

THE AUSTRALIAN MAYFLY FAUNA: COMPOSITION, DISTRIBUTION AND CONVERGANCE

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ABSTRACT

The mayfly fauna of Australia includes 100 described species from 9 families. The fauna is dominated by Leptophlebiidae and Baetidae with Heptageniidae, Tricorythidae and Ephemeridae notably absent. The Australian mayflies can be classified into three groups based on probable biogeographic origin: those which are cosmopolitan (such as *Baetis*) those with northern origins (such as *Prosopistoma*) and those with Gondwanaland affinities (such as *Coloburiscoides*, *Mirawara* and *Tasmanophlebia*). To a certain extent the present distributions reflect these origins. A feature of the Australian fauna is the degree of morphological convergence between the Australian leptophlebiidae and Northern Hemisphere heptageniids and ephemeroptera.

INTRODUCTION

The first mayfly to be described from Australia was *Atalophlebia albiterminata*, first described by Burmeister in 1839 as *Baetis costalis*. There are now more than 100 described species (Campbell 1988), and, although there is still a substantial amount of taxonomic work required before the fauna will be well known, some general trends can be discerned.

COMPOSITION OF THE AUSTRALIAN FAUNA

The Australian mayfly fauna is dominated by Leptophlebiidae and Baetidae (Table 1). This dominance is likely to become even more pronounced as taxonomic studies proceed because both the leptophlebiids and baetids are widespread, abundant, apparently diverse and poorly studied in Australia compared with the other families of mayflies present.

Table 1. Composition of the Australian Mayfly (Ephemeroptera) Fauna

Family	Number of Genera	% Genera	Number of Species	% Species
Caenidae	1	3.7	5	6.0
Baetidae	5	18.5	13	15.7
Ephemerellidae	1	3.7	1	1.2
Prosopistomatidae	1	3.7	1	1.2
Siphonuridae	1	3.7	1	1.2
Ameletopsidae	1	3.7	3	3.6
Oniscigastridae	1	3.7	3	3.6
Coloburiscidae	1	3.7	3	3.6
Leptophlebiidae	15	55.6	53	63.9
Total	27	100	83	100

Table 2. Composition of the ten largest families of mayflies world wide and in North America. Based on Hubbard and Peters (1976) and Merritt and Cummins (1984)

Family	North America		World	
	Number of Genera	Number of Species	Number of Genera	Number of Species
Baetidae	10	130	17	519
Heptageniidae	15	105	28	378
Leptophlebiidae	8	70	66	379
Siphonuridae	7	56	26	163
Ephemerellidae	8	85	7	163
Tricorythidae	2	21	13	122
Ephemeridae	3	13	8	99
Caenidae	2	18	6	81
Polymitarcyidae	3	6	6	70
Oligoneuriidae	3	32	9	49

In comparison with the mayfly fauna of other regions (Table 2) there are several notable features of the Australian fauna. Whilst the leptophlebiids and baetids comprise a large proportion of the fauna elsewhere, they do not constitute such a dominant component of the world or North American faunas. The Ephemerellidae, which comprise a large part of the fauna of North America and elsewhere, are known from Australia only from a single species, apparently of limited distribution (see below), and the large Northern Hemisphere families Heptageniidae, Ephemeridae and Tricorythidae are absent.

DISTRIBUTION OF AUSTRALIAN MAYFLIES

Virtually the entire Australian mayfly fauna is endemic at the specific level, with only *Cloeon virens* Klapalek, *C. fluviatile* Ulmer and *Pseudocloeon kraepelini* Klapalek being recorded from elsewhere. Most of the genera are also endemic, including all but one of the Leptophlebiidae, and this appears to be a characteristic of the "Gondwanaland" component of the fauna.

The greater part of the fauna seems to have southern origins. This is true for the Coloburiscidae, Ameletopsidae and Oniscigastridae – families which are restricted to Australia, New Zealand

and South America (Campbell 1981), and most of the Australian Leptophlebiidae which seem most closely related to South American genera (Peters and Campbell, in press). This component of the fauna is most abundant in the southeastern corner of Australia with families such as the Oniscigastridae and the Coloburiscidae restricted to this area. However some families in this group are far more widespread. The ameletopsid genus *Mirawara*, for example, occurs up the entire east coast of Australia extending well into the tropics, but, curiously, is absent from Tasmania (Campbell 1981). The leptophlebiids are also widespread, occurring in tropical and arid areas as well as the wetter temperate parts of the continent.

The second component of the fauna is a cosmopolitan component, including the Baetidae and Caenidae, two families which occur on all continents. In Australia the caenids are represented by a single endemic genus – *Tasmanocoenis*, although there may also be other undescribed genera (P. Suter, pers. comm.), while the baetids include several cosmopolitan genera, including *Baetis* and *Centroptilum*. Both baetids and caenids are widespread throughout Australia. Notably the only non-endemic species of Australian mayflies, (viz. *Cloeon virens*, *C. fluviatile* and *Pseudocloeon kraepelini*) belong to the cosmopolitan group but their distribution also includes the Indonesian ar-

chipelago, indicating that this group probably entered Australia from the north, and that the division between this group and the tropical component may be artificial.

The final component of the Australian mayfly fauna is the tropical component, species with a recent northern origin. To a large extent these species are restricted to tropical Australia and, although this component appears to be small at the moment, the tropical fauna is as yet poorly known. The most obvious member of this group is *Prosopistoma* (Prosopistomatidae), first recorded from north Queensland by Pearson and Penridge (1979). The species is widespread in northeast Queensland, and according to Peters (pers. comm) is not *P. sedlaceki*, as Pearson and Penridge thought, but an undescribed Australian

species. The leptophlebiid genus *Thraulus* is also widespread in northern Australia and belongs in this group.

The sole Australian ephemereid *Ephemerellina* (*Austremerella*) *picta* is somewhat enigmatic. It has been recorded only by Riek (1963) from southeastern Queensland and does not appear to be widespread. The subfamily to which it belongs is primarily Ethiopian and Oriental in distribution, suggesting that it may be a recent northern immigrant. However, if that were the case it could be expected to be collected in the northeastern streams, but so far it has not been collected in this region.

MORPHOLOGICAL CONVERGANCE

Hynes (1970) noted that aquatic insects from stony streams in Europe, North America and Africa

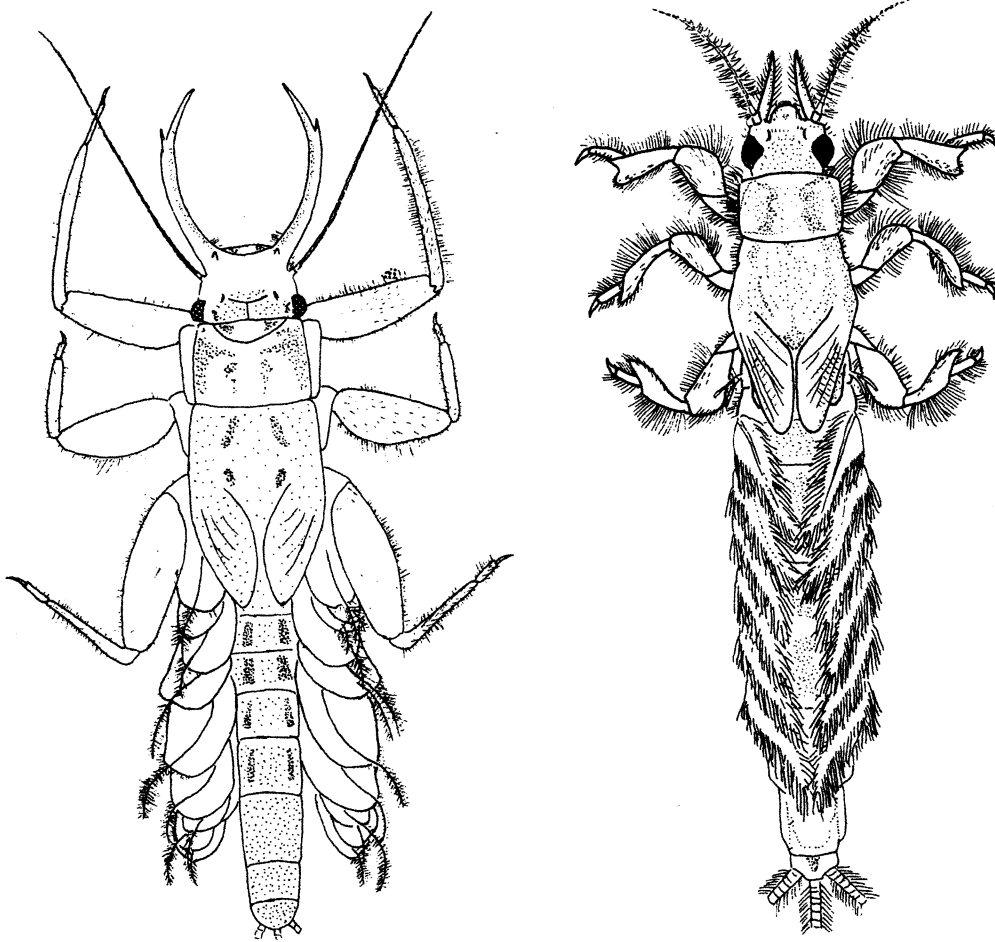


Fig. 1. The nymphs of *Jappa edmunds* (left) and *Hexagenia limbata* (right) (*Hexagenia* redrawn after Edmunds *et al.* 1976).

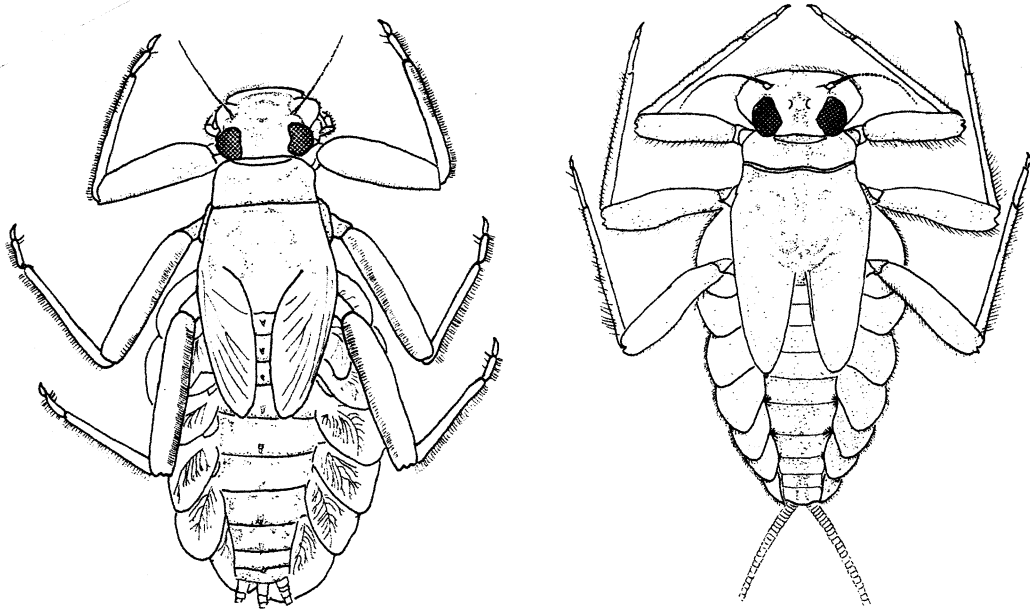


Fig. 2. The nymphs of *Kirrara procera* (left) and *Epeorus longimanus* (right) (*Epeorus* redrawn from Edmunds *et al.* 1976).

had undergone remarkable morphological convergences. The same has been true of the Australian leptophlebiid mayflies. The two most striking examples are the genus *Jappa* which bears remarkable similarities with the North American genus *Hexagenia* (Heptageniidae) and the European genus *Ephemera* (Ephemeridae) (Fig. 1), and

Kirrara which is similar to some species of *Rhithrogena* and *Epeorus* from North America and Europe (Fig. 2). In each case the Australian genus occurs in a similar habitat to its Northern Hemisphere convergant. Nymphs of *Jappa* burrow under rocks, using the "horns" which project from their heads to burrow. Their Northern Hemi-

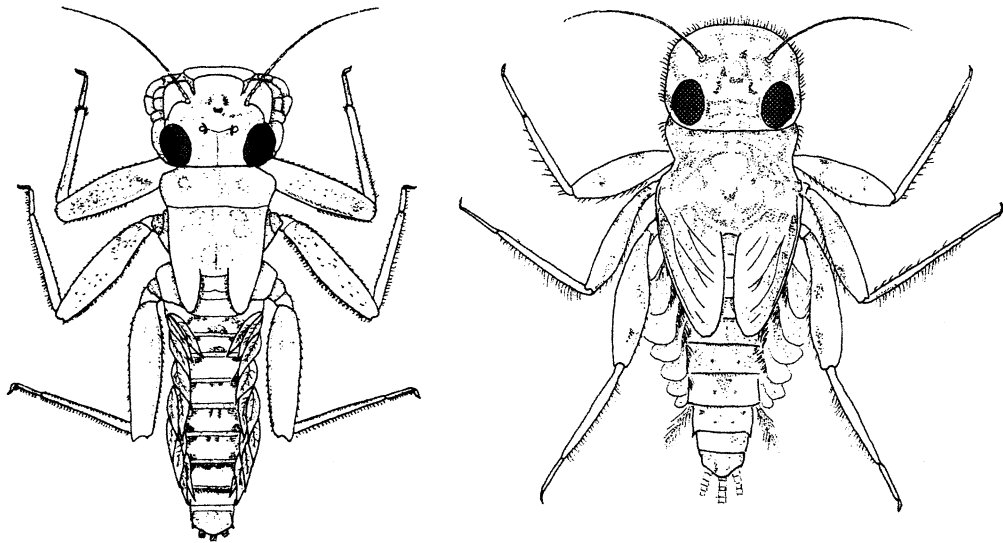


Fig. 3. The nymphs of *Austrophlebioides pusillus* (left) and *Stenonema exiguum* (right) (*Stenonema* redrawn from Edmunds *et al.* 1976).

sphere convergants have enlarged projecting mandibles which they use for digging while the "horns" of *Jappa* are not modified mouthparts but completely new structures. Nymphs of *Kirrara* live on the tops of rocks in rapid current as do the nymphs of *Rhithrogena* and *Epeorus* and members of all three genera have strikingly enlarged gills forming an adhesion disk. In the case of *Rhithrogena* and *Epeorus* the nymphs also have a gill tuft which is missing in *Kirrara*, which in turn have double gill lamellae missing in *Rhithrogena*. The nymphs of *Austrophlebioides* could also be said to converge with Northern Hemisphere heptageniids (Fig. 3) in that they are flattened nymphs with broad heads living on the tops of rocks in moderate current, but the parallel is not so striking.

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