter 3).

2.5.49

Atherigona perfida Stein, 1913

Fig. 34

Atherigona perfida Stein, 1913: 533; van Emden 1940: 126, figs 26, 57; van Emden 1956: 520; Deeming 1971: 155, figs 166, 167; Deeming 1979: 44, figs 30–34.

Diagnosis: This species can be distinguished from other species with a tridentate hypopygial prominence through the combination of entirely yellow forelegs and having the frontal vitta infuscated.

Material examined: Paralectotype ♂: ETHIOPIA: Dire Dawa, 19.xi.1911, Abyssinia, Kovaca, Brit Mus. 1949-630., det. P. Stein (ZMHB).

Other material examined: BOTSWANA: 1♂ Tsessebe, Bechuanaland, i.1956, F. Zumpt (BMNH);

MALAWI: 2♂ Zomba Plateau, Chinwe's Hole, Forest Patch, 12–13.iii.1987, J.G.H. Londt & A. Londt, Malaise trap (NMSA); SOUTH AFRICA: 1♂ *Eastern Cape*: Ingeli Forest, Kokstad Dist. Griqualand East, 17.x.1959, B.R. Stuckenberg & P. Stuckenberg (NMSA); 1♂ *Gauteng*: Johannesburg, 27.iii.1949, F. Zumpt (BMNH); *KwaZulu-Natal*: 2♂ Cathedral Peak area, Forest & Grassland, 14–18.ix.1982, D. Barraclough & C. Barraclough (NMSA); 1♂ Cathedral Peak Edu. Camp, 11–12.ix.2004, M.B. Mostovski, Yellow pan traps (NMSA); 3♂ Cathedral Peak N.R., Didima, 28°57.4'S 29°14.4'E, 1420 m, 12–16.xii.2005, M.B. Mostovski (NMSA); 7♂ Cathedral Peak, Didima, 28°57.000'S 29°14.395'E, 1422 m, 13–16.xii.2004, M.B. Mostovski (NMSA); 3♂ Cathedral Peak, Didima, 28°57.000'S 29°14.395'E, 1422 m, 14–16.xii.2005, M.B. Mostovski (NMSA); 1♂ Cedara College, 8.viii.1976, R.M. Miller (SANParks); 1♂ Drakensberg Garden Caravan Park, 29°45'S 29°15'E, ca. 1750 m, On Cassine flowers, 6–11.i.1988, J.G.H. Londt (NMSA); 2♂ Giant's Castle, 29°15.955'S 29°31.228'E, 1710 m, 8–10.xii.2004, M.B. Mostovski (NMSA); 1♂ Injasuti Nature Reserve, 29°12'S 29°11'E, 1500 m, 25.iii.1994, J.G.H. Londt (NMSA); 1♂ Karkloof, 8.i.1957, B.R. Stuckenberg & P. Stuckenberg (NMSA); 1♂ Lions Bush, Nottingham, 9.xiii.1954, B.R. Stuckenberg (NMSA); 3♂ Louwsberg, iGwala Gwala, 27°34'S 31°17.9'E, 1090 m, 2–3.vi.2005, M.B. Mostovski, YPT (NMSA); 1♂ Midlands, Howick, 29°29'S 30°13'E, 1060 m, Streamside vegetation, 10.viii.1991, A.E. Whittington (NMSA); 1♂ Newcastle, xii.1952 (BMNH); 1♂ Pongola Bush Nature Reserve, 27°21'S 30°26'E, Indigenous forest, 18.i.1995, B.R. Stuckenberg (NMSA); 2♂ Royal Natal Nat. Res [National Park], 28°41.4'S 28°56.3'E, 1420 m, 8–12.xii.2005, M.B. Mostovski, Sweeping (NMSA); 7♂ Royal Natal National Park, 28°41.362'S 28°56.327'E, 1425 m, stream, y-wood, 10–13.xii.2004, M.B. Mostovski, Malaise trap (NMSA); 1♂ Royal Natal National Park, 1500 m, 13.ix.1963, B.R. Stuckenberg & P. Stuckenberg (NMSA); 10♂ Royal Natal National Park, Thendele, 28°42.378'S 28°56.083'E, 1600 m, *Leucosedes* [*Leucosidea*] dominated scrub, 15–17.ii.2010, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 19754, 19714, 19832, 19724, 19725, 19722, 19709, 19765, 19594, 19726); 1♂ Royal Natal National Park, Tugela Valley, 5.iv.1951, Brinck & Rudebeck, insect trap (MZLU); 1♂ *Limpopo*: Nylsvley [Nature] Reserve, Naboomspruit, 28.iii.1979, P. Ferrar (BMNH).

Distribution: Botswana (new), Burundi, Cameroon, Ethiopia, Kenya, Malawi (new), Nigeria, Rwanda, South Africa (new), Uganda. Appendix 3.6 – Fig. 12B (in Chapter 3).

2.5.50

Atherigona piscatoris sp. n.

Fig. 27

Etymology: From the Latin *piscator* (fisherman), which alludes to the unique shape of the apex of the trifoliate process which is shaped like a fish hook.

Diagnosis: This species keys to (Dike 1989a) and is very similar to *A. binubila* in terms of coloration and the shape of the hypopygial prominence. It differs, however, entirely from that species (and others) in that it has a uniquely shaped median piece of the trifoliate process (Fig. 27a, b).

Male.

Description:

Body length: 4.309 mm; wing: 3.12 mm; r-m crossvein ratio: 0.412.

Head: Ground colour dark. All head setae and setulae infuscated. Occiput grey dusted posteriorly with narrow median part glossy, laterally also grey dusted. Ocellar triangle grey dusted. Frontal vitta infuscated. Frontal plate grey dusted, with three pairs of

proclinate frontal and two pairs of orbital setae. Parafacial golden-grey dusted, at narrowest as wide as arista base. Scape and pedicel infuscated with ferruginous apex. Postpedicel infuscated. Arista infuscated. Palpus infuscated; apically dilated and truncated, with hyaline setulae.

Thorax: Ground colour dark. Postpronotal lobe grey dusted, lobe with three setae and 12 setulae. Pleura golden-grey dusted. Proepisternum inconspicuous. Scutum grey dusted, with three faint and barely visible 2-4 dorsocentral vittae, not extending to the scutellum; Scutellum grey dusted, apical edge yellow; one pair of basal setae, one pair of discal setae and six discal setulae, one pair of subbasal setae and one pair of apical setae, subbasal and apical pair equal.

Legs: All legs yellow except for apical half of fore tibia and first three tarsal segments of fore tarsi which are infuscated.

Leg chaetotaxy: Fore tarsi without any specialised chaetotaxy.

Wings: Hyaline, except for slight brown smoky suffusion at apex of Sc-R₁ and humeral crossvein. Veins brown. Halteres with white knob and yellow stalk. Calypters white.

Abdomen: All tergites yellow; tergite 1+2 with a brown marking; tergite 3 with two large dark-brown oblong marks taking up approximately two thirds of surface; tergite 4 with two small round markings, taking up a third of segment; tergite 5 immaculate. Hypopygial prominence knob-shaped with two anteriorly projecting tubercles. Trifoliate process stem 2× the length of the apical process; trifoliate process infuscated except for brown stem; median piece with filiform in posterior view except for apex which is abruptly dilated, with hyaline setulae: one pair small and undifferentiated and the other pair long and hair-like (at least half the length of median piece); median piece almost angular in profile, with gradual dilation towards apex starting from middle of piece in profile, appearing to be shaped like a fishhook; lateral plates barely wider than median piece in profile, no inner lobes present. Surstylus not infuscated.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *KwaZulu-Natal*: Giant's Castle, 29°15.955'S 29°31.228'E, 1710 m, 8–10.xii.2004, M.B. Mostovski (NMSA).

Paratypes: 9 ♂ Same label data as Holotype (NMSA); 4♂ *Free State*: Geluksdal farm, 27°54'7.05"S 29°23'31.9"E, sparse *Leucisedea* [*Leucosidea*] dominated scrub, 9–10.xi.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 13289, 13292, 13293, 13294); 6♂ Harrismith, Scotland farm, 27°58'59.5"S 29°37'09.8"E, dense *Leucosidea* [*Leucosidea*] dominated scrub, 10–12.xi.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 12761, 12769, 12770, 12773, 12779, 12782); *KwaZulu-Natal*: 4♂: Cathedral Peak, Didima, 28°57.000'S 29°14.395'E, 1422 m, 13–16.xii.2004, M.B. Mostovski (NMSA); 1♂ Royal Natal National Park, 28°41.362'S 28°56.327'E, 1425 m, stream, y-wood, 10–13.xii.2004, M.B. Mostovski, Malaise trap (NMSA); 1♂ Royal Natal National Park, Riverine bush, montane slopes, 6–10.xiii.1984, J.G.H. Londt (NMSA); 32♂ Royal Natal National Park, Thendele, 28°42.378'S 28°56.083'E, 1600 m, *Leucosedes* [*Leucosidea*] dominated scrub, 15–17.ii.2010, A.H. Kirk-Spriggs, Malaise trap (BMSA(D)

19691, 19678, 19836, 19827, 19689, 19782, 19565, 19739, 19608, 19786, 19696, 19582, 19790, 19710, 19795, 19579, 19661, 19701, 19606, 19603, 19650, 19758, 19736, 19638, 19637, 19776, 19623, 19632, 19598, 19766, 19590).

Distribution: South Africa. Appendix 3.6 – Fig. 12C (in Chapter 3).

2.5.51 *Atherigona pulla* (Wiedemann, 1830)

Fig. 6

Coenosia pulla Wiedemann, 1830: 441.

Orthostylum rufipes Macquart, 1851a: 245 (1851b: 272).

Atherigona destructor Malloch, 1923: 185.

Atherigona pulla: Pont 1972: 51, fig. 14 (synonymised with *A. destructor*); Deeming 1979: 39.

Diagnosis: This species can be distinguished from most other species in that it has yellow vibrissae, compared to the more common infuscated state in others. It can be distinguished from *A. angulata* due to the shape of the trifoliate process. It can further be distinguished from *A. chrysohypene* by the shape of the hypopygial prominence which is knoblike and emarginate compared to the latter's being bilobate.

Type material: Paralectotype ♀ housed in Natural History Museum of Denmark (ZMUC), but not seen.

Other material examined: SOUTH AFRICA: *Free State*: 1♂ Brandfort, Florisbad Research Station, 28°46.039'S 26°04.234'E, Acacia Savanna, 4–6.iv.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 05525); 1♂ *Western Cape*: Clanwilliam 32 km NE Clanwilliam, Brandewyn R. [River], 2–3.x.1997, R.M. Miller (NMSA); 1♂ Kroonplanskloof, 10 km S Citrusdal, 32°40'S 19°01'E, 200–270 m, 4–8.x.1994, R. Danielsson (MZLU).

Distribution: Kenya, Madagascar, Mali, Morocco, Nigeria, South Africa, Sudan, Uganda, Zimbabwe. Appendix 3.6 – Fig. 12D (in Chapter 3).

2.5.52 *Atherigona rimapicis* sp. n.

Fig. 58

Etymology: From the Latin *rima* (cleft) and *apicis* (top), referring to the cleft apex of the median piece of the trifoliate process.

Diagnosis: This species keys close to *A. facilis* Deeming, 1971 in Dike (1989a) but differs from it in that it does not have a strongly bifurcated hypopygial prominence (Fig. 58c). It has the median piece of the trifoliate process almost bent angular and apically dilated in profile, compared to *A. facilis* which has the median piece linear in profile.

Male.

Description:

Body length: 3.937 mm; wing: 3.168 mm; r-m crossvein ratio: 0.377.

Head: Ground colour dark. All head setae and setulae infuscated. Occiput silver-grey

dusted with narrow median part glossy, laterally silver-grey dusted. Ocellar triangle silver-grey dusted. Frontal vitta infuscated. Frontal plate golden dusted around three pairs of proclinate frontal setae and grey dusted around two pairs of orbital setae. Parafacial golden dusted, wider at narrowest than arista base. Scape, pedicel and postpedicel infuscated except for and apical edge of pedicel and basal area of postpedicel. Arista infuscated. Palpus yellow; truncated and dilated with hyaline hairs. *Thorax*: Ground colour dark. Postpronotal lobe golden dusted, with three setae and 11 setulae. Pleura grey dusted. Proepisternum inconspicuous and gold dusted. Scutum grey dusted, with three 2-4 dorsocentral vittae, stopping before scutellum. Scutellum grey dusted; one pair of basal setae, one pair of discal setae and six discal setulae, one pair of subbasal setae and one stronger pair of apical setae (subbasal 0.88× apical).

Legs: All legs yellow.

Leg chaetotaxy: Apical three segments of fore tarsi with dorsal setulae that are at least as long as segments are wide.

Wings: Hyaline. Veins brown. Knob of halteres white with stalk yellow. Calypters white.

Abdomen: All tergites yellow; tergite 1+2 immaculate; tergite 3 with a pair of small teardrop shaped dark markings, taking up a third of dorsal surface; tergite 4 with two small dark spots, taking up a third of dorsal surface; tergite 5 immaculate. Hypopygial prominence with strong bifurcation, lobes appearing as two fused triangles in apical view. Trifoliate process stem 2.3× the length of the apical process; entire process brown throughout except for hyaline base of stem; median piece very strongly apically dilated, almost circular, with deep cleft at apex and appearing somewhat angular in profile (Holotype specimen is damaged with median piece separated from rest of process); lateral plates without inner lobes. Surstylus without dark markings.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *Western Cape*: De Hoop Nature Reserve, 34°27'S 20°25'E, 0–200 m, 10–13.x.1994, R. Danielsson (MZLU).

Paratypes: 1♂ same data as Holotype (MZLU); 1♂ *Eastern Cape*: Grahamstown, Albany Museum grounds, 33°18.822'S 26°31.315'E, 15–23.x.2007, A.H. Kirk-Spriggs, Malaise trap (AMGS).

Distribution: South Africa. Appendix 3.6 – Fig. 12E (in Chapter 3).

2.5.53

Atherigona rubricornis Stein, 1913

Fig. 45

Atherigona rubricornis Stein, 1913: 531; van Emden 1940: 101, figs. 15, 51; Deeming 1971: 157, figs 47, 48 (*A. tritici* Pont & Deeming figured); Deeming 1979: 39, figs 19 (female tergite 8); Pont & Deeming 2001: 298, figs 1–4.

Diagnosis: This species can be distinguished from other species with a partially yellow frontal vitta by the trifoliate process with median piece entirely linear in posterior view.

The species is very similar to *A. tritici* Pont & Deeming, 2001 (with *A. tritici* previously regarded as a form of *A. rubricornis*) with the main difference being the shape of the median piece which is dilated at its apex.

Type material examined: Syntype ♂: [ZIMBABWE]: Salisbury [Harare], Mashonaland, G.A.K. Marshall (ZMHB).

Other material examined: BOTSWANA: 1♂ Tlokweng, Sorghum field, 6–13.iii.1990, J.M. Mashonja, Malaise trap (NMSA); 1♂ Tsessebe, Bechuanaland, i.1956, F. Zumpt (BMNH); ♂ SOUTH AFRICA: *Eastern Cape*: 1♂ Aliwal North, 30°42'S 26°43'E, iii.1979, C.D. Eardley, C. Kok & S.J. van Tonder, Malaise trap (SANC); 1♂ Grahamstown (plot 5280), Three Chimneys farm, 33°18.542'S 26°29.846'E, 2–13.iii.2008, A.H. Kirk-Spriggs, Malaise trap (AMGS); *Free State*: 42 km SW of Winburg, 28°45'S 26°45'E, 1500 m, Grassland & bushes, 20.iii.1991, J.G.H. Londt & A.E. Whittington (NMSA); 7♂ Adullam Farm nr. Clarens, 28°32'S 28°28'E, 20–26.ii.1980, S.J. van Tonder, C. Kok & W.A. Harrop, Malaise trap (SANC); 2♂ Adullam Farm nr. Clarens, 28°32'S 28°28'E, 20–26.ii.1980, C. Kok, Malaise trap (SANC); 6♂ Brandfort, Florisbad Research Station, 28°46.039'S 26°04.234'E, Acacia Savanna, 4–6.iv.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 05592, 05591, 05516, 05521, 05581, 05570); 4♂ Brandfort, Soetdoring Nature Reserve, Kruger's Drift, 28°51.303'S 26°02.302'E, Acacia Savanna, 5–6.iv.2009, A.H. & M.K. Kirk-Spriggs, Malaise trap (BMSA(D) 5455, 5431, 5477, 5482); *KwaZulu-Natal*: 1♂ 20 mi. N Jozini, 750 ft., dry hillside, 28.xi.1971, M.E. Irwin & B.J. Irwin (NMSA); 1♂ Ferncliff Nature Reserve, 29°33.2'S 30°20.5'E, 855 m, 5.xii.2004, M.B. Mostovski, light trap (NMSA); 1♂ Hilton Road, 13.xii.1963, B.R. Stuckenberg (NMSA); 3♂ Himeville, 3–5.iii.2004, M.B. Mostovski, light trap (NMSA); 1♂ Howick, 29°28'S 30°13'E, 1060 m, 9.iv.1993, A.E. Whittington, Mercury blended light (NMSA); 1♂ Ndumo Game Reserve, main road, 26°54.288'S 32°17.974'E, Sand and broad-leaved deciduous forest, 4–8.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 17559); 1♂ Pietermaritzburg, Hilton, garden, 13–23.xi.2003, M.B. Mostovski, Malaise trap (NMSA); 2♂ Royal Natal National Park, 28°41.362'S 28°56.327'E, 1425 m, stream, y-wood, 10–13.xii.2004, M.B. Mostovski, Malaise trap (NMSA); 3♂ Royal Natal National Park, 7–11.iv.1951, Brinck & Rudebeck, insect trap (MZLU); 1♂ Royal Natal National Park, Thendele, 28°42.378'S 28°56.083'E, 1600 m, *Leucosedes* [*Leucosidea*] dominated scrub, 15–17.ii.2010, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 19723); 2♂ St. Lucia Nature Reserve, Coastal bush & forest, 18–20. xii.1981, J.G.H. Londt & B.R. Stuckenberg (NMSA); *Limpopo*: 1♂ 23 mi. NW of Naboomspruit, 20.ii.1949 (BMNH); 1♂ Nylsvley Nature Reserve, 24°39'S 28°42'E, 10–11.xii.1979, C.D. Eardley, C.G. Moolman & W.A. Harrop, Malaise trap (SANC); *Mpumalanga*: 1♂ 8 km NW Baberton on Badplaas Rd., Bushveld long grass, 6–8.iv.1985, J.G.H. Londt (NMSA); 1♂ Baberton, 13.xii.1910, A.J.T. Janse (NMSA); 1♂ Loskopdam Nature Reserve area, Bushveld nr. River, 24.i.1978, J.G.H. Londt (NMSA); *North West Province*: 1♂ S.A. Lombaard Nature Reserve, 27°36'05"S 25°28'51"E, 1230 m, Rhus, Acacia savanna, 11.iii.2003, J.G.H. Londt, Malaise and light traps (NMSA); *Western Cape*: 1♂ Malgas, 34°20'S 20°30'E, 40 m, 11–13.x.1994, R. Danielsson (MZLU).

Distribution: Botswana, Chad, Kenya, Namibia, Nigeria, South Africa, Uganda, Zimbabwe. Appendix 3.6 – Fig. 12F (in Chapter 3).

2.5.54

Atherigona ruficornis Stein, 1913

Fig. 38

Atherigona ruficornis Stein, 1913: 532; van Emden 1940: 121, figs 20, 50.

Diagnosis: This species can be distinguished from similar species such as *A. rubricornis* by its entirely yellow fore femur. The hypopygial prominence, whilst bifurcated and

quite similar to that of *A. rubricornis* is more apically pointed. The trifoliate process is filiform in posterior view, and apically curved and dilated.

Type material examined: Syntype ♂: [ZIMBABWE]: Salisbury [Harare], Mashonaland, G.A.K. Marshall (ZMHB).

Other material examined: ETHIOPIA: 2♂ Alemaya, vii–viii.1986, T. Mesfin, leg. J.C. Deeming (NMSA) (Previously NMW.Z.1986–118); SOUTH AFRICA: 1♂ *KwaZulu-Natal*: Cathedral Peak area, 5–6.ii.1993, J.G.H. Londt, ex. Malaise (NMSA).

Distribution: Angola, Ethiopia, Kenya, Nigeria, South Africa, Tanzania, Uganda, Yemen, Zanzibar, Zimbabwe. Appendix 3.6 – Fig. 13A (in Chapter 3).

2.5.55 *Atherigona secrecauda* Séguy, 1938

Fig. 50

Atherigona secrecauda Séguy, 1938: 372; Deeming 1971: 155, figs 39–41; Deeming 1979: 38, figs 16–18; Deeming 1981: 104, figs 14, 15.

Diagnosis: This species can be distinguished from others by the winglike projections of the hood and the bilobate hypopygial prominence that which appears like two fused triangles when viewed dorsally.

Type material examined: Lectotype ♂: KENYA; Elgon Saw mill; Mt. Elgon Ver' Est (Camp II) 2.470m-- Museum De Paris; Mission de l'Omo; C. Arambourg; P.A. Chappuis & R. Jeannel; *Atherigona secrecauda* Séguy; E. Seguy det. 1935 (MNHM).

Other material examined: ETHIOPIA: 2♂1♀ Alemaya, vii–viii.1986, T. Mesfin (NMSA) (Previously NMW.Z.1986–118); MOZAMBIQUE: 2♂ Lourenço Marques [Maputo], 11–ii.1953, Paterson (BMNH); SOUTH AFRICA: *Free State*: 4♂ Harrismith, Mooihoekkop, 28°18'50.0"S 29°10'51.1"E, 1800 m, *Leucosedes* [*Leucosidea*] dominated scrub, 14–16.ix.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 09860, 10250, 09849, 10252); 1♂ Harrismith, Scotland farm, 27°58'59.5"S 29°37'09.8"E, dense *Leucosidea* [*Leucosidea*] dominated scrub, 10–12.xi.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 12780); *KwaZulu-Natal*: 1♂ Cathedral Peak N.R., Didima, 28°57.4'S 29°14.4'E, 1420 m, 12–16.xii.2005, M.B. Mostovski (NMSA); 1♂ Cathedral Peak, Didima, 28°57.000'S 29°14.395'E, 1422 m, 13–16.xii.2004, M.B. Mostovski (NMSA); 1♂ 1.5 km NW Lidgetton, ca. Cavasham Falls, 2.xii.1979, R.M. Miller & P. Stabbins (NMSA); 1♂ Kosi Bay - Lakeside, Papyrus Swamp Malaise, 16–19.iii.1982, D.A. Barraclough (NMSA); 1♂ Ozabeni-Manzimbomvu Section, Greater St. Lucia Wetland Park, 27–28.v.2006, G.B.P. Davies (NMSA); ♂ Richards Bay, 28°46'S 32°04'E, 24.x.1994, R. Danielsson (MZLU); 4♂ Royal Natal National Park, Thendele, 28°42.378'S 28°56.083'E, 1600 m, *Leucosedes* [*Leucosidea*] dominated scrub, 15–17.ii.2010, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 19780, 19577, 19552, 19747); 1♂ Tugela River, N Gobevo, 25 mi. N Greytown, 29.iii.1954 (BMNH); *Limpopo*: 1♂ Mogoto [Private] Nature Reserve, 24°15'S 29°13'E, 22–25.x.1979, C.D. Eardley, Malaise trap (SANC).

Distribution: Burkina Faso, Burundi, Cameroon, Congo, Democratic Republic of the Congo, Ethiopia, Kenya, Mali, Mozambique (new), Nigeria, Rwanda, Sierra Leone, South Africa, Tanzania, Uganda, Zimbabwe. Appendix 3.6 – Fig. 13B (in Chapter 3).

2.5.56 *Atherigona soccata* Rondani, 1871

Fig. 54

Atherigona soccata Rondani, 1871: 332; Deeming 1987: 18.*Atherigona indica* Malloch, 1923: 193.*Atherigona varia* Meigen, 1826 (misident.).*Atherigona indica infuscata* van Emden, 1940: 123, fig. 19.*Atherigona varia* (Meigen) var. *soccata*: Deeming 1971: 165, figs 85–91.

Diagnosis: This species has a very characteristically shaped hypopygial prominence, that is very widely bifurcated. The aforementioned in combination with yellow palpi and an infuscated frontal vitta makes the species distinguishable from other similarly coloured species.

Type material: Holotype housed in Museo Zoologico La Specola (MZLSF), but not seen.

Other material examined: SOUTH AFRICA: *KwaZulu-Natal*: Ndumo Game Reserve, Shokwe area, 26°52.125'S 32°13.731'E, Ficus forest, 30.xi–4.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 16489); 1♂ *Mpumalanga*: Kiepersol, Burgers Hall, Exper [Experimental]. Stn. [Station], xii.1996–i.1997, T. Sherwill (NMSA).

Distribution: Burkina Faso, Côte d'Ivoire, Egypt, Kenya, Madagascar, Mauritius, Nigeria, Réunion, South Africa, Tanzania, Uganda. Appendix 3.6 – Fig. 13C (in Chapter 3).

2.5.57 *Atherigona steeleae* van Emden, 1940

Fig. 63

Atherigona steeleae van Emden, 1940: 129; Deeming 1971: 170, figs 103–107; Deeming 1979: 38.

Diagnosis: This species is distinguishable by the combination of its entirely yellow legs and palpi, a subcordiform hypopygial prominence and the trifoliate process with the median piece apically dilated and the apex slightly emarginate.

Type material examined: Holotype ♂ UGANDA: Ruwenzori Range; xii.1934–i.1935; B.M.E. Afr. Exp. B.M. 1935-203; Kilembe; 4500ft. F.W. Edwards (BMNH).

Material examined: KENYA: 1♂ Maungu Hills, 7.i.1973, I. Bampton (NMSA); SOUTH AFRICA: *KwaZulu-Natal*: 1♂ Port Edward, 31°03'S 30°13'E, 9.vi.1997, K.R. Cradock, Malaise trap (NMSA).

Distribution: Cameroon, Democratic Republic of the Congo, Ethiopia, Kenya, Mali, Nigeria, South Africa, Sudan, Tanzania, Uganda. Appendix 3.6 – Fig. 13D (in Chapter 3).

2.5.58 *Atherigona stuckenbergi* sp. n.

Fig. 62

Etymology: Named for the collector of the type series, Dr Brian Stuckenberg.

Diagnosis: This species has the median piece of the trifoliate process very similar to *A. occidentalis* due to the y-shaped apex, but it differs from the latter and is also very similar to *A. parvhumilata* in that it has its abdominal tergites entirely infuscate and

not covered with paired markings as is custom for most species of the genus. It further differs from *A. parviumilata* by the shape of the hypopygial prominence that is a well developed bilobate structure compared to that of *A. parviumilata* which is reduced and weakly bifurcated.

Male.

Description:

Body length: 3.72 mm; wing: 3.28 mm; r-m crossvein ratio: 0.392.

Head: Ground colour brown. All head setae and setulae infuscated. Upper occiput brown, glossy, laterally silver-grey dusted. Ocellar triangle infuscated, with slight pruinosity. Frontal vitta infuscated. Frontal plate appearing glossy with slight pruinosity throughout, with three pairs of proclinate frontal setae and two pairs of orbital setae. Parafacial gold dusted, as wide as arista base at narrowest. Scape, pedicel, postpedicel and arista infuscated. Palpus yellow, apex truncated and dilated with hyaline hairs.

Thorax: Ground colour dark. Postpronotal lobe gold dusted, with three setae and 10 setulae. Pleura entirely gold dusted, except for bottoms of katepisternum and meron which are silver-grey dusted; Proepisternum inconspicuous and gold dusted. Scutum brown, glossy with slight pruinosity throughout three dark brown 2-4 dorsocentral vittae, having a slight dusted appearance between each vitta, stopping before scutellum. Scutellum with the same appearance as the scutum; one pair of basal setae, one pair of discal setae and eight discal setulae, one pair of subbasal setae and one pair of apical setae (subbasal pair 0.75× apical pair).

Legs: All legs yellow except for entire fore tibia and all leg basitarsi as well as second tarsal segment.

Leg chaetotaxy: Dorsal surfaces of fore tarsi, except for basitarsus with long setulae (at least as long as width of segments).

Wings: Hyaline. Veins dark brown. Knob of halteres white with stalk yellow. Calypters white.

Abdomen: All tergites yellow; tergites 1+2, 3 and 4 with dorsal surfaces entirely infuscated; tergite 5 immaculate. Hypopygial prominence bilobed. Trifoliate process stem 3× the length of the apical process; trifoliate process entirely infuscated except for basal third of stem which is hyaline and median piece and hood which are brown; median piece with wide apical dilation and bifurcation in posterior view, appearing almost y-shaped; median piece basally dilated in profile, gradually constricting towards apex; lateral plates with inner lobes, appearing wider than median piece in profile and in posterior view. Surstylus without any infuscation.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *Limpopo*: Entabeni Forest Station, Zoutpansberg range, Indigenous forest, i. 1975, B.R. Stuckenberg (NMSA).

Paratype ♂: same label data as holotype (NMSA).

Distribution: South Africa. Appendix 3.6 – Fig. 13E (in Chapter 3).

2.5.59 *Atherigona tetrastigma* Paterson, 1956

Fig. 2

Atherigona tetrastigma Paterson, 1956: 169, fig. 7; Deeming 1975: 1, fig. 3 (female tergite 8).

Diagnosis: This species is easily distinguished from other species due to the combination of an absent hypopygial prominence and the proepisternum not being knoblike (unlike *A. divergens* which has it knoblike).

Type material examined: Holotype ♂: TANZANIA: Kware b. moshi; 27.XII.1952; D.O.A exp.; *Atherigona tetrastigma* '55, det Paterson (SMNS).

Distribution: Democratic Republic of the Congo, Kenya, South Africa, Tanzania (No South African map data).

2.5.60 *Atherigona theodori* Hennig, 1963

Fig. 44

Atherigona theodori Hennig, 1963: 2; Deeming 1981: 102, fig. 8 (female tergite 8).

Diagnosis: This species can be distinguished from others with the occiput and frontal plate glossy by its frontal vitta being yellow on more than its anterior half, Tergite 3 immaculate and the trifoliate process entirely infuscate on a short stem and the hypopygial prominence bifurcate.

Type material examined: Holotype ♂: [EGYPT]: "Kairo (XI. 44 229)" (ZMHB)

Material examined: NAMIBIA: 2♂ Nr. Onseepkans, Orange River banks, 8–10.i.1972, Southern African Expedition, general sweeping (BMNH); 7♂ Swakopmund, 26–30.i.1972, southern African Expedition, general sweeping (BMNH); 2♂ Swakopmund, 26–30.i.1972, southern African Expedition, Swept vegetation around sewage farm settling tanks (BMNH); SOUTH AFRICA: *Eastern Cape*: 1♂ 3 km E Grahamstown, Belmont Valley, 2&5.i.1986, J.G.H. Londt & B. Londt, Malaise trap (NMSA); 3♂ Grahamstown (plot 5280), Three Chimneys farm, 33°18.542'S 26°29.846'E, 2–13.iii.2008, A.H. Kirk-Spriggs, Malaise trap (AMGS); *Free State*: 1♂ Brandfort, Soetdoring Nature Reserve, train camp, 28°50.934'S 26°01.996'E, Acacia Savanna thicket, 5–6.iv.2009, A.H. & M.K. Kirk-Spriggs, Malaise trap (BMSA(D) 05492); *KwaZulu-Natal*: 21 Jesmond Road, Pietermaritzburg, 29°37'S 30°22'E, 730 m, suburban garden, 9.xii.2007, G.B.P. Davies (NMSA); 1♂ Ndumu Game Reserve, pan, 26°54.288'S 32°17.974'E, Grassy flood plain, 9–10.xii.2009, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 19464); 2♂ Ndumu [Ndumo] Game Reserve, Camp & Riverine bush, 4–9.x.1982, J.G.H. Londt (NMSA); 1♂ Ndumu [Ndumo] Game Reserve, Ingwavuma District, Tongaland, 1–10.xii.1963, B.R. Stuckenberg & P. Stuckenberg (NMSA); *Western Cape*: 1♂ 10 km S Bredasdorp, 34°37'S 20°03'E, 12.x.1994, R. Danielsson (MZLU); 1♂ 10 km SE Vanrhynsdorp, along river, 14.x.1977, R.M. Miller (NMSA); 4♂ 3 km E Kaap Agulhas, 34°49'S 20°01'E, 12.x.1994, R. Danielsson (MZLU); 3♂ 32 km NE Clanwilliam, Brandewyn R. [River], 2–3.x.1977, R.M. Miller (NMSA); 1♂ 70 km E of Laingsburg, Dwyka River area, 33°06'S 21°35'E, 500 m, Dry Dwyka River area, 24.xi.1990, A.E. Whittington & J.G.H. Londt (NMSA);

1♂ Cedarberg, 3 km ESE Kriedowkrans, 32°22'S 18°59'E, 350 m, 6.x.1994, R. Danielsson (MZLU); 1♂ Cogman's Kloof, Ashton-Montagu Road, along river, 11.i.1983, P. Stabbins & R.M. Miller (NMSA); 1♂ De Hoop Nature Reserve, 34°27'S 20°25'E, 0–200 m, 10–13.x.1994, R. Danielsson (MZLU); 18♂ Kroonplanskloof, 10 km S Citrusdal, 32°40'S 19°01'E, 200–270 m, 4–8.x.1994, R. Danielsson (MZLU); ZIMBABWE: 1♂ 10 km SE of Harare, 19.ii.1997, J.W. Ismay, leg. J.C. Deeming (NMSA) (Previously NMW.Z.1981–001).

Distribution: Botswana, Democratic Republic of the Congo, Egypt, Ethiopia, Kenya, Mozambique, Namibia, Oman, Saudi Arabia, Senegal, South Africa, Sudan, Zimbabwe. Appendix 3.6 – Fig. 13F (in Chapter 3).

2.5.61

***Atherigona tigris* sp. n.**

Fig. 61

Etymology: From the Latin *tigris* (tiger), referring to the type locality Tiger Falls, Royal Natal National Park, South Africa.

Diagnosis: This species is similar to *A. secrecauda* but differs from it in having the hypopygial prominence weakly bifurcate and not bilobate in the shape of two fused triangles. Whilst *A. tigris* has the trifoliate process with a similar coloration, it differs structurally by not having a winglike hood and having the median piece without any emargination and with only a slight apical dilation.

Male.

Description:

Body length: 3.782 mm; wing: 3.088 mm; r-m crossvein ratio: 0.427.

Head: Ground colour brown. All head setae and setulae infuscated. Occiput silver-grey dusted throughout with narrow median part glossy. Ocellar triangle silver-grey dusted. Frontal vitta infuscated. Frontal plate apically gold dusted around three pairs of proclinate frontal setae and basally silver-grey dusted around two pairs of orbital setae. Parafacial gold dusted, slightly wider than arista base at narrowest. Scape and pedicel ferruginous, postpedicel infuscated except for basal margins which are ferruginous. Arista infuscated. Palpus yellow; truncated and dilated with hyaline hairs.

Thorax: Ground colour dark. Postpronotal lobe golden dusted, with two setae and 11 setulae. Pleura silver-grey dusted Proepisternum inconspicuous and gold dusted. Scutum grey dusted, with three weak 2-4 dorsocentral vittae, stopping before scutellum. Scutellum grey dusted; one pair of basal setae, one pair of discal setae and six discal setulae, one pair of subbasal setae and one pair of apical setae (subbasal pair 0.8× apical pair).

Legs: All legs yellow except for apical third of fore tibia and entire fore basitarsus which is slightly infuscated.

Leg chaetotaxy: Fore tarsi without any specialised chaetotaxy.

Wings: Hyaline except for slight brown smoky suffusion at apex of Sc-R₁. Veins brown. Knob of halteres white, with stalk yellow. Calypters white.

Abdomen: All tergites yellow; tergite 1+2 immaculate; tergite 3 and 4 each with a pair of small round spots, equal in size, taking up less than a third of dorsal surfaces; tergite 5 immaculate. Hypopygial prominence weakly bifurcate. Trifoliate process stem ca. 3× the length of the apical process; trifoliate process infuscated except for bases of median piece and lateral plates, as well as hood and apical third of stem, which are hyaline; median piece linear with slight abrupt apical dilation in posterior view, strongly dilated in profile; lateral plates with inner lobes, appearing wider than median piece in profile; Epandrium with dark markings and surstylus entirely infuscated (paratypes without infuscation).

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *KwaZulu-Natal*: Royal Natal National Park, Tiger Falls area, 28°41.341'S 28°56.047'E, *Protea caffra* woodland, 17–18.ii.2010, A.H. Kirk-Spriggs, Malaise trap (BMSA(D) 19807).

Paratype 2♂: Royal Natal National Park, 7–11.iv.1951, Brinck & Rudebeck, insect trap (MZLU); 1♂ Royal Natal National Park, 28°41.362'S 28°56.327'E, 1425 m, stream, y-wood, 10–13.xii.2004, M.B. Mostovski, Malaise trap (NMSA).

Distribution: South Africa. Appendix 3.6 – Fig. 14A (in Chapter 3).

2.5.62 *Atherigona trapezia* van Emden, 1940

Fig. 66

Atherigona trapezia van Emden, 1940: 135, figs 4, 30, 48; Deeming 1971: 171, figs 108–110; Deeming 1987: 20.

Diagnosis: This species can be distinguished from others that also have Tergite 1+2 broadly infuscated by its wholly infuscated trifoliate process which is without inner lobes. The hypopygial prominence is stalked with lateral lobes.

Type material examined: Holotype ♂: UGANDA: Kigezi Dist. 18.xi.1934. B.M.E. Afr. Exp. B.M. 1935-203; Mabungo Camp; 6000ft; J. Ford (BMNH).

Other material examined: ETHIOPIA: 1♂ Alemaya, ix.1992, S. Gudeta (NMSA); SOUTH AFRICA: 1♂ *KwaZulu-Natal*: Vernon Crookes Nature Reserve, near Umzinto, 30°16'S 30°36'E, 2–7.xi.2008, G.B.P. Davies, Sweep net (NMSA); 1♂ Dhlinda Forest, Eshowe, Zululand, 5–6.iv.1960, B.R. Stuckenberg & P. Stuckenberg (NMSA).

Distribution: Burundi, Cameroon, Democratic Republic of the Congo, Ethiopia, Kenya, Madagascar, Nigeria, Rwanda, South Africa, Sudan, Tanzania, Uganda, Zimbabwe. Appendix 3.6 – Fig. 14B (in Chapter 3).

2.5.63 *Atherigona tritici* Pont & Deeming, 2001

Fig. 47

Atherigona tritici Pont & Deeming, 2001: 299, figs 5–10.

Diagnosis: See *A. rubricornis* (section 2.5.53) for diagnostic information.

Type material examined: Holotype ♂: EGYPT: Beni Sueif [Suef], Sids Agricultural Research Station, ex. Wheat deadheart, i–iii.1999, S.A.El Serwy, leg. Pont & Deeming, 1999 (NMWC).

Paratypes: 1♂ Same data as holotype (NMSA) (Previously NMW.Z.1987–144); 1♀ MALI: Mourdiah, 3–12.x.1986, M. Matthews, J.C. Deeming (NMSA) (Previously NMW.Z.1987–144).

Type remarks: Paratype material examined was donated to the KwaZulu-Natal Museum (NMSA). The type deposition information is hereby updated.

Distribution: Botswana, Egypt, Ethiopia, The Gambia, Mali, Namibia, Nigeria, South Africa, Uganda, Yemen (No South African map data).

2.5.64 *Atherigona umbonata* sp. n.

Fig. 15

Etymology: From the Latin *umbo* (knuckle, knob), referring to the shape of the hypopygial prominence.

Diagnosis: This species is most similar to *A. aurifacies* but differs from it in having its hypopygial prominence quite different compared to that of *A. aurifacies* (Fig. 15c, d vs. Fig. 12c, d). The trifoliate process has the lateral lobes appearing tapered in posterior view, compared to those of *A. aurifacies* that are more rounded. The lateral lobes are also hyaline on their basal half compared to *A. aurifacies* that has them entirely infuscated (Fig. 12a vs. Fig. 15a).

Male.

Description:

Body length: 4.278 mm; wing: 3.600 mm; r-m crossvein ratio: 0.418.

Head: Ground colour dark. All head setae and setulae infuscated. Occiput silver-grey dusted posteriorly and gold dusted laterally with narrow median part glossy. Ocellar triangle silver-grey dusted. Frontal vitta infuscated. Frontal plate silver-grey dusted with three pairs of proclinate frontal setae and two pairs of orbital setae; glossy around bases of setae. Parafacial gold dusted, at narrowest equal in width to arista base. Scape infuscated, pedicel darkly ferruginous, postpedicel infuscated with slight ferruginous basal edge. Arista infuscated. Palpus entirely infuscated; apex truncated and dilated, with hyaline hairs and yellow vertex.

Thorax: Ground colour dark. Postpronotal lobe gold dusted, with three setae and 13 setulae. Pleura gold dusted. Proepisternum inconspicuous. Scutum grey dusted, with three 2-4 dorsocentral vittae, stopping before scutellum. Scutellum grey dusted; one pair of basal setae, one pair of discal setae and nine discal setulae, one pair of subbasal setae and one stronger pair of apical setae (cannot compare length due to damage to apical pair).

Legs: All legs yellow except for forelegs with apical half of femur with slight mark, apical half of tibia and first two basal tarsi infuscated.

Leg chaetotaxy: Fore femur with one submedial posteroventral seta; fore tarsi without any specialised chaetotaxy

Wings: Hyaline, except for slight brown smoky suffusion at areas around Sc-R₁ and the humeral cross-vein. Veins brown. Knob of halteres white with stalk yellow. Calypters white.

Abdomen: All tergites yellow; tergite 1+2 immaculate; tergite 3 with two medium sized dark-brown marks taking up just over two thirds of dorsal surface; tergite 4 with two small round markings, taking up a third of dorsal surface; tergite 5 immaculate. Hypopygial prominence knoblike (Fig 15c, d). Trifoliate process stem 2.2× the length of the apical process; basal quarter of median piece, basal half of lateral plates, hood and apical third of stem hyaline, the rest of process infuscated; median piece apically dilated, gradually dilating in profile, narrower than lateral plates; lateral plates without inner lobe, appearing tapered in posterior view. Surstylus without dark markings.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *KwaZulu-Natal*: Cathedral Peak, Didima, 28°57.000'S 29°14.395'E, 1422 m, 13–16.xii.2004, M.B. Mostovski (NMSA).

Distribution: South Africa. Appendix 3.6 – Fig. 14C (in Chapter 3).

2.5.65 *Atherigona univittata* Deeming & Overman, 1987

Fig. 9

Atherigona univittata Deeming & Overman, 1987: 118, figs 1–3.

Diagnosis: This species can be distinguished from most other species with an infuscated frontal vitta by its unusual infuscated ground coloured postpronotal lobe (as noted by Deeming & Overman 1987) in combination with an apically rounded median piece and the lateral lobes appearing almost the same size as the median piece.

Type material examined: Holotype ♂: KENYA: Kitale, 14.xi.1972., Overman, J.L (BMNH)

Other material examined: SOUTH AFRICA: *KwaZulu-Natal*: 2♂ Ferncliff Nature Reserve, 29°33.2'S 30°20.5'E, 855 m, 5.xii.2004, M.B. Mostovski, light trap (NMSA); 1♂ Ntsikeni Nature Reserve, Swartberg District, 30°07'S 29°28'E, 1850 m, High altitude grasslands, 24–25.x.2006, G.B.P. Davies (NMSA).

Distribution: Kenya, South Africa. Appendix 3.6 – Fig. 14D (in Chapter 3).

2.5.66 *Atherigona valida* (Adams, 1905)

Fig. 67

Coenosia valida Adams, 1905: 207.

Atherigona valida: Deeming 1971: 170, figs 101, 102; Deeming 1979: 44.

Diagnosis: This species can be distinguished from others with an infuscated frontal vitta and yellow palpi by the truncated hypopygial prominence dorsally appearing in

the shape of two fused, pointed triangles, slightly projecting. The trifoliate process is entirely infuscated with the median piece apically dilated, without any emarginations.

Type material: Type material housed in the University of Kansas, Museum of Natural History (UKMNH), but not seen.

Distribution: Burkino Faso, Guinea, Kenya, Mali, Nigeria, South Africa, Uganda, Zimbabwe (No South African map data).

2.5.67

***Atherigona vernoni* sp. n.**

Fig. 56

Etymology: Named for the type locality, Vernon Crookes Nature Reserve. KwaZulu-Natal, South Africa.

Diagnosis: This species would key to *A. robertsi* Deeming in Deeming (1971) and Dike (1989a), but differs from it in having a roundly bifurcated hypopygial prominence compared to a knoblike structure. *A. vernoni* also has its median piece of the trifoliate process apically dilated, whereas *A. robertsi* has it filiform in posterior view.

Male.

Description:

Body length: 2.821 mm; wing: 2.32 mm; r-m crossvein ratio: 0.407.

Head: Ground colour brown. All head setae and setulae infuscated. Occiput glossy on upper half, weakly dark grey dusted laterally. Ocellar triangle weakly dark grey dusted, subshining. Frontal vitta infuscated with slight ferruginous suffusion. Frontal plate for the most part dark grey, very weakly dusted, appearing glossy, with three pairs of proclinate frontal setae (apical pair's area surrounded by gold dusted surface) and two pairs of orbital setae. Parafacial gold dusted, narrower than arista base at narrowest. Scape, pedicel and postpedicel infuscated. Arista brown. Palpus yellow, appearing almost straplike.

Thorax: Ground colour dark. Postpronotal lobe golden dusted, with three setae and 8 setulae. Pleura gold dusted, Proepisternum inconspicuous and gold dusted. Scutum appearing brown with slight grey pruinosity, with three dark brown 2-4 dorsocentral vittae, stopping before scutellum. Scutellum with same coloration as scutum, apically edge yellow; one pair of basal setae, one pair of discal setae and six discal setulae, one pair of subbasal setae and one pair of apical setae (equal in length).

Legs: All legs yellow except for fore basitarsus which appears darker than the rest of tarsi.

Leg chaetotaxy: Fore tarsi with 3rd and 4th segments from base each with long setulae dorsally, each being longer than the three apical tarsal segments combined.

Wings: Hyaline. Veins brown. Knob of halteres white with stalk yellow. Calypters white.

Abdomen: All tergites yellow; tergite 1+2 immaculate; tergite 3 with a pair oblong dark markings taking up two thirds of dorsal surface; tergites 4 and 5 each with a pair of small brown spots taking up a third of dorsal surfaces. Hypopygial prominence roundly bifurcated. Trifoliolate process stem 1.7× the length of the apical process; trifoliolate light brown to hyaline with the exception of the basal half of stem, extreme apex of median piece, and posterior and lateral edges of lateral plates; median piece apically dilated in posterior view appearing almost triangular, linear in profile with apex curved; lateral plates without inner lobes, appearing wider than median piece in profile. Surstylus lightly infuscated at base and apex.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *KwaZulu-Natal*: Vernon Crookes Nature Reserve, Mthakati Valley, 30°17'S 30°36'E, ca. 450 masl, Forest understorey, lush shrubbery and herbage, 16.iii.2008, G.B.P. Davies (NMSA).

Distribution: South Africa. Appendix 3.6 – Fig. 14E (in Chapter 3).

2.5.68

***Atherigona zulu* sp. n.**

Fig. 68

Etymology: Named for the province of KwaZulu-Natal, South Africa.

Diagnosis: This species keys to *A. secrecauda* in Deeming (1971) and Dike (1989a), but differs from it by having the hypopygial prominence weakly bifurcate as opposed to being bilobate and appearing as two fused triangles in dorsal view. The trifoliolate process of *A. zulu* is also missing the winglike hood of *A. secrecauda*, as well as being more less abruptly dilated apically compared so *A. secrecauda* (Fig. 68b vs. Fig. 50b).

Male.

Description:

Body length: 4.216 mm; wing: 3.312 mm; r-m crossvein ratio: 0.413.

Head: Ground colour brown. All head setae and setulae infuscated. Occiput grey dusted throughout with narrow median part glossy, laterally silver-grey dusted. Ocellar triangle grey dusted. Frontal vitta infuscated. Frontal plate grey dusted on basal third, gold dusted on apical two thirds with three pairs of proclinate frontal setae and two pairs of orbital setae. Parafacial gold dusted, as wide as arista base at narrowest. Scape and pedicel ferruginous, postpedicel infuscated except for basal area. Arista infuscated. Palpus yellow, apex truncated and dilated with hyaline hairs.

Thorax: Ground colour dark. Postpronotal lobe gold dusted, with three setae and 13 setulae. Pleura entirely silver-grey dusted, except for bottom of katepisternum which is grey dusted; Proepisternum inconspicuous and gold dusted. Scutum grey dusted throughout, with three faint 2-4 dorsocentral vittae, stopping before scutellum.

Scutellum grey dusted; one pair of basal setae, one pair of discal setae and ten discal setulae, one pair of subbasal setae and one pair of apical setae (subbasal and apical setae equal).

Legs: All legs yellow except for apical quarter of fore tibia and fore tarsi which are infuscated.

Leg chaetotaxy: Fore femur with one submedial posteroventral seta; dorsal surfaces of fore tarsi, except for basitarsus, with long setulae (at least as long as width of segments).

Wings: Hyaline. Veins light brown. Knob of halteres white with stalk yellow. Calypters white.

Abdomen: All tergites yellow; tergite 1+2 immaculate; tergite 3 with a pair oblong dark markings taking up two thirds of dorsal surface; tergites 4 with a pair of small brown oblong markings taking up a third of dorsal surface; tergite 5 immaculate. Hypopygial prominence bilobed. Trifoliate process stem 2× the length of the apical process; trifoliate process entirely infuscated except for stem and hood which are brown; median piece with strong apical dilation and bifurcated in posterior view, with slight apical dilation in profile with an overall slightly curved appearance; lateral plates with inner lobes, appearing wider than median piece in profile, but not in posterior view. Surstylus with slight infuscation at base and apex.

Female: Unknown.

Holotype ♂: SOUTH AFRICA: *KwaZulu-Natal*: Richards Bay, 28°46'S 32°04'E, 24.x.1994, R. Danielsson (MZLU).

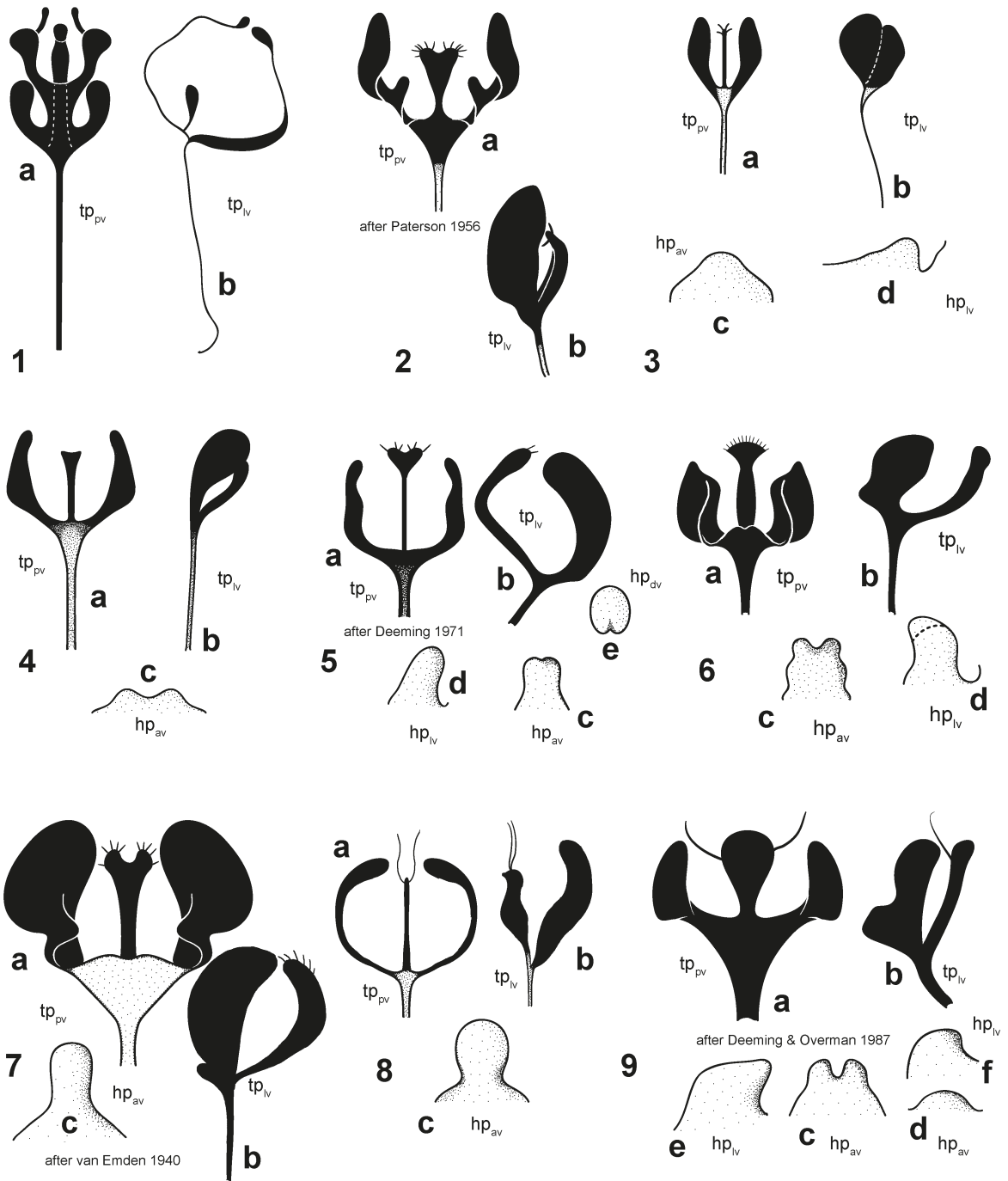
Paratypes 2♂: Ongoye (Ngoye) Forest, 28°50'S 31°44'E, 300 masl, Eastern side of forest, 21.x.2008, R.M. Miller (NMSA).

Distribution: South Africa. Appendix 3.6 – Fig. 14F (in Chapter 3).

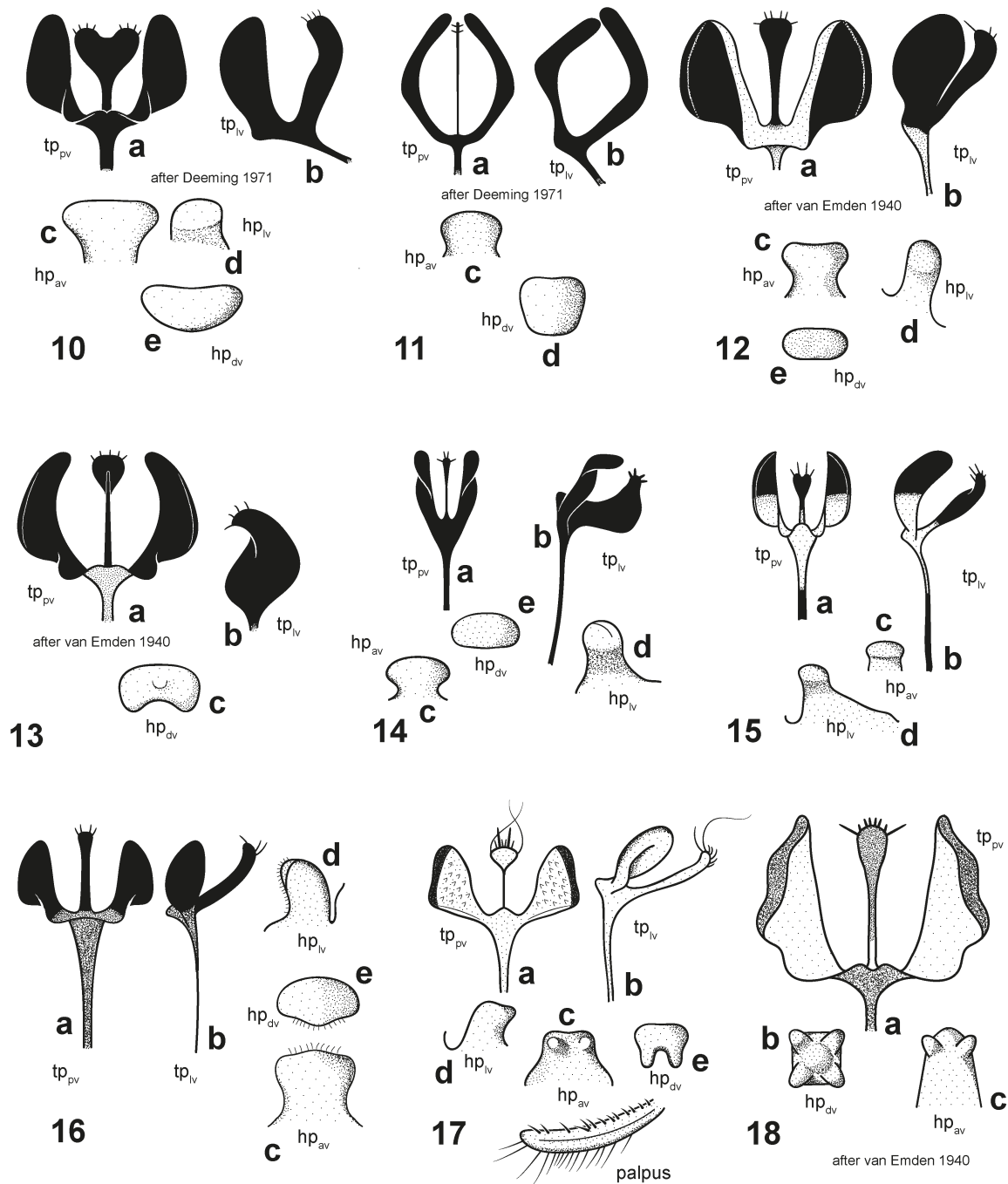


2.6

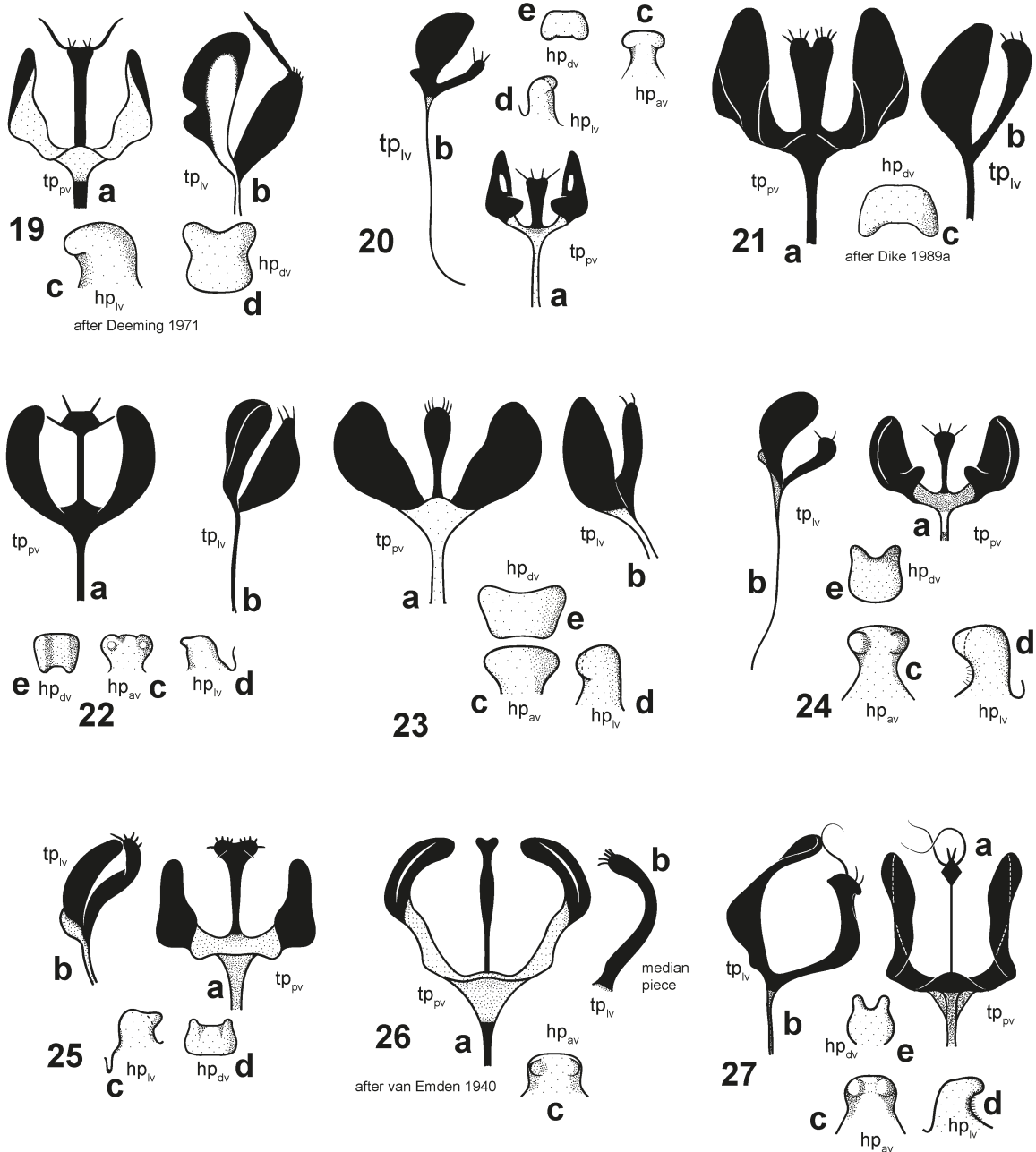
Illustrations



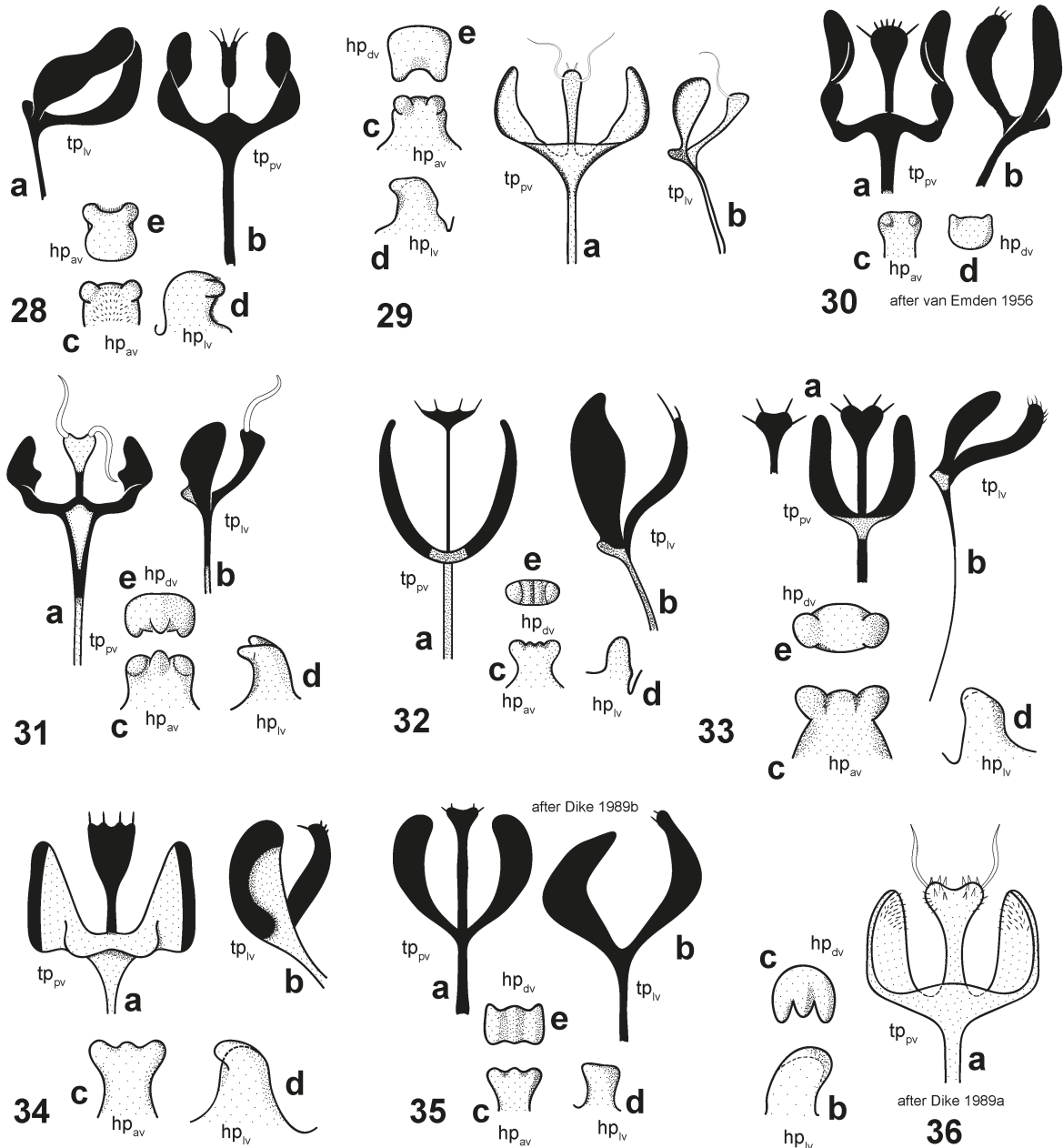
Figures 1–9: *Atherigona* spp.: trifoiliate process and hypopygial prominence of (1) *A. divergens* Stein; (2) *A. tetrastigma* Paterson; (3) *A. parviclivis* sp. n.; (4) *A. parvihumilata* sp. n.; (5) *A. angulata* Deeming; (6) *A. pulla* (Wiedemann); (7) *A. laevigata* (Loew); (8) *A. bimaculata* Stein; (9) *A. univitatta* Deeming & Overman. Not to scale.



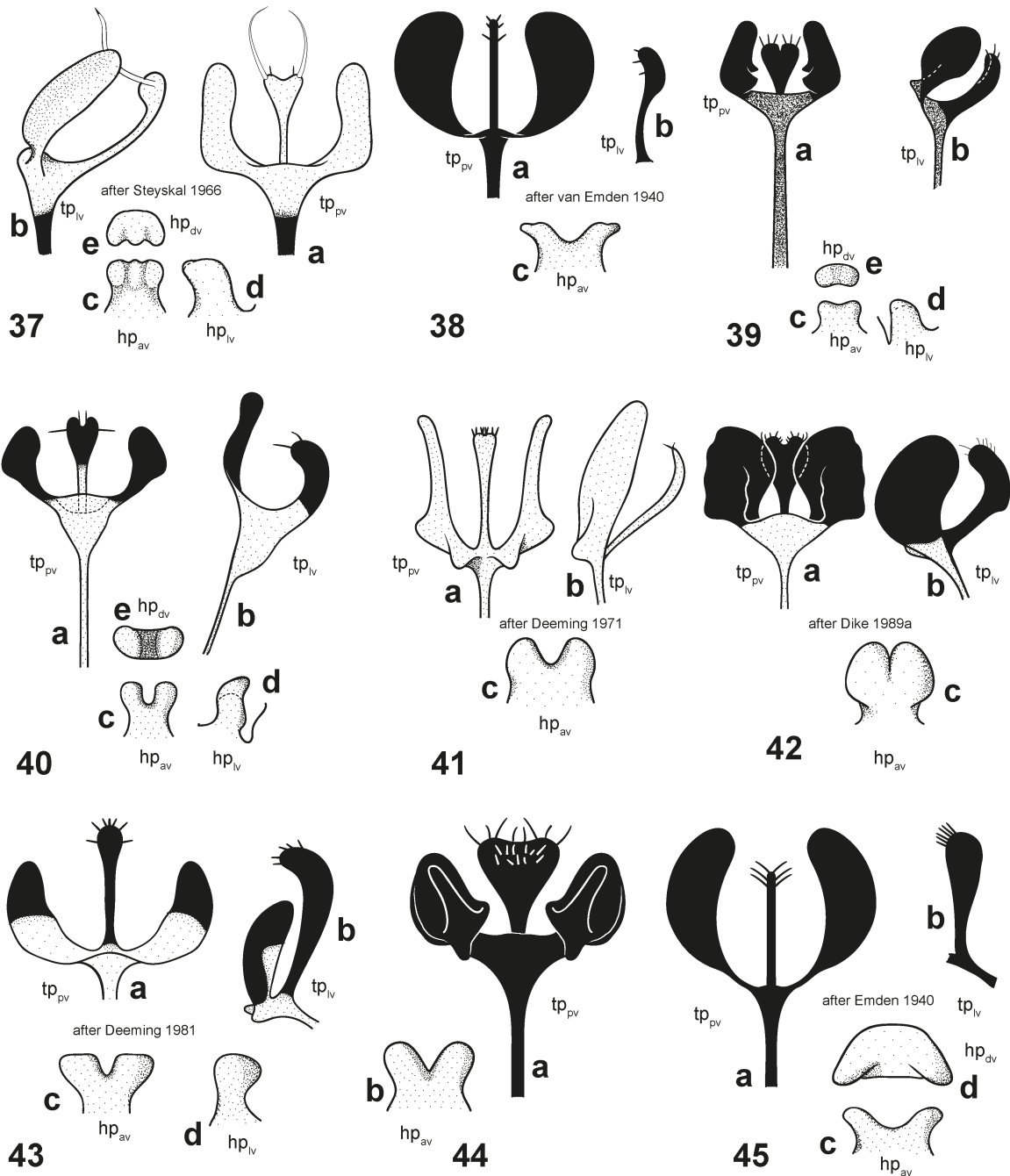
Figures 10–18: *Atherigona* spp.: trifoliate process and hypopygial prominence of (10) *A. nigrapicalis* Deeming; (11) *A. longifolia* van Emden; (12) *A. aurifacies* van Emden; (13) *A. griseiventris* van Emden; (14) *A. capitulata* sp. n.; (15) *A. umbonata* sp. n.; (16) *A. flavifinis* sp. n.; (17) *A. heteropalpata* sp. n., also palpus; (18) *A. aster* van Emden. Not to scale.



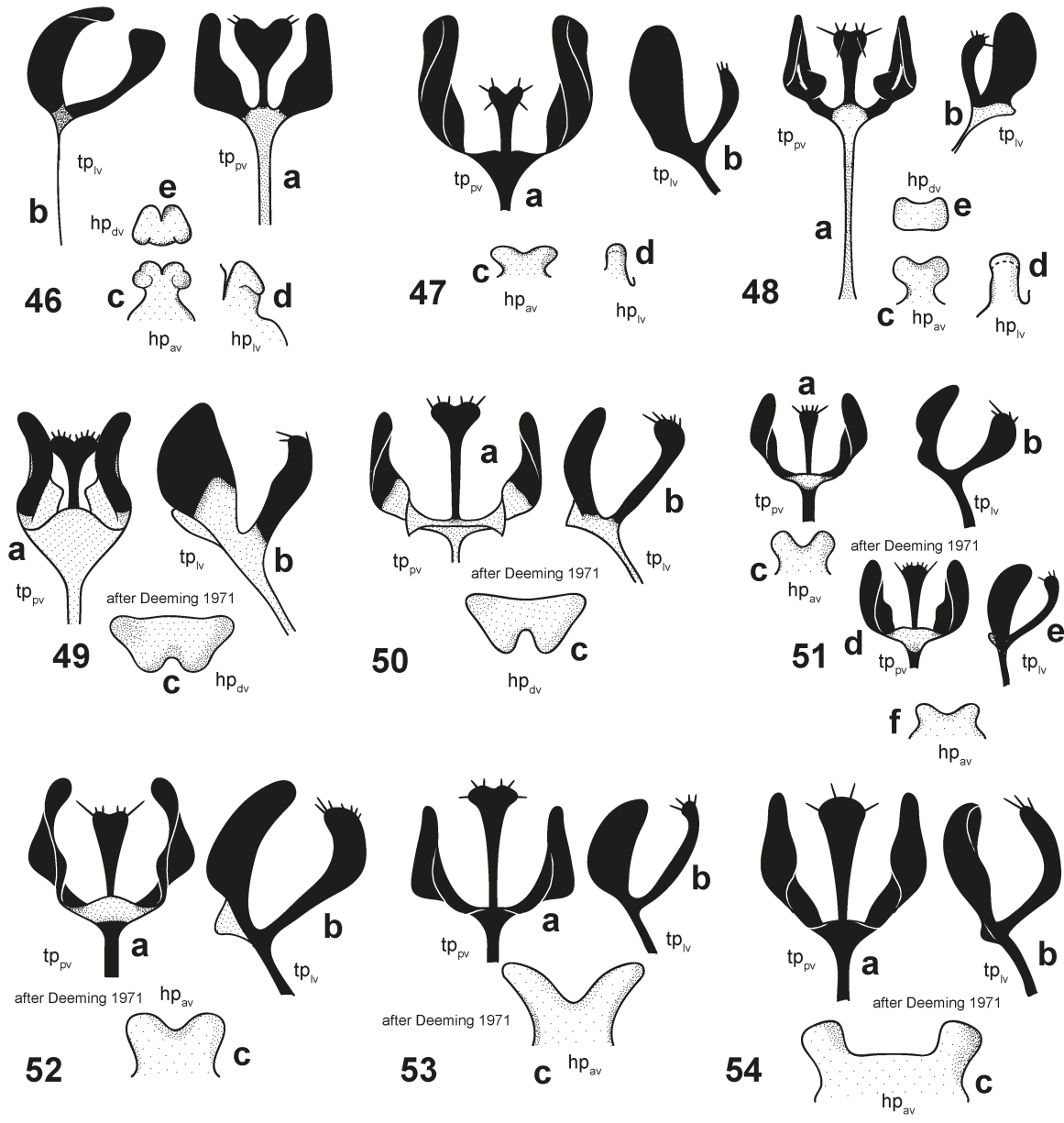
Figures 19–27: *Atherigona* spp.: trifoliate process and hypopygial prominence of (19) *A. marginifolia* van Emden; (20) *A. erectisetula* sp. n.; (21) *A. humeralis* (Wiedemann); (22) *A. bundongoana* van Emden; (23) *A. falcata* (Thomson); (24) *A. ndumoensis* sp. n.; (25) *A. decempilosa* Dike; (26) *A. binubila* van Emden; (27) *A. piscatoris* sp. n. Not to scale.



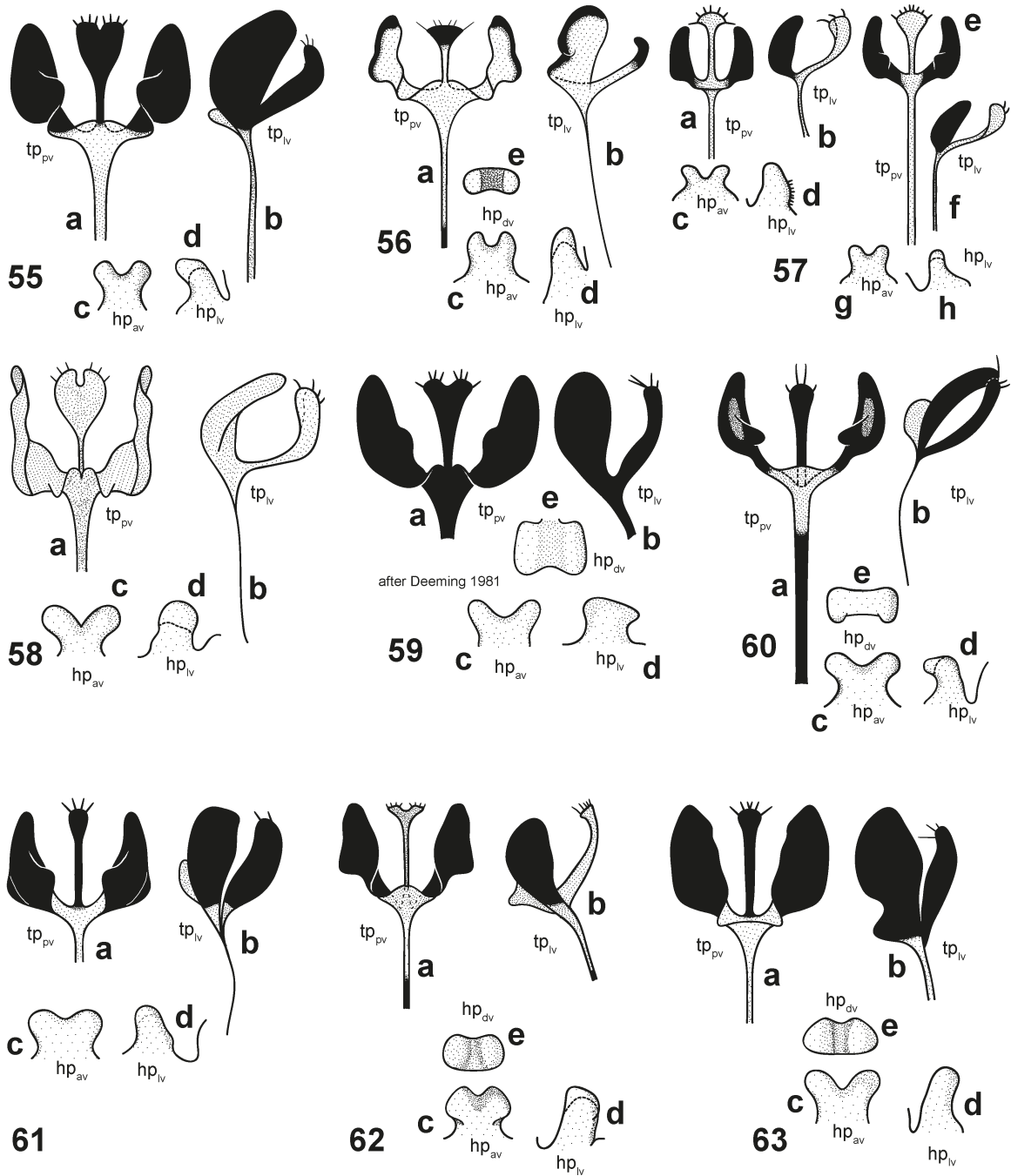
Figures 28–36: *Atherigona* spp.: trifoliate process and hypopygial prominence of (28) *A. oblonga* sp. n.; (29) *A. libertensis* sp. n.; (30) *A. angustiloba* van Emden; (31) *A. albicornis* sp. n.; (32) *A. occidentalis* Deeming; (33) *A. kirkspriggsi* sp. n.; (34) *A. perfida* Stein; (35) *A. chirinda* Dike; (36) *A. cinarina* Séguy. Not to scale.



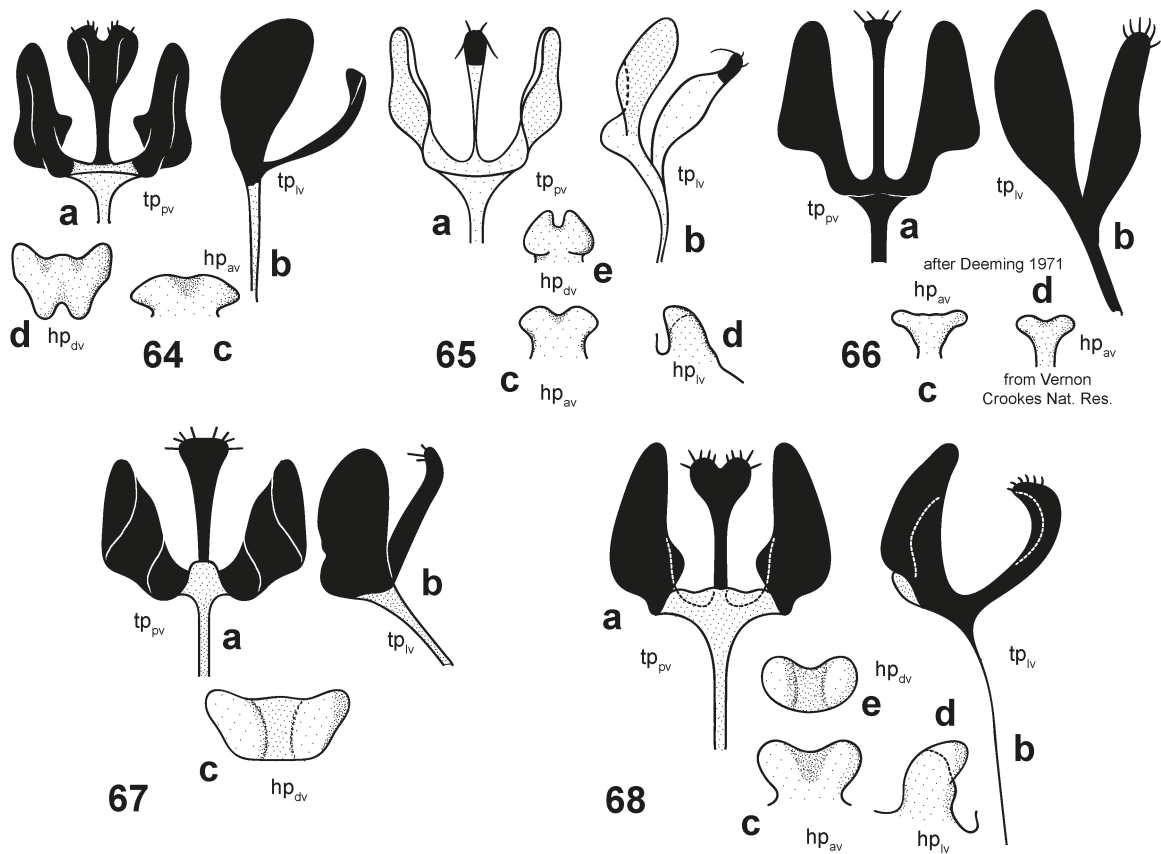
Figures 37–45: *Atherigona* spp.: tritofoliate process and hypopygial prominence of (37) *A. naqvii* Steyskal; (38) *A. ruficornis* Stein; (39) *A. flaviheteropalpata* sp. n.; (40) *A. latibasilaris* sp. n.; (41) *A. mitrata* Séguéy; (42) *A. bedfordi* van Emden; (43) *A. ochracea* Deeming; (44) *A. theodori* Hennig; (45) *A. rubricornis* Stein. Not to scale.



Figures 46–54: *Atherigona* spp.: trifoliate process and hypopygial prominence of (46) *A. chrysohypene* sp. n.; (47) *A. tritici* Pont & Deeming; (48) *A. londti* sp. n.; (49) *A. hyalinipennis* van Emden; (50) *A. secrecauda* Séguy; (51) *A. lineata lineata* (Adams); (52) *A. lineata torrida* Deeming; (53) *A. lineata ugandae* van Emden; (54) *A. soccata* Rondani. Not to scale.

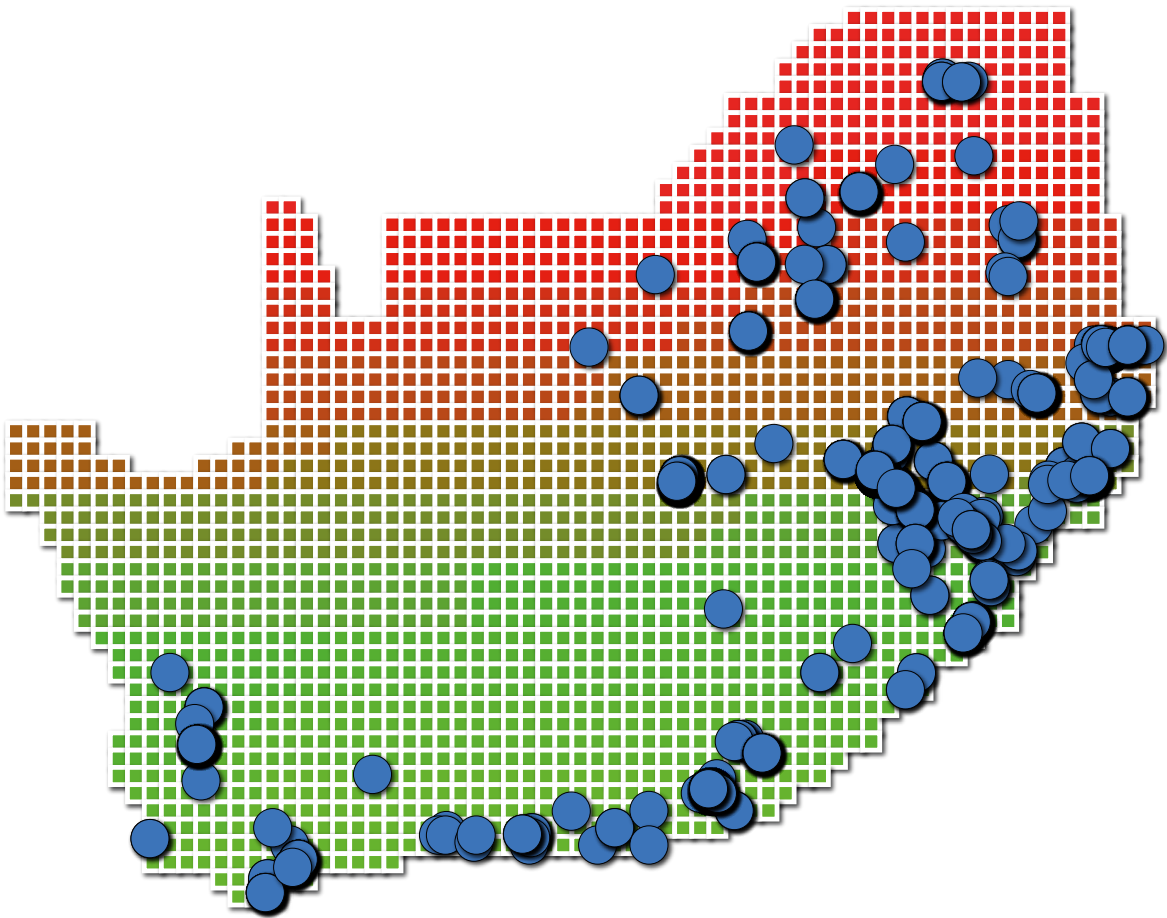


Figures 55–63: *Atherigona* spp.: trifoliate process and hypopygial prominence of (55) *A. nesshurstensis* sp. n.; (56) *A. vernoni* sp. n.; (57) *A. convexa* sp. n.; (58) *A. rimapicis* sp. n.; (59) *A. falkei* Deeming; (60) *A. danielssoni* sp. n.; (61) *A. tigris* sp. n.; (62) *A. stuckenbergi* sp. n.; (63) *A. steeleae* van Emden. Not to scale.



Figures 64–68: *Atherigona* spp.: trifoliate process and hypopygial prominence of (64) *A. matilei* Deeming; (65) *A. gilvifolia* van Emden; (66) *A. trapezia* van Emden; (67) *A. valida* (Adams); (68) *A. zulu* sp. n. Not to scale.

CHAPTER 3



Distribution of *Atherigona Rondani sensu stricto*
(Diptera: Muscidae) in South Africa

3.1

Abstract

Distributions of all species and associated material of *Atherigona s. str.* recorded through personal collecting and from institutional collections were mapped. Species distribution was compared to various biomes, and species richness and observations were determined for localities using DIVA-GIS. From that a regression analysis was performed to determine the strength of the correlation between richness and observations with regard to sampling bias. A correlation of $R^2 = 0.7447$ was calculated, pointing to a definite relationship between the two variables. It was found that 40% of newly described South African species are only known from type localities, with the majority of new species occurring in KwaZulu-Natal, particularly the Drakensberg Mountains.

3.2

Introduction

Very few publications have focussed directly on the distribution of *Atherigona* and its subgenera *Atherigona s. str.* Rondani and *Acritochaeta* Grimshaw. In the majority of cases the distributions were published as part of revisionary work, *i.e.* material examined, or in catalogues, with notable examples being that of Deeming (1971, 1972a, 1975, 1977, 1979, 1981, 1987) and Pont (1980). The importance of species distribution cannot be overstated, as many species, especially those of economic importance, can have a very wide range coinciding with their host plants. This especially holds true for recognised pest species, such as *A. soccata* Rondani, *A. tritici* Pont and Deeming, *A. naqvii* Steyskal and *A. lineata* (Adams), which have very wide distributions throughout the Afrotropics (Dike 2003). *Atherigona s. str.* has been recorded from most African countries (Fig. 1), and it can be safely assumed that, if not for the lack of active collecting in the unrecorded countries, the entire genus has a pan-African distribution.

Dike (1987) in his taxonomic work on Afrotropical *Atherigona*, published, not only keys to species of both subgenera (Dike 1989a, Dike 1990b), but also analyses dealing with intraspecific variability (Dike 1994) and the zoogeographical distribution of Nigerian species (Dike 1991).

It is very important to at least have a general idea with regard to the species distribution and composition of these flies in South Africa. Changes in climate and the effect thereof on associated crop planting times could lead to pest outbreak. It is essential to have knowledge regarding possible pests in an area, as without it, management practices cannot be adapted proactively before economic thresholds are breached. Different species of *Atherigona s. str.* can attack the same host, but at different times during the growing season, an example being *A. lineata* (ssp. *lineata* and ssp. *ugandae*) in Nigeria, which occur earlier in the season on rain grown sorghum, compared to *A. soccata* which only arrives later during the season on irrigated sorghum. However, *A. soccata* can infest both rain and irrigated sorghum (Deeming 1972b).



Figure 1: Afrotropical countries from which *Atherigona s. str.* spp. have been recorded (**grey**), or not (**white**). Adapted from Dike (2003) and updated with current examined material.

The association of *Atherigona s. str.* with graminaceous crops and wild grasses makes for a very widespread distribution due to the prevalence of grass species throughout Africa. This especially holds true for South Africa, seeing that the grassland and savanna biomes cover just over 30% and 33% of the country's surface area, respectively (Rouget *et al.* 2005). Historically, collections made from the high grasslands of western and eastern Africa have exhibited a great diversity due to the comparably high diversity of graminaceous species in the regions. This does unfortunately not hold true for especially western Africa anymore, as it has experienced substantial overgrazing. This has also resulted in trampling and selection for tougher, less nutritious grasses. Pockets of woodland in the high pastures are also used for firewood by herdsman with resulting soil erosion (Deeming pers. comm.). Such circumstances makes the prediction of biodiversity based on past and present collection data difficult, and should be taken into consideration when any form of analysis is performed on areas that have been disturbed.

3.3 Material and Methods

Distribution maps of species were generated using georeferenced specimen records. All coordinates were converted to decimal degrees and added to a species shape file for mapping in DIVA-GIS. Specimen records were analysed using DIVA-GIS at a resolution of 15 minutes (in the form of quarter degree grid squares), as this allowed for historical museum records without very precise information to be georeferenced and included accurately, without introducing false precision. Species observations and richness were evaluated by performing a regression analysis using points which have been converted to grids, and visualising them through the circular neighbourhood method (in doing so various similar localities within a grid would become generalised and contribute to the richness of that grid point, instead of measuring the richness of a specific locality). The 296 unique localities (Fig. 2) were generalised to 140 (Fig. 3) through the aforementioned process. Vegetation maps from Mucina and Rutherford (2006) were used for comparison with species distribution. Layout of the final figure plates were done in Adobe Photoshop and Illustrator CS5 for improved visual clarity.

3.4 Results and Discussion

The recorded species of *Atherigona s. str.* were mapped onto individual maps (Appendix: Figs 5–14), but also superimposed onto the biomes of South Africa (Fig. 2), with a richness analysis performed on a quarter degree grid level (Fig. 3). The biome map revealed that the majority of localities where specimens were collected fell within the grassland and savanna biomes, followed by fynbos. This fits perfectly with the ecology of the subgenus as it is very closely associated with graminaceous plants, such as wild grasses (Deeming 1971, 1972b; Dike 2003).

From the species richness analysis it was found that only five out of the 140 generalised localities mapped had a species richness of 10 or higher. The five localities in descending species richness were: Royal Natal National Park (18 species), Ndumo Game Reserve (16 species), Grahamstown area (14 species), Cathedral Peak Nature Reserve (13 species) and The Florisbad Research Station area, near Brandfort (10 species). All of these localities fall within grassland or savanna biomes, or at least close to small patches thereof. One could conclude that the high number of species recorded from the mentioned areas is due to, in general, the high levels of alpha diversity associated with grasslands, in particular the nature reserves and national park included in the top five localities, based on their status as Type 1 conservation areas (Rouget *et al.* 2005).

To test this, the species observations of *Atherigona s. str.* were compared to the species richness, and a regression analysis performed (Fig. 4). The analysis found that the Coefficient of Determination had an R^2 value of 0.7447, indicating that there

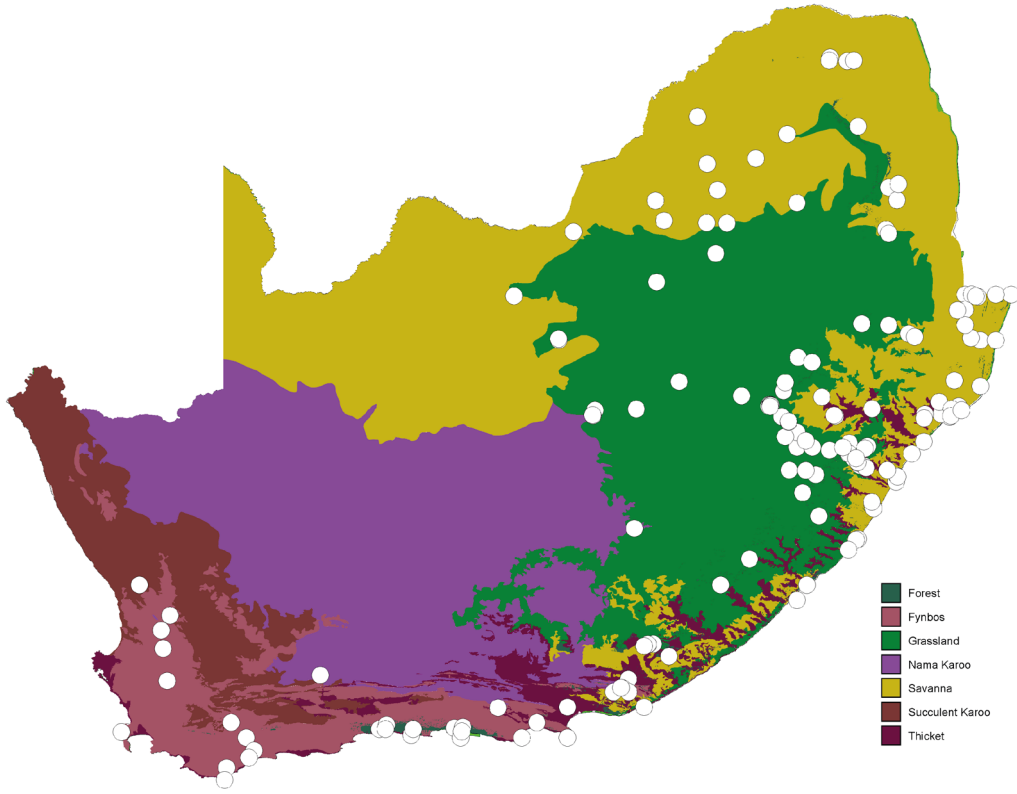


Figure 2: Generalised distribution of South African *Atherigona s. str.* spp. superimposed on South African vegetation biomes (Mucina & Rutherford 2006).

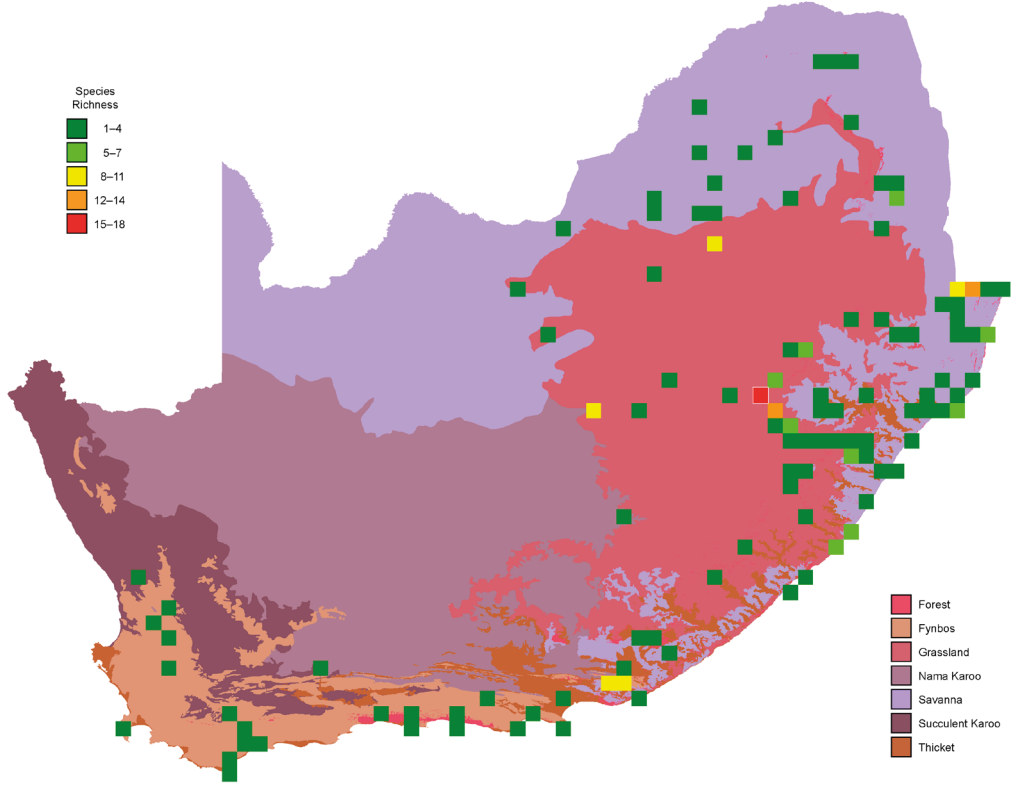


Figure 3: Species richness of South African *Atherigona s. str.* spp. superimposed on South African vegetation biomes (Mucina & Rutherford 2006).

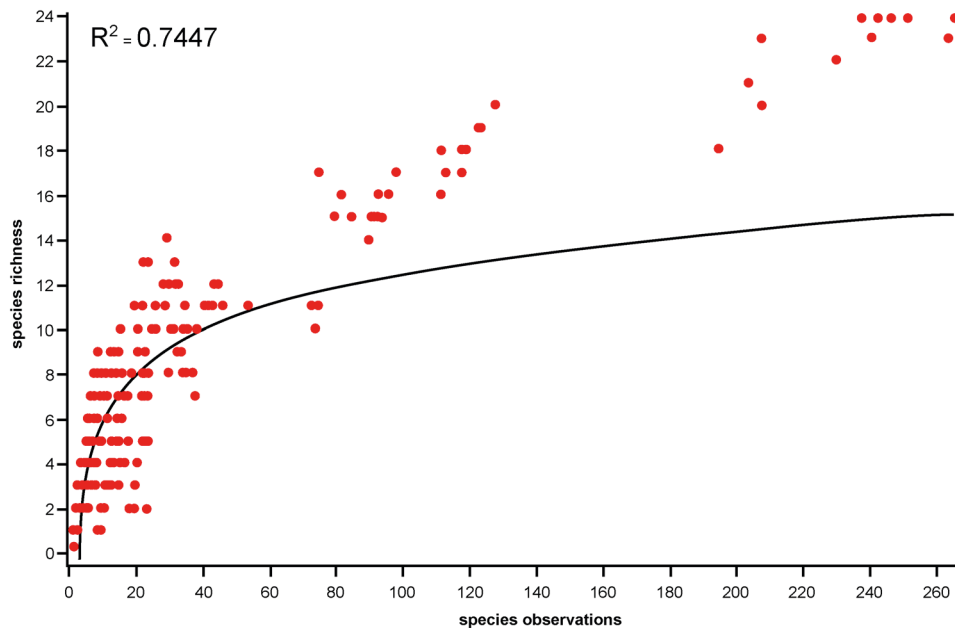


Figure 4: Regression analysis, comparing species richness of *Atherigona s. str.* to species observations in order to determine the presence of sampling bias.

is a 74.47% correlation between the two variables; in short revealing a relatively high degree of sampling bias present in the collection data. The effect of conservation efforts should, however, not be excluded. Areas with a high yield of species richness and abundance tend to be visited more frequently, as they provide collectors with a greater return on investment, so to speak. When examining and comparing the locality data with that of the collectors and collecting methods (material examined for species in Chapter 2), it becomes readily apparent that the top sites garnered the most species due to the use of catch-all Malaise traps and repeated collecting trips (especially in the case of the nature reserves) over decades.

Due to the above mentioned sampling bias, it would be inaccurate to compare the various distributions of the treated species on a one to one basis, since undersampling in all provinces is evident (with KwaZulu-Natal less so due to the efforts of numerous dipterists since the 1950s). Dike (2003) interestingly noted that approximately 33% of the *Atherigona* species recorded in the Afrotropical region are not recorded beyond their locality of description. This appears to hold true with regard to South African records as well.

Even though the adults of *Atherigona s. str.* are present throughout spring and summer, they are very much reliant on rainfall for their occurrence and abundance. In the case of *A. soccata*, the females oviposit on five to ten day old sorghum seedlings that are usually between the 3rd and 7th leaf stage of development, and are preferred over older seedlings. Eggs are generally oviposited on the 4th leaf (Taksdal & Baliddawa 1975; Ogwaro 1978; Raina 1982). Delobel and Lubega (1984) found that rainfall

adversely affects the survival of adult shoot flies, with a marked drop in numbers collected in traps after heavy rainfall. This all contributes to the difficulty in effectively collecting shoot fly specimens in large numbers outside high diversity areas without the use of traps which are weather independent and can be left out for weeks (such as Malaise traps). The collection yield on *Atherigona s. str.* can be quite low if one is not collecting in accordance with seasonality, both climate-wise and shoot fly preference-wise. Yellow pan traps and fishmeal bait traps prove highly effective, but are obviously also affected by rain.

The currently known distribution of *Atherigona s. str.* is subdivided into individual maps for examined species (Appendix 3.5: Figs 5–14). Many species, such as *A. aurifacies* van Emden, 1940 and *A. bedfordi* van Emden, 1940, were only collected from a single locality, possibly emphasising the presence of refined biological and ecological preferenda of the species. Dike (2003) listed these species as occurring in numerous Afrotropical countries, but they are less common in South Africa. *A. laevigata* (Loew, 1852), *A. theodori* Hennig, 1963 and *A. lineata* (Adams, 1905) are widespread throughout South Africa, as well as the rest of the Afrotropical Region.

Interestingly 40 % of newly described species are only known from the type locality, which is quite similar to that observed by Dike (2003) for the Afrotropical Region. The majority of new species with a wider distribution typically include KwaZulu-Natal (in particular eastern KwaZulu-Natal up to the Drakensberg), with the exception of *A. londti* sp. n. which appears to be restricted to the lower Eastern and Western Cape provinces.

Throughout the entire study, for all of the specimens examined, not one species of *Atherigona s. str.* was found to occur in the Northern Cape. The province is very similar in surface area to that of the Nama Karoo vegetation biome, and the possibility could exist that the vegetation requirements, as well as rainfall isohyets and index for the area are not conducive to support abundant numbers of shoot fly individuals. These aspects, coupled with very little generalised or focussed dipterological collecting in the region, could account for the apparent absence of the genus.

3.5 Conclusion

The current knowledge on the distribution of *Atherigona s. str.* in South Africa has increased substantially. One area of definite future sampling would have to be the Northern Cape, even if it is just to establish the presence or absence of the subgenus in the Nama Karoo biome. There, however, also remains a great deal of sampling bias in institutional collections. In order for this sampling bias to be addressed, gaps would need to be identified, and probable areas of high occurrence should be determined. This can most easily be accomplished through the use of predictive modelling using environmental and climatic variables in conjunction with the latest available data on

vegetation. Focussed collecting in these identified areas would have to be undertaken to test the model hypotheses and ensure that a complete picture of the distribution of South African *Atherigona s. str.* is established.

3.6 APPENDIX: Distribution of *Atherigona s. str.* (Diptera: Muscidae) in South Africa

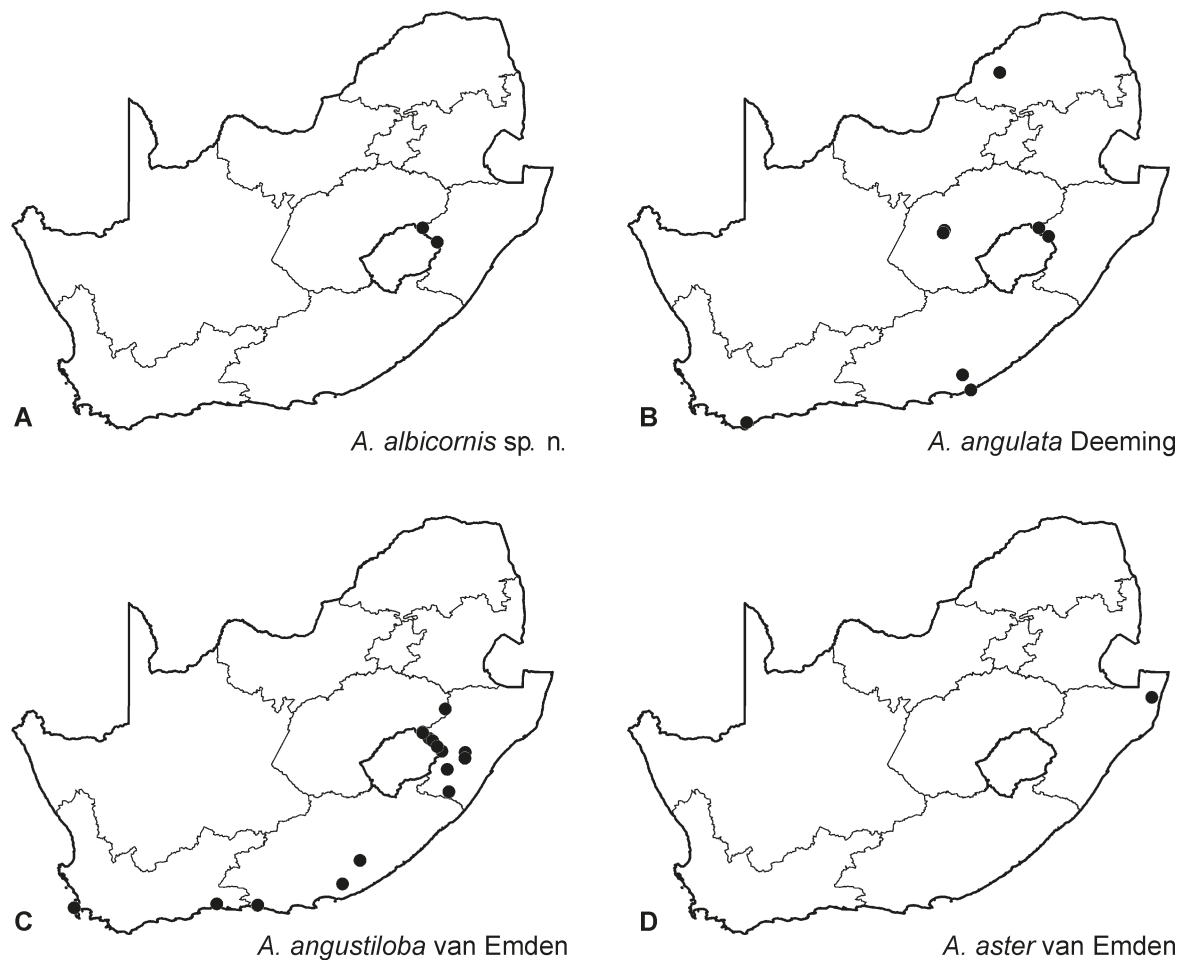


Figure 5: Distribution maps of *Atherigona s. str.* spp. recorded from South Africa: (A) *A. albicornis* sp. n.; (B) *A. angulata* Deeming; (C) *A. angustiloba* van Emden; (D) *A. aster* van Emden.

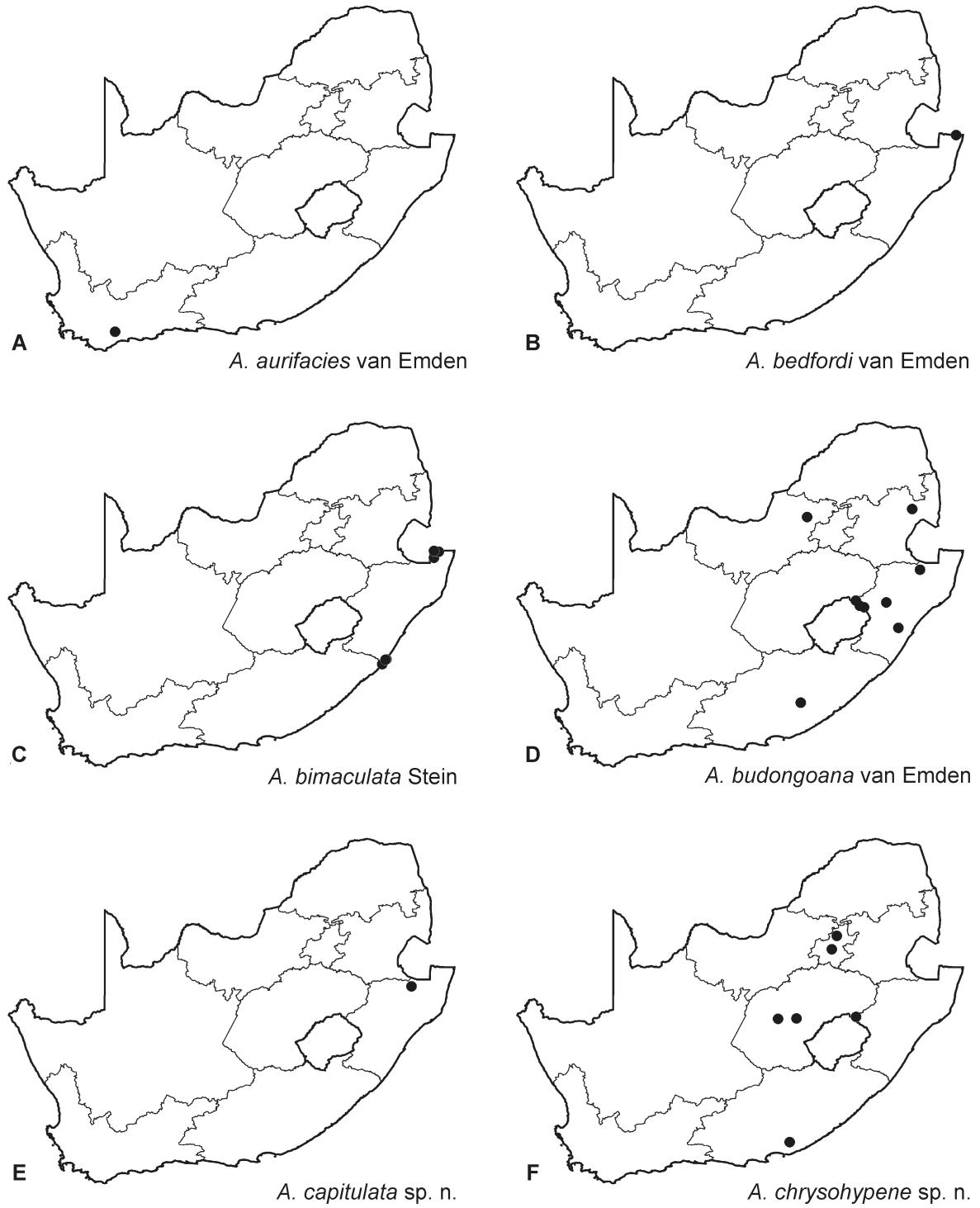


Figure 6: Distribution maps of *Atherigona s. str.* spp. recorded from South Africa: (A) *A. aurifacies* van Emden; (B) *A. bedfordi* van Emden; (C) *A. bimaculata* Stein; (D) *A. budongoana* van Emden; (E) *A. capitulata* sp. n.; (F) *A. chrysohypene* sp. n.

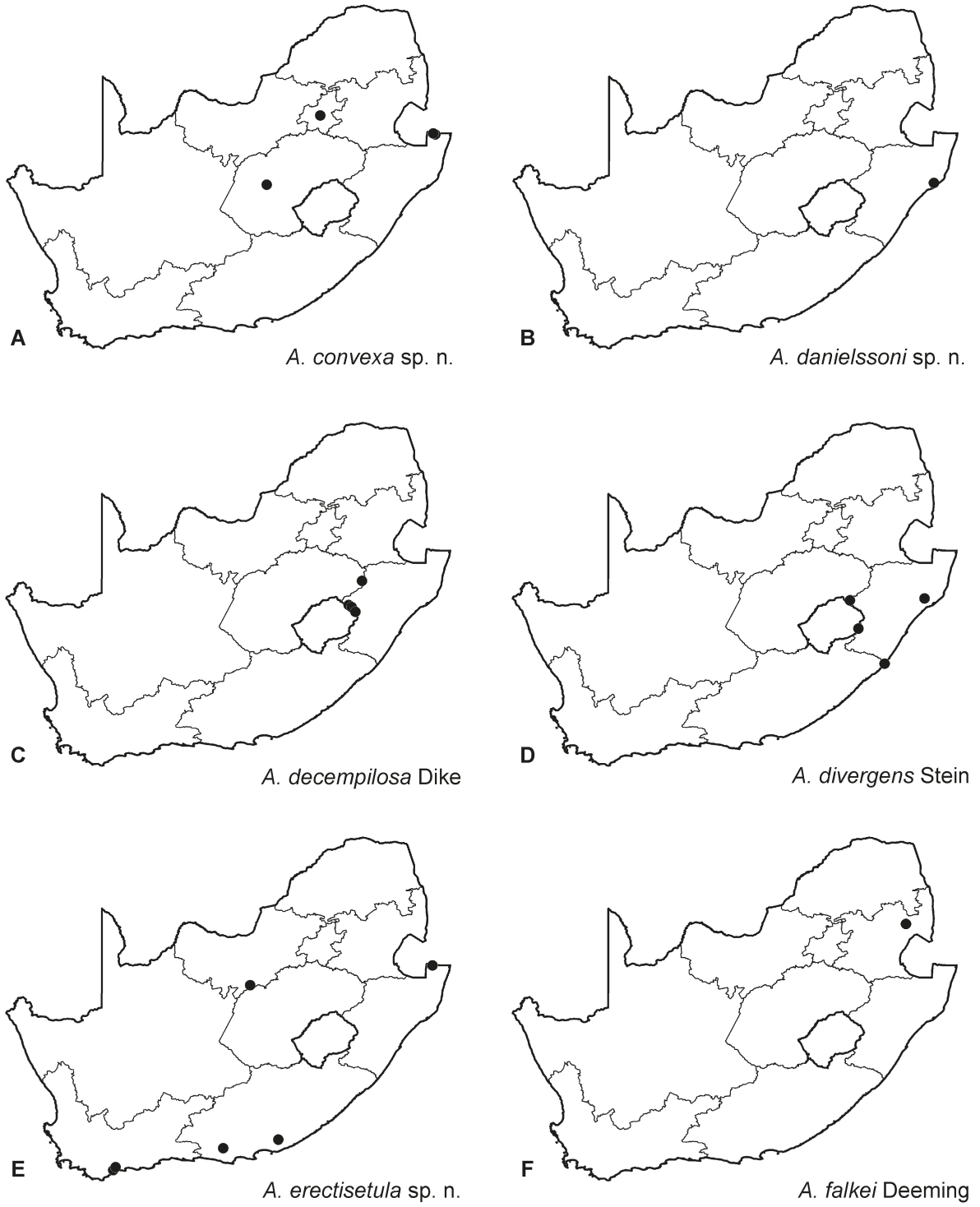


Figure 7: Distribution maps of *Atherigona s. str.* spp. recorded from South Africa: (A) *A. convexa* sp. n.; (B) *A. danielssoni* sp. n.; (C) *A. decempilosa* Dike; (D) *A. divergens* Stein; (E) *A. erectisetula* sp. n.; (F) *A. falkei* Deeming.

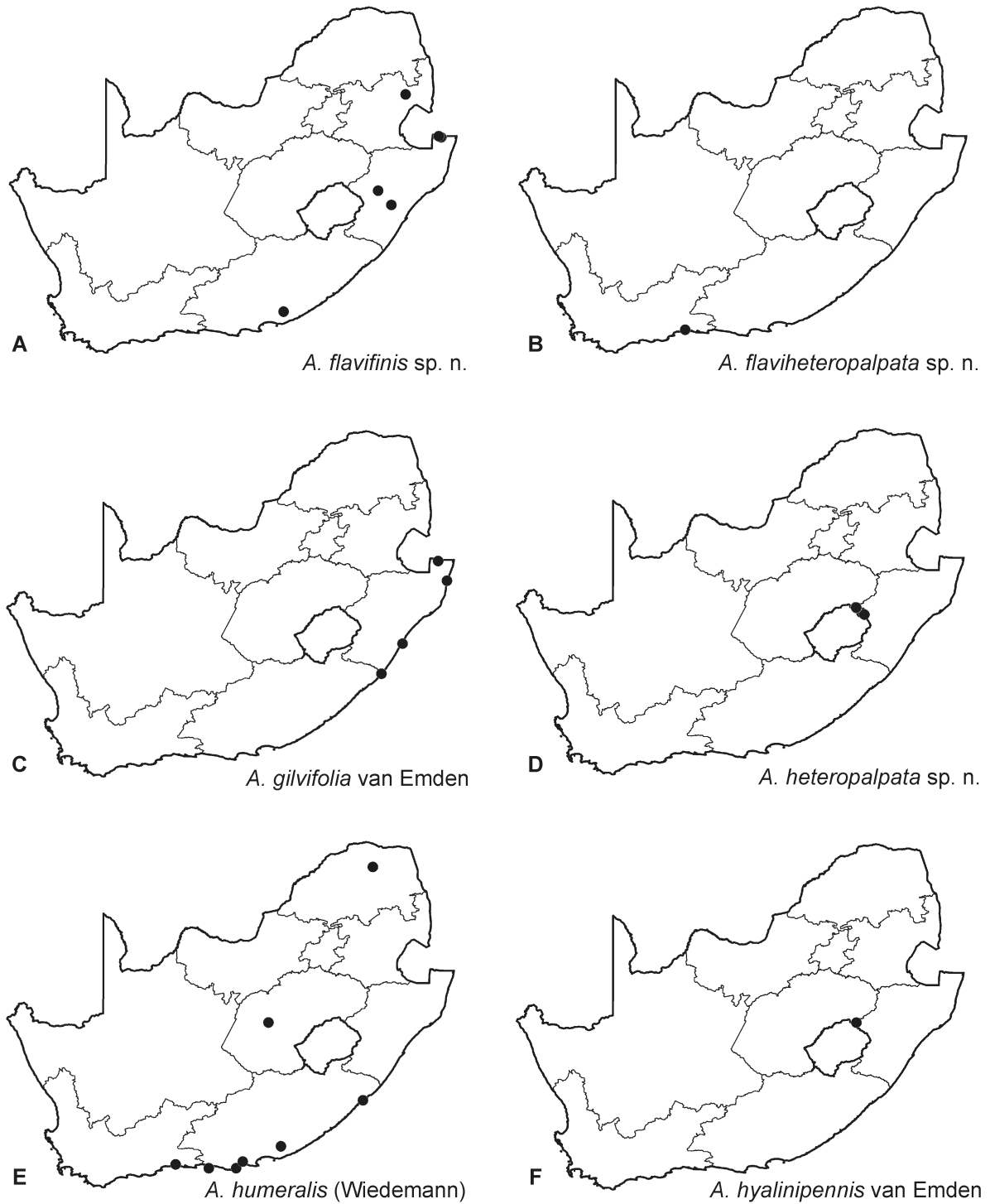


Figure 8: Distribution maps of *Atherigona* s. str. spp. recorded from South Africa: (A) *A. flavifinis* sp. n.; (B) *A. flaviheteropalpata* sp. n.; (C) *A. gilvifolia* van Emden; (D) *A. heteropalpata* sp. n.; (E) *A. humeralis* (Wiedemann); (F) *A. hyalinipennis* van Emden.

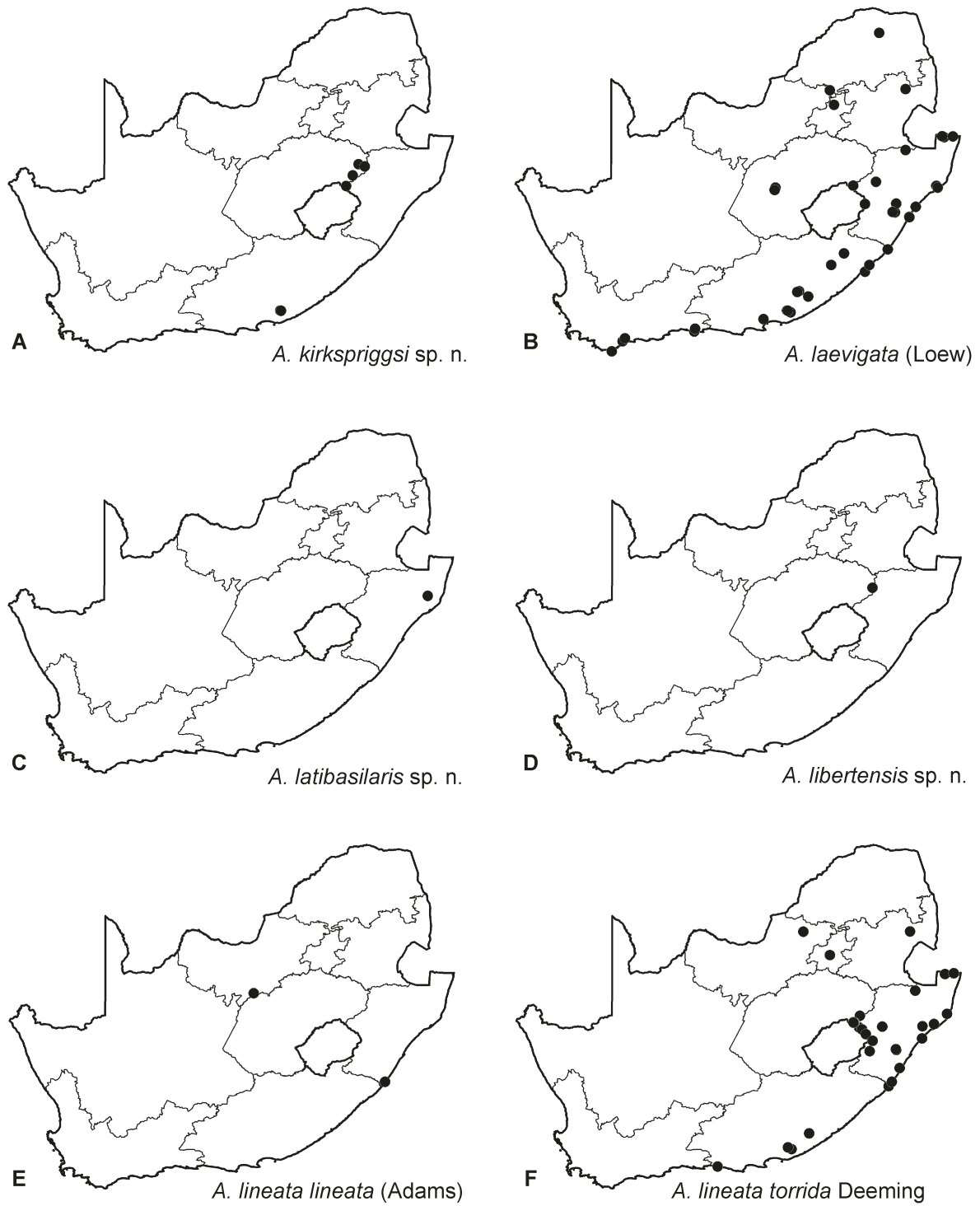


Figure 9: Distribution maps of *Atherigona* s. str. spp. recorded from South Africa: (A) *A. kirkspriggsi* sp. n.; (B) *A. laevigata* (Loew); (C) *A. latibasilaris* sp. n.; (D) *A. libertensis* sp. n.; (E) *A. lineata lineata* (Adams); (F) *A. lineata torrida* Deeming.

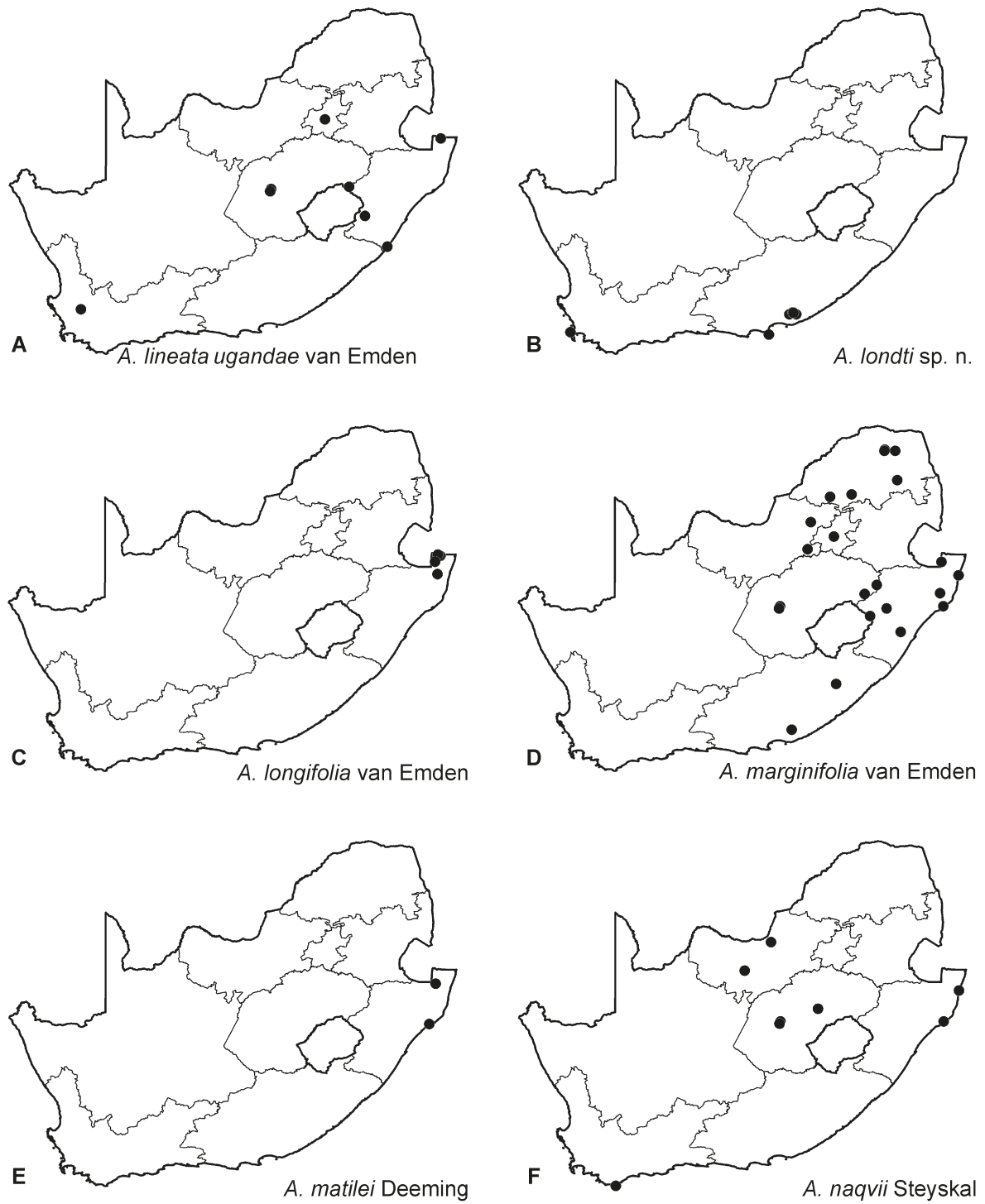


Figure 10: Distribution maps of *Atherigona* s. str. spp. recorded from South Africa: (A) *A. lineata ugandae* van Emden; (B) *A. londti* sp. n.; (C) *A. longifolia* van Emden; (D) *A. marginifolia* van Emden; (E) *A. matilei* Deeming; (F) *A. naqvii* Steyskal.

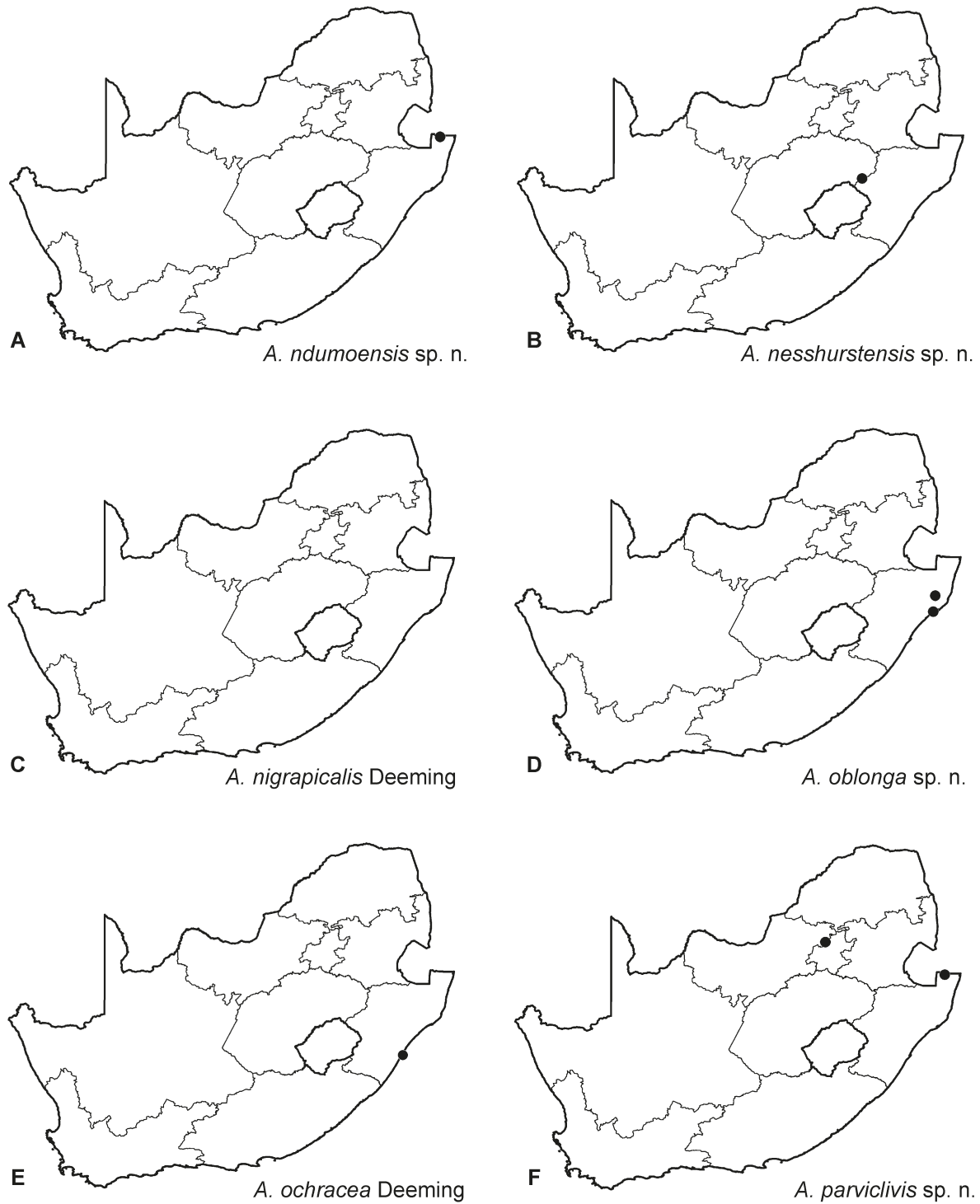


Figure 11: Distribution maps of *Atherigona s. str.* spp. recorded from South Africa: (A) *A. ndumoensis* sp. n.; (B) *A. nesshurstensis* sp. n.; (C) *A. nigrapicalis* Deeming; (D) *A. oblonga* sp. n.; (E) *A. ochracea* Deeming; (F) *A. parviclivis* sp. n.

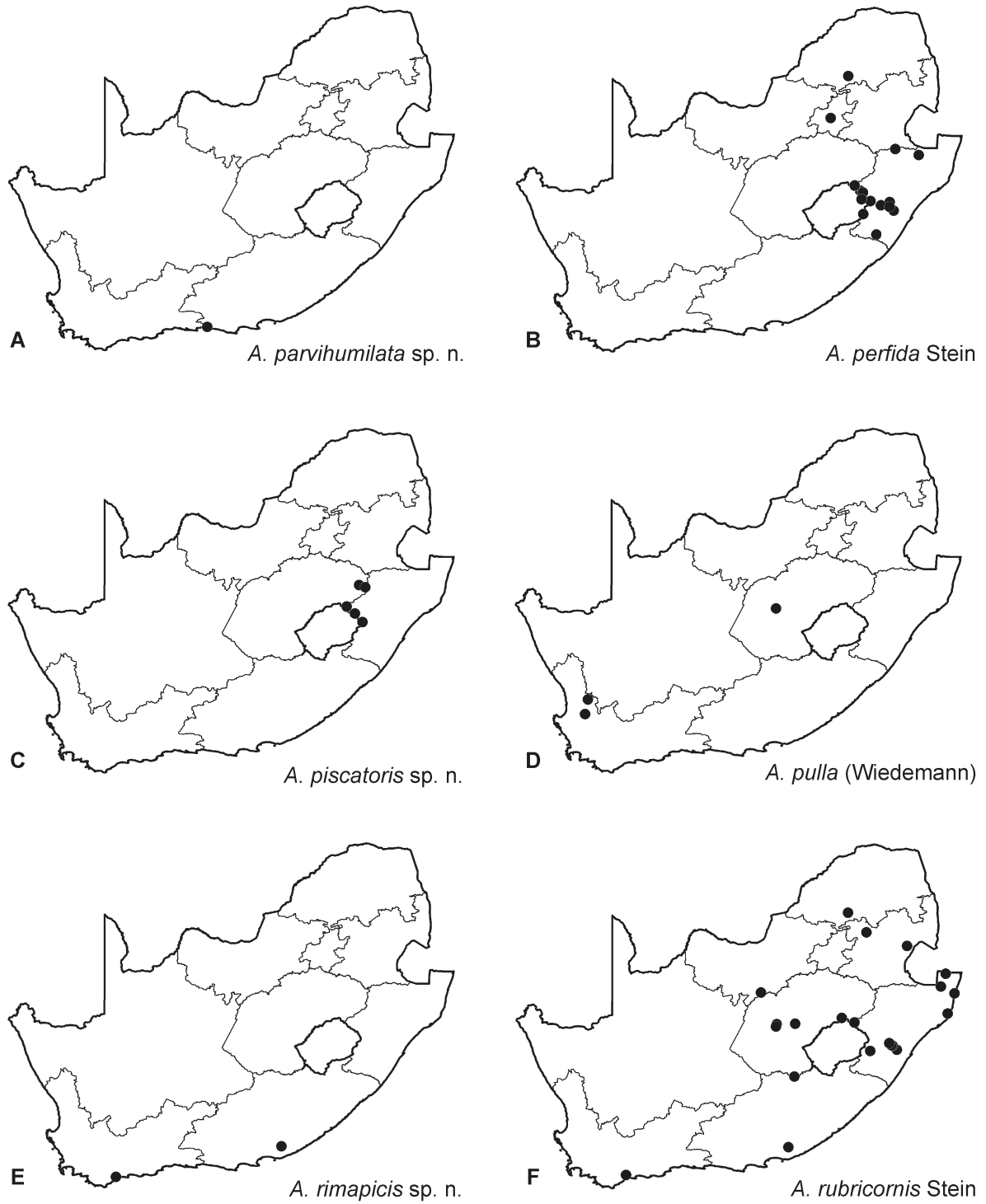


Figure 12: Distribution maps of *Atherigona* s. str. spp. recorded from South Africa: (A) *A. parvhumilata* sp. n.; (B) *A. perfida* Stein; (C) *A. piscatoris* sp. n.; (D) *A. pulla* (Wiedemann); (E) *A. rimapicis* sp. n.; (F) *A. rubicornis* Stein.

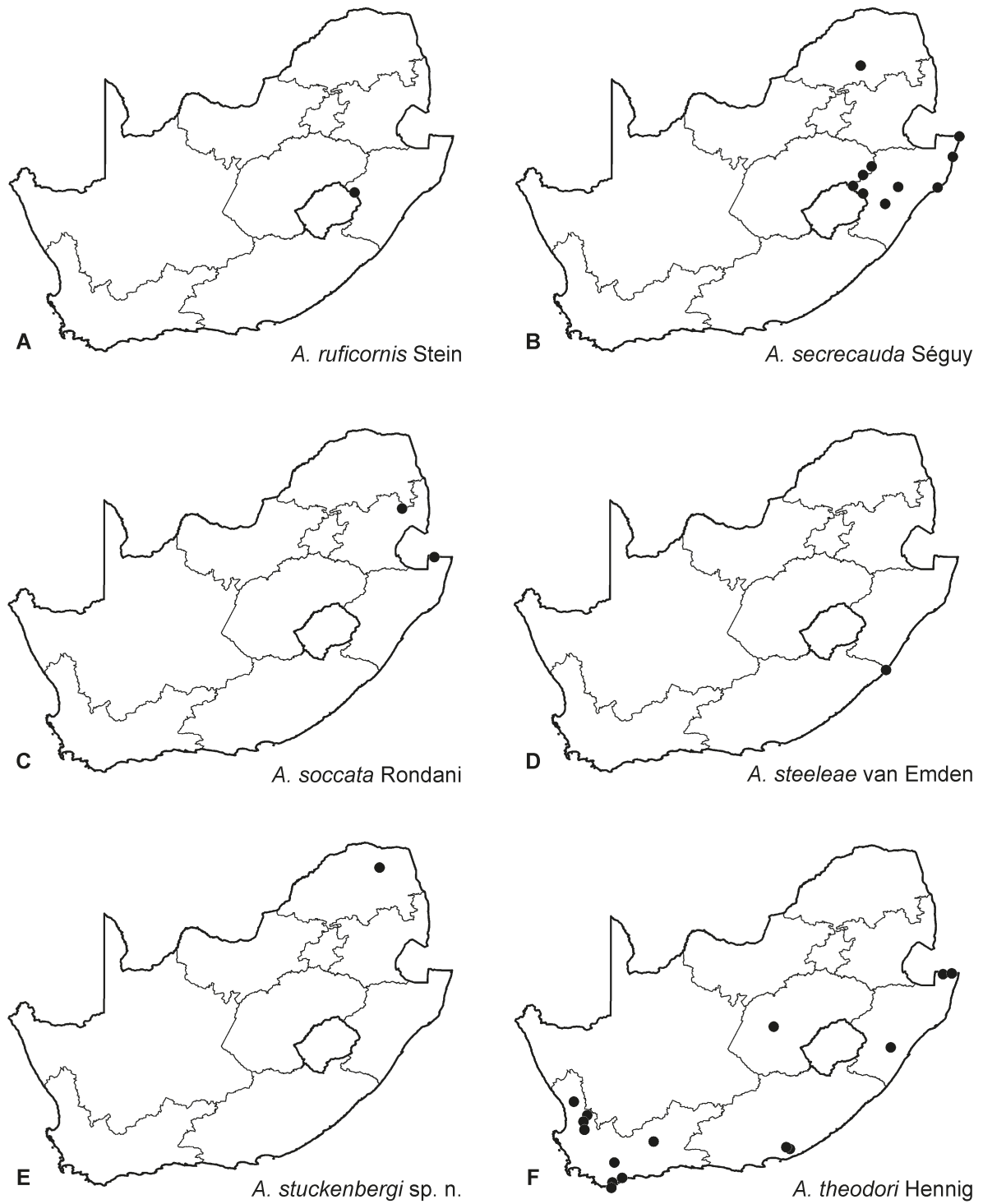


Figure 13: Distribution maps of *Atherigona* s. str. spp. recorded from South Africa: (A) *A. ruficornis* Stein; (B) *A. secrecauda* Séguy; (C) *A. soccata* Rondani; (D) *A. steeleae* van Emden; (E) *A. stuckenbergi* sp. n.; (F) *A. theodori* Hennig.

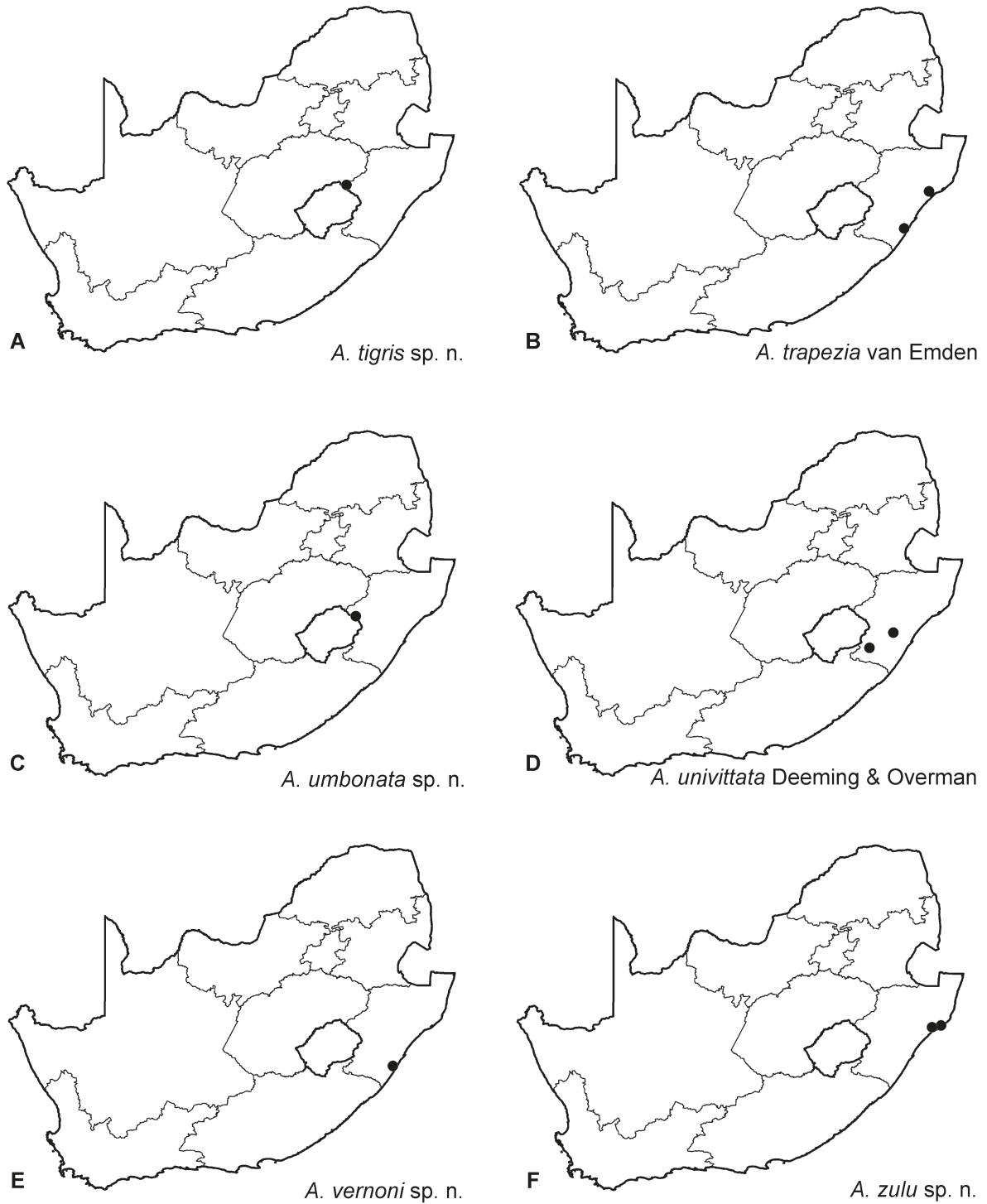
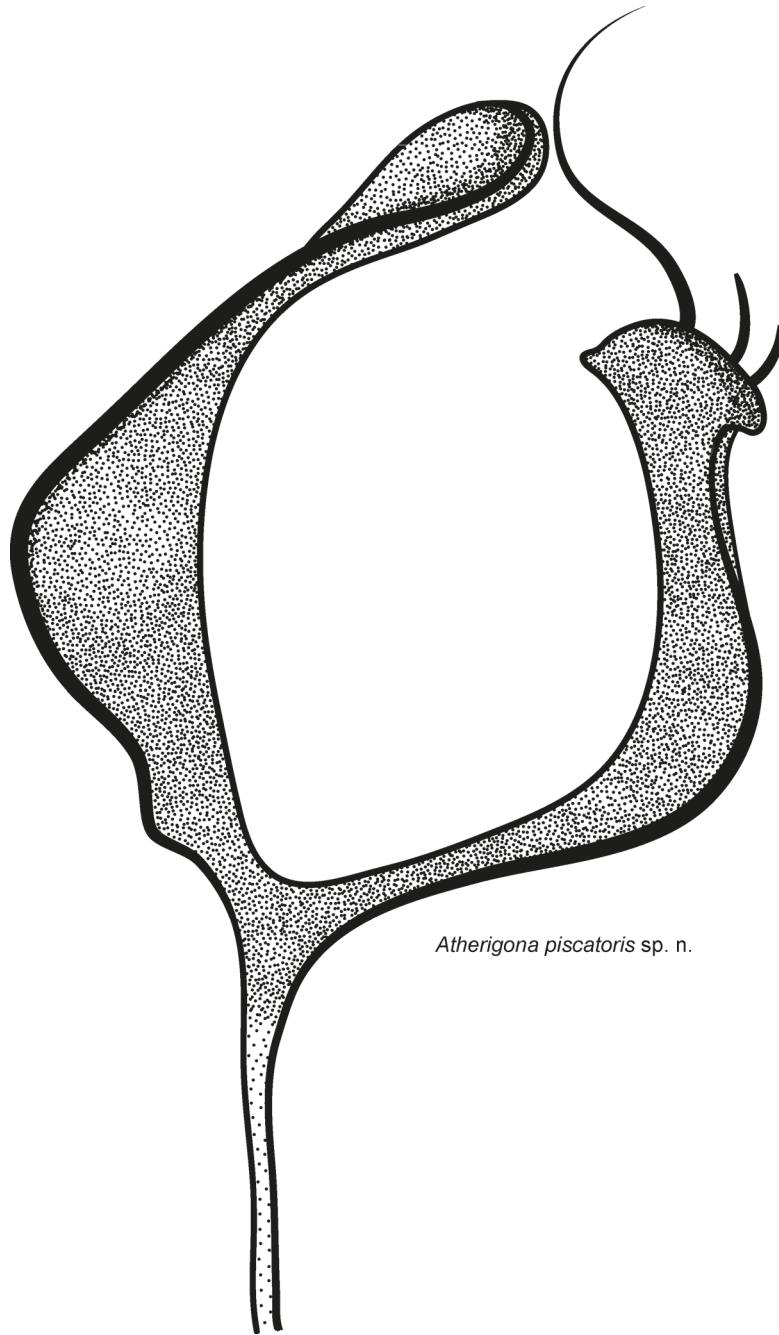


Figure 14: Distribution maps of *Atherigona* s. str. spp. recorded from South Africa: (A) *A. tigris* sp. n.; (B) *A. trapezia* van Emden; (C) *A. umbonata* sp. n.; (D) *A. univittata* Deeming & Overman; (E) *A. vernoni* sp. n.; (F) *A. zulu* sp. n.

CHAPTER 4



Atherigona piscatoris sp. n.

Concluding remarks and future research

4.1 Concluding remarks

This dissertation primarily focussed on the systematics and distribution of the males of the subgenus *Atherigona s. str.*, of the genus *Atherigona* Rondani (Diptera: Muscidae). The main purpose of the study was to review and update the current knowledge of species known to occur in South Africa, and to describe the numerous specimens which do not fit into the existing taxonomic structure of the group. Specific characters of a single species, *A. decempilosa* Dike, were reconsidered and a redescription provided, since the original description did not match the characteristics of the holotype.

Some species of *Atherigona s. str.* can be very damaging on numerous graminaceous crops, a notable example being *A. soccata* Rondani, commonly referred to as the sorghum shoot fly. This species has a more or less worldwide distribution and can infect up to 90% of crop seedlings under the optimum environmental circumstances. The precise identification of this species and other related species is paramount in the context of successful agricultural pest management, since some other damaging species (such as *A. lineata* ssp. *ugandae* van Emden) can occur earlier than *A. soccata* during a planting season in certain regions.

An illustrated key for species known to occur in South Africa is provided. There is a departure from the traditional use of the appearance of the occiput as starting point for separating the species due to possible error in interpretation. This new key focuses on the general shape of the male hypopygial prominence, *i.e.* reduced, knoblike, bifurcate and bilobate, to initially separate the species, with the traditionally used characters and the trifoliate process appearance used as final characters for keying the specific species. This led to a key that grouped closely related species (especially subspecies) closer together than some previous keys which relied heavily on colour. Twenty-five new species are described from South Africa, with eight additional known species recorded for the country.

The use of robust georeferenced localities allowed for an accurate means of mapping species records from as early as 1910. This data allowed individual localities to be transformed and merged into quarter degree grid squares representing 15 minutes each. Occurrence and species richness estimates were calculated, and used in a regression analysis to determine whether any sampling bias was present. It was important to establish the presence of bias, even though it was expected. Collectors are usually creatures of habit and tend to collect at their favourite haunts, which are usually convenient and environmentally favourable. These areas tend to be easily accessible, protected areas, with a rich species diversity, as collecting in such areas is much more successful than more remote areas where the species yield could be lower. The resulting R^2 value of approximately 0.7447 is proof of the expected bias. From the maps generated, clear gaps in the collection record can be observed, together with a

species distribution that is associated with biomes that are interspersed with grassland vegetation. The study revealed that the Northern Cape was apparently devoid of any *Atherigona*. This is unusual, and a clear future objective should be to conduct a proper survey of the province with regards to not only *Atherigona* but Diptera as a whole, since the entire province is undersampled.

Future work on *Atherigona* should include numerous areas of focus:

A thorough revision of the entire genus within the Afrotropical Region is necessary. Whilst species have been recorded for most of Africa, many of the records consists of only a handful for each country, and in various cases only collected from areas of agricultural importance. An effort should be made to try and collect in accessible, protected, grassland areas to increase the known distribution of current species and also to record and describe any new species from the region. Fresh material needs to be collected for species of the genus, as there is an extreme disjuncture between the known male types of species and the unknown females. Males and females of species may also be collected through rearing of specimens from identified host plants (where this information is known) or through collection during copulation. Fresh material will also allow this connection to be made through DNA barcoding or through the use of molecular phylogenetics. Whilst it would be unrealistic to assume that all known species will be collected, DNA barcoding will provide an important comparison against which morphological interpretations and decisions can be judged. This information can additionally also be used to study the phylogeography of specific species in order to better understand their distribution and associated geographic variation. A project of this scale would justify a study at Ph.D. level.

A secondary focus could be to untangle the finer complexities of the trifoliate process ultrastructure. The entire trifoliate process is very important in sexual selection, and fulfils a telling function leading to and during the process of copulation. It has already been shown that related species have similar adaptations with regards to the inner and outer surfaces of the lateral plates, as well as the trifoliate process stem. A thorough study utilising scanning electron microscopy could shed light on interspecific relationships. It could also form part of a larger cladistic analysis based on a complete morphological character evaluation, which could ultimately supplement the first-mentioned future objective, especially in cases where the molecular results are not clear-cut.

If the above proposed work areas can be completed, it would be a great step towards understanding this fascinating and economically important genus.

4.2 Summary

This study focused on an update of the taxonomy of South African *Atherigona s. str.* (Diptera: Muscidae), including their taxonomic history throughout the Afrotropical

Region, and the distribution of the subgenus within South Africa. The following was produced:

- An illustrated key to the males of South African *Atherigona sensu stricto*.
- The subgenus *Atherigona s. str.* was taxonomically treated, with new species records for South Africa and also other African countries, which was mainly based on examining material from Botswana, Benin, Ethiopia, Malawi, South Africa, Swaziland and Zimbabwe.
- Twenty-five new species were described for South Africa: *i.e.* *A. albicornis* **sp. n.**, *A. capitulata* **sp. n.**, *A. chrysohypene* **sp. n.**, *A. convexa* **sp. n.**, *A. danielssoni* **sp. n.**, *A. erectisetula* **sp. n.**, *A. flavifinis* **sp. n.**, *A. flaviheteropalpata* **sp. n.**, *A. heteropalpata* **sp. n.**, *A. kirkspriggsi* **sp. n.**, *A. latibasilaris* **sp. n.**, *A. libertensis* **sp. n.**, *A. londti* **sp. n.**, *A. ndumoensis* **sp. n.**, *A. nesshurstensis* **sp. n.**, *A. oblonga* **sp. n.**, *A. parviclivis* **sp. n.**, *A. parviumilata* **sp. n.**, *A. piscatoris* **sp. n.**, *A. rimapicis* **sp. n.**, *A. stuckenbergi* **sp. n.**, *A. tigris* **sp. n.**, *A. umbonata* **sp. n.**, *A. vernoni* **sp. n.** and *A. zulu* **sp. n.**
- One species was synonymised, with *A. hancocki* van Emden, 1940 designated as junior synonym of *A. divergens* Stein, 1913.
- The distribution of South African species of *Atherigona s. str.* was determined using original locality information as well as georeferenced records, which were superimposed on and correlated to South African vegetation biomes. An individual distribution map for each species was also created. Species richness and species occurrences were determined within DIVA-GIS and used to determine the degree of collection bias.



CHAPTER 5

BRITISH MUSEUM (NATURAL HISTORY)

RUWENZORI EXPEDITION
1934-5

VOL. II. No. 4

MUSCIDAE : B.—COENOSIINAE

F. I. VAN EMDEN

LONDON

PRINTED BY ORDER OF THE TRUSTEES OF THE BRITISH MUSEUM

References

- ADAMS, C.F. 1905. Diptera Africana, I. *Kansas University Science Bulletin* **3**:149–208.
- ATOKPLE, I.D.K. 2003. Sorghum and millet breeding in West Africa in practice [Paper 14]. In: Belton, P.S. & Taylor, J.R.N., eds, *AFIPRO: Workshop on the proteins of sorghum and millets: Enhancing nutritional and functional properties for Africa*. Pretoria, pp. 137–148.
- AXTELL, J.D. 1998. Opening Comments: In: *Proceedings of the West African Hybrid Sorghum and Pearl Millet Seed Workshop, in September 28–October 2, (1998)*. Palais de Congres, Niamey, Niger, pp. 1–19.
- BECKER, T. 1903. Aegyptische Dipteren (Fortsetzung und Schluss). *Mitteilung aus dem Zoologischen Museum in Berlin* **2**: 67–195.
- BEZZI, M. 1908. Diagnoses d'espèces nouvelles de Diptères d'Afrique. *Annales de la société entomologique de Belgique* **52**: 374–388.
- CHIKONDA, M.M. 1988. Some of the entomological aspects of the irrigated sorghum trials at Kasithula, Malawi. In: *Proceedings of the Fifth Annual Workshop on Sorghum and Millets for southern Africa, Maseru, Lesotho, 21–23 September*. pp. 92–94. Bulawayo: SADC/ICRISAT/Sorghum and Millet Improvement Program.
- CLEARWATER, J.R., THIEL, F. & KOKWARO, E.D. 1981. Comparative ultrastructure of the trifoliolate organ of *Atherigona Rondani* (Diptera: Muscidae). *Insect Science and its Application* **2**: 11–23.
- COURI, M.S., PONT, A.C. & PENNY, N.D. 2006. Muscidae (Diptera) from Madagascar: identification keys, descriptions of new species, and new records. *Proceedings of the California Academy of Sciences, Fourth Series* **57** (29): 799–923.
- DEEMING, J.C. 1971. Some species of *Atherigona Rondani* (Diptera, Muscidae) from northern Nigeria, with special reference to those injurious to cereal crops. *Bulletin of Entomological Research* **61**: 133–190.
- DEEMING, J.C. 1972a. Two remarkable new species of *Atherigona Rondani sensu stricto* (Dipt., Muscidae) from East Africa. *Entomologist's Monthly Magazine* **108**: 3–6.
- DEEMING, J.C. 1972b. A review of the taxonomy of African shoot flies of sorghum. In: Jotwani, M.G. & Young, W.R., eds, *Control of Sorghum Shoot Fly*. New Delhi: Oxford & IBH Publishing Co., pp. 2–26.
- DEEMING, J.C. 1975. Some species of *Atherigona* (Diptera, Muscidae) collected by Prof. E. Lindner in Africa. *Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie)* **279**: 1–4.
- DEEMING, J.C. [1977]. Three new African species of *Atherigona Rondani* (Diptera:

- Muscidae). *Nigerian Journal of Entomology* **1** (1975):147–151.
- DEEMING, J.C. 1978. Diptera Muscidae Atherigonini from the Comoros Archipelago. *In: Faune Entomologique de l'archipel des Comores. Mémoires du Muséum National D'Histoire Naturelle novella série A, Zoologie* **109**: 367–370.
- DEEMING, J.C. 1979. New and little known species of *Atherigona* Rondani (Dipt., Muscidae) from Nigeria and Cameroun. *Entomologist's Monthly Magazine* **114**: 31–52.
- DEEMING, J.C. 1981. New and little-known African species of *Atherigona* Rondani (Dipt., Muscidae). *Entomologist's Monthly Magazine* **117**: 99–113.
- DEEMING, J.C. 1987. Some new and little known species of *Atherigona* Rondani (Diptera: Muscidae) from the Malgasian subregion. *Entomologist's Monthly Magazine* **123**: 15–25.
- DEEMING, J.C. 2000. Muscidae: Atherigonini (Diptera: Muscoidea). *Cimbebasia Memoir* **9**: 283–287.
- DEEMING, J.C. & OVERMAN, J.L. 1987. A collection of *Atherigona* Rondani (Dipt., Muscidae) from Kenya and Uganda, with the description of a new species. *Entomologist's Monthly Magazine* **123**: 117–120.
- DELOBEL, A.G.L. & LUBEGA, M.C. 1984. Rainfall as a mortality factor in the Sorghum Shootfly, *Atherigona soccata* Rond. (Diptera, Muscidae). *Zeitschrift für angewandte Entomologie* **37**: 510–516.
- DIKE, M.C. 1987. *Taxonomic studies on Afrotropical shootflies of the genus Atherigona Rondani (Diptera: Muscidae)*. Unpublished Ph.D. thesis. Cardiff: University of Wales.
- DIKE, M.C. 1989a. A key for the identification of Afrotropical species of the shoot-fly subgenus *Atherigona* of *Atherigona* (Diptera: Muscidae), with a description of some new species from Africa. *Bulletin of Entomological Research* **79**: 545–566.
- DIKE, M.C. 1989b. Some new species of *Atherigona* Rondani (Dipt., Muscidae) from Africa. *Entomologist's Monthly Magazine* **125**: 73–79.
- DIKE, M.C. 1990a. Key to males of Nigerian species of the shootfly genus *Atherigona* Rondani (Diptera: Muscidae). *Samaru Journal of Agricultural Research* **7**: 97–124.
- DIKE, M.C. 1990b. Two new species of *Atherigona* from Nigeria with a key to the identification of Afrotropical species of the subgenus *Acritochaeta* (Diptera: Muscidae). *Systematic Entomology* **15**: 297–303.
- DIKE, M.C. 1991. The zoogeographical distribution of *Atherigona* species (Diptera: Muscidae) in Nigeria. *Nigerian Journal of Entomology* **12**: 13–24.

- DIKE, M.C. 1992. The ultrastructure of the trifoliate process of some species of *Atherigona* (Diptera: Muscidae). *Insect Science and its Application* **13** (2): 265–277.
- DIKE, M.C. 1994. Intraspecific variability in *Atherigona lineata* (Adams) (Diptera: Muscidae). *Insect Science and its Application* **15** (4/5): 513–523.
- DIKE, M.C. 2003. Distributional patterns of Afrotropical species of *Atherigona* Rondani (Diptera: Muscidae). *Cimbebasia* **19**: 215–221.
- GRIMSHAW, P.H. 1901. Diptera. *Fauna Hawaiiensis* **3** (1): 1–77.
- HACKMAN, R.H. 1953. Chemistry of insect cuticle. 3. Hardening and darkening of the cuticle. *The Biochemical Journal* **54** (3): 371–377.
- HENNIG, W. 1963: Zwei neue palaarktische Arten aus der Familie Muscidae Dipt. *Stuttgarter Beiträge zur Naturkunde* (dedic. E. Lindner) **101**: 1–3.
- HENNIG, W. 1965. Vorarbeiten zu einem phylogenetischen System der Muscidae (Diptera: Cyclorrhapha). *Stuttgarter Beiträge zur Naturkunde* **141**: 1–100.
- KARSCH, F.A. 1888. Bericht über die durch Herrn Lieutenant Dr. Carl Wilhelm Schmidt in Ost-Afrika gesammelten und von der zoologischen Abtheilung des Königlichen Museums für Naturkunde in Berlin erworbenen Dipteren. *Berliner entomologische Zeitschrift* **31** (1887): 367–382.
- LEUSCHNER, K. 1988. Cereal Entomology in the SADC Region. In: *Proceedings of the Fourth Regional Workshop on Sorghum and Millets for southern Africa, Matopos, Zimbabwe, 21–24 September 1987*, pp. 273–280. Bulawayo: SADC/ICRISAT/Sorghum and Millet Improvement Program.
- LOEW, H. 1852. Hr. Peters legte Diagnosen und Abbildungen der von ihm in Mossambique neu entdeckten Dipteren vor, welche von Hrn. Professor Loew bearbeitet worden sind. *Bericht über die zur Bekanntmachung geeigneten Verhandlungen der Königlich-Preussischen Akademie der Wissenschaften zu Berlin 1852*: 658–661.
- MACQUART, J. 1851a. Diptères exotiques nouveaux ou peu connus. Suite due 4.^e supplement publié dans les memoires de 1849. *Mém. Soc. Sci. Agric. Lille* (1850), pp. 134–294.
- MACQUART, J. 1851b. Ibidem, reprinted with pagination, pp. 161–336.
- MALLOCH, J.R. 1923. Exotic Muscaridae (Diptera). X. *Annals and Magazine of Natural History* (Series 9) **12**: 177–194.
- MATHEE, J.J. 1974. Pests of graminaceous crops in South Africa. *Entomology Memoir no. 40*. South Africa: Department of Agricultural and Technical Services.

- McALPINE, J.F. 1981. Morphology and terminology—Adults. *In*: McAlpine, J.F., Peterson, B.V., Shewell, G.E., Teskey, H. J., Vockeroth, J.R. & Wood, D.M., eds, *Manual of Nearctic Diptera*. Vol. 1. Monograph 27. Ottawa: Agriculture Canada, Research Branch, pp. 9–63.
- MEIGEN, J.W. 1803. Versuch einer neuen Gattungseintheilung der europäischen zweiflügligen Insekten. *Magazin für Insektenkunde* (Illiger) **2**: 259–281.
- MEIGEN, J.W. 1826. Systematische Beschreibung der bekannten europäischen zweiflügeligen Insekten **5**: xii + 1–412.
- MUCINA, L. & RUTHERFORD, M.C., eds. 2006. *The vegetation of South Africa, Lesotho and Swaziland*. Strelitzia, Vol. 19. Pretoria: South African National Biodiversity Institute.
- OGWARO, K. 1978. Observations on longevity and fecundity of the sorghum shoot fly, *Atherigona soccata* (Diptera: Anthomyiidae). *Entomologia Experimentalis et Applicata* **23**: 131–138.
- PATERSON, H.E. 1956. East-African Muscidae (Diptera). Ergebnisse der Deutschen Zoologischen Ostafrika-Expedition 1951/52, Gruppe Lindner, Stuttgart, Nr. 20. *Beiträge zur Entomologie* **6** (1/2): 154–179.
- PONT, A.C. 1969. Afrikanische Musciden (Dipt.). Ergebnisse der Forschungsreise Lindner 1958/59 – Nr 22.). *Stuttgarter Beiträge zur Naturkunde* **201**: 1–27.
- PONT, A.C. 1972. A Review of the Oriental Species of *Atherigona* Rondani (Diptera, Muscidae) of economic Importance. *In*: Jotwani, M.G & Young, W.R., eds, *Control of Sorghum Shoot Fly*. New Delhi: Oxford & IBH Publishing Co., pp. 27–104.
- PONT, A.C. 1977. Family Muscidae. *In*: Delfinado, M.D. & Hardy, D.E., eds, *A catalogue of the Diptera of the Oriental Region. Vol. 3. Suborder Cyclorrhapha (excluding Division Aschiza)*. Honolulu: University of Hawaii, pp. 451–523.
- PONT, A.C. 1980. Family Muscidae. *In*: Crosskey, R.W. ed. *Catalogue of the Diptera of the Afrotropical Region*. London: British Museum (Natural History), pp. 721–761.
- PONT, A.C. 1981. Some new oriental shoot-flies (Diptera: Muscidae, genus *Atherigona*) of actual or suspected economic importance. *Bulletin of Entomological Research* **71** (3): 371–393.
- PONT, A.C. 1986. Studies on Australian Muscidae (Diptera) VII. The genus *Atherigona* Rondani. *Australian Journal of Zoology, supplementary series* **120**: 1–90.
- PONT, A.C. & DEEMING, J.C. 2001. A shoot-fly *Atherigona tritici* sp. n. (Diptera: Muscidae), attacking wheat *Triticum aestivum* in Egypt. *Bulletin of Entomological Research* **91** (4): 297–300.

- RAINA, A.K. 1982. Fecundity and Oviposition behaviour of the sorghum shootfly, *Atherigona soccata*. *Entomologia Experimentalis et Applicata* **31**: 381–385.
- RONDANI, C. 1856. *Dipterologiae Italicae Prodrum. Vol. I. Genera italica ordinis Diptero-ordinatim disposita et distincta et in familias et stirpes aggregata*. Parmae: Stocchi.
- RONDANI, C. 1871. Diptera Italica non vel minus cognita descripta aut annotata. Fasc. IV. Addenda Anthomyinis Prodr. Vol. VI. *Bollettino della Società entomologica Italiana* **2** (1870): 317–338.
- ROUGET, N., REYERS, B., JONAS, Z., DESMET, P., DRIVER, A., MAZE, K., EGOH, B. & COWLING, R.M., eds. 2005. *South African National Spatial Biodiversity Assessment 2004: Technical Report, Volume 1: Terrestrial Component*. Pretoria: South African National Biodiversity Institute.
- SCHINER, I.R. 1968. Diptera. Reise der österreichischen Fregatte Novara um die Erde in den Jahren 1857, 1858, 1859, unter den Befehlen des Commodore B. von Wüllerstorff-Urbair. Zoologischer Theil **2** (1) section B: vi + 388pp.
- SCHNABL, J. & DZIEDZICKI, H. 1911. Die Anthomyiden. Abh. Der. Kaiserl. Leop.-Carol. Deutschen Akademie der Naturforscher *blad*, Series: Nova acta **95** (2): 53–358.
- SÉGUY, E. 1938. Mission scientifique de l'Omo. IV. Fasc. 39. Diptera I. Nematocera et Brachycera. *Mémoires du Muséum National D'Histoire Naturelle Paris* **8**: 319–380.
- SÉGUY, E. 1955. Un nouveau Muscicide africain nuisible au riz (Dipt., Muscidae). *Revue française d'entomologie* **22**: 164–165.
- SHERWILL, T., BYRNE, M. & VAN DEN BERG, J. 1999. Shoot fly species on sorghum in the Mpumalanga subtropics of South Africa: relative abundance and infestation levels. *African Plant Protection* **5** (1): 31–35.
- SITHOLE, S.Z. 1987. The effect of date of planting on shootfly and stemborers on sorghum. In: *Proceedings of the Third Annual Workshop on Sorghum and Millets for southern Africa, Lusaka, Zambia, 6–10 October 1986*. Bulawayo: SADC/ICRISAT/Sorghum and Millet Improvement Program, pp 174–183.
- SITHOLE S.Z., DE MILIANO, W.A.J., KAULA, G., MOTALAOTE, B., MTISI, E., KUNENE, S. & LEPHEANA, F.T.M. 1987. In: *Proceedings of the Third Annual Workshop on Sorghum and Millets for southern Africa, Lusaka, Zambia, 6–10 October 1986*. Bulawayo: SADC/ICRISAT/Sorghum and Millet Improvement Program, pp 375–381.
- SKIDMORE, P. 1985. *The biology of the Muscidae of the world*. Series Entomologica Volume 29. Dordrecht: Dr. W. Junk Publishers, xiv + 550pp.

- STEIN, P. 1906. Die afrikanischen Anthomyiden des Königl. Zoologischen Museums zu Berlin. *Berliner entomologische zeitschrift* **51**: 33–80.
- STEIN, P. 1910. The Percy Sladen Trust expedition to the Indian Ocean in 1905, under the leadership of Mr J. Stanley Gardiner. Vol 3. No. IX. – Diptera, Anthomyidae, mit den Gattungen *Rhinia* und *Idiella*. *Transactions of the Linnaean Society of London*. (2, Zool.) **14**: 149–163.
- STEIN, P. 1913. Neue afrikanische Anthomyiden. *Annales Musei Nationalis Hungarici* **11**: 457–583.
- STEIN, P. 1914. Anthomyidae. *Résult. Scient. Voy. Ch. Alluaud et R. Jeannel en Afrique orientale (1911-1912) (Dipt.)* **4**: 100–143.
- STEYSKAL, G.C. 1966. A new species of *Atherigona* Rondani causing damage to wheat plants in West Pakistan (Diptera: Muscidae). *Proceedings of the Entomological Society of Washington* **68** (1): 53–56.
- STUCKENBERG, B.R. 1999. Antennal evolution in the Brachycera (Diptera), with a reassessment of terminology relating to the flagellum. *Studia dipterologica* **6**: 33–48.
- TAKSDAL, G. & BALIDDAWA, C.W. 1975. Studies of the biology of sorghum shoot flies, *Atherigona* spp. (Muscidae: Diptera), and shoot fly-sorghum host plant relationships. *Zeitschrift für angewandte Entomologie* **79**: 239–249.
- THOMSON, C.G. 1869. Diptera. Species novas descripsit C.G. Thomson. In: *Kongliga svenska fregatten Eugenie resa omkring jorden under befall af C.A. Virgin, åren 1851–1853*. **2** (Zoologi), [section] I (Insecta), pp. 443–614.
- VAN EMDEN, F.I. 1940. Muscidae: B.–Coenosiinae. In: *British Museum (Natural History) Ruwenzori Expedition 1934–35* Vol. 2 no 4. 91–255. London: British Museum (Natural History).
- VAN EMDEN, F.I. 1956. Contributions à l'étude de la faune entomologique du Ruanda-Urundi (Mission P. Basilewsky 1953) CVIII. Diptera Muscidae. *Annales du Musée Royal du Congo Belge, Série 8vo (Zoologie)* **51**: 506–531.
- VAN EMDEN, F.I. 1958. Muscidae collected on the Cape Verde Islands. In: R. Frey and H. Lindberg, eds, *Results of the Zoological Expedition of Professor Dr. Håkan Lindberg to the Cape Verde Islands in the winter 1953–54*. No: 24. Societas Scientiarum Fennica. Commentationes Biologicae **20** (1): 2–18.
- VAN EMDEN, F.I. 1959. Journey to High Simien (northern Ethiopia), 1952–53: Diptera, Calyptrata. *Journal of the Linnean Society (Zool)* **44**: 186–195.
- VAN RENSBURG, J.B.J & VAN DEN BERG, J. 1992. Stem borers in grain sorghum: II. Yield loss compensation in relation to borer attack. *South African Journal of Plant and Soil* **9**:1–86.

- VENTURI, F. 1968. La struttura morfologica addominale del mashio di *Atherigona quadripunctata* Rossi (Dipt. Muscidae Chelisiini). *Frustula Entomologica* **7** (3): 1–22.
- VILLENEUVE, J. [1922]. Remarques sur quelques Diptères d'Égypte communiqués par M. Alfieri et description de deux espèces nouvelles. *Bulletin de la Société Royale d'Entomologie d'Égypte* **6** (1921): 51–54.
- WIEDEMANN, C.R.W. 1830. *Aussereuropäische zweiflügelige Insekten* Volume 2. Hamm: Schulzischen Buchhandlung, xii + 684pp.
- YOUNG, W.R. & TEETES, G.L. 1977. Sorghum entomology. *Annual Review of Entomology* **22**: 193–218.



