



## A new species of sucking louse (Phthiraptera: Anoplura) from Australia, and a key to the Australian species of *Hoplopleura*

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### Abstract

A new species of sucking louse, *Hoplopleura zyzomydis*, is described and illustrated from the common Australian rock rat *Zyzyomys argurus* (Thomas, 1889) (Rodentia: Muridae), collected in northwest Queensland, Australia. This is the first record of a sucking louse from the genus *Zyzyomys*, and its morphology is contrasted with other Australian *Hoplopleura* species. *Hoplopleura zyzomydis* is unique in having a combination of short dorsal principal thoracic setae and setae absent from paratergal plates 4–6. A key to the Australian species of *Hoplopleura* is presented.

**Key words:** Anoplura, Australia, *Hoplopleura*, Muridae, Phthiraptera, *Zyzyomys*

### Introduction

The genus *Hoplopleura* Enderlein, 1904 (Phthiraptera: Anoplura) is a cosmopolitan group of anopluran lice comprising over 136 species worldwide, and its members parasitise rodents almost exclusively (Durden & Musser, 1994). There are seven endemic (Neumann, 1909; Johnson, 1960; Kuhn & Ludwig, 1967; Kim, 1972) and one introduced species (Ewing, 1924) of *Hoplopleura* currently known from Australia.

The rodent subfamily Hydromyinae is thought to have been present in Australia for the longest period of time with colonisation by ancestral hydromyine rodents occurring during the late Miocene (Godthelp, 2001). The Hydromyinae comprises three tribes, the Conilurini, the Uromyini and the Hydromyini. The Conilurini is the largest tribe and the most diverse, and includes the genus *Zyzyomys* Thomas, 1909. *Zyzyomys argurus* (Thomas, 1889) is the smallest member of the genus, and has the largest distribution. It is a rock-dwelling generalist, and occurs in outcrops of sedimentary or igneous rocks throughout tropical Australia (Fleming, 1995; Trainor, *et al.*, 2000).

While examining material for a parasitological study of *Z. argurus*, a new species of *Hoplopleura* was discovered and is described herein.

### Material and methods

*Zyzyomys argurus* were live trapped at May Downs Station, Mount Isa (20°39'S, 139°23'E) in May 2005, Moondarra Dam, Mount Isa (20°32'S, 139°28'E) in July – August 2004 and May 2005, and Mount Morgan Gold Mine, Mount Morgan (23° 38'S, 150° 21'E) in February and June 2004, and April 2005 in Queensland, Australia. Host animals were euthanased by an intraperitoneal injection of pentobarbitone sodium.

The skins of 20 *Z. argurus* were each digested in a 5% aqueous solution of potassium hydroxide to

recover all ectoparasites present in the pelage. Specimens of lice collected from the digests were first neutralised in 10% aqueous acetic acid, then stored in 70% ethanol. All lice collected live from hosts were fixed and stored in 70% ethanol. Lice collected live were cleared in 5% aqueous potassium hydroxide prior to staining and mounting. Lice were stained with carbol fuchsin, put through a dehydration series of ethanol and mounted in Canada balsam (Palma, 1978). The mounted lice were examined under an Olympus BX microscope and measurements were made using a calibrated eyepiece graticule. Measurements are given in millimetres (mm) as the mean, with the range given in parentheses. All drawings were made using a drawing tube. The material was deposited in the Australian National Insect Collection (ANIC), Canberra.

The descriptive format followed in this paper is that of Kim, *et al.*, (1986). Names and abbreviations for setae also follow Kim, *et al.*, (1986) and are spelled out in full on first mention.

## Results

### Taxonomy

#### Family Hoplopleuridae Ewing, 1929

#### Genus *Hoplopleura* Enderlein, 1904

#### *Hoplopleura zyzomydis* n. sp.

(Figs. 1–9)

**Material examined.** Holotype: male, ex *Zyzomys argurus*, May Downs Station, Mount Isa, Queensland, Australia (20°39'S, 139°23'E), coll. H. J. Weaver, 14.v.2005, ANIC 19-000001.

Allotype: female, same data, ANIC 19-000002.

Paratypes: 1 male, 9 females, same data, ANIC 19-000003, 19-000004, 19-000005.

Other material examined: 2 females, 15.v.2005, ANIC 19-000015, ex *Z. argurus*, coll H. J. Weaver, May Downs Station, Mount Isa, Queensland. 4 males, 8 females, 27.vii.2004, ANIC 19-000008, 19-000009, 19-000010, 19-000011; 1 male, 29.vii.2004, ANIC 19-000012; 1 male, 5 females, 30.vii.2004, ANIC 19-000013, 19-000014; 2 females, 24.v.2005, ANIC 19-000016; 1 male, 10 females, 4 immature, 27.v.2005, ANIC 19-000017, 19-000018, 19-000019, 19-000020; ex *Z. argurus*, coll. H. J. Weaver, Moondarra Dam, Mount Isa, Queensland (20°32'S, 139°28'E). 2 females, 8.iv.2005, ANIC 19-000006, 19-000007 ex *Z. argurus*, coll H. J. Weaver, Mt Morgan, central Queensland (23° 38'S, 150° 21'E).

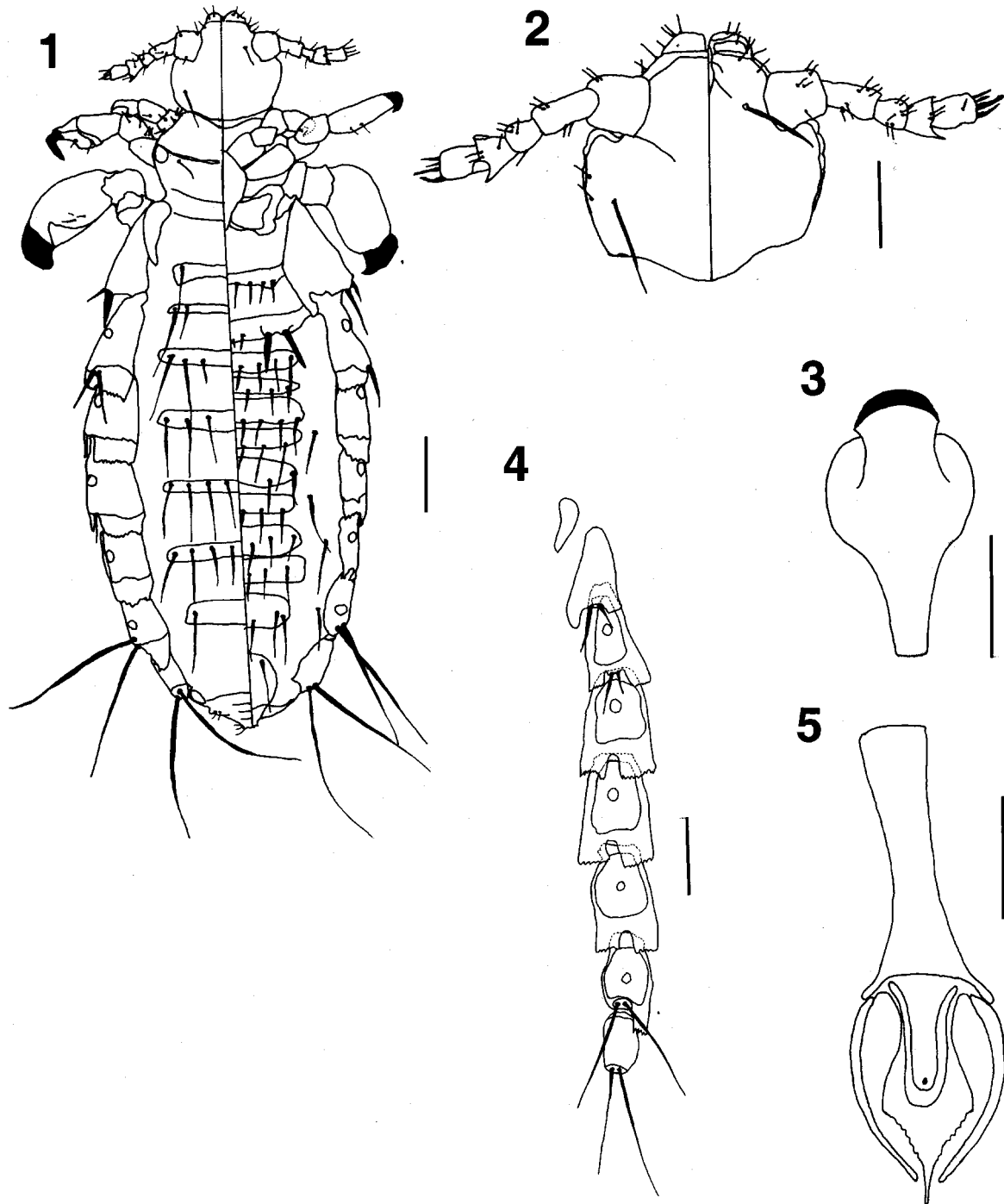
**Description.** **Male** (Fig 1): Total body length,  $\bar{x}$  = 1.014 (0.950 – 1.130, n = 5). Head, thorax and abdomen moderately sclerotised.

Head as wide as long (Fig 2), 3 or 4 apical head setae (ApHS), 3 or 4 anterior marginal head setae (AnMHS), 2 dorsal marginal head setae (DMHS), 1 long dorsal principal head seta (DPHS) on each side, 2 ventral pre-antennal head setae (VPaHS), 1 long ventral principal head seta (VPHS) on each side. Antenna 5 segmented with basal segment larger than other segments and as wide as long, fourth antennal segment with small posterior spur.

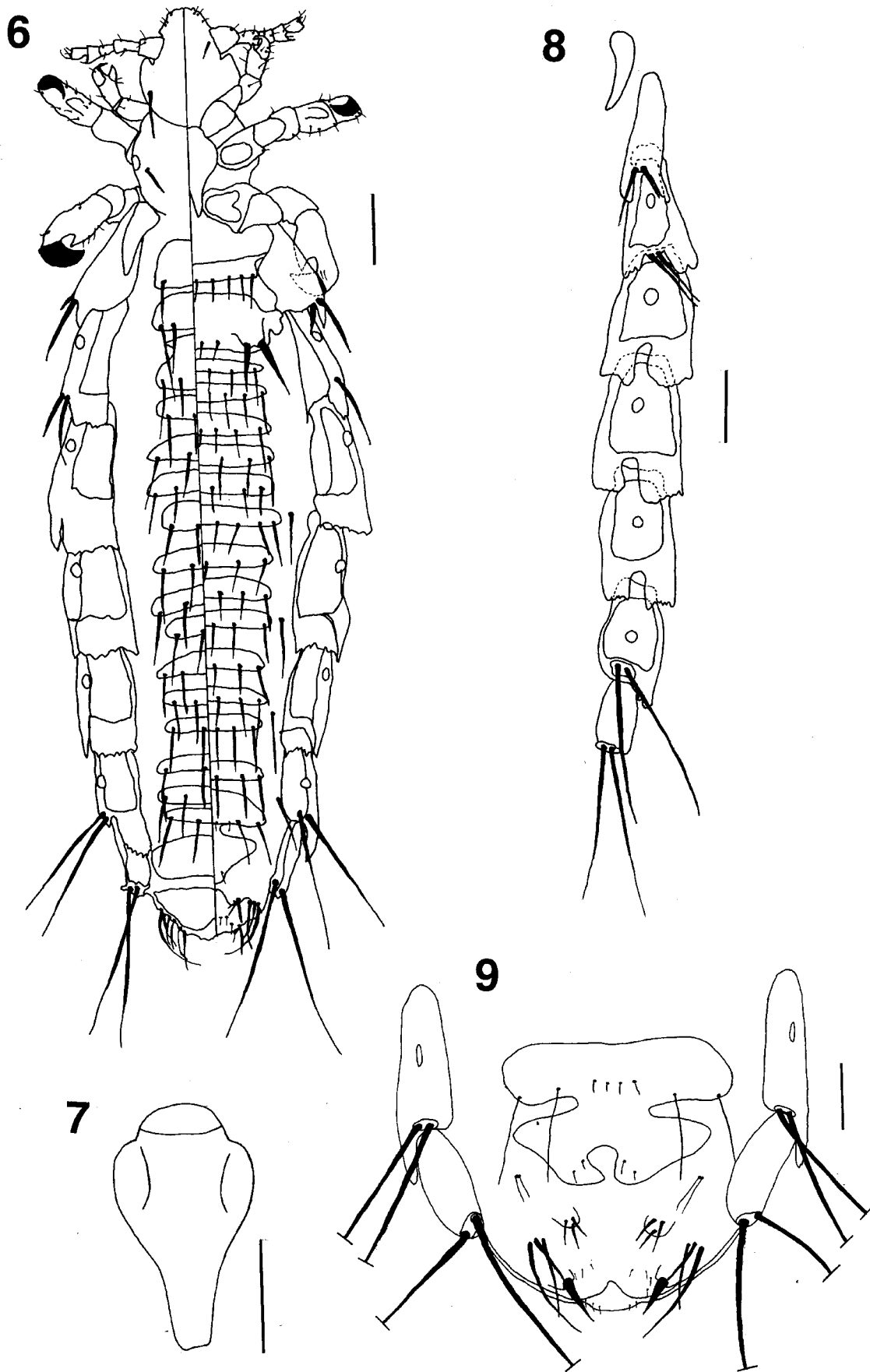
Thorax wider than long. Thoracic sternal plate (Fig 3) club-shaped with rounded lateral margins and elongated posterior process. Anterior process present and sclerotised, marked off laterally by a notch from the main plate. Mesothoracic spiracle diameter  $\bar{x}$  = 0.0165 (0.0125 – 0.0175, n = 5). Dorsal principal thoracic seta (DPTS) length  $\bar{x}$  = 0.0340 (0.0275 – 0.0375, n = 5), no other setae present on thorax except on legs.

Abdomen wider than thorax. Ventrally, no sternite on segment 1, two elongate sternites (nos. 1 and 2) on segment 2 each articulating with corresponding 2<sup>nd</sup> paratergal plate, two sternites on each of segments 3–6 (nos. 3–10), one sternite on segment 7 (no. 11), sternites absent on segment 8. Sternite 1 with eight sternal

abdominal setae (StAS), sternite 2 with seven StAS with two lateral StAS on each side markedly thickened, sternites 3–5 with seven or eight StAS, sternites 6–11 with five to seven StAS. One ventral lateral abdominal seta (VLAS) lateral to sternite 6 and sternites 8–11. Dorsally, one narrow tergite on segment 2, one narrow and one comparatively broader tergite on segment 3. One tergite on each of segments 4–7. Tergites 1 and 7 each with one tergal abdominal seta (TeAS) each side positioned laterally, tergite 2 with two TeAS each side, tergites 3–6 each with five to seven TeAS.



**FIGURES 1–5.** Male of *Hoplopleura zyzomydis* n. sp.: 1. Whole body, dorsal/ventral view, 2. Head, dorsal/ventral view, 3. Thoracic sternal plate, 4. Paratergites, 5. Genitalia. Scale bars: 1, 4 = 0.100 mm; 2, 3, 5 = 0.050 mm.



**FIGURES 6–9.** Female of *Hoplopleura zyzomydis* n. sp.: 6. Whole body, dorsal/ventral view, 7. Thoracic sternal plate, 8. Paratergites, 9. Genitalia. Scale bars: 6, 8= 0.100 mm; 7, 9 = 0.050 mm.

Paratergal plates (Fig 4) present on segments 1–8, plate 1 reduced and lacking setae, plate 2 with two apical setae of moderate size and unequal length, plate 3 with two apical setae of moderate size and equal length, plates 7 and 8 each with two long apical setae. Plates 3–6 each with serrated posterolateral lobes. Plate 7 with posterolateral lobe on dorsal side only. Plates 3–7 each with moderately sized spiracles, spiracle size on 5<sup>th</sup> abdominal segment  $\bar{x} = 0.0158$  (0.0150 – 0.0175, n = 5). All plates differentially sclerotised.

Genitalia (Fig 5) with basal apodeme longer than parameres, parameres slender and tapering posteriorly, pseudopenis extending beyond apices of parameres with serrated posterolateral margins.

**Female** (Fig 6): Total body length,  $\bar{x} = 1.293$  (1.210 – 1.400, n = 10). Head, thorax and abdomen as in male unless indicated otherwise.

Head longer than wide.

Thorax as long as wide. Thoracic sternal plate similar to male but with less sclerotisation (Fig 7). Mesothoracic spiracle diameter,  $\bar{x} = 0.0165$  (0.0125 – 0.0200, n = 9). DPTS length,  $\bar{x} = 0.0375$  (0.0350 – 0.0425, n = 8).

Abdomen wider than thorax. Ventrally, two sternites on segment 2 each articulating with corresponding paratergal plate, sternite 2 markedly broader than sternite 1. Three narrow sternites on each of segments 3–6, one narrow sternite on segment 7. Sternite 2 as in male with two thickened lateral StAS each side, sternites 3–15 each with five to eight StAS, one VLAS lateral to sternites 8, 11, 13 and 15. Dorsally, two broad tergites on segment 2, one broad and one narrow tergite on segment 3, three narrow tergites on segments 4 to 7, one broad tergite on segment 8. One lateral TeAS on each side of tergites 1 and 2, four to six TeAS on each of tergites 3–16, setae absent on tergite 17.

Paratergal plates as in male (Fig 8), spiracle diameter on 5<sup>th</sup> abdominal segment,  $\bar{x} = 0.0176$  (range = 0.0150 – 0.0200, n = 10).

Genitalia (Fig 9) with moderately sclerotised subgenital plate, marked lateral indentations and rounded indentation in the posterior margin. Two setae inserted on the anterior arms of subgenital plate on each side, four small setae arranged in a line centrally and two small setae on each side of posterior lobes of subgenital plate. Gonopod VIII on each side with three small setae posteromedially, gonopod IX on each side with stout terminal seta and three long setae anteriorly, several small setae medial to gonopods IX.

**Etymology.** This species is named after the genus of its rodent host, *Zyzyomys argurus*.

**Remarks.** This new species of *Hoplopleura* was collected from seven of 20 *Z. argurus* from localities at Mount Isa and Mount Morgan in Queensland, Australia.

A list of the Australian species of *Hoplopleura*, their rodent hosts and distribution are shown in Table 1.

**TABLE 1.** Australian species of *Hoplopleura*, their hosts and distribution (Durdin & Musser, 1994; Palma & Barker, 1996).

Species	Host	Distribution
<i>H. pacifica</i>	<i>Rattus</i> spp.	Near global – wide ranging tropical, subtropical and warm temperate areas
<i>H. uromydis</i>	<i>Uromys caudimaculatus</i> (Kreft, 1867)	Queensland
<i>H. bidentata</i>	<i>Hydromys chrysogaster</i> Geoffroy, 1804	New South Wales, South Australia, Tasmania
<i>H. calabyi</i>	<i>Pseudomys higginsii</i> (Trouessart, 1897)	Tasmania
<i>H. cornata</i>	<i>Rattus sordidus</i> (Gould, 1858)	Queensland
<i>H. gyomydis</i>	<i>Pseudomys fumeus</i> (Brazenor, 1934)	Victoria
<i>H. irritans</i>	<i>Rattus fuscipes</i> (Waterhouse, 1839), <i>Rattus lutreolus</i> (Gray, 1867)	Tasmania, Victoria, New South Wales, Queensland
<i>H. mastacomydis</i>	<i>Mastacomys fuscus</i> Thomas, 1882	New South Wales, Tasmania
<i>H. zyzyomydis</i> n. sp.	<i>Zyzyomys argurus</i> (Thomas, 1889)	Queensland

*Hoplopleura zyzomydis* can be distinguished from all other Australian species by having short DPTS and setae absent from paratergal plates 4–6. All other Australian species have long DPTS and setae present, although reduced in some, on paratergal plates 2–8.

The absence of a ventral posterolateral lobe on the 7<sup>th</sup> paratergal plate is a further diagnostic feature. Both the dorsal and ventral lobes of the 7<sup>th</sup> paratergal plate are absent or reduced in *H. cornata*, *H. gyomydis*, *H. irritans*, *H. uromydis*, *H. bidentata* and *H. pacifica*, and both conspicuously present in *H. mastacomydis* and *H. calabyi*.

Male *H. zyzomydis* have one tergite and two sternites on each of abdominal segments 4–6 which is similar to *H. uromydis*, *H. gyomydis*, *H. irritans* and *H. mastacomydis* but dissimilar to *H. cornata* which has three sternites on segment 4. Female *H. zyzomydis* have three tergites and three sternites on each of abdominal segments 4–6 which is similar to *H. mastacomydis*, *H. irritans*, *H. gyomydis*, *H. cornata* and *H. uromydis* but dissimilar to *H. bidentata* which has only two sternites on segments 4–6.

*Hoplopleura zyzomydis* is morphologically dissimilar to the unnamed *Hoplopleura* sp. from *Melomys cervinipes* (Gould, 1852) (Rodentia: Muridae) partially described by Kuhn & Ludwig (1967) by having short DPTS and setae absent from paratergal plates 4–6. Of note is the presence of a single prominent dorsal lobe on paratergal plate 7, similar to *H. zyzomydis*.

The original description of *H. pacifica* by Ewing (1924) is limited, but comments by Johnson (1972) and examination of specimens from the ANIC indicate clearly that it is morphologically dissimilar to *H. zyzomydis* with apical setae present on paratergites 4–6 and long DPTS.

#### A key to the Australian species of the Genus *Hoplopleura*

1. First sternal plate of abdominal segment 3 extended laterally to articulate with the corresponding paratergites ..... 2
  - First sternal plate of abdominal segment 3 not extended laterally *Hoplopleura bidentata* (Neumann, 1909)
2. Paratergite of abdominal segment 7 with distinct apical lobe ..... 3
  - Paratergite of abdominal segment 7 without distinct apical lobe ..... 5
3. Paratergite of abdominal segment 8 without distinct apical lobe ..... 4
  - Paratergite of abdominal segment 8 with distinct apical lobe, paratergite of segment 3 with one short apical seta ..... *Hoplopleura mastacomydis* Kuhn & Ludwig, 1967
4. Paratergite of segment 3 with a pair of long apical setae ..... *Hoplopleura calabyi* Johnson, 1960
  - Paratergites of segments 4–6 with no apical setae, dorsal principal thoracic seta short ..... *Hoplopleura zyzomydis* n. sp.
5. Paratergites of abdominal segments 3–5 deeply bilobate, sternal thoracic plate with reduced posterior process ..... *Hoplopleura gyomydis* Kuhn & Ludwig, 1967
  - Paratergites of abdominal segments 3–5 not deeply bilobate, sternal thoracic plate with developed posterior process ..... 6
6. Abdominal spiracles large, diameter greater than 0.030 mm ..... *Hoplopleura uromydis* Kuhn & Ludwig, 1967
  - Abdominal spiracles small, diameter less than 0.020 mm ..... 7
7. Paratergite of abdominal segment 6 with two distinct apical lobes, sternal thoracic plate rounded laterally ..... *Hoplopleura cornata* Kim, 1972
  - Paratergite of abdominal segment 6 with a single or no apical lobe ..... *Hoplopleura irritans* Kuhn & Ludwig, 1967

## Discussion

This is the first description of a new *Hoplopleura* in Australia for 35 years and the first record of a species of louse from *Zyromys argurus*. This description brings the total number of *Hoplopleura* species known from Australia to nine, including the introduced species *H. pacifica* (see Palma & Barker, 1996). There is also one unidentified species from *M. cervinipes* partially described by Kuhn & Ludwig (1967), and two different unidentified species, also likely to be new, collected from *Pseudomys delicatulus* (Gould, 1842) and *P. desertor* Troughton, 1932 (Muridae) by Weaver (2007). This potentially increases the number to 11 endemic species. The distribution of the described species of *Hoplopleura* is so far limited to the eastern states, with no records from Western Australia or the Northern Territory (Table 1). All described species of Australian *Hoplopleura* are poorly studied, with the majority of known species coming from collections made by J.H. Calaby over 4 decades ago (Kuhn & Ludwig, 1967).

All Anoplura are permanent and obligate parasites of their eutherian mammal hosts (Kim, 1985). It appears that the species of *Hoplopleura* from Australian rodents are host-specific, with each species recorded only from the type host, with one exception (*H. irritans*; Palma & Barker, 1996). This is most likely due to the coevolutionary relationships that restrict a species of louse to a particular host. The Australian species of *Hoplopleura* are probably derived from ancestral lice that were present on early rodents as they migrated to Australia from south-east Asia (Godthelp, 2001). Speciation of the ancestral rodents has resulted in over 35 extant species of Hydromyinae (Strahan, 1995), which may have resulted in cospeciation of associated lice. Durden (1990) briefly discussed the likely coevolution of *Hoplopleura* species and their host rodents from Sulawesi, Indonesia, although there were not enough louse species known for a comprehensive cladistic analysis to be carried out. We suggest it is also likely that Australian *Hoplopleura* species have coevolved with their hosts, due to apparent high host specificity (Table 1), and patterns of migration of rodents from Asia. The phylogenetic relationships of Australian Hydromyinae have been examined (Baverstock, *et al.*, 1981; Watts, *et al.*, 1992; Ford, 2006); however, no research has been carried out on the phylogeny of the Australian *Hoplopleura* species. This description of *H. zyzomydis* has resulted from the first comprehensive study of parasites of *Z. argurus* (see Weaver, 2007). Further study of the parasites of hydromyine rodents in northern Australia may result in the collection and description of other new species of *Hoplopleura*. Investigations into the phylogeny of these lice may provide insights to the origin, speciation and coevolution of Australian conilurine rodents and species of *Hoplopleura*.

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