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BITING MIDGES, *CULICOIDES* SPP (DIPTERA:CERATOPOGONIDAE) OF TASMANIA

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Introduction

Collections of *Culicoides* spp were made in Tasmania in the summers of 1964, 1971 and 1972 to determine which of the species known to bite livestock were present. The standard techniques of light traps, vehicle-mounted traps, and searching for breeding places were used. In 1972 light traps were sited close to livestock. All collections were stored in 70% alcohol and selected specimens were mounted in Canada Balsam on glass slides for identification. Full details of the findings will be reported elsewhere.

Results

A preliminary listing of the species found and the localities where they were found is given below.

1	*C. angularis*	Falmouth
2	*C. bundyensis*	Falmouth, Sheffield, Scamander
3	*C. dycei*	Falmouth
4	*C. fulbrighti*	Falmouth
5	*C. marmoratus*	Montagu
6	*C. multimaculatus*	Falmouth, Scamander, Tomahawk River near to entrance, "Emita" on Flinders Island
7	*C. sigmoides*	Falmouth
8.	*C. victoriae*	Port Davey, Strahan, 6km west of Maydena, Bridgewater. Duck River 36km south of Smithton, Montagu River 1km from sea, Alberton, Bridport, Falmouth, Green's Beach, Preolenna, Railton, Scamander, Tomahawk River, Flinders Island — 11km south of Whitemark, "Emita".
9	*C. waringi*	Tomahawk River near to entrance, Flinders Island — 22km east and 11km south of Whitemark and "Emita".

Discussion

The species found were typical of a southern fauna. *C. victoriae* which feeds on mammals, including man, was widespread. *C. bundyensis* which feeds on cattle, horses and marsupials (Muller and Murray 1977) was common in the north-east. *C. angularis, C. fulbrighti* and *C. sigmoides* were captured in the forested slopes near Falmouth, and *C. marmoratus, C. multimaculatus* and *C. waringi* near to the coast. The fauna of north-east Tasmania was similar to that of south-eastern Victoria. *C. dycei,* a mammal feeder with a wide distribution on the mainland of Australia, was found once but *C. austropalpalis,* a wide spread bird-feeding species, was noticeably absent.

Species of importance in the transmission of arboviruses that cause diseases of livestock were absent, as would be expected as they are all more "tropical" insects. *C. brevitarsis,* which is distributed the most extensively, has a classical megathermic distribution and extends farthest south along the eastern coastal plains but only as far as the south coast of New South Wales (Murray and Nix 1988).

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Officers of the Tasmanian Department of Agriculture gave much assistance in these surveys, which were part of an Australian wide survey being undertaken by the CSIRO. In particular I wish to thank P.G. Campbell, G. Carr, G. Hill, C. Moore, T.C. Wardlaw and H. Willis, and in particular Dr T.J. McManus, who set traps extensively around Falmouth. My colleague A.L. Dyce confirmed the identifications.

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SWAMP ANTECHINUS — EXTENSION TO RECORDED DISTRIBUTION, HABITAT PREFERENCE AND BODY SIZE

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Green (1972, 1973) gave the Tasmanian distribution of the Swamp Antechinus *Antechinus minimus* as being confined to the western half of the state and also on Maatsuyker Island, Flinders Island and King Island. He gave its preferred habitat as wet sedgeland and swampy drainage areas, ranging from sub-alpine

to coastal. The maximum weight was given as 57 grams and the greatest length, including tail, as 20 centimetres.

Over the last ten years surveys and acquisitions have added much more data and additional specimens to the research collections of the Queen Victoria Museum, extending our knowledge of distribution, habitat preference and maximum body size of the Swamp Antechinus.

Following a ten day field survey and collecting trip to the Sumac Forest, south of the Arthur River, north-west Tasmania, in March 1978 Green (1979) extended the previously recorded habitat of the Swamp Antechinus to include rainforest, finding it there to the exclusion of its near relative, the Dusky Antechinus *A. swainsonii.*

Table 1 gives accession data for twelve recently accessed specimens, all males, and illustrates a wider distribution, more diverse habitat and greater body size than has previously been published, and that males attain a much greater size than females. The largest female we have recorded weighed 62 grams and had a total length of 203 millimetres.

Table 1

Reg. No.	*Locality*	*Date*	*Weight (gm)*	*Total Length (mm)*
1979/1/32	Bridport, NE Tasmania	2/7/79	100	257
1987/1/29	Bridport, NE Tasmania	19/3/87	70	225
1987/1/81	Bridport, NE Tasmania	24/3/87	73	225
1987/1/82	Bridport, NE Tasmania	24/3/87	73	210
1987/1/72	Swan Bay, East Tamar	5/8/87	117	248
1988/1/28	Dilston	17/3/88	45	176
1988/1/45	Mt. Direction	23/6/88	118	240
1979/1/69	Lunawanna, Bruny Island	16/7/79	124	247
1979/1/70	Lunawanna, Bruny Island	/7/79	111	235
1986/1/52	King Island	10/10/86	103	222
1978/1/340	Mt. Maggs	6/9/78	89	240
1979/1/80	Lighthouse, Bruny Island	/7/79	85	214
1987/1/80	Elizabeth Town	27/7/79	80	230
1984/1/100	Mt. Arthur, Northern Tasmania	23/3/84	83	223

The material cited in Table 1 now further extends our knowledge of the distribution of and the habitats in which the Swamp Antechinus lives. Some of the localities cited in Table 1 encompass areas of rainforest or wet sedgeland, but others such as Bridport, Swan Bay, Dilston, Lunawanna, King Island, Bruny Island and Elizabeth Town are dry, mixed forest or scrub and atypical of the habitat to which the Swamp Antechinus was previously believed to be restricted.

It is interesting to note that there is a marked bias towards large individuals occuring in the drier habitats and that earlier collecting in wet habitats (Green, 1972, 1973) had failed to produce any of a weight greater than 59 grams.

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NOTES ON *EUCALYPTUS PAUCIFLORA* IN TASMANIA

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INTRODUCTION

The biogeography and population ecology of *Eucalyptus pauciflora* Sieb. ex Spreng., or Snow Gum (for those of us on mainland Australia) or Cabbage/Weeping Gum (in Tasmania), is interesting and instructive. Its geographic distribution exhibits the broadest altitudinal range, and one of the largest latitudinal ranges, of any of the 600 odd extant species of eucalypt. Thus the species spans a multitude of environmental gradients.

On continental, south-east Australia *E. pauciflora* is found throughout the mountains and sub-alpine regions of eastern Victoria, New South Wales and the most southerly part of Queensland. It is the dominant tree at high altitudes and, as pure stands, forms the tree-line. At the same time, populations occur down to close to sea level. In southern Victoria and south-east South Australia, for example, many disjunct populations occur below about 700 metres in elevation (Williams & Ladiges, 1985).

In Tasmania *E. pauciflora* is displaced from its typical position as 'Snow Gum' by endemic *Eucalyptus coccifera* Hook f.. Here *E. coccifera* is typically the tree-line species and *E. pauciflora* is restricted in distribution to the eastern and central regions of the State within the altitudinal range of about 0-730 metres although some extension occurs up to about 1,275 metres (Hall, Johnston & Chippendale 1970).

On a relatively coarse spatial scale, *E. pauciflora* in Tasmania is typically found on more fertile soils as a component of grassy woodland or forest (Kirkpatrick & Backhouse,undated). However in the north-east, for example around Ringarooma Bay, it does occur on sand in situations apparently comparable to those occupied by lowland populations at Wilsons Promontory and Powlett River in coastal, southern Victoria. More widely in mainland Australia *E. pauciflora* is commonly found on shallow rocky soils and well-drained alluvia of relatively moderate quality (Boland *et al.*, 1984).

RESEARCH ON MAINLAND POPULATIONS

Most of the earlier work *E. pauciflora* has concerned those populations on mainland Australia, particularly in relation to their distribution, morphological variation with altitude (Pryor,1957) and their ecophysiology (as e.g.,Slatyer, 1978, Slatyer and Ferrar, 1977, and Slatyer and Morrow, 1977). More recently, the patterns of morphological variation in isolated lowland populations were investigated by Williams and Ladiges (1985). They sampled 20 populations of *E. pauciflora* ranging from that in Caroline State Forest in South Australia, the most westerly occurrence, to those at Wilsons Promontory and Eildon in Victoria. Highland populations (e.g. Mt Cole & Mt Buffalo, Victoria) were also examined to provide a basis for comparison. Williams and Ladiges (1985) found that the morphology of adults varied relatively little between lowland populations and suggested that this may be due to the general uniformity of the habitat these populations occupied. In other words, these populations were probably less subject to intense selection pressures compared to the highland populations. Of interest, also, was the fact that seedlings showed two distinct morphological forms, a 'lowland' and 'highland' (samples from 1000m or above) form, within the range of *E. pauciflora* sampled. The seed sample from Tasmania, although from a forest site of only 470 metres in elevation, produced seedlings which were classified as highland. Presumably this result was related to climatic differences arising from the much more southerly location of this site. In conjunction with cladistical data derived from a separate study, Williams and Ladiges (1985) proposed that the lowland form of the seedlings perhaps represents the ancestral condition. Their conclusion added a new dimension to the earlier suggestion of Slatyer and Morrow (1977) of a single gene pool for *E. pauciflora* and the contention of Dodson (1975) and, more recently, Hope and Kirkpatrick (in press) that this species had a widespread lowland population during the most recent glaciation. In summarising, Williams and Ladiges (1985) speculated that during the relatively warmer climatic conditions of the Holocene, several of the lowland populations of *E. pauciflora* extended their geographic range upslope. In turn it was suggested that the extant, lowland population-isolates of *E. pauciflora* may represent the remainder of a more widespread distribution which has been significantly reduced by competitively-superior species of eucalypts adapted to the current, warmer interglacial phase.

Recent experiments conducted as part of a doctoral study have, albeit somewhat indirectly, shed more light on some of the areas discussed above. This work has concentrated on identifying the ecological factors effecting the lower distributional boundary of the higher altitude populations of *E. pauciflora*. For example, at study sites in the sub-alpine forests of the Brindabella Range in the Australian Capital Territory, *E. pauciflora* is typically replaced downslope, at around 1240m above sea level, by the Broad-leaved Peppermint, *E. dives* Schau. Further, the transition zone or ecotone between these forests is relatively narrow, commonly less than about 30 metres in elevation. Using seedling

transplants, I have shown that *E. pauciflora* can grow successfully below its current limit given that it has the opportunity to become established. Several additional experiments have indicated some of the major interactions operating within the ecotone. Put simply, it appears that the peppermint cannot extend its range further upslope to any significant degree because it is intolerant of a variety of environmental extremes, but probably in particular climatic extremes, it would then encounter. Individuals in the ecotone appear less healthy and more susceptible to disease. In contrast, *E. pauciflora* is unable to extend its range downslope because, *inter alia*, its intrinsic rate-of-growth is somewhat less than that of the peppermint. In other words, *E. pauciflora* is excluded from growing in areas downslope, where the peppermint can grow.

Eucalyptus pauciflora IN TASMANIA

In a general sense it seems that the highland populations of *E. pauciflora* on continental Australia, at least, have 'traded-off' the ability to cope with environmental extremes and shorter periods of summer growth often experienced at higher altitudes with, again generally, a relatively high intrinsic rate-of-growth. For example, proportionally much more carbon may be allocated to protecting tissues from damage from extremes than to height increment *per se*. In this sense, *E. pauciflora* is a highly specialised species being able to occupy a high altitude 'niche' (outside of Tasmania) in the absence of all other eucalypts. At the same time it probably has the ability to occupy a far greater range of habitats than it does currently in the absence of faster-growing eucalypts. Hence the interesting question then becomes 'why is the pattern of distribution of *E. pauciflora* in Tasmania different from that observed on continental Australia?'

It is clear that without further work any explanation to the above question is speculative. However, several testable hypotheses could be formulated which might increase our understanding not only of this phenomenon but also of some of the processes influencing the biogeography of associated taxa in southern Australia during the early Holocene. One idea is that the high altitude 'niche' in Tasmania may have already been occupied before *E. paucliflora* was able to exploit it. Alternatively, the niche that *E. pauciflora* occupies in Tasmania may be comparable to that in highland areas elsewhere, the apparent anomaly in its observed distribution being related simply to a different spatial arrangements of, say, certain climatic and/or edaphic factors. Moreover, matters are undoubtedly complicated by the genetic architecture of the species, particularly the degree of genetic variation between major highland, population isolates. These areas are (or are proposed to be) currently being investigated.

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BOOK REVIEW

The Wombat : Common Wombats in Australia

By Barbara Triggs, illustrated by Ross Goldingay.

Published by NSW University Press
R.R.P. $14.95 paperback only
Reviewed by D.G. Hird

In south-eastern Australia wombats are well known to many people who regularly traverse bushland areas. Unfortunately this may often be due to road casualties, although fleeting glimpses at night or around campsites are also not

uncommon. To the initiated their prominently placed cuboid scats are tell-tale calling cards. In Tasmania most broad habitat types from coastal scrub and woodland through lowland forests of most types to button grass plains and highland areas all provide habitat for this adaptable marsupial, the largest extant burrowing mammal. The life of the wombat has nonetheless remained somewhat cryptic to naturalists and scientists alike, as evidenced by this book being the first to be dedicated to its topic.

The Platypus and *The Koala*, previous volumes on mammals in this NSW University Press *Australian Natural History* series, could, given their high almost glamorous profiles, be regarded as hard acts to follow, but the clear layout and attractive illustrations make an initial impression of quality of design and production. Topics from phylogeny and relationships of modern wombats through general biology including behaviour are covered in a clear narrative style, with a reference list to each. A useful supplement provides clear advice on the hand-rearing of orphan wombats. Much of the original information included derives from the author's patient and sustained field observation of a free-living population of wombats in eastern Victoria, Wombats are notoriously difficult to study and, although somewhat anecdotal, fascinating insights into, for example, some behavioural patterns such as sleeping and feeding are provided. An example of the latter is the characteristic way in which wombats feed on their 'delicacy' of leaf bases of cutting-grass *(Gahnia spp).*

Unfortunately this volume is not without production errors. On page one the extinct Marsupial Lion genus *Thylacoleo* is misspelt. Plates are unnumbered and some indexed references are misplaced. On page 127 the citation of some references are confused. These detract in a minor way from a generally attractive book.

For anyone who has harboured curiosity about wombats, this volume will answer some questions while probably raising many more. Local issues would include which elements of button-grass communities do wombats use, and, given that these frequently occur on water-logged soils, is proximity to suitable burrow sites at least sometimes a limiting factor in this situation? While it is no fault of the author that many questions about wombats remain unanswered, some of the elements of basic wombat biology could have been further elaborated, even if as challenges to be answered. One example would be on population dynamics — it would be of considerable interest to determine age-specific mortality patterns; perhaps some of Tasmania's 'diurnal' wombat populations (as at Asbestos Range National Park) could help resolve this issue.

Many passages in *The Wombat* bear testimony to the author's dedication and stamina in her study. These deserve wide appreciation; this book is thoroughly recommended.