strategy to assist with recovery and monitoring of *C. nanus* in this area (e.g. Bladon *et al*. 2002).

The confirmation of the ongoing presence of *C. nanus* in these Box-Ironbark forests of central Victoria is noteworthy, and needs to be considered in developing wildlife management strategies for the region.

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The rare collembolan genus, *Temeritas* (Symphypleona: Sminthuridae), in southern Australia: systematics, distribution and conservation status

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Abstract
A brief summary of the genus *Temeritas* is given with distributions of the four described Australian species and records of other species in the genus. A spelling correction is documented for the Western Australian species and a new name for the Victorian species is formally proposed here as the original name is preoccupied. Characters that distinguish *Temeritas* from allied genera are noted and the conservation status of the three southern species and Collembola in general are discussed. (*The Victorian Naturalist* **130** (1) 2013, 45–48)

Keywords: *Temeritas denisi, Temeritas regalis, Temeritas elegans*

Introduction

The Collembola, common name Springtail, are a group of arthropods, little known because of their small size and cryptic habits. However, the class is abundant, widespread and species-rich with a high proportion of species endemic to Australia. Genera in several families include a high proportion of endemic species (short-range endemics), an example being the genus *Temeritas* Delamare Deboutteville and Massoud 1963.

Species of *Temeritas* are easily recognised as they are globular, up to 2 mm long, usually brightly coloured with purple stripes and spots and slender antennae that are longer than the head and body combined (Figs 1, 2, 3).

The genus has a predominantly pantropical distribution although, exceptionally, some species in Australia and New Zealand are restricted to temperate climates. At present 47 species are known in the genus, of which three have been described from Australia (Bellinger *et al.* 2012). The Australian species were described originally in the genus *Sminthurus* Latreille as *S. denisi* Womersley, 1934 from south-west Western Australia, *S. regalis* Womersley, 1939 from southern South Australia and *S. elegans* Womersley, 1939 from southern Victoria. These species are clearly allopatric. *Sminthurus denisi* was incorrectly named as *S. denisii* by Womersley (1934) but, in his subsequent publications

Fig. 1. Pen and ink drawing of *Temeritas regalis* (Womersley) by JM Betsch

(1936, 1939), he correctly changed the specific name to *S. denisi*. Womersley also recorded this species from New Zealand (Womersley 1936) but the record is unlikely and remains unconfirmed. Najt (1968) transferred two of the Australian species, *S. regalis* and *S. elegans,* to the genus *Temeritas,* but transposed their localities in her publication. Later, *S. denisi* was also transferred to *Temeritas* by Greenslade (1994).

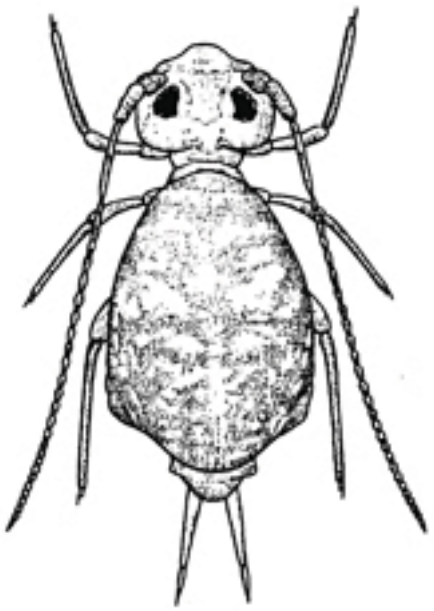

Fig 2. Line drawing of *Temeritas denisi* (Womersley) from Womersley (1939)

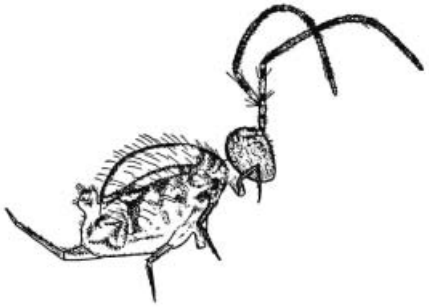

Fig. 3. Line drawing of *Temeritas isabellae* Greenslade from Womersley (1939)

Distribution

A number of undescribed species have been collected from the northern regions of Western Australia, Northern Territory and Queensland including the Torres Strait Islands. The species from Murray Island, Torres Strait, has been identified as *Temeritas womersleyi* (Denis, 1948) originally described from Vietnam (P. Greenslade new record). Localities from where undescribed species have been collected in the last 20 years are Sweers Island, Kuranda, Woodstock, Lamington National Park in Queensland, McArthur River and Jabiru in the Northern Territory, New England National Park, Lord Howe Island and Norfolk Island in New South Wales, and Brookton and Barrow Island in Western Australia. The genus has not been collected from Tasmania.

Systematics

Among the other genera of globular Collembola in Australia, *Temeritas* is distinct because of the relatively large size of species (nearly 2 mm long), their strongly annulated antennae that are longer than the body, and attractive colour patterns and bands (Fig. 1). Species of *Temeritas* can be distinguished from *Sminthurus*, in which genus Womersley (1934) first described the southern Australian species, by the lack of an internal spine on trochanter III and the shorter antennae. There is only one species of *Sminthurus* in Australia, the pest species *S. viridis* (L.). There are three other genera in Australia with which *Temeritas* might be confused but are distinct because of their long, strongly anulated antennae, often relatively large size and attractive colour patterns, particularly in the banded antennae (Fig. 4). The first of these is *Parropalites* Bonet and Tellez, new record, which is known only from rainforests in northern Queensland; but this genus is poorly characterised at present and it has much shorter antennae. The second genus with which *Temeritas* could be confused is *Pararrhopalites* Bonet and Tellez, new record. The third is *Sphyrotheca* Börner, another superficially similar genus but it has a neosminthuroid seta ventrolaterally on abdominal segment IV and also antennae that are shorter than the body.

Nomenclature

As the original name of the Victorian *Sminthurus elegans* is preoccupied by *Sminthurus elegans* Fitch, 1863 from North America (now *Sminthurinus elegans*), even though the Australian species has been transferred to a different genus, a new name is required and it is renamed here as *Temeritas isabellae*.

Table 1. Total number of described species, endemic species and percentage of endemic species in each family of Collembola known from Australia

Higher taxon	Total described species	Number of endemic species	% endemic species
Arrhopalitidae	2	0	0
Bourletiellidae	24	16	66
Brachystomellidae	21	18	85
Cyphoderidae	4	2	50
Dicyrtomidae	4	3	75
Entomobryidae	76	33	50
Hypogastruridae	28	7	25
Isotomidae	53	23	44
Katiannidae	32	24	75
Neanuridae	46	36	78
Neelidae	3	0	0
Odontellidae	4	3	75
Oncopoduridae	1	1	100
Onychiuridae	5	0	0
Paronellidae	14	10	71
Sminthuridae	6	3	50
Sminthurididae	6	2	33
Spinothecidae	1	1	100
Tomoceridae	7	3	43
Tullbergiidae	17	8	47
Mean			53

Conservation status

In spite of the high proportion of nationally endemic and locally endemic species, the conservation of only a few Collembola has been given attention. *Tasphorura vesiculata* Greenslade and Rusek (Tullbergiidae), occurs only in moss in a small patch of rainforest in north-east Tasmania, which has been given a low level of protection in that any future logging must consider protecting this species. Another is a species of *Australotomurus* (Entomobryidae: Orcheselinae) found in only four vegetation remnants in urban Perth. It was listed with the *Western Australian Wildlife Conservation* Act 1950 but delisted a few years later even though one of the remnants was partially alienated (P. Greenslade submitted). Some other genera of Collembola known to contain short range endemics are *Nasosminthurus* Stach (Bourletiellidae), *Epimetrura* Schött (Entomobryidae) and *Folsomotoma* Bagnall (Isotomidae). The percentages of endemic compared with total species in each family known from Australia are given in Table 1. Total mean endemism is 53% and several of the larger families contain more than 70% endemic species (Brachystomellidae, Katiannidae, Neanuridae, Paronellidae) (Table 1). Many of these endemic species would be short range endemics.

All southern Australian species of *Temeritas* are uncommon and patchy in distribution. Because their habitats include leaf litter, native grasses, moss and under logs in humid forests, they are likely to be susceptible to climate warming. Indeed, some populations may already have become locally extinct as a result of drought and competition from invasive exotic species as well as longer term climate

Fig. 4. Photograph of *Temeritas isabellae* from the Dandenong Ranges, Victoria.

change. For instance, *T. regalis* was collected relatively frequently in the southern Mt Lofty Ranges in the 1970s but has not been found in the last 20 years in localities where it was previously present. *Temeritas isabellae* was described originally from Kalorama, Mt Dandenong and there are also old records from Erskine River, Toolangi State Forest, Bellel Creek, Coranderrk Reserve, Silverband Falls in the Grampians, all in Victoria. As with *T. regalis*, the Victorian species has not been collected in the last 30 years. A search in suitable localities and habitats should be undertaken as a priority, to establish its current conservation status.

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Leech predation of frog spawn

Introduction

The predators of Australian anurans and their larvae are well documented (Tyler 1976, 1994, Littlejohn and Wainer 1978; Davies *et al*. 1979; Morgan and Buttemer 1996, Gillespie and Hero 1999). By contrast, little has been published on the sources of predation of their spawn. Tyler (1976, 1994) states that there are relatively few predators of frog spawn and that 'fish probably constitute the major predator'. He notes in particular that the foam nests of the genus *Limnodynastes* are probably most accessible to terrestrial insects because they tend to be located around the edges of ponds where they are attached to peripheral vegetation, and that they are occasionally eaten by ants. Members of the Australian frog genus *Limnodynastes* produce floating foam-capped nests below which the egg mass resides (Parker 1940; Tyler and Davies 1979; Roberts 1989). One member of this genus, the Spotted Marsh Frog *Limnodynastes tasmaniensis*, is a very common species throughout much of south-eastern Australia where it breeds in most months of the year in both temporary and permanent water bodies and in a wide variety of both natural and man-made habitats (Barker *et al*. 1995; Hero *et al*. 1991; Littlejohn 2003). Herein I report the predation of *L. tasmaniensis* spawn by leeches in an ephemeral wetland near Melbourne some 25 years ago and compare these observations with a very similar report of predation documented by Burgin and Schell (2005) in the Sydney area.

Observations

1. On 6 January 1987, following two days of heavy rain, a shallow ephemeral wetland located in remnant River Red Gum *Eucalyptus camaldulensis* woodland adjacent to the Darebin Creek in the north of Bundoora (37°69'S, 145°05'E) Victoria, was visited. The swamp had been completely dry since about mid-December of the previous year but rain had refilled it and had stimulated a burst of breeding activity in *L. tasmaniensis*. There were large persistent daytime choruses (> 50 males) and numerous freshly deposited foam nests around clumps of aquatic vegetation. Most nests were aggregated amongst a 9 m^2 patch of Spikerush *Eleocharis sphaecelata* where they were exposed to dappled sunlight or else were completely shaded. A total of 27 nests were located in this patch. The site was visited over four consecutive days and nests inspected for the presence of leeches and other invertebrates on each occasion. Water temperature approximately 10 cm below the surface varied between 21–24°C at midday over the four days.

Leeches were observed on the foam caps of *L. tasmaniensis* nests on each day. All of the leeches appeared to belong to the same species and were uniform black in colour and approx. 50–60 mm in length. (Leeches were not able to be identified to genus (or species) level owing to the lack of an appropriate identification guide at the time.) The leeches were observed typically lying completely still on the foam cap of the nests with the head and anterior body buried down through the foam cap into the gelatinous egg mass below. While most of the affected nests contained a single leech, on three nests there were two, and on one nest, three leeches. On three nests the surface of the foam caps had dried to a polystyrene-like consistency and leeches had attached themselves to the side of the nest where they were just visible above the water line. Nests around the periphery of the aggregation were most affected by leeches while only one leech was recorded on a nest near the 'centre'. On the first day, three of the leeches (taken from nests outside of the aggregation) were euthanised and found to contain numerous (> 10), mostly intact frog's eggs.

The incidence of leeches on foam nests remained fairly constant over the four days, affecting about one-third of all nests (30–37%;