REVISION OF THE GENUS *CTENOLEPISMA* ESCHERICH (THYSANURA : LEPISMATIDAE) IN SOUTHERN AFRICA

John Anthony Irish

Submitted in partial fulfilment
of the requirements for the
M.Sc. degree in Entomology
in the
Faculty of Science,
University of Pretoria.

30 March 1986

OPSOMMING

Die genus Ctenolepisma Escherich (Thysanura: Lepismatidae) se suider-Afrikaanse species word taksonomies hersien. Die 19 beskrewe species word behandel en 16 word behou nadat een species na 'n ander genus oorgeplaas word en twee ander nuwe sinonieme word. Ses species word herbeskryf, en 17 word nuut beskryf. Die mates van elke species, materiaal ondersoek, verspreiding en habitat word telkens behandel. Die metodes wat tydens die studie gebruik is, die verskillende karakters wat by beskrywing gebruik word, sowel as lg. se filogenetiese beduidenis, word behandel. Ten slotte word 'n nuwe subgeneriese sisteem vir die genus voorgestel.

ABSTRACT

A taxonomic revision of the southern African species of the genus Ctenolepisma Escherich (Thysanura: Lepismatidae) is provided. The 19 described species are treated and 16 are retained after one species is transferred to another genus and two others become new synonyms. Six species are redescribed and 17 newly described. Measurements, material examined, distribution and habitat are treated for each species. Methods used during the study, the different characters used in description, and each of the latter's phylogenetic significance, are also treated. In conclusion, a new subgeneric system for the genus is proposed.

C O N T E N T S

I. INTRODUCTION

The Thysanura have always been a neglected group in southern Africa, that is to say, contributions to our knowledge of them have been few and far between. To a greater or lesser extent this is also true for the rest of the world. Because Thysanura are normally ignored during general collecting, and because specimens collected without care (as they usually are) are practically useless from a systematic viewpoint, the systematist finds himself working with unrelated bits and pieces of more extensive faunas. Information on any single species is usually slowly accumulated over decades by different workers. As a result, almost all of thysanuran taxonomy to date exists in the form of numerous short articles in scientific journals all over the world, and a comprehensive modern work on the world's Thysanura is lacking.

Prior to 1900 the results of the circumstances outlined above were firstly that almost all species, at least in the Lepismatidae, were indiscriminately assigned to the genus Lepisma L., with little or no attempt made at defining the sometimes obvious differences between presently accepted genera. Secondly, because of the inherent fragmentary nature and haphazard progress of thysanuran systematics, no single worker had a clear concept of which characters were taxonomically significant and which not. This often resulted in quite lengthy descriptions which contain absolutely no taxonomically useful information, to the extent that the species in question cannot even be unequivocally assigned to a genus. The work of Ridley (1890), whose species remain generically indeterminate to this day, is a prime example of the latter.

Towards the end of the nineteenth century, two Italian entomologists, B. Grassi and G. Rovelli, working first individually and then in co-operation, thoroughly reviewed the Italian Lepismatidae and Nicoletiidae. As a result of this first work based on extensive, systematically collected material, they were able to differentiate between taxonomically significant and insignificant characters, and they also developed a reasonably sound system for Italian Thysanura. Of interest to us here is their culminating work, Grassi & Rovelli (1890), in which they established the importance of dorsal setation as one of the most reliable characters available to the thysanuran systematist.

Grassi & Rovelli spared little thought for extra-Italian Thysanura, and it was up to Escherich (1905) to work the principles established by them into a system for the Thysanura of the world. Escherich examined material from all over the world, and established several new genera, including Ctenolepisma, as well as the criteria to be used in the delimitation of both genera and species. It stands to Escherich's credit that all pre-Escherichian taxonomic problems not resolved by him have remained unsolved to this day. Escherich (1905) can be considered the cornerstone of modern thysanuran systematics.

Apart from one more short paper of little consequence, Escherich never published on Thysanura again. As far as the Lepismatidae are concerned, our knowledge of them was steadily expanded over the next four decades by the prolific works of F. Silvestri, up to his death in 1949, with J.

Stach making a lesser but still important contribution. Since the Second World War and up to the middle 1970's, contributions were primarily made by P. Wygodzinsky, and secondarily by J. Paclt. In the last decade L.F. Mendes has made, and continues to make, several important contributions, and V. Kaplin publishes intermittently on Russian species.

As far as the genus *Ctenolepisma* in southern Africa is concerned, Escherich (1905) described the first two endemic species, *C. grandipalpis* and *C. weberi*, based on material collected in the southern Cape Province by H. Brauns and M. Weber. Escherich also described the cosmopolitan *C. longicaudata* from South Africa.

Silvestri (1908) described an additional five new *Ctenolepisma* species, based on material collected in Namaqualand, South West Africa and southern Botswana by L. Schultze. Silvestri (1913) published on material collected by I. Trägårdh in Natal, including new records for *C. grandipalpis*. Silvestri (1922) added five more new species, based on material collected by W. Michaelsen in South West Africa.

Wygodzinsky (1955) described the material collected by the Swedish South Africa Expedition, including odd specimens from other collections. He described five further new species, and provided the most comprehensive review of southern African Thysanura available today. Wygodzinsky (1959) added the new species *C. pauliani*. Theron (1963) gave a review of domestic southern African Lepismatidae. Wygodzinsky (1970), describing a collection of mainly termitophilous Nicoletiidae made by W.G.H. Coaton and J.L. Sheasby in southern Africa, included new records for a few *Ctenolepisma* species. Paclt (1966; 1979), publishing on the apterygote collection of the Hamburg Museum (ZSZM; a list of institutional abbreviations used here is provided in Appendix 1), included a few new southern African records. Mendes (1982), in a review of the Afrotropical *Ctenolepisma* species, added a few new records for southern Africa.

Among non-taxonomic works in the southern African context, the physiological investigations on *C. longicaudata* by Heeg (1967*a*, *b*, 1969) may be mentioned, as well as physiological and ecological investigations of the Thysanura at Gobabeb in the Namib desert, primarily by Edney and/or Holm (various papers).

In the present study, *Ctenolepisma* was found to be the most common genus of Lepismatidae in southern Africa, both in terms of number of species and number of individuals encountered. Most of the older (Escherich and Silvestri) species required redescription, and it was possible to do this in all but one case, that of *C. weberi* Escherich, where the types could not be traced. Two cases of synonymy were resolved, and one species, described as a *Ctenolepisma*, was found not to belong to the genus. All available material of Lepismatidae in southern African collections was examined, as well as extensive material collected by myself, mainly in south-western Africa. The known distributions of most existing species were expanded, and a further 17 new species are described. Finally, a new subgeneric system for the genus is proposed.

II. METHODS AND MATERIALS

1. Literature

A fundamental prerequisite for any serious systematic research is a thorough knowledge of all previous work published on the taxon in question. In the case of the Lepismatidae, Paclt's (1967) catalogue of the world's species provides a summary of the pre-1967 literature. Papers published after 1967 were located by referring to the respective editions of The Zoological Record, up to 1982, which is the most recent edition available. Still more recent papers were located firstly by establishing a system of reprint exchange with the only other worker presently active in the Lepismatidae, Dr. L.F. Mendes of the Museu Bocage in Lisbon (MBOC), secondly by subscribing to the SASDI abstracting service, and thirdly by regular perusal of international journals likely to publish thysanuran systematics.

I have obtained a copy of the original description of all described Ctenolepisma species, and the papers including these proved to also include most other published information on the genus. These articles are listed under Part VI, References, and in Appendix 3.

2. Acquisition of material

As a general rule, the more material available for a revision, the more thorough a revision may be made. In the present work, two main categories of material were examined.

Category I included all types and other material previously published on. Most of the material collected by Brauns for Escherich (1905), was traced through Weidner's (1962) type list to ZSZM, and borrowed from them. Silvestri's (1922) types were similarly traced to ZSZM and borrowed. The material collected by Weber for Escherich (1905), including the types of C. weberi, could not be traced. Horn & Kahle (1935-7) mention that some of Weber's material went to AMMU, but this proved not to be so in the case of the Lepismatidae (W. Hogenes, pers. comm.).

The types of Silvestri's (1908) species were located in and borrowed from ZMHU, after Dr. M.-L. Penrith (SM, now TM) informed me that other material from the same expedition was deposited there. No attempt was made to trace Silvestri's (1913) material. As the specimens in question belong to a single distinctive species and come from well within its established distribution range, their re-examination was deemed unnecessary. Most of Wygodzinsky's (1955) material is located at LUND, but only a few specimens of which the identifications were doubtful (whether on distributional grounds or from personal experience of difficulties within the species) were borrowed. Because of the clarity of Wygodzinsky's descriptions, it was only neccessary to examine the types of one species, C. petronia, which were obtained from LUND and NM.

Repeated letters attempting to borrow the types of Wygodzinsky's (1959) species from IRSM and IML, where they were stated to be deposited, went unanswered, but Mr. R.B. Toms (TM) eventually discovered some of the types in TM. No attempt was made to trace or borrow the material of Theron (1963), Paclt (1966, 1979) or Mendes (1982), as there was no need to re-examine it. Wygodzinsky's (1970) material was borrowed from NCI. The unsuccessfull attempts to trace Edney's and Holm's (various papers) material used in physiological/ecological experiments have been detailed under C. terebrans in Part IV.

Category II included all previously unpublished material. This may again be subdivided into existing unworked collections (IIa) and newly collected material (IIb). Requests to loan material were directed to all institutions in southern Africa known to keep insect collections, but were unsuccessful in all but a few cases. The most material came from the DERU collection, now SM, and the most valuable material from TM, with smaller contributions from SM, SAM, NCI, UP, NMB and FORC. No attempt was made to borrow material abroad, as most of what was available had already been studied by Mendes (1982).

The largest quantity of material was collected by myself (IIb ii), or by colleagues at my request during the duration of the study (IIb i). Most of this was deposited in SM, with a few specimens being donated to MBOC, AMNH and DERU. A map of the distribution of collecting stations is given in fig. 1 and a summary of the present location of examined material follows.

	Category				
Institution	I	IIa	IIb i	IIb ii	Total
AMNH	-	-	-	7	7
DERU	-	-	1	-	1
FORC	-	-	2	-	2
LUND	18	-	-	-	18

MBOC	-	-	6	22	28
NCI	5	15	5	-	25
NM	1	-	-	-	1
NMB	-	-	7	-	7
SAM	-	27	-	-	27
SM	-	37	1059	1358	2454
TM	2	87	22	-	111
UP	-	48	-	-	48
ZMHU	66	-	-	-	66
ZSZM	61	-	-	-	61
	----	----	-----	------	------
Total	153	214	1102	1387	2856

Collecting methods

The easiest way to capture lepismatids in a condition suitable for taxonomic study is by sucking them into an aspirator, and then allowing the animals to run from the aspirator directly into a container filled with 75 % ethyl alcohol. Any attempt to touch the live insect, whether by hand or with forceps, leads to a massive loss of scales, setae and appendages, and renders the specimen exceedingly difficult, if not impossible, to identify. Aspirators should be used to capture specimens, whatever the method used to locate them. A method quoted by several general entomological texts for the capture of Thysanura, namely touching them with a thin brush dipped in alcohol, is not recommended. The alcohol is supposed to both stun and pick up (by its surface tension) the specimen, but since this involves touching the animal, it causes much damage, besides the fact that a considerable amount of alcohol is required to stun the average silverfish.

The most effective method of locating lepismatids in the field is by actively searching under all available shelter, keeping in mind that Ctenolepisma species usually occupy the relatively drier microhabitats available in a specific area. A fair yield is obtained by overturning stones, but dry plant material and dung also provide shelter for many species. In desert areas, psammophilous species are located by digging under dune hummocks and other vegetation. Running the excavated sand through an ordinary kitchen sieve effectively seperates sand from silverfish. Pittraps, if they are deep and steep-sided enough to prevent the animals from escaping, are quite successful. Preservative pittraps filled with mono-ethylene glycol are also effective, but yield material of which only about 70 % is identifiable, and none is suitable for description. This is due to the fact that mono-ethylene glycol is not a good preservative for softbodied insects; also, because the nature of preservative trapping is such that the traps are subjected to quite robust treatment between the time of removal and time of sorting. In areas with well known faunas, preservative traps may be used to obtain distributional data, or they may be used in conjunction with hand-sampling in an area to again obtain distributional data for species which may be described from hand-sampled material. Preservative trapping alone in an area with an unknown fauna yields material which is highly frustrating to work with, because the species are usually new, but in a condition unsuitable for accurate description.

Silverfish are only rarely attracted to lighttraps.

3. Preservation and preparation

Once a live specimen is dropped into 75 % ethyl alcohol, it requires little further attention, as the alcohol both fixes and preserves the specimen. At lower alcohol concentrations, the intersegmental membranes disintegrate and the specimens start breaking up; moderately higher concentrations have little effect, but above 90 % dehydration begins to set in. Some specimens preserved in methyl alcohol were examined, and found to be generally more brittle than those from ethyl alcohol. Formalin and acetic acid, or solutions which contain either or both (e.g. Pampel's fluid), eventually dissolve specimens.

As far as the container is concerned, care should be taken that it is neither too large, in which case the specimen may be damaged by fluid movement, nor too small, in which case the specimen cannot be removed without damage. In the present study, Polytop or Apex glass vials numbers 3 and 4 were found to be most suitable. If too many specimens are placed together in a vial, the friction between their bodies leads to damage. Similarly, very small species should not be placed in the same bottle with robust species, nor should pebbles, bits of grass or other hard-bodied insects be transported in the same vial. Labels should be of large pieces of flexible paper, which may be bent to fit snugly against the curve of the glass. Small labels of stiff cardboard tend to occupy a transverse position in the bottom of the vial, usually resting on the specimens to their detriment.

In the initial stages of this study I experimented with heat-sealing individual specimens into small alcohol-filled polythene bags (Irish, 1981). While this was practical for small batches of material, it was later abandoned as being too time-consuming for large amounts of material. If time allows, it is still the surest way of negating the effects of possible evaporation of the alcohol, and is recommended for any especially valuable material, e.g. types. Evaporation of the preservative leads to rapid dehydration of the specimen and leaves it in a state useless for taxonomic purposes. The process is irreversible; re-filling of containers does not lead to re-hydration of specimens.

The ultimate method of preserving Thysanura is by dissecting and mounting on a microscope slide, using standard methods, as e.g. described by Ledger (1980). Careful dissection of especially small lepismatids takes at least two hours for each dissection, over and above the time needed to prepare and mount the specimen, and because of the strain on both eyes and patience no more than one per day is feasible. For this reason slide mounting is impractical as a general preserving method, and is usually used only for small numbers of specimens in species not readily examinable in the natural state, e.g. very small species which require high magnification, or globose species, where laterally situated structures are invisible in dorso-ventral view. In the present study, it was found that Ctenolepisma species, by virtue of their relatively large size and dorso-ventrally flattened bodies, could be examined and described without recourse to slide mounting, though this is not the case for most other genera.

4. Examination and description

The main difficulty during the examination of lepismatids is preventing them from dehydrating while being examined. They should therefore be kept submerged in alcohol, e.g. in a petri dish, during examination. Immersion in fluid has the added advantage that setae, which otherwise lie flat against the body, float up and are more easily visible. The specimen can also better withstand repeated handling and overturning, as is necessary for a thorough examination, while in fluid than otherwise. A problem arises when specimens continually float out of the field of view. This may be alleviated by placing something that restricts the specimen's movement in the dish with it. A small paper clip, or a bent paper staple, were found to be effective for this purpose, the insect then resting in the space between the legs of the object. The alcohol in the petri-dish needs regular topping-up as it evaporates, and this is best accomplished with a plastic squirt bottle.

The average dissecting microscope does not provide adequate magnification for the study of Lepismatidae, but a stage microscope can be easily modified by removal of the slide holders to accomodate a petri-dish. Because much examination is done at high magnification, a powerful external light source is required. It was found that only halogen bulbs provide bright enough light, and the preferred system is a fiber-optic light source. The end of the latter may be submerged in the alcohol, which refracts the light and effectively illuminates the small space between the specimen and the microscope's objective, which otherwise stays quite dark, even when light is directed obliquely or horizontally into it.

The specimen is inspected from anterior to posterior end, first the dorsal and then the ventral side. In order to minimise damage, the specimen should preferably be turned over once only. The order of description followed here was adopted with this in mind: the first paragraph treats general aspects applicable to the whole body, and the second paragraph the head, which has both dorsal and ventral structures; thereafter the rest of the body's structures are treated in the sequence suggested above. Wherever possible, descriptions were based on a number of specimens rather than a single one or two, though this was not possible in species of which very few specimens were available. Descriptions were done on a sheet of paper listing the main characters and leaving space for their description, allowing data for subsequent specimens to be simply added to those for previous specimens. A description was deemed adequate when the examination of more material ceased to significantly add to the existing description. The terminology used in the descriptions in Part IV is as given in Part III.

It was found necessary to redescribe all Escherich and Silvestri's species. Though excellent for their time, their original descriptions became inadequate as more and more *Ctenolepisma* species were discovered. In a surprising number of cases they also include inaccuracies (? printing errors) with regard to important characters, notably urosternal setation.

Illustrations were done with the help of a *camera lucida*. Measurements were made by placing the animal on a piece of plastic ruler and estimating lengths to the nearest 0,25 mm. It was felt that more accurate measurements would be superfluous for ametabolous insects which are continually growing. In all tables of proportions, the following abbreviations were used:

ave.	-	average of all measurements
s.d.	-	standard deviation
max.	-	maximum length or largest proportion recorded
n	-	sample size

Only measurements taken from adults (i.e. specimens which may be positively sexed) were used, which is why the number of specimens measured is always less than the total number examined. Body lengths are given in millimetres, and appendage lengths are expressed as a proportion of the body length, and the tables should be read thus. Only seemingly intact appendages were measured, which explains the very small samples in some cases; the average lepismatid specimen does not have intact appendages. The crudeness of the measurements were compensated for by expressing two measurements with similar degrees of (in)accuracy as proportions of each other. This produced remarkably consistent results (compare measurements for males and females in species for which large samples were available). Males and females were measured seperately because one sex usually is larger and/or has longer appendages than the other, but total figures for both sexes of each species are also given.

Data from holo- and allotype labels were quoted directly and completely. Wherever possible, females were selected as holotypes, because their ovipositors often yield useful characters, while the penes of males are similar throughout the genus and much of the family. Though "The Code" (ICZN, 1985) does not consider an allotype to have higher status than a paratype, I have designated allotypes wherever possible. This is in view of the considerable differences in sexes of the same species sometimes found on the one hand, and the fact that especially males of different species are sometimes indistinguishable on the other hand. Because article 74(a) of The Code (ICZN, 1985) uses the word "may" and not "must" with regard to the designation of lectotypes, the latter were only designated in cases where this action would make a significant contribution to the stability of the species. Paratype label data, to save space and prevent unnecessary repetition, were reduced to locality, date and collector only, omitting geographical co-ordinates, country designations, collection names or notes if they were recorded. The collections in which specimens are deposited are designated by abbreviations, as listed in Appendix 1. A list of localities from which the species has been recorded follows, the geographical co-ordinates of which may be found in Appendix 2. A brief note summarising the distribution follows that.

Macro- and microhabitat data were compiled by summarising label data and observations. Any other biological information available, e.g. ability to sanddive, activity periods etc., were included here. No observations of activity over the annual cycle were made, because material for more than a single month was unavailable for most localities. Also, in the few cases where numerous samples over a long period were available (e.g. Rössing survey), results indicated that most Thysanura were present throughout the year, though less common in winter.

In the section termed "DISCUSSION", features distinguishing the species from closely related or similar species, the derivations of the names of new species, and any other matters requiring attention, are treated. All figures are appended to the end of the work.

III. MORPHOLOGY

In this section, morphological characters used for Ctenolepisma species are treated, in the order in which they occur in descriptions. Treatment is subdivided into two subsections per character. In the first subsection, (a), the reader is orientated as to the position of the structures on the lepismatid body, the terminology used for the character and its different character states are established, and the latter are illustrated if necessary. This is intended to simplify descriptions. In subsection (b) the intra- and, where necessary, intergeneric phylogenetic significance of the different character states are discussed, with the view to examining the internal phylogeny of the genus in Part V. Many of the inferences on which phylogenetic assumptions are based are derived from unpublished work on the generic phylogeny of the Lepismatidae, which is not repeated here because it is meant to be included in a subsequent thesis.

1. Body length

a) Body length in lepismatids is the straight distance between the frons and the posterior margin of urotergite X, i.e. excluding appendages. This is quoted at the beginning of each description in order to give the reader an idea of the size of the species in question, and is treated in more detail in the table of proportions.

b) Certain lineages of Ctenolepisma include predominantly larger species, while others are made up of smaller species. The phylogenetic significance of body size is unkown. Presumably both large and small body size can and do exist as both apomorphic and plesiomorphic character states in different lineages. Once the evolutionary trend for this character within a lineage has been established, though, body size may be a useful accessory character for the placing of difficult species.

2. Body shape

a) Ctenolepisma species usually have slender (elongate, dorso-ventrally flattened) bodies (fig. 106), but some are squat (thickset, spindle-shaped) (fig. 196).

b) The slender body shape is plesiomorphic, and the one typical for Ctenolepisma species. The squat body shape is only found in a few psammophilous species. Since psammophyly is an apomorphic trait in the family, and a spindle-shaped body probably simplifies sanddiving, the squat body shape is considered apomorphic.

3. Ground colour and hypodermal pigment

a) The ground colour of the body is the colour when unpigmented and denuded of scales, usually yellowish white. Hypodermal pigment, which is usually violaceous and less commonly brownish, may occur on many parts of the body, usually on all appendages and the posteroventral abdomen. The extent of hypodermal pigmentation may show considerable individual variation, but the simple presence or absence thereof is a strong character. Because ground colour is often obscured by hypodermal pigment, the two characters are complimentary; neither one can be fully present unless the other is completely absent.

b) Absence of hypodermal pigment is probably an apomorphic trait, as it is often found in species possessing other apomorphic characters. Also, genera such as Thermobia and Stylifera, which are probably close to the ancestor from which Ctenolepisma may have evolved, are heavily pigmented. The character should be used only in an accessory capacity, e.g. to determine the positions of species within a lineage defined by other characters.

4. Scale colour

a) The dorsal scales of Ctenolepisma species are usually uniform in colour, usually a shade of brown or grey, though black occurs occasionally. The ventral scales are always transparent. Occasional species have dorsal patterns, usually of dark and light scales (fig. 94). Damage during capture often denudes specimens of scales, robbing this character of much potential worth. Scale colour may also change after prolonged immersion in alcohol.

b) Colour patterns, or any deviation from uniform colouring, should be considered apomorphic. The same colour patterns may occur in unrelated species, e.g. the South African Hemilepisma nudata (Wygodzinsky) and the Japanese Lepisma albomaculata Uchida, therefore the character should be used with care.

5. Scale morphology

a) The typical lepismatid scale is ovoid, with numerous parallel striae which do not surpass the posterior margin of the scale (fig. 2). A few species also possess numbers of relatively larger scales with very few striae, in addition to the normal scales, e.g. *C. diversisquamis* Silvestri (fig. 3). As with colour, scale loss robs the character of its worth, especially as the larger modified scales are more easily lost than the normal scales. The striae, in sunlight, give rise to metallic interference colours, from which *i.a.* the name "silverfish" is derived.

b) Any deviation from the typical lepismatid scale should be considered apomorphic. Use of this character is at present complicated by the confusion surrounding *C. diversisquamis* and at least five other species, all of which may be conspecific (Irish, in press). None of these species occur near the study area. Since aberrant scale forms are found in several species in different genera of Lepismatidae, the character should be used with care.

6. Macrosetal colour

a) Most species have golden yellow macrosetae, but some, e.g. *C. picturata*, have them heavily pigmented and nearly black.

b) The significance of setal colour is unknown. Possibly pigmented macrosetae are plesiomorphic, because they are often associated with general heavy pigmentation, but this is uncertain and the character was not used in the phylogenetic analysis.

7. Macrosetal morphology

a) All *Ctenolepisma* species have plumose (feathered, barbed) macrosetae (fig. 4), as opposed to the smooth macrosetae (fig. 5) found in some other genera.

b) This character is significant on the generic level, and is not used in intrageneric phylogeny. Plumosity is apomorphic and smoothness plesiomorphic.

8. Setation of head

a) The setation on the heads of Ctenolepisma species consists of a number of setal tufts, that is, groups of setae the bases of which are proximate to each other, while the apices diverge. In all examined species there are 1+1 small dorsolateral pre-ocular tufts, 1+1 large dorsomedial frontal tufts, 1+1 large ventromedial frontal tufts, and 1+1 small medial tufts on the labrum. The bases of the mandibles are also heavily and evenly setated.

b) The character is constant for all examined species, but data for the rest of the genus is lacking. The setation of the head shows some intergeneric variation in the family.

9. Maxillary palp

a) The maxillary palp consists of five segments. The relative lengths of the segments are not absolutely constant, and cannot be used as a character, although this has been done in the past. Apical sensillae are found in some other genera and a few extralimital Ctenolepisma species, but none were noted in the examined species. An indication of relative maxillary palpal length has been given in the descriptions.

b) Because maxillary palpal sensillae have been ignored in descriptions until very recently, the distribution of their occurrence in the family is not yet known and the character cannot yet be used for phylogenetic analysis. Short maxillary palps (fig. 6) are associated with psammophily and must be considered more apomorphic than longer palps (fig. 7). Because of its relativity, the character should be used with care.

10. Size and shape of distal segment of labial palp

a) The labial palp consists of four segments. The distal segment may be dilated (fig. 8) or not (fig. 9). If dilated, it may be unilaterally (fig. 8) or bilaterally so (fig. 10). The degree of dilation is usually expressed as e.g. "1,5 times wider than long". Nymphs have the distal segment of the labial palp practically undilated, and acquire the degree of dilation typical for a given species step by step towards maturity. Adult males usually have the labial palp with a wider distal segment than do adult females of the same species. All proportions given in the text refer to adult individuals.

b) Within the lepismatid lineage which includes *Ctenolepisma*, other genera (e.g. *Thermobia*) which have generally retained the more plesiomorphic state for a given character when compared to *Ctenolepisma*, have undilated distal segments of the labial palp. The widest dilation is found in *Ctenolepisma* species which also possess other apomorphic traits, therefore dilation *per se* should be considered apomorphic. Most lepismatids have unilaterally dilated distal segments of the labial palp, and those that are bilaterally dilated should be considered apomorphic, because this, too, is usually associated with other apomorphic characters. The character is useful if used with care and bearing in mind its potential for variation with age and sex.

11. Labial palp sensillae

a) Most Ctenolepisma species have five sensory papillae arranged in a single row, situated apically on the distal segment of the labial palp (fig. 8). Odd species have four, three or two papillae, or more than five, but always arranged in a single straight row. The number of papillae is usually intraspecifically stable, although rarely individual exceptions occur.

b) The number and positioning of papillae is usually intragenerically stable, and deviations from the normal configuration for the genus are the exception. Ctenolepisma has rather more such exceptions than most other genera. The plesiomorphic intrageneric papillar configuration for Ctenolepisma is five papillae in one row. On the intergeneric level, the latter is the apomorphic state for which the plesiomorphic state is five papillae arranged in two rows of two and three each. It follows that all deviations of papillar number in Ctenolepisma, if they occur as a single row of papillae only, should be relatively more apomorph. There is certainty about the apomorphy of papillar numbers less than five, but papillar numbers many more than five (e.g. 9 to 12 in C. longicaudata sensu Slabaugh) may be plesiomorph. The latter configuration is also found in genera such as Stylifera, which may share a common ancestor with Ctenolepisma. There will be more certainty about the significance of large papillar numbers once the generic phylogeny of the family is clearer.

12. Eyes

a) All Lepismatidae have compound eyes, but lack ocelli. In all Ctenolepisma species examined during the present study the compound eyes were found to be composed of 11-14 ommatidia each. Data for the rest of the family are not available. The number of ommatidia per eye shows little intraspecific variation.

b) The phylogenetic significance of the number of ommatidia is unknown, as the character has never been used before. There exist in the literature on Lepismatidae a few illustrations of species with more (up to 30) ommatidia per eye, but it is not known how accurate these observations are. The inclusion of the character in the descriptions following is a first step towards testing its possible significance.

13. Antennae

a) Antennae are setated in whorls of fine setae, usually light-coloured, but occasionally pigmented. The distal segments usually carry a number of sensillae, in Ctenolepisma usually of the "campaniform" type. Within broad limits the relative lengths of the antennae are intraspecifically stable. Damage during capture, causing antennal loss, often makes one or more of the above characters unusable. One species possesses fleshy, swollen antennae in the male, probably as a secondary sexual character.

b) The significance of antennal setal colour is unknown, but may become known once more data for other genera are available. Antennal sensillae are too small to be seen in detail under a light microscope, and recourse has to be made to electron microscopy in their case. Study of the antennal sensillae has application in generic phylogeny only, as they are usually genus or genus-group specific, and the matter was not pursued further here. Shortened antennae (fig. 196) are usually associated with psammophilous species, though _C. pauliani_, which has excessively long antennae (fig. 174) is an exception to this rule. Relative antennal length can have phylogenetic application in psammophilous lineages which are well-defined on the basis of other characters, and one would expect to find e.g. a series of progressively shorter antennae in species occupying progressively more sandy habitats. Any aberration in basic antennal morphology (as e.g. fleshiness which was mentioned above), would be a strong apomorphic character.

14. Setation of nape

a) The anterior margin of the pronotum (here designated as the "nape"), carries a relatively wide setal fringe in all _Ctenolepisma_ species examined during the present study (fig. 11).

b) The significance of the character is unknown because it is seldom mentioned in descriptions, but it is included here because some other genera lack setation on the nape, and the character therefore has potential future application on the generic level.

15. Thoracic notal setation

a) All _Ctenolepisma_ species have a lateral marginal setal fringe on each thoracic notum, and this is not mentioned in the following descriptions. The further thoracic notal setation is of two kinds. Laterally there are a number of transverse submarginal bristlecombs, and laterally on the posterior margin there are usually 1+1 bristlecombs (fig. 12). The number of lateral bristlecombs as well as the number of macrosetae per bristlecomb, are intraspecifically stable within broad limits. The posterolateral bristlecombs are occasionally lacking, and in other cases are situated in an unusually lateral position.

b) Apomorphic species usually have more and better defined lateral thoracic notal bristlecombs than plesiomorphic species. The significance of the number of macrosetae per bristlecomb is unknown, but it is assumed that within a specific lineage it would either be relatively uniform, or show a specific trend in one or other direction, but not vary at random. The presence of posterolateral bristlecombs is an ancestral character for <u>Ctenolepisma</u>, and their absence or shift in position must be considered apomorphic within that specific lineage.

16. Setation of urotergite I

a) Urotergite I carries 1+1 bristlecombs in most <u>Ctenolepisma</u> species, but 2+2 in a few. ("1+1", "2+2" etc. are standard notations for especially abdominal setation in Lepismatidae. The notations for different setations are illustrated in figs 13-17).

b) The plesiomorphic state is probably 1+1 bristlecombs on urotergite I, with 2+2 being apomorphic, because the latter is usually found in species also possessing many other apomorphic characters.

17. Setation of urotergites II to VIII

a) All Ctenolepisma species have 3+3 bristlecombs on at least urotergites II-V. Urotergites VI-VIII carry either 3+3 or 2+2 bristlecombs each, the 3+3 configuration, if present, being on the anterior of these urotergites and the 2+2 configuration, if present, following on the posterior urotergites. In the case of the 3+3 configuration, the bristlecombs are named from the outer to the inner pair, as the lateral, sublateral and submedian bristlecombs respectively (fig. 18). The number of macrosetae is usually largest in the lateral and smallest in the submedian bristlecombs. The arrangement of bristlecombs on all urotergites is intraspecifically stable, and aberrations are rare and usually easily recognisable as such by their asymmetry.

In order to simplify description and comparison of different urotergal setations, a convention for writing them in abbreviated form is introduced here. The number of bristlecombs on each urotergite, in succession from urotergite I to X, is written in standard notation, separated by dashes.

b) Though Escherich (1905) used the setation of these urotergites to divide Ctenolepisma into three species-groups (implying a fourth group which was only discovered later), the case of C. terebrans, C. pluriseta and a related species cited in Part IV shows this to be an unnatural grouping. No clear significance above the specific level is presently known for the character. The significance of the number of macrosetae per bristlecomb is as was noted under subsection 15 above for the thoracic notal bristlecombs.

18. Urotergite X: shape and setation.

a) In most Ctenolepisma species, urotergite X is trapezoidal in shape, with the posterolateral angles rounded, and the posterior margin straight (fig. 19), rounded (fig. 20) or emarginate (fig. 21). A few species, none of which occur in southern Africa, have urotergite X subtriangular in shape (fig. 22). The length of the tenth urotergite is expressed as a width to length ratio, as defined by Mendes (1982), with e.g. a width to length ratio of 0,6 signifying a relatively longer urotergite X than one with e.g. a ratio of 0,4. This ratio is intraspecifically stable within broad limits. Urotergite X carries 1+1 posterolateral bristlecombs of a varying number of macrosetae each, as well as a lateral marginal setal fringe, in all Ctenolepisma species.

b) The subtriangular tenth urotergite of some Ctenolepisma species is considered plesiomorphic because it is usually associated with other plesiomorphic characters, notably the posession of three pairs of styli. Subtriangular tenth urotergites are pointers to the possible common ancestry of Ctenolepisma and Thermobia, for which such a shape is typical. The typical trapezoidal urotergite X of Ctenolepisma is then apomorphic. The significance of the length of urotergite X is not yet clear. Extremely shortened tenth urotergites are associated with psammophily, and thus apomorphic, on the one hand, but on the other hand some generally more plesiomorphic groups also have short tenth urotergites. Significance of number of macrosetae per bristlecomb is as before.

19. Thoracic sterna: shape and setation

a) The thoracic sterna of Ctenolepisma species are always subtriangular and apically rounded (fig. 23). The width of individual sternites may vary, the narrower sternites being found anteriorly and the wider sternites posteriorly. Thoracic sternal shape is best described by illustration. All thoracic sterna carry a sparse marginal fringe of very slender setae, which has been omitted in all descriptions and illustrations following. The sterna also carry a number of bristlecombs each, often more on the anterior sterna than on the posterior ones. Number of thoracic sternal bristlecombs, as well as sternal shape, are intraspecifically stable within broad limits.

b) Plesiomorphic species such as C. submagna Silvestri have the thoracic sterna all with similar shape and setation (Irish, in press). Psammophilous species often have especially the prosternum very narrow, and this must be considered apomorphic. Progressively larger differences between the number of bristlecombs on anterior and posterior sternites should also be considered progressively more apomorphic. Significance of number of macrosetae per bristlecomb is as before.

20. Legs

a) Though some Ctenolepisma species have all three pairs of legs similar, many have the third legs longer than the first. The relative lengths of the first and third legs are expressed by comparing the lengths of the respective tibiae, assigning a length of "one" to tibia I. The setation of the legs is intraspecifically fairly stable. The setation of the tibia is usually the most distinctive and is best described by illustration.

b) The most extreme proportionate lengthening of the hind legs is found in psammophilous species, therefore lengthened hind legs are apomorphic. The latter are probably an aid to efficient sand-diving, and as such may have evolved more than once in different lineages. Therefore the character can carry relative weight only within lineages which are well-defined on the basis of other characters.
The significance of different leg setations in relation to each other is not yet clear. Where different species have similar distinctive leg setations, they must be considered to be related. Sparsely setated legs are probably plesiomorphic, and the robust leg setations associated with psammophily are probably apomorphic. Due to the difficulty of describing and comparing different leg setations, the character is not often used.

21. Tarsi

a) All Ctenolepisma species have two tarsal claws, and the majority also have an empodium medially between the two claws, though at least one species lacks an empodium.

b) The presence of an empodium is an ancestral state in the Lepismatidae, and the loss thereof must be considered apomorphic. Because "loss" characters are usally weak synapomorphs, different species sharing this character need not be closely related.

22. Setation of urosternites I to VIII

a) Any urosternite may have one of three different types of setation: either a single median bristlecomb only, or two lateral bristlecombs only, or both a median and two lateral bristlecombs. These are respectively designated as a setation of 1, 1+1 or 1+1+1 (figs 17, 13, 16). Some species completely lack median bristlecombs. Those with median bristlecombs usually lack at least some anterior lateral bristlecombs and some posterior median bristlecombs. There are a finite number of urosternal setations known, and the principles governing urosternal setational patterns that emerge from these allow for the possible existence of very few others. Urosternite VIII is entire in the male, but divided into two coxites VIII in the female. Urosternal setation is given in abbreviated form in descriptions, similar to the convention described for urotergal setation under subsection 17 above.

b) It was found that species with similar urosternal setation also share many other characters, and urosternal setation was made the basis for a new subgeneric system for the genus, to be treated in Part V. Presence of median bristlecombs is an apomorphic trait, and a higher total number of urosternal bristlecombs usually accompanies a higher general level of apomorphy in Ctenolepisma species.

23. Styli

a) Ctenolepisma species carry from one to three pairs of styli on the posterior coxites/urosternites. Nymphs have no styli or less than adults, and acquire their full complement of styli step by step towards maturity. In some species males take longer (i.e. attain a larger body size) than females before acquiring all their styli, and in some species males always have less styli than females. Number of styli in the adult state is fairly constant intraspecifically.

b) Loss of styli is an apomorphic trait in the Lepismatidae.

24. Coxites IX

a) Each coxite is divided into an inner and an outer process, seperated by the stylus. The outer processes are usually short, simple and rounded, with ill-defined setation, and are not at present used in the systematics of the genus. As far as the inner processes are concerned, both their shape and their setation is important. The shape is mostly subtriangular, but the length may vary considerably between species. Males often have wider coxites IX than females of the same species. The inner processes always carry a marginal setal fringe, but only rarely any bristlecombs. Presence or absence of bristlecombs on coxites IX is denoted by a "+" or "-", following on the abbreviated formula for urosternal setation.

b) Extreme elongation of the inner processes of coxites IX is associated with lack of median urosternal bristlecombs, while short inner processes are associated with more apomorphic characters. The former is thus plesiomorphic and the latter apomorphic. The presence of bristlecombs on coxites IX should be considered apomorphic, though they may have evolved independently in different lineages.

25. Ovipositor

a) The length of the ovipositor may vary, and is expressed as the extent to which it surpasses (if at all) the apices of coxites IX or styli IX. Immature females have shorter ovipositors than mature females of the same species, and in very small females the ovipositor is practically non-existent. The shaft of the ovipositor is unsetated, or may carry short laterally-directed setae or, rarely, anteriorly-directed setae. The ovipositor consists of four valvulae, found in two pairs termed the anterior and posterior gonapophyses respectively. The apices of the gonapophyses are usually simple and rounded, but may be sclerotised to varying degrees in some species. The precise distribution of setae and sensillae on the apices of the gonapophyses has in the past been considered to be of paramount taxonomic importance, but the work of Kaplin & Martynova (1976) has shown up the high level of intraspecific variability of this character, and it has not been used in this study.

b) Short ovipositors are usually associated with psammophily and must be considered apomorphic. The same is true of anteriorly-directed setae on the shaft of the ovipositor. Sclerotised posterior gonapophyses are only found in a few generally apomorphic species, and this, too, must be considered apomorphic. Gonapophysal sclerotisation, as an aid to ovipositioning, may have evolved independantly a number of times, therefore sclerotisation *per se* does not imply synapomorphy. The exception to this rule occurs in those cases where different species share both the same type of sclerotisation as well as other corellated synapomorphic characters.

26. Penis

a) The penes of all *Ctenolepisma* spp. are simple and similar. Parameres (male genital appendages) found in some other genera, are absent in *Ctenolepisma*.

b) The constancy of the character excludes its use in phylogenetic analysis.

27. Caudal filaments

a) The setation of the caudal filaments is fairly constant in all species of the genus, and consists of whorls of long macrosetae at segmental nodes, with regularly spaced whorls of shorter setae on the internodes. The lateral cercal bases have in addition a dense clothing of scattered macrosetae. All setal whorls on the terminal filament have longer and more robust setae ventrally than dorsally, creating a brush-like effect on the ventral terminal filament. The preceding is valid for all examined species, but may not be true for all species in the genus, as information for all other species is lacking at present. The proportionate lengths of the caudal filaments are intraspecifically stable within broad limits, and the terminal filament is always longer than the cerci, except in a single species.

b) The setation is constant within the genus and carries no phylogenetic weight in this case. Shortened caudal filaments, as also antennae, are associated with psammophily and therefore apomorphic. Any deviation from the normal relation between the lengths of the caudal filaments (constant for the rest of the family) must be considered apomorphic.

IV. SYSTEMATICS

Genus CTENOLEPISMA Escherich

Ctenolepisma Escherich, 1905: 75.

Type-species: Lepisma lineata F. (type by subsequent designation on the grounds of priority: Paclt, 1967).

DESCRIPTION

Body length of adults 6-18 mm. Body shape usually slender. Hypodermal pigment present or absent. Macrosetae plumose. Distal segment of labial palp usually with five sensory papillae arranged in a single row, occasionally more or less. Thoracic nota with lateral bristlecombs and usually also with 1+1 posterolateral bristlecombs each. Urotergite I with 1+1 or 2+2 bristlecombs. Urotergites II-V with 3+3 bristlecombs. Urotergites VI-VIII with 2+2 or 3+3 bristlecombs. Urotergite IX unsetated. Urotergite X trapezoidal or subtriangular, with 1+1 bristlecombs. Empodia usually present. Urosternites each with 1, 1+1 or 1+1+1 bristlecombs. One to three pairs of styli. Male parameres absent.

The phylogenetic basis which provided the motivation for the system of subgenera and species-groups introduced below will be discussed in Part V.

Subgenus Ctenolepisma (Ctenolepisma) Escherich

Ctenolepisma Escherich, ut supra.

Characterised by the absence of median bristlecombs on all urosternites. According to Article 43(a) of "The Code" (ICZN, 1985), the above subgeneric name became available with original author and date when Wygodzinsky (1955) described the subgenus Sceletolepisma, even though it is here used for the first time.

Type-species: as for nominal genus above.

Subgenus Ctenolepisma (Sceletolepisma) Wygodzinsky sensu nov.

Ctenolepisma (Sceletolepisma) Wygodzinsky, 1955: 154.

Characterised by the presence of median bristlecombs on at least one, but commonly most, urosternites. When created, the subgenus was monotypical. I reject the basis on which Wygodzinsky founded the subgenus, but the name is the next oldest (and only) available genus-group name, and has to be used for the new subgenus proposed here (in terms of Article 23(e) of "The Code" (ICZN, 1985)), even though C. (Sceletolepisma) Wygodzinsky bears little resemblance to the present taxon with the same name.

Type-species: Ctenolepisma (Sceletolepisma) arenicola Wygodzinsky (type by original designation).

KEY TO THE SUBGENERA, SPECIES-GROUPS AND SOUTHERN AFRICAN SPECIES OF CTENOLEPISMA ESCHERICH

All southern African species are keyed out individually, but extralimital species are keyed out to groups of species only. A list of both included and excluded species to be provided in Part V, section 4.

1. Median urosternal bristlecombs completely absent...... ....Subgenus Ctenolepisma Escherich...2
- Median bristlecombs present on at least one, but commonly on 4-6 urosternites..........................

................Subgenus _Sceletolepisma_ Wygodzinsky...3

2. Urotergite X subtriangular (fig. 22)..................
.................................._lineata_ species-group

\- Urotergite X trapezoidal (fig. 19)...................
...........not yet differentiated into species-groups, only _C_. _longicaudata_ Escherich found in southern Africa

3. Median bristlecombs present on from one to four urosternites...................._howa_ species-group...4

\- Median bristlecombs present on at least five, commonly six, and sometimes more urosternites.................5

4. Median bristlecombs present on from one to three urosternites only.........................Extralimital

\- Median bristlecombs present on four urosternites (III-VI).........................._C_. _pretoriana_ Wygodzinsky

5. Urosternite VII with 1+1+1 bristlecombs.............10

\- Urosternite VII with 1+1 bristlecombs only...........6

6. Urosternite I unsetated......_villosa_ species-group...7

\- Urosternite I with a median bristlecomb...............
..............._michaelseni_ species-group (Extralimital)

7. Urotergites II-V with 3+3 bristlecombs....Extralimital

\- Urotergites II-VI with 3+3 bristlecombs...Extralimital

\- Urotergites II-VII with 3+3 bristlecombs............8

8. Adults with two pairs of styli; distal segment of labial palp with 3 sensillae only.....................
............................_C_. _africanella_ Wygodzinsky

\- Adults with one pair of styli only; distal segment of labial palp (usually) with 5 sensillae...............9

9. Metasternum with 1+1 bristlecombs only...............
....................._C_. _weberi_ Escherich _s_. Wygodzinsky

\- Metasternum with 2+2 bristlecombs.........Extralimital

10. Urosternite I lacking bristlecombs.................16

- Urosternite I with one median bristlecomb..........11

11. Urosternite II with one median bristlecomb..........
............................*corvina* species-group..14

- Urosternite II with 1+1+1 bristlecombs...............
..............................*activa* species-group..12

12. Urotergites II-V with 3+3 bristlecombs...............
..............................*C. pauliani* Wygodzinsky

- Urotergites II-VI with 3+3 bristlecombs............13

- Urotergites II-VII with 3+3 bristlecombs.............
.....................................Extralimital

- Urotergites II-VIII with 3+3 bristlecombs...........
.............................*C. arenicola* Wygodzinsky

13. Inner processes of coxites IX short (fig. 161);
adults of both sexes with one pair of styli only;
thoracic sternal bristlecombs of 3-8 macrosetae each
(figs 162-164); northern South West Africa...........
...................................*C. activa* Silvestri

- Inner processes of coxites IX longer (figs 167, 173);
adults with one or two pairs of styli; thoracic sternal
bristlecombs of 3-16 macrosetae each (figs 169-171);
western Cape Province.............*C. capensis* sp. nov.

14. Urotergites II-V with 3+3 bristlecombs...............
.................................*C. corvina* Silvestri

- Urotergites II-VI with 3+3 bristlecombs............15

15. Urotergite I with 1+1 bristlecombs...................
...............................*C. desperata* sp. nov.

- Urotergite I with 2+2 bristlecombs...................
.............................*C. namaquensis* sp. nov.

16. Urosternite III with 1+1+1 bristlecombs.............
.......................*grandipalpis* species-group..17

- Urosternite III with one median bristlecomb only.....

........spinipes species-group: C. spinipes sp. nov.

17. Urotergites II-V with 3+3 bristlecombs.............18

- Urotergites II-VI with 3+3 bristlecombs............25

- Urotergites II-VII with 3+3 bristlecombs...........37

- Urotergites II-VIII with 3+3 bristlecombs..........24

18. Urotergite I with 1+1 bristlecombs only; coxites IX with marginal setal fringe only.....................19

- Urotergite I with 2+2 bristlecombs; coxites IX each with 2+2 transverse bristlecombs, in addition to fringe (figs 100, 102)..........C. namibensis sp. nov.

19. Urotergite X posteriorly straight, rounded or only slightly emarginate; one or two pairs of styli......20

- Urotergite X very short and posteriorly deeply emarginate (fig. 116); adults with one pair of styli only........................C. ossilitoralis sp. nov.

20. Median urosternal bristlecombs of relatively few (2-11) macrosetae each; female posterior gonapophyses apically sclerotised or unsclerotised 21

- Median urosternal bristlecombs of more (14-28) macrosetae each; female posterior gonapophyses apically sclerotised......................Extralimital

21. Adults with two pairs of styli; female posterior gonapophyses apically sclerotised or unsclerotised..22

- Adults with one pair of styli only; female posterior gonapophyses unsclerotised....C. subterebrans sp. nov.

22. Tibia III robustly setated, with many (7+) ventral spines exceeding the diameter of the tibia in length (fig. 35); female posterior gonapophyses sclerotised (fig. 32).......................C. terebrans Silvestri

- Tibia III moderately to weakly setated, with at most 4-6 ventral spines, if any, attaining but not surpassing the diameter of the tibia in length; female posterior gonapohyses unsclerotised.................23

23. Median urosternal bristlecombs of 6-11 macrosetae each; 7-8 + 7-8 lateral thoracic notal bristlecombs... ....*C. penrithae* sp. nov.

- Median urosternal bristlecombs of 3-5 macrosetae each; 8-13 + 8-13 lateral thoracic notal bristlecombs. ....Extralimital

24. Female posterior gonapophyses sclerotised (fig. 158); Namaqualand and southwestern South West Africa........ ....*C. parcespinata* Silvestri

- Female posterior gonapophyses unsclerotised; northern and central South West Africa........................ ....*C. plusiochaeta* Silvestri

25. Urotergite I with 1+1 bristlecombs.................28

- Urotergite I with 2+2 bristlecombs.................26

26. Females...27

- Males...................*C. intercursa/prompta* indet.

27. Female posterior gonapophyses sclerotised........... ....*C. intercursa* Silvestri

- Female posterior gonapophyses unsclerotised.......... ....*C. prompta* Silvestri

28. Coxites IX with transverse bristlecombs, besides a marginal setal fringe (fig. 37)....*C. placida* sp. nov.

- Coxites IX with a marginal setal fringe but lacking bristlecombs.......................................29

29. Urotergite X short, as in fig. 68..................30

- Urotergite X of normal length, as in figs 34, 83, 136, 145, 146.......................................32

30. Prosternum with 5-6 + 5-6 bristlecombs (fig. 86)..... ....*C. ugabensis* sp. nov.

\- Prosternum with 2-3 + 2-3 bristlecombs.............31

31. Female posterior gonapophyes sclerotised (fig. 76)... ....*C. detritus* sp. nov.

\- Female posterior gonapophyses unsclerotised......... ....Extralimital

32. Posterolateral thoracic notal bristlecombs of 2-4 macrosetae each; northern and eastern South West Africa...33

\- Posterolateral thoracic notal bristlecombs of 5-7 macrosetae each; southwestern South West Africa....... ....*C. saxeta* sp. nov.

33. Prosternum with 2-3 + 2-3 bristlecombs.............34

\- Prosternum with 4-6 + 4-6 bristlecombs.............36

34. Female posterior gonapophyses sclerotised (fig. 32); tibia III with spines as long as or longer than the tibial diameter in length (fig. 35).................. ....*C. latera* sp. nov.

\- Female posterior gonapophyses unsclerotised; tibia III with spines shorter than tibial diameter in length...35

35. Prosternal bristlecombs apical, proximal to each other, as in fig. 139............*C. inornata* sp. nov.

\- Prosternal bristlecombs situated further apart, as in fig. 149.....................*C. kaokoensis* sp. nov.

36. Female posterior gonapophyses sclerotised (fig. 85); adults with two pairs of styli; urotergite X longer (fig. 83); tibia I with spines about equal to tibial diameter in length (fig. 82)...*C. occidentalis* sp. nov.

\- Female posterior gonapophyses unsclerotised; adults with one pair of styli only; urotergite X shorter (fig. 89); tibia I with spines about 1,5 to 2 times tibial diameter in length (fig. 91)................... ....*C. ugabensis* sp. nov.

37. Coxites IX with marginal setal fringes but lacking bristlecombs.......................................38

\- Coxites IX with 2-5 transverse bristlecombs each, besides a marginal setal fringe (fig. 51)............. ....*C. luederitzi* sp. nov.

38. Tibia III robustly setated, with many ventral spines surpassing the diameter of the tibia in length........ ....*C. pluriseta* Silvestri

\- Tibia III less robustly setated, with few, if any, ventral spines attaining but not surpassing the tibial diameter in length.................................39

39. Scale cover unicolourous, shades of brown; adults with two pairs of styli; macrosetae light to dark brown.......................*C. grandipalpis* Escherich

\- Scale cover bicolourous, black and white (in fresh material at least); adults with one pair of styli only; macrosetae black........*C. picturata* Wygodzinsky

SUBGENUS *Ctenolepisma* (*Ctenolepisma*) Escherich

Only one species of this subgenus is found in southern Africa.

Ctenolepisma (*C.*) *longicaudata* Escherich

Ctenolepisma longicaudata Escherich, 1905: 83; Silvestri, 1908: 291, 1922: 85; Wygodzinsky, 1955: 140; Theron, 1963: 125; Paclt, 1966: 152; Heeg, 1967*a*: 21, 1967*b*: 43, 1969: 135; Mendes, 1982: 645.

Ctenolepisma lingicaudata Escherich: Paclt, 1979: 223. (_laps_. _cal_.)

Ctenolepisma urbana Slabaugh, 1940: 95; Theron, 1963: 126; Paclt, 1966: 153.

Besides original descriptions and papers making important taxonomic statements on the species, the above list includes references pertinent to southern Africa only, though it includes non-taxonomic southern African references. For a more complete list of synonymy and literature on the species, refer to Paclt (1967).

DESCRIPTIVE NOTES

Although a modern redescription of _C_. _longicaudata_ is needed, this is not given here because of the problems mentioned under "DISCUSSION" below. Also, a redescription should preferably be done in conjunction with a revision of the predominantly Palaearctic subgenus to which _C_. _longicaudata_ belongs. This falls outside the scope of the present study.

In southern Africa, _C_. _longicaudata_ is the only recorded species which lacks median urosternal bristlecombs, and identifying it should pose no problems.

Urosternal setation: 0 / 0 / 1+1 / 1+1 / 1+1 / 1+1 / 1+1 / 1+1 / - bristlecombs.

Urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 0 / 1+1 bristlecombs.

Adults of both sexes with two pairs of styli.

Proportions

		ave.	s.d.	max.	n
Body length,	female	10.31	2.01	13.00	18
" " ,	male	9.69	1.76	12.00	21
" " ,	both	9.71	2.25	13.00	39
Antennae,	female	0.87	0.20	1.09	7
" ,	male	1.08	0.11	1.25	11
" ,	both	1.00	0.18	1.25	18
Cerci,	female	0.83	0.10	0.91	4
" ,	male	0.79	0.13	1.04	5
" ,	both	0.81	0.12	1.04	9
Filum	female	1.09	0.00	1.09	1
terminale,	male	0.99	0.10	1.13	5
" ,	both	1.01	0.10	1.13	6

MATERIAL EXAMINED

Lectotype, female, body length 12,5 mm, labelled: Bothaville, Orange-Freistaat, Dr. H. Brauns leg., vend. 9.X.1899, L. longicauda n. sp. Escherich, H 105, Ctenolepisma longicaudatum Escherich 1905, LECTOTYPUS ! - festgelegt van J. PACLT 1966 (dazu 1 Präparat). In alcohol. (ZSZM; the microscope preparation referred to on the label is of the labial palp (Paclt, 1966), and was not examined).

Paralectotypes: 12 specimens; 1 female, 11 unsexed. All in alcohol. All ZSZM.

1 female, labelled: Bothaville, Orange-Freistaat, Dr. H. Brauns leg., vend. 9.X.1899, Ctenolepisma longicaudatum (Paratypoid).

11; unsexed: badly damaged, labelled: Bothaville, Orange-Freistaat, Dr. H. Brauns leg., vend. 9.X.1899, Bothaville, lästig in hausern, *Ctenolepisma* Esch. *longicaudata* Esch., K. Escherich determ. 1903/04, Paratypoide (dazu ein Präparat !). (ZSZM; microscope preparation as above, not examined)

Additional material: 142 specimens; 60 females, 45 males, 37 unsexed. 63 (TM); 34 (SM); 26 (UP); 12 (NCI); 5 (ZSZM); 2 (FORC).

LOCALITIES (Southern Africa only)

Literature. Escherich (1905): Bothaville (type locality). (ZSZM, examined)

Silvestri (1908): Kamaggas; Kang-Khakhea; Kubub; Rooibank; Severelela; Steinkopf. (ZMHU, not examined)

Silvestri (1922): Brackwater (ZSZM, not examined); Neitsas; Swakopmund. (ZSZM, examined)

Wygodzinsky (1955): Amanzi Estate, Uitenhage; Mosselbaai; Mount Fletcher; Natal National Park; Pietermaritzburg. (LUND, not examined)

Theron (1963): Bonnievale; Cape Town; Gobabis; Indwe; King William's Town; Malmesbury; Mariental; Redelinghuys; Stellenbosch; Ventersdorp; Volksrust; Wolseley. (not examined)

Paclt (1966): Beira; Orungauu bei Okahandja. (ZSZM, not examined)

Heeg (1967*a*, *b*, 1969): Grahamstown. (not examined)

Paclt (1979): Keetmanshoop. (ZSZM, not examined)

Mendes (1982): Pretoria. (CRAC, not examined)

Present material: Charlottenfelder; Christiana; Colbyn; Grahamstown; Grillenthal; Hardap Rest Camp; Hazyview; Makapansgat; Mile 72; Möwebaai; Okahandja; Parktown North;

Pretoria; Royal Natal National Park; Swaneng Hill School; Swinburne; Winburg; Windhoek.

DISTRIBUTION

Cosmopolitan. Found almost anywhere where there is or has been human habitation (fig. 24).

HABITAT

Domestic. Usually in or around buildings. May survive long after humans have left, as witnessed by their occurrence in derelict miner's huts at Charlottenfelder in the Namib desert, which have been deserted since about the 1940's. Prefers living among papers, e.g. old files or stacks of newspapers, and especially common in kitchens, pantries and bathrooms. May do extensive damage by eating books or dry foodstuffs. Of localised economic importance, but easily controlled by standard methods, e.g. spraying of skirtings with contact insecticide and/or fumigation.

DISCUSSION

Slabaugh (1940) noted three points of difference between her new species, C. urbana, and C. longicaudata. The first species was stated to have five sensory papillae on the distal segment of the labial palp, more and also more randomly spaced macrosetae on the frons, and a consistently posteriorly slightly indented urotergite X. The second species reputedly had 9-12 sensory papillae, frontal setae arranged in incipient rows, and a more variable posterior margin to urotergite X. In view of the generic significance of the number and arrangement of the sensory papillae on the distal segment of the labial palp, this character carries great weight, but the other two characters mentioned are indefinite and cannot by themselves be used to distinguish the two taxa.

Theron (1963) reported the presence (in southern Africa) of specimens both with five sensory papillae on the distal segment of the labial palp (which he referred to *C. urbana*) and specimens with 9 to 10 such papillae (referred to *C. longicaudata*). He found his "*C. urbana*" to be much more common and widespread than his "*C. longicaudata*". Theron's figures 4 and 6 clearly illustrate the two different arrangements of sensillae.

Paclt (1966) examined the type material of *C. longicaudata* and found all specimens to have five sensory papillae on the distal segment of the labial palp. He synonymised *C. urbana* with *C. longicaudata*, and speculated that both Slabaugh (1940) and Theron (1963) may have mistaken particles of dust or coagulated secretions for papillae.

In the present study, specimens with both five and nine papillae were again encountered. The former are undoubtedly *C. longicaudata*, of which *C. urbana* is a synonym. The status of specimens with 9-12 papillae, which have been found both in southern Africa and Australia (see below), is still uncertain. No other *Ctenolepisma* species shows comparable variation in the number of papillae, thus the possibility exists that these are two distinct species or subspecies, although their similar habits (and probably distribution as well) argues against this. Whether the number of papillae have any specific significance or not in this case, can probably be ascertained by simple breeding experiments, but this was not further pursued in the present study, for the reasons noted above.

[Slabaugh's material of "*C.* *longicaudata*" was supplied by E. Lindsay, then of the University of California, but it is probable that the specimens originated in Australia, because Lindsay (1940), in a paper published in the same month as Slabaugh's description of *C.* *urbana*, reports on extensive behavioral studies on "*C.* *longicaudata*" in Australia. Most records from America (as summarised by Wygodzinsky, 1972) are of *C.* *longicaudata* *sensu* Escherich and not of *C.* *longicaudata* *sensu* Slabaugh. The latter does occur in Australia, as is witnessed by an illustration of "*C.* *longicaudata*" with 11 sensory papillae in Watson's (1970) review of Australian Thysanura.]

Brauns found the species common at Bothaville in 1899, and Schultze collected it in 1904 at a number of places in South West Africa and Botswana which remain off the beaten track to this day. The species was thus already firmly established in southern Africa by the turn of the century. In all probability it arrived with the early Europeans and dispersed with them. It was probably re-introduced several times thereafter.

Heeg (1967*a*) investigated the water economy and Heeg (1967*b*) the responses to temperature, light and atmospheric humidity of both *C.* *longicaudata* and *Machiloides* *delanyi* Wygodzinsky (Archaeognatha: Meinertellidae). Heeg (1969) compared the results of his previous investigations for these two species and deduced that the different distributions of the southern African Thysanura and Archaeognatha are a result of their differing water requirements.

SUBGENUS *Ctenolepisma* (*Sceletolepisma*) Wygodzinsky

With seven species-groups, of which six occur in southern Africa.

SPECIES-GROUP *howa*

Characterised by having few (one to four) median urosternal bristlecombs only. Only one species, *C.* *pretoriana*, in southern Africa. Also includes *C.* *howa* (Madagascar) and *C.* *unipectinata* (Kenya).

Ctenolepisma (*S.*) *pretoriana* Wygodzinsky

Ctenolepisma *pretoriana* Wygodzinsky, 1955: 140.

Comparison of the holotype with recently collected topotypical material confirmed that the urosternal setation of this species is: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / 1+1 / 1+1 / - bristlecombs, *i.e.*, urosternite VI carries 1+1 bristlecombs and not 1+1+1 as stated in the original description. In all other respects the latter is accurate and sufficient for the recognition of the species. No other southern African *Ctenolepisma* sp. has adults with three pairs of styli, and the urosternal setation is unique in the genus.

Proportions

Body length of female holotype: 9,5 mm (Wygodzinsky, 1955).

MATERIAL EXAMINED

HT, female, body length indeterminate (in pieces), labelled: *Ctenolepisma* *pretoriana* Wygodzinsky, Holotype, Hennop's

rivier by Pretoria, 6 Okt. 1938, L.D. Brongersma. (LEID)
Additional material: 2 specimens; 1 female, 1 male (SM).

LOCALITIES

Literature. Wygodzinsky (1955): Hennop's rivier (type locality). (LEID, not examined)

Present material: Hennopsrivier.

DISTRIBUTION

Known only from the type locality, west of Pretoria (fig. 24).

HABITAT

The type locality is among dolomite hills in Acocks' veld type number 61 (b), the central variation of the Bankenveld (Acocks, 1975). The present material was from under stones.

DISCUSSION

This species, previously known from the unique holotype only, is probably more widespread and common than the above suggests.

SPECIES-GROUP *villosa*

Characterised by urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / 1+1 / $\pm$ bristlecombs. Widespread, from the Cape to East Asia. Two species in southern Africa.

Ctenolepisma (*S.*) *africanella* Wygodzinsky

Ctenolepisma africanella Wygodzinsky, 1955: 146.

The original description is sufficient for the recognition of this species.

Proportions

		ave.	s.d.	max.	n
Body length,	female	9.50	0.00	9.50	1
" "	, male	6.50	0.71	7.00	2
" "	, both	7.50	1.80	9.50	3
Antennae,	female	No data available			
" ,	male	1.00	0.00	1.00	1
" ,	both	No data available			
Cerci,	female	No data available			
" ,	male	0.69	0.03	0.71	2
" ,	both	No data available			
Filum terminale		No data available			

MATERIAL EXAMINED

Types. (LUND; LEID) Not examined.

Additional material: 2 males. 1 (SM); 1 (TM).

LOCALITIES

Literature. Wygodzinsky (1955): Bain's Kloof; Viljoenspas (type locality). (LUND, LEID; not examined)

Present material: Bushy Park; Grahamstad.

DISTRIBUTION

Southern parts of the Cape Province (fig. 25).

HABITAT

Macchia, escarpmental mountains. Holotype from "under bark of Pinus log" (Pinaceae), Grahamstown specimen from under a stone.

DISCUSSION

Most other *Ctenolepisma* spp. with abdominal setations similar to that of *C. africanella* occur in the Palaearctic region. The only southern African species which has a similar overall abdominal setation is *C. weberi sensu* Wygodzinsky, see there. The absence of a median bristlecomb on urosternite VI, the three relatively large sensory papillae on the distal segment of the labial palp, and the short urotergite X, are distinctive.

Wygodzinsky (1955) expressed doubt as to whether his males actually belonged to this species or not, mainly on the grounds that they had one pair of styli only whereas the females (including the holotype) had two pairs. He expressly excluded them from the type series, in the sense of Articles 72(b)(i) and (vi) of "The Code" (ICZN, 1985), on this basis. Because a number of *Ctenolepisma* spp. exhibit retarded appearance of styli in their males, I do not consider Wygodzinky's doubts valid, and the males I examined confirmed this.

The species was previously known from the types only.

Ctenolepisma (*S.*) *weberi* Escherich

Ctenolepisma weberi Escherich, 1905: 86; Wygodzinsky, 1955: 152.

The original description of this species includes little taxonomically useful information. *C. weberi* is stated to be very near to *C. grandipalpis*, with the chief distinguishing features between the species being body shape and pigmentation, both of which are not very reliable characters.

In any case, Escherich's concept of C. grandipalpis probably included a number of different species, see there.

Wygodzinsky's (1955) redescription of C. weberi was done without recourse to the types, on the basis that his specimens corresponded well with the original description, but then, there is so little information in the original description that the same can be said for a number of other species. I cannot be certain that Wygodzinsky's species is indeed C. weberi, neither could I trace the types which could clarify the matter.

The only other southern African Ctenolepisma species with a similar overall abdominal setation to C. weberi sensu Wygodzinsky, is C. africanella, which has a completely different thoracic sternal setation.

Proportions

Body length 10 mm (Escherich, 1905) to 11 mm (Wygodzinsky, 1955).

MATERIAL EXAMINED

None

LOCALITIES

Literature. Escherich (1905): Willowmore; Zwartberg-Pass. (not traced, not examined)

Wygodzinsky (1955): De Hoop Vlei. (LUND, not examined)

DISTRIBUTION

Southern Cape Province (fig. 25).

HABITAT

Wygodzinsky's material came from in and under dry trunks of Aloe sp. (Liliaceae).

DISCUSSION

None

SPECIES-GROUP grandipalpis

Characterised by urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / ± bristlecombs. Five loosely-bound lineages may be distinguished.

LINEAGE dewittei

Characterised by having many (up to 13+13) lateral bristlecombs on the thoracic nota, while species in other lineages have at most 10+10, and usually less. Extralimital: Zaire and Tanzania. Includes C. dewittei Mendes, C. desaegeri Mendes and C. tanzanica Mendes.

LINEAGE terebrans

Characterised by having anteriorly-directed setae on the shaft of the ovipositor and (except in one species) also sclerotised female posterior gonapophyses. Mainly psammophilous species, most abundant in western southern Africa. Besides the six species treated below, it also includes the extralimital C. sanctaehelenae Wygodzinsky from St. Helena.

Ctenolepisma terebrans Silvestri

Ctenolepisma terebrans Silvestri, 1908: 291; Wygodzinsky, 1955: 138, 1970: 253.

Ecological/physiological references (identifications in doubt, see below): Holm, 1970: 37; Edney, 1971a: 62, 1971b: 264; Holm & Edney, 1973: 48.; Holm & Scholtz, 1980: 16.

The original description, though lacking in many details, is sufficient for identifying the species if it is used in conjunction with the decription of *C. latera* sp. nov. *C. terebrans* differs from *C. latera* only in urotergal setation, the former having 2+2 bristlecombs on urotergite VI, and the latter 3+3. In all other aspects the two species are similar.

Proportions

Specimens from the main Namib dune sea between Lüderitz and Walvis Bay ("Namb" in the table below) have smaller bodies with relatively longer appendages than specimens from the rest of the species' range ("Rest" in the table below), which is why they are listed seperately. Despite these marked proportional differences I can find no taxonomic basis on which to seperate the Namib specimens even subspecifically from typical (=Kalahari) *C. terebrans*.

	Region	ave.	s.d.	max.	n
Body length, female,	Rest	11.77	2.52	18.5	53
" " , " ,	Namb	8.13	1.92	12.0	54
" " , " ,	both	9.94	2.88	18.5	107
" " , male,	Rest	10.40	1.85	15.0	67
" " , " ,	Namb	7.41	1.74	12.0	63
" " , " ,	both	9.02	2.46	15.0	130
" " , both,	Rest	11.07	2.27	18.5	120
" " , " ,	Namb	7.75	1.86	13.0	117
" " , " ,	both	9.39	2.65	18.5	237

Antennae,	female,	Rest	0.68	0.09	0.87	24
" ,	" ,	Namb	0.78	0.09	0.91	15
" ,	" ,	both	0.71	0.11	0.91	39
" ,	male,	Rest	0.67	0.14	0.92	23
" ,	" ,	Namb	0.87	0.11	1.07	14
" ,	" ,	both	0.75	0.16	1.07	37
" ,	both,	Rest	0.68	0.12	0.92	47
" ,	" ,	Namb	0.83	0.11	1.07	29
" ,	" ,	both	0.74	0.14	1.07	76
Cerci,	female,	Rest	0.54	0.08	0.70	18
" ,	" ,	Namb	0.64	0.09	0.82	11
" ,	" ,	both	0.58	0.09	0.82	29
" ,	male,	Rest	0.56	0.10	0.73	17
" ,	" ,	Namb	0.67	0.07	0.83	7
" ,	" ,	both	0.59	0.10	0.83	24
" ,	both,	Rest	0.55	0.09	0.73	18
" ,	" ,	Namb	0.65	0.09	0.83	18
" ,	" ,	both	0.58	0.10	0.83	53
Filum	female,	Rest	0.55	0.05	0.64	14
terminale,	" ,	Namb	0.73	0.07	0.83	10
" ,	" ,	both	0.62	0.11	0.83	24
" ,	male,	Rest	0.60	0.09	0.78	17
" ,	" ,	Namb	0.81	0.15	1.00	4
" ,	" ,	both	0.64	0.14	1.00	21
" ,	both,	Rest	0.56	0.08	0.78	31
" ,	" ,	Namb	0.74	0.10	1.00	14
" ,	" ,	both	0.63	0.12	1.00	45

MATERIAL EXAMINED

Designation of lectotypes: The type material of _C_. _terebrans_ consists of seven samples containing (about) 41 specimens. All samples are identified as C. terebrans in Silvestri's own hand, and all form part of a larger sample collected by L. Schultze, but only two samples bear Silvestri's designation as "Cotypi !". All samples have (later) labels in another hand stating "Co-Typus". At least three samples, including both Silvestri's co-type samples, include positively identifiable specimens of C. pluriseta (considered a subspecies of C. terebrans by Silvestri), and many other specimens are today so badly damaged as to be completely indeterminate. An especially problematic sample includes at least 26 specimens of which the majority consist of head and thorax only.

In the midst of this confusion I have selected the best-preserved female as lectotype and male as allolectotype. Because of the poor condition and doubtful identity of the other co-types, I have not designated any of them as paralectotypes.

Lectotype (here designated), female, body length 11 mm, labelled: Ctenolepisma terebrans Silv., Cotypi, L. Schultze, Kalahari, Severelela-Kooa, Oct/Nov 04, No 835. In alcohol. (ZMHU)

Allolectotype (here designated), male, body length 12,5 mm, labelled: Ctenolepisma terebrans Silv., Cotypi !, L. Schultze, Kalahari, Kakir-Kang, Dez. 04, No 967. In alcohol. (ZMHU)

"Co-types": All in alcohol, all ZMHU.

1 female, 2 males, 2 broken pieces; 1 male C. pluriseta; sample labelled as lectotype, which came from here.

1 female, 1 unsexable specimen; 1 male C. pluriseta,

sample labelled as allolectotype, which came from here.

1 male, labelled: *Ctenolepisma terebrans* Silv., L. Schultze, Kalahari, Kooa, Nov. 04, In den Eierhöhlen d. Ameise No 833.

1 female, labelled: *Ctenolepisma terebrans* Silv., L. Schultze, Kalahari, Kakir-Kang, Des. 04, No. 967.

26 heads with bits of thorax and abdomen attached, of which at least one belongs to *C. pluriseta*, 2 other major pieces, labelled: *Ctenolepisma terebrans* Silv., exempla omma mutilata, *Kalahari*, zw. Severelela n Kokir, Okt. Nov. 04, No. 904, L. Schultze.

1 unsexable specimen, labelled: *Ctenolepisma terebrans* Silv., juvenis !, L. Schutze (*sic*!), Dez. 04, Kalahari, Kank-Kakir (*sic*!).

1 female, labelled only: *Ctenolepisma terebrans* Silv.

Additional material: 409 specimens; 146 females, 165 males, 98 unsexed. 392 (SM); 5 (TM); 5 (UP); 2 (LUND); 2 (MBOC); 1 (AMNH); 1 (NCI); 1 (DERU).

LOCALITIES

Literature. Silvestri (1908): Khakhea-Kang; Severelela-Kooa (ZMHU, examined; plus additional locality: Kooa, see above).

Wygodzinsky (1955): Aggeneys (LUND, examined).

Wygodzinsky (1970): Colesberg District (NCI, examined); De Aar, 18 miles *ex*, towards Philipstown. (?AMNH, not examined)

Holm (1970): Gobabeb (material unpreserved).

Edney (1971*a*): Gobabeb (material unpreserved).

Edney (1971*b*): Gobabeb (material unpreserved).

Holm & Edney (1973): Gobabeb (material unpreserved).

Holm & Scholtz (1980): Gobabeb (material unpreserved).

Present material: Agub Mt. SW; Aurus; Boesmanberg;

Chowagasberg, 15 km NW; Chulon, on Narib Ost 602; De Hoop; Donkermodder 60; Elephant Valley; Far East dunes; Farquarson; Fischersbrunn; Grillenthal; Grootderm, 4 km WSW; Grootderm, 13 km SSW; Guinassibberg, 1 km SE; Haris; Hierlê, op Nongcaib; Jakkalsputs; Jumbo dune; Kahani dune; Karakanos; Kaukausib fountain; Kaukausib, 2 km E; Khubus 10 km WSW; Kleinduin; Klipneus; Klinghardts Mts. at 2715Bc (3); Kortdoringberg; Mniszechi's Vlei; Nama Pan; Nata; Noctivaga dune; Obib Mountain; Oranjemund; Rooibank; Rooibank, 10 km W; Schaaprivier; Swartbaas Ost 285; Tsaus dunes; Tsondab flats at 2315Cc; Tsumkwe, 50 km E; Uri-Hauchab Mt.; Vioolsdrif; Vioolsdrif, 11 km ENE; Visitor's dune; Volstruiswerf 513; Vredeshoop 283; Witberg; 2515Cd2.

DISTRIBUTION

Kalahari desert in South West Africa and Botswana, the drier parts of the Cape Province, and the Namib desert as far north as the Kuiseb River (fig. 25).

HABITAT

Dry woodland to desert, always on sandy substrates, most commonly coarse red sand but also fine white sand, e.g. along the Orange River and in the northern Kalahari. Usually under vegetation on such sand, e.g. dry grassclumps (Kalahari) or dune hummocks (Namib), but will utilise any suitable shelter, e.g. stones, dry dung or dry wood. Enters both ant and termite nests, but is not an obligate nidicole. Wygodzinsky (1970) lists specimens from nests of *Hodotermes mossambicus* (Hagen) (Hodotermitidae) and *Amitermes* sp. (Termitidae). A co-type label states that the specimen was captured in an ant's nest, and the label of a specimen from Rooibank, Namib, states: "*Camponotus* nest, middune, 08h30"

(Formicidae; species probably Camponotus detritus Emery).

In the Namib desert dune area they prefer relatively less sandy and/or more vegetated areas, e.g. regions with wide interdune valleys, around isolated mountains in the dunes, around the Tsondab flats and in the Meob/Conception area. They are absent from uninterrupted vegetationless dune tracts as e.g. the coastal dunes. Analysis of the label data for material from an extensive pittrapping survey by DERU staff along the northern edge of the dune sea, over a three year period, shows them to be most abundant on the dune slopes (plinth) and in the interdune valleys (53 % and 41 % of total respectively); they rarely venture onto the slipfaces (6 % ; n = 88). Results of extensive hand-sampling by myself throughout the dune area confirm this.

DISCUSSION

C. terebrans is a very distinctive species, and the commonest and most widespread psammophilous lepismatid in southern Africa. For the largest part of its range no other Ctenolepisma species has a similar overall abdominal setation as well as robust tibial setation. In northern South West Africa it may be confused with C. subterebrans sp. nov., see there.

"C. terebrans" from Gobabeb in the Namib desert has been the subject of some very interesting physiological work, which showed i. a. that it can absorb moisture from air with a humidity as low as 47,5 % RH (Edney, 1971a), and has an upper lethal temperature of 48 °C (Edney, 1971b). Because of the doubtful identity of the species in question (see below), I have tried to ascertain whether voucher specimens of the animals used in these experiments were kept. Edney (pers. comm., 1982) doubted this, but suggested I contact the Zoology Department of the University of Cape Town, where much of the work was done. Prof. G. Louw (pers. comm., 1983) could locate no such material at Cape Town, nor are there any specimens from this period in the thysanuran collection of DERU, which was deposited in its entirity in SM in 1981.

Holm (1970) included _C. terebrans_ and _C. pauliani_, along with two other lepismatids, in a survey of the apterous insects at Gobabeb. This data was repeated partly or in full by Holm & Edney (1973), Holm & Scholtz (1980) and Robinson & Seely (1980). Initial identification of these species was by Wygodzinsky, subsequent identifications were done visually and the specimens then released (Holm, pers. comm., 1981), which explains the lack of voucher specimens in this case. While adult _C. pauliani_ at Gobabeb may be easily recognised by their size alone, personal experience in the area as well as that of DERU staff (Osberg, pers. comm., 1982; Watson, pers. comm., 1985) has shown that there is no foolproof way of distinguishing _C. terebrans_ and subadult _C. pauliani_ with the naked eye. While some of Holm's (1970) remarks fit each of the two species perfectly, (e.g. their relative sizes, the long appendages of _C. pauliani_ and the latter's habit of digging burrows), other aspects are less clear. Thus the banded vs. unicolourous pattern described for _C. pauliani_ and _C. terebrans_ respectively may be found in both species. The banded effect commonly precedes ecdysis, irrespective of the species concerned.

The ecological data given for the two species does not fit either. _C. pauliani_ is said to be fairly evenly distributed over the dunes, though commoner at the dune base. C. terebrans is said to have a similar distribution, and to be much commoner than C. pauliani. This is irreconsilable with the habitat data presented here, see especially the results of the DERU survey under "HABITAT" for the two species. This shows C. pauliani to be the commonest species and to be found mainly on the slipfaces, while the less common C. terebrans prefers dune slopes and interdune valleys. One of the sites of the DERU survey (Kahani dune), corresponds closely to Holm's (1970) study site.

I am thus forced to conclude that there was a degree of misidentification as regards Holm's material. This permeates through to all the authors listed above who have quoted his data, and it unfortunately casts doubt on the identity of Edney's "C. terebrans" (det. Holm) too. Thus the only physiological data available for an endemic southern African thysanuran loses much of its worth.

Ctenolepisma (S.) pluriseta Silvestri

Ctenolepisma terebrans pluriseta Silvestri, 1908: 292, 1922: 79; Wygodzinsky, 1955: 139, 1965: 86.
Ctenolepisma pluriseta Silvestri : Paclt, 1966: 154; Mendes, 1982: 646.

The original description of C. pluriseta is very brief, but the species may be readily identified by referring to the description and illustrations of C. latera sp. nov. These two species are similar with regard to all characters except the setation of urotergite VII, which has 2+2 bristlecombs in C. latera but 3+3 in C. pluriseta. Illustrations of C.

pluriseta may also be found in Silvestri (1908, 1922).

Proportions

		ave.	s.d.	max.	n
Body length,	female	11.91	1.62	16.00	27
" " ,	male	11.60	2.20	18.00	40
" " ,	both	11.72	1.98	18.00	67
Antennae,	female	0.70	0.09	0.83	10
" ,	male	0.77	0.13	0.92	15
" ,	both	0.75	0.12	0.92	25
Cerci,	female	0.57	0.08	0.67	6
" ,	male	0.64	0.08	0.74	11
" ,	both	0.61	0.08	0.74	17
Filum	female	0.61	0.08	0.70	3
terminale,	male	0.62	0.10	0.78	10
" ,	both	0.62	0.09	0.78	13

MATERIAL EXAMINED

Designation of lectotypes: A similar condition with regard to types as in C. terebrans exists for C. pluriseta. The type material consists of four samples of (about) 15, 4, 4 and 1 specimens respectively. Only two samples carry Silvestri's designation "Cotypi !", but all have later labels stating "Co-Typus". Some specimens are positively identifiable as C. terebrans, but many are damaged beyond identification. The samples from Lüderitzbucht are particularly problematic: though many specimens are dessicated, one is clearly a Hyperlepisma sp. while the others, though definitely Ctenolepisma spp., possibly do not belong to C. pluriseta. By their smaller size and the fact that all have one pair of styli only, I would expect them to rather be C. luederitzi sp. nov., but, due to their poor condition, it is not possible to discern the bristlecombs on coxites IX which would prove this to be true. Lüderitz lies outside the verified range of C. pluriseta, but within that of C. luederitzi. Also, later material from the same locality, identified by Silvestri (1922) as C. pluriseta, proved to be C. luederitzi, see there. As with C. terebrans, I have tried to solve the problem by designating the best-preserved female as lectotype, again from one of from Silvestri's original "Cotypi !" samples. There was no male suitable for designation as allolectotype. Because of the specific and generic heterogeniety of the remaining co-types, none were designated as paralectotypes.

Lectotype (here designated), female, body length 12,5 mm, labelled: Ctenolepisma terebrans Silv. var. pluriseta Silv., Cotypi !, L. Schultze, Kalahari, Kang-Kakir, Dez. 04, No 968. In alcohol. (ZMHU)

Remaining co-types: 18 specimens; 7 females, 7 males, 4 unsexed; 4 major fragments; 1 male Hyperlepisma sp. In alcohol. (ZMHU)

1 male, 2 fragments, labelled as lectotype, which came from this sample.

14; 5 females, 5 males, 3 unsexed, 1 fragment; also 1 male Hyperlepisma sp., labelled: Ctenolepisma terebrans Silv. var. pluriseta Silv., Cotypi !, L. Schultze, S.W.Afr., Lüder.-bucht, No 293. (Identity in doubt, see above)

1 female, labelled: Ctenolepisma terebrans Silv. var. pluriseta Silv., Severelela (Kalahari).

3; 1 female, 1 male, 1 unsexed; 1 fragment, labelled: Ctenolepisma terebrans Silv. var. pluriseta Silv., stilorum pare uno, L. Schultze, Südafrika, 28.4/1903, Fundort: Lüd-bucht, Datum [crossed out]: No 79, Konserv. Alk. 94. (Identity in doubt, see above)

Additional material: 94 specimens; 30 females, 47 males, 16 unsexed. 66 (SM); 19 (ZSZM); 7 (TM); 1 (LUND).

LOCALITIES

Literature. Silvestri (1908): Kang-Khakhea (type locality); Lüderitzbucht (locality doubtfull); Severelela. (ZMHU, examined).

Silvestri (1922): Karibib; Okahandia (sic! = Okahandja); Teufelsbach; Usakos; (all preceding, ZSZM, examined); Winduck (sic! = Windhuk) (ZSZM, not examined).

Wygodzinsky (1955): Hout Bay. (LUND, examined, see below)

Wygodzinsky (1965): Katesh, centrefort Sud du Mont Hanang; Makuyuni, sur la route Arusha - Babati. (AMNH and MRAC, not examined)

Paclt (1966): Farm Okosongomingo, Bez. Omaruru; Usakos. (ZSZM, not examined)

Mendes (1982): Barrow's Hope. (CRAC and MBOC, not examined)

Present material: Alkmar 512; Blumfelde 95; Breekkierie farm; Chulon, on Narib Ost 602; Daweb 43: De Hoop; Dickdorn 98; Gibeon, 4 km WSW; Kalkrand, 11 km SE; Karakanos; Labora 436; Nata; Olifantsvlei farm; Otjitoroa Süd 55; Sandveld 314; The Dunes 234; Tses; Volstruiswerf 513.

DISTRIBUTION

Kalahari desert and fringes, ranging north to Tanzania and south to the Cape Peninsula (fig. 26).

HABITAT

Typically partially vegetated dunes in semi-desert areas, but ranges into macchia and mesic savanna woodland. Substrate specific: always associated with sand, typically red sand. Under any available shelter on sand, usually stones, dry grassclumps or dry dung, but also under fallen bark, dry wood or vegetable detritus. Often buried in the sand under shelter. Sanddives.

DISCUSSION

_C_. _pluriseta_ is very similar to both _C_. _terebrans_ and _C_. _latera_ sp. nov., but differs from both in urotergal setation. It superficially resembles _C_. _luederitzi_ sp. nov., but lacks the transverse bristlecombs on coxites IX found in the latter species.

The specimen listed by Wygodzinsky (1955) from Hout Bay, was examined because it came from far outside the usual range of _C_. _pluriseta_, and its identity was confirmed.

Wygodzinsky's (1965) specimens from Tanzania were not examined, but since _C_. _pluriseta_ is so distinctive it is unlikely that they were wrongly identified. Though the localities are far removed from those in southern Africa, the intervening area is practically uncollected for lepismatids, and they may occur there too. The Hout Bay specimen mentioned above shows that _C_. _pluriseta_ does have the wide habitat tolerance often associated with a wide distribution.

Ctenolepisma (_S_.) _latera_ sp. nov.

DESCRIPTION

Body length of females up to 15 mm, of males up to 16 mm. Body shape slender but robust. Ground colour of body yellowish white. Hypodermal pigment absent. Scales dorsally yellowish brown, ventrally transparent; morphology as usual for genus. Macrosetae golden yellow, plumose.

Setation of head as usual for genus. Maxillary palp fairly short. Distal segment of labial palp unilaterally dilated, about 1,5 times wider than long in most females and young males (fig. 31), up to 3 times wider than long in most males above body length 10-11 mm (fig. 30); with five sensory papillae arranged in a single row. Eye black, composed of 12 ommatidia. Antennae with whorls of light-coloured setae.

Nape setated. Thoracic nota each with 8-10 + 8-10 lateral bristlecombs of 3-5 macrosetae each, as well as 1+1 posterolateral bristlecombs of 3-4 macrosetae each.

Urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 0 / 1+1 bristlecombs. Submedian and lateral bristlecombs of 3-5 (usually 4) macrosetae each, and sublateral bristlecombs of 4-6 macrosetae each. Urotergite X trapezoidal, width to length ratio 0,54, posteriorly straight or slightly rounded, with a lateral marginal setal fringe and 1+1 bristlecombs of 5-7 macrosetae each (fig. 34).

Thoracic sterna shaped as figs 27, 28, 29. Each with 2-3 + 2-3 bristlecombs of 3-8 macrosetae each; bristlecombs often subparallel to edge of sterna and then difficult to discern. Setation often asymmetrical.

Successive posteriad pairs of legs longer, tibia III about 2 times longer than tibia I. Tibial setation very distinctive (fig. 35). Tarsi with two claws and an empodium.

Urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / - bristlecombs. Lateral bristlecombs of 5-10, median bristlecombs of 3-6 (usually 4) macrosetae each. Coxites IX subtriangular, with a robust marginal setal fringe (figs 32, 33). Adults of both sexes with two pairs of styli, acquiring the second pair at about body length 5-7 mm.

Ovipositor shortish, reaching just beyond the apices of styli IX, robust, the shaft distally with laterally directed setae and proximally with anteriorly directed setae; apices of posterior gonapophyses sclerotised, spine-like, the spines varying in both length and degree of curvature (fig. 32). Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions

		ave.	s.d.	max.	n
Body length,	female	10.51	1.92	15.00	64
" " ,	male	10.03	1.92	16.00	118
" " ,	both	10.12	2.03	16.00	182
Antennae,	female	0.73	0.10	1.00	16
" ,	male	0.78	0.11	1.08	21
" ,	both	0.76	0.11	1.08	37
Cerci,	female	0.57	0.09	0.69	11
" ,	male	0.60	0.08	0.70	15
" ,	both	0.58	0.08	0.70	26

Filum	female	0.63	0.08	0.80	11
terminale,	male	0.65	0.09	0.83	20
" ,	both	0.64	0.09	0.83	31

MATERIAL EXAMINED

Holotype, female, body length 12 mm, labelled: SM H 45491, Dickdorn 98, 24° 49'S, 17° 41'E, 6 July 1982, under dry cattle dung on sand, J. Irish. In alcohol. SM type-number T 012. (SM)

Allotype, male, body length 11 mm, labelled: SM H 45492, Sandveld 314, 24° 33'S, 18° 55'E, 13 July 1982, under detritus patch on red dune, J. Irish. In alcohol. (SM)

Paratypes: 138 specimens; 51 females, 56 males, 31 unsexed. All in alcohol.

3; 2 females, 1 male, labelled: SM H 45469, Fish/Lewer Rivers: confluence, 7 July 1982, J. Irish. (SM)

2; 1 female, 1 unsexed, labelled: SM H 45473, rest as preceding sample. (SM)

17; 4 females, 10 males, 3 unsexed, labelled: SM H 45470, Sandveld 314, 13 July 1982, J. Irish. (SM)

1 female, labelled: SM H 45493, Sandveld 314, 14 July 1984, J. Irish. (SM)

7; 2 females, 4 males, 1 unsexed, labelled: SM H 45476, Sandveld 314, 13 July 1982, M.-L. Penrith. (SM)

2; 1 female, 1 male, labelled: SM H 45488, rest as preceding sample. (SM)

11; 2 females, 4 males, 5 unsexed, labelled: SM H 45471, Swartbaas Ost 285, 11 July 1982, M.-L. Penrith. (SM)

4; 1 male, 3 unsexed, labelled: SM H 45539, rest as preceding sample. (SM)

12; 3 females, 4 males, 5 unsexed, labelled: SM H 45474,

Swartbaas Ost 285, 11 July 1982, J. Irish. (SM)
8; 3 females, 3 males, 2 unsexed, labelled: SM H 45472, Dickdorn 98, 6 July 1982, J. Irish. (SM)

10; 5 females, 5 males, labelled: SM H 45496, rest as preceding sample. (SM)

8; 3 females, 4 males, 1 unsexed, labelled: SM H 45477, Dickdorn 98, 5 July 1982, J. Irish. (SM)

2 females, labelled: SM H 45478, Dickdorn 98, 6 July 1982, M.-L. Penrith. (SM)

1 female, labelled: SM H 45480, Dickdorn 98, 6/7 July 1982, M.-L. Penrith & J. Irish. (SM)

7; 2 females, 3 males, 2 unsexed, labelled: SM H 45475, Narib Oos 602, 5 July 1982, J. Irish. (SM)

1 male, labelled: SM H 45495, rest as preceding sample. (SM)

9; 5 females, 2 males, 2 unsexed, labelled: SM H 45489, Vredeshoop 283, 10 July 1982, J. Irish. (SM)

3; 1 male, 2 unsexed, labelled: SM H 45494, Hohedun 277, 10 July 1982, J. Irish. (SM)

8; 3 females, 4 males, 1 unsexed, labelled: SM H 45533, rest as preceding sample. (SM)

3; 2 females, 1 unsexed, labelled: SM H 45645, Gavaams 6, 9 August 1983, J. Irish. (SM)

2 males, labelled: SM H 45646, Karakanos, 8 August 1983, E. Griffin. (SM)

5; 4 females, 1 male, labelled: SM H 45648, Witsand, 14 December 1983, J. Irish. (SM)

6; 3 females, 3 males, labelled: SM H 45647, 25 km ENE Upington, 24 November 1983, J. Irish. (SM)

1 male, labelled: SM H 4426, Blinkoog 30, 14-17 October 1971, M.-L. Penrith, C.G.Coetzee & P.G.Olivier.

3; 1 male, 2 unsexed, labelled: SM H 45765, Karakanos, 8 August 1983, J. Irish. (SM)

2 females, labelled: SM H 45766, 3 km S Berseba, 9 August 1983, E. Griffin. (SM)

Additional material examined (not designated types due to damage or immaturity): 141 specimens; 45 females, 87 males, 9 unsexed. (SM)

LOCALITIES

Berseba, 3 km S; Blinkoog 30; Dickdorn 98; Fish/Lewer Rivers: confluence; Gavaams 6; Hohedun 277; Karakanos; Koras 412; Narib Oos 602; Sandveld 314; Swartbaas Ost 285; Upington, 25 km ENE; Vredeshoop 283; Witsand.

DISTRIBUTION

Southwestern Kalahari desert (fig. 36).

HABITAT

Arid semi-desert shrubland, on red sandy substrates only, usually on dunes. Found under shelter on sand, especially under dry grassclumps, but also under dry dung, fallen bark or stones on sand. Only once found under a stone on hard ground, but then adjacent to a dune.

Nocturnal, moving about on dunes at night. Sanddives.

DISCUSSION

C. latera is distinguishable from _C. terebrans_ and _C. pluriseta_ only be their different urotergal setations. In all other aspects (except distribution) these three species are practically identical. They are evidently closely related, and the occurrence of surprisingly large percentages of individuals with aberrant urotergal setation (apparently natural hybrids) confirms this.

In two or more species which differ morphologically only in urotergal setation, the expected phenotype of a successful F1-hybridisation would include an asymmetrical urotergal setation, intermediate between those of the two species involved. Thus, for C. terebrans x C. latera the expected urotergal setation would be: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 3+2 / 2+2 / 2+2 / 0 / 1+1 bristlecombs, and for C. latera x C. pluriseta: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 3+2 / 2+2 / 0 / 1+1 bristlecombs, if no other factors were involved. As detailed below, one does find such specimens. The possibility that they are individual variants may be discounted, because asymmetrical urotergal setations, though they do occur, are extremely rare in the family. (This is also a reason why urotergal setation is such a good character). The only mention of such animals in the literature is by Mendes (1979). In the present study, only 3 other specimens (of C. pauliani) were found to have asymmetrical urotergal setation while in the examples cited below they make up as much as 6,5 % of one sample.

At only one locality, namely Chulon on Narib Oos 602, were all three species recorded together, and the highest percentage of hybrids were also found there.

The total numbers of specimens were:

C. latera :	129
C. terebrans :	42
C. pluriseta :	1
C. terebrans x C. latera :	3
C. latera x C. pluriseta :	4
? F2-hybrids	5

Percentage of hybrids: (12 / 184) x 100 = 6,5 %

The ? F2- hybrids are 4 specimens with urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 2+1 / 2+2 / 0 / 1+1 bristlecombs, and one with: 1+1 / 3+3 / 3+3 / 1+3 / 1+3 / 2+3 / 2+2 / 2+2 / 0 / 1+1 bristlecombs.

Hybrids were only encountered at one other locality, namely Dickdorn 98, where C. terebrans apparently does not occur. The figures for Dickdorn are:

C. latera :	46
C. pluriseta :	3
C. latera x C. pluriseta :	2

Percentage of hybrids: (2 / 51) x 100 = 3,9 %

At four other localities (Volstruiswerf 513, Swartbaas Ost 285, Vredeshoop 283, Sandveld 314) two of the three species were found together, but the available material included no hybrids. All these samples were smaller than those above (2, 34, 10 and 31 specimens respectively), therefore it is possible that hybridisation occurs there too.

My assumption that asymmetrical urotergal setation is (in this case) caused by interspecific hybridisation is strengthened by the fact that a higher percentage of hybridisation was recorded at the locality above where all three species occur, than at the locality where only two occur. Also, at the latter locality the hybrids are as one would expect from the two species present.

The question arises as to whether, in the light of the preceding, these three taxa still deserve full specific status. I believe so, because:

1. In the rest of the genus and the family, urotergal setation is intraspecifically and often also intragenerically stable and one of the strongest characters available to the systematist. The present exception does not disprove the rule that different urotergal setations imply different species.

2. Many other completely valid species are known to hybridise under natural conditions.

3. The majority of these hybrids ([9 / 14] x 100 = 64,3 %) are simple F1-hybrids, with possible F2-hybrids (which may also be inbred or backbred F1-hybrids) in the minority, as one would expect if the F1 individuals were partially sterile, as is the case with most interspecific hybrids. The fact that F2-hybrids occur at all, testifies to the close relationship of the three taxa involved. The latter is one of the main reasons why I rejected Escherich's species-groups, which place the three species concerned in three different species-groups.

4. All three species occur sympatrically in the southwestern Kalahari, but have significantly different distributions outside this region. *C. latera* (fig. 36) does not occur outside the southwestern Kalahari (according to present knowledge), but the other two are found throughout the Kalahari desert. *C. terebrans* (fig. 25) ranges into the southern Namib, where *C. pluriseta* does not occur, and *C. pluriseta* (fig. 26) ranges north and south beyond the range of *C. terebrans*. If these three were conspecific, one would have expected either complete sympatry (ascribing their differences to intraspecific variation) or intergrading

allopatry (their differences then being of a subspecific nature).

Etymology: From Latin lateo, -ere (to be concealed) referring to the fact that this large and common species had not been recorded previously.

Ctenolepisma (*S.*) *placida* sp. nov.

DESCRIPTION

Body length of females up to 10.5 mm, of males up to 11 mm. Body shape slender. Ground colour of body yellowish white. Hypodermal pigment absent. Scales dorsally light brown, ventrally transparent; morphology as usual for genus. Macrosetae golden yellow, plumose.

Setation of head as usual for genus. Maxillary palp fairly long, slender. Distal segment of labial palp unilaterally dilated, 1,5 to 2 times wider than long in adult females, up to 2,5 times wider than long in adult males; with five sensory papillae arranged in a single row (fig. 40). Eye black, composed of 12 ommatidia. Antennae with whorls of light-coloured setae.

Nape setated. Thoracic nota with 1+1 posterolateral bristlecombs of 3 macrosetae each. Pronotum with 6-7 + 6-7, mesonotum with 8-9 + 8-9, and metanotum with 7-8 + 7-8 lateral bristlecombs of 3 macrosetae each.

Urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 0 / 1+1 bristlecombs. Submedian bristlecombs of 6-8, lateral bristlecombs of 6-7 and sublateral bristlecombs of 6-10 macrosetae each. Urotergite X trapezoidal, width to length ratio 0,56, posteriorly straight to rounded, with a marginal setal fringe and 1+1 bristlecombs of 6-7 macrosetae each (fig. 38).

Thoracic sterna shaped as in figs 41, 42, 43. Prosternum (fig. 41) with 4-5 + 4-5 bristlecombs of 1-2 (apically) to 12 (proximally) macrosetae each. Mesosternum (fig. 42) with 3-4 + 3-4 bristlecombs of 5-13 macrosetae each. Metasternum (fig. 43) with 2-3 + 2-3 bristlecombs of 2-11 macrosetae each.

Successive posteriad pairs of legs lengthening, tibia III about twice length of tibia I. Femorae and tibiae with short but very robust spines (fig. 44). Tarsi with two claws and an empodium.

Urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / + bristlecombs. Lateral bristlecombs of 10-13, median bristlecombs of 12-20 macrosetae each. Coxites IX with inner processes subtriangular, narrower in female than in male; with a robust marginal setal fringe, 1+1 transverse subapical bristlecombs of about 6 macrosetae each, and 3+3 inner marginal bristlecombs proximal to the preceding, decreasing in size from about 5 macrosetae each distally to 2 macrosetae each proximally (figs 37, 39). Adults of both sexes with two pairs of styli, acquiring the second pair at about body length 7-8 mm.

Ovipositor short, reaching to halfway between the apices of coxites IX and styli IX, robust, distally swollen; apices of posterior gonapophyses acute, sclerotised; setae on shaft directed anteriorly (fig. 37). Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions

		ave.	s.d.	max.	n
Body length,	female	8.81	0.83	10.50	8
" " ,	male	9.50	1.14	11.00	5
" " ,	both	9.08	1.02	11.00	13
Antennae,	female	0.66	0.03	0.69	2
" ,	male	0.68	0.04	0.73	3
" ,	both	0.67	0.04	0.73	5
Cerci,	female	0.71	0.09	0.79	4
" ,	male	0.62	0.12	0.79	3
" ,	both	0.67	0.11	0.79	7
Filum	female	0.86	0.04	0.89	2
terminale,	male	0.53	0.00	0.53	1
" ,	both	0.75	0.16	0.89	3

MATERIAL EXAMINED

Holotype, female, body length 8 mm, labelled: SM H 45558, 7 km N Grillenthal, 26°51'S, 15°22'E, 29 September 1982, under stone on sand, J. Irish. In alcohol. SM type-number T 014. (SM)

Allotype, male, body length 10 mm, labelled: SM H 45193, Vrede 80, 25°09'S, 16°14'E, 21 June 1982, under dry cattle dung on red sand, J. Irish. In alcohol. (SM)

Paratypes: 11 specimens; 7 females, 4 males. All in alcohol.

6; 4 females, 2 males, SM H 45152, rest as allotype. (SM)

1 female, labelled: SM H 45580, Guinasibberg, 16 April

1983, P. Horn. (SM)

2; 1 female, 1 male, labelled: SM H 45636, Agub Mt., 12 August 1983, E. Griffin. (SM)

1 female, labelled: SM H 45640, 2 km E Kaukausib, 12 August 1983, J. Irish. (SM)

1 male, labelled: SM H 45641, Kaukausib fountain, 10 August 1983, J. Irish. (SM)

Additional material examined (not designated types due to damage): 3 specimens; 1 female, 2 males. (SM)

LOCALITIES

Agub Mt.SW; Grillenthal, 7 km N; Guinasibberg; Kaukausib fountain; Kaukausib, 2 km E; Tsaukhaib Mts.; Vrede 80.

DISTRIBUTION

Central southern Namib and Pro-Namib (fig. 26).

HABITAT

Desert, on consolidated sandy substrates. Under shelter on the latter, usually stones, but also dry dung and wood.

DISCUSSION

No other species with a similar overall abdominal setation also has transverse bristlecombs on coxites IX as *C. placida* has.

Etymology: From Latin *placidus* (peacefull), referring to the locality where I first encountered the species, namely Vrede (Afrikaans: peace).

Ctenolepisma (*S.*) *luederitzi* sp. nov.

Ctenolepisma terebrans pluriseta Silvestri 1908: 292 (*p.p.*) (??), 1922: 79 (*p.p.*).

DESCRIPTION

Body length of females up to 13 mm, of males up to 12 mm. Body shape slender. Ground colour of body yellowish white. Faint to distinct brownish hypodermal pigment present on the antennae and caudal filaments. Scales dorsally uniform yellowish brown, ventrally transparent; morphology as usual for genus. Macrosetae golden yellow, plumose.

Setation of head as usual for genus. Maxillary palp with individual segments rather short. Distal segment of labial palp unilaterally dilated, about 2 to 2,5
times wider than long in adults of both sexes (fig. 45), but more slender in the female; with five sensory papillae arranged in a single row. Eye black, composed of 12 ommatidia. Antennae with whorls of light-coloured setae.

Nape setated. Thoracic nota each with 1+1 posterolateral bristlecombs of 3 macrosetae each, situated very lateral. Pro- and metanota with 7+7, mesonotum with 8+8 lateral bristlecombs of 2-4 macrosetae each.

Urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 0 / 1+1 bristlecombs. Lateral and sublateral bristlecombs of 5-7, submedian bristlecombs of 5-6 macrosetae each. Urotergite X trapezoidal, shortish, width to length ratio about 0,55, posterior margin slightly rounded, with a lateral marginal setal fringe and 1+1 bristlecombs of 6 macrosetae each (fig. 46).

Thoracic sterna shaped as in figs 47, 48, 49. Prosternum (fig. 47) with 5-6 + 5-6 bristlecombs of 5-7 macrosetae each. Mesosternum (fig. 48) with 3-4 + 3-4 bristlecombs of 5-11 macrosetae each. Metasternum (fig. 49) with 2-3 + 2-3 bristlecombs of 5-7 macrosetae each.

Successive posteriad pairs of legs lengthening strongly, tibia III about 2,5 times longer than tibia I. Setation of legs reminiscent of that of C. terebrans (fig. 50). Tarsi with two claws and an empodium.

Urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / + bristlecombs. Lateral bristlecombs of 7-11, median bristlecombs of 7-9 macrosetae each. Coxites IX with inner processes subtriangular, with a marginal setal fringe and 2-5 + 2-5 transverse bristlecombs of 2-7 macrosetae each (fig. 52). Adults of both sexes with two pairs of styli, acquiring the second pair at about body length 6-7 mm in females and 9-10 mm in males.

Ovipositor short, reaching to about halfway between the apices of coxites IX and the apices of styli IX, robust, with the setae on shaft directed anteriorly; apices of posterior gonapophyses sclerotised. Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions

	ave.	s.d.	max.	n
Body length, female	9.85	1.68	13.00	54
" " , male	9.36	1.83	12.00	52

" "	, both	9.69	1.51	13.00	106
Antennae,	female	0.67	0.08	0.80	21
" ,	male	0.71	0.10	0.89	21
" ,	both	0.69	0.09	0.89	42
Cerci,	female	0.61	0.11	0.82	14
" ,	male	0.62	0.09	0.78	12
" ,	both	0.62	0.10	0.82	26
Filum	female	0.65	0.13	0.88	14
terminale,	male	0.72	0.11	0.90	11
" ,	both	0.68	0.12	0.90	25

MATERIAL EXAMINED

Holotype, female, body length 12 mm, labelled: SM H 45556, 10 km NW Rosh Pinah, 27°42'S, 16°42'E, 3 December 1980, under stone, J. Irish. In alcohol. SM type-number T 023. (SM)

Allotype, male, body length 11 mm, labelled: SM H 45730, Tsaus dunes, 27°11'S, 16°13'E, 13 August 1983, moving about on dune at night, J. Irish. In alcohol. (SM)

Paratypes: 86 specimens; 34 females, 43 males, 9 unsexed. All in alcohol.

1 male, labelled: SM H 45540, Agate Beach, 26 December 1982, J. Irish. (SM)

5; 4 females, 1 male, labelled: SM H 45542, Grosse Bucht, 27 December 1982, J. Irish. (SM)

2; 1 female, 1 male, labelled: SM H 45543, Klinghardts Mts. at 2715Bc (3), 4 October 1982, J. Irish. (SM)

5; 2 females, 2 males, 1 unsexed, labelled: SM H 45544, Klinghardts Mts. W. at 2715Bc, 4 October 1982, J. Irish. (SM)

3 males, labelled: SM H 45545, 10 km S Grillenthal, 4

October 1982, J. Irish. (SM)

2; 1 female, 1 male, labelled: SM H 45548, 7 km N Grillenthal, 29 September 1982, J. Irish. (SM)

5; 1 female, 2 males, 2 unsexed, labelled: SM H 45552, 13 km SSW Grootderm, 6 September 1982, J. Irish. (SM)

2; 1 female, 1 unsexed, labelled: SM H 45554, Süd Witpütz 31, 7 December 1980, J. Irish. (SM)

1 female, labelled: SM H 45555, Pockenbank 68, 1 January 1983, J. Irish. (SM)

1 female, labelled: SM H 8326, Namuskluft 88, 6 October 1970, SM-staff. (SM)

2; 1 female, 1 male, labelled: SM H 45719, Obib dunes at 2816Ba, 17 August 1983, J. Irish. (SM)

10; 2 females, 6 males, 2 unsexed, labelled: SM H 45720, Wolwekop, 20 August 1983, J. Irish. (SM)

5; 1 female, 3 males, 1 unsexed, labelled: SM H 45723, Boesmanberg, 15 August 1983, J. Irish. (SM)

16; 5 females, 9 males, 2 unsexed, labelled: SM H 45724, Aurus, 15 August 1983, E. Griffin. (SM)

4; 3 females, 1 male, labelled: SM H 45726, Uguchab River at 2716Ca, 14 August 1983, E. Griffin. (SM)

1 female, labelled: SM H 45727, Diamond Area I at 2716Ac, 14 August 1983, E. Griffin. (SM)

9; 4 females, 5 males, labelled: Diamond Area I at 2716Dc, 17 August 1983, J. Irish. (MBOC)

1 male, labelled: SM H 45742, Tsaukhaib Mts. E. at 2615Da, 11 August 1983, J. Irish. (SM)

1 female, labelled: SM H 45747, Tsaukhaib Mts., 11 August 1983, E. Griffin. (SM)

4; 2 females, 2 males, labelled: SM H 45748, Kaukausib, 2 km E, 12 August 1983, J. Irish. (SM)

6; 2 females, 4 males, labelled: SM H 45755, Lüderitz, 22/23 August 1983, E. Griffin. (SM)

Additional material examined (not designated types due to damage or immaturity): 79 specimens; 31 females, 31 males, 17 unsexed. 69 (SM); 10 (ZSZM).

LOCALITIES

Agate Beach; Aurus; Boesmanberg; Daberas dunes at 2816Ba; Diamond Area I at 2615Dc; Diamond Area I at 2716Ac; Diamond Area I at 2716Dc; Dreizackberg, 2 km N; Grillenthal; Grillenthal, 7 km N; Grillenthal, 10 km S; Grootderm, 13 km SSW; Grosse Bucht; Kaukausib, 2 km E; Klinghardts Mts. at 2715Bc (3); Klinghardts Mts. W at 2715Bc; Lüderitz; Namuskluft 88; Obib dunes at 2816Ba; Pockenbank 68; Rosh Pinah, 10 km NW; Süd Witpütz 31; Tsaukhaib Mts.: Tsaukhaib Mts. E at 2615Da; Tsaus dunes; Uguchab River at 2716Ca; Wolwekop.

DISTRIBUTION

Southwestern South West Africa and the far northwestern Cape Province (fig. 36).

HABITAT

Arid succulent shrubland. Mostly on sandy substrates, but occasionally on hard ground. Under shelter, usually stones, but also in sand or detritus under dune hummocks, under dry wood, dry dung or the prone shoots of Gryllum sp. (Neuradaceae). One was found in a tiny burrow under a stone on sand. Moves about on dunes at night. Sanddives.

DISCUSSION

Resembles C. pluriseta, which is the only other species with both similar overall abdominal setation and robust tibial setation, but differs in the presence of transverse bristlecombs on coxites IX.

The specimens of C. pluriseta from Lüderitzbucht, listed by Silvestri (1922), were examined (ZSZM) and found to belong to C. luederitzi. Due to ther bad condition, they were not designated as types. The paratypes of C. pluriseta from Lüderitz listed by Silvestri (1908) were also examined (ZMHU). Their bad condition rendered them indeterminate, but it is probable that they can also be referred to C. luederitzi.

Etymology: the name refers to Adolf Lüderitz, founder of the town of Lüderitz, where the species occurs.

Ctenolepisma (S.) subterebrans sp. nov.

DESCRIPTION

Body length of females up to 9 mm, of males up to 8 mm. Body shape fairly slender (fig. 53). Ground colour of body yellowish white. Hypodermal pigment absent. Scales dorsally yellowish brown, ventrally transparent; morphology as usual for genus. Macrosetae golden yellow, plumose.

Setation of head as usual for genus. Maxillary palp fairly short, slender (fig. 56). Distal segment of labial palp unilaterally dilated, up to 1,5 times wider than long in females and nymphs (fig. 54), up to 2 times wider than long in adult males (fig. 55); with five sensory papillae arranged in a single row. Eye black, composed of 13-14 ommatidia. Antennae with whorls of light-coloured setae.

Nape setated. Thoracic nota each with 8+8 lateral bristlecombs of 3-4 macrosetae each, as well as 1+1 posterolateral bristlecombs of 2-3 macrosetae each.

Urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 2+2 / 0 / 1+1 bristlecombs. Submedian bristlecombs of 3-4 macrosetae each, sublateral bristlecombs of 4-9 macrosetae each (the largest numbers occurring on urotergite I), and lateral bristlecombs of 3-5 macrosetae each. Urotergite X trapezoidal, width to length ratio 0,44, posterior margin straight, with a lateral marginal setal fringe and 1+1 bristlecombs of 4-5 macrosetae each (fig. 59).

Thoracic sterna shaped as in figs 60, 61, 62. Setation irregular, with bristlecombs parallel to edge of sternum and difficult to distinguish from marginal fringe. Prosternum (fig. 60) with 2+2 bristlecombs of 3-5 macrosetae each, mesosternum (fig. 61) with 2+2 bristlecombs of 3-4 macrosetae each, and metasternum (fig. 62) with 1-2 + 1-2 bristlecombs of 3-7 macrosetae each.

Successive posteriad pairs of legs lengthening, tibia III about 2 times longer than tibia I. Setation of legs robust, generally similar to that of _C. terebrans_ (figs 57, 58). Tarsi with two claws and an empodium.

Urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / - bristlecombs. Lateral bristlecombs of 5-7, median bristlecombs of 2-4 macrosetae each. Coxites IX subtriangular, narrower in the female than in the male, with a robust marginal setal fringe (figs 63, 64). Adults of both sexes, down to the smallest nymphs examined (at body length 3,5 mm) with one pair of styli only.

Ovipositor short, reaching to about the apices of styli IX, robust, shaft proximally with anteriorly directed setae, distally with laterally directed setae; apices of gonapophyses unsclerotised (fig. 63). Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions

		ave.	s.d.	max.	n
Body length,	female	7.83	0.97	9.00	9
" " ,	male	7.04	0.66	8.50	7
" " ,	both	7.48	0.94	9.00	16
Antennae,	female	0.70	0.07	0.77	2
" ,	male	0.66	0.07	0.73	2
" ,	both	0.68	0.07	0.77	4
Cerci,	female	0.62	0.09	0.69	3
" ,	male	No data available			
" ,	both	No data available			
Filum	female	0.68	0.13	0.85	3
terminale,	male	0.71	0.00	0.71	1
" ,	both	0.69	0.11	0.85	4

MATERIAL EXAMINED

Holotype, female, body length 9 mm, labelled: SM H 45384, Huab River at 20°37'S, 13°54'E, 27 October 1982, dug out of sand under hummock on dune, J. Irish. In alcohol. SM type-number T 008. (SM)

Allotype, male, body length 8,5 mm, labelled as holotype. In alcohol. (SM)

Paratypes: 75 specimens; 39 females, 23 males, 13 unsexed. All in alcohol.

3; 1 female, 2 males, labelled: SM H 45382, Zebrapomp, Kaross, 22 October 1982, J. Irish. (SM)

4; 2 females, 2 males, labelled: SM H 45383, Ozonjuitji M'bari, 22 October 1982, J. Irish. (SM)

4; 2 females, 2 unsexed, labeled: SM H 45385, Huab River valley at 2013Db, 26 October 1982, J. Irish. (SM)

1 female, labelled: SM H 45386, Leeukamp, 22 October 1982, J. Irish. (SM)

5; 2 females, 2 males, 1 unsexed, labelled: SM H 45388, Luiperdskop, 23 October 1982, J. Irish. (SM)

2 females, labelled: SM H 45392, Alkmar 512, 2 March 1982, J. Irish. (SM)

40; 23 females, 11 males, 6 unsexed, labelled: SM H 45669, Okumutati, 19 February 1985, J. Irish/H. Rust. (SM)

6; 1 female, 1 male, 4 unsexed, labelled: SM H 45670, Khowarib Schlucht, 26 February 1985, J. Irish/H. Rust. (SM)

1 female, labelled: SM H 45671, 6 km NE Orumana, 20 February 1985, J. Irish. (SM)

1 male, labelled: SM H 45734, SE Ovamboland at 1816Bd, 10 June 1985, J. Irish. (SM)

7; 3 females, 4 males, labelled: SM H 45752, Andonivlakte S at 1816Db, 8 June 1985, J. Irish. (SM)

1 female, labelled: Welkom 680, 30 October 1985, J. Irish. (MBOC)

Additional material examined (not designated types due to damage or immaturity): 5 specimens; 3 females, 2 unsexed. (SM)

LOCALITIES

Alkmar 512; Andonivlakte S at 1816Db; Huab River at 2013Db; Huab River valley at 2013Db; Kamandjab, 10 km N; Khowarib Schlucht; Leeukamp; Luiperdskop; Okumutati; Olifantsrus; Orumana, 6 km NE; Ozonjuitji M'bari; SE Ovamboland at 1816Bd; Tsumkwe, 40 km NW; Welkom 680; Zebrapomp, Kaross.

DISTRIBUTION

Northern South West Africa (fig. 36).

HABITAT

Savanna woodland to desert, on vegetated red sandy substrates, whether soft or consolidated. Found under shelter on such sand, e.g. dry dung, rocks or (in the Huab valley) dune hummocks. Sanddives.

DISCUSSION

The only other Ctenolepisma species with both similar overall abdominal setation and as robust tibial setation as C. subterebrans are C. terebrans, C. ossilitoralis and C. namibensis. C. subterebrans may be distinguished from C. namibensis by the lack of bristlecombs on coxites IX, and from C. ossilitoralis by the differently shaped tenth urotergite. Adult C. subterebrans may be distinguished from the very similar C. terebrans by their smaller size, one pair of styli only, and the lack of sclerotisation of the female posterior gonapophyses; nymphs are difficult to distinguish, but may be placed by referring to associated adults or to the locality (the two species are sympatric only in the northern Kalahari).

Etymology: from Latin _sub_ (_i_._a_. close to) and _terebrans_ (from _C_. _terebrans_ Silvestri), referring to the present species' close resemblance to _C_. _terebrans_.

LINEAGE _detritus_

Includes six new species with a mainly northern Namib distribution, all characterised by two or more of the following characters, which are usually associated with psammophily: shortened ovipositors, robust tibial setation, shortened urotergites X, general multiplication of bristlecombs, and mostly with one pair of styli only.

Ctenolepisma (_S_.) _detritus_ sp. nov.

DESCRIPTION

Body length of females up to 8 mm, of males up to 7,5 mm. Body shape slender. Ground colour of body dirty yellowish white, with faint brownish hypodermal pigment fairly generally distributed but especially distinct on the antennae, palpi, styli and the outer margins of the femorae. Scales dorsally brown to dark yellowish brown, ventrally transparent; morphology as usual for genus. Macrosetae golden yellow, plumose.

Setation of head as usual for genus. Maxillary palp rather short. Distal segment of labial palp unilaterally dilated, up to 1,5 times wider than long in adult females (fig. 71), and up to 1,75 times in adult males (fig. 70); with five sensory papillae arranged in a single row. Eye black, composed of 11-12 ommatidia. Antennae with whorls of light-coloured setae.

Nape setated. Thoracic nota each with 6-8 + 6-8 lateral bristlecombs of 2-4 (usually 3) macrosetae each, as well as 1+1 posterolateral bristlecombs of 3-7 macrosetae each.

Urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 0 / 1+1 bristlecombs, all of 4-8 macrosetae each. Urotergite X trapezoidal, very short, width to length ratio 0,23, posteriorly slightly emarginate, with a lateral marginal setal fringe and 1+1 bristlecombs of 5-6 macrosetae each (fig. 68).

Thoracic sterna shaped as figs 65-67, 73-75. Prosternum (figs 65, 73) with 2-3 + 2-3 bristlecombs of 5-14 macrosetae each, as well as a few subapical macrosetae. Mesosternum (figs 66, 74) with 1-2 + 1-2 bristlecombs of 6-12 macrosetae each, as well as a few subapical macrosetae. Metasternum (figs 67, 75) with 1-2 + 1-2 bristlecombs of 8-17 macrosetae each.

Successive posteriad pairs of legs lengthening moderately, tibia III about 1,75 times length of tibia I. Legs sparsely spined, each tibia with 3-4 ventral spines. Tarsi with two claws and an empodium.

Urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / - bristlecombs. Lateral bristlecombs of 10-14 macrosetae each, but only 6-8 on coxites VIII. Median bristlecombs of 9 (posteriorly) to 24 (anteriorly) macrosetae each. Coxites IX with inner processes subtriangular, with a marginal setal fringe (figs 69, 72). Adults of both sexes with two pairs of styli, the second pair very slow to appear, in the case of the female only at about body length 8 mm, so that the majority of specimens examined will have one pair of styli only.

Ovipositor short, reaching past the apices of styli IX by nearly the latter's length, robust, the setae on the shaft directed laterally (fig. 69) and the apices of the posterior gonapophyses sclerotised (fig. 76). Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

In general, individuals from the northern part of the species' range (Rössing area) have higher numbers of macrosetae in all bristlecombs than individuals from the south (Meob-Conception area).

Proportions

		ave.	s.d.	max.	n
Body length,	female	7.14	0.79	8.00	7
" " ,	male	6.56	0.53	7.50	8
" " ,	both	6.83	0.72	8.00	15
Antennae,	female	0.53	0.02	0.56	3
" ,	male	0.59	0.09	0.68	4
" ,	both	0.56	0.07	0.68	7
Cerci,	female	0.49	0.14	0.71	4
" ,	male	0.51	0.10	0.67	4
" ,	both	0.50	0.12	0.71	8
Filum	female	0.61	0.07	0.71	4
terminale,	male	0.60	0.16	0.83	4
" ,	both	0.61	0.13	0.83	8

MATERIAL EXAMINED

Holotype, female, body length 8 mm, labelled: SM H 45650, Diamond Area II at 24°15'S, 14°37'E, 20 May 1984, J. Irish. In alcohol. SM type-number T 011. (SM)

Paratypes: 14 specimens; 6 females, 8 males. All in alcohol

3; 1 female, 2 males, labelled: SM H 45649, Vogelfederberg, 3 April 1983, J. Irish. (SM)

1 female, labelled: SM H 45651, Diamond Area II at 24° 03'S, 14°37'E, 18 May 1984, J. Irish. (SM)

1 female, labelled: SM H 45673, Swakopmund district at 22° 36'S, 14°54'E, 29 August 1984, J. Irish. (SM)

1 female, labelled: SM H 45675, Swakopmund district at 22° 34'S, 14°52'E, 1 August 1984, J. Irish. (SM)

1 female, labelled: SM H 45676, rest as preceding sample. (SM)

3 males, labelled: SM H 45677, Swakopmund district at 22° 34'S, 14°52'E, 1 August 1984, H. Liessner. (SM)

4; 1 female, 3 males, labelled: SM H 45678, Swakopmund district at 22°29'S, 14°52'E, 1 August 1984, J. Irish. (SM)

Additional material examined (not designated types due to damage or immaturity): 3 specimens; 2 female, 1 male. (SM)

LOCALITIES

Diamond Area II at 2414Ba; Diamond Area II at 2414Bc; Fischersbrunn; Swakopmund district at 2214Bd (1); Swakopmund district at 2214Bd (2); Swakopmund district at 2214Db (1); Swakopmund district at 2214Db (2); Vogelfederberg.

DISTRIBUTION

Central Namib Desert, up to 60 km inland (fig. 36).

HABITAT

Desert, gravelly to sandy substrates. Primarily under dry vegetable detritus wherever it occurs.

DISCUSSION

All other Ctenolepisma species with similar overall abdominal setation do not have as short a tenth urotergite as C. detritus, except for C. desaegeri, which has a fairly short tenth urotergite. The latter species has only been recorded from central Africa and differs from C. detritus in a number of important characters, notably its unsclerotised female posterior gonapophyses.

Etymology: from L. detritus, referring to the species' preferred habitat.

Ctenolepisma (S.) occidentalis sp. nov.

DESCRIPTION

Body length of females up to 12 mm, of males up to 11 mm. Body shape slender. Ground colour of body yellowish white. Hypodermal pigment absent. Scales dorsally light yellowish brown, ventrally transparent; morphology as usual for genus. Macrosetae golden yellow, plumose.

Setation of head as usual for genus. Maxillary palp rather long. Distal segment of labial palp unilaterally dilated, 1,5 to 1,75 times wider than long in both sexes; with five sensory papillae arranged in a single row (fig. 81). Eye black, composed of 12 ommatidia. Antennae with whorls of light-coloured setae.

Nape setated. Thoracic nota each with 6-8 + 6-8 lateral bristlecombs of 2 (anteriorly) to 5 (posteriorly), usually 3, macrosetae each, as well as 1+1 posterolateral bristlecombs of 4 macrosetae each.

Urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 0 / 1+1 bristlecombs. Submedian and lateral bristlecombs of 4-5, rarely 6, macrosetae each, and sublateral bristlecombs of 6-10 macrosetae each. Urotergite X trapezoidal, width to length ratio 0,60, posteriorly straight, with a lateral marginal setal fringe and 1+1 bristlecombs of 6-7 macrosetae each (fig. 83).

Thoracic sterna shaped as in figs 77, 78, 79; with setation very irregular and as a rule asymmetrical (refer to figures, which were all done from the holotype). Prosternum (fig. 77) with 4-5 + 4-5, mesosternum (fig. 78) with 3-4 + 3-4, and metasternum (fig. 79) with 2-4 + 2-4 bristlecombs each. Bristlecombs of 3-13 macrosetae each, the smaller bristlecombs occurring distally.

Successive posteriad pairs of legs lengthening; tibia III about 2 times longer than tibia I. Tibial setation robust (fig. 82). Tarsi with two claws and an empodium.

Urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / - bristlecombs. Lateral bristlecombs of 12-16 macrosetae each, but only 8-10 on coxites VIII. Median bristlecombs of 15 (posteriorly) to 39 (anteriorly) macrosetae each. Coxites IX with inner processes subtriangular, wider in the male than in the female; with a robust marginal setal fringe (figs 80, 84). Adults of both sexes with two pairs of styli.

Ovipositor short, reaching just past the apices of styli IX, robust, apically dilated (fig. 80); apices of posterior gonapophyses with small, rounded, cup-shaped hyaline sclerotisations (fig. 85). Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions

		ave.	s.d.	max.	n
Body length,	female	12.00	0.00	12.00	1
" " ,	male	10.50	0.71	11.00	3
" " ,	both	10.90	0.89	12.00	4
Antennae,	female	0.42	0.00	0.42	1
" ,	male	0.61	0.04	0.64	3
" ,	both	0.56	0.09	0.64	4
Cerci,	female	0.50	0.00	0.50	1
" ,	male	No data available			
" ,	both	No data available			
Filum terminale		No data available			

MATERIAL EXAMINED

Holotype, female, body length 12 mm, labelled: SM H 45661, Upper Panner Gorge, 22° 29'S, 15° 01'E, 31 July 1984, E. Griffin. In alcohol. SM type-number T 018. (SM)

Allotype, male, body length 11 mm, labelled: SM H 45664, 22° 36'S, 14° 54'E, 29 August 1984, under stone, H. Liessner. In alcohol. (SM)

Paratype, male, labelled: SM H 45662, 6 km N Arandis, 31 July 1984, J. Irish. (SM)

Additional material examined (not designated a type due to damage): 1 male (SM).

LOCALITIES

Arandis, 6 km N; Lower Ostrich Gorge; Swakopmund district at 2214Db (1); Upper Panner Gorge.

DISTRIBUTION

Known only from a limited area in the central Namib desert (fig. 25).

HABITAT

Desert. Under stones.

DISCUSSION

Nearest to C. ugabensis sp. nov., differing by the characters given in the key. Differs from other species with a similar overall abdominal setation by the combination of sclerotised female posterior gonapophyses, length of urotergite X, and prosternal setation.

Etymology: from Latin, occidentalis (west) referring to its westerly distribution in southern Africa.

Ctenolepisma (S.) ugabensis sp. nov

DESCRIPTION

Body length of females up to 9,5 mm, of males up to 8 mm. Body shape slender. Ground colour of body yellowish white. Hypodermal pigment absent. Scales dorsally uniformly light yellowish brown, ventrally transparent; morphology as usual for genus. Macrosetae yellowish brown, plumose.

Setation of head as usual for genus. Maxillary palp short. Distal segment of labial palp unilaterally dilated, in female small, up to 1,25 times wider than long only, in males up to 1,75 times wider than long; with five sensory papillae arranged in a single row (fig. 93). Eye black, composed of 12 ommatidia. Antennae with whorls of light-coloured setae.

Nape setated. Thoracic nota each with a lateral marginal setal fringe and 1+1 posterolateral bristlecombs of 2-4 macrosetae each, the latter situated very laterally; as well as 7-8 + 7-8 lateral bristlecombs of 3-5 macrosetae each.

Urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 0 / 1+1 bristlecombs. Submedian bristlecombs of 3-4, lateral bristlecombs of 4-5 and sublateral bristlecombs of 6-7 macrosetae each. Urotergite X trapezoidal, fairly short, width to length ratio 0,43, posteriorly straight, with a lateral marginal setal fringe and 1+1 bristlecombs of 7 macrosetae each (fig. 89).

Thoracic sterna shaped as in figs 86, 87, 88; with setation very irregular and often asymmetrical, refer figures, which were all done from the holotype. Prosternum (fig. 86) with 5-6 + 5-6, mesosternum (fig. 87) with 3-4 + 3-4 and metasternum (fig. 88) with 2-3 + 2-3 bristlecombs of varying numbers of macrosetae each.

Successive posteriad pairs of legs lengthening, tibia III about 2,5 times longer than tibia I. Legs, especially tibiae, strongly spined (fig. 91). Tarsi with two claws and an empodium.

Urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / - bristlecombs, all of 6-10 macrosetae each. Coxites IX with inner processes subtriangular, with a robust marginal setal fringe (fig. 92). Adults of both sexes with one pair of styli only, present in nymphs down to at least 4,5 mm body length.

Ovipositor short, reaching to about the apices of coxites IX; apices of posterior gonapophyses rounded, hyaline but unsclerotised (fig. 90). Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions

		ave.	s.d.	max.	n
Body length,	female	7.75	1.75	9.50	2
" " ,	male	8.00	0.00	8.00	1
" " ,	both	7.83	1.43	9.50	3
Antennae,	female	0.68	0.00	0.68	1
" ,	male	0.75	0.00	0.75	1
" ,	both	0.72	0.04	0.75	2
Cerci,	female	0.79	0.05	0.83	2
" ,	male	0.78	0.00	0.78	1
" ,	both	0.78	0.04	0.83	3
Filum	female	1.00	0.00	1.00	1
terminale,	male	No data available			
" ,	both	No data available			

MATERIAL EXAMINED

Holotype, female, body length 9,5 mm, labelled: SM H 45514, Ugab River at 20°58'S, 14°13'E, 29 October 1982, pitfall trap in windblown sand on hill along river, J. Irish. In alcohol. SM type-number T 015. (SM)

Allotype, male, body length 8 mm, labelled as holotype. In alcohol. (SM)

Paratypes: 2 specimens; 1 female, 1 unsexed, labelled: SM H 45515, Vegkop 528, 30 October 1982, J. Irish. In alcohol. (SM)

LOCALITIES

Ugab River at 2014Cc; Vegkop 528.

DISTRIBUTION

Lower Ugab valley, northwestern South West Africa (fig. 25).

HABITAT

Desert to semi-desert, very sandy substrates. Under detritus on sand.

DISCUSSION

No other species with a similar overall abdominal setation also has a similar combination of thoracic sternal and tibial setation.

Etymology: the name refers to the Ugab River, in the valley of which the species is found.

Ctenolepisma (_S._) _namibensis_ sp. nov.

DESCRIPTION

Body length of females up to 7 mm, of males up to 6 mm. Body shape fairly squat (fig. 94). Ground colour of body yellowish white. Faint brownish hypodermal pigment present on distal antennal flagellum, palpi, posterior abdomen, styli and caudal appendages. Scales dorsally yellowish brown with a golden tinge, slightly darker on the posterior margins of the thoracic nota and urotergites, much darker towards the lateral sides of the body, forming two dark longitudinal lines immediately medial to the lateral thoracic and urotergal bristlecombs (fig. 94), but this pattern is easily lost with rough handling; scales ventrally transparent; morphology as usual for genus. Macrosetae golden yellow, plumose.

Setation of head as usual for genus. Mandibles bulging, visible in dorsal aspect. Frons slightly bulging. Maxillary palp with individual articles rather short (fig. 96). Distal segment of labial palp unilaterally dilated, small, rounded (fig. 95), about 1,25 times wider than long in adult females and young males, up to 1,75 times wider than long in adult males; with two small sensory papillae. Eye black, composed of 12 ommatidia, smallish. Antennae with whorls of light-coloured setae.

Nape setated. Thoracic nota lacking posterolateral bristlecombs (fig. 103). Pronotum with 5+5, mesonotum with 6+6 and metanotum with 7+7 lateral submarginal bristlecombs of 3-5 macrosetae each.

Urotergal setation: 2+2 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 2+2 / 0 / 1+1 bristlecombs. Submedian and lateral bristlecombs of 2-6 macrosetae each; sublateral bristlecombs of 3-5 macrosetae each on urotergites II-VIII, but up to 9 on urotergite I (fig. 103). Urotergite X trapezoidal, short, width to length ratio 0,33, posterior margin variable: from slightly rounded, through straight to slightly emarginate, with a lateral marginal setal fringe and 1+1 bristlecombs of 3-4 macrosetae each (fig. 101).

Thoracic sterna shaped as in figs 97, 98, 99; setation very irregular and often asymmetrical. Prosternum with 5+5 (in one case 3+5) bristlecombs of from 3 macrosetae each (apically) to 12 macrosetae each (proximally) (fig. 97); mesosternum with 2-3 + 2-3 bristlecombs of 4-7 macrosetae each (fig. 98); metasternum with 2+2 bristlecombs of 6-8 macrosetae each (fig. 99).

Successive posteriad pairs of legs lengthening strongly; tibia III about 2,5 times longer than tibia I. Setation of legs very robust (figs 104, 105), especially the apical tibial spines on the first legs. Tarsi with two claws and an empodium, though the latter is often small and difficult to discern.

Urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / + bristlecombs. Lateral bristlecombs of 3-8, median bristlecombs of 3-6 macrosetae each. Coxites IX with inner processes subtriangular, apically rounded, but more so in the male than in the female (figs 100, 102); with 1+1 large oblique bristlecombs of 5-6 macrosetae each, and above and below them single setae sometimes also arranged in small bristlecombs (the figures show commonly occurring setal arrangements). Inner processes also with a dense marginal setal fringe; outer processes with 1+1 bristlecombs of 3-4 macrosetae each, far removed from the posterior margin. Both sexes, down to nymphs of 3,5 mm body length, with one pair of styli only.

Ovipositor short, seldom reaching beyond the bases of styli IX, conical; tips of gonapopyses rounded, unsclerotised (fig. 102). Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions

		ave.	s.d.	max.	n
Body length,	female	5.42	0.72	7.0	16
" " ,	male	4.65	0.58	6.0	21
" " ,	both	4.99	0.75	7.0	37
Antennae,	female	0.47	0.05	0.55	6
" ,	male	0.56	0.12	0.75	14
" ,	both	0.53	0.11	0.75	20
Cerci,	female	0.27	0.06	0.39	10
" ,	male	0.33	0.06	0.41	12
" ,	both	0.31	0.06	0.41	21
Filum	female	0.43	0.04	0.50	8
terminale,	male	0.54	0.07	0.61	11
" ,	both	0.49	0.08	0.61	19

MATERIAL EXAMINED

Holotype, female, body length 7 mm, labelled: SM H 45395, 25 km ENE Hentiesbaai, 22°03'S, 14°27'E, 15 December 1981, dug out of sand under dune hummock on gravel plain, J. Irish. In alcohol. SM type-number T 006. (SM)

Allotype, male, body length 5 mm, labelled: SM H 45401, Unjab River at 20°10'S, 13°16'E, 5-6 August 1982, dug out of sand under narra plants on dune, M.-L. Penrith. (SM)

Paratypes: 41 specimens; 15 females, 20 males, 6 nymphs. All in alcohol.

1 female, labelled: SM H 45396, Ugab River gate, 13 December 1982, J. Irish. (SM)

10; 2 females, 4 males, 4 nymphs, labelled: SM H 45406, rest as preceding sample. (SM)

11; 6 females, 3 males, 2 nymphs, labelled: SM H 45397, Huab River, 5 km from mouth, 22 January 1982, J. Irish. (SM)

7; 1 female, 6 males, labelled: SM H 45403, Khumib River, ca. 15 km from mouth, 21 January 1981, J. Irish. (SM)

2; 1 female, 1 male, labelled: SM H 45399, Ugab River mouth, 28 March 1982, J. Irish. (SM)

5; 2 females, 3 males, labelled: SM H 45400, Hoanib River mouth, 23 January 1982, J. Irish. (SM)

1 female, labelled: SM H 45405, Samanab River at 2013Ab, 2-4 August 1982, M.-L. Penrith. (SM)

3 males, labelled: SM H 45644, Rössing Mts. E at 2214Bd (1), 1 August 1984, H. Liessner. (SM)

1 female, labelled: SM H 45666, Rössing Mts. E at 2214Bd (2), 1 August 1984, J. Irish. (SM)

Additional material examined (not designated types due to damage or immaturity): 8 specimens; 2 females, 4 males, 2 nymphs. All (SM).

LOCALITIES

Arandis, 6 km N; Hentiesbaai, 25 km ENE; Hoanib River mouth; Hoarusib River, 9 km from mouth; Huab River, 5 km from mouth; Khumib River, ca. 15 km from mouth; Rössing Mts. E at 2214Bd (1); Rössing Mts. E at 2214Bd (2); Rössing Mts. SE at 2214Db; Samanab River at 2013Ab; Ugab River gate; Ugab River mouth; Unjab River at 2013Ab.

DISTRIBUTION

Northern Namib desert, between Swakop and Khumib Rivers, up to 40 km inland (fig. 26).

HABITAT

Desert. Prefers flat, sandy, vegetated areas. Mostly found under driftwood in dry riverbeds or less commonly on beaches. Also found in sand under dune hummocks on gravel plains, at dune bases, or in riverbeds. One specimen from under a stone on a sand-covered hill.

DISCUSSION

No other species has a similar overall abdominal setation. Bears a close resemblance to _C. spinipes_ sp. nov., with which it also shares the possession of only two sensory papillae on the distal segment of the labial palp.

Etymology: From "Namib", the coastal desert of South West Africa.

Ctenolepisma (_S._) _ossilitoralis_ sp. nov.

DESCRIPTION

Body length of both sexes up to 7 mm. Body shape fairly slender (fig. 106). Ground colour of body yellowish white to white. Faint but distinct hypodermal pigment present or absent; when present, at most on antennae, palpi, legs, posterior abdomen, styli and caudal appendages. Scales dorsally yellowish brown with a golden tinge, darker laterally, ventrally transparent; morphology as usual for genus. Macrosetae golden yellow, plumose.

Setation of head as usual for genus. Maxillary palp rather short, with individual segments plump (fig. 110). Distal segment of the labial palp unilaterally dilated, about 1,5 times wider than long, with five sensory papillae arranged in a single row (fig. 111). Eye black, composed of 12 ommatidia. Antennae with whorls of light-coloured setae.

Nape setated. Thoracic nota each with a lateral marginal setal fringe and 1+1 posterolateral bristlecombs of 2 macrosetae each. Pronotum with 5+5, mesonotum with 7+7, and metanotum with 6+6 lateral bristlecombs of 2-4 macrosetae each.

Urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 2+2 / 0 / 1+1 bristlecombs. Submedian and lateral bristlecombs of 4-5, sublateral bristlecombs of 3-5 macrosetae each. Urotergite X trapezoidal, rather short, width to length ratio 0,29, posteriorly distinctly emarginate, with a lateral marginal setal fringe and 1+1 bristlecombs of five macrosetae each (fig. 116).

Thoracic sterna shaped as in figs 107, 108, 109; setation rather irregular, often asymmetrical. Prosternum (fig. 107) with 3-4 + 3-4 bristlecombs of 3-6 macrosetae each, mesosternum (fig. 108) with 2-3 + 2-3 bristlecombs of 4-8 macrosetae each, and metasternum (fig. 109) with 2+2 bristlecombs of 5-7 macrosetae each.

Successive posteriad pairs of legs lengthening strongly, tibia III about 2 times longer than tibia I. Tibial setation especially robust (figs 112, 113). Tarsi with two claws and an empodium.

Urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / - bristlecombs. Lateral bristlecombs of 3-4 (sometimes 5 on posterior urosternites), and median bristlecombs of 3-4 macrosetae each. Coxites IX with inner processes subtriangular, wider in male than in female (figs

114, 115), with a robust marginal setal fringe; outer processes with 1+1 small bristlecombs of 3-4 macrosetae each. Adults of both sexes with one pair of styli only; styli absent in nymphs below about 3 mm body length.

Ovipositor fairly short, reaching beyond the apices of styli IX by about the latter's length, robust, apically thickened (fig. 114); apices of gonapophyses unsclerotised. Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions

		ave.	s.d.	max.	n
Body length,	female	6.09	0.82	7.00	23
" " ,	male	5.56	0.81	7.00	18
" " ,	both	5.85	0.86	7.00	41
Antennae,	female	0.52	0.11	0.75	12
" ,	male	0.57	0.06	0.67	9
" ,	both	0.54	0.10	0.75	21
Cerci,	female	0.42	0.04	0.50	13
" ,	male	0.43	0.06	0.50	8
" ,	both	0.42	0.05	0.50	21
Filum	female	0.50	0.06	0.62	12
terminale,	male	0.50	0.07	0.64	7
" ,	both	0.50	0.07	0.64	19

MATERIAL EXAMINED

Holotype, female, body length 7 mm, labelled: SM H 45020, Möwe Bay, 19°22'S, 12°42'E, 28 March 1982, under stone, J. Irish. In alcohol. SM type-number T 007. (SM)

Allotype, male, body length 5 mm, labelled: SM H 45022, Bosluisbaai, 17° 23', 11° 45'E, 2 February 1982, pitfall trap among Salsola clumps, J. Irish. In alcohol. (SM)

Paratypes: 43 specimens; 22 females, 21 males. All in alcohol.

2; 1 female, 1 male, labelled: SM H 45017, Hoanib Oasis, 6 February 1982, J. Irish. (SM)

12; 5 females, 7 males, labelled: SM H 45018, Hoanib River mouth, 23 January 1982, J. Irish. (SM)

2 females, labelled: SM H 45019, 8 km E Möwe Bay, 20 January 1981, J. Irish. (SM)

2; 1 female, 1 male, labelled: SM H 45021, rest as holotype. (SM)

4; 3 females, 1 male, labelled: Bosluisbaai, 30 January 1982, J. Irish. (AMNH)

2; 1 female, 1 male, labelled: SM H 45023, Bosluisbaai, 30/31 January 1982, J. Irish. (SM)

3 females, labelled: SM H 45024, 7 km N Bosluisbaai, 2 February 1982, J. Irish. (SM)

1 female, labelled: SM H 45025, Kunene River mouth, 1 February 1982, J. Irish. (SM)

2 males, labelled: SM H 45026, rest as preceding sample. (SM)

9; 1 female, 8 males, labelled: SM H 45027, Kunene River, 3 km from mouth, 29 January 1982, J. Irish. (SM)

1 female, labelled: SM H 45028, rest as preceding sample. (SM)

1 female, labelled: SM H 45199, Uniab River delta at 2013Aa, 6 August 1982, M.-L. Penrith. (SM)

2 females, labelled: SM H 45411, Hoarusib River, 31

January 1982, P. Bridgeford. (SM)

LOCALITIES

Bosluisbaai; Bosluisbaai, 7 km N; Hoanib Oasis; Hoanib River mouth; Hoarusib River; Kunene River, 3 km from mouth; Kunene River mouth; Möwe Bay; Möwe Bay, 8 km E; Uniab River delta at 2013Aa.

DISTRIBUTION

Coastal northern Namib, north of the Uniab River, up to 8 km inland (fig. 117).

HABITAT

Desert coast, sandy substrates. Mainly in sand under littoral dune hummocks, ranging inland along riverbeds. Occasionally under other shelter, e.g. driftwood in riverbeds (but not on beaches, see C. arenicola) or stones.

DISCUSSION

The only other Ctenolepisma species with both similar overall abdominal setation and one pair of styli only in adults, are C. subterebrans sp. nov. and the extralimital C. sanctaehelenae. Both the latter differ from C. ossilitoralis in having longer tenth urotergites which are not posteriorly emarginate, as well as different tibial setations.

Etymology: From Latin ossium (bone) and litoralis (of the coast), referring to the Skeleton Coast, where the species occurs.

Ctenolepisma (*S.*) *penrithae* sp. nov.

DESCRIPTION

Body length of females up to 7 mm, of males up to 8 mm. Body shape fairly slender (fig. 118). Ground colour of body obscured by hypodermal pigment occurring generally, especially distinct on the palpi, legs and posterior abdomen. Scales dorsally brownish, appearing darker locally due to underlying hypodermal pigment, ventrally transparent; morphology as usual for genus. Intact scale cover unicolourous; rough handling and partial scale loss results in a brown speckled effect, with longitudinal lines through the bristlecombs (which protect scales in their immediate vicinity) emerging. Macrosetae brownish yellow to brown, plumose.

Setation of head as usual for genus. Maxillary palp as in fig. 121. Distal segment of labial palp unilaterally dilated, about 1,5 to 2 times wider than long in adult males (fig. 120), narrower in females (fig. 119); with five sensory papillae arranged in a single row. Eye black, composed of 13 ommatidia. Antennae with whorls of lightly pigmented (brownish) setae.

Nape setated. Thoracic nota each with 7-8 + 7-8 lateral bristlecombs of 2-4 macrosetae each, 1+1 posterolateral bristlecombs of 4-5 macrosetae each, and a lateral marginal setal fringe.

Urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 2+2 / 0 / 1+1 bristlecombs. Submedian bristlecombs of 3 (anteriorly) to 6 (posteriorly) macrosetae each, sublateral bristlecombs of 5-6 and lateral bristlecombs of 4-5 macrosetae each. All bristlecombs on urotergites II-V equidistant from each other (fig. 127). Urotergite X trapezoidal, rather short, width to length ratio 0,29, posterior margin slightly emarginate, with a lateral marginal setal fringe and 1+1 bristlecombs of 5-7 macrosetae each (fig. 126).

Thoracic sterna shaped as in figs 122, 123, 124. Prosternum (fig. 122) with 2-3 + 2-3 bristlecombs of 3-4 macrosetae each, mesosternum (fig. 123) with 2+2 bristlecombs of 3-6 macrosetae each, and metasternum (fig. 124) with 1-2 + 1-2 bristlecombs of 3-5 macrosetae each.

Successive posteriad pairs of legs lengthening, tibia III 1,5 to 2 times wider than long. Tibiae I-III respectively with 2-3, 3 and 4 strong ventral spines each (fig. 129). Tarsi with two claws and an empodium, the latter rather long.

Urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / - bristlecombs. Lateral bristlecombs of 7-9, median bristlecombs of 6-11 macrosetae each, the larger bristlecombs occurring anteriorly. Coxites IX subtriangular, apically rounded, with a robust marginal setal fringe (fig. 125). Adults of both sexes with two pairs of styli, acquiring the second pair at about body length 5-6 mm; the smallest nymphs examined, at body length 3 mm, still had one pair of styli.

Ovipositor shortish, reaching just past the apices of styli IX, robust and apically swollen; apices of gonapophyses unsclerotised (fig. 128). Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions

		ave.	s.d.	max.	n
Body length,	female	5.89	1.07	7.00	9
" " ,	male	5.39	1.15	8.00	14
" " ,	both	5.59	1.15	8.00	23
Antennae,	female	0.57	0.00	0.57	1
" ,	male	0.72	0.11	0.90	5
" ,	both	0.69	0.11	0.90	6
Cerci,	female	0.60	0.03	0.64	4
" ,	male	0.56	0.06	0.69	7
" ,	both	0.57	0.06	0.69	11
Filum	female	0.69	0.02	0.71	4
terminale,	male	0.64	0.10	0.80	4
" ,	both	0.66	0.07	0.80	8

MATERIAL EXAMINED

Holotype, female, body length 6,5 mm, labelled: SM H 45287, Ambrose Bay, 21°03'S, 13°33'E, 27 March 1982, under littoral dune hummock, J. Irish. In alcohol. SM type-number T 010. (SM)

Allotype, male, body length 8 mm, labelled: SM H 45282, 10 km NE Cape Cross, 21°44'S, 14°01'E, 12 December 1981, under plank, J. Irish. In alcohol. (SM).

Paratypes: 29 specimens; 8 females, 13 males, 8 unsexed. All in alcohol.

2; 1 male, 1 unsexed, labelled: SM H 45279, Groot Spitskop, 29 August 1982, J. Irish. (SM)

11; 7 females, 3 males, 1 unsexed, labelled: SM H 45280, 20 km NE Swakopmund, 11 December 1981, J. Irish. (SM)

7; 2 males, 5 unsexed, labelled: SM H 45281, 25 km ENE Hentiesbaai, 15 December 1981, J. Irish. (SM)

1 unsexed, labelled: SM H 45283, Messum River, 10 km from coast, 12 December 1981, J. Irish. (SM)

4 males, labelled: SM H 45284, rest as preceding sample. (SM)

2 males, labelled: SM H 45286, Nabab, 29 October 1982, J. Irish. (SM)

1 male, labelled: SM H 45289, Ogams, 30 January 1982, P. Bridgeford. (SM)

1 female, labelled: SM H 45290, Okau, 5 February 1982, J. Irish. (SM)

Additional material examined but not designated as types due to damage: 2 specimens; 1 female, 1 unsexed. (SM)

LOCALITIES

Ambrose Bay; Cape Cross, 10 km NE; Groot Spitskop; Hentiesbaai, 25 km ENE; Messum River, 10 km from coast; Nabab; Ogams; Okau; Swakopmund, 20 km NE; Ugab River gate.

DISTRIBUTION

Namib and Pro-Namib north of Swakop River, up to 60 km inland (fig. 117).

HABITAT

Desert and semi-desert, on fairly hard substrates. Prefers detritus-rich microhabitats, e.g. under patches of windblown detritus in depressions or under stones associated with lichen-fields or detritus-patches. Common in leaf-litter under Welwitschia mirabilis J.D. Hook (Welwitschiaceae). Occasionally under dry dung, dry wood or dune hummocks.

DISCUSSION

All other small *Ctenolepisma* species with similar overall abdominal setations found within the distribution area of *C. penrithae* have adults with one pair of styli only.

Etymology: Named after my friend and colleague, Dr. Mary-Louise Penrith, in appreciation for her support in this study. Dr. Penrith *i.a.* collected the specimen of *C. corvina* which provided a basis for distinguishing the latter from the present species.

LINEAGE *parcespinata*

Includes seven fairly slender-bodied species, all with long ovipositors, two pairs of styli, and fairly long tenth urotergites. Mainly western southern African in distribution, with one species possibly ranging north to East Africa. Most species petrophilous.

Ctenolepisma (*S.*) *prompta* Silvestri

Ctenolepisma prompta Silvestri, 1922: 77.
Ctenolepisma cf. *prompta* Silvestri : Mendes, 1982: 638.
Ctenolepisma petronia Wygodzinsky, 1955: 143. syn. nov.
Ctenolepisma cf. *petronia* Wygodzinsky : Wygodzinsky, 1965: 86.

C. prompta differs from *C. intercursa* only in the shape of the female posterior gonapophyses, which are rounded and unmodified in the former but acute and sclerotised in the latter species. In all other respects the redescription of *C. intercursa* which follows may also be used to identify *C.*

prompta. Though erronous with regard to the number of bristlecombs on urotergite I, the description and illustrations of C. petronia (Wygodzinsky, 1955) are accurate on all other aspects and may also be used. Adult females with two pairs of styli, acquiring the second pair at body length 7-8 mm.

Proportions (females only)

	ave.	s.d.	max.	n
Body length, female	8.50	1.80	12.50	35
Antennae, "	0.60	0.08	0.80	13
Cerci, "	0.57	0.08	0.70	15
Filum terminale, "	0.59	0.07	0.71	13

Males: see C. intercursa/prompta indet.

MATERIAL EXAMINED

Holotype, female, body length 8 mm, labelled: Ctenolepisma prompta Silv, Typi!, Windhuk, Dr. Michaelsen - 1911. In alcohol. (ZSZM)

Allotype, male, body length 7,5 mm, labelled as holotype (in same vial). (ZSZM)

Holotype (of C. petronia), male, body length 11 mm, labelled: S. Afr., Cape P., Landsvågen stax SW Lootsberg pass, c. 25 miles SW Middelburg, under steine, 19/10/ (sic!), Swedish South Africa Expedition 1950-51, Dr. Brinck - Dr. Rudebeck. In alcohol. (LUND)

Allotype (of C. petronia), female, body length indeterminate (broken), labelled as holotype. In alcohol. (LUND)

Paratypes (of C. petronia): 9 specimens; 4 females, 4 males, 1 unsexed. All in alcohol.

1 male, labelled: S. Afr., C.P., Upington, Orange River,

26.11.1950, Swedish South Africa Expedition 1950-51, Dr. Brinck - Dr. Rudebeck. (LUND)

6; 2 females, 3 males, 1 unsexed, labelled: S. Africa, Kakamas, på torr grusmark, 12.11.1950, Brinck - Rudebeck. (LUND)

1 female, labelled: S. Afr., Basutoland, Mt. Morosi, 7700 ft, Under sten på frapen, 18/3 51, Swedish South Africa Expedition 1950-51, Dr. Brinck - Dr. Rudebeck. (LUND)

1 female, labelled: Botha's Pass, Newcastle, Natal, B. Stuckenberg, VII/54. NM type-number 744. (NM)

Additional material: 91 specimens; 49 females, 42 associated males or unsexed specimens. (SM)

LOCALITIES

Literature. Silvestri (1922): Windhuk (type locality). (ZSZM, examined)

Wygodzinsky (1955), (_C._ _prompta_): Specimens indet., see under "DISCUSSION" below.

Wygodzinsky (1955), (_C._ _petronia_): Botha's Pass; Kakamas; Lootsberg; Mount Morosi; Upington. (LUND, NM, examined)

Wygodzinsky (1965) (_C._ cf. _petronia_): Massif du Ngorongoro. (MRAC, not examined)

Paclt (1966): Specimens referred to _C._ _intercursa/prompta_ indet., see there.

Mendes (1982): Barrow's Hope; Hartebeespoort Dam. (CRAC, not examined).

Present material: Chaudamas 33; Christiana; Far East dunes; Groot Spitskop; Karakapi-Daneib confluence; Moonlight; Ombirisu 684; Onganja East 190; Otjihangweberg; The Dunes 234; Victoria West; Wellwood; Welwesburg 191; Windhoek.

DISTRIBUTION

The eastern half of southern Africa, ranging west into central and northern South West Africa. Possibly north to Tanzania (fig. 130).

HABITAT

From semi-desert to humid montane habitats, absent from true desert. Primarily under stones, irrespective of substrate, but also under other shelter such as dry dung or leaves.

DISCUSSION

Nearest to _C. intercursa_, see there.

Examination of the types of _C. petronia_ showed them to have 2+2 bristlecombs on urotergite I, and not 1+1 as stated in the description. In all other respects they fall within the range of variation of _C. prompta_.

The material of _C. prompta_ listed by Wygodzinsky (1955) from Pofadder and vicinity (1 female, 1 unsexed, Pofadder; 1 male, 30 miles Ö Pofadder; LUND) was examined. The specimens do not belong to _C. prompta_, because they have only 1+1 bristlecombs on urotergite I. They are closest to _C. saxeta_ sp. nov., but the fact that their posterolateral thoracic notal bristlecombs are comprised of only 3-4 macrosetae each, excludes them from the latter species too. They possibly represent a further new species, but their imperfect condition does not allow me to base a new taxon on them.

Wygodzinsky's (1965) specimens from Tanzania were both males, _i.e._ could also belong to _C. intercursa_. They are here retained as _C. prompta_ mainly on distributional grounds. Wygodzinsky mentioned that his specimens were poorly preserved and that he was uncertain as to the correctness of his determination. It is therefore possible that they represent yet another (new) species, but because description of such on the basis of the existing poorly preserved all-male material would not be advisable, I have not taken further action in this regard.

The all-male material listed by Paclt (1966) has been referred to C. intercursa/prompta indet.

Mendes' (1982) reasons for being unsure whether his specimens indeed belonged to C. prompta have been resolved in the present study.

Ctenolepisma (S.) intercursa Silvestri

Ctenolepisma intercursa Silvestri, 1922: 80; Wygodzinsky, 1955: 142, 1970: 253.

REDESCRIPTION

The original description of C. intercursa fails to mention a number of important characters. The redescription which follows is based on the holotype and the (female) material listed below. The species was adequately illustrated by Silvestri (1922), and no illustrations are included here.

Body length of females up to 12 mm. Body shape slender. Ground colour of body yellowish white. Brownish hypodermal pigment present, varying in intensity and distribution; at least faintly and on the palpi, legs and posterior abdomen only, at most fairly heavy and general. Scales dorsally light to dark yellowish brown, ventrally light brownish to transparent; morphology as usual for genus.

Macrosetae brownish-yellow, plumose.

Setation of head as usual for genus. Maxillary palp stout, of moderate length. Distal segment of labial palp unilaterally dilated, up to 1,5 times wider than long in adult females; with five sensory papillae arranged in a single row. Eye black, composed of about 12 ommatidia. Antennae with whorls of light-coloured to lightly pigmented setae.

Nape setated. Thoracic nota each with 5-9 + 5-9 lateral bristlecombs of 2-3 macrosetae each, as well as 1+1 posterolateral bristlecombs of 3-6 macrosetae each.

Urotergal setation: 2+2 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 0 / 1+1 bristlecombs. Submedian and lateral bristlecombs of 5-8, sublateral bristlecombs of 7-10 macrosetae each. Urotergite X trapezoidal, width to length ratio 0,60, posteriorly straight to slightly emarginate, with a lateral marginal setal fringe and 1+1 bristlecombs of 5-7 macrosetae each.

Thoracic sterna subtriangular, apically rounded, widening on successive posterior segments. Prosternum with 2-3 + 2-3 bristlecombs of which the anterior pair is far removed from the posterior pair(s). Mesosternum with 2+2 and metasternum with 1-2 + 1-2 bristlecombs each. Number of macrosetae per bristlecomb 5-18, irregular.

Successive posteriad pairs of legs lengthening moderately, tibia III about 1,5 to 1,75 times longer than tibia I. Legs moderately spined. Tarsi with two claws and an empodium.

Urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 /

1+1+1 / 1+1 / - bristlecombs. Lateral bristlecombs of 10-17 macrosetae each, but only 6-8 on coxites VIII; median bristlecombs of 6-15 macrosetae each, numbers increasing anteriad. Coxites IX with inner processes subtriangular, narrower in female than in male, with a robust marginal setal fringe. Adult females with two pairs of styli, acquiring the second pair at body length 5-6 mm.

Ovipositor of varying length, reaching to anywhere between from the apices of coxites IX to beyond the apices of styli IX by twice the latter's length. Variation in ovipositor length apparently random, neither geographical nor age-related. Apices of posterior gonapophyses acute, sclerotised.

Caudal filaments setated as usual for genus.

Proportions

	ave.	s.d.	max.	n
Body length, female	8.88	1.50	12.00	91
Antennae, female	0.64	0.11	0.86	24
Cerci, female	0.59	0.09	0.75	18
Filum terminale, female	0.67	0.14	1.00	21

Males: see _C_. _intercursa_/_prompta_ indet.

MATERIAL EXAMINED

Holotype, female, body length 11,5 mm, labelled: _Ctenolepisma intercursa_ Silv., cotypi!, Hamb. dtsch-sw afr. Studienr. 1911, Windhuk, W. Michaelsen leg., 29.IV - 8.V.1911. In alcohol. (ZSZM)

Allotype, male, body length 9 mm, labelled as female (in same vial). (ZSZM)

Additional material: 203 specimens; 105 females, 80 associated males, 18 unsexed. 198 (SM); 2 (NCI); 2 (LUND); 1 (MBOC).

LOCALITIES

Literature. Silvestri (1922): Voigtsland; Windhuk (type locality); Woldaw (sic! = Waldau). (Windhuk-specimens in ZSZM, examined; other material (paratypes) not traced)

Wygodzinsky (1955): De Aar (LUND, not examined); Steenkamp Puts (LUND, examined).

Wygodzinsky (1970): Brandvlei, 3 miles ex, towards Kenhardt (?AMNH, not examined; Kenhardt, 55 miles ex, towards Pofadder (?AMNH, not examined); Kenhardt, 85 miles ex, towards Pofadder (NCI, examined).

Present material: Arutal 25; Aus Townlands 36; Beaufort West, 30 miles ex towards Willowmore; Berseba, 3 km S; Brukkaros; Chowagasberg, 10 km NW; Diamond Area I at 2716Ac; Dickdorn 98; Donkermodder 60; Far East dunes; Gamsberg; Göllschau 20; Gurumanas Wes 241; Haris 367; Hauchab Mt.; Kaukausib fountain; Klinghardts Mts.W at 2715Bc; Klipneus; Namib Desert Park at 2315Bc; Namuskluftberg; Okaruheke Wes 45; Ombirisu 684; Oranjemund; Otjihangweberg; Tiras 39; Volstruiswerf 513; Windhoek.

DISTRIBUTION

Central and southern South West Africa and the interior of the Cape Province (fig. 130).

HABITAT

Arid areas, from desert and semi-desert to dry savanna. Primarily under stones, on both rocky and sandy substrates, but also utilises other shelter, e.g. dry wood, dry dung or dry grassclumps. At the Orange River mouth *C. intercursa* is abundant under driftwood on the beach, a niche occupied by *C. arenicola* further north. Occasionally enters human habitation, and once found on the seventh floor of a building in central Windhoek, but of no economic importance. Though not an obligate nidicole, it may enter termite nests and Wygodzinsky (1970) lists specimens from nests of *Microhodotermes viator* (Latreille) (Hodotermitidae) and *Psammotermes allocerus* Silvestri (Rhinotermitidae). Occasionally exhibits diurnal activity.

DISCUSSION

The only other species with a similar overall abdominal setation is *C. prompta*. Females may be distinguished by their differently structured posterior gonapophyses, but males are indistinguishable (see *C. intercursa/prompta* indet.).

Ctenolepisma (*S.*) *intercursa/prompta* indet.

Ctenolepisma prompta Silvestri : Paclt, 1966: 154.

Males, immature females and adult females with broken ovipositors of *C. intercursa* and *C. prompta* are indistinguishable. All samples consisting exclusively of such material are therefore indeterminate, and such samples (mostly males) are listed here.

Body length of adult males up to 12 mm. Distal segment of labial palp in adult males unilaterally dilated, up to 2,5 times wider than long. Most males, up to the largest recorded, have one pair of styli only, but single males of body length above 9 mm are sometimes found with two pairs of styli. Penis as usual for genus, parameres absent.

Proportions

		ave.	s.d.	max.	n
Body length,	male	7.79	1.64	12.00	36
Antennae,	"	0.68	0.16	1.00	10
Cerci,	"	0.52	0.12	0.67	7
Filum terminale,	"	0.58	0.11	0.74	7

MATERIAL EXAMINED

In addition to males associated with females of *C. intercursa* or *C. prompta*, and which were listed under those species, the following were examined:

57 specimens; 7 females, 43 males, 7 unsexed. 53 (SM); 3 (NCI); 1 (TM).

LOCALITIES

Literature. Paclt (1966): Sandfeld südlich des Waterberges; Windhoek. Treated as indeterminate because samples are all-male. (ZSZM, not examined)

Present material, (only localities not already listed under *C. intercursa* or *C. prompta*): Agub Mt.SW; Chowagasberg, 15 km NW; Excelsior 286; Gavaams 6; Gemsbokvlakte; Gocheganas 26; Griekwastad, 34 miles *ex* towards Kimberley; Grillenthal, 7 km N; Hopefield 18; Keetmanshoop, 10 km SE; Kranzberg 59; Namus Mts.at 2716Dd; Pass S Tsondab flats; Pockenbank 68; Prince Albert, 4 miles *ex* towards Fraserburg; Rostock 393; Sebrapan; Swartbaas Ost 285; Tsaukhaib Mts; Verneukpan at 2921Cc; Vryburg, 10 km WSW.

DISTRIBUTION (fig. 130) and HABITAT

As for *C. intercursa* and *C. prompta* combined.

DISCUSSION

Though males of these two species are strictly indistinguishable, they may usually be placed by referring to associated females, or to the locality: while their distribution areas do overlap, for large parts of southern Africa only one or the other species normally occurs.

Ctenolepisma (*S.*) *saxeta* sp. nov.

DESCRIPTION

Body length of both sexes up to 9 mm. Body shape slender. Ground colour of body yellowish white. Brownish hypodermal pigment present on the distal antennal flagellum, palpi, femorae and tibiae. Scales dorsally uniformly light brownish, ventrally transparent; morphology as usual for genus. Macrosetae golden yellow, plumose.

Setation of head as usual for genus. Maxillary palp rather long. Distal segment of labial palp unilaterally dilated, up to 1,5 times wider than long in females (fig. 138), up to 3,25 times wider than long in males (fig. 134); with five sensory papillae arranged in a single row. Eye black, composed of 12 ommatidia. Antennae with whorls of light-coloured setae.

Nape setated. Thoracic nota each with 1+1 posterolateral bristlecombs of 7 macrosetae each. Pronotum with 7-8 + 7-8, mesonotum with 9+9 and metanotum with 6+6 lateral bristlecombs of 3-4 macrosetae each.

Urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 0 / 1+1 bristlecombs, all of 6-9, usually 7-8, macrosetae each. Urotergite X trapezoidal, width to length ratio 0,59, posteriorly slightly rounded, with a lateral marginal setal fringe and 1+1 bristlecombs of 9 macrosetae each (fig. 136).

Thoracic sterna shaped as in figs 131, 132, 133. Prosternum (fig. 131) with 2+2 bristlecombs, situated distant from each other, of 16-18 (proximally) and 10-12 (distally) macrosetae each. Mesosternum (fig. 132) with 1-2 + 1-2 bristlecombs of a total of 18-26 macrosetae per side. Metasternum (fig. 133) with 1-2 + 1-2 bristlecombs of a total of 17-25 macrosetae per side. All thoracic sternal bristlecombs consisting of two parallell rows of macrosetae instead of the usual one row only.

Successive posteriad pairs of legs lengthening moderately, tibia III about 1,75 times longer than tibia I. Tibiae with a few stout spines each. Tarsi with two claws and an empodium.

Urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / - bristlecombs. Lateral bristlecombs of 13-18 macrosetae each, but only 6-8 on coxites VIII. Median bristlecombs of 21-26 macrosetae on urosternite II, 13-18 macrosetae each on urosternites III-VI, and 9 on urosternite VII. Coxites IX with inner processes subtriangular, wider in male than in female, with a robust marginal setal fringe (fig. 135). Adults of both sexes with two pairs of styli.

Ovipositor long, reaching past the apices of styli IX by up to twice the latter's length, slender; apices of gonapophyses unsclerotised (fig. 137). Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions.

		ave.	s.d.	max.	n
Body length,	female	7.75	1.15	9.00	4
" " ,	male	8.75	0.25	9.00	2
" " ,	both	8.08	1.06	9.00	6
Antennae,	female	0.64	0.04	0.67	3
" ,	male	0.65	0.00	0.65	1
" ,	both	0.65	0.03	0.67	4
Cerci,	female	0.59	0.00	0.59	1
" ,	male	No data available			
" ,	both	No data available			
Filum terminale		No data available			

MATERIAL EXAMINED

Holotype, female, body length 9 mm, labelled: SM H 45015, 5 km NE Cornellskop, 28°22'S, 16°55'E, 22 December 1980, under dry cattle dung, J. Irish. In alcohol. SM type-number T 017. (SM)

Paratypes: 7 specimens; 3 females, 4 males. All in alcohol.

3; 2 females, 1 male, labelled: SM H 45503, Maerpoort, 29 November 1980, J. Irish. (SM)

1 female, labelled: SM H 45507, Süd Witpütz 31, 7 December 1980, J. Irish. (SM)

1 male, labelled: SM H 45718, 13 km SSW Grootderm, 6 September 1982, J. Irish. (SM)

1 male, labelled: SM H 45754, Lüderitz, 22/23 August 1983, E. Griffin. (SM)

1 male, labelled: SM H 45706, Rooilepel, 19 August 1983, E. Griffin. (SM)

Additional material examined (not designated as types due to damage): 2 specimens; 1 male, 1 unsexed. (SM)

LOCALITIES

Cornellskop, 5 km NE; Grootderm, 13 km SSW; Lüderitz; Maerpoort; Plateau 38; Rooilepel; Rosh Pinah, 10 km NW; Süd Witpütz 31.

DISTRIBUTION

Southwestern South West Africa and the adjacent northwestern Cape Province (fig. 117).

HABITAT

Arid succulent desert shrubland. Hard substrates, under stones or dry cattledung. One specimen came to a lighttrap.

DISCUSSION

Resembles C. *inornata* in many respects, but differs in the spacing of the prosternal bristlecombs.

Etymology: from Latin *saxetum* (a rocky place), referring to the rocky habitats frequented by the species.

Ctenolepisma (*S.*) *inornata* sp. nov.

Body length of both sexes up to 14 mm. Body shape slender. Ground colour of body yellowish white. Brown hypodermal pigment present, often very intense and nearly black, on all or some of the following: caudal filaments, styli, coxites IX, tibiae, tarsi, distal antennal flagellum and palpi. Scales dorsally uniformly yellowish brown to dark brown, ventrally transparent; morphology as usual for genus. Macrosetae golden yellow, plumose.

Setation of head as usual for genus. Maxillary palp rather long. Distal segment of labial palp unilaterally dilated, about 1,75 times wider than long in both sexes; with five sensory papillae arranged in a single row (fig. 143). Eye black, composed of 12 ommatidia. Antennae with whorls of light-coloured setae.

Nape setated. Thoracic nota each with a lateral marginal setal fringe and 1+1 posterolateral bristlecombs of 3-4 macrosetae each. Pronotum with 8-9 + 8-9, mesonotum with 7-8 + 7-8 and metanotum with 6-7 + 6-7 bristlecombs of 2-4 macrosetae each.

Urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 0 / 1+1 bristlecombs, all of 5-7 macrosetae each. Urotergite X trapezoidal, width to length ratio 0,55, posteriorly straight or slightly rounded; with a robust marginal setal fringe and 1+1 bristlecombs of 6-7 macrosetae each (fig. 145).

Thoracic sterna shaped as in figs 139, 140, 141. Prosternum (fig. 139) with 2+2 subapical bristlecombs, situated near to each other, of which the proximal ones of 6-7 and the distal ones of 4 macrosetae each. Mesosternum (fig. 140) with 1-2 + 1-2 bristlecombs, of, or of a total of, 9-10 macrosetae per side. Metasternum (fig. 141) with 1+1 bristlecombs of 9-10 macrosetae each.

Successive posteriad pairs of legs lengthening slightly, tibia III about 1,25 times longer than tibia I. Tibiae with a few short, robust spines each. Tarsi with two claws and an empodium.

Urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / - bristlecombs. Lateral bristlecombs of 10-17, median bristlecombs of 7-11 macrosetae each. Coxites IX with inner processes subtriangular, wider in the male than the female, with a robust marginal setal fringe (fig. 144). Adults of both sexes with two pairs of styli, acquiring the second pair at about body length 8-10mm.

Ovipositor long, reaching past the apices of styli IX by about the latter's length, slender; apices of gonapophyses unsclerotised (fig. 142). Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions

		ave.	s.d.	max.	n
Body length,	female	10.83	1.57	14.00	12
" " ,	male	10.69	1.87	14.00	8
" " ,	both	10.78	1.65	14.00	20
Antennae,	female	0.65	0.17	0.80	5
" ,	male	0.77	0.09	0.89	5
" ,	both	0.72	0.11	0.89	10
Cerci,	female	0.52	0.08	0.64	7
" ,	male	0.66	0.04	0.70	2
" ,	both	0.55	0.09	0.70	9

Filum	female	0.59	0.03	0.63	4
terminale,	male	0.68	0.10	0.80	3
" ,	both	0.63	0.09	0.80	7

MATERIAL EXAMINED

Holotype, female, body length 14 mm, labelled: SM H 45654, Windhoek, 22°34'S, 17°05'E, 27 June 1984, J. Irish. In alcohol. SM type-number T 016. (SM)

Allotype, male, body length 10 mm, labelled: SM H 45016, Alkmar 512, 21°51'S, 19°55'E, 2 March 1982, under piece of wood, J. Irish. In alcohol. (SM)

Paratypes: 26 specimens; 15 females, 6 males, 5 unsexed. All in alcohol.

4; 1 female, 3 males, labelled: SM H 45655, Windhoek, 28 May 1983, J. Irish. (SM)

5; 2 females, 2 males, 1 unsexed, labelled: SM H 45656, Windhoek, 7 May 1983, J. Irish. (SM)

1 female, labelled: SM H 7530, Okaukuejo, March 1972, H. Ebedes. (SM)

1 female, labelled: SM H 45658, Okaukuejo, 21 October 1982, J. Irish. (SM)

1 female, labelled: SM H 45732, Hohenstein 39, 15 June 1985, J. Irish. (SM)

1 female, labelled: SM H 45733, Olifantshoek 297, 15 June 1985, J. Irish. (SM)

1 male, labelled: SM H 45743, Windhoek, 20 June 1985, E. Irish, J. Irish. (SM)

9; 5 females, 4 unsexed, labelled: SM H 45744, Sprokieswoud, 14 June 1985, J. Irish. (SM)

1 female, labelled: SM H 45753, Uithoek 770, 7 June 1985, J. Irish. (SM)

1 female, labelled: SM H 45767, Okaukuejo, 12 June 1985, J. Irish. (SM)

1 female, labelled: SM H 45768, Halali-koppie, 11 June 1985, J. Irish. (SM)

Additional material examined (damaged, not designated as types): 2 specimens; 1 female, 1 male. (SM)

LOCALITIES

Alkmar 512; Halali-koppie; Hohenstein 39; Okaukuejo; Olifantshoek 297; Sprokieswoud; Uithoek 770; Windhoek.

DISTRIBUTION

Northern interior of South West Africa (fig. 117).

HABITAT

Dry savanna bushland. Under shelter (stones or wood) in microhabitats rich in vegetable detritus, e.g. fallen leaves under trees, dry dung in abandoned cattle kraals, or town gardens. Two specimens (Alkmar 512) from a termitarium of *Trinervitermes trinervoides* (Sjöstedt) (Termitidae) (det. J. Irish, deposited in SM under SM H 62241), but not an obligate nidicole.

DISCUSSION

In both overall abdominal setation and general appearance, *C. inornata* resembles *C. saxeta* sp. nov., see there.

Etymology: from Latin *inornatus* (plain), referring to the plain appearance of this insect.

Ctenolepisma kaokoensis sp.nov

DESCRIPTION

Body length of females up to 8 mm, of males up to 9 mm. Body shape slender. Ground colour of body yellowish white. Faint to distinct brownish hypodermal pigment present on the palpi, antennal flagellum, posterior abdomen, styli, genitalia and caudal filaments. Scales dorsally dark brown, ventrally transparent; morphology as usual for genus. Macrosetae golden yellow, plumose.

Setation of head as usual for genus. Maxillary palp of moderate length. Distal segment of labial palp unilaterally dilated, up to 1,5 times wider than long in adult males, a little narrower in females; with five sensory papillae arranged in a single row (fig. 147). Eye black, composed of about 13 ommatidia. Antennae with whorls of light-coloured setae.

Nape setated. Thoracic nota each with 7-9 + 7-9 lateral bristlecombs of 2-3 macrosetae each, as well as 1+1 posterolateral bristlecombs of 2-3 macrosetae each.

Urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 0 / 1+1 bristlecombs, all of 4-5 macrosetae each. Urotergite X trapezoidal, width to length ratio 0,54, posteriorly slightly emarginate, with a lateral marginal setal fringe and 1+1 bristlecombs of 6-8 macrosetae each (fig. 146).

Thoracic sterna shaped as in figs 149, 150, 151. Prosternum (fig. 149) with 2-3 + 2-3 bristlecombs situated distant from each other, of 4-8 macrosetae each. Mesosternum (fig. 150) with 2-3 + 2-3 bristlecombs of 4-6 macrosetae each. Metasternum (fig. 151) with 1-2 + 1-2 bristlecombs of 4-6 macrosetae each.

Successive posteriad pairs of legs lengthening moderately, tibia III about 1,25 to 1,5 times longer than tibia I. Legs sparsely spined, tibiae each with 2-3 short ventral spines. Tarsi with two claws and an empodium.

Urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / - bristlecombs. Lateral bristlecombs of 9-12 macrosetae each. Median bristlecombs of 6-10 macrosetae each, the larger numbers occurring anteriorly. Coxites IX subtriangular (fig. 148), with a marginal setal fringe. Most specimens of both sexes with one pair of styli only, but some of the largest specimens (above body length 9 mm) with two pairs of styli.

Ovipositor reaching past the apices of styli IX by about the latter's length; apices of gonapophyses unsclerotised. Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions

	ave.	s.d.	max.	n
Body length, female	6.45	0.95	8.00	5
" " , male	6.25	1.63	9.00	6
" " , both	6.34	1.37	9.00	11
Antennae, female	0.56	0.00	0.56	1
" , male	0.62	0.02	0.63	2
" , both	0.60	0.03	0.63	3

Cerci,	female	0.38	0.00	0.38	1
" ,	male	0.48	0.08	0.56	2
" ,	both	0.45	0.08	0.56	3
Filum	female	0.44	0.00	0.44	1
terminale,	male	0.55	0.00	0.55	1
" ,	both	0.50	0.06	0.55	2

MATERIAL EXAMINED

Holotype, female, body length 8 mm, labelled: SM H 45745, Urumube 287, 19°29'S, 15°11'E, 15 June 1985, under stone, J. Irish. In alcohol. SM type-number T 019. (SM)

Allotype, male, body length 8 mm, labelled: SM H 45680, Palmwag 702, 19°53'S, 13°54'E, 24 October 1982, under dry elephant dung, J. Irish. In alcohol. (SM)

Paratypes: 9 specimens; 4 females, 3 males, 2 unsexed. All in alcohol.

8; 3 females, 3 males, 2 unsexed, labelled: SM H 45682, Oruvandjei, 22 February 1985, J. Irish & H. Rust. (SM)

1 female, labelled: SM H 45746, Omarassa 4, 7 June 1985, J. Irish. (SM)

Additional material examined (not designated as types due to damage or immaturity): 9 specimens; 2 females, 2 males, 5 unsexed. (SM)

LOCALITIES

Omarassa 4; Oruvandjei; Palmwag 702; Ruacana; Uhima; Urumube 287; Usakos, 18 km W.

DISTRIBUTION

Northwestern South West Africa (fig. 24).

HABITAT

Arid savanna bushland, ranging into semi-desert and desert where the habitat is suitable, e.g. along major riverbeds.

Hard substrates. Under stones or dry elephant dung.

DISCUSSION

Nearest to C. inornata and C. saxeta spp. nov. Differs from the former in the spacing of the prosternal bristlecombs, and from the latter in the number of macrosetae in the posterolateral thoracic notal bristlecombs.

Etymology: from Kaokoveld, a regional name for northwestern South West Africa, where the species occurs.

Ctenolepisma (S.) plusiochaeta Silvestri

Ctenolepisma plusiochaeta Silvestri, 1922: 83 (p. p.); Wygodzinsky, 1955: 154.

REDESCRIPTION

The redescription which follows is intended to supplement the rather brief original description. It is based on the holotype and the other material listed below. The species was adequately illustrated by Silvestri (1922).

Body length of females up to 10 mm, of males up to 8 mm. Body shape slender. Ground colour of body yellowish white to white, but often obscured by hypodermal pigment; the latter varying from faint to distinct on the antennae, caudal filaments and genitalia, and sometimes occurring generally. Scales dorsally shiny black in life, dark brown in alcohol, ventrally transparent; morphology as usual for genus. Macrosetae golden yellow, plumose.

Setation of head as usual for genus. Maxillary palp of moderate length. Distal segment of labial palp unilaterally dilated, 1,25-1,5 times wider than long, with five sensory papillae arranged in a single row. Eye black, composed of 12 ommatidia. Antennae with whorls of light-coloured setae.

Nape setated. Thoracic nota each with 7-8 + 7-8 lateral marginal bristlecombs of 2-4 macrosetae each, as well as 1+1 posterolateral bristlecombs of four macrosetae each.

Urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 0 / 1+1 bristlecombs. Submedian and lateral bristlecombs of 3-4 macrosetae each, sublateral bristlecombs of 5-6 macrosetae each. Urotergite X trapezoidal, width to length ratio 0,46, posteriorly distinctly emarginate, with a lateral marginal setal fringe and 1+1 bristlecombs of 3-4 macrosetae each.

Thoracic sterna subtriangular, apically rounded, progressively widening from prosternum to metasternum. Prosternum with 2-3 + 2-3, mesosternum with 2+2 and metasternum with 1-2 + 1-2 bristlecombs each; bristlecombs of 3-6 macrosetae each, the larger numbers occurring anteriorly, often asymmetrical.

Successive posteriad pairs of legs lengthening moderately, tibia III about 1,5 times longer than tibia I. Legs with a few sparse spines. Tarsi with two claws and an empodium.

Urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / - bristlecombs. Lateral bristlecombs of 5-11, median bristlecombs of 10-17 macrosetae each. Coxites IX subtriangular, narrow, with a robust marginal setal fringe.

Adults of both sexes wth two pairs of styli, acquiring the second pair at about body length 5 mm.

Ovipositor fairly long, slender, reaching past the apices of styli IX by about the latter's length; tips of gonapophyses rounded, unsclerotised. Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions

		ave.	s.d.	max.	n
Body length,	female	7.96	1.07	10.00	12
" " ,	male	7.36	0.74	8.00	11
" " ,	both	7.67	0.97	10.00	23
Antennae,	female	0.67	0.14	0.92	6
" ,	male	0.69	0.12	0.81	2
" ,	both	0.67	0.13	0.92	8
Cerci,	female	0.54	0.09	0.69	4
" ,	male	0.50	0.00	0.50	1
" ,	both	0.53	0.08	0.69	5
Filum	female	0.59	0.09	0.77	5
terminale,	male	0.50	0.00	0.50	1
" ,	both	0.57	0.09	0.77	6

MATERIAL EXAMINED

Holotype, female, body length 8 mm, labelled: Ctenolepisma plusiochaeta Silv, Typus !, Hamb. dtsch-s.w. afr. Studienr. 1911, Farm Voigtsland a.d. Bismarck-Bergen (38 km O Windhuk), W. Michaelsen leg., 16.-19.V.1911. In alcohol. (ZSZM)

Additional material: 32 specimens; 15 females, 13 males, 4 unsexed. 30 (SM); 2 (MBOC).

LOCALITIES

Literature. Silvestri (1922): Neudamm; Voigtsland (type locality); Windhuk. (ZSZM; type examined, others not traced) Wygodzinsky (1955): Kowares. (LUND, not examined)

Present material: Arandisberg, 2 km NE; Chaudamas 33; Gocheganas 26; Groot Tinkas; Hoffnung 66; Makuri Pan; Namutoni; Onganja East 190; Otjihangweberg; Ozonjuitji M'bari; Pionierspark; Sandveld 314; Windhoek.

DISTRIBUTION

Central and northern South West Africa (fig. 152).

HABITAT

Dry savanna bushland, but may range into desert. Under shelter, usually stones or fallen bark of <u>Acacia</u> <u>erioloba</u> E. Meyer (Leguminosae). Occasionally enters houses in Windhoek, but of no economic importance; twice found active at midday in full sunlight on pavements in the city centre.

DISCUSSION

In life the shiny black colour is distinctive. The only other similarly coloured species in western southern Africa is the much smaller <u>C</u>. <u>corvina</u>, which also has a different urosternal setation. The only other species with a similar overall abdominal setation is <u>C</u>. <u>parcespinata</u>, see there.

Besides the holotype above, Silvestri (1922) lists specimens from Windhuk, Neudamm and Lüderitzbucht. These specimens are technically paratypes, though Silvestri did not label them as such. The specimen from Lüderitz (ZSZM) was examined. It is a male in rather poor condition, and I referred it to *C. parcespinata*. Lüderitz lies far outside the confirmed range of *C. plusiochaeta*, but within that of *C. parcespinata*. Males of the two species are virtually indistinguishable.

Ctenolepisma (*S.*) *parcespinata* Silvestri

Ctenolepisma parcespinata Silvestri, 1908: 292.
Ctenolepisma plusiochaeta Silvestri, 1922: 83 (*p. p.*).

REDESCRIPTION

The original description of *C. parcespinata* states the urotergal setation to be "*ut in specie praecedenti*". It is not clear whether this refers to *C. terebrans* or *C. pluriseta* (listed as a variety of *C. terebrans* in Silvestri, 1908), but both Wygodzinsky (1955) and Mendes (1982) in their keys to southern African and African species respectively, have assumed that Silvestri referred to *C. terebrans*. Examination of the types shows the urotergal setation to be as in neither *C. terebrans* nor *C. pluriseta*. The redescription which follows is intended to rectify these and other faults in the original description, as well as describe the hitherto unknown female, and is based on the holotype as well as the material listed below. Structures adequately illustrated in the original description were not re-illustrated here.

Body length of females up to 9 mm, of males up to 10 mm. Body shape slender. Ground colour of body dirty yellowish white. Hypodermal pigment absent, or at most faintly visible on the distal antennal flagellum. Scales dorsally yellowish brown to dark brown in alcohol, ventrally transparent; morphology as usual for genus. Macrosetae golden yellow, plumose.

Setation of head as usual for genus. Maxillary palp of moderate length. Distal segment of labial palp unilaterally dilated, 1,25 to 1,5 times wider than long; with five sensory papillae arranged in a single row. Eye black, composed of 11 ommatidia. Antennae with whorls of light-coloured setae.

Nape setated. Thoracic nota each with 7-8 + 7-8 lateral bristlecombs of 2-3 macrosetae each, as well as 1+1 posterolateral bristlecombs of 3-4 macrosetae each.

Urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 0 / 1+1 bristlecombs. Submedian and lateral bristlecombs of 4-5, and sublateral bristlecombs of 5-7 macrosetae each. Urotergite X trapezoidal (fig. 157), width to length ratio 0,46, posteriorly distinctly emarginate (as in fig. 157, and not as in fig. 19 of the original description), with a lateral marginal setal fringe and 1+1 bristlecombs of 3 macrosetae each.

Thoracic sterna shaped as in figs 154, 155, 156; their setation very irregular and often asymmetrical. Prosternum with 3-4 + 3-4 (fig. 154), mesosternum with 2-3 + 2-3 (fig. 155), and metasternum (fig. 156) with 1-2 + 1-2 bristlecombs each. Bristlecombs of 4-7 macrosetae each, the larger ones occurring anteriorly.

Successive posteriad pairs of legs lengthening moderately, tibia III about 1,75 times longer than tibia I. Legs with a few sparse spines. Tarsi with two claws and an empodium.

Urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 /

1+1+1 / 1+1 / - bristlecombs. Lateral bristlecombs of 8-14, median bristlecombs of 16-25 macrosetae each. Coxites IX subtriangular, narrower in female than in male, with a robust marginal setal fringe (fig. 153). Adults of both sexes with two pairs of styli.

Ovipositor fairly long, reaching beyond the apices of styli IX by about the latter's length; apices of posterior gonapophyses sclerotised (fig. 158). Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions

	ave.	s.d.	max.	n
Body length, female	9.00	0.00	9.00	2
" " , male	10.00	0.00	10.00	1
" " , both	9.33	0.33	10.00	3
Antennae, female	No data available			
" , male	1.10	0.00	1.10	1
" , both	No data available			
Cerci	No data available			
Filum terminale	No data available			

MATERIAL EXAMINED

Holotype, male, body length 10 mm, labelled: Ctenolepisma parcespinata Silv., Typus !, L. Schultze, Südafrika, 1904, Steinkopf - Juli, No 718. In alcohol. (ZMHU)

Plesio-allotype (here designated, see below), female, body length 9 mm, labelled: SM H 45621, E of Tshaukhaib Mts. at: 26°43'S, 15°43'E, 11 August 1983, under limestone rock on coarse sand, J. Irish. In alcohol. SM type-number T 005. (SM)

Additional material: 2 specimens; 1 female, 1 male. 1 (SM); 1 (ZSZM).

The decision to designate a plesio-allotype for C. parcespinata was prompted by the fact that the unique holotype is a male and as such is indistinguishable from males of C. plusiochaeta. It can thus hardly fulfill its function as the sole objective criterion for the species. The plesio-allotype is better able to fulfill this function. It has no official status, as "The Code" (ICZN, 1985) makes no provision for plesiotypes, and its designation serves only to draw attention to a specimen which is more representative of the species than the existing holotype. In effect, it has a type's function but not a type's status.

LOCALITIES

Literature. Silvestri (1908): Steinkopf (type locality). (ZMHU, examined)

Silvestri (1922), (as C. plusiochaeta, see under the latter species): Lüderitzbucht. (ZSZM, examined)

Present material: Diamond Area I at 2716Ac; Tsaukhaib Mts. E. at 2615Da.

DISTRIBUTION

Namaqualand and southwestern South West Africa (fig. 152).

HABITAT

Arid succulent shrubland. Under shelter, usually stones, on coarse gravelly substrates.

DISCUSSION

C. parcespinata is very similar to *C. plusiochaeta*, but females are easily distinguished by their different posterior gonapophyses. Males are indistinguishable in most cases. There is a tendency towards wider median urosternal bristlecombs in *C. parcespinata*, but this is not an absolute character. *C. parcespinata* also lacks the jet black scale colour of *C. plusiochaeta*, but this character is of little use in anything but perfect material. According to present knowledge the two species have non-overlapping distributions.

The species was previously known from the holotype only.

LINEAGE *grandipalpis*

Includes two robust, heavily pigmented species, which resemble each other but do not fit comfortably into any of the other lineages.

Ctenolepisma (*S.*) *grandipalpis* Escherich

Ctenolepisma grandipalpis Escherich, 1905: 85; Silvestri, 1913: 11; Wygodzinsky, 1955: 148, 1965: 86, 1970: 252.
Ctenolepisma laticauda Silvestri, 1922: 79; Mendes, 1982: 645. syn. nov..

REDESCRIPTION

The original description of *C. grandipalpis* is very brief and it is not possible to identify the species from it. The redescription which follows was done with reference to the types and the material listed below. The species was adequately illustrated (as *C. laticauda*) by Silvestri (1922).

Body length of females up to 17 mm, of males up to 14 mm. Body shape slender. Ground colour of body yellowish white, mostly obscured by hypodermal pigment. Hypodermal pigment dark brownish, especially distinct on the legs, palpi, caudal filaments, styli and posteroventral abdomen; sometimes fairly generally distributed. Scales dorsally yellowish brown to dark brownish, ventrally transparent; morphology as usual for genus. Macrosetae golden yellow to dark brown, plumose.

Setation of head as usual for genus. Maxillary palp rather long. Distal segment of labial palp unilaterally dilated, up to 2,5 times wider than long in adult males, up to 1,5 in adult females; with five sensory papillae arranged in a single row. Eye black, composed of about 13 ommatidia. Antennae with whorls of light-coloured setae.

Thoracic nota each with 6-10 + 6-10, typically 8+8, lateral bristlecombs of 2-4 macrosetae each, as well as 1+1 posterolateral bristlecombs of 5-6 macrosetae each.

Urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 0 / 1+1 bristlecombs, all of 5-7 macrosetae each. Urotergite X trapezoidal, width to length ratio 0,48, posteriorly straight to slightly emarginate, with a lateral marginal setal fringe and 1+1 bristlecombs of 7 macrosetae each.

Thoracic sterna subtriangular, apically rounded. Number of macrosetae per bristlecomb very variable, bristlecombs often multiseriate. Prosternum with 2-3 + 2-3 bristlecombs of 2-10 macrosetae each. Mesosternum with 1-2 + 1-2 bristlecombs of 5-8 macrosetae each. Metasternum with 1+1 bristlecombs of

12-24 macrosetae each. The larger bristlecombs always situated more proximally.

Successive posteriad pairs of legs lengthening moderately, tibia III about 1,75 times longer than tibia I. Tibiae each with three strong ventral spines. Tarsi with two claws and an empodium.

Urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / - bristlecombs. Lateral bristlecombs of 12-14 macrosetae each. Median bristlecombs very variable, of 8-35 macrosetae each, the larger numbers occurring anteriorly, and more common in larger individuals. Coxites IX with inner processes subtriangular, with a robust marginal setal fringe. Adults of both sexes with two pairs of styli, acquiring the second pair at body length 7-9 mm.

Ovipositor reaching beyond the apices of styli IX by 1-1,5 times the latter's length; apices of gonapophyses unsclerotised. Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions

	ave.	s.d.	max.	n
Body length, female	9.86	2.20	17.00	32
" " , male	9.40	1.82	14.50	48
" " , both	9.64	1.94	17.00	80
Antennae, female	0.65	0.11	0.88	13
" , male	0.65	0.23	1.00	13
" , both	0.65	0.18	1.00	26

Cerci,	female	0.57	0.08	0.67	6
" ,	male	0.55	0.12	0.77	7
" ,	both	0.56	0.10	0.77	13
Filum	female	0.61	0.09	0.78	7
terminale,	male	0.65	0.11	0.93	9
" ,	both	0.63	0.10	0.93	16

MATERIAL EXAMINED

Types (*C. grandipalpis*): 4 specimens; 1 female, 3 males, labelled: Port Elizabeth, Dr. med. H. Brauns leg., ded. 15.XII.98, H. 68, Syntypen. In alcohol. (ZSZM)

Types (*C. laticauda*): 1 female, 1 male, labelled: *Ctenolepisma laticauda* Silv., Cotypi !, Hamb. dtsch-s.w.afr. Studienr. 1911, Windhuk, W. Michaelsen leg., 29.IV.-8.V.1911 ded. In alcohol. (ZSZM)

Additional material: 125 specimens; 44 females, 54 males, 27 unsexed. 69 (SM); 31 (TM); 21 (SAM); 3 (NCI); 1 (MBOC).

LOCALITIES

Literature. Escherich (1905): Klipfontein; Ladysmith; Matjesfontein; Port Elizabeth (type locality) (ZSZM, examined); Willowmore. (Others untraced, not examined)

Silvestri (1913): Junction of the white and black Umfolozi; Umfolozi. (Untraced, not examined)

Silvestri (1922) (*C. laticauda*): Karibib (untraced, not examined); Windhuk (type locality), (ZSZM, examined).

Wygodzinsky (1955): Arniston; De Aar; De Hoop Vlei; Drechin; Echo Valley, Table Mountain; Grey's Pass; Jessie; Leeu Pan; Letaba Camp; Malmesbury; Malmesbury, 5 miles N; Pakhuispas; Platberg,Swartbergpas; Satara; Tweede Rivieren. (LUND and BM, not examined)

Wygodzinsky (1965): Katesh, contrefort Sud du Mont Hanang.

(MRAC, not examined)

Wygodzinsky (1970): Bothaville, 30 miles S (published as 3 miles S); Groblershoop, 47 miles ex, towards Griekwastad.

(NCI, examined)

Mendes (1982) (*C. laticauda*): Gobabeb, 6 km NW. (MUC, not examined)

Present material: Afguns 447; Anenous Pass, S. side; Arniston; Aroab; Brackfontein farm; Brandkaross; Brukkaros; Calitzdorp; Cape Town, 65 km N; Dzundwini; Flaminksvlakte; Friedrichsfelde; Graskom; Grootderm, 13 km SSW; Halali-koppie; Het Kruis; Hobas 374; Jacobs Bay; Kleinduin; Kuiseb R nr. Gobabeb; Langebaan, 4 km NE; Lehmpütz 76; Leliefontein, 8 km SE; Maerpoort; Melkbos to Malmesbury; Numees Mine; Omarassa 4; Ombindi-Karambi 155; Onganja East 190; Plateau 38; Schaaprivier; Spektakelberg; Springbok, Modderfontein; Teufelsburg 153; Trekkopje, 4 km S; Victoria West; Victoria West Nature Reserve; Vioolsdrif; Warmfontein 280; Wiedou; Windhoek.

DISTRIBUTION

Throughout most of southern Africa, ranging north to Tanzania (fig. 159).

HABITAT

Euryecious. From desert and semi-desert to macchia, temperate grassland, arid savanna bushland and mesic savanna woodland. Most commonly found under stones, but also utilises other shelter, e.g. under plants, dry wood or dry dung. Non-substrate specific. Ranges into towns, common in gardens, but does not enter houses.

Silvestri (1913) lists a specimen found in the nest of an unspecified termite, and Wygodzinsky (1970) a specimen found with Promirotermes sp. (Termitidae) in a derelict mound of Trinervitermes sp. (Termitidae). Not an obligate nidicole.

DISCUSSION

Escherich (1905) commented on the great variability of C. grandipalpis, in particular on its supposed intraspecific heterogeneity with regard to urotergal setation. Such setations as described by Escherich were not found in the types examined, which conform to Escherich's typical form, and I would consider grandipalpis-like specimens with non-grandipalpis setation to represent other species. Escherich's confusion may have arisen from the great significance he attached to the relatively elongate body shape of the types, but this is a feature of most subadult Ctenolepisma spp., such as the types I have examined are.

Silvestri (1922) was probably misled by Escherich's insistance on the importance of body shape in C. grandipalpis when he described C. laticauda from adult, normally shaped specimens. The fact that Silvestri describes the urosternal setation of C. laticauda in (for him) unusual detail, may mean that he was also misled by the incorrectly quoted urosternal setation given for C. grandipalpis by Escherich (1905). Comparison of the types of both species show them to be conspecific.

Nearest to C. picturata, but the latter species has a distinctive colour pattern, one pair of styli only, shorter ovipositor and longer urotergite X.

Ctenolepisma (*S.*) *picturata* Wygodzinsky

Ctenolepisma picturata Wygodzinsky, 1955: 149.

The original description is sufficient for the recognition of this species.

MATERIAL EXAMINED

One female (TM).

LOCALITIES

Literature. Wygodzinsky (1955): Jessie; Skukuza (type locality). (LUND, not examined)

Present material: Satara region.

DISTRIBUTION

Known from three localities in the Kruger National Park and Zimbabwe only (fig. 26).

HABITAT

Dry savanna woodland. The types were from under stones.

DISCUSSION

Near to *C. grandipalpis*, see there.

SPECIES-GROUP *activa*

Characterised by urosternal setation: 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 (+1) / - bristlecombs. Besides the four southwestern African species listed below, the group includes *C. tenebrica* Silvestri from Angola, Zaire and Tanzania (if the latter's description is correct with regard to urosternal setation).

Ctenolepisma (S.) activa Silvestri

Ctenolepisma activa Silvestri, 1922: 82.

REDESCRIPTION

The original description of C. activa is very brief and fails to mention the distinctive urosternal setation, among other important characters. A redescription, based on the holotype and the material listed below, follows. Only structures which were not illustrated in Silvestri (1922) have been illustrated here.

Body length of females up to 8,5 mm, of males up to 7,5 mm. Body shape slender (fig. 160). Ground colour of body whitish to dirty whitish. Hypodermal pigment absent, or confined to distal antennae and caudal appendages only. Scales dorsally uniform light brownish, ventrally transparent; morphology as usual for genus. Macrosetae golden yellow, plumose.

Setation of head as usual for genus. Maxillary palp rather short. Distal segment of labial palp unilaterally dilated, 1,25 to 1,75 times wider than long; with five sensory papillae arranged in a single row. Eye black, composed of 11 ommatidia. Antennae with whorls of light-coloured setae.

Nape setated. Thoracic nota each with 7-8 + 7-8 lateral bristlecombs of 2-4 macrosetae each, as well as 1+1 posterolateral bristlecombs of 2-3 macrosetae each.

Urotergal setation: 2+2 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 0 / 1+1 bristlecombs. Submedian bristlecombs of 3-5 macrosetae each, lateral bristlecombs of 4-8 macrosetae each, and sublateral bristlecombs of 4-7 macrosetae each.

Urotergite X trapezoidal, rather long, width to length ratio 0,76, posterior margin slightly rounded to straight; with a lateral marginal setal fringe and 1+1 posterolateral bristlecombs of 4-6 macrosetae each.

Thoracic sterna shaped as in figs 162, 163, 164. Each with 2+2 irregular bristlecombs of 6-8 (proximally) to 3-5 (distally) macrosetae each.

Legs rather short and similar to each other. Tibia III about 1,5 times longer than tibia I. Spines on femur and tibia short and stout. Tarsi with two claws and an empodium.

Urosternal setation: 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / - bristlecombs. Lateral bristlecombs of 7-14 macrosetae each, median bristlecombs of 6-11 macrosetae each, but numbers individually very variable. Coxites IX subtriangular, very short, with a moderate to robust marginal setal fringe (fig. 161). Adults of both sexes with one pair of styli only.

Ovipositor long, reaching beyond the apices of styli IX by about twice the latter's length; tips of gonapophyses rounded, unsclerotised. Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions

		ave.	s.d.	max.	n
Body length,	female	7.75	0.43	8.5	4
" " ,	male	7.07	0.49	7.5	7
" " ,	both	7.31	0.57	8.5	11
Antennae,	female	0.45	0.03	0.47	3
" ,	male	0.47	0.03	0.50	3
" ,	both	0.46	0.03	0.50	6
Cerci,	female	0.47	0.00	0.47	1
" ,	male	0.45	0.05	0.50	3
" ,	both	0.46	0.05	0.50	4
Filum	female	0.47	0.00	0.47	1
terminale,	male	0.52	0.02	0.53	4
" ,	both	0.51	0.02	0.53	5

MATERIAL EXAMINED

Holotype, female, body length 8 mm, labelled: *Ctenolepisma activa* Silv., Typus!, Hamb. dtsch-s.w.afr. Studienr. 1911, Omaruru, W. Michaelsen leg., 21.-22.VI.1911. In alcohol. (ZSZM)

Additional material: 14 specimens; 4 females, 10 males. All (SM).

LOCALITIES

Literature. Silvestri (1922): Omaruru (type locality) (ZSZM, examined).

Present material: Kamandjab, 10 km N; Otjihangweberg, 1 km E; Owingi 246; Zebrapomp, Kaross.

DISTRIBUTION

Northern South West Africa (fig. 117).

HABITAT

Dry savanna. Under shelter on compact sandy soils. Most specimens from under dry cattle dung; some from under fallen bark of *Acacia erioloba* trees or from under rocks.

DISCUSSION

The only other species with a similar overall abdominal setation is *C. capensis* sp. nov. Differences between *C. activa* and *C. capensis* are discussed under the latter species. *C. activa* is similar to both *C. intercursa* and *C. prompta* in both urotergal setation and general appearance, but differs from them in urosternal setation.

C. activa was previously known from the holotype only.

Ctenolepisma (*S.*) *capensis* sp. nov.

DESCRIPTION

Body length of both sexes up to 9,5 mm. Body shape slender. Ground colour of body pale yellowish white. Faint to distinct violaceous hypodermal pigment present posteroventrally on the abdomen. Scales dorsally uniform yellowish-brown, ventrally transparent; morphology as usual for genus. Macrosetae golden yellow, plumose.

Setation of head as usual for genus. Maxillary palp with individual segments rather stout. Distal segment of labial palp unilaterally dilated, about 1,75 times wider than long in adult males (fig. 166), narrower in females (fig. 165); with five sensory papillae arranged in a single row. Eye black, composed of 12 ommatidia. Antennae with whorls of light-coloured setae.

Nape setated. Thoracic nota each with 7-9 + 7-9 lateral bristlecombs of 3-4 macrosetae each, as well as 1+1 posterolateral bristlecombs of 4-6 macrosetae each.

Urotergal setation: 2+2 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 0 / 1+1 bristlecombs. Submedian bristlecombs of 4-8, lateral bristlecombs of 5-7 and sublateral bristlecombs of 5-8 macrosetae each. Urotergite X trapezoidal, width to length ratio 0,48; posteriorly slightly to distinctly emarginate, with a lateral marginal setal fringe and 1+1 bristlecombs of 5-7 macrosetae each (fig. 172).

Thoracic sterna shaped as in figs 169, 170, 171. Prosternum (fig. 169) with 2-3 + 2-3 bristlecombs of 3 (distally) to 16 (proximally) macrosetae each. Meso- and metasterna (figs 170, 171) each with 2+2 bristlecombs of 8-11 macrosetae each.

Successive posteriad pairs of legs lengthening; tibia III about 1,5 times longer than tibia I. Femorae and tibiae sparsely spined (fig. 168). Tarsi with two claws and an empodium.

Urosternal setation: 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / - bristlecombs. Lateral bristlecombs of 11-13, median bristlecombs of 7-13 macrosetae each. Coxites IX subtriangular, with a robust marginal setal fringe (fig. 173). Adult females with two pairs of styli. All available males with one pair of styli only.

Ovipositor long, reaching beyond the apices of styli IX by about 1,5 times the latter's length; apices of gonapophyses unsclerotised (fig. 167). Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions

		ave.	s.d.	max.	n
Body length,	female	7.50	1.18	9.50	5
" " ,	male	8.00	2.12	9.50	2
" " ,	both	7.64	1.41	9.50	7
Antennae,	female	0.70	0.13	0.83	2
" ,	male	No data available			
" ,	both	No data available			
Cerci,	female	0.60	0.07	0.67	2
" ,	male	No data avialable			
" ,	both	No data available			
Filum terminale		No data available			

MATERIAL EXAMINED

Holotype, female, body length 9,5 mm, labelled: Jacobs Bay (inland), 26 March 1977, A.J. Prins, Dry to mod. wet cowdung, GC-113-8. In alcohol. (SAM)

Allotype, male, body length 9,5 mm, labelled: Jacobs Bay (inland), 9 December 1978, A.J. Prins, Very dry cowdung, GC-207-6. In alcohol. (SAM)

Paratypes: 6 specimens; 4 females, 2 males. All in alcohol.

1 female, labelled as holotype. (SAM)

1 female, labelled as allotype. (SAM)

1 female, labelled: Jacobs Bay (inland), 28-30 March 1978, A.J. Prins, Dry cowdung, GC-116-8. (SAM)

1 female, labelled: Jacobs Bay (inland), 11-12 April 1977, A.J. Prins, Dry cowdung, GC-119-11. (SAM)

1 male, labelled: SM H 45623, 10 km W Anenouspas, December 1980, J. Irish. SM Type number T 020. (SM)

1 male, labelled: SM H 45422, Kleinduin, 30 November 1980, J. Irish.

LOCALITIES

Anenouspas, 10 km W; Jacobs Bay; Kleinduin.

DISTRIBUTION

Western Cape Province and Namaqualand (fig. 26).

HABITAT

Semi-arid succulent shrubland. Sandy substrates. Under shelter, usually dry cattle dung or stones.

DISCUSSION

The only other species with a similar overall abdominal setation is _C. activa_. _C. capensis_ may be distinguished from the latter by having longer inner processes of coxites IX, larger numbers of macrosetae in the thoracic sternal bristlecombs, and (at least in adult females) two pairs of styli. The two species do not occur in the same areas.

Etymology: the name refers to the Cape Province, where the species occurs.

Ctenolepisma (_S._) _arenicola_ Wygodzinsky

Ctenolepisma (Sceletolepisma) arenicola Wygodzinsky, 1955: 154.

The original description is sufficient for the recognition of this species.

Adults possess a single pair of styli only, which they acquire at body length 3-4 mm.

Proportions

		ave.	s.d.	max.	n
Body length,	female	6.30	1.05	9.50	33
" " ,	male	6.09	1.13	8.50	41
" " ,	both	6.18	1.11	9.50	74
Antennae,	female	0.56	0.09	0.75	9
" ,	male	0.56	0.09	0.73	8
" ,	both	0.56	0.09	0.75	17
Cerci,	female	0.54	0.04	0.58	2
" ,	male	0.40	0.04	0.43	2
" ,	both	0.47	0.08	0.58	4
Filum	female	0.56	0.13	0.71	6
terminale,	male	0.52	0.09	0.62	3
" ,	both	0.55	0.12	0.71	9

MATERIAL EXAMINED

Types: (LUND) Not examined.

Additional material: 130 specimens; 45 females, 52 males, 33 unsexed. (SM)

LOCALITIES

Literature. Wygodzinsky (1955): Rocky Point (type locality). (LUND, not examined)

Present material: Ambrose Bay; Angra Fria, 10 km NNW; Bosluisbaai; Bosluisbaai, 7 km N; Bosluisbaai, 12 km S; Cape Fria; Edvard Bohlen wreck; Kunene River mouth; Terrace Bay, 18 km SSE; Torrabaai; Toscanini; Ugab River mouth.

DISTRIBUTION

North coast of South West Africa (fig. 152).

HABITAT

Littoral. Found exclusively under driftwood.

DISCUSSION

The overall abdominal setation of _C. arenicola_ is unique in the family, and renders it unmistakeable.

Wygodzinsky (1955) created the monospecific subgenus _Sceletolepisma_ for this species, mainly on the basis of its urotergal setation. Reasons for rejecting this as a basis for subgeneric division are given in Part V, and the subgeneric name is here used in a different sense.

The species was previously known from the types only.

Ctenolepisma (_S._) _pauliani_ Wygodzinsky

Ctenolepisma pauliani Wygodzinsky, 1959: 442; Holm, 1970: 37; Holm & Scholtz, 1980: 16.

DESCRIPTIVE NOTES

The original description is sufficient for the recognition of this species. The following may be added:

The antennae and cerci, when intact, reach lengths of more than twice that of the body, but the filum terminale is consistently considerably shorter than body length (see fig. 174, and under "Proportions" below). Damage to the types probably prevented Wygodzinsky (1959) from recognising this characteristic, and his fig. 1, which shows _C. pauliani_ with caudal filaments of normal proportions, must be regarded as incorrect.

The distal segment of the labial palp is bilaterally dilated, and may be up to four times wider than long in large adults (above body length 11 mm in females or 10 mm in males). In small nymphs (below about body length 5-6 mm) the distal segment of the labial palp is unilaterally dilated only, and much narrower.

Urosternite VIII exhibits an interesting secondary sexual setational feature in males. Smaller (subadult) males, up to body length 9-10 mm, have urosternite VIII with 1+1 bristlecombs only, but larger (adult) males have this with 1+1+1 bristlecombs.

Tarsi with two claws, but lacking an empodium.

The very smallest specimen examined, at 3 mm body length, lacked styli. Even at this size the distinctive tibial setation made positive identification possible.

A few specimens with individual aberrations with regard to urotergal setation were examined. A specimen from Kahani dune and another from the Tsondab flats had urotergite VI with 2+3 bristlecombs, and a specimen from Boesmanberg had urotergite V with the same setation.

Proportions

	ave.	s.d.	max.	n
Body length, female	9.44	1.89	15.00	169
" ", male	8.16	1.73	13.00	179
" ", both	8.77	1.92	15.00	348
Antennae, female	1.44	0.42	2.50	34
" , male	1.05	0.39	1.81	18
" , both	1.11	0.41	2.50	52

Cerci,	female	1.33	0.40	2.42	44
" ,	male	1.25	0.31	2.00	34
" ,	both	1.28	0.36	2.42	78
Filum	female	0.65	0.10	0.93	41
terminale,	male	0.61	0.09	0.83	42
" ,	both	0.63	0.10	0.93	83

MATERIAL EXAMINED

Holotype, male, body length 13 mm, labelled: Ctenolepisma pauliani, Wygodzinsky det. 1959, HOLOTYPUS, Namib, South Africa, Sandwich Bay, 13-V-1959, R. Paulian. In alcohol. (TM)

Allotype, female, body length 11 mm, labelled: Ctenolepisma pauliani, Wygodzinsky det. 1959, ALLOTYPUS, Namib, SOUTH AFRICA, Sandwich Bay, 13-V-1959, R. Paulian. In alcohol. (TM)

Paratypes, 7 specimens from Sandwich Bay and Gobabeb. (?IRSM, ?IML and AMNH, not examined)

Additional material: 531 specimens; 187 females, 193 males, 151 nymphs. 507 (SM); 16 (UP); 10 (MBOC); 4 (NCI); 2 (DERU); 2 (AMNH).

LOCALITIES

Literature. Wygodzinsky (1959): Gobabel (sic! = Gobabeb), Sandwich Bay (type locality). (TM, examined; and ?IRSM, ?IML, AMNH, not examined)

Holm (1970): Gobabeb (material not preserved).

Holm & Scholtz (1980): Gobabeb (material not preserved).

Present material: Agub Mt. SW; Boesmanberg; Bosluisbaai, 1 km E.; Bosluisbaai, 3 km E.; Cape Fria Radio Station; Conception; Diamond Area II at 2314Dc; Diamond Area II at

2415Ca; Diamond Area II at 2514Bb; Diamond Area II at 2515Aa (1); Diamond Area II at 2515Aa (2); Diamond Area II at 2515Ab; Diamond Area II at 2515Ad; Dreizackberg, 2 km N.; Duin 7; Far East dunes; Fischersbrunn; Fischersbrunn, coast S of; Fischersbrunn, coast 11 km SSE of; Gobabeb; Gobabeb, 15 km S; Grasplatz, 2 km N.; Grillenthal; Grillenthal, 2 km W; Grillenthal, 10 km S; Grootderm, 13 km SSW; Guinassibberg; Guinassibberg, 5 km SW; Haris; Hoarusib River mouth; Jumbo dune; Kahani dune; Kaukausib fountain; Kharu-gaiseb at 1913Cc; Khumib River, ca. 15 km from coast; Kleinduin; Klinghardts Mts. at 2715Bc (1); Klinghardts Mts. at 2715Bc (2); Mniszechi's Vlei; Möwebaai; Möwebaai, 8 km E.; Noctivaga dune; Northern Namib at 1711Bd; Rooibank; Rooibank, 10 km W; Samanab River at 2013Ab; Sandwich Harbour; Swartbank; Sylvia Hill, 2 km N; Sylvia Hill, 5 km SE; Torra Bay; Tsaus dunes; Tsondab flats at 2315Cc; Uguchab River at 2716Ca; Uniab River at 2013Ab; Uri-Hauchab Mt.; Visitor's dune; Witberg; Witberg, 4 km W; 2515Aa4; 2515Ac4; 2515Cd2.

DISTRIBUTION

Namib desert dunes, from the Kunene River to Port Nolloth (fig. 177).

HABITAT

Desert sand dunes. Found under shelter on the dunes, usually under dune hummocks (81% of hand-sampled material), but also dry wood or dung. Once in windblown sand under a *Euphorbia* sp. shrub on hard ground several kilometres from the nearest dunes (2 km N. Dreizackberg), and another single specimen found running at sunset on a gravel plain about 1 km from the nearest dune (Uri-Hauchab). Nocturnal, found running on slipfaces at night, less commonly in the late afternoon.

Apart from sanddiving, which they do well, they also build tiny burrows on the dune slope, and may often be dug from these in the morning. *C. pauliani* is the only *Ctenolepisma* species found in the vegatationless coastal dunes of the Namib.

Analysis of label data from a pittrap survey by DERU staff (see also under *C. terebrans*), shows them to be commonest on the dune slipface and slope (52,3% and 42,6% of total respectively), but rare in the interdune valley (5,1% of total, n = 195 specimens).

DISCUSSION

C. pauliani is one of the most apomorphic species in the genus. The combination of comb-like setal arrangement on the mesotibia and the unusual relative lengths of the caudal filaments make it unmistakeable among the very few other species with similar urosternal setation.

A few specimens from the northern edge of the main Namib dune sea were found to be infested with what seems to be one species only of parasitic mite (Acari). The mites were attached to various parts of the insects' bodies, and have not been identified. All have been deposited in SM, either individually (catalogue numbers SM N 25146, 25147 and 25148) or still attached to their hosts (SM H 45111 and 45574).

Holm (1970) and Holm & Scholtz (1980) reported on the ecology of the species at Gobabeb.

SPECIES-GROUP _corvina_

Characterised by urosternal setation: 1 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / - bristlecombs. Includes three species found in southwestern South West Africa and the northwestern Cape Province.

Ctenolepisma (_S._) _corvina_ Silvestri

Ctenolepisma _corvina_ Silvestri, 1908: 293.

REDESCRIPTION

Because the original description was based on a single specimen in less than perfect condition, and fails to mention the distinctive urosternal setation, among other important characters, a redescription based on the holotype and the material listed below is provided. Structures already illustrated in Silvestri (1908) were not re-illustrated here.

Body length of females up to 6 mm, of males up to 5 mm. Body shape slender. Ground colour of body dirty yellowish white. Most of body and appendages with faint to distinct hypodermal pigment; the latter conspicuously absent from the caudal appendages and ovipositor, which are pure white. Scales dorsally and ventrolaterally pitch black in life, fading to yellowish brown after prolonged immersion in alcohol, ventromedially transparent; morphology as usual for genus. Macrosetae yellowish brown to black, plumose.

Setation of head as usual for genus. Maxillary palp slender, individual segments rather short (fig. 176). Distal segment of labial palp 1,25 to 1,5 times wider than long, small, roundish; with five sensory papillae arranged in a single row. Eye black, composed of 12 ommatidia. Antennae with whorls of light-coloured setae.

Nape setated. Pronotum with 7+7, meso- and metanotum each with 8+8 bristlecombs of 2-3 macrosetae each. Each thoracic notum also with 1+1 posterolateral bristlecombs of 2-3 macrosetae each.

Urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 2+2 / 0 / 1+1 bristlecombs. Submedian bristlecombs of 2-3, lateral bristlecombs of 2-4, and sublateral bristlecombs of 3-4 macrosetae each. Distance between lateral and sublateral bristlecombs about twice larger than distance between lateral and submedian bristlecombs. Urotergite X trapezoidal, width to length ratio 0,65, posteriorly straight to rounded, with a marginal setal fringe and 1+1 small bristlecombs of 3 macrosetae each. (fig. 175; these bristlecombs were omitted in Silvestri's (1908) figure 26).

Prosternum subtriangular, narrow, apically rounded, with 2+2 bristlecombs of 2-4 macrosetae each, situated distant from each other. Mesosternum shaped as prosternum, but wider, with 2+2 bristlecombs of 2-5 macrosetae each, situated proximal to each other. Metasternum still wider, with 1+1 bristlecombs of 3-6 macrosetae each.

Successive posteriad pairs of legs lengthening moderately; tibia III about 1,5 times longer than tibia I. Tibia with 3 and femur with 4 darkly coloured ventral spines each. Tarsi with two claws and an empodium.

Urosternal setation: 1 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / - bristlecombs. Lateral bristlecombs of 3-7, median bristlecombs of 4-8 macrosetae each, the smaller bristlecombs anteriad. Coxites IX with inner processes subtriangular and with a marginal setal fringe; outer processes short, and with one small bristlecomb each. Both sexes with two pairs of styli, the anteriad pair short.

Ovipositor reachng beyond the apices of styli IX by about 1,5 times the latter's length; tips of gonapophyses rounded, unsclerotised. Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions

		ave.	s.d.	max.	n
Body length,	female	5.50	0.71	6.00	2
" " ,	male	5.25	0.00	5.25	1
" " ,	both	5.42	0.52	6.00	3
Antennae,	female	0.43	0.04	0.45	2
" ,	male	0.38	0.00	0.38	1
" ,	both	0.41	0.04	0.45	3
Cerci,	female	0.33	0.04	0.35	2
" ,	male	No data available			
" ,	both	No data available			
Filum	female	0.35	0.07	0.40	2
terminale,	male	No data available			
" ,	both	No data available			

MATERIAL EXAMINED

Holotype, female, body length 6 mm, labelled: <u>Ctenolepisma corvina</u> Silv., Typus - Steinkopf. In alcohol (ZMHU). Additional material: 2 specimens; 1 female, 1 male. Both (SM).

LOCALITIES

Literature. Silvestri (1908): Steinkopf (type locality). (ZMHU, examined)

Present material: Agub Mt.SW; Anenous Pass, S side.

DISTRIBUTION

Namaqualand and southwestern South West Africa (fig. 178).

HABITAT

Arid succulent shrubland. Under stones.

DISCUSSION

No other Ctenolepisma species has the same overall abdominal setation. In fresh material the black scales (black as a raven, as suggested by the species name) are distinctive. C. corvina bears a superficial resemblance to C. penrithae sp. nov., but the latter has a different urosternal setation and evenly spaced urotergal bristlecombs.

Wygodzinsky (1955) listed the species from Anabib, northwestern South West Africa. The specimen (ex LUND) was examined. It is badly damaged and the abdomen posterior to urotergite V is completely missing. The urotergal bristlecombs are evenly spaced and the first urosternal bristlecomb (on urosternite II), is very wide, comprising about 18 macrosetae. Its length is 7 mm, which gives it an estimated body length when intact of 10-12 mm. In all these characters the specimen differs significantly from C. corvina, and it definitely does not belong to the latter species, though, due to its damaged state, it is not possible to say what else it may be.

The species was previously known from the holotype only.

Ctenolepisma (*S.*) *desperata* sp. nov.

DESCRIPTION

Body length of both sexes up to 12 mm. Body shape slender. Ground colour of body yellowish white. Brownish hypodermal pigment present on the caudal filaments, sometimes also on the antennae. Scales dorsally uniform yellowish brown, ventrally transparent; morphology as usual for genus. Macrosetae golden yellow, plumose.

Setation of head as usual for genus. Maxillary palp shortish. Distal segment of labial palp unilaterally dilated, about 3 times wider than long in adult males (fig. 185) and 2 times wider than long in adult females (fig. 186); with five sensory papillae arranged in a single row. Eye black, composed of about 12 ommatidia. Antennae with whorls of light-coloured setae.

Nape setated. Thoracic nota each with 7-8 + 7-8 lateral bristlecombs of 2-4 macrosetae each, as well as 1+1 posterolateral bristlecombs of 3 macrosetae each.

Urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 0 / 1+1 bristlecombs. Submedian bristlecombs of 4-5, lateral bristlecombs of 5, and sublateral bristlecombs of 5-7 macrosetae each. Urotergite X trapezoidal, width to length ratio 0,49, posteriorly slightly emarginate, with a marginal setal fringe and 1+1 bristlecombs of 7 macrosetae each (fig.187).

Thoracic sterna shaped as in figs 179, 180, 181. Prosternum (fig. 179) with 4-6 + 4-6 bristlecombs of 3 (distally) to 11 (proximally) macrosetae each. Mesosternum (fig. 180) with 3-4 + 3-4, and metasternum (fig. 181) with 2-3 + 2-3 bristlecombs of 3 (distally) to 7 (proximally) macrosetae each.

Successive posteriad pairs of legs lengthening strongly, tibia III about 3 times longer than tibia I. Setation of legs robust, reminiscent of that of C. terebrans and similar species (fig. 183). Tarsi with two claws and an empodium.

Urosternal setation: 1 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / - bristlecombs. Lateral bristlecombs of 10-15 macrosetae each, median bristlecombs of 14 (posteriorly) to 30 (anteriorly) macrosetae each. Coxites IX with inner processes subtriangular, wider in the male than the female (figs 182, 184) with a robust marginal setal fringe. Adults of both sexes with two pairs of styli.

Ovipositor short, reaching to about halfway between the apices of coxites IX and the apices of styli IX, robust, shaft with setae directed anteriad; apices of gonapophyses unsclerotised (fig. 182). Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions

	ave.	s.d.	max.	n
Body length, female	10.40	1.16	12.00	5
" " , male	10.60	1.37	12.00	6
" " , both	10.50	1.28	12.00	11

Antennae,	female	No data available			
" ,	male	0.79	0.10	0.91	3
" ,	both	No data available			
Cerci,	female	0.66	0.45	0.70	2
" ,	male	0.90	0.00	0.90	1
" ,	both	0.74	0.12	0.90	3
Filum	female	0.61	0.00	0.61	1
terminale,	male	0.90	0.00	0.90	1
" ,	both	0.76	0.15	0.90	2

MATERIAL EXAMINED

Holotype, female, body length 11 mm, labelled: SM H 45520, Anenous Pass, S side, 29°17'S, 17°37'E, 7-9 September 1982, under stones, hillside, M.-L. Penrith. In alcohol. SM type number T 021. (SM)

Allotype, male, body length indeterminate due to stretching, labelled: SM H 45518, rest as holotype. In alcohol. (SM)

Paratypes: 16 specimens; 8 females, 8 males. All in alcohol.

6; 2 females, 4 males, labelled: SM H 45516, Farquarson, 11-13 September 1982, M.-L. Penrith. (SM)

1 female, labelled: SM H 45519, rest as preceding sample. (SM)

9; 5 females, 4 males, labelled: SM H 45521, Kleinduin, 30 November 1980, J. Irish. (SM)

LOCALITIES

Anenous Pass, S side; Farquarson; Kleinduin.

DISTRIBUTION

Northwestern Cape Province (fig. 36).

HABITAT

Semi-arid succulent shrubland. Sandy substrates. Under dry dung, stones or plants.

DISCUSSION

No other species has a similar overall abdominal setation. C. namaquensis, which has a similar urosternal setation differs in the setation of urotergite I.

Etymology: from Latin desperatio (despair) reflecting the author's reaction at having to provide a name for yet another new species.

Ctenolepisma (S.) namaquensis sp. nov.

DESCRIPTION

Body length of females up to 10 mm, of males up to 12 mm. Body shape slender. Ground colour of body dirty yellowish white. Fairly generally distributed brownish hypodermal pigment present, especially distinct on the antennae, ranging to black on the caudal filaments. Scales dorsally uniform dark brown, ventrally transparent; morphology as usual for genus. Macrosetae dark brown to yellowish brown, plumose.

Setation of head as usual for genus. Maxillary palp quite long and robust, densely clothed with dark-coloured setae. Distal segment of labial palp unilaterally dilated, about 2,25 times wider than long in adult males (fig. 193) (Note: fig. 193 is a partly ventral aspect of the palp, which was unfortunately the best available. When viewed perpendicularly, the palp is shaped as usual for other members of the genus), in females 1,5 times wider than long;

with five sensory papillae arranged in a single row. Eye black, composed of 11 ommatidia. Antennae densely clothed in whorls of slender dark-coloured setae. Adult males with antennae swollen, fleshy.

Nape setated. Thoracic nota each with 8-9 + 8-9 lateral bristlecombs of 2-3 macrosetae each, as well as 1+1 posterolateral bristlecombs of 4-5 macrosetae each.

Urotergal setation: 2+2 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 0 / 1+1 bristlecombs. Submedian bristlecombs of 6-7, lateral bristlecombs of 5-7 and sublateral bristlecombs of 7-9 macrosetae each. Urotergite X trapezoidal, width to length ratio 0,39, posteriorly straight to slightly rounded, with a lateral marginal setal fringe and 1+1 bristlecombs of 6-7 macrosetae each (fig. 191).

Thoracic sterna shaped as in figs. 188, 189, 190. Prosternum (fig. 188) with 2+2 bristlecombs, situated distant from each other; mesosternum (fig. 189) with 2+2 proximate bristlecombs; metasternum (fig. 190) with 1-2 + 1-2 proximate bristlecombs; all bristlecombs of 6-9 macrosetae each.

Successive posteriad pairs of legs lengthening, tibia III 1,75 to 2 times longer than tibia I. Legs sparsely setated. Tarsi with two claws and an empodium.

Urosternal setation: 1 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / - bristlecombs. Lateral bristlecombs of 9-13 macrosetae each, median bristlecombs of 10-15, but as few as 7 on urosternite I, macrosetae each. Coxites IX with inner processes subtriangular, with a robust marginal setal fringe (fig. 192). Adult females with two pairs of styli, acquiring the second pair at about body length 5 mm. Males up to 12 mm body length with one pair of styli only.

Ovipositor long, reaching beyond the apices of styli IX by about 1,5 times the latter's length, slender; apices of gonapophyses slightly swollen, but unsclerotised (fig. 194). Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions

		ave.	s.d.	max.	n
Body length,	female	7.52	1.53	10.00	28
" " ,	male	7.94	1.63	12.00	32
" " ,	both	7.81	1.54	12.00	60
Antennae,	female	0.66	0.08	0.80	5
" ,	male	0.82	0.10	1.00	10
" ,	both	0.77	0.12	1.00	15
Cerci,	female	0.80	0.00	0.80	1
" ,	male	0.72	0.09	0.90	6
" ,	both	0.73	0.09	0.90	7
Filum	female	0.66	0.10	0.75	2
terminale,	male	0.74	0.05	0.80	3
" ,	both	0.71	0.08	0.80	5

MATERIAL EXAMINED

Holotype, female, body length 8 mm, labelled: SM H 45457, Schaaprivier, 29°41'S, 17°40'E, 13-15 September 1982, under plants, M.-L. Penrith. In alcohol. SM type-number T 022. (SM)

Allotype, male, body length 9 mm, labelled: SM H 45522, 10 km S Jakkalsputs, 28°31'S, 17°00'E, 11 September 1982, under quartz, M.-L. Penrith. In alcohol. (SM)

Paratypes: 61 specimens; 23 females, 28 males, 10 unsexed. All in alcohol.

27; 14 females, 13 males, labelled: SM H 45456, 22 km N Eksteenfontein, 11 September 1982, M.-L. Penrith. (SM)

1 male, labelled: SM H 45419, Numees Mine, 22 December 1980, J. Irish. (SM)

4; 1 female, 3 males, labelled: SM H 45458, Die Koei, 22 December 1980, J. Irish. (SM)

3; 2 females, 1 male, labelled: SM H 45459, rest as holotype. (SM)

1 male, labelled: SM H 45461, Pink Pan, 23 December 1980, J. Irish. (SM)

1 male, labelled: SM H 45462, Jakkalsputs, 9-11 September 1982, M.-L. Penrith. (SM)

3; 1 female, 2 males, labelled: SM H 45463, Graskom, 15-18 September 1982, M.-L. Penrith. (SM)

19; 3 females, 6 males, 10 unsexed, labelled: SM H 45464, Flaminksvlakte, 18-20 September 1982, M.-L. Penrith. (SM)

1 female, labelled: SM H 45517, Farquarson, 11-13 September 1982, M.-L. Penrith. (SM)

1 female, labelled: SM H 45703, Rooilepel, 19 August 1983, E. Griffin. (SM)

Additional material examined (not designated as types due to damage or immaturity): 15 specimens; 7 females, 7 males, 1 unsexed. (SM)

LOCALITIES

Anenouspas, 10 km W; Die Koei; Eksteenfontein, 22 km N; Farquarson; Flaminksvlakte; Graskom; Jakkalsputs; Jakkalsputs, 10 km S; Khubus, 2 km E; Numees Mine; Pink Pan; Rooilepel; Rosh Pinah, 10 km NW; Rosyntjiewater; Schaaprivier; Wolwekop.

DISTRIBUTION

Northwestern Cape Province and southwestern South West Africa (fig. 195).

HABITAT

Semi-arid succulent shrubland. Hard substrates. Mostly under stones, but also under dry dung, wood or plants.

DISCUSSION

No other species has a similar overall abdominal setation. Superficially resembles _C_. _capensis_, _C_. _activa_, _C_. _intercursa_, _C_. _prompta_ and _C_. _desperata_.

Etymology: from Namaqualand, a regional name for the northwestern Cape Province, where the species occurs.

SPECIES-GROUP _spinipes_

Characterised by urosternal setation: 0 / 1 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / + bristlecombs. Includes a single highly apomorphic species from the central Namib desert.

Ctenolepisma (*S.*) *spinipes* sp. nov.

DESCRIPTION

Body length of females up to 5,5 mm, of males up to 5 mm. Body shape squat (fig.196). Ground colour of body yellowish white. Faint brownish hypodermal pigment present on the antennae, maxillary palpi, caudal filaments and posteroventral abdomen. Scales dorsally golden yellow, ventrally transparent; morphology as usual for genus. Macrosetae golden yellow, plumose.

Setation of head as usual for genus. Maxillary palp short, with individual segments very short and plump (fig. 198). Distal segment of labial palp small, rounded, scarcely dilated, with two tiny sensory papillae only (fig. 197). Eye black, composed of 14 ommatidia, small. Antennae with whorls of light-coloured setae.

Nape setated. Thoracic nota laterally very rounded, lacking posterolateral bristlecombs. Pronotum with 6+6 lateral bristlecombs of 4-6 macrosetae each. Meso- and metanota with 7+7 lateral bristlecombs of 5-7 macrosetae each.

Urotergal setation: 2+2 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 2+2 / 0 / 1+1 bristlecombs. Submedian and lateral bristlecombs of 3-5 macrosetae each. Sublateral bristlecombs of 5-8 macrosetae each on urotergites I-III and 2-4 macrosetae each on urotergites IV-VIII. Urotergite X trapezoidal, short, width to length ratio 0,23, not covering the base of the filum terminale, posterior margin distinctly emarginate; with a lateral marginal setal fringe and 1+1 bristlecombs of 5-6 macrosetae each (fig. 203).

Thoracic sterna shaped as in figs 199, 200, 201. Prosternum (fig. 199) with 3-4 + 3-4 bristlecombs of 3-8 macrosetae each. Mesosternum (fig. 200) with 3+3 bristlecombs of 3-4 macrosetae each. Metasternum (fig. 201) with an irregular setal fringe, not differentiated into bristlecombs.

Successive posteriad pairs of legs lengthening strongly, tibia III about twice length of tibia I. Setation of legs much as in _C. namibensis_, with the very robust apical tibial spines especially noticable (fig. 202). Tarsi with two claws and an empodium, but the latter small and often difficult to discern.

Urosternal setation: 0 / 1 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / + bristlecombs. Lateral bristlecombs of 2-5, median bristlecombs of 3 macrosetae each. Coxites IX with inner processes short, subtriangular in the female but apically rounded in the male, with a robust marginal setal fringe and 1+1 oblique bristlecombs of 4-5 macrosetae each; outer processes with scattered setae (figs 204, 205). Both sexes with one pair of styli only, absent in small nymphs.

Ovipositor short, reaching to about the bases of styli IX, conical; apices of gonapophyses unsclerotised (fig. 204). Penis as usual for genus, parameres absent.

Caudal filaments setated as usual for genus.

Proportions

		ave.	s.d.	max.	n
Body length,	female	4.75	0.61	5.50	3
" " ,	male	4.50	0.41	5.00	3
" " ,	both	4.63	0.54	5.50	6
Antennae,	female	0.29	0.03	0.32	2
" ,	male	0.30	0.03	0.33	3
" ,	both	0.29	0.03	0.33	5
Cerci,	female	0.19	0.01	0.21	3
" ,	male	0.22	0.02	0.25	3
" ,	both	0.21	0.02	0.25	6
Filum	female	0.32	0.005	0.32	3
terminale,	male	0.39	0.008	0.40	3
" ,	both	0.35	0.04	0.40	6

MATERIAL EXAMINED

Holotype, female, body length 4,75 mm, labelled: SM H 45409, Kahani dune, 23°34'S, 15°00'E, 21 April 1982, pittraps, 09h15, D. Osberg. In alcohol. SM type-number T 010. (SM)

Allotype, male, body length 5 mm, labeled: SM H 45613, Kahani dune, 23°34'S, 15°00'E, 6 November 1982, pittraps in interdune valley, J. Irish. In alcohol. (SM)

Paratypes: 7 specimens; 4 females, 2 males, 1 nymph. All in alcohol.

5; 2 females, 2 males, 1 nymph, labelled: SM H 45173, rest as allotype. (SM)

2 females, labelled: SM H 45408, Mniszechi's Vlei, 11 December 1981, Fielden. (SM)

2 males, labelled: Tsondab flats at 2315Cc, 15/16 May

1984, J. Irish, H. Liessner. (MBOC)

LOCALITIES

Kahani dune; Mniszechi's Vlei; Tsondab flats at 2315Cc.

DISTRIBUTION

Known only from a limited area on the northern edge of the main Namib dune sea (fig. 178), but probably more widespread within the dune sea.

HABITAT

Desert. Gravelly to sandy substrates. All specimens from pittraps on the interdune valley or lower dune slope. Since they were found at sunset in traps set out that morning, I must conclude that the species is at least partly diurnally active.

DISCUSION

Superficially resembles *C. namibensis*, but may be distinguished from this and all other *Ctenolepisma* species by the unique urosternal setation.

Etymology: from Latin *spina* (thorn) and *pes* (foot), referring to the robust setation of the legs.

SPECIES EXCLUDED FROM *Ctenolepisma*

"*Ctenolepisma*" *schultzei* Silvestri

Ctenolepisma schultzei Silvestri, 1908: 294.

Examination of the types (from Steinkopf, in ZMHU) as well as newly collected material (from near Pofadder) shows that this is not a *Ctenolepisma* species, as it has a urotergal setation atypical for the genus. A new genus, to include this and two other undescribed species (from the central and northern Namib respectively), will be described in a subsequent study.

V. PHYLOGENY AND EVOLUTION

1. Characters utilised

A list of the phylogenetic significance of the different character states found in Ctenolepisma species follows. These are based on the information given in Part III. The latter was deduced mainly by outgroup-comparison with the family Nicoletiidae, tested against data available for the more plesiomorphic lepismatid genera (e.g Lepisma) as well as the relatively plesiomorphic genera (e.g. Thermobia) which probably share recent ancestors with Ctenolepisma. Wherever possible, the plesiomorphic and apomorphic states for a specific character are noted, but this was of course not possible in the case of character states with relative significance only. Characters constant within the genus, or of totally unknown phylogenetic significance, or for which information is available mainly for the species treated in Part IV only, are omitted.

The characters below were noted for each Ctenolepisma species in Table 1, the information in the latter coming from Part IV here and descriptions as listed in Appendix 3. In cases of simple apo/plesiomorphy, "0" was used to denote plesiomorphy and "1" to denote apomorphy. In other cases the information as noted below was used in the table. Numbers of characters in the list below correspond to character numbers on the table.

CHARACTER	PLESIOMORPHIC STATE	APOMORPHIC STATE	DENOTED IN TABLE BY:

1. Body length.	(Relative)		Maximum recorded value in mm.
2. Body shape.	Slender.	Squat.	0/1
3. Hypodermal pigment.	Present.	Absent.	0/1
4. Colour.	Uniform.	Patterned.	0/1
5. Scale morphology.	Densely striate.	Finely striate.	0/1
6. Maxillary palp, length.	Longer. (Relative)	Shorter.	0/1
7. Labial palp, distal segment.	Undilated. (Relative)	Dilated, wide.	Maximum recorded.
7a. If dilated:	Unilateral.	Bilateral.	0/1
8. Labial palp, sensillae.	Five (? and more).	Less than five.	0/1, with actual number for "1".
9. Antennal length.	Longer.	Shorter.	Maximum recorded.
10. Antennae: sexual dimorphism.	Absent.	Present.	0/1
11. Thoracic nota, lateral bristlecombs, number.	More.	Less.	Recorded range, all nota.
12. Thoracic nota, lateral bristlecombs, macrosetae per comb.	More.	Less.	Recorded range, all nota.
13. Thoracic nota, posterolateral bristlecombs.	Present.	Absent.	0/1

13a. If present:	Normal position.	Lateral position.	0/1
14. Thoracic nota, posterolateral bristlecombs, macrosetae per comb.	(Relative)		Recorded range.
15. Urotergite I.	1+1 bristlecombs.	2+2 bristlecombs.	0/1
16. Urotergal bristle-combs, macrosetae per comb.	More.	Less.	Recorded range.
17. Urotergite X.	Subtriangular.	Trapezoidal.	0/1
17a. If trapezoidal, length:	(Relative)		Recorded ratio.
18. Urotergite X, macrosetae per comb.	(Relative)		Recorded range.
19. Thoracic sterna, relative shapes.	Similar throughout.	Narrower anteriorly.	0/1
20. Thoracic sterna, setation.	Similar throughout.	Dissimilar.	Maximum recorded.
21. Thoracic sterna, macrosetae per comb.	(Relative)		Recorded range.
22. Legs, relative lengths.	Similar.	Dissimilar.	Tibial ratio.
23. Setation of legs, similarity.	Only in <u>terebrans</u>-lineage.		
24. Empodium.	Present.	Absent.	0/1
25. Median urosternal bristlecombs.	Absent.	Present.	0/1
26. Urosternites, macrosetae per comb.	(Relative)		Recorded range: median/lateral.

27. Styli.	More.	Less.	Maximum recorded.
28. Coxites IX, inner processes.	Longer, narrower.	Shorter, wider.	0/1
29. Coxites IX, inner processes.	No bristlecombs.	Bristlecombs present.	0/1
30. Ovipositor, length.	Longer.	Shorter.	Maximum recorded.
31. Ovipositor, setae.	Absent, or directed posteriorly or laterally.	Directed anteriorly.	0/1
32. Female posterior gonapophyses.	Unsclerotised.	Sclerotised.	0/1
33. Caudal filaments, relative lengths.	As usual.	Otherwise.	0/1
33a. If normal:	Longer.	Shorter.	Maximum recorded.

The information in Table 1 could not be analysed in the conventional way by e.g. calculation of Wagner Algorithm (Wiley, 1981) or Simple Matching Coefficients (Sneath & Sokal, 1973). This is because many characters for many species have missing values, and also because many characters are expressed as ranges of values, which are impossible to reduce to simple "0/1" notation in any objective manner. The phylogenetic analysis of the genus therefore had to proceed in a more subjective way.

2. Subgeneric system for world species

Because the genus seemed to consist of several different lineages, and because analysing these in bulk would have led

TABLE I

	1	2	3	4	5	6	7	a	8	9	10	11	12	13	a	14	15	16	17	a	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	a
<u>Ctenolepisma</u> (<u>Ctenolepisma</u>)																																					
species-group <u>lineata</u>																																					
<u>C. submagna</u>	12	0	0	0	0	0	¾	0	0	.87	0	8-11	2-3	0	0	5	0	4-6	0	-	6-7	0	1/1/1	2-3	-	-	0	0	9-11	3	0	0	1¾	0	0	0	.78
<u>C. basilewskyi</u>	10	0	0	-	0	1	1¼	0	0	.66	0	8-10	2-3	0	0	4	0	4-10	0	-	6	1	1/1/1	5-8	-	-	-	0	5-10	3	1	0	-	-	-	0	.60
<u>C. hummelincki</u>	9	-	0	-	0	-	1½	0	0	-	-	8-11	2-5	0	-	8-10	0	6-16	0	-	6-7	1	6/2/1	4-14	-	-	0	0	16-20	3	0	0	-	0	0	-	-
<u>C. versluysi</u>	7	0	0	0	-	-	1¼	0	-	-	-	-	-	0	-	-	-	-	0	-	4	-	-	-	-	-	-	0	-	3	0	0	-	-	0	-	-
<u>C. vieirai</u>	9	0	0	1	-	-	1½	0	0	.50	-	7-9	3-5	0	0	4-6	0	4-12	0	-	6-11	1	5/2/2	4-10	-	-	-	0	10-19	3	1	0	2	0	0	-	.50
<u>C. brauni</u>	15	0	0	-	0	-	1¼	0	0	1.2	-	8-12	5-6	0	-	6-9	0	5-12	0	-	6	1	1/2/2	7	-	-	0	0	12-15	3	0	0	2	0	0	0	1.1
<u>C. lineata</u>	12	0	0	1	-	0	1½	0	0	1.2	-	-	-	0	0	-	0	-	0	-	6	-	5/2/1	9	-	-	0	0	-	3	1	0	-	0	0	-	1.2
undifferentiated groups																																					
<u>C. targioniana</u>	15	-	0	-	0	-	1¼	0	0	.55	-	8-15	1-4	0	0	4-6	0	3-13	1	.29	4-8	1	1/1/1	4-10	-	-	0	0	6-15	3	0	0	1½	0	0	-	.56
<u>C. brachyura</u>	6	-	-	-	1	-	1¼	0	-	-	-	-	-	-	-	-	-	2-4	1	.34	3	-	-/-/1	-	-	-	0	0	4-6	2	0	0	-	-	-	-	-
<u>C. conductrix</u>	10	-	-	-	-	-	1¼	0	-	.67	-	-	-	-	-	-	-	6-8	1	.51	7	-	-/-/2	-	-	-	-	0	10-12	2	0	0	1½	0	0	-	-
<u>C. diversisquamis</u>	6	0	-	-	1	-	1¼	0	-	.77	-	-	-	0	-	-	0	-	1	.36	3	-	-/-/1	-	-	-	0	0	-	2	1	0	1	0	0	-	.69
<u>C. incita</u>	10	-	-	-	1	-	¾	-	-	.65	-	-	-	-	-	-	-	2-4	1	.36	3	-	-/-/1	-	-	-	-	0	3-6	2	0	0	2	0	0	-	-
<u>C. nigerica</u>	14	-	0	-	1	-	1¼	0	0	-	-	8-14	3-6	0	0	4-6	0	5-13	1	.56	5-7	1	1/1/1	9-15	-	-	0	0	10-18	2	0	0	-¼	0	0	-	.64
<u>C. nigra</u>	6	0	-	-	0	-	1	0	0	.83	-	-	-	0	-	2-3	0	2-7	1	.25	-	-	-/-/1	-	-	-	0	0	2-3	2	1	0	-	-	-	0	.83
<u>C. reducta</u>	7	0	-	-	0	-	¾	-	-	-	-	-	-	0	0	2-3	0	2-4	1	.25	-	-	-	-	-	-	-	0	4	2	0	-	-	-	-	-	-
<u>C. rothschildi</u>	7	-	-	-	-	-	1	-	-	.86	-	-	2-3	-	-	-	0	2-3	1	.44	3	-	-/-/1	-	-	-	-	0	-	2	1	0	-	-	-	-	-
<u>C. abyssinica</u>	8	-	0	-	1	-	1	-	0	.29	-	8-12	2-4	0	0	3	0	3-8	1	.41	5-7	1	3/1/1	3-11	-	-	0	0	7-12	2	0	0	1	0	0	-	.36
<u>C. alghartica</u>	11	0	0	-	0	-	1	0	0	.50	-	7-10	2-6	0	0	7-8	0	6-9	1	.20	7-8	1	4/2/2	5-10	-	-	-	0	11-15	2	-	0	1	0	0	-	.50
<u>C. burmanica</u>	13	-	0	-	-	-	1½	0	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	1.3
<u>C. ciliata</u>	10	-	0	1	-	-	-	-	-	1	-	5-7	-	0	0	-	0	-	1	-	-	-	-	-	-	-	0	0	-	2	0	0	-	0	0	-	1
<u>C. feae</u>	15	0	-	-	0	0	1¼	0	-	2	-	-	-	0	-	-	0	-	0	-	-	-	-/-/2	-	-	-	-	0	-	2	0	0	1½	0	0	0	1.2
<u>C. longicaudata</u>	15	0	0	0	0	-	½	-	0	1	-	10	4-6	0	-	7	0	5-11	1	.39	7-11	1	3/3/2	-	-	-	0	0	11-18	2	0	0	1½	0	0	-	1.5
<u>C. alticola</u>	15	0	-	-	-	-	¾	0	0	.66	-	7-12	-	0	-	-	-	10-12	1	.47	6-7	-	-	-	-	-	-	0	-	2	0	0	1	0	0	-	.73
<u>C. boetgerianum</u>	9	0	-	-	-	-	1½	0	(3)	.66	-	-	2-3	0	-	3	0	3-4	1	-	4	-	-	-	-	-	-	0	6	2	-	-	2	0	0	-	.90
<u>C. insulicola</u>	12	-	0	-	0	-	1½	0	0	.60	-	9-14	2-7	0	0	8-12	0	6-15	1	.34	7-10	1	6/3/1	4-16	-	-	-	0	13-25	2	1	0	1½	0	0	-	.50
<u>C. mauritanica</u>	13	0	0	0	-	-	1¾	0	0	.95	0	9-11	3-7	0	-	4	0	9-15	1	.35	10-13	1	3/2/1	-	-	-	0	0	9-17	2	0	0	¼	0	0	-	.75
<u>C. dubitalis</u>	10	-	0	-	0	-	1½	0	0	1.0	-	5-8	2-8	0	0	2-3	0	1-6	1	.26	2	1	4/4/3	3-8	-	-	0	0	8-12	2	1	0	-⅓	0	1	0	1.0

TABLE I (continued)

	1	2	3	4	5	6	7	a	8	9	10	11	12	13	a	14	15	16	17	a	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	a
Ctenolepisma (Sceletolepisma)																																					
species-group hova																																					
C. unipectinata	8	-	0	-	-	-	1.1	0	(6)	.75	-	7-10	2-5	0	0	2-3	0	3-7	1	.31	4-6	1	2/2/2	2-5	-	-	0	0	3-4/5-9	3	0	0	2.0	0	0	-	.61
C. pretoriana	9	-	0	-	0	-	$1\frac{1}{4}$	0	0	.66	-	8-10	3-4	0	-	5-6	0	6-9	1	.35	7-8	1	2/2/1	12-15	-	-	-	1	-	3	0	0	1.0	0	0	-	.90
C. howa	13	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-
species-group villosa																																					
C. decellei	10	-	1	-	0	-	$1\frac{1}{4}$	0	0	.50	-	6-9	2-4	0	0	4	0	4-9	1	.39	6	1	2/2/2	4-6	-	-	0	1	5-6/6-10	2	1	0	-	-	-	-	-
C. targionii	10	0	1	0	0	-	1	0	0	.66	-	-	3-5	0	-	3-7	0	5-10	1	-	7-8	-	-	-	-	-	0	1	6-10/11-15	2	0	0	1.0	0	0	0	.55
C. villosa	10	0	-	0	0	-	$1\frac{1}{4}$	0	(4)	.70	-	-	4-5	0	-	4-6	0	4-8	1	-	6-9	-	-	-	-	-	-	1	6/6-7	2	0	0	.50	0	0	0	.70
C. sudanica	10	-	1	-	0	-	$1\frac{1}{2}$	0	0	.40	-	6-9	2-6	0	0	4-6	0	6-11	1	.40	8-9	1	3/2/2	4-7	-	-	0	1	8-16/8-14	2	1	0	1.2	0	0	-	-
C. confusum	11	0	-	0	0	-	$1\frac{1}{2}$	0	0	.66	-	5-9	2-6	0	-	3-4	0	5-15	1	.37	8-9	1	2/2/2	7-10	-	-	-	1	8-16/11-21	1	1	0	-.3	0	0	-	.61
C. gambiana	5	0	0	0	0	1	$1\frac{1}{4}$	0	(4)	1.0	0	4-6	2-3	0	0	2-3	0	1-4	1	.40	4	1	2/2/2	2-4	-	-	0	1	3-4/4-6	2	0	1	1.0	0	0	0	.75
C. halophila	7	-	-	-	-	-	$1\frac{1}{4}$	0	(3)	-	-	4-9	2-4	-	-	-	0	3-5	1	.30	2-4	1	2/2/2	2-5	-	-	0	1	4-5/3-7	1	1	0	1.0	0	0	-	-
C. lindbergi	7	0	0	0	0	-	$\frac{3}{4}$	0	0	.50	-	5-8	3-4	0	-	3-5	0	4-7	1	.47	5-8	1	1/2/2	4-7	-	-	-	1	5-7/8-11	1	1	0	1.1	0	0	0	.35
C. roszkowskii	10	0	-	0	0	-	$\frac{3}{4}$	-	(3)	.50	-	6-9	3-6	0	-	5	0	5-10	1	.35	6-8	1	4/3/2	4-12	-	-	-	1	8-15/10-14	1	1	0	1.0	0	0	-	.40
C. sabirovae	7	-	0	0	-	-	1.1	0	0	-	-	5-7	2-5	0	-	3	0	3-5	1	.33	5	1	3/3/2	2-5	-	-	0	1	4/5-7	1	0	0	.25	-	1	-	-
C. wahrmani	15	0	1	-	0	0	$1\frac{3}{4}$	0	0	-	-	6-9	5-8	0	-	6-7	0	8-12	1	.37	11-13	1	2/2/2	-	-	-	-	1	25/25	1	1	0	1.0	0	0	-	1.0
C. kervillei	8	-	-	-	0	-	1.1	0	-	.63	-	-	-	0	-	-	-	-	1	.29	8	-	-/-/2	-	-	-	-	1	-	1	1	0	-	-	-	0	.56
C. maroccana	6	0	1	-	0	-	1	-	0	.50	-	4	2-3	0	-	1-2	0	2	1	.29	3	1	2/2/2	2-3	-	-	0	1	3/3	1	1	1	2.0	0	0	-	.50
C. africanella	9	0	0	-	0	1	1.1	0	(3)	.66	-	7-8	1-4	0	-	4	0	3-5	1	.26	4	1	5/3/2	1-5	-	-	-	1	4-5/6-10	2	1	0	.50	0	0	0	.90
C. weberi	11	-	0	-	0	-	1.5	0	0	1.1	-	6-10	3-5	0	-	8-10	0	8-12	1	.30	10	1	3/1/1	5-25	-	-	-	1	10-11/12-20	1	1	0	-	-	-	-	1.0
species-group michaelseni																																					
C. kaszabi	11	0	0	0	0	-	$1\frac{1}{4}$	0	0	1.0	0	5-8	2-5	0	1	3-4	0	4-11	1	.50	5	1	3/3/3	8-16	-	-	-	1	8-11/11-15	1	1	0	1.1	0	0	0	.66
C. michaelseni	9	0	-	-	-	-	2.0	0	0	.78	-	5-6	-	0	-	-	0	-	1	.45	6	-	-/-/2	-	-	-	-	1	-	1	1	1	1.5	0	0	0	.89
species-group grandipalpis																																					
C. dewittei	7	-	0	-	0	-	1.2	0	0	1.0	-	8-13	2-4	0	0	5-7	0	5-10	1	.38	7	1	2/2/1	4-13	-	-	-	1	4-5/8-14	2	0	0	1.0	0	0	-	.70
C. tanzanica	8	-	0	-	0	-	.75	-	(6)	-	-	8-12	2-3	0	0	4-5	0	3-8	1	.35	5	1	2/2/2	2-7	-	-	-	1	3/5-9	2	1	0	-	-	-	-	.30
C. desaegeri	9	-	0	-	0	-	$1\frac{1}{4}$	0	0	.30	-	7-12	2-3	0	0	3-4	0	3-6	1	.28	4-5	1	3/2/1	2-9	-	-	0	1	1-4/5-10	2	1	0	$1\frac{1}{2}$	0	0	-	-
C. grandipalpis	17	0	0	0	0	0	$2\frac{1}{2}$	0	0	1.0	0	6-10	2-4	0	0	5-6	0	5-7	1	.48	5-6	1	3/2/1	2-24	$1\frac{3}{4}$	-	0	1	8-35/12-14	2	1	0	$1\frac{1}{2}$	0	0	0	.93
C. picturata	12	0	0	1	0	-	$2\frac{1}{2}$	0	0	.50	-	7-9	2-3	0	-	4-5	0	5-7	1	.75	7-8	1	3/2/2	6-9	-	-	0	1	14-25/12-18	1	1	0	.50	0	0	0	.30

TABLE I (continued)

	1	2	3	4	5	6	7	a	8	9	10	11	12	13	a	14	15	16
C. *inornata*	14	0	0	0	0	0	1¾	0	0	.89	0	6-9	2-4	0	0	3-4	0	5-7
C. *kaokoensis*	9	0	0	0	0	0	1½	0	0	.63	0	7-9	2-3	0	0	2-3	0	4-5
C. *saxota*	9	0	0	0	0	0	3¼	0	0	.67	0	6-9	3-4	0	0	7	0	6-9
C. *prompta*	12	0	0	0	0	0	2½	0	0	.80	0	5-9	2-3	0	0	3-6	1	5-10
C. *intercursa*	12	0	0	0	0	0	2½	0	0	.86	0	5-9	2-3	0	0	3-6	1	5-10
C. *plusiochaeta*	10	0	0	0	0	0	1½	0	0	.92	0	7-8	2-4	0	0	4	0	3-6
C. *parcespinata*	10	0	0	0	0	0	1½	0	0	1.1	0	7-8	2-3	0	0	3-4	0	4-7
C. *penrithae*	8	0	0	0	0	1	2	0	0	.64	0	7-8	2-4	0	0	4-5	0	3-6
C. *detritus*	8	0	0	0	0	0	1¾	0	0	.68	0	6-8	2-3	0	0	3-7	0	4-8
C. *occidentalis*	12	0	1	0	0	1	1¾	0	0	.64	0	6-8	2-5	0	0	4	0	4-10
C. *ugabensis*	9	0	1	0	0	1	1¾	0	0	.75	0	7-8	3-5	0	1	2-4	0	3-7
C. *ossilitoralis*	7	0	0	0	0	1	1½	0	0	.75	0	5-7	2-4	0	0	2	0	3-5
C. *namibensis*	7	1	0	1	0	1	1¾	0	(2)	.75	0	5-7	3-5	1	-	-	1	2-9
C. *terebrans/pluriseta/latera*	18	0	1	0	0	1	3	0	0	1.1	0	8-10	3-5	0	0	3-4	0	3-6
C. *subterebrans*	9	0	1	0	0	1	2	0	0	.77	0	8	3-4	0	0	2-3	0	3-9
C. *placida*	11	0	1	0	0	0	2½	0	0	.73	0	6-8	3	0	0	3	0	5-10
C. *luederitzi*	13	0	0	0	0	1	2½	0	0	.69	0	7-8	2-4	0	1	3	0	5-7
C. *sanctaehelenae*	13	0	0	0	0	-	1½	0	0	1.0	0	8-10	3-5	0	0	7	0	7-11
species-group *activa*																		
C. *activa*	8	0	1	0	0	1	1¾	0	0	.50	0	7-8	2-4	0	0	2-3	1	3-8
C. *capensis*	9	0	0	0	0	1	1¾	0	0	.83	0	7-9	3-4	0	0	4-6	1	4-8
C. *pauliani*	15	0	1	0	0	1	4	1	0	2.5	0	6-12	2-4	0	0	2	0	3-5
C. *arenicola*	10	0	1	0	0	1	1¾	0	0	.75	0	5-6	1-3	0	1	2	1	2-5
C. *tenebrica*	11	0	-	-	0	-	2½	0	-	.45	-	6	1-3	0	0	5	0	4-5
species-group *corvina*																		
C. *corvina*	6	0	0	0	0	1	1½	0	0	.45	0	7-8	2-3	0	0	2-3	0	2-4
C. *desperata*	12	0	0	0	0	1	3	0	0	.91	0	7-8	2-4	0	0	3	0	4-7
C. *namaquensis*	12	0	0	0	0	0	2¼	0	0	1.0	1	8-9	2-3	0	0	4-5	1	6-9
species-group *spinipes*																		
C. *spinipes*	5	1	0	0	0	1	1	-	(2)	.33	0	6-7	4-6	1	-	-	1	2-8

	17	a	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	a
C. *inornata*	1	.55	6-7	1	2/2/1	4-10	1¼	-	0	1	7-11/10-17	2	1	0	1.0	0	0	0	.80
C. *kaokoensis*	1	.54	6-8	1	3/2/2	4-8	1½	-	0	1	6-10/9-12	2	1	0	1.0	0	0	0	.56
C. *saxota*	1	.59	9	1	2/2/1	10-26	1¾	-	0	1	9-26/6-18	2	1	0	2.0	0	0	0	.59
C. *prompta*	1	.60	5-7	1	3/2/2	5-18	1¾	-	0	1	6-15/6-17	2	1	0	2.0	0	0	0	.71
C. *intercursa*	1	.60	5-7	1	3/2/2	5-13	1¾	-	0	1	6-15/6-17	2	1	0	2.0	0	1	0	1.0
C. *plusiochaeta*	1	.46	3-4	1	3/2/2	3-6	1½	-	0	1	10-17/5-11	2	1	0	1.0	0	0	0	.77
C. *parcespinata*	1	.46	3	1	4/3/2	4-7	1¾	-	0	1	16-25/8-14	2	1	0	1.0	0	1	0	-
C. *penrithae*	1	.29	5-7	1	3/2/2	3-6	2	-	0	1	6-11/7-9	2	1	0	.1	0	0	0	.80
C. *detritus*	1	.23	5-6	1	3/2/1	5-17	1¾	-	0	1	9-24/6-14	2	1	0	.9	0	1	0	.83
C. *occidentalis*	1	.60	6-7	1	5/4/3	3-13	2	-	0	1	15-39/8-16	2	1	0	.1	0	1	0	.50
C. *ugabensis*	1	.43	7	1	6/4/3	-	2½	-	0	1	6-10/6-10	1	1	0	-.5	0	1	0	1.0
C. *ossilitoralis*	1	.29	5	1	4/3/2	4-8	2	-	0	1	3-4/3-5	1	1	0	1.0	0	0	0	.64
C. *namibensis*	1	.33	3-4	1	5/3/2	3-12	2½	-	0/1	1	3-6/3-6	1	1	1	-	0	0	0	.61
C. *terebrans/pluriseta/latera*	1	.54	5-7	1	2/2/2	3-8	2	x	0	1	3-6/5-10	2	1	0	.20	1	1	0	1.0
C. *subterebrans*	1	.44	4-5	1	2/2/1	3-7	2	x	0	1	2-4/5-7	1	1	0	-	1	0	0	.85
C. *placida*	1	.56	6-7	1	5/4/3	1-13	2	x	0	1	12-20/10-13	2	1	1	-.7	1	1	0	.89
C. *luederitzi*	1	.64	6	1	6/4/3	5-11	2½	x	0	1	7-9/7-11	2	1	1	-.7	1	1	0	.90
C. *sanctaehelenae*	1	.34	6-7	1	4/3/3	6-14	-	-	-	1	14-28/17-21	1	1	0	1.0	1	1	0	.90
species-group *activa*																			
C. *activa*	1	.76	4-6	1	2/2/2	3-5	1½	-	0	1	6-11/7-14	1	1	0	2.0	0	0	0	.50
C. *capensis*	1	.48	5-7	1	3/2/2	3-16	1½	-	0	1	7-13/10-13	2	1	0	1.5	0	0	0	.67
C. *pauliani*	1	.58	6	1	fringe	-	2½	x?	1	1	5-7/5-7	1	1	0	-.5	0	0	1	2.4
C. *arenicola*	1	.28	1-2	1	5/5/4	2-7	1½	-	0	1	10-15/5-14	1	1	0	-.5	0	0	0	.71
C. *tenebrica*	1	.62	5	-	-/-/2	5-6	-	-	0	1	4-6/8-10	1	1	0	-	-	0	0	.36
species-group *corvina*																			
C. *corvina*	1	.65	3	1	2/2/1	2-6	1½	-	0	1	4-8/3-7	2	1	0	1.5	0	0	0	.40
C. *desperata*	1	.49	7	1	6/4/3	3-11	3	x	0	1	14-30/10-15	2	1	0	-.7	1	0	0	.90
C. *namaquensis*	1	.39	6-7	1	2/2/1	6-9	2	-	0	1	7-15/9-13	2	1	0	1.5	0	0	0	.90
species-group *spinipes*																			
C. *spinipes*	1	.23	5-6	1	4/3/fr.	3-8	2	-	0/1	1	3/2-5	1	1	1	-.5	0	0	0	.40

to erronous results (because I would then have been working with an unnatural group) the first priority was to establish a firm subgeneric system. In this regard I was led by two principles, as follows:

1. Characters used in denotion of subgenera should be absolute, not relative. It should be possible to assign any species unequivocally to a subgenus. Relative characters do have use on the species level, but it was felt that subgenera represent more ancient evolutionary units, and as such should be definable by less relative characters. If this is impossible, subgenera should not be designated.

2. The distribution of subgenera should be compatible with the allopatric speciation model, as expounded *i.a.* by Wiley (1981). Sympatric speciation undoubtedly can and does occur, and in the present study a case for sympatric speciation may be made out of *C. terebrans*, *C. latera* and *C. pluriseta*. This is, however, an exception, and in the majority of other species one finds closely related species pairs occupying allopatric distribution ranges, implying that they originated by allopatric speciation. Examples are *C. placida*/*C. luederitzi*, *C. intercursa*/*C. prompta*, *C. occidentalis*/*C. ugabensis*, *C. namibensis*/*C. spinipes* and (extralimitally) *C. maroccana*/*C. gambiana* (sp. in press). What is valid for species should then also be valid (at least to an extent) for subgenera, which were once species, too, and valid subgenera should then have allopatric distributions. It should, however, be kept in mind that time may have partly obliterated the allopatric distribution patterns on the subgeneric level and they may not necessarily be as clear as on the specific level.

Escherich (1905) divided his new genus Ctenolepisma into three species-groups on the basis of urotergal setation and named them as follows:

Group "targionii", urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 2+2 / 0 / 1+1 bristlecombs.

Group "ciliata", urotergal setation: 1+1/ 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 2+2 / 0 / 1+1 bristlecombs.

Group "lineata, urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 2+2 / 0 / 1+1 bristlecombs.

Although Escherich examined no such material, the later description of species with urotergal setation: 1+1 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 3+3 / 0 / 1+1 bristlecombs, implied the existence of a fourth group.

The inadequacy of this system was mentioned under C. latera. Further evidence for rejecting this system comes from distribution data for these four groups (fig 206). Three groups are largely sympatric, and the fourth, though occupying a more restricted range, includes only four species and is so small that comparison with the other three is hardly possible. (Domestic species have been excluded from the above maps because they readily disperse with humans outside their natural ranges). Also, many allopatric species pairs belong to different Escherichian species groups, despite their obvious similarity otherwise.

I therefore set to work mapping the distributions of species with different character states for those characters lending themselves to absolute distinction of apo/plesiomorphy. The best results were obtained with urosternal setation, contrasting lack of median bristlecombs with presence thereof, and correlating this with other reliable characters.

Only one type of urosternal setation lacking median bristlecombs is found in _Ctenolepisma_, namely, 0 / 0 / 1+1 / 1+1 / 1+1 / 1+1 / 1+1 / 1+1 / ± bristlecombs. This group is the only one also occurring in the New World (fig. 207), all other groups having an exclusively Old World distribution. Excluding the possibility of rafting, the fact that some species (e.g. _C. diversisquamis_) today occur on both sides of the North Atlantic, testifies to the antiquity of the group lacking median urosternal bristlecombs. The other groups probably evolved _via_ a representative of this group, in the Old World, and after the break-up of Gondwanaland/Laurasia. The inferred plesiomorphy of the group is strengthened by the possession of plesiomorph characters in many species. All species with subtriangular tenth urotergites fall in this group. Eight of the ten known species with three pairs of styli similarly belong here. Similarly, apomorphies as e.g. the possession of 2+2 bristlecombs on urotergite I, the absence of hypodermal pigment or the presence of sclerotised female posterior gonapophyses (excepting _C. dubitalis_ Wygodzinsky, where the sclerotisation is of a type typical for several plesiomorph genera which share distant ancestors with _Ctenolepisma_), are not found in this group.

I considered the group including species lacking median urosternal bristlecombs to be natural and worthy of subgeneric status on the above evidence. Because it includes the type species of the genus, _Lepisma lineata_ F., this must then be the nominate subgenus, _Ctenolepisma_ (_Ctenolepisma_), as it was denoted in Part IV. Because of the absence of the subgenus from southern Africa (excepting _C. longicaudata_) and my consequent lack of experience in the group, I have not attempted to research its internal phylogeny in any detail, beyond noting the existence of a very distinctive group, which I term the lineata species-group (not to be confused with Escherich's lineata-group), and which includes most species with both subtriangular tenth urotergites and three pairs of styli. Obviously, the lineata species-group includes the most plesiomorphic Ctenolepisma stock surviving today.

In the case of those species possessing median urosternal bristlecombs, the subgeneric name Sceletolepisma Wygodzinsky is available. Wygodzinsky created his subgenus for the single species C. arenicola, one of the most apomorphic in the genus. It was felt that subgeneric division in a genus as large as Ctenolepisma should be on a more basic level, therefore I rejected the subgenus Sceletolepisma in the sense in which it was described (as was also done by Paclt, 1967). The name remains available, in a new sense, for the group which includes C. arenicola, as it was used in Part IV.

At least seven distinct types of urosternal setation are found in the subgenus Sceletolepisma. I termed each assemblage of species with the same kind of urosternal setation as a "species-group", followed by the name of the oldest described species included in the group. These species-groups are intended to be used for ease of reference only. Though largely monophyletic, there are clear exceptions to this rule, and especially some of the more apomorphic groups probably include heterogenous species assemblages. It may prove possible in future to provide a more definite system at this level, too, but at present we know too little about too many described species, and nothing of the undoubtedly many species still awaiting collection and description.

Species-group howa includes three species, all with urosternal setations intermediate between that of the subgenus Ctenolepisma and the majority of species in the subgenus Sceletolepisma. The first species, C. unipectinata, has urosternal setation: 0 / 1 / 1+1 / 1+1 / 1+1 / 1+1 / 1+1 / 1+1 / - bristlecombs. Though it belongs to the subgenus Sceletolepisma by virtue of its single median urosternal bristlecomb, it possesses many plesiomorph characters more typical of the subgenus Ctenolepisma, notably its three pairs of styli. In many ways it is a pointer as to how the first C. (Sceletolepisma) species to evolve from C. (Ctenolepisma) may have looked. Its distribution (Kenya) is marginal to the distribution of the subgenus Ctenolepisma (figs 207, 208a), as would be expected if its ancestors evolved by geographical separation of a peripheral isolate. Its distribution is also central to that of the next two major sections, which probably evolved via species resembling C. unipectinata. The second species, C. howa, from Madagascar, with urosternal setation cited as 0?/ 1+1+1?/ 1+1+1 / 1+1 / 1+1 / 1+1 / 1+1 / 1+1 / - bristlecombs, probably represents a step in the development of species with more median urosternal bristlecombs from stock resembling C. unipectinata. The third species, C. pretoriana from the Transvaal, has urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / 1+1 / 1+1 / - bristlecombs, and is the only other species in the subgenus with three pairs of styli. It represents a further evolutionary step towards the possession of a full complement of median urosternal bristlecombs. The three species of the howa-group are probably relicts of the ancestral stock of C. (Sceletolepisma), and their distribution (southeastern Africa) denotes the probable area of origin of the subgenus. South East Africa is badly collected for lepismatids, and the future discovery of more species in this group is likely.

Species-group villosa has urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / 1+1 / ± bristlecombs, i.e., with a single bristlecomb more than C. pretoriana. The two southern African species in the group probably share an ancestor with C. pretoriana. The group is also widespread in North Africa and Eurasia, and the species in the latter areas probably evolved from the howa-group in a manner similar to the southern species, and not necessarily independantly. There is a bipolar decrease in the number of styli with increase in distance from the inferred centre of origin in this group (fig. 208b).

Species-group michaelseni has urosternal setation: 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / 1+1 / ± bristlecombs. It includes two species, one in the Sahara and one in the Gobi desert. Both species probably evolved independantly from villosa-group stock, in response to desert environments. Their anteriad urosternal setation is similar to that of some psammophilous western southern African species, but their lack of a median bristlecomb on urosternite VII shows their affinity with the villosa-group.

Species-group grandipalpis has urosternal setation: 0 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / ± bristlecombs, i.e. it differs from the _villosa_-group only in the setation of urosternite VII. It has a wide distribution in subequatorial Africa, occurring mainly west of the range of the southern African representatives of the _villosa_-group, and includes a species from St. Helena (fig. 208c). Its species possess many apomorphies, and may have evolved directly from the _howa_-group, or _via_ the _villosa_-group. The _villosa_ and _michaelseni_ groups on the one hand, and the _grandipalpis_ and other following groups on the other hand, possibly represent two natural lineages.

Three other small groups of mainly southwestern African species exist (fig. 209). All probably share ancestors with the _grandipalpis_-group, but all are not necessarily monophyletic. Species-group _activa_ has urosternal setation: 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / - ; species-group _corvina_: 1 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / - ; and species-group _spinipes_: 0 / 1 / 1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1+1 / 1+1 / + bristlecombs.

A list of all species included in each of the groups mentioned above will be provided under section 4 below, while the phylogeny of the southern African species will be considered in more detail in the next section.

3. Phylogeny of southern African species

The discussion which follows is summarised in fig. 215.

Considering first the two subequatorial species of the _villosa_-group, we find a southward decrease in number of styli (an apomorphic trait) as was illustrated in fig. 208b. _C_. _africanella_ seems to be the most apomorphic, having a reduced number of labial palpal sensory papillae, less lateral thoracic notal bristlecombs, less macrosetae in all bristlecombs and an increased number of thoracic sternal bristlecombs, all of which are apomorphic traits. The group probably includes more, undescribed, species, but, having an eastern and southern distribution in southern Africa, it falls outside the area of most intensive collecting of lepismatids thus far. The above notes will probably need to be revised once more species become known.

In the grandipalpis-group, because it includes many species of which most were seen by me, I could identify several subgroups or lineages, though the latter are often ill-defined and all may not be completely natural. Initial grouping was done mainly by intuitive association of those species with general overall similarity, and these preliminary groups were then refined by cross-comparison with reference to character states of included species and distributional considerations.

Of the five preliminary lineages identified thus, one occurs in central and eastern Africa only, three occur mainly in southern Africa but also have representatives in adjacent areas, and the fifth occurs only in western southern Africa. There is a general increase in apomorphy, both among lineages and among species within a specific lineage, with increase in distance from the possible centre of origin of the grandipalpis-group (East Africa).

The dewittei-lineage, as one would expect on distributional grounds (fig. 210), includes fairly plesiomorphic species. They possess the highest numbers of lateral thoracic notal bristlecombs found in the grandipalpis-group, relatively few thoracic sternal bristlecombs, and two pairs of styli each (within the grandipalpis-group, two pairs of styli is the most plesiomorphic state known for this character). I have no experience of this subgroup.

The grandipalpis and terebrans lineages seem to be the most plesiomorphic occurring in southern Africa. The terebrans lineage is probably a psammophilous derivate of the grandipalpis lineage. Both groups include large species with robust bodies, characterised especially by the relatively wide thorax. Both have representatives outside southern Africa.

The grandipalpis lineage (fig. 211) includes only two species at present, both heavily pigmented. C. picturata, with a patterned scale cover and a single pair of styli only, is more apomorphic than C. grandipalpis.

The terebrans lineage (fig. 212) is one of the most clearcut. It includes C. terebrans, C. latera, C. pluriseta, C. subterebrans, C. placida, C. luederitzi and the extralimital C. sanctaehelenae. All have anteriorly-directed setae on the shaft of the ovipositor (unique in the genus), many have sclerotised female posterior gonapophyses of a specific kind (clearly distinct from that found in e.g. C. intercursa, C. parcespinata and other species in the lineages following) and all have robust tibial setation, often identical to that typical for C. terebrans. All the species (except C. sanctaehelenae for which no information is available), are psammophilous and possess the ability to sanddive. The most plesiomorphic species, by virtue of its occurrence also in East Africa, is C. pluriseta. It almost certainly shares ancestors with the very similar C. terebrans and C. latera. C. subterebrans agrees with C. terebrans in most aspects except the one pair of styli only (apomorphic) and the presumably secondary loss of sclerotisation of the female posterior gonapophyses; it probably shares an ancestor with C. terebrans and it probably evolved in the northwestern Kalahari (where both occur) and spread westwards on sand of the Kalahari system, eventually invading the northern Pro-Namib. The fact that the Kalahari system in northern South West Africa does not form dunes, the preferred habitat of C. terebrans, while C. subterebrans prefers level sand, may mean that the evolution of these two species was habitat-related. The closely-related C. placida and luederitzi probably also share an ancestor with C. terebrans, the only other species in the lineage occurring in their area, and their evolution may have taken place in a habitat-related manner similar to the case of C. subterebrans (both are psammophilus but do not occur on dunes). Their possession of bristlecombs on coxites IX make them relatively more apomorphic. The ancestors of C. sanctaehelenae probably reached St. Helena by rafting. St. Helena is situated about 2200 km WNW (a direction compatible with present ocean currents) of that portion of the South West African coast where the subgroup occurs. Again, the most likely shared ancestor would be with C. terebrans.

The parcespinata lineage (fig. 213) probably diverged from the grandipalpis lineage at an early stage. All included species are non-psammophilous to petrophilous, have more slender bodies than the preceding two lineages, and have two pairs of styli. Again by virtue of its occurrence in East Africa, the most plesiomorphic species should be C. prompta, with which the very similar and more apomorphic (sclerotised ovipositor) C. intercursa probably shares an ancestor. The sclerotised ovipositor of C. parcespinata links it to C. intercursa, which occurs in the same area. C. plusiochaeta and C. parcespinata have similar urotergal setations, and are probably related, though it is not clear how. C. saxeta is very similar to C. prompta, and they probably evolved from the same stock. The same may also be true for C. kaokoensis and C. inornata, or they may have evolved independantly from the grandipalpis lineage. The positions of most species in the lineage are not very clear.

The namibensis lineage has a fairly restricted distribution (fig. 214). It is the most apomorphic lineage within the species-group, and is characterised mainly by adaptations to a psammophilous lifestyle. Two species with two pairs of styli (plesiomorphic), C. detritus and C. occidentalis, both also have sclerotised ovipositors. In this regard they resemble both C. parcespinata and C. intercursa, though, by their light pigmentation and psammophily, they are probably more closely related to the former. C. detritus is the species within the lineage with the southernmost distribution, approaching the range of C. parcespinata most closely. C. ugabensis is little more than an apomorphic (one pair of styli, posterolateral thoracic notal bristlecombs situated very lateral) version of C. occidentalis, and continues the south to north evolutionary trend in this lineage. C. ossilitoralis and C. namibensis resemble each other on many counts, with C. namibensis being the most apomorphic (reduced number of labial palpal sensory papillae, absence of posterolateral thoracic notal bristlecombs, bristlecombs on coxites IX). The inferred evolutionary trend for these species (see also C. spinipes below) is from north to south. This is contrary to the trend for the previous species. Either this was caused by continued adaptation to sandier habitats which enabled these species to re-invade the original range of the ancestral species and occupy different (sandier) niches in the same area, or they are unrelated and have a northern origin. In the latter case, they probably share an ancestor with C. subterebrans. For the time being, these species are considered part of the namibensis lineage on grounds of overall similarity. C. penrithae is included here for the same reasons, though it does not seem to be closely related to any of the other species.

The only species in the spinipes-group, C. spinipes, is clearly related to C. namibensis, with which it shares many apomorphies, notably the three labial palpal sensory papillae.

Neither of the remaining southern African species-groups, though each has unique urosternal setation, is thought to be monophyletic. In the activa-group, C. activa, C. capensis and C. arenicola, with 2+2 bristlecombs on urotergite I, resemble the species of the parcespinata- lineage, C. pauliani resembles the species near C. terebrans, and the affinities of C. tenebrica (if it belongs here) are unknown.

In the corvina-group, C. corvina seems nearest to C.

penrithae, C. namaquensis (2+2 bristlecombs on urotergite I) has affinities with the parcespinata- lineage and C. desperata (anteriorly-directed setae on the shaft of the ovipositor) with the terebrans- lineage. This means that the most apomorphic urosternal setations in the genus have evolved more than once, although this does not seem to be the case for the more plesiomorphic urosternal setal configurations.

It will probably be possible to refine the above as more southern African species become known. Many areas are still only superficially collected, and I have on hand material belonging to several undescribed species, but so damaged as to be unsuitable for description (preservative trap material). Perhaps among these and others will be found the "missing links" which would help to clarify the many uncertainties still remaining in the phylogeny of the genus.

4. Composition of proposed subgeneric groups

For those species not known to me personally, I have accepted all synonymies as proposed in the literature.

GENUS Ctenolepisma Escherich

SUBGENUS Ctenolepisma (Ctenolepisma) Escherich

SPECIES-GROUP lineata

C. lineata (Fabricius, 1775)

syn. C. vittata (Fabricius, 1798)

syn. C. annuliseta (Lucas, 1840)

syn. C. pilifera (Lucas, 1840)

syn. C. subvittata (Lucas, 1840)

syn. C. nicoleti (Lucas, 1846)

syn. _C._ _parisiensis_ (Nicolet, 1847)

? syn. _C._ _horrens_ (Nicolet, 1847)

syn. _C._ _quadriseriata_ (Packard, 1873)

syn. _C._ _eatoni_ (Ridley, 1881)

syn. _C._ _rubroviolacea_ (Schött, 1897)

syn. _C._ _reticulata_ (Schött, 1897)

_C._ _versluysi_ Escherich, 1905

_C._ _submagna_ Silvestri, 1908

_C._ _brauni_ Wygodzinsky, 1941

_C._ _basilewskyi_ Wygodzinsky, 1957

_C._ _hummelincki_ Wygodzinsky, 1959

_C._ _vieirai_ Mendes, 1981

SPECIES-GROUPS undifferentiated at present

_C._ _ciliata_ (Dufour, 1831)

syn. _C._ _fuliginosa_ (Lucas, 1846)

? syn. _C._ _quadrilineata_ (Lucas, 1846)

? syn. _C._ _unistila_ Silvestri, 1908

_C._ _mauritanica_ (Lucas, 1846)

syn. _C._ _transcaspica_ Escherich, 1905

_C._ _nigra_ (Oudemans, 1890)

? _C._ _burmanica_ (Parona, 1892)

_C._ _longicaudata_ Escherich, 1905

? syn. _C._ _leai_ (Ridley, 1890)

? syn. _C._ _ciliata_ _dives_ Silvestri, 1908

syn. _C._ _urbana_ Slabaugh, 1940

syn. _C._ _longicaudata_ _coreana_ Uchida, 1943

syn. _C._ _pinicola_ Uchida, 1964

_C._ _rothschildi_ Silvestri, 1907

_C._ _diversisquamis_ Silvestri, 1908

_C._ _feae_ Silvestri, 1908

syn. _C._ _feae_ _regalis_ Silvestri, 1908

C. targioniana Silvestri, 1908

C. brachyura Silvestri, 1918

C. conductrix Silvestri, 1918

C. incita Silvestri, 1918

C. reducta Folsom, 1923

? *C. confalonierii* Silvestri, 1932

C. alticola Silvestri, 1935

C. dubitalis Wygodzinsky, 1959

C. boettgeriana Paclt, 1961

C. algharbica Mendes, 1978

C. abyssinica Mendes, 1982

C. nigerica Mendes, 1982

C. insulicola Mendes, 1984

SUBGENUS *Ctenolepisma* (*Sceletolepisma*) Wygodzinsky

SPECIES-GROUP *howa*

C. howa Escherich, 1910

C. pretoriana Wygodzinsky, 1955

C. unipectinata Mendes, 1982

SPECIES-GROUP *villosa*

C. villosa (Fabricius, 1775)

C. targionii (Grassi & Rovelli, 1889)

? *C. weberi* Escherich, 1905

C. kervillei Silvestri, 1911

C. roszkowskii Stach, 1935

C. wahrmani Wygodzinsky, 1952

C. africanella Wygodzinsky, 1955

C. lindbergi Wygodzinsky, 1955

C. confusum Paclt, 1967

C. maroccana Mendes, 1980

C. halophila Kaplin, 1981

C. sabirovae Kaplin, 1982

C. decellei Mendes, 1982

C. sudanica Mendes, 1982

C. gambiana Irish, in press

SPECIES-GROUP michaelseni

C. michaelseni Escherich, 1905

syn. C. silvestrii Stach, 1946

? C. albida Escherich, 1905

C. kaszabi Wygodzinsky, 1970

SPECIES-GROUP grandipalpis

Lineage dewittei

C. dewittei Mendes, 1982

C. desaegeri Mendes, 1982

C. tanzanica Mendes, 1982

Lineage grandipalpis

C. grandipalpis Escherich, 1905

syn. nov. C. laticauda Silvestri, 1922

C. picturata Wygodzinsky, 1955

Lineage terebrans

C. terebrans Silvestri, 1908

C. pluriseta Silvestri, 1908

C. sanctaehelenae Wygodzinsky, 1970

C. latera sp. nov.

C. luederitzi sp. nov.

C. placida sp. nov.

C. subterebrans sp. nov.

Lineage parcespinata

C. parcespinata Silvestri, 1908

C. intercursa Silvestri, 1922

C. plusiochaeta Silvestri, 1922

C. prompta Silvestri, 1922

syn. nov. C. petronia Wygodzinsky, 1955

C. inornata sp. nov.

C. kaokoenis sp. nov.

C. saxeta sp. nov.

Lineage *namibensis*

C. namibensis sp. nov.

C. detritus sp. nov.

C. occidentalis sp. nov.

C. ossilitoralis sp. nov.

C. penrithae sp. nov.

C. ugabensis sp. nov.

SPECIES-GROUP *activa*

C. activa Silvestri, 1922

? *C. tenebrica* Silvestri, 1949

C. arenicola Wygodzinsky, 1955

C. pauliani Wygodzinsky, 1959

C. capensis sp. nov.

SPECIES-GROUP *corvina*

C. corvina Silvestri, 1908

C. desperata sp. nov.

C. namaquensis sp. nov.

SPECIES-GROUP *spinipes*

C. spinipes sp. nov.

SPECIES-GROUP *incertae cedis*

C. angustiella Silvestri, 1949

SUBGENUS *incertae cedis*

C. madagascariensis Escherich, 1910

VI. LITERATURE REFERENCES

ACOCKS, J.P.H. 1975. Veld types of South Africa. (Second edition) Memoirs of the Botanical Survey of South Africa 40: 1-128.

EDNEY, E.B. 1971a. Some aspects of water balance in tenebrionid beetles and a thysanuran from the Namib Desert of southern Africa. Physiological Zoölogy 44 (2): 61-76.

EDNEY, E.B. 1971b. The body temperature of tenebrionid beetles in the Namib Desert of southern Africa. Journal of Experimental Biology 55: 253-272.

ESCHERICH, K. 1905. Das System der Lepismatiden. Zoologica, Stuttgart 43: 1-164.

GRASSI, B. & G. ROVELLI. 1890. I progenitori dei Miriapodi e degli Insetti. Memoria VI. Il sistema dei Tisanuri fondato sopratutto sullo studio dei Tisanuri italiani. Il Naturalista Siciliano 9 (4): 77-87; 9 (5): 105-124.

HEEG, J. 1967a. Studies on Thysanura. I. The water economy of *Machiloides delanyi* Wygodzinsky and *Ctenolepisma longicaudata* Escherich. Zoologica Africana 3 (1): 21-41.

HEEG, J. 1967b. Studies on Thysanura. II. Orientation reactions of *Machiloides delanyi* Wygodzinsky and *Ctenolepisma longicaudata* Escherich to temperature, light and atmospheric humidity. Zoologica Africana 3 (1): 43-57.

HEEG, J. 1969. Studies on Thysanura. III. Some factors affecting the distribution of South African Thysanura. Zoologica Africana 4 (2): 135-143.

HOLM, E. 1970. The influence of climate on the activity patterns and abundance of xerophilous Namib Desert dune insects. M.Sc.-thesis, University of Pretoria. pp. 44.

HOLM, E. & E.B. EDNEY. 1973. Daily activity of Namib Desert arthropods in relation to climate. Ecology 54 (1): 45-56.

HOLM, E. & C.H. SCHOLTZ. 1980. Structure and pattern of the Namib Desert dune ecosystem at Gobabeb. Madoqua 12 (1): 5-39.

HORN, W. & I. KAHLE. 1935-37. Über entomologische Sammlungen, Entomologen & Entomo-Museologie. Dahlem, Berlin. Originally published in Entomologische Beihefte 2-4. pp. 540.

ICZN. 1985. Abbreviation used in text for:

INTERNATIONAL COMMISION ON ZOOLOGICAL NOMENCLATURE. 1985. International Code of Zoological Nomenclature. Third edition. International Trust for Zoological Nomenclature, London. pp. 338.

IRISH, J. 1981.Projekvoorstel vir 'n M.Sc.-studie getiteld: "'n Taksonomiese hersiening van die Lepismatidae (Thysanura, Insecta) van Suidwes-Afrika." Unpublished report, Department of Entomology, University of Pretoria. pp. 24.

IRISH, J. in press. A new species and records of Senegambian Lepismatidae (Thysanura). Journal of the entomological Society of southern Africa

KAPLIN, V.G. & Y.F. MARTYNOVA. 1976. On the systematics and ecology of Ctenolepisma mauritanica (Lucas, 1840) (Thysanura, Lepismatidae). Entomological Review 55 (3): 52-55.

LEDGER, J.A. 1980. The arthropod parasites of vertebrates in Africa south of the Sahara. IV. Phthiraptera (Insecta). Publications of the South African Institute for Medical Research No. 56: 1-327.

LINDSAY, E. 1940. The biology of the silverfish Ctenolepisma longicaudata Esch. with particular reference to its feeding habits. Proceedings of the Royal Society of Victoria 52(s.n.): 35-83.

MENDES, L.F. 1979. Note sur quelques malformations recontreés sur des exemplaires de Ctenolepisma et Asterolepisma (Zygentoma, Lepismatidae). Boletim da Sociedade portuguesa de Ciências naturais Ser. 2 19: 95-97.

MENDES, L.F. 1982. Notas e descricoẽs de Lepismatidae afrotropicais (Zygentoma: Apterygota). II. Géneros Ctenolepisma e Namunukulina. Revue de zoologique africaine 96 (3): 591-661.

PACLT, J. 1967. Thysanura. Fam. Lepidotrichidae, Maindroniidae, Lepismatidae. Genera Insectorum 218e: 1-86.

PACLT, J. 1966. Neue Beiträge zur Kenntnis der Apterygoten-Sammlung des Zoologischen Staatsinstituts und Zoologischen Museums Hamburg. II. Lepismatidae und Maindroniidae. Entomologische Mitteilungen aus dem Zoologischen Staatsinstitut und Zoologischen Museum Hamburg 3 (57): 147-161.

PACLT, J. 1979. Neue Beiträge zur Kenntnis der Apterygoten-Sammlung des Zoologischen Instituts und Zoologischen Museums der Universität Hamburg. VI. Weitere Doppel- und Borstenschwänze (Diplura: Campodeidae; Thysanura: Lepismatidae und Nicoletiidae).

Entomologische Mitteilungen aus dem Zoologischen Museum Hamburg 6 (105): 221-228.

RIDLEY, H.N. 1890. Thysanura and Collembola. Journal of the Linnean Society, Zoology 20: 556-559.

ROBINSON, M.D. & M.K. SEELY. 1980. Physical and biotic environments of the southern Namib dune ecosystem. Journal of Arid Environments 3: 183-203.

SILVESTRI, F. 1908. Thysanura. In: Schultze, L. (Ed.) Forschungsreise im westlichen und zentralen Südafrika 1903-1905. (= Denkschriften der Medizinisch-naturwissenschaftlichen Gesellschaft zu Jena 13: 291-300).

SILVESTRI, F. 1913. Tisanuri raccolti dal Dr. I. Trägårdh nel Natal e nel Zululand. Årkiv för Zoologi 8 (1): 1-15.

SILVESTRI, F. 1922. Thysanura. In: Michaelsen, W. (Ed.) Beiträge zur Kenntnis der Land- und Süsswasserfauna Deutsch-Südwestafrikas 2: 73-89.

SLABAUGH, R.E. 1940. A new thysanuran, and a key to the domestic species of Lepismatidae (Thysanura) found in the United States. Entomological News 51: 95-98.

SNEATH, P.H.A. & R.R. SOKAL. 1973. Numerical taxonomy: the principles and practice of numerical classification. Freeman, San Francisco.

THERON, J.G. 1963. The domestic fish moths (sic!) of South Africa (Thysanura: Lepismatidae). South African Journal of Agricultural Science 6: 125-130.

WATSON, J.A.L. 1970. Apterygota (primitively wingless insects). In: Mackerras, I.M. (Ed.), Insects of Australia: 217-223. Melbourne University Press, Victoria.

WEIDNER, H. 1962. Die Entomologischen Sammlungen des Zoologischen Staatsinstituts und Zoologischen Museums Hamburg. IV. Teil. Insecta I. Mitteilungen aus dem Hamburgischen zoologischen Museum und Institut 60: 81-109.

WILEY, E.O. 1981. Phylogenetics. The theory and practice of phylogenetic systematics. Wiley, New York.

WYGODZINSKY, P. 1955. Thysanura. In: Hanström, B., P. Brinck & G. Rudebeck (Eds.) South African Animal Life 2: 83-190. Almqvist & Wiksell, Stockholm.

WYGODZINSKY, P. 1959. Contribution to the knowledge of the "Thysanura" and "Machilidae" (Insecta). Revista Brasileira de Biologia 19 (4): 441-457.

WYGODZINSKY, P. 1965. Mission zoologique de l'I.R.S.A.C. en Afrique orientale. (P. Basilewsky et N. Leleup, 1957). LXXXVII. - Thysanura. Annales du Musée royale de l'Afrique central, Série in 8vo, Zoologique 138: 79-87.

WYGODZINSKY, P. 1970. Thysanura associated with termites in southern Africa. Bulletin of the American Museum of Natural History 142 (3): 211-254.

WYGODZINSKY, P. 1972. A review of the silverfish (Lepismatidae, Thysanura) of the United States and the Caribbean area. American Museum Novitates 2481: 1-26.

APPENDIX I: ABBREVIATIONS

The following institutional abbreviations were used. I am much indebted to the respective curators mentioned for making available material or information.

AMMU	-	Instituut voor Taxonomische zoölogie, Universiteit van Amsterdam, Amsterdam, THE NETHERLANDS; Dr. W. Hogenes.
AMNH	-	American Museum of Natural History, New York, UNITED STATES OF AMERICA; Dr. P. Wygodzinsky.
BM	-	British Museum (Natural History), London, ENGLAND.
CRAC	-	Instituto de Zoologia, Academia Polaca das Ciẽncias de Cracóvia, Cracow, POLAND.
DERU	-	Desert Ecological Research Unit, Gobabeb, SOUTH WEST AFRICA; Miss D. Osberg, Dr. M.K. Seely.
FORC	-	Private collection, P. Forchhammer, Serowe, BOTSWANA.
IML	-	Intituto Miguel Lillo, Tucumán, ARGENTINE.
IRSM	-	Institut de Recherches Scientifiques de Madagascar, Tananarive, MADAGASCAR.
LEID	-	Rijksmuseum van Natuurlijke Historie, Leiden, THE NETHERLANDS; Dr. L. v.d. Hammen.
LUND	-	Zoological Institute, Lund University, Lund, SWEDEN; Dr. R. Danielsson.
MBOC	-	Museu Bocage, Lisbon, PORTUGAL; Dr. L.F. Mendes.
MRAC	-	Museé Royal de l'Afrique Centrale, Tervuren, BELGIUM.
MUC	-	Zoologisk Museum, University of Copenhagen,

		Copenhagen, DENMARK.
NCI	-	National Collection of Insects, Pretoria, SOUTH AFRICA; Dr. G. Prinsloo, Mr. R. Oberprieler, Miss V. Swain.
NM	-	Natal Museum, Pietermaritzburg, SOUTH AFRICA; Dr. J.G.H. Londt.
NMB	-	Nasionale Museum, Bloemfontein, SOUTH AFRICA; Dr. S. Louw.
SAM	-	South African Museum, Cape Town, SOUTH AFRICA; Dr. V.B. Whitehead, Dr. A.J. Prins.
SM	-	State Museum, Windhoek, SOUTH WEST AFRICA.
TM	-	Transvaal Museum, Pretoria, SOUTH AFRICA; Dr. M.-L. Penrith, Mr. R.B. Toms, Dr. S. Endrödy-Younga.
UP	-	Department of Entomology, University of Pretoria, Pretoria, SOUTH AFRICA; Dr. E. Holm.
ZMHU	-	Zoologishes Museum an der Humboldt-Universität, Berlin, EAST GERMANY; Dr. U. Göllner-Scheiding.
ZSZM	-	Zoologisches Staatsinstitut und Zoologisches Museum, Universität Hamburg, Hamburg, WEST GERMANY; Dr. H. Strümpel.

APPENDIX II: GAZETTEER

Where possible, the geographical co-ordinates of a collecting locality are given, as well as the standard quarter degree reference. In cases where this was not possible, e.g. some of the older literature records, the most accurate quarter degree reference possible under the circumstances is given.

The following abbreviations were used:

ANG	-	Angola
BOT	-	Botswana
CP	-	Cape Province, South Africa
LES	-	Lesotho
MOZ	-	Mozambique
NAT	-	Natal, South Africa
OVS	-	Orange Free State, South Africa
RHO	-	Zimbabwe
SWA	-	South West Africa
TAN	-	Tanzania
TVL	-	Transvaal, South Africa
WBT	-	Walvis Bay Territory

Locality	Country/Area	Co-ordinates	Quarter degree
Afguns 447	SWA	19°33'S, 15°53'E	SE 1915Db
Agate Beach	SWA	26 36'S, 15 11'E	SE 2615Ca
Aggeneys	CP	29 12'S, 18 51'E	SE 2918Bb
Agub Mt. SW	SWA	26 59'S, 15 58'E	SE 2615Dd
Alkmar 512	SWA	21 51'S, 19 55'E	SE 2119Dd
Amanzi Estate, Uitenhage	CP	33 43'S, 25 26'E	SE 3325Cd
Ambrose Bay	SWA	21 03'S, 13 33'E	SE 2113Ba
Anabib	SWA	18 09'S, 12 33'E	SE 1812Ba

Andonivlakte S at 1816Db	SWA	18 33'S, 16 49'E	SE 1816Db
Anenouspas, 10 km W	CP	29 16'S, 17 32'E	SE 2917Bc
Anenous Pass, S side	CP	29 17'S, 17 37'E	SE 2917Bc
Angra Fria, 10 km NNW	SWA	18 08'S, 11 51'E	SE 1811Bb
Arandis, 6 km N	SWA	22 22'S, 14 59'E	SE 2214Bd
Arandisberg, 2 km NE	SWA	22 23'S, 15 02'E	SE 2215Ac
Arniston	CP	34 39'S, 20 13'E	SE 3420Ca
Aroab	SWA	26 47'S, 19 39'E	SE 2619Dc
Arutal 25	SWA	27 01'S, 16 23'E	SE 2716Ab
Aurus	SWA	27 37'S, 16 16'E	SE 2716Ca
Aus Townlands 36	SWA	26 38'S, 16 20'E	SE 2616Cb
Bain's Kloof	CP	33 06'S, 19 08'E	SE 3319Ca
Barrow's Hope	CP	exact loc. indet. ca.	SE 3226Ab
Beaufort West, 30 miles ex towards Willowmore	CP	±32 40'S, 22 56'E	SE 3222Db
Beira	MOZ	19 51'S, 34 50'E	SE 1934Dd
Berseba, 3 km S	SWA	26 02'S, 17 46'E	SE 2617Bb
Blinkoog 30	SWA	exact loc. indet.	SE 2719Ca
Blumfelde 95	SWA	23 35'S, 18 17'E	SE 2318Cb
Boesmanberg	SWA	27 47'S, 16 25'E	SE 2716Cd
Bonnievale	CP	33 56'S, 20 07'E	SE 3320Cc
Bosluisbaai	SWA	17 23'S, 11 45'E	SE 1711Bc
Bosluisbaai, 1 km E	SWA	17 23'S, 11 45'E	SE 1711Bd
Bosluisbaai, 3 km E	SWA	17 23'S, 11 47'E	SE 1711Bd
Bosluisbaai, 7 km N	SWA	17 20'S, 11 45'E	SE 1711Bd
Bosluisbaai, 12 km S	SWA	17 29'S, 11 45'E	SE 1711Bc
Botha's Pass	NAT	27 38'S, 29 44'E	SE 2729Da
Bothaville	OVS	27 23'S, 26 37'E	SE 2726Bc
Bothaville, 30 miles S	OVS	exact loc. indet.	SE 2726Dc
Brackfontein farm	CP	32 56'S, 18 15'E	SE 3218Cc

Brackwater	SWA	22 25'S, 17 04'E	SE 2217Ac
Brandvlei, 3 miles ex towards Kenhardt			
	CP	30 25'S, 20 29'E	SE 3020Ad
Brandkaross	CP	28 28'S, 16 41'E	SE 2816Bc
Breekkierie farm	CP	30 07'S, 21 34'E	SE 3021Ba
Brukkaros	SWA	25 53'S, 17 47'E	SE 2517Dd
Bushy Park	CP	34 41'S, 20 07'E	SE 3420Ca
Calitzdorp	CP	33 32'S, 21 43'E	SE 3321Da
Cape Cross, 10 km NE	SWA	21 44'S, 14 01'E	SE 2114Ca
Cape Fria	SWA	18 26'S, 12 00'E	SE 1812Ac
Cape Fria Radio Station			
	SWA	18 14'S, 12 02'E	SE 1812Aa
Cape Town	CP	33 55'S, 18 25'E	SE 3318Cd
Cape Town, 65 km N	CP	33 21'S, 18 15'E	SE 3318Ac
Charlottenfelder	SWA	24 12'S, 14 37'E	SE 2414Ba
Chaudamas 33	SWA	19 41'S, 15 32'E	SE 1915Da
Chowagasberg, 10 km NW	SWA	25 13'S, 15 40'E	SE 2515Ba
Chowagasberg, 15 km NW	SWA	25 11'S, 15 38'E	SE 2515Ba
Christiana	TVL	27 55'S, 25 09'E	SE 2725Cc
Chulon, on Narib Ost 602			
	SWA	24 10'S, 17 42'E	SE 2417Ba
Colbyn	TVL	= Pretoria	
Colesberg District	CP	indet., taken at Colesberg:	
		30 44'S, 25 05'E	SE 3025Ca
Conception	SWA	24 01'S, 14 33'E	SE 2414Ba
Cornellskop, 5 km NE	CP	28 22'S, 16 55'E	SE 2816Bd
Daberas dunes at 2816Ba			
	SWA	28 10'S, 16 42'E	SE 2816Ba
Daweb 43	SWA	24 57'S, 16 57'E	SE 2416Dd
De Aar	CP	30 39'S, 24 01'E	SE 3024Ca

De Aar, 18 miles ex towards Philipstown			
	CP	30 29'S, 24 13'E	SE 3024Ac
De Hoop	CP	32 08'S, 22 24'E	SE 3222Ab
De Hoop Vlei	CP	34 22'S, 20 21'E	SE 3420Ad
Diamond Area I at 2615Dc			
	SWA	26 46'S, 15 35'E	SE 2615Dc
Diamond Area I at 2716Ac			
	SWA	27 20'S, 16 09'E	SE 2716Ac
Diamond Area I at 2716Dc			
	SWA	27 52'S, 16 30'E	SE 2716Dc
Diamond Area II at 2314Dc			
	SWA	23 59'S, 14 39'E	SE 2314Dc
Diamond Area II at 2414Ba			
	SWA	24 03'S, 14 37'E	SE 2414Ba
Diamond Area II at 2414Bc			
	SWA	24 15'S, 14 37'E	SE 2414Bc
Diamond Area II at 2415Ca			
	SWA	24 53'S, 15 14'E	SE 2415Ca
Diamond Area II at 2514Bb			
	SWA	25 14'S, 14 54'E	SE 2514Bb
Diamond Area II at 2515Aa (1)			
	SWA	25 03'S, 15 08'E	SE 2515Aa
Diamond Area II at 2515Aa (2)			
	SWA	25 12'S, 15 12'E	SE 2515Aa
Diamond Area II at 2515Ab			
	SWA	25 02'S, 15 12'E	SE 2515Ab
Diamond Area II at 2515Ad			
	SWA	25 20'S, 15 25'E	SE 2515Ad
Dickdorn 98	SWA	24 49'S, 17 41'E	SE 2417Dc
Die Koei	CP	28 17'S, 17 00'E	SE 2817Ac
Donkermodder 60	SWA	26 54'S, 18 40'E	SE 2618Dc

Drechin	RHO	not traced	
Dreizackberg, 2 km N.	SWA	26 59'S, 15 24'E	SE 2615Cd
Duin 7	WBT	22 58'S, 14 35'E	SE 2214Dc
Dzundwini	TVL	22 46'S, 31 10'E	SE 2231Cd
Echo Valley, Table Mountain	CP	33 58'S, 18 24'E	SE 3318Cd
Edvard Bohlen wreck	SWA	24 00'S, 14 28'E	SE 2314Cd
Eksteenfontein, 22 km N	CP	28 38'S, 17 15'E	SE 2817Cb
Elephant Valley	SWA	23 41'S, 15 22'E	SE 2315Cb
Excelsior 286	SWA	22 27'S, 17 35'E	SE 2217Bc
Far East dunes	SWA	23 46'S, 15 47'E	SE 2315Dd
Farm Okosongomingo, Bez. Omaruru	SWA	?=Okozongominja,	SE 2116Ca/Cc
Farquarson	CP	29 14'S, 17 16'E	SE 2917Ab
Fischersbrunn	SWA	24 38'S, 14 13'E	SE 2414Da
Fischersbrunn, coast S of	SWA	24 41'S, 14 43'E	SE 2414Da
Fischersbrunn, coast 11 km SSE of	SWA	24 44'S, 14 46'E	SE 2414Db
Fish/Lewer Rivers: confluence	SWA	25 32'S, 17 44'E	SE 2517Da
Flaminksvlakte	CP	31 14'S, 18 35'E	SE 3118Ba
Friedrichsfelde	SWA	21 58'S, 15 59'E	SE 2115Dd
Gamsberg	SWA	23 20'S, 16 14'E	SE 2316Ac
Gavaams 6	SWA	26 16'S, 17 40'E	SE 2617Bc
Gemsbokvlakte	CP	29 02'S, 19 37'E	SE 2919Ba
Gibeon, 4 km WSW	SWA	25 09'S, 17 45'E	SE 2517Bb
Gobabeb	SWA	23 04'S, 15 03'E	SE 2315Ca
Gobabeb, 6 km NW	SWA	exact loc. indet.	SE 2315Ca
Gobabeb, 15 km S	SWA	23 42'S, 15 04'E	SE 2315Ca
Gobabis	SWA	22 29'S, 18 53'E	SE 2218Bd

Gocheganas 26	SWA	22 50'S, 17 11'E	SE 2217Cc
Göllschau 20	SWA	23 18'S, 16 32'E	SE 2316Bc
Grahamstad/town	CP	33 19'S, 26 31'E	SE 3326Bc
Graskom	CP	30 18'S, 17 23'E	SE 3017Ad
Grasplatz, 2 km N	SWA	26 42'S, 15 17'E	SE 2615Cb
Grey's Pass	CP	32 37'S, 18 58'E	SE 3218Db
Griekwastad, 34 miles ex towards Kimberley			
	CP	28 47'S, 23 49'E	SE 2823Dd
Grillenthal	SWA	26 59'S, 15 22'E	SE 2615Cd
Grillenthal, 2 km W	SWA	26 59'S, 15 20'E	SE 2615Cd
Grillenthal, 7 km N	SWA	26 51'S, 15 22'E	SE 2615Cd
Grillenthal, 10 km S	SWA	27 05'S, 15 22'E	SE 2715Ab
Groblershoop, 47 miles ex, towards Griekwastad			
	CP	28 55'S, 22 40'E	SE 2822Dc
Grootderm, 4 km WSW	CP	28 33'S, 16 35'E	SE 2816Da
Grootderm, 13 km SSW	CP	28 39'S, 16 38'E	SE 2816Da
Groot Spitskop	SWA	21 50'S, 15 12'E	SE 2115Cc
Groot Tinkas	SWA	22 51'S, 15 28'E	SE 2215Cd
Grosse Bucht	SWA	26 44'S, 15 06'E	SE 2615Ca
Guinassibberg	SWA	25 16'S, 15 32'E	SE 2515Bc
Guinassibberg, 1 km SE = Guinassibberg			
Guinassibberg, 5 km SW	SWA	25 20'S, 15 28'E	SE 2515Ad
Gurumanas Wes 241	SWA	23 01'S, 16 48'E	SE 2316Bb
Halali-koppie	SWA	19 02'S, 16 28'E	SE 1916Ab
Hardap Rest Camp	SWA	24 29'S, 17 52'E	SE 2417Bd
Haris	SWA	26 33'S, 15 22'E	SE 2615Cb
Haris 367	SWA	22 49'S, 16 52'E	SE 2216Dd
Hartebeespoort Dam	TVL	25 44'S, 27 52'E	SE 2527Db
Hauchab Mt.	SWA	25 25'S, 15 17'E	SE 2515Ad
Hazyview	TVL	exact loc. indet.	SE 2531Aa
Hennop's rivier	TVL	= Hennopsrivier	

Hennopsrivier	TVL	25 50'S, 27 58'E	SE 2527Dd
Hentiesbaai, 25 km ENE			
	SWA	22 03'S, 14 27'E	SE 2214Ab
Het Kruis	CP	32 34'S, 18 44'E	SE 3218Ba
Hierlê, op Nongcaib	CP	29 02'S, 19 28'E	SE 2919Ab
Hoanib Oasis	SWA	19 27'S, 12 50'E	SE 1912Bd
Hoanib River mouth	SWA	19 28'S, 12 46'E	SE 1912Bd
Hoarusib River	SWA	indet., ?=mouth.	
Hoarusib River, 9 km from mouth			
	SWA	19 02'S, 12 38'E	SE 1912Ba
Hoarusib River mouth	SWA	19 04'S, 12 34'E	SE 1912Ba
Hobas 374	SWA	exact loc. indet.	SE 2717Da
Hoffnung 66	SWA	exact loc. indet.	SE 2217Ca
Hohedun 277	SWA	27 24'S, 19 32'E	SE 2719Bc
Hohenstein 39	SWA	19 48'S, 15 53'E	SE 1915Cd
Hopefield 18	SWA	23 16'S, 16 19'E	SE 2316Ad
Hout Bay	CP	34 32'S, 18 22'E	SE 3418Ab
Huab River, 5 km from mouth			
	SWA	20 53'S, 13 29'E	SE 2013Cd
Huab River at 2013Db	SWA	20 37'S, 13 54'E	SE 2013Db
Huab River valley at 2013Db			
	SWA	20 40'S, 13 51'E	SE 2013Db
Indwe	CP	31 28'S, 27 20'E	SE 3127Ad
Jacobs Bay	CP	32 58'S, 17 53'E	SE 3217Dd
Jakkalsputs	CP	28 38'S, 16 54'E	SE 2816Db
Jakkalsputs, 10 km S	CP	28 31'S, 17 00'E	SE 2817Cc
Jessie	RHO	21 05'S, 29 20'E	SE 2129Ab
Jumbo dune	SWA	23 31'S, 14 52'E	SE 2314Db
Junction of the white and black Umfolozi			
	NAT	28 21'S, 31 59'E	SE 2831Bd
Kahani dune	SWA	23 34'S, 15 02'E	SE 2315Ca

Kakamas	CP	28 16'S, 20 37'E	SE 2820Dc
Kalkrand, 11 km SE	SWA	24 09'S, 17 40'E	SE 2417Ba
Kamaggas	CP	29 47'S, 17 29'E	SE 2917Cd
Kamandjab, 10 km N	SWA	19 32'S, 14 49'E	SE 1914Db
Kang-Khakhea (variable spelling)	BOT	indet., taken at:	SE 2423Aa
Karakanos	SWA	25 45'S, 17 53'E	SE 2517Db
Karakapi-Daneib confluence	SWA	20 17'S, 20 49'E	SE 2020Bd
Karibib	SWA	21 56'S, 15 46'E	SE 2115Dd
Katesh, contrefort Sud du Mont Hanang	TAN	04 32'S, 35 24'E	SE 0435Cb
Kaukausib fountain	SWA	26 59'S, 15 39'E	SE 2615Dc
Kaukausib, 2 km E	SWA	26 59'S, 15 41'E	SE 2615Dc
Keetmanshoop	SWA	26 35'S, 18 08'E	SE 2618Ca
Keetmanshoop, 10 km SE	SWA	26 39'S, 18 13'E	SE 2618Ca
Kenhardt, 55 miles *ex* towards Pofadder	CP	±29 29'S, 20 19'E	SE 2920Ad
Kenhardt, 85 miles *ex* towards Pofadder	CP	±29 18'S, 19 54'E	SE 2919Bd
Khakhea-Kang = Kang-Khakhea			
Kharu-gaiseb at 1913Cc	SWA	19 54'S, 13 11'E	SE 1913Cc
Khowarib Schlucht	SWA	19 18'S, 13 55'E	SE 1913Bd
Khubus, 2 km E	CP	28 28'S, 17 01'E	SE 2817Ac
Khubus, 10 km WSW	CP	28 28'S, 16 54'E	SE 2816Bd
Khumib River, *ca.* 15 km from coast/mouth	SWA	18 47'S, 12 33'E	SE 1812Dc
King William's Town	CP	32 53'S, 27 53'E	SE 3227Cd
Kleinduin	CP	29 13'S, 17 03'E	SE 2917Aa

Klinghardts Mts. at 2715Bc (1)

SWA 27 21'S, 15 42'E SE 2715Bc

Klinghardts Mts. at 2715Bc (2)

SWA 27 23'S, 15 39'E SE 2715Bc

Klinghardts Mts. at 2715Bc (3)

SWA 27 24'S, 15 42'E SE 2715Bc

Klinghardts Mts. W. at 2715Bc

SWA 27 26'S, 15 35'E SE 2715Bc

Klipfontein CP indet., taken at: SE 3321Bb

because this nearest to other Weber-localties

Klipneus	CP	28 26'S, 17 22'E	SE 2817Ad
Kooa (=Kue Pan)	BOT	24 53'S, 24 27'E	SE 2424Cd
Koras 412	CP	28 18'S, 21 53'E	SE 2821Bd
Kortdoringberg	CP	28 35'S, 16 35'E	SE 2816Da
Kowares	SWA	19 04'S, 14 21'E	SE 1914Ab
Kranzberg 59	SWA	21 56'S, 15 44'E	SE 2115Dc
Kubub	SWA	26 43'S, 16 17'E	SE 2616Cb
Kuiseb R nr. Gobabeb	SWA	23 34'S, 15 03'E	SE 2315Ca

Kunene River, 3 km from mouth

ANG 17 16'S, 11 47'E SE 1711Bd

Kunene River mouth	SWA	17 16'S, 11 46'E	SE 1711Bd
Labora 436	SWA	21 50'S, 19 25'E	SE 2119Cd

Ladysmith (taken at Ladismith because this near other

Weber-localities) CP 33 09'S, 21 16'E SE 3321Ad

Langebaan, 4 km NE	CP	33 03'S, 18 04'E	SE 3318Aa
Leeukamp	SWA	Exact loc. indet.	SE 1914Ba
Leeu Pan	TVL	24 50'S, 31 48'E	SE 2431Dd
Lehmpütz 76	SWA	20 17'S, 16 13'E	SE 2016Cc
Leliefontein, 8 km SE	CP	30 21'S, 18 06'E	SE 3018Ac
Letaba Camp	TVL	23 51'S, 31 35'E	SE 2331Dc
Lootsberg	CP	+31 50'S, 24 49'E	SE 3124Dd

Lower Ostrich Gorge	SWA	22 30'S, 14 58'E	SE 2214Db
Lüderitz	SWA	26 39'S, 15 09'E	SE 2615Ca
Lüderitzbucht = Lüderitz			
Luiperdskop	SWA	19 08'S, 14 24'E	SE 1914Ab
Maerpoort	CP	28 14'S, 17 08'E	SE 2817Aa
Makapansgat	TVL	24 09'S, 29 11'E	SE 2429Aa
Makuri Pan	SWA	19 39'S, 20 43'E	SE 1920Da
Makuyuni, sur la route Arusha - Babati			
	TAN	03 33'S, 36 08'E	SE 0336Ca
Malmesbury	CP	33 28'S, 18 44'E	SE 3318Bc
Malmesbury, 5 miles N	CP	33 23'S, 18 41'E	SE 3318Bc
Mariental	SWA	24 38'S, 17 57'E	SE 2417Db
Massif du Ngorongoro	TAN	03 11'S, 35 32'E	SE 0335Ba
Matjesfontein	CP	33 14'S, 20 34'E	SE 3320Ba
Melkbos to Malmesbury	CP	Exact loc. indet.	±SE 3318Da
Messum River, 10 km from coast			
	SWA	21 26'S, 13 55'E	SE 2113Bd
Mile 72	SWA	21 52'S, 14 03'E	SE 2114Cc
Mniszechi's Vlei	SWA	23 43'S, 15 19'E	SE 2315Cb
(The latter on DERU labels as "Miss Checkie's Flay")			
Moonlight	TVL	23 15'S, 28 14'E	SE 2328Aa
Mosselbaai	CP	34 12'S, 22 09'E	SE 3422Aa
Mount Fletcher	CP	30 42'S, 28 31'E	SE 3028Da
Mount Morosi	LES	30 16'S, 27 53'E	SE 3027Bd
Möwebaai/Bay	SWA	19 22'S, 12 42'E	SE 1912Bc
Möwebaai/Bay, 8 km E	SWA	19 21'S, 12 47'E	SE 1912Bd
Nabab	SWA	21 18'S, 14 35'E	SE 2114Bc
Nama Pan	SWA	19 55'S, 20 43'E	SE 1920Dc
Namib Desert Park at 2315Bc			
	SWA	23 21'S, 15 33'E	SE 2315Bc
Namuskluft 88	SWA	exact loc. indet.	SE 2716Dd

Namuskluftberg	SWA	27 48'S, 16 52'E	SE 2716Dd
Namus Mts. at 2716Dd	SWA	27 33'S, 16 55'E	SE 2716Dd
Namutoni	SWA	18 48'S, 16 57'E	SE 1816Dd
Narib Oos 602	SWA	= Chulon, on Narib Oos 602	
Nata	BOT	20 12'S, 26 11'E	SE 2026Aa
Natal National Park	NAT	28 42'S, 28 57'E	SE 2828Db
Neitsas	SWA	exact loc. indet.	SE 1918Bc
Neudamm	SWA	exact loc. indet. 2217Ad/Cb	
Noctivaga dune	SWA	23 43'S, 15 14'E	SE 2315Ca
Northern Namib at 1711Bd			
	SWA	17 23'S, 11 50'E	SE 1711Bd
Numees Mine	CP	28 18'S, 16 58'E	SE 2816Bd
Obib dunes at 2816Ba	SWA	28 09'S, 16 39'E	SE 2816Ba
Obib Mountain	SWA	28 02'S, 16 39'E	SE 2816Ba
Ogams	SWA	18 31'S, 12 30'E	SE 1812Da
Okahandja	SWA	21 58'S, 16 54'E	SE 2116Dd
Okaruheke Wes 45	SWA	21 40'S, 16 52'E	SE 2116Db
Okau	SWA	18 19'S, 12 05'E	SE 1812Ac
Okaukuejo	SWA	19 11'S, 15 55'E	SE 1915Bb
Okumutati	SWA	18 52'S, 14 21'E	SE 1814Cd
Olifantshoek 297	SWA	19 25'S, 15 20'E	SE 1915Ad
Olifantsrus	SWA	18 58'S, 14 52'E	SE 1814Dd
Olifantsvlei farm	CP	30 08'S, 21 32'E	SE 3021Ba
Omarassa 4	SWA	20 09'S, 16 54'E	SE 2016Bb
Omaruru	SWA	21 25'S, 15 57'E	SE 2115Bd
Ombindi-Karambi 155	SWA	20 22'S, 16 08'E	SE 2016Ac
Ombirisu 684	SWA	21 35'S, 19 15'E	SE 2119Ca
Onganja East 190	SWA	22 06'S, 17 34'E	SE 2217Ba
Oranjemund	SWA	28 33'S, 16 25'E	SE 2816Cb
Orumana, 6 km NE	SWA	18 13'S, 13 57'E	SE 1813Bb

Orungauu bei Okahandja	SWA	untraced, taken at Okahandja	SE 2116Dd
Oruvandjei	SWA	18 17'S, 13 4'E	SE 1813Bc
Otjihangweberg	SWA	21 55'S, 17 40'E	SE 2117Dc
Otjihangweberg, 1 km E	SWA	21 55'S, 17 41'E	SE 2117Dc
Otjitoroa Süd 55	SWA	20 32'S, 16 06'E	SE 2016Ca
Owingi 246	SWA	21 52'S, 18 53'E	SE 2118Dd
Ozonjuitji M'bari	SWA	18 59'S, 15 31'E	SE 1815Dc
Pakhuispas	CP	32 09'S, 18 56'E	SE 3218Bd
Palmwag 702	SWA	19 53'S, 13 54'E	SE 1913Dd
Parktown North	TVL	exact loc. indet.	SE 2628Aa
Pass S Tsondab flats	SWA	untraced	?±SE 2315Cd
Pietermaritzburg	NAT	29 36'S, 30 23'E	SE 2930Cb
Pink Pan	SWA	28 37'S, 16 26'E	SE 2816Cb
Pionierspark	SWA	= Windhoek	
Platberg, Swartbergpas	CP	33 20'S, 22 02'E	SE 3322Ac
Plateau 38	SWA	exact loc. indet.	SE 2616Da
Pockenbank 68	SWA	27 14'S, 16 30'E	SE 2716Ab
Pofadder	CP	29 07'S, 19 24'E	SE 2919Ab
Pofadder, 30 miles Ö	CP	= Pofadder, 30 miles NE	
Pofadder, 30 miles NE	CP	exact loc. indet.	±SE 2819Da
Port Elizabeth	CP	33 55'S, 25 35'E	SE 3325Dc
Pretoria	TVL	exact loc. indet.	SE 2528Ca/b/c/d
Prince Albert, 4 miles ex towards Fraserburg	CP	33 09'S, 22 02'E	SE 3322Aa
Redelinghuys	CP	32 28'S, 18 32'E	SE 3218Bc
Rocky Point	SWA	19 00'S, 12 29'E	SE 1812Cd
Rooibank	WBT	23 10'S, 14 38'E	SE 2314Ba
Rooibank, 10 km W	?SWA/WBT	±23 10'S, 14 03'E	SE 2314Ba
Rooilepel	SWA	28 12'S, 16 40'E	SE 2816Ba

Rosh Pinah, 10 km NW SWA 27 42'S, 16 42'E SE 2716Dc

Rössing Mts, E at 2214Bd (1)

SWA 22 29'S, 14 51'E SE 2214Bd

Rössing Mts, E at 2214Bd (2)

SWA 22 29'S, 14 52'E SE 2214Bd

Rössing Mts, SE at 2214Db

SWA 22 34'S, 14 52'E SE 2214Db

Rostock 393 SWA 23 21'S, 15 51'E SE 2315Bd

Rosyntjiewater CP 28 21'S, 17 04'E SE 2817Ac

Royal Natal National Park = Natal National Park

Ruacana SWA exact loc. indet. SE 1714Ac/Ad

Samanab River at 2013Ab

SWA 20 02'S, 13 18'E SE 2013Ab

Sandfeld südlich des Waterberges

SWA untraced ±SE 2017C-

Sandveld 314 SWA 24 33'S, 18 55'E SE 2418Db

Sandwich Bay (= Sandwich Harbour)

Sandwich Harbour SWA 23 20'S, 14 30'E SE 2314Bc

Satara TVL 24 53'S, 31 47'E SE 2431Bd

Schaaprivier CP 29 41'S, 17 40'E SE 2917Da

Sebrapan SWA 23 31'S, 15 31'E SE 2315Da

SE Ovamboland at 1816Bd SWA 18 27'S, 16 46'E SE 1816Bd

Severelela (=Seherelela Pan)

BOT 24 52'S, 24 54'E SE 2424Dd

Severelela-Kooa (variable spelling)

BOT indet., taken at: SE 2424Dc

Skukuza TVL 25 00'S, 31 36'E SE 2431Dc

Spektakelberg CP 29 41'S, 17 40'E SE 2917Da

Springbok, Modderfontein

CP 29 40'S, 17 48'E SE 2917Da

Sprokieswoud SWA 19 05'S, 15 38'E SE 1915Ba

Steenkamp Puts (=Steenkampsputs)			
	CP	28 06'S, 20 49'E	SE 2820Bb
Steinkopf	CP	29 16'S, 17 44'E	SE 2917Bc
Stellenbosch	CP	33 56'S, 18 52'E	SE 3318Dd
Süd Witpütz 31	SWA	27 37'S, 16 43'E	SE 2716Da
Swakopmund	SWA	22 40'S, 14 32'E	SE 2214Da
Swakopmund, 20 km NE	SWA	22 32'S, 14 40'E	SE 2214Da
Swakopmund district at 2214Bd (1)			
	SWA	22 29'S, 14 52'E	SE 2214Bd
Swakopmund district at 2214Bd (2)			
	SWA	22 23'S, 14 52'E	SE 2214Bd
Swakopmund district at 2214Db (1)			
	SWA	22 36'S, 14 54'E	SE 2214Db
Swakopmund district at 2214Db (2)			
	SWA	22 34'S, 14 52'E	SE 2214Db
Swaneng Hill School	BOT	22 25'S, 26 46'E	SE 2226Bd
Swartbaas Ost 285	SWA	27 02'S, 19 43'E	SE 2719Ba
Swartbank	SWA	23 21'S, 14 51'E	SE 2314Bd
Swinburne	OVS	28 21'S, 29 16'E	SE 2829Ad
Sylvia Hill, 2 km N	SWA	25 08'S, 14 51'E	SE 2514Bb
Sylvia Hill, 5 km SE	SWA	25 10'S, 14 53'E	SE 2514Bb
Terrace Bay, 18 km SSE	SWA	20 07'S, 13 07'E	SE 2013Aa
Terrace Spring	SWA	20 38'S, 13 51'E	SE 2013Db
Teufelsbach	SWA	exact loc. indet.	SE 2217Aa
Teufelsburg 153	SWA	20 14'S, 16 09'E	SE 2016Aa
The Dunes 234	SWA	22 50'S, 17 55'E	SE 2217Dd
Tiras 39	SWA	26 13'S, 16 36'E	SE 2616Ba
Torrabaai/bay	SWA	20 19'S, 13 14'E	SE 2013Ac
Toscanini	SWA	20 49'S, 13 24'E	SE 2013Cd
Trekkopje, 4 km S	SWA	22 20'S, 15 07'E	SE 2215Ac
Tsaukhaib Mts.	SWA	26 43'S, 15 40'E	SE 2615Da

Tsaukhaib Mts. E. at 2615Da			
	SWA	26 43'S, 15 43'E	SE 2615Da
Tsaus dunes	SWA	27 11'S, 16 13'E	SE 2716Aa
Tses	SWA	25 54'S, 18 07'E	SE 2518Cc
Tsondab flats at 2315Cc			
	SWA	23 50'S, 15 04'E	SE 2315Cc
Tsumkwe, 40 km NW	SWA	exact loc. indet.	SE 1920Ad
Tsumkwe, 50 km E	SWA	exact loc. indet.	SE 1920Db
Tweede Rivieren	CP	= Tweerivieren	
Tweerivieren	CP	26 28'S, 20 07'E	SE 2620Bc
Ugab River at 2014Cc	SWA	20 58'S, 14 13'E	SE 2014Cc
Ugab River gate	SWA	21 10'S, 13 40'E	SE 2113Ba
Ugab River mouth	SWA	21 11'S, 13 38'E	SE 2113Ba
Uguchab River at 2716Ca			
	SWA	27 37'S, 16 10'E	SE 2716Ca
Uhima	SWA	19 23'S, 13 03'E	SE 1913Ac
Uithoek 770	SWA	19 20'S, 17 39'E	SE 1917Bc
Umfolozi	NAT	exact loc. indet.	±SE 2831Bd
Uniab River at 2013Ab	SWA	20 09'S, 13 18'E	SE 2013Ab
Uniab River delta at 2013Aa			
	SWA	20 11'S, 13 12'E	SE 2013Aa
Unjab River at 2013Ab	SWA	20 10'S, 13 16'E	SE 2013Ab
Upington	CP	28 57'S, 21 14'E	SE 2821Ac
Upington, 25 km ENE	CP	28 23'S, 21 29'E	SE 2821Ad
Upper Panner Gorge	SWA	22 29'S, 15 01'E	SE 2215Ac
Uri-Hauchab Mt.	SWA	25 23'S, 15 11'E	SE 2515Ac
Urumube 287	SWA	19 29'S, 15 11'E	SE 1915Ac
Usakos	SWA	22 00'S, 15 36'E	SE 2115Dc
Usakos, 18 km W	SWA	21 59'S, 15 25'E	SE 2115Cd
Vegkop 528	SWA	20 51'S, 14 33'E	SE 2014Dc
Ventersdorp	TVL	26 19'S, 26 50'E	SE 2626Bd

Verneukpan at 2921Cc	CP	exact loc. indet.	SE 2921Cc
Victoria West	CP	31 24'S, 23 07'E	SE 3123Ac
Victoria West Nature Reserve = Victoria West			
Viljoenspas	CP	34 05'S, 19 04'E	SE 3419Aa
Vioolsdrif	CP	28 46'S, 17 08'E	SE 2817Dc
Vioolsdrif, 11 km ENE	SWA	28 44'S, 17 43'E	SE 2817Da
Visitor's dune	SWA	±23 38'S, 15 02'E	SE 2315Ca
Vogelfederberg	SWA	23 03'S, 14 29'E	SE 2314Bb
Voigtsland	SWA	22 34'S, 17 19'E	SE 2217Cb
Volksrust	TVL	27 22'S, 29 51'E	SE 2729Bd
Volstruiswerf 513	SWA	21 55'S, 19 45'E	SE 2119Dd
Vrede 80	SWA	25 09'S, 16 14'E	SE 2516Aa
Vredeshoop 283	SWA	27 05'S, 19 32'E	SE 2719Ba
Vryburg, 10 km WSW	CP	27 00'S, 24 38'E	SE 2624Dc
Waldau	SWA	21 54'S, 16 43'E	SE 2116Dc
Warmfontein 280	SWA	27 08'S, 19 14'E	SE 2719Aa
Welkom 680	SWA	20 09'S, 14 35'E	SE 2014Ba
Wellwood	CP	31 29'S, 24 38'E	SE 3124Dc
Welwesburg 191	SWA	21 09'S, 16 49'E	SE 2116Bb
Wiedou	CP	31 44'S, 18 47'E	SE 3118Db
Willowmore	CP	33 17'S, 23 29'E	SE 3323Ad
Winburg	OVS	28 31'S, 27 01'E	SE 2827Ca
Windhoek	SWA	22 34'S, 17 05'E (taken at city centre)	SE 2217Ca
Windhuk (= Windhoek)			
Witberg	SWA	24 50'S, 15 17'E	SE 2415Cd
Witberg, 4 km W	SWA	24 52'S, 15 14'E	SE 2415Cc
Witsand	CP	28 32'S, 22 29'E	SE 2822Cb
Wolseley	CP	33 25'S, 19 12'E	SE 3319Ac
Wolwekop	SWA	28 13'S, 16 12'E	SE 2816Aa
Zebrapomp, Kaross	SWA	19 22'S, 14 29'E	SE 1914Ad

Zwartberg-Pass	CP	exact loc. indet.	SE 3322Ac

APPENDIX III: ADDITIONAL REFERENCES: Consulted, not cited.

(Descriptions of non-southern African *Ctenolepisma* spp.)

ESCHERICH, K. 1910. Lepismatiden von Madagaskar, den Comoren und Ostafrika. In: Voeltzkow, A. (Ed.) *Reise in Ostafrika in den Jahren 1903-1905* 2: 535-538. Stuttgart.

FOLSOM, J.W. 1923. A new lepismid from Porto Rico. *Proceedings of the entomological Society of Washington* 25 (7-8): 170.

KAPLIN, V.G. 1977. A comparative ecological and morphological description of bristletails of the family Lepismatidae (Thysanura) in the eastern Karakum sands. *Entomological Review* 56(2): 72-84.

KAPLIN, V.G. 1981. (In Russian:) Thysanura Lepismatidae in the Eradzhin Reserve, the eastern Karakums. *Izvestiya Akademii nauk Turkmenskoi SSR, Ser. Biol. Nauk,* 6: 42-45.

KAPLIN, V.G. 1982. New species of Lepismatidae (Thysanura) from Turkmenia. *Entmological Review* 59 (2): 27-36.

MENDES, L.F. 1978. Nota sobre o género *Ctenolepisma* (Zygentoma, Lepismatidae) em Portugal. *Arquivos do Museu Bocage*, Ser. 2, 6: 279-298.

MENDES, L.F. 1980. Note sur les Zygentoma (Insecta: Apterygota) de l'Europe et du bassin Mediterraneen. *Arquivos do Museu Bocage*, Ser. 2, 7: 215-260.

MENDES, L.F. 1981. Nova nota e descrições de Tisanuros (Microcoryphia e Zygentoma: Aperygota (*sic*!)) da Macaronésia. *Arquivos do Museu Bocage*, Ser. A, 1: 143-164.

MENDES, L.F. 1984. The fauna of the Aegaean island of

Santorini. Part 7. Microcoryphia and Zygentoma, with additional records from other Greek localities. Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie) 372: 1-12.

PACLT, J. 1961. Borstenschwänze (Ins. Thysanura) des Senckenberg-Museums. Senckenbergiana biologia 42 (1/2): 75-84.

SILVESTRI, F. 1908. Tisanuri raccolti da L. Fea alla isole del Capo Verde, alla Guinea Portoghese e alla isole S. Thomè, Principe e Fernando Poo. Annali del Museo civico di Storia naturale di Genova, s. 3, 4: 133-187.

SILVESTRI, F. 1913. On some Thysanura in the Indian Museum. Records of the Indian Museum 9: 51-62.

SILVESTRI, F. 1918. Insectes Aptérygogéniens. I. Thysanoures. In: Alluaud, C. & R. Jaennel (Eds.) Voyage de Ch. Alluaud et R. Jaennel en Afrique Orientale (1911-1912) : 1-27. Lhomme, Paris.

SILVESTRI, F. 1922. Thysanoures. In: de Rothschild, M. (Ed.) Voyage de M. Maurice de Rothschild en Éthiopie : 157-165.

SILVESTRI, F. 1926. Thysanoures recueillis par M. Henri Gadeau de Kerville pendant son voyage zoologique en Syrie (Avril-Juin 1908). In: Gadeau de Kerville, H. (Ed.) Voyage zoologique d'Henri Gadeau de Kerville en Syrie (Avril-Juin 1908) 1: 267-274. Baillière, Paris.

SILVESTRI, F. 1932. Spedizione scientifica all'oasi di Cufra (Marzo-Luglio 1931). Tisanuri. Annali del Museo civico di storia naturale Giacomo Doria 55: 293-301.

SILVESTRI, F. 1935. Lepismidae (sic!) (Thysanura). In: Visser, _. (Ed.) Wissenschaftliche Ergebnisse der Niederlandschen Expedition nach den Karakorum 1:

205-207.

SILVESTRI, F. 1938. Tisanuri raccolti dal Prof. G. Scortecci nel Fezzan (Missione della R. Societa Geografica) Atti della Società italiana di scienze naturali 77: 61-64.

SILVESTRI, F. 1949. Insecta Thysanura hucusque in Lunda reperta. Publicações culturais da Companhia de Diamantes de Angola 6: 7-30.

STACH, J. 1935. Fauna rybików Egiptu. Die Lepismatiden-fauna Ägyptens. Annales Musei Zoologici Polonici 11 (4): 27-111.

UCHIDA, H. 1964. A new Ctenolepisma living beneath the bark of pine trees (Thysanura, Lepismatidae). Kontyû 32: 367-370.

WALL, W.J. 1954. A redescribed species and a new genus and species of the family Lepismatidae in California (Thysanura). The Pan-Pacific Entomologist 30 (1): 72-76.

WYGODZINSKY, P. 1941. Thysanuren aus Nordafrika und von den Atlantischen Inseln. Mitteilungen der Schweizerischen entomlogischen Gesellschaft 18: 249-272.

WYGODZINSKY, P. 1952. On some Machilidae and Lepismatidae from Israel, Cyprus and Arabia (Thysanura, Insecta). Bulletin of the Research Council of Israel 2 (3): 260-263.

WYGODZINSKY, P. 1955. Ergebnisse der Zoologischen Forschungsreise von Prof. Dr. Håkan Lindberg nach den Kapverdischen Inseln im Winter 1953-1954, No. 2. Thysanura. Commentationes biologicae 15 (11): 1-4.

WYGODZINSKY, P. 1959. Thysanura and Machilida of the

Lesser Antilles and northern South America. In: Wagenaar-Hummelinck, P. (Ed.) Studies on the fauna of Curaçao and other Caribbean islands 9: 28-49.

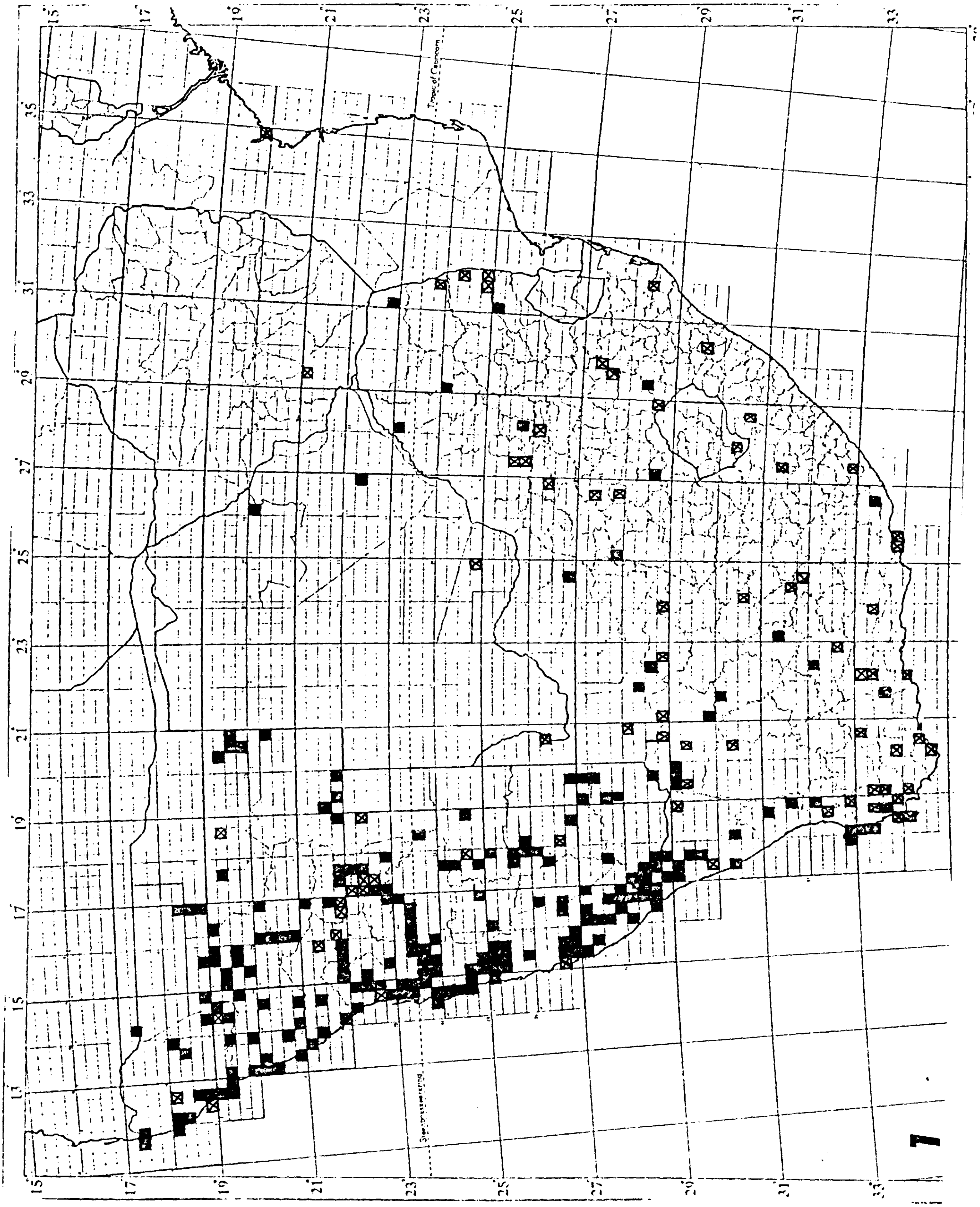
WYGODZINSKY, P. 1970a. Results of the zoological explorations of Dr. E. Kaszab in Mongolia. 202. Thysanura and Microcoryphia (Insecta). American Museum Novitates 2401: 1-25.

WYGODZINSKY, P. 1970b. La faune terrestre de l'Ile de Sainte-Helene (Première partie). 3. Thysanura. Annales du Museé royale de l'Afrique central, Serie in 8vo, Zoologique 181: 155-160.

YOSII, R. 1939. Wiederbeschreibung eines Bücherwurms, Ctenolepisma villosa. Zoological Magazine, Tokyo 51: 677-682.

FIGURE 1

Distribution of collecting stations for Lepismatidae in southern Africa. Crosses denote records from the literature and filled squares denote new material.


15
17
19
21
23
25
27
29
31
33
35
13
Tropic of Capricorn
1

FIGURES 2-10

Figure 2. A typical lepismatid scale.

Figure 3. Aberrant scale of *C. diversisquamis*.

Figure 4. Plumose macroseta.

Figure 5. Smooth macroseta.

Figure 6. Short maxillary palp.

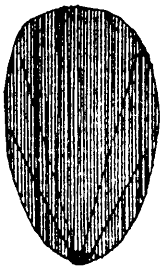
Figure 7. Long maxillary palp.

Figures 8-10. Distal segments of labial palpi.

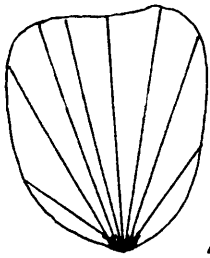
Figure 8. Unilaterally dilated.

Figure 9. Undilated.

Figure 10. Bilaterally dilated.



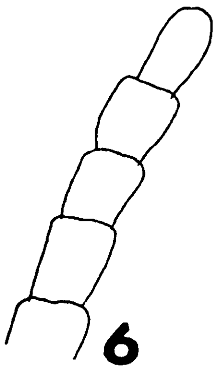
2



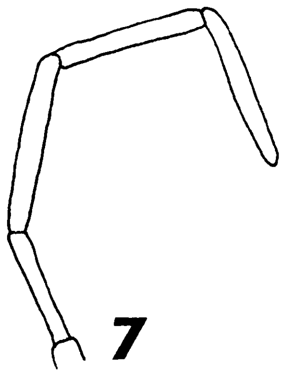
3

4

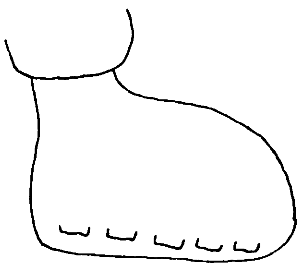
5



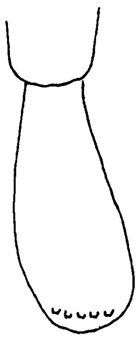
6



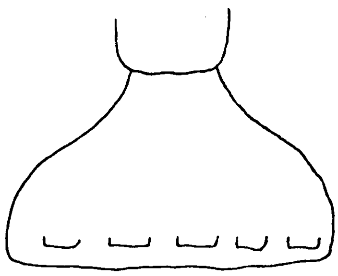
7



8



9



10

FIGURES 11-16

Figure 11. Setation of nape, *Ctenolepisma* sp.

Figure 12. Typical thoracic notum, *Ctenolepisma* sp.

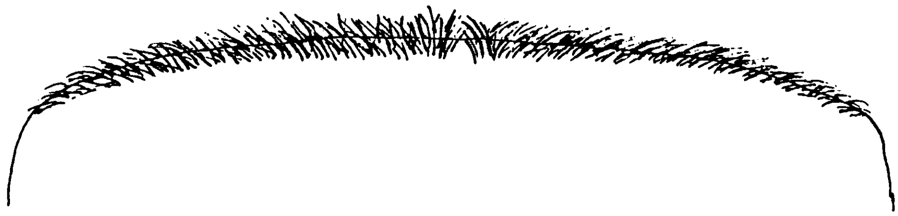
Figures 13-16. Setal configurations of:

Figure 13. 1+1.

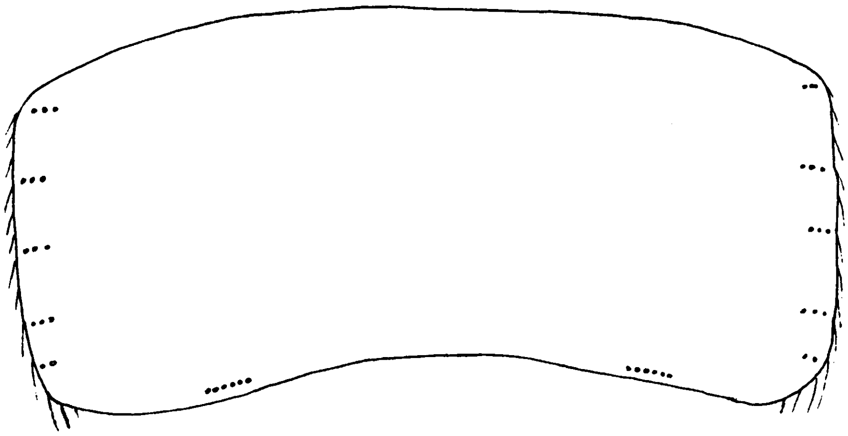
Figure 14. 2+2.

Figure 15. 3+3.

Figure 16. 1+1+1.

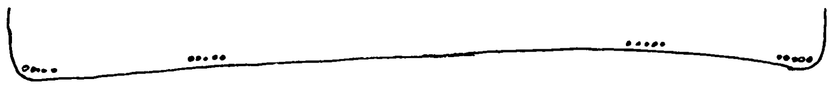


11

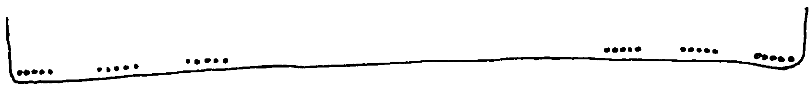


12

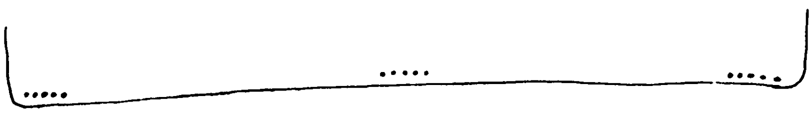
13



14



15



16

FIGURES 17-23

Figure 17. Setal configuration of 1.

Figure 18. Lateral urotergite, Ctenolepisma sp., showing terminology for bristlecombs. Abbreviations: sm = submedian; sl = sublateral; l = lateral.

Figure 19. Trapezoidal urotergite X, posteriorly straight.

Figures 20-21. Trapezoidal urotergites X, posterior portions.

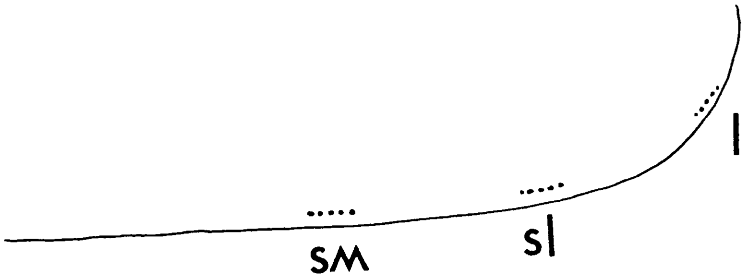
Figure 20. Posteriorly rounded.

Figure 21. Posteriorly emarginate.

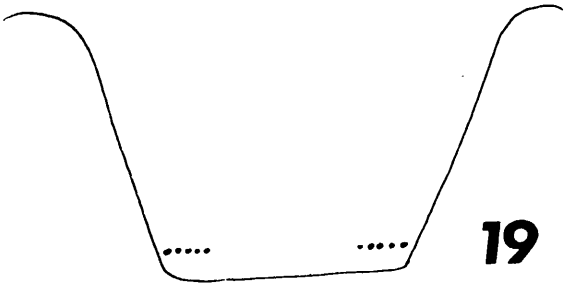
Figure 22. Subtriangular urotergite X.

Figure 23. Typical thoracic sternum, Ctenolepisma sp.

17



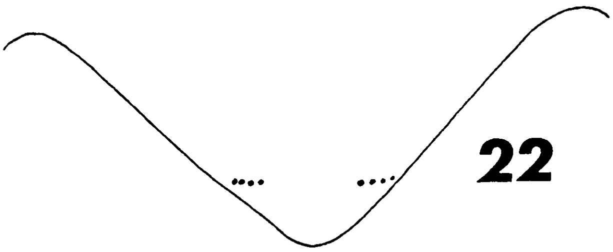
18



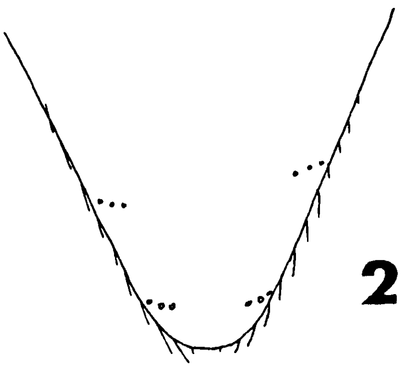
19

20

21



22



23

FIGURE 24

Distributions of:

C. longicaudata Escherich (filled squares)

(inset: world distribution by country or major region)

C. pretoriana Wygodzinsky (crossed square)

C. kaokoensis sp. nov. (filled triangle)

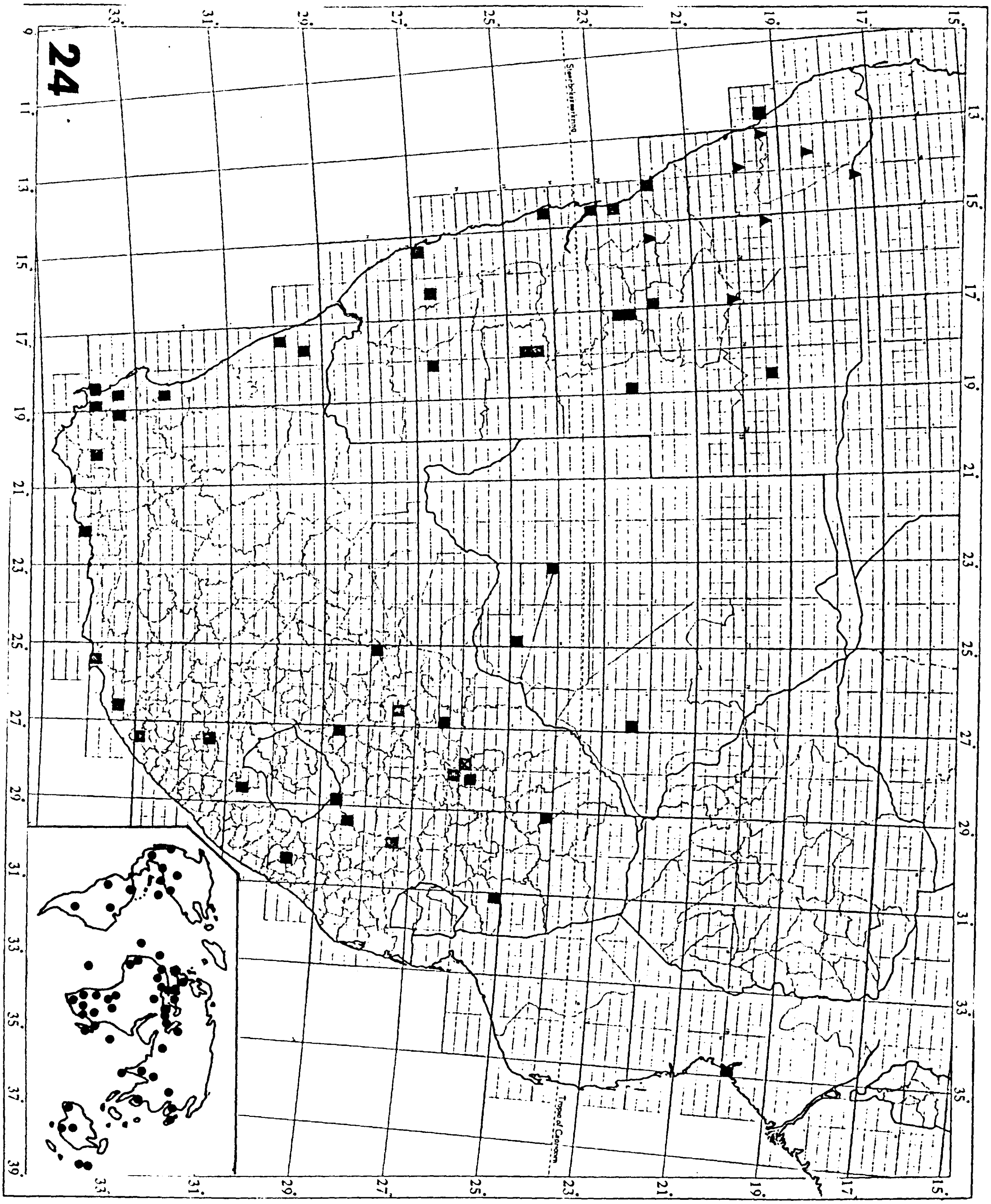

24
Tropic of Capricorn

FIGURE 25

Distributions of:

C. africanella Wygodzinsky (filled upright triangle)

C. weberi Escherich (filled circle)

C. terebrans Silvestri (filled square)

C. occidentalis sp. nov. (crossed square)

C. ugabensis sp. nov. (filled inverted triangle)

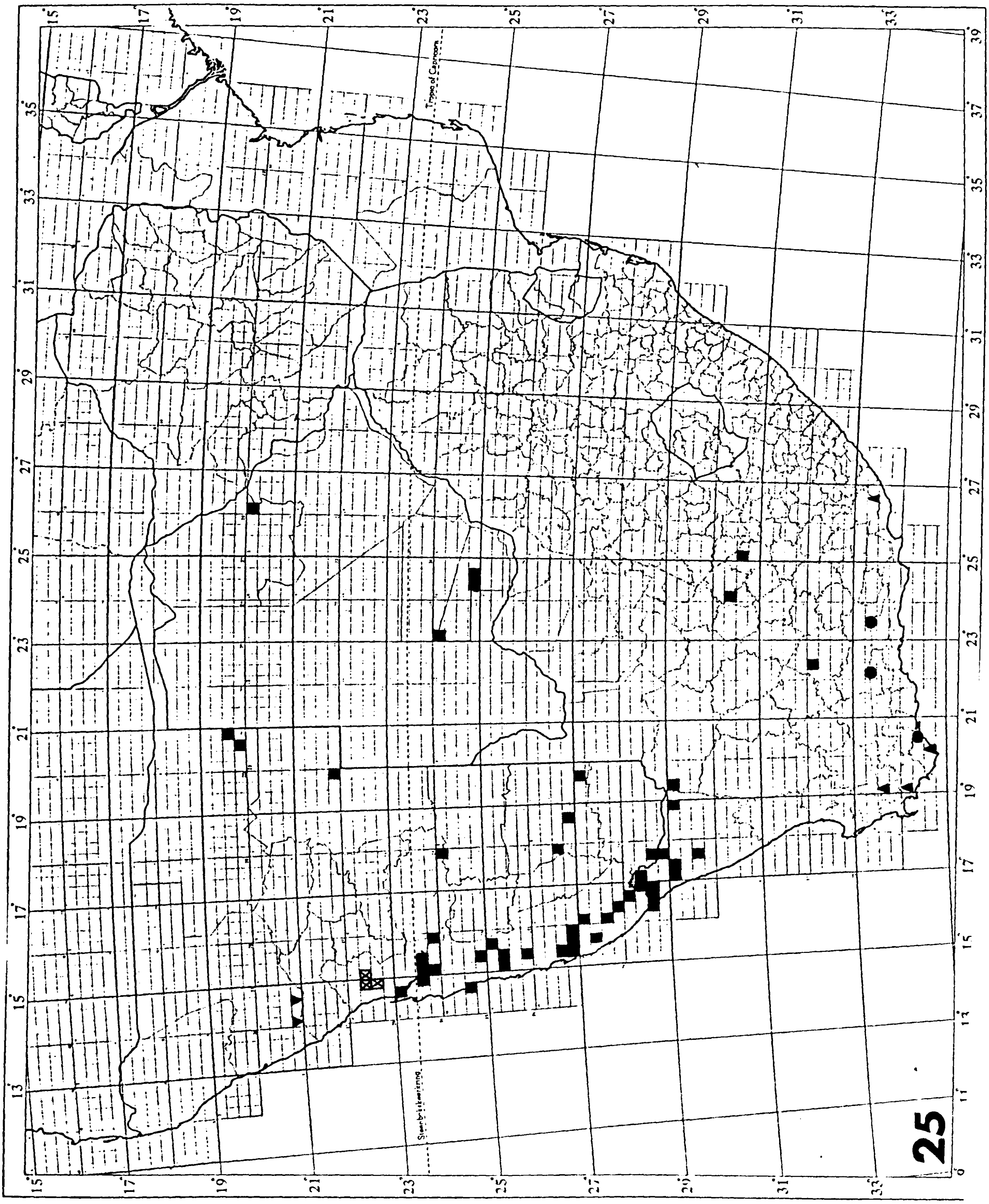

25

FIGURE 26

Distributions of:

C. pluriseta Silvestri (filled squares)

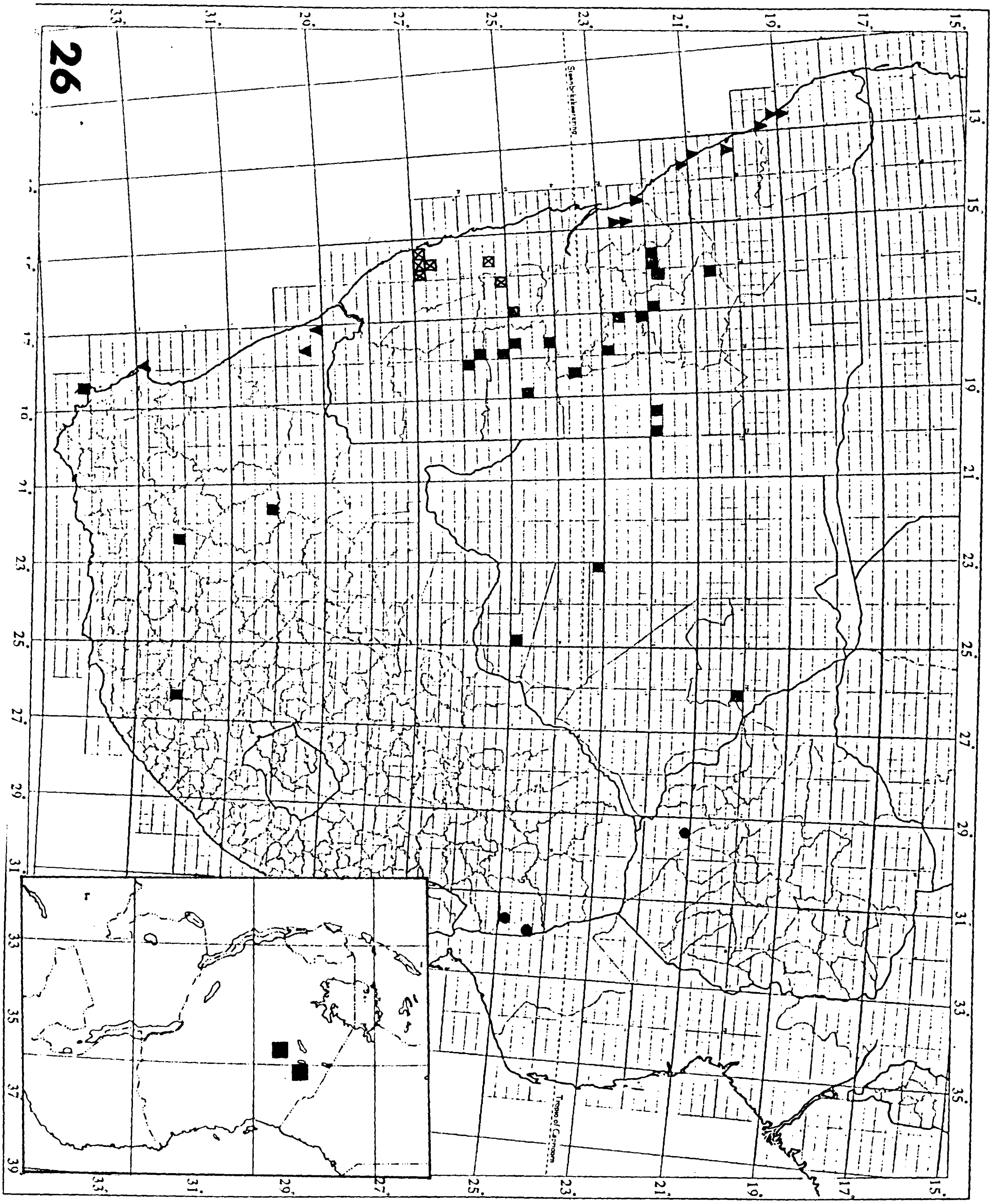
(inset: distribution in East Africa)

C. placida sp. nov. (crossed squares)

C. namibensis sp. nov. (filled upright triangles)

C. picturata Wygodzinsky (filled circles)

C. capensis sp. nov. (filled inverted triangles)


26
Tropic of Capricorn

FIGURES 27-35

_C_. _latera_ sp. nov.

Figure 27. Prosternum.

Figure 28. Mesosternum.

Figure 29. Metasternum.

Figure 30. Distal labial palp, male.

Figure 31. Distal labial palp, female.

Figure 32. Female genitalia.

Figure 33. Coxite IX, male.

Figure 34. Urotergite X.

Figure 35. Third leg.

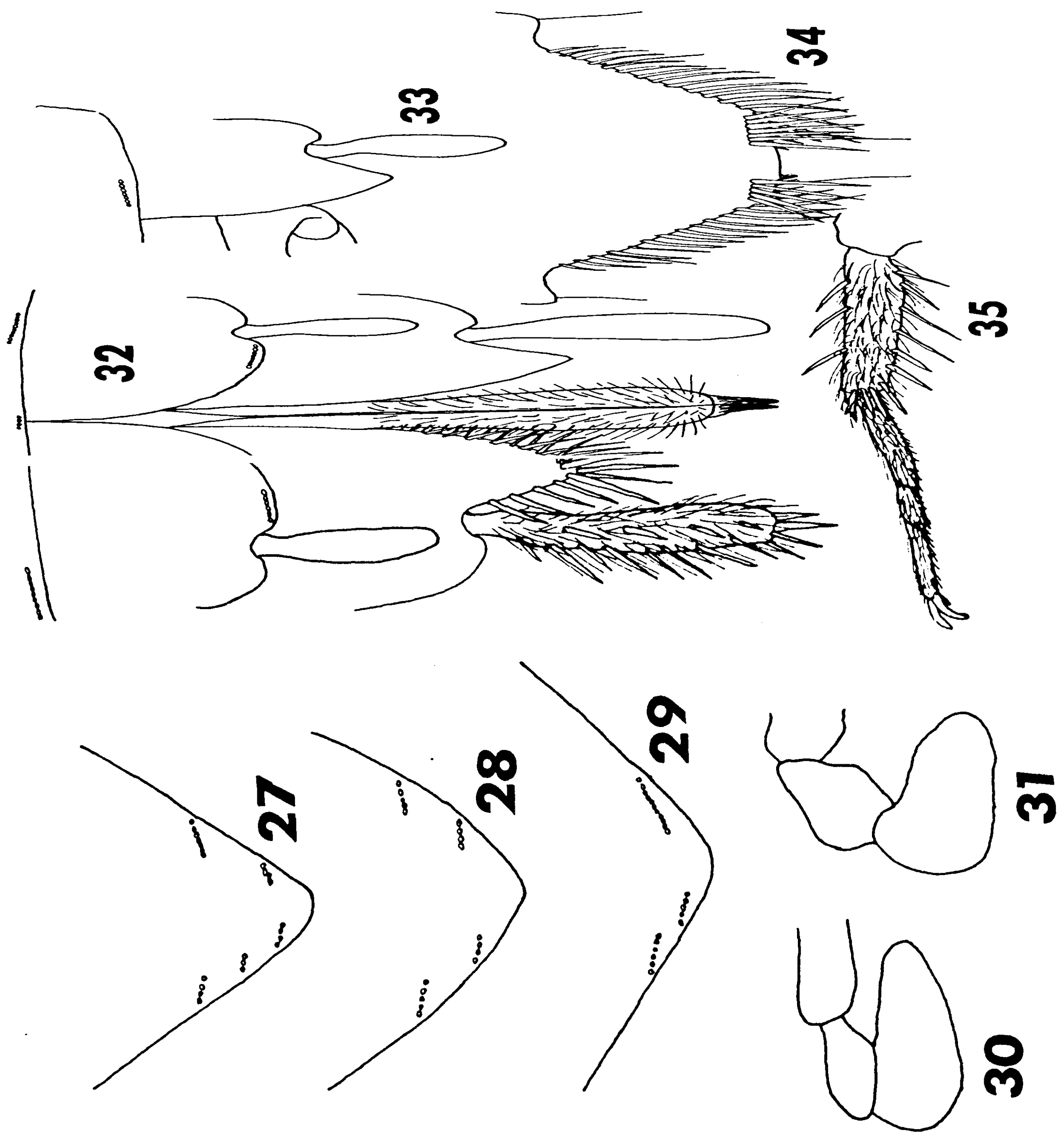

27
28
29
30
31
32
33
34
35

FIGURE 36

Distributions of:

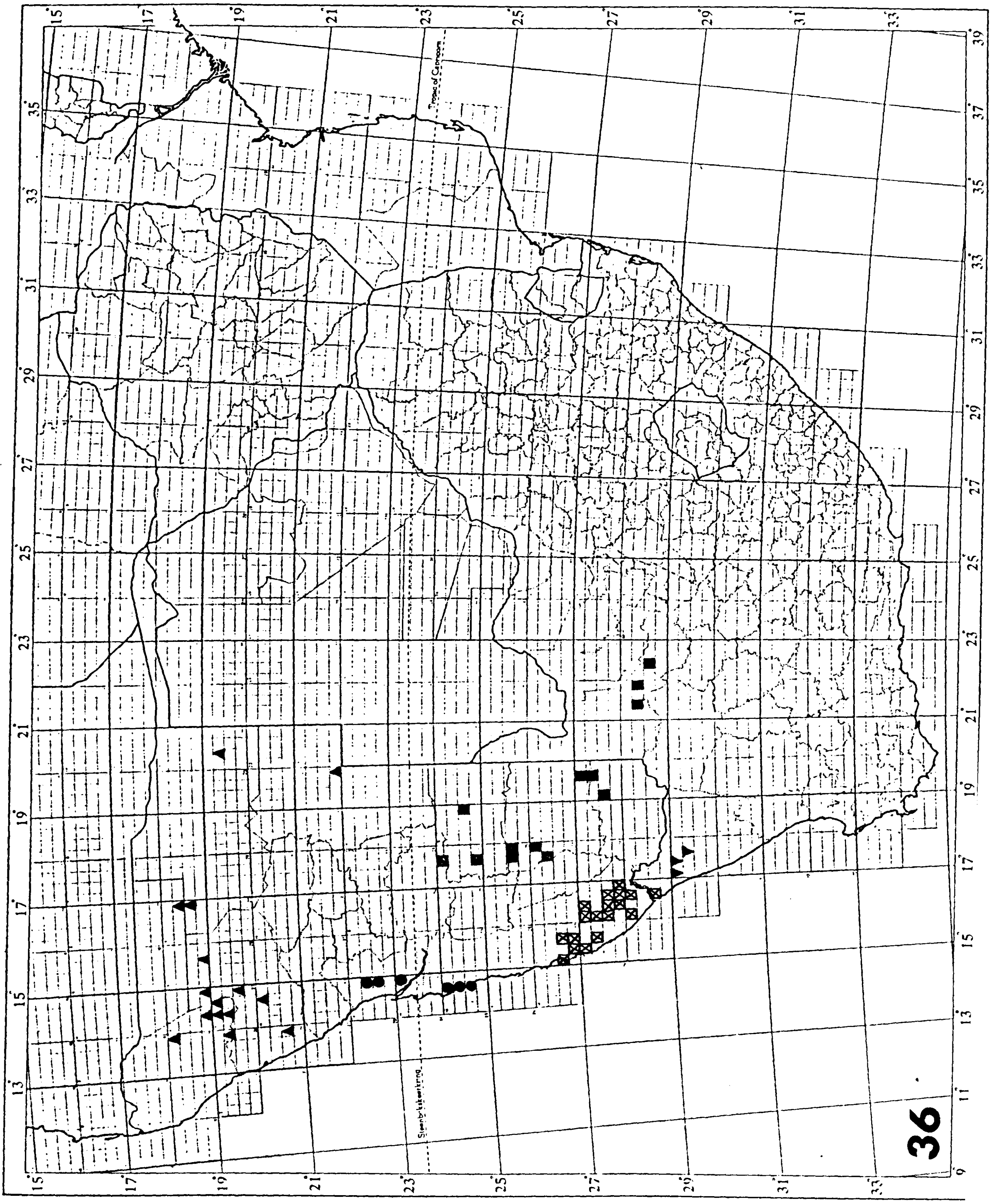
C. latera sp. nov. (filled squares)

C. luederitzi sp. nov. (crossed squares)

C. subterebrans sp. nov. (filled upright triangle)

C. detritus sp. nov. (filled circle)

C. desperata sp. nov. (filled inverted triangle)


Tropic of Capricorn
Steenbokskeerkring
36

FIGURES 37-44

C. placida sp. nov.

Figure 37. Female genitalia.

Figure 38. Urotergite X.

Figure 39. Coxite IX, male.

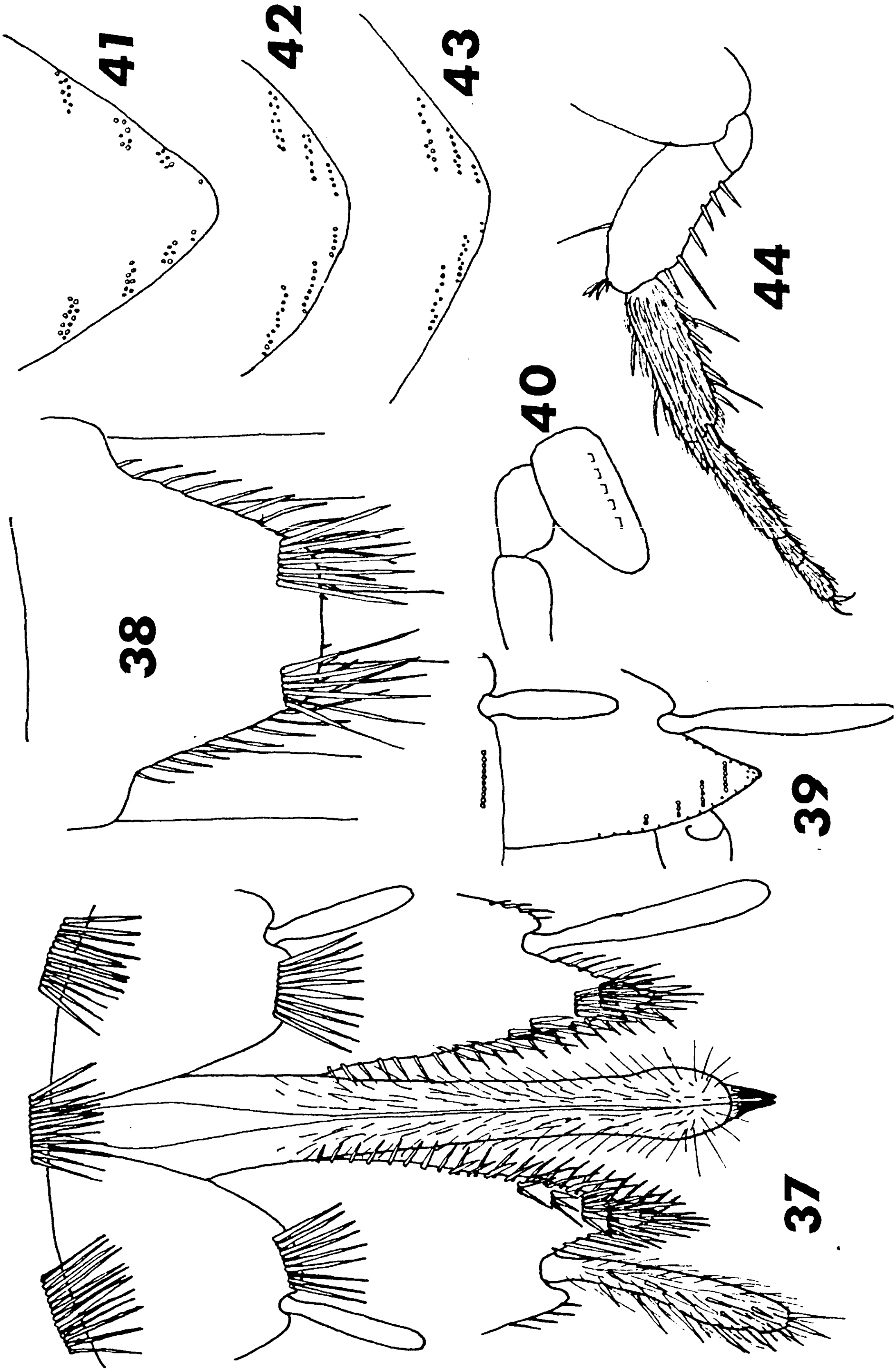
Figure 40. Distal labial palp, male.

Figure 41. Prosternum.

Figure 42. Mesosternum.

Figure 43. Metasternum.

Figure 44. Third leg.


41
42
43
44
40
38
39
37

FIGURES 45-52

C. luederitzi sp. nov.

Figure 45. Distal labial palp, male.

Figure 46. Urotergite X.

Figure 47. Tibia III.

Figure 48. Prosternum.

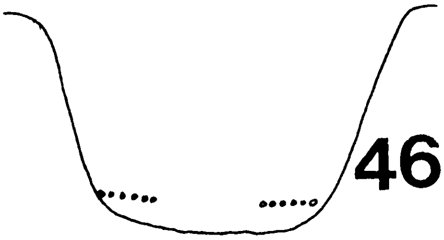
Figure 49. Mesosternum.

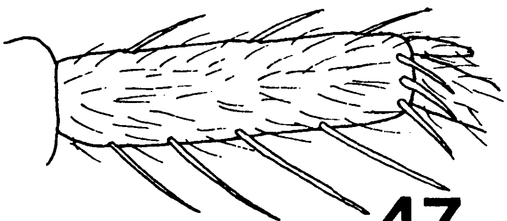
Figure 50. Metasternum.

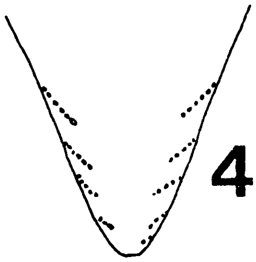
Figure 51. Coxite IX, male.

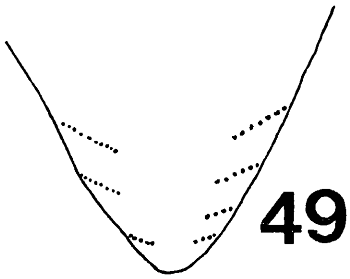
Figure 52. Female genitalia.

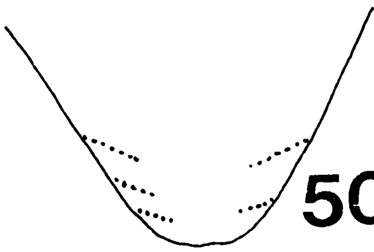

45

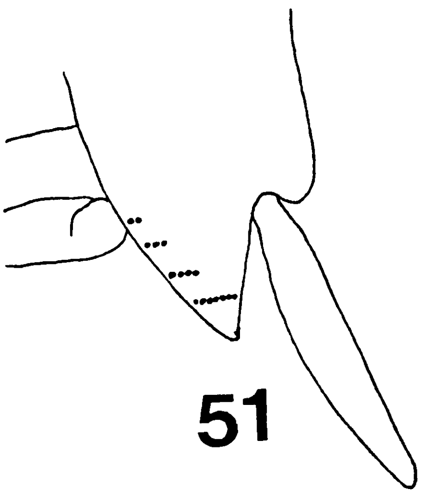

46

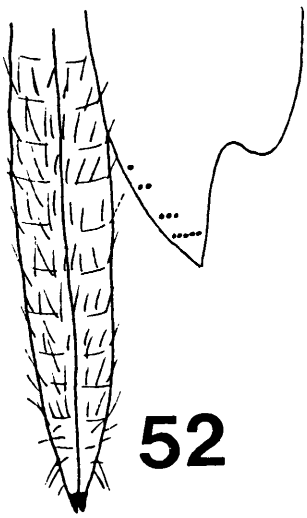

47


48


49


50


51


52

FIGURES 53-64

C. subterebrans sp. nov.

Figure 53. Body, dorsal.

Figure 54. Distal labial palp, female.

Figure 55. Distal labial palp, male.

Figure 56. Maxillary palp.

Figure 57. Tibia III.

Figure 58. First leg.

Figure 59. Urotergite X.

Figure 60. Prosternum.

Figure 61. Mesosternum.

Figure 62. Metasternum.

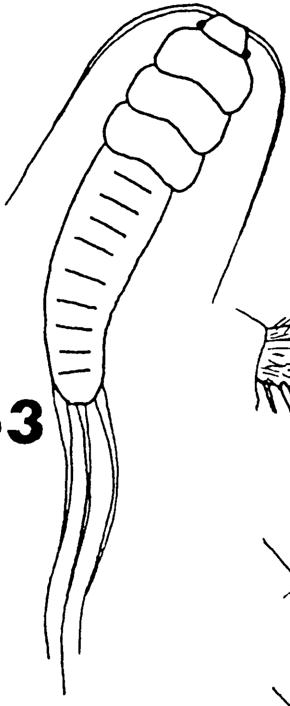
Figure 63. Female genitalia.

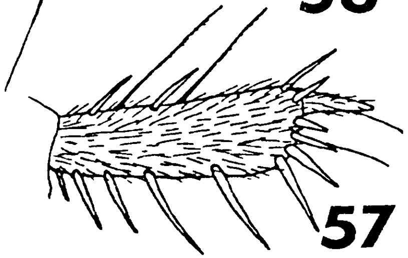
Figure 64. Male genitalia.

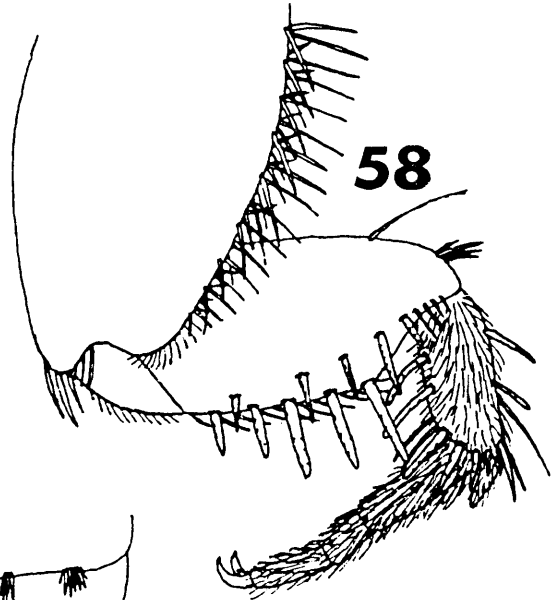

54

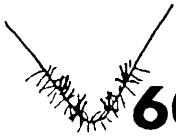

55

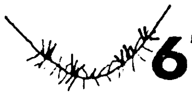

56

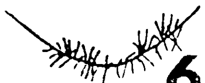

53

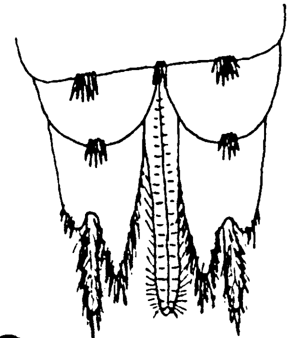

57

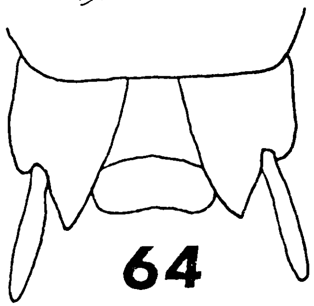

58

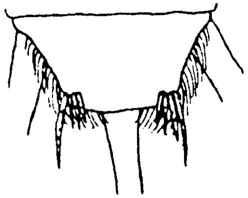

60


61


62


63


64


59

FIGURES 65-76

C. detritus sp. nov.

Figure 65. Prosternum.

Figure 66. Mesosternum.

Figure 67. Metasternum.

Figure 68. Urotergite X.

Figure 69. Female genitalia.

Figure 70. Distal labial palp, male.

Figure 71. Distal labial palp, female.

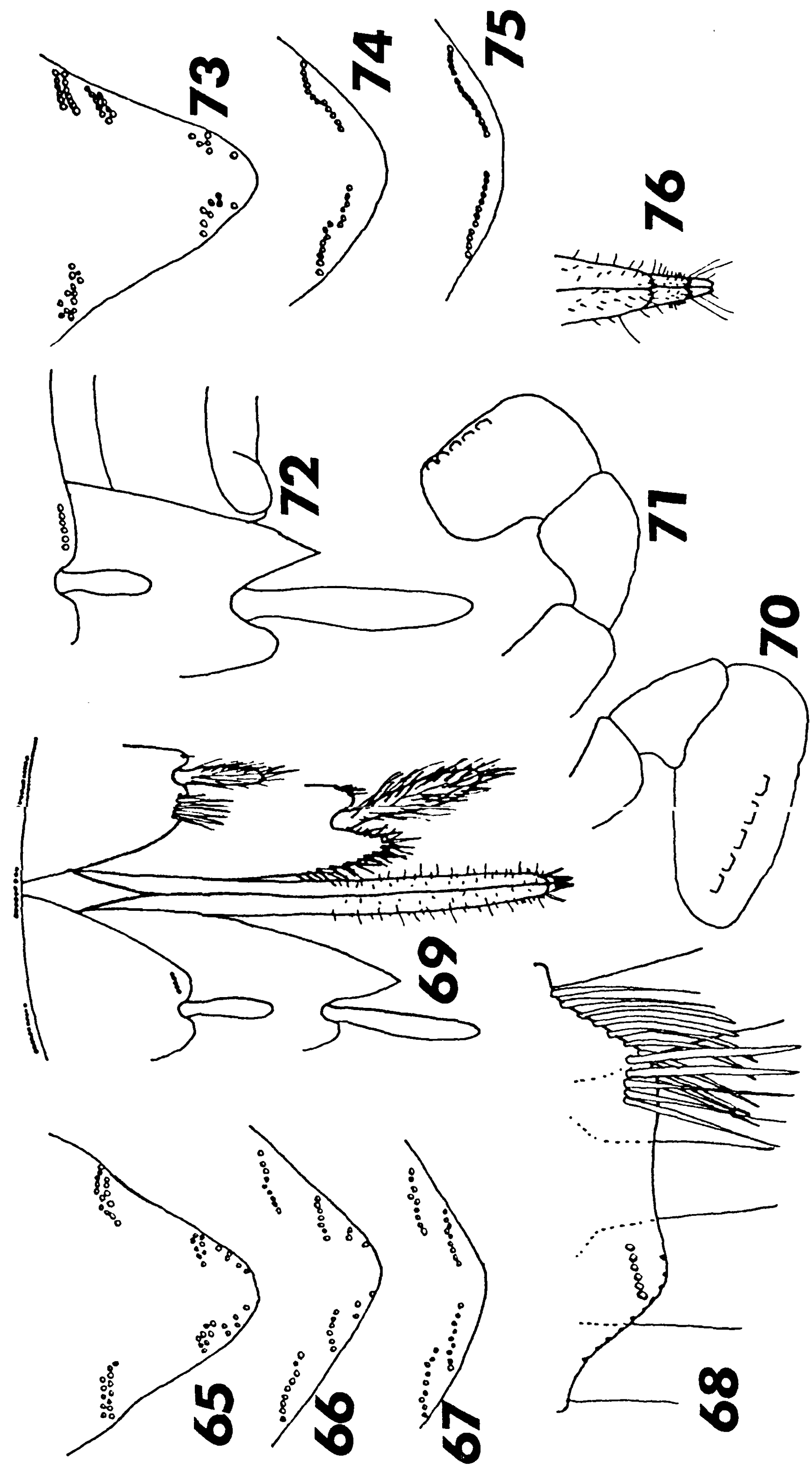
Figure 72. Coxite IX, male.

Figure 73. Prosternum, another individual.

Figure 74. Mesosternum, another individual.

Figure 75. Metasternum, another individual.

Figure 76. Apex of ovipositor.


73
74
75
76
72
71
70
69
65
66
67
68

FIGURES 77-85

C. occidentalis sp. nov.

Figure 77. Prosternum.

Figure 78. Mesosternum.

Figure 79. Metasternum.

Figure 80. Female genitalia.

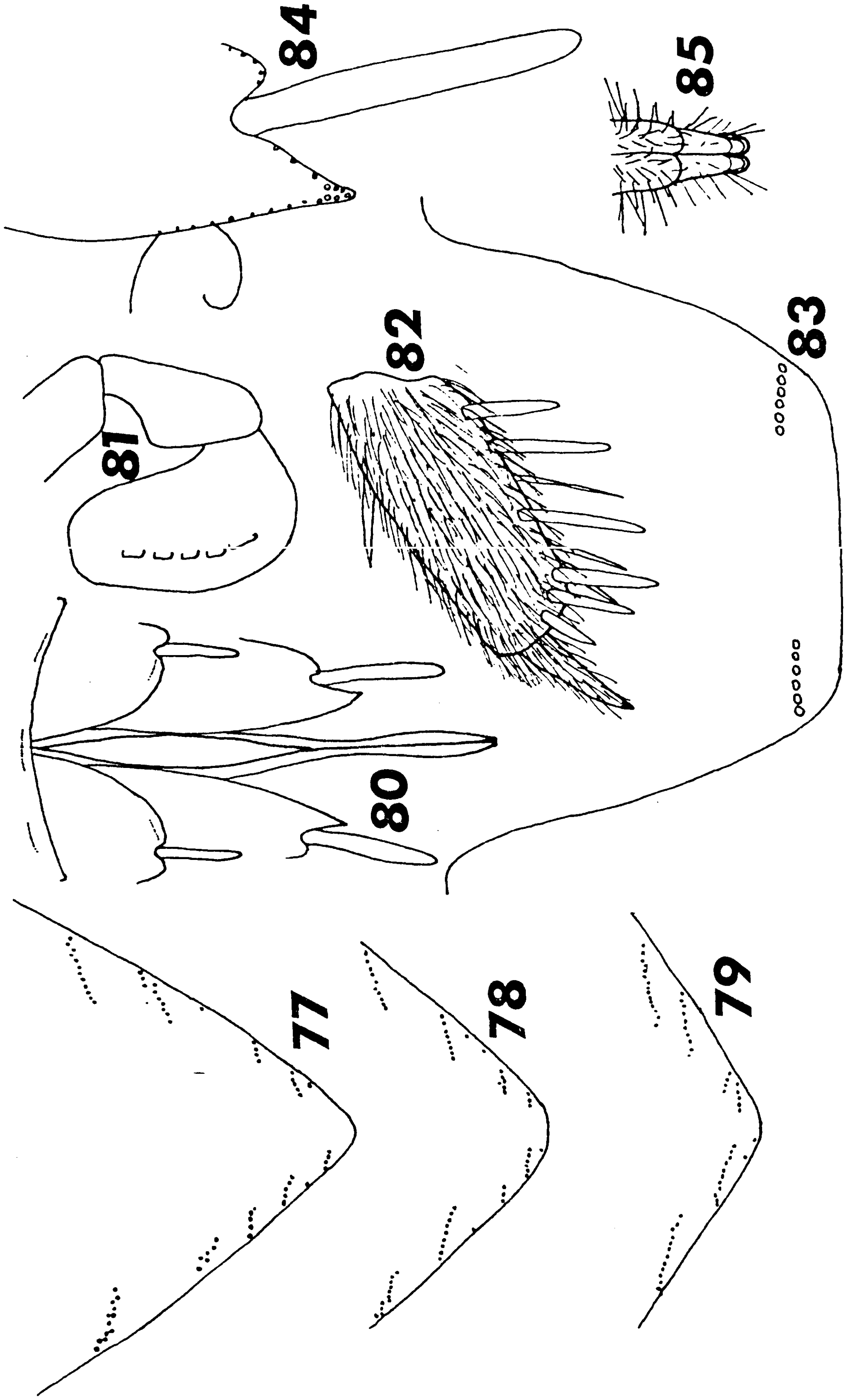
Figure 81. Distal labial palp, male.

Figure 82. Tibia III.

Figure 83. Urotergite X.

Figure 84. Coxite IX, male.

Figure 85. Apex of ovipositor.


84
85
81
82
83
80
77
78
79

FIGURES 86-93

C. ugabensis sp. nov.

Figure 86. Prosternum.

Figure 87. Mesosternum.

Figure 88. Metasternum.

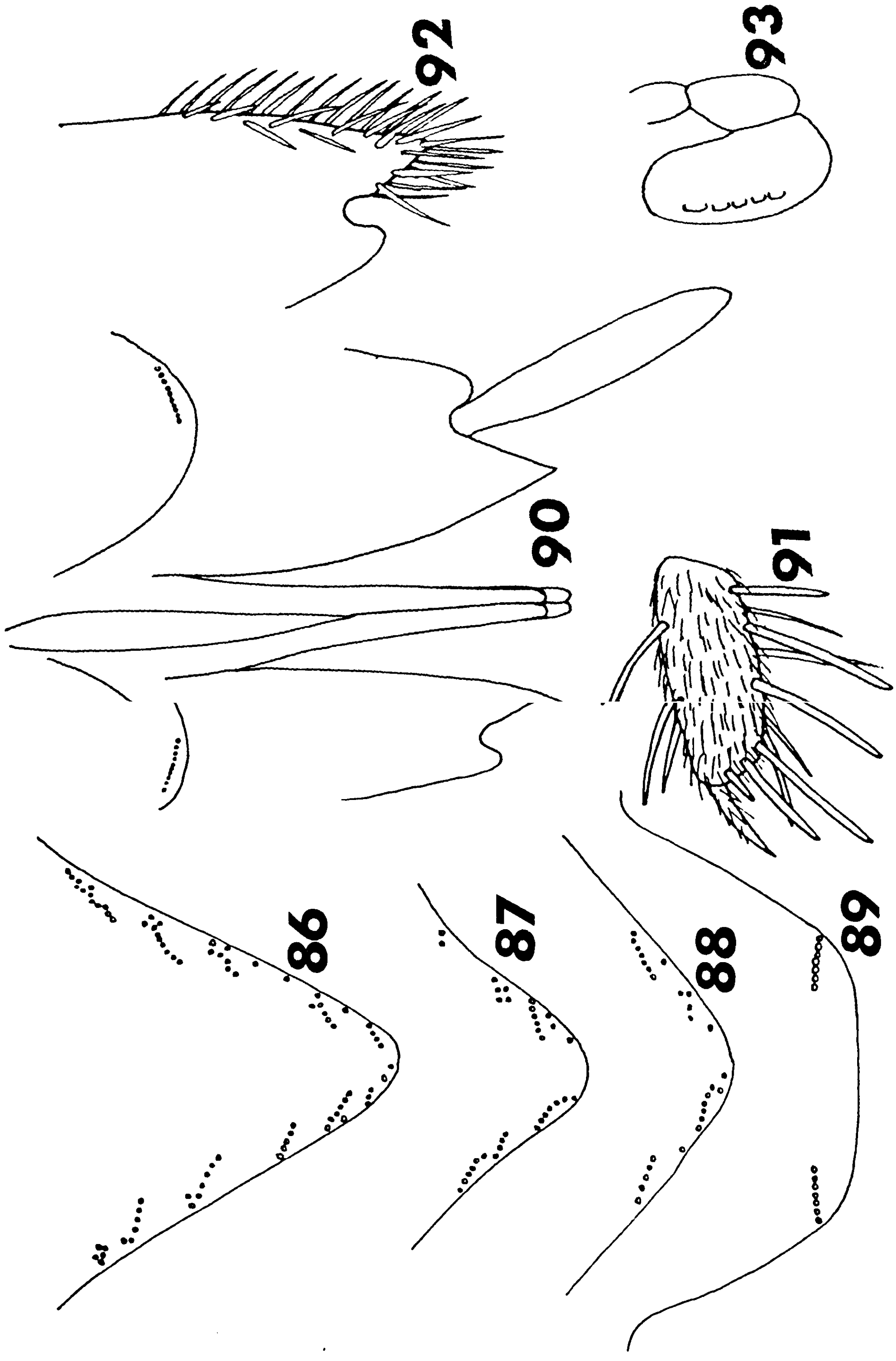
Figure 89. Urotergite X.

Figure 90. Female genitalia.

Figure 91. Tibia I.

Figure 92. Coxite IX, male.

Figure 93. Distal labial palp, male.


92
93
90
91
86
87
88
89

FIGURES 94-105

C. namibensis sp. nov.

Figure 94. Body, dorsal.

Figure 95. Distal labial palp, male.

Figure 96. Maxillary palp.

Figure 97. Prosternum.

Figure 98. Mesosternum.

Figure 99. Metasternum.

Figure 100. Male genitalia.

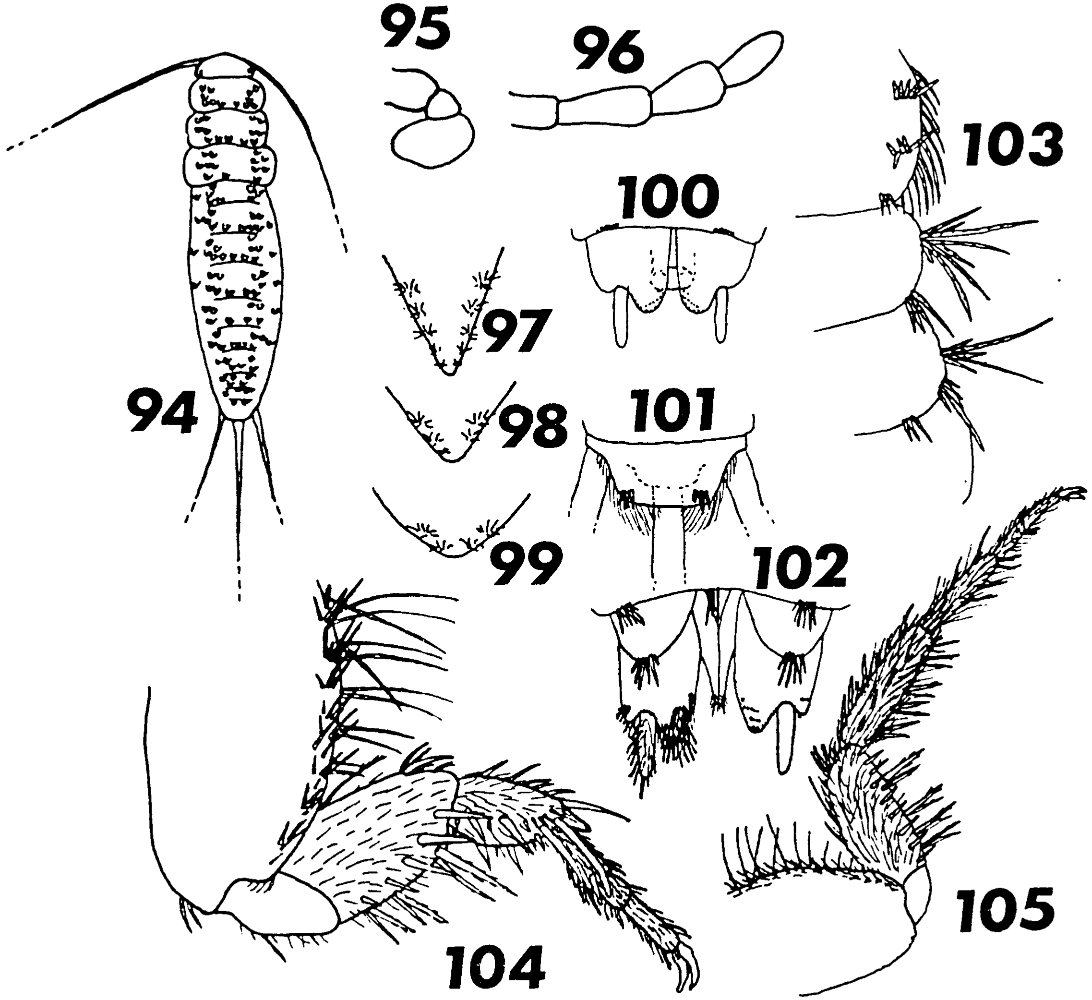
Figure 101. Urotergite X.

Figure 102. Female genitalia.

Figure 103. Lateral metanotum and urotergites I-II.

Figure 104. First leg.

Figure 105. Third leg.


94
95
96
97
98
99
100
101
102
103
104
105

FIGURES 106-116

C. ossilitoralis sp. nov.

Figure 106. Body, dorsal.

Figure 107. Prosternum.

Figure 108. Mesosternum.

Figure 109. Metasternum.

Figure 110. Maxillary palp.

Figure 111. Distal labial palp, male.

Figure 112. First leg.

Figure 113. Distal third leg.

Figure 114. Female genitalia.

Figure 115. Male genitalia.

Figure 116. Urotergite X.

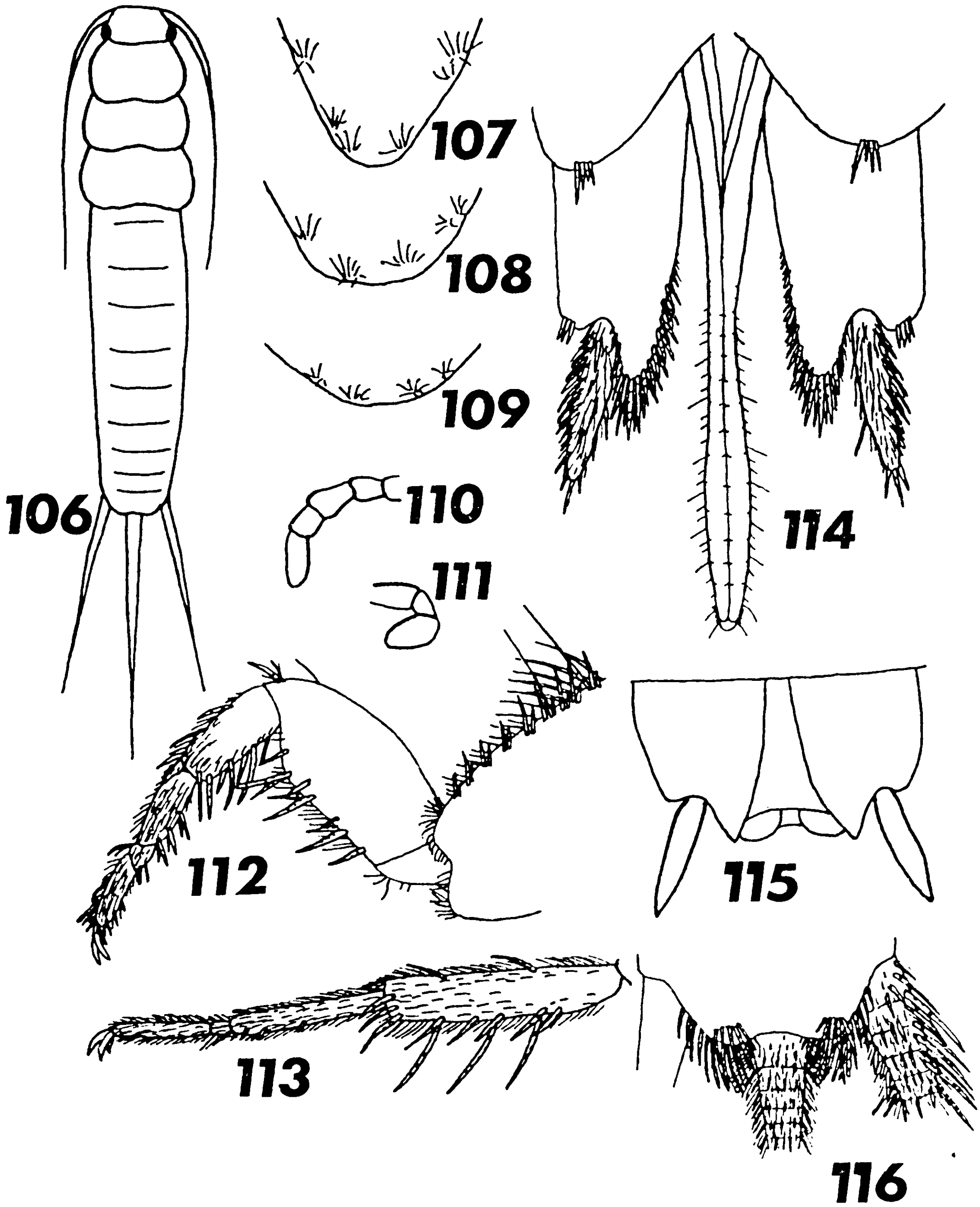

106
107
108
109
110
111
112
113
114
115
116

FIGURE 117

Distributions of:

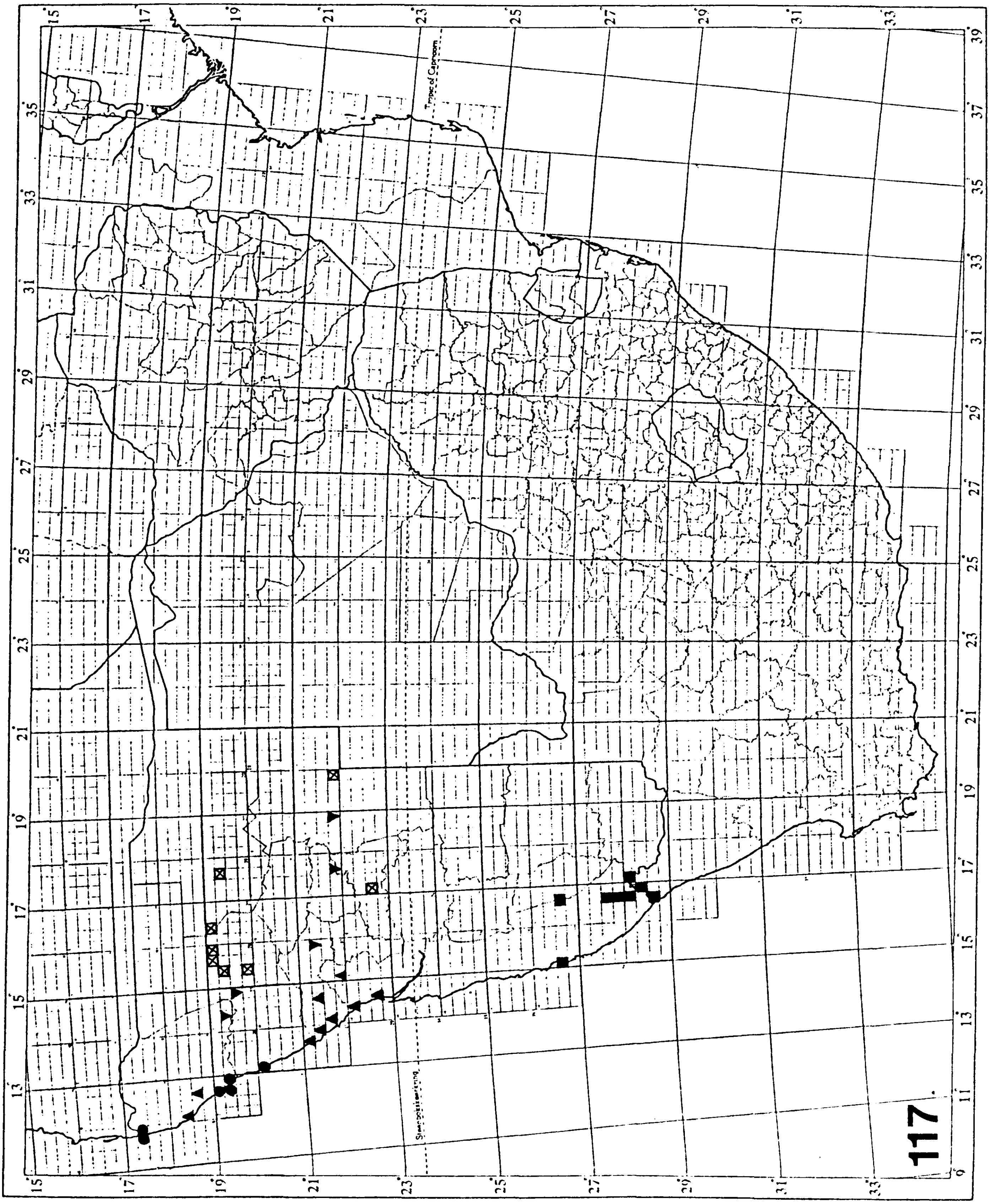
C. ossilitoralis sp. nov. (filled circles)

C. penrithae sp. nov. (filled upright triangles)

C. saxeta sp. nov. (filled squares)

C. inornata sp. nov. (crossed squares)

C. activa Silvestri (filled inverted triangles)


Tropic of Capricorn
Steenbokskeerkring
117

FIGURES 118-129

_C_. _penrithae_ sp. nov.

Figure 118. Body, dorsal.

Figure 119. Distal labial palp, female.

Figure 120. Distal labial palp, male.

Figure 121. Maxillary palp.

Figure 122. Prosternum.

Figure 123. Mesosternum.

Figure 124. Metasternum.

Figure 125. Male genitalia.

Figure 126. Urotergite X.

Figure 127. Lateral urotergite III.

Figure 128. Female genitalia.

Figure 129. First leg.

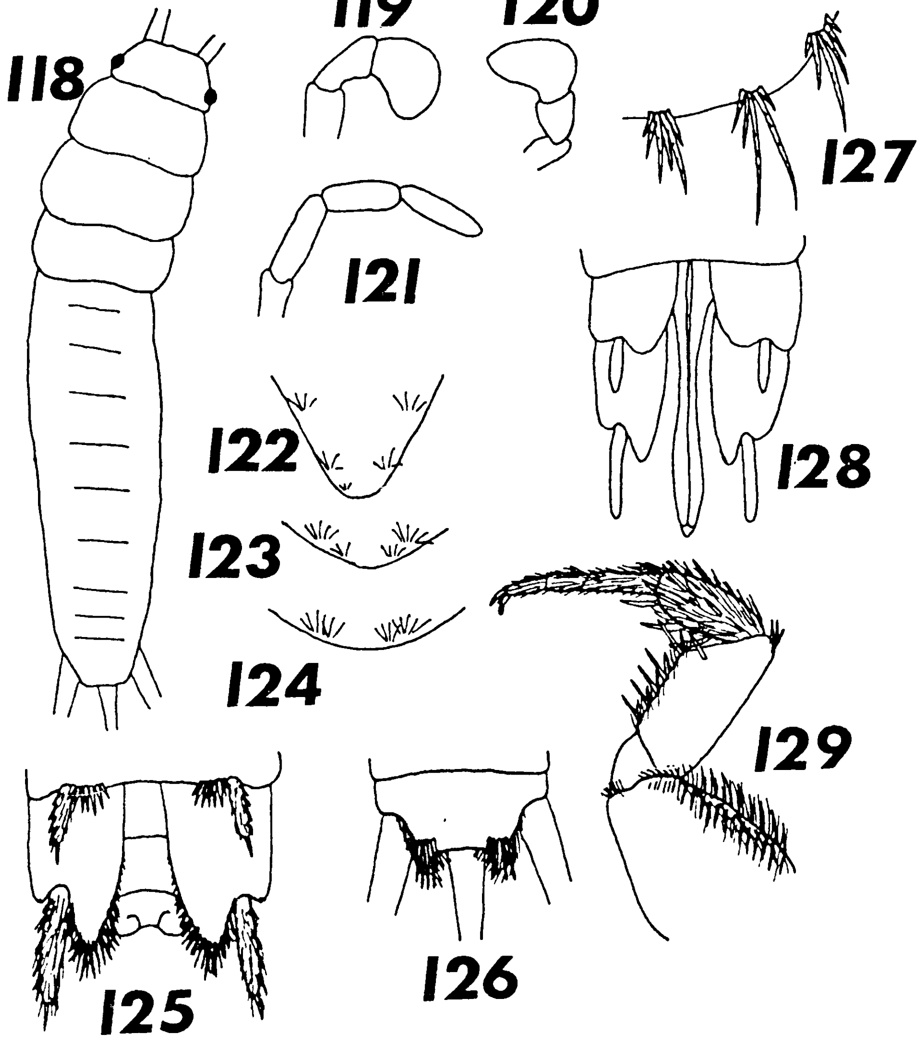

118
119
120
121
122
123
124
125
126
127
128
129

FIGURE 130

Distributions of:

_C_. _intercursa_ Silvestri (shaded left lower half of square)

_C_. _prompta_ Silvestri (shaded right upper half of square)

_C_. _intercursa/prompta_ indet. (crossed squares)

Lines denote the western limit of _C_. _prompta_ and the eastern limit of _C_. _intercursa_ respectively.


Tropic of Capricorn
Steenbokskeerkring
130

FIGURES 131-138

C. saxeta sp. nov.

Figure 131. Prosternum.

Figure 132. Mesosternum.

Figure 133. Metasternum.

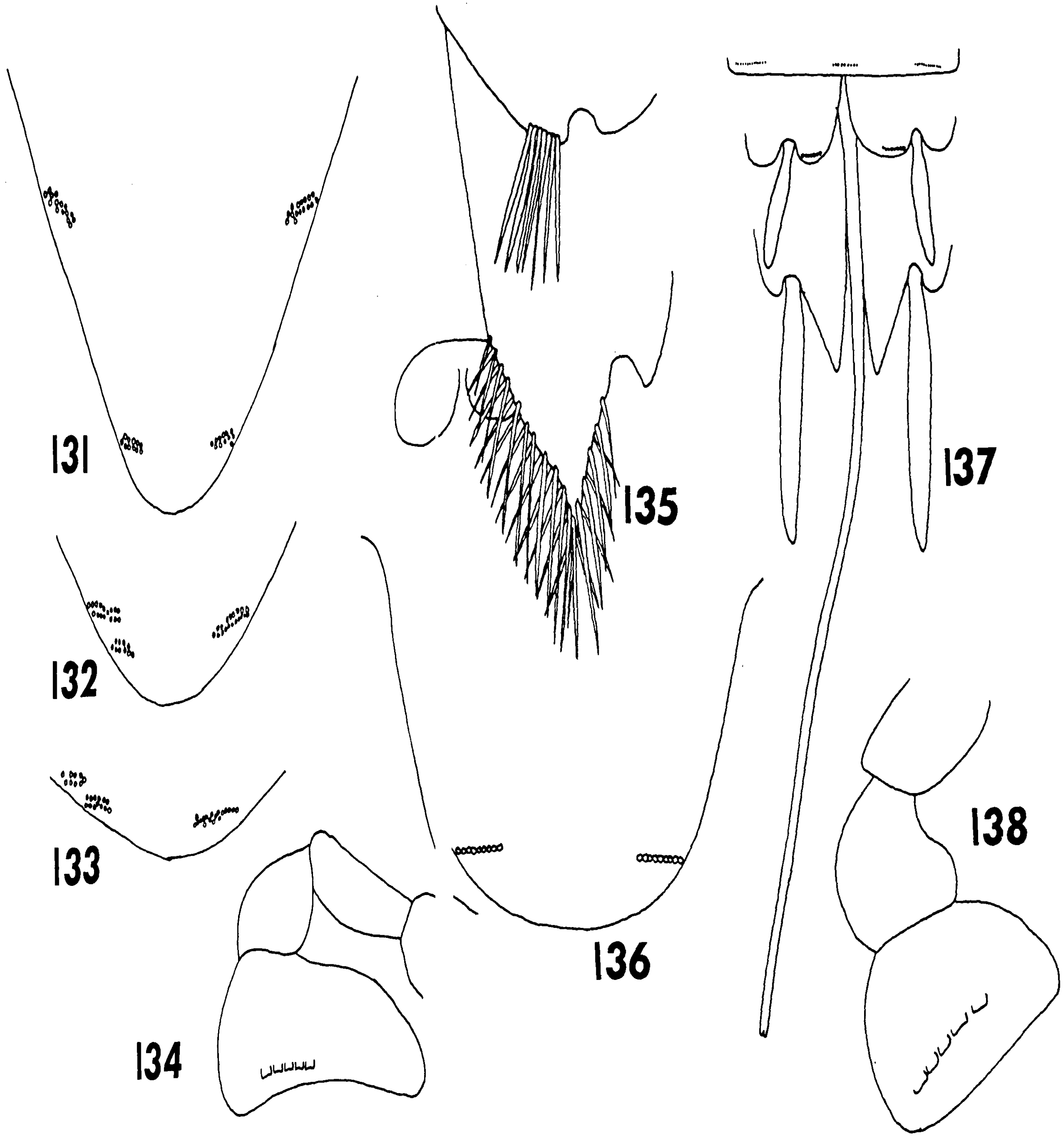
Figure 134. Distal labial palp, male.

Figure 135. Coxite IX, male.

Figure 136. Urotergite X.

Figure 137. Female genitalia.

Figure 138. Distal labial palp, female.


131
132
133
134
135
136
137
138

FIGURES 139-145

C. inornata sp. nov.

Figure 139. Prosternum.

Figure 140. Mesosternum.

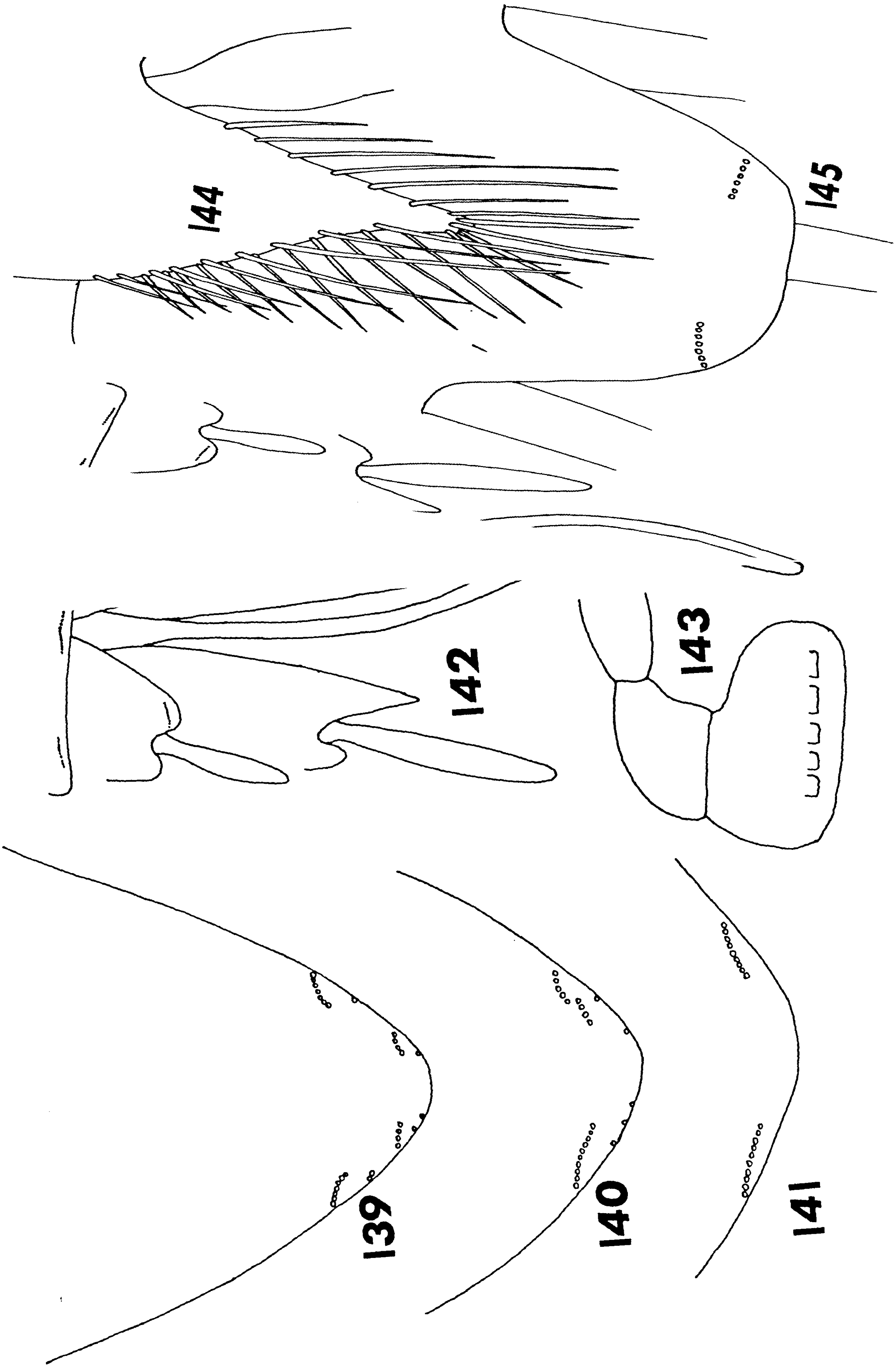
Figure 141. Metasternum.

Figure 142. Female genitalia.

Figure 143. Distal labial palp, male.

Figure 144. Coxite IX, male.

Figure 145. Urotergite X.


144
145
142
143
139
140
141

FIGURES 146-151

C. kaokoensis sp. nov.

Figure 146. Urotergite X.

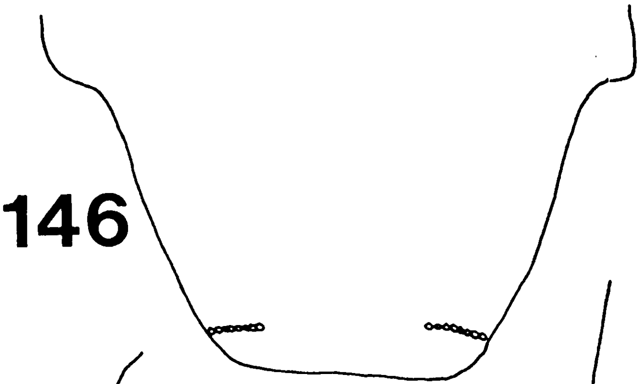
Figure 147. Distal labial palp, male.

Figure 148. Coxite IX, male.

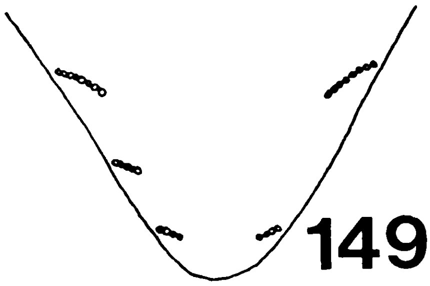
Figure 149. Prosternum.

Figure 150. Mesosternum.

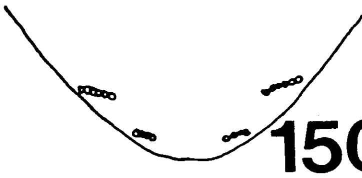
Figure 151. Metasternum.



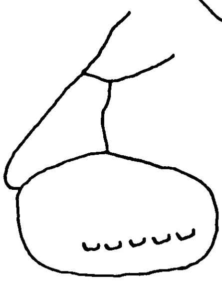
146



149

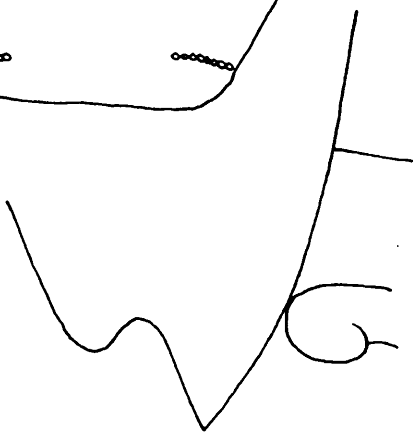


150



147

151



148

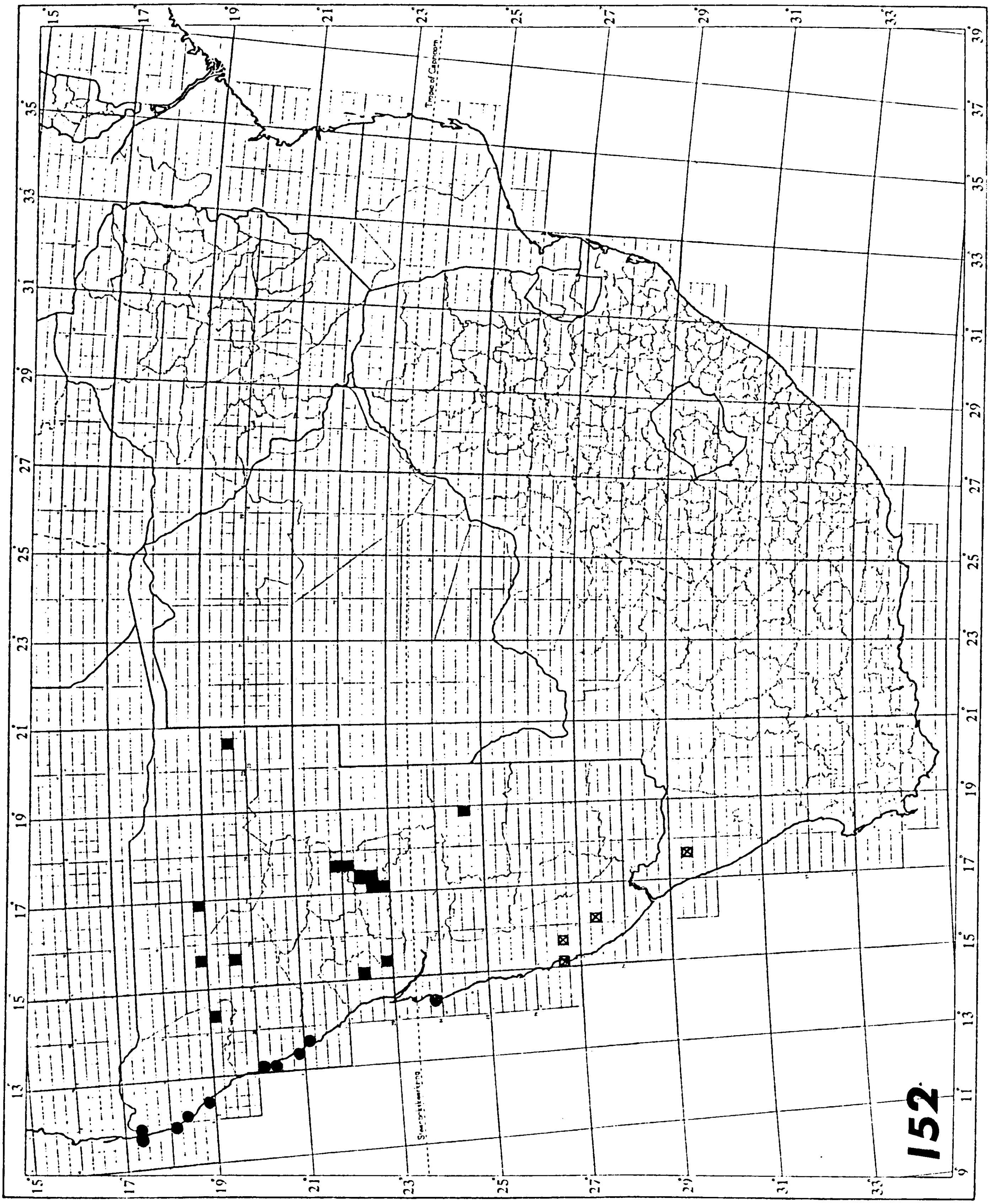
FIGURE 152

Distributions of:

C. plusiochaeta Silvestri (filled squares)

C. parcespinata Silvestri (crossed squares)

C. arenicola Wygodzinsky (Filled circles)


152
Tropic of Capricorn

FIGURES 153-158

C. *parcespinata* Silvestri

Figure 153. Female genitalia.

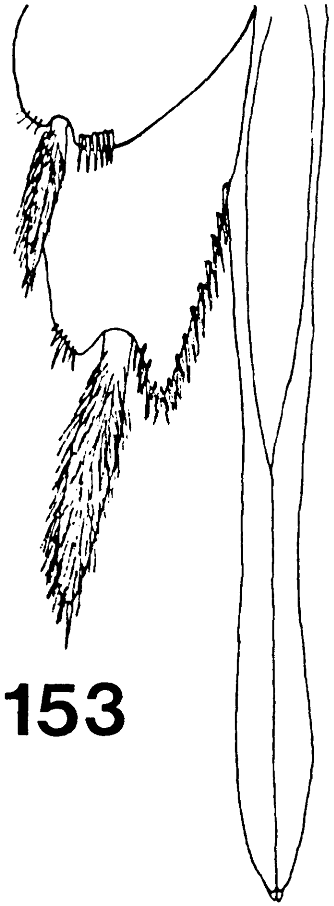
Figure 154. Prosternum.

Figure 155. Mesosternum.

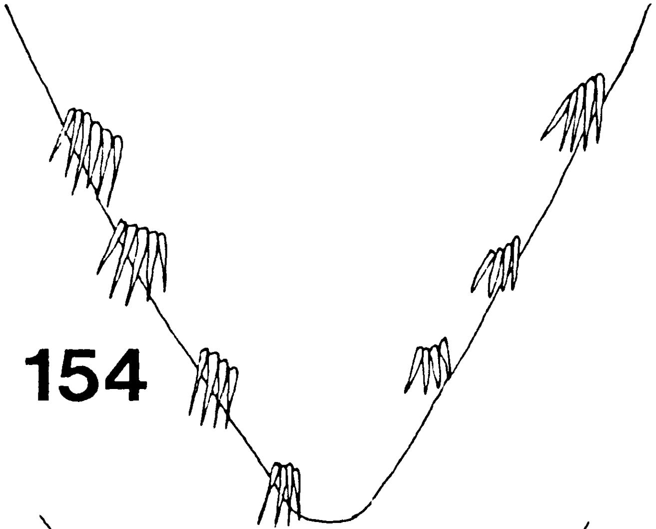
Figure 156. Metasternum.

Figure 157. Urotergite X.

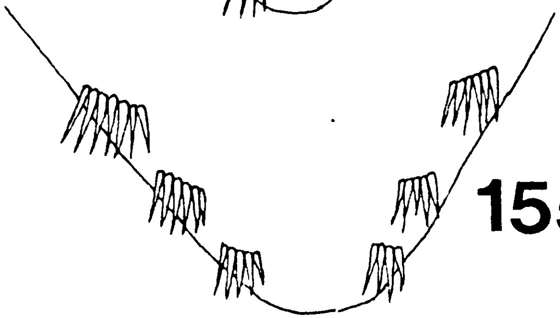
Figure 158. Apex of ovipositor.



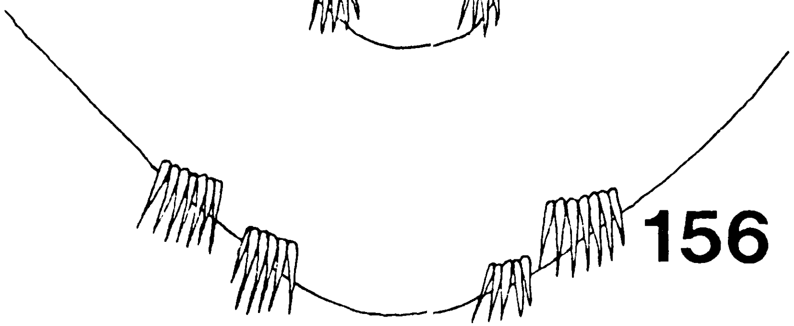
153



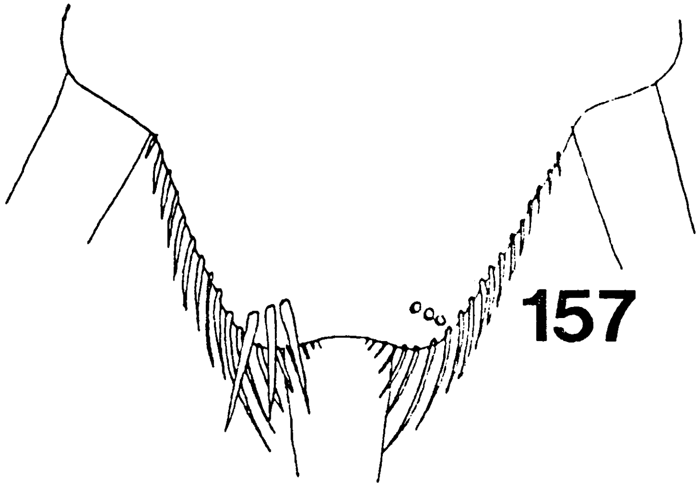
154



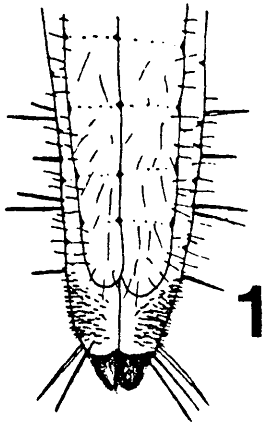
155



156



157

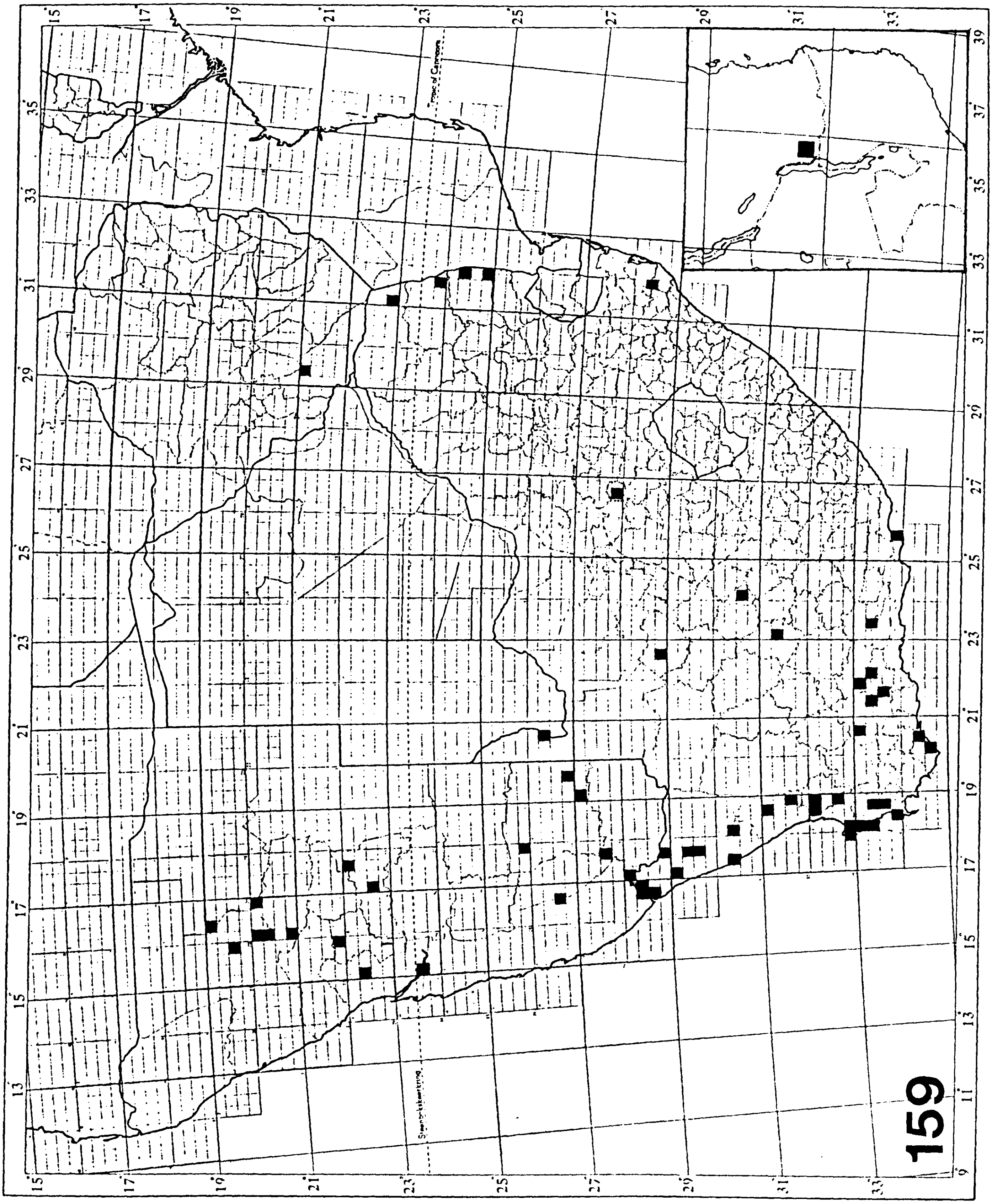


158

FIGURE 159

Distribution of C. grandipalpis Escherich.

(inset: distribution in East Africa)


159

FIGURES 160-164

C. activa Silvestri

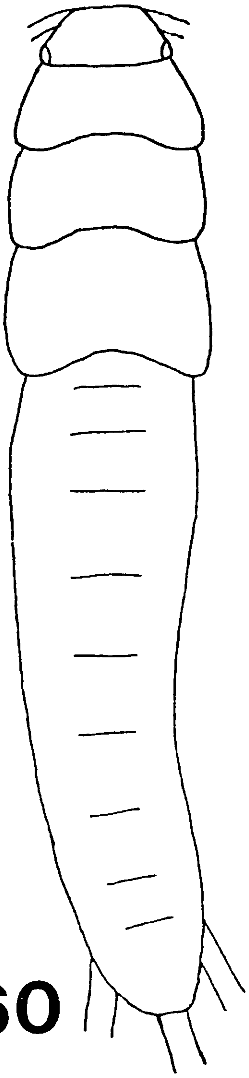
Figure 160. Body, dorsal.

Figure 161. Male genitalia.

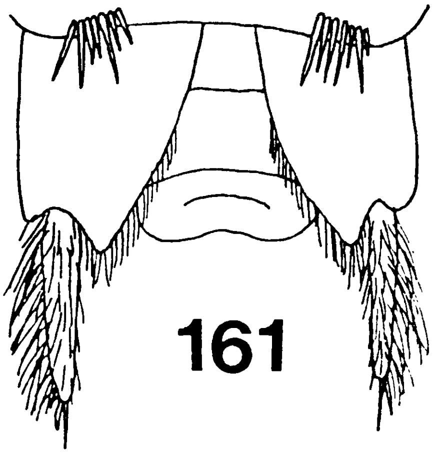
Figure 162. Prosternum.

Figure 163. Mesosternum.

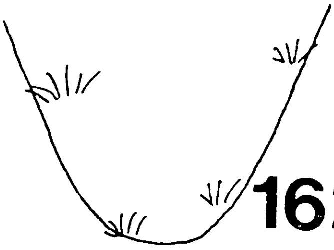
Figure 164. Metasternum.



160



161



162

163

164

FIGURES 165-173

C. capensis sp. nov.

Figure 165. Distal labial palp, female.

Figure 166. Distal labial palp, male.

Figure 167. Female genitalia.

Figure 168. Second leg.

Figure 169. Prosternum.

Figure 170. Mesosternum.

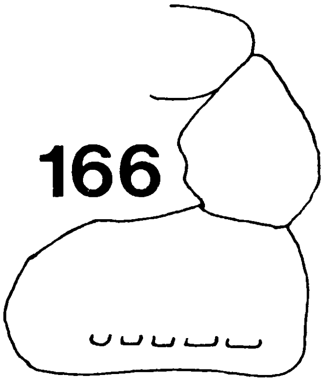
Figure 171. Metasternum.

Figure 172. Urotergite X.

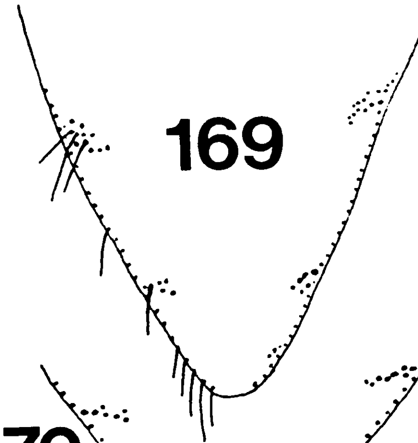
Figure 173. Coxite IX, male.

165

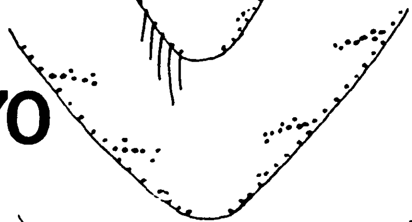
166



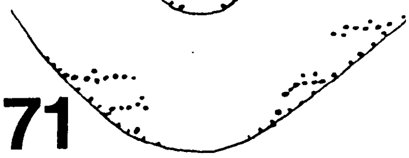
169

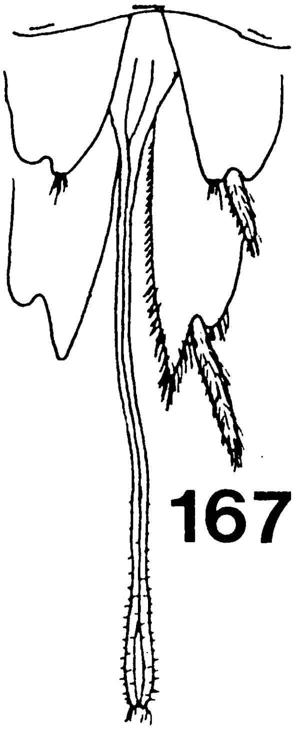


170



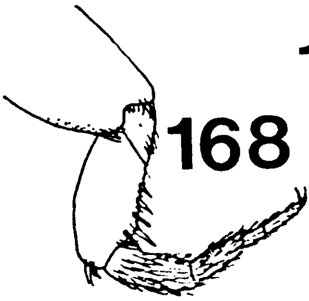
171

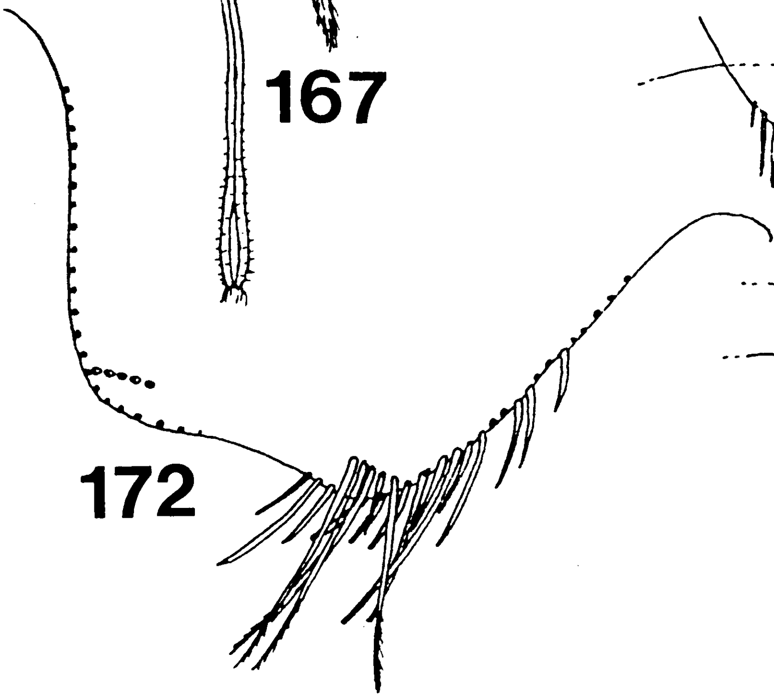




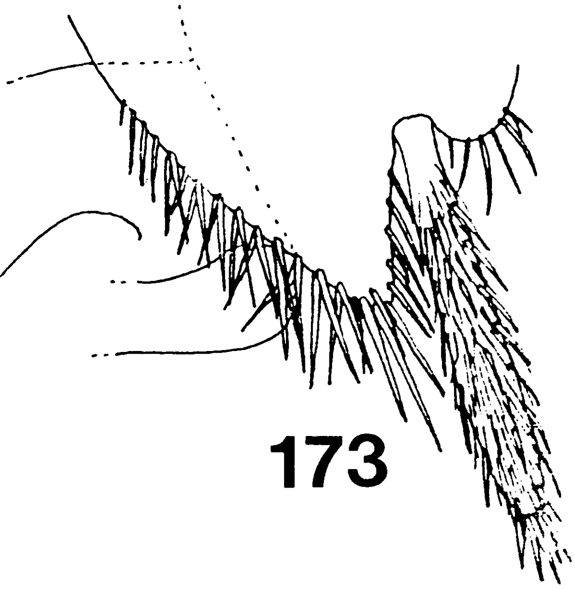
167

168





172



173

FIGURES 174-176

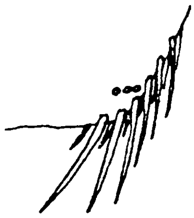
Figure 174. C. pauliani Wygodzinsky, body dorsal showing appendage lengths. Solid lines: average length; broken lines: maximum recorded length.

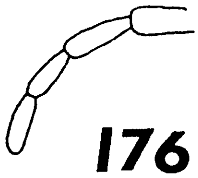
Figures 175-176. C. corvina Wygodzinsky.

Figure 175. Posterolateral portion of urotergite X.

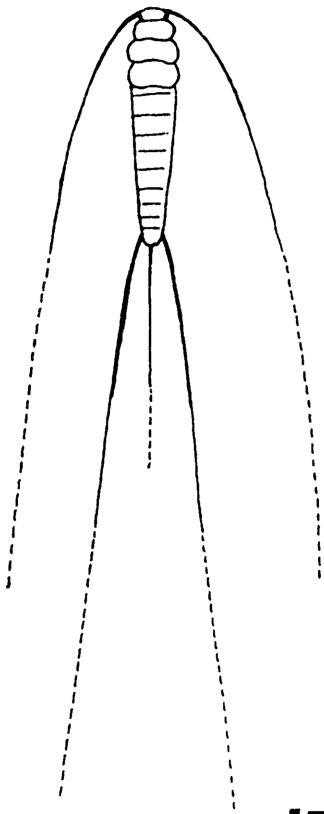
Figure 176. Maxillary palp.

175





176



174

FIGURE 177

Distribution of C. pauliani Wygodzinsky.

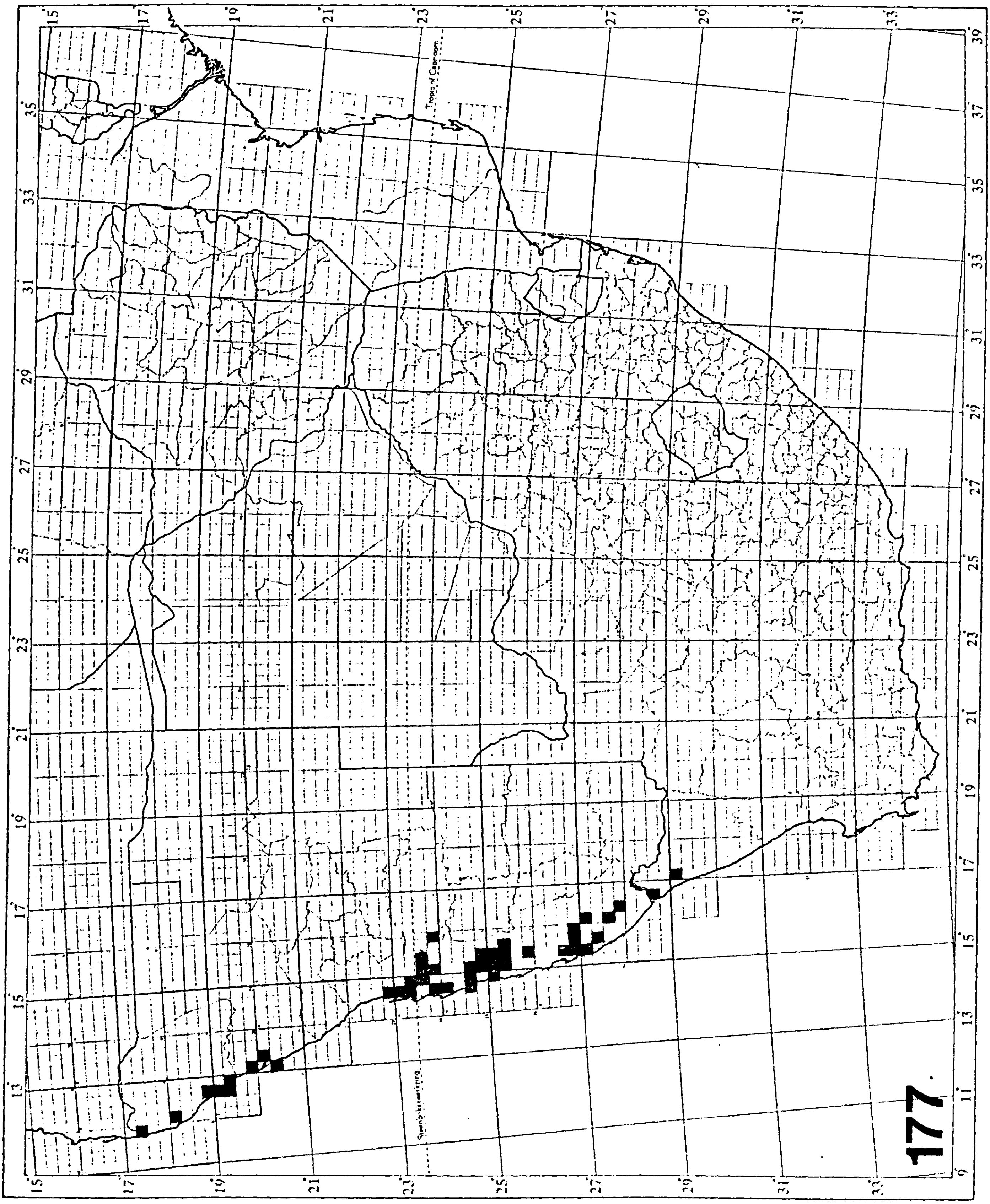
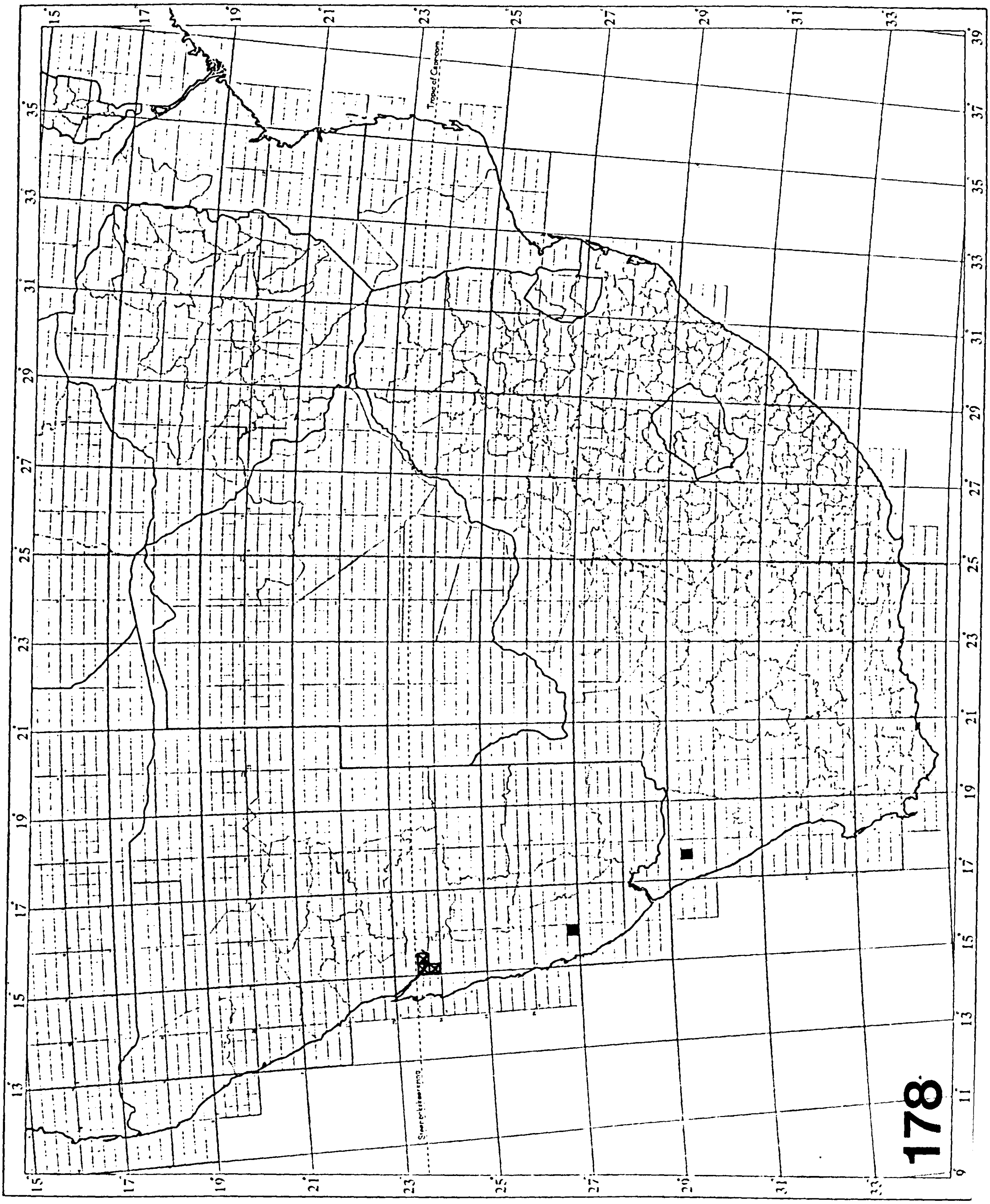

177

FIGURE 178

Distributions of:

C. corvina Silvestri (filled squares).

C. spinipes sp. nov. (crossed squares)


Tropic of Capricorn

FIGURES 179-187

C. desperata sp. nov.

Figure 179. Prosternum.

Figure 180. Mesosternum.

Figure 181. Metasternum.

Figure 182. Female genitalia.

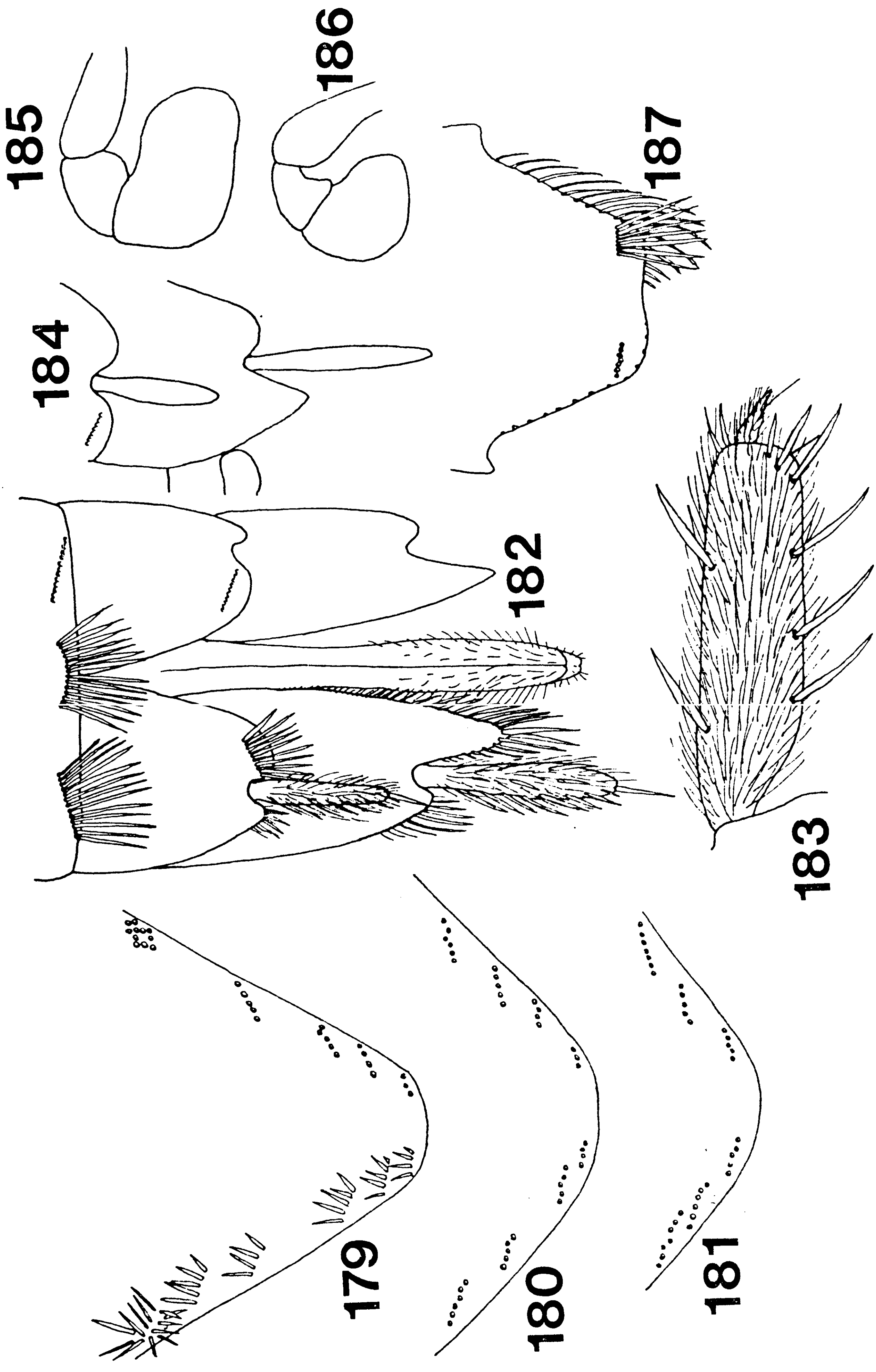
Figure 183. Tibia III.

Figure 184. Coxite IX, male.

Figure 185. Distal labial palp, male.

Figure 186. Distal labial palp, female.

Figure 187. Urotergite X.


185
186
184
187
182
183
179
180
181

FIGURES 188-194

C. namaquensis sp. nov.

Figure 188. Prosternum.

Figure 189. Mesosternum.

Figure 190. Metasternum.

Figure 191. Urotergite X.

Figure 192. Coxite IX, male.

Figure 193. Distal labial palp, male.

Figure 194. Female genitalia.

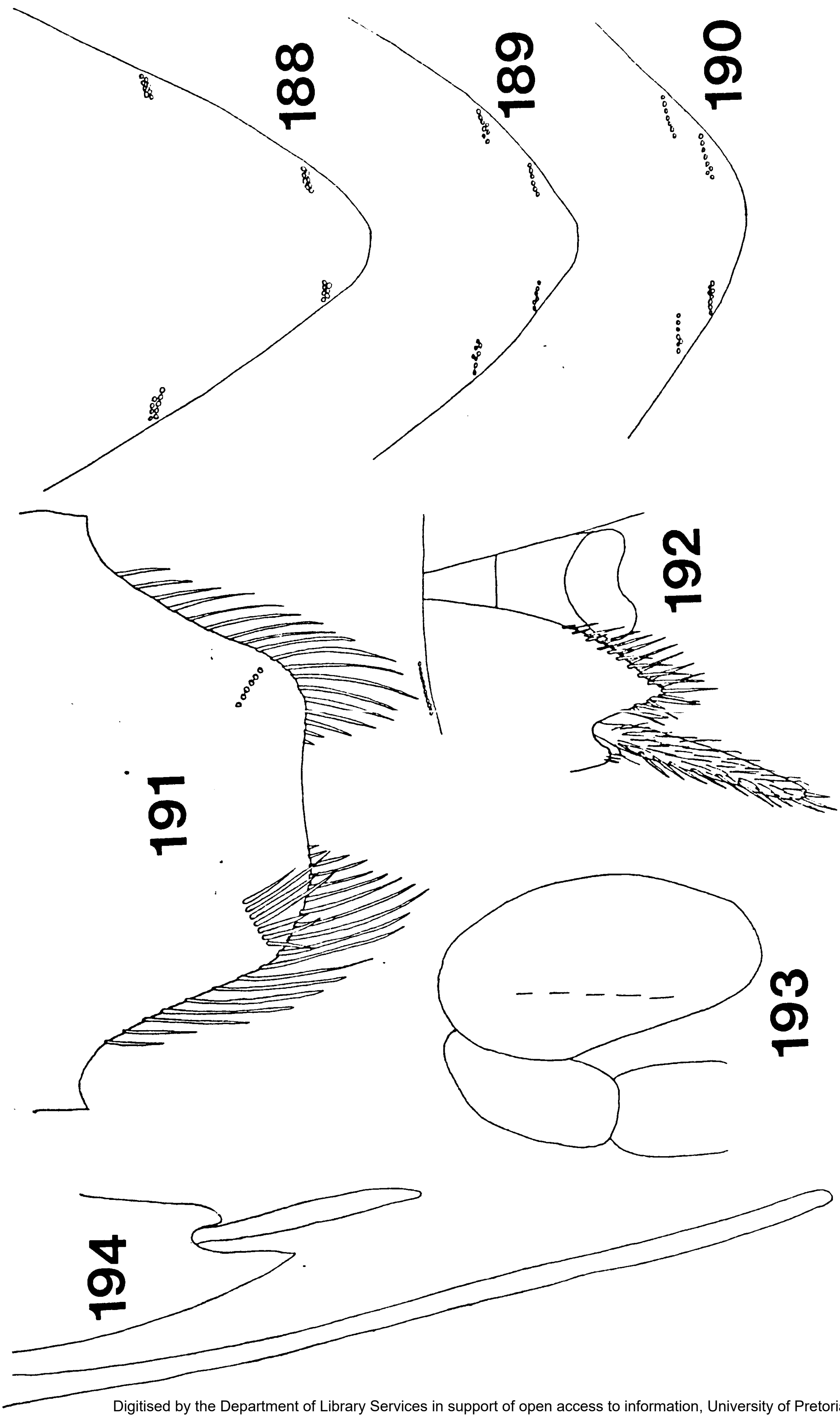
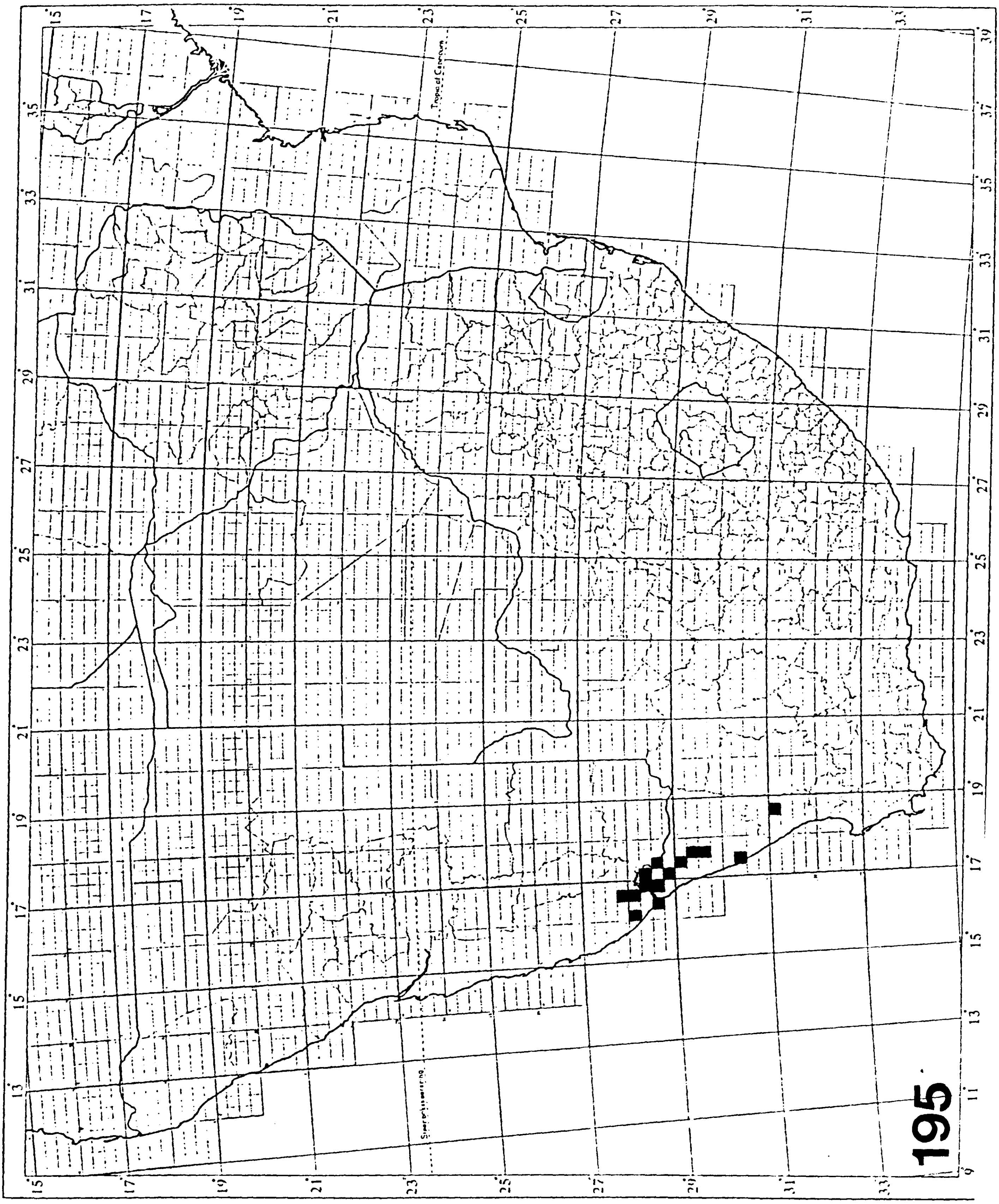

188
189
190
191
192
193
194

FIGURE 195

Distribution of *C. namaquensis* sp. nov.



FIGURES 196-205

C. *spinipes* sp. nov.

Figure 196. Body, dorsal.

Figure 197. Distal labial palp.

Figure 198. Maxillary palp.

Figure 199. Prosternum.

Figure 200. Mesosternum.

Figure 201. Metasternum.

Figure 202. First leg.

Figure 203. Urotergite X.

Figure 204. Female genitalia.

Figure 205. Male genitalia.

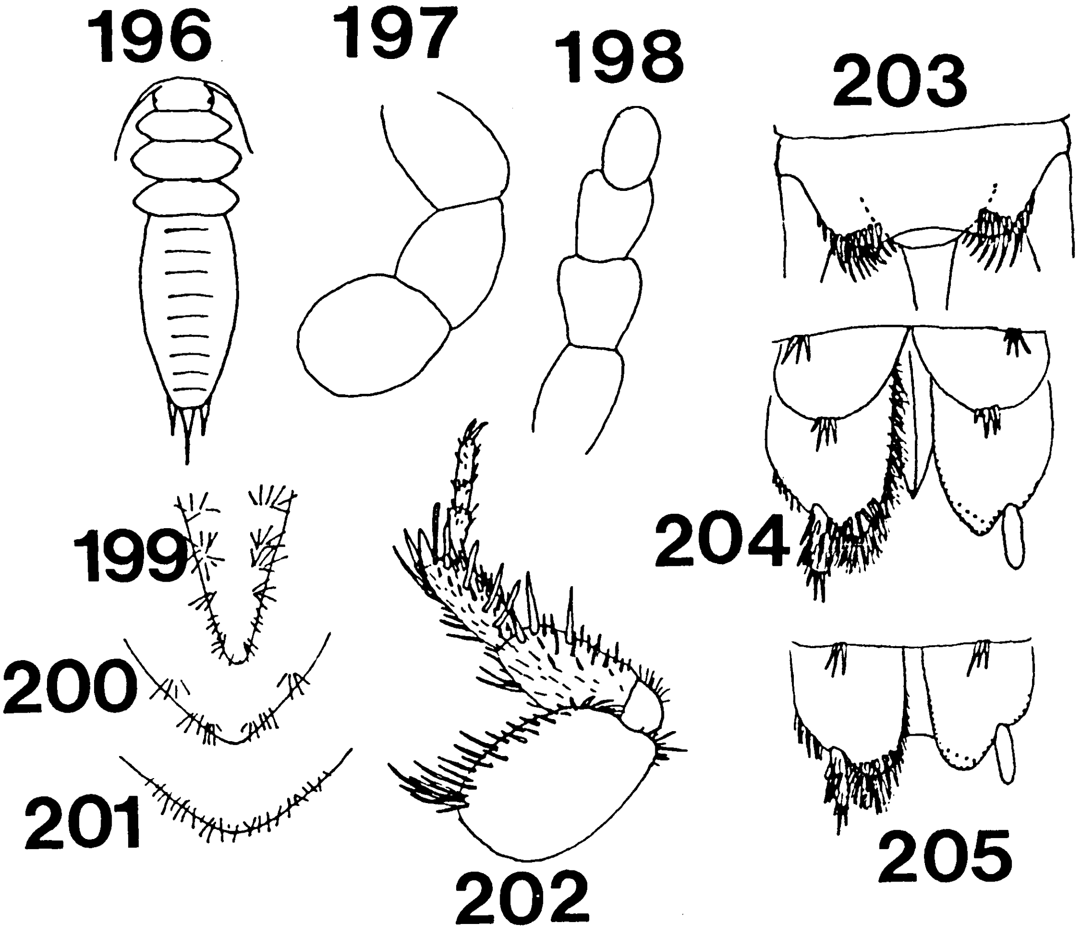

196
197
198
203
199
204
200
201
202
205

FIGURE 206

Distribution of Escherichian species-groups:

(domestic species excluded)

a. "targionii"-group (excluding C. targionii).

b. "ciliata"-group (excluding C. ciliata and C. longicaudata).

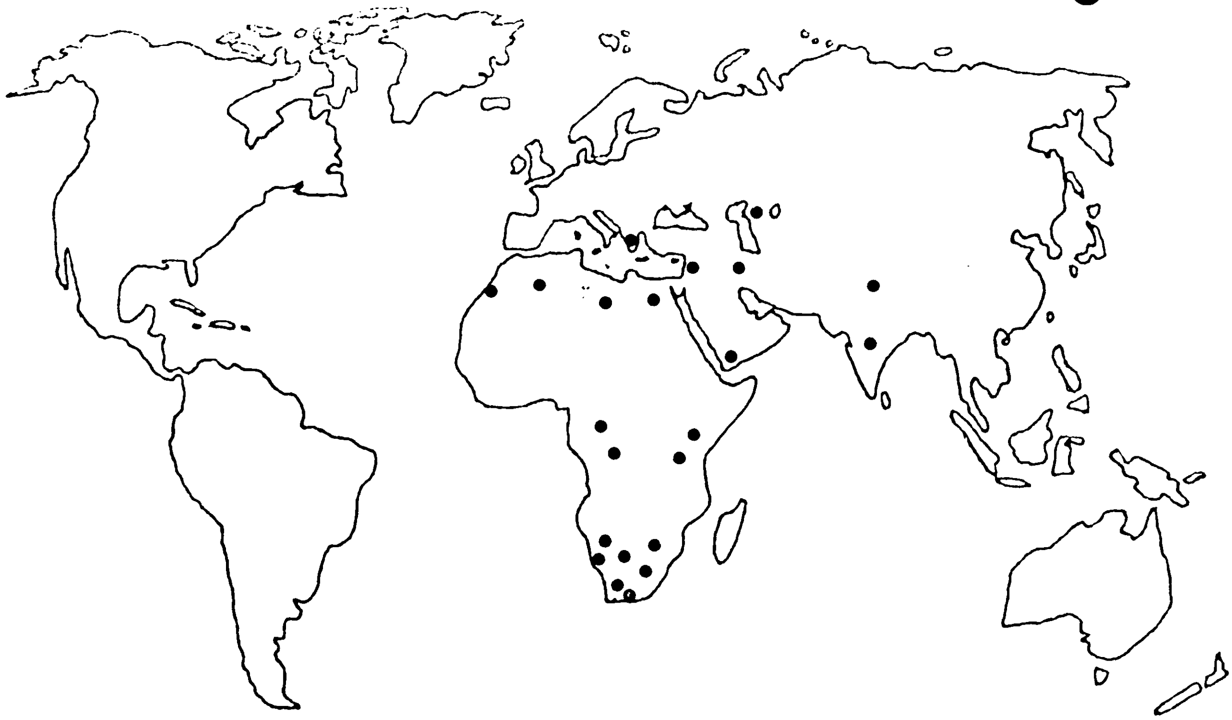
c. "lineata-group (excluding C. lineata).

d. unnamed fourth group.

206a

b

c



d

FIGURE 207

Distribution of the subgenera of *Ctenolepisma* (domestic species excluded).

a. *C.* (*Ctenolepisma*) (excluding *C. ciliata*, *C. lineata* and *C. longicaudata*).

b. *C.* (*Sceletolepisma*) (excluding *C targionii*).

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

207a

b

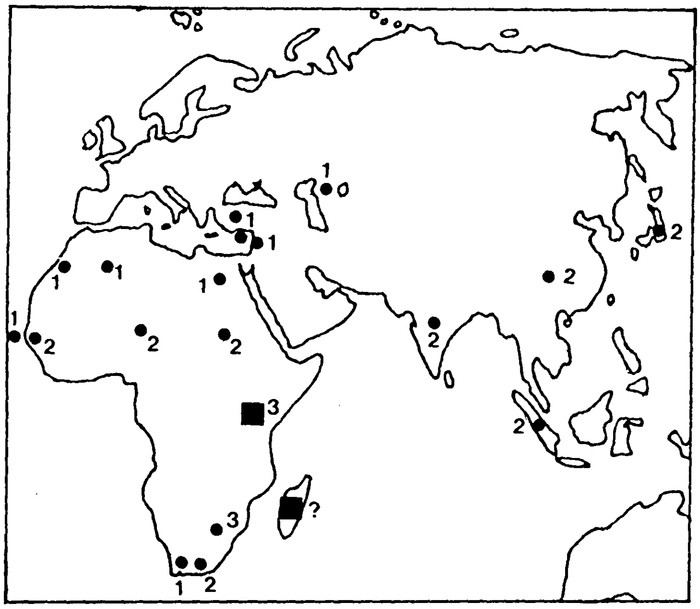
FIGURE 208

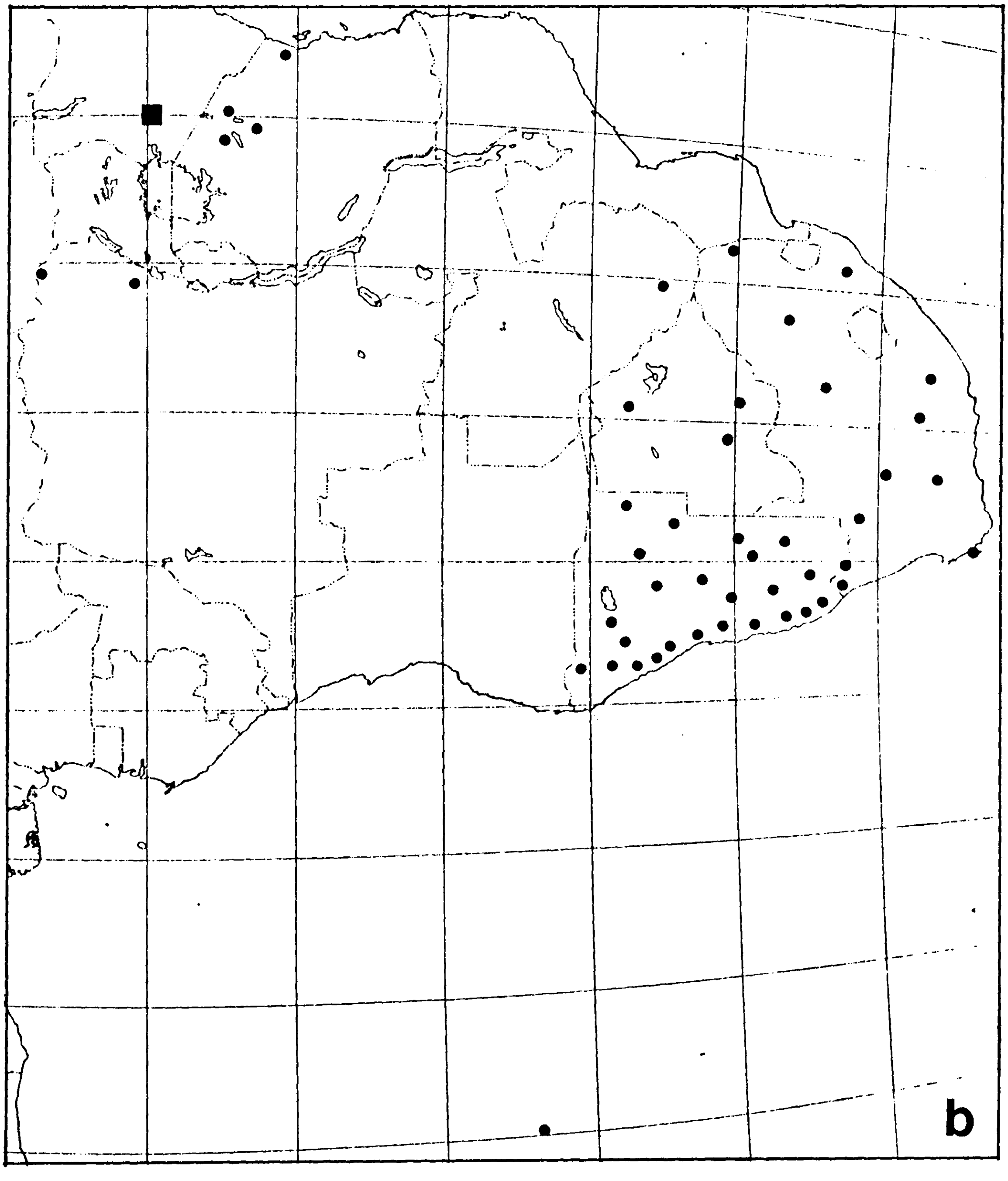
Distribution of:

a. species-groups _howa_ (squares) and _villosa_ (excluding _C. targionii_) (dots). Numbers refer to the number of styli possessed by included species in different areas.

b. species-groups _grandipalpis_ (dots) and _howa_ (squares).

208 a





b

FIGURES 209-210

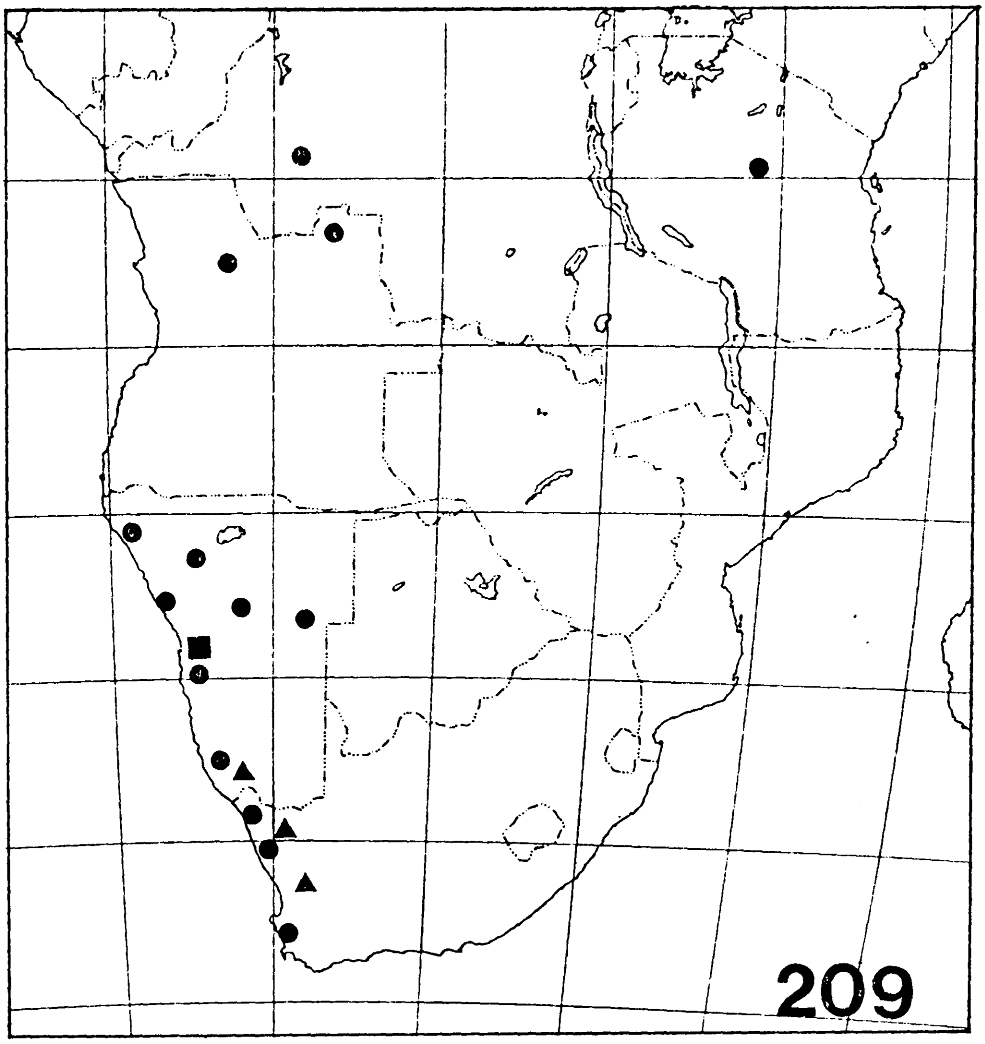
Figure 209. Distribution of:

a. species-group *activa* (dots).

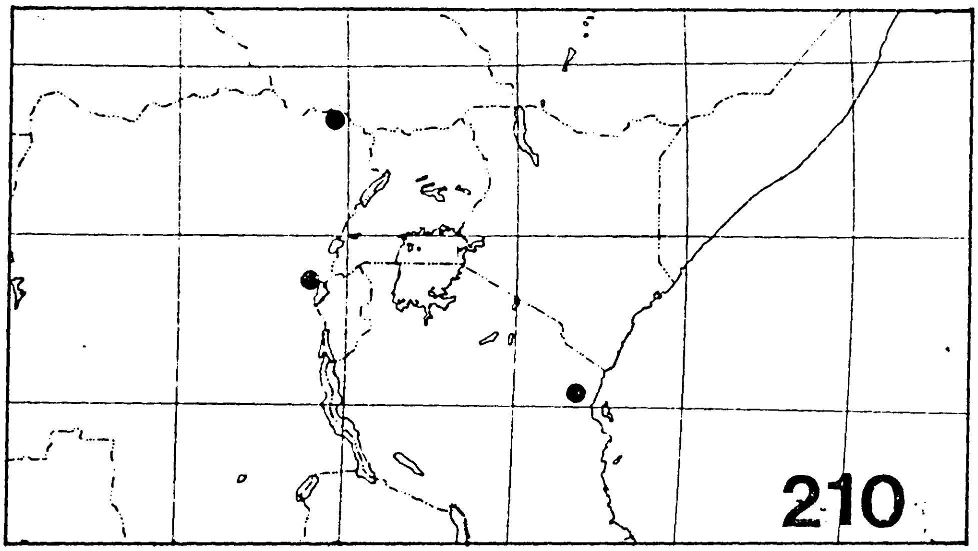
b. species-group *corvina* (triangles).

c. species-group *spinipes* (square).

Figure 210. Distribution of species-group *grandipalpis*, lineage *dewittei*.



209



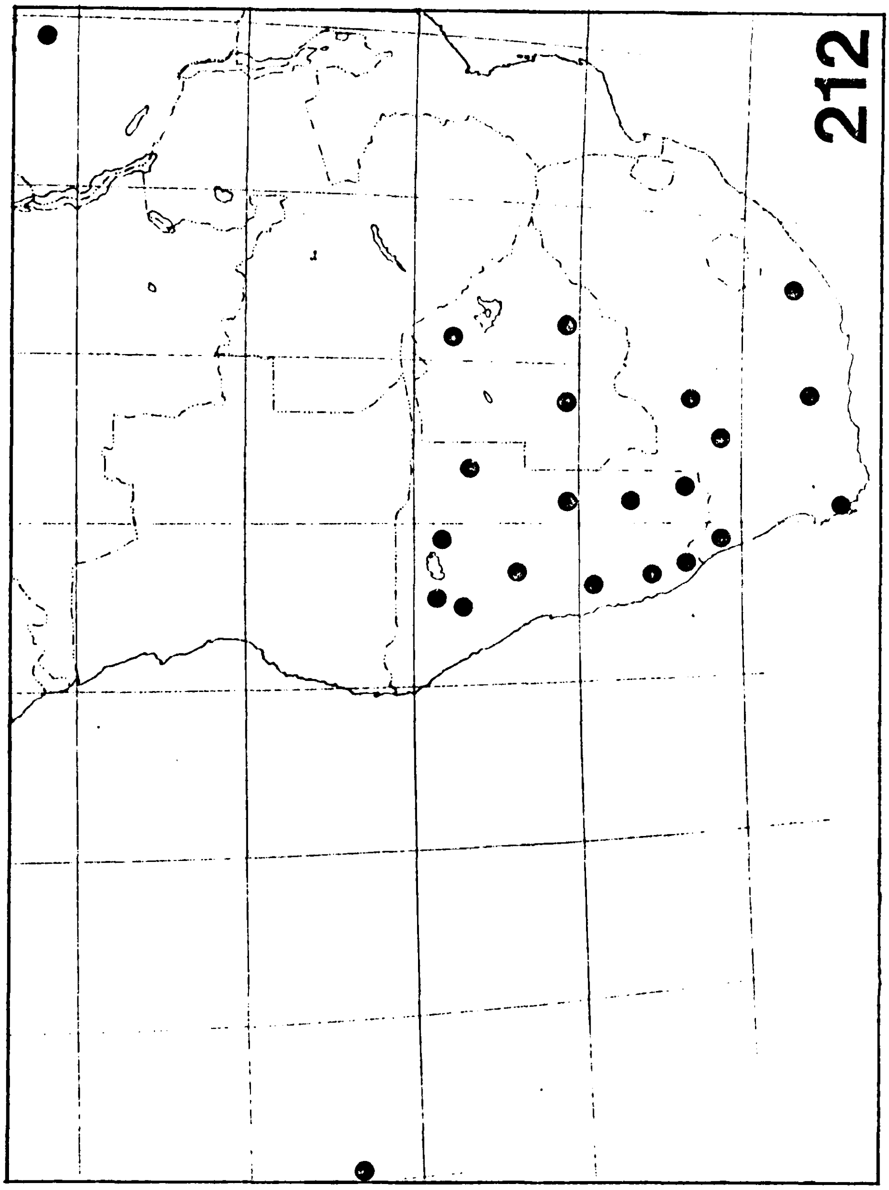
210

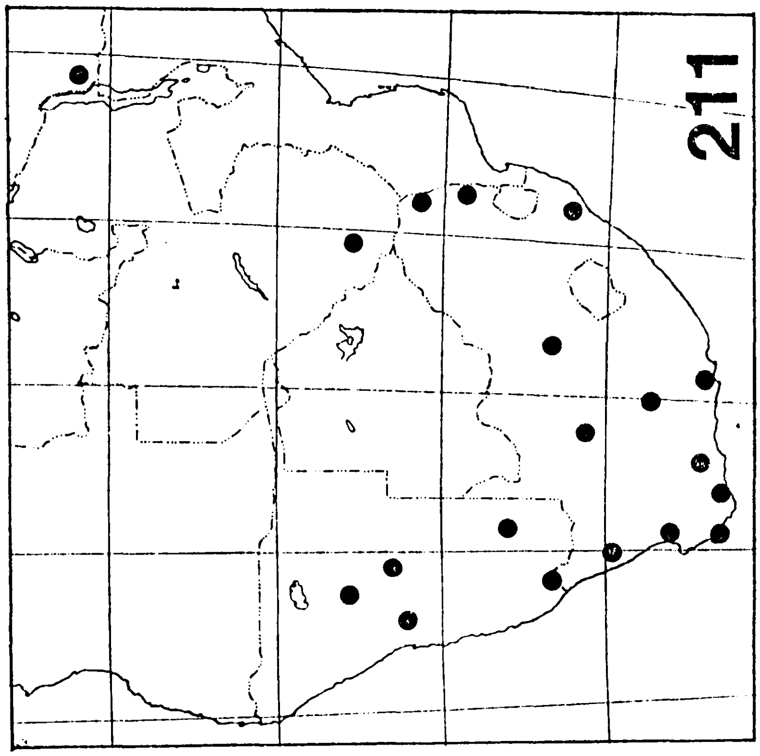
FIGURES 211-212

Distribution of species-group _grandipalpis_ lineages:

Figure 211. lineage _grandipalpis_

Figure 212. lineage _terebrans_


212

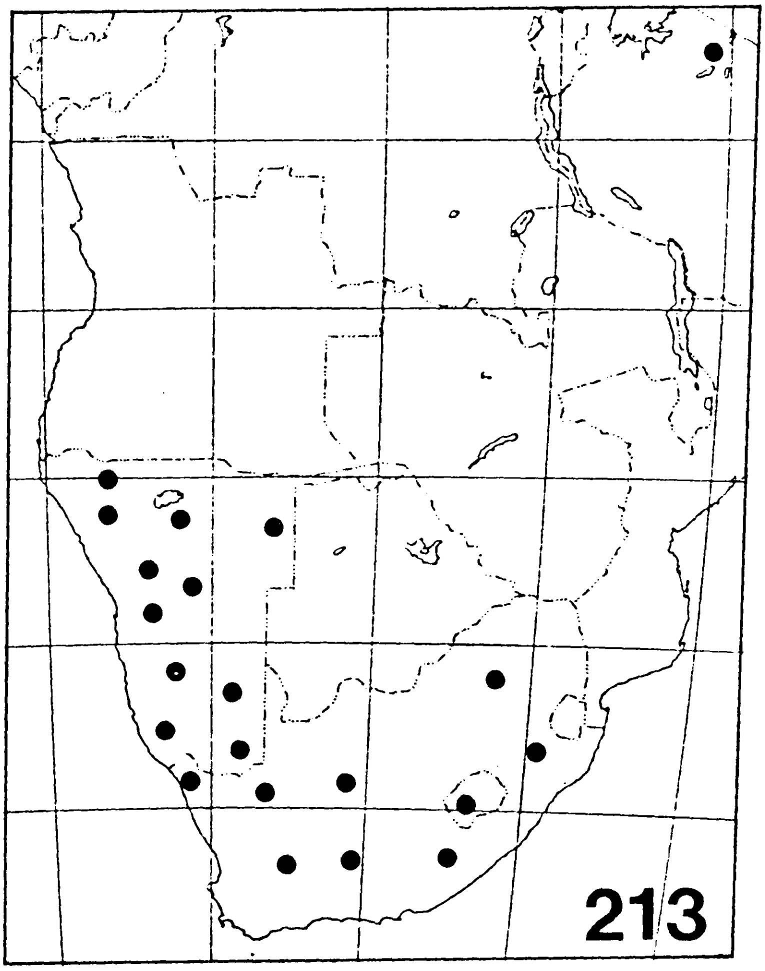

211

FIGURES 213-214

Distribution of species-group grandipalpis lineages:

Figure 213. lineage parcespinata

Figure 214. lineage namibensis


213

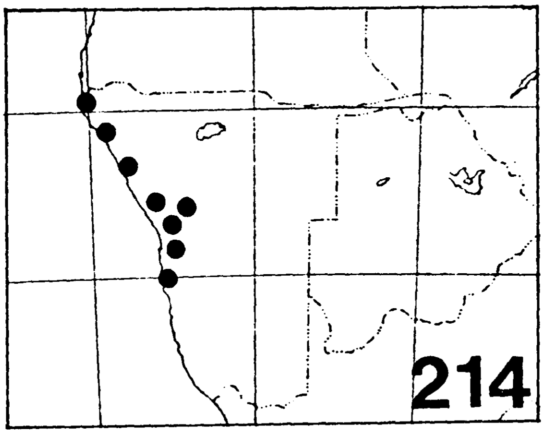
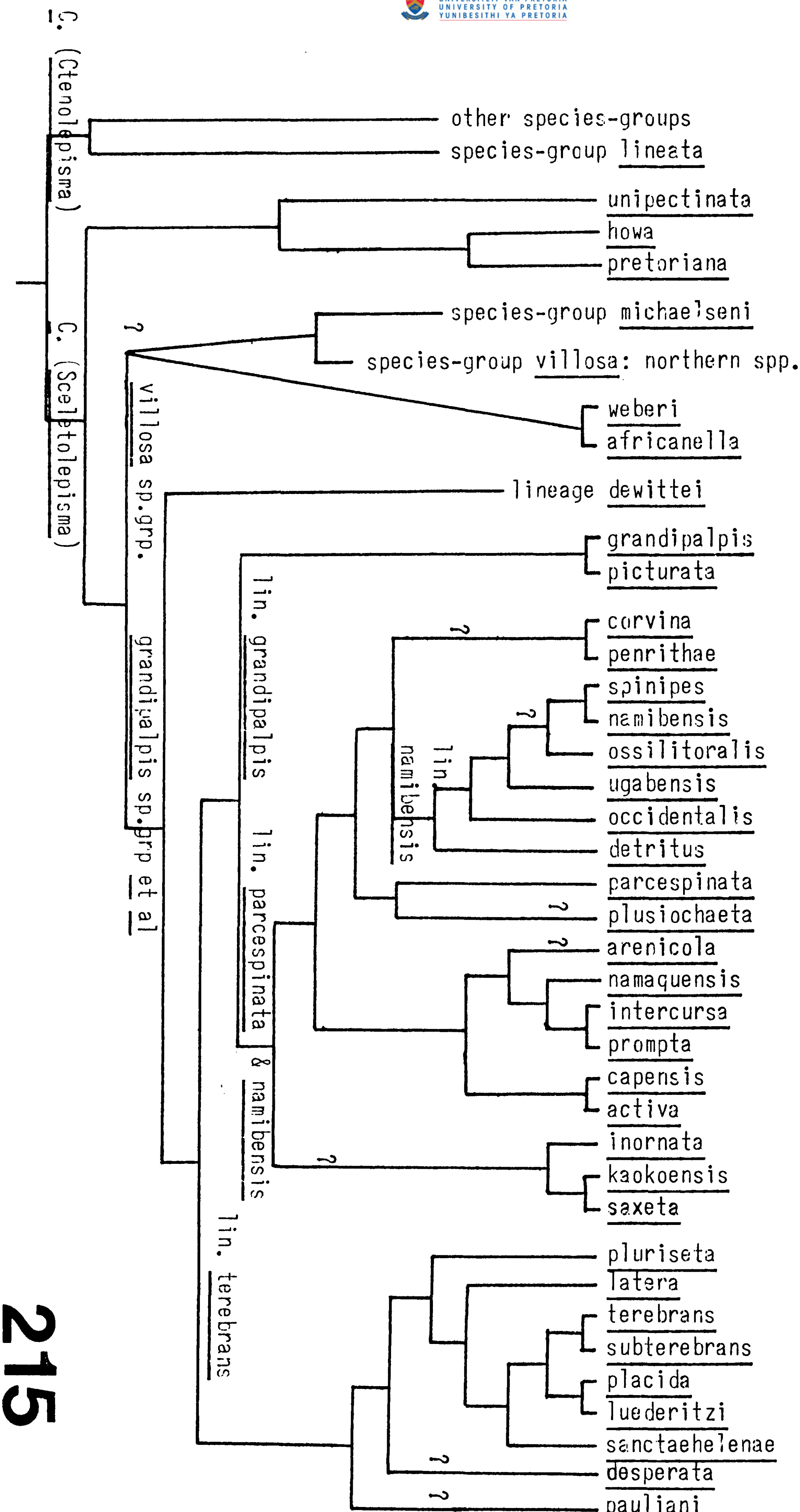

214

FIGURE 215

Provisional cladogram for southern African _Ctenolepisma_ species.


C. (Ctenolepisma)
C. (Sceletolepisma)
other species-groups
species-group lineata
unipectinata
howa
pretoriana
species-group michaelseni
species-group villosa: northern spp.
weberi
africanella
villosa sp.grp.
lineage dewittei
grandipalpis
picturata
lin. grandipalpis
corvina
penrithae
spinipes
namibensis
ossilitoralis
ugabensis
occidentalis
detritus
lin. namibensis
parcespinata
plusiochaeta
lin. parcespinata & namibensis
arenicola
namaquensis
intercursa
prompta
capensis
activa
inornata
kaokoensis
saxeta
grandipalpis sp.grp et al
pluriseta
latera
terebrans
subterebrans
placida
luederitzi
sanctaehelenae
desperata
pauliani
lin. terebrans